

cta

567 West Lake Street Chicago. Illinois 60661-1498 TEL 312 664-7200 www.transitchicago.com

January 14, 2014

Subject: Requisition No. C13FI101372531 - IFB to Purchase Rapid Transit Cars Specification CTA 7000-12

Re: Addendum 19

All Potential Bidders:

Enclosed please find Addendum 19. This Addendum revises the General Specifications of the IFB. Insert this Addendum 19 into the Contract Documents of the subject requisition and consider it part of the official Contract Documents.

Addendum 19 shall be acknowledged as received by identification of Addendum 19 on the IFB – Bid Proposal Exhibit 2 – Bidder's Signature Page, to be submitted with the Bid Proposal and/or the Acknowledgement of Addenda Form provided with Addendum <u>18</u>. Failure to acknowledge receipt of Addendum 19 or any other addenda with your Bid Proposal shall render the Bid Proposal as non-responsive.

The Chicago Transit Authority is seeking bids for the subject procurement. Bid packages are to be delivered to:

By Mail, In Person Drop Off or Delivery Service

Chicago Transit Authority Bid Office - 2nd Floor 567 W. Lake Street Chicago, IL 60661-1498

Bid Due Date (Bid Opening): Monday, January 27, 2014, no later than 11:00 A.M. Chicago time

Each Bidder bears full responsibility for delivery to the Bid Office before the advertised date and hour for the opening of Bids. Bidders are solely responsible for ensuring that its Bid is received by the Authority in a timely manner prior to the date and time of Bid Opening. If mail or delivery is delayed beyond the date and hour set for the Bid Opening, Bids delayed will not be considered and will be returned unopened. Bid Office hours are Monday through Friday from 8:00 am to 4:30 pm Chicago time, except holidays.

If you have any questions, please contact Maria Williams-Baxter, Sr. Procurement Administrator <u>mwilliams@transitchicago.com</u> or 312-681-2437.

Sincerely,

Ellen McCormack, Vice President, Purchasing

Item 1. Addendum 18, Item 5 is corrected below. There are no additional changes to the wording that was issued in Addendum 18. Addendum 19 only changes the lower case "g" to an upper case "I".

General Specifications <u>Page GS-49 and GS-50, Section 32, Escalation Clause for Options</u>

Delete paragraphs 32, H and I, and replace with the following:

- H. The adjustment to the Total Option Price shall be based solely on changes in the labor and material indices identified herein. For the purposes of this paragraph:
 - a. 40% of the Total Option Price shall be deemed to constitute the labor cost subject to adjustment.
 - b. 50% of the Total Option Price shall be deemed to constitute the material cost subject to adjustment.
 - c. No labor or material adjustment will be made on 10% of the Total Option Price.
 - d. Adjustments based on changes in the labor and material indices shall be computed for the period from the time of the Notice to Proceed (NTP) or the end of the Bid Validity Period, whichever comes first (base indices) to the <u>Option Exercise Timeframe date for each Option as specified in the Bid Proposal, Section II, Part 2</u> (current indices) as set forth in Section 32.
 - e. The base average labor index and the base average material index are the arithmetic averages of the <u>published</u> base labor and material indices for the last <u>six (6) months</u> preceding the date of NTP of this Contract (or the end of the Bid Validity period), as computed below:

Base Average Labor Index:

Manufacturing Series ID: CEU 300000015

Electronic Series ID: CEU3133400015

Trans Equip Series ID: CEU3133600015

<u>M1</u>	<u>M2</u>	<u>M3</u>	<u>M4</u>	<u>M5</u>	<u>M6</u>	<u>Avg</u>

Base Average Material Index:

Cap Equip - Series ID: wpusop3200 Durable Mfg - Series ID: wpusop2130

<u>M1</u>	<u>M2</u>	<u>M3</u>	<u>M4</u>	<u>M5</u>	<u>M6</u>	<u>Avg</u>

f. The current average labor index and the current average material index shall be the arithmetic averages, computed in the same manner as in paragraph H above, of the current <u>published</u> labor and material indices for the last <u>six (6) months</u> preceding the <u>Option Exercise Timeframe date for each Option as specified in the Bid Proposal, Section II, Part 2</u>.

I. g=For Change Orders which have an impact on the Option price and are executed after the Date of Award and before exercise of the Option, the Total Option Price will be adjusted in the following manner: Escalation on the value of the Change Order shall be calculated for the duration of time elapsed between the Change Order execution date and the Option Exercise Timeframe date for each Option specified in the Bid Proposal, Section II, Part 2, not back to the end of the Bid Validity Period or NTP. (Example: If a Change Order is executed in Year 2 of the contract performance period, and an Option is exercised in Year 5, three (3) years of escalation will be calculated and added to the adjusted Option Price (i.e., after escalation has been calculated on the option price in the Bid Proposal). The published base indices (for both material and labor) used will be the last six (6) months preceding the date of the Change Order.

CHICAGO TRANSIT AUTHORITY

567 West Lake Street Chicago, Illinois 60661-1498 TEL 312 664-7200 www.transitchicago.com

December 20, 2013

Subject: Requisition No. C13FI101372531 - IFB to Purchase Rapid Transit Cars Specification CTA 7000-12

Re: Addendum 18

All Potential Bidders:

Enclosed please find Addendum 18. This Addendum revises the Instructions to Bidders, General Specifications, and Bid Proposal of the IFB. Insert this Addendum 18 into the Contract Documents of the subject requisition and consider it part of the official Contract Documents.

Included with Addendum 18 are the following two (2) attachments:

Attachment A – Written Questions Submitted from Potential Bidders and CTA's Responses Attachment B – Acknowledgement of Addenda Form

Addendum 18 shall be acknowledged as received by identification of Addendum 18 on the IFB – Bid Proposal Exhibit 2 – Bidder's Signature Page, to be submitted with the Bid Proposal and/or the Acknowledgement of Addenda Form provided with Addendum 18. Failure to acknowledge receipt of Addendum 18 or any other addenda with your Bid Proposal shall render the Bid Proposal as non-responsive.

The Chicago Transit Authority is seeking bids for the subject procurement. Bid packages are to be delivered to:

By Mail, In Person Drop Off or Delivery Service

Chicago Transit Authority Bid Office - 2nd Floor 567 W. Lake Street Chicago, IL 60661-1498

Bid Due Date (Bid Opening): Monday, January 27, 2014, no later than 11:00 A.M. Chicago time

Each Bidder bears full responsibility for delivery to the Bid Office before the advertised date and hour for the opening of Bids. Bidders are solely responsible for ensuring that its Bid is received by the Authority in a timely manner prior to the date and time of Bid Opening. If mail or delivery is delayed beyond the date and hour set for the Bid Opening, Bids delayed will not be considered and will be returned unopened. Bid Office hours are Monday through Friday from 8:00 am to 4:30 pm Chicago time, except holidays.

If you have any questions, please contact Maria Williams-Baxter, Sr. Procurement Administrator <u>mwilliams@transitchicago.com</u> or 312-681-2437.

Sincerely,

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Ellen McCormack, Vice President, Purchasing

Item 1. BID PROPOSAL

Page P-7 Section II, Bidding Form, Part 2, Optional Purchases

In addition to the lump sum Base Pricing for 100 Rapid Transit Cars (50 two-car units), Bidders must also quote a price per two-car unit, for the Option quantities listed below. The price per two-car unit for each Option must be quoted inclusive of special test equipment, replacement units and support as required by the Technical Specifications. The price per two-car unit for each Option must include all costs to furnish any of the three (3) exterior designs specified in Technical Specifications, 3.01.M.1 and any of the three (3) interior designs specified in Technical Specifications, 3.01.M.2 as quoted in the Bid Proposal. CTA reserves the right to exercise or decline each option to purchase additional cars in sequential order within the timeframes shown. However, if any exercised timeframe expires, CTA reserves the right to purchase any or all of the subsequent options prior to the expiration dates.

The exercising of options shall be deemed timely if notice is issued by the Authority in accordance to Section 34.II – Notice, General Specifications on or before the calendar day timeframe indicated in the column headed "OPTION EXERCISE TIMEFRAME".

Notwithstanding the above, to ensure production continuity of the Cars, any remaining option must be exercised no later than one of the following, whichever comes first: 1) the timeframe for each option specified in the Bid Proposal, Section II, Part 2, or 2) a date that is 12 months in advance of the scheduled delivery date of the last Car of the Base Order or any exercised option under production.

If CTA elects to exercise an option, the price for the additional cars and replacement units for all options shall be the purchase price for the two-car unit on each option, and the figure supplied by the Bidder on the Bid Proposal Bidding Summary Form at the time of the Bid submission date. Escalation will apply as calculated under Section 32 of the General Specifications on a one time basis (on the date the option is exercised) for each option.

The exercise of any or all option(s) shall be at the sole discretion of the Authority and is subject to funding availability and will be subject to mutually acceptable delivery schedules.

The terms and conditions by the Contract Documents, Specification No. CTA 7000-12 shall be applicable to the number of Cars selected by the CTA under this Optional Purchase Agreement.

Item 2. BID PROPOSAL

Page P-8, Section II, Bidding Form, Part 2, Optional Purchases

Delete Option 4, Option Exercise Timeframe 1550 Days After Contract Effective Date and replace with the following:

OPTION EXERCISE TIMEFRAME 1700 DAYS AFTER CONTRACT EFFECTIVE DATE

Item 3. BID PROPOSAL Page P-9, Section II, Bidding Form, Part 2, Optional Purchases

Delete Option 5, Option Exercise Timeframe 1790 Days After Contract Effective Date and replace with the following:

OPTION EXERCISE TIMEFRAME 1940 DAYS AFTER CONTRACT EFFECTIVE DATE

Item 4. General Specifications Page GS-48, Section 32, Escalation Clause for Options, A

Insert the following sentence at the end of the paragraph:

To ensure production continuity of the Cars, any remaining option must be exercised no later than one of the following, whichever comes first: 1) the timeframe for each option specified in the Bid Proposal, Section II, Part 2, or 2) a date that is 12 months in advance of the scheduled delivery date of the last Car of the Base Order or any exercised option under production.

Item 5. General Specifications

Page GS-49, Section 32, Escalation Clause for Options, H

Delete paragraph 32, H, and replace with the following:

- H. The adjustment to the Total Option Price shall be based solely on changes in the labor and material indices identified herein. For the purposes of this paragraph:
 - a. 40% of the Total Option Price shall be deemed to constitute the labor cost subject to adjustment.
 - b. 50% of the Total Option Price shall be deemed to constitute the material cost subject to adjustment.
 - c. No labor or material adjustment will be made on 10% of the Total Option Price.
 - d. Adjustments based on changes in the labor and material indices shall be computed for the period from the time of the Notice to Proceed (NTP) or the end of the Bid Validity Period, whichever comes first (base indices) to the <u>Option Exercise Timeframe date for each Option as specified in the Bid Proposal, Section II, Part 2</u> (current indices) as set forth in Section 32.
 - e. The base average labor index and the base average material index are the arithmetic averages of the <u>published</u> base labor and material indices for the last <u>six (6) months</u> preceding the date of NTP of this Contract (or the end of the Bid Validity period), as computed below:

Base Average Labor Index:

	<u>M1</u>	<u>M2</u>	<u>M3</u>	<u>M4</u>	<u>M5</u>	<u>M6</u>	Avg
Manufacturing Series ID: <u>CEU 3000000015</u>							
Electronic Series ID: <u>CEU3133400015</u>							
Trans Equip Series ID: CEU3133600015							

Base Average Material Index:

Cap Equip - Series ID: wpusop3200

Durable Mfg - Series ID: wpusop2130

	<u>M1</u>	<u>M2</u>	<u>M3</u>	<u>M4</u>	<u>M5</u>	<u>M6</u>	<u>Avg</u>	
30								

f. The current average labor index and the current average material index shall be the arithmetic averages, computed in the same manner as in paragraph H above, of the current <u>published</u> labor and material indices for the last <u>six (6) months</u> preceding the <u>Option Exercise Timeframe date for</u> <u>each Option as specified in the Bid Proposal, Section II, Part 2</u>.

g. For Change Orders which have an impact on the Option price and are executed after the Date of Award and before exercise of the Option, the Total Option Price will be adjusted in the following manner: Escalation on the value of the Change Order shall be calculated for the duration of time elapsed between the Change Order <u>execution date</u> and the <u>Option Exercise Timeframe date for each Option specified in the Bid Proposal, Section II, Part 2</u>, not back to the end of the Bid Validity Period or NTP. (Example: If a Change Order is executed in Year 2 of the contract performance period, and an Option is exercised in Year 5, three (3) years of escalation will be calculated and added to the adjusted Option Price (i.e., after escalation has been calculated on the option price in the Bid Proposal). The <u>published</u> base indices (for both material and labor) used will be the last <u>six (6) months</u> preceding the date of the Change Order.

Item 6. BID PROPOSAL

Page P-2, Section I, GENERAL PROVISIONS AND METHODS OF PAYMENT, C, 1,c

Delete paragraph c, and replace with the following:

c. <u>Escalation for Options</u>

Escalation will apply as calculated under Section 32 of the General Specifications, on a one time basis for each option. After the escalation adjustment, the total Option Price will then be the total price to be paid by the Authority. See also GENERAL SECTION 32 – ESCALATION CLAUSE FOR OPTIONS.

Item 7. INSTRUCTIONS TO BIDDERS Exhibit 2, Insurance and Bond Requirements, Part II – Insurance Requirements, C

Delete paragraph C and replace with the following:

C. All insurance carriers must be acceptable to the CTA. All insurance companies shall have at least an A VII POLICY HOLDER RATING, or better, by the A.M. Best Co., Inc. Insurance companies with lower ratings will not be accepted. Carriers licensed to do business in the State of Illinois must issue all insurance, with the exception of Rail Road Protective <u>and Professional Liability</u>.

Item 8. ACKNOWLEDGEMENT OF ADDENDA FORM

Addendums shall be acknowledged as received by identification of the Addendum number on the IFB – Bid Proposal Exhibit 2 – Bidder's Signature Page, to be submitted with the Bid Proposal and/or Addendum 18, <u>Attachment B - Acknowledgement of Addenda Form</u>. Bidders can acknowledge addenda by inserting all of the addenda numbers in the space in the box at the top of the Bidder's Signature Page or Bidders can acknowledge using the new form furnished with Addendum 18 or Bidders can use both.

Item 9. INSTRUCTIONS TO PROPOSERS

Page IB-2, Bid Preparation

Delete the last sentence of the section and replace with the following:

All signatures must be sworn to before a notary public for all forms that require a notary seal/stamp and signature.

Requisition No. C13FI101372531 Addendum 18 Attachment A

Written Questions Submitted from Potential Bidders and CTA's Responses

1. Bid Proposal, Page P-23, CERTIFICATIONS AND SUBMISSION FORMS, and Page P-24, Bidder's Signature Page

Ansaldobreda submitting the following:

We understand that the two above mentioned documents are the only ones that must bear a notary's stamp. Please, confirm or advise differently.

CTA RESPONSE:

CTA has further clarified in Addendum 18, Item 9 and confirms that all forms that require a notary seal/stamp and signature must be notarized.

2. General Specifications, Page GS-49, Section 32, Escalation Clause for Options, H, d

Ansaldobreda submitting the following:

According to the sub-section subject of this question, the option prices shall be adjusted at the time of exercise of the relevant option and item B of same section 32 states that "The Contractor warrants that the Option prices set forth in this Contract do not include any allowance for any contingency to cover anticipated increased costs of performance to the extent such increases are covered by this economic adjustment clause".

Considering that the exercise of the options could, in principle, be carried out by CTA much in advance with respect to the timeframe set up in table of part 2 of the Bidding form (while relevant deliveries might not be anticipated being linked with deliveries of base order or previous option orders), there is the possibility that the resulting price adjustment cannot cover the increased costs of performance, which depend from the timing of production/delivery.

Consequently, we kindly ask CTA to amend the subsection H.d by stating that escalation is calculated until the date written in the "Option exercise timeframe" column of Part 2 of Bidding Form, regardless of the actual date of exercise the option.

CTA RESPONSE:

CTA agrees to the proposed change. The escalation clause for options has been amended to calculate escalation until the option exercise timeframe date for each option specified in the Bid Proposal, regardless of the actual option exercise date. See Addendum 18, Item 5 for changes to General Specifications Section 32 – Escalation Clause for Options.

Please note the Bureau of Labor Statistics' website address <u>http://data.bls.gov/cgi-bin/srgate</u> for the referenced published indices.

3. Bid Proposal, Page P-7, Section II Bidding Form, Part 2 – Optional Purchases

Ansaldobreda submitting the following:

We deem that, after the modification of the delivery date of the first ten cars, five married pairs, as per Addendum 17, the column "Option exercise timeframe" should be adjusted accordingly. Please confirm.

CTA RESPONSE:

See Addendum 18, Items 2 and 3 for changes to Option 4 and Option 5 exercise timeframes.

4. Instructions to Bidders, Page IB-12, Section V, Bid Submission Requirements

Ansaldobreda submitting the following:

- A. In none of the Bid Proposal Bidding Forms to be included in the bid package it is required to specify the bid validity period. We deem that this matter is governed by Section H of the same Instruction to Bidders and, due to that, the bid validity period shall not be indicated anywhere in the bid documentation. Please confirm.
- B. All the Bid Proposal Bidding Forms shall be signed by an "authorized officer" but the evidence of such authorization (the Power of Attorney) seems not required to be included in the bid package. Please confirm.

CTA RESPONSE:

- A. CTA agrees that the bid bond validity period (120 days) is governed by Instructions to Bidders, Section H Modifications, Withdrawals and Late Bids. Additionally, per Section D Bid Deposit, Instructions to Bidders, the period of the bid bond must be for not less than 120 days from the date of Bid Opening.
- B. CTA has not specified requirements for a Power of Attorney for the Bid Proposal documents. However, see Instructions to Bidders, page IB-2, Section E – Bid Preparation for requirements regarding evidence of authority to sign for corporations, partnerships and joint ventures. For limited liability companies (LLCs), please have the contract executed by a member or manager with authority to sign and provide evidence of such authority. For any other types of business entities please provide evidence of authority to execute.
- 5. Instructions to Bidders, Exhibit 2, Insurance and Bond Requirements, PART IV Section B & Form of Performance Bond

Ansaldobreda submitting the following:

The CTA Web site shows that the AIA Performance Bond Form is regularly accepted on Construction contracts. The Surety Industry affirms that the AIA performance bond form has been issued in favor of the CTA several time in the past to secure Construction contracts. Please confirm that also in this case such AIA form can be accepted by the CTA.

CTA RESPONSE:

Construction requirements and forms are not relevant to this rolling stock procurement. For this rolling stock procurement, the American Institute of Architects (AIA) performance bond is not acceptable. For the acceptable Performance Bond, see Instructions to Bidders, Exhibit 2, Form of Performance Bond. Additionally, see Addendum 13 - Attachment F, for the acceptable Bid Deposit Bond Form.

6. Bid Proposal, Pages P2 – P5, Section I, Subsection C. Method of Payment

Ansaldobreda submitting the following:

- A. The payment provisions for the Options result in a deep negative cash flow. Connected to the long period of deliveries (6 years approx. for all the Options), such negative cash flow would produce a considerable financial burden for the Contractor. Therefore, we kindly ask CTA to change the payment provisions for the Options considering the following proposed modifications, as minimum improvement:
 - Milestone 1, upon acceptance of production schedule: 10% (instead of 4%)
 - Milestone 2, upon delivery of spare parts and PTUs: 3% (unchanged)
 - Production payment, upon start of final assembly: 56% (instead of 44%)
 - Acceptance payment, upon acceptance of car sets: 27% (instead of 45%), same % as Base Contract
 - Final payment: 4% (unchanged)
- B. As far as the Final Payments are concerned, please confirm that:
 - the 4% balance payment it is also referred to Total Price of each Option
 - the condition "upon acceptance of the last Car and receipt of all required deliverables" is referred to the Base Contract and to each Option, separately.

CTA RESPONSE:

A. CTA does not agree to the suggested changes.

B. No, this is not correct. See Addendum 5, Items 10 and 11.

7. General Specifications, Page GS-37, Availability of Funding, Sub-Section A

Bombardier submitting the following:

During CTA's initial Pre-Bid meeting on March 1, 2013, Mr. Tom McKone described how the 7000 Series cars fall into the fiveyear capital improvement program and stated, in general, the sources of funding that CTA would use to procure the new cars. Since that meeting CTA has recently issued its proposed 2014 budget and its five-year capital improvement program for 2014-2018. On page 50 of the proposed CTA 2014 budget plan, under the section for "New Rail Cars", the total of \$497 million with \$265 million reserved to complete the 714 new 5000 Series cars, and the remaining amount for the 7000 series would be \$232 million.

The Bidder requests CTA to explain more fully how the funding for the planned purchase of all 846 new 7000 series cars will be funded through the Contract. What will be the source and mix of funds CTA will use to procure the new 7000 series cars?

CTA RESPONSE:

Additional funding for the 7000 Series cars is anticipated to come from a number of sources including: 1) alternative federal sources; 2) new Federal, State and RTA Transit authorization programs. For example, the most recent (2010) five year State Authorization provided the CTA \$1.4 billion of capital funds. Traditionally the State authorizes transit funding in five year increments, when the state authorizes the next five year transit program these funds will be available in the CTA Capital Plan and are eligible for the 7000 Series rail car order.

8. <u>Bid Proposal, Page P-1, Section I, General Provisions and Method of Payment, Sub-Section B, Complete Lump Sum</u> <u>Price</u>

Bombardier submitting the following:

Can CTA please confirm that the prices for the replacement units and special tools listed in section 17 of the Technical Specifications need to be included in the Lump Sum Price?

CTA RESPONSE:

Per Bid Proposal, Section, I, Sub-Section B – Complete Lump Sum Price, the CTA confirms that the Contractor must provide and furnish, all items necessary and incidental for the manufacturing and delivery of a Base Order and eight (8) Options, including but not limited to all materials, parts (replacement units), labor, supervision, coordination, administration, equipment, tools (special tools), drawings, and incidentals required by the Contract and necessary for the full completion of the Contract, inclusive of all cost to furnish the exterior and interior designs specified in the Technical Specifications.

9. Instructions to Bidders, Page 2, Exhibit 2, Insurance and Bond Requirements, PART II Insurance Requirements, Sub-Section C.

Bombardier submitting the following:

Paragraph C of Part II of the Insurance and Bond Requirements requires that all insurance, with the exception of Railroad Protective, be issued by insurance carriers licensed to do business in the State of Illinois. With regards to Professional Liability insurance, many insurance carriers write such coverage on an "Excess and Surplus lines" (E&S) basis, which is a standard form in the industry for professional liability coverage. However, such insurance carriers are usually not licensed to do business in each and every state for professional liability coverage since the E&S basis does not require that they are. Therefore, the Bidder respectfully suggests that CTA expands its exception to state licensing requirement to apply to the professional liability in addition to the railroad protective, so that it can be compliant with the insurance requirements.

CTA RESPONSE:

See Addendum 18, Item 7. CTA has modified its exception to the state licensing requirement to include Professional Liability.

10. Instructions to Bidders, Page IB-10, Section S - Parent Company Guarantee and Instructions to Bidders, Exhibit 2, Form of Parent Company Guarantee

Bombardier submitting the following:

A. Neither Section S of the Instructions to Bidders, nor the Form of Parent Company Guarantee attached in Exhibit 2, provides any reduction m echanism for the Parent Company G uarantee. Such a mechanism should be put in place in order to diminish the value of such guarantee as the risks of the Authority diminish upon delivery of the Cars. Could CTA please confirm that the reduction mechanism applicable for the performance bond, which is specified in the second paragraph of section T of the Instructions to Bidders, also applies to the Parent Company G uarantee? If this is the case, the Bidder respectfully suggests that such reduction mechanism also appear within this Parent Company Guarantee.

B. Moreover, since a Performance Bond or Letter of Credit worth twenty-five percent (25%) of the total contract price has to be also issued to ensure performance, the Bidder respectfully suggests that CTA should insert wording into the form of Parent Company Guarantee which would not allow CTA to claim under both guarantees. Could CTA please amend the wording of the Parent Company Guarantee to ensure only one guarantee will be drawn upon in the event of a default by the Contractor?

CTA RESPONSE:

- A. This is not correct. The reduction mechanism does not apply to the parent guarantee.
- B. CTA does not agree to this request.
- 11. Instructions to Bidders, Page IB-12, Section V Bid Submission Requirements

Bombardier submitting the following:

- A. Could CTA please confirm Bidder's interpretation that the Bid Bond of \$500,000 (as required by Section D Bid Deposit of the Instructions to Bidders) must be provided as part of the package to be submitted on the Bid due date?
- B. Could CTA please confirm that the U.S. Employment Information Form (added to the Bid Proposal in Addendum 16) shall be provided with the supplemental package that is required to be submitted by the lowest bidder within two (2) business days of request from CTA, as such form may contain sensitive information that bidders would not want to be disclosed during the public opening of the bids?

CTA RESPONSE:

- A. Yes, CTA confirms the Bid Bond is due on the Bid Due Date. Per Instructions to Bidders, Section D, <u>the Bid shall</u> <u>be accompanied</u> by cash, a cashier's check, a certified check, a money order, approved Letter of Credit, or Bid Bond Form. CTA further clarifies that the Bid shall be accompanied with one of these bid submission requirements on the Bid Due Date, no later than 11:00 A.M, Chicago time.
- B. CTA cannot confirm because your statement is incorrect. The U.S. Employment Information Form is to be submitted with the Bid Proposal on the Bid Due Date should Bidders volunteer to complete the form per Addendum 16, Item 1. The U.S. Employment Information Form, along with all other bid content, will be made available for public review at the bid opening (See paragraph J, page IB-9 of the IFB). All bid content will also be provided after execution of the contract if requested under the Illinois Freedom of Information Act.

Additionally, any and all questions pertaining to the U.S. Employment Information Form should only be directed to Maria Williams-Baxter, Sr. Procurement Administrator at <u>mwilliams@transitchicago.com</u> or 312-681-2437. Please note that no other entity has the authority to speak on behalf of the CTA concerning any aspect of this procurement, including the U.S. Employment Information Form.

12. Instructions to Bidders, Page IB-2, Section E - Bid Preparation

Bombardier submitting the following:

In Addendum 17, in a response to a question asked by AnsaldoBreda, CTA confirmed that only Bid Proposal P-23, Disclosure of Ownership and Bid Proposal P-24, Bidder's Signature Page are the two documents which are required to be notarized in the Bid Proposal. On the other hand, Section E of the Instructions to Bidders requires that all signatures must be sworn to before a notary public. Can CTA please confirm that only Bid Proposal P-23, Disclosure of Ownership and Bid Proposal P-24, Bidder's Signature Page are required to be notarized amongst all forms to be submitted with the bid and make the appropriate changes to Section E of the Instructions to Bidders?

CTA RESPONSE:

See Addendum 18, Item 9. CTA confirms that all forms that require a notary seal/stamp and signature must be notarized.

13. <u>Bid Proposal, Page P-23, Exhibit 1 - Certifications and Submission Forms, Disclosure of Ownership and Interest</u> <u>Affidavit, Subsection 3</u>

Bombardier submitting the following:

The Bidder understands that, in the event any stock or beneficial interest in the Bidder is held by a corporation, such corporation shall complete and sign an a dditional Disclosure of Ownership and Interests Affidavit. Does this obligation to provide an additional D isclosure of Ownership and Interests Affidavit extend beyond the level of the corporation owning the Bidder, or only to the Bidder's owner?

CTA RESPONSE:

This extends beyond the level of the company owning the bidder. Per the Disclosure of Ownership Form and Interest Affidavit instructions, page P-19, identify all layers of ownership.

Requisition No. C13FI101372531 Addendum 18 Attachment B - Acknowledgement of Addenda Form

Addenda shall be acknowledged as received by identification of the Addendum number on the IFB – Bid Proposal Exhibit 2 – Bidder's Signature Page, to be submitted with the Bid Proposal and/or Addendum 18, <u>Attachment B - Acknowledgement of Addenda Form</u>. Bidders can acknowledge addenda by inserting all of the addenda numbers in the space in the box at the top of the Bidder's Signature Page, or Bidders can acknowledge using the this form, or Bidders can use both. Failure to acknowledge receipt of any addenda with your Bid Proposal shall render the Bid Proposal as non-responsive.

The undersigned acknowledges receipt of the following addenda to the official Contract Documents for Requisition C13FI101372531 – IFB to Purchase Rapid Transit Cars:

Addendum No.: 1 Addendum No.: 2 Addendum No.: 3 Addendum No.: 4 Addendum No.: 5 Addendum No.: 6 Addendum No.: 7 Addendum No.: 8 Addendum No.: 9 Addendum No.: 10 Addendum No.: 11 Addendum No.: 12 Addendum No.: 13 Addendum No.: 14 Addendum No.: 15 Addendum No.: 16 Addendum No.: 17 Addendum No.: 18 Addendum No.: ____ Addendum No.: ____ Addendum No.: ____ Addendum No.: ____

Name of Bidder:	
Print Name of Authorized Official:	
Title:	
Phone:	
Street address:	
City, state, ZIP:	

Signature of Authorized Official

Date

CHICAGO TRANSIT AUTHORITY Advertisement for Professional Services

NOTICE OF TIME EXTENSION

Notice is hereby given that the proposed due date heretofore advertised as Wednesday, December 18, 2013 has been extended to Monday, January 27, 2014 no later than 11:00 A.M. in the Bid Office - 2nd Floor, 567 W. Lake, Chicago, Illinois 60661-1498 for the following item:

> Req. C13FI101372531 Rapid Transit Cars.

> > Bid Deposit: \$500,000.00

For additional information, please contact Maria Williams-Baxter, Sr. Procurement Administrator, at 312/681-2437.

Any contract resulting from this bid is subject to a financial assistance between the Chicago Transit Authority, the United States Department of Transportation and the Regional Transportation Authority.

Contractor will be required to comply with all applicable Equal Employment Opportunity laws and regulations and affirmative action requirements of the Federal Transit Administration and Illinois Human Rights Commission.

All bidders will be required to certify that they are not on the Comptroller General's list of ineligible contractors.

The contractor will be required to furnish certified copies of any and all Insurance Policies required in relation to this contract prior to CTA's execution.

Any contract resulting from this advertisement will be awarded to the lowest responsive and responsible bidder.

Chicago Transit Authority hereby notifies all bidders that it will affirmatively ensure that in regard to any contract entered into pursuant to this advertisement, Disadvantaged Business Enterprise will be afforded full opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color or national origin in consideration for an award.

PLEASE NOTE: Where bids are sent by mail, delivery service or delivered in-person to the CTA Bid Office, the bidders shall be

responsible for their delivery only to the Bid Office before the advertised date and hour for the opening of the bids. The Bid Office hours are Monday through Friday from 8:00 a.m. to 4:30 p.m. Chicago time, except holidays.

The right is reserved to accept any bid or any part or parts thereof or to reject any and all bids.

All inquiries should be directed to and copies of bid documents obtained from the Bid Office - 2nd Floor, 567 W. Lake Street, Chicago, Illinois 60661-1498.

CHICAGO TRANSIT AUTHORITY

By: Ellen McCormack Vice President Purchasing

November 20, 2013



567 West Lake Street Chicago, Illinois 60661-1498 TEL 312 664-7200 www.transitchicago.com

cta

November 18, 2013

Subject: Requisition No. C13FI101372531 - IFB to Purchase Rapid Transit Cars Specification CTA 7000-12

Re: Notice of Time Extension

All Potential Bidders:

The Bid Due Date for the subject requisition has been extended from December 18, 2013 to January 27, 2014.

The Chicago Transit Authority is seeking bids for the subject procurement. Bid packages are to be delivered to:

By Mail, In Person Drop Off or Delivery Service

Chicago Transit Authority Bid Office - 2nd Floor 567 W. Lake Street Chicago, IL 60661-1498

Previous Bid Due Date (Bid Opening): Wednesday, December 18, 2013

New Bid Due Date (Bid Opening): Monday, January 27, 2014, no later than 11:00 A.M. Chicago time

Each Bidder bears full responsibility for delivery to the Bid Office before the advertised date and hour for the opening of Bids. Bidders are solely responsible for ensuring that its Bid is received by the Authority in a timely manner prior to the date and time of Bid Opening. If mail or delivery is delayed beyond the date and hour set for the Bid Opening, Bids delayed will not be considered and will be returned unopened. Bid Office hours are Monday through Friday from 8:00 am to 4:30 pm Chicago time, except holidays.

If you have any questions, please contact Maria Williams-Baxter, Sr. Procurement Administrator mwilliams@transitchicago.com or 312-681-2437.

Sincerely,

Ellen McCormack, Vice President, Purchasing

CHICAGO TRANSIT AUTHORITY

cta

567 West Lake Street Chicago, Illinois 60661-1498 TEL 312 664-7200 www.transitchicago.com

October 29, 2013

Subject: Requisition No. C13FI101372531 - IFB to Purchase Rapid Transit Cars Specification CTA 7000-12

Re: Addendum 17

All Potential Bidders:

Enclosed please find Addendum 17. This Addendum revises the Instructions to Bidders, General Specifications, Bid Proposal and Technical Specifications of the IFB. Insert this Addendum 17 into the Contract Documents of the subject requisition and consider it part of the official Contract Documents.

Included with Addendum 17 are the following four (4) attachments:

Attachment A – Sumitomo Corporation of America, Pre-Bid Meeting Minutes and Attendance List (SCOA-8) Attachment B – Written Questions Submitted from Potential Bidders and CTA's Responses Attachment C – Instructions to Bidders, Exhibit 2 – Insurance and Bond Requirements (Replacement) Attachment D – Sample Independent Contractor Endorsement

Addendum 17 shall be acknowledged as received by identification of Addendum 17 on the IFB – Bid Proposal Exhibit 2 – Bidder's Signature Page, to be submitted with the Bid Proposal. Failure to acknowledge receipt of Addendum 17 or any addenda with your Bid Proposal shall render the Bid Proposal as non-responsive.

The Chicago Transit Authority is seeking bids for the subject procurement. Bid packages are to be delivered to:

By Mail, In Person Drop Off or Delivery Service

Chicago Transit Authority Bid Office - 2nd Floor 567 W. Lake Street Chicago, IL 60661-1498

Bid Due Date (Bid Opening): Wednesday, December 18, 2013, no later than 11:00 A.M. Chicago time

Each Bidder bears full responsibility for delivery to the Bid Office before the advertised date and hour for the opening of Bids. Bidders are solely responsible for ensuring that its Bid is received by the Authority in a timely manner prior to the date and time of Bid Opening. If mail or delivery is delayed beyond the date and hour set for the Bid Opening, Bids delayed will not be considered and will be returned unopened. Bid Office hours are Monday through Friday from 8:00 am to 4:30 pm Chicago time, except holidays.

If you have any questions, please contact Maria Williams-Baxter, Sr. Procurement Administrator <u>mwilliams@transitchicago.com</u> or 312-681-2437.

Sincerely, ! lomack

Ellen McCormack, Vice President, Purchasing

Item 1. INSTRUCTIONS TO BIDDERS

Page IB-11, T. Performance Bond and/or Letter of Credit and Insurance

Delete Paragraph T, Performance Bond and/or Letter of Credit in its entirety and replace with the following:

T. PERFORMANCE BOND AND/OR LETTER OF CREDIT AND INSURANCE

The successful Bidder, within ten (10) working days after written notice of award of a Contract is issued to the Bidder by the Authority, shall furnish a performance bond and/or Letter of Credit in the amount of twenty five percent (25%) of the Base Contract price on the form attached in Exhibit 2 – Insurance and Bond Requirements of the Instructions to Bidders.

Any Letter of Credit with less than a Moody's P2, S&P A2, or Fitch F2 rating will not be acceptable to the Authority. If any of the sureties on said bond at any time fail financially or are deemed by the Authority to be insufficient security of the penalty of said bond, then in that case the Contract Officer may, on giving ten (10) working days notice thereof in writing, require the Contractor to furnish a new and additional bond with such sureties thereon as shall be satisfactory to the Contract Officer. The amount of the initial performance bond shall be calculated on the Base Contract Price, on the Contract effective date, at the time the Contract is awarded to the Bidder, and shall be adjusted appropriately whenever the Contract value is adjusted.

The performance bond adjustment for Option No. 1 is required 1120 days after Base Contract effective date. The performance bond adjustment for Option No. 2 (if exercised) shall be required 1240 days after Base Contract effective date. The performance bond adjustment for the Option No. 3 (if exercised) shall be required 1340 days after Base Contract effective date. The performance bond adjustment for the Option No. 4 (if exercised) shall be required 1550 days after Base Contract effective date. The performance bond adjustment for the Option No. 4 (if exercised) shall be required 1550 days after Base Contract effective date. The performance bond adjustment for the Option No. 5 (if exercised) shall be required 1790 days after Base Contract effective date. The performance bond adjustment for the Option No. 6 (if exercised) shall be required 2130 days after Base Contract effective date. The performance bond adjustment for the Option No. 7 (if exercised) shall be required 2340 days after Base Contract effective date. The performance bond adjustment for the Option No. 8 (if exercised) shall be required 2460 days after Base Contract effective date.

Separate performance bonds and/or letters of credit are acceptable for fulfilling the performance bond requirement or the existing bond amount and/or letter of credit may be increased. For each performance bond adjustment the Proposer must furnish the Authority with a performance bond and/or letter of credit in accordance with Instructions to Bidders, Exhibit 2 – Insurance and Bond Requirements form confirming such adjustment based on the options exercised. The required bond amount may be reduced as follows: (1) to sixty-five percent (65%) of the bond original amount including exercised option amounts, when fifty percent (50%) of the required number of Rail Cars are delivered and accepted, (2) to thirty percent (30%) of the original amount when one hundred percent (100%) of the required number of Rail Cars are delivered and accepted, and (3) to zero percent (0%) of the original amount when the total required number of Rail Cars have been accepted and the two year guarantee period has expired as indicated in Section 16 of the General Specification at which time no further bond is required. If a separate bond or letter of credit is provided for an option, then the required percentage amount may be

reduced in accordance with the percentages and requirements specified above with respect to that separate bond or letter of credit.

The successful Bidder shall keep in force during the life of the Contract any and all insurance in the amounts designated by the Insurance and Bond Requirements (Instructions to Bidders, Exhibit 2), and as indicated in Section 11 of the General Specifications, with Insurance companies acceptable to the Authority. Any Insurance company with less than an A VII Policy Holder Rating by Alfred M. Best Company will not be acceptable to the Authority.

Item 2. INSTRUCTIONS TO BIDDERS Exhibit 2, Insurance and Bond Requirements

Delete Exhibit 2, Insurance and Bond Requirements in its entirety and replace with Addendum 17, Attachment C.

Item 3. INSTRUCTIONS TO BIDDERS IB-2, Section F, Bidder Qualifications; Basis for Responsibility Determination

Delete the first paragraph and replace with the following:

The responsive Bidder who proposes the lowest Total Lump Sum Bid Price shall provide within two (2) business days of request, information addressing the following factors bearing on the responsibility of the Bidder and its ability to comply with the terms of the Contract Documents, signed by an authorized officer.

Item 4. INSTRUCTIONS TO BIDDERS Page IB-12, V. BID SUBMISSION REQUIREMENTS

Delete Item 1. Bidder Qualifications; Basis for Responsibility Determination as described in Section F, of the Instructions to bidders signed by an authorized officer.

Item 5. GENERAL SPECIFICATIONS GS-12, Section 6, Indemnity, Sub-Section A

12, Section 6, indennity, Sub Section A

Delete the last paragraph of Sub-Section 6A and replace it with the following:

The Contractor's obligation under this Section 6 shall not apply to the extent that the injury, or death, or damages are determined by a court of competent jurisdiction to have been caused by the negligent or willful acts, errors or omissions of the Chicago Transit Authority, its officers, employees, agents or consultants.

Item 6. GENERAL SPECIFICATIONS GS-48, Section 32, Escalation, D

Delete the U.S. Department of Labor Bureau of Labor Statistics indices and replace with the following:

- Manufacturing (Series I.D. CEU 300000015)
- Computer and electronic products (Series I.D. CEU3133400015)
- Transportation equipment (Series I.D. CEU3133600015)

Item 7. GENERAL SPECIFICATIONS

Page GS-39, Section 27, Liquidated Damages, Sub-Section C

Insert the following language to the end of Sub-Section C:

These liquidated damages establish a pre-agreed measure for damages for railcar delays and excess weight in lieu of the assessment of actual damages. However, CTA reserves all other remedies provided for in the Contract, including, but not limited to, the right to refuse to approve or accept railcars that do not comply with the specifications (including weight limits), its rights under Section 28 A 1 in the event that the Contractor fails to make delivery within the time required, and 28 A2 in the event that the Contractor fails to make progress so as to endanger performance of the Contract. In addition, in the event of termination for default, CTA shall be entitled to recover all damages applicable to termination for default pursuant to Section 28.

Item 8. GENERAL SPECIFICATIONS

Page GS-12, Section 6, Indemnity

Subsection 6C of Section 6 Indemnity is changed to read as follows with the addition of the underlined language:

C. The Contractor's liability under this indemnity during this Contract <u>and Contractor's liability</u> <u>under all other remedies and damages provided to the Authority in this Contract</u> shall be limited to an amount equal to the Total Contract Price of this Contract as defined in GENERAL SECTION 2 - DEFINITION OF TERMS AS USED IN THIS SPECIFICATION, FF – Total Contract Price.

Item 9. GENERAL SPECIFICATIONS

Page GS-42, Section 28, Default

Insert the following new subsection H to Section 28, Default:

H. In no event shall the Contractor be liable to the Authority for any special, indirect incidental or consequential losses or damages, including liability for loss of investment, profit, revenue, return, use, operating time, business interruption or otherwise, resulting from, or arising out of, performance of the Work or breach of the Contract, except to the extent that:

- 1. any such damages are included in liquidated damages;
- 2. any such damages are recoverable under policies of insurance required to be carried by the Contractor hereunder;

3. any such damages arise by way of, or are based upon claims of third parties;

4. any such damages are expressly available to the Authority in the Contract;

whether such damages arise by way of, or are based upon, breach of the Contract based on breach of warranty or other breaches.

Item 10. General Specifications

Page GS-34, Section 23, C, Delivery

Delete the first sentence of 23.C and replace with the following:

The first ten (10) Cars, five married pairs, shall be delivered not later than twelve-hundred seventy five (1275) calendar days from the Notice to Proceed.

Item 11. General Specifications Page GS-35, Section 23, E, 1, Delivery

Delete 23, E, 1 and replace with the following:

1. First ten (10) Cars within twelve-hundred seventy five (1275) calendar days from Notice to Proceed.

Item 12. General Specifications Page GS-35, Section 23, E, 2, Delivery

Delete the second, third and fourth paragraphs of the section and replace with the following:

For purposes of assessing liquidated damages, the formula above shall be used to calculate delivery dates for the first one hundred (100) cars and each subsequent fifty (50) car increment (with the exception of Option 5, which will consist of two 50 car increments and one 56 car increment and Option 8 which will consist of one 50 car increment and one 40 car for purposes of assessing liquidated damages) up to the maximum number of cars manufactured. Liquidated damages will be assessed upon failure to meet each of these calculated incremental deadlines for delivery. Damages will be assessed for each Car at the per Car rate specified in Section 27 for each Car that is not delivered by the required date until each such Car is delivered and accepted.

Example for first increment of one hundred cars: Assumptions used for this example: prototypes delivered two days late and Prototype test actually took 365 days to complete.

B = (90 x 3) + (1277+365) B= 270 + 1642 B= 1912 days from NTP is the due date for the first 100 cars.

Item 13. Technical Specifications

Page DS 1-6, Section 1.12, A, Operations, Maintenance and Parts Manuals – General

Delete the last three sentences of the third paragraph and replace with the following:

The Contractor shall deliver three (3) additional printed draft copies of the Parts Manuals to the Authority for review. The draft copies shall be printed on plain paper. One (1) copy with the Authority's comments and required revisions/corrections will be returned to the Contractor within 270 days. Several review cycles may be required to reach an acceptable final revision. Upon completion of the final revision of the Parts Manual, the Contractor shall an electronic, spreadsheet based version of the manual to allow the authority to readily upload the required data and assign its lot (stock) numbers. Details on spreadsheet format and required data will be provided during Design Review. The Contractor shall then insert the lot numbers into the final printed manuals and electronic software.

Item 14. Technical Specifications Page DS 1-6, Section 1.12, A, Operations, Maintenance and Parts Manuals – General

Delete the last paragraph of the section and replace with the following:

Final copies of the Parts Manuals shall be delivered within 180 days of the Contractor receiving the final revision manual/spreadsheet with the CTA lot (stock) numbers inserted.

Item 15. Technical Specifications Page DS 1-8, Section 1.12, C, 1, Maintenance Manuals

Delete the row for Section 16 in the table and replace with the following two rows:

16	Periodic and Annual Inspection
17	Reference Documents/Special Gauges and Tools

Item 16. Technical Specifications

Page DS 1-19, Section 1.13, E, 3, Classification Training – Maintenance Training

Add the following two rows to the end of the referenced table:

Periodic Inspection	-	2 days
Annual Inspection	-	2 days

Item 17. Technical Specifications Page DS 2-5, Section 2.03, A, Weight Specification

rage D3 2-3, Section 2.05, A, Weight Specification

Delete section 2.03 A in its entirety and replace with the following:

The reference weights per car shall be as follows:

Passenger weight shall be calculated at 175 lbs per person.

Maximum Light Weight (AW0)	56,450 lbs
Nominal Seated Passenger Weight	7,200 lbs
Nominal Reference Weight with Seated Load (AW1)	63,650 lbs
Nominal Maximum Passenger Weight	23,100 lbs
Nominal Reference Weight with Maximum Load (AW3)	79,550 lbs

ltem 18.	Technical Specifications Page DS 6-8, Section 6.04, E, 2, Passenger Alerting Light and Audible Signal
	Delete the first paragraph of E, 2 and replace with the following two paragraphs:
	2. An audible signal shall be incorporated in the side door operating system. The signal shall sound simultaneously with the alerting light during the door closing cycle and as defined below for the door opening cycle. The signals shall be the same sound as on CTA's 5000 Series cars which have distinctly different sounds to differentiate the opening cycle from the closing cycle. Provisions shall be made to allow the adjustment of volume to a higher level than that of the 5000 series cars. This shall be demonstrated on the door mockup and reviewed by the Engineer.
	The audible signal for the door opening cycle shall start at the same time as the alerting light and shall continue to sound until the doors are commanded to close or for a PTU adjustable time period which shall be set initially at 18 seconds. The duration of the signal shall be adjustable from 2.5 seconds to infinite, unless agreed to by the Engineer.
ltem 19.	Technical Specifications Page DS 7-4, Section 7.01, C, 1, Air Comfort-Controls
	Delete the third sentence and replace with the following:
	A red indicator light shall be furnished, located adjacent to this switch, to indicate when the air comfort system is "ON". The light shall light in all cabs of the train regardless of master controller position.
ltem 20.	Technical Specifications Page DS 7-4, Section 7.01, C, 2, Air Comfort-Controls
	Delete the second sentence of the paragraph and replace with the following:
	The time out shall be PTU adjustable from at least thirty (30) minutes to six (6) hours and initially set for four (4) hours.
ltem 21.	Technical Specifications Page DS 9-27, Section 9.05, C, 1, b, Electrical Equipment-Operator's Control Panel
	Delete the second sentence and replace with the following:
	The indicator lights shall be activated only when the Master Controller in that cab is turned on except the indicator lights for Exterior Lights and Air Comfort which shall be lit while the Exterior Lights or Air Comfort are turned on.

Item 22. Technical Specifications

Page DS 7-3, Section 7.01, B, Air Comfort-Operating Parameters

Inside Car Mode Air Fan Cooling Heaters Temperature Comfort Speed Used Used On High Full None Full Cool Off Off Above 74°F None None None Partial None Mod. Cool On High Off Off Above 72°F None None None On High Partial Partial Reheat Cool Off Above 70°F Off None None None On Low None None Vent Above 65°F Off None None None Off Below 65°F & Above 36°F Partial Part Heat On Low None Off (Above 48°F Off None None None Outside) Below 65°F & Above 36°F On Full **Full Heat** Low None Off (Below 48°F Off None None None Outside) Full **Full Heat** On Low None Off Below 36°F Partial Layover None None

Delete the entire table and replace with the following:

Note: The parameters above are generic guidelines for operation; a more detailed control scheme shall be developed to optimize temperature uniformity and reduce short cycling/temperature oscillations.

Attachment A

Pre-Bid Meeting held at CTA Skokie Shops with Sumitomo Corporation of America (SCOA) / Nippon Sharyo on October 18, 2013, relative to Requisition C13FI101372531, Specification CTA-7000-12 for the Purchase of Rapid Transit Cars.

The following were in attendance:

Representing Chicago Transit AuthorityMaria Williams-BaxterRobert Kielba*Walter KeevilJorge Silva

John Kilstrom

Representing Sumitomo Martin Green

<u>Representing Nippon Sharyo</u> Ken Kuriyama Masaki Maeda

Tsutomu Shirai

Daniel Gornstein

*- Indicates part-time attendance.

CHICAGO TRANSIT AUTHORITY PURCHASE OF RAPID TRANSIT CARS REQUISITION C13FI101372531 Pre-Bid Meeting #8 October 18, 2013

1. Technical Specification, Page DS 2-5, Section 2.03, A, Weight Specification (SCOA-8, 10/18/13)

Sumitomo/Nippon Sharyo requested to increase the maximum light weight by 950 pounds to a total of 56,450 pounds.

CTA agreed. See Addendum17, Item 17.

2. Technical Specification, Page DS 2-6, Section 2.03, Estimated Weights (SCOA-8, 10/18/13)

Sumitomo/Nippon Sharyo submitted their revised weight of the complete car.

CTA acknowledged receipt of the weight estimate.

 Technical Specification, Page DS 9-38, Section 9.10 & 9.11, A, Printed Circuit Cards and Electronic System Testers (SCOA-8, 10/18/13)

Sumitomo/Nippon Sharyo submitted the following:

Propulsion/TCMS potential supplier Toshiba notes that their Printed Circuit Board (PCB) construction, an internationally-applied methodology in use for well over a decade, does, in fact, use a clear conformal coating. However, it is not "readily removable," as the boards use surface-mount and multi-layer technologies that are not repairable. Further, all such PC Boards have no manual adjustments (PTE adjusting only, if required), and thus no need to remove the conformal coating. Toshiba considers the PCB's to be the Lowest Level Replaceable Units (LLRU), and as such do not require repairs or manual adjustments, only replacement.

Regarding the Bench Test Equipment (BTE) described in sub-section 9.11 A.1., the TS states that the BTE shall be able to do a "...complete verification of operation and for adjustment of the cards/boards..." Toshiba's philosophy for their BTE's is that they be, effectively, electronic "Go – No-Go" gauges, capable of complete verification of the full functionality of each PCB. Again, no adjustments are needed or required for the BTE to fully test each Propulsion and TCMS PC Card/Board.

We request, on behalf of Toshiba, acceptance of PC Boards as LLRU's, with non-removable clear conformal coating including no manual adjustment requirements. Further, it is requested that the Bench Test Equipment (BTE) be understood to be capable of full and complete testing of PCB's, capable of determining that any card/board tested is either good or bad. Finally, it is requested that, if possible, BTE's be permitted to be capable of testing all PCB's provided by an individual supplier; in this case, that Toshiba proposes to provide a BTE to test the Propulsion and TCMS system PC Cards/Boards.

CTA advised that:

- a) CTA agrees that most conformal coating is not "readily removable". However, it is CTA's intent to have the capability to do some repair of these "un-repairable" circuit boards and CTA will use whatever method is needed to remove the coating to repair the board. In some cases, these complex, multi-layer boards still have components on them that may be tested and replaced by CTA.
- b) Adjustment of boards is not necessary on the BTE if the sub-suppliers' boards are designed without adjustable components or components that require some method of calibration.
- c) CTA requires that the bench test equipment allow CTA to verify full functionality of the boards and identify defects. In addition, full and complete documentation such as parts breakdowns, board schematics operational and functional descriptions with logic charts, voltages, signal types, signal paths and descriptions, etc., as well as inputs and outputs must be provided to allow CTA to further manually troubleshoot the boards and replace components on the board if found to be defective.
- d) CTA requires that each sub-system have its own BTE. CTA will have personnel working on Propulsion boards and TCMS boards simultaneously so a single BTE for both is not acceptable. For pricing purposes Bidders must consider these as separate BTEs.

4. <u>Technical Specification, Page DS 17-3, Section 17.02, Replacement Units and Special Tools-Units and</u> <u>Quantities (SCOA-8, 10/18/13)</u>

Sumitomo/Nippon Sharyo submitted the following:

Three clarifications are requested:

- a) In Item 24, use of the term "Auxiliary Power Supply Systems" is not clear. Does CTA intend this to include the APS, LVPS and BC and their enclosure(s), or solely the APS and the system enclosure?
- b) It is our thought that Item 25 is intending to describe the high voltage modules related to power conversion (Front End Conditioning Modules, if used, and Phase Modules) within the APS only, and, should the design include an Intermediate Voltage Power Supply (IVPS), those similar high voltage, high power modules also. Is this understanding correct?
- c) For Items 27 and 28, does CTA expect to receive enclosures with these Items?

CTA advised:

a) Item 24, Auxiliary Power Supply System, is inclusive of all elements including all electronic modules or assemblies such as Auxiliary Inverter, Intermediate Voltage Power Supply, Low Voltage Power Supply, Battery Charger, Input Power Conditioning, Dead Battery Start and all contactors, relays, transformers, inductors, capacitors, wire harnesses and cables, terminal boards and connectors, cable glands, fans, insulating plates or separators, etc. and all enclosures with all covers so that the assembled systems are complete and ready to install on a car and the kits include all parts and can be assembled into complete, ready to install units.

- b) The understanding is correct. Item 25 includes the input power conditioning module(s), phase modules and intermediate voltage power supply module (if used) with any associated high voltage, high power modules.
- c) For Items 27 and 28, unless separate enclosures are part of the Low Voltage Power Supply and Battery Charger, they are not expected to be included. The shipping protection that is part of each module must be included.

If the foregoing does not agree with your understanding of the items discussed, contact Maria Williams-Baxter, Sr. Procurement Administrator as soon as possible.

Attachment B

Written Questions Submitted from Potential Bidders and CTA's Responses

1. <u>Bid Proposal, Page P-23, CERTIFICATIONS AND SUBMISSION FORMS, and Page P-24, Bidder's Signature</u> Page

Ansaldobreda submitting the following:

We understand that the two above mentioned documents are the only ones that must bear a notary's stamp. Please, confirm or advise differently.

CTA RESPONSE:

CTA confirms that Bid Proposal P-23, Disclosure of Ownership and Bid Proposal P-24, Bidder's Signature Page are the two documents which are required to be notarized in the Bid Proposal.

2. General Specifications, Page GS-48, Escalation Clause for Options, Sub-Section D

Ansaldobreda submitting the following:

In the site <u>www.bls.gov</u> we could find the material indices tables to be used for the adjustment to the Total Option Price (that is to say the Durable manufacturing Series I.D. wpusop2130 and the Capital equipment Series I.D. wpusop3200) but we were not able to find the labor indices tables (that is to say the Manufacturing Series I.D. eeu30000033, the Electronic and electrical equipment Series I.D. eeu3133400033 and the transportation equipment Series I.D. eeu3133600033). Please advise.

CTA RESPONSE:

See Addendum 17, Item 6.

3. Instructions to Bidders, Page IB-11, Section T, Performance Bond and/or Letter of Credit and Insurance

Ansaldobreda submitting the following:

The above mentioned paragraph states that the successful Bidder shall furnish a Performance Bond and/or letter of credit in the amount of twenty-five percent (25%) of the Base contract price within 10 working days after written notice of award is issued and that such performance bond will be adjusted appropriately whenever any subsequent Option is exercised, to decrease to 65% when 50% of the required number of rail cars are delivered and accepted, to 30% when 75% of the required number of rail cars are delivered and to 0% when 100% of the rails cars are delivered and accepted. This will result in having a unique bond in place for a very long period, well beyond the usual tenor currently accepted by the financial institutions that are, therefore, usually not allowed to commit themselves on such a long tenor.

Please confirm that, in lieu of extending the Base buy initial bond, Performance Bonds of the subsequent Options can be covered by a separate, independent bond for each one of them, to be issued within 10 working days from notice of award of each option until acceptance of rail cars of such option.

CTA RESPONSE:

See Addendum 17, Item 1. CTA confirms that separate performance bonds and/or letters of credit are acceptable.

4. Instructions to Bidders, Exhibit 2 Insurance and Bond Requirements, Part IV Section B & Form of Performance Bond

Ansaldobreda submitting the following:

- a) Exhibit 2, Instructions to Bidders, part IV sect. B states that the Performance bond must cover the Warranty period required by the Contract. Please confirm that the Warranty period to be covered by the bond is considered to be the 2 year general guarantee on all other parts of the car as per item 2 Sect. 16, A of General Specification. This provision, if approved, should be specified in the Bid Documents.
- b) The form of performance bond contained in the Instructions to Bidders results to be unacceptable to the Surety Industry because of some clauses and terms that would limit the Surety action in case they are called to cure a Contractor's default. We are hereby enclosing a revised bond form for which we are requesting your approval.

CTA RESPONSE:

- a) See Addendum 17, Item 1. CTA confirms the warranty period for the two year general guarantee period as indicated in Section 16 of the General Specifications.
- b) CTA determined the language stands as is. CTA has reviewed the bonding requirements of other major transit agencies and has concluded that the provided form is consistent with what other major U.S. transit agencies are requiring.
- 5. <u>Technical Specifications, Page DS-2, Section 2.03, Weight and Certified Weight Slips, A. Weight</u> <u>Specification</u>

Bombardier submitting the following:

Please revise the AW0 car weight as follows:

Maximum Light Weight (AW0) 56,300 lbs

An increase of 800 lbs results from converting the existing CTA seat installation to an esthetic cantilevered design as required by the Technical Specifications and in the arrangement defined by CTA Drawing SKE-1-06112013, Addendum 11, Attachment A – Drawing DR-1A.

CTA RESPONSE:

See Addendum17, Item 17.

6. <u>General Specifications, Page GS-35, Section 23, Delivery, Sub-Section E,2</u>

Bombardier submitting the following:

As currently written, paragraph E of Section 23 would require the Contractor to deliver one (1) Car every three (3) days (N x 3) throughout the entire contract, including for the first vehicles delivered. As is common in our industry, carbuilders typically ramp-up production over the first couple of months prior to achieving their contractual beat rate for the rest of the project. As such and to be consistent with industry production methods, the Bidder respectfully submits that paragraph E of Section 23 be amended so that for the first forty (40) Cars of the Base Order, the delivery rate be one (1) Car every six (6) days.

CTA RESPONSE:

See Addendum 17, Item 12.

7. Instructions to Bidders, Exhibit 2 Insurance and Bond Requirements, Page 4, Insurance Certificate of Coverage

Bombardier submitting the following:

Pursuant to the Insurance Certificate provided in the IFB, the Certificate issuer shall, in the event of cancellation, non-renewal or material change involving the indicated policies, provide at least sixty (60) days prior *written notice* of such change to CTA.

- a) The Bidder respectfully suggests to change the delay to provide prior written notice to thirty (30) days prior to the change.
- b) Since insurers generally will not agree to provide prior notice of non-renewal or material change, the Bidder also respectfully suggests to delete the reference to non-renewal or material change to the policy.

CTA RESPONSE:

- a) See Addendum 17, Item 2. This has been revised.
- b) CTA determined the language stands as is.
- 8. Instructions to Bidders, Exhibit 2 Insurance and Bond Requirements, Page 4, Insurance Certificate of Coverage

Bombardier submitting the following:

Pursuant to the Insurance Certificate provided in the IFB, the Commercial General Liability policy must be written on the ISO Occurrence Form CG 00 01 12 04 (or a substitute form providing equivalent coverage). Can CTA please confirm that they accept CG 00 01 12 07 as being "a substitute form providing equivalent coverage"?

CTA RESPONSE:

CTA confirms that the proposed substitute is acceptable.

9. Instructions to Bidders, Page IB-11, Section T, Performance Bond and/or Letter of Credit and Insurance & Instructions to Bidders, Exhibit 2 Insurance and Bond Requirements Part IV

Bombardier submitting the following:

The second paragraph of section T of the Instructions to Bidders specifies that the performance bond shall remain in full force until all Rail Cars to be furnished have been accepted. On the other hand, paragraph B of part IV of the Insurance and Bond requirements specifies that the bond must cover the warranty period covered by the Contract. In order to avoid confusion as to the expiry of the performance bond, the Bidder respectfully suggests that the last sentence of paragraph B of part IV of the Insurance and Bond Requirements be removed, in order to confirm that the bond shall be reduced as established in section T of the Instructions to Bidders.

CTA RESPONSE:

See Addendum 17, Items 1 and 2. The bond must cover the two year warranty period.

10. Instructions to Bidders, Exhibit 2 Insurance and Bond Requirements, Page, 3, Part IV, Sub-Section B

Bombardier submitting the following:

Pursuant to paragraph B of part IV of the Insurance and Bond Requirements, the surety must have underwriting limitation in excess of the Contract Price. Usually, sureties are required to have limits to cover the bonds that they write (which is, in this case, 25% of the Base Contract Price). The requirement to have underwriting limitation in excess of the Contract Price usually appears only for bonds of 100% of the Contract Price, which is not the case here. The Bidder respectfully suggests to amend the language contained in paragraph B of part IV of the Insurance and Bond Requirements from "in excess of the Contract Price" to "in excess of the bond amount".

CTA RESPONSE:

See Addendum 17, Item 2. The requirement is changed from "in excess of the Contract Price" to "in excess of the bond amount."

11. Instructions to Bidders, Page IB-11, Section T, Performance Bond and/or Letter of Credit and Insurance

Bombardier submitting the following:

Section T of the Instructions to Bidders require the successful Bidder to furnish a Performance Bond or a Letter of Credit in the value of 25% of the Total Contract Price to CTA within ten working days after written notice of award. The Bidder respectfully submits that a different Performance Bond or Letter of Credit should be issued for the base order and for each options exercised by CTA. This would allow the reduction mechanism described in the second paragraph of Section T to apply for each order and would also cover the risk incurred by CTA for each order independently, which will result in an overall cost decrease for CTA.

- a) Can CTA please confirm that a different performance bond can be issued for the base order and each exercised option.
- b) If yes, that the reduction mechanism described in the second paragraph of Section T will apply to each of these bonds individually?

CTA RESPONSE:

- a) Yes. See Addendum 17, Item 1.
- b) The reduction mechanism is explained in Addendum 17, Item 1.
- 12. General Specifications, Page GS-11, Section 6, Indemnity, Sub-Section A

Kawasaki submitting the following:

In the 8th line, please insert the word "negligent" before "acts" to clarify that only negligent acts of the Contractor fall within the indemnity clause.

CTA RESPONSE:

CTA determined the original language stands as is.

13. General Specifications, Page GS-39, Section 27, Liquidated Damages, Sub-Section C

Kawasaki submitting the following:

Section 27 and Sub-Section C in particular should be amended to confirm that liquidated damages are the Authority's exclusive remedies for delay and excess weight.

CTA RESPONSE:

See Addendum 17, Item 7.

14. General Specifications, Page GS-41, Section 28, Default, Sub-Section B

Kawasaki submitting the following:

While it is recognized that the Authority will have the right to re-procure at the Contractor's expense in the event of termination for default of the Contractor, the total liability to the Contractor should be limited to the value of the Contract.

Further, the Bidder requires that a suitable limitation of liability clause be added to the Contract to limit the Contractor's total liability under the Contract to the value of the Contract.

Lastly, with respect to consequential damages, the Bidder requests that the following clause be added to the Contract:

"In no event shall either party be liable to the other party whether in contract, warranty, tort (including negligence or strict liability) or otherwise for any special, indirect, incidental or consequential losses or damages of any kind or nature."

CTA RESPONSE:

- a) See Addendum 17, Item 8. The existing language in Subsection 6C limiting indemnification to the Total Contract Price has been expanded to cover all contractual remedies and damages.
- b) See Addendum 17, Item 9. A new subsection H regarding indirect damages has been added to Section 28, Default.

15. General Specifications, Page GS-32, Section 21, Changes, Sub-Section D.1

Kawasaki submitting the following:

The Bidder requests that 14 days to submit a written notice of Claim should be changed to 30 days as a minimum.

CTA RESPONSE:

The requirement has been revised. See Addendum 16, Item 3.

16. Instructions to Bidders, Page IB-9, Section J, Public Opening of Bids

Sumitomo submitting the following:

We do not wish for everything contained in our Bid Submission to be made public, at the bid opening or at any later date during an FOIA request.

- What portions of Bidders' submissions do you intend to make public and which will you not?
- If CTA's intention is to make the entire bid submission open to the public, can we mark parts of our submission "Confidential" or otherwise keep it from public viewing?
- More broadly, what is CTA's procedure for keeping confidential information and/or trade secrets out of the public realm?

CTA RESPONSE:

Per Instructions to Bidders, Section J, all Bid content will be made available for public review at the time of the Bid Opening. All Bid content will also be subject to public disclosure after the contract is executed in connection with this procurement if requested under the Illinois Freedom of Information Act (FOIA).

See Addendum 17, Items 3 and 4 for changes in the Basis of Responsibility Determination and Bid Submission requirements. The Basis of Responsibility will be made subsequent to the Bid Opening. To the extent that the content of any items provided by a Bidder pursuant to Instructions to Bidders, Section J, <u>subsequent to the Bid Opening</u> contain privileged, proprietary or confidential trade secret, commercial or financial information that would cause competitive harm to a Bidder if publicly disclosed, a Bidder must identify and mark the privileged, proprietary or confidential information at the time that the items are submitted to CTA. CTA can only withhold from public disclosure the specific

Page 18 of 21

information that is privileged, proprietary or confidential or that is otherwise exempt from public disclosure under FOIA. All other information must be publicly disclosed. Therefore, Bidder markings indicating that an entire item or a large portion of an item are privileged, proprietary or confidential may not be honored by CTA.

17. Instructions to Bidders, Page IB-11, Section T, Performance Bond And/Or Letter of Credit and Insurance

Sumitomo submitting the following:

Section T includes a minimum policyholder rating requirement for any insurance company issuing a Performance Bond. Does CTA have any comparable minimum rating criteria for any bank issuing a Letter of Credit?

CTA RESPONSE:

See Addendum 17, Item 1 & Item 2, Attachment C – Part IV, Performance Bond Requirements/Letter of Credit, Part D. Any Letter of Credit with less than a Moody's P2, S&P A2, or Fitch F2 rating will not be acceptable to the Authority.

18. General Specifications, Page GS-12, Section 6, Indemnity, Sub-Section A

Sumitomo submitting the following:

The limit on Contractor's liability should not only be for negligent acts "solely" of CTA. As written, if Contractor is partly to blame and the CTA is partly to blame, Contractor will have sole liability. Please strike the word "solely."

In addition, please change "negligent" to "negligent or willful." We believe these changes are fair and in accordance with industry standards.

CTA RESPONSE:

See Addendum 17, Item 5.

19. Instructions to Bidders, Exhibit 2 – Insurance and Bond Requirements, Form of Performance Bond, Part 1. General Instructions and Requirements, A. Ways to Comply with CTA Insurance Requirements

Sumitomo submitting the following:

- a. The CTA certificate form (included in Exhibit 2) is non-standard. In our experience such certificates are not accepted for use by insurance companies. In addition, the CTA certificate includes a requirement for 60-day notice of cancelation be provided directly to CTA. The insurance industry no longer allows this type of provision.
- b. We request to substitute the Acord standard form insurance certificate. The last paragraph of Section A, as revised, reads "...that CTA reserves the right to request a copy of the policy after reasonable notice." Our insurance policies, which cover much more than a specific project, are confidential corporate documents, and therefore we do not provide copies of these policies to anyone.

As an alternative we propose the certificates of insurance together with copies of relevant endorsements.

We request CTA review and consideration of these reasonable changes.

CTA RESPONSE:

- a) See Addendum 17, Item 2. The Acord standard is acceptable and the notice of cancellation has been revised.
- b) The CTA reserves the right to request a copy of the policy after reasonable notice, if needed, for any claims or litigation pertaining to the contract.
- 20. Instructions to Bidders, Exhibit 2 Insurance and Bond Requirements, Page 2, Part III Insurance Coverages

Sumitomo submitting the following:

We – as well as our insurance providers – are unfamiliar with Independent Contractors' Protective Liability coverage.

We request CTA provide further explanation and/or a sample policy endorsement.

CTA RESPONSE:

See Addendum 17, Attachment D.

21. Instructions to Bidders, Page IB-11, Section T, Performance Bond And/Or Letter of Credit and Insurance

Sumitomo submitting the following:

According to the surety company the maximum duration of a bond available in this industry is five (5) years; longer duration bonds are not generally available. We request that CTA consider an adjusted process whereby:

- A. A new bond is issued for each exercised Option, and
- B. Each bond (for Base Contract and each exercised Option) is reduced separately according to CTA's schedule.

We propose the following modifications to the second paragraph of Section T (new text is underlined): The required bond amount <u>(for Base Contract and each exercised Option separately)</u> may be reduced as follows: (1) to sixty-five percent (65%) of the bond original amount <u>including exercised option amounts</u>, when fifty percent (50%) of the required number of Rail Cars <u>in each order (either in Base Contract or each exercised Option)</u> are delivered and accepted, (2) to thirty percent (30%) of the original amount when seventy-five percent (75%) of the required number of Rail Cars <u>in each order (either in Base Contract or each exercised Option)</u> are delivered and accepted, and (3) to zero percent (0%) of the original amount when one hundred percent (100%) of the required number of Rail <u>Cars in each order (either in Base Contract or each exercised Option)</u> are delivered and accepted. The performance bond <u>for each</u> <u>order</u> shall remain in full force and effect until the total number of Rail Cars to be furnished under the
Requisition No. C13FI101372531 Addendum 17

<u>corresponding Base</u> Contract <u>or exercised Option</u> has been accepted, at which time no further bond is required.

Failure to provide a bond for an exercised Option shall not be considered as an event of default for the existing bonds (Base Contract or exercised Option (s)).

CTA RESPONSE:

See revisions in Addendum 17, Item 1.

22. Instructions to Bidders, Page IB-11, Section T, Performance Bond And/Or Letter of Credit and Insurance

Sumitomo submitting the following:

Would CTA please confirm that no performance bond is required to be maintained during the warranty period (as defined in Section 16 of the General Specification)?

CTA RESPONSE:

The bond is required during the two year warranty. See Addendum 17, Items 1 & 2.

23. General Specifications, Page GS-35, Section 23, Delivery, Paragraph C

Sumitomo submitting the following:

We respectfully request that the time limit for delivery of the first ten Cars be extended to "not later than one thousand three hundred sixty-five (1,365) calendar days from the Notice to Proceed."

Production cars would follow in accordance with the remaining provisions of this section (no other changes required or requested).

CTA RESPONSE:

See Addendum 17, Item 11.

CHICAGO TRANSIT AUTHORITY **INSURANCE AND BOND REQUIREMENTS**

[Short Form rev. 11/13/09]

ADDENDUM 17 ATTACHMENT C 5 PAGES

REQUISITION NUMBER: C13FI101372531 SPECIFICATION NUMBER CTA: CTA 7000-12

PART I. **GENERAL INSTRUCTIONS AND REQUIREMENTS**

Α. WAYS TO COMPLY WITH CTA INSURANCE REQUIREMENTS.

1. HOW TO COMPLY IF CGL, AUTOMOBILE LIABILITY, OWNERS PROTECTIVE LIABILITY, BUILDER'S RISK INSURANCE, CONTRACTORS POLLUTION LIABILITY, WORKERS COMPENSATION AND/OR PROFESSIONAL LIABILITYARE REQUIRED BY PART III OF THIS DOCUMENT.

Contractors must provide the CTA with the following documents:

- a) CTA Certificate of Coverage on the CTA approved form. The CTA Certificate of Coverage may be completed only by an authorized representative of the insurance company, an agent, broker, or underwriter. Certificates of Insurance must disclose all deductibles and/or self insured retentions.
- b) CTA will accept the Standard Acord Certificate including all endorsements pertaining to the policy.

If a CTA Certificate of Coverage or Standard Acord Certificate is provided, the CTA reserves the right to request a copy of the policy after reasonable notice, if needed. Failure to provide the policy after reasonable notice, is a material breach of the Contract which may result in default and, if uncured, termination for default.

Β. DEADLINE FOR INITIAL SUBMITTAL OF CONTRACTOR'S INSURANCE AND BOND DOCUMENTS.

The Contractor must furnish all required insurance and performance and payment bond documents within fourteen days of the date that the Contractor receives a letter (the "Insurance Submittal Letter") from the CTA's General Manager of Purchasing requesting the Contractor to submit the documents required by these Insurance and Bond Requirements. CTA will not execute the Contract until the required insurance and bond documents are delivered to CTA and approved by CTA. Failure to deliver the required documents within fourteen days of receipt of the Insurance Submittal Letter is a material failure to comply with the specifications and may result in any or all of the following at the CTA's sole discretion:

- 1. debarment or suspension, and
- 2. determination of Contractor non-responsibility.

C. CTA ADDRESS.

All notices and documents must be mailed to the CTA at:

Chicago Transit Authority Manager of Insurance Controls, Risk Compliance 567 W. Lake St. Chicago, IL 60661

D. OBLIGATION TO MAINTAIN CONTINUOUS COMPLIANCE

1. The Contractor expressly agrees that failure to comply and maintain compliance with all insurance and bond requirements shall constitute a material breach of the Contract which may result in default and, if uncured, termination for default under the contract. In addition, such failure, if uncured, may result in debarment and suspension.

2. The Contractor is prohibited from performing any work if Contractor has allowed any of the required insurance policies to expire.

PART II. INSURANCE REQUIREMENTS

- A. The CTA must be named as an Additional Insured and Certificate Holder on all policies except Workers Compensation and Professional Liability. When the CTA is an additional insured, the coverage shall be primary.
- **B.** The Commercial General Liability and Owners Protective Liability, General Aggregate Limit of Liability, if any, must apply on a per occurrence basis.
- C. All insurance carriers must be acceptable to the CTA. All insurance companies shall have at least an A VII POLICY HOLDER RATING, or better, by the A.M. Best Co., Inc. Insurance companies with lower ratings will not be accepted. Carriers licensed to do business in the State of Illinois must issue all insurance, with the exception of Railroad Protective.
- **D.** To the extent permitted by the Contractor's insurance policies required by the CTA, the Contractor and its insurers waive all rights of subrogation against the CTA.
- E. The insurance to be carried shall in no way be subject to limitations, if any, expressed in the indemnity section of the General Conditions (or any statutory, judicial or common law limitations).

PART III. INSURANCE COVERAGES

A. WORKERS COMPENSATION

- Coverage A: In form and in accordance with the laws of the State of Illinois.
- Coverage B: Employers Liability:
- **\$1,000,000** Bodily Injury by Accident
- \$1,000,000 Bodily Injury by Disease, Policy Limit
- B. COMPREHENSIVE OR COMMERCIAL GENERAL LIABILITY:
- \$2,000,000 General Aggregate
- \$2,000,000 Products/Completed Operations Aggregate
- \$1,000,000 Personal Injury and Advertising Injury
- \$1,000,000 Per Occurrence

The Commercial General Liability policy shall include, without limitation: (i) Broad Form Contractual Liability, (ii) Products/Completed Operations to be maintained in full force and effect for a period of five (5) years following final completion of the work under the Contract, (iii) Independent Contractors' Protective Liability, (iv) Premises/Operations, including deletion of explosion, collapse and underground (XCU) exclusions, (v) Broad Form Property Damage, including Products/Completed Operations, (vi) Bodily Injury and Personal Injury Liability, with employee and contractual exclusions deleted, (vii) Severability of Interest and Cross Liability endorsement and (viii) Contractor expressly agrees to waive, and will require its insurer to waive, its rights, benefits and entitlement under the "Other Insurance" clause of its Commercial General Liability policy, with respect to the CTA.

C. AUTOMOBILE LIABILITY

\$1,000,000	Combined Single Limit (Bodily Injury and Property Damage)
N/A	Uninsured/Underinsured Motorist Including Owned, Non- Owned, Hired and Borrowed Vehicles and Equipment

D. UMBRELLA LIABILITY

\$10,000,000 Each occurrence and in the aggregate, excess of the underlying policies.

The Umbrella Liability Policy shall specifically identify each of the policies described in A, B, and C above on the Schedule of Underlying Coverages, and shall provide coverage at least as broad as each of the underlying policies.

- E. PROPERTY LIABILITY REPLACEMENT VALUE
- F. CARGO LIABILITY/INLAND MARINE \$25,000,000 OCC/AGG
- G. PROFESSIONAL LIABILITY \$2,000,000 PER CLAIM
- H. OTHER INSURANCE: CTA NAMED ADDITIONAL INSURED ON THE GENERAL LIABILITY POLICY.

PART IV PERFORMANCE BOND REQUIREMENTS/LETTER OF CREDIT

- A. The Contractor may furnish separate Performance Bonds and/or Letter of Credits or the existing bond and/or letter of credit can be increased.
- B. The surety or sureties issuing the bond must be acceptable to the Authority and must have a Best's Key Rating Guide of A VII or greater and be listed in the most recently published "Listing of Approved Sureties" of the U.S. Department of the Treasury Circular 570, with underwriting limitations in excess of the Bond Amount. The bond must cover the 2 year warranty period required by the Contract.
- C. The Performance Bond shall be for faithful performance of the Contract.
- D. Any Letter of Credit with less than a Moody's P2, S&P A2, or Fitch F2 rating will not be accepted.
- E. The Authority reserves the right to require additional security under this Contract if any surety upon any bond furnished with this Contract becomes unacceptable to the Authority.

PART V. PERFORMANCE BONDS REQUIRED FOR THIS CONTRACT.

Parent Company Guarantee Performance Bond and/or Letter of Credit: REQUIRED



Issue Date: _

INSURANCE CERTIFICATE OF COVERAGE

	RFP#:			
•			Project #:	
(NUMBER & STREE	T)			
(CITY) (STATE)	(ZIP)			
Description of Operation/Location				
The insurance policies and endorsements operation described within the contract in non-renewal or material change involving Authority at the address shown on this Ce insured, and it is mutually understood that	s indicated below have been issued volving the named insured and the the indicated policies, the issuer w ertificate. This certificate is issued to the Chicago Transit Authority relie	to the designated named ins Chicago Transit Authority. Ti ill provide at least thirty (30) c o the Chicago Transit Author is on this certificate as a basis	ured with the policy limits a he Certificate issuer agrees lays prior written notice of s ity in consideration of the co s for continuing such agree	s set forth herein covering the that in the event of cancellation, uch change to the Chicago Tran ontract entered into with the nam ment with the named insured.
Type of insurance	Insurer Name	Policy Number	Policy Period	Limits of Liability All Limits in Thousand
Commercial General Liability Occurrence Claims made Premise-Operations Explosion/Collapse Underground Products/Completed Operations Blanket Contractual Broad Form Property Damage Independent Contractors Personal Injury				Each Occurrence <u>\$</u> General Aggregate <u>\$</u> Products/Completed Operations Aggregate <u>\$</u> <u>Deductible and/or</u> Self logured Ratention
Commercial General Liability Form #: CG 00 01				<u>\$</u>
Automobile Liability (Any Auto)				Each Occurrence \$
Excess Liability Umbrella Liability				Each Occurrence \$
Workers' Compensation and Employer's Liability				WC \$ Employers Liability \$_
Builders' Risk/Course of Construction				Amount of Contract \$
Professional Liability				\$
Owner Contractors Protective				\$
			1	

The General, Automobile and Excess/Umbrella Liability Policies described provide for separation of insureds applicable to the named insured and the CTA. b)

General Liability, Auto Liability, Workers Compensation and Property insurers shall waive all rights of subrogation against the Chicago Transit Authority. c)

d) The General Liability policies, including excess and umbrella will insure all liabilities assumed under the provisions of the Hold Harmless and Indemnity Clause contained in the Contract and not exclude any construction and/or demolition work performed within 50 feet of railroad track. Commercial General Liability must be written on the ISO Occurrence Form CG 00 01 12 04 (or a substitute form providing equivalent coverage) and include the following endorsement: Contractual Liability Railroads ISO Form CG 24 17 10 01 (or a substitute form providing equivalent coverage). The Contractor shall be responsible for arranging that all subcontractors maintain the necessary insurance requirements.

e) The receipt of this certificate by the CTA does not constitute agreement by the CTA that the insurance requirements in the contract have been fully met, or that the insurance companies indicated by this certificate are in compliance with all contract requirements.

Name and Address of Certificate Holder and Receipt of Notice	Signature of Authorized Representative
Certificate Holder/Additional Insured Chicago Transit Authority Dept. of Risk Management 567 W Lake St. Chicago, IL 60661	Agent/Company Address

This endorsement, effective at 12:01 AM

forms a part of

Policy number

Issued to:

By:

INDEPENDENT CONTRACTOR ENDORSEMENT

This endorsement amends the SPL Coverage Section.

In consideration of the premium charged, it is hereby understood and agreed that in **SPL Coverage Section** of the policy, paragraph (d), the definition of **"Insured**" is amended to include the following at the end thereof:

"Insured" also means any natural-person independent contractor, but only while acting on behalf of, or at the direction of, a **Company**.

ALL OTHER TERMS, CONDITIONS AND EXCLUSIONS REMAIN UNCHANGED.

[°] Chartis Inc. All rights reserved

AUTHORIZED REPRESENTATIVE

105386 (4/10)

ADDENDUM 17 ATTACHMENT D



567 West Lake Street Chicago, Illinois 60661-1498 TEL 312 664-7200 www.transitchicago.com

October 17, 2013

Subject:

Requisition No. C13FI101372531 - IFB to Purchase Rapid Transit Cars Specification CTA 7000-12

Re: Addendum 16

All Potential Bidders:

Enclosed please find Addendum 16. This Addendum revises the Instructions to Bidders and Bid Proposal of the IFB. Insert this Addendum 16 into the Contract Documents of the subject requisition and consider it part of the official Contract Documents.

Included with Addendum 16 are the following two (2) attachments:

Attachment A – Written Question Submitted from Potential Bidders and CTA's Responses Attachment B – U.S. Employment Information Form (New)

Questions previously received in writing formally will be formally responded to by subsequent addendum.

Addendum 16 shall be acknowledged as received by identification of Addendum 16 on the IFB – Bid Proposal Exhibit 2 – Bidder's Signature Page, to be submitted with the Bid Proposal. Failure to acknowledge receipt of Addendum 16 or any addenda with your Bid Proposal shall render the Bid Proposal as non-responsive.

The Chicago Transit Authority is seeking bids for the subject procurement. Bid packages are to be delivered to:

By Mail, In Person Drop Off or Delivery Service

Chicago Transit Authority Bid Office - 2nd Floor 567 W. Lake Street Chicago, IL 60661-1498

Bid Due Date (Bid Opening): Wednesday, December 18, 2013, no later than 11:00 A.M. Chicago time

Each Bidder bears full responsibility for delivery to the Bid Office before the advertised date and hour for the opening of Bids. Bidders are solely responsible for ensuring that its Bid is received by the Authority in a timely manner prior to the date and time of Bid Opening. If mail or delivery is delayed beyond the date and hour set for the Bid Opening, Bids delayed will not be considered and will be returned unopened. Bid Office hours are Monday through Friday from 8:00 am to 4:30 pm Chicago time, except holidays.

If you have any questions, please contact Maria Williams-Baxter, Sr. Procurement Administrator <u>mwilliams@transitchicago.com</u> or 312-681-2437.

Sincerely,

<u>ellen McCormack</u>

Ellen MćCormack, Vice President, Purchasing

Requisition No. C13FI101372531 Addendum 16

Item 1. U. S. EMPLOYMENT INFORMATION FORM

Submit Addendum 16, Attachment B – U.S. Employment Information Form with the Bid Proposal.

Item 2. GENERAL SPECIFICATIONS

Page GS-6, Section 2, DEFINITION OF TERMS AS USED IN THIS SPECIFICAITON

Insert new definition: JJ. "Days", "days" or "DAYS" means calendar days unless provision specifies working days.

Item 3. GENERAL SPECIFICATIONS Page GS-32, Section 21, CHANGES

Delete the forth sentence of subsection D.1 and replace with the following:

The Contractor shall deliver written notice of such Claim to the Engineer and the General Manager, Purchasing within 30 days of oral notice.

Item 4. GENERAL SPECIFICATIONS Page GS-37, Section 25, Risk of Loss

Delete Section 25, paragraphs A and B and replace with the following:

- A. Except for loss or damage determined to be caused directly and solely by the Authority, any risk of loss or damage to the Rail Car or to any part thereof prior to issuance of the Certificate of Acceptance of Vehicle-or thereafter while in the possession of the Contractor or under the Contractor's control is assumed and shall be borne by the Contractor, and any such loss or damage shall be made good by the Contractor at its own cost, and the performance of the Contract shall be carried forward by the Contractor in accordance with the Contract Documents without additional cost to the Authority by reason of such loss or damage.
- B. With the exception of the risk allocated to the Contractor in 25A, risk of loss of all Rail Cars except the prototype Rail Cars shall pass to the Authority upon issuance of the Certificate of Acceptance of Vehicle.

Item 5. GENERAL SPECIFICATIONS

GS-51, Section 34, General Government Requirements, Sub-Section B

Delete the Sub-Section B in its entirety and replace with the following:

B. The Contractor agrees to comply with all federal "Buy America" requirements applicable to this Contract as set forth in 49 U.S.C. §5323(j) and 49 CFR Parts 661-663. For rolling stock, the cost of Components produced in the U.S. must be at least sixty percent (60%), and one hundred percent (100%) of final assembly must occur in the U.S.

In addition to the pre-award and post-delivery audits required by 49 U.S.C. 5323(m) and 49 CFR Part 663 to verify compliance, the Contractor agrees to interim audits to be conducted by the Authority, subject to reasonable notice to the Contractor.

Requisition No. C13FI101372531 Addendum 16

Item 6. GENERAL SPECIFICATIONS Page GS-22, Section 16, Guarantees, B.7

Delete the first sentence of paragraph 7 and replace with the following:

Following the expiration of the two year full warranty in Section 16.A.2 of these General Specifications, the traction motors shall be further guaranteed to be reliable for an additional period of two (2) years.

Requisition No. C13FI101372531 Addendum 16 - Attachment A

Written Questions Submitted from Potential Bidders and CTA's Responses

1. <u>Technical Specifications, Page DS-3-5, Section 3, Carbody, 3.01.M Esthetic Design – Exterior and Interior</u>

Bombardier submitting the following:

Pursuant to paragraph M of section 3.01 of the Technical Specifications, Bidders have to submit at least three concepts of exterior and interior renderings for approval by CTA during the pre-bid phase. CTA will then select one exterior and one interior rendering per Bidder and the Bidder will have to bid using such renderings as its cost basis. The Bidder seeks confirmation from CTA that in the event CTA elects to modify the interior and exterior renderings from the ones pre-selected by CTA during the bid process, then such changes shall be subject to the Changes provision of General Specifications Section 21.

CTA RESPONSE:

This provision was reissued in Addendum 11, Item 5.

2. <u>Bid Proposal, Page P-4, Section C, Method of Payment, Sub-Section 2 – Progress Payment Milestones (b.</u> Options)

Bombardier submitting the following:

Pursuant to paragraph b of the "Progress Payment Milestones" section of the Bid Proposal, the only progress payment milestone to be paid to the Contractor before the start of production will be 4.0% of the price for review and acceptance of the detailed production schedule. Since there is no guarantee of continuity in production between the base order and each of the options, the Contractor may have to stop its assembly line and restart it once an option is exercised. This situation would have a major cost impact on the Contractor and would result in an increased price in the Bidder's proposal. Therefore, the Bidder respectfully submits to CTA an alternate language for the payment milestones associated with the options, which would help the Contractor bear the costs of the reassembly of its production line. Please consider the revision proposed to the option payment milestones in order to allow the Bidder to provide its most aggressive option price:

b. Options:

Mil	lestone	Payment
1)	Review and acceptance, in accordance with Section 13 of the General Specifications, of the detailed production	
	schedules for the Rail Cars.	4-0 <u>6.0</u> %
<u>2)</u>	Issuance of Major Purchase Orders for the options.*	<u>11%</u>
<u>3)</u>	Completion of the preparation of the assembly line.	<u>11%</u>
<u>4</u> 2)	Delivery of a II spare units and PTU's required for Options as defined in Section 17 of the Technical Specifications.	3.0%

* "Major Purchase Orders" shall be defined as the purchase orders for the following systems: HVAC, brakes, lighting, communications, door operators, and couplers.

3. Production, Acceptance and Final Payments

(...)

<u>c. Production Payment — Options</u> — Upon start of final assembly of each Car, the Authority will pay for each Car an amount equal to forty four <u>thirty</u> two percent (44<u>32</u>%) of the Total Option Price per Car.

<u>d. Acceptance Payment — Options</u> — Upon acceptance of e ach two-car set of Cars, the Authority will pay for each Car an amount equal to forty five thirty three percent (4533%) of the Total Option Price per Car.

e. Final Payments — The balance of payments due under the Contract (4% of the Total C ontract Price) shall be payable upon completion of any modifications required at the acceptance of the last Car and receipt of all required deliverables.

CTA RESPONSE:

CTA determined the language stands as is.

3. <u>General Specifications, Page GS-8, Section 3, General Obligations of the Contractor, Sub-Section H</u> Kawasaki submitting the following:

"It shall be specifically understood that the omission of any drawing or schedule, or reference thereto, or of any part or item from any drawing or schedule, or from these Contract Documents, which is required to make the Work furnished by a subcontractor or the Contractor fully complete and suitable for successful performance of the specified functions in accordance with the requirements of the Contract Documents shall not relieve said subcontractor or the Contractor from furnishing the required items or parts under the Contract Documents."

Omissions from the Contract Documents cannot be estimated by the Bidder and should therefore be removed from this clause.

CTA RESPONSE:

CTA does not agree with the deletion and has determined the original language stands as is. The drawings and other items supplied in the Technical Specification and other Contract Documents by CTA are not purported to be complete. The contractor is fully responsible for making the actual designs and drawings and supplying parts and systems that perform the intended functions and are complete in all details as well as being specification compliant.

4. <u>General Specifications, Page GS-10, Section 3, General Obligations of the Contractor, Sub-Section M</u>

Kawasaki submitting the following:

The Bidder will use its best efforts and as part of its fixed price proposal to work with the Authority following contract award to provide a plan that will achieve a reasonable level of interoperability between existing CTA cars and the 7000 Series cars, however, without having the detailed interface data, the

Bidder is unable to provide assurance that full interoperability can be accomplished within the available budget established by the Bidder.

CTA RESPONSE:

The Bidder must ensure that the requirement of Subsection M, Section 3 of the General Specifications is met: "...successful operation of the Cars in train with existing Authority equipment". There is no requirement to provide "full interoperability". It must be understood that all the subsystems that will allow the train to operate and pick up passengers must be functional in the mixed consist train. This includes and is not limited to propulsion, braking, passenger communications/signs, HVAC, lighting and doors. CTA understands that all subsystems may not be fully interoperable in all aspects, however they must perform their basic duties in service.

5. General Specifications, Page GS-15, Section 10, Access to Work and Records, Sub-Section B

Kawasaki submitting the following:

This clause should be revised so that inspection of records is limited to records pertaining to Changed Work as all other records associated with the original fixed price portion of the Contract should not be subject to such inspections.

CTA RESPONSE:

CTA determined the original language stands as is. FTA requires inclusion of an access to records provision. That requirement is not limited to Changed Work.

6. General Specifications, Page GS-37, Section 25, Risk of Loss, Sub-Sections A.B. and C

Kawasaki submitting the following:

In order to better define the point in time at which risk of loss passes to the Authority, please revise this clause to read as follows:

A. Except for loss or damage determined to be caused directly and solely by the Authority, any risk of loss or damage to the Rail Car or to any part thereof prior to release for revenue service or thereafter while in the possession of the Contractor or under the Contractor's <u>control issuance of the Certificate of Acceptance of Vehicle</u> is assumed and shall be borne by the Contractor, and any such loss or damage shall be made good by the Contractor at its own cost, and the performance of the Contract shall be carried forward by the Contractor in accordance with the Contract Documents without additional cost to the Authority by reason of such loss or damage.

B. Risk of loss of all Rail Cars except the prototype Rail Cars shall pass to Authority upon the Authority's acceptance and release of Rail Cars for revenue service issuance of the Certificate of Acceptance of Vehicle.

C. Risk of loss of prototype Rail Cars shall pass to the Authority upon the Authority's release of Rail Cars for prototype Car revenue service or delivery of Rail Cars to the Authority's Maintenance Training Center in accordance with the Contract Documents whichever occurs first.

CTA RESPONSE:

Paragraph A - See Addendum 16, Item 4.

Paragraph B - See Addendum 16, Item 4.

Paragraph C - CTA determined the language stands as is.

7. General Specifications, Page GS-38, Section 26, Availability of Funding, D

Kawasaki submitting the following:

"If for some reason beyond the control of the Authority, IDOT, RTA or FTA, the funds are not on hand when progress payment milestones or delivery payments are due, the invoices will be held until funds are available and no late payment charges or other penalties shall be added to the amount d ue."

In such cases, the Bidder will require interest on late payments at the prevailing rates.

CTA RESPONSE:

CTA determined the original language stands as is.

8. General Specifications, Page GS-45, Section 30, Title to Property, Sub-Section J.3

Kawasaki submitting the following:

"Manuals or instructional materials, detailed manufacturing or process data, and commercial computer software documentation prepared or required to be delivered under this Contract or any subcontract necessary for installation, operation, maintenance or training purposes, including those specified in Section 1.12, of the Technical Specifications."

Detailed manufacturing or process data prepared by the Contract or its Subcontractors are oft en based on sensitive background data and therefore, rights to that knowhow cannot be transferred to the Authority.

With respect to "Limited Rights", we agree that the Authority should have Limited Rights in all Technical data created for delivery to the Authority for the project (foreground data), however, Section 30.J.1. also implies that Limited Rights in detailed proprietary design data "prepared" now or in the past (background data) shall belong to the Authority. Unless the clause is modified accordingly, one could argue that the CTA has Limited Rights in all of the technologies that have evolved over time to arrive at the existing state of the art in car design, propulsion, brakes, train control and every other subsystem. We therefore respectfully request the Authority to modify the clause as suggested.

CTA RESPONSE:

CTA determined the original language stands as is. The purpose of this section is to ensure CTA has all the necessary documentation needed to repair, maintain, and overhaul the Cars.

9. General Specifications, Page GS-51, Section 34, General Government Requirements, Sub-Section B

Kawasaki submitting the following:

Section 34 relating to Buy America cites the usual 60% component and final assembly requirement applicable to rolling stock. However it then goes on to say that for "all other deliverables" there is a 100% standard. It should be clarified that there are no other deliverables or if there are the parties should understand what they are agreeing to in terms of BA requirements.

CTA RESPONSE:

See Addendum 16, Item 5.

10. General Specifications, Page GS-42, Section 29, Disputes

Kawasaki submitting the following:

Section 29 allows the Authority's representative to determine Disputes, and any appeal to court would be based on an "arbitrary or capricious standard" which is an impossible burden for a contractor. It would be far preferable to have independent dispute resolution or to say that any judicial review is de novo, meaning that it does not give deference to the Authority's determination but rather that the court reviews independently of any prior agency process.

CTA RESPONSE:

CTA determined the language stands as is.

11. General Specifications, Page GS-43, Section 30, Title to Property

Kawasaki submitting the following:

Title should pass to the Authority only when payment has been made to the Contractor in full.

CTA RESPONSE:

CTA determined the original language stands as is. This contract includes progress payments. FTA Circular 4220.1F requires transfer of title as the progress payments are made.

12. General Specifications, Page GS-37, Section 25, Risk of Loss, Sub-Section A

Sumitomo submitting the following:

The limit on Contractor's risk of loss should not only be for loss or damage caused "solely" by CTA. As written, if Contractor is partly to blame and the CTA is partly to blame, Contractor will have sole responsibility. Please strike the word "solely."

We believe this change is fair and in accordance with industry standards.

CTA RESPONSE:

See Addendum 16, Item 4.

Requisition No. C13FI101372531 Addendum 16 - Attachment A

13. General Specifications, Page GS-22, Section 16, Guarantees, B.7

Sumitomo submitting the following:

In the first sentence of paragraph 7 we believe the word "warrant" should be "warranty."

CTA RESPONSE:

See Addendum 16, Item 6.

14. Instructions to Bidders, Exhibit 2 – Insurance and Bond Requirements, Page 2 of 4, Form of Performance Bond

Sumitomo submitting the following:

Section T of the Instructions to Bidders (Page IB-11) notes that an AIA bond form will be required for any bond adjustment, however the performance bond form presented in Exhibit 2 differs from this. One consequence of the current language is that it restricts the Surety's options for remedying a claim regardless of the possible existence of more favorable options.

We request to remove this paragraph and replace it with standard surety bond wording, as follows:

"Whenever Contractor shall be, and declared by the Authority to be, in default under the Contract, the Authority having performed Authority's obligations thereunder, the Surety may promptly remedy the default, or shall promptly:

- 1. Complete the Contract in accordance with its terms and conditions, or
- 2. Obtain a bid or bids for completing the Contract in accordance with its terms and conditions, and upon determination by Surety of the lowest responsible bidder, or, if the Authority elects, upon determination by the Authority and the Surety jointly of the lowest responsible bidder, arrange for a contract between such bidder and Authority, and make available as work progresses (even though there should be a default or a succession of defaults under the contract or contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the contract price; not exceeding, including other costs and damages for which the Surety may be liable hereunder, the amount set forth in the first paragraph hereof. The term "balance of the contract price," as used in this paragraph, shall mean the total amount payable by the Authority to Contractor."

CTA RESPONSE:

CTA determined the original language stands as is. CTA has reviewed the bonding requirements of other major transit agencies and has concluded that the provided form is consistent with what other major U.S. transit agencies are requiring.

15. Instructions to Bidders, Exhibit 2 – Insurance and Bond Requirements, Page 2, Part II Insurance Requirements, Section E

Sumitomo submitting the following:

Section E: "The insurance to be carried <u>shall in no way be subject to limitations</u>, if any, expressed in the indemnity section of the General Conditions (or any statutory, judicial or common law limitations)."

Requisition No. C13FI101372531 Addendum 16 - Attachment A

All insurance policies have limitations and exclusions.

Please explain CTA's intent regarding the inclusion of this language.

CTA RESPONSE:

CTA determined the language stands as is. CTA understands that insurance policies have limitations and exclusions. This provision only provides that the insurance shall not be limited by Section 6, pages GS-11 and GS-12, of the General Specifications.

16. Instructions to Bidders, Exhibit 2 – Insurance and Bond Requirements, Page 3, Part III Insurance Coverages

Sumitomo submitting the following:

Part H: "PROFESSIONAL LIABILITY, \$2,000,000 PER CLAIM"

In our experience, Professional Liability insurance is a common requirement for Design-Build construction projects and other instances where such professional services are being contracted for directly by the Authority. However we have participated in many railcar supply contracts where such coverage has not been required.

We believe this requirement adds unnecessary cost to the project, putting upward pressure on the price that can be offered to CTA.

Sumitomo respectfully requests that the requirement for Professional Liability coverage be removed.

CTA RESPONSE:

CTA determined the original language stands as is.

The purpose of this U.S. Employment Information Form is to capture relevant information about the number, quality and access to U.S. jobs created or retained by the Bidder in the furtherance of the Work. Bidders are encouraged to respond to all of the following Information Prompts below for the base order portion of the Contract, to the best of the Bidder's ability at the time of Bid. While CTA strongly encourages the voluntary completion of the U.S. Employment Information Form, failure to complete the form will not preclude Bidders from participating in the Bid.

Any and all questions pertaining to the U.S. Employment Information Form should be directed to Maria Williams-Baxter, Sr. Procurement Administrator at <u>mwilliams@transitchicago.com</u> or 312-681-2437. Please note that no other entity has the authority to speak on behalf of the CTA concerning this procurement, including this U.S. Employment Information Form.

All capitalized terms in this U.S. Employment Information Form shall have the meanings described below in the section entitled Definitions. The Definitions capitalized below are to be used solely for the purpose of completing the U.S. Employment Information Form.

If necessary, use additional sheets to respond to the following Information Prompts.

Information Prompts:

1. Outreach and Recruitment Plans for New U.S. Hires: Describe plans for the Recruitment and hiring of New U.S. Hires and Disadvantaged Workers (if any) for new positions, including coordination with nonprofit and/or governmental organizations to assist in the Recruitment of New Hires (if any).

2. Workforce Training Plans: Describe Workforce Training designed to create permanent, transferable skills for all U.S. Hires for the Work by job category, if any. Include in this description any plans to take advantage of publicly funded workforce development Programs or union apprenticeship Programs for the relevant job categories. List applicable transferrable credentialing opportunities that will be provided to any or all U.S. Hires for the Work and plans for coordinating with workforce development, apprenticeship and training programs to deliver that training, if any.

3. **Description of U.S. Jobs Created and/or Retained**: Describe the number, quality and range of U.S. employment opportunities for both skilled and nonskilled workers proposed to be created for the Work, minimum requirements for the positions, and include the extent to which the plan is likely to produce long-term employment in skilled or trade labor for Disadvantaged Workers. This should include a description of the opportunities for ongoing promotion, if any, for New Hires and Incumbent Workers in entry level and/or semiskilled positions.

4. **Compensation and Benefits:** Describe base compensation provided to all U.S. Hires. Also describe eligibility requirements for and employer contributions to be made to employee benefits for U.S. Hires, partners and dependents; including out-of-pocket costs for medical and dental coverage, retirement benefits, paid vacation and paid sick leave, if any.

5. **Commitment to U.S. Production Site**: Identify the specific U.S. location or locations—by U.S. zip code-- of the Final Assembly and/or Manufacture of the Vehicles.

Definitions:

As used in this U.S. Employment Information Form, the following capitalized terms will have the following meanings. All definitions include both the singular and plural form.

AREA OF CONCENTRATED POVERTY means a U.S. Census tract that qualifies as a HUD designated Qualified Census Tract (QCT) in which 50 percent of all households have incomes less than 60 percent of the area median income (AMI) – OR – the poverty rate in the tract is 25 percent or more.¹ To determine an employee's eligibility, enter the employee's home address or census tract within HUD's QCT mapping application: <u>http://www.huduser.org/QCT2013/qctmap.html</u>.

BID means a submission to the Agency in response to and as described in this IFB, required in order to be eligible for award of a Contract.

BIDDER means an entity that submits a Bid and that would serve as the Contractor if awarded the Contract.

CONTRACT means the agreement and all attachments and exhibits related to the purchase by the Agency of the Vehicles, as awarded pursuant to the procedures and requirements set forth in this IFB and other Agency contract award guidelines.

DISABILITY means, with respect to an individual, a physical or mental impairment that substantially limits one or more life activities of such individual.

VETERAN means any person, who served honorably on active duty in the armed forces of the **United** States.

DISABLED WORKER refers to a person who has a type of Disability that is targeted for emphasis in affirmative action planning for federal employment by the Office of Personnel Management (See, <u>http://www.opm.gov/diversityandinclusion/reports/disability/DisabilityReportFY11_07-24-12.pdf</u>) and who has documentation of her/his Disability from a licensed medical professional (e.g., a physician or other medical professional certified by a state, the District of Columbia, or a U.S. territory to practice medicine); a licensed vocational rehabilitation specialist (i.e., state or private); or any Federal Agency, state Agency, or Agency of the District of Columbia or a U.S. territory that issues or provides disability benefits. Targeted disabilities include deafness, blindness, missing extremities, partial paralysis, complete paralysis, convulsive disorders, intellectual disabilities, mental illness, genetic or physical condition affecting limbs and/or spine.

¹ For more on Qualified Census Tracts, see: HUD User, "HUD Designates Low-Income Housing Tax Credit Qualified Census Tracts for 2013," <u>http://www.huduser.org/portal/pdredge/pdr_edge_research_042412.html</u>.

DISADVANTAGED WORKER means an individual who (a) prior to commencing work for the Work, has a household income of less than 50 percent of the Area Median Income (AMI) as defined by the U.S. Department of Housing and Urban Development. See: <u>http://www.huduser.org/portal/datasets/il.html</u> and, (b) faces at least one of the following four (4) barriers to employment:

a. Being a Disabled Worker,

b. Being a current recipient of Supplemental Nutrition Assistance Program (SNAP) benefits or Temporary Assistance for Needy Families (TANF) benefits because of extreme poverty, ;

c. Being a Veteran;

d. Being an individual who resides in an Area of Concentrated Poverty. (To determine an employee's eligibility for this status, enter the employee's home address or census tract within HUD's QCT mapping application: <u>http://www.huduser.org/QCT2013/qctmap.html</u>.)

FINAL ASSEMBLY means in the case of the production of a new rail car –the Installation and interconnection of car bodies or shells, propulsion control equipment, propulsion cooling equipment, brake equipment, energy sources for auxiliaries and controls, heating and air conditioning, communications equipment, pneumatic and electrical systems, door systems, passenger seats, passenger interiors, destination signs, wheelchair lifts, motors, wheels, axles, and gear units, suspensions, frames, and chassis; the inspection and verification of all installation and interconnection work; and the in-plant testing of the stationary product to verify all functions.

FTA means the United States Federal Transit Administration.

HIRES means the natural persons to be employed by Contractor and all Subcontractors to produce the Vehicles.

HUD means the United States Department of Housing and Urban Development.

INCUMBENT WORKERS means Bidders' current employees who will be employed solely to perform work in furtherance of the Contract.

MANUFACTURING OR MANUFACTURE means all activities relating to the engineering and design and production of the component parts of the Vehicles in the United States <u>except for</u> the Final Assembly of the Vehicles.

NEW HIRES means new employees whose first day of employment will be on or after the date the Contract begins, and who will be employed solely to perform work in furtherance of the Contract.

PROJECT means performance of the base order portion of the Contract.

RECRUITMENT means the process of finding candidates, reviewing applicant credentials, screening potential employees, and selecting employees for an organization.

WORKFORCE TRAINING means all activities related to the provision of skills, knowledge and capacity to U.S. Hires working on the Contract.

END OF U.S. EMPLOYMENT INFORMATION FORM

CHICAGO TRANSIT AUTHORITY



567 West Lake Street Chicago, Illinois 60661-1498 TEL 312 664-7200 www.transitchicago.com

October 2, 2013

Subject: Requisition No. C13FI101372531 - IFB to Purchase Rapid Transit Cars Specification CTA 7000-12

Re: Addendum 15

All Potential Bidders:

Enclosed please find Addendum 15. This Addendum updates the Technical Specifications of the IFB. Insert this Addendum 15 into the Contract Documents of the subject requisition and consider it part of the official Contract Documents.

Included with Addendum 15 are the following five (5) attachments:

Attachment A – Kawasaki Rail Car, Inc., Pre-Bid meeting Minutes and Attendance List (KRC-7)

Attachment B – AnsaldoBreda, Pre-Bid meeting Minutes and Attendance List (AB-3)

Attachment C – Sumitomo Corporation of America, Pre-Bid Meeting Minutes & Attendance List (SCOA-7)

Attachment D – Correction Bombardier Transit Corporation, Pre-Bid Meeting Minutes (BTC-1)

Attachment E – Accepted Subcontractors List

Questions previously received in writing formally will be formally responded to by subsequent addendum.

Addendum 15 shall be acknowledged as received by identification of Addendum 15 on the IFB – Bid Proposal Exhibit 2 – Bidder's Signature Page, to be submitted with the Bid Proposal. Failure to acknowledge receipt of Addendum 15 or any addenda with your Bid Proposal shall render the Bid Proposal as non-responsive.

The Chicago Transit Authority is seeking bids for the subject procurement. Bid packages are to be delivered to:

By Mail, In Person Drop Off or Delivery Service

Chicago Transit Authority Bid Office - 2nd Floor 567 W. Lake Street Chicago, IL 60661-1498

Bid Due Date (Bid Opening): Wednesday, December 18, 2013, no later than 11:00 A.M. Chicago time

Each Bidder bears full responsibility for delivery to the Bid Office before the advertised date and hour for the opening of Bids. Bidders are solely responsible for ensuring that its Bid is received by the Authority in a timely manner prior to the date and time of Bid Opening. If mail or delivery is delayed beyond the date and hour set for the Bid Opening, Bids delayed will not be considered and will be returned unopened. Bid Office hours are Monday through Friday from 8:00 am to 4:30 pm Chicago time, except holidays.

If you have any questions, please contact Maria Williams-Baxter, Sr. Procurement Administrator <u>mwilliams@transitchicago.com</u> or 312-681-2437.

Sincerely,

Ellen McCormack, Vice President, Purchasing

Requisition No. C13FI101372531 Addendum 15 - Attachment A

Pre-Bid Meeting held at CTA Skokie Shops with Kawasaki Rail Car (KRC) on September 17, 2013 and September 23, 2013 relative to Requisition C13FI101372531, Specification CTA-7000-12 for the Purchase of Rapid Transit Cars.

The following were in attendance:

Representing Chicago Transit Authority Maria Williams-Baxter(by phone on 9/23) Fred Lonnes Dawid Skarzynski* Jorge Silva*

Robert Kielba Eric Mattson John Kilstrom Klaudiusz Kruszecki* Walter Keevil* Grant Macey*

Representing Kawasaki Rail Car Tomonori Umebayashi*

Chuck Wochele*

Shozo Ito*

Representing Toyo Denki Bob Kish*

*- Indicates part-time attendance.

CHICAGO TRANSIT AUTHORITY PURCHASE OF RAPID TRANSIT CARS REQUISITION C13FI101372531 Pre-Bid Meeting #7 September 17 & 23, 2013

1. Technical Specification, Page DS 2-6, Section 2.03, Estimated Weights (KRC-7, 9/17 & 9/23/13)

Kawasaki submitted their estimated weight of the complete car.

CTA acknowledged receipt of the weight estimate.

Technical Specification, Page DS 3-5, Section 3.01, Esthetic Design – Exterior and Interior (KRC-7, 9/17 & 9/23/13)

Kawasaki presented their three exterior and interior esthetic design renderings for review.

CTA acknowledged receipt of the renderings and provided comments for development of the renderings to be presented with the Bid.

3. <u>Technical Specifications, Page DS 10-5, Section 10.02, B, 6, Characteristic Curves and Simulations (KRC-7, 9/17 & 9/23/13)</u>

Toyo Denki presented their propulsion curves and simulations.

CTA acknowledged receipt of the corrected curves and simulations.

4. Technical Specifications, Page DS 10-10, Section 10.03, F, 2, b, Filter Capacitors (KRC-7, 9/17 & 9/23/13)

Kawasaki/Mitsubishi presented their filter charging curves.

CTA acknowledged receipt of the filter charging curves.

5. Technical Specifications, Page DS 10-10, Section 10.03, F, 2, b, Filter Capacitors (KRC-7, 9/17 & 9/23/13)

Kawasaki/Toyo Denki presented their filter charging curves.

CTA acknowledged receipt of the filter charging curves.

If the foregoing does not agree with your understanding of the items discussed, contact Maria Williams-Baxter, Sr. Procurement Administrator as soon as possible.

Requisition No. C13FI101372531 Addendum 15 - Attachment B

Pre-Bid Meeting held at CTA Skokie Shops with Ansaldo Breda (AB) on September 18, 2013, relative to Requisition C13FI101372531, Specification CTA-7000-12 for the Purchase of Rapid Transit Cars.

The following were in attendance:

Representing Chicago Transi	t Authority	
Maria Williams-Baxter	Walter Keevil	Robert Kielba
John Kilstrom	Klaudiusz Kruszecki	Eric Mattson
Fred Lonnes	Dawid Skarzynski	

Representing Andaldo Breda Bruno Tasselli

Luca Iurato

Paolo Pezza

*- Indicates part-time attendance.

CHICAGO TRANSIT AUTHORITY PURCHASE OF RAPID TRANSIT CARS REQUISITION C13FI101372531 Pre-Bid Meeting #3 September 18, 2013

1. Technical Specification, Page DS 2-6, Section 2.03, Estimated Weights (AB-3, 9/18/13)

Ansaldo Breda submitted their estimated weight of the complete car.

CTA acknowledged receipt of the weight estimate.

2. Technical Specification, Page DS 3-5, Section 3.01, Esthetic Design – Exterior and Interior (AB-3, 9/18/13)

Ansaldo Breda presented their three exterior and interior esthetic design renderings for review.

CTA acknowledged receipt of the renderings and provided comments for development of the renderings to be presented with the Bid.

If the foregoing does not agree with your understanding of the items discussed, contact Maria Williams-Baxter, Sr. Procurement Administrator as soon as possible.

Requisition No. C13FI101372531 Addendum 15 - Attachment C

Pre-Bid Meeting held at CTA Skokie Shops with Sumitomo Corporation of America (SCOA) / Nippon Sharyo on September 23, 2013, relative to Requisition C13FI101372531, Specification CTA-7000-12 for the Purchase of Rapid Transit Cars.

The following were in attendance:

Representing Chicago Transit Autho	ority
Maria Williams-Baxter	Robert Kielba
Klaudiusz Kruszecki	Fred Lonnes

John Kilstrom Dawid Skarzynski

Representing Sumitomo Martin Green

<u>Representing Nippon Sharyo</u> Ken Kuriyama Satoshi Suzuki

Tsutomu Shirai

Daniel Gornstein

*- Indicated part-time attendance.

CHICAGO TRANSIT AUTHORITY PURCHASE OF RAPID TRANSIT CARS REQUISITION C13FI101372531 Pre-Bid Meeting #7 September 23, 2013

1. Technical Specification, Page DS 2-6, Section 2.03, Estimated Weights (SCOA-7, 9/23/13)

Sumitomo/Nippon Sharyo submitted their estimated weight of the complete car.

CTA acknowledged receipt of the weight estimate.

 Technical Specification, Page DS 3-5, Section 3.01, Esthetic Design – Exterior and Interior (SCOA-7, 9/23/13)

Sumitomo/Nippon Sharyo presented their three exterior and interior esthetic design renderings for review.

CTA acknowledged receipt of the renderings and provided comments to further assist with development of the renderings to be presented with the Bid.

If the foregoing does not agree with your understanding of the items discussed, contact Maria Williams-Baxter, Sr. Procurement Administrator as soon as possible.

REQUISITION C13FI101372531 Addendum 15 - Attachment D

CORRECTION to Addendum 5 – Attachment A

Pre-Bid Meeting held at CTA Skokie Shops with Bombardier Transit Corporation (BTC) on April 11 & 12, 2013, relative to Requisition C13FI101372531, Specification CTA-7000-12 for the Purchase of Rapid Transit Cars.

The following item was omitted:

26. Page DS 10-10, Section 10.03, F, 2, b, Filter Capacitors (BTC-1, 4/11 - 4/12/13)

Bombardier presented their filter charging curves.

CTA acknowledged receipt of the filter charging curves.

If the foregoing does not agree with your understanding of the items discussed, contact Maria Williams-Baxter, Sr. Procurement Administrator as soon as possible.

Requisition No. C13FI101372531 Addendum 15 – Attachment E

Technical Specifications 1.16 SUBCONTRACTOR IDENTIFICATION AND EVALUATION

The following subcontractors have been proposed by prospective Bidders and evaluated by the Authority in accordance with Pre-Bid Procedures, Section G, Instructions to Bidders:

			Accepted Subcontractors
1.	Side, end, and operator's cab doors	KRC-1	Vapor Stone Rail Syst ems
		KRC-2	Kawasaki
		SCOA-4	Faiveley
-			
2.	Side door operator, control system and upper tracks	KRC-1	Vapor Stone Rail Systems
		KRC-5	Fuiji Electric Corp.*
		SCOA-4	Faiveley *
3.	Window sash	BTC-2	NASG
		BTC-3	DURA
		KRC-4	Dynamic Metals
		KRC-4	Faiveley
		KRC-6	Kawasaki
4.	Floor panels	BTC-4	Milwaukee Composites
		AB-1	Baultar
		BTC-5	Haysite Reinforced Plastics
		BTC-5	SpaceAge Synthetics, Inc.
5.	Passenger and operator seats	KRC-2	Kustom Seating Unlimited, Inc.
		BTC-4	Seats Inc. (cab seat only)
		BTC-5	Freedman

6.	Carbody shell	BTC-1	Bombardier
		KRC-2	Kawasaki
		SCOA-1	Nippon Sharyo/Sumitomo
		AB-1	AnsaldoBreda
7.	No. 1 end coupler system and No. 2 end drawbar system	BTC-1	Wabtec
8.	All light fixtures, interior and exterior	KRC-1	TDG Transit Design Group
		BTC-4	LECIP, Inc
		BTC-2	Luminator
-		AB-2	Trans-Lite
9.	All cab control, switch, and indicator panels	BTC-2	Bombardier
		KRC-1	Vapor Stone Rail Systems
		AB-2	AnsaldoBreda
		KRC-5	Kawasaki
		SCOA-5	Nippon Sharyo/Sumitomo
10.	Undercar air comfort package	BTC-3	Liebherr
		BTC-3	Merak (Knorr)
		BTC-4	Mitsubishi Electric
		BTC-4	ThermoKing *
		AB-1	Sigma (Knorr)
		KRC-4	Faiveley

11 .	Air comfort control system	BTC-3	Liebherr
		BTC-3	Merak (Knorr)*
		BTC-3	Bombardier*
		BTC-4	Mitsubishi Electric *
		BTC-4	ThermoKing *
		AB-1	Sigma (Knorr)
		KRC-4	Faiveley*
12.	Auxiliary Power Supply System	BTC-2	PCS Power Converter Solutions
		BTC-3	Turbo Power Systems
		BTC-4	ABB*
		AB-1	AnsaldoBreda
		SCOA-3	Transtechnik
		KRC-4	Sepsa
		BTC-5	Mitsubishi Electric *
		SCOA-5	Faiveley
13.	Battery	BTC-2	SAFT
		BTC-3	Hoppecke
14.	Horn	BTC-2	Federal Signal
		KRC-3	TOA*
15.	Propulsion System	BTC-1	Bombardier
		SCOA-1	Toshiba
		AB-1	AnsaldoBreda
		KRC-4	Mitsubishi Electric
		KRC-6	ABB
		KRC-6	Toyo Denki*
		Page 11 of 14	

16.	Friction brake system	BTC-1	Wabtec
		KRC-2	Knorr Brake Corp.
17.	Track brakes	BTC-1	Hanning & Kahl
		KRC-2	Knorr Brake Corp.
		SCOA-2	Wabtec/Tec Tran
18.	Trucks	BTC-1	Bombardier
		KRC-2	Siemens
		AB-1	AnsaidoBreda*
		SCOA-2	Nippon Sharyo/Sumitomo
		KRC-5	Kawasaki
19.	Active suspension system	BTC-2	Liebherr
		KRC-2	Knorr Brake Corp.
20.	ATC/ATO System	BTC-2	PHW
		BTC-4	Ansaldo STS, USA
21.	Unit and Train Network and Diagnostics System	BTC-1	Bombardier
		SCOA-1	Toshiba
		AB-1	AnsaidoBreda
		KRC-3	Quester Tangent
		KRC-3	ISC Applied Systems
		KRC-4	Mitsubishi Electric Corp.

22.	Car Communications System	BTC-2	Luminator (Electronic Signs only)
		BTC-2	Axion
		BTC-4	Mitsubishi Electric
		AB-1	ISC Applied Systems
		KRC-5	Sepsa
		KRC-4	Woojin Ind. Sys. Co. Ltd.
		KRC-5	TOA Communication System
23.	Video System	AB-1	ISC Applied Systems
		KRC-3	Sepsa
		KRC-4	Woojin Ind. Sys. Co. Ltd.
		KRC-5	TOA Communication System
		BTC-5	Mitsubishi Electric
		BTC-4	Axion
		BTC-4	Axion
24.	Event recorder	BTC-4 BTC-1	Axion Bach Simpson
24.	Event recorder	BTC-4 BTC-1 KRC-3	Axion Bach Simpson Quester Tangent
24.	Event recorder	BTC-4 BTC-1 KRC-3 KRC-3	Axion Bach Simpson Quester Tangent Sepsa
24.	Event recorder	BTC-4 BTC-1 KRC-3 KRC-3 KRC-4	Axion Bach Simpson Quester Tangent Sepsa Saira/Far Americas
24.	Event recorder	BTC-4 BTC-1 KRC-3 KRC-3 KRC-4	Axion Bach Simpson Quester Tangent Sepsa Saira/Far Americas
24.	Event recorder CBT Training	BTC-4 BTC-1 KRC-3 KRC-3 KRC-4 BTC-1	Axion Bach Simpson Quester Tangent Sepsa Saira/Far Americas XPan
24.	Event recorder CBT Training	BTC-4 BTC-1 KRC-3 KRC-3 KRC-4 BTC-1 SCOA-3	Axion Bach Simpson Quester Tangent Sepsa Saira/Far Americas XPan JTM Concepts, Inc.
24.	Event recorder CBT Training	BTC-4 BTC-1 KRC-3 KRC-3 KRC-4 BTC-1 SCOA-3 KRC-5	Axion Bach Simpson Quester Tangent Sepsa Saira/Far Americas XPan JTM Concepts, Inc. Pennant Information Services
24.	Event recorder CBT Training	BTC-4 BTC-1 KRC-3 KRC-3 KRC-4 BTC-1 SCOA-3 KRC-5 KRC-5	Axion Bach Simpson Quester Tangent Sepsa Saira/Far Americas XPan JTM Concepts, Inc. Pennant Information Services D & R Technical Solutions
26.	Automatic Passenger Counter		
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BTC-1	Bombardier*
BTC-3	Infodev
AB-1	ISC Applied Systems
KRC-4	Dilax Systems, Inc.
KRC-6	Acorel

*Accepted but there were concerns/reservations noted.

CHICAGO TRANSIT AUTHORITY Advertisement for Professional Services

NOTICE OF TIME EXTENSION WITH ADDENDUM No.14

Notice is hereby given that the proposed due date heretofore advertised as Wednesday, October 23, 2013 has been extended to Wednesday, December 18, 2013 no later than 11:00 A.M. in the Bid Office - 2nd Floor, 567 W. Lake, Chicago, Illinois 60661-1498 for the following item:

Req. C13FI101372531 Rapid Transit Cars.

Bid Deposit: \$500,000.00

For additional information, please contact Maria Williams-Baxter, Sr. Procurement Administrator, at 312/681-2437.

Any contract resulting from this bid is subject to a financial assistance between the Chicago Transit Authority, the United States Department of Transportation and the Regional Transportation Authority.

Contractor will be required to comply with all applicable Equal Employment Opportunity laws and regulations and affirmative action requirements of the Federal Transit Administration and Illinois Human Rights Commission.

All bidders will be required to certify that they are not on the Comptroller General's list of ineligible contractors.

The contractor will be required to furnish certified copies of any and all Insurance Policies required in relation to this contract prior to CTA's execution.

Any contract resulting from this advertisement will be awarded to the lowest responsive and responsible bidder.

Chicago Transit Authority hereby notifies all bidders that it will affirmatively ensure that in regard to any contract entered into pursuant to this advertisement, Disadvantaged Business Enterprise will be afforded full opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color or national origin in consideration for an award.

PLEASE NOTE: When bids are sent by mail, delivery service or delivered in-person to the CTA Bid Office, the bidders shall be responsible for their delivery only to the Bid Office before the

advertised date and hour for the opening of the bids. The Bid Office hours are Monday through Friday from 8:00 a.m. to 4:30 p.m. Chicago time, except holidays.

The right is reserved to accept any bid or any part or parts thereof or to reject any and all bids.

All inquiries should be directed to and copies of bid documents obtained from the Bid Office - 2^{nd} Floor, 567 W. Lake Street, Chicago, Illinois 60661-1498.

CHICAGO TRANSIT AUTHORITY

By: Ellen McCormack Vice President, Purchasing

September 23, 2013





567 West Lake Street Chicago, Illinois 60661-1498 TEL 312 664-7200 www.transitchicago.com

September 20, 2013

Subject: Requisition No. C13FI101372531 - IFB to Purchase Rapid Transit Cars Specification CTA 7000-12

Re: Notice of Time Extension & Addendum 14

All Potential Bidders:

The Bid Due Date for the subject requisition has been extended from October 23 to December 18, 2013.

Enclosed please find Addendum 14. This Addendum updates the Technical Specifications of the IFB. Insert this Addendum 14 into the Contract Documents of the subject requisition and consider it part of the official Contract Documents.

Included with Addendum 14 is the following one (1) attachment:

Attachment A - Technical Specifications Section 13 - Automatic Train Control (Replacement)

Questions previously received in writing formally will be formally responded to by subsequent addendum.

Addendum 14 shall be acknowledged as received by identification of Addendum 14 on the IFB – Bid Proposal Exhibit 2 – Bidder's Signature Page, to be submitted with the Bid Proposal. Failure to acknowledge receipt of Addendum 14 or any addenda with your Bid Proposal shall render the Bid Proposal as non-responsive.

The Chicago Transit Authority is seeking bids for the subject procurement. Bid packages are to be delivered to:

By Mail, In Person Drop Off or Delivery Service

Chicago Transit Authority Bid Office - 2nd Floor 567 W. Lake Street Chicago, IL 60661-1498

Previous Bid Due Date (Bid Opening): Wednesday, October 23, 2013

New Bid Due Date (Bid Opening): Wednesday, December 18, 2013, no later than 11:00 A.M. Chicago time

Each Bidder bears full responsibility for delivery to the Bid Office before the advertised date and hour for the opening of Bids. Bidders are solely responsible for ensuring that its Bid is received by the Authority in a timely manner prior to the date and time of Bid Opening. If mail or delivery is delayed beyond the date and hour set for the Bid Opening, Bids delayed will not be considered and will be returned unopened. Bid Office hours are Monday through Friday from 8:00 am to 4:30 pm Chicago time, except holidays.

If you have any questions, please contact Maria Williams-Baxter, Sr. Procurement Administrator <u>mwilliams@transitchicago.com</u> or 312-681-2437.

Sincerely a Cormorel

Ellen McCormack, Vice President, Purchasing

Requisition No. C13FI101372531 Addendum 14

Item 1. TECHNICAL SPECIFICATIONS Page DS 9-45, Section 9.16, B, 13, Event Recorder Inputs

Delete the existing Section 9.16, B, 13 and replace it with the following:

13. Cab signal inputs from ATC system. See Section 13.22, A and Section 13.23 for required signals.

Item 2. TECHNICAL SPECIFICATIONS

Page DS 9-58, Section 9.20, D, Vehicle Identification and Annunciation System

Delete the existing Paragraph 1 and replace it with the following:

 The Contractor shall supply five (5) sets of hand held readers similar to those supplied for CTA's 5000 Series cars and two (2) sets of wayside transponders for test and verification of the system. The transponders shall be provided complete with all hardware, connectors, cables, control modules and 120 Vac power supplies needed to install the equipment at a trackside location. The readers and transponders shall be reviewed by the Engineer. These units shall be delivered within 180 days of the delivery of the first production cars.

Item 3. TECHNICAL SPECIFICATIONS

Section 13, Automatic Train Control

Delete Section 13 in its entirety and replace with Attachment A. Additions have been underlined for ease of identification.

Item 4. TECHNICAL SPECIFICATIONS Page DS 15-12, Section 15.11, Automatic Maintenance Data Upload

Delete the paragraph A, General in its entirety and replace it with the following:

A. General

The data radio shall be used to upload maintenance data, train control data, mileage information and location data to wayside servers/terminals. The system shall be designed to be similar to CTA's Automatic Vehicle Monitoring system supplied on CTA's 5000 Series cars and interface with CTA's AssetWorks Maintenance Management Information System.

All data shall be readily accessible Via the CTA MMIS System. The data shall be stored in such a manner that the records can be sorted by any field and shall also be capable of being exported to Microsoft Excel, Word or Access without any loss or corruption of data.

The Contractor shall provide the appropriate server, server software and terminal AVM software with an unlimited site license to be installed on existing CTA computers. Hardware and software shall be reviewed by the Engineer.

Requisition No. C13FI101372531 Addendum 14

Item 5. TECHNICAL SPECIFICATIONS Page DS 15-13, Section 15.11, Automatic Maintenance Data Upload

Delete the paragraph C, Fault Annunciation and replace it with the following:

C. Fault Annunciation

Blue Light, White Light, Suspension System, Air Comfort System, Door System, Video Recorder System and ATC/ATO System fault information shall be transmitted immediately (within 30 seconds) upon detection and every 30 minutes along with additional system information. The information sent in the data packets shall be the same as on CTA's 5000 Series cars when existing and shall be proposed by the Contractor for newly included or expanded systems. Details of the information sent in the Data Packets will be provided during design reviews.

Item 6. TECHNICAL SPECIFICATIONS

Page DS 15-13, Section 15.11, Automatic Maintenance Data Upload

Add the following new paragraph:

E. <u>Train Control Data Upload</u>

The train shall report the information specified in Section 13.22, B to the Automatic Vehicle Monitoring Network through the Train Data Radio System as described in Section 15.10. All transmissions shall include at least the information specified in Section13.22, B, unless otherwise agreed to by the Engineer.

Requisition No. C13FI101372531

ADDENDUM 14 – ATTACHMENT A (26 Pages)

SECTION 13 AUTOMATIC TRAIN CONTROL

13.01 GENERAL

The Contractor shall furnish, install and wire on each two-car unit, a microprocessor based Automatic Train Control (ATC) System functionally equivalent to the PHW system furnished on CTA's 5000 Series cars, with the Automatic Train Operation (ATO) sub-system, forty-five miles per hour (45 mph) and "Slow Order" commands as specified herein.

The ATC and ATO sub-system functions shall be implemented using fail-safe, closed loop detection principles to determine the correct operation of the system.

The term "Fail-Safe" as used herein is defined as a characteristic of a system which ensures that any malfunction affecting train safety will cause the system to revert to a state that is known to be safe.

Vital relays shall be defined as any relay the function of which affects the safety of train operations.

The ATC and ATO systems shall be of the most modern type, including the latest improved designs; and the apparatus, when installed, shall provide the highest degree of safety and reliability in Rapid Transit Service. The system and apparatus shall be designed to meet all the applicable specifications of the Signal and Communication Section, AREMA. The Contractor shall submit to the Engineer for review sufficient evidence to show that the manufacturer selected has had adequate experience in the design of Rapid Transit Cab Signal Systems and in the successful manufacture of the basic railway signal equipment and apparatus, and that the type of basic railway signal equipment and apparatus of a period sufficient to demonstrate that such equipment and apparatus is suitable for the service specified herein as to design, manufacture and installation.

The trainborne equipment will be organized into receiving equipment, decoders including output relays, cab signal display drivers, and speed measurement and enforcement equipment. All equipment shall be of modular construction, rugged in design and suitable for carborne shock, vibration and the environment encountered in Rapid Transit service.

The ATC and ATO systems shall operate from the car's low voltage system. It shall be capable of operating normally with an input voltage range of 18-41 Vdc. Voltages below 18 Vdc or above 41 Vdc shall not cause damage to the system.

13.02 VITAL MICROPROCESSORS

Vital microprocessors shall conform to all the requirements of this Section, as well as Section 13.12 - Solid-State Equipment.

Vital microprocessors shall utilize a vital "kill" circuit to de-energize all outputs in the event of an I/O or processor failure. The system shall attempt an automatic reset after executing safety checks when the shutdown was caused by an I/O failure. In the event that this automatic reset is unsuccessful, shutdown shall require the operator to operate the ATC bypass push button to operate the train. While operating on ATC bypass, the audible alarm shall operate intermittently as defined in Section 13.03.

Each vital sub-system shall consist of a single microprocessor with CPU, I/O ports, and memory, and shall use closed-loop feedback and continuous self-checking to maintain vital integrity. Vital system outputs shall be positively monitored with independent current or voltage sensors and compared to the requested values. A vital "kill" circuit shall be used to de-energize all outputs when the outputs fail to correspond to the required state. The applications program shall be checked for alterations to ensure that no modifications have taken place after being installed. The CPU shall be continually tested to ensure that all instructions are being executed properly and that processor integrity is being maintained.

Diagnostic checks shall act on current (fresh) data only. Memory locations used to determine the proper states of inputs and outputs shall be cleared or overwritten prior to being reused during each cycle of tests to ensure the integrity of the check. The diagnostic checks shall be an integral part of the application (train control) logic for the system.

A complete and detailed program printout of all software for each vital processor is required. The program shall be modularized in a logical and easily understood manner. Each module of the program shall be fully documented with a plain English explanation of its purposes and the method by which it is accomplished, the modules to which it is related, and the modules of which it is a part.

A description of the program functions and details with flowcharts, a programming manual and a key sheet which lists all symbols, abbreviations and other aspects of the program is also required. This shall be one of the first items submitted for review for equipment to be furnished under this Section.

A full description of, and documentation for, the compiler shall be provided. This shall be a standard commercially-available compiler reviewed and accepted by the Engineer.

The ATC subcontractor shall provide compiler software maintenance for a period of five year (5 yrs) after the delivery of the last car of this order including any options.

The vital processor system shall not use a multi-processor voting scheme to evaluate the correctness of output.

13.02 <u>VITAL MICROPROCESSORS</u> (Continued)

The output states of the processor shall be verified at least once every 250 ms to ensure correspondence between the actual and requested values. The vital "kill" circuit shall remove power from all vital outputs in the event an output that should be off is on. Testing of outputs shall not cause false energy to momentarily occur on a de-energized output.

Inputs shall be re-evaluated at least once every 250 ms. Continuous vital checks shall be included in the processing of inputs to ensure the data base has not been corrupted in any fashion. Checks shall be included to ensure the independence of inputs from one another.

PROM's and EPROM's used shall be checked to ensure they have been unaltered during processor execution. Check words shall be created for blocks of memory to implement these tests. Unique check words shall be assigned for each vital input and output for this purpose.

Continuous vital integrity checks shall take place to monitor the execution of the software. Asynchronous tasks shall execute properly, and synchronized tasks shall execute in the proper order. Checks shall be included to shut down the system in the event the processor is overloaded.

Power for the outputs shall be vitally controlled by a vital power controller reviewed and accepted by the Engineer. This vital power controller shall be driven by a vital clock signal generated by the processor checks and diagnostics. The vital clock signal shall pass through filters tuned to prevent a false signal from energizing the output of this device. The signal frequency shall be immune to interference from any other device on the car: i.e., power supplies, audio or code equipment, or harmonics of these devices. The vital "kill" circuit shall remove the vital energy energizing all vital outputs.

13.03 OVERSPEED OPERATION

Overspeed control shall be provided for all speeds. When an aspect changes to require a more restrictive speed and the train is exceeding that speed, or when a train exceeds the allowable speed, i.e. an overspeed condition is detected, the ATO sub-system shall command coast by de-energizing the coast relay and the operator must initiate braking action within the set overspeed reaction time at not less than 90% of the maximum service brake rate, see Section 13.23. If the operator does not respond within the set overspeed reaction time, the train shall be brought to a stop automatically by the ATC equipment at the maximum service brake rate. The automatic brake application shall not be released until the train has stopped and the Master Controller is placed in the maximum service brake position. An audible alarm shall be provided, and shall operate as shown in the chart below. The audible alarm shall be a solid-state sound emitter interchangeable with a Mallory Sonalert. The sound level shall be no greater than presently generated by the existing Sonalert and shall be demonstrated and adjusted as required on the prototype units.

When continuous sound is called for, no "pulsing" will be accepted. Intermittent operation, when called for, shall be 200 ms sounding and 4 sec, silent, plus or minus fifteen percent (±15%), repeating as long as the condition remains.

The audible alarm shall be mounted behind the bypass panel in the cab ceiling.

13.03 OVERSPEED OPERATION (Continued)

The overspeed reaction time shall be adjustable by the ATC Computer Aided Applications (CAA) system software over a range of 0.3 seconds to 3.0 seconds and shall be initially set at 2.5 seconds. The timer shall stop running as soon as the acknowledgement signal is received and shall reset when the actual speed is below the allowable speed.

When the train speed has decreased to meet the re-initialization speed specified in Section 13.23, the ATO sub-system shall energize the coast relay to allow the train to motor.

AUDIBLE ALARM OPERATION						
WITH	AND	AND	SONALERT SOUNDS			
No Automatic Brake Application	Overspeed Detected	No Acknowledgement (Not at least 90% of Max. Service Brake)	Continuously			
No Automatic Brake Application	Overspeed Detected	Acknowledgement (At least 90% of Max. Service Brake)	Intermittently			
No Automatic Brake Application	No Overspeed	Moving on "Rule R6.4" Indication	Intermittently			
No Automatic Brake Application	No Overspeed	Moving on "Slow Order" Indication	Intermittently			
Automatic Brake Application	Not on Bypass		Continuously			
Attempted Automatic Brake Application	On "ATC" Bypass		Intermittently			
Non-Recoverable System Shutdown	Not on Bypass		Continuously			
Non-Recoverable System Shutdown	On "ATC" Bypass		Intermittently			
The audible alarm shall be silent under other conditions.						

13.04 <u>COMPATIBILITY OF SYSTEM</u>

The cab signal system furnished on this Contract must be compatible with the existing cab signal system on the CTA. The system must be able to operate with the level of energy on the rails that the existing system uses.

The cab signal frequency shall be 4.55 KHz ± 100 Hz interrupted at:

50 cycles per min \pm 5% for Slow Order (6 -15) mph 75 cycles per min \pm 5% for 15 mph 120 cycles per min \pm 5% for 25 mph 180 cycles per min \pm 5% for 35 mph 270 cycles per min \pm 5% for 55 mph 410 cycles per min \pm 5% for 45 mph 648 cycles per min \pm 5% for 70 mph

When no recognizable coded signal is received, the ATC equipment shall interpret this as STOP. To proceed after coming to a stop, the operator must depress and release the R6.4 Push Button, see Section 13.19.

The energy level of this interrupted 4.55 KHz signal in the rail or in a loop is such as to produce a field six inches (6") above the rail head of between 1.4 milligauss and 42 milligauss at every point in the track circuit when in the "on" state. This can be measured with an air core search coil of less than one square inch (\leq 1 sq. in.) of area through a 4.55 KHz filter with above band width.

The 4.55 KHz \pm 200 cycle component of the current in the rail generated by the track detection equipment anywhere in the circuit does not exceed an instantaneous value sufficient to produce 0.15 milligauss measured six-inches (6") above rail head by the same means.

The frequency response of the system shall be as follows:

Center Frequency 4550 Hz

- 3 dB points ± 100 Hz maximum
- 60 dB points ± 600 Hz maximum

CTA 7000-12

13.05 SPECIAL PROVISIONS

The trainborne cab signal system shall be so designed that removal of power from the system will not result in a change in the mode of operation: from "Normal" to "Slow Order" enabled to disabled or vice versa. The trainborne cab signal system shall not require any load to remain on the battery while the car is "layed up" on live or dead third rail. The carbody shall not be used for any ATC return circuits.

A push button switch shall be provided on the Operator's Bypass Panel, as specified in Section 9.05, D, 4, a, 3), to bypass the ATC overspeed penalty brake interface, ATO sub-system coast interface to the propulsion system and to modify operation of the audible alarm in accordance with Section 13.03.

An interlock shall be provided on the power control relay to prevent the ATC system from detecting "no motion" when the Master Controller is in a power position until the power control relay (or equivalent) is energized.

Each readily removable unit, including but not limited to, the aspect display units, equipment racks, relays, and plug-in printed circuit boards shall have a serial number permanently affixed.

A switch shall be provided in the ATC equipment case which, when actuated by maintenance personnel, will place the ATC system into the "Self-Test" mode, as described in Section 13.15. The switch and its location shall be reviewed by the Engineer and demonstrated in the mock-up.

The ATC system shall be designed to preclude operation of the train if both Master Controllers of a married pair are turned on.

The ATC system shall be designed so that it shall not be affected by high input signals from either the pick-up coils or speed sensors.

The ATC system shall be designed so that signal detection levels, number of "good" cycles and timing are coordinated to prevent low signal levels, distortion or intermittent loss of track signal from causing a penalty stop.

Removal of an ADU unit from a cab of a married pair shall be deemed a critical failure and the ATC system shall apply a penalty brake application when that married pair is turned on. Operation of the bypass button specified above and in Section 9.05, D, 4, a, 3, shall be required to operate the train. A missing ADU shall also be logged in both the ATC and car event recorders.

13.05 SPECIAL PROVISIONS (continued)

The ATC system shall have a manual "Cut Out" switch located in the Car Carried Equipment case as described in section 13.09. When the Manual "Cut Out" switch is placed in the "Cut Out" position, the ATC equipment shall not have control of train speed or train operation but event logging and recording equipment shall remain fully functional. The position of the manual "Cut Out" switch shall be reported to the vehicle ETHERNET system and subsystems as described in specification sections 9.16, 15.10, 15.11 and ATC Manual Cut-Out status shall be displayed on the operator's TOTS screen as described in section 15.09. The ATC manual cut-out function and display shall be reviewed and agreed to by the Engineer.

Power supply capacity shall be sufficient to power both ADUs simultaneously.

The ATC system supplier shall provide as-built drawings and program listings and shall provide documentation of any and all changes made to the system during the warranty period.

13.06 RECEIVING AND DECODING

The reception and decoding equipment shall be of fail-safe design and capable of receiving and decoding the rate-coded audio frequency signals from the running rails and loops. The system shall have the capacity to decode seven (7) commands (70, 55, 45, 35, 25, 15 mph and Slow Order). When no recognizable coded signal is received, the ATC equipment will interpret this to mean STOP unless the system is in the Slow Order mode. To proceed after coming to a stop, the operator must depress and release the R6.4 push-button, see Section 13.19.

Carrier frequency detection shall utilize fail-safe circuitry and equipment. If relays are required, they shall be vital relays.

Rate code detection equipment shall be of fail-safe design using no active components for relay drive or filtering. Active components may be used for decoding with the provision for cross-checks and failure detection reviewed by the Engineer.

13.07 SPEED MEASUREMENT AND ENFORCEMENT

The speed measurement and enforcement equipment shall be of fail-safe design. The speed command input shall be obtained in a manner that gives priority to the more restrictive codes.

Actual train speed determination shall be accomplished by measuring the output frequency of a sensor which monitors the rotation of gear teeth in the traction drive. Electronic circuitry of fail-safe design used to measure speed shall be continuously checked to verify its proper operation and the presence of the speed sensor.

The speed sensor shall also be checked to ensure that it will recognize gear teeth rotation. This check will be accomplished by providing a motion detection feature which will ensure the speed sensor is producing an actual velocity output. The ATC system shall initiate a penalty brake application upon a detected failure of the speed sensor or a no motion condition ("No Motion" is defined as: the master controller has been placed in a power position and the speed sensor circuit does not detect velocity. This function has an allowed timeout period to allow the propulsion package to activate and the speed of the vehicle to accelerate to a detectable velocity. The time period shall be initially the same as on CTA's 5000 Series cars and shall be verified and adjusted as required during prototype car testing. The ATC system supplier shall incorporate adjustments for the "No Motion" time period in the CAA package.

See also Section 13.20.

Overspeed control shall be accomplished by comparing the actual train speed with the command speed. When the actual train speed is equal to or greater than the command speed, the system shall respond to an overspeed condition and start the automatic brake application process. This comparison will be adjustable to an accuracy of ± 1 mph under all environmental and wheel wear conditions. Zero speed will be determined by a fail-safe check that the train speed is less than three miles per hour (<3 mph).

13.08 ASPECT DISPLAY UNIT

An aspect display unit (ADU) shall be installed in each operator's cab on the left side as on CTA's 5000 Series cars. The aspect unit shall show the actual train speed as well as the allowable speed.

The actual train speed indicator shall be a row of LED lights corresponding to the actual train speed in single mile-per-hour increments. The maximum speed displayed shall be seventy-two miles per hour (72 mph). The display operation and appearance to the Operator shall be the same as that on the ADUs presently installed in CTA's 5000 Series cars.

The allowable speed indicator shall be a row of light bars, which shall light in a continuous line from zero to the appropriate command speed. The allowable speed display light bar segments shall be 0 - 15 mph, 15 - 25 mph, 25 - 35 mph, 35 - 45 mph, 45 - 55 mph and 55 - 70 mph. All light bars below the command speed shall be lighted.

Although the speed command display circuitry may be non-vital in design, the method of interface to the decoder shall not degrade the fail-safe performance of the decoder.

Block conditions shall be indicated by the use of colored aspects. The "Green" aspect shall be lit when the allowable speed is 70 mph or 55 mph. The "Yellow" aspect shall be lit when the allowable speed is 45 mph, 35 mph, 25 mph or 15 mph. The "Red" aspect shall be lit when no recognizable coded signal is received by the train. After a stop has been made as required by the "Red" aspect and the R6.4 activate button has been pressed, the "Rule R6.4" light shall flash and the "Red" aspect shall remain lighted, see Section 13.19.

Two (2) printed messages shall also be included: The nomenclature and layout for "Slow Order" shall be white illuminated letters on a black background unless otherwise agreed to by the Engineer and "Rule R6.4" shall be black letters on a white illuminated background. When not illuminated, the printed messages shall not be readable.

The aspect display, train speed indicator, allowable speed indicator, block condition and message lights shall be housed in a single package.

The design and operation of the ADU shall be reviewed and demonstrated to the Engineer prior to production.

The cab signal aspects shall be of a translucent material lighted from within the unit. The lighting from within the unit shall be so designed that there will be no leakage of light from any aspect which could be construed as a false indication.

The lamps used in the aspect display unit shall be long lasting LED's designed for use in the environment of an operator's cab on a rapid transit car.

The incoming wires shall be in the form of a cable and shall be plug coupled to the aspect display unit with a suitable plug capable of withstanding severe vibration. The plugs shall be inaccessible with the ADU installed.

13.08 ASPECT DISPLAY UNIT (Continued)

The aspect display unit shall be so designed that external light shall cause neither a false indication nor a washout of indication.

The aspect display unit in the operating cab only shall be operable and illuminated.

Fastenings used for assembly of the unit or mounting to the car which are accessible from the outside of the unit shall be Holt head tamperproof type screws. Any fastening on the face of the unit shall have dulled surfaces to lessen unwanted light reflections.

A mock-up of the proposed aspect display unit shall be provided in the operator's cab mock-up for review by the Engineer.

The unit shall be easily removable from the car without removing or disassembling any trim or other equipment.

13.09 CAR-CARRIED EQUIPMENT CASE

The ATC equipment rack shall be mounted within its own enclosure integrated into the cab-equipment cabinet opposite the operator's position unless otherwise agreed to by the Engineer. Access shall be through a hinged stainless steel cover secured by a Best Lock Corp. lock using an uncombinated, High Security Core #1CP7WC1-626 and #1AP1WC1 key blank for each unit delivered. Cores and blanks shall be shipped to CTA and installed by CTA personnel.

13.10 **SECURITY**

The system shall be extremely secure so that no output function is allowed to change as a result of noise or transients which might simulate a signal. The design of the system shall be for extreme reliability and long service with minimum maintenance.

13.11 VOLTAGE PROTECTION

The design of the system shall include means of protecting the equipment from malfunctioning or damage due to voltage transients on or induced in the wiring. The equipment shall also be protected from damage from accidental over voltage or voltage reversal. Possible signals generated by other car systems, which may affect the cab signal system, shall be identified by the Contractor. Special attention shall be taken in the design of the ATC equipment and its installation to ensure that these signals will not interfere with the proper operation of the system.

13.12 SOLID-STATE EQUIPMENT

Solid-state equipment and microprocessor based equipment, where required in this Section, shall be provided by the ATC System subcontractor. Such equipment provided shall be of the most modern design and meet the highest standards of industry and all applicable specifications of the Communications and Signal Section of the Association of American Railroads. The design and materials provided shall meet the requirements of this Section.

The equipment shall be provided complete with the necessary isolation and power regulation devices to ensure its performance and reliability upon installation. The equipment design and fabrication shall be such as to make it immune from whatever noise and transients may be present; surge protection shall be provided. Solid-state equipment shall be immune to electrostatic discharges to all devices and surfaces exposed to human touch during operation or servicing.

The Equipment shall be modular in design. Plug-in type printed circuit boards shall be used wherever possible. <u>Plug-in boards shall have a positive locking system to prevent</u> them from becoming disconnected from their mating connectors. They shall be manufactured with mechanical keying which will prevent a wrong board from being installed in an improper slot and with rugged ejectors able to withstand the stresses of multiple insertions and ejections.

The system shall incorporate continuous self-checking features to ensure that the equipment, and program, where applicable, is functioning correctly. These checks shall be integral parts of both the hardware and software to provide for a secure system. Vital processors shall not allow false information to be transmitted to external devices which will create a hazardous condition. In no case may false information persist long enough to allow an unsafe condition to occur. Visual indications, such as LED lamps, shall demonstrate that the system is functioning properly; similarly, failure and diagnostic indications shall be provided. Indications shall isolate a failure to a particular function, or to the interface between two (2) functions.

Inputs for the equipment shall be debounced and shall be electrically isolated from one another. A visual indication, such as an LED lamp, shall be provided on the input board to each input to indicate when the input is activated.

Vital outputs for the equipment shall be electrically and physically isolated from one another. A visual indication, such as an LED lamp, shall be provided on the output board for each output to indicate when the output is activated. Use of any output contact for a load in excess of its design capability is not permitted.

Labels shall be provided by each input and output indication which clearly denote the respective function of each for ease of maintenance and troubleshooting.

13.12 SOLID-STATE EQUIPMENT (Continued)

Relay and/or logic equivalent of all vital programs shall be furnished to show the functional relationship between inputs and outputs.

A complete computer-aided applications package (CAA), including hardware, software, and training shall be provided for programming the microprocessor-based equipment covered under this Section, the CAA package shall be stand alone and separate from the PTU software.

The CAA package shall allow, at least, but not be limited to, the same adjustments used on the CTA 5000 Series car package. The CAA package shall have the same default values and ranges used on the CTA 5000 Series car package except as listed elsewhere in this specification. The CAA package shall not have conflicts with other software such as, but not limited to, Norton PC Anywhere, virus protection and scanning programs from Norton or McAfee, AutoCAD, Corel Suite and MS Professional Office Suite in their latest versions. The CAA package shall reside on an IBM compatible personal computer reviewed by the Engineer of the highest quality and latest technology at the time of delivery to CTA.

The package shall also include a Windows[™] based EPROM burner equal to the latest technology version of Data I/O's "Chiplab" for reprogramming the microprocessor based sub-systems.

In support of the applications package, PTU package and the vital software development system, Windows[™] Operating System, latest version, of all software shall be supplied. All software provided shall include licenses granted to the Chicago Transit Authority.

One (1) stand alone bench test unit complete with all required commercial and specialized test equipment, simulation equipment, component removal and replacement equipment, schematics, test procedures, test software, fixtures, cables, extender boards and interface units completely wired with convenient test points brought out to the front, shall be supplied for testing, by plug-in/extension/probe or better method, all ATC car equipment. The bench test unit utilizing the combination of schematics, test equipment, written test procedures, automated test procedures, and test fixtures shall be able to identify defective parts down to the component level. The bench test unit shall utilize the latest technology; highest quality equipment at the time of delivery to the CTA and all equipment supplied shall be new. The unit and its components shall be delivered to the Engineer within one year (1 yr) after delivery of the first production cars. 1 copy of Fluke Met/Cal/Team software Item number 4220971 and Met/Support gold Item number 4082647 shall be provided and licensed to the CTA. Test standards shall be provided to the CTA so that annual calibration of the cab signal test sets described in section 13.16 can be done by CTA forces.

Any modifications to the equipment made subsequent to the delivery of these items shall also be made to them at no cost to CTA.

13.13 <u>RELAYS</u>

All relays shall be of the plug-in type, except as otherwise specified, complete with their plug boards. Relays of the same type or style shall be uniform in size and in coil resistance. The dc relays shall be plug-in relays.

Relays shall conform to the applicable specifications of the Communication and Signal Section of the Association of American Railroads. Exceptions may be permitted but require review and consent by the Engineer.

Each relay and its repeaters shall have at least one spare front and back contact.

13.14 RECEIVER COIL SWITCHING

Two (2) individual receiver coil switching devices shall be provided in the equipment case to energize the receiver coils on the lead end of a unit. These devices shall be individually controlled by a contact in the Master Controller reverser mechanism to only energize the lead coils. Both receiver coil leads shall be broken by the switch. The switching circuit shall be designed to operate at the voltage parameters specified in section 13.01. The circuit shall be designed to provide high reliability and shall not degrade the incoming signal nor decay over time. Switch circuit design shall be reviewed by the Engineer.

13.15 INTERNAL SYSTEM TEST AND DIAGNOSTIC FAULT RECORDING MODULE

The ATC subcontractor, as part of the Automatic Train Control system furnished under this Specification, shall provide an internal System Test Module to provide the following functions:

A. When actuated by maintenance personnel by means of the Self-Test switch, the Internal System Test Module will begin a diagnostic procedure which will check the operation of all portions of the ATC system, including the functioning of the Aspect Display Unit, overspeed control, ATO functions, R6.4 functions, acknowledging functions, and penalty brake application. Operation of the Self-Test switch shall prevent train operation.

13.15 INTERNAL SYSTEM TEST AND DIAGNOSTIC FAULT RECORDING MODULE (Continued)

- Β. The Internal System Test Module shall also provide means by which maintenance personnel can, from the ATC equipment case, perform more detailed diagnostic procedures which will allow them to identify defective components or modules down to the level of individual printed circuit boards. This diagnostic capability shall include the speed sensors and pick-up coils. Speed sensor, all power supply voltages, Vital relay coil, Coast Contactor, Vital kill frequency and pick-up coil test points shall be incorporated and shall be readily accessible in the equipment case. All failures shall be recorded in an internal buffer with time/date stamp, an error code, and a Log Snapshot containing the complete I/O status of the system, system mode, direction, speed, system voltages, input voltage and bus status. This snapshot shall be a continuous series of frames taken every clock cycle of the system for a period no less than two seconds prior to through two seconds after the failure. The event codes shall be easily accessed through a board level alphanumeric display and all information shall be accessible and downloadable to the PTU provided under Section 17.04 through an external port with a high speed data connection reviewed by the Engineer. The system shall have the capability to store at least 5 weeks of data recorded in chronological order. CTA estimates that a system utilizing a change of state recording method will require approximately 6 MB of memory. Recorded events shall be comparable to those stored on the CTA 5000 series cars and include the operation of the self-test switch and the manual cut out switch each time a transition is made. The system shall be designed such that when the memory buffer is full, the system will continue to update, saving the most current data and overwriting the oldest. This overwriting shall not cause problems with the system or its recording ability. Any software needed for the transfer, decoding or analysis of this data shall be provided as part of the software development system Section 13.12 shall be installed in the PTU units provided under Section 17.04, B. See Section 13.17. The software shall provide for three levels of password protected administrator selected access.
- C. Any Modifications required to the internal test modules subsequent to their delivery as a result of changes in the hardware or software of the ATC system shall be made to all modules at no cost to CTA.
- D. The internal system test and diagnostic fault recording module shall, at a minimum, perform the same diagnostic self test and record the same event and fault information recorded as on the CTA 5000 Series cars with additional information as listed in this specification. In addition, the system shall record any conflict in the coast command status between the ATO sub-system command and the propulsion system feedback signal.

13.16 PORTABLE FIELD TEST UNITS

The Contractor shall supply fifteen (15) portable digital signal processor-based testing units with pre-programmed test algorithms and serial communication interface capability, designed to test cab signal equipment in CTA's rapid transit rail cars. Three (3) units shall be delivered with the prototype cars. The remaining units shall be delivered within 180 days after the delivery of the first production cars.

The test units shall be similar in design and function to the existing units used by the CTA and shall provide 0.05% or better accuracy with stable outputs and adjustment. The portable test units shall communicate with the cab signal package to obtain the required data, measurements and statuses necessary to perform a system test and inspection. The information required shall be at least, but not limited to, the entries required on the CTA 5000 Inspection and Calibration sheets including the Coast Contactor and ATO status. The units shall be designed such that a short placed across any output for any length of time shall not cause damage to the unit. The units shall come with calibrating instructions, adjustment procedures and detailed schematics for internal circuitry. The units shall be self-contained and provided with all connecting cables and plugs and hard carrying cases.

One (1) prototype unit shall be built and delivered to the CTA for review by the Engineer before additional units are built. Any modifications requested by the Engineer shall be incorporated into the prototype at no additional cost before final acceptance and shall be included in the remaining units at no additional cost.

The test unit shall generate audio frequency sine wave signals that can drive the rail car on-board cab signal receivers and speed detection equipment (Automatic Train Control) to test for proper operation. The unit shall have a three channel output to produce one (1) cab signal and two (2) signal generator output signals simultaneously. The unit shall have three operating modes below: Basic mode, Cab signal 1 mode, and Cab signal 2 mode.

13.16 PORTABLE FIELD TEST UNITS (Continued)

The test unit shall have:

- 1. Automated testing capabilities programmable by the user along with ramp, ramp and measure, and input capabilities. The unit shall have a password protected, administrator modifiable, algorithm which mimics the CTA cab test procedure. The algorithm shall be reviewed by the engineer and the contractor will allow for changes to the algorithm during the acceptance/warranty period with no additional cost to the CTA.
- 2. An output function that can be programmed to open or close contacts, based on specific pre-programmed input or output criteria specified by the user.
- 3. Two digital input/output ports: One (1) standard RS232 serial communications port, and one (1) general purpose eight bit input/output.
- 4. Two measurement inputs, capable of measuring AC and DC voltages and resistance. When in the input mode of operation, the inputs shall provide auto-ranging digital voltmeter or ohmmeter operation, with automatic detection of AC or DC voltages. The unit shall be capable of measuring resistance from 0.1 ohm to one (1) Megohm with an accuracy of at least 1%.
- 5. An input interface that, when connected to certain types of cab signal receivers, will provide the ability to detect when the cab signal receiver has picked up the applied code rate. The preferred location of the input interface is the front panel of the unit.

The test unit shall come pre-programmed with CTA specified values, tests and inspections. The test unit shall have a feature that allows the operator to edit and save the pre-programmed and user defaults from the front panel of the test unit using the menus available. The test unit shall be capable of storing 100 tests with pre-programmed reports to duplicate the CTA forms. The test unit must also allow the operator to enter defaults onto a PC, using included software and then load the defaults into the test unit from the PC serial port.

To provide real time feedback to the digital signal processor for output control and accuracy, all outputs shall be adjustable in real time and utilize closed loop design.

The operator's manual describing each capability and function along with setup instructions shall be provided. One copy shall be provided with each test unit provided along with an electronic copy.

13.16 **PORTABLE FIELD TEST UNITS** (Continued)

The test unit shall operate from 110/120 Vac, 60 Hz. The test unit shall come with a built in circuit breaker for overload protection. The unit shall be light weight and compact in size for easy portability.

Indicators - The test unit shall come with the following LED indicators: Power Supply Status, Switch Status and Operating Mode (2 lines by 40 characters, minimum).

Signal Generator Output - The Signal Generator or Speed Outputs shall produce audio frequency sine waves used to simulate the speed inputs of the Cab Signal Receiver or Automatic Train Control System. The code rate output and both speed signal outputs shall be closed loop design to provide instantaneous feed back to the digital processor, even while coding. The test unit shall be capable of generating a user adjustable cab carrier frequency of 4,550 Hz with an accuracy of at least 0.2 Hz with a maximum THD of 0.2%. The code rate generator portion shall produce the following pulses per minute (ppm) code rates at a user adjustable duty cycle from at least 20% to 90% in 1% increments. Steady (0 ppm), 75 ppm, 120 ppm, 180 ppm, 270 ppm, 410 ppm, and 648 ppm. These pulse rates shall be user adjustable in 1 ppm increments with 1 ppm accuracy.

The test unit shall be capable of generating 2 separate output frequencies referred to as Speed 1 and Speed 2. Speed 1 shall be user adjustable from at least 20 Hz to a minimum of 5 KHz in one (1) Hz increments, ranging from 0 to 5 volts rms user adjustable in 100 mV increments with an attached 50 ohm load. Speed 2 shall be user adjustable from at least 20 Hz to a minimum of 5 KHz in one (1) Hz increments, ranging from 0 to 50 volts p-p user adjustable in 100 mV increments with an attached 600 ohm load. The speed output shall be configured so that it can be instantaneously interrupted from an external switch supplied with the test unit. The speed output display shall be user configurable and adjustable in frequency, miles per hour and kilometers per hour. The speed outputs shall also have user configurable pre-sets (at least 5) to produce quick user selectable output frequencies.

The test unit shall have stored values of wheel diameters and the corresponding pulses per revolution, in a menu format, that the operator can select to establish the correct frequencies for miles or kilometers per hour outputs. The speed outputs shall have different output levels and shall be usable independently or locked together when in the MPH or KPH mode, so that the operator can adjust the output in MPH or KPH steps, and adjust both outputs simultaneously. If only one speed outputs shall be configurable to produce the correct frequencies for display and control in MPH or KPH, by setting the wheel diameter and pulses per revolution values in a separate speed setup menu. The test unit shall generate a modulated code rate at each rate defined in Section 13.04 with an output current of from 0 to 2 amps minimum in one (1) mA increments with an average 1.2 ohm load attached at the output.

13.16 **PORTABLE FIELD TEST UNITS** (Continued)

The unit shall have the following operating modes:

Basic Mode:	The Basic mode shall allow the user to make basic cab signal tests such as carrier frequency, code rates, and output current.
Cab Signal 1:	The Cab Signal 1 mode shall allow the user full access to all capabilities of the testing unit for the seven (7) code rates used by CTA.
Cab Signal 2:	The Cab Signal 2 Mode shall allow the user full access to all capabilities of the testing unit for the seven (7) code rates used by CTA and three (3) additional code rates.

The unit shall be capable of working problem free when subjected to the following environmental conditions:

Operating Temperature:	0 to +122 ⁰ F (-18 to +50 ⁰ C)
Storage:	-4 to +140 ^o F (-20 to +60 ^o C)
Humidity:	Up to 80% non condensing
Shock:	Up to 6g each axis
Vibration:	Up to 1g at 0-100 Hz, each axis

Test units shall be shipped with all connectors and cables required to test equipment input and output functions. One (1) set of Cab Signal Test Equipment calibration modules, procedures, instructions, software and specifications shall be included so that CTA can calibrate the test units in house. One (1) complete copy of Fluke Met/Cal/Team software Item number 4220971 and Met/Support gold Item number 4082647 shall be provided and licensed to the CTA. Test standards and all pertinent calibration information shall be provided to the CTA so that the test sets can be programmed into a Fluke Model 5520A Calibrator for annual calibration of the cab signal test sets.

Any modifications required to be made to these test units subsequent to their delivery as a result of changes in the hardware or software of the ATC system shall be made to all units at no cost to CTA.

13.16 PORTABLE FIELD TEST UNITS (Continued)

The contractor shall provide three (3) portable field units to activate the ATC system "Slow Order" Command from any wayside location. The system shall be housed in a portable ruggedized IP65, Nema 4X enclosure to withstand weather conditions within the Chicago region. The units shall operate on both 120 Vac and 10-24 Vdc power and shall have sufficient output to activate the "Slow Order" function throughout a 500' circuit length. The units shall be designed to operate continuously 24 hrs per day, 7 days per week, 365 days per year without failure under all weather conditions. The field units shall be provided with test and troubleshooting documentation, component level schematics and calibration and adjustment procedures. One (1) prototype unit shall be built and delivered to the CTA for review by the Engineer before additional units are built. Any modifications requested by the Engineer shall be incorporated in the prototype at no additional cost to CTA before final acceptance and shall be included in the remaining units at no additional cost to CTA. The units shall be self-contained and provided with all connecting cables and plugs and hard carrying cases.

13.17 PORTABLE TEST UNITS

The Contractor shall furnish rugged Portable Test Units (PTU) as specified in Section 17.04, to access the microprocessor controls beyond the built-in diagnostics and to access the ATC event recorder.

The PTU shall perform the following functions:

- 1. Fault event display and reset.
- 2. Manual test of controller and devices.
- 3. Data memory display of system operation both before and after a fault shutdown of the system. In addition, it shall be possible to create snapshots by setting snapshot parameter levels to trigger a memory function of system operation. This function shall be reviewed by the Engineer.
- 4. Real time monitoring and recording of system performance and operation.
- 5. Download of data from car to PTU memory/storage for later analysis.
- 6. Download software from PTU to car.
- 7. Display and adjust system fault event parameters, fault lockout parameters that are adjustable, including car identification.
- 8. Download data from the ATC event recorder.

Three levels of password protected access shall be incorporated to prevent unauthorized access to and erasure of various functions and information, the highest level being the administrator shall control access to the other two levels. The security levels and their contents and the passwords used shall be reviewed by the Engineer.

The software shall incorporate at least all the functions and capabilities of the system supplied with the CTA's 5000 Series cars.

13.18 INTERNAL EVENT RECORDER

The carborne ATC system shall incorporate an internal event recording sub-system which shall reside within the ATC card file to provide extended time for system status recording. This system shall be separate from the Event Recorder specified in Section 9.16. The recorder shall record "Change of State" all available Inputs, Outputs, Direction, Car Number, Time, Date, Speed, Control Voltage, System Voltages, System Conditions, System Generated Status and up to ten (10) additional Inputs as designated by the Engineer, for a period of no less than five (5) weeks under a normal operating cycle of twelve (12) hrs. per day, seven (7) days per week and shall continue to record for fifteen (15) seconds after the control voltage has been removed unless otherwise agreed to by the Engineer. The recorder shall provide for multiple passwords with administrator selected access within its program (if possible) for various utilities and functions providing limitations for each level of access as reviewed by the Engineer. The system shall not allow any user to erase or clear data under any circumstances. The system shall also incorporate a multidirectional accelerometer to record force levels from +/- 0.5g to at least +/- 8g in the X, Y, and Z directions. The internal event recorder shall update accelerometer data in all directions any time there is a change of state in any other data field. The system shall provide a high speed data connection to download all information to the PTU provided under Section 17.04. All software and connecting cables needed to download and utilize the information shall be provided at no additional cost and shall meet the Specifications under Section 13.17.

The Internal Event Recorder system shall include the interface software to generate at a minimum the following report types:

- Chronologically ordered event text, displaying stored events in a columnar format displaying all specific or partial details as selected by the user. This report system shall incorporate multiple search functions and speed keys for all areas. Final configuration of the system hardware, software and generated output shall be reviewed by the Engineer.
- 2. Chronologically ordered event graphing, displaying change in state events over time in a chart type format displaying all, specific or partial details as selected by the user. This report system shall incorporate multiple search functions, zoom options, multiple event marking, multiple event line coloring, event pop-up data windows when event is keyed with a mouse, event ordering, time distinction between multiple events and speed keys for all areas. Event graphing shall display speed, voltages and forces in a linear type graph with the above options. Final Configuration of the system hardware, software and generated output shall be reviewed by the Engineer.

13.19 R6.4 SWITCH AND LIGHT

A push-button switch shall be installed above the ADU as on CTA's 5000 Series cars. The switch shall have a smooth, black anodized face plate engraved and white filled reading "Activate R6.4". A white button shall activate the switch and be set in a recess to make it flush with the face of the plate. The plate shall be retained with 10-32 stainless steel, Holt head screws the same as those that retain the ADU. In the absence of valid code, the switch shall activate the flashing R6.4 light in the ADU, cause a red indicator light mounted on the top of the run number sign box to light and allow train movement at no greater than fifteen miles per hour (15 mph). The switch is functional only after a stop has been made as required by a "Red" aspect.

A red indicator light similar to that on CTA's 5000 Series cars consisting of an assembly of red LEDs behind a red lens, shall be installed on the top of the run number sign box, see Section 14.02, L.

The switch assembly, the red indicator light, both installations and the circuits used shall be reviewed by the Engineer.

13.20 SPEED SENSORS AND CABLES

The gearbox mounted speed sensors shall be installed on the No. 1 axle. The sensor design shall be suitable for installation on rail car gearboxes and shall be reviewed by the Engineer.

Speed sensor cables shall be molded into the sensor body with an integral strain relief. The cables shall be wired directly to the truck mounted junction box, also see Section 9.12.

13.21 ATC COILS AND JUNCTION BOX

Rugged, untuned ATC pick-up coils shall be installed on all cars. If additional electrical filtering is required, it shall be installed in the equipment rack. Fabreeka ATC pick-up coil supports shall also be installed to isolate the coils from the truck mounted support bracket.

The design of the support brackets shall be such that they will not fail from the severe vibration or environment of a rapid transit car truck.

An appropriate weatherproof junction box with a stud type terminal board shall be provided on the truck for connecting the receiver coil and speed sensor leads to the equipment. The lead from the junction box to the carbody shall be provided with a weatherproof plug as specified in Section 9.02, J, at the carbody end to facilitate the removal of the truck.

The pick-up coils, brackets, speed sensors and junction box shall be demonstrated on the truck mock-up.

13.22 SPECIAL PROVISIONS

- A. The ATC system supplier shall provide a dedicated Ethernet link to the main vehicle event recorder specified in Section 9.16. The supplier shall provide information to the recorder in the protocol requested by the supplier of the vehicle event recorder. Information to be supplied shall be at least: All Inputs, All Outputs, Actual Speed, Allowable Speed, ATC Mode (Normal, Slow Order), ATC Cut-Out switch position, R6.4 Acknowledge, Audible Alarm, ATC Bypass, Brake Acknowledge (90% Full Service Brake or greater), Motion, BRR Status, accelerometer values in excess of +/- 0.5 g, date - time synchronized with that in the event recorder as stated in IEEE Standard 1482.1-1999, and car number.
- B. The ATC system and train network shall report through the onboard train data radio system, as described in section 15.10, the following information to the Automatic Vehicle Monitoring network, as described in section 15.11, E when any of the following events occur, unless otherwise agreed to by the Engineer: R6.4 Activated, Penalty Brake Application, ATC Manual "Cut Out" Activated, Any Bypass Activated, Emergency Circuit (de)activated and occurrence of an accelerometer reading in any axis of +/- 4g or greater. The accelerometer event level shall be adjustable in the CAA package to increase or decrease the level in increments as agreed to by the Engineer. All events shall be stamped with at least the following information: Time, Date, Head Car number, Train Speed and Location (GPS and any other location available). The data shall be stored in such a manner that the records can be sorted by any field and shall also be capable of being exported to Microsoft Excel, Word or Access without any loss or corruption of data.
- <u>C</u>. The ATC system shall put the cab signal package into the "Slow Order" mode upon the receipt of a valid 50 CPM code rate. A valid 50 CPM code rate shall be defined as four (4) periods of the 50 CPM rate at the 4550 carrier frequency at the set vehicle pick up level or as otherwise agreed to by the Engineer. When the cab signal package accepts the code-rate, it will automatically limit and latch the over speed setting of the train to the programmed speed setting until the system is commanded to the "Normal" operation mode. While the Cab package is in the "Slow Order" mode, the R.6.4 mode will not be operable. The cab package will return to the "Normal" operation mode upon the receipt of a valid code rate (other than the 50 CPM) at a high rail current of between 700 and 900 ma unless otherwise agreed to by the Engineer. The default setting for the "Slow Order" mode over speed shall be 6 mph with an adjustable range from 6 mph to 15 mph in 0.5 mph increments. When the cab package enters the "Slow Order" mode, the system shall light a printed message as described in section 13.08, the allowable speed bars shall be turned off and the yellow aspect shall flash at a rate agreed to by the Engineer. The operation and specifics of the "Slow Order" mode shall be reviewed and agreed to by the Engineer prior to the production of the prototype units. The Engineer may request adjustment after review of the prototype and changes to the function will be at no additional cost to the CTA. Entry into and exit from the "Slow Order" mode shall be recorded in the ATC and car event recorders.

13.23 ATO SUB-SYSTEM

The ATC system shall be equipped with an Automatic Train Operation (ATO) sub-system to provide a speed control interface with the propulsion system. This interface shall consist of a relay in the ATO sub-system that delivers a coast command to the propulsion system, see Section 10.03, K, 2.

The ATO sub-system shall override the propulsion system power command and cause the train to go into coast when the relay is de-energized and allow the train to motor when the relay is energized (initialized on start up or re-initialized after command coast.

The ATO sub-system shall report the relay position to the internal event recorder and shall also export this information to the car event recorder.

If the relay position does not correspond to the command signal, the ATC system shall declare a critical fault and de-energize the Brake Release Relay and energize the audible alarm. It shall be necessary to energize the ATC By-Pass in order to operate the train.

The relay driver logic shall have speed settings associated with each allowable command speed, except "Slow Order" mode and the absence of recognizable code. Each individual allowed speed, including R6.4, shall have a separate coast speed setting that shall be adjustable via the CAA package within a range of 5.0 mph below the command setting to 2.0 mph above the command setting. The re-initialization of the relay shall be adjustable from 6.0 mph below the command speed to 1.5 mph above the command speed. The default value for coast command shall be command speed and re-initialization speed shall be 2.0 mph below the command speed. The speed and re-initialization speed shall be adjustable to an accuracy of +/-0.2 mph under all environmental and wheel wear conditions.

13.23 ATO SUB-SYSTEM (Continued)

The ATO sub-system shall measure the rate of change (acceleration) of car speed towards the coast speed setting and shall de-energize the relay to prevent the train from reaching the coast speed setting, based on the acceleration profile. A value shall be stored for each coast speed setting, including absence of recognizable code (R6.4), to determine the time delay offset for de-energizing the relay. These values shall be adjustable via the CAA package in 0.1 second increments from 0.0 seconds to 3.0 seconds before reaching the coast speed setting, with a default value the same as on CTA's 5000 Series cars.

See Section 13.03 - Overspeed Operation for a description of the ATO sub-system operation during overspeed conditions.

When the ATC system is in the manual "Cut Out" mode from the ATC manual cut out switch or in "Slow Order" mode, the ATO sub-system shall be bypassed and not control train speed.

The ATC bypass button shall include a separate contact to energize the relay when activated. This contact shall be in addition to the contact that bypasses the overspeed penalty brake command see Sections 9.05, D, 4, Section 10.03, K, and Section 13.05.



cta

567 West Lake Street Chicago, Illinois 60661-1498 TEL 312 664-7200 www.transitchicago.com

September 18, 2013

Subject: Requisition No. C13FI101372531 - IFB to Purchase Rapid Transit Cars Specification CTA 7000-12

Re: Addendum 13

All Potential Bidders:

Enclosed please find Addendum 13. This Addendum updates the Instructions to Bidders, Technical Specifications and Drawings of the IFB. Insert this Addendum 13 into the Contract Documents of the subject requisition and consider it part of the official Contract Documents.

Included with Addendum 13 are the following seven (7) attachments:

Attachment A – Kawasaki Rail Car, Inc., Pre-Bid Meeting Minutes & Attendance List (KRC-6) Attachment B – Sumitomo Corporation of America, Pre-Bid Meeting Minutes & Attendance List (SCOA-5) Attachment C – Sumitomo Corporation of America, Pre-Bid Meeting Minutes & Attendance List (SCOA-6) Attachment D – Bombardier Transit Corporation, Pre-Bid Meeting Minutes and Attendance List (BTC-6) Attachment E – Written Questions Submitted from Potential Bidders and CTA's Responses Attachment F – Bid Deposit Bond Form (New) Attachment G – Drawing DR-1A Rev. 1 (Replacement)

Questions previously received in writing and not addressed in this addendum will be formally responded to by subsequent addendum.

Addendum 13 shall be acknowledged as received by identification of Addendum 13 on the IFB – Bid Proposal Exhibit 2 – Bidder's Signature Page, to be submitted with the Bid Proposal. Failure to acknowledge receipt of Addendum 13 or any addenda with your Bid Proposal shall render the Bid Proposal as non-responsive.

The Chicago Transit Authority is seeking bids for the subject procurement. Bid packages are to be delivered to:

By Mail, In Person Drop Off or Delivery Service Chicago Transit Authority Bid Office - 2nd Floor 567 W. Lake Street Chicago, IL 60661-1498

Bid Due Date (Bid Opening): Wednesday, October 23, 2013, no later than 11:00 A.M. Chicago time

Each Bidder bears full responsibility for delivery to the Bid Office before the advertised date and hour for the opening of Bids. Bidders are solely responsible for ensuring that its Bid is received by the Authority in a timely manner prior to the date and time of Bid Opening. If mail or delivery is delayed beyond the date and hour set for the Bid Opening, Bids delayed will not be considered and will be returned unopened. Bid Office hours are Monday through Friday from 8:00 am to 4:30 pm Chicago time, except holidays.

If you have any questions, please contact Maria Williams-Baxter, Sr. Procurement Administrator <u>mwilliams@transitchicago.com</u> or 312-681-2437.

Sincerely,

Ellen McCormack, Vice President, Purchasing

Requisition No. C13FI101372531 Addendum 13

Item 1. INSTRUCTIONS TO BIDDERS Page IB-1, Section D, Bid Deposit

Delete Section D - Bid Deposit in its entirety, and replace with the following:

D. The Bid shall be accompanied by cash, a cashier's check, a certified check, a money order, approved Letter of Credit, or Bid Bond Form (Addendum 13, Attachment F), in the amount of five hundred thousand dollars (\$500,000.00). Bidders must submit the proposed Letter of Credit for approval no later than 30 days prior to the Bid Due date.

All certified, cashier's checks or money orders shall be drawn on a responsible organization doing business in the United States and shall be made payable to the order of the Chicago Transit Authority.

The period of the bond must be for not less than one hundred twenty (120) days from the date of Bid Opening. Bid deposits will be returned after the Authority has awarded a Contract.

Item 2. TECHNICAL SPECIFICATIONS Page DS 15-11, Section 15.10, A, 1, Data Radio – General

Delete the first sentence in paragraph A, 1, and replace with the following:

The Contractor shall provide a CTA standard 12 volt Mobile Router, Utility Associates Rocket COM-H-5208 or equal, in each unit (married pair).

Item 3. DRAWINGS

Page DR-1A, Plan and Elevation, DR-1A

Delete Drawing DR-1A and replace with Attachment G - DR-1A Rev. 1.

Requisition No. C13FI101372531 Addendum 13 - Attachment A

Pre-Bid Meeting held at CTA Skokie Shops with Kawasaki Rail Car (KRC) on August 20 and 21, 2013, relative to Requisition C13FI101372531, Specification CTA-7000-12 for the Purchase of Rapid Transit Cars.

The following were in attendance:

Representing Chicago Transit Authority

Maria Williams-Baxter Fred Lonnes Dawid Skarzynski	Robert Kielba Eric Mattson John Kilstrom	Klaudiusz Kruszecki Walter Keevil Grant Macey
<u>Representing Kawasaki Rail Car</u> Kakushin Hirano Akihiro Ito	Tomonori Umebayashi Motoki Nagano	Chuck Wochele Don Lin*
<u>Representing ABB</u> Viktor Nyden* Pascal Gysin*	Steven Ojaluo*	Michael Habouri*
Representing Acorel Bruno Aulanger*		

Representing Toyo Denki Chuck Cook*

Naoki Okuyama*

Ichiro Sueoka*

Representing Mitsubishi Electric Company Koji Kondo* Yoshiaki Wakabayashi*

*- Indicates part-time attendance.

CHICAGO TRANSIT AUTHORITY PURCHASE OF RAPID TRANSIT CARS REQUISITION C13FI101372531 Pre-Bid Meeting #6 August 20 and 21, 2013

<u>Technical Specifications</u>, Page DS 1-34, Section 1.16, Subcontractor Identification and Evaluation (KRC-6, 8/20 - 8/21/13)

Kawasaki submitted information on the following firms and proposed them as a subcontractor for the items listed in Section 1.16 as follows:

1.16, 3 Window Sash

1.16, 15 Propulsion System

ABB

Kawasaki

CTA Accepted

CTA Accepted

Toyo-Denki

Subsequent to the meeting, based upon the materials and information presented, CTA Accepted Toyo Denki as a supplier of Propulsion. However, CTA had reservations over the conceptual designs presented. CTA further commented that the conceptual design shown for the motor-gearbox assembly was not suitable due to the motor being hard mounted to the truck. Also, the design of the motor gearbox coupling, and the gearbox filling and inspection covers were not compliant. In addition, the LRU weights and dead rail detection on a per car basis were a concern.

1.16, 26 Passenger Counter System

Alcorel

CTA Accepted

Technical Specifications, Page DS 10-2, Section 10.01, L, Propulsion System - General (KRC-6, 8/20 -8/21/13

Kawasaki submitted the following:

According to Drawing DR-1A (SKE-1-06112013), there are four (4) types of seats in the seating arrangement plans provided by the Authority as part of Addendum No. 11, as follows:

- 1) Single seat with a narrow width located near the No.2 end structure
- 2) Single seat with a wide width located near the car body center
- 3) Two-passenger seat, 35" wide

4) Two-passenger convertible seat located near the wheel chair area.

In order for the Bidder to prepare the requested design concepts, please provide dimensional data for the Single seat with a wide width (width, depth and any other criteria).
CTA clarified that the single seats throughout the car are of the standard size of nominally 17" in width. There was a scaling issue with the drawing and it did not show properly. The only wider width single seat would be the convertible seat with the wheelchair securement directly rearward of the #2 doorway. The wider seat would be necessary to provide sufficient width to accommodate the securement clamp and belts.

 Technical Specifications, Page DS 10-2, Section 10.01, L, Propulsion System - General (KRC-6, 8/20 -8/21/13

Kawasaki presented their lab and field EMI testing results as extrapolated to the proposed CTA vehicle to demonstrate the ability to achieve EMI compliance. Kawasaki advised they will coordinate their EMI/EMC with the propulsion and other vendors to ensure compliance.

CTA acknowledged receipt of this data.

 Technical Specifications, Page DS 10-2, Section 10.01, L, Propulsion System - General (KRC-6, 8/20 -8/21/13)

ABB presented their EMI testing capabilities, example of EMV of a similar unit and ability to achieve EMI compliance.

CTA acknowledged receipt of this data.

5. <u>Technical Specifications, Page DS 10-2, Section 10.01, L, Propulsion System - General (KRC-6, 8/20 - 8/21/13)</u>

Mitsubishi presented their EMI testing capabilities and ability to achieve EMI compliance.

CTA acknowledged receipt of this data.

6. <u>Technical Specifications, Page DS 10-5, Section 10.02, B, 6, Characteristic Curves and Simulations (KRC-6),</u> 8/20 - 8/21/13)

Toyo Denki presented their propulsion curves and simulations.

CTA advised that there was a discrepancy in their deceleration curves (figure 5.1) since they only included regenerative braking and not the full specified braking rate. CTA also clarified that the regenerative braking current could go as high as 1000 amps and does not need to be current limited to 600 amps as shown in some of the curves. CTA advised that the braking performance curves will have to be corrected to show the required rate and resubmitted to CTA.

7. <u>Technical Specifications, Page DS 10-5, Section 10.02, B, 6, Characteristic Curves and Simulations (KRC-6, 8/20 - 8/21/13)</u>

Mitsubishi presented their characteristic curves and simulations.

CTA acknowledged receipt of this data.

8. <u>Technical Specifications, Page DS 10-5, Section 10.02, B, 6, Characteristic Curves and Simulations (KRC-6, 8/20 - 8/21/13)</u>

ABB presented their characteristic curves and simulations.

CTA acknowledged receipt of this data.

<u>Technical Specifications, Page DS 10-10, Section 10.03, F, 2, b, Filter Capacitors (KRC-6, 8/20 - 8/21/13)</u>
 ABB presented their filter charging curves.

CTA acknowledged receipt of this data.

10. Technical Specifications, Page DS 10-10, Section 10.03, F, 2, b, Filter Capacitors (KRC-6, 8/20 - 8/21/13)

Mitsubishi presented their filter charging curves.

CTA advised that there appeared to be some discrepancies with the charging curve. CTA advised that the curves will need to be corrected and resubmitted to demonstrate compliance to the filter charging requirements provided in Addendum 7.

If the foregoing does not agree with your understanding of the items discussed, contact Maria Williams-Baxter, Sr. Procurement Administrator as soon as possible.

Requisition No. C13FI101372531 Addendum 13 - Attachment B

Pre-Bid Meeting held at CTA Skokie Shops with Sumitomo Corporation of America (SCOA) / Nippon Sharyo on August 23, 2013, relative to Requisition C13FI101372531, Specification CTA-7000-12 for the Purchase of Rapid Transit Cars.

The following were in attendance:

representing emerge mansic Authority	Representing (Chicago	Transit	Authority
--------------------------------------	----------------	---------	---------	-----------

Maria Williams-Baxter	
John Kilstrom	
Dawid Skarzynski	

Wałter Keevil Klaudiusz Kruszecki Robert Kielba Eric Mattson

Representing Sumitomo Martin Green

Representing Nippon Sharyo Ken Kuriyama* Daniel Gornstein

Tsutomu Shirai

Jack Martinson*

Kazuki Ogura

<u>Representing Faiveley</u> Didier Aubert*

CHICAGO TRANSIT AUTHORITY PURCHASE OF RAPID TRANSIT CARS REQUISITION C13FI101372531 Pre-Bid Meeting #5 August 23, 2013

1. <u>Technical Specification, Page DS 1-34, Section 1.16, Subcontractor Identification and Evaluation (SCOA-5, 8/23/13)</u>

Sumitomo/Nippon Sharyo submitted information on the following firms and proposed them as a subcontractor for the items listed in Section 1.16 as follows:

1.16, 9 <u>Cab Control and Operators Panels</u>

Nippon Sharyo

CTA Accepted

1.16, 12 Auxiliary Power Supply System

Faiveley

CTA Accepted

2. <u>Technical Specification, Page DS 9-13, Section 9.03, A, 16, Auxiliary Power Supply System – General</u> (SCOA-5, 8/23/13)

Faiveley presented their block diagram of the APS.

CTA stated that the block diagram included in the presentation was for Faiveley's "Katium" design and not the proposed, specification compliant system with independent Auxiliary Inverter, LVPS and Battery charger. CTA advised that a corrected block diagram must be resubmitted.

If the foregoing does not agree with your understanding of the items discussed, contact Maria Williams-Baxter, Sr. Procurement Administrator as soon as possible.

Page 8 of 13 (Attachment E)

Requisition No. C13FI101372531 Addendum 13 - Attachment C

Pre-Bid Meeting held at CTA Skokie Shops with Sumitomo Corporation of America (SCOA) / Nippon Sharyo on September 5, 2013, relative to Requisition C13FI101372531, Specification CTA-7000-12 for the Purchase of Rapid Transit Cars.

The following were in attendance:

Representing Chicago Transit Authority		
Maria Williams-Baxter	Robert Kielba	
Klaudiusz Kruszecki	Fred Lonnes	

John Kilstrom Dawid Skarzynski

Representing Sumitomo Martin Green

Representing Nippon Sharyo Ken Kuriyama

Tsutomu Shirai

Daniel Gornstein

*- Indicates part-time attendance.

Page 9 of 13 (Attachment E)

CHICAGO TRANSIT AUTHORITY PURCHASE OF RAPID TRANSIT CARS REQUISITION C13FI101372531 Pre-Bid Meeting #6 September 5, 2013

1. Technical Specification, Page DS 3-5, Section 3.01, Esthetic Design – Exterior and Interior (SCOA-6, 9/5/13)

Sumitomo/Nippon Sharyo presented information on their capabilities for interior design and examples of past projects. Three preliminary exterior and interior esthetic design renderings were presented for review.

CTA acknowledged receipt of the renderings and provided comments for development of the renderings to be presented with the Bid. CTA further reinforced that the intent of the esthetic design process is to provide a new, modern appearance to the rail cars. Each of the three esthetic designs must contain distinctly different design elements other than color.

Technical Specification, Page DS 9-13, Section 9.03, A, 16, Auxiliary Power Supply System – General (SCOA-6, 9/5/13)

Nippon Sharyo presented the block diagram of the Faiveley APS. This diagram was revised to more closely reflect CTA specification requirements.

CTA acknowledged receipt of the corrected block diagram.

If the foregoing does not agree with your understanding of the items discussed, contact Maria Williams-Baxter, Sr. Procurement Administrator as soon as possible.

REQUISITION C13FI101372531 Addendum 13 - Attachment D

Pre-Bid Meeting held at CTA Skokie Shops with Bombardier Transit Corporation (BTC) on September 6, 2013, relative to Requisition C13FI101372531, Specification CTA-7000-12 for the Purchase of Rapid Transit Cars.

The following were in attendance:

Representing Chicago Transit Authority Maria Williams-Baxter Klaudiusz Kruszecki

Robert Kielba Fred Lonnes John Kilstrom Dawid Skarzynski

Representing Bombardier Transit Corporation Joe Kenas Tom Purmort

Yves Laperriere

CHICAGO TRANSIT AUTHORITY PURCHASE OF RAPID TRANSIT CARS REQUISITION C13FI101372531 Pre-Bid Meeting #6 September 6, 2013

1. Page DS 2-6, Section 2.03, Estimated Weights (BTC-6, 9/6/13)

Bombardier submitted their estimated weight of the complete car.

CTA acknowledged receipt of the weight estimate.

2. Technical Specification, Page DS 3-5, Section 3.01, Esthetic Design – Exterior and Interior (BTC-6, 9/6/13)

Bombardier presented their three exterior and interior esthetic design renderings for review.

CTA acknowledged receipt of the renderings and provided comments for development of the renderings to be presented with the Bid.

3. Technical Specification, Page DS 3-25, Section 3.10, A, 3. (BTC-6, 9/6/13)

Bombardier submitted the following:

Drawing DR1-A shows three types of single seats. Please confirm our understanding as follows:

- 1. At No.2 end, one (A-car) or tow (B-car) single seats, width 17-1/2 inches.
- 2. Three (3) wide single seats, width of 22 inches.
- 3. One wide "flip-up" single seat at wheelchair area, width 22 inches.

CTA clarified that the single seats throughout the car are of the standard size of nominally 17" in width. There was a scaling issue with the drawing and it did not show properly. The only wider width single seat would be the convertible seat with the wheelchair securement directly rearward of the #2 doorway. The wider seat would be necessary to provide sufficient width to accommodate the securement clamp and belts.

If the foregoing does not agree with your understanding of the items discussed, contact Maria Williams-Baxter, Sr. Procurement Administrator as soon as possible.

REQUISITION C13FI101372531 Addendum 13 - Attachment E

Written Questions from Potential Bidders and CTA's Responses

1. Instructions to Bidders, Page IB-2, Section F, Bidder Qualifications; Basis for Responsibility Determination

Ansaldobreda submitting the following:

We would like to inform you that the bid for the requisition C13FI101372531 will be submitted by AnsaldoBreda Inc., a wholly owned subsidiary of Ansaldobreda S.p.A., located in 1464 Loveridge Road, 94565 Pittsburg (California). Ansaldobreda S.p.A. will make available to AnsaldoBreda Inc. all the designing, manufacturing, managing and financial capabilities for the correct execution of the project, issuing also the Parent company guarantee required as per section S of the Instruction to Bidders.

Please confirm that the above described scheme is acceptable for you and list document and additional declarations required for such a purpose, if any.

CTA RESPONSE:

It is acceptable for a Bidder to be a wholly owned subsidiary of a U.S. or foreign corporation.

Please note that bidder responsibility will be determined after bids are submitted based on the information required by Instructions to Bidders, Section F, page IB-2, Bidder Qualifications; Basis for Responsibility Determination. Bidders should also include information for parent companies to the extent that the information will be needed for CTA to determine qualifications and responsibility. As provided in Instructions to Bidders, Section F, page IB-4, CTA reserves the right to request additional information.

2. Instructions to Bidders, Page IB-1, Section D, Bid Deposit

Ansaldobreda submitting the following:

The above mentioned paragraph states that the Bid Deposit must be under the form of an approved Bid Bond. Please confirm that the submitted AIA Bid Bond format is acceptable for the Authority.

CTA RESPONSE:

The Bid Deposit Bond Form attached to this addendum must be used. See Addendum 13, Item 1 and Attachment F.



BID BOND

For use when bidding on Chicago Transit Authority contracts. See instructions following.

PRINCIPAL (Legal name and business address)

State of incorporation or organization:

SURETY (Legal name and business address)

State of incorporation:

BID IDENTIFICATION

BID OPENING DATE:

SPECIFICATION NUMBER:

SPECIFICATION TITLE (AND PROJECT NUMBER IF AVAILABLE):

PENAL SUM OF BOND

%,

PERCENT OF BASE BID

Surety Bond No.:

Obligation:

We, the Principal and Surety, are firmly bound to the Chicago Transit Authority (hereinafter called the Authority) in the above penal sum. For payment of the penal sum, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally.

Conditions:

The Principal has submitted a bid on the Specification identified above.

Therefore:

The above obligation is void if the Authority accepts the Principal's bid on the Specification identified above and the Principal enters into a Contract with the Authority in accordance with the terms of such bid, executes such further contractual documents that may be required by the terms of the Specification, and gives such other bond(s) as may be specified in the Specification with a surety acceptable to the Authority.

The Surety executing this instrument agrees that its obligation is not impaired by any extension(s) of the time for acceptance of the bid that the Principal may grant to the Authority and waives any requirement of notice to the Surety of any such extension(s).

ADDENDUM 13 ATTACHMENT F 3 PAGES In the event the Authority brings suit upon this bond, Surety will pay reasonable attorney's fees and costs incurred by the Authority in such suit.

Witness:

The Principal and Surety executed this bid bond and affixed their seals on the below dates. The person signing below on behalf of the Principal warrants that he or she is authorized to execute this document on behalf of the Principal.

	PRINCIPAL		
PRINCIPAL			Corporate Seal
NAME			
PRINCIPAL			
SIGNATURE			
SIGNER'S			
NAME & TITLE			
DATE			
	SURETY		······································
			Corporate Seal
SURETY NAME			
ATTORNEY-IN-			
FACT SIGNATURE			
ATTORNEY-IN-			
FACT NAME			
DATE			
	NOTARY		
STATE OF	, COUNTY OF		
I,	, a Notary Public in the Cour	nty and State aforesaid	l, do hereby certify that
	of	the	
	who is personally known	to be the same persor	n whose name he/she
subscribed in the fores	roing instrument as such Attorney-in-Fact anneared h	efore me this day in r	verson and acknowledged
that he/she signed sea	led and delivered the said instrument of writing as hi	-there free and valueto	with and acknowledged
voluntory act of the so	itu, and denvereu me salu mshument or writing as m	s/her free and voluma	ry act, and as the free and
voluntary act of the sa	tor the use	s and purposes therein	n set forth, and caused the
corporate seal of said (company to be thereto attached.		
GIVEN UNDER MY HAN	D AND NOTARIAL SEAL THIS	DAY OF	,20
		·	<u></u>
	NOTARY PUBLIC		

The signature of the Surety's attorney-in-fact must be notarized, and an original power of attorney granting him or her authority to sign this document must be attached to this document.

INSTRUCTIONS FOR CHICAGO TRANSIT AUTHORITY BID BOND FORM <u>Bidders/Proposers:</u> Give these instructions to your surety.

1. The Bond must be on the Authority's form. No substitutions will be acceptable.

- 2. When printing the Bond for execution, it must be printed double sided, with page 1 on one side of the paper, and page 2 on the opposite side of the paper.
- 3. The amount of the Bond must be that stated in the Specification. Unless otherwise specified in the Specification, the amount of the Bond should be expressed as a percentage of the bid amount.
- 4. All blank spaces to be filled in must be completed using a typewriter or legible hand printing unless otherwise indicated. Determinations of legibility will be in the sole discretion of the Authority's General Manager, Purchasing. Photocopied insertions will not be accepted, nor will any Bond form on which there is any evidence of correction fluid ("white-out").
- 5. Insert the full legal name and business address of the Principal in the space designated "Principal" on the face of the form. If the Bidder/ Proposer is bidding under an assumed business name ("d/b/a") the assumed business name must be separately stated in the same space as the full legal name for identification purposes.
- 6. The address of the Principal must be complete. If a different mailing address should be used, it should be included as well, as Bonds to be returned will be mailed to the address shown on the Bond.
- 7. The Bond must include the Surety's name, the state in which the Surety was incorporated, and the Surety's address.
- 8. The Specification number must appear on the Bond.
- 9. The Surety executing the Bond must appear on the Department of the Treasury's list of approved sureties (available at http://www.fms.treas.gov/c570/c570.html) and must act within the limitations listed therein.
- 10. The names and titles of the people signing the Bond must be given in the spaces provided.
- 11. Corporations executing the Bond shall affix their corporate seals if required. If a seal is not required, please indicate "seal not required" in the space where the seal would otherwise be affixed.
- **12.** A person authorized to bind the Bidder as the Principal must sign the Bond.
- 13. The Bond must be signed by an attorney-in-fact of the Surety company. An original Power of Attorney that identifies the surety company's signatory as an attorney-in-fact must be attached.
- 14. The date on which the Surety's Power of Attorney was certified should be the same or later than the date on which the bond was signed by the Surety.
- 15. In its application to negotiated contracts, the terms "bid" and "bidder" shall include "proposal" and "proposer" or "offeror."





cta

567 West Lake Street Chicago, Illinois 60661-1498 TEL 312 664-7200 www.transitchicago.com

August 19, 2013

Subject: Requisition No. C13FI101372531 - IFB to Purchase Rapid Transit Cars Specification CTA 7000-12

Re: Addendum 12

All Potential Bidders:

Enclosed please find Addendum 12. This Addendum updates the Technical Specifications of the IFB. Insert this Addendum 12 into the Contract Documents of the subject requisition and consider it part of the official Contract Documents.

Included with Addendum 12 are the following four (4) attachments:

Attachment A – Sumitomo Corporation of America, Pre-Bid Meeting Minutes & Attendance List (SCOA-4) Attachment B – Bombardier Transit Corporation, Pre-Bid Meeting Minutes and Attendance List (BTC-5) Attachment C – Correction Sumitomo Corporation of America, Attendance List - July 18 (SCOA-3) Attachment D – Correction Kawasaki Rail Car, Inc., Attendance List - May 30 and 31 (KRC- 3)

Additional questions received in writing will be clarified in Pre-Bid Meetings and formally responded by subsequent addendum.

Addendum 12 shall be acknowledged as received by identification of Addendum 12 on the IFB – Bid Proposal Exhibit 2 – Bidder's Signature Page, to be submitted with the Bid Proposal. Failure to acknowledge receipt of Addendum 12 or any addenda with your Bid Proposal shall render the Bid Proposal as non-responsive.

The Chicago Transit Authority is seeking bids for the subject procurement. Bid packages are to be delivered to:

By Mail, In Person Drop Off or Delivery Service

Chicago Transit Authority Bid Office - 2nd Floor 567 W. Lake Street Chicago, IL 60661-1498

Bid Due Date (Bid Opening): Wednesday, October 23, 2013, no later than 11:00 A.M. Chicago time

Each Bidder bears full responsibility for delivery to the Bid Office before the advertised date and hour for the opening of Bids. Bidders are solely responsible for ensuring that its Bid is received by the Authority in a timely manner prior to the date and time of Bid Opening. If mail or delivery is delayed beyond the date and hour set for the Bid Opening, Bids delayed will not be considered and will be returned unopened. Bid Office hours are Monday through Friday from 8:00 am to 4:30 pm Chicago time, except holidays.

If you have any questions, please contact Maria Williams-Baxter, Sr. Procurement Administrator <u>mwilliams@transitchicago.com</u> or 312-681-2437.

Sincerely

Ellen McCormack Vice President, Purchasing

Requisition No. C13FI101372531 Addendum 12 – Attachment A

Pre-Bid Meeting held at CTA Skokie Shops with Sumitomo Corporation of America (SCOA) / Nippon Sharyo on July 31, 2013, relative to Requisition C13FI101372531, Specification CTA-7000-12 for the Purchase of Rapid Transit Cars.

The following were in attendance:

Representing Chicago Transit Authority

Maria Williams-Baxter John Kilstrom Grant Macey Dawid Skarzynski Walter Keevil Klaudiusz Kruszecki Eric Mattson

Robert Kielba Fred Lonnes Jorge Silva

Representing Sumitomo Martin Green

Representing Nippon Sharyo Daniel Gornstein

Representing Faiveley Dan Simpson

Mark Kaidy

Fabrice Lamide

CHICAGO TRANSIT AUTHORITY PURCHASE OF RAPID TRANSIT CARS REQUISITION C13FI101372531 Pre-Bid Meeting #4 July 31, 2013

<u>Technical Specifications, Page DS 1-34, Section 1.16, Subcontractor Identification and Evaluation (SCOA-4, 7/31/13)</u>

Sumitomo/Nippon Sharyo submitted information on the following firms and proposed them as a subcontractor for the items listed in Section 1.16 as follows:

1.16,1 Side, End and Operator's Cab Doors

Faiveley

1.16, 2 Side Door Operator, Control System and Upper Tracks

Faiveley

CTA Accepted. However, CTA had reservations about the operator that requires greasing and advised that the non-greaseable option would be more suitable for CTA's operation and maintenance practices. In addition, the detail on door control boxes and bench test equipment was missing from the presentation.

CTA Accepted

If the foregoing does not agree with your understanding of the items discussed, contact Maria Williams-Baxter, Sr. Procurement Administrator as soon as possible.

Requisition No. C13FI101372531 Addendum 12 – Attachment B

Pre-Bid Meeting held at CTA Skokie Shops with Bombardier Transit Corporation (BTC) on August 1 and 2, 2013, relative to Requisition C13FI101372531, Specification CTA-7000-12 for the Purchase of Rapid Transit Cars.

The following were in attendance:

Representing Chicago Transit Authority				
Maria Williams-Baxter	Walter Keevil	Robert Kielba*		
John Kilstrom	Klaudiusz Kruszecki*	Fred Lonnes		
Grant Macey*	Eric Mattson*	Jorge Silva		
Dawid Skarzynski				
Representing Bombardier Transit C	orporation			
Joe Kenas	Tom Purmort	Simon Deslauriers		
Haysite Reinforce Plastics				
John Steimer*	Anthony Lignetta*	Tim Pfister*		
Kiel				
Alvaro Peralta*				
Space Age Synthetics				
Luke Gibbon*	Mike Kalberer*			
Freedman Seating				
Steve Orzech Jr.*	Dan Cohen*	Sudha Veerapaneni*		
Sojitz/Mitsubishi Electric (Melco)				
Jim Knapp*	Hiroki Kanamoto*	Shuhei Ozu*		
Dai Iwama*	Sam Anand*			
<u>Teleste</u>				

Jani Rautaneva*

CHICAGO TRANSIT AUTHORITY PURCHASE OF RAPID TRANSIT CARS REQUISITION C13FI101372531 Pre-Bid Meeting #5 August 1 and 2, 2013

<u>Technical Specifications, Page DS 1-34, Section 1.16, Subcontractor Identification and Evaluation (BTC-5, 8/1 – 8/2/13)</u>

Bombardier submitted information on the following firms and proposed them as a subcontractor for the items listed in Section 1.16 as follows:

1.16, 4	Floor Panels	
	Haysite Reinforced Plastics	CTA Accepted
	Space Age Synthetics	CTA Accepted
1.16, 5	Passenger and Operator Seats	
	Kiel (Passenger Seats Only)	
	Subsequent to the meeting, based upon the materials and in was unable to accept Kiel as a supplier of Passenger Seats. Ki demonstrate compliance to the specification requirements. areas of accessible Aluminum frame members would greatly to vandalism vs. a stainless steel framed seat and would be n	formation provided, CTA iel's presentation failed to The seat design with large increase the damage due nore costly to repair.
	Freedman	CTA Accepted
1.16, 12	Auxiliary Power Supply System	
	Mitsubishi Electric	CTA Accepted
1.16, 23	<u>Video</u>	
	Mitsubishi Electric	CTA Accepted
	Axion	CTA Accepted

2. Technical Specifications, Page DS 3-17, Section 3.07, B, Floor Panels (BTC-5, 8/1 - 8/2/13)

Bombardier/Haysite proposed a Polyester resin material for the construction of the floor panels in lieu of the phenolic composite specified.

CTA advised that the proposed Polyester resin based composite flooring is accepted as an equivalent to the phenolic composite flooring specified.

3. <u>Technical Specifications, Page DS 9-13, Section 9.03, A,16, Auxiliary Power System – General (BTC-5, 8/1 – 8/2/13)</u>

Bombardier proposed for Pre-Bid evaluation per Technical Specifications, 9.03.A.16, the block diagram of the Mitsubishi Electric Auxiliary Power Supply. The qualifying information can be found in the documentation submitted to qualify Mitsubishi Electric for the supply of the Auxiliary Power Supply which has been provided.

CTA acknowledged receipt of Bombardier/Mitsubishi's proposed block diagram for the APS.

4. <u>Technical Specifications, Page DS 9-22, Section 9.03, F,1, a, Auxiliary Power System (BTC-5, 8/1 – 8/2/13)</u>

Bombardier submitted the following:

Section 1.23 does not exist in the Technical Specifications. Please clarify, as it appears the proper reference should be section 1.22.

CTA agreed that there was a typographical error and the proper reference is 1.22.

5. Technical Specifications, Page DS 9-38, Section 9.11,A,1, Electronic System Testers (BTC-5, 8/1 – 8/2/13)

Bombardier submitted the following:

Does CTA require that all BTEs for electronic systems have the capability to download new revisions of application software to system LRUs or does this function reside only with the PTUs?

CTA advised that the CTA's Heavy Maintenance practice is that each LRU must be programmed and ready to be installed once it is tested and verified on the bench tester. If this functionality is not integrated directly in the bench tester computer, then an additional PTU must be provided, as a part of the BTE, to provide this functionality.

If the foregoing does not agree with your understanding of the items discussed, contact Maria Williams-Baxter, Sr. Procurement Administrator as soon as possible.

Requisition No. C13FI101372531 ADDENDUM 12 - ATTACHMENT C

Correction Addendum 10 – Attachment A

Pre-Bid Meeting held at CTA Skokie Shops with Sumitomo Corporation of America (SCOA) / Nippon Sharyo on July 18, 2013, relative to Requisition C13FI101372531, Specification CTA-7000-12 for the Purchase of Rapid Transit Cars.

The following were in attendance:

Representing Chicago Transit Authority		
Maria Williams-Baxter	Walter Keevil	Robert Kielba *
John Kilstrom	Grant Macey *	Eric Mattson *
Jorge Silva	Dawid Skarzynski	
Representing Sumitomo		
Martin Green		
Representing Nippon Sharyo		
Daniel Gornstein	Ken Kuriyama	Tsutomu Shirai
Robert Street		
Representing Toshiba		
Syuuji Moriya*	John Strohm*	
Representing Transtechnik		
Gary Provenzano*	Thomas Doering*	
Representing Faiveley		
Didier Aubert*	C. Jack Martinson*	Mike Haskins*
Representing JTM Concepts		
Tracey Masamoto Marler*	Doug Sand*	

Requisition No. C13FI101372531 ADDENDUM 12 - ATTACHMENT D

Correction Addendum 8 – Attachment C

Pre-Bid Meeting held at CTA Skokie Shops with Kawasaki Rail Car (KRC) on May 30 and 31, 2013, relative to Requisition C13FI101372531, Specification CTA-7000-12 for the Purchase of Rapid Transit Cars.

The following were in attendance:

Representing Chicago Transit Authority			
Maria Williams-Baxter	Fred Lonnes	Dawid Skarzynski	
Robert Kielba*	Eric Mattson*	John Kilstrom	
Klaudiusz Kruszecki	Jorge Silva		
Representing Kawasaki Rail Car			
Maurice Andriani	Steven Kraycar	Chuck Wochele	
Kakushin Hirano	Motoki Nagano*		
Representing TOA Communication Syste	<u>ms, Inc.</u>		
Takeshi Morita*	Rei Watanabe*		
Tamamo Yura*	Toshiyuki Katsumura*		
Representing QuesterTangent			
David Gregson*	Larry Kubek*		
Representing Fuji Electric Corp.			
Barbara Houston*	Kazuki Iwao*	Satoru Ozaki*	
Takao Kamada*			
Representing SEPSA			
Julio Rodriguez*	Rodrigo Serrano*	Rafael Zamorano*	
Representing ISC Applied Systems			
Eric Garzon*	Carmen Gonzalez*		

CHICAGO TRANSIT AUTHORITY



567 West Lake Street Chicago, Illinois 60661-1498 TEL 312 664-7200 www.transitchicago.com

August 2, 2013

Subject: Requisition No. C13FI101372531 - IFB to Purchase Rapid Transit Cars Specification CTA 7000-12

Re: Addendum 11

All Potential Bidders:

Enclosed please find Addendum 11. This Addendum updates the Instructions to Bidders, Bid Proposal, Technical Specifications and Drawings of the IFB. Insert this Addendum 11 into the Contract Documents of the subject requisition and consider it part of the official Contract Documents.

Included with Addendum 11 is the following attachment: Attachment A – Drawing DR - 1A

Additional questions received in writing will be clarified in Pre-Bid Meetings and formally responded by subsequent addendum.

Addendum 11 shall be acknowledged as received by identification of Addendum 11 on the IFB – Bid Proposal Exhibit 2 – Bidder's Signature Page, to be submitted with the Bid Proposal. Failure to acknowledge receipt of Addendum 11 or any addenda with your Bid Proposal shall render the Bid Proposal as non-responsive.

The Chicago Transit Authority is seeking bids for the subject procurement. Bid packages are to be delivered to:

By Mail, In Person Drop Off or Delivery Service

Chicago Transit Authority Bid Office - 2nd Floor 567 W. Lake Street Chicago, IL 60661-1498

Bid Due Date (Bid Opening): Wednesday, October 23, 2013, no later than 11:00 A.M. Chicago time

Each Bidder bears full responsibility for delivery to the Bid Office before the advertised date and hour for the opening of Bids. Bidders are solely responsible for ensuring that its Bid is received by the Authority in a timely manner prior to the date and time of Bid Opening. If mail or delivery is delayed beyond the date and hour set for the Bid Opening, Bids delayed will not be considered and will be returned unopened. Bid Office hours are Monday through Friday from 8:00 am to 4:30 pm Chicago time, except holidays.

If you have any questions, please contact Maria Williams-Baxter, Sr. Procurement Administrator <u>mwilliams@transitchicago.com</u> or 312-681-2437.

Sincerely.

Ellen McCormack Vice President, Purchasing

Item 1. INSTRUCTIONS TO BIDDERS

Page IB-5, Section G.3, PRE-BID PROCEDURES – Other Pre-Bid Meetings

Delete subsection d) and replace with the following:

d) Pre-Bid Meetings for review of the Bidder's esthetic design concepts as required in Technical Specifications, 3.01. M shall be scheduled no later than 30 calendar days prior to the Bid submission date.

Item 2. INSTRUCTIONS TO BIDDERS Page IB-12, V. BID SUBMISSION REQUIREMENTS

Delete Item 4 in its entirety and replace with Items 4, 5 and 6 as follows:

- 4. Bidder's three (3) exterior designs specified in Technical Specifications, 3.01.M.1.
- 5. Bidder's three (3) interior designs specified in Technical Specifications, 3.01.M.2.
- 6. Bid Proposal, Exhibit 2 Execution by Bidder **Bidder Signature Page signed by an** authorized officer as described in Section E, of the Instructions to Bidders.

Item 3. BID PROPOSAL

Page P-1, Section I - GENERAL PROVISIONS AND METHODS OF PAYMENT, B – COMPLETE LUMP SUM PRICE

Delete the first paragraph and replace with the following:

Except as otherwise stated in the Contract, the Bid Proposal includes, and the Contractor must provide and furnish, all items necessary and incidental for the manufacturing and delivery of a base order of 100 Rapid Transit Cars (50 two-car units) with eight (8) options to purchase up to 746 additional cars, including but not limited to all materials, parts, labor, supervision, coordination, administration, equipment, tools, drawings, and incidentals required by the Contract and necessary for the full completion of the Contract, inclusive of all costs to furnish any of the three (3) exterior designs specified in Technical Specifications, 3.01.M.1 and any of the three (3) interior designs specified in Technical Specifications, 3.01.M.2 as quoted in the Bid Proposal. The Bid also includes all costs relating to, or associated with, the foregoing including, but not limited to, all direct costs, overhead, and profit. No terms of the Contract, which more specifically indicate that the Contractor will bear the costs of an item or which more specifically indicate that an item will be performed at no additional cost to the Authority, will be construed or interpreted to in any way limit the foregoing.

Item 4. BID PROPOSAL

Page P-7, Section II – BIDDING FORM, PART 2 - Optional Purchases

Delete the first paragraph in its entirely and replace with the following:

In addition to the lump sum Base Pricing for 100 Rapid Transit Cars (50 two-car units), Bidders must also quote a price per two-car unit, for the Option quantities listed below. The price per two-car unit for each Option must be quoted inclusive of special test equipment, replacement units and support as required by the Technical Specifications. The price per two-car unit for each Option must include all costs to furnish any of the three (3) exterior designs specified in Technical Specifications, 3.01.M.1 and any of the three (3) interior designs specified in Technical Specifications, 3.01.M.2 as quoted in the Bid Proposal. CTA reserves the right to exercise or decline each option to purchase additional cars in sequential order within the timeframes shown. However, if any option exercised timeframe expires, CTA reserves the right to purchase any or all of the subsequent options prior to the expiration dates. The exercising of options shall be deemed timely if notice is issued by the Authority in accordance to Section 34.II – Notice, General Specifications on or before the calendar day timeframe indicated in the column headed "OPTION EXERCISE TIMEFRAME".

Item 5. TECHNICAL SPECIFICATIONS

Page DS 3-5, Section 3.01. M - Esthetic Design – Exterior and Interior

Delete Section 3.01.M in its entirety and replace with the following:

- During Pre-Bid Meetings, Bidders shall submit three (3) alternate design concepts for the exterior of the car including color renderings. The concepts shall show alternate shapes and configurations for the end cap and color schemes for both the end cap and sides. The concepts shall retain all functional aspects of the car as required in the Technical Specifications, but offer alternate appearances. Maintainability, both routine and damage repair, must be considered in the designs.
- 2. During Pre-Bid Meetings, Bidders shall submit three (3) alternate design concepts for the interior of the car including color renderings. The design concepts shall be based upon the seating layout as specified in Drawing DR-1A with three (3) distinctly different esthetic design concepts. Each alternate design must include variations to the specified seat shell/insert designs, windscreens, window masks, wainscots, ceiling, lighting, floor color and other interior elements that can be changed without compromising functionality, maintainability, vandal resistance or operational characteristics. The concepts shall show three (3) different combinations of colors and finishes, contours and materials. Reduction of floor obstructions should be addressed, but weight constraints/reduction must be considered. Bidders shall ensure that the esthetic designs include as many of the above variations as practical to provide a new, modern appearance.

- 3. The Authority will review the alternate design concepts during the Pre-Bid phase and provide comments for Bidders to develop suitable and complete representations of the conceptual designs that will be provided with the Bids.
- 4. After award of Contract, the CTA will select one (1) design from the Contractor's three (3) exterior designs, and one (1) design from the Contractor's three (3) interior designs specified in Technical Specifications 3.01.M submitted with the Bid. The Contractor shall finalize the designs during the Design Review phase for review and acceptance by Authority.

Item 6. TECHNICAL SPECIFICATIONS

Page DS 3-25, Section 3.10. A. 3 - Seats

Delete paragraph 3 in its entirety and replace with the following:

3. The seating arrangement and quantity of seats for each car shall be as shown on CTA Drawing SKE -1-06112013 on Attachment A - Drawing DR-1A.

Item 7. TECHNICAL SPECIFICATIONS

Page DS 3-35, Section 3.11. D. Horizontal Stanchions

Delete the last two paragraphs and add the following new paragraphs:

A horizontal stanchion approximately fifty inches (50") long shall be installed on the longitudinal center line of the car mid-way between the No. 1 and No. 2 side doors. The stanchion shall be supported from the roof structure and may include a vertical support at the center if required to meet the strength requirements specified above.

Grab straps and grab handles shall be attached to the horizontal stanchions. The grab straps shall be one-inch (1") wide, of PVC material, reviewed by the Engineer, and shall be securely retained to the horizontal stanchion with a locking feature to prevent loosening in service. The grab straps shall be adequately reinforced in the area of the fasteners to prevent tearing. The grab straps shall extend approximately ten-inches (10") below the bottom of the horizontal stanchion. Approximately thirty-two (32) grab straps shall be installed in each car. The grab handles shall be stainless steel, swing down type, spring loaded to return to the horizontal position when released. The grab handles shall be equal to Ellcon National Type 46 and shall be reviewed by the Engineer. Two (2) grab handles shall be installed on the horizontal stanchions on each side of the car forward of the wheel chair seats. These grab handles shall be installed in a staggered arrangement so that those on one side of the aisle are not immediately opposite those on the other side of the aisle. Four (4) grab handles shall be installed on the horizontal stanchion at the No. 1-No. 2 side door area. The grab handles shall be installed so that two (2) swing down on each side of the stanchion and shall be spaced evenly along the stanchion.

The stanchion/grab handle installation at the No.1-No.2 side door area shall be mounted to provide a minimum of seventy-six inches (76") of clearance above the floor to the lowest point when the handles are in the released position. Provisions shall be made to protect the light fixtures/lenses and/or car ceiling from impacts of the handles if they can swing up when released and hit them. The installation of the stanchion and grab handles shall be reviewed by the Engineer.

The final quantity and location of the grab straps and handles shall be determined during the esthetic design review process and shall be demonstrated on the Convertible Seat/Wheel Chair Area mock-up as defined in Section 3.14, D. If the No. 1-No. 2 side door area horizontal stanchion and grab handle installation is not part of any of the specified mock-ups, the first prototype car shall be deemed a mock-up of these features and shall be reviewed by the Engineer and any changes to the design or installation and final car design shall be made as necessary, at no cost to the CTA, to satisfy the comments of the Engineer.

Item 8. DRAWINGS

Page DR 1, Plan and Elevation

Insert Attachment A – Drawing DR-1A after DR-1.

ADDENDUM 11 ATTACHMENT - A





CHICAGO TRANSIT AUTHORITY

567 West Lake Street Chicago, Illinois 60661-1498 TEL 312 664-7200 www.transitchicago.com

July 30, 2013

Subject: Requisition No. C13FI101372531 - IFB to Purchase Rapid Transit Cars Specification CTA 7000-12

Re: Addendum 10

All Potential Bidders:

Enclosed please find Addendum 10. This Addendum updates the Technical Specifications of the IFB. Insert this Addendum 10 into the Contract Documents of the subject requisition and consider it part of the official Contract Documents.

Included with Addendum 10 are the following four (4) attachments: Attachment A – Sumitomo Corporation of America, Pre-Bid Meeting Minutes & Attendance List (SCOA-3) Attachment B – AnsaldoBreda, Pre-Bid Meeting Minutes and Attendance List (AB-2) Attachment C – Kawasaki Rail Car, Inc. Pre-Bid Meeting Minutes and Attendance List (KRC-5) Attachment D – Inspection Meeting Attendance (7/20/13)

Additional questions received in writing will be clarified in Pre-Bid Meetings and formally responded by subsequent addendum.

Addendum 10 shall be acknowledged as received by identification of Addendum 10 on the IFB – Bid Proposal Exhibit 2 – Bidder's Signature Page, to be submitted with the Bid Proposal. Failure to acknowledge receipt of Addendum 10 or any addenda with your Bid Proposal shall render the Bid Proposal as non-responsive.

The Chicago Transit Authority is seeking bids for the subject procurement. Bid packages are to be delivered to:

By Mail, In Person Drop Off or Delivery Service

Chicago Transit Authority Bid Office - 2nd Floor 567 W. Lake Street Chicago, IL 60661-1498

Bid Due Date (Bid Opening): Wednesday, October 23, 2013, no later than 11:00 A.M. Chicago time

Each Bidder bears full responsibility for delivery to the Bid Office before the advertised date and hour for the opening of Bids. Bidders are solely responsible for ensuring that its Bid is received by the Authority in a timely manner prior to the date and time of Bid Opening. If mail or delivery is delayed beyond the date and hour set for the Bid Opening, Bids delayed will not be considered and will be returned unopened. Bid Office hours are Monday through Friday from 8:00 am to 4:30 pm Chicago time, except holidays.

If you have any questions, please contact Maria Williams-Baxter, Sr. Procurement Administrator mwilliams@transitchicago.com or 312-681-2437.

Sincerel - Comach

Ellen McCormack Vice President, Purchasing

Requisition No. C13FI101372531 Addendum 10 – Attachment A

Pre-Bid Meeting held at CTA Skokie Shops with Sumitomo Corporation of America (SCOA) / Nippon Sharyo on July 18, 2013, relative to Requisition C13FI101372531, Specification CTA-7000-12 for the Purchase of Rapid Transit Cars.

The following were in attendance:

Representing Chicago Transit Authority		
Maria Williams-Baxter	Walter Keevil	Robert Kielba *
John Kilstrom	Grant Macey *	Eric Mattson *
Jorge Silva	Dawid Skarzynski	
Representing Sumitomo		
Martin Green		
Representing Nippon Sharyo		i
Akira Koyasu	Thomas Heyden	Ken Kuriyama
Daniel Gornstein	Tsutomu Shirai	Daniel Gornstein
Robert Street	Thomas Heyden	
Representing Toshiba		
Syuuji Moriya*	John Strohm*	
Representing Transtechnik		
Gary Provenzano*	Thomas Doering*	
Representing Faiveley		
Didier Aubert*		
Representing JTM Concepts		
C. Jack Martinson*	Tracey Masamoto Marler*	Doug Sand*

CHICAGO TRANSIT AUTHORITY PURCHASE OF RAPID TRANSIT CARS REQUISITION C13FI101372531 July 18, 2013

<u>Technical Specifications, Page DS 1-34, Section 1.16, Subcontractor Identification and Evaluation (SCOA-3, 7/18/13)</u>

Sumitomo/Nippon Sharyo submitted information on the following firms and proposed them as a subcontractor for the items listed in Section 1.16 as follows:

1.16, 12 Auxiliary Power Supply System

Transtechnik Corp. USA

CTA Accepted

Faiveley Transport North America

Subsequent to the meeting, based upon the materials and information provided, CTA was unable to accept Faiveley as a supplier of the Auxiliary Power Supply. Based on CTA's judgment and past experience, the presentation failed to demonstrate sufficient understanding of the Technical Specifications. The presentation did not fully identify a compliant approach to the requirements.

1.16, 25 <u>CBT Training</u>

JTM Concepts, Inc.

CTA Accepted

 Technical Specifications, Page DS 9-13, Section 9.03, A, 16, Auxiliary Power Supply System - General (SCOA-3, 7/18/13)

SCOA proposed for Pre-Bid evaluation per Technical Specification Section 9.03, A, 16, the block diagram of the Transtechnik Corp. USA Auxiliary Power Supply as part of its Subcontractor Qualification presentation.

CTA acknowledged receipt of SCOA/Transtechnik Corp. USA proposed block diagram for the APS.

3. <u>Technical Specifications, Page DS 9-13, Section 9.03, A, 16</u>, <u>Auxiliary Power Supply System - General</u> (SCOA-3, 7/18/13)

SCOA proposed for Pre-Bid evaluation per Technical Specification Section 9.03, A, 16, the block diagram of the Faiveley Transport North America Auxiliary Power Supply as part of its Subcontractor Qualification presentation.

CTA acknowledged receipt of SCOA/Faiveley Transport North America proposed block diagram for the APS. However, The Block Diagram did not address the control input 600VDC i.e. Input contactor and show low voltage LVPS and BC compliance.

4. <u>Technical Specifications, Page DS 10-02, Section 10.01, L, General (SCOA-3, 7/18/13)</u>

SCOA/Toshiba Corporation proposed for Pre-Bid review the lab and field EMI test data from an existing product extrapolated to the installation on the CTA vehicle to demonstrate the ability to achieve EMI/EMC compliance.

CTA acknowledged receipt of Toshiba Corporation's updated documentation in regards to lab and field EMI test data.

5. <u>Technical Specifications, Page DS 10-15, Section 10.03, Traction Motors (SCOA-3, 7/18/13)</u>

SCOA/Toshiba Corporation proposed for Pre-Bid review an alternate to the specified traction motor. SCOA/Toshiba Corporation presented a Totally Enclosed Fan Cooled Motor type (TEFC).

CTA acknowledged receipt of the documentation and agreed to consider the TEFC type provided it can be accommodated within the size and weight constraints of the car and truck designs and the duty cycle requirements of the specification.

6. <u>Technical Specifications, Page DS 15-1, Section 15.01, A, 4, Serial Trainline and Data Communications –</u> Overview (SCOA-1, 5/17/13)

SCOA/Toshiba Corporation provided for Pre-Bid evaluation per Technical Specification Section 15.01, A, 4, the Serial Trainline and Data Communications system block diagrams as a part of its May 17, 2013, Subcontractor Qualification presentation for supply of the Serial Trainline and Data Communications.

CTA acknowledged receipt of the block diagrams.

If the foregoing does not agree with your understanding of the items discussed, contact Maria Williams-Baxter, Sr. Procurement Administrator as soon as possible.

Requisition No. C13FI101372531 Addendum 10 – Attachment B

Pre-Bid Meeting held at CTA Skokie Shops with AnsaldoBreda (AB) on July 19, 2013, relative to Requisition C13FI101372531, Specification CTA-7000-12 for the Purchase of Rapid Transit Cars.

The following were in attendance:

Representing Chicago Transit Authority Maria Williams-Baxter Grant Macey *

Walter Keevil Eric Mattson John Kilstrom Dawid Skarzynski

<u>Representing AndaldoBreda</u> Bruno Tasselli Giulio Calone

Luca lurato Marco Malanima Paolo Pezza

Representing Trans-Lite William Maley, Jr. *

Mikko Kosonrn *

Representing DRS Tech Dennis Funkhouser *

Stephen Webb *

CHICAGO TRANSIT AUTHORITY PURCHASE OF RAPID TRANSIT CARS REQUISITION C13FI101372531 July 19, 2013

<u>Technical Specifications, Page DS 1-1, Section 1.02, COMPATIBILITY WITH EXISTING CTA CARS (AB-2, 07/19/2013)</u>

AnsaldoBreda submitted the following:

We kindly ask CTA to evaluate the possibility of removing the requirement of interoperability of the new 7000 series cars with the already existing CTA 5000 Series cars for the following main reasons:

- Such requirement leads to a competitive advantage for the manufacturer of the Series 5000, compared to any other possible bidder; in fact, such manufacturer can price its bid without charging (relevant) extra costs (engineering, software development, testing etc.) to implement the interoperability function;
- Each bidder, with the exception of the manufacturer of the Series 5000, has to consider the risk of not all necessary detailed technical documentation being available from said manufacturer during contract phase, due to possible intellectual property limitations, patents etc.;
- The lack of operational flexibility, consequent to removing the interoperability requirement, seems a minor drawback that could be acceptable to CTA, since both the 5000 and the 7000 fleets are going to be large fleets (approx. 800 cars each);
- The Series 7000 cars will probably have a distinctive design, quite different from the Series 5000, and mixing cars from the two series in a train consist may have an aesthetically negative effect.

Subsequent to the meeting, CTA determined there will be no change to the Technical Specifications, Section 1.02 Compatibility with Existing CTA Cars requirement.

 Technical Specifications, Page DS 1-28, Section 1.13, G, 2, Self Paced Computer-Based Training Program (CBT) (AB-2, 07/19/2013)

AnsaldoBreda submitted the following:

We ask CTA to evaluate the possibility of removing the requirement of previous experience in rail systems for the CBT supplier, in order to widen competition and allow a higher number of qualified suppliers, with demonstrated previous specific and successful experience in CBT, to apply for this project.

Subsequent to the meeting, CTA determined there will be no change to the Technical Specifications, Section 1.13 Self Paced Computer-Based Training Program requirement.

3. <u>Technical Specifications, Page DS 1-34, Section 1.16, Subcontractor Identification and Evaluation (AB-2, 07/19/2013)</u>

AnsaldoBreda submitted information on the following firms and proposed them as a subcontractor for the items listed in Section 1.16 as follows:

1.16, 08 All light fixtures, interior and exterior

Trans-Lite

CTA Accepted

- 1.16, 09
 All cab control, switch, and indicator panels

 AnsaldoBreda
 CTA Accepted
- 1.16, 25 CBT Training

DRS Technologies

Subsequent to the meeting, based upon the materials and information presented, CTA was unable to accept DRS Technologies as a supplier of CBT Training. The presentation failed to demonstrate previous experience in the development of CBT for rail mechanical and electrical systems as stated on Page DS 1-28, Section 1.13, G, 2.

4. Technical Specifications, Page DS 10-02, Section 10.01, L, General (AB-2, 07/19/2013)

AnsaldoBreda presented for Pre-Bid review the lab and field EMI test data from an existing product extrapolated to the installation on the CTA vehicle to demonstrate the ability to achieve EMI/EMC compliance.

CTA acknowledged receipt of AnsaldoBreda's updated documentation in regards to lab and field EMI test data.

 Technical Specifications, Page DS 10-10, Section 10.03, E, 2, b, Filter Capacitors (AB-2, 7/19/13) AnsaldoBreda presented for Pre-Bid review the required charging curve, as a part of its May 23, 2013, Subcontractor Qualification presentation for supply of the Propulsion System.

CTA acknowledged receipt of AnsaldoBreda's updated documentation in regards to the filter charging curves.

If the foregoing does not agree with your understanding of the items discussed, contact Maria Williams-Baxter, Sr. Procurement Administrator as soon as possible.

Requisition No. C13FI101372531 Addendum 10 – Attachment C

Pre-Bid Meeting held at CTA Skokie Shops with Kawasaki Rail Car (KRC) on July 22 and 23, 2013, relative to Requisition C13FI101372531, Specification CTA-7000-12 for the Purchase of Rapid Transit Cars.

The following were in attendance:

Representing Chicago Transit Authority		
Maria Williams-Baxter	Fred Lonnes	Dawid Skarzynski
Robert Kielba	Eric Mattson	John Kilstrom
Grant Macey*	Jorge Silva	Walter Keevil
Representing Kawasaki Rail Car		
Marek Vitek*	Steven Kraycar	Chuck Wochele
Shozo Ito	Kazuo Isomura	Brady Geril*
Tomonori Umebayashi		
Representing TOA Communication Syste	ms, Inc.	
Takeshi Morita*	Kazuhito Kitasawa*	
<u>Representing Pennant</u> John Churchman*		
Representing D&R Technical Solutions Skip Thoman*	Paul Braden*	
Representing Sepsa Ralph Prete*	Julio Rodriguez Perez*	
<u>Representing Fuji Electric Corp.</u> Barbara Houston*	Tomoaki Yokoyama*	Satoru Ozaki*

CHICAGO TRANSIT AUTHORITY **PURCHASE OF RAPID TRANSIT CARS REQUISITION C13FI101372531**

July 22 and 23, 2013

1. Technical Specifications, Page DS 1-34, Section 1.16, Subcontractor Identification and Evaluation (KRC-5, 7/22 - 7/23/13)

Kawasaki submitted information on the following firms and proposed them as a subcontractor for the items listed in Section 1.16 as follows:

1.16, 2	Side Door Operator, Control System and Upper Tracks		
	Fuji Electric Corp.	CTA Accepted	
	CTA stated it has reservations about Fuji's integration of all a	spects of the Door System.	
1.16, 9	All cab control, switch, and indicator panels		
	Kawasaki	CTA Accepted	
1.16, 12	Auxiliary Power Supply System		
	SEPSA	CTA Accepted	
1.16, 18	Trucks		
	Kawasaki	CTA Accepted	
1.16, 22	Car Communications System		
	TOA Communications Systems, Inc.	CTA Accepted	
1.16, 23	<u>Video System</u>		
	TOA Communications Systems, Inc.	CTA Accepted	
1.16, 25	CBT Training		
	Pennant Information Services Ltd.	CTA Accepted	
	D & R	CTA Accepted	
	Page 9 of 13		
2. <u>Technical Specifications, Page DS 9-13, Section 9.03, A. Subcontractor Identification and Evaluation (KRC-5, 7/22 - 7/23/13)</u>

Kawasaki proposed for Pre-Bid evaluation per technical specification section 9.03.A.16, the block diagram of SEPSA's Auxiliary Power Supply as a part of its Subcontractor Qualification presentation.

CTA acknowledged receipt of SEPSA's proposed block diagram for the APS.

If the foregoing does not agree with your understanding of the items discussed, contact Maria Williams-Baxter, Sr. Procurement Administrator as soon as possible.

Requisition No. C13FI101372531 Addendum 10 – Attachment D

Inspection of Cars held at the CTA Skokie Shop, 3701 Oakton St., Skokie, Illinois at 9:00 AM, Saturday, July 20, 2013, relative to Requisition C13FI101372531-Specification CTA 7000-12 for the Purchase of Rapid Transit Cars.

The following were in attendance:

Representing Chicag	<u> zo Transit Authority</u>	
Primary Contact: M	laria Williams, <u>mwilliams@transitchica</u>	go.com
Robert Kielba	John Kilstrom	Fred Lonnes
Jorge Silva	David Skarzynski	

Representing Ansaldo Breda

Primary Contact:Bruno Tasselli, VP Sales Mass Transit, tasselli.bruno@ansaldobreda.itPaolo PezzaLuca luratoGiulio CaloneMarco MalanimaSales Mass Transit, tasselli.bruno@ansaldobreda.it

Representing Bombardier

Primary Contact: Thomas Purmort, Business Development and Sales Executive, <u>Thomas.purmort@us.transport.bomardier.com</u>

<u>Representing Faiveley Transport</u> *Primary Contact:* Didier Aubert, Power & Information System Manager, <u>didier.aubert@faiveleytranspoet.com</u>

Mike Haskins Travis McMahan

<u>Representing ISC Applied Systems</u> *Primary Contact:* Eric Garzon, President, <u>egarzon@iscappliedsystems.com</u>

Representing KawasakiPrimary Contact:Akihiro Ito, Supervisor Marketing & Contracts, itoa@kawasakirailcar.comTomonoki UmebaychiKazuo Isomura

<u>Representing Lecip, Inc</u> *Primary Contact:* Natalie Cornell, Vice President, <u>ncornell@lecipinc.com</u>

Representing Nippon Sharyo USA

Primary Contact: Ken Kuriyama, Manager, Marketing, kuriyama@nipponsharyo.com

Jeremy Walls	Greg Noble	Richard Peacock	Dan Gorstein
Tsutomu Shirai	Pete Kazmarek	Leo Bauby	Udit Dave
Erwin Hartmann	Takemura Masato	Tanigawa Tomoaki	Sakaguchi Yuya
Nakayama Yuta	Suzuki Youhei	Nagai Satoru	Kumada Mitsuru
Masayuki Hayashi	Terry Blair	Frank Archambault	Rick Lupo
Adnan Mehmood			

Representing Sumitomo

Primary Contact: Martin Green, Manager, martin.green@sumitomocorp.com

Representing Toshiba International

Primary Contact:	Takuo Kuwahara, Assista	nt General Manager, <u>takuo</u> .	kuwahara@tic.toshiba.com
Saeed Lewinson	Syuuji Moriya	John Strohm	Mike Murphy
Naoyaki Kurisu	Shirji Kamo	Hiroyuki Suto	

Representing Transit Associates

Primary Contact:Dave Hillock, President, dahtransit@sbcglobal.netTerry BerneroTom Duerr

Representing Wabtec

Primary Contact:	Cornelius R. Stevenson	, Regional Manager, <u>cstevenson@wabtec.com</u>
Zolton Kovacs	John Listar	Jamie Franks – Tec Tran

Representing Liebherr

Primary Contact: Jan Radtke, Sales and Marketing North America, jan.radtke@liebherr.com

Representing Motion Sensors

Primary Contact: Michael Wells, Rail Transit Sales & Customer Support Manager, <u>mwells@motionsensors.com</u>

Representing UKM Transit Products

Primary Contact: Frank Weisbecker, VP, Sales, frank.weisberker@ukmco.com

Representing TransTech

Primary Contact: lan Paradis, President, iparadis@transtech.com

Representing Post Glover Resistors Primary Contact: Bob Roesing, Engineer, 815.727.5000

Representing ABB

Primary Contact: Viktor Nyden, Area Sales Manager, viktor.nyden@ch.abb.com

Representing Dynamic Metals, LLC

Primary Contact: Glen Elijah, Manufacturing Engineer, <u>gelijah@dynamicmetalsllc.com</u> Matt O'Neill

Representing Fuji Electric

Primary Contact:Tomoaki Yokoyama, Manager Sales Dept. II, yokoyama-tomoaki@fujielectric.co.jpSatoru OzakiHiroshi HarieMario Babin

Representing Haysite Reinforced Plastics

Primary Contact: John Steimer, Market Manager Transit, jsteimer@haysite.com

Representing TOA Communication Systems

Primary Contact: Takeshi Morita, President & CEO, <u>takeshi.morita@toacommunications.com</u> Kazuhito Kitasawa

Representing Quester Tangent

Primary Contact: Daniel Cumming, P.Eng., Director, Sales & Marketing, <u>dcumming@questertangent.com</u>

Representing Toyo Denki

Primary Contact:Ito San, Program Manager, cook@toyodenki.netIchiro SueokaCharles Cook

Representing Siemens

Primary Contact: Robert Punzul, Product Marketing Manager, robert.punzul@siemens.com

Representing INIT

Primary Contact: Alfred Burger, APC Project Manager, aburger@intiusa.com



June 26, 2013

CHICAGO TRANSIT AUTHORITY

567 West Lake Street Chicago, Illinois 60661-1498 TEL 312 664-7200 www.transitchicago.com

Subject: Requisition No. C13FI101372531 - IFB to Purchase Rapid Transit Cars Specification CTA 7000-12

Re: Notice of Inspection Meeting & Addendum No. 9

All Potential Bidders:

An Inspection Meeting has been scheduled for all Potential Bidders which have previously requested Pre-Bid Meetings for the subject requisition. This meeting will allow the Potential Bidders to further acquaint themselves with an example of the Authority's 5000 Series Rail Cars. The Inspection Meeting will take place on July 20, 2013, 9:00 AM – 1:00 PM at the following location:

Chicago Transit Authority Skokie Shops, Engineering Offices 3701 Oakton Street Skokie, IL 60076

Enclosed please find Addendum No. 9. This Addendum consists of the Kawasaki Rail Car, Inc. Pre-Bid Meeting Minutes and Attendance List (KRC-4). Insert this Notice of Inspection Meeting and Addendum No. 9 into the Contract Documents of the subject requisition and consider it part of the official Contract Documents.

Additional questions received in writing will be clarified in Pre-Bid Meetings and formally responded by subsequent addendum.

Addendum No.9 shall be acknowledged as received by identification of Addendum No. 9 on the IFB – Bid Proposal Exhibit 2 – Bidder's Signature Page, to be submitted with the Bid Proposal. Failure to acknowledge receipt of Addendum No. 9 or any addenda with your Bid Proposal shall render the Bid Proposal as non-responsive.

The Chicago Transit Authority is seeking bids for the subject procurement. Bid packages are to be delivered to:

By Mail, In Person Drop Off or Delivery Service

Chicago Transit Authority Bid Office - 2nd Floor 567 W. Lake Street Chicago, IL 60661-1498

Bid Due Date (Bid Opening): Wednesday, October 23, 2013, no later than 11:00 A.M. Chicago time

Each Bidder bears full responsibility for delivery to the Bid Office before the advertised date and hour for the opening of Bids. Bidders are solely responsible for ensuring that its Bid is received by the Authority in a timely manner prior to the date and time of Bid Opening. If mail or delivery is delayed beyond the date and hour set for the Bid Opening, Bids delayed will not be considered and will be returned unopened. Bid Office hours are Monday through Friday from 8:00 am to 4:30 pm Chicago time, except holidays.

If you have any questions, please contact Maria Williams-Baxter, Sr. Procurement Administrator <u>mwilliams@transitchicago.com</u> or 312-681-2437.

Sincerely

Ellen McCormack Vice President, Purchasing

Requisition No. C13FI101372531 ADDENDUM No. 9

Pre-Bid Meeting held at CTA Skokie Shops with Kawasaki Rail Car (KRC) on June 19 and 20, 2013, relative to Requisition C13FI101372531, Specification CTA-7000-12 for the Purchase of Rapid Transit Cars.

The following were in attendance:

Representing Chicago Transit Authority

Maria Williams-Baxter	Eric Mattson*	Dawid Skarzynski
Robert Kielba	Jorge Silva	John Kilstrom
Fred Lonnes	Walter Keevil*	Grant Macey*
Representing Kawasaki Rail Car		
Kakushin Hirano	Shozo Ito	Motoki Nagano*
Chuck Wochele		-
Representing Woojin		
Allen Wright*	Joseph Kim*	Junsuk Jeong*
Representing Teleste		
<u>Representing Teleste</u>		
Jani Raytaneva*	Piotr Jurczvnski*	Jerry Castillo*
	· · · · · · · · · · · · · · · · · · ·	
Representing Dilax		
Sylvain Besner*	Alexander Okapuu*	
Representing Dynamic Metals		
Matt O'Neill*	Randy Oswald*	
	Nandy Oswald	
Representing Mitsubishi Electric Con	npany	
Kenneth Buzzard*	Koji Kondo*	Yuya Nakamura*
Akihiro Murahashi*	Shuhei Ozu*	Takahiro Ito*
Hidenari Akagi*		
Faiveley Transport - Elicon National (division	
Dan Simpson*	Mark Kaidut	Michoel Knowsk
Ban Simpson		withder Krause*
<u>Saira – Far Americas</u>		
Michael P Pracht*	Alessandro Fava*	
*- Indicates part-time attendance.		

CHICAGO TRANSIT AUTHORITY PURCHASE OF RAPID TRANSIT CARS **REQUISITION C13FI101372531**

June 19 and 20, 2013

1. <u>Technical Specifications, Page DS 1-34, Section 1.16, Subcontractor Identification and Evaluation</u> (KRC-4, 6/19 - 6/20/13)

Kawasaki submitted information on the following firms and proposed them as a subcontractor for the items listed in Section 1.16 as follows:

1.16, 3	Window Sash	
	Dynamic Metals	CTA Accepted
	Faiveley-Ellcon National Division	CTA Accepted
1.16, 10	Undercar air comfort package	
	Faiveley	CTA Accepted
1.16, 11	Air comfort control system Based upon the materials and information presented, C a supplier of air comfort controls. CTA further commer presentation did not provide details on the relays, cont etc. and the packaging of these controls. CTA had reser supplier's ability to fit all the controls and electrical con comfort unit and still have sufficient space for the equip maintainable.	CTA Accepted Faiveley as nted that the actors, circuit breakers, rvations over the nponents within the air pment to be
1.16, 15	Propulsion System	
	Mitsubishi Electric	CTA Accepted
1.16, 21	Unit and Train Network and Diagnostic System	
	Mitsubishi Electric	CTA Accepted
1.16, 22	Car Communication System	
	Woojin	CTA Accepted
1.16, 23	<u>Video System</u>	
	Woojin	CTA Accepted
1.16, 24	Event Recorder	
	Saira – Far Americas	CTA Accepted

1.16, 26 <u>Automatic Passenger Counter</u> Dilax

CTA Accepted

If the foregoing does not agree with your understanding of the items discussed, contact Maria Williams-Baxter, Sr. Procurement Administrator as soon as possible.



CHICAGO TRANSIT AUTHORITY

567 West Lake Street Chicago, Illinois 60661-1498 TEL 312 664-7200 www.transitchicago.com

June 12, 2013

Subject:

Requisition No. C13FI101372531 - IFB to Purchase Rapid Transit Cars Specification CTA 7000-12

Re: Addendum 8

All Potential Bidders:

Enclosed please find Addendum No. 8. This Addendum revises and updates the Technical Specifications of the IFB. Insert this Addendum No. 8 into the Contract Documents of the subject requisition and consider it part of the official Contract Documents.

Included with Addendum No. 8 are the following four (4) attachments: Attachment A – Sumitomo Corporation of America, Pre-Bid Meeting Minutes & Attendance List (SCOA-1) Attachment B – AnsaldoBreda, Pre-Bid Meeting Minutes and Attendance List (AN-1) Attachment C – Kawasaki Rail Car, Inc., Pre-Bid Meeting Minutes and Attendance List (KRC- 3) Attachment D – Sumitomo Corporation of America, Pre-Bid Meeting Minutes & Attendance List (SCOA-2)

Additional questions received in writing will be clarified in Pre-Bid Meetings and formally responded by subsequent addendum.

Addendum No.8 shall be acknowledged as received by identification of Addendum No.8 on the IFB – Bid Proposal Exhibit 2 – Bidder's Signature Page, to be submitted with the Bid Proposal. Failure to acknowledge receipt of Addendum No. 8 or any addenda with your Bid Proposal shall render the Bid Proposal as non-responsive.

The Chicago Transit Authority is seeking bids for the subject procurement. Bid packages are to be delivered to:

By Mail, In Person Drop Off or Delivery Service

Chicago Transit Authority Bid Office - 2nd Floor 567 W. Lake Street Chicago, IL 60661-1498

Bid Due Date (Bid Opening): Wednesday, October 23, 2013, no later than 11:00 A.M. Chicago time

Each Bidder bears full responsibility for delivery to the Bid Office before the advertised date and hour for the opening of Bids. Bidders are solely responsible for ensuring that its Bid is received by the Authority in a timely manner prior to the date and time of Bid Opening. If mail or delivery is delayed beyond the date and hour set for the Bid Opening, Bids delayed will not be considered and will be returned unopened. Bid Office hours are Monday through Friday from 8:00 am to 4:30 pm Chicago time, except holidays.

If you have any questions, please contact Maria Williams-Baxter, Sr. Procurement Administrator <u>mwilliams@transitchicago.com</u> or 312-681-2437.

Sincerely,

Comack

Ellen McCormack Vice President, Purchasing

Requisition No. C13FI101372531 Addendum 8

Item 1. TECHNICAL SPECIFICATIONS Addendum 7, Item 3 is corrected as follows:

Page DS 17-7, Section 9.05, D, 4, b., Bypass Activator Switch (BAS) Page DS 17-7, Section 17.03, SPECIAL TOOLS AND EQUIPMENT

Delete the last sentence of the second paragraph and replace with the following:

For air conditioning maintenance equipment, see Section 7.01, H.

Item 2. TECHNICAL SPECIFICATIONS Page DS 14-22, Section 14.03, C, 2, Video System – Network Video Recorder

Delete paragraph C,2 in its entirety and replace with the following:

The network video recorder shall be a ruggedized mobile computer with an embedded operating system. The network video recorder shall be of the latest design and shall be reviewed by the Engineer.

Item 3. TECHNICAL SPECIFICATIONS Page DS 14-22, Section 14.03, C, 3, Video System - Network Video Recorder

Delete paragraph C,3 in its entirety and replace with the following:

The recorder shall capture two (2) simultaneous streams of video for each camera. The low bandwidth stream shall be used for remote viewing of the recorded video and the high bandwidth stream shall be used for downloading and archiving for investigation purposes. The recording shall be done on a removable hard disc or solid state drive of sufficient capacity to hold a minimum of one hundred sixty eight hours (168 hrs.) of continuous recording from all nine (9) cameras on a car at a maximum total data rate of 6 Mbps per camera before overwriting occurs. Recorded video shall be in a non-proprietary MPEG4 h.264 format. Recording settings shall be adjusted to meet the image quality requirements of specification section 14.03, B, 2 and optimize storage capacity. Frame rate and low/high bandwidth settings shall be PTU adjustable and reviewed by the Engineer.

Requisition No. C13Fl101372531 Addendum 8

TECHNICAL SPECIFICATIONS

Item 4.

Page DS 14-23, Section 14.03, D, 1, Video System – Remote Interrogation Delete the paragraph D,1 in its entirety and replace with the following: 1. The video system shall be configured for remote interrogation and download via CTA's Teleste video management system. In addition, the system shall stream live video from four (4) preselected cameras to the Train Operator's Touch screen whenever a Passenger Intercom is activated. This live streaming functionality shall be configured as was provided on the 5000 series cars. Item 5. **TECHNICAL SPECIFICATIONS** Page DS 14-23, Section 14.03, D, 4, Video System - Remote Interrogation Delete paragraph D,4 and add paragraph D,3: 3. The video system shall be configured for remote download of recorded images and associated metadata to the Teleste video management system's way side servers. CTA will provide information on the video management system interface requirements during the Design Review phase. Item 6. **TECHNICAL SPECIFICATIONS**

Page DS 14-23, Section 14.03, E, 1, Video System – Playback Equipment

Add the following sentence to the end of paragraph E,1:

In addition, these units shall be equipped with functionality to remotely view live/recorded images and to download recorded images from the NVRs.

 Item 7.
 TECHNICAL SPECIFICATIONS

 Page DS 17-1, Section 17.01, Replacement Unites and Special Tools – General

Delete the first paragraph in its entirety and replace with the following:

The Contractor shall supply replacement units and special tools as detailed below. These units shall be shipped to the Authority as directed by the Engineer. If modifications are made to any unit on the cars before or after delivery to the Authority during the warranty period, they shall be incorporated into all of the replacement units at no cost to CTA. All units shall be complete assemblies, painted as required, ready for installation. Prior to delivering any replacement units, the Contractor shall submit for review by the Engineer a complete listing, with manufacturer part numbers, of all the items to be supplied under Section 17.02.

Requisition No. C13FI101372531 Addendum 8

Item 8. TECHNICAL SPECIFICATIONS

Page DS 17-1, Section 17.01, Replacement Unites and Special Tools – General

Insert the following after the second paragraph of the section:

The initial quantity of spare units shall be delivered as early as practical following completion of the delivery of the Base quantity of cars. The delivery of spare units to be provided for the cars beyond the Base quantity shall be following completion of delivery of each subsequent Option.

Requisition No. C13FI101372531 Addendum 8 - Attachment A

Pre-Bid Meeting held at CTA Skokie Shops with Sumitomo Corporation of America (SCOA) / Nippon Sharyo on May 17, 2013, relative to Requisition C13FI101372531, Specification CTA-7000-12 for the Purchase of Rapid Transit Cars.

The following were in attendance:

Representing Chicago Transit A	uthority	
Maria Williams-Baxter	Klaudiusz Kruszecki	Jorge Silva
Walter Keevil	Fred Lonnes*	Dawid Skarzynski
Robert Kielba	Grant Macey	
John Kilstrom	Eric Mattson	
Representing Sumitomo		
Hideyuki Ninomiya*	Martin Green	
Representing Nippon Sharyo		
Akira Koyasu	Tsutomu Shirai	Thomas Heyden
Ken Kuriyama	Daniel Gornstein	
Representing Toshiba		
Syuuji Moriya*	John Strohm*	Mike Murphy*
Hiroshi Hitta*	Takau Kuwahara*	Masahiko Kamiya*
Jaideep Luthra*		

*- Indicates part-time attendance.

CHICAGO TRANSIT AUTHORITY PURCHASE OF RAPID TRANSIT CARS REQUISITION C13FI101372531 May 17, 2013

1. Instructions to Bidders, Page IB-3, Section F, 7, Bidder Qualifications; Basis For Responsibility Determination (SCOA-1, 5/17/13)

Sumitomo submitted the following:

Would CTA please clarify and/or elaborate what is required to be submitted in order to satisfy this requirement?

CTA advised that Bidders must provide information for evidence of a plan for local problem resolution between the Bidder and the Authority, addressing their plans to supply on-site Engineering and Technical field support during the performance of the Contract and the information must be submitted with the Bid in accordance to Instructions to Bidders, Section V - Bid Submission Requirements. This would be similar to the support information submitted during Pre-Bid subcontractor qualification.

2. <u>Technical Specifications, Page DS 1-4, Section 1.09, Stress Analysis (SCOA-1, 5/17/13)</u>

Nippon Sharyo included for Pre-Bid evaluation a description and provided examples of its stress analysis capabilities, as a part of its May 17, 2013, Subcontractor Qualification presentation for the Carbody Shell.

CTA acknowledged receipt of the information showing Nippon Sharyo's capability to conduct the required stress analyses.

 Technical Specifications, Page DS 1-34, Section 1.16, Subcontractor Identification and Evaluation (SCOA-1, 5/17/13)

Sumitomo/Nippon Sharyo submitted information on the following firms and proposed them as a subcontractor for the items listed in Section 1.16 as follows:

1.16, 6	Carbody Shell		
	Nippon Sharyo	CTA Accepted	
1.16, 15	Propulsion System		
	Toshiba	CTA Accepted	
1.16, 21	Unit and Train Network and Diagnostic Systems		
	Toshiba	CTA Accepted	

4. <u>Technical Specifications, Page DS 2-5, Section 2.03, A, Weight And Certified Weight Slips (SCOA-1, 5/17/13)</u>

Sumitomo submitted the following:

In Section TS 2.02.B. the minimum seating capacity is stated as 38. When multiplying **175** lbs. X 38 (passengers), the result is 6,650 lbs., not 7,200 lbs. Will CTA state which figure is to be used?

CTA confirmed that the 7,200 pounds is to be used for the nominal seated passenger weight.

5. Technical Specifications, Page DS 3-9, Section 3.03, Carbody – Body Bolster (SCOA-1, 5/17/13)

Nippon Sharyo included for Pre-Bid review a description and an example of a body bolster design indicating its intent to use the King Pin – PCC type carbody to truck attachment, as a part of its May 17, 2013, Subcontractor Qualification presentation for the Carbody Shell.

CTA acknowledged receipt of the information showing Nippon Sharyo's intent to use the King Pin – PCC type carbody to truck attachment.

6. <u>Technical Specifications, Page DS 10-5, Section 10.02, B, 6, Operating Conditions and</u> <u>Performance Requirements – Characteristic Curves and Simulations (SCOA-1, 5/17/13)</u>

SCOA/Toshiba proposed for Pre-Bid review the characteristic curves and simulations of the propulsion system, as a part of its May 17, 2013, Subcontractor Qualification presentation for supply of the Propulsion System.

CTA acknowledged receipt of the propulsion curves and simulations.

<u>Technical Specifications, Page DS 10-9, Section 10.03, C, 7, Propulsion Control Units (SCOA-1, 5/17/13)</u>

Sumitomo submitted the following:

According to pictures taken at the Pre-Bid Inspection Meeting, the propulsion enclosure is not of a design that will prevent blowing snow entry. Therefore, the supplier wishes to offer its standard design for enclosures.

CTA advised that the enclosure design is a detail that can be discussed with the successful bidder during the Design Review phase.

8. <u>Technical Specifications, Page DS 10-10, Section 10.03, E, 2, b, Acceleration and Braking Controls</u> <u>– Input Filter – Filter Capacitors (SCOA-1, 5/17/13)</u>

SCOA/Toshiba included for Pre-Bid review the required charging curve, as a part of its May 17, 2013, Subcontractor Qualification presentation for supply of the Propulsion System.

CTA acknowledged receipt of the filter charging curves.

9. <u>Technical Specifications, Page DS 10-23, Section 10.08, A, 1, A Master Controller (SCOA-1, 5/17/13)</u>

Sumitomo submitted the following:

Is it acceptable for the Master Controller to be supplied by the Carbuilder rather than the Propulsion supplier?

CTA stated that it is up to the Carbuilder to determine their supplier for the master controller, CTA has no preference.

10. Technical Specifications, Page DS 11-4, Section 11.03, E, Gear Box Assembly (SCOA-1, 5/17/13)

Sumitomo submitted the following:

CTA's intent is unclear – are the gear boxes, or only the magnetic pick-ups, to be interchangeable with the 5000 & 3200 Series cars' components? If it is the gear box, will CTA provide drawings for the complete assembly?

CTA clarified that only the magnetic pick-ups shall be equivalent and interchangeable with other series cars. CTA further clarified that the gearboxes used on the 7000 Series cars must be interchangeable with each other. For example, if one axle's gear box requires 3 or more magnetic pick-up ports, then all gearboxes must have those provisions even if they are not used.

11. <u>Technical Specifications, Page DS 15-1, Section 15.01, A, 1, Serial Trainline And Data</u> <u>Communications (SCOA-1, 5/17/13)</u>

Sumitomo submitted the following:

Is it possible to supply an interface document for the 5000 Series for trainline compatibility research with 5000 Series?

CTA advised that no additional technical information will be provided other than what is detailed in the Technical Specifications. After Contract Award, CTA will work with the Contractor to provide the necessary information.

12. <u>Technical Specifications, Page DS 15-10, Section 15.09, A, 2, Train Operator's Touch Screen</u> (TOTS) (SCOA-1, 5/17/13)

Sumitomo submitted the following

A potential subcontractor for the TOTS system has interpreted this sub-section to mean display units should be physically interchangeable with those of the 5000 Series. To accommodate their

selection of an appropriate display panel will CTA furnish drawings and specifications for the unit used on the 5000 Series cars?

CTA clarified that the screens displayed on the TOTS shall have a similar appearance to what was provided on the 5000's. The display panel itself does not have to be physically interchangeable with the TOTS screens on the 5000 Series cars.

13. <u>Technical Specifications, Page DS 15-10, Section 15.09, A, 2, Train Operator's Touch Screen</u> (TOTS) (SCOA-1, 5/17/13)

Sumitomo submitted the following:

Is it possible to provide information on how the TOTS works and what the TOTS screens are, in case no documentation is available?

CTA advised that no additional technical information will be provided other than what is detailed in the specifications. After Contract Award, CTA will work with the Contractor to provide the necessary information.

14. <u>Technical Specifications, Page DS 1-1, Section 1.02, Compatibility with Existing CTA Cars (SCOA-1, 5/17/13)</u>

Sumitomo submitted the following:

The requirement to be fully compatible and interoperable with the 5000 Series cars will force a number of systems and components to be functionally and, possibly, physically interchangeable with the 5000 Series cars. Initial questions from one potential subcontractor indicate the need for the electric coupler design of the 7000 Series to be the same as the 5000 Series to accomplish that goal. In particular, Ethernet trainline availability is restricted to the design of the 5000 Series, regardless of any new specification requirements or design preferences of the carbuilder.

Thus, to ensure the carbuilder understands the limitations imposed by the Compatibility requirement, will CTA provide both electric coupler schematics and physical layout drawings for the 5000 Series cars?

CTA stated that no additional technical information will be provided other than what is detailed in the Technical Specifications. After Contract Award, CTA will work with the Contractor to provide the necessary information.

Also see Addendum 4, Attachment B, Item 2.

If the foregoing does not agree with your understanding of the items discussed, contact Maria Williams-Baxter, Sr. Procurement Administrator as soon as possible.

Requisition No. C13FI101372531 Addendum 8 – Attachment B

Pre-Bid Meeting held at CTA Skokie Shops with AnsaldoBreda (AB) on May 20-21 and 23-24, 2013, relative to Requisition C13FI101372531, Specification CTA-7000-12 for the Purchase of Rapid Transit Cars.

The following were in attendance:

Representing Chicago Transit Autho	rity	
Maria Williams-Baxter	John Kilstrom	Eric Mattson
Walter Keevil	Klaudiusz Kruszecki	Jorge Silva*
Robert Kielba	Grant Macey	Dawid Skarzynski
Representing AndaldoBreda		
Bruno Tasselli	Paolo Pezza	Salvator Zazzaro*
David Howe	Luca Lenzi*	Vincenzo Improta*
Luca Lurata	Francesco Oliviero*	Luca Nero*
Representing Baultar		
Tom Fox*	Gilles Bernat*	
Representing Sunglass		
Gery Chimzi*	Marc Bernardoit*	
Representing Sigma-KBC		
Ignacio Fuster*	Jose Luis Caladayud*	Joe Schembri*
Representing IFE N.A.		
Karl Mullinix*	Keith Frazier*	
Representing ISC Applied Systems		
Eric Garzon*	Chris Catterall*	Jean-Yves Monette*

*- Indicates part-time attendance.

CHICAGO TRANSIT AUTHORITY PURCHASE OF RAPID TRANSIT CARS REQUISITION C13FI101372531 May 20-21 and 23-24, 2013

1. Instructions to Bidders, Page IB-1, Section D, BID DEPOSIT – (AB-1, 5/24/13)

AnsaldoBreda submitted the following:

The above mentioned paragraph states that the Bid Deposit must be under the form of an approved Bid Bond. Please confirm that the attached AIA Bid Bond format is acceptable for the Authority.

CTA replied that the question was under review.

Subsequent to the meeting, CTA determined that the proposed bid bond format is under review and a response to this question will be issued in a subsequent addendum.

2. <u>Instructions to Bidders, Page IB-11, Section T, PERFORMANCE BOND AND/OR LETTER OF CREDIT</u> <u>AND INSURANCE – (AB-1, 5/24/13)</u>

AnsaldoBreda submitted the following:

The above mentioned paragraph states that the successful Bidder shall furnish a Performance Bond and/or letter of credit in the amount of twenty-five percent (25%) of the Base contract price within 10 working days after written notice of award is issued and that such performance bond will be adjusted appropriately whenever any subsequent Option is exercised, to decrease to 65% when 50% of the required number of rail cars are delivered and accepted, to 30% when 75% of the required number of rail cars are delivered and accepted and to 0% when 100% of the rails cars are delivered and accepted. This will result in having a unique bond in place for a very long period, well beyond the usual tenor currently accepted by the financial institutions that are, therefore, usually not allowed to commit themselves on such a long tenor. Please confirm that, in lieu of extending the Base buy initial bond, Performance Bonds of the subsequent Options can be covered by a separate, independent bond for each one of them, to be issued within 10 working days from notice of award of each option until acceptance of rail cars of such option.

CTA replied that the question was under review.

Subsequent to the meeting, CTA determined that a response to this question will be issued in a subsequent addendum.

3. <u>Instructions to Bidders, Page 3, Exhibit 2, Insurance and Bond Requirements, Part IV</u> <u>Performance and Payment Bond Requirements/Letter of Credit – (AB-1, 5/24/13)</u>

AnsaldoBreda submitted the following:

The above mentioned paragraph states that the Contractor shall furnish separate Performance and Payment Bonds. Please confirm that both the two different Bonds are required and, in such a case, please inform us about the percentage of the Payment bond. Please, confirm also that the attached AIA Payment bond format is acceptable for the Authority.

CTA replied that the question was under review.

Subsequent to the meeting, CTA clarified Per Exhibit 2, Insurance and Bond Requirements, Part V - Performance and Payment Bonds Required for this Contract, a payment bond is not required.

4. Instructions to Bidders, Page IB-5, Section G, 3, e, Pre-Bid Procedures (AB-1, 5/20/13)

AnsaldoBreda submitted the following:

With reference to the abovementioned requirement, please, confirm that the word 'equal' has to be intended as "equivalent or better" in term of performance, safety, quality, functionality, maintainability, availability, etc. Please, moreover, confirm that technical deviations from the actual design of 3000 and 5000 Series Rail Cars may involve all the vehicle subsystems provided that the operability and relevant compatibility as detailed in the Technical Specifications will be maintained.

CTA confirmed that this interpretation is correct.

5. Technical Specifications, Page DS 1-1, Section 1.03, Car Suitability to CTA Service (AB-1, 5/20/13)

AnsaldoBreda submitted the following:

Please, provide:

1) the relevant running miles/year you foresee the CTA's 7000 series car will run in one year?

2) service day hours

- 3) total hours of power-on (not in running)
- 4) service days per year

CTA advised that the annual average mileage per car is approximately 57,000 miles per year. Daily mileage varies anywhere between 90 and 230 miles based upon the Line where the cars are assigned. Service hours per day also can vary on key routes where service is run 24 hours a day, some number of cars can be in service 16 to 24 hours a day. CTA runs the maximum consist lengths in the AM and PM rush hours and reduces the size of the consists in the off peak so it is difficult to determine what the actual hours of service are per day. Total hours of power – on also varies in the hot summers and cold winters, the cars could be on 24hrs a day if there is a need to keep them cool or warm. CTA service runs year round so it is expected that cars could be in operation all year except for days the cars are held in for maintenance.

6. <u>Technical Specifications, Page DS 1-4, Section 1.09, Stress Analysis (AB-1, 5/20/13)</u>

AnsaldoBreda included for Pre-Bid evaluation a description and provided examples of its stress analysis capabilities, as a part of its Subcontractor Qualification presentation for the Carbody Shell.

CTA acknowledged receipt of the information showing AndaldoBreda's capability to conduct the required stress analyses.

7. <u>Technical Specifications, Page DS 1-34, Section 1.16, Subcontractor Identification and Evaluation</u> (AB-1, 5/20/13)

AnsaldoBreda submitted information on the following firms and proposed them as a subcontractor for the items listed in Section 1.16 as follows:

1.16, 1 <u>Side, end, and operator's cab doors</u>

IFE N.A.

Subsequent to the meeting, based upon the materials and information presented, CTA was unable to accept IFE as a supplier of side, end and operator's cab doors. The presentation failed to demonstrate sufficient understanding of the Technical Specifications.

1.16, 2 Side door operator, control system and upper tracks

IFE N.A.

Subsequent to the meeting, based upon the materials and information presented, CTA was unable to accept IFE as a supplier of side door operator, control system and upper tracks. The presentation failed to demonstrate sufficient understanding of the Technical Specifications.

1.16, 3 <u>Window sash</u>

Sunglass

Subsequent to the meeting, based upon the materials and information presented, CTA was unable to accept Sunglass as a supplier of window sash. The presentation failed to demonstrate sufficient understanding of the Technical Specifications and did not present compliant design concepts.

1.16, 4 Floor panels

Baultar

1.16, 6 <u>Carbody shell</u>

AnsaldoBreda

CTA Accepted

CTA Accepted

1.16, 10	Undercar air comfort package	
	Sigma	CTA Accepted
1.16, 11	Air comfort control system	
	Sigma	CTA Accepted
1.16, 12	Auxiliary Power Supply System	
	AnsaldoBreda	CTA Accepted
1.16, 15	Propulsion System	
	Ansaldo Breda	CTA Accepted
1.16, 18	Trucks	
	AnsaldoBreda Based upon the information and data presented, CTA A a supplier of trucks. However, CTA had reservations ov design concept presented. CTA has had poor experience and has since specified only a flexible frame truck.	ccepted AnsaldoBreda as er the articulated truck e with similar designs
1.16, 21	Unit and Train Network and Diagnostic Systems	
	AnsaldoBreda	CTA Accepted
1.16, 22	Car Communications System	
	ISC Applied Systems	CTA Accepted
1.16, 23	<u>Video System</u>	
	ISC Applied Systems	CTA Accepted
1.16, 26	Automatic Passenger Counter	
	ISC Applied Systems	CTA Accepted

8. <u>Technical Specifications, Page DS 2-1, Section 2.01, Dimensions (AB-1, 5/20/13)</u>

AnsaldoBreda submitted the following:

Considering a pull down system the AB proposal is to have the complete range from 3'-9-1/2" max. at AWO to 3'6-7/8" (available for the primary and secondary suspension vertical play in all the running conditions.

CTA stated the specification was written around a push up system. CTA clarified that if a pull down system is used, it is expected that the car's vertical travel in operation would be between 3'-9-1/2" at AW0 and 3'-7-1/2" at AW3. Car floor height at the platform level would bring the car down into the range of 3'-6" to 3'-6-5/8" regardless of passenger load.

9. <u>Technical Specifications, Page DS 2-2, Section 2.02, Design Requirements- Curve Negotiation -</u> Vertical (AB-1, 5/20/13)

AnsaldoBreda submitted the following:

Please provide the relevant drawings and characteristics of the coupler, to define the minimum vertical curve radius which can be negotiated from the vehicles. And, please, confirm if the assumed parameters values shown in the attached drawings are correct. If not, please provide them.

The minimum vertical curve radius impacts on the undercar equipment dimensions.

CTA advised that information on the vertical curve radius is unavailable. The carbuilder will have to make some assumptions for the design.

10. Technical Specifications, Page DS 3-6, Section 3.02, A, Carbody Framing (AB-1, 5/20/13)

AnsaldoBreda submitted the following:

AnsaldoBreda proposal is to show full vehicle crash simulation according to ASME-RT2 crash scenarios and requirements, giving in that way the evidences that the collapsible zones are outside the bolsters and that the passenger saloon integrity is preserved. Is in this case still necessary to provide evidences of the different strength of the different portion of the carbody? If yes what kind of evidence CTA is willing for?

CTA clarified that as stated in the Technical Specifications, the RT-2 must be followed in principle. In some case the RT-2 requirements may be unsuitable to a short car such as CTA's. Car compatibility and the Technical Specifications would supersede the RT-2 requirements if there is a conflict. This would apply for the testing also.

11. Technical Specifications, Page DS 3-9, Section 3.03, Carbody – Body Bolster (AB-1, 5/20/13)

AnsaldoBreda included for Pre-Bid review a description and an example of a body bolster design indicating its intent to use the King Pin – PCC type carbody to truck attachment, as a part of its Subcontractor Qualification presentation for the Carbody Shell.

CTA acknowledged receipt of the information showing Ansaldo Breda's intent to use the King Pin – PCC type carbody to truck attachment.

12. <u>Technical Specifications, Page DS 3-17, Section 3.07, B, 1, and C, 1, Floor Panels & Floor Covering</u> (AB-1, 5/20/13)

AnsaldoBreda submitted the following:

With reference to the possibility to propose to furnish an item functionally and materially equal to that specified in the Technical Specifications, Ansaldo Breda proposed the following:

AnsaldoBreda "equal" proposal is: "Epoxy based composite Flooring panels with integrated Epoxy/Quartz based Floor Covering is proposed in lieu of a Floor panel and a Floor Covering installed afterward". The documentation and the samples to substantiate such proposal (Abrastop[™] Technical Specification IR50-0055) were given during the May 20 pre-bid meeting.

CTA advised that the proposed epoxy based composite flooring with integrated floor covering is accepted as an equivalent to the composite flooring and rubber floor covering as specified.

13. <u>Technical Specifications, Page DS 3-26, Section 3.10, B, 5, Single and Two Passenger Seats (AB-1, 5/20/13)</u>

AnsaldoBreda submitted the following:

Please, confirm that the relevant addendum reference is related to all the compartment seats and not only to the transversal seat. The question arises from the fact that the previous clause revision refers to the transversal seat: "The transversal seats shall be....".

Please, moreover, confirm if the handrail design shall reflect what foreseen in the 5000 series cars seat design shown in the DR-3 drawing.

CTA advised that Addendum 2, Item 3 for cantilever seats is intended to apply to both longitudinal and transverse seats. CTA also advised that the drawing DR-3 does not reflect the correct hand rail design. The drawing was just for illustration purposes of the cantilever only.

14. Technical Specifications, Page DS 5-8, Section 5.08, Photoluminescent Strips (AB-1, 5/20/13)

With reference to the possibility to propose to furnish an item functionally and materially equal to that specified in the Technical Specifications, Ansaldobreda proposed the following:

AnsaldoBreda "equal" proposal is: "Photoluminescent strip, integrated to the Floor Covering, will run from on both sides of the side doors along the edge of the windscreen and must meet with the strips each side of the aisle". The documentation and the samples to substantiate such proposal (HPPL Technical Specification IR50-0009) were given during the May 20 pre-bid meeting.

CTA advised that the photoluminescent strips as described above are accepted as an equivalent to what is specified.

15. Technical Specifications, Page DS 7-9, Section 7.02, B, Cab Heater and Defroster (AB-1, 5/20/13)

AnsaldoBreda submitted the following:

Please, confirm if the activation of the cab heater is possible only when the master controller is unlocked. Please, confirm if the cab heater fan could be fed from Auxiliary inverter at 230 Vac.

CTA clarified that the cab heater is activated by either the unlocked master controller or the door control box key switch. CTA advised that the cab heater fan must be 37.5VDC, not 230 VAC.

16. <u>Technical Specifications, Page DS 9-11, Section 9.03, A, 3 Auxiliary Power Supply System</u> -<u>General (AB-1, 5/20/13)</u>

AnsaldoBreda submitted the following:

The functionality is clear, but it could be useful to receive detailed information about the switch characteristics already foreseen on the CTA's existing cars. Please, provide them.

CTA advised that a Cutler-Hammer switch is currently used by CTA. Detail of the switch can be discussed at Design Review.

17. <u>Technical Specifications, Page DS 9-13, Section 9.03, A, Subcontractor Identification and</u> <u>Evaluation (AB-1, 5/20/13)</u>

AnsaldoBreda proposed for Pre-Bid evaluation per technical specification section 9.03.A.16, the block diagram of their Auxiliary Power Supply as a part of its Subcontractor Qualification presentation.

CTA acknowledged receipt of Ansaldo Breda's proposed block diagram for the APS.

Technical Specifications, Page DS 9-18, Section 9.03, D, 1, e, Battery Charger – General (AB-1, 5/20/13)

AnsaldoBreda submitted the following:

Please, define what are the "layover loads" and what functions have to be fed.

CTA advised that the layover loads are the various "parasitic" loads that need to be on at all times to provide the specified car and subsystem functionality and minimize the time required for system initialization (boot up) when the car is turned on. These could vary based upon the carbuilder's design.

19. <u>Technical Specifications, Page DS 9-24, Section 9.04, A, 5, Recharge Capability – Full Discharge</u> (AB-1, 5/20/13)

AnsaldoBreda submitted the following:

Please, confirm that the complete discharge (OV) reported in the contractual clause refers to a design condition and not to an operative condition. If not, please define the occurrency of this condition. The reason of this request arises from the fact this kind of discharge reduces the battery capacity proportionally with the quantity of the number of discharge and, consequently, the charging voltage needs to be increased to realize a boost charge.

CTA confirmed that this is a Design condition. CTA notes, however, that a complete discharge can occur and the recharge requirement from 0 volts must be met.

20. Technical Specifications, Page DS 9-26, Section 9.05, A, Air Comfort Panel (AB-1, 5/20/13)

AnsaldoBreda submitted the following:

APS shut down is controlled by the train control logic which sends the off command to the APS. Please, confirm if the reference to APS included in the clause refer also to LVPS and battery charger and not only to the Auxiliary Inverter.

CTA confirmed that this refers to all three elements: LVPS, battery charger and auxiliary inverter. CTA notes that the battery charger operation is dependent on battery voltage and that it will operate independently when the car is shut down.

21. Technical Specifications, Page DS 9-33, Section 9.05, F, 2, Control Panels (AB-1, 5/20/13)

AnsaldoBreda submitted the following:

The APS manual start pushbutton will be powered by Low Voltage system. No specific insulation is needed. Please confirm.

CTA advised that this is not correct. This must be a 600V switch.

22. <u>Technical Specifications, Page DS 9-40, Section 9.13, B, 600VDC Auxiliary Power Trainline (AB-1, 5/20/13)</u>

AnsaldoBreda submitted the following:

Please, detail the function of the combined fuse-switch.

CTA stated the function of the switch is to isolate the 600V trainline between the A and B cars. This is a Filnor switch and details can be discussed during Design Review.

23. <u>Technical Specifications, Page DS 9-40, Section 9.13, B, 3, 600VDC Auxiliary Power Trainline</u> (AB-1, 5/20/13)

AnsaldoBreda submitted the following:

The function of this Isolation contactor should be clarified in details because its function is not specified. The backfeed diodes prevent the current return on the third rail shoes and APS is foreseen with an internal contactor that could be opened to solve this function. Moreover it seems that the isolation contactor should be controlled by the train control logic basing on the signal of line voltage presence coming from the 600Vdc line voltage transducer. In this case, when the battery is dead, how it is possible to close the IC contactor? As alternative the IC coil could powered directly from 600 Vdc; would you provide the relevant equipment reference used on CTA's existing cars?

CTA advised that this is typically done with diodes and a contactor in series. A contactor with a 600 VDC coil has been used in the past. CTA noted that if a low voltage coil, logic driven, contactor is used, the process of powering a car or cars with dead batteries relies on the battery train line circuit receiving power from the car that has been manually started and this may cause problems due to battery trainline capacity and fuse rating. The carbuilder needs to ensure that all auxiliary 600 volt loads are disconnected when the contactor is open. This detail can be discussed during Design Review.

24. <u>Technical Specifications, Page DS 9-40, Section 9.13, B, 6, 600VDC Auxiliary Power Trainline</u> (AB-1, 5/20/13)

AnsaldoBreda submitted the following:

Please provide the relevant drawings and electrical characteristics if the inter-car jumper connector of the CTA's 5000 series cars.

CTA advised that a circular Litton-Veam type connector is used on the 5000's. After Contract Award, CTA will work with the Contractor to provide the necessary information.

25. <u>Technical Specifications, Page DS 9-40</u>, Section 9.13, B, 4, 600VDC Auxiliary Power Trainline (AB-1, 5/20/13)

AnsaldoBreda submitted the following:

AB proposes to put the backfeed prevention diodes in the APS enclosures being the unique equipment on the trainline with the filter capacitors. Please, confirm if this design is acceptable.

CTA confirmed that this is acceptable and will be reviewed during the Design Review phase.

26. <u>Technical Specifications, Page DS 10-5, Section 10.02, B, 6, Performance Requirements –</u> <u>Characteristic Curves and Simulations (AB-1, 5/20/13)</u>

AnsaldoBreda proposed for Pre-Bid review the characteristic curves and simulations of the propulsion system, as a part of its Subcontractor Qualification presentation for supply of the Propulsion System.

CTA acknowledged receipt of the Propulsion curves and simulations.

27. <u>Technical Specifications, Page DS 10-5, Section 10.02, A, 3, Acceleration and Braking Controls</u> (AB-1, 5/20/13)

AnsaldoBreda submitted the following:

In accordance with the requirement 10.03, B, 10 electronic control equipment will be segregated from power equipment except for power semiconductor drive circuits and it will be included in the PCU enclosure.

High speed circuit breaker will be installed outside the PCU enclosures but filter capacitors are located inside.

CTA advised this is a detail that will be discussed during the Design Review phase.

28. Technical Specifications, Page DS 10-10, Section 10.03, E, 2, e, Filter Capacitors (AB-1, 5/20/13)

AnsaldoBreda submitted the following:

The functionality is clear, but it could be useful to receive detailed information about the **switch** characteristics already foreseen on the CTA's existing cars. Please, provide them.

CTA advised that a Cutler-Hammer switch is currently used by CTA. Detail of the switch can be discussed at Design Review.

29. Technical Specifications, Page DS 10-14, Section 10.04, Knife Switch (AB-1, 5/20/13)

AnsaldoBreda submitted the following:

The requirement refers only to the two following positions:

1. Normal operating position (all HV circuit connected to the third rail shoes)

2. Non-operating position: auxiliary circuit connected to split test plug

In the non-operating position third rail shoes and traction inverters are disconnected from the circuit. No grounding position is foreseen. Please, confirm.

CTA confirmed that no grounding position is required.

30. Technical Specifications, Page DS 10-23, Section 10.08, A, 2, Master Controller (AB-1, 5/20/13)

AnsaldoBreda submitted the following:

Master controller is interfaced with PCN by means of Car Control Unit. No electronic control unit and Ethernet interface is foreseen for the master controller.

CTA advised this is a design detail that can vary based on the suppliers design. The 5000 Series car's master controllers currently have an internal electronic control and Ethernet interface.

31. Technical Specifications, Page DS 11-4, Section 11.03, D, Trucks - Ground Brush (AB-1, 5/20/13)

AnsaldoBreda submitted the following:

Please, confirm if two brushes per axle (one-1 for traction current return and one-1 for grounding) are enough.

CTA advised that it is up to the system designer to determine if there are sufficient ground brushes.

32. Technical Specifications, Page DS 11-5, Section 11.03, G, Trucks - Bolster (AB-1, 5/20/13)

AnsaldoBreda submitted the following:

Is 1/2-inch each side of center only the air gap or the total displacement?

In the case 1/2-inch [12 mm] is only the air gap, what is the total displacement? In the case 1/2-inch is the total displacement; our experience says that it is very narrow. This small displacement can lead to uncomfortable behavior. Is it possible to increase the lateral displacement, let's say to 1-3/16" - 1-9/16" [30-40 mm]?

CTA confirmed that $\frac{1}{2}$ " is the air gap. CTA does not have information on the total displacement.

33. <u>Technical Specifications, Page DS 11-7, Section 11.03, H, 3, b., 1) Suspension System (AB-1, 5/20/13)</u>

AnsaldoBreda submitted the following:

Is the note one (1) to be respected on both raised and lowered conditions? Can we propose to calculate the available space for the underframe with different conditions for vehicle at platform and vehicle in running order?

CTA clarified that this note is applicable for the lowered condition. The design height from top of rail for the platforms is 42". To meet the ADA requirements, the threshold height shall be between 42" and 42-5/8" regardless of load. In the raised condition the height is based upon spring deflection and passenger load. The static under car clearances are outlined in drawing DR-14.

34. Technical Specifications, Page DS 12-16, Section 12.08, Welding (AB-1, 5/20/13)

AnsaldoBreda submitted the following:

Does CTA have any restriction in principle about laser welding process?

CTA advised there are no restrictions on the use of laser welding. CTA stated that this can be discussed during Design Review. The repair-ability of laser welded materials must be taken into consideration when determining the design of the welds.

35. <u>Technical Specifications, Page DS 15-1, Section 15.01, A, 4, Serial Trainline and Data</u> <u>Communications – Overview (AB-1, 5/20/13)</u>

AnsaldoBreda provided for Pre-Bid evaluation per Technical Specification Section 15.01, A, 4, the Serial Trainline and Data Communications system block diagrams. The information was submitted as a part of its Subcontractor Qualification presentation for supply of this system.

CTA acknowledged receipt of the block diagrams.

36. Technical Specifications, Page DS 2-1, Section 2.01, L, Dimensions (AB-1, 5/20/13)

AnsaldoBreda submitted the following:

With reference to the requirement, please confirm if the above reported dimensions refer to the height of the secondary suspension at the two levels of load and permit to calculate the vertical displacement from AW0 to AW3 of both primary and secondary suspension. If so, we intend that the displacement is only 5/8'' [≈ 16 mm] for both primary and secondary suspension. In our opinion, this displacement is very low and would lead to a very

uncomfortable behavior. Normally, for vehicle of this type we have about 1-3/16" to 1-9/16" [30÷40 mm] for the secondary suspension and 13/32" to 25/32" [10÷20 mm] for the primary suspension when, like in this case, the truck frame is articulated.

Please, confirm if the total displacement (both for primary and secondary suspension) is equal to 5/8" or give us the correct value of such displacement.

If the total displacement is 5/8", can we increase this displacement provided that the height of the threshold when the train is at the platform is the correct one (set point)?

CTA clarified that this is incorrect; there must have been an error in AB's calculation. The displacement between AWO and AW3 in the fully raised position is actually 2" (3'-9-1/2" minus 3'-7-1/2").

37. Technical Specifications, Page DS 2-2, Section 2.02, C, 2, Design Requirements (AB-1, 5/20/13)

AnsaldoBreda submitted the following:

Please, provide the detailed drawings of the coupler Wabtec No. 060031-3002, Form 5H tightlock type: the coupler length and pivot location are needed to define the minimum vertical radius that can be negotiated by the vehicle.

CTA advised that no additional technical information will be provided other than what is detailed in the Technical Specifications. After Contract Award, CTA will work with the Contractor to provide the necessary information.

38. Technical Specifications, Page DS 2-2, Section 2.02, C, 2, Design Requirements (AB-1, 5/20/13)

AnsaldoBreda submitted the following:

It's not totally clear to AnsaldoBreda what the "pilot" is. Drawing or pictures or any further explanation about its functionality would be very appreciated.

CTA clarified that the pilot is a blade on the front of the car used to clear snow or other debris from the tracks as the car is moving. These are installed on all CTA rail cars. The blade is shown on the front of the car in the Plan and Elevation drawing on page DR-1.

CTA advised that no additional technical information will be provided other than what is detailed in the Technical Specifications. After Contract Award, CTA will work with the Contractor to provide the necessary information.

39. Technical Specifications, Page DS 3-7, Section 3.02, B, End Posts (AB-1, 5/20/13)

AnsaldoBreda submitted the following:

To ensure a perfect compatibility in the collision load exchange between existing and new cars Ansaldo Breda kindly requests to CTA some clarifications or sketches or drawings about the current anti-telescoping plate detail. CTA advised that no additional technical information will be provided other than what is detailed in the Technical Specifications. After Contract Award, CTA will work with the Contractor to provide the necessary information.

40. <u>Technical Specifications, Page DS 11-7, Section 11.03,H, 3, a</u>, <u>Secondary Suspension System</u> - <u>General (AB-1, 5/20/13)</u>

AnsaldoBreda submitted the following:

The height (in inches) of the set point is not clearly stated in the technical specification, but in section 2.01, letter "L" point 3, there is written that the height of the secondary suspension at platform level is 3'-6-1/4" + 5/8" / -1/4" [1073 + 15,9 / -6,4 mm]. We think that 3'-6-1/4" is the set point, i.e., the height of the secondary suspension from the top of rail when the hydraulic system keep the car at this height to permit the passenger to circulate through the door. Could you confirm this assumption?

Moreover, please, confirm if it is possible to compensate the wheel wear by means of shims (i.e. at the secondary suspension).

CTA advised that this dimension referenced in 2.01,L is from top of running rail to door threshold not height of secondary suspension. CTA further clarified that the CTA station platforms are set at 3'-6-1/4'' and the goal is to have the threshold height even with the station platform regardless of load. ADA allows from some variation which is reflected in the +5/8'' and -1/4''

CTA also clarified that wheel wear is compensated for by shimming at the king pin not secondary suspension.

If the foregoing does not agree with your understanding of the items discussed, contact Maria Williams-Baxter, Sr. Procurement Administrator as soon as possible.

Requisition No. C13FI101372531 Addendum 8 – Attachment C

Pre-Bid Meeting held at CTA Skokie Shops with Kawasaki Rail Car (KRC) on May 30 and 31, 2013, relative to Requisition C13FI101372531, Specification CTA-7000-12 for the Purchase of Rapid Transit Cars.

The following were in attendance:

Representing Chicago Transit Author	ity	
Maria Williams-Baxter	Fred Lonnes	Dawid Skarzynski
Robert Kielba*	Eric Mattson*	John Kilstrom
Klaudiusz Kruszecki	Jorge Silva	
Representing Kawasaki Rail Car		
Maurice Andriani	Steven Kraycar	Chuck Wochele
Kakushin Hirano	Motoki Nagano*	
Representing TOA Communication Sy	<u>/stems, Inc.</u>	
Takeshi Morita*	Rei Watanabe*	
Tamamo Yura*	Toshiyuki Katsumura*	
Representing QuesterTangent		
David Gregson*	Larry Kubek*	
<u>Representing Fuji Electric Corp.</u> Barbara Houston* Takao Kamada*	Kazuki Iwao*	Satoru Ozaki*

*- Indicates part-time attendance.

CHICAGO TRANSIT AUTHORITY PURCHASE OF RAPID TRANSIT CARS REQUISITION C13FI101372531 May 30 and 31, 2013

1. <u>Bid Proposal, Page P-6, Section II, Bidding Form, 3rd Paragraph, 1st Sentence (KRC-3, 5/31/13)</u>

Kawasaki submitted the following:

Kawasaki Rail Car, Inc. (KRC) recognizes that the bid prices applicable to Part 1 - Base Contract for 100 cars is to be firm fixed United States Dollars, however, we understand that bid prices applicable to Part 2 - Optional Purchases will be subject to escalation in accordance with General Specifications Section 32, Escalation Clause for Options.

KRC is pleased to provide the following modification for the Authority's review and consideration:

"With respect to Part 1 – Base Contract, the bid price shall be a firm fixed price for the duration of the Contract and be quoted in United States Dollars. With respect to Part 2 - Optional Purchases, the bid prices shall be firm for the duration of the Contract, subject to escalation in accordance with General Specifications Section 32 and shall be quoted in United States Dollars."

CTA responded that the question is under review.

Subsequent to the meeting, CTA confirmed that all bid prices shall be firm fixed prices for the duration of the Contract and be quoted in United States Dollars. Escalation will apply for Options on a one time basis as specified in Section 32 of the General Specifications. Also see Addendum 5, Item 13.

2. <u>Bid Proposal, Page P-7, Section II, Bidding Form, Part 2 – Optional Purchases (KRC-3, 5/31/13)</u>

Kawasaki submitted the following:

Kawasaki Rail Car, Inc. (KRC) intends to furnish the special test equipment and replacement units set out in the Technical Specifications, as part of the Base Contract. Can the Authority please clarify what additional special test equipment and replacement units will be required with any or all of the eight options included on the Bidding Form?

CTA clarified that quantities of replacement units and PTUs for options are required to be provided as specified in the Technical Specifications, Section 17 – Replacement Units and Special Tools. CTA further clarified that additional special tools are not required for the Options.

3. <u>Technical Specifications, Page DS 1-34, Section 1.16, Subcontractor Identification and Evaluation</u> (KRC-3, 5/30 - 5/31/13)

Kawasaki submitted information on the following firms and proposed them as a subcontractor for the items listed in Section 1.16 as follows:

1.16, 2Side Door Operators Control System and Upper Tracks

Fuji Electric Corp.

Subsequent to the meeting, based on the information presented, CTA was unable to accept Fuji as a supplier of Side Door Operators & Controls. The presentation failed to demonstrate sufficient understanding of the Technical Specification requirements, such as lubrication and door control box arrangement as well as other details related to the operation & control of the doors.

1.16, 12	Auxiliary Power Supply System
-	

Fuji Electric Corp.

Subsequent to the meeting, based on the information presented, CTA was unable to accept Fuji as a supplier of the Auxiliary Power Supply. The presentation failed to demonstrate sufficient understanding of the Technical Specification requirements. The presentation did not fully identify a compliant approach to the requirements and, in addition, did not address the diagnostic requirements called for in the specification.

SEPSA

Subsequent to the meeting, based on the information presented CTA was unable to accept SEPSA as a supplier of the Auxiliary Power Supply. The presentation failed to show full understanding of important specification requirements notably diagnostics.

1.16, 14 <u>Horn</u>

1.16, 22

TOA Communications Systems, Inc.

Subsequent to the meeting, CTA Accepted TOA as a supplier of the Horn System. However, CTA had reservations about the mechanical strength of the Horn mounting bracket, power rating of the horn speaker and the Power Output of the Horn Amplifier as well as the size of the Horn Amplifier.

1.16, 21 Unit and Train Network and Diagnostic System

Quester Tangent	CTA Accepted
ISC Applied Systems	CTA Accepted
Car Communications System	
Sepsa	CTA Accepted
TOA Communications Systems, Inc.	

Subsequent to the meeting, based on the information presented, CTA was unable to accept TOA as a supplier of the Communications System. The

presentation failed to demonstrate a full understanding of the Technical Specification requirements.

1.16, 23 <u>Video System</u>

Sepsa

CTA Accepted

TOA Communications Systems, Inc.

Subsequent to the meeting based on the information presented CTA was unable to accept TOA as a supplier of the Video System. The presentation failed to demonstrate sufficient understanding of the Technical Specification requirements.

1.16, 24 Event Recorder

Quester Tangent	CTA Accepted
Sepsa	CTA Accepted

4. <u>Technical Specifications, Page DS 17-9, Section 17.04, D, Portable Test Units (PTU), (KRC-3, 5/30</u> - 5/31/13)

Kawasaki submitted the following:

This section requires the PTU laptop to be equipped with a WIFI capability.

Please tell us what type of information transmitted between the Data Radio and PTU.

Page DR-11, SKE-1-092112A, the block diagram shows the antennas of the Data Radio and the PTU facing each other implying the WIFI data transmission between the two systems. However, the Technical Specification did not contain details for this aspect.

CTA stated that the information that would be transmitted between the Data Radio and PTU is Live Video.

5. <u>Technical Specifications, Page DS 17-9, Section 17.04, D, Portable Test Units (PTU), (KRC-3, 5/30 - 5/31/13)</u>

Kawasaki submitted the following:

The requirement states "each type of PTU shall be the same for all type". We would like to know if the phrase "the same for all types" means PTU applications must look the same regardless of the systems. For example, Propulsion PTU, HVAC PTU, and other system PTU must look alike on the screen (the same menu items, Button layout, etc). In other words, do we need to standardize the look and feel of the PTU applications' Graphical User Interface?

CTA stated that this statement refers to the computer hardware and Operating System of the Laptop (PTU) not the car system specific software.

6. <u>Technical Specifications, Page DS 17-8, Section 17.04, A~C, Portable Test Units (PTU), (KRC-3, 5/30 - 5/31/13)</u>

Kawasaki submitted the following:

a) We would like to verify that we are to supply three types of PTU configurations as follows:
 PTU Type 1 = System PTU: loaded with applications for systems identified in Item A
 PTU Type 2 = ATC PTU: only with ATC PTU application.
 PTU Type 3 = Video PTU: installed only with the Video PTU application.

We are accustomed to provide one type of PTU configuration for a project, and this CTA's requirement found in the TS to be unique to Kawasaki.

CTA confirmed the Contractor is to supply all three types of PTU.

b) What is the primary reason CTA wishes to separate ATC PTU and Video PTU from other system PTU?

CTA stated this is for security purposes. ATC diagnostics are only accessed by the ATC department and not general repairmen. The video PTUs are to be used strictly by the security/claim departments who don't need access to any of the other PTU programs. CTA also stated that the Video PTU application is to be installed in the Type 1 = System PTU for general repairmen that do the periodic maintenance on the video system.

c) Will it be acceptable to install all PTU applications, including ATC and Video PTU, on to one computer?

CTA stated that this is unacceptable.

If the foregoing does not agree with your understanding of the items discussed, contact Maria Williams-Baxter, Sr. Procurement Administrator as soon as possible.
Requisition No. C13FI101372531 Addendum 8 - Attachment D

Pre-Bid Meeting held at CTA Skokie Shops with Sumitomo Corporation of America (SCOA) / Nippon Sharyo on June 7, 2013, relative to Requisition C13FI101372531, Specification CTA-7000-12 for the Purchase of Rapid Transit Cars.

The following were in attendance:

Representing Chicago Transit Authority

Maria Williams-Baxter Walter Keevil Robert Kielba	John Kilstrom Klaudiusz Kruszecki Eric Mattson	Jorge Silva Dawid Skarzynski
Representing Sumitomo		
Hideyuki Ninomiya	Martin Green	Satoshi Suzuki
Representing Nippon Sharyo		
Akira Koyasu Ken Kuriyama	Thomas Heyden Daniel Gornstein*	Toshiki Hunii
Representing Wabtec		
Cornelious Stevenson*	Jamie Franks*	Zoli Kovacs*
Representing Tech Tran		
John Listar*		

*Indicates part-time attendance.

CHICAGO TRANSIT AUTHORITY PURCHASE OF RAPID TRANSIT CARS REQUISITION C13FI101372531 June 7, 2013

<u>Technical Specification, Page DS 1-34, Section 1.16, Subcontractor Identification and Evaluation</u> (SCOA-2, 6/7/13)

Sumitomo/Nippon Sharyo submitted information on the following firms and proposed them as a subcontractor for the items listed in Section 1.16 as follows:

1.16,17 <u>Track Brakes</u>

Wabtec-Tech Tran

CTA Accepted

CTA Accepted

1.16, 18 <u>Trucks</u>

Nippon Sharyo

1.16, 19 Active Suspension System

Wabtec-Tech Tran

Subsequent to the meeting, based on the materials and information provided, CTA advised that they are unable to accept Wabtec-Tech Tran as a supplier of the Active Suspension System. The presentation failed to demonstrate sufficient understanding of the Technical Specifications. Details on the controls, PTU diagnostics, and bench test equipment were not included. Based upon CTA's judgment, the supplier lacks suitable experience and qualifications in supplying Active Suspension Systems.

2. <u>Technical Specification, Page DS 11-5, Section 11.03, Trucks- Design Requirements – Bolster</u> (SCOA-2, 6/7/13)

Nippon Sharyo included for Pre-Bid review a description and an example of a conceptual truck design indicating its intent to use the PCC type King Pin carbody to truck attachment their Subcontractor Qualification presentation for the Trucks.

CTA acknowledged receipt of the information showing Nippon Sharyo's intent to use the PCC type King Pin carbody to truck attachment.

If the foregoing does not agree with your understanding of the items discussed, contact Maria Williams-Baxter, Sr. Procurement Administrator as soon as possible.



cta

May 28, 2013

567 West Lake Street Chicago, Illinois 60661-1498 TEL 312 664-7200 www.transitchicago.com

Subject: Requisition No. C13FI101372531 - IFB to Purchase Rapid Transit Cars Specification CTA 7000-12

Re: Addendum 7

All Potential Bidders:

Enclosed please find Addendum No. 7. This Addendum updates the Technical Specifications of the IFB and consists of the Bombardier Transit Corporation, Pre-Bid Meeting Minutes and Attendance List (BTC-4). Insert this Addendum No. 7 into the Contract Documents of the subject requisition and consider it part of the official Contract Documents.

Additional questions received in writing will be clarified in Pre-Bid Meetings and formally responded by subsequent addendum.

Addendum No.7 shall be acknowledged as received by identification of Addendum No. 7 on the IFB – Bid Proposal Exhibit 2 – Bidder's Signature Page, to be submitted with the Bid Proposal. Failure to acknowledge receipt of Addendum No. 7 or any addenda with your Bid Proposal shall render the Bid Proposal as non-responsive.

The Chicago Transit Authority is seeking bids for the subject procurement. Bid packages are to be delivered to:

By Mail, In Person Drop Off or Delivery Service

Chicago Transit Authority Bid Office - 2nd Floor 567 W. Lake Street Chicago, IL 60661-1498

Bid Due Date (Bid Opening): Wednesday, October 23, 2013, no later than 11:00 A.M. Chicago time

Each Bidder bears full responsibility for delivery to the Bid Office before the advertised date and hour for the opening of Bids. Bidders are solely responsible for ensuring that its Bid is received by the Authority in a timely manner prior to the date and time of Bid Opening. If mail or delivery is delayed beyond the date and hour set for the Bid Opening, Bids delayed will not be considered and will be returned unopened. Bid Office hours are Monday through Friday from 8:00 am to 4:30 pm Chicago time, except holidays.

If you have any questions, please contact Maria Williams-Baxter, Sr. Procurement Administrator <u>mwilliams@transitchicago.com</u> or 312-681-2437.

Sincerely,

Ellen McCormack Vice President, Purchasing

Requisition No. C13FI101372531 ADDENDUM No. 7

Item 1. TECHNICAL SPECIFICATIONS

Page DS 7-8, Section 7.01, H, Air Comfort - Maintenance Equipment

Add the following new paragraph to the end of the subsection:

4. Twelve (12) hand held temperature simulator boxes that will allow maintenance personnel to simulate the return air and fresh air temperature sensors to manually cycle the air comfort system controller though the various modes of operation.

Item 2. TECHNICAL SPECIFICATIONS Page DS 10-10, Section 10.03, E, 2, b. Filter Capacitors

Add the following to the end of the paragraph:

Filter charging characteristics shall be such that if 24 fully discharged cars are recharged simultaneously on one power section, the substation feeder breakers shall not trip. The 600 volt power system feeder circuit breakers have the following characteristics: Rate of rise tripping can be one of two characteristics: a) 24,000 Amps/second for 100 msec; or, b) 30,000 Amps/second followed by a 3000 Amp step function. In addition, the current trip is set for 10,000 Amps on feeder breakers.

Item 3. TECHNICAL SPECIFICATIONS

Page DS 17-7, Section 9.05, D, 4, b., Bypass Activator Switch (BAS)

Delete the last sentence of the second paragraph and replace with the following:

For air conditioning maintenance equipment, see Section 7.01, H.

CHICAGO TRANSIT AUTHORITY PURCHASE OF RAPID TRANSIT CARS REQUISITION C13FI101372531

May 15 and 16, 2013

Pre-Bid Meeting held at CTA Skokie Shops with Bombardier Transit Corporation (BTC) on May 15 and 16, 2013, relative to Requisition C13FI101372531, Specification CTA-7000-12 for the Purchase of Rapid Transit Cars.

The following were in attendance:

Representing Chicago Transit Autho	prity	
Maria Williams-Baxter	Klaudiusz Kruszecki	Jorge Silva
Walter Keevil	Fred Lonnes	Dawid Skarzynski*
Robert Kielba	Grant Macey*	· · · · · · · · · · · · · · · · · · ·
John Kilstrom	Eric Mattson	
Representing Bombardier Transit Co	orporation	
Joe Kenas	Simon Deslauriers	
Tom Purmort	Martin Dufour	
STE Electronics		
Gho Eng Cian*	Liao Jun*	
Sojitz Corporation		
Dai Iwama*	Hats Kageyama*	
<u>Mitsubishi Electric</u> Ken Buzzard*	Shuboi Ozu*	
Sam Kosuga*	Thaddous Pagowski*	Sam Anand *
Huotaro Harata*	Vasuuki Sagawa*	Shinichi Isurumoto*
Rick Foster*	Shiro Takatani*	
ABB		
Ted loannou*	Erik Martensson*	Patrick Scherrer*
Keyvan Shokoofh*	Michael Habouri*	Pascal Gysin*
Thermo King		
Magdi Sayegh*	Dominique Vallas*	Pavel Doubek*
Natalle Cornell*	Naoki Yada*	Chung-Chung Tam*
Milwaukee Composites		
Ryan Kober*	Balph Dolinger*	loff Kohor*
,	Naiph Domiger	
Ansaldo STS		
Eric Schook*	Brad Guest*	

*Indicates part-time attendance.

CHICAGO TRANSIT AUTHORITY PURCHASE OF RAPID TRANSIT CARS REQUISITION C13FI101372531 May 15 and 16, 2013

1. Page DS 1-34, Section 1.16, Subcontractor Identification and Evaluation (BTC-4, 5/15 – 5/16/13)

Bombardier submitted information on the following firms and proposed them as a subcontractor for the times listed in Section 1.16 as follows:

1.16, 4 Floor Panels

RailTech Composites

Based upon the presentation, CTA did not accept Rail Tech Composites as a subcontractor for floor panels. The Plymetal Panels proposed are not compliant to the specification requirements for "Composite" flooring.

Milwaukee Composites

CTA Accepted

1.16, 8 All light fixtures, Interior and Exterior

Lecip

CTA Accepted

1.16, 10 Undercar Air Comfort Package

Thermo King

Based upon the materials and information presented, CTA accepted Thermo King as supplier of air comfort units. However, CTA had reservations over some of the elements in the presentation and materials presented. The preliminary design concept in the presentation was based upon a condenser core arrangement that was proven to be problematic in the past at CTA.

Mitsubishi Electric

CTA Accepted

1.16, 11 Air Comfort Control System

Thermo King

Based upon the materials and information presented, CTA Accepted Thermo King as a supplier of air comfort controls. However, CTA had reservations over the supplier's ability to fit all the controls and electrical components (relays, contactors, circuit breakers, etc.) within the air comfort unit and still have sufficient space for the equipment to be maintainable. In addition, the electronic controller's electrical connections were not compliant to the specifications.

Mitsubishi Electric

Based upon the materials and information presented, CTA Accepted Mitsubishi as a supplier of air comfort controls. However, CTA had reservations over the supplier's ability to fit all the controls and electrical components (relays, contactors, circuit breakers, etc.) within the air comfort unit and still have sufficient space for the equipment to be maintainable. CTA further commented that the example provided in the presentation did not fully illustrate the packaging of all the controls.

1.16, 12 <u>Auxiliary Power Supply System</u>

ABB

Subsequent to the meeting, CTA Accepted ABB as a supplier for Auxiliary Power Supply System. However, based on the materials and information provided, CTA had reservations over the maintenance access and failure to include the required Galvanic isolation in the presentation.

Mitsubishi Electric

Subsequent to the meeting, based upon the materials and information provided, CTA was unable to accept Mitsubishi as a supplier. The presentation failed to demonstrate sufficient understanding of the Technical Specifications. Details on the controls, conceptual equipment layout, PTU diagnostics, and bench test equipment were not included.

1.16, 20 ATC/ATO System

Ansaldo

CTA Accepted

1.16, 22 Car Communications System

Bombardier/ST Electronics

Subsequent to the meeting, based on the materials and information provided, CTA was unable to accept Bombardier/ST Electronics as a supplier of the Communications System package. Based upon CTA's judgment, the supplier lacks suitable experience and qualifications in supplying and supporting the proposed communications systems in the US.

Mitsubishi Electric

CTA Accepted

1.16, 23 <u>Video System</u>

Bombardier/ST Electronics

Subsequent to the meeting, CTA was unable to accept Bombardier/ST Electronics for the video system. Based upon the presentation, ST Electronics did not show compliance to Section 14.03, C, 2 or sufficient detail as to how they will accomplish compatibility to the Teleste VMX video management system. In addition, based upon CTA's judgment, the supplier lacks suitable experience and qualifications in supplying and supporting the proposed video systems in the US. Mitsubishi Electric

Subsequent to the meeting, CTA did not accept Mitsubishi for the video system. Based upon the presentation, Mitsubishi did not show compliance to Section 14.03, C, 2 or sufficient detail as to how they will accomplish compatibility to the Teleste VMX video management system.

1.16, 26 <u>Automatic Passenger Counter</u>

Bombardier/ST Electronics

Subsequent to the meeting, based on the materials and information provided, CTA was unable to accept Bombardier/ST Electronics as a supplier of the Automatic Passenger Counter System. Based upon CTA's judgment, the supplier lacks suitable experience and qualifications in supplying and supporting the proposed APC systems in the US.

Page DS 9-13, Section 9.03, A, Subcontractor Identification and Evaluation (BTC-4, 5/15 – 5/16/13)

Bombardier proposes for Pre-Bid evaluation per technical specification section 9.03.A.16, the block diagram of the ABB Auxiliary Power Supply. The qualifying information can be found in the documentation submitted to qualify ABB for the supply of the Auxiliary Power Supply which has been provided.

CTA acknowledged receipt of Bombardier/ABB's proposed block diagram for the APS.

3. Page DS 9-13, Section 9.03, A, Subcontractor Identification and Evaluation (BTC-4, 5/15 – 5/16/13)

Bombardier proposes for Pre-Bid evaluation per technical specification section 9.03.A.16, the block diagram of the Mitsubishi Electric Auxiliary Power Supply. The qualifying information can be found in the documentation submitted to qualify Mitsubishi Electric for the supply of the Auxiliary Power Supply which has been provided.

CTA acknowledged receipt of Bombardier/Mitsubishi's proposed block diagram for the APS.

4. Page DS 14-18, Section 14.02, L, Destination and Run Number Signs (BTC-4, 5/15 – 5/16/13)

Bombardier/ST Electronics requested that CTA clarify if both sides of the dual faced side destination sign must be full color LED. This is different than what was provided on the 5000 Series cars.

CTA confirmed that the sign requirement has changed since the 5000 series specification and paragraph 1 of Section 14.02, L applies to both sides of the sign. CTA also stated that the intensity of the interior color sign may have to be reduced below that of the exterior sign.

If the foregoing does not agree with your understanding of the items discussed, contact Maria Williams-Baxter, Sr. Procurement Administrator as soon as possible.

CHICAGO TRANSIT AUTHORITY Advertisement for Professional Services

NOTICE OF TIME EXTENSION WITH ADDENDUM No.6

Notice is hereby given that the proposed due date heretofore advertised as Thursday, July 25, 2013 has been extended to Wednesday, October 23, 2013 no later than 11:00 A.M. in the Bid Office - 2nd Floor, 567 W. Lake, Chicago, Illinois 60661-1498 for the following item:

> Req. C13FI101372531 Rapid Transit Cars.

> > Bid Deposit: \$500,000.00

For additional information, please contact Maria Williams-Baxter, Sr. Procurement Administrator, at 312/681-2437.

Any contract resulting from this bid is subject to a financial assistance between the Chicago Transit Authority, the United States Department of Transportation and the Regional Transportation Authority.

Contractor will be required to comply with all applicable Equal Employment Opportunity laws and regulations and affirmative action requirements of the Federal Transit Administration and Illinois Human Rights Commission.

All bidders will be required to certify that they are not on the Comptroller General's list of ineligible contractors.

Any contract resulting from this advertisement will be awarded to the lowest responsive and responsible bidder.

Chicago Transit Authority hereby notifies all bidders that it will affirmatively ensure that in regard to any contract entered into pursuant to this advertisement, Disadvantaged Business Enterprise will be afforded full opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color or national origin in consideration for an award.

PLEASE NOTE: Where bids are sent by mail, delivery service or delivered in-person to the CTA Bid Office, the bidders shall be responsible for their delivery only to the Bid Office before the advertised date and hour for the opening of the bids. The Bid Office hours are Monday through Friday from 8:00 a.m. to 4:30 p.m. Chicago time, except holidays.

The right is reserved to accept any bid or any part or parts thereof or to reject any and all bids.

All inquiries should be directed to and copies of bid documents obtained from the Bid Office – 2^{nd} Floor, 567 W. Lake Street, Chicago, Illinois 60661-1498.

CHICAGO TRANSIT AUTHORITY

By: Ellen McCormack Vice President, Purchasing

May 17, 2013





567 West Lake Street Chicago, Illinois 60661-1498 TEL 312 664-7200 www.transitchicago.com

May 15, 2013

Subject: Requisition No. C13FI101372531 - IFB to Purchase Rapid Transit Cars Specification CTA 7000-12

Re: Notice of Time Extension & Addendum 6

All Potential Bidders:

The Bid Due Date for the subject requisition has been extended from July 25 to October 23, 2013. Enclosed please find Addendum No. 6. This Addendum updates the Technical Specifications of the IFB and consists of the Bombardier Transit Corporation, Pre-Bid Meeting Minutes and Attendance List (BTC-3). Insert this Notice of Time Extension & Addendum No. 6 into the Contract Documents of the subject requisition and consider it part of the official Contract Documents.

Additional questions received in writing will be clarified in Pre-Bid Meetings and formally responded by subsequent addendum.

Addendum No.6 shall be acknowledged as received by identification of Addendum No. 6 on the IFB – Bid Proposal Exhibit 2 – Bidder's Signature Page, to be submitted with the Bid Proposal. Failure to acknowledge receipt of Addendum No. 6 or any addenda with your Bid Proposal shall render the Bid Proposal as non-responsive.

The Chicago Transit Authority is seeking bids for the subject procurement. Bid packages are to be delivered to:

By Mail, In Person Drop Off or Delivery Service

Chicago Transit Authority Bid Office - 2nd Floor 567 W. Lake Street Chicago, IL 60661-1498

Previous Bid Due Date (Bid Opening): Thursday, July 25, 2013 New Bid Due Date: Wednesday, October 23, 2013, no later than 11:00 A.M. Chicago time

Each Bidder bears full responsibility for delivery to the Bid Office before the advertised date and hour for the opening of Bids. Bidders are solely responsible for ensuring that its Bid is received by the Authority in a timely manner prior to the date and time of Bid Opening. If mail or delivery is delayed beyond the date and hour set for the Bid Opening, Bids delayed will not be considered and will be returned unopened. Bid Office hours are Monday through Friday from 8:00 am to 4:30 pm Chicago time, except holidays.

If you have any questions, please contact Maria Williams-Baxter, Sr. Procurement Administrator <u>mwilliams@transitchicago.com</u> or 312-681-2437.

Sincerely, 1 mach

Ellen McCormack Vice President, Purchasing

Requisition No. C13FI101372531 **ADDENDUM No. 6**

Pre-Bid Meeting held at CTA Skokie Shops with Bombardier Transit Corporation (BTC) on May 2 and 3, 2013, relative to Requisition C13FI101372531, Specification CTA-7000-12 for the Purchase of Rapid Transit Cars.

The following were in attendance:

Representing Chicago Transit	Authority	
Maria Williams-Baxter	John Kilstrom	Eric Mattson
Chris Hegarty*	Klaudiusz Kruszecki	Jorge Silva
Walter Keevil	Fred Lonnes	Dawid Skarzynski
Robert Kielba	Grant Macey*	

Representing Bombardier Transit Corporation Joe Kenas Chris Kreuter* Tom Purmort **Rene Beaulieu*** Louis Cossette* Ian Wanless*

Representing Liebherr Joe Faber* Jan Radtke*

Representing Dura Dave Cassilly*

John Johnstone*

Micheael Rathbruer*

Ian Fetterolf*

Representing	<u>Turbo</u>	Power	Systems	<u>(TPS)</u>	
Tim lceton*				Hassan	Mar

nsir*

Richard Kapuscinski*

Debbie Jean*

Representing Infodev Pierre Deslaurieis*

Representing Hoppecke Robert Magdule*

Representing Merak N.A. Ignacio Fuster* Jose Calertayud*

Representing Seats Incorporated Engineered Products Paul Frank*

*- Indicates part-time attendance.

CHICAGO TRANSIT AUTHORITY PURCHASE OF RAPID TRANSIT CARS REQUISITION C13FI101372531 May 2 and 3, 2013

1. Page DS 1-34, Section 1.16, Subcontractor Identification and Evaluation (BTC-3, 5/2 – 5/3/13)

Bombardier submitted information on the following firms and proposed them as a subcontractor for the times listed in Section 1.16 as follows:

1.16, 3	Window Sash	
	Dura	CTA Accepted
1.16, 5	Passenger and operator seats	
	Seats Inc. (Operator's Seat Only)	CTA Accepted
1.16, 10	Undercar Air Comfort Package	
	Bombardier Subsequent to the meeting, based on the m CTA was unable to accept Bombardier as a s package because they did not demonstrate understanding of the specification requirem judgment and past experience, they lack sui to be accepted as a subcontractor for under	aterials and information provided, supplier of the Undercar Air Comfort sufficient detail of their ents. Also, based on CTA's table qualifications and experience car air comfort units.
	Liebherr	CTA Accepted
	Merak	CTA Accepted
1.16, 11	Air Comfort Control	
	Bombardier Subsequent to the meeting, CTA Accepted B comfort controls. However, CTA had reserva fit all the controls and electrical component breakers, etc.) within the air comfort unit ar equipment to be maintainable.	combardier as a supplier of air ations about the supplier's ability to s (relays, contactors, circuit nd still have sufficient space for the
	Liebherr	CTA Accepted
	Merak	

Based upon the materials and information presented, CTA Accepted Merak as a supplier of air comfort controls. However, CTA had reservations about the supplier's ability to fit all the controls and electrical components (relays, contactors, circuit breakers, etc) within the air comfort unit and still have

sufficient space for the equipment to be maintainable. CTA further commented that electrical compartments of the 5000 Series air comfort units are not easily maintainable and a similar arrangement would not be acceptable.

1.16, 12	Auxiliary Power Supply System			
	Turbo Power Systems	CTA Accepted		
1.16, 13	Battery			
	Hoppecke	CTA Accepted		
1.16, 19	Active Suspension System			
	Liebherr	CTA Accepted		
1.16, 20	Automatic Passenger Counter			
	Infodev	CTA Accepted		

 Page DS 9-13, Section 9.03, A, Subcontractor Identification and Evaluation (BTC-3, 5/2 – 5/3/13) Bombardier proposes for Pre-Bid evaluation per technical specification section 9.03.A.16, the block diagram of the TPS Auxiliary Power Supply. The qualifying information can be found in the documentation submitted to qualify TPS for the supply of the Auxiliary Power Supply which has been provided.

CTA acknowledged receipt of Bombardier/TPS's proposed block diagram for the APS.

 Page DS 14-17, Section 14.02, K, Illuminated Rail System Map Display (BTC-3, 5/2 – 5/3/13) Bombardier submitted the following:

The specification describes the features for the IRSM Display but no dimensions for the Supplier to propose. Please provide dimensional guidelines for the Supplier to define a monitor screen that will meet CTA's expectations. Also, please define the minimum Top-of-Floor to Bottom-of-Display dimension that is acceptable.

CTA advised that the dimension from the floor to the bottom of the Display must be no less than 6'4". CTA also clarified that the display monitor's viewable area should be as large as possible to fit the across the ceiling in the aisle. The viewable area of the monitor(s) must be no less than 34 inches wide by 12 inches high.

If the foregoing does not agree with your understanding of the items discussed, contact Maria Williams-Baxter, Sr. Procurement Administrator as soon as possible.



CHICAGO TRANSIT AUTHORITY

567 West Lake Street Chicago, Illinois 60661-1498 TEL 312 664-7200

Subject: Requisition No. C13FI101372531 - IFB to Purchase Rapid Transit Cars Specification CTA 7000-12

Re: Addendum No. 5

All Potential Bidders:

Enclosed please find Addendum No. 5. This Addendum revises and updates the Instructions to Bidders, General Specifications and Technical Specifications of the IFB. Insert this Addendum No. 5 into the Contract Documents of the subject requisition and consider it part of the official Contract Documents.

Included with Addendum No. 5 are the following three (3) attachments:

Attachment A – Bombardier Transit Corporation, Pre-Bid Meeting Minutes and Attendance List (BTC-1) Attachment B – Bombardier Transit Corporation, Pre-Bid Meeting Minutes and Attendance List (BTC-2) Attachment C – Kawasaki Rail Car, Inc., Pre-Bid Meeting Minutes and Attendance List (KRC-2)

Questions previously received in writing, and not addressed in this addendum, will be clarified in Pre-Bid Meetings and formally addressed in a subsequent addendum.

Addendum No.5 shall be acknowledged as received by identification of Addendum No. 5 on the IFB – Bid Proposal Exhibit 2 – Bidder's Signature Page, to be submitted with the Bid Proposal. Failure to acknowledge receipt of Addendum No. 5 or any addenda with your Bid Proposal shall render the Bid Proposal as non-responsive.

The Chicago Transit Authority is seeking bids for the subject procurement. Bid packages are to be delivered to:

Delivery Service or Drop Off

Chicago Transit Authority Bid Office - 2nd Floor 567 W. Lake Street Chicago, IL 60661-1498

Bid Due Date (Bid Opening): Thursday, July 25, 2013, no later than 11:00 A.M. Chicago time

Each Bidder bears full responsibility for delivery to the Bid Office before the advertised date and hour for the opening of Bids. Bidders are solely responsible for ensuring that its Bid is received by the Authority in a timely manner prior to the date and time of Bid Opening. If mail or delivery is delayed beyond the date and hour set for the Bid Opening, Bids delayed will not be considered and will be returned unopened. Bid Office hours are Monday through Friday from 8:00 am to 4:30 pm Chicago time, except holidays.

If you have any questions, please contact Maria Williams-Baxter, Sr. Procurement Administrator <u>mwilliams@transitchicago.com</u> or 312-681-2437.

Ellen McCormack Vice President, Purchasing

Requisition No. C13FI101372531 ADDENDUM No. 5

Item 1. INSTRUCTIONS TO BIDDERS Page IB-1 Section D. Bid Denosit

Page IB-1, Section D, Bid Deposit

Delete the first sentence of the paragraph and replace with the following:

The Bid shall be accompanied by cash, a cashier's check, a certified check, a money order, approved Letter of Credit, or an approved bid bond in the amount of five hundred thousand dollars (\$500,000.00). Bidders must submit the proposed Letter of Credit or bid bond for approval no later than 30 days prior to the Bid Due date.

Item 2. INSTRUCTIONS TO BIDDERS

Page IB-11, Section T, Performance Bond And/Or Letter of Credit and Insurance

Delete the last sentence of the paragraph and replace with the following:

Any Insurance company with less than an A VII Policy Holder Rating by Alfred M. Best Company will not be acceptable to the Authority.

Item 3. INSTRUCTIONS TO BIDDERS

Page 1, Exhibit 2 - Insurance and Bond Requirements, Part I, General Instructions and Requirements, A. Ways to comply with CTA Insurance Requirements

Delete the last paragraph of Section A. and replace with the following paragraph:

If a CTA Certificate of Coverage is provided, the CTA reserves the right to request a copy of the policy after reasonable notice, if needed. Failure to provide the policy after reasonable notice, is a material breach of the Contract which may result in default and, if uncured, termination for default.

Item 4. INSTRUCTIONS TO BIDDERS

Page 2, Exhibit 2 - Insurance and Bond Requirements, Part II - Insurance Requirements

Delete paragraph A. and replace with the following:

A. The CTA must be named as an Additional Insured and Certificate Holder on all policies except Workers Compensation and Professional Liability. When the CTA is an additional insured, the coverage shall be primary.

Item 5. INSTRUCTIONS TO BIDDERS

Page 3, Exhibit 2 - Insurance and Bond Requirements, Part III - Insurance Coverages

Delete paragraph D. and replace with the following:

- D. Umbrella Liability
 - \$10,000,000 Each occurrence and in the aggregate, excess of the underlying policies.

Item 6. GENERAL SPECIFICATIONS Page GS-14, Section 9, Federal, State and Local Regulations, A and C

Delete paragraphs A. and C. and replace with the following:

- A. Cars manufactured and delivered by Contractor shall comply with all applicable Federal, State and Local laws, standards and regulations, in effect on the Bid Due Date or enacted prior to the Bid Due Date and scheduled to go into effect prior to the final completion date for the Work. Any Federal, State and Local law, standard and regulation in effect on the Bid Due Date or enacted prior to the Bid Due Date and scheduled to be effective during the manufacturing and delivery of the Cars, shall be applicable to the entire number of Rail Cars to be furnished by Contractor.
- C. Any change in the Work to be performed under these Contract Documents which is necessitated by a law, standard or regulations enacted after the Bid Due Date shall constitute Changed Work in accordance with GENERAL SECTION 21- <u>CHANGES</u>, provided however, that any change in the Work necessitated by a law, standard or regulation enacted prior to the date of the deadline for submitting Bids and scheduled to go into effect prior to the final completion date for the Work shall not constitute Changed Work.

Item 7. GENERAL SPECIFICATIONS

Page GS-30, Section 21, Changes, A

Delete the second paragraph of A and replace with the following:

All Changed Work must be executed under applicable Conditions of the Contract Documents. It is agreed by the Contractor that any Change resulting in Changed Work will be paid at the applicable rates set forth in the Contractor's proposal for the Changed Work and shall include the Contractor's overhead and profit, at a rate not to exceed twenty-one percent (21%). Additionally, the Contractor's fully burdened hourly rates for Changed Work shall not include any allowances for overtime and premium time compensation and must comply with the Federal Acquisition Regulations Part 31 – Contract Cost Principles and Procedures. The Authority reserves the right to audit the fully burdened rates plus any applicable Escalation pursuant to GENERAL SECTION 32 - <u>ESCALATION CLAUSE FOR OPTIONS</u> for equivalent items as determined by the General Manager, Purchasing or as otherwise agreed to by the parties and set forth in the terms of a Change Order.

Item 8. GENERAL SPECIFICATIONS

Page GS-43, Section 30, Title to Property, A

Delete paragraph A and replace with the following:

A. Title to the Property described in this Section 30 shall vest in the Authority at the earlier of i) when the Authority makes a progress payment including the Property or ii) when the Property is allocated or properly charged to this contract.

Item 9. GENERAL SPECIFICATIONS

Page GS-60, Section 34, General Government Requirements, L, 7

Delete the last sentence of L, 7 and replace with the following:

If the total of such payments is in excess of the amount finally agreed or determined to be due under this Section, such excess shall be payable by the Contractor to the Authority upon demand together with interest at the bank prime loan rate published by the US Federal Reserve plus 4%.

Item 10. BID PROPOSAL Page P-5, Section I, GENERAL PROVISIONS AND METHODS OF PAYMENT, 3, e

Delete paragraph e, and replace with the following:

e. Final Payment – The balance of payments due under the Contract (4% of the Total Contract Price, Base plus exercised Options) shall be payable upon completion of any modifications required at the acceptance of the last Car and receipt of all required deliverables.

Item 11. BID PROPOSAL

Page P-5, Section I, GENERAL PROVISIONS AND METHODS OF PAYMENT, C,3, f

Add the following paragraph f:

f. At the sole discretion of the Authority, upon the Contractor's request, when 65% of the total required number of Cars (Base plus exercised Options) have been accepted, the 4% Final Payment (of the Total Contract Price) may be partially paid on these accepted Cars so that the retained amount is reduced to an amount no less than the cost of any modifications or deliverables outstanding with respect to these accepted Cars. The 4% Final Payment amount for the remaining Cars will be paid following completion of all Cars (Base plus exercised Options).

Item 12. BID PROPOSAL

Page P-7, Section II, Bidding Form, Part 2 – Optional Purchases

Add the following three (3) paragraphs:

If CTA elects to exercise an option, the price for the additional cars and replacement units for all options shall be the purchase price for the two-car unit on each option, and the figure supplied by the Bidder on the Bid Proposal Bidding Summary Form at the time of the Bid submission date. Escalation will apply as calculated under Section 32 of the General Specifications on a one time basis (on the date the option is exercised) for each option.

The exercise of any or all option(s) shall be at the sole discretion of the Authority and is subject to funding availability and will be subject to mutually acceptable delivery schedules.

The terms and conditions by the Contract Documents, Specification No. CTA 7000-12 shall be applicable to the number of Cars selected by the CTA under this Optional Purchase Agreement.

Item 13. BID PROPOSAL Page P-2, Section I, GENERAL PROVISIONS AND METHODS OF PAYMENT, C, 1,c

Delete paragraph c, and replace with the following:

c. Escalation for Options

Escalation will apply as calculated under Section 32 of the General Specifications, to the Contractor on a one time basis (on the date the option is exercised) for each option. After the escalation adjustment, the total Option Price will then be the total price to be paid by the Authority. See also GENERAL SECTION 32 – ESCALATION CLAUSE FOR OPTIONS.

Item 14. TECHNICAL SPECIFICATIONS Page DS 8-7, Section 8.02, E, Side Body Indicator Lights

Delete the third sentence in the referenced paragraph and replace with the following:

The fixtures at the No.3 and No.4 side doors shall have three (3) lenses colored red, yellow and blue from top to bottom.

Item 15. TECHNICAL SPECIFICATIONS Page DS 9-31, Section 9.05, D, 4, b., Bypass Activator Switch (BAS)

Delete the first sentence of the second paragraph and replace with the following:

When in the "ACTIVATE" position, this switch shall energize all bypass push buttons on the bypass panel, turn on the red taillights and marker lights on that car, and light a red LED assembly with red lens on the rear of the cab rear bulkhead.

Item 16. TECHNICAL SPECIFICATIONS Page DS 9-36, Section 9.08, White Light Trouble Indicator System

Delete the third sentence in the referenced paragraph and replace with the following:

White lights shall be located on the Operator's Indicator Panel, per Section 9.05, E, and outside the car adjacent to the No. 1 and No. 2 side doors, per Section 8.02, E".

Item 17. TECHNICAL SPECIFICATIONS Page DS 12-8, Section 12.05, J, 5. Materials and Workmanship – Glass

Delete item 5 in its entirety and replace with the following:

5. The glass covering the electronic message sign and in the cover of the illuminated map shall be 7/32-inch clear, tempered float glass equipped with clear protective sheeting as specified in Section 12.12.

Page 5 of 27

Item 18. TECHNICAL SPECIFICATIONS Page DS 3-32, Section 3.10, F, 3, Operator's Seat

Delete subsection 3 in its entirety and replace with the following:

3. The operator's seat structure shall be Type 304 stainless steel with No. 3 finish, designed to withstand all loads and stresses applied to it. The design and installation of the seat shall be reviewed by the Engineer and be demonstrated in the mock-up.

Item 19. TECHNICAL SPECIFICATIONS

Page DS 7-3, Section 7.01, B, Operating Parameters

Inside Car Temperature	Master Controller	Air Comfort	Fan Speed	Cooling Used	Heaters Used	Mode
Above 74°F	On Off	On Off On	High None High	Full None Full	None None None	Full Cool Off Pre-Cool
		Oli	None	None	None	UI
Above 72°F	On	On Off On	High None High	Partial None Partial	None None	Mod. Cool Off Pre-Cool
	011	Off	None	None	None	Off
Above 70°F	On Off	On Off On	High None High	Partial None Partial	Partial None None	Reheat Cool Off Pre-Cool
		Off	None	None	None	Off
Above 65°F	On	On Off	Low None	None None	None None	Vent Off
		Off	None	None	None	Off
Below 65°F & Above 36°F	On	On Off	Low None	None None	Partial None	Part Heat Off
(Above 48°F Outside)	Off	On Off	Low None	None None	None None	Vent Off
Below 65°F & Above 36°F	On	On Off	Low None	None None	Full None	Full Heat Off
(Below 48°F Outside)	Off	On Off	Low None	None None	None None	Vent Off
Below 36°F	On	On Off	Low None	None None	Full Partial	Full Heat Lavover
	Off	On Off	Low None	None None	Full Partial	Heat to Layover Layover

Delete the entire table and replace with the following:

Item 20. TECHNICAL SPECIFICATIONS Page DS 7-5, Section 7.01, C, 5, Air Comfort - Controls

Delete the paragraph in its entirety and replace with the following:

5. The controller on each car shall include a diagnostic system that shall be interfaced to the Control and Monitoring Network as specified in Section 15.06 to provide information on system operation and failures to the car monitoring network and the TOTS in the active cab. The controller shall have built in diagnostics and a fault display. The display may be alpha-numeric or numeric and shall be used for the first level of trouble shooting. Additional diagnostics shall be accessed from the PTU. See Section 1.22 for diagnostic software requirements. The exact details and displays shall be reviewed by the Engineer.

Item 21. TECHNICAL SPECIFICATIONS

Page DS 11-9, Section 11.03, H,3, d., 2) (b) Suspension System Electronic Controller

Delete subsection 2) (b) in its entirety and replace with the following:

(b) The controller shall have built in diagnostics and a fault display. The display may be alpha-numeric or numeric and shall be used for the first level of trouble shooting. Additional diagnostics shall be accessed from the PTU. See Section 1.22 for diagnostic software requirements.

Requisition No. C13FI101372531 Addendum 5 - Attachment A

Pre-Bid Meeting held at CTA Skokie Shops with Bombardier Transit Corporation (BTC) on Wednesday, April 11 and 12, 2013, relative to Requisition C13FI101372531, Specification CTA-7000-12 for the Purchase of Rapid Transit Cars.

The following were in attendance:

Representing Chicago Transit Aut	hority	
Maria Williams-Baxter	John Kilstrom*	Eric Mat
Chris Hegarty*	Fred Lonnes*	Dawid S
Robert Kielba	Grant Macey	
Representing Bombardier Transit	Corporation	
Said Amellal*	Joe Kenas	
Hugues Gregaire*	Benoit Lussier*	
Eric Prefontaine*	Paolo Valsorda*	
Tom Purmort	Paul Yves-Noel*	
Representing Bach Simpson		
Charles Taylor*	Paul Weber*	

Representing Bombardier Transportation Propulsion and ControlsJoe Korenic*Fred Dimasi*

Representing Xpan Interactive
Rene Smid*

Ron Thiele*

Representing Wabtec John Corvin* Cornelius Stevenson*

John Listar* Zoltan Kovacs*

*- Indicates part-time attendance.

Ron Kurta*

Brenda Thomas*

Eric Mattson Dawid Skarzynski

CHICAGO TRANSIT AUTHORITY PURCHASE OF RAPID TRANSIT CARS REQUISITION C13FI101372531 April 11 and 12, 2013

<u>Bid Proposal, Page P-5, Section I - General Provisions and Methods of Payment, Subsection C (3)</u> (e)(BTC-1, 4/11 – 4/12/13)

Bombardier submitted the following:

The Method of Payment described in the Bid Proposal specifies that 4% of the Total Contract Price shall be payable upon completion of any modifications required at the acceptance of the last Car. Can CTA please confirm Bidder's understanding that different payments will be made for the base order and each option exercised rather than a one-time lump sum amount?

CTA replied that the question was under review.

Subsequent to the meeting, CTA clarified that the Total Contract Price is the Base Contract price plus the price of all exercised options. Refer to this Addendum 5, Item 10 and Item 11 for clarification.

2. General Specifications, Page GS-38, Section 26, Availability of Funding (BTC-1, 4/11 – 4/12/13)

Bombardier submitted the following:

The last paragraph of Subsection B of Section 26 of the General Specifications specify that the Contractor shall be liable for any liability which exceeds the payment schedule described in Subsection A. Can CTA please confirm that should CTA foresee any risk in not obtaining additional funding beyond the thresholds set in Subsection A of Section 26, CTA will inform the Contractor as soon as possible?

CTA replied that the question was under review.

Subsequent to the meeting, CTA determined there will be no change to the General Specifications, Section 26 requirements.

3. <u>Bid Proposal, Page P-7, Section II, Bidding Form, Part 2 – Optional Purchases (BTC-1, 4/11 – 4/12/13)</u>

Bombardier submitted the following:

Part 2 of the Bidding Form states that CTA reserves the right to exercise or decline each option in sequential order within the timeframes specified in the form and without specifying any delivery dates for such options. For example, this could mean that CTA could decide to decline the first three options but exercise options number four and five, which options would be delivered many years after the end of the production of the base order. In such an event, there would be no continuity in production and that would result in a major increase in the cost to perform the work by the Bidder, as this would require the Bidder to re-start a manufacturing line. As such, the Bidder respectfully suggests that CTA revise the option provision to ensure that continuity in production be assured in order to benefit from an optimized option price for all options of the Contract.

This can be done while keeping maximum flexibility for CTA in the exercise of the options by adding a mobilization fee in the event the options exercised by CTA do not allow such continuity in production. Such mobilization fee would only be payable in the event an option exercised by CTA does not allow continuity in production. The exercise of the option would be deemed to not allow production in continuity in the event such option is exercised less than 12 months prior to the scheduled date of delivery of the last car of the base or the previous exercised option. Such Mobilization fee would also be subject to escalation in accordance with Section 32 of the General Specifications. Please consider the revised language proposed by the Bidder below:

"Part 2 – Optional Purchases

In addition to the lump sum Base Pricing for 100 Rapid Transit Cars (50 two-car units), Bidders shall also quote a price per two-car unit, for the Option quantities listed below. The price per two-car unit for each option shall be quoted inclusive of special test equipment, replacement units and support as required by the specification. CTA reserves the right to exercise or decline each option to purchase additional cars in sequential order within the timeframes shown. However, if any option exercise timeframe expires, CTA reserves the right to purchase any or all of the subsequent options prior to the expiration dates. The prices quoted herein assume Continuity of Production of the Option Rail Cars throughout the project, either from the Base Contract or from the previous Option exercised. In the event the exercise of any Option from CTA does not allow Continuity of Production, then in addition to the prices of the Option Rail Cars, CTA shall pay the Bidder the Mobilization Fee included in this Bid Proposal Bidding Form. To exercise an Option and allow Continuity in Production, CTA needs to exercise such Option at least 12 months prior to the scheduled delivery date of the last Rail Car under the Base Contract or the previously exercised Option. It is understood by the parties that no Mobilization Fee will be payable in the event CTA exercised its Options in continuity. In addition, both parties agree that such Mobilization Fee shall be payable each time an exercised Option does not allow Continuity in Production and that such Mobilization Fee is subject to Escalation. The exercising of options shall be deemed timely if notice is issued by the Authority in accordance to Section 34.11 — Notice, General Specifications on or before the calendar day timeframe indicated in the column headed "OPTION EXERCISE TIMEFRAME". The price for any or all of the additional cars and replacement units shown for all options shall be the purchase price for the two-car unit on each option at the time of the Bid submission date."

CTA replied that the question was under review.

Subsequent to the meeting, CTA determined the proposed language could not be accepted. However, note the language regarding escalation for options has been clarified; see this Addendum 5, Item 12 and Item 13.

 General Specifications, Page GS-49, Section 32, Escalation Clause for Options (BTC-1, 4/11 – 4/12/13)

Bombardier submitted the following:

Section 32 of the General Specifications state that the escalation for the options' price will be

calculated at the time of the of exercise of the Option. For example, CTA could decide to exercise the first option on the date of NTP with a delivery date five years after the date of exercise of such option. Based on the actual wording of section 32, no escalation would apply to the price of the option set forth in the Bidder's Bidding Form, since the date of NTP and the date of exercise of the option is the same. Therefore, all the changes in the indices part of the escalation formula would not be taken into consideration. Based on the above, the Bidder respectfully suggests to use the time of manufacture of the Option Cars as the date of applicability of the escalation formula, as such date corresponds to the date where the cost to perform the work is expended by the Bidder. In addition, in order to alleviate any concerns that CTA may have with escalating prices due to the Contractor's own delay, our revised provision ensures that the escalation applied will not increase in the event of a delay in delivery of the options cars by the Contractor. Please consider the alternate proposed language: "SECTION 32 – ESCALATION CLAUSE FOR OPTIONS

Н. (...)

d. Adjustments based on changes in the labor and material indices shall be computed for the period from the time of the Notice to Proceed (NTP) or the end of the Bid Validity Period, whichever comes first (base indices) to the time of the start of final assembly of the Option Rail Car representing the midpoint of the total quantity of the Option Rail Cars ordered under such Option (current indices) as set forth in Section 32. It is understood that the date used to obtain the escalated month indices shall not be after the scheduled date (at the time of election of the Option) of the start of assembly of the midpoint of the total quantity of the Option Rail Cars for the Option for which that Rail Car is related, unless the delay to the start of the manufacture of such midpoint Rail Car is due (i) to a delay caused by CTA; or (ii) to Change Work performed by the Contractor as provided in Section 21 of the General Specifications; or (iii) to an extension of time as provided in Section 27.

CTA replied that the question and proposed language was under review.

Subsequent to the meeting, CTA determined there will be no change to the General Specifications, Section 32 requirements.

5. <u>Instructions to Bidders, Page IB-10, Section S - Parent Company Guarantee & Section T -</u> Performance Bond and/or Letter of Credit and Insurance (BTC-1, 4/11 – 4/12/13)

Bombardier submitted the following:

Section S of the Instructions to Bidders (ITB) request the successful Bidder to furnish an executed Parent Company Guarantee (PCG) within ten working days after written notice of award. Based on the PCG form provided in Exhibit 2 of the ITB, such PCG shall cover 100% of the performance of the Contractor for all work performed and obligations undertaken in accordance with the Contract. Section T of the ITB requests the successful Bidder to also furnish a Performance Bond in the amount of 25% of the Base Contract price. Based on the above, CTA seems to request two instruments to guarantee the performance of the Contract by the Contractor. The Bidder respectfully suggests to provide only a PCG worth 100% of the Total Contract Price in order to guarantee the performance of all of its obligations under the contract.

Such instrument would also be to CTA's advantage, as it would diminish the Bidder's proposed price.

CTA replied that the question was under review.

Subsequent to the meeting, CTA determined that the proposed language is not acceptable and there will be no change to the Instructions to Bidders, Section S - Parent Company Guarantee requirements.

Instructions to Bidders, Page IB-11, Section T, Performance Bond and/or Letter of Credit and Insurance (BTC-1, 4/11 – 4/12/13)

Bombardier submitted the following:

Section T of the Instructions to Bidders require the successful Bidder to furnish a Performance Bond or a Letter of Credit in the value of 25% of the Total Contract Price to CTA within ten working days after written notice of award. The Bidder respectfully submits that a different Performance Bond or Letter of Credit should be issued for the base order and for each option exercised by CTA. This would allow the reduction mechanism described in the second paragraph of Section T to apply for each order and would also cover the risk incurred by CTA for each order independently, which will result in an overall cost decrease for CTA. Can CTA please confirm that a different performance bond can be issued for the base order and each exercised option and, if yes, that the reduction mechanism described in the second paragraph of Section T will apply to each of these bonds individually?

CTA replied that the question was under review.

Subsequent to the meeting, CTA determined that a response to this question will be issued in a subsequent addendum.

 Instructions to Bidders, Exhibit 2, Page 1, Insurance and Bond Requirements, General Instructions and Requirements, A. Ways to comply with CTA Insurance Requirements (BTC-1, 4/11-4/12/13)

Bombardier submitted the following:

The Insurance and Bond Requirements section of the Invitation for Bids requests the Contractor to submit temporarily a certificate of insurance to prove the insurance coverage required. Such method is only valid for 90 days. After the expiration of such period, the Contractor is required to submit a certified copy of its insurance policy. The Bidder considers that a certificate of insurance constitutes a sufficient proof of its insurance coverage. Therefore, the Bidder respectfully suggests to CTA to change the wording of paragraph 1 of section A of part I of the Insurance and Bond requirements in order to reflect that only certificates of insurance will be provided to CTA. However, the Bidder could allow CTA to have access to its insurance policy upon prior reasonable notice sent by CTA.

CTA replied that the question is under review.

Subsequent to the meeting, CTA determined that accepting the Certificate and requesting the policy after reasonable notice, if needed, is acceptable. See this Addendum 5, Item 3.

 Instructions to Bidders, Page IB-11, Section T, Performance Bond And/Or Letter of Credit; Insurance and Bond Requirements Page 2; and Insurance and Bond Requirements, Part II (C) (BTC-1, 4/11 – 4/12/13)

Bombardier submitted the following:

The third paragraph of section T of the Instructions to Bidders requires that the insurance company that will issue the insurance coverage required under the Invitation for Bids (hereinafter referred to as "IFB") shall have at least a 'B+' policyholder rating by Alfred M. Best Company. On the other hand, paragraph C of Part II of the Insurance and Bond Requirements require that such insurance company shall have at least an A VII policyholder rating by A.M. Best Co., Inc. Can CTA please clarify which rating it requires the insurance company to have for the issuance of the different insurance coverage required by the IFB?

CTA replied that the question was under review.

Subsequent to the meeting, CTA determined that a correction is necessary; see this Addendum 5, Item 2.

9. <u>Instructions to Bidders, Exhibit 2, Insurance and Bond Requirements, Pages 2 and 3, Parts II & III</u> (BTC-1, 4/11 – 4/12/13)

Bombardier submitted the following:

Paragraph A of Part II of the Insurance and Bond Requirements require that CTA be named as an additional insured, without specifying on which required insurance coverage. Paragraph I of Part III of the Insurance and Bond Requirements require that CTA be named additional insured on the General Liability Policy. Can CTA please confirm Bidder's interpretation that CTA shall be named additional insured only on the General Liability Policy?

CTA replied that the question was under review.

Subsequent to the meeting, CTA determined that CTA should be named as additional insured on all policies except Workers Compensation and Professional Liability; see this Addendum 5, Item 4.

10. Instructions to Bidders, Exhibit 2, Insurance and Bond Requirements, Page 3, Part III (BTC-1, 4/11 – 4/12/13)

Bombardier submitted the following:

The Insurance and Bond Requirements require the Bidder to procure professional liability coverage in the amount of \$2,000,000 per claim. Since CTA is procuring railcars (delivery of a product) and not consultative advice under this IFB, the Bidder respectfully suggests the removal of the requirement to procure insurance coverage for professional liability.

CTA replied that the question was under review.

Subsequent to the meeting, CTA determined there will be no change to Instructions to Bidders, Insurance requirements for Professional Liability coverage.

11. <u>General Specifications, GS-14, Section 9, Federal, State and Local Regulations, A & C (BTC-1, 4/11</u> -4/12/13)

Bombardier submitted the following:

Section 9 paragraph A of the General Specifications provides that the Cars have to comply with all applicable laws at the time of the submission of the proposal and that all laws existing at the time of the Effective Date, which is the date of the execution of the Contract, shall be applicable. Section 9 paragraph C provides that if a change in law occurs after the Effective Date of the Contract, it shall constitute a Changed Work in accordance with Section 21 of the General Specifications. Could the Authority confirm Contractor's interpretation that should a change in law occur during the period between the Proposal Submittal date and the Effective Date of the Contract, such change would be treated as a Changed Work in accordance with Section 21 of the General Specifications?

CTA replied that the question was under review.

Subsequent to the meeting, CTA determined that a clarification is necessary; see this Addendum 5, Item 6.

12. General Specifications, GS-30, Section 21, Changes (BTC-1, 4/11-4/12/13)

Bombardier submitted the following:

The second paragraph of sub-section A of Section 21 of the General Specification specifies that any Changed Work will be paid at the applicable rates set forth in the Contractor's Bid Proposal. Can CTA please confirm where in the Bidder's proposal these rates should be inserted? Also, could CTA confirm that such rates will be subject to an annual adjustment to cover for escalation of costs over time?

CTA replied that the question was under review.

Subsequent to the meeting, CTA determined that a clarification is necessary; see this Addendum 5, Item 7.

13. General Specifications, GS-15, Section 12, Assigning or Subcontracting (BTC-1, 4/11 – 4/12/13)

Bombardier submitted the following:

Paragraph B of Section 9 of the General Specifications specify that the Contractor cannot sell any portions of payments due or rights without the prior written consent of the General Manager, Purchasing. The Bidder respectfully suggests that the Contractor should be able to sell receivables without the written consent of the General Manager, Purchasing, provided the Contractor notifies such person in writing and that the Contractor will remain liable under the Contract.

CTA replied that the question was under review.

Subsequent to the meeting, CTA determined there will be no change to the General Specifications, Section 12 requirements.

14. <u>General Specifications, GS-43, Section 30, Title to Property, Subsection A (BTC-1, 4/11 – 4/12/13)</u>

Bombardier submitted the following:

Paragraph A of Section 30 of the General Specifications states that title to Property could transfer to the Authority when the Property is allocated to this Contract. Could CTA please confirm Bidder's interpretation that Property is allocated to this Contract when such Property has been manufactured by the Bidder or delivered to the Bidder by its subcontractors?

CTA replied that the question was under review.

Subsequent to the meeting, CTA determined that a clarification is necessary; see this Addendum 5, Item 8.

15. <u>General Specifications, GS-60, Section 34, General Government Requirements, Subsection L,</u> (BTC-1, 4/11 – 4/12/13)

Bombardier submitted the following:

The Bidder kindly requests that the interest rate charged for any late payment be aligned with prevailing market rates at the time payment is due, such as the Bank Prime Rate of the U.S. Federal Reserve plus two percent (2%).

CTA replied that the question was under review.

Subsequent to the meeting, CTA determined that a clarification is necessary; see this Addendum 5, Item 9.

16. <u>Technical Specifications, Page DS 1-34, Section 1.16, Subcontractor Identification and Evaluation</u> (BTC-1, 4/11 – 4/12/13)

Bombardier submitted information on the following firms and proposed them as a subcontractor for the times listed in Section 1.16 as follows:

1.16, 6 <u>Carbody Shell</u>

Bombardier Transportation

CTA Accepted

1.16, 7	No.,1 end coupler system and No,2 end drawbar system		
	Wabtec	CTA Accepted	
1.16, 15	Propulsion		
1.16, 16	Bombardier Transportation Propulsion and Controls Friction Brake System	CTA Accepted	
	Wabtec	CTA Accepted	
1.16, 17	Track Brakes		
	Hanning and Kahl	CTA Accepted	
1.16, 18	Trucks		
	Bombardier Transportation	CTA Accepted	
1.16, 21	Unit and Train Network and Diagnostic Systems		
	Bombardier Transportation	CTA Accepted	
1.16, 24	Event Recorder		
	Bach Simpson	CTA Accepted	
1.16, 25	CBT Training		
	Xpan Interactive	CTA Accepted	
1.16, 26	Automatic Passenger Counter		
	Bombardier Transportation Based upon the presentation and information provided, Bombardier as a supplier for Automatic Passenger Coun was expressed over how the system would differentiate boarding vs. alighting passengers at each station.	, CTA accepted Iter. However, concern between the number of	

17. <u>Technical Specifications, Page DS 1-1, Section 1.02</u>, Compatibility with Existing CTA Cars (BTC-1, 4/11 – 4/12/13)

Bombardier submitted the following question:

Many car systems are specified to be operationally compatible with the 5000 Series cars. Please confirm the PTU are not required to be backwards compatible with the 5000 Series cars.

CTA confirmed that there is no requirement to make the PTU software backwards compatible to the 5000 Series cars.

18. Technical Specifications, Page DS 1-4, Section 1.09, F, Stress Analyses (BTC-1, 4/11 – 4/12/13)

Bombardier provided for Pre-Bid evaluation per Technical Specifications Section 1.09, F, and the stress analysis. The necessary technical information related to stress analyses can be found in document 076-BRA-0016-Rev.1.doc, Carbody Structural Analysis Report submitted independently as additional information for Bombardier's supply of the Carbody Shell.

CTA acknowledged receipt of the information showing Bombardier's capability to conduct the stress analyses.

 <u>Technical Specifications, Page DS 1-39, Section 1.22, A, System PTU Applications and Diagnostic</u> <u>Software (BTC-1, 4/11 – 4/12/13)</u>

Bombardier submitted the following question:

We request clarification to permit Windows 7 for use as the latest Windows[®] operating system. This will maximize the ability for PTU to be backwards compatible with the 5000 Series vehicles whenever feasible.

CTA did not agree to the selection of an operating system at this time. CTA stated it is unknown if Windows 7 will be available and supported for commercial/professional use at the time the PTU software will be developed for CTA. The successful Bidder must propose, during design review, the most suitable, latest operating system for review by the Engineer.

20. Technical Specifications, Page DS 3-3, Section 3.03, Body Bolster (BTC-1, 4/11 – 4/12/13)

Bombardier proposed for Pre-Bid evaluations per technical specification section 3.03, the carbody bolster to truck attachment. The qualifying information can be found in the documentation submitted to qualify Bombardier for the supply of the carbody shell.

CTA acknowledged receipt of this information design submitted is as provided on the 7000 Series cars.

21. <u>Technical Specifications, Page DS 7-3, Section 7.10,B, Air Comfort, General - Operating</u> Parameters (BTC-1, 4/11 – 4/12/13)

	On	On	Low	None	None	Vent	
Above 65°F		Off	None	None	None	Off	
	Off	On	Low	None	None	Vent	
		Off	None	None	None	Off	

Bombardier submitted the following question:

It is our understanding the operating parameter in the table copied above should read "Above 68 F", same as for the 5000 Series cars. Please confirm.

CTA stated that Bombardier's assumption is incorrect. The specification for the 7000 Series cars has been changed and 65°F is the correct value. In addition, as stated in Specification Section 7.01, C, 5, paragraph 4, CTA expects that the microprocessor control be utilized to further optimize the temperature control above and beyond that of the 5000 Series to eliminate short cycling and temperature oscillations. The details of the final control scheme will be discussed with the successful Bidder during Design Review.

22. <u>Technical Specifications, Page DS 9-58, Section 9.21, Automatic Passenger Counter System (BTC-1, 4/11 – 4/12/13)</u>

Bombardier submitted the following question:

The Bidder request that CTA consider equipping only 25% of the fleet or the base order with the automatic passenger counting system. Passenger counting data is voluminous and to have the entire fleet monitored will result with large files of data transferred to wayside servers that will become cumbersome to manage on a regular basis.

CTA did not agree; the passenger counter systems must be installed on the entire fleet of 7000 Series cars. CTA also stated that the APC download software must have some method of managing or controlling the data being downloaded to avoid having a cumbersome amount of data. These details will be reviewed by the Engineer during Design Review with the successful Bidder.

23. <u>Technical Specifications, Page DS 10-2, Section 10.01, L, Propulsion System – General (BTC-1,</u> <u>4/11 – 4/12/13)</u>

Bombardier submitted the following:

The necessary technical information related to the EMI/EMC compliance can be found in the documentation submitted to qualify Bombardier for the supply of the Propulsions system.

CTA acknowledged receipt of the information showing Bombardier's capability to achieve EMI/EMC compliance.

24. <u>Technical Specifications, Page DS 10-5, Section 10.02, B, 6, Propulsion System – Characteristic</u> <u>Curves and Simulations (BTC-1, 4/11 – 4/12/13)</u>

Bombardier proposed for Pre-Bid evaluation per Technical Specification Section 10.02, B, 6, the Characteristics Curves and Simulations of the Propulsion System. The qualifying information can be found in the documentation submitted to qualify Bombardier for the supply of the Propulsion System.

CTA acknowledged receipt of the information demonstrating an understanding of the operating and performance requirements of Section 10 and the duty cycles specified in Section 2.02, D.

25. <u>Technical Specifications, Page DS 15-1, Section 15.01, A, 4, Serial Trainline and Data</u> <u>Communications – Overview (BTC-1, 4/11 – 4/12/13)</u>

Bombardier provided for Pre-Bid evaluation per Technical Specification Section 15.01, A, 4, the Serial Trainline and Data Communications system block diagrams. The qualifying information can be found in the documentation submitted to qualify Bombardier for the supply of the Unit and Train Network Diagnostics system.

CTA acknowledged receipt of the block diagrams.

If the foregoing does not agree with your understanding of the items discussed, contact Maria Williams-Baxter, Sr. Procurement Administrator as soon as possible.

Requisition No. C13FI101372531 Addendum 5 - Attachment B

Pre-Bid Meeting held at CTA Skokie Shops with Bombardier Transit Corporation (BTC) on April 18 and 19, 2013, relative to Requisition C13FI101372531, Specification CTA-7000-12 for the Purchase of Rapid Transit Cars.

The following were in attendance:

Representing Chicago Transit Authority

Maria Williams-Baxter Chris Hegarty* Walter Keevil Robert Kielba* John Kilstrom Klaudiusz Kruszecki Grant Macey* Eric Mattson

Jorge Silva Dawid Skarzynski

Martin Lessard*

Representing Bombardier Transit CorporationJoe KenasTom Purmort

Representing Luminator Labon Ruth*

Ranzin Safavi*

Representing NASG Scott Seiler*

Representing Axion Sylvain Boulanger*

Representing PCS Noel Comtois*

Stephan Siebert*

<u>Representing Liebherr</u> Joclen Faber* Ian Fetterolf*

Anton Gaile* Jurgen Heinle*

Representing PHW Kim Anderson* John Harrison*

David Cichowski*

*- Indicates part-time attendance.

CHICAGO TRANSIT AUTHORITY PURCHASE OF RAPID TRANSIT CARS **REQUISITION C13FI101372531**

April 18 and 19, 2013

1. Page DS 1-34, Section 1.16, Subcontractor Identification and Evaluation (BTC-2, 4/18 – 4/19/13)

Bombardier submitted information on the following firms and proposed them as a subcontractor for the times listed in Section 1.16 as follows:

1.16, 3	Window Sash	
	NASG	CTA Accepted
1.16, 8	All light fixtures interior and exterior	
	Luminator	CTA Accepted
1.16, 9	All cab control, switch, and indicator panels	
	Bombardier Transportation	CTA Accepted
1.16, 12	Auxiliary Power Supply System	
	PCS	CTA Accepted
1.16, 13	Battery	
	Saft	CTA Accepted
1.16, 14	Horn	
	Federal Signal	CTA Accepted
1.16, 19	Active Suspension System	
	Liebherr	CTA Accepted
1.16, 20	ATC/ATO System	
	PHW	CTA Accepted
1.16, 22	Car Communication System	
	Axion	CTA Accepted
	Luminator (Electronic Message signs, Illuminated Rail S Destination Signs and Run number signs)	ystem Map Display, CTA Accepted

Page 22 of 27
1.16, 23 Video System

Axion

Subsequent to the meeting, CTA did not accept Axion for the video system. Based upon the presentation, Axion did not show compliance to Section 14.03, C, 2 or sufficient detail as to how they will accomplish compatibility to the Teleste VMX video management system.

Page DS 9-13, Section 9.03, A, Subcontractor Identification and Evaluation (BTC-2, 4/18 – 4/19/13)

Bombardier proposes for Pre-Bid evaluation per technical specification section 9.03.A.16, the block diagram of the Auxiliary Power Supply. The qualifying information can be found in the documentation submitted to qualify PCS for the supply of the Auxiliary Power Supply which has sent to CTA on April 10, 2013.

CTA acknowledged receipt of Bombardier/PCS's proposed block diagram for the APS.

If the foregoing does not agree with your understanding of the items discussed, contact Maria Williams-Baxter, Sr. Procurement Administrator as soon as possible.

Requisition No. C13FI101372531 Addendum 5 - Attachment C

Pre-Bid Meeting held at CTA Skokie Shops with Kawasaki Rail Car (KRC) on April 24 and 25, 2013, relative to Requisition C13FI101372531, Specification CTA-7000-12 for the Purchase of Rapid Transit Cars. The following were in attendance:

Representing	Chicago	Transit	Authority

Maria Williams-Baxter	Klaudiusz Kruszecki	Jorge Silva
Chris Hegarty*	Fred Lonnes	Dawid Skarzynski
Walter Keevil	Grant Macey*	
Robert Kielba	Eric Mattson	
Representing Kawasaki Rail Car		
Maurice Andriani	Steven Kravcar	Tomonori Umebavashi
Kakushin Hirano	Brian Saucerman	Chuck Wochele
Shozo Ito	Yuji Tova	
Representing Knorr Brake Company		
Andy Loij*	Mike Walton*	
Representing Kustom Seating		
Gene Germaine*	Rick Kemm*	William Lubke*
Representing Siemens	Omid Paydar*	Richard Trail*
Dave Ward*		

*- Indicates part-time attendance.

CHICAGO TRANSIT AUTHORITY PURCHASE OF RAPID TRANSIT CARS REQUISITION C13FI101372531 Pre-Bid Meeting April 24 and 25, 2013

1. Page IB-1, Section D, Bid Deposit (KRC-2, 4/24 - 4/25/13)

Kawasaki requested to submit a Letter of Credit as its form of bid bond. The Letter of Credit would be in the amount of five hundred thousand dollars (\$500,000.00).

CTA replied that the question was under review.

Subsequent to the meeting, CTA determined that a clarification was necessary. See this Addendum 5. Item 1.

Page 3, Exhibit 2 - Insurance and Bond Requirements, Part III - Insurance Coverages (KRC-2, 4/24 - 4/25/13)

Kawasaki carries comprehensive insurance to cover the requirements specified in its project contract terms. Current industry standard for Commercial General Liability Insurance provides a maximum for Umbrella Coverage at \$10 Million. Kawasaki's policy provides for Umbrella Coverage at \$10 Million. Kawasaki requests for CTA to confirm that its insurance policy is acceptable.

CTA replied that the question was under review.

Subsequent to the meeting, CTA determined that a modification was necessary. See this Addendum 5, Item 5.

3. Page DS 1-4, Section 1.09, Stress Analysis (KRC-2, 4/24 - 4/25/13)

Kawasaki provided examples for Pre-Bid evaluation per Technical Specifications Section 1.09, F, of their capability to conduct the required stress analyses. The information related to their stress analysis capabilities was presented as a part the Subcontractor Qualification presentation for the Carbody Shell.

CTA acknowledged receipt of the information showing Kawasaki's capability to conduct the required stress analyses.

4. Page DS 1-34, Section 1.16, Subcontractor Identification and Evaluation (KRC-2, 4/24 - 4/25/13)

Kawasaki submitted information on the following firms and proposed them as a subcontractor for the times listed in Section 1.16 as follows:

1.16, 1	Side, end, and operator's cab doors.	o doors.	
	Kawasaki	CTA Accept ed	
1.16, 5	Operator and Passenger Seats		
	Kustom Seating	CTA Accept ed	
1.16, 6	Carbody shell.		
	Kawasaki	CTA Accept ed	
1.16, 16	Friction Brake System		
	Knorr Brake Company	CTA Accepted	
1.16, 17	Track Brakes		
	Knorr Brake Company	CTA Accepted	
1.16, 18	Trucks		
	Siemens	CTA Accepted	
1.16, 19	Active Suspension		
	Knorr Brake Company	CTA Accepted	

5. Page DS 3-9, Section 3.03, Carbody – Body Bolster (KRC-2, 4/24 - 4/25/13)

Kawasaki presented, for Pre-bid review, their preliminary carbody and body bolster designs as a part of their Subcontractor Qualifications proposal.

CTA acknowledged receipt of the information showing Kawasaki's intent to use the King Pin – PCC type carbody to truck attachment.

6. Page DS 11-5, Section 11.03, F, Trucks – Bolster (KRC-2, 4/24 - 4/25/13)

Kawasaki/Siemens presented the preliminary truck/truck bolster designs as a part of their Subcontractor Qualifications proposal.

CTA acknowledged receipt of the information showing Kawasaki's intent to use a truck bolster compatible with the King Pin – PCC type carbody to truck attachment.

If the foregoing does not agree with your understanding of the items discussed, contact Maria Williams-Baxter, Sr. Procurement Administrator as soon as possible.



CHICAGO TRANSIT AUTHORITY

567 West Lake Street Chicago, Illinois 60661-1498 TEL 312 664-7200 www.transitchicago.com

April 26, 2013

Subject: Requisition No. C13FI101372531 - IFB to Purchase Rapid Transit Cars Specification CTA 7000-12

Re: Addendum No. 4

All Potential Bidders:

Enclosed please find Addendum No. 4. This Addendum revises and updates the Instructions to Bidders and Technical Specifications of the IFB. Insert this Addendum No. 4 into the Contract Documents of the subject requisition and consider it part of the official Contract Documents.

Included with Addendum No. 4 are the following two (2) attachments:

Attachment A – Written Questions from Potential Bidders and CTA's Responses Attachment B – Kawasaki Rail Car, Inc. Pre-Bid Meeting Minutes and Attendance List (KRC-1)

Addendum No.4 shall be acknowledged as received by identification of Addendum No. 4 on the IFB – Bid Proposal Exhibit 2 – Bidder's Signature Page, to be submitted with the Bid Proposal. Failure to acknowledge receipt of Addendum No. 4 or any addenda with your Bid Proposal shall render the Bid Proposal as non-responsive.

The Chicago Transit Authority is seeking bids for the subject procurement. Bid packages are to be delivered to:

Delivery Service or Drop Off

Chicago Transit Authority Bid Office - 2nd Floor 567 W. Lake Street Chicago, IL 60661-1498

Bid Due Date (Bid Opening): Thursday, July 25, 2013, no later than 11:00 A.M. Chicago time

Each Bidder bears full responsibility for delivery to the Bid Office before the advertised date and hour for the opening of Bids. Bidders are solely responsible for ensuring that its Bid is received by the Authority in a timely manner prior to the date and time of Bid Opening. If mail or delivery is delayed beyond the date and hour set for the Bid Opening, Bids delayed will not be considered and will be returned unopened. Bid Office hours are Monday through Friday from 8:00 am to 4:30 pm Chicago time, except holidays.

Page 1 of 11

If you have any questions, please contact Maria Williams-Baxter, Sr. Procurement Administrator <u>mwilliams@transitchicago.com</u> or 312-681-2437.

Sincerely, le McCormack Gelene Brown Director, Purchasing

Requisition No. C13FI101372531 ADDENDUM No. 4

Item 1. TECHNICAL SPECIFICATIONS Page DS 17-9, Section 17.04, C, Portable Test Units (PTU)

Delete the first sentence in paragraph C and replace with the following:

The Contractor shall furnish two (2) semi-rugged PTUs as called for in Section 14.04, A to access the video recorder diagnostics, set-up, recorder viewing and video recording and perform set-up diagnostics.

Item 2. TECHNICAL SPECIFICATIONS Page DS 16-8, Section 16.01,W, EMI/EMC Tests

Delete the paragraph and replace with the following:

The prototype cars and individual systems shall be tested for EMI/EMC emissions in accordance with Section 9.19, F.

Requisition No. C13FI101372531 ADDENDUM No. 4 - ATTACHMENT A

Written Questions from Potential Bidders and CTA's Responses:

Question 1: Instructions to Bidders, Page IB-5, Section G, 3, e), Pre-Bid Procedures- Other Pre-Bid Meetings

In the second paragraph of Section G, 3, Other Pre-Bid Meetings, there is a requirement to certain Pre-Bid tasks "sixty (60) calendar days" prior to the Bid submission date.

Addendum No. 3 named two types of Pre-Bid Meetings: Subcontractor Qualifications Pre-Bid Meetings and Other Pre-Bid Meetings, and stated that the technical data and information specified in new subsection i) be submitted "during Other Pre-Bid Meetings scheduled no later than 30 calendar days prior to the Bid submission date."

Would you please clarify which topics to be discussed in Pre-Bid Meetings—subsections a) through i) of Section 3—must be completed by which deadline, i.e., 60 calendar days prior, or 30 calendar days prior?

- Response: The specific technical data and information required by the Technical Specifications in Instruction to Bidders G, 3, i must be submitted for evaluation no later than 30 calendar days prior to the Bid submission date. Instructions to Bidders G, 3, a) through
 h) must be completed 60 calendar days in advance of the scheduled Bid submission date.
- Question 2:Technical Specifications, Page DS 17-9, Section 17.04, C, Portable Test Units (PTU)Please clarify if the correct number of PTUs to be furnished under 17.04, C is 10
or 2.
- Response: See Addendum 4, Item 1.
- Question 3: IFB Title Pages Specification No. CTA 7000-12

It is observed that the title pages of various sections of the IFB contain Specification 7200-12, while other references are to Specification 7000-12. Will CTA clarify the use of the two (2) differing specification numbers?

- Response: Specification No. CTA 7000-12 is correct for all Contract Documents. The various title pages have been updated with Specification 7000-12.
- Question 4: Instructions to Bidders, Pages IB-6 and IB-7, Section G, 5, Subcontractor Qualifications

We understood that the list of the items whose subsuppliers need to be qualified is the one you can find in Technical Specification at page DS 1-34, section 1.16. Please confirm.

With reference to the truck manufacturer subsupplier, please confirm that the subsupplier of truck components listed in section 11 of technical specifications, that is to say:

Wheels Axles Journal Bearings Ground Brush Gear Box Truck Frames Bolster Suspension System Track-Trip Switch Current Collection Equipment Wear Plates

doesn't have to be qualified, as only the truck manufacturer needs to be preliminary approved by CTA.

With reference to the propulsion system, please confirm that the subsupplier of the propulsion system listed in section 10 of technical specifications, that is to say:

Traction inverter Knife Switch Traction Motor Master controller High Speed Circuit Breaker Braking Resistor Input Filter reactor

doesn't have to be qualified, as only the propulsion system needs to be preliminary approved by CTA.

With reference to the auxiliary system, please confirm that the subsupplier of the auxiliary system listed in section 9.03 of technical specifications, that is to say:

Auxiliary Inverter Low Voltage power supply

doesn't have to be qualified, as only the auxiliary system needs to be preliminary approved by CTA.

Please, confirm also that each potential tenderer may ask for the qualification of more than one possible subsupplier for each item on the list provided in Technical Specification at page DS 1-34, section 1.16.

Response: Technical Specifications, Section 1.16 – Subcontractor Identification and Evaluation lists the subcontractors to supply the components/subsystems to be evaluated by the Authority in accordance with Pre-Bid procedures as specified in Section G, Instructions to Bidders.

The subcontractors proposed to supply the components/subsystems specified in Section 1.16 of the Technical Specifications must demonstrate an understanding of all the elements of the subsystem they are providing which will include some of those sub-components which are mentioned in your above question. In order to be accepted as a Subcontractor they must be able to demonstrate their capability to meet all requirements listed in Instructions to Bidders, Section G,5.

Bidders may propose multiple subcontractors to supply the components/subsystems in Technical Specifications, Section 1.16, Items 1-26 for evaluation by the Authority in accordance with Pre-Bid procedures as specified in Section G of the Instructions to Bidders. Additionally, once a subcontractor is accepted by the Authority, it is accepted for use by all potential Bidders.

Question 5: Instructions to Bidders, Pages IB-6 and IB-7, Section G, 5, Subcontractor Qualifications

With reference to the documents we need to supply for the Subcontractors qualification procedure, we understand that we have to provide you the following:

Subcontractor company profile & references (to show technical capability, expertise to meet the design requirements, product support including delivery of renewal parts, quality of documentation and timely delivery, timeliness of parts turnaround for warranty and modifications, quality of instruction in troubleshooting and repair techniques).

Subcontractor technical sheet (to show demonstrated understanding of the Contract Technical Specifications)

Please confirm and list any other required document (if any).

- Response: Instructions to Bidders, Section G, 5, Subcontractor Qualifications lists the subcontractor qualifications required. Bidders may submit any additional documentation it feels necessary to demonstrate the capabilities of each subcontractor.
- Question 6: <u>Technical Specifications CTA 7000-12</u>

We kindly ask if it is possible for you to provide us the TECHNICAL SPECIFICATIONS for Rapid Transit Cars in word format.

Response: The Technical Specifications are not available in Word format. Also see Addendum No. 1, Attachment A, Question 2.

Requisition No. C13FI101372531 Addendum 4 - Attachment B

Pre-Bid Meeting held at CTA Skokie Shops with Kawasaki Rail Car (KRC) on Wednesday, April 10, 2013, relative to Requisition C13FI101372531, Specification CTA-7000-12 for the Purchase of Rapid Transit Cars.

The following were in attendance:

Representing Chicago Transit Authority

Maria Williams-Baxter	John Kilstrom
Chris Hegarty	Fred Lonnes
Robert Kielba	Grant Macey

Eric Mattson Jorge Silva Dawid Skarzynski

Representing Kawasaki Rail Car Maurice Andriani

Steven Kraycar **Chuck Wochele** Kakushin Hirano Shuhei Matsumoto Shozo Ito Tomonori Umebayashi

Representing Lecip Inc. *Natalie Cornell

Representing TDG Transit Design Group *Clark Aubert *Marc J. Gagne

Representing Vapor Stone Rail Systems *Dean Chiappini *Martin Blonde

*Roger Weseloh

*Eric Garvis

Representing Wabtec Transit *Bill Saddler

*- Indicates part-time attendance.

CHICAGO TRANSIT AUTHORITY PURCHASE OF RAPID TRANSIT CARS REQUISITION C13FI101372531 April 10, 2013

1. <u>Technical Specifications, Page DS 1-34, Section 1.16, Subcontractor Identification and</u> <u>Evaluation (KRC-1, 4/10/13)</u>

Kawasaki submitted information on the following firms and proposed them as subcontractors for the items listed in Section 1.16 as follows:

1.16, 1	Side, end, and operator cab doors		
	Vapor Stone Rail Systems	CTA Accepted	
1.16, 2	Side door operator, control system and upper tracks		
	Vapor Stone Rail Systems	CTA Accepted	
1.16, 8	All light fixtures, interior and exterior		
	TDG Transit Design Group	CTA Accepted	
	Lecip Inc Based on the presentation and information presented, CTA could not accept Lecip Inc. as a supplier of all light fixtures, interior and exterior, because they failed to demonstrate a complete understanding of the specifications and failed to identify specification compliant solutions for the required items.		
1.16, 9	All cab control, switch, and indicator panels		
	Vapor Stone Rail Systems	CTA Accepted	

2. <u>Technical Specifications, Page DS 1-1, Section 1.02, Compatibility with Existing CTA Cars</u> (KRC-1, 4/10/13)

Kawasaki submitted the following:

There are many sections in the technical specification, including the referenced, where compatibility with the existing cars is required. In order to achieve the required compatibility, the Bidder requests the CTA to provide comprehensive and detailed information of the design and the system architecture of all equipment that requires compatibility or interchangeability with the 5000 Series cars.

CTA advised that no additional technical information will be provided other than what is detailed in the specifications. After Contract Award, CTA will work with the Contractor to provide the necessary information. CTA further clarified that it is the Authority's intent to operate 5000 and 7000 Series cars together in service. Compatibility of those systems as outlined in the specifications is needed to accomplish this.

3. <u>Technical Specifications, Page DS 1-1, Section 1.02, Compatibility with Existing CTA Cars</u> (KRC-1, 4/10/13)

Kawasaki submitted the following:

The technical specification requires the 7000 Series cars to be compatible with the 5000 Series cars to enable both classes to operate together within the same train.

System Level Discrete Trainline Serial Trainline and Data Communications (CMN and PCN) TS 15.01.A.2 Communication System TS 14.01.A Video System TS 14.01.A Automatic Maintenance Data Upload TS 15.11.A Smart Card Reader Interface TS 15.08.A.1

Kawasaki requests the CTA for comprehensive and detailed information of the design and the system architecture of all equipment that requires compatibility in order to assist Kawasaki in evaluating compatibility, prior to or at time of Contract award, as follows:

A) A "Compatibility and Interoperability Document" for the interfaces and systems listed above is needed from the CTA.

Required Information	Reason / Purpose
Details of Propulsion Control and its Test Data where available, as follows: 1) Bl ending Control (Speed) 2) "Soft Stop" Feature 3) Response Time between powering and braking	To avoid potential "bucking motions" caused by draft and buff forces due to the performance differences between the 5000 Series and 7000 Series cars.
Schematic Diagram	To achieve discrete trainlines' compatibility.
Electrical Loads of each Discrete Trainline	To determine the circuit characteristics (e.g. circuit breaker rating, wire gauge, etc.)

B) In addition, the following specific information is requested from the CTA:

CTA advised that no additional technical information will be provided other than what is detailed in the specifications. After Contract Award, CTA will work with the Contractor to provide the necessary information.

4. <u>Technical Specifications, Page DS 1-1, Section 1.02, Compatibility with Existing CTA Cars</u> (KRC-1, 4/10/13)

Kawasaki submitted the following:

On the existing CTA 5000 Series cars, it is assumed that the train operator touch screen (TOTS) will require a function to be added to not allow the train crew to access the Maintenance Screen for the new 7000 Series car system when the train consists only of 5000 Series cars. Is the CTA planning to make a software modification to the 5000 Series TOTS?

CTA advised that they will not be making any changes to the 5000 Series cars. CTA further advised that full compatibility of the Maintenance Screens is not necessarily required. 7000 Specific maintenance data will only be shown on compatible 7000 series cars in the consist.

5. <u>Technical Specifications, Page DS 1-1, Section 1.02, Compatibility with Existing CTA Cars</u> (KRC-1, 4/10/13)

Kawasaki submitted the following:

In order to allow Kawasaki to better understand the diagnostics architecture for compatibility, please advise if, on the train operator touch screen (TOTS) Event View for the 5000 Series cars, are the characters of the Event Message transmitted in text code (e.g. ASCII), or stored in the TOTS or in the logic control unit (LCU)? If the latter, are there spare Event Message numbers for the 7000 Series cars' event messages? If so, please provide available details.

CTA once again advised that full compatibility of the Maintenance Screens and Event codes/messages are not necessarily required. However, after Contract Award, during Design Review, the potential for harmonization of event codes can be discussed and CTA would work with the Contractor to provide the necessary information.

6. <u>Technical Specifications, Page DS 1-1, Section 1.02, Compatibility with Existing CTA Cars</u> (KRC-1, 4/10/13)

Kawasaki submitted the following:

Do existing CTA 5000 Series cars have fault/event reporting function(s) that consist of events from various systems? If this is the case, these events will have to be completely consistent between 5000 Series and 7000 Series cars. For example, if more than 50% of the propulsion fails, is it considered to be a critical failure?

CTA advised that 5000 Series cars do not report any maintenance data that is calculated on a train consist basis and this is not required on the 7000 Series cars.

7. <u>Technical Specifications, Page DS 3-2, Section 3.01, D Car Behavior under Collision</u> <u>Conditions-Crash Energy Management (KRC-1, 4/10/13)</u>

Kawasaki submitted the following:

To ensure compliance with the compatibility and crashworthiness requirements, please provide the following information for the 5000 Series cars:

Page 9 of 11

- Weight
- Peak Force
- Mean Force
- Deformation
- Absorption Energy
- Anti-Climber Dimensions

This information is requested by Kawasaki to assist in Kawasaki's analysis and evolution of the situation where a 7000 Series car is braking when coupled to a 5000 Series car, as well as to assess the performance implications on train operation and crashworthiness in the event that CTA may operate mixed car trains.

CTA advised that no additional technical information will be provided other than what is detailed in the specifications. After Contract Award, CTA will work with the Contractor to provide the necessary information. CTA further clarified that compatibility of anti-climbers for all existing CTA cars series is required.

8. <u>General Specifications, Page GS-7, Section 3, F, and Technical Specifications, DS 10-2,</u> Section 10.01, P, Propulsion System - General (KRC-1,4/10/13)

Kawasaki submitted the following excerpts from the specifications:

<u>GS-7, 3,F - Test Plan</u>

The Test Plan shall include not only the functional and performance testing to be done by the Contractor, but also that which will be performed by its subcontractors, suppliers and manufacturers, as well as inspections to be done by the Contractor at these subcontractors, manufacturers and suppliers (source inspections).

Propulsion, 10.01 General, P.

Should equipment similar to previous contract be supplied on this contract, the Engineer at his sole discretion may accept qualification tests performed earlier, provided that the performance and environmental requirements are also comparable.

Kawasaki submitted the following question:

To provide a fair and equitable basis for the development of each carbuilder's technical approach and pricing, Kawasaki requests that CTA confirm whether waivers for testing will be received, reviewed and approved during the 7000 series project. If a subsystem, proposed during the vendor qualification pre-bid meeting for the 7000 series procurement is approved and is stated to be functionally the same design as that operating in revenue service on the 5000 series vehicles and with the ability to meet the performance requirements of the 7000 series specifications, will a qualification test or other testing requirement(s) be waived during the 7000 series test phase?

CTA replied that this is a new car Contract and all testing would need to be accounted for in the Bid Price. Acceptance of testing done previously would only be considered if it is specifically referenced in the Specification requirements as the example cited by Kawasaki in Section10.01, P. This acceptance is at the sole discretion of the Engineer and all the systems involved in the test would have to be unchanged from the previous run.

9. <u>Technical Specifications, Page DS 16-8, Section 16.01, W, EMI/EMC Tests (KRC-1, 4/10/13)</u>

Kawasaki submitted the following excerpt from the specification:

TS 16.01, W "The cars and individual systems shall be tested for EMI/EMC emissions in accordance with Section 9.20, F."

Kawasaki noted that there is a typo in the specification reference as it should be 9.19, F, not 9.20, F and submitted the following question:

Please clarify if TS 16.01, W for EMI/EMC testing applies to each production car? If not, please remove it or change the text to read: "The prototype cars and individual systems shall be tested for EMI/EMC emissions in accordance with Section 9.19, F." CTA reviewed the issue and agrees that Section 16.01, W, applies only to the prototype cars.

See Addendum 4, Item 2.

If the foregoing does not agree with your understanding of the items discussed, contact Maria Williams-Baxter, Sr. Procurement Administrator as soon as possible.



CHICAGO TRANSIT AUTHORITY

567 West Lake Street Chicago, Illinois 60661-1498 TEL 312 664-7200 www.transitchicago.com

March 29, 2013

Subject: Requisition No. C13FI101372531 - IFB to Purchase Rapid Transit Cars Specification CTA 7000-12

Re: Addendum No. 3

All Potential Bidders:

Enclosed please find Addendum No. 3. This Addendum revises and updates the Instructions to Bidders and Technical Specifications of the IFB. Insert this Addendum No. 3 into the Contract Documents of the subject requisition and consider it part of the official Contract Documents.

Included with Addendum No. 3 is the following attachment:

Attachment A – Written Questions from Potential Bidders and CTA's Responses

Addendum No. 3 shall be acknowledged as received by identification of Addendum No. 3 on the IFB – Bid Proposal Exhibit 2 – Bidder's Signature Page, to be submitted with the Bid Proposal. Failure to acknowledge receipt of Addendum No. 3 or any addenda with your Bid Proposal shall render the Bid Proposal as non-responsive.

The Chicago Transit Authority is seeking bids for the subject procurement. Bid packages are to be delivered to:

Delivery Service or Drop Off

Chicago Transit Authority Bid Office - 2nd Floor 567 W. Lake Street Chicago, IL 60661-1498

Bid Due Date (Bid Opening): Thursday, July 25, 2013, no later than 11:00 A.M. Chicago time

Each Bidder bears full responsibility for delivery to the Bid Office before the advertised date and hour for the opening of Bids. Bidders are solely responsible for ensuring that its Bid is received by the Authority in a timely manner prior to the date and time of Bid Opening. If mail or delivery is delayed beyond the date and hour set for the Bid Opening, Bids delayed will not be considered and will be returned unopened. Bid Office hours are Monday through Friday from 8:00 am to 4:30 pm Chicago time, except holidays.

If you have any questions, please contact Maria Williams-Baxter, Sr. Procurement Administrator <u>mwilliams@transitchicago.com</u> or 312-681-2437.

Sincerely, Gelene Brown

Gelene Brown Director, Purchasing

Requisition No. C13FI101372531 ADDENDUM No. 3

Item 1. INSTRUCTIONS TO BIDDERS Page IB-6, Section G, 3, PRE-BID PROCEDURES – Other Pre-Bid Meetings

Add the following new subsection i):

"i) Authority evaluation of the technical data and information required by the Technical Specifications must be submitted during Other Pre-Bid Meetings as specified in Sections 1.09.F, 2.03.D, 3.03, 9.03.A.16, 10.01.L, 10.02.B.6, 10.03.E.2.b, 11.03.G, and 15.01.A.

This information must be submitted for evaluation Pre-Bid during either Subcontractor Qualifications Pre -Bid Meetings, or if necessary, during Other Pre-Bid Meetings scheduled no later than 30 calendar days prior to the Bid submission date.

Item 2. TECHNICAL SPECIFICATIONS

Page DS 1-4, Section 1.09, F, Stress Analysis

Delete paragraph F and replace with the following:

Bidders shall demonstrate per Pre-Bid Procedures, Section G, 3, i, Page IB-5, to the satisfaction of the Engineer the capability to conduct the required analyses.

Item 3. TECHNICAL SPECIFICATIONS

Page DS 2-6, Section 2.03, D, DIMENSIONS AND WEIGHTS - Estimated Weights

Delete the first sentence in paragraph D and replace with the following:

Bidders shall furnish Pre-Bid per Pre-Bid Procedures, Section G, 3, i, Page IB-5, an estimated weight of the complete car.

Item 4. TECHNICAL SPECIFICATIONS
Page DS 9-13, Section 9.03, A, 16, ELECTRICAL EQUIPMENT – Auxiliary Power
Supply System

Delete paragraph 16 and replace with the following:

Bidders shall furnish Pre-Bid, per Pre-Bid Procedures, Section G, 3, i, Page IB-5, a block diagram of the Auxiliary Power Supply.

Requisition No. C13FI101372531 ADDENDUM No. 3

Item 5. TECHNICAL SPECIFICATIONS Page DS 10-2, Section 10.01, L, PROPULSION SYSTEM - General

Delete the second sentence of paragraph L and replace with the following:

Bidders shall furnish Pre-Bid, per Pre-Bid Procedures, Section G, 3, i Page IB-5, lab and field EMI test data from an existing product extrapolated to the installation on the CTA vehicle to demonstrate the ability to achieve EMI/EMC compliance.

Item 6. TECHNICAL SPECIFICATIONS
Page DS 15-1, Section 15.01, A, 4, SERIAL TRAINLINE AND DATA
COMMUNICATIONS – General - Overview

Delete paragraph 4 and replace with the following:

Bidders shall furnish Pre-Bid, per Pre-Bid Procedures, Section G, 3, i, Page IB-5, system block diagrams.

Requisition No. C13FI101372531 ADDENDUM No. 3 - ATTACHMENT A

Written Questions from Potential Bidders and CTA's Responses:

Question 1: Page IB-5, Section G, 3, e), Pre-Bid Procedures- Other Pre-Bid Meetings

Do Bidders need to submit documents electronically and by FedEx to CTA for these Pre-Bid meetings? Is submission of documents via the internet and electronic file acceptable?

- Response: The submission of documents electronically is acceptable. Email is preferred, however, if the size of the file is larger than 20 Mb an alternate means such as FedEx or a web-based file transfer is necessary or the submittal must be broken into elements of smaller size.
- Question 2: Page IB-5, Section G, 3, e), Pre-Bid Procedures- Other Pre-Bid Meetings

Would CTA consider a specific "web based link" to be established for the transfer of documents for this specific car procurement?

- Response: CTA will consider a web based link. In the event that a web-based alternative is used, the Bidder must ensure, well in advance of making the submission, that the chosen web-based file share/download method will not be blocked by CTA's network security. In addition to this electronic version of the documents, CTA requests that three (3) hard copies be provided on the day of the Pre-Bid Meeting.
- Question 3: Page IB-5, Section G, 3, Pre-Bid Procedures- Other Pre-Bid Meetings

Paragraph 3 of Section G of the Instructions to Bidders specifies that minutes of Pre-Bid Meetings will be prepared by CTA and distributed as Addenda to all firms. Can CTA please confirm Bidder's interpretation that such minutes of meetings will not contain a detailed description of all elements discussed (including potential strategic and/or sensitive information of the Bidders), but only a summary of the discussion and any information which results in a modification of the General Specifications, the Technical Specifications or any related contract document, or in the pre-qualification of a subcontractor?

Response: The meeting minutes will disclose the Bidder's questions regarding the matters listed in Section G, 3 of the Instructions to Bidders, including clarifications, variations, and approved equals, and will include CTA's response. CTA advises that the Bidder should avoid presenting trade secrets and confidential or proprietary information during the Pre-Bid meetings. However, if the Bidder finds it necessary to present such information, as part of the substantiation documentation required by Section G, 3, e of the Instructions to Bidders, it must bear the appropriate notices to its confidential character so it may be withheld from disclosure.

Question 4: Page IB-12, Section V, Bid Submission Requirements

Reading the above mentioned paragraph, we understood that items 1, 2, 3 and 4 are the complete list of the documents requested to be included in the bid package.

Nevertheless, it seems that the Technical Specification contains requirements for additional technical documentation to be included in the bid package; e.g. at page DS15-1, Section 15 ("SERIAL TRAINLINE AND DATA COMMUNICATIONS") subsection 15.01 ("GENERAL") A ("Overview") item 4, it is written "Bidders shall submit system block diagrams with the Bid". Please clarify.

Response: See Addendum 3, Items 1-6.

CHICAGO TRANSIT AUTHORITY



567 West Lake Street Chicago, Illinois 60661-1498 TEL 312 664-7200 www.transitchicago.com

March 19, 2013

Subject: Requisition No. C13FI101372531 - IFB to Purchase Rapid Transit Cars Specification CTA 7000-12

Re: Addendum No. 2

All Potential Bidders:

Enclosed please find Addendum No. 2 and two (2) attachments. This Addendum revises and updates the Instructions to Bidders, Technical Specifications and Drawings of the IFB. Insert this Addendum No. 2 into the Contract Documents of the subject requisition and consider it part of the official Contract Documents.

Included with Addendum No. 2 are the following attachments:

Attachment A – Written Questions from Potential Bidders and CTA's Responses Attachment B – Drawing DR-3 rev1

Addendum No. 2 shall be acknowledged as received by identification of Addendum No. 2 on the IFB – Bid Proposal Exhibit 2 – Bidder's Signature Page, to be submitted with the Bid Proposal. Failure to acknowledge receipt of Addendum No. 2 or any addenda with your Bid Proposal shall render the Bid Proposal as non-responsive.

The Chicago Transit Authority is seeking bids for the subject procurement. Bid packages are to be delivered to:

Delivery Service or Drop Off

Chicago Transit Authority Bid Office - 2nd Floor 567 W. Lake Street Chicago, IL 60661-1498

Bid Due Date (Bid Opening): Thursday, July 25, 2013, no later than 11:00 A.M. Chicago time

Each Bidder bears full responsibility for delivery to the Bid Office before the advertised date and hour for the opening of Bids. Bidders are solely responsible for ensuring that its Bid is received by the Authority in a timely manner prior to the date and time of Bid Opening. If mail or delivery is delayed beyond the date and hour set for the Bid Opening, Bids delayed will not be considered and will be returned unopened. Bid Office hours are Monday through Friday from 8:00 am to 4:30 pm Chicago time, except holidays.

If you have any questions, please contact Maria Williams-Baxter, Sr. Procurement Administrator <u>mwilliams@transitchicago.com</u> or **312-681-2437**.

Sincerely,

Gelene Brown Director, Purchasing

Requisition No. C13FI101372531

ADDENDUM No. 2

Item 1. INSTRUCTIONS TO BIDDERS Page IB – 5, Section G – PRE-BID PROCEDURES

Delete Section 3, first paragraph and replace with the following:

Subjects which the Bidders wish to discuss shall be submitted in writing on the "Bidder Request Form" Exhibit 1, in these Instructions to Bidders to the Sr. Procurement Administrator, no later than **five (5)** working days prior to the scheduled meeting date.

Item 2. TECHNICAL SPECIFICATIONS Page DS 3-25, Section 3.10, B, 4, Single and Two Passenger Seats

Add the following sentence to the end of the sub-section:

The passenger seat frame and its supporting structure shall be constructed and mounted so that space under the seat is maximized and is free of obstructions to facilitate cleaning.

Item 3. TECHNICAL SPECIFICATIONS

Page DS 3-26, Section 3.10, B, 5, Single and Two Passenger Seats

Delete the entire sub-section and replace with the following:

5. The seats shall be fully cantilevered from the sidewall with sufficient strength for the intended service. The lowest part of the seat assembly that is within 12 inches of the aisle shall be at least 10 inches above the floor. In locations at which cantilevered installation is precluded by design and/or structure, a semi-cantilevered seat mounting as reviewed and agreed to by the Engineer may be used. The semi-cantilevered design shall provide support with braces angled back to the floor/wall at the bottom of the heater cover. The pedestal/brace shall be Type 304 stainless steel with No. 3 finish, designed to withstand all loads and stresses applied to it. The pedestal/brace base shall be so designed as to prevent the base from cutting through the floor covering if attached to the floor. The anchorage of the pedestal, if attached to the floor shall be designed to minimize dirt accumulation. The seat frame, wall structure and seat attachment of the cantilevered or semi-cantilevered seats shall be designed to minimize any extra weight and shall be reviewed by the Engineer.

Item 4. TECHNICAL SPECIFICATIONS Page DS 15-10, Section 15.09, B, Color Display and Touch Screen

Insert the new sub-section as follows:

6. The TOTS screen shall be ruggedized to prevent damage due to scratching, impacts, vandalism or abuse. If not inherently rugged, the screen shall be provided with a rugged, transparent protective covering. The screen shall be suitable for easy manual action with the touch of a finger, gloves or pen. TOTS screen shall be reviewed by the Engineer.

Delete the drawing on page DR-3 of the DRAWINGS and replace with the following:

Addendum 2, Attachment B – Drawing DR-3 rev1

Item. 5 DRAWINGS Page DR-3

Requisition No. C13FI101372531 ADDENDUM No. 2 - ATTACHMENT A

Written Questions from Potential Bidders and CTA's Responses:

Question 1: PAGE DS 1-34, Section 1.16, Subcontractor Identification & Evaluation

We kindly ask CTA to provide the Bidders with a sufficiently detailed list of suppliers currently providing equipment for the vehicles of the 5000 series (e.g. HVAC, brakes, door operators, door panels, floors, windows, passenger seats, propulsion, PIS, trucks, traction motors, truck suspensions, inverters, cab equipment, interior lights, exterior lights, interiors linings, fiberglass panels, etc.) together with, to the extent possible, a summary of the main technical features of each equipment.

Response: The following Subcontractors were accepted by CTA for the Series 5000 Cars and are currently in use on the Series 5000 Cars. Please note that these components/Subcontractors are <u>not</u> pre-accepted for use on the Series 7000 Cars and are not necessarily fully compliant to the Series 7000 Technical Specifications. The technical features of the Series 5000 equipment were described in the Series 5000 Technical Specifications.

> Side, end, and operator's cab doors - Vapor Rail - Milufab Side door operator, control system and upper tracks - Vapor Window sash – Dynamic Metals Floor panels – Railtech Composites Passenger and operator seats – Kustom Seating **Carbody shell - Bombardier** No. 1 end coupler system and No. 2 end drawbar system – Wabco All light fixtures, interior and exterior – Luminator All cab control, switch, and indicator panels – Bombardier Undercar air comfort package – Merak Air comfort control system - Merak Auxiliary Power Supply System – Turbo Power System Battery - Saft Horn – Federal Signal **Propulsion System – Bombardier** Friction brake system – Wabco Track brakes – Hanning & Kahl **Trucks – Bombardier** Active suspension system – Liebherr ATC/ATO System – PHW Unit and Train Network and Diagnostics Systems - Bombardier **Car Communications System – Axion** Video System – Verint Event recorder – Bach-Simpson **CBT** Training – XPan

Question 2: PAGE IB-5, Section G, Pre-Bid Procedures

The first paragraph of subsection 3 of Section G of the Instructions to Bidders specifies that Bidders need to submit the subjects they wish to discuss during Pre-Bid Meetings no later than ten (10) working days prior to the scheduled meeting date. The Bidder respectfully asks to reduce the number of days to submit such subjects to five (5) working days.

Response: See Addendum No. 2, Item 1.





CHICAGO TRANSIT AUTHORITY

567 West Lake Street Chicago, Illinois 60661-1498 TEL 312 664-7200 www.transitchicago.com

March 7, 2013

Subject: Requisition No. C13FI101372531 - IFB to Purchase Rapid Transit Cars Specification CTA 7000-12

Re: Addendum No. 1

All Potential Bidders:

Enclosed please find Addendum No. 1 and four (4) attachments. This Addendum revises and updates the Instructions to Bidders and the Technical Specifications of the IFB. Insert this Addendum No. 1 into the Contract Documents of the subject requisition and consider it part of the official Contract Documents.

Included with Addendum No. 1 are the following attachments:

Attachment A – Written Questions from Potential Bidders and CTA's Responses Attachment B – Initial Pre-Bid Meeting Attendance Attachment C – Inspection Meeting Attendance Attachment D – Initial Pre-Bid Meeting Transcript

Addendum No. 1 shall be acknowledged as received by identification of Addendum No. 1 on the IFB – Bid Proposal Exhibit 2 – Bidder's Signature Page, to be submitted with the Bid Proposal. Failure to acknowledge receipt of Addendum No. 1 or any addenda with your Bid Proposal shall render the Bid Proposal as non-responsive.

The Chicago Transit Authority is seeking bids for the subject procurement. Bid packages are to be delivered to:

Delivery Service or Drop Off

Chicago Transit Authority Bid Office - 2nd Floor 567 W. Lake Street Chicago, IL 60661-1498

Bid Due Date: Thursday, July 25, 2013, no later than 11:00 A.M. Chicago time

Each Bidder bears full responsibility for delivery to the Bid Office before the advertised date and hour for the opening of Bids. Bidders are solely responsible for ensuring that its Bid is received by the Authority in a timely manner prior to the date and time of Bid Opening. If mail or delivery is delayed beyond the date and hour set for the Bid Opening, Bids delayed will not be considered and will be returned unopened. Bid Office hours are Monday through Friday from 8:00 am to 4:30 pm Chicago time, except holidays.

If you have any questions, please contact Maria Williams-Baxter, Sr. Procurement Administrator at 312-681-2437.

Sincerely,

Gelene Brown Director, Purchasing

Requisition No. C13FI101372531

ADDENDUM No. 1

Item 1. INSTRUCTIONS TO BIDDERS Page IB – 2, Section D – BID DEPOSIT

Delete Section D, last paragraph and replace with the following: The period of bond must be for not less than one hundred twenty (120) days from the date of Bid Opening. Bid deposits will be returned after the Authority has awarded a contract.

Item 2. INSTRUCTIONS TO BIDDERS Page IB – 12, Section A – BID SUBMISSION REQUIREMENTS

Delete Section A – BID SUBMISSION REQUIREMENTS and replace with the following: Section V – BID SUBMISSION REQUIREMENTS

Item 3. TECHNICAL SPECIFICATIONS

PAGE C-14, Section 9.21, Table of Contents, Automatic Passenger Counting System

Delete the page number entry for the Automatic Passenger Counting System and Replace with the following:

9.21 AUTOMATIC PASSENGER COUNTING SYSTEM.......9-58

Requisition No. C13FI101372531 ADDENDUM No. 1 - ATTACHMENT A

Written Questions from Potential Bidders and CTA's Responses:

Question 1: PAGE IB-2, Section D, Bid Deposit (IPB-1, 3/1/13, SCOA)

Instructions to Bidder Section D last paragraph states. "The period of the bond must be for not less than one hundred eighty (120) days from the date of......". Please clarify if the correct number of days is 180 or 120?

Response: See Addendum No. 1, Item 1.

Question 2: Page IB-2, Section E, Bid Preparation (IPB-1, 3/1/13, SCOA)

In order to enable Bidders to be able to quickly and efficiently review IFB documents and prepare a bid we would like to request that the RFP documents be provided in PDF searchable format.

Question 3: Page IB-4, Section G, Pre-Bid Procedures (IPB-1, 3/1/13, SCOA)

Please clarify the process of submitting subcontractor qualifications at "Pre-Bid Meetings", also which "Pre-Bid Meetings" are being referred to in this statement? (The IFB refers to initial, other and final "Pre-Bid Meetings"). Also, please clarify the procedure referred to in this section for submitting an "Alternative Request".

Response: There are two methods for submitting subcontractor qualifications for review and acceptance by the Authority. Bidders must submit documentation either at Pre-Bid Meetings or through Alternate Requests stating the qualifications of its subcontractors proposed to perform the work as identified in the Technical Specifications.

> See Instructions to Bidders: Section G, 3, g - Other Pre-Bid Meetings; Section G, 4 - Alternate Requests; and Section G, 5 - Subcontractor Qualifications.

Question 4: Page IB-6 & IB-7, Section G, Pre-Bid Procedures (IPB-1, 3/1/13, BOM)

Section G paragraph 5 of the Instructions to Bidders provides that Bidders shall submit for acceptance by the Authority documentation stating the qualifications of its subcontractors proposed to perform the work as identified in the Technical Specifications. Could the Authority confirm Bidder's interpretation that should a proposed subcontractor submitted by a Bidder be accepted by the Authority, such subcontractor is deemed to be accepted for all bidders?

Response: Once a subcontractor is accepted by the Authority, it is accepted for use by all potential Bidders. The subcontractor's qualifications do not need to be resubmitted.

Requisition No. C13FI101372531 ADDENDUM No. 1 - ATTACHMENT B

Initial Pre-Bid Meeting held at the CTA Headquarters, Conference Rooms 2A-B, 567 West Lake Street, Chicago, IL at 11:30 AM, Friday, March 1, 2013, relative to Requisition C13FI101372531-IFB for Rapid Transit Cars - Specification CTA 7000-12.

The following were in attendance:

Representing Chicago Transit Authority

Primary Contact: Maria Williams-Baxter, mwilliams@transitchicago.com			
Walter Keevil	John Kilstrom	Fred Lonnes	David Johnson
Robert Kielba	Robert Miller	Phil Lamont	
Chris Hegarty	Kevin Loughlin	Gelene Brown	
Tom McKone	Klaudiusz Kruszecki	Ellen McCormack	

Representing Albatros Group

Primary Contact: William Kolberg, Director of Finance, William.kolberg@sepsa.es

Ivan Beltran

<u>Representing Alstom Transport</u> *Primary Contact*: Lowell Goudge, Technical Bid Manager, Lowell.Goudge@Alstom.com

Joe Quigley Darin Grzenda

<u>Representing Ansaldo Breda</u> *Primary Contact*: Bruno Tasselli, VP Sales Mass Transit, <u>tasselli.bruno@ansaldobreda.it</u>

Antonio Torcia

<u>Representing Best Packaging, LLC</u> *Primary Contact*: Valerie Matthews, Principal, <u>service@bestpackforyou.com</u>

<u>Representing Bombardier Transportatin</u> <u>Primary Contact</u>: Thomas Purmort, Business Development and Sales Executive, <u>Thomas.purmort@us.transport.bombardier.com</u>

Simon Deslauriers Michel Frenette Joseph E. Kenas

Representing Buildex Electronics Inc. Primary Contact: B.J. Parecha, President, buildex1@yahoo.com

Representing CAFUSA, Inc

Primary Contact: Jitendra S. Tomar, Vice President, Marketing & Business Development, tomar@cafusa.com

Murphy Madison

<u>Representing Faiveley Transport</u> <u>Primary Contact</u>: Peter Basile, Director of OE Sales - North America, <u>peter.basile@faiveleytransport.com</u>

Michael Haskins

Representing Freedman Seating Primary Contact: Sudha Veerapaneni, New Business Development Mgr., sudhav@freedmanseat.com

Dan Cohen Steve Orzech Jr. Sara Diorio

<u>Representing GMA International Services, Inc.</u> *Primary Contact*: Gino Antoniello, President/CEO, GMA@gma-intl.com

<u>Representing Hoppecke Batteries</u> *Primary Contact*: Robert Magdule, Manager – Transit Sales N.A., <u>Rmagdule@Hoppecke-US.com</u>

Representing Illinois Department of Transportation (IDOT) Primary Contact: Joe Shacter, Director, Joseph.Shacter@illinois.gov

<u>Representing ISC Applied Systems</u> *Primary Contact*: Eric Garzon, President, egarzon@iscappliedsystems.com

<u>Representing Kawasaki Rail Car, Inc.</u> *Primary Contact*: Shozo Ito, Manager, Contracts & Marketing, ito@kawasakirailcar.com

Maurice Andriani

<u>Representing Knorr Brake Corporation</u> <u>Primary Contact</u>: Mike Walton, Director of Sales & Marketing, <u>mike.walton@knorrbrakecorp.com</u>

<u>Representing Kustom Seating Unlimited</u> <u>Primary Contact:</u> Rick Komm, Director of Sales and Marketing, <u>rkomm@kustomseating.com</u>

Gene Germaine

<u>Representing LECIP, Inc</u> *Primary Contact*: Natalie Cornell, Vice President, ncornell@lecipinc.com

<u>Representing Liebherr – Transportation Systems</u> <u>Primary Contact</u>: Jan Radtke, Sales & Marketing, North America jan.radtke@liebherr.com</u>

<u>Representing Luminator Technology Group</u> <u>Primary Contact</u>: Labon Ruth, Manager Rail Sales & Business Development, <u>Iruth@luminatorusa.com</u>

Steven Ojalvo

Representing Mitsubishi Electric Power Products, Inc.

Primary Contact: Koichiro Tsuji, Market Development Manager, koichiro.tsuji@meppi.com

John Kulak

<u>Representing Nippon Sharyo USA</u> Primary Contact: Ken Kuriyama, Manager, Marketing, <u>kuriyama@nipponsharyo.com</u>

Kevin Koyasu David Yamada

<u>Representing Parsons Brinckerhoff, Inc.</u> *Primary Contact*: Art Petersen, Sr. Engineering Manager, <u>petersona@pbworld.com</u>

Representing PHW, Inc. Primary Contact: John R. Harrison, Vice President, jrharrison@phwinc.com

David E. Cichowski Kim Anderson

Representing Railliance Inc. Primary Contact: Eric L. Schook, President, eschook@railliance.com

<u>Representing RTR Technologies</u> *Primary Contact*: DJ Hogan, Sales Manager, d.hogan@rtrtechnologies.com

Representing RL Controls, LLC Primary Contact: Lena Walsh, Owner, lena@rlcontrols.com

Bill Hennigan

<u>Representing Saft America. Inc.</u> *Primary Contact*: Michael Simon, Sr. Manager Contracts & OEM Sales, Michael.simon@saftbatteries.com

<u>Representing Schunk Graphite Technology</u> *Primary Contact*: John Butler, Sr. Sales Engineer, <u>john.butler@schunkgraphite.com</u>

Greg Scearce

<u>Representing Siemens Rail Systems</u> *Primary Contact*: Richard Trail, Director Business Development, <u>Richard.trail@siemens.com</u>

Representing Sojitz Corporation of America Primary Contact: Daisuke Iwama, Associate Director Project, iwama.daisuke@sky.sojitz.com

<u>Representing Sumitomo Corporation of America</u> <u>Primary Contact</u>: Hideyuki Ninomiya, Director, Transportation Systems & Equipment <u>hideyuki.ninomiya@sumitomocorp.com</u>

Martin Green

Representing Toshiba International Corporation

Primary Contact: Jaideep S. Luthra, Sr. Product Manager, Rail Transportation Systems, jaideep.luthra@tic.toshiba.com

Representing Traction Systems, Inc.

Primary Contact: Bill Umbenhaur, President, bill.umbenhaur@tractionsystems.com

<u>Representing Transit Associates</u> *Primary Contact:* David Hillock, President, <u>dahtransit@sbcglobal.net</u>

Terry Bernero Tom Kohler Tom Duerr

<u>Representing TransitConsult LLC</u> *Primary Contact:* Charles Wochele, Managing Partner, <u>cwochele@transitconsult.com</u>

<u>Representing Turbo Power Systems Limited</u> <u>Primary Contact: Richard Kapuscinsiki, Vice President Sales, North America,</u> <u>rak@turbopowersystems.com</u>

<u>Representing Ungaretti & Harris LLP</u> *Primary Contact*: Charles Bernardini, Partner, crbernardini@uhlaw.com

Representing Voith Turbo Inc.

Primary Contact: Meredith Carter, Sales Manager, Meredith.carter@voith.com

<u>Representing Vossloh Kiepe, Inc.</u> *Primary Contact:* John Andreas, Vice President, j.andreas@vku.vossloh.com

<u>Representing Vulcanite</u> <u>Primary Contact</u>: James Hurley, Business Development, Technical Sales Representative, <u>jhurley@vulcanite.com</u>

<u>Representing Wabtec Corporation</u> *Primary Contact*: Zoltan Kovacs, Regional Manager, <u>zkovacs@wabtec.com</u>

Cornelius R. Stevenson

<u>Representing Wilson IHRIG & Associates</u> *Primary Contact*: Derek L. Watry, Chief Executive Officer, dwatry@wiai.com

<u>Representing Woojin Is America, Inc.</u> *Primary Contact*: Joseph Sang-Hyun Kim, Vice President & COO, <u>isk@wjisamerica.com</u>

Allen Wright

<u>Representing ZF Industries, LLC</u> *Primary Contact*: Michael J. Hall, Sales and Project Manager, <u>Michael.hall@zf.com</u>

Jeff Henning

Requisition No. C13FI101372531 ADDENDUM No. 1 - ATTACHMENT C

Inspection Meeting held at the CTA Skokie Shop, 3701 Oakton St., Skokie, Illinois at 9:00 AM, Saturday, March 2, 2013, relative to Requisition C13FI101372531 - IFB for Rapid Transit Cars - Specification CTA 7000-12.

The following were in attendance:

Representing Chicago Transit Authority

Primary Contact: Maria W	/illiams-Baxter, <u>mwilliams@tra</u>	nsitchicago.com
Robert Kielba	John Kilstrom	Fred Lonnes
Chris Hegarty	Holly Blicharz	Gelene Brown
Klaudiusz Kruszecki	Jorge Silva	
David Skarzynski	Ellen McCormack	

Representing Albatros Group

Primary Contact: William Kolberg, Director of Finance, William.kolberg@sepsa.es

Ivan Beltran

<u>Representing Alstom Transporation</u> *Primary Contact:* Darin Grzenda, Sr Trains System Engr. <u>darin.grzenda@Alstom.com</u>

Lowell Goudge

Representing Ansaldo Breda

Primary Contact: Bruno Tasselli, VP Sales Mass Transit, tasselli.bruno@ansaldobreda.it

Antonio Torcia

Representing Best Packaging

Primary Contact: Valerie Matthews, Principal, service@bestpackforyou.com

Representing Bombardier

Primary Contact: Thomas Purmort, Business Development and Sales Executive, Thomas.purmort@us.transport.bombardier.com

Joseph E. Kenas Michel Frenette Simon Deslauriers

<u>Representing Buildex Electronics Inc.</u> *Primary Contact:* B.J. Parecha, President, buildex1@yahoo.com

Don Basaek
Representing CAFUSA, Inc Primary Contact: Jitendra S. Tomar, Vice President, Marketing, tomar@cafusa.com						
Ander Labari	Betiri Estornes	Murphy Madison	Adam Wasserzug			
Representing Curtis Engineering Consulting Services, Inc. Primary Contact: Richard Curtis, President, <u>curtisengr@aol.com</u>						
<u>Representing Faiveley Transport</u> Primary Contact: Mike Haskins, Account Manager, <u>mhaskins@grahamwhite.com</u>						
Representing Freedman Primary Contact: Dan C	<u>Representing Freedman Seating</u> Primary Contact: Dan Cohen, Vice President, <u>danc@freedmanseating.com</u>					
Representing ISC Applied Systems Primary Contact: Eric Garzon, President, egarzon@iscappliedsystems.com						
Representing Kawasaki Primary Contact: Shozo	lto, Manager Contracts	& Marketing, <u>ito@kawa</u>	sakirailcar.com			
Shuhei Matsumoto Kunihiko Takagi	Kunihiko Takagi Eiichi Kato	Maurice Andria Tomonoki Ume	ni Yoichiro Araki baychi			
Representing Lecip, Inc Primary Contact: Natalie Cornell, Vice President, <u>ncornell@lecipinc.com</u>						
<u>Representing Luminator Technology Group</u> Primary Contact: Steven Ojalvo, Business Development Manager, <u>smo@focon.dk</u>						
Representing Mitsubishi Electric Power Products Primary Contact: John R. Kulak, Manager Engineer, john.kulak@meppi.com						
Hiroyuki Shiota						
<u>Representing Nippon Sharyo USA</u> Primary Contact: Ken Kuriyama, Manager, Marketing, <u>kuriyama@nipponsharyo.com</u>						
Toshiki Kunii Tsutomu Shirai Takashi Ishizuka Satoru Ohshima	Kazuhiro Okada Thomas Heyden Kazutaka Fujii Yukiaki Ito	Yoshiaki Ota Susumu Nakane Richard Vadnal Akira "Kevin" Koyasu	Dan Gorstein			
Representing PHW, Inc. Primary Contact: John R. Harrison, Vice President, jrharrison@phwinc.com						

David E. Cichowski

Kim Anderson

Representing Railliance Inc.

Primary Contact: Eric L. Schook, President, eschook@railliance.com

Representing Schunk Graphite Technology

Primary Contact: John Butler, Sr. Sales Engineer, <u>johnbutler@schunkgraphite.com</u> Greg Scearce

<u>Representing Sumitomo</u> *Primary Contact:* Martin Green, Manager, <u>martin.green@sumitomocorp.com</u>

<u>Representing Toshiba International</u> *Primary Contact:* Jaideep S. Luthra, Sr. Product Manager, jaideep.luthra@tic.toshiba.com

Saeed Lewinson Takahiko Minami Takuo Kuwahara

<u>Representing Transit Associates</u> *Primary Contact:* Dave Hillock, President, <u>dahtransit@sbcglobal.net</u>

Terry Bernero Tom Duerr

<u>Representing Vossloh Kiepe, Inc.</u> *Primary Contact:* John Andreas, Vice President, j.andreas@vku.vossloh.com

Representing Vulcanite

Primary Contact: James Hurley, Technical Services Rep., jhurley@vulcanite.com

<u>Representing Wabtec</u> *Primary Contact:* Zolton Kovacs, Regional Manager, <u>zkovacs@wabtec.com</u>

Cornelius R. Stevenson

<u>Representing Weseloh Consultancy</u> Primary Contact: Roger J. Weseloh, P.E., Engineer, <u>rweseloh1@gmail.com</u>

Representing Woojin Is America, Inc.

Primary Contact: Joseph Sang-Hyun Kim, Vice President, jsk@wjisamerica.com

REQUISITION No. C13FI101372531 ADDENDUM No. 1 ATTACHMENT D 7 Pages



03-01-13cta_-_Vol._I[1] rev 2 13 meeting in our first addendum next week. 14 Second -- now, this is a slight change from the instructions to bidders. 15 16 Questions asked today must also be submitted in 17 writing and the questions will be formally responded to by addendum. So for questions previously submitted before today's meeting those questions will also be formally responded to in writing. However, for the technical questions 18 19 20 21 previously submitted, the answers will be covered 22 in the technical section of today's meeting. Next, I would like to strongly 23 24 L.A. COURT REPORTERS, LLC. (312) 419-9292 0004 recommend that all potential bidders use the 1 2 bidding request form found in Exhibit 1 of the 3 instructions to bidders when submitting requests for any consideration, including to schedule other pre-bid meetings and please send those forms to my 4 5 6 attention and my e-mail address is 7 mwilliams@transitchicago.com and purchasing will 8 promptly respond by addendum. 9 So the agenda for today we will 10 hear from our senior staff. We will walk through 11 the bid submission requirements and the 12 instructions to bidders We will talk about funding the project 13 14 from our budget and capital finance department and then we will 15 hear the Series 7,000 presentation. 16 So, at this time, I would like 17 to introduce to you our vice president of 18 purchasing, Ellen McCormack. 19 MS. MCCORMACK: Good morning.As Maria previously stated, my name is Ellen McCormack and I am the vice president of purchasing and supply chain for the Chicago Transit Authority. I'd like to welcome you to the 20 21 22 23 City of Chicago and more particularly to the 24 L.A. COURT REPORTERS, LLC. (312) 419-9292 0005 1 Chicago Transit Authority headquarters. We're 2 3 very excited to see all of you here today. The purchase of the Series 7,000 rail cars is a very important procurement for the CTA. AUDIENCE MEMBER: Can you please 4 5 6 speak into the microphone? 7 MS. MCCORMACK: The purchase of the 8 Series 7,000 rail cars is a very important procurement for the CTA because it will allow us 9 10 to continue modernizing our fleet in order to 11 improve the experience we provide to our 12 customers. The rail stock we intend to replace is approximately 30 years of age. The replacement of our aging rail cars will reduce service delays by 13 14 diminishing mechanical breakdowns while also 15 saving millions of dollars in operating costs. 16 The Series 7,000 rail cars will complement the 17 Series 5,000 rail cars, which the CTA is currently 18 19 introducing into our fleet. 20 Forrest Claypool, the CTA's 21 president, is continuing the CTA's aggressive plan of investment into the modernization of the 22 nation's second largest transit system. We are 23 Page 2

03-01-13cta_-_Vol._I[1] rev 2 24 heavily investing in our transit system in order L.A. COURT REPORTERS, LLC. (312) 419-9292 0006 to fulfil Mayor Emanuel's vision of providing a 1 2 world class public transportation system for a 3 world class city. 4 At this time, I would like to 5 6 introduce Gelene Brown, director of purchasing CTA. 7 MS. BROWN: Because this is an 8 invitation for bids, we want to emphasize the 9 following requirements of all bidders. All 10 bidders must submit a bid deposit and sealed bid 11 duplicate in one envelope package. 12 Also, bids must include the 13 following items: A bidder's qualification, the basis for responsibility determination as 14 described in ITB Section F. This form must be signed 15 by an authorized officer. Also, what must be included is bid proposal bidding forms in 16 17 18 Section 2, bidding forms Part 1, 2 and 3. These 19 forms must also be signed by an authorized officer and, number three, as found in Bid Proposal Exhibit 1 all certification and submission forms signed by an 20 21 authorized officer including: Buy America 22 certification, certification of primary participant regarding debarment suspension and 23 24 L.A. COURT REPORTERS, LLC. (312) 419-9292 0007 other responsibility matters, certification of 1 2 lower tier participant regarding debarment, 3 certification of contracts, grants, loans and 4 cooperative agreements, certification regarding a drug free workplace, a TVM certification and a 5 6 disclosure of ownership. 7 In addition as required in Bid Proposal Exhibit 2, we need execution by bidder signed by 8 an authorized officer as described in ITB Section E. 9 10 Please note that all addendums issued under this 11 procurement must be properly acknowledged on that form to be considered a proper bid. Failure to 12 13 submit or sign documents listed in these bid 14 submission requirements may result in your firm not being awarded the contract. So please make sure at your submission you do have an authorized officer to execute this bid. 15 16 17 18 Each bidder bears full responsibility for delivery to the bid office, 19 which is located in the Chicago Transit Authority bid office on the second floor, 567 West Lake. 20 21 Bids are due Thursday, July 25th, 2013, at 11:00 a.m. Chicago time. It is important that everyone 22 23 24 notes the CTA is trying to hold firm with this L.A. COURT REPORTERS, LLC. (312) 419-9292 0008 date and it is important we receive all bids at 1 2 this time. 3 Our next speaker will be Tom 4 McKone who is the vice president of budget and 5 capital finance. 6 MR. MCKONE: Thank you, Gelene. 7 Good morning. I want to take you through our 8 five-year capital improvement program and Page 3

03-01-13cta_-_Vol._I[1] rev 2 9 emphasize how the 7,000 Series fits into that 10 capital improvement program and our commitment to 11 funding a state of good repair at the CTA. This 12 is our five-year capital improvement program. These are the sources of funds Fiscal Year 2013 through 2017 as published in our 13 14 capital improvement plan and program. You can see the total here is \$2.98 billion. So nearly \$3 15 16 billion in our five-year program. This is consistent with the over \$4 billion including 17 18 19 funds from previous programs that we're currently 20 underway in delivering now. 21 A little more detail on that. We have a \$1 billion plan CTA bond program anticipating \$1.35 billion through our federal 22 23 24 program and this is consistent with the marks that L.A. COURT REPORTERS, LLC. (312) 419-9292 0009 have been provided to us through the Regional 1 2 Transportation Authority and an additional close 3 to half a billion via the state program. 4 We the CTA have made a 5 significant commitment and President Claypool has made a significant commitment and ries dent craypoor has made a significant commitment to getting our fleet, both bus and rail, into a state of good repair. This includes: The current commitment for 714 rail cars, the 5,000 series that is being delivered; an overhaul of 656 of our other 6 7 8 9 10 existing rail cars; bus procurements of 400 buses; and an overhaul of 1,000 buses that were 11 12 13 originally purchased five to eight years ago. 14 I want to emphasize also our financial capacity and our commitment to funding major projects at the CTA. The previous rail car purchase was over \$1 billion. We are currently 15 16 17 18 programming and committing nearly \$1 billion to 19 reforming and rebuilding and putting the Red Line 20 into a state of good repair. 21 Previously, we've expanded the 22 Brown Line, the Blue Line as well and procured 23 large amounts of bus vehicles as well. This order, and I know our rail car guys will be able L.A. COURT REPORTERS, LLC. (312) 419-9292 24 0010 1 2 3 to speak in more detail on this, will help us continue that commitment, putting our fleet into a state of good repair. We have 400 cars that are 4 currently approaching 30 years of age that we need 5 to look at replacing and in addition another 256 cars that are going to be hitting 30 years of age when we look at their replacement as well. With that, I'd like to turn it 6 7 8 9 over to Chris Hegarty, the GM of rail equipment 10 engineering. 11 MR. HEGARTY: Good morning. I just want to kind of go into -- back to the contract 12 13 and get into the layout of the base order and 14 options and the timeline we see this project 15 unfolding. 16 So regarding the contract, 17 there's a base order of one hundred cars plus eight options. So this takes the contract -- that takes the total contract up to possible approaches 18 19 Page 4

03-01-13cta_-_Vol._I[1] rev 2 20 of 846 rail cars. The base order in the first 21 four options are intended to allow us to replace the 2,600 Series cars and as Tom said those cars are, you know, past their useful life at this point. They were built between 1981 and 1987. 22 23 24 L.A. COURT REPORTERS, LLC. (312) 419-9292 0011 The next two options for 256 1 2 cars total will allow us to replace the 3,200 3 Series fleet which as Tom mentioned is also 4 growing in age. They were built between 1992 and 5 1994 and the last two options will allow the CTA 6 7 to expand its rail fleet size based on projected arowth in ridership. So that's kind of the layout 8 of the eight options. 9 Regarding the project timeline 10 that we see as it has been said, the bids are due July 25th. We expect the contract to be awarded 11 12 in the fourth quarter of this year. After that, 13 the next big milestone for us is to actually see the prototype cars, the ten cars, which should be delivered in 2016 and once those are delivered 14 15 we'll do initial -- there will be initial testing that is done before they're put into revenue service testing and that is a minimum nine month 16 17 18 19 requirement and we require that we -- as part of 20 that, it goes through a winter season and a summer 21 season in Chicago. 22 Assuming that -- when that 23 testing is successful, we would expect delivery of 24 the production cars and that projected timeline L.A. COURT REPORTERS, LLC. (312) 419-9292 0012 1 for that to begin is 2017. With the delivery of 2 3 the production cars beginning, you know, ultimately we expect to see a rate of 10 to 14 4 cars per month. 5 With that, I want to turn it 6 over to Bob Kielba who is our chief rail equipment 7 engineer to talk about some of the details, 8 technical specifications. Welcome and I'd like to get started talking a little bit about the specification. I see a lot 9 10 11 12 of familiar faces out there. So a lot of you may 13 be familiar with the specs already. Our specs are 14 based pretty much like the 7,000 -- 5,000 Series 15 specs; AC propulsion cars, stainless steel car 16 bodies with active suspension. It's a very easy 17 to read, thin document available. So it's easy to 18 search. 19 Right now what I'd like to touch 20 base with you guys there was some request for a 21 searchable PDF version of it. It is available 22 online now. You'd have to go back in the same 23 process on CTA's website and reregister and then 24 you can download the PDF version and that's only L.A. COURT REPORTERS, LLC. (312) 419-9292 0013 1 the technical portion of the spec. 2 Basically, changes from the 5,000 spec is we're asking for kind of a new interior/exterior design. We want to have a 3 4 Page 5

03-01-13cta_-_vol._I[1] rev 2 5 little newer look to the cars. Kind of have a fresher appearance. We're adding passenger 6 counting. We're requiring an Ethernet train line. We are adding LED interior lighting and full color counting. 7 8 LED destination signs. Also, we're asking for full color -- LCD screens used for interior maps, 9 10 to have like an active map that follows along as 11 the train is moving. Other changes, we're adding 12 13 a network video surveillance system. The 5,000 previously had just the standard DVR type system. 14 15 One of the things we're talking about is the interior and exterior esthetic 16 17 design. we're asking for three different design proposals to give us some options of what we can 18 choose and what you guys can come up with a nice, new look for us. We'd like to modernize the look of the interior, optimize the seating arrangement 19 20 21 and select materials that are rugged and easy to 22 clean. That is one big issue here. We're constantly cleaning the vehicles. So we want some 23 24 L.A. COURT REPORTERS, LLC. (312) 419-9292

0014

1 equipment that stands up.

Related to the cleanability. One of the issues that we'll be issuing a 2 3 technical addendum soon is for seating. The seats 4 we'd like to have like a cantilever style design 5 6 to allow us easily to sweep underneath the seats. 7 So that will be an addendum coming sometime soon 8 and obviously some alternate color schemes. We're done with the dusky walnut and beige and tan. So something new would be nice. 9 10

11 The next big question, 12 subcontractor qualifications. In Section 1.16 of the spec, we have a list of subcontractors. Those 13 contractors we want to evaluate during the pre-bid 14 phase and that we do in the other pre-bid 15 16 meetings. The other pre-bid meetings -- I lost 17 track. Through the other pre-bid meetings or the alternate response method. I'll go over those in 18 a minute. Basically, if you're involved in the 5,000 series specs, you're not automatically accepted for this one. We want everybody to come 19 20 21 back and we want to meet you in person again and 22 23 go through the acceptance process. 24

The acceptance process is L.A. COURT REPORTERS, LLC. (312) 419-9292

0015

1 basically you must prove your understanding of the 2 specifications as written and your capability to 3 produce and support the specification compliant 4 components in order to be accepted and that is per IB Section G5. The accepted subcontractors only 5 6 need to be presented once. So if they're accepted for one bidder, they can be used by any bidder. 7 8 Also, the subcontractors -- make sure. Make sure 9 the subcontractors get the whole specification 10 because there is material specs, there is 11 electrical specs, warranty issues that all the 12 subs need to be perfectly aware of and that is one thing that during their qualifications they need to kind of prove their understanding of all 13 14 applicable sections to them. And then also with 15 Page 6

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16 the subcontractors once we have an accepted list 17 of subcontractors obviously each bidder will be 18 able to choose whoever they want to use and that 19 should be identified sometime after award of the 20 contract.

So now in our pre-bid process,
like I mentioned, we talk about these other
pre-bid meetings. Those are pre-bid meetings that
we want the bidders to schedule with Maria
L.A. COURT REPORTERS, LLC. (312) 419-9292

0016

23

1 Williams to meet with myself and my department to discuss various technical issues, subcontractor qualifications, clarifications to the spec, any variation that you may offer to the spec, approved equal and also to look at the proposed esthetic designs.

7 So we'd like you to schedule 8 that as soon as possible and these individual meetings are kind of I'm going to say my 9 personally preferred method of doing things, but 10 11 there is also what we call the alternate 12 responses. The alternate responses are due 60 13 days from the date of advertisement. So I think that comes out to March 26th and in this alternate response method you can also request the approved 14 15 equals, variations, acceptance of subcontractors, et cetera, but that all needs to be supplied in 16 17 one lump sum, in paper, in writing, by March 26th. So if you don't get all that in 18 19 20 by the 60 days are up, you basically have to use the other pre-bid meeting process where you need 21 22

22 to schedule pre-bid meetings with us and then we 23 can go over all those issues in person. And 24 that's all I have.

L.A. COURT REPORTERS, LLC. (312) 419-9292 0017

1 MS. WILLIAMS-BAXTER: So that 2 concludes the information for today's meeting. Ι 3 want to remind you all again to please use the 4 bidder's request form. Please schedule your 5 pre-bid meetings as soon as possible and we look forward to seeing you tomorrow at Skokie, our engineering shops in Skokie, Illinois. So that's it for today. Thank you for all coming. I'm 6 7 8 9 sorry. You had a question? MR. TOCCIA: Yes, I had a question. 10 Sorry. Is it possible to have a list of the 11 suppliers that currently are supplying these 12

13 subsystems for the 5K or the Series 5,000?
14 MS. WILLIAMS-BAXTER: We will -- if
15 you submit that question in writing, we will
16 promptly respond by addendum.

Any other questions? The question was if we can issue the Series 5,000 list of suppliers accepted. Okay. So that's it. Thank you all for coming. We'll see you tomorrow. Thank you all for coming. We'll see you tomorrow.

24 L.A. COURT REPORTERS, LLC. (312) 419-9292 0018

CHICAGO TRANSIT AUTHORITY Advertisement for Bids

NOTICE OF PRE-BID MEETING AND INSPECTION MEETING CHANGES

Notice is to inform all potential bidders that the initial Pre-Bid Meeting and Inspection Meeting for the referenced requisition have been changed as follows:

Req. C13FI101372531 Invitation for Bids (IFB) for Rapid Transit Cars.

Bid Deposit: \$500,000.00

Pre-Bid meeting originally scheduled for Friday, February 22, 2013 at 10:00 a.m. has been changed to Friday, March 1, 2013 at 11:30 a.m. in the Chicago Transit Authority 2nd Floor Conference Rooms A & B, 567 W. Lake Street, Chicago, IL 60661.

Inspection Meeting originally scheduled for Saturday, February 23, 2013 from 9:00 a.m. - 3:00 p.m. has been changed to Saturday, March 2, 2013 from 9:00 a.m. -3:00 p.m. in Skokie Shops, Engineering Offices at 3701 Oakton Street, Skokie, IL 60076.

If you have any questions, please contact Maria Williams-Baxter, Sr. Procurement Administrator, at 312/681-2437.

Any contract resulting from this bid is subject to a financial assistance between the Chicago Transit Authority, the United States Department of Transportation and the Regional Transportation Authority.

Contractor will be required to comply with all applicable Equal Employment Opportunity laws and regulations and affirmative action requirements of the Federal Transit Administration and Illinois Human Rights Commission.

All bidders will be required to certify that they are not on the Comptroller General's list of ineligible contractors.

The contractor will be required to furnish certified copies of any and all Insurance Policies required in relation to this contract prior to CTA's execution.

Any contract resulting from this advertisement will be awarded to the lowest responsive and responsible bidder.

Chicago Transit Authority hereby notifies all bidders that it will affirmatively ensure that in regard to any contract entered into pursuant to this advertisement, Disadvantaged Business Enterprise will be afforded full opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color or national origin in consideration for an award. **PLEASE NOTE:** Where bids are sent by mail, delivery service or delivered in-person to the CTA Bid Office, the bidders shall be responsible for their delivery only to the Bid Office before the advertised date and hour for the opening of the bids. The Bid Office hours are Monday through Friday from 8:00 a.m. to 4:30 p.m. Chicago time, except holidays.

The right is reserved to accept any bid or any part or parts thereof or to reject any and all bids.

All inquiries should be directed to and copies of bid documents obtained from the Bid Office - 2^{nd} Floor, 567 W. Lake Street, Chicago, Illinois 60661-1498.

CHICAGO TRANSIT AUTHORITY

By: Ellen McCormack Vice President, Purchasing

February 11, 2013



INVITATION FOR BIDS (IFB) FOR RAPID TRANSIT CARS

REQUISITION NO .: C13FI101372531

SPECIFICATION NO.: CTA 7000-12

DRAWING NO.: CTA 7000-12

INSURANCE REQUIRED: Yes

BID DEPOSIT AMOUNT: \$500,000

INFORMATION: Procurement Administrator: Maria Williams-Baxter Phone Number: 312-681-2437

BID PACKAGES TO BE RETURNED TO:

By Mail, In Person Drop-off or Delivery Service Chicago Transit Authority Bid Office - 2nd Floor 567 W. Lake Street Chicago, IL 60661

All Signatures to be sworn before a Notary Public



ISSUED BY

Purchasing Department, Chicago Transit Authority 567 W. Lake Street, Chicago IL 60661 Ellen McCormack, Vice President, Purchasing Forrest Claypool, President Terry Peterson, Chairman

Chicago Transit Authority

INSTRUCTIONS TO BIDDERS AND GENERAL SPECIFICATIONS

For

Rapid Transit Cars

Requisition: C13FI101372531 Specification: CTA 7000-12



2013

REQUISITION: C13FI101372531 IFB FOR RAPID TRANSIT CARS

INSTRUCTIONS TO BIDDERS

Bids will be received by the CHICAGO TRANSIT AUTHORITY (Authority), a municipal corporation, in accordance with the Contract Documents set forth herein. Bidder is defined as a person or entity that submits a Bid or intends to submit a Bid for Rapid Transit Cars that the Contractor is required to design, build and deliver to the Authority under the Contract Documents. All defined terms shall have the meanings assigned to such terms in Section 2, of the General Specifications. The published advertisement is the Invitation for Bids (IFB) for purposes of this procurement.

A. DESCRIPTION OF WORK

The work under these Contract Documents consists of the manufacturing and delivery of a base order of 100 Rapid Transit Cars (50 two-car units) with eight options to purchase up to 746 additional cars. The base order and eight options are defined in the Bid Proposal, Section II, Part 1 and Part 2.

B. USE OF ENGLISH LANGUAGE AND UNITED STATES DOLLARS

With the exception of drawings, graphs, charts and schedules, all Contract Documents, conferences, and correspondence between the Parties and other documentation created in connection with the Contract, shall be conducted or offered solely in the English Language and using U.S. customary system of weights and measures. Drawings, graphs, charts and schedules may be offered in multiple languages only if one of the languages is English. In any event, the English wording shall govern the interpretation of all Contract Documents, conferences and correspondence between the Parties and other documentation created in connection with the Contract. All communications conducted or offered in the English Language and all deliverables shall utilize clear, idiomatic American English and not be a literal translation to English from another language.

All Contract Documents, computations required by this Contract, invoices and statements of costs and prices shall be conducted or presented solely in United States Dollars.

C. <u>COMPLIANCE WITH LAWS</u>

Bidders shall at all times observe and comply with all laws, ordinances, regulations and codes of the Federal, State and other local governmental agencies, which may in any manner affect the preparation of Bids or the performance of the Contract.

D. BID DEPOSIT

The Bid shall be accompanied by cash, a cashier's check, a certified check, a money order or an approved bid bond in the amount of five hundred thousand dollars (\$500,000).

All certified, cashier's checks or money orders shall be drawn on a responsible organization doing business in the United States and shall be made payable to the order of the Chicago Transit Authority.

Any Bid bond submitted must reference the specific Authority inquiry numbers and have an Alfred M. Best Company 'B+' Policyholders Rating and an 'X' Financial Rating or better.

The period of the bond must be for not less than one hundred eighty (120) days from the date of Bid Opening. Bid deposits will be returned after the Authority has awarded a Contract.

E. BID PREPARATION

Bidders will receive one (1) copy of the Instructions to Bidders, Bid Proposal and General Specifications and one (1) copy of the Technical Specifications and Drawings CTA 7000-12.

The Authority is not responsible for any costs incurred by Bidders prior to award and execution of a Contract. Bidders shall not include any such expenses as a part of its Bid. The Bidder must prepare its Bid on the forms included in the Bid Proposal, Section II – Bidding Form – Parts 1, 2 and 3. All blank spaces on the forms, applicable to the subject specification, must be correctly completed either typed or written in ink.

A unit price or a lump-sum price, as required, must be stated for every item, either typed or written in ink, in figures, and, if required, in words.

If the Bidder is a corporation, the president or vice-president must sign all copies of the Bid. In the event that the Bid is executed by someone other than the President or Vice President, a certified copy of the section of the corporate by-laws or resolution of the corporation that permits the person to execute the offer for the corporation must be furnished with the Bid.

If the Bidder is a partnership or a Joint Venture, all Partners or participants in the joint venture must sign all copies of the Bid unless one Partner or Joint Venturer participant has been authorized to sign for the Partnership or Joint Venture, in which case evidence of such authority, satisfactory to the Contract Officer, must be submitted with the Bid.

Any business operating under an assumed name must be registered with the Illinois County in which it is located, as provided in the Assumed Business Name Act, 805 ILCS 405 et seq., as amended.

All signatures must be sworn to before a notary public.

F. BIDDER QUALIFICATIONS; BASIS for RESPONSIBILITY DETERMINATION

The Bidder must provide information addressing the following factors bearing on the responsibility of the Bidder and its ability to comply with the terms of the Contract Documents, signed by an authorized officer.

- The Critical Path Plan for the work to be accomplished for the manufacturing and delivery of a base of 100 Rapid Transit Cars and eight options per the Technical Specifications including man-hour estimates for engineering and production;
- 2. The qualifications and experience of current key executive personnel and officers required for the performance of the contract;

7000-12

- 3. The qualifications and experience of key technical personnel for engineering, quality control, management and contract administration; and detail as to how the Bidder intends to recruit additional personnel, if required;
- 4. A list of contracts of similar magnitude and nature, including the design and assembly of electrically self-propelled rail cars, successfully completed as a prime contractor within the last five years including names and telephone numbers of owner representatives familiar with the Bidder's contract performance;
- 5. Evidence and details of the Bidder's currently available manufacturing plant and proposed improvements required to assure delivery of all Rapid Transit Cars within the time specified under the contract. The plant details shall include a list of new plant machinery required for performance of the work. The Authority reserves the right to inspect, review and approve the plant, along with equipment and/or facilities identified by the Bidder;
- Evidence of adequate engineering and service personnel available, within twenty-four (24) hours from the time of request, to respond to any engineering or service problems during testing and warranty period;
- 7. Evidence of a plan for local problem resolution between the Bidder and the Authority;
- 8. Bank and credit references, including the name, position and contact information for bank representatives;
- 9. A copy of the Bidder's audited financial statements for the prior five (5) years and most recent interim financial statement, prepared in accordance with the Generally Accepted Accounting Principles (GAAP) of the Bidder's jurisdiction, and audited by an independent certified public accountant authorized to practice in the jurisdiction of either Chicago, IL or the city of in which the Bidder is headquartered;
- 10. Ability to secure required bond(s) and/or letters of credit, as evidenced by a letter of commitment from an insurance underwriter, broker, and/or bank confirming that the Bidder can be bonded or secured for the required amounts;
- 11. Evidence that the Bidder has suitable financial assets to meet all obligations incidental to performance of the Contract;
- 12. A description of all indebtedness, including the identification of creditors, judgments against the Bidder within the last five (5) years, repayment schedule, and significant characteristics;
- 13. A summary of pending litigation, (whether the Bidder is plaintiff or defendant), arbitrations (whether the Bidder is claimant or respondent), mediations, or other dispute resolution processes;
- 14. A list of all equipment required to perform this Contract, specifying which equipment is currently owned or leased by the Bidder and how it proposes to obtain any additional required equipment that it does not currently own or lease;

- 15. Evidence that the Bidder is licensed, bonded, and registered in compliance with ordinances, statutes, codes and regulations of the municipality in which the work is to be performed; and
- 16. Evidence that the Bidder is not in arrears or default to the Authority upon any debt or contract, or is not a defaulter, as surety or otherwise, upon any obligations to the Authority, or has not failed to perform faithfully on any previous Contract with the Authority.

The Authority reserves the right to refuse to accept any Bid from any person, firm or corporation that is in arrears or in default to the Authority upon any debt or contract, or that is a defaulter, as surety or otherwise, upon any obligations to the Authority, or has failed to perform faithfully any previous contract with the Authority.

The decision of the Contract Officer shall be final in determining compliance with the stated Bidder qualifications as the basis for the responsibility determination.

The provisions of this Section also apply to past joint venture agreements involving the Bidder and to the individual components of a joint venture submitting Bid(s) to this solicitation. Failure by the Bidder to address the matters contained within this Section may result in the Bidder being rejected as non-responsible.

The Authority reserves the right to request additional and supplemental information under this Section to form a determination of Bidder responsibility, and any Bidder so requested must provide such information in the manner and within the time set by the Authority.

G. PRE-BID PROCEDURES

It is the intent of this Section that the following matters, and all other major engineering considerations, be settled to the Authority's and the Bidder's satisfaction before submission of Bids. Failure of prospective Bidders to comply with these Pre-Bid Procedures shall be cause for rejection of Bids received. After submission of Bids, the Authority recognizes no obligation to consider any matter not presented during the Pre-Bid Procedure period.

1. Initial Pre-Bid Meeting

In accordance with the date contained in the publicly advertised solicitation, the Contract Officer shall convene an Initial Pre-Bid Meeting to which all prospective Bidders will be invited. The purpose of the meeting is to explain the Bid Procedures and answer any questions Bidders may have regarding the Contract Documents. Bidders are required to submit any questions or comments regarding the Contract Documents in writing or email to the Director, Purchasing, at the Chicago Transit Authority, not less than five (5) working days prior to the scheduled date of the Initial Pre-Bid Meeting. Follow-up questions on the Bid Procedures will be accepted in writing subsequent to the Initial Pre-Bid Meeting, if such questions were not previously submitted.

Attendance at this meeting is not mandatory. Minutes of the meeting, to include all questions and answers, will be prepared by the Authority and issued via Addendum to registered solicitation recipients and Bidders in attendance at the Initial Pre-Bid Meeting. Minutes of the meeting constitute the official record. Verbal statements are not binding on any party.

2. Inspection Meeting

In accordance with the date contained in the solicitation advertisement, the Contract Officer shall convene an inspection of a representative example of the Authority's 5000 Series Rail Cars. This inspection will provide an opportunity for all prospective Bidders to acquaint themselves with the 5000 Series Rail Cars. Only one inspection meeting will be scheduled. All Bidders are strongly encouraged to attend this inspection, however attendance is not mandatory. Any questions arising from the inspection may be presented at a subsequent "Pre-Bid Meeting," or by "Alternate Requests".

3. Other Pre-Bid Meetings

Subjects which the Bidders wish to discuss shall be submitted in writing on the "Bidder Request Form", Exhibit 1, in these Instructions to Bidders to the Director, Purchasing no later than ten (10) working days prior to the scheduled meeting date.

Bidders, when requesting Pre-Bid Meetings, shall do so to allow the Authority to convene such meetings if deemed necessary, with all Bidders prior to sixty (60) calendar days in advance of the scheduled Bid submission date.

Minutes of Pre-Bid Meetings will be prepared by the Authority and distributed as Addenda to all firms. Minutes of Pre-Bid Meetings constitute the official record. Verbal statements are not binding on any party.

Bidders may request individual Pre-Bid Meetings, to discuss the following:

- a) Questions regarding clarification of the Contract Documents.
- b) Consideration of Bidder requests for variation to the Technical Specifications.
- c) Bidders may request consideration of variations to the Instructions to Bidders and General Conditions. Purchasing will not respond to such requests at the Pre-Bid meetings. The response, if any, to such requests will be issued via Addendum.
- d) Bidder's esthetic design concepts for end cap and interior as required in Technical Specifications, Section 3.01.M.
- e) Consideration of all items which the Bidders propose to offer as an 'equal' to those specified in the Technical Specifications. Bidders are encouraged to propose 'equals' that would allow reduced engineering and production costs while maintaining all essential performance, functionality, safety, and quality as detailed in the Technical Specifications.

The Bidder shall submit, attached to its Bidder Request Form, documentation to substantiate that the Bidder proposes to furnish an item functionally and materially equal to that specified in the Technical Specifications. Such documentation shall include: descriptive literature, test data, evidence and description of successful application on similar projects; and, comparative evaluation of the proposed 'equal' and the Technical Specification as written.

The Engineer may require, and the Bidder must provide, samples(s) of the proposed 'equal' and/or additional documentation to satisfy the Authority that the Bidder's assertions are true and accurate.

- f) Consideration of all items, procedures, systems and sub-systems that the Bidder proposes to furnish and utilize in the performance of the work required by the Technical Specifications, wherein review by the Authority is required but no part number or other definitive ordering description is stated.
- g) Authority evaluation of all subcontractors, as specified in Section 1.16 of the Technical Specifications, proposed by the prospective Bidders.
- h) Consideration of any other Technical Specification matter that the prospective Bidder desires considered prior to Bidding.

4. Alternate Requests

- a) If a prospective Bidder elects not to request Pre-Bid Meetings, the Bidder is required to submit all requests for approved equals, deviations, subcontractors, etc., covering the complete specification within sixty (60) calendar days from the initial Bid advertisement date. Such requests shall be submitted to the General Manager, Purchasing on the submittal form "Bidder Request Form", Exhibit 1 in the Instructions to Bidders.
- b) The Authority will review the submittal information.
- c) The Authority will then contact the Bidder to confirm that the Bidder Request Form has been received.
- d) Any written documentation issued by the Authority resulting from the reviews will be circulated to all firms on the list of Bidders.
- e) Bidders which have previously scheduled a Pre-Bid Meeting shall not use the Bidders Request Form to pose additional questions for clarification or present requests for approved equals, deviations, approval of subcontractors, etc. in lieu of requesting another Pre-Bid Meeting.

5. Subcontractor Qualifications

Bidders must submit documentation either at Pre-Bid Meetings or through "Alternate Requests" stating the qualifications of its subcontractors proposed to perform the work as identified in the Technical Specifications.

Subcontractor qualifications shall include: technical capability; expertise to meet the design requirements; demonstrated understanding of the Contract Technical Specifications; product support including delivery of renewal parts; quality of documentation and timely delivery; timeliness of parts turnaround for warranty and modifications; and quality of instruction in troubleshooting and repair techniques (where applicable). The Authority may request additional information during the Pre-Bid

Meetings or through the Alternate Request process before making a determination of the subcontractor.

In the judgment of the Authority, a lack of suitable qualifications in the above specified areas, or prior poor performance by a proposed subcontractor on an Authority project whether through direct or indirect participation, shall render the proposed subcontractor unacceptable to be utilized in the performance of this Contract. Subcontractor qualification documentation shall be submitted either in Pre-Bid Meetings utilizing the Bidder Request Form, or submitted utilizing the Alternate Request Procedure above if no Pre-Bid Meetings are requested.

Minutes of the Pre-Bid Meetings will document each subcontractor proposed and accepted. If the Authority determines that a subcontractor is unacceptable the reason will be documented in the minutes. Bidders may request subsequent Pre-Bid Meetings to request reconsideration of the Authority's determination.

6. Final Pre-Bid Meeting

In the Authority's judgment, following issuance of addenda and completion of Pre-Bid Meetings, the Contract Officer may schedule a Final Pre-Bid Meeting. All prospective Bidders are strongly encouraged to attend.

Attendance at this meeting is not mandatory. Minutes of the meeting will be prepared by the Authority and issued via Addendum to registered solicitation recipients and Prospective Bidders in attendance. Minutes of the meeting constitute the official record. Verbal statements are not binding on any party.

7. Addenda

The Contract Officer reserves the right to revise and clarify the Contract Documents prior to Bid Opening through the issuance of Addenda. Addenda become part of the Contract Documents and constitute changes to the same. The Authority will furnish copies of such addenda to all registered Bidders. Additionally, the Contract Officer may issue Notice to Bidders of any change to the Initial Pre-Bid Meeting, Inspection or Final Pre-Bid Meetings dates and times.

Addenda issued within five (5) days of the Bid submission date will contain a provision postponing the date to allow Bidders adequate time to respond and/or incorporate the Addenda into Bids as appropriate.

Bidders are required to acknowledge receipt of all Addenda in its Bid. Failure to acknowledge all Addenda will cause a Bid to be considered non-responsive, resulting in rejection of that Bid. Space for this acknowledgment is provided on the Bidder's Signature Page, located in the Bid Proposal Exhibit 2 – Execution by Bidder and Acceptance.

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8. Authority's Bid Protest Procedure

CTA's protest procedures for all RFPs, IFBs and LIQs are available on-line in Chapter 15 of the following document:

http://www.transitchicago.com/assets/1/procurement/Procurement_Policy_and_Procedur es_version_4_1_11_6_12.pdf

Any protest regarding the solicitation, bid evaluation or award must be submitted in accordance with these protest procedures.

9. Postponement of Bid Submissions

If the Bid submission date is postponed, the Contract Officer will notify all registered Bidders. Appropriate notice will be issued extending the Bid submission date.

10. Interpretation of Contract Documents

If any Bidder contemplating submitting a Bid is in doubt as to the meaning of any part of the Contract Documents, the Bidder may submit a written request for an interpretation hereof utilizing the Bidder Request Form at any time prior to ten (10) working days of the Bid submission date. A Bidder submitting such an inquiry is fully responsible for ensuring the request is received by the Authority within the required timeframe. Any interpretation of the Contract Documents will be issued only by Addendum.

Copies of such Addenda will be issued to registered Bidders. It is strongly recommended and encouraged that requests for interpretation of Contract Documents be made well in advance of the Bid submission date (see "Initial Pre-Bid Meeting" above). Failure on the part of the prospective Bidder to receive a written interpretation prior to the time of the submission of Bids will not be grounds for withdrawal of Bid. Any oral explanation or interpretation of Contract Documents will not be binding on the Authority.

H. MODIFICATIONS, WITHDRAWALS AND LATE BIDS

Bidders may withdraw Bids at any time prior to the date and hour specified in the advertisement for the receipt of Bids. However, no Bidder shall withdraw or cancel its Bid for a period of 120 calendar days after said advertised date and hour for the receipt of Bids.

I. REVISIONS PRIOR TO DATE SET FOR OPENING OF BIDS

Prospective Bidders may request clarifications or changes to the Contract Documents through written notice to the Contract Officer. The Authority reserves the right to determine whether a response is needed to any such requests. If the Authority determines that a response is needed, then the response will be provided through an Addendum. Only written modifications issued as addenda will effectuate changes in the Bidding and Contract Documents. Failure of a Bidder to request clarifications prior to Bid Opening constitutes a waiver of its legal right to raise any such ambiguity after Bid Opening.

J. PUBLIC OPENING OF BIDS

Bids will be publicly opened at the time and date set for the opening noted in the Invitation for Bid. Bid content will be made available for review at the bid opening by Bidders and other interested parties or persons who may be present either in person or by representative.

K. CONSIDERATION OF BIDS

The Authority reserves the right to extend the Bid Opening date and to reject any or all Bids or any part thereof. The Authority further reserves the right to excuse informalities in the Bids and bidding when, in the judgment of the Authority, the best interests of the Authority will be served and the spirit of competition will be maintained.

L. SINGLE RESPONSE

If only one Bid is received in response to the IFB, a cost or price analysis and evaluation and/or audit shall be performed of the single Bidder's cost breakdown in order to determine if the price is fair and reasonable.

M. **DISQUALIFICATION**

The Authority reserves the right to disqualify Bids, before and after the Bid Opening, upon evidence of collusion with intent to defraud, or other illegal or unethical practices, on the part of the Bidder.

N. ORGANIZATIONAL CONFLICT OF INTEREST

The Bidder is prohibited from performing any work or services for the Authority that conflicts with work or services that the Bidder performs under any other contract with the Authority. Such conflicts include, but are not limited to, design work for the Project under another contract, supervision or management for the Project under another contract, and review or audit work for the Project under another contract. The restrictions in this paragraph are applicable to all Subcontractors. The Bidder has sole responsibility for compliance with this provision. Any violation of this provision is a material breach of the Contract which is cause for termination.

O. TRADE NAMES

In cases where an item is identified by a manufacturer's name, trade name, catalog number or reference, it is understood that the Bidder proposes to furnish the item so identified and does not propose to furnish an "equal" unless the proposed "equal" is definitively indicated by the Bidder at a "Pre-Bid Meeting" and specifically accepted by the Authority in minutes of Pre-Bid Meetings, and incorporated into the Contract Documents via addenda.

The reference to the manufacturer's name, or reference, is intended to be descriptive but not restrictive and only to indicate to Bidders articles that will be satisfactory. Specific articles, equipment or material mentioned shall be understood as establishing the type, function, salient characteristics and minimum standard of design, efficiency, quality and performance desired, and shall not be construed in such a manner as to exclude manufacturer's products of comparable design, efficiency, quality and performance. Bids on alternate items will be

considered, provided each Bidder clearly states during the Pre-Bid Procedure, as described in Section G, Instructions to Bidders, what is exactly proposed to furnish.

The Authority hereby reserves the right to approve an "equal", or to reject as not being an "equal", any article the Bidder proposes to furnish which contains major or minor variations from the Technical Specification requirements.

P. <u>TAXES</u>

Federal Tax does not apply to materials purchased by the Chicago Transit Authority by virtue of Exemption Certificate No. 36-73-0234K. Illinois Retailers' Occupation Tax, Use Tax, and Municipal Retailers' Occupational Tax do not apply to materials or services purchased by the Authority by virtue of Statue Chapter 111 2/3 and Section 333, Illinois Revised Statutes as amended. These taxes shall not be included in any prices quoted herein. 605-33, Illinois Tax Exemption Identification number is E9978-2987-05.

Q. NOTICES

See General Specifications Section 34,II.

R. <u>AWARD</u>

The Authority will accept in writing one Bid or reject all Bids within 120 days from the date of opening of Bids, unless the Bidders, upon request of the Contract Officer, extend the time of acceptance.

If awarded, the Contract will be awarded to the qualified, responsive and responsible Bidder who proposes the lowest Total Lump Sum Bid Price for the manufacturing and delivery of a base order of 100 Rapid Transit Cars (50 two-car units) and eight options. The Bid Proposal, Section II – Bidding Form – Part 2 BIDDING SUMMARY FORM shall determine the lowest Total Lump Sum Bidder.

The Contract shall not be effective until the President of the Authority, or the President's designee, has executed the Contract following the approval of the Chicago Transit Board (see General Specifications, Section 22). Contractor shall not begin work until issuance of Notice to Proceed (General Specifications, Section 2 – Definitions, Notice-to-Proceed).

S. PARENT COMPANY GUARANTEE

The successful Bidder, within 10 working days after written notice of award, shall furnish an executed Parent Company Guaranty, in the form attached in Exhibit 2 – Insurance and Bond Requirements of the Instructions to Bidders. This guarantee shall be in effect until the total number of Rail Cars to be furnished under the Contract has been accepted, at which time no further guarantee is required.

T. PERFORMANCE BOND AND/OR LETTER OF CREDIT AND INSURANCE

The successful Bidder, within ten (10) working days after written notice of award of a Contract is issued to the Bidder by the Authority, shall furnish a performance bond and/or Letter of Credit in the amount of twenty five percent (25%) of the Base Contract price on the form attached in Exhibit 2 - Insurance and Bond Requirements of the Instructions to Bidders. If any of the sureties on said bond at any time fail financially or are deemed by the Authority to be insufficient security of the penalty of said bond, then in that case the Contract Officer may, on giving ten (10) working days notice thereof in writing, require the Contractor to furnish a new and additional bond with such sureties thereon as shall be satisfactory to the Contract Officer. The amount of the initial performance bond shall be calculated on the Base Contract Price, on the Contract effective date, at the time the Contract is awarded to the Bidder, and shall be adjusted appropriately whenever the Contract value is adjusted. The performance bond adjustment for Option No. 1 is required 1120 days after Base Contract effective date. The performance bond adjustment for Option No. 2 (if exercised) shall be required 1240 days after Base Contract effective date. The performance bond adjustment for the Option No. 3 (if exercised) shall be required 1340 days after Base Contract effective date. The performance bond adjustment for the Option No. 4 (if exercised) shall be required 1550 days after Base Contract effective date. The performance bond adjustment for the Option No. 5 (if exercised) shall be required 1790 days after Base Contract effective date. The performance bond adjustment for the Option No. 6 (if exercised) shall be required 2130 days after Base Contract effective date. The performance bond adjustment for the Option No. 7 (if exercised) shall be required 2340 days after Base Contract effective date. The performance bond adjustment for the Option No. 8 (if exercised) shall be required 2460 days after Base Contract effective date.

For each performance bond adjustment the Proposer shall furnish the Authority with an A.I.A bond form confirming such adjustment based on the options exercised. The required bond amount may be reduced as follows: (1) to sixty-five percent (65%) of the bond original amount including exercised option amounts, when fifty percent (50%) of the required number of Rail Cars are delivered and accepted, (2) to thirty percent (30%) of the original amount when seventy-five percent (75%) of the required number of Rail Cars are delivered and accepted, and (3) to zero percent (0%) of the original amount when one hundred percent (100%) of the required number of Rail Cars are delivered and accepted, and in full force and effect until the total number of Rail Cars to be furnished under the Contract has been accepted, at which time no further bond is required.

The successful Bidder shall keep in force during the life of the Contract (including all guarantee periods in the Specifications), any and all insurance in the amounts designated by the Insurance and Bond Requirements (Instructions to Bidders, Exhibit 2), and as indicated in Section 11 of the General Specification, with Insurance companies acceptable to the Authority. Any Insurance company with less than a 'B+' policyholder rating by Alfred M. Best Company will not be acceptable to the Authority.

U. BIDDER REQUEST FORM INSTRUCTIONS

Bidders shall submit <u>all</u> requests for which consideration is requested on an individual Bidder Request Form, Instructions to Bidders, Exhibit 1. Letters, telephone calls, and other forms of communication will not be recognized as a formal request.

The supporting documentation for any issues to be addressed including, but not limited to, deviations from the Technical Specification, requested equals, clarifications of requirements or wording and sub-contractor qualification must include the following as appropriate:

- 1. Reason and justification for request (label this "ATTACHMENT A").
- 2. Complete details of what is being proposed including prints and specification sheets (label this "ATTACHMENT B"). List all specifications and print numbers.
- 3. Samples where applicable and practical (label this "ATTACHMENT C")
- 4. Laboratory and field-testing details and history (label this "ATTACHMENT D").
- 5. Detailed description of any and all variances from the specification, each requiring specific concurrence (label as "ATTACHMENT E").
- 6. Detailed comparison between what is specified and what is being proposed. This comparison must be complete, giving the details of both (specified vs. Bid) including such items as dimensions, function, strength, testing performed, in-service history, etc. (label as "ATTACHMENT F").

A. BID SUBMISSION REQUIREMENTS

All Bidders must submit a Bid deposit and sealed Bid, in DUPLICATE, in one (1) envelope or package with the following on the cover: Bidder's name, Address, Title: IFB for Rapid Transit Cars, Requisition C13FI101372531 and advertised date and hour designated for the Bid Opening as shown on the advertisement. CTA recommends that Bidders make and retain one copy for your records. The sealed Bid must include the following:

1. Bidder Qualifications; Basis for Responsibility Determination as described in Section F, of the Instructions to Bidders signed by an authorized officer;

2. Bid Proposal Bidding Forms, Section II, Bidding Forms Part 1, Part 2 and Part 3; all forms must be fully completed and signed by an authorized officer;

- 3. Bid Proposal, Exhibit 1 Certifications and Submission Forms signed by an authorized officer:
 - a) Buy America Certification
 - b) Certification of Primary Participant Regarding Debarment, Suspension and Other Responsibility Matters
 - c) Certification of Lower Tier Participant Regarding Debarment, Suspension and Other Responsibility Matters
 - d) Certification for Contracts, Grants, Loans and Cooperative Agreements (Lobbying Certification)
 - e) Certification Regarding a Drug Free Workplace
 - f) TVM Certification
 - g) Disclosure of Ownership

4. Bid Proposal, Exhibit 2 – Execution by Bidder – **Bidder Signature Page signed by an** authorized officer as described in Section E, of the Instructions to Bidders.

FAILURE TO SUBMIT AND/OR SIGN THE DOCUMENTS LISTED IN THESE BID SUBMISSION REQUIREMENTS MAY RESULT IN YOUR FIRM NOT BEING AWARDED THE CONTRACT

Each Bidder bears full responsibility for delivery to the Bid Office before the advertised date and hour for the opening of Bids. Bidders are solely responsible for ensuring that its Bid is received by the Authority in a timely manner prior to the date and time of Bid Opening. If mail or delivery is delayed beyond the date and hour set for the Bid Opening, Bids delayed will not be considered and will be returned unopened. Bid Office hours are Monday through Friday from 8:00 am to 4:30 pm Chicago time, except holidays.

INSTRUCTIONS TO BIDDERS

EXHIBIT 1

BIDDER REQUEST FORM

EXHIBIT 1

BIDDER REQUEST FORM

BIDDER'S NAME

<u>ITEM</u>

SPECIFICATION PAGE NO. _____ SECTION NO. _____

SECTION TITLE

SUB-SECTION _____

EXCERPT FROM AUTHORITY CONTRACT DOCUMENTS AND/OR TECHNICAL SPECIFICATION REQUIREMENT FOR WHICH SUBMITTAL IS PROVIDED

DETAILS OF SUBMITTAL REQUEST

SUPPORTING DOCUMENTATION FOR REQUEST SUBMITTAL (CHECK ATTACHMENTS BEING PROVIDED)

____A. JUSTIFICATION ____B. PRINTS ____ C. SAMPLES

_____D. TESTING/FIELD EXP. ____E. VARIANCES _____F. COMPARISON

____G. OTHER

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INSTRUCTIONS TO BIDDERS

EXHIBIT 2

INSURANCE and BOND REQUIREMENTS

CHICAGO TRANSIT AUTHORITY INSURANCE AND BOND REQUIREMENTS [Short Form rev. 11/13/09]

REQUISITION NUMBER: C13FI101372531 SPECIFICATION NUMBER CTA: CTA 7200-12

PART I. **GENERAL INSTRUCTIONS AND REQUIREMENTS**

Α. WAYS TO COMPLY WITH CTA INSURANCE REQUIREMENTS.

1. HOW TO COMPLY IF CGL. AUTOMOBILE LIABILITY. OWNERS PROTECTIVE LIABILITY, BUILDER'S RISK INSURANCE, CONTRACTORS POLLUTION LIABILITY, WORKERS COMPENSATION AND/OR PROFESSIONAL LIABILITYARE REQUIRED BY PART III OF THIS DOCUMENT.

Contractors must provide the CTA with the following documents:

- a) CTA Certificate of Coverage on the CTA approved form. The CTA Certificate of Coverage may be completed only by an authorized representative of the insurance company, an agent, broker, or underwriter. Certificates of Insurance must disclose all deductibles and/or self insured retentions.
- b) Certified copy of the insurance policy

Methods (a) is a temporary method that is valid only for 90 days. Policies must be furnished prior to the expiration of this 90 day period. Failure to provide policies before expiration of this 90 day period is a material breach of the Contract which may result in default and, if uncured, termination for default.

Β. DEADLINE FOR INITIAL SUBMITTAL OF CONTRACTOR'S INSURANCE AND BOND DOCUMENTS.

The Contractor must furnish all required insurance and performance and payment bond documents within fourteen days of the date that the Contractor receives a letter (the "Insurance Submittal Letter") from the CTA's General Manager of Purchasing requesting the Contractor to submit the documents required by these Insurance and Bond Requirements. CTA will not execute the Contract until the required insurance and bond documents are delivered to CTA and approved by CTA. Failure to deliver the required documents within fourteen days of receipt of the Insurance Submittal Letter is a material failure to comply with the specifications and may result in any or all of the following at the CTA's sole discretion:

- 1. debarment or suspension, and
- 2. determination of Contractor non-responsibility.

C. **CTA ADDRESS.**

All notices and documents must be mailed to the CTA at:

Chicago Transit Authority Manager of Insurance Controls, Risk Compliance 567 W. Lake St. Chicago, IL 60661

D. **OBLIGATION TO MAINTAIN CONTINUOUS COMPLIANCE**

1. The Contractor expressly agrees that failure to comply and maintain compliance with all insurance and bond requirements shall constitute a material breach of the Contract which may result in

default and, if uncured, termination for default under the contract. In addition, such failure, if uncured, may result in debarment and suspension.

2. The Contractor is prohibited from performing any work if Contractor has allowed any of the required insurance policies to expire.

PART II. INSURANCE REQUIREMENTS

- A. The CTA must be named as an Additional Insured and Certificate Holder. When the CTA is an additional insured, the coverage shall be primary.
- **B.** The Commercial General Liability and Owners Protective Liability, General Aggregate Limit of Liability, if any, must apply on a per occurrence basis.
- **C.** All insurance carriers must be acceptable to the CTA. All insurance companies shall have at least an A VII POLICY HOLDER RATING, or better, by the A.M. Best Co., Inc. Insurance companies with lower ratings will not be accepted. Carriers licensed to do business in the State of Illinois must issue all insurance, with the exception of Railroad Protective.
- **D.** To the extent permitted by the Contractor's insurance policies required by the CTA, the Contractor and its insurers waive all rights of subrogation against the CTA.
- E. The insurance to be carried shall in no way be subject to limitations, if any, expressed in the indemnity section of the General Conditions (or any statutory, judicial or common law limitations).

PART III. INSURANCE COVERAGES

A. WORKERS COMPENSATION

Coverage A:	In form and in accordance with the laws of the State of Illinois.			
Coverage B:	Employers Liability:			
\$1,000,000	Bodily Injury by Accident			
\$1,000,000	Bodily Injury by Disease, Policy Limit			
B. COMPREHENSIVE OR COMMERCIAL GENERAL LIABILITY:				
\$2,000,000	General Aggregate			
\$2,000,000	Products/Completed Operations Aggregate			
\$1,000,000	Personal Injury and Advertising Injury			
\$1.000.000	Per Occurrence			

The Commercial General Liability policy shall include, without limitation: (i) Broad Form Contractual Liability, (ii) Products/Completed Operations to be maintained in full force and effect for a period of five (5) years following final completion of the work under the Contract, (iii) Independent Contractors' Protective Liability, (iv) Premises/Operations, including deletion of explosion, collapse and underground (XCU) exclusions, (v) Broad Form Property Damage, including Products/Completed Operations, (vi) Bodily Injury and Personal Injury Liability, with employee and contractual exclusions deleted, (vii) Severability of Interest and Cross Liability endorsement and (viii) Contractor expressly agrees to waive, and will require its insurer to waive, its rights, benefits and entitlement under the "Other Insurance" clause of its Commercial General Liability policy, with respect to the CTA.

C. AUTOMOBILE LIABILITY

\$1,000,000	Combined Single Limit (Bodily Injury and Property Damage)
N/A	Uninsured/Underinsured Motorist Including Owned, Non- Owned, Hired and Borrowed Vehicles and Equipment

D. UMBRELLA LIABILITY

\$50,000,000 Each occurrence and in the aggregate, excess of the underlying policies.

The Umbrella Liability Policy shall specifically identify each of the policies described in A, B, and C above on the Schedule of Underlying Coverages, and shall provide coverage at least as broad as each of the underlying policies.

F. PROPERTY LIABILITY REPLACEMENT VALUE

- G. CARGO LIABILITY/INLAND MARINE \$25,000,000 OCC/AGG
- H. PROFESSIONAL LIABILITY \$2,000,000 PER CLAIM

I. OTHER INSURANCE: CTA NAMED ADDITIONAL INSURED ON THE GENERAL LIABILITY POLICY.

PART IV PERFORMANCE AND PAYMENT BOND REQUIREMENTS/LETTER OF CREDIT

- A. The Contractor shall furnish separate Performance and Payment Bonds.
- B. The surety or sureties issuing the bond must be acceptable to the Authority and must have a Best's Key Rating Guide of A VII or greater and be listed in the most recently published "Listing of Approved Sureties" of the U.S. Department of the Treasury Circular 570, with underwriting limitations in excess of the Contract Price. The bond must cover the warranty period required by the Contract.
- C. The Performance Bond shall be for faithful performance of the Contract.
- D. The Payment Bond shall be for security for the payment of all persons for furnishing materials, provisions, or other supplies, or items used in, upon, for, or about the performance of the Work contracted to be done, or for performing any Work or labor thereon of any kind.
- E. The Authority reserves the right to require additional security under this Contract if any surety upon any bond furnished with this Contract becomes unacceptable to the Authority.

PART V. PERFORMANCE AND PAYMENT BONDS REQUIRED FOR THIS CONTRACT.

Parent Company Guarantee Performance Bond and/or Letter of Credit: REQUIRED 25% of CONTRACT



Issue Date: _

INSURANCE CERTIFICATE OF COVERAGE

d ed:				RFP#:		Specification #:		
						Project #:	<u> </u>	
ess:		(NUM	BER & STREET	<u></u>		Contract #:	······	
	(CITY)	(STAT	ГЕ) 	(ZIP)				
	Description of Operation/Location							
	The insurance policies and endorsements indicated below have been issued to the designated named insured with the policy limits as set forth herein covering the operation described within the contract involving the named insured and the Chicago Transit Authority. The Certificate issuer agrees that in the event of cancellation, non-renewal or material change involving the indicated policies, the issuer will provide at least sixty (60) days prior written notice of such change to the Chicago Transit Authority at the address shown on this Certificate. This certificate is issued to the Chicago Transit Authority in consideration of the contract entered into with the named insured, and it is mutually understood that the Chicago Transit Authority relies on this certificate as a basis for continuing such agreement with the named insured.							
	Type of ins	uranc	e	Insurer Name	Policy Number	Policy Period	Limits of Liability All Limits in Thousands	
	Commercial Generati Occurrence Explosion/Collap Underground Products/Comple Operations Blanket Contract Broad Form Prog Independent Cor Personal Injury Pollution Commercial Gene Form #: CG 00 01	al Liat Cl mad ons se eted ual berty I htracto	<u>sility</u> aims e Damage ors ability				Each Occurrence <u>\$</u> General Aggregate <u>\$</u> Products/Completed Operations Aggregate <u>\$</u> Deductible and/or <u>Self Insured Retention</u>	
	Automobile Liability	ı (Any	Auto)				Each Occurrence \$	
l	Excess Liability Umbrella Liability	/					Each Occurrence	
	Workers' Compens Employer's Liability	ation	and				WC \$ Employers Liability \$	
	Builders' Risk/Cour Construction	se of		an an ann an t- Cha <u>n</u>			Amount of Contract \$	
	Professional Liabili	ty					\$	
	Owner Contractors	Prote	ctive				\$	
	Other			····				

a)

b)

Each insurance policy required by this agreement, except policies for workers' compensation and professional liability, will read: "The Chicago Transit Authority is an additional insured as respects to operations and activities of, or on behalf of the named insured, performed under contract with or permit from the Chicago Transit Authority". The General, Automobile and Excess/Umbrella Liability Policies described provide for separation of insureds applicable to the named insured and the CTA. General Liability, Auto Liability, Workers Compensation and Property insurers shall waive all rights of subrogation against the Chicago Transit Authority. The General Liability policies, including excess and umbrella will insure all liabilities assumed under the provisions of the Hold Harmless and Indemnity Clause the Content of the Content of the Content of the Chicago Content of the Chicago Transit Authority. c) d) contained in the Contract and not exclude any construction and/or demolition work performed within 50 feet of railroad track. Commercial General Liability must be written on the ISO Occurrence Form CG 00 01 12 04 (or a substitute form providing equivalent coverage) and include the following endorsement: Contractual Liability Railroads ISO Form CG 24 17 10 01 (or a substitute form providing equivalent coverage). The Contractor shall be responsible for arranging that all subcontractors

e) The receipt of this certificate by the CTA does not constitute agreement by the CTA that the insurance requirements in the contract have been fully met, or that the insurance companies indicated by this certificate are in compliance with all contract requirements.

Name and Address of Certificate Holder and Receipt of Notice	Signature of Authorized Representative
Certificate Holder/Additional Insured	Agent/Company Address
Chicago Transit Authority Dept. of Risk Management 567 W Lake St	
Chicago, IL 60661	Telephone

CTA - INSURANCE AND BOND REQUIREMENTS FOR CONSTRUCTION CONTRACTS - 10/1/09

Instructions to Bidders Exhibit 2 - Insurance and Bond Requirements

FORM OF PERFORMANCE BOND

PERFORMANCE BOND

CONTRACT: _____

KNOW	ALL	PERSONS	BY	THESE	PRES	ENTS,	that [*]
of							,
(hereinafter c	called the "Co	ntractor") and _					
(hereinafter	called the "St	urety"), are hel	d and firmly	bound unto	the Chicago	Transit A	uthority,
(hereinafter	called	the	"Authority"), in	the	sum	of
. <u></u>							dollars
(\$), la	wful money of	the United Sta	tes of Ameri	ica, to be paid	to the Co	ntracting
Party and the	Authority, fo	or which payme	nt well and tru	lv to be mad	le, the Contra	ctor and th	ne Suretv

Party and the Authority, for which payment well and truly to be made, the Contractor and the Surety do hereby bind themselves jointly and severally and their, and each of their executors, administrators, successors and assigns firmly by these presents.

Insert Contractor's name. If a corporation, give the State of incorporation, also using the phrase "a corporation organized under the laws of ______." If a partnership, give full names of partners, also using the phrase, "co-partners, doing business under the firm name of ______." If a joint venture, give the name of the joint venture or the names of the joint venturers, also using the phrase "a joint venture formed under the laws of ______." If an individual using a trade name, give individual name, using also the phrase, "an individual doing business under the trade name of ______."

Instructions to Bidders Exhibit 2 - Insurance and Bond Requirements

FORM OF PERFORMANCE BOND

WHEREAS, the Contractor is seeking to enter, or has entered, into a contract known as Contract No. ______, (the "Contract") a copy of which Contract is annexed to and hereby made a part of this bond as though herein set forth in full:

NOW, THEREFORE, the conditions of this obligation are such that if the Contractor, its representatives or assigns, shall well and faithfully perform the said Contract and all modifications, amendments, additions and alterations thereto that may hereafter be made, according to its terms and its true intent and meaning, including repair and/or replacement of defective work and guarantees of maintenance for the periods stated in the Contract, and shall fully indemnify and save harmless the Authority from all cost and damage which it may suffer by reason of failure so to do, and shall fully reimburse and repay the Authority for all outlay and expense which the Authority may incur in making good any such default, and shall protect the Authority against, and pay any and all amounts, damages, costs and judgments which may or shall be recovered against the Authority or its officers or agents or which the Authority may be called upon to pay any person or corporation by reason of any damages arising or growing out of the doing of said work, or the repair or maintenance thereof, or the manner of doing the same, or the neglect of the said Contractor, or it agents or servants, or the infringement of any patent rights by reason of the use of any materials furnished or work done as aforesaid or otherwise, then this obligation shall be null and void, otherwise to remain in full force and effect.

The Surety, for value received, hereby stipulates and agrees, if requested to do so by the Authority, to fully perform and complete the Project to be performed under the Contract, pursuant to the terms, conditions, and covenants thereof, if for any cause, the Contractor fails or neglects to so fully perform and complete such Project. The Surety further agrees to commence such work of completion within twenty (20) days after written notice thereof from the Authority and to complete such Project within such time as the Authority may fix.

The Surety, for value received, for itself and its successors and assigns, hereby stipulates and agrees that the obligation of said Surety and its bond shall be in no way impaired or affected by any extension of time, modification, omission, addition, or change in or to the said Contract or the Project to be performed thereunder, or by any payment thereunder before the time required therein, or by any waiver of any provisions thereof, or by any assignment, subletting or other transfer thereof or of the Project to be performed or any monies due or to become due thereunder; and said Surety does hereby waive notice of any and all of such extensions, modifications, omissions, additions, changes, payments, waivers, assignments, subcontracts and transfers, and hereby expressly stipulates and agrees that any and all things done and omitted to be done by and in relation to assignees, subcontractors, and other transferees shall have the same effect as to said Surety as though done or omitted to be done by or in relation to said Contractor.

Instructions to Bidders Exhibit 2 - Insurance and Bond Requirements

FORM OF PERFORMANCE BOND

IN WITNESS WHEREOF, the Contractor and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereunto affixed and these presents to be signed by their proper officers, this _____ day of _____, 20____.

(Seal)

Contractor's Name

Contractor's Authorized Signature*

Print Name

Title

Attest:

Secretary

(Seal)

By__

By

Surety's Name

Authorized Signature

Print Name

* If the Contractor is a partnership, the bond should be signed by one of the partners in the firm name.

If the Contractor is a corporation, the bond should be signed in its correct corporate name by a duly authorized officer, agent, or attorney-in-fact.

If the Contractor is a joint venture, the bond should be signed by an individual duly authorized by the parties of the joint venture to act for the joint venture.

The number of original bonds to be executed should correspond with the number of originals of the Contract to be executed.

1/22/13 CTA
Instructions to Bidders Exhibit 2 - Insurance and Bond Requirements

FORM OF PERFORMANCE BOND

ACKNOWLEDGMENT FOR CONTRACTOR

STAT	TE OF)
COU) SS.: NTY OF)
On	this day of 20, before me personally appeared , known to me to be the person who executed the
foreg	oing instrument, who, being duly sworn by me did depose and say that s/he resides at , in the City of, in the
Coun s/he:	ty of; and further that
[Mari	k an X in the appropriate box and complete the accompanying statement.]
	(If an individual): executed the foregoing instrument in her/his name and on her/his own behalf.
	(If a corporation): is the of
	and that, pursuant to that authority, s/he executed the foregoing instrument in the name of and on behalf of said corporation as the act and deed of said corporation.
	(If a partnership): is the of
	, the partnership described in said instrument; that, by the terms of said partnership s/he is authorized to execute the foregoing instrument on behalf of the partnership for the purposes set forth therein; and that, pursuant to that authority, s/he executed the foregoing instrument in the name of and on behalf of said partnership as the act and deed of said partnership.
	(If a limited liability company): is a duly authorized member or manager of LLC, the limited
	liability company described in said instrument; that, s/he is authorized to execute the foregoing instrument on behalf of the limited liability company for the purposes set forth therein; and that, pursuant to that authority, s/he executed the foregoing instrument in the name of and on behalf of said limited liability company as the act and deed of said limited liability company.

Notary Public

1/22/13 CTA

FORM OF LETTER OF CREDIT

Sample Form of Letter of Credit

[Insert Date]

CREDIT NO.

Chicago Transit Authority 567 West Lake Street Chicago, IL 60661 Attention:

Dear Sir/Madam:

In accordance with instructions received from ______, we hereby establish our irrevocable letter of credit in your favor for a sum or sums not exceeding a total of \$______ available by your draft on us, together with your written statement signed by one of your officials that "(i)_______ has failed to perform its obligations under that certain Agreement, dated as of ______, between the Chicago Transit Authority and _______; and pursuant to the terms of the Agreement we hereby draw upon the Bank Letter of Credit Number ______ in the amount of \$______." You may draw on this Letter of Credit for the amount set forth in such statement, but not to exceed the balance of this Letter of Credit. Multiple and partial drawing(s) are permitted under this Letter of Credit; provided, however, that the total amount of any payment(s) made under this Letter of Credit will not exceed the total amount available under this Letter of Credit.

It is a condition of this irrevocable Letter of Credit that it shall be automatically extended for an additional period of one (1) year from the present or each future expiration date, unless at least sixty (60) days prior to such date we send you notice in writing, by registered mail, or hand delivery at the above address, that we elect not to renew this Letter of Credit for such additional period, however in no event shall this Letter of Credit be extended beyond the final expiry date of ______. Upon our sending you such notice of the non-renewal of this Letter of Credit, you may draw drafts on us for an amount not to exceed the balance remaining in this letter of credit within the then applicable expiry date, accompanied by the statement "(i)_______ has failed to secure renewal of the required letter of credit or provide a replacement performance bond or letter of credit as required under that certain Agreement, dated as of ______, between the Chicago Transit Authority and ______; and pursuant to the terms of the Agreement we hereby draw upon the Bank Letter of Credit Number ______ in the amount of \$______."

We hereby agree that drafts in accordance with the terms stipulated herein will be duly honored upon delivery of the statements as specified if presented to our Letter of Credit Department, on or before [Insert date which is a date not earlier than one (1) year from the date of this letter of credit] on which date this credit expires or any automatically extended date as herein provided.

All correspondence and any drawings presented in connection with this letter of credit must be presented to us at the _____Bank, [Insert Chicago address for presentment].

Instructions to Bidders Exhibit 2 - Insurance and Bond Requirements

Attention:______. Drawings may be presented to us at our above office by hand delivery or delivered to us by U.S. Postal Service mail, registered mail or certified mail or by express courier or

overnight courier. Drawings may also be presented to us by facsimile transmission to facsimile number______ (each such drawing, a "Fax Drawing"); provided, however, that a Fax Drawing will not be effectively presented until you confirm by telephone our receipt of such Fax Drawing by calling us at telephone number ______. If you present a Fax Drawing under this Letter of Credit you do not need to present the original of any drawing documents, and if we receive any such original drawing documents they will not be examined by us.

This credit is subject to the Uniform Customs and Practice for Documentary Credits (2006 Revision), International Chamber of Commerce Publication No. 600.

Very truly yours,

[Authorized Signatory]

FORM OF PARENT COMPANY GUARANTY

In consideration of the execution of Contract ______ by and between the Chicago Transit Authority (CTA) and ______ (Guarantor) hereby guarantees the performance of (*Company Name*) for all work performed and obligations undertaken in accordance with the above referenced Contract to be executed by and between the CTA and (*Company Name*). Should (*Company Name*) fail or otherwise be unable to fully perform in accordance with the terms of the Contract, and (*Company Name*) receives written notice of failure to satisfactorily perform as such, Guarantor shall itself, acting directly or through others, fully perform such obligations under the terms of the Contract.

The CTA may at any time and from time to time without notice to or consent of the Guarantor and without impairing or releasing the obligations of the Guarantor hereunder; (1) agree with the (*Company Name*) to make any change in the terms of any obligation or liability of (*Company Name*) to the CTA under the Contract, (2) take or fail to take any action of any kind in respect of any security for any obligation or liability of (*Company Name*), (3) exercise or refrain from exercising any rights against (*Company Name*), or (4) compromise or subordinate any obligation or liability of (*Company Name*) to the CTA, including any security therefore. Any and all suretyship defenses are hereby waived by the Guarantor.

The Guarantor has the necessary power and authority, and all necessary corporate and other action has been taken, to enable the Guarantor to sign and deliver this Guaranty and perform its obligations hereunder; implementation by the Guarantor of the foregoing will not contravene any law, order or third party agreement by which the Guarantor is bound.

THIS GUARANTY SHALL BE GOVERNED BY AND CONSTRUED IN ACCORDANCE WITH THE INTERNAL LAWS OF THE STATE OF ILLINOIS WITHOUT GIVING EFFECT TO PRINCIPALS OF CONFLICTS OF LAW. GUARANTOR AGREES TO THE EXCLUSIVE JURISDICTION OF THE STATE AND FEDERAL COURTS LOCATED IN THE COOK COUNTY, ILLINOIS OVER ANY DISPUTES ARISING UNDER OR RELATING TO THIS GUARANTY.

(Corporate Seal)	** Approved Signature _	
(Corporate Seal)	** Approved Signature _	

Title

Date

Attest:

Name Title

**If this document is signed by an officer other than the President, the Contractor shall furnish a certified copy of by-laws or resolution authorizing said officer to sign.

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GENERAL SPECIFICATIONS

SECTION 1 - SCOPE AND PURPOSE

- A. These Contract Documents are intended to establish and control both specific and general design criteria and specification for the construction and delivery of electrically self-propelled, multiple-unit Rapid Transit Cars.
- B. These Contract Documents are intended to include everything required for the construction and assembly of the number of Rapid Transit Cars indicated in the Contract Documents, completely tested, and ready for operation when accepted by the Authority. This includes, but is not limited to, all labor, tools, materials, apparatus and equipment. The Contract Documents may be referred to herein collectively as the "Contract."
- C. Contract Interpretation. Any headings of this Contract are for convenience of reference only and do not define or limit the provisions. Words importing persons will include firms, associations, partnerships, trusts, corporations, joint ventures, and other legal entities, including public bodies, as well as natural persons. Words of gender will be deemed and construed to include correlative words of other genders. Words importing the singular number will include the plural and vice versa, unless the context otherwise indicates. All references to any exhibit or document will be deemed to include all supplements and amendments to any such exhibits or documents entered into in accordance with the terms and conditions of this Contract. All references to any person or entity will be deemed to include any person or entity succeeding to the rights, duties, and obligations of such persons or entities in accordance with the terms and conditions of this Contract.

Material, equipment, supplies, components, other products, and workmanship specified by reference to the number, symbol, or title of a published standard must comply with the latest edition or revision thereof and all amendments and supplements thereto in effect on the Effective Date of this Contract, except where a specific issue is specified. In case of a conflict between the Specifications and the standard referred to, the Specifications will govern. The Authority will not give consideration to any claimed ignorance of a cited standard. The Contractor is responsible for being knowledgeable and familiar with its own trade's generally accepted published standards of quality and workmanship.

The Contract Documents include, the following different Parts: (1) these General Specifications; (2) the Technical Specifications; (3) the Bid Proposal; (4) Instructions to Bidders; and the other documents listed in General Specifications Section 33.

<u>SECTION 1 – SCOPE AND PURPOSE (CONT'D)</u>

Each of the Parts listed in 1 through 4 above are divided into Sections. The Sections are divided into subsections. General Specification subsections are numbered with the Section number before the decimal and with the subsection letter after the decimal. For example, Section 9.A would be paragraph A in Section 9.

SECTION 2 - DEFINITION OF TERMS AS USED IN THIS SPECIFICATION

Wherever in the Contract Documents the following terms, or pronouns in place of them, or abbreviations are used, the intent and meaning shall be interpreted as follows:

- A. "Chicago Transit Authority", "Transit Authority", "Authority", "CTA" means the Chicago Transit Authority, a municipal corporation created pursuant to the Metropolitan Transit Act and its duly authorized agents, and employees.
- B. "Chicago Transit Board" or "Board" means the governing body of Chicago Transit Authority.
- C. "Chairman" means the Chairman of the Chicago Transit Board, or successor or successors upon whom the duties may devolve.
- D. "Secretary" means the Secretary of Chicago Transit Board.
- E. "RTA" means Regional Transportation Authority, a unit of local government, body politic, political subdivision and municipal corporation under the laws of the State of Illinois.
- F. "FTA" means Federal Transit Administration, an Agency of the Department of Transportation of the United States Government.
- G. "IDOT" means Illinois Department of Transportation.
- H. "Addendum" means the written or graphic documents issued prior to the submission of bids that clarify, correct, or change the Authority's Contract Documents. Each Addendum is uniquely numbered. The plural form, Addenda, refers to all uniquely numbered Addendum, or more than one of the same.
- I. "Bidder" means a person or entity that submits a bid or intends to submit a bid.

SECTION 2 – DEFINITION OF TERMS AS USED IN THIS SPECIFICATION (CONT'D)

- J. "Changed Work" means a material change (either an increase or decrease) in the quality, quantity, or programmatic requirements of the Work specified in the Contract Documents. Changed Work does not include Work that is reasonably inferable from the Contract Documents as being necessary for the proper, timely, and orderly completion of the Work or functioning of the Work in accordance with the requirements of the Contract Documents.
- K. "Change Order" means a written order to the Contractor issued by the Authority in accordance with the Contract. A fully executed change order must be approved by the Authority's Board, where required, and have the signatures of all required parties. Also referred to as an Amendment.
- L. "Contractor" means the builder and assembler of the complete Rail Car. Prior to the Effective Date of the Contract, the "Contractor" shall be known as a "Bidder".
- M. "Contract Documents" means those documents stated in GENERAL SECTION 33 <u>ORDER OF PRECEDENCE</u>, and attachments thereto, if any, made a part of the Contract Documents, including executed Change Orders and Addenda.
- N. "Contract Officer" means the Director, Purchasing of the Authority or designee. The Contract Officer may also be referred to herein as the General Manager, Purchasing.
- O. "Contract Time" means the number of days allowed for completion of the Work, including authorized adjustments for time necessary to complete Work for options exercised by the Authority. The starting date for the Contract Time period is stated on the Notice-to-Proceed issued by the Authority.
- P. "Effective Date" means the date on which the Contract becomes fully executed by the parties' authorized representatives in accordance with the terms of this Contract.
- Q. "Engineer" means the Chief Rail Equipment Engineer of the Authority or any other person designated in writing to be the Engineer.
- R. "Engineering Conferences" means those meetings held with the Contractor to finalize specific design details and to verify compliance with the technical specification requirements. A written record of these meetings will be prepared by the Engineer and provided to the Contractor. The agreed upon changes shall amend the technical specifications.

SECTION 2 – DEFINITION OF TERMS AS USED IN THIS SPECIFICATION (CONT'D)

- S. "Escalation" means adjustments to the Contract due to changes in labor and material costs as measured by specific U.S. labor and material indices. See General Section 32 <u>ESCALATION for OPTIONS.</u>
- T. "General Manager, Purchasing" means the Authority's General Manager, Purchasing, or his/her authorized representative.
- U. "Inspector" means the representative(s) of the Authority assigned to the inspection of materials and workmanship under the Contract Documents.
- V. "Invitation for Bids" means the Authority's solicitation for the Work, which is the subject of this Contract, including all Addenda thereto. Also referred to herein as IFB.
- W. "Manufacturer" means the original manufacturer supplying material, equipment or apparatus for installation on the Rail Cars.
- X. "Notice-to-Proceed" means the written notice issued by the Authority to the Contractor authorizing the Contractor to begin the Work on a certain date. The date specified in the Notice to Proceed is the first day of Contract Time
- Y. "Pre-Bid Meetings" means those meetings held with prospective Bidders after the IFB is issued, whether singly or in common, and before the deadline for submitting bids.
- Z. "Pre-Bid Meeting Minutes" means the written record prepared by the Authority of meetings held with Bidders before the deadline for submitting bids and issued by the Contract Officer.
- AA. "Rapid Transit Cars", "Rail Cars" or "Car(s)" means electrically selfpropelled passenger carrying vehicles as defined in the accompanying General Specifications.
- BB. "Review by the Engineer" means the Contractor shall submit sufficient information to allow the Engineer to determine the suitability of the proposed design or equipment for the use intended. The Engineer will respond in the same manner as specified for drawing reviews defined in GENERAL SECTION 13 REVIEW OF DRAWINGS AND DATA AND DESIGNS.
- CC. "Schedule" means the schedule for the performance of the Contractor's Work, as prepared by the Contractor and as accepted by the Authority pursuant to the Contract Documents.

SECTION 2 - DEFINITION OF TERMS AS USED IN THIS SPECIFICATION (CONT'D)

- DD. "Specifications" means the standards for the performance of the Work contained in the Contract Documents.
- EE. "Subcontractor(s)" means any person or entity with whom the Contractor subcontracts to provide any part of the Work and all subcontractors of any tier, suppliers and material suppliers, whether or not in privity with the Contractor.
- FF. "Total Contract Price" which shall be calculated from time to time, shall be the total contract price as of the Effective Date of this Contract, and approved Change Orders and Amendments.
- GG. "Work" means the furnishing of all labor, materials and equipment necessary for the successful completion of the Contract and the carrying out of all duties and obligations imposed by the Contract Documents.
- HH. "Working Days" means any day (other than a Saturday or Sunday) on which the business offices of the Authority are open.
- II. "V.P. Purchasing and Warehousing" means the Vice President of Purchasing and Warehousing of the Authority, or authorized representative.

SECTION 3 - GENERAL OBLIGATIONS OF THE CONTRACTOR

- A. The Contractor shall design and build the Cars and complete all of the Work, strictly in accordance with the requirements of the Contract Documents.
- B. The Contractor shall furnish all labor and materials, plant, tools, test equipment, test track and transportation required for the performance and completion of the Work in the manner and within the time specified in the Contract Documents. It is understood and agreed that the Contractor shall do all the Work necessary to build the Cars and prepare the required detail drawings of the various parts. The Contractor shall assume responsibility for the proper working and fitting together of all parts and specialties, with necessary clearance for successful operation in accordance with the Contract Documents. Each end product shall function as intended.
- C. The Contractor shall perform at no additional expense to the Authority all of the items set forth as its responsibility under this Contract and pay all fees, permits and royalties for patented appliances, products or processes incorporated in the Work.

SECTION 3 – GENERAL OBLIGATIONS OF THE CONTRACTOR (CONT'D)

- D. The Contractor shall furnish a Schedule and Critical Path Method ("CPM") chart for the Work, the form and substance of which shall have sufficient detail for equipment or designating major mileposts of engineering, materials procurement, building and testing, as determined by the Engineer. The Schedule and CPM chart shall be kept current throughout the performance of the Work. In addition, the Contractor shall furnish an organizational chart showing clear lines of communication and responsibility of personnel completing the Work. This organizational chart shall be updated to be kept current throughout the performance of the Work.
- E. The Contractor shall prepare a written Quality Assurance Program ("QA Program") which outlines how all of the quality assurance requirements and functions will be defined, implemented, executed, managed, controlled, recorded and reported. All essential elements of a quality assurance program shall be included and all documentation shall be referenced. Interface with the Authority and the Contractor's control of subcontractors and suppliers compliance shall be included. Quality assurance procedures shall be addressed and shall include, as a minimum, control of subcontractors; receiving, first article, in-process, and final inspection; production and process control; functional test; control of non-conformances; corrective action; calibration and certification of measuring and test equipment; drawing and configuration control; QA records; shipping inspection; and other quality activities necessary to ensure compliance with the Contract Documents. The QA Program shall be furnished to the Authority for review and acceptance and shall be revised and updated as required during the life of the Contract.
- F. The Contractor shall prepare an Inspection and Test Plan ("Test Plan") for Review by the Engineer. The Test Plan shall be forwarded to the Engineer as soon as practicable and in accordance with the Schedule and shall include, but not necessarily be limited to; identification of each and every inspection and test point, and its location in the manufacturing cycle; the inspection or test procedures and forms to be used at each of those points; and the Authority's hold/control points.

The Test Plan shall include not only the functional and performance testing to be done by the Contractor, but also that which will be performed by its subcontractors, suppliers and manufacturers, as well as inspections to be done by the Contractor at these subcontractors, manufacturers and suppliers (source inspections). The Test Plan shall also include a product work flow chart showing each significant generation and the related control/holdpoint for inspections and tests, and the type or level of the inspection or test.

<u>SECTION 3 – GENERAL OBLIGATIONS OF THE CONTRACTOR (CONT'D)</u>

Such review of the Test Plan by the Engineer does not in any way relieve the Contractor of responsibility for the adequacy of the inspection and testing of the Work in accordance with the Contract Documents.

See Also GENERAL SECTION 19 - INSPECTION.

- G. The Contractor shall submit drawings and schedules of equipment, material and specialties for Review by the Engineer in accordance with GENERAL SECTION 13 - <u>REVIEW OF DRAWINGS AND DATA AND DESIGNS</u>. Such drawings shall be those necessary to convey design concept, operation, overall assembly aspects, maintenance accessibility, and interfaces. Ordering or manufacturing of any parts prior to the completion of the Review by the Engineer of these drawings in accordance with GENERAL SECTION 13 will be entirely at the Contractor's risk. Detail part drawings for manufacturing purposes need not be furnished except on request of the Engineer, but shall be available and accessible to the Engineer at all times. Such Review by the Engineer does not in any way relieve the Contractor of responsibility for the adequacy of the design, and fitting of the various parts in accordance with the Contract Documents.
- H. It shall be specifically understood that the omission of any drawing or schedule, or reference thereto, or of any part or item from any drawing or schedule, or from these Contract Documents, which is required to make the Work furnished by a subcontractor or the Contractor fully complete and suitable for successful performance of the specified functions in accordance with the requirements of the Contract Documents shall not relieve said subcontractor or the Contractor from furnishing the required items or parts under the Contract Documents.
- I. The Contractor shall advise the Engineer of the latest applicable revision of any drawing, chart, listing, model, part, style or similar identification referenced in the technical specifications. The Engineer will decide whether the revision is acceptable to the Authority and may be applied under the terms of the Contract Documents.
- J. As part of the data assembled for the design of the Cars, the Contractor shall make its own study of the Authority's current practices in the operation and maintenance of its rail cars, related safety practices, and the environmental conditions (including track, shops and right-of-way) in the Authority's area of operations. The Contractor shall also study the average skill levels of Authority's present operating and maintenance personnel and the Authority's car repairman training.

SECTION 3 – GENERAL OBLIGATIONS OF THE CONTRACTOR (CONT'D)

The Contractor's study shall include enrollment of two Contractor employees responsible for detail and interface design in the Authority's operator training program required in the Specifications. The Contractor shall submit the proposed personnel for Review by the Engineer.

The Contractor shall prepare and submit for Review by the Engineer a comprehensive report of the study conducted on the Authority's operation and maintenance practices.

- K. The mention or specification of a brand name, a component and/or equipment in the Specifications shall not relieve the Contractor of the responsibility to produce the Cars in accordance with the performance, warranty and contractual requirements. The Contractor shall notify the Authority of any inappropriate brand names, components and/or equipment that may be called for in the Specifications, and to propose a suitable alternate for Review by the Engineer.
- L. The Contractor shall prepare and submit for Review by the Engineer a Configuration Management Program ("CMP"). The CMP shall provide a detailed discussion for all configuration management measures to be taken by the Contractor. The CMP shall encompass the Car, its subsystems, and interfaces between subsystems, including all system hardware and microprocessor software. The CMP shall be comprised of the elements of configuration identification control, configuration accountability and design.

The Contractor shall maintain accurate and current configuration records, which shall be made available to the Authority throughout the Contract Time, including the warranty periods, and shall be disposed of after the Contractor completes performance of the Contract as directed by the Authority. The Contractor's technical documentation shall be prepared to acceptable documented commercial standards, as determined by the Engineer, and shall be capable of defining the approved configuration of system equipment under procurement, production, test, installation, or operational use. The technical documentation shall identify the configuration to the lowest level required to install replacement parts. Parts lists, in hierarchy format, identifying all replaceable parts, shall be structured in accordance with the above.

The Contractor shall include the primary drawing numbering system to be utilized, including the significance of all the characters used.

Nameplates on major equipment items shall provide space for Authority assigned numbers to be added.

SECTION 3 – GENERAL OBLIGATIONS OF THE CONTRACTOR (CONT'D)

The part numbering system shall provide for assigning discrete serial numbers for each type of equipment or item to be serialized. A list of the items to be serialized, arranged in hierarchy format, and a description of the serialization method to be used shall be included for each system or type of equipment having serialized items.

Once final production configuration baseline is established, all changes thereto shall be processed through the configuration management system.

M. The Contractor shall be entirely responsible for the management of all interfaces within his design effort and between the Contractor and each system supplier in order to insure successful fit and function of all the components of the Cars and successful operation of the Cars in train with existing Authority equipment.

The Contractor shall submit for Review by the Engineer a plan for the identification and control of mechanical and electrical interfaces within the Car and between the Car and other CTA cars.

SECTION 4 - GOVERNING LAW

- A. This Contract and the settlement of any disputes arising under it shall be governed by the law of the State of Illinois and the United States of America.
- B. <u>Consent of Jurisdiction and Venue</u>

The Contractor hereby irrevocably:

- 1. Submits, and will cause its Subcontractors to submit, to the original jurisdiction of those State or Federal courts located within the County of Cook, State of Illinois, with regard to any controversy arising out of, relating to, or in any way concerning the award, execution or performance of this Contract.
- 2. Agrees that service of process on the Contractor may be made, at the option of the Authority, as provided in the Notice Provisions of this Contract, GENERAL SECTION 34.II, NOTICE addressed to the office actually maintained by the Contractor, or by personal delivery on any officer, director, or managing or general agent of the Contractor.

SECTION 4 - GOVERNING LAW (CONT'D)

3. Waives any objection which it may have to the laying of venue of any such suit, action or proceeding in any of such courts and any claim that such suit, action or proceeding has been brought in an inconvenient forum.

The Contractor agrees that a final judgment in any such suit, action or proceeding shall be conclusive and may be enforced in other jurisdictions by suit on the judgment or in any other manner provided by law.

Nothing in this Section 4 shall affect the right of the Authority to serve legal process in any other manner permitted by law or affect the right of the Authority to bring any suit, action or proceeding against the Contractor, any of its subcontractors or their respective property, as the case may be, in the courts of any other jurisdiction.

SECTION 5 - SEVERABILITY

If any provision within these Contract Documents is held to be invalid, illegal or unenforceable for any reason, it shall be deemed to be modified or restricted to the extent necessary to make such provision valid, binding and enforceable, or, if such provision cannot be modified or restricted in a manner so as to make such provision valid, binding and enforceable, then such provision shall be deemed to be excised from this Agreement. In any event, the effect of such modification, restriction or excision shall not affect, impair, invalidate or nullify the remainder of this Contract but the effect thereof shall be confined to the provision of this Contract so adjudged to be invalid or unenforceable.

SECTION 6 - INDEMNITY

A. The Contractor shall, to the extent permitted by law, (1) protect, indemnify and save the Authority and its officers, employees and agents, including consultants, harmless from and against any and all liabilities, damages, claims, demands, liens, encumbrances, judgments, awards, losses, costs, and suits or actions or proceedings, including reasonable expenses, costs and attorneys' fees, incurred by the Authority and its officers, employees and agents, including consultants, and assigns in the defense, settlement or satisfaction thereof, for any injury, death, loss or damage to persons or property of any kind whatsoever, arising out of, or resulting from, the acts, errors or omissions of the Contractor, including but not limited to acts, errors or omissions of its officers, employees, servants, agents, subcontractors and suppliers and assigns and (2) upon receipt of notice and if given authority, shall settle at its own expense or undertake at its own expense the defense of any such suit, action or proceeding, including appeals against the Authority and its officers, employees and agents, including consultants, relating to such injury, death, loss or damage. The Authority shall promptly notify the Contractor in writing of the notice or assertion of any claim, demand, lien, encumbrance, judgment, award, suit, action or other proceeding hereunder. The Contractor shall have sole charge and direction of the defense of such suit, action or proceeding.

The Authority shall at the request of the Contractor furnish to the Contractor all the reasonable assistance that may be necessary for the purpose of defending such suit, action or proceeding, and shall be repaid all reasonable costs incurred in doing so. The Authority shall have the right to be represented therein by advisory counsel of its own selection at its own expense.

The obligation of the Contractor under the above paragaraph shall not extend to circumstances where the injury, or death, or damages is caused soley by the negligent acts, errors or omissions of the Chicago Transit Authority, its officers, employees, agents or consultants, including negligence in (1) the preparation of the Contract documents, or (2) the giving of directions or instructions with respect to the requirements of the Contract by written order.

- B. The Contractor agrees to pay any duties (estimated or final) assessed under the United States Antidumping Act, U.S. Code, Title 19, Sections 1673-1673i, as amended, and the United States Countervailing Duty Act, U.S. Code, Title 19, Sections 1671-1671f, without any payment of such duties or related expenses by the Authority. The Contractor also agrees to indemnify and hold harmless the Authority from the costs of any claim, demand or investigation of an alleged violation of the Antidumping Duty or Countervailing Duty Acts cited above, including all related costs and attorney fees.
- C. The Contractor's liability under this indemnity during this Contract shall be limited to an amount equal to the Total Contract Price of this Contract as defined in GENERAL SECTION 2 <u>DEFINITION OF TERMS AS USED</u> IN THIS SPECIFICATION, FF Total Contract Price.

SECTION 7 - PATENTED DEVICES, MATERIALS AND PROCESSES

- A. Contractor shall defend, indemnify and hold harmless the Authority from and against any suits, claims, actions, losses, damages, expenses (including, without limitation, attorneys' fees and costs) or liabilities that may result by reason of any alleged violation, infringement or misappropriation of a United States patent, trade secret, copyright or other proprietary interest based on the Work provided under this Contract. The Authority shall promptly notify Contractor of any claim of infringement or misappropriation for which Contractor is responsible and shall cooperate with Contractor to facilitate the defense or settlement of such claim. Contractor or Contractor's attorney(s) shall keep the Authority reasonably apprised of the continuing status of the claim, including any lawsuit resulting therefrom, and shall permit the Authority, upon the Authority's written request and at its expense, to participate in the defense or settlement of such claim.
- B. If use of a Car or any part of the Work shall be prevented or appears likely to be prevented by an injunction or court order or by settlement resulting from any such claim, Contractor shall, at its expense, either:
 - 1. By license or release from claim of violation, infringement or misappropriation, procure for the Authority the right to continue using said item;
 - 2. Modify the item so that it is functionally equivalent to the original items and meets the requirements in the specifications but is no longer subject to a claim or violation, infringement or misappropriation; or
 - 3. Remove any infringing materials and replace same with equally suitable materials free from claim of infringement or misappropriation.
- C. The foregoing undertaking of Contractor shall not apply if the alleged infringement results from modification or enhancement of the item by the Authority, or its consultants, or by use of the Authority or its consultants of an item in combination with other software or work not provided under the Contract where such infringement would not have occurred from the use of the item in other than the alleged infringing combination.
- D. The provisions of this Section shall survive the expiration or termination of this Contract.

SECTION 8 - DISADVANTAGED BUSINESS ENTERPRISES

The requirements of 49 CFR Part 26.49, Transit Vehicle Manufacturer (TVM) Certification of Compliance with Disadvantaged Business Enterprise (DBE) Regulations, are incorporated in this Contract by reference. Failure by the Contractor to carry out these requirements is a material breach of the Contract which may result in the termination of this Contract or such other remedy, as the Authority deems appropriate.

SECTION 9 - FEDERAL, STATE AND LOCAL REGULATIONS

- A. Cars manufactured and delivered by Contractor shall comply with all applicable Federal, State and Local laws, standards and regulations, in effect on the date of the deadline for submitting bids or enacted prior to the deadline for submitting Bids and scheduled to go into effect prior to the final completion date for the Work. Any Federal, State and Local law, standard and regulation existing on the Effective Date or scheduled to be effective during the manufacturing and delivery of the Cars, shall be applicable to the entire number of Rail Cars to be furnished by Contractor.
- B. If any part of these Contract Documents shall be, at the date of issue or during performance of the Contract, in nonconformity with Federal, State or Local laws or regulations because of materials or requirements specified therein or herein, the Authority shall have the right to require additional or substitute materials and/or requirements.
- C. Any change in the Work to be performed under these Contract Documents which is necessitated by a law, standard or regulations enacted after the Effective Date of the Contract shall constitute a Changed Work in accordance with GENERAL SECTION 21- <u>CHANGES</u>, only if such new law, standard or regulation was not scheduled to become effective as of the Effective Date.
- D. All Work performed under this Contract shall comply with applicable laws, regulations, policies, statutes, executive orders, directives and policies imposed by Federal, State and local government agencies.

SECTION 10 - ACCESS TO WORK AND RECORDS

A. The Engineer and his inspectors shall have access to the premises used by the Contractor or to any plant or place where materials, Work or any part thereof including the Rail Cars, are being made, performed, or stored.

SECTION 10 - ACCESS TO WORK AND RECORDS (CONT'D)

- B. The General Manager, Purchasing or his designee, and the authorized representative of the U.S. Department of Transportation, RTA and IDOT shall have access at any reasonable time, to inspect the records and documents of the Contractor and his suppliers, relating to any labor, materials, plant and equipment used in the performance of the Contract.
- C. Access shall be given or obtained both before and after completion of this Contract for the duration of the longest guarantee period as specified in GENERAL SECTION 16 <u>GUARANTEES</u>.

SECTION 11 - INSURANCE REQUIREMENTS

The Contractor must take out and maintain, as of the Effective Date and continuing for the Contract Time, insurance in accordance with the requirements set forth in Exhibit 2 - Instructions to Bidders.

SECTION 12 - ASSIGNING OR SUBCONTRACTING

- A. The Contractor shall give its personal attention to the fulfillment of the Contract and shall keep the Work under its control.
- B. The Contractor shall not sell, transfer, assign or otherwise dispose of the Contract or any portion of payments due thereof, or of its right, title or interest therein, without written consent of the General Manager, Purchasing. No sales, transfer or assignment of this Contract, shall in any case release the Contractor of its liability under the Contract and bonds.
- C. Subcontracting of those sub systems and components listed in Section 1.17 of the Technical Specifications which require the prior acceptance of the Authority to sublet any part of the Work shall not be construed to be an approval of the said subcontract or of any of its terms, but shall operate only with concurrence of the making of a subcontract between the Contractor and subcontractor.
- D. All Work performed for the Contractor by a subcontractor shall be pursuant to an appropriate agreement between the Contractor and the subcontractor (and where appropriate between subcontractors and sub-subcontractors) which shall contain provisions that:

SECTION 12 - ASSIGNING OR SUBCONTRACTING (CONT'D)

- 1. Preserve, protect and guarantee the rights of the Authority under the Contract Documents with respect to the Work to be performed under the subcontract so that the subcontractor, thereof, will not prejudice such rights.
- 2. Require that such Work be performed in accordance with the requirements of these Contract Documents.
- 3. Require that all claims for extensions of time, damages for delays or otherwise with respect to subcontracted portions of the Work shall be submitted to the Contractor (via any subcontractor or subsubcontractor where appropriate) in the manner provided in these Contract Documents for like claims by the Contractor upon the Authority.
- 4. Obligate each subcontractor specifically to consent to the provisions of this Paragraph in writing.
- 5. The Contractor shall be responsible to the Authority for any failure of a subcontractor (and where appropriate a sub-subcontractor) to comply with the provisions of these Contract Documents.
- E. No subcontractor or other third party will be recognized as having privity of contract with the Authority. The parties agree that this Contract is solely for the benefit of Contractor and the Authority.
- F. The Contractor shall direct the attention of its subcontractors to the requirements of all Federal, State and Municipal laws, ordinances, rules and regulations as they apply.

SECTION 13 - REVIEW OF DRAWINGS AND DATA AND DESIGNS

A. The Contractor shall submit for Review by the Engineer, all drawings and data required by the Contract Documents and such other drawings and data as may be requested by the Engineer. These documents shall be sufficiently detailed to enable the Engineer to determine a high degree of confidence based on applicable industry standards and practices that the Contractor will deliver Cars conforming to the Contract Documents suitable for the Authority operations, maintenance and safety practices, and operation in the Authority's operating environment. The Authority agrees that, to the best of its ability, non-complying and unsuitable features proposed by the Contractor will be identified by the Engineer at the design stage of Car development, and returned to the Contractor for corrections and/or adjustments.

SECTION 13 - REVIEW OF DRAWINGS AND DATA AND DESIGNS (CONT'D)

- B. Drawings and data submitted by the Contractor for Review by the Engineer which contain variation from the requirements of the Contract Documents shall be accompanied by an explanation detailing the justification for variation. Drawings and data by themselves will not be recognized by the Engineer as valid instruments for request and acceptance of variations from the requirements of the Contract Documents. Any drawings and data submitted by the Contractor without any explanation for a proposed variation, shall not be used by the Contractor to implement the proposed variation.
- C. The Engineer shall return drawings and data to the Contractor within fifteen (15) working days after acknowledged receipt, with one of the following notations:
 - 1. No comment
 - 2. See comments
 - 3. Request for additional information

Only in the event the drawing is returned with "no comment" may the Contractor proceed with the Work on the basis of such drawings. In the event the drawing is returned with the notation "see comments", or

In the event the drawing is returned with the notation "see comments", or "request for additional information", the Contractor shall have fifteen (15) Working Days from the date of the notation to make the required changes or modification or to supply the required additional information and return the drawing for review. The Contractor shall be granted no extension of the Schedule as a consequence of drawings being returned with comments or requesting additional information.

All technical data, including management plans, quality assurance programs, production schedules, test schedules, test results, progress schedules and reports, drawing lists, samples and other data submitted by the Contractor and requiring Review by the Engineer will be handled in accordance with the above provisions.

Review of Contractor's drawings or any other submissions by the Engineer hereunder shall not relieve the Contractor of any responsibility, including but not limited to, responsibility for accuracy of dimensions and details. The Contractor shall remain responsible for agreement and conformity of its drawings and data with the Contract Documents, and for conformity of the completed Cars and all components thereof with the Contract Documents.

D. Engineering Conferences shall be conducted for the purpose of reviewing designs, establishing baseline configurations and answering questions raised by the Contractor or suppliers. Engineering Conferences shall be conducted

SECTION 13 - REVIEW OF DRAWINGS AND DATA AND DESIGNS (CONT'D)

at facilities suitable for the purpose (including Contractor and supplier plants) as recommended by the Contractor and agreed to by the Engineer. For design reviews, the Contractor shall transmit data applicable for each review to the Engineer at least 10 Working Days prior to the scheduled review.

E. First Article Inspections shall be conducted to confirm equipment compliance with the specification and design requirements. A First Article Inspection shall consist of a physical configuration inspection as well as a functional demonstration unless otherwise agreed to by the Engineer.

First Article Inspections shall be scheduled by the Contractor and shall be conducted at each manufacturer's plant unless otherwise agreed to in writing by the Engineer.

The Contractor shall be responsible for documenting the final configuration of the items inspected and maintaining configuration control if any changes are made after the final inspection.

The Contractor shall furnish to the Engineer prior to each First Article Inspection a written inspection and demonstration plan for each item for Review by the Engineer. The Engineer shall make every effort to identify any omissions or additions needed and relay them to the Contractor for inclusion in the inspection and demonstration plan.

The Engineer will attend all First Article Inspections unless the Engineer specifically waives that right in writing.

The results of each First Article Inspection shall be documented by the Contractor in a format deemed acceptable by the Engineer and all documents relating to the inspection shall be attached and a copy forwarded to the Engineer. If re-testing is required, the Contractor shall document the results and forward them to the Engineer.

SECTION 14 - LOCAL REPRESENTATION

A. For the period of time between the delivery of the first prototype Cars and the acceptance of the last Car, the Contractor shall have in Chicago or in close proximity to the Authority's rapid transit network, a site manager, field office and competent technical field representatives who will provide technical assistance on any problem that arises with the Cars at no additional cost to the Authority. The technical representatives shall be located at each terminal location and shop location specified by the Authority.

SECTION 14 - LOCAL REPRESENTATION (CONT'D)

The Contractor's representatives will:

- 1. Assist in post-shipment check-out of Cars
- 2. Provide technical support to CTA maintenance personnel
- 3. Provide on-site assistance during Car revenue operation
- 4. Provide warranty support to the Authority

During all prototype Car testing at the Authority, including such tests as noise, wayside vibration, performance and revenue testing, the Contractor shall provide 24-hour-per-day on-site field service technical support and provide a parts package at the Authority as well as expedited provisioning for any other spares requirement that is required to support the tests and the Cars revenue service operation for up to one year.

- B. After acceptance of the last Car, competent technical personnel shall also be made available by the Contractor during the guarantee period for items covered by the Contractor's guarantee. Such personnel shall be available to perform corrective and warranty work within twenty-four (24) hours after the Authority notifies the Contractor of a problem by mail, facsimile, or e-mail in accordance with GENERAL SECTION 34.II <u>NOTICE</u>, at no additional cost to the Authority.
- C. These technical personnel shall continuously work on the problem and remain on the Authority's property until all problems are resolved to the satisfaction of the Engineer.

<u>SECTION 15 – [INTENTIALLY LEFT BLANK]</u>

SECTION 16 - GUARANTEES

In addition to the warranties and remedies provided by law, the Contractor expressly warrants as follows:

- A. The Contractor shall warrant and guarantee that each Car is free from defects in material and workmanship and properly designed in conformance with the Contract Documents to provide the services and functions therein described. This warranty and guarantee shall apply for the time periods and conditions which follow:
 - 1. The Contractor shall guarantee the Car body structure, car body underframe, truck frame and bolster, suspension, (including truck mounted hydraulic and rubber elements), axles and wheels, journal

SECTION 16 – GUARANTEES (CONT'D)

bearings, journal bearing housings (if separate from truck frame), door panels, floor panels, floor covering, painting, and seat frames for a period of five (5) years from the date of acceptance of each Car by the Contract Officer in accordance with the Contract Documents. Any replacement units for the items listed in 16.A.1 purchased under this Contract shall be guaranteed for five (5) years from date of delivery.

- 2. The Contractor shall guarantee all other parts of the Car for a period of two (2) years from the date of acceptance of each Car pursuant to the Contract Documents by the Contract Officer. Any replacement units, other than those listed in 16.A.1 purchased under this Contract shall be guaranteed for two (2) years from date of delivery.
- 3. The guarantee on parts replaced or repaired under warranty shall extend from the time of replacement or repair to termination of the guarantee period of the original part.
- B. In addition to the warranties and guarantees stated above, the Contractor shall further warrant and guarantee that the Cars will provide reliable low maintenance operation. This warranty and guarantee shall apply for the time periods and conditions, which follow:
 - 1. In the event any line replaceable unit ("LRU") having a quantity of one (1) to nine (9) on each Car shall have a failure rate of ten percent (10%) or greater during any twelve (12) month period of either of the guarantee periods established in Section 16.A above or the reliability period established in this Section 16.B, the Contractor agrees that the unit is unsuitable for the application and shall promptly replace such unit with units of improved reliability on all of the Cars so equipped. The guarantee period for the improved units will start with date of installation and extend for the period of time for the category of unit as detailed above.
 - 2. In the event any LRUs having a quantity of ten (10) or greater on each Car shall have a failure rate of five percent (5%) or greater during any twelve (12) month period of the guarantee periods established in Section 16.A above or the reliability period established in this Section 16.B, the Contractor agrees that the unit is unsuitable for the application and shall promptly replace such unit with units of improved reliability on all of the Cars so equipped. The guarantee period for the improved units will start with date of installation and extend for the period of time for the category of unit as detailed

<u>SECTION 16 – GUARANTEES (CONT'D)</u>

3.

4.

5.

above.

- LRUs include those items the Authority regularly and commonly changes as part of its routine maintenance and troubleshooting procedures in the Rail Terminals. These include, but are not limited to, lighting assemblies, network and communication control units, P-A amplifiers, passenger intercoms, interior message and destination signs (displays), Train Operator Touch Screen, pre-recorded announcement system control units and memory unit, cab control panels, ATC racks, ATC power supplies, ADU's, auxiliary power supply modules (inverter, LVPS, side door BC, controls), operators and controls, traction motors, friction brake calipers, hydraulic power units, temperature controllers, independently mounted contactors and relays, circuit breakers, printed circuit boards, seats, movable sash, electric couplers, side door edge assemblies, heater strips, expansion valves, solenoid valves, electric motors, cab heater assemblies, A/C compressors, horn amplifiers, speakers and foot switches, track brakes, axle gear boxes, shock absorbers (including those that include position sensors), communications control panels, speed sensors and trucks. The specific classification of all items as LRUs or not shall be determined by the final design of the equipment and decision of the Engineer.
- In the case that the LRU is electronic in nature even if it contains electro-mechanical devices, the extended warranty shall apply to the entire LRU, regardless of what components were replaced.
- In the case that the LRU is mechanical or electro-mechanical in nature and includes moving, wearing components, and the modification required disassembly and repair or replacement of any of the moving, wearing components, the extended warranty shall apply to the entire unit. If no disassembly or repair or replacement of moving, wearing components was required either to correct the failure rate or to repair consequential damage, the extended warranty shall apply only to the components replaced.
- 6. In the case that the LRU is comprised of several assemblies or subassemblies, removal of non-defective assemblies or sub-assemblies to gain access to or to allow repair of the defective unit shall not constitute disassembly of moving, wearing components and shall not require warranty extension of the items removed.

<u>SECTION 16 – GUARANTEES (CONT'D)</u>

- 7. Following the expiration of the two year full warrant in Section 16.A.2 of these General Specifications, the traction motors shall be further guaranteed to be reliable for an additional period of two (2) years. The Contractor agrees that the reliability for the traction motors during this guarantee period will be such that no more than three percent (3%) of the traction motors used by the Authority in its operations will require repair or replacement during any twelve (12) month period during this guarantee period. In addition to other guarantees and warranties established in this Section 16.A.2 and B.1, the Contractor shall fully repair, adjust or replace all traction motor units which fail in excess of the three percent (3%) rate of limit of this reliability guarantee.
- C. Contractor's warranty and guarantee is subject to the condition that the Authority has reasonably complied with the requirements of any maintenance manual furnished by the Contractor to the Engineer covering the item which is the subject of a claim provided the manual reflects standard industry practice and is compatible with the Authority's normal maintenance practices. Should a part, component or item that is considered a consumable fail at the end of its normal service life as determined by the Engineer in his reasonable discretion, and such failure shall occur prior to the expiration of the guarantee periods set forth is this General Section 16, such component or item shall be deemed to be outside the coverage of the guarantee.
- D. During the respective periods of the guarantee, the Engineer will promptly notify the Contractor in writing of each claim and the Contractor shall promptly remove the items that are the subject of a claim and replace the same with new parts, or if agreed to by the Engineer, remove, repair and replace (or repair in place) all parts which fail under the terms of this General Section 16, including parts damaged as a result of defect in, or malfunction of other Car parts, all without any expense to Authority.

In the event the Contractor fails to comply promptly with the written order of the Engineer to repair, replace or correct damaged or defective Work, materials, specialties, equipment and accessories, the General Manager, Purchasing shall, upon written notice to the Contractor, have authority to deduct the cost of such repair, replacement or correction from any compensation due or to become due the Contractor. In the event the Contractor has been paid, the Contractor agrees to reimburse Authority for the cost thereof.

SECTION 16 - GUARANTEES (CONT'D)

E. Any Car held out of service for a period greater than three (3) consecutive calendar days awaiting warranty repair or modification due to lack of logistical support (parts, manuals, personnel, etc.) shall have the warranty period for the entire Car extended by the total number of days the Car remains out of service.

The Authority and the Contractor agree that this General Section 16 is fully understood by the parties, and that the price of the Cars and the other mutual agreements of the parties set forth in this Agreement were arrived at in consideration of the provisions of this General Section 16, specifically

Any Authority labor, material and facilities used in connection herewith shall be paid for by the Contractor in accordance with GENERAL SECTION 20 - AUTHORITY LABOR, MATERIALS AND FACILITIES.

SECTION 17 - PARTS AND AVAILABILITY

- A. The Contractor shall supply to the Engineer, in addition to the parts catalogs, lists detailing recommended initial CTA spare parts inventory adequate for an average of 70,000 miles of operation per year, per Car. The Contractor will make its best effort to notify the Authority at least sixty (60) calendar days prior to placing a production order with an O.E.M. or in scheduling its own production run.
- B. During the basic warranty period the Contractor shall provide to the Authority upon request, the price of any material or parts used in the construction of the Rail Car and all its subsystems.
- C. The Contractor shall maintain all designs and drawings and be responsible for making Car parts or components that are not generally available on the open market available for the Authority to purchase at any time during the period commencing with the expiration of the Warranty Period of the last delivered Car under this Contract, inclusive of any Options and ending twenty (20) years thereafter. In the event the parts or components become obsolete or unavailable, the Contractor shall be obligated to provide sufficient design documentation and/or detailed engineering information for those parts or components upon request by the Authority.

SECTION 18 - AUTHORITY OF THE ENGINEER

- A. The Engineer shall be the principal contact between the Authority and Contractor and will handle, on behalf of the Authority, all matters within the scope of the Engineer's authority under the Contract Documents. Decisions and orders of the Engineer are subject to appeal under GENERAL SECTION 29 - <u>DISPUTES</u>.
- B. The Contractor shall proceed on the basis of any order or decision of the Engineer except for those for which the Contractor proposes to make claim for change in the Total Contract Price or Schedule. When the Contractor proposes to make such claim as a result of an order or decision of the Engineer, the provisions of GENERAL SECTION 21 <u>CHANGES</u> shall be followed by the Contractor before proceeding.
- C. The Engineer may reject any design or Work proposed or supplied which the Engineer determines is not in conformance with the Specifications; is not suitable for Authority operation, maintenance or safety practices; or is not suitable for the Authority's environment.

The Engineer will determine which alternate products, proposed by the Contractor subsequent to the Effective Date of the Contract, are qualified and may be used by the Contractor.

The Engineer will interpret all questions concerning the meaning and intent of the Technical Specifications including Drawings.

The Engineer may permit variations from requirements requested by the Contractor and which, as determined by the Engineer in the Engineer's sole discretion, are in accordance with the intent of the Technical Specifications, provided that any approval of variation shall only be effective if granted in writing.

D. All orders and decisions of the Engineer will be confirmed promptly in writing. When the Engineer issues an order or decision rejecting a design, material or Work proposed or accomplished by the Contractor, such instrument of rejection shall include the Engineer's reasons for rejection.

SECTION 19 - INSPECTION

A. The Contractor shall perform or have performed the inspections and tests (except those performed solely by the Authority) required to substantiate that the Work provided under the Contract conforms to the Contract Documents. Inspection shall occur at appropriate points in the manufacturing and installation sequence to ensure compliance with drawings, test specifications,

<u>SECTION 19 – INSPECTION (CONT'D)</u>

process specifications, and quality standards. The Authority may designate inspection hold points in the manufacturing, installation, and inspection planning.

Inspection shall be 100% or, upon prior written approval by the Engineer, a statistical sampling plan may be used. Nonconforming materials shall be identified as such, and shall be segregated and reviewed for disposition.

B. The Contractor shall provide and maintain an inspection system acceptable to the Engineer covering the Work hereunder. Records of all inspection Work by the Contractor shall be kept complete and available to the Engineer at all times during the performance of this Contract and for the duration of the guarantee period and for such longer period as may be specified elsewhere in the Contract Documents.

The Contractor shall provide copies of its inspection plan to the Authority for information.

C. All samples for analyses and tests shall be taken in such manner as to be truly representative of the entire lot under test and shall not be worked on in any way to alter the quality before testing. Where expressly permitted by the Engineer in writing, in the case of materials taken from stock or for use in minor parts, certified analyses and tests of the manufacturer, furnished in triplicate, may be accepted by the Engineer in the Engineer's sole discretion. In case the records of physical and chemical tests of stock materials are not available, the results of a reasonable number of tests shall be furnished to the Engineer, free of charge, as required by the Engineer to satisfy him as to their qualities.

All testing shall provide a measure of the overall quality of the completed work product and shall be performed so that it simulates end product use and function. When modification, repairs, or replacements are required, there shall be re-inspection or retest of the characteristics affected.

D. All Work shall be subject to inspection and test by the Authority to the extent practicable at all times and places including the period of manufacture, and in any event prior to acceptance. Upon the Authority's request, the Authority also shall have the right of observe the Contractor's inspection.

SECTION 19 – INSPECTION (CONT'D)

E. Requests by the Contractor for attendance of the Engineer at inspections and tests shall be in writing. These written requests shall be received by the Engineer sufficiently in advance of the inspections and tests to allow the Engineer at least fourteen (14) full calendar days for domestic travel and twenty-eight (28) calendar days for travel outside North America to make travel arrangements.

Except as agreed to by the Engineer, inspections and tests to be witnessed by the Engineer at the request of the Contractor shall be performed during regular business hours, weekdays between 8:00 AM to 5:00 PM.

F. The Authority will perform or arrange to have performed in process and final inspections on each car/married pair of cars at the final assembly location. The final inspections will include a static inspection of the car interior, exterior (including roof), under car and trucks and a functional inspection of each married pair. The Authority final inspections will be conducted after the Contractor has completed all its assembly and testing, both static and dynamic, of the cars and shall be conducted without any Contractor personnel in attendance. For final static inspection, the Contractor shall arrange for the car interior lighting to be fully functional. For final functional inspection the Contractor shall provide 600 Vdc power sufficient to operate the auxiliary power supplies and heat on both cars of each married pair and shall arrange to electrically connect the two cars of each pair if they are not already connected. The Contractor shall provide adequate physical accommodations for the final inspections including lighting and heat; well lighted pits of sufficient width and depth to allow full inspection of all the undercar wiring and components; provisions to permit the easy inspection of the roof; and easy and sufficient access to permit the opening and cover removal of undercar equipment enclosures including sufficient space to roll the battery cradle out of the box.

The Authority will provide the Contractor the results of its inspections and the Contractor shall then make all corrections to the cars and their functioning and notify the Authority that the cars are ready for re-inspection. The Authority will then conduct a re-inspection and either accept or reject the work. This sequence may be repeated until the cars are found to be acceptable to the Authority.

Authority inspections will be performed during regular first shift hours, Monday through Friday.

The Authority will authorize the Contractor to load and ship each married pair after successful completion of all the static and functional tests.

<u>SECTION 19 – INSPECTION (CONT'D)</u>

The Authority will maintain a site office at the final assembly/test location and staff it with a Site Manager and inspectors.

G. The Contractor and his major subcontractors shall provide office space, when needed, suitable to and for use by the Engineer in managing this Contract, performing inspections, witnessing tests, maintaining records, auditing the quality control program, reviewing incorporation of design and configuration changes, and similar tasks. Such office space shall be adequate, in the opinion of the Engineer, for the intended purpose. The office shall have installed heating and air conditioning, electric power, telephone with both direct outside line and an inside extension, fax machine, digital answering machine, Personal Computer ("PC") with direct high speed internet access, photo copy machine and color printer for PC. The PC shall be equal in quality, performance and features to the PTU's specified in Section 17.04 of the Technical Specification and shall be submitted for Review by the Engineer. The direct internet access shall be equivalent to that provided by the Contractor for its own engineering office. All equipment and furnishings shall be new unless otherwise agreed to by the Engineer. The office shall also be furnished, maintained, cleaned and security protected by the Contractor in a manner equivalent to that provided by the Contractor for performing similar functions within his own shop and office facilities.

H. In case any Work does not conform with the requirement of this Contract, the Engineer, or Inspector(s) designated by him, shall have the right either to reject it or require correction. Work which has been rejected or required to be corrected shall be removed or, if permitted or required by the Engineer, corrected in place by and at the expense of the Contractor promptly after notice, and shall not thereafter be tendered for acceptance unless the former rejection or requirement of correction is disclosed. If, after written notice, the Contractor fails promptly to replace or correct such Work, the Contract Officer either: (1) may by separate contract or otherwise replace or correct such Work and charge to the Contractor the cost incurred by the Authority for such replacement or correction; or (2) may terminate this Contract for default as provided in GENERAL SECTION 28 - <u>DEFAULT</u>.

I.

For inspections or tests made by the Engineer on the premises of the Contractor or a subcontractor, the Contractor without additional charge to the Authority shall provide all reasonable facilities and assistance for the safety and convenience of the Engineer's inspectors in the performance of their duties. See paragraph E. above.

If the Engineer's inspection or test is made at a location other than the premises of the Contractor or a subcontractor; it shall be at the expense of the Authority except as otherwise provided in this Contract; provided, however, that the Authority shall not be liable for any cost of samples used in connection with such inspection or test. All inspections and tests by the Engineer shall be performed in such manner as not to unduly delay the Work. The General Manager, Purchasing reserves the right to charge to the Contractor any additional cost of inspection and test when the Work is not ready at the time such inspection and test was scheduled by the Contractor or when reinspection or retest is necessitated by prior rejection. Acceptance or rejection of the Work shall be made as promptly as practical, except as otherwise provided in this Contract; but the Authority's failure to inspect and accept or reject Work shall neither relieve the Contractor from responsibility for such Work that is not in accordance with the Contract requirements nor impose liability on the Authority thereof.

The inspection and test by the Engineer of any Work does not relieve the Contractor from any responsibility regarding defects or other failures to meet the requirements of the Contract Documents or the proper functioning of the part, sub-system or Car, which may be discovered after acceptance.

If the General Manager, Purchasing shall have reasonable evidence that defective Work has been permitted by the Contractor or the subcontractors, or that defective materials have been used, and shall desire to make an examination of Work partly or fully completed, the Contractor or subcontractor shall furnish the appliances and labor for making such investigation and inspection as may be required by the Engineer. Any defective Work which may be disclosed shall be promptly corrected.

- J. If investigation discloses no defect, the expense of such investigation, including any additional cost incurred by the Contractor as a result thereof, shall be borne by the Authority, and the Schedule shall be adjusted accordingly, if necessary.
- K. FTA, IDOT, RTA or a designee may conduct periodic on-site inspections of the Work to evaluate the effectiveness of the Authority's arrangement for supervision and inspection and to evaluate the Work done and adherence to this Agreement.

SECTION 20 - AUTHORITY LABOR, MATERIALS AND FACILITIES

A. The Authority shall be under no obligation to provide its own labor or facilities in the performance of requirements which are obligations of the Contractor under terms of the Contract Documents, unless specifically so stated in the Contract Documents.

SECTION 20 - AUTHORITY LABOR, MATERIALS AND FACILITIES (CONT'D)

Notwithstanding the provisions of this Section 20.A of the General Specifications, the Contractor and Authority, may at the Authority's option, arrange for the performance of necessary modification, retrofit, or warranty work by the Authority at the expense of the Contractor. The Authority specifically reserves the right of first refusal on any modification, retrofit, or warranty work required on Cars built under this Contract.

- B. When Authority labor or facilities are used in the performance of the obligations of the Contractor with mutual agreement or as permitted by terms of the Contract Documents, the Contractor shall reimburse the Authority for the cost of such Work as follows:
 - 1. For labor supplied by the Authority at the average hourly rate then in effect for the type of Work performed. If Work is actually performed on overtime, CTA overtime wage rates will apply.
 - 2. For an amount applied to its wage cost to cover the cost of fringe benefits.
 - 3. For Authority supplied materials, specialties, equipment and accessories in the amount, which is the sum of the purchase price, paid by the Contractor plus the then current rate for handling charges plus delivery charges.
 - 4. For shop overhead.
 - 5. For an amount for general and administrative expenses incurred by the Authority.
- C. The rate to be applied for fringe benefits, supervision and accounting, material handling charges, use of shop facilities and general and administrative expenses shall be those most recent rates periodically developed and published on the basis of actual experience by the Authority's Financial Reporting and Analysis Section.
- D. Under circumstances in which Work is performed by Contractor personnel at Authority facilities, the Contractor shall reimburse the Authority for materials and supplies at rates as defined above and for use of shop facilities in amounts to be negotiated between the Contractor and the Authority.

SECTION 21 - CHANGES

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A. Right to Change Work.

The Authority may at any time or from time to time, order additions, deletions, or revisions to the Work. If the Contractor does not have written authorization from the Authority to proceed with Changed Work, as specified in this General Section 21, then the Contractor will not be compensated for any Changed Work.

All Changed Work must be executed under applicable Conditions of the Contract Documents. It is agreed by the Contractor that any Change resulting in Changed Work will be paid at the applicable rates set forth in the Contractor's Bid Proposal. The rates shall include the Contractor's overhead and profit, at a rate not to exceed twenty-one percent (21%). These fully burdened hourly rates shall not include any allowances for overtime and premium time compensation and must comply with the Federal Acquisition Regulations Part 31 – Contract Cost Principles and Procedures. The Authority reserves the right to audit the fully burdened rates plus any applicable Escalation pursuant to GENERAL SECTION 32 - <u>ESCALATION CLAUSE FOR OPTIONS</u> for equivalent items as determined by the General Manager, Purchasing or as otherwise agreed to by the parties and set forth in the terms of a Change Order.

In the event of a decrease in the Work, the Authority will not pay for lost or anticipated profits resulting from partial or complete deletions of the Work and an equitable decrease of the Total Contract Price and Schedule will be made to reflect the terms of the Change Order as determined by the Authority.

B. Proposed Changes in Work.

The process for Changed Work is as follows. The Engineer will request the Contractor to submit a bid for Changed Work. The Contractor shall submit a bid within sixty (60) days after receipt of the Engineer's request or such shorter time as the Engineer may set forth in the request for Changed Work.

In the alternative, if the Contractor chooses to propose Changed Work, the Contractor must submit notice of such request to the Authority for its prior written approval. The Authority may choose to request Contractor to submit a bid within a specified time period after receiving Contractor's notice.

The Contractor's Bid shall set forth any changes to the Total Contract Price, Contract Time, weight, and/or noise levels required, in the opinion of the Contractor, to perform the Changed Work.

<u>SECTION 21 – CHANGES (CONT'D)</u>

The Authority may or may not choose to authorize the Contractor to perform the Changed Work as identified in the Bid.

- C. Proceed Orders and Change Orders.
 - 1. <u>Proceed Order</u> If the Authority orders Changed Work, and the Contractor and the Authority agree on an adjustment, if any, to the Total Contract Price, Contract Time, and/or Specifications, the Authority will issue a Proceed Order. The General Manager, Purchasing's agreement to an adjustment under this Section is subject to final approval as required by the Authority's ordinances, regulations, and rules. The General Manager, Purchasing may issue a Proceed Order to direct the Contractor to proceed with the Changed Work for which the Contractor and the General Manager, Purchasing propose in writing an adjustment in price, time and/or Specifications, if applicable. Proceed Orders will not entitle the Contractor to compensation or any other adjustment to the Specifications until the Proceed Order is incorporated into a Change Order(s).
 - 2.

<u>Change Order</u> - The Authority may issue a Change Order as authorization for the Changed Work and/or for payment or time extension, or both. The Authority may also issue a Change Order to modify the terms of the Contract. A Change Order may include future Work to be performed under the Contract or Work performed in accordance with previously authorized Proceed Orders. The Contractor cannot be compensated for any Work authorized through a Proceed Order until a Change Order is executed.

3.

<u>Directive Order</u> - If the Authority orders Changed Work, and the Contractor and the Authority have not agreed on an adjustment to the Total Contract Price, Contract Time, and/or Specifications, the General Manager, Purchasing will issue a Directive Order directing Contractor to perform the Changed Work. The General Manager, Purchasing, may determine an adjustment to the Total Contract Price, Contract Time, and/or Specifications, for the Changed Work. The decision of the General Manager, Purchasing, will be final and binding, subject only to SECTION 29 - DISPUTES.

The Contractor shall perform the Changed Work as directed in the Directive Order. The Contractor's refusal or failure to proceed promptly with the Changed Work as directed shall constitute an event of default.

SECTION 21 – CHANGES (CONT'D)

D. Claims by Contractor.

1. All claims made by the Contractor under this Contract shall be made in accordance with the requirements stated below. The Contractor shall provide immediate oral notification to the Engineer upon discovering any conditions or circumstances that may require an adjustment to the Total Contract Price, Contract Time, and/or Specifications. Upon notification, the Engineer will attempt to resolve the identified issue as promptly as possible. The Contractor shall deliver written notice of such Claim to the Engineer and the General Manager, Purchasing within fourteen (14) days of oral notice. All additional correspondence from the Contractor concerning the Claim must be sent to both the Engineer and the General Manager, Purchasing. The written notice shall include the following information:

- a. Documents to substantiate Contractor's proposed cost for Changed Work. The Contractor's proposed cost for Changed Work must meet the limitations and requirements set forth in this Section.
- b. Accounting records and statements and any other applicable documentation to support the claimed costs.
- c. Data and information used to assemble the Bid, if Bid preparation is relevant to the disputed issue.
- d. Each Claim shall include a sworn certification signed by the Contractor. The Contractor must certify that it has fully reviewed the Claim and has determined that the supporting data is current, accurate, and complete and, to the best of the Contractor's knowledge and belief, the amount requested reflects the Contract adjustment for which the Contractor believes the Authority to be responsible under the terms of the Contract. In addition, the certification must include a statement that the signatory is authorized to certify the Claim on behalf of the Contractor and must be signed by the Contractor's president, vice-president, or other officer who is authorized to bind the Contractor.
- 2. The Engineer or the General Manager, Purchasing will respond to the Claim in writing within thirty (30) days of receipt. The response will be either a determination of the Claim or a determination that additional time or documentation is needed to evaluate the Claim. If the Engineer or General Manager, Purchasing determines that additional documentation is required to evaluate the Claim, he or she
<u>SECTION 21 – CHANGES (CONT'D)</u>

will advise the Contractor of claimed costs for which insufficient documentation has been provided to support the claimed costs, and will state the time for providing additional documentation. If the Engineer or General Manager, Purchasing requires additional time to evaluate the Claim, the Contractor will be advised in writing of the additional time that will be required. Failure to provide any of the required information may result in denial of the Claim. The determination of the Claim will be sent to the Contractor in writing by the General Manager, Purchasing. If the determination of the Claim requires an adjustment to Total Contract Price, Contract Time, and/or the Specifications, a Change Order must be issued in accordance with GENERAL SECTION 21.C before that change becomes effective.

If the Contractor accepts the Authority's determination of the Claim, then the Claim will be handled in accordance with GENERAL SECTION 21.C, <u>PROCEED ORDERS AND CHANGE ORDERS</u>. If the Contractor does not accept the decision with respect to the Claim, then the Contractor may submit a dispute to the General Manager, Purchasing in accordance with GENERAL SECTION 29, within thirty (30) days after receipt of the response to the Claim unless the General Manager, Purchasing extends the time, in writing. By failing to meet the time limits specified in this GENERAL SECTION 21, the Contractor waives the right to seek an adjustment to Total Contract Price, Contract Time, and/or Specifications. The Contractor's compliance with this process is a condition precedent to filing suit.

4.

3.

The Contractor further understands and agrees that, regardless of any case law decision to the contrary, the notice requirements of this subsection, shall not be subject to or diminished by any claim on the part of the Contractor that the Authority or any person acting on behalf of the Authority, directed the Contractor to make changes in the Work or had actual or constructive knowledge of any changes in the Work. The Contractor further acknowledges that the time requirements and notice content requirements of this Section have the purpose, among others, of allowing the Engineer and the General Manager, Purchasing, to evaluate claims related to Changed Work contemporaneously with the Work that is the subject of the Claim and to be able to make decisions that may mitigate the cost of such changes.

No changes authorized under the provisions of this Section shall release the sureties from their obligations under any performance bond required by this Contract.

SECTION 22 - EFFECTIVE DATE OF CONTRACT

The Effective Date of the Contract shall be the date that the Contract is fully executed by the parties' authorized representatives in accordance with the requirements set forth in the Contract Documents. The Contractor shall furnish satisfactory Insurance and a Performance Bond prior to the Authority fully executing the Contract in accordance with applicable laws and policies. The Authority will issue a Notice to Proceed to the Contractor specifying the date on which the Contractor will commence Work under the Contract.

SECTION 23 - DELIVERY

- A. The Contractor shall deliver the Rail Cars as specified in the Technical Specification, SECTION 16.03 for unloading and acceptance inspection by the Authority. (See GENERAL SECTION 24 <u>ACCEPTANCE</u>.) Replacement units shall be delivered to CTA, Skokie Shops, Skokie, Illinois.
- B. For purposes of late delivery liquidated damages, as defined in GENERAL SECTION 27 <u>LIQUIDATED DAMAGES</u>, Paragraph A, a Car will be considered as delivered on the date both Cars of a two-Car unit are received at Skokie Shops if both are subsequently determined to be in acceptable condition for revenue service. If either Car of a two-Car unit is found not acceptable for revenue service, repairs will be effected by the Contractor at no cost to the Authority, and the date of delivery will be the date these repairs are found acceptable by the Authority, and the repaired cars acceptable for revenue service.
- C. The first ten (10) Cars, five married pairs, shall be delivered not later than nine-hundred ten (910) calendar days from the Notice to Proceed. Eight (8) of these Cars as selected by the Authority in its sole discretion shall be subjected to the prototype testing required by the Technical Specifications. The Contractor shall not ship additional Cars until notified by the Contract Officer that these eight (8) Cars have successfully completed the prototype tests.
- D. The first of the remaining Cars shall be delivered beginning no earlier than two-hundred-ninety (290) calendar days after the date of delivery of the 10 prototype Cars. The base order and subsequent options rate of delivery shall be between ten (10) Cars and fourteen (14) per thirty (30) calendar days.

By mutual agreement between the Contractor and the Authority in writing, the delivery rate may be raised to a maximum of twenty (20) Cars per thirty (30) calendar days. By no means shall this increase in rate be made until the Contractor has demonstrated his capability to consistently to deliver the maximum of fourteen (14) cars per thirty (30) calendar days.

<u>SECTION 23 – DELIVERY (CONT'D)</u>

2.

- E. Liquidated damages in accordance with GENERAL SECTION 27, A, shall be assessed against the delivery schedule as outlined in this Section as follows:
 - 1. First ten (10) Cars within nine-hundred ten (910) calendar days from Notice to Proceed.
 - The following formula is based upon the minimum delivery rate of ten (10) cars per thirty (30) calendar days. Balance of Cars to be delivered no later than the number of calendar days calculated according to the formula $B=(N \times 3) + (P + 290)$, where N equals the balance of Cars after the ten (10) prototypes, P equals the number of calendar days from Notice to Proceed to delivery of last prototype Car, 290 equals the minimum number of calendar days it takes to complete all of the required prototype tests in Chicago (see paragraph E.3 below) and B equals the number of calendar days after Notice to Proceed.

For purposes of assessing liquidated damages, the formula above shall be used to calculate delivery dates in fifty (50) car increments (with the exception of Option 5, which will consist of two 50 car increments and one 56 car increment and Option 8 which will consist of one 50 car increment and one 40 car for purposes of assessing liquidated damages) up to the maximum number of cars manufactured. Liquidated damages will be assessed upon failure to meet each of these calculated incremental deadlines for delivery. Damages will be assessed for each Car at the per Car rate specified in Section 27 for each Car that is not delivered by the required date until each such Car is delivered and accepted.

Example for first increment of fifty cars:

Assumptions used for this example: prototypes delivered two days late and Prototype test actually took 365 days to complete.

B = (40 x 3) + (912+365)B= 120+ 1277 B= 1397 days from NTP is the due date for fifty cars.

3.

If the prototype test period is extended beyond the minimum, twohundred ninety (290) calendar days, the above formula shall be extended by an equal number of days. The 290 days in the formula shall be adjusted to correspond with the actual days after delivery of the prototypes that it takes to complete all testing in Chicago.

<u>SECTION 23 – DELIVERY (CONT'D)</u>

The prototype testing includes the non-revenue qualification testing, EMI testing and the minimum 9-month in-service testing inclusive of all required extensions to the in service testing.

In the event that any option or options are not exercised and this results in a gap in the production of Cars, the Parties shall then agree to a mutually acceptable delivery date for the next option quantity increment of fifty (50) railcars, which shall be the date upon liquidated damages will be assessed. Any remaining fifty car increments will be set based on this mutually agreed date, using the minimum delivery rate of ten (10) cars per month.

SECTION 24 - ACCEPTANCE

- A. Each Rail Car when received by the Authority will be given a visual and functional inspection following the Authority's standard procedure, utilizing a comprehensive new Car check list as developed by the Authority specifically for the Cars under this Contract, to determine if it is in compliance with the Specifications and is in acceptable operating condition for revenue service. The Contract Officer will notify the Contractor, in writing, within fifteen (15) calendar days after delivery as to whether the Car has or has not been accepted. If the Car is not accepted, the Authority's reason for rejection will be stated in the written notification. The Contractor shall correct all defects and resubmit the Rail Car for acceptance. The Authority will accept or reject the resubmitted Rail Car within fifteen (15) calendar days from the date a corrected Rail Car is delivered in accordance with the Contract Documents. Acceptance of the Rail Cars will be made at CTA, Skokie Shops, Skokie, Illinois. When accepted, a "Certificate of Acceptance of Vehicle", shall be executed by the Authority accepting the Rail Car and authorizing payment in accordance with the Contract Documents. The date of acceptance shall be the date that the Rail Car is found acceptable for revenue service as noted on the Certificate of Acceptance of Vehicle.
- B. Acceptance of prototype Rail Cars for revenue service under this Section does not constitute "Successful Completion of Prototype Tests," required by the Technical Specifications.
- C. The two (2) prototype Cars delivered to the Maintenance Training Center shall be given a final inspection when they are delivered to Skokie Shops in accordance with the Contract Documents following completion of the training classes. A preliminary inspection and conditional acceptance of these two Cars shall be made upon such delivery to authorize payment.

SECTION 25 - RISK OF LOSS

- A. Except for loss or damage determined to be caused directly and solely by the Authority, any risk of loss or damage to the Rail Car or to any part thereof prior to release for revenue service or thereafter while in the possession of the Contractor or under the Contractor's control is assumed and shall be borne by the Contractor, and any such loss or damage shall be made good by the Contractor at its own cost, and the performance of the Contract by the Contract by the Contract or in accordance with the Contract Documents without additional cost to the Authority by reason of such loss or damage.
- B. Risk of loss of all Rail Cars except the prototype Rail Cars shall pass to Authority upon the Authority's acceptance and release of Rail Cars for revenue service.
- C. Risk of loss of prototype Rail Cars shall pass to the Authority upon the Authority's release of Rail Cars for prototype Car revenue service or delivery of Rail Cars to the Authority's Maintenance Training Center in accordance with the Contract Documents whichever occurs first.

SECTION 26 – AVAILABILITY OF FUNDING

A. The Authority's acquisition of the Rail Cars will be funded by a series of FTA, RTA and IDOT grants. Therefore, when performing under the Contract Documents, the Contractor shall adhere to the following "PAYMENT SCHEDULE" in incurring liability for its performance.

PAYMENT SCHEDULE

Total liability shall not exceed this percentage of Total Contract Price for the **base car contract**:

TIMEFRAME

Upon execution of Contract	35%
580 days after Notice to Proceed	70%
970 days after Notice to Proceed	100%

Total liability inclusive of Escalation adjustment shall not exceed this percentage of Total Contract Price including Escalation for <u>each option</u> <u>exercised</u>:

<u>SECTION 26 – AVAILABILITY OF FUNDING (CONT'D)</u>

TIMEFRAME	
Upon exercise of option	25%
365 days after exercise of option	100%

B. On the Effective Date, the Contracts will be executed by all parties, however not all the funds committed by the Contracts will be on hand.

Upon availability of funds to the Authority sufficient for performance of the full requirements of percentage steps indicated in the "PAYMENT SCHEDULE" above, the Contract Officer shall so notify the Contractor, in writing, that total liability may be increased to the extent indicated in the notification. The Contractor is not obligated to incur costs for the Contract performance for any percentage step, unless and until the Contractor has been notified by the Contract Officer of an increase in the availability of funds. This procedure will apply to each percentage step for the base Car Contract and any option exercised.

The Contractor shall be responsible for any liability which exceeds the Total Liability according to the above "PAYMENT SCHEDULE" unless notified otherwise, in writing, by the Authority.

C. If termination of this Contract occurs either at the Authority's convenience under GENERAL SECTION 34.L, <u>TERMINATION FOR CONVENIENCE</u> or under GENERAL SECTION 34.M, <u>CANCELLATION</u>, the Authority's total obligation shall not exceed the amount stated in the "PAYMENT SCHEDULE" as Total Liability to date of termination or cancellation.

Notification to the Contractor from the Authority that funds will not be made available for any funding year shall be treated as GENERAL SECTION 34. M, <u>CANCELLATION</u>.

- D. If for some reason beyond the control of the Authority, IDOT, RTA or FTA, the funds are not on hand when progress payment milestones or delivery payments are due, the invoices will be held until funds are available and no late payment charges or other penalties shall be added to the amount due.
- E. Payment to the Contractor will be made upon completion of various milestones as described in the Bid Proposal. The amount of such progress payments will be determined by the dollar value of the Contract as described in the Bid Proposal.
- F. Contractor's invoices for progress, production, acceptance and final payments shall be submitted monthly. Upon receipt of properly executed

SECTION 26 – AVAILABILITY OF FUNDING (CONT'D)

invoices, the Authority will make payments to the Contractor.

G. Payment for performance of this Contract shall be made by check or via electronic transfer of funds in United States dollars within thirty (30) calendar days after acceptance of Contractor's properly executed and certified invoices by the Contract Officer.

If Contractor elects to be paid via electronic transfer, Contractor shall provide written instructions to the Authority identifying its election and all required bank and account information as required by the Authority.

SECTION 27 – LIQUIDATED DAMAGES

- A. Contractor agrees that failure to complete delivery of the Cars in acceptable condition for revenue service as provided in the Schedule and other time requirements set forth in the Contract Documents will result in additional cost, and tangible and intangible losses to the Authority. Therefore, Contractor agrees to pay Authority \$300.00 per Car per calendar day for each and every day a Car remains undelivered beyond the dates established in GENERAL SECTION 23 <u>DELIVERY</u> or as adjusted by GENERAL SECTION 21 <u>CHANGES</u>.
- B. Contractor agrees that failure to manufacture and deliver a Car that is less than or equal to the referenced light weight stated in SECTION 2.03, A of the Technical Specifications or as adjusted by GENERAL SECTION 21 <u>CHANGES</u> will result in additional costs and tangible and intangible losses to the Authority. Therefore, Contractor agrees to pay the Authority \$20.00 for each and every pound by which each delivered Car exceeds the reference light weight stated in Section 2.03, A of the Technical Specifications.
- C. Contractor agrees that any monies paid pursuant to Paragraphs A and B of this Section 27, are not penalties, but a reasonable attempt to establish agreed measures of damages because of Contractor's failure to conform to the established delivery and weight.
- D. Contractor agrees that any liquidated damages due Authority because of Contractor's failure to comply with the delivery provisions of the Contract Documents shall be deducted from invoices submitted by Contractor, or if monies due or to become due Contractor are insufficient, Contractor or its Surety shall pay such sums as have been determined to be liquidated damages.
- E. Contractor shall not be liable for the liquidated damages established in

SECTION 27 – LIQUIDATED DAMAGES (CONT'D)

Paragraph A of this Section 27 if Contractor's failure to deliver arises out of causes beyond its control and without the fault or negligence of the Contractor. Such causes may include, but are not restricted to, acts of God or of the public enemy, acts of the Government in either its sovereign or contractual capacity, fires, floods, epidemics, quarantine restrictions, freight embargoes, and unusually severe weather, but in every case the failure to perform must be beyond the control and without the fault or negligence of the Contractor. If the failure to perform is caused by the failure of a subcontractor to perform or make progress, and if such a failure arises out of causes beyond the control of both the Contractor and subcontractor, and without the fault or negligence of either of them, the Contractor shall not be liable for late delivery liquidated damages unless: (a) the supplies or services to be furnished by the subcontractor were obtainable from other sources; and (b) the Contract Officer shall have issued a written order directing the Contractor to procure such supplies or services from such other sources; and (c) the Contractor shall have failed to comply reasonably with such order. If such order by the Contract Officer results in unreasonable unit cost differences, the provisions of GENERAL SECTION 21 - CHANGES, shall apply. Upon request of the Contractor, the Contract Officer shall ascertain the facts and extent of such failure and, if he shall determine that any failure to perform was occasioned by any one or more of the said causes, the Schedule shall be revised accordingly, subject to the rights of the Authority under GENERAL SECTION 28 - DEFAULT or GENERAL SECTION 34, Paragraph L, TERMINATION FOR CONVENIENCE. There shall be no relief afforded the Contractor, under this subsection 27.E, other than an extension of time for completion of performance or a part thereof.

F. Contractor liabilities under the provisions of this Section 27 shall not exceed ten percent (10%) of the Total Contract Price.

SECTION 28 - DEFAULT

- A. The General Manager, Purchasing, may, subject to the provisions of Section 28.C below, by written notice of default to the Contractor, terminate the whole or any part of this Contract in any one of the following circumstances:
 - 1. If the Contractor fails to make delivery of the Work within the time required by the Contract Documents, Schedule, or any extension thereof; or
 - 2. If the Contractor fails to perform any of the other provisions of this Contract, or so fails to make progress as to endanger performance of this Contract in accordance with its terms, and in either of these two circumstances does not cure such failure within a period of ten (10)

SECTION 28 – DEFAULT (CONT'D)

Working Days (or such longer period as the Contract Officer may authorize in writing) after receipt of notice from the Contract Officer specifying such failure.

- B. In the event the Authority, through the Contract Officer, terminates this Contract in whole or in part as provided in Section 28.A, the Authority may procure, upon such terms and in such manner as the Authority may deem appropriate, Work similar to that so terminated, and the Contractor shall be liable to the Authority for any excess costs for such Work. The Contractor shall continue the performance of this Contract to the extent not terminated under provisions of this Section 28.
- C. Except with respect to defaults of subcontractors, the Contractor shall not be liable for any excess costs if the failure to perform on the Contract arises out of causes beyond the control and without the fault or negligence of the Contractor. Such causes may include, but are not restricted to, acts of God or of the public enemy, acts of the Government or Authority in either its sovereign or contractual capacity, fires, floods, epidemics, quarantine restrictions, and unusually severe weather; but in every case the failure to perform must be beyond the control and without the fault or negligence of the Contractor. If the failure to perform is caused by the default of a subcontractor, and if such default arises out of causes beyond the control of both the Contractor and subcontractor, and without the fault or negligence of either of them, the Contractor shall not be liable for any excess costs for failure to perform, unless the Work to be furnished by the subcontractor was obtainable from other sources in sufficient time to permit the Contractor to meet the applicable time requirement.
- D. If the Contract is terminated as provided in Paragraph (A) of this Section 28, the Contract Officer, in addition to any other rights provided in this Section 28, may require the Contractor to transfer title and deliver to the Authority, in the manner and to the extent directed by the Contract Officer: (i) any completed Work; and (ii) such partially completed supplies and materials, parts, tools, dies, jigs, fixtures, plans, drawings, information and contract rights (hereinafter called "manufacturing materials") as the Contractor has specifically produced or specifically acquired for the performance of such part of this Contract as has been terminated for which the Authority has not already received title as provided under GENERAL SECTION 30 - TITLE TO PROPERTY; and the Contractor shall protect and preserve property in possession of the Contractor with respect to which title has been vested in the Authority, although still in the possession of the Contractor, and shall ship such manufacturing materials and completed Work to a place designated by the Contract Officer FOB freight included destination. Payment for

SECTION 28 – DEFAULT (CONT'D)

completed Cars shall be provided at the price in Contractor's Bid Proposal, including applicable Escalation under GENERAL SECTION 32, <u>ESCALATION CLAUSE FOR OPTIONS</u>. Payment for manufacturing materials delivered to and accepted by the Contract Officer for which the Authority has not paid and received title as provided under GENERAL SECTION 30 - <u>TITLE TO PROPERTY</u>, and for the protection and preservation of property shall be in an amount agreed upon by the Contractor and Authority; failure to agree to such amount shall be a dispute concerning a question of fact within the meaning of SECTION 29 - <u>DISPUTES</u>. The Contract Officer may withhold from amounts otherwise due the Contract officer for such completed Cars or manufacturing materials such sum as the Contract Officer determines to be necessary to protect the Authority against loss because of outstanding liens or claims of former lien holders.

- E. If, after notice of termination of this Contract under the provisions of this Section 28, it is determined for any reason that the Contractor was not in default under the provisions of this Section 28, or that the default was excusable under the provisions of this Section 28, the rights and obligations of the parties shall be the same as if the notice of termination had been issued pursuant to GENERAL SECTION 34, Paragraph L, <u>TERMINATION FOR CONVENIENCE</u>.
- F. The rights and remedies of the Authority provided in this Section 28 shall not be exclusive and are in addition to any other rights and remedies provided by law or under this Contract.
- G. As used in Section 28.C, the terms "subcontractor" and "subcontractors" means subcontractor(s) at any tier.

SECTION 29 - DISPUTES

Any dispute concerning a question of fact arising under the Contract Documents that is not resolved by an agreement between the Authority and the Contractor will be decided by the Contract Officer. The Contract Officer will reduce the decision to writing and send a copy of it by certified mail, return receipt requested, to the Contractor. The decision of the Contract Officer will be final and binding on the Contractor unless, within thirty (30) days after receipt of a copy of a decision, the Contractor sends by certified mail, return receipt requested, a written appeal to the Authority's Vice President, Purchasing and Warehousing. In connection with such an appeal, the Contractor will have an opportunity to be heard and to offer evidence in support of its appeal. The decision of the Vice President, Purchasing and Warehousing will be final and binding on the Contractor unless the Contractor files an action to challenge the decision in a court of competent jurisdiction in Chicago, Illinois and the court determines the decision to be arbitrary and capricious or

SECTION 29 – DISPUTES (CONT'D)

obtained by fraud. If the Contractor does not commence such an action for judicial review within 60 days after the Contractor receives a copy of the decision of the Vice President, Purchasing and Warehousing, the Contractor waives all right to seek judicial review. Nothing in this Section 29 relieves the Contractor from diligently proceeding with the Work under the Contract, as directed by the Authority.

SECTION 30 - TITLE TO PROPERTY

- A. Title to the Property described in this Section 30 shall vest in the Authority. Vestiture shall occur at the earlier of i) when the Authority makes a progress payment including the Property or ii) when the Property is allocated or properly charged to this Contract.
- B. As used in this Section 30, the term "Property" includes all of the following items that are acquired or produced by the Contractor for which progress payments have been made or should be allocated or properly charged to this Contract under sound and generally accepted accounting principles and practices including, without limitations:
 - 1. Parts, materials, inventory, and work in process.
 - 2. Special tooling and special test equipment to which the Authority is to acquire title under any other provision of this Contract.
 - 3. Nondurable (i.e., non-capital) tools, jigs dies, fixtures, molds, patterns, taps, gauges, test equipment, and other similar manufacturing aids, title to which would not be obtained as special tooling under paragraph 2; and
 - 4. Drawings and technical data, to the extent the Contractor or subcontractor(s) are required to deliver them to the Authority by other provisions of this Contract.
- C. The title received by the Authority pursuant to this Section 30 shall be considered to be full legal title with rights to possession, ownership, and transfer and shall not be considered to constitute only a lien on the Property acquired or produced, except that the incidents of holding such title shall be the responsibility of the Contractor, including, without limitation, the payment of taxes and rents that may be an incidence of holding such title. From time to time after the Notice to Proceed has been issued by the Authority, the Contractor and the Authority shall, upon request of the

Authority, execute any documents deemed necessary by the Authority to evidence the legal rights and responsibilities described in the immediately preceding sentence. The Contractor agrees that it will take such action as may be necessary to assure that title to Property received by the Authority pursuant to this Section 30 is free and clear of all liens, security interests and other encumbrances, and further warrants that nothing under the law of its jurisdiction precludes the vesting of title in the Authority in accordance with this Section 30.

Invoices for progress payments shall identify all Property, including, but not limited to, any Work in progress, for which title is transferring to the Authority pursuant to this provision. In addition, Contractor's other books and records shall distinguish Authority-owned property from other property held by Contractor. Authority-owned property shall be labeled as CTA property or otherwise identified to distinguish from other property held by Contractor.

- D. All incidents of title as to which the Contractor retains responsibility under Paragraph C, above, shall be transferred to the Authority upon passage of risk of loss as specified in GENERAL SECTION 25 <u>RISK OF LOSS</u>.
- E. Although title to property is in the Authority under this Section 30, other applicable provisions of this Contract shall determine the handling and disposition of the property. See GENERAL SECTION 25 <u>RISK OF LOSS</u>, GENERAL SECTION 28 <u>DEFAULT</u>, GENERAL SECTION 34.L, <u>TERMINATION FOR CONVENIENCE</u> and/or GENERAL SECTION 34.M, <u>CANCELLATION</u>.
- F. The Contractor may sell any scrap resulting from production under this Contract without requesting the Contract Officer's approval, but the proceed shall be credited against the costs of performance of this Contract.
- G. To acquire for its own use or dispose of property to which title is vested in the Authority under this Section 30, the Contractor must obtain the Contract Officer's advance approval of the action and the terms. The Contractor shall exclude the allocable costs of the above described property from the costs of contract performance.
- H. When the Contractor completes all of the obligations under this Contract, title shall vest in the Contractor for all property (or the proceeds thereof) that has not been:
 - 1. Delivered to, and accepted by, the Authority under this Contract; or

SECTION 30 - TITLE TO PROPERTY (CONT'D)

- 2. Incorporated in supplies delivered to, and accepted by, the Authority under this Contract and to which title is vested in the Authority under this Section 30.
- I. Prior to vesting of title under Subsection H above, the Contractor shall give the Authority the right of first refusal on all drawings, special molds, patterns, dies, tools and other special apparatus required for construction of the Cars under this Contract before such items are sold or scrapped or otherwise disposed of. The Contractor shall also give the Authority the right of first refusal on all excess stock, damaged material and rejected material before such items are sold, scrapped, or otherwise disposed of. The Contract Officer will advise the Contractor, in writing, of what items will be shipped to the Authority.
- J. Unless otherwise agreed to in writing by the Authority, the Authority is entitled to and will receive "Limited Rights" in:
 - 1. All Technical data required to be delivered under this Contract or any subcontract, including, but not limited to: Construction drawings, wiring diagrams and individual circuit schematics, required to be delivered under Section 1.10 and 1.11, of the Technical Specifications, which includes all drawings necessary to convey design concept, operation, overall assembly aspects, maintenance accessibility, and interfaces as specified in GENERAL SECTION 3.G, all stress and dynamic analyses of the Car body structure and trucks, referred to in Section 1.09 of the Technical Specifications; all Car body static test data, referred to in Section 3.01,C, of the Technical Specifications; all truck frame static, dynamic and fatigue test data, referred to in Section 11.07 of the Technical Specifications; all Car Performance Test Data, referred to in Section 16.01, E, of the Technical Specification; and all Noise and Vibration Test Data, referred to in Section 16.02 of the Technical Specifications.
 - 2. All Technical data pertaining to items, components, or processes prepared or required to be delivered under this Contract or any subcontract and which describes the required overall physical, functional, and performance characteristics (along with the qualification requirements, if applicable) of an item, component, or process to the extent necessary to permit identification of physically and functionally interchangeable items.
 - 3. Manuals or instructional materials, detailed manufacturing or process data, and commercial computer software documentation prepared or

SECTION 30 - TITLE TO PROPERTY (CONT'D)

required to be delivered under this Contract or any subcontract necessary for installation, operation, maintenance or training purposes, including those specified in Section 1.12, of the Technical Specifications.

- 4. All computer software, required to be delivered under this Contract or any subcontract.
- 5. Technical data prepared or required to be delivered under this

Contract or any subcontract and constituting corrections or changes to data furnished by the Authority.

K. Limited Rights will remain in effect so long as the technical data remains unpublished and provided that only the portions of each piece of data subject to Limited Rights are identified and the piece of data is marked with a legend entitled "Limited Rights Legend" at the top of each applicable page stating that the data is subject to Limited Rights, specifies the Contract number of this Contract, and identifies the Contractor by name. Notwithstanding anything to the contrary contained in this Section 30.K, if and to the extent any technical data, process data or software described in Section 30. J, above is published, otherwise becomes publicly available or has been released or disclosed by the Contractor or a subcontractor, without restriction on further release or disclosure, then the Authority's rights in all such data, information and software shall automatically become Unlimited Rights.

- L. Definitions
 - 1. "Detailed manufacturing or process data" as used in this Section 30,

means technical data that describes the steps, sequences, and conditions of manufacturing, processing or assembly used by the manufacturer to produce an item or component or to perform a process.

2. "Technical data" as used in this Section 30, means recorded information, regardless of the form or method of the recording of a scientific or technical nature (including computer software documentation), whether produced specifically for this Contract or previously produced by the Contractor or subcontractor. The term does not include data or computer software incidental to Contract administration, such as financial and/or management information.

SECTION 30 - TITLE TO PROPERTY (CONT'D)

- 3. "Unlimited Rights" as used in this Section 30, means a non-exclusive, royalty-free, irrevocable license and right to use, duplicate, release or disclose, Technical data or computer software in whole or in part, in any manner and for any purpose whatsoever, and to have or permit others to do so.
- 4. "Limited Rights" as used in this Section 30, means a non-exclusive, royalty-free, irrevocable license and right to use, duplicate, or disclose Technical data, information or software in whole or in part, by or for the Authority, including use by the Authority for manufacture, with the express limitation that such Technical data shall not, without the written permission of the party asserting limited rights, be released or disclosed outside the Authority or used by a party other than the Authority, except that the Authority may release or disclose Technical data to persons outside the Authority or permit the use of Technical data by such persons, if
 - a. Such release, disclosure, or use is necessary for repair or overhaul of Authority property; and
 - b. Such release, disclosure, or use is made subject to a prohibition that any person to whom the data is released or disclosed may not release, disclose, or use such data for purposes other than performing for the Authority repair or overhaul services; and
 - c. The Contractor or subcontractor asserting the restriction is notified of such release, disclosure, or use.
- M. Technical data and computer software tendered to the Authority with limited

rights shall be clearly marked as "Limited Rights" data and included on a list of such data furnished to the Authority.

N. Any restrictive legend contained on Technical data which is not authorized by this Section 30 or authorized in writing by the Authority may be unilaterally removed by the Authority.

SECTION 31 - [INTENTIALLY LEFT BLANK]

SECTION 32 - ESCALATION CLAUSE FOR OPTIONS

A. The Authority shall have an irrevocable Option to increase the Work to be ordered under the Base Contract, in sequential order, within the timeframes

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set forth under the Bid Proposal, Section II, Part 2 – Optional Purchases. However, if any option exercise timeframe expires without CTA exercising such option, CTA reserves the right to exercise any or all of the remaining options prior to the expiration dates of the remaining options. The exercise of any Option shall be in the Authority's sole and absolute discretion.

- B. The Contractor warrants that the Option prices set forth in this Contract do not include any allowance for any contingency to cover anticipated increased costs of performance to the extent such increases are covered by this economic adjustment clause.
- C. This Section shall be the sole and exclusive measure of adjustment to the Option price for each Option specified in the Bid Proposal, Section II, Part 2 Optional Purchases of this Contract ("BID PROPOSAL BIDDING SUMMARY FORM") without regard to actual changes in the cost or use of labor or materials. The Total Option Price shall be the total price to be paid by the Authority for the Option after adjustment of the Total Option Price pursuant to this Section 32.
- D. Adjustment to the Total Option Price, upward or downward, for changes in labor indices shall be made one time only based upon the change in the following labor indices, or their equivalent by heading determined and reported monthly:
 - Manufacturing (Series I.D. eeu30000033)
 - Electronic and electrical equipment (Series I.D. eeu3133400033)
 - Transportation equipment (Series I.D. eeu3133600033)
- E. The above indices appear in the publication "Employment, Hours, and Earnings" published by the U.S. Department of Labor, Bureau of Labor Statistics under the heading "Average Hourly Earnings, Excluding Overtime." This referenced publication can be found on the Bureau of Labor Statistics website at <u>www.bls.gov.</u>
- F. Adjustment to the Total Option Price, upward or downward, for changes in material indices shall be made one time only based upon the change in the following material indices, or their equivalent by heading determined and reported monthly:
 - Durable manufacturing (Series I.D. wpusop2130)
 - Capital equipment (Series I.D. wpusop3200)
- G. The above indices appear in the publication "Producer Price index" published by the U.S. Department of Labor, Bureau of Labor Statistics under the

SECTION 32 - ESCALATION CLAUSE FOR OPTIONS (CONT'D)

heading "Stage of Processing." This referenced publication can be found on the Bureau of Labor Statistics website at <u>www.bls.gov.</u>

- H. The adjustment to the Total Option Price shall be based solely on changes in the labor and material indices identified herein. For the purposes of this paragraph:
 - a. 40% of the Total Option Price shall be deemed to constitute the labor cost subject to adjustment.
 - b. 50% of the Total Option Price shall be deemed to constitute the material cost subject to adjustment.
 - c. No labor or material adjustment will be made on 10% of the Total Option Price.
 - d. Adjustments based on changes in the labor and material indices shall be computed for the period from the time of the Notice to Proceed (NTP) or the end of the Bid Validity Period, whichever comes first (base indices) to the time of exercise of the Option (current indices) as set forth in Section 32.
 - e. The base average labor index and the base average material index are the arithmetic averages of the base labor and material indices for the last two calendar quarters preceding the date of NTP of this Contract (or the end of the Bid Validity period), as computed below:

Base Average Labor Index:

Manufacturing Series ID: eeu30000033 Electronic Series ID: eeu3133400033 Trans Equip Series ID: eeu3133600033

<u>M1</u>	<u>M2</u>	<u>M3</u>	<u>M4</u>	<u>M5</u>	<u>M6</u>	Avg

Base Average Material Index:

Cap Equip - Series ID: wpusop3200 Durable Mfg - Series ID: wpusop2130

<u>M1</u>	<u>M2</u>	<u>M3</u>	<u>M4</u>	<u>M5</u>	<u>M6</u>	<u>Avg</u>
					a	

f. The current average labor index and the current average material index shall be the arithmetic averages, computed in the same manner as in paragraph H above, of the current labor and material indices for the last two (2) calendar quarters preceding the date of exercise of the Option.

SECTION 32 - ESCALATION CLAUSE FOR OPTIONS (CONT'D)

- I. For Change Orders which have an impact on the Option price and are executed after the Date of Award and before exercise of the Option, the Total Option Price will be adjusted in the following manner: Escalation on the value of the Change Order shall be calculated on an Option for the duration of time elapsed between the Change Order and the exercise of the Option, not back to the end of the Bid Validity Period or NTP. (Example: If a Change Order is executed in Year 2 of the contract performance period, and an Option is exercised in Year 5, three (3) years of escalation will be calculated and added to the adjusted Option Price (i.e., after escalation has been calculated on the option price in the Bid Proposal). The base indices (for both material and labor) used will be the last two calendar quarters preceding the date of the Change Order.
- J. In the event the US Department of Labor, Bureau of Labor Statistics discontinues determining an index cited in this Contract, the parties shall mutually agree upon the appropriate substitute for the discontinued index for use in determining the price adjustments described herein.
- K. In the event the US Department of Labor, Bureau of Labor Statistics alters its method of calculating an index cited herein (including a change in the base period), appropriate adjustments in the affected index shall be agreed upon by the parties, to put it on a comparable basis with the index as calculated before the change.

SECTION 33 – ORDER OF PRECEDENCE

The Contract Documents for this Contract shall consist of the following component parts, listed in their order of precedence, with the item of greatest precedence listed first:

- 1. All Addenda, and Contract Change Orders, the most recent in time taking precedence
- 2. General Specifications
- 3. Instructions to Bidders
- 4. Technical Specifications,
- 5. Plans and Drawings, if any
- 6. Contractor's Bid Proposal
- 7. Insurance Requirements

SECTION 33 – ORDER OF PRECEDENCE (CONT'D)

The foregoing order of precedence shall govern the interpretation of the Contract Documents in all cases of conflict or inconsistency therein.

SECTION 34 - GENERAL GOVERNMENT REQUIREMENTS

- A. This Contract is subject to financial assistance contracts between the Federal Transit Administration (FTA), the Regional Transportation Authority (RTA), the State of Illinois Department of Transportation (IDOT) and the Authority.
- B. The Contractor agrees to comply with all federal "Buy America" requirements applicable to this Contract as set forth in 49 U.S.C. §5323(j) and 49 CFR Parts 661-663. For rolling stock, the cost of Components produced in the U.S. must be at least sixty percent (60%), and one hundred percent (100%) of final assembly must occur in the U.S. With respect to all other deliverables, steel, iron, and manufactured products are to be produced in the United States, unless a waiver has been granted by FTA or the product is subject to a general or specific waiver.

In addition to the pre-award and post-delivery audits required by 49 U.S.C. 5323(m) and 49 CFR Part 663 to verify compliance, the Contractor agrees to interim audits to be conducted by the Authority, subject to reasonable notice to the Contractor.

C. Excluded Parties List - Contractor agrees to check the Federal Excluded Parties List System ("EPLS"), and to require its subcontractors to check the EPLS, prior to subcontracting any services or products purchased under this Contract. Contractor agrees, and shall require its subcontractors to agree, that any "person" as defined in 49 CFR 29.985 who is excluded pursuant to 49 CFR Part 29 shall not provide any Work, products or services under this Contract.

D. [INTENTIONALLY LEFT BLANK]

- E. Civil Rights.
 - <u>Nondiscrimination</u>. In accordance with Title VI of the Civil Rights Act, as amended, 42 U.S.C. § 2000d, Section 303 of the Age Discrimination Act of 1975, as amended, 42 U.S.C. § 6102, Section 202 of the Americans with Disabilities Act of 1990, 42 U.S.C. §12132, and Federal transit law at 49 U.S.C. § 5332, the Contractor

agrees that it will not discriminate against any employee or applicant on the basis of race, color creed, national origin, sex, age, or disability. In addition, the Contractor agrees to comply with applicable Federal implementing regulations and other implementing requirements FTA may issue.

- 2. <u>Equal Employment Opportunity</u>. The following equal employment opportunity requirements apply to this Contract:
 - Race, Color, Creed, National Origin, Sex. In accordance with a. Title VII of the Civil Rights Act, as amended, 42 U.S.C. § 2000e, and Federal transit laws at 49 U.S.C. § 5332, the Contractor agrees to comply with all applicable equal employment opportunity requirements of U.S. Department of Labor (U.S. DOL) regulations, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor," 41 CFR Parts 60 et seq., (which implement Executive Order No. 11246, "Equal Employment Opportunity," as amended by Executive Order No. 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," 42 U.S.C. § 2000e note), and with any applicable Federal statutes, executive orders, regulations, and Federal policies that may in the future affect construction activities undertaken in the course of the Work. In addition, the Contractor agrees to comply with all implementing requirements FTA may issue.
 - b. <u>Age</u>. In accordance with Section 4 of the Age Discrimination in Employment Act of 1967, as amended, 29 U.S.C. § 623 and Federal transit law at 49 U.S.C. § 5332, the Contractor agrees to refrain from discrimination against present and prospective employees for reason of age. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.
 - c.
- <u>Disabilities</u>. In accordance with Section 102 of the Americans with Disabilities Act, as amended, 42 U.S.C. §

12112, the Contractor agrees that it will comply with the requirements of U.S. Equal Employment Opportunity Commission, "Regulations to Implement the Equal Employment Provisions of the Americans with Disabilities Act," 29 CFR Part 1630, pertaining to employment of persons

with disabilities. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

- 3. During the performance of this Contract, the Contractor agrees as follows:
 - a. The Contractor will not discriminate against any employee or applicant for employment because of race, color, creed, sex, disability, age, or national origin. The Contractor must take affirmative action to ensure that applicants are employed and that employees are treated, during employment, without regard to their race, color, creed, sex, disability, age, or national origin. Such action will include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Contract Officer setting forth the provision of this nondiscrimination clause.
 - b. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, creed, sex, disability, age, or national origin.
 - c. The Contractor will send to each labor union or representative of workers with whom the representative has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the Authority's General Manager, Purchasing, advising the labor union or workers' representative of the Contractor's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, and will post copies of the notice in conspicuous places available to employees and applicants for employment.
 - d.

The Contractor will comply with all provisions of Executive Order No. 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

The Contractor will furnish all information and reports required by Executive Order No. 11246 of September 24,

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1965, and by the rules, regulations and orders of the Secretary of Labor, or pursuant thereto, and will permit access to its books, records, and accounts by the Authority and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulation and orders.

In the event of the Contractor's noncompliance with the nondiscrimination clauses of this Contract or with any of such rules, regulations, or orders, this Contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, and such other sanctions may be imposed and remedies applied as provided in Executive Order No. 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

The Contractor must include the provisions of the above Paragraphs (a) through (f) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, so that such provision will be binding upon each subcontractor or vendor. The Contractor must take such action with respect to any subcontract or purchase order as the Authority may direct as a means of enforcing such provisions including sanctions for noncompliance, provided, however, that in the event the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the Federal Government contracting agency, the Contractor may request the Unites States to enter into such litigation to protect the interests of the United States.

- 4. The Contractor also agrees to include these requirements in each subcontract financed in whole or in part with Federal assistance provided by FTA, modified only if necessary to identify the affected parties.
- F. Illinois Human Rights Act.

During the term of this Contract, the Contractor must:

- 1. Refrain from unlawful discrimination and discrimination based on citizenship status in employment and undertake affirmative action to assure equality of employment opportunity and eliminate the effects of past discrimination;
- 2. Comply with the procedures and requirements of the Illinois Department of Human Rights' regulations concerning equal employment opportunities and affirmative action;
- 3. Provide such information, with respect to its employees and applicants for employment, and assistance as the Department may reasonably request from time to time;
- 4. Have written sexual harassment policies that must include, at a minimum, the following information: (i) the illegality of sexual harassment; (ii) the definition of sexual harassment under State law; (iii) a description of sexual harassment, utilizing examples (iv) Contractor's internal complaint process including penalties; (v) the legal recourse, investigative and complaint process available through the Illinois Department of Human Rights and the Illinois Human Rights Commission; (vi) directions on how to contact the Illinois Department of Human Rights and the Illinois Human Rights Commission; and (vii) protection against retaliation as provided in Section 6-101 of the Illinois Human Rights Act (775 ILCS 5/2-105). A copy of the policies must be provided to the Illinois Department of Human Rights upon request;
- 5.

The Contractor must include verbatim or by reference, the provisions of this Section in every subcontract it awards under which any portion of its obligations under this Contract are undertaken or assumed, so that such provisions will be binding upon such Subcontractor. In the same manner as with other provisions of this Contract, Contractor must be liable for such Subcontractor's compliance with applicable provisions of this clause; and further it will promptly notify the Authority and the Illinois Department of Human Rights in the event that any Subcontractor fails or refuses to comply therewith. In addition, the Contractor must not utilize any Subcontractor declared by the Illinois Human Rights Commission to be ineligible for contracts or subcontracts with the State of Illinois or any of its political subdivisions or municipal corporations.

- G. [Intentionally left blank]
- H. Energy Conservation Requirements The Contractor agrees to comply with

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mandatory standards and policies relating to energy efficiency, which are contained in the State energy conservation plan issued in compliance with the Energy Policy and Conservation Act (42 U.S.C. 6321 et seq).

The Contractor agrees to include the requirements in all subcontracts.

I. Specific Materials and/or Specific Equipment - Wherever in the Contract Documents an article, equipment or material is defined by describing a proprietary product or by using the name of a manufacturer or vendor or trade name including catalog numbers and/or drawing numbers, the term "or equal" if not inserted shall be implied. The specific article, equipment or material mentioned shall be understood as establishing the type, function and minimum standard of design, efficiency, quality and performance desired shall not be construed in such a manner as to exclude manufacturer's products of comparable design, efficiency, quality and performance. The Engineer shall decide whether or not the article, equipment or material proposed by the Contractor is equal to that specified in the Specification.

J. Cargo Preference - Use of United States - Flag Vessels.

The Contractor agrees:

- 1. To utilize privately owned United States flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved, whenever shipping any equipment, materials or commodities pursuant to this Contract, to the extent such vessels are available at fair and reasonable rates for United States-flag commercial vessels.
- 2. To furnish within 20 days following the date of loading for shipments originating within the United States, or within 30 working days following the date of loading for shipments originating outside the United States, a legible copy of a rated, "on-board" commercial ocean bill-of-lading in English for each shipment of cargo described in paragraph (1) above to the Grantee (through the prime contractor in the case of subcontractor bill-of-lading) and to the Division of National Cargo, Office of Market Development, Maritime, Administration, 400 Seventh Street, S.W., Washington, D.C. 20590, marked with appropriate identification of the Project.

To include these requirements in all subcontracts issued pursuant to this Contract when the subcontract may involve the transport of equipment, material or commodities by ocean vessel.

3.

K. Patent Rights and Subject Data.

In addition to the rights under GENERAL SECTION 30 - <u>TITLE TO</u> <u>PROPERTY</u>, if any invention, improvement, or discovery of the Contractor is conceived or first actually reduced to practice in the course of or under the Work, and that invention, improvement, or discovery is patentable under the laws of the United States of America or any foreign country, the Contractor agrees to notify the Authority immediately and provide a detailed report. Contractor irrespective of its status or the status of any subcontractor at any tier (i.e., large business, small business, non-profit organization, institution) agrees to grant the Authority and the Federal Government upon request a non-exclusive, royalty-free and irrevocable license to use that patentable invention, improvement, or discovery as Limited Rights.

L. Termination for Convenience.

The Authority may terminate this Contract, in whole or in part, at any time, when it is in the Authority's best interest. If the Authority decides to terminate the Contract, the Contract Officer, will send a written Notice of Termination for Convenience to the Contractor specifying the extent to which performance of Work under the Contract is terminated. Such Notice will be effective on the date of receipt. The Contractor shall then restrict its activities, and those of its Subcontractors, to winding down its Work. No payment will be made for Work performed after the Notice of Termination becomes effective, except for winding down activities specified in the termination notice and as provided in this Section.

- 1. Obligations of the Contractor Upon Termination for Convenience. After receipt of a Notice of Termination for Convenience, except as otherwise directed by the Authority, the Contractor must do the following:
 - a. Transfer title and deliver to the Authority in the manner, at the times, and to the extent directed by the Authority, parts, work in process, completed Work, supplies and other material procured as a part of, or acquired in connection with the performance of, the Work terminated by the Notice of Termination, as well as the completed or partially completed plans, drawings, information, and other property, which if the Contract had been completed, would have been required to be furnished to the Authority;
 - b. Use its best efforts to sell, in the manner, at the times, to the extent and at the price or prices directed or authorized by the

Authority, property of the types referred to in (a) above; provided, however, that the Contractor (i) shall not be required to extend credit to any purchaser, and (ii) may acquire any such property under the conditions prescribed by and at a price or prices approved by the Authority; provided, further, that the proceeds of any such transfer or disposition will be applied in reduction of any payments to be made by the Authority to the Contractor under the Contract or will otherwise be credited to the price or cost of the Work covered by the Contract or paid in such other manner as the Authority may direct;

- c. Complete performance of each part of the Work that was not terminated by the Notice of Termination for Convenience in accordance with the Contract;
- d. Take such action as may be necessary, or as the Authority may direct, for the protection and preservation of the property related to this Contract which is in the possession of the Contractor and in which the Authority has or may acquire an interest; and
- e. Comply with all other requirements of the Authority as may be specified in the Notice of Termination for Convenience.
- 2. Termination Claim. After receipt of a Notice of Termination for Convenience, the Contractor shall submit to the Contract Officer its termination Claim, in the form and with certification prescribed by the Authority. Such claim shall be submitted promptly, but no later than 150 days after the receipt of the Notice of Termination from the Authority.
- 3. Agreement As to Amount to be Paid. Subject to the provisions of Paragraph 2 of this Sub-section, the Contractor and the Authority may agree upon the whole or part of the amount or amounts to be paid to the Contractor by reason of the total or partial termination of Work for convenience pursuant to this Section, which amount or amounts may include an allowance for profit solely on Work done; provided that such agreed amount or amounts, exclusive of settlement costs, shall not exceed the portion of the Total Contract Price related to the Work completed by the Contractor immediately prior to the Notice of Termination, adjusted to account for defective Work not remedied as reduced by the amount of payments otherwise made. The Contract

4.

will be amended accordingly, and the Contractor will be paid the agreed amount. Nothing in Paragraph 4 of this Sub-section (prescribing the amount to be paid to the Contractor in the event of failure of the Contractor and the Authority to agree upon amount to be paid to the Contractor by reason of the termination of Work pursuant to this subsection) shall be deemed to limit, restrict, or otherwise determine or affect the amount or amounts which may be agreed upon to be paid to the Contractor pursuant to this Paragraph 3.

Determination As to Amount to be Paid. In the event of failure of the Contractor and the Authority to agree, as provided in Paragraph 3, upon the whole amount to be paid the Contractor by reason of the termination of Work for convenience pursuant to this Sub-section, the Authority will pay the Contractor the amounts determined by the Authority as follows, but without duplication of any amounts agreed upon in accordance with Paragraph 3, with respect to Work performed prior to the effective date of the Notice of Termination for Convenience, the total (without duplication of any items) of:

- a. The portion of the Total Contract Price related to the Work completed by the Contractor immediately prior to the Notice of Termination, adjusted to account for defective Work not remedied;
- b. The cost of settling and paying claims arising out of the termination of Work under subcontracts or orders, exclusive of the amounts paid or payable on account of supplies or materials delivered or services furnished by the Subcontractor prior to the effective date of the Notice of Termination of Work under the Contract, which amounts shall be included in the cost on account of which payment is made under (a) above;
- c. The reasonable cost of the preservation and protection of property incurred pursuant to Paragraph 1.d and any other reasonable cost incidental to termination of Work under the Contract, including expense incidental to the determination of the amount due to the Contractor as the result of the termination of Work under the Contract.
- d. In no event shall the Authority be responsible for unabsorbed or under-absorbed overhead as part of termination claims under this sub-section.

- 5. Deductions from Amount to be Paid. In arriving at the amount due the Contractor under this Sub-section, there will be deducted, (1) any claim which the Authority may have against the Contractor in connection with the Contract including but not limited to a credit for defective Work and (2) the agreed price for, or the proceeds of sale of, materials, supplies or other things acquired by the Contractor or sold, pursuant to the provisions of this subsection, and not otherwise recovered by or credited to the Authority.
- 6. Partial Termination. If the termination hereunder is partial, prior to the settlement of the terminated portion of this Contract, the Contractor may file with the Authority a request in writing for an adjustment of the price or prices specified in the Contract relating to the continued portion of the Contract (the portion not terminated by the Notice of Termination for Convenience), and such adjustment as may be agreed upon will be made in such price or prices.
- 7. Payments on Account of Termination Payment. The Authority may from time to time, under such terms and conditions as it may prescribe and in its sole discretion, make partial payments on accounts against cost incurred by the Contractor in connection with the terminated portion of the Contract whenever in the opinion of the Authority the aggregate of such payments shall be within the amount to which the Contractor will be entitled hereunder. If the total of such

payments is in excess of the amount finally agreed or determined to be due under this Section, such excess shall be payable by the Contractor to the Authority upon demand together with interest at a rate equal to the highest rate permitted by applicable law.

- Preservation of Records. Unless otherwise provided for in the Contract or by applicable statute, the Contractor, from the effective date of termination and for a period of three (3) years after final settlement under the Contract, shall preserve and make available to the Authority at all reasonable times at the office of the Contractor but without direct charge to the Authority, all its books, records, documents, electronic data, and other evidence bearing on the costs and expenses of the Contractor under the Contract and relating to the Work terminated hereunder, or to the extent approved by the Authority, microfilm, microfiche, or other authentic reproductions thereof.
- 9. Flow Through to Subcontractors. The Contractor shall insert in all subcontracts that the Subcontractor shall stop Work on the date of and

8.

to the extent specified in a Notice of Termination for Convenience from the Authority and shall require that any tier Subcontractors insert the same provision in any tier subcontracts. The Contractor shall communicate, immediately upon receipt thereof, any Notice of Termination for Convenience issued by the Authority to the affected Subcontractors of any tier.

- 10. No Other Payments; No Damages. Under no circumstances is the Contractor entitled to anticipatory, unearned profits or consequential damages as a result of a termination or partial termination under this Section. The payment to the Contractor determined in accordance with this Section constitutes its exclusive remedy for a termination hereunder.
- 11. No Waiver. Anything contained in the Contract to the contrary notwithstanding, a termination under this sub-section shall not waive any right or claim to damages that the Authority may have and the Authority may pursue any cause of action that it may have under the Contract.
- M. Cancellation "Cancellation" as used in this subsection, means that the Authority is canceling its requirements for all items and/or Work in program years subsequent to that in which notice of cancellation is provided. Cancellation shall occur, if the General Manger, Purchasing notifies the Contractor in writing that funds are not available for further contract performance for any subsequent Capital program year. Cancellation notice shall be provided pursuant to GENERAL SECTION 34.II <u>GENERAL</u> <u>GOVERNMENT REQUIREMENTS</u>, Notice.

The cancellation charge shall be computed and the claim made for same shall be determined as if the claim were being made under the "Termination For Convenience" clause stipulated in GENERAL SECTION 34.L - <u>GENERAL</u> <u>GOVERNMENT REQUIREMENTS</u>, Termination For Convenience.

- N. Clean Water
 - 1. The Contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Federal Water Pollution Control Act, as amended, 33 U.S.C. 1251 et <u>seq</u>. The Contractor agrees to report each violation to the Authority and understands and agrees that the Authority will, in turn, report each violation as required to assure notification to FTA and the appropriate EPA Regional Office.

- 2. The Contractor also agrees to include these requirements in each subcontract exceeding \$100,000
- O. Recycled Products The Contractor agrees to comply with all the requirements of Section 6002 of the Resource Conservation and Recovery Act (RCRA), as amended (42 U.S.C 6962), including but not limited to the regulatory provisions of 40 CFR Part 247, and Executive Order 12873, as they apply to the procurement of the items designated in Subpart B of 40 CFR Part 247.

The Contractor agrees to include this requirement in all subcontracts.

P. No Obligation by the Federal Government IDOT or RTA- The Contractor acknowledges and agrees that notwithstanding any concurrence by the Federal Government, IDOT or RTA in or approval of the solicitation or award of the underlying Contract, absent the express written consent by the Federal Government IDOT or RTA, the Federal Government, IDOT or RTA are not a parties to this Contract and shall not be subject to any obligations or liabilities to the Contractor, or any other party pertaining to any matter resulting from the underlying Contract.

The Contractor agrees to include this requirement in all subcontracts.

- Q. Privacy Act The following requirements apply to a Contractor and its employees that administer any system or records on behalf of the Federal Government under any Contract.
 - 1. The Contractor agrees to comply with, and assure the compliance of its employees with, the information restrictions and other applicable requirements of the Privacy Act of 1974, 5 USC subsection 552a. The Contractor agrees to obtain the express consent of the Federal Government before the Contractor or its employees operate a system of records on behalf of the Federal Government. The Contractor understands that the requirements of the Privacy Act, including the civil and criminal penalties for violations of that Act, apply to those individuals involved, and that failure to comply with the terms of the Privacy Act may result in termination of the underlying Contract.
 - 2. The Contractor also agrees to include these requirements in each subcontract to administer any system of records on behalf of the Federal Government financed in whole or in part with FTA funding.

- R. Access to Records and Reports The following access to records requirement apply to this Contract.
 - 1. The Contractor agrees to provide the Authority, FTA, IDOT, RTA, and the Comptroller General of the United States or any other authorized representatives access to any books, documents, papers and records of the Contractor, which are directly pertinent to this Contract for the purposes of making audits, examination, excerpts, and transcriptions from the date of this agreement through and until the expiration of five years after completion of this agreement. Contractor also agrees, pursuant to 49 C.F.R. 633.17 to provide the FTA Administrator or his authorized representatives access to Contractor's records and construction sites pertaining to a major capital project defined at 49 U.S.C. 5302 (a)1, which is receiving federal financial assistance through the programs described at 49 U.S.C. 5307, 5309 or 5311. By definition, a major capital project excludes contracts of less than the simplified acquisition threshold currently set at \$100,000.
 - 2. For any contract for a capital project or improvement entered into which was not the result of competitive bidding, the Contractor shall make available records related to the Contract to the Authority, FTA, IDOT, RTA and the Comptroller General or any authorized officer or employee of any of them for the purposes of conducting an audit andinspection.
 - 3. The Contractor agrees to permit the authorized representatives to reproduce by any means whatsoever or to copy excerpts and transcriptions as reasonably needed.
 - 4. The Contractor agrees to maintain all books, records, documents, accounts and reports and other evidence required under this Contract, except in the event of litigation of settlement of claims arising from the performance of this Contract, in which case Contractor agrees to maintain same under the Authority, FTA Administrator, Comptroller General, or any of their duly authorized representatives, until all such litigation, appeals, claims, or exceptions related thereto have been disposed.
 - 5. No provision in this agreement granting the CTA a right of access to records and documents is intended to impair, limit or affect any right of access to such records and documents which the CTA would have had in the absence of such provisions.

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S. Fraud and False or Fraudulent Statements or Related Acts - The Contractor acknowledges that the provisions of the Program Fraud Civil Remedies Act of 1986, as amended, 31 U.S.C. subsection 3801 <u>et seq</u> and U.S. Department of Transportation and FTA regulations. Program Fraud Civil Remedies 49 C.F.R. Part 31, apply to its actions pertaining to this Contract.

By submitting a Bid and execution of the Contract, the Contractor certifies or affirms the truthfulness and accuracy of any statement it has made, it makes, it may take, or causes to be made, pertaining to the Contract Documents. In addition to other penalties that may be applicable the Contractor further acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification, the Federal Government reserves the right to impose the penalties of the Program Fraud Civil Remedies Act of 1986 on the Contractor. The Contractor also acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification to the Federal Government under a contract connected with a project that is financed in whole or in part with Federal assistance originally awarded by FTA under the authority of 49 U.S.C. subsection 5307, the Government reserves the right to impose the penalties of 18 U.S.C. subsection 5307, the Government reserves the right to impose the penalties of 18 U.S.C., subsection 1001 and 49 U.S.C. subsection 5307 (n)(1) on the Contractor, to the extent the Federal Government deems appropriate. The Contractor agrees to include the above language in each subcontract without modification, except to identify the subcontractor who will be subject to the provisions.

- T. Clean Air (1) The Contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act, as amended, 42 U.S.C. (7401 et seq). The Contractor agrees to report each violation to the Authority and understands and agrees that the Authority will, in turn, report each violation as required to assure notification to FTA and the appropriate EPA Regional Office. (2) The Contractor also agrees to include these requirements in each subcontract exceeding \$100,000.
- U. Federal, IDOT and RTA Changes Contractor shall at all times comply with all applicable FTA regulations, policies, procedures and directives, including without limitation those listed directly or by reference in the FTA Master Agreement (FTA MA (18) dated October, 2011) between the Authority and FTA, as they may be amended or promulgated from time to time during the term of this Contract. Contractor's failure to so comply shall constitute a material breach of this Contract.

The Contractor agrees to include this requirement in all subcontracts.

- V. Foreign Trade Restrictions The Contractor or Subcontractor certifies that it:
 - 1. Is not owned or controlled by one or more citizens of a foreign country included in the list of countries that discriminate against U.S. firms published by the Office of the United States Trade Representatives (USTR);
 - 2. Has not knowingly entered into any Contract or Subcontract for this Project with a person that is a citizen or national of a foreign country on said list, or is owned or controlled directly or indirectly by one or more citizens or nationals of a foreign country on said list; or
 - 3. Has not procured any product nor subcontracted for the supply of any product for use on the Project that is produced in a foreign country on said list.

Unless the restrictions of this clause are waived by the Secretary of Transportation in accordance with 49 CFR Part 30.17, no Contract will be awarded to a Subcontractor who is unable to certify to the above. If the Contractor knowingly procures or subcontracts for the supply of any product or service of a foreign country on said list for use on the Project, the FTA may direct, through the Authority, cancellation of the Contract at no cost to the Government or the Authority. Further, Contractor agrees that it will incorporate this provision for certification without modification in each subcontract. The Contractor may rely on the certification of a prospective subcontractor unless the Contractor has knowledge that the certification is erroneous. The Contractor will provide immediate written notice to the Authority if it learns that its certification or that of a Subcontractor was erroneous when submitted or has become erroneous by reason of changed circumstances.

Further, the Contractor will provide immediate written notice to the Authority if the Contractor learns that its certification or that of a Subcontractor was erroneous when submitted or has become erroneous by reason of changed circumstances.

Each Subcontractor must agree to provide written notice to the Contractor if at any time it learns that its certification was erroneous by reason of changed circumstances.

This certification is a material representation of fact upon which reliance was placed when making the Contract award. If it is later determined that the Contractor or any Subcontractor of any tier knowingly rendered an erroneous certification, the FTA may direct, through the Authority, cancellation of the Contract or subcontract for default at no cost to the Federal Government or the Authority.

Nothing contained in the foregoing will be construed to require establishment of a system of records in order to render, in good faith, the certification required by this provision. The knowledge and information of a Contractor is not required to exceed that, which is normally possessed by a prudent person in the ordinary course of business dealings.

This certification concerns a matter within the jurisdiction of an agency of the United States of America, and making of a false, fictitious, or fraudulent certification may render the maker subject to prosecution under Title 18, U.S.C., Provision 1001.

W. [INTENTIONIALLY LEFT BLANK]

- X. Prompt Payment to Subcontractors.
 - The Contractor is required to pay all Subcontractors for all work that the Subcontractor has satisfactorily completed, no later than seven (7) Working Days after the Contractor has received payment from the Authority. All of the Contractor's contracts with its Subcontractors must state that the Subcontractor will receive payment within seven (7) calendar days of the date that the Contractor has received payment from CTA.
 - 2. In addition, all Retainage amounts must be paid by the Contractor to the Subcontractor no later than fourteen (14) Working Days after the Subcontractor has, in the opinion of the Engineer, satisfactorily completed its portion of the Work. All of the Contractor's contracts with its Subcontractors must state that the Subcontractor will receive payment of Retainage within fourteen 14 calendar days of the date that the Subcontractor has, in the opinion of CTA's authorized representative, satisfactorily completed its portion of the Work.
 - 3. A delay in or postponement of payment to the Subcontractor requires good cause and prior written approval of the General Manager, Purchasing.

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- 4. The Contractor is required to include, in each subcontract, a clause requiring the use of appropriate arbitration mechanisms to resolve all payment disputes.
- 5. The Authority will not pay the Contractor for work performed unless and until the Contractor ensures that the Subcontractors have been promptly paid for the work they have performed under all previous payment requests, as evidenced by submitting a statement with the Authority of canceled checks (if requested). The Contractor must submit a prompt payment affidavit, (form to be provided by the disputhority) that it has complied with the prompt payment requirements, which identifies each subcontractor and the date and amount of the last payment to such subcontractor, with every payment request filed with the Authority, except for the first payment request, on every contract with the Authority.
- 6. Failure to comply with these prompt payment requirements is a breach of the Contract which may lead to any remedies permitted under law, including, but not limited to, Contractor debarment. In addition, Contractor's failure to promptly pay its Subcontractors is subject to the provisions of 50 ILCS 505/9.
- Y. Co-operation by Parties The parties hereby agree to use their best efforts and good faith in the performance of this Contract and to co-operate with each other in the completion of the Work hereunder. The Contractor further agrees to implement such measures as may be necessary to ensure that its staff and its subcontractors will be bound by the provisions of this Contract. The Authority will be expressly identified as third party beneficiary in the subcontracts and granted a direct right of enforcement thereunder.
- Z. Incorporation of FTA, IDOT and RTA Terms.

The preceding provisions include, in part, certain Standard Terms and Conditions required by the U.S. Department of Transportation (DOT), RTA and IDOT whether or not expressly set forth in the preceding contract provisions. All contractual provisions required by DOT, as set forth in the latest revision of FTA Circular 4220.1F, dated November 1, 2008 (revised February 15, 2011), as it may be amended from time to time, are hereby incorporated by reference. Anything to the contrary herein notwithstanding, all FTA, IDOT and RTA mandated terms will be deemed to control in the event of a conflict with other provisions contained in this Contract. The Contractor must not perform any act, fail to perform any act, or refuse to comply with any Authority requests that would cause the Authority to be in

violation of the FTA, RTA and IDOT terms and conditions.

The Contractor agrees to include this requirement in all subcontracts.

AA. Obligation to Comply with the Illinois State Officials and Employees Ethics Act.

The Contractor agrees to comply with all applicable requirements of the Illinois State Officials and Employees Ethics Act, 5 ILCS 430/1-1 et seq, ("Ethics Act"), as it may be amended from time to time, the applicable provisions of which are incorporated into this Contract to the same force and effect as if set forth in full herein. As required by the Ethics Act, as amended, the Contractor agrees to cooperate fully and expeditiously with the State Office of the Executive Inspector General in all investigations. This obligation applies to all officers, directors, agents, partners, employees, and subcontractors of the Contractor.

BB. Authority Ethics Ordinance.

Contractor agrees to comply with the CTA Ethics Ordinance, CTA Ordinance No. 004-76, as amended from time to time, the provisions of which are hereby incorporated into this Contract. The Contractor agrees that, as provided by Section 5.3 of the CTA Ethics Ordinance, any contract negotiated, entered into, or performed in violation of any of the provisions of the Ethics Ordinance shall be voidable as to the Authority at the election of the Authority.

CC. [INTENTIALLY LEFT BLANK]

- DD. Conflict of Interest.
 - 1. No Board member, officer or employee of the Authority or other unit of local government, who exercises any functions or responsibilities in connection with the carrying out of the Work or the carrying out of the Work to which this Contract pertains, may have any personal interest, direct or indirect, in this Contract or the proceeds thereof.
 - 2. In accordance with 41 USC §22, the Contractor agrees that no member of or Delegate to the Congress of the United States, or the Illinois General Assembly and no members of the Chicago Transit Board or Authority employees, may be admitted to any share or part of this Contract or to any private financial interest, profit, or benefit arising herefrom.
SECTION 34 - GENERAL GOVERNMENT REQUIREMENTS (CONT'D)

3. The Contractor covenants that it, its officers, directors and employees, and the officers, directors, and employees of such of its members if a joint venture, and subcontractors presently have no interest and must not acquire any interest, direct or indirect, in the Work to which this Contract pertains, which would conflict in any manner or degree with the performance of the Work hereunder. The Contractor further covenants that in the performance of this Contract, no person having any such interest must be employed by the Contractor.

The Contractor is prohibited from performing any Work or services for the Authority under this Contract that conflict with work or services that the Contractor performs under any other contract with the Authority. Such conflicts include, but are not limited to, design work for the Project under another contract, supervision or management for the Project under another contract, and review or audit work for the Project under another contract. The restrictions in this paragraph are applicable to all subcontractors. The Contractor has sole responsibility for compliance with this provision. Any violation of this provision is a material breach of the Contract, which is cause for termination.

EE. Recovered Materials.

The Contractor agrees to comply with all the requirements of Section 6002 of the Resource Conservation Recovery Act (RCRA), as amended (42 USC § 6962), including but not limited to the regulatory provisions of 40 CFR Part 247, and Executive Order 12873, as they apply to the procurement of the items designated in Subpart B of 40 CFR Part 247.

This requirement applies to all procurement actions involving items designated by the EPA, where the Contractor purchases \$10,000 or more of one of these items in a fiscal year, or when the cost of such items purchased during the previous fiscal year was \$10,000.

FF. Fly America.

The Contractor agrees to comply with 49 U.S.C. 40118 (the "Fly America" Act) in accordance with the General Services Administration's regulations at 41 CFR Part 301-10, which provide that recipients and subrecipients of Federal funds and their contractors are required to use U.S. Flag air carriers for U.S. Government-financed international air travel and transportation of their personal effects or property, to the extent such service is available, unless travel by foreign air carrier is a matter of necessity, as defined by the Fly America Act. The Contractor must submit, if a foreign air carrier was

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used, an appropriate certification or memorandum adequately explaining why service by a U.S. flag air carrier was not available or why it was necessary to use a foreign air carrier and must, in any event, provide a certificate of compliance with the Fly America requirements. The Contractor agrees to include the requirements of this section in all subcontracts that may involve international air transportation.

GG. Independent Contractor – Contractor shall perform Contractor's Work under this Agreement as a non-exclusive independent contractor, and nothing herein is intended or shall be construed to create any partnership, agency or joint venture relationship between the Authority and Contractor. Neither Contractor nor Contractor's subcontractors, or the employees of any of them, shall be deemed for any purpose to be employees of the Authority.

Contractor shall be solely responsible for the withholding or payment of all applicable federal, state, and local personal income taxes, social security taxes, unemployment and sickness disability insurance, and other payroll taxes with respect to Contractor's employees.

- HH. Employee Protection The Contractor agrees that all Work performed under the Contract shall comply with all applicable employee protection requirements for nonconstruction employees of section 102 of the Contract Work Hours and Safety Standards Act, as amended, 40 U.S.C. §§ 327-333, and U.S. Department of Labor Regulations "Labor Standards, Provisions Applicable to Contracts Governing Federally Financed and Assisted Construction (also Labor Standards Provisions Applicable to Nonconstruction Contracts Subject to the Contract Work Hours and Safety Standards Act)," 29 CFR. Part 5 and 29 CFR Part 1926.
- II. Notice Unless provided otherwise in the Contract Documents notices will be in writing, delivered personally or by mail or electronic mail to the name and address of the Contractor as provided on the signature page of the Bid Proposal, or to the Authority at the following address:

Chicago Transit Authority Attention: Director, Purchasing 567 West Lake Street, 4th Floor Chicago, Illinois 60661 With copy to the Engineer

SECTION 34 - GENERAL GOVERNMENT REQUIREMENTS (CONT'D)

Notices delivered by mail will be deemed effective three (3) days after mailing in accordance with this Section. Notices delivered personally will be deemed effective upon receipt. Notices delivered by electronic mail will be deemed effective at the time and date of confirmation electronic delivery receipt. The addresses stated herein may be revised without need for modification or amendment of this Contract, provided written notification is given in accordance with this section.

Where the terms of this Contract explicitly permit notice via facsimile, written notice may be sent via facsimile to the parties at the numbers provided by the parties to each other in writing for such notice after the Effective Date.

Notice delivered by facsimile where permitted, will be deemed effective at the time and date the facsimile was sent in accordance with this Section. The facsimile number provided by the parties for facsimile notice as provided herein may be revised without need for Change Order or Amendment to this Contract.

- JJ. Non-Waiver Any previous waiver, forbearance, or course of dealing will not affect the right of either party to require strict performance of any provision of this Contract.
- KK. Entire Contract The Contract Documents represent the entire agreement and understandings of the parties hereto and all prior agreements, understandings, representations and warranties, whether written or oral, in regard to the subject matter hereof are and have been merged herein.

Chicago Transit Authority

BID PROPOSAL

For

Rapid Transit Cars

Requisition: C13FI101372531 Specification: CTA 7000-12



2013

BID PROPOSAL

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REQUISITION: C13FI101372531 IFB FOR RAPID TRANSIT CARS

BID PROPOSAL

SECTION I - GENERAL PROVISIONS AND METHODS OF PAYMENT

A. <u>OVERVIEW</u>

The Chicago Transit Authority (Authority) desires to procure new Rapid Transit Rail Cars as defined by the Technical Specifications. The requirements for this procurement are set forth in the Contract Documents as defined in Section 33 of the General Specifications.

B. <u>COMPLETE LUMP SUM PRICE</u>

Except as otherwise stated in the Contract, the Bid Proposal includes, and the Contractor must provide and furnish, all items necessary and incidental for the manufacturing and delivery of a base order of 100 Rapid Transit Cars (50 two-car units) with eight options to purchase up to 746 additional cars, including but not limited to all materials, parts, labor, supervision, coordination, administration, equipment, tools, drawings, and incidentals required by the Contract and necessary for the full completion of the Contract. The Bid also includes all costs relating to, or associated with, the foregoing including, but not limited to, all direct costs, overhead, and profit. No terms of the Contract, which more specifically indicate that the Contractor will be performed at no additional cost to the Authority, will be construed or interpreted to in any way limit the foregoing.

Prices quoted for the cars which the Bidder proposes shall include any and all costs of manufacturing, delivery, testing, applicable taxes, the furnishing of duties or permits, if any, for complete items of material or equipment, ready for use or operation, and shall include export or import duties, insurance, replacement parts or accessories required by the Specifications, and warranty service, whether or not it is the Bidder's practice to quote on some other basis.

C. <u>METHOD OF PAYMENT</u>

1. <u>General</u>

a. <u>Milestone Payments</u>

The Authority shall make progress payments to the Contractor during the period of Contract performance. For each milestone, the Authority has established a percentage of the Total Base Contract Price (excluding escalation) and Total Option Price that will be paid to the Contractor. The Milestones are not necessarily listed in the order that they might occur chronologically. See also GENERAL SECTION 26 – AVAILABILITY OF FUNDING.

b. Production, Acceptance and Final Payments

The Authority shall make Production, Acceptance and Final Payments to the Contractor during the period of Contract performance. The Authority has established a percentage of the Total Contract Price and Total Option Prices calculated on a per Car basis that will be paid to the Contactor. See also GENERAL SECTION 26 – AVAILABILITY OF FUNDING.

c. Escalation for Options

Escalation will apply as calculated under Section 32 of the General Specifications, to the Contractor on a one time basis for each option. After the escalation adjustment, the total Option Price will then be the total price to be paid by the Authority. See also GENERAL SECTION 32 – ESCALATION CLAUSE FOR OPTIONS.

d. <u>Timing of Payments</u>

Payment for performance of this Contract shall be made by check or via electronic transfer of funds in United States Dollars within thirty (30) calendar days after acceptance and approval by the Contract Officer of the Contractor's properly executed and certified invoices.

2. <u>Progress Payment Milestones</u>

a. Base Contract:

Milestone

Payment

1) Review and acceptance, in accordance with Section 13 of the General Specifications, of the management plan, quality assurance program and detailed engineering and production schedules for the Rail Cars.

a) Management Plan	0.5%
b) Quality Assurance Program	0.5%
c) EMI/EMC Control Plan	0.5%
d) Detailed Engineering Schedule	0.5%
e) Detailed Production Schedule	0.5%

2) Review and acceptance, in accordance with Section 13 of the General Specifications of the preliminary design, with arrangement drawings of the rail cars.

4.0 %

3) Review and acceptance, in accordance with Section 13 of the General Specifications, of the final design with arrangement drawings of the rail cars.

4) Review and acceptance, in accordance with Section 13 of the General Specifications, of the car body and truck stress analysis, the truck qualification tests and the truck first article inspection.

a) Car Bod	ly Stress Analyses	2.5%
b) Truck Q	ualification Tests & FAI	3.0%

5) Review and acceptance, in accordance with Section 13 of the General Specifications, of the first article inspections and qualification tests for the following major systems:

a) Propulsion system including gear units	1.5%
b) Air comfort system including controls	0.5%
c) Auxiliary power supply system	0.5%
d) ATC/ATO system	0.5%
e) Friction brake system including controls	0.5%
f) Number 1 end mechanical and electric	
couplers and drawbar and Number 2	
end drawbar	0.5%
g) Side door operator and controls	0.5%
h) Communication system	0.5%

6) Review and acceptance of all required mockups.

a) Underfloor	0.5%
b) Cab	1.0%
c) Convertible Seat Area	0.5%
d) No. 1 End	0.5%
e) Side Door	1.0%
f) Air Distribution	0.5%
g) Truck	1.0%

7) Review and acceptance, in accordance with Section 13 of the General Specifications of electrical schematics, wiring diagrams, and cabling conduit and piping diagrams.

8) Delivery of prototype cars. 4.0%

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1.0 %

4.0 %

9) Acceptance of prototype cars following successful completion of revenue service demonstration period.

10) Delivery of spare units, special tools and PTU's as defined in Section 17 of the Technical Specifications.

11) Completion of all training and delivery of simulators as defined in Section 1 of the Technical Specifications.

12) Delivery of all maintenance, operations and parts manuals as defined in Section 1 of the Technical Specifications.

b. Options:

Milestone

1) Review and acceptance, in accordance with Section 13 of the General Specifications, of the detailed production schedules for the Rail Cars.

2) Delivery of all spare units and PTU's required for Options as defined in Section 17 of the Technical Specifications

3. Production, Acceptance and Final Payments

- a. <u>Production Payment Base Contract</u> Upon start of final assembly of each Car (work begun installing equipment for each Car shell on the production line) the Authority will pay for each Car an amount equal to twenty five percent (25%) of the Total Contract Price per Car.
- b. <u>Acceptance Payment Base Contract</u> Upon acceptance of each two-car set of Cars, the Authority will pay for each Car an amount equal to twenty seven percent (27%) of the Total Contract Price per Car.
- c. <u>Production Payment Options –</u> Upon start of final assembly of each Car, the Authority will pay for each Car an amount equal to forty four percent (44%) of the Total Option Price per Car.

4.0 %

3.0 %

3.0 %

3.0 %

Payment

4.0 %

3.0 %

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- d. <u>Acceptance Payment Options</u> Upon acceptance of each two-car set of Cars, the Authority will pay for each Car an amount equal to forty five percent (45%) of the Total Option Price per Car.
- e. <u>Final Payments</u> The balance of payments due under the Contract (4% of the Total Contract Price) shall be payable upon completion of any modifications required at the acceptance of the last Car and receipt of all required deliverables.

SECTION II - BIDDING FORM

The Bid, in accordance with the terms and conditions of the Contract Documents, of which this Bid is a part, to manufacture and deliver a base order of 100 Rapid Transit Cars (50 two-car units) and eight options, F.O.B. freight included, Skokie, IL, and the replacement units all in accordance with Specification No. CTA 7000-12 for the Total Lump Sum Bid prices indicated.

The Bid Proposal Bidding Form Parts 1, 2 and 3 shall conform to the Contract Documents. All Bidding forms shall be submitted without modifications or reservation on the forms with each space properly completed.

All bid prices shall be firm fixed prices for the duration of the Contract and be quoted in United States Dollars. As indicated in Instruction to Proposers, Section V – BID SUBMISSION REQUIREMENTS, failure to provide complete bid information on the Bid Proposal Bidding Forms Parts 1, 2 and 3 will result in disqualification of the bid.

The total price quoted for any work shall be deemed by the Authority to include these costs and NO EXTRAS will be allowed on that account. Bids which purport to exclude these costs shall be rejected as non-responsive.

SECTION II – BIDDING FORM (continued)

BID PROPOSAL BIDDING FORM

PART 1 - Base Contract

100 CARS (50 TWO-CAR UNITS)

PRICE PER TWO-CAR UNIT

(FIGURES)

(WORDS)

DOLLARS

PART 2 - Optional Purchases

In addition to the lump sum Base Pricing for 100 Rapid Transit Cars (50 two-car units), Bidders shall also quote a price per two-car unit, for the Option quantities listed below. The price per two-car unit for each option shall be quoted inclusive of special test equipment, replacement units and support as required by the specification. CTA reserves the right to exercise or decline each option to purchase additional cars in sequential order within the timeframes shown. However, if any option exercise timeframe expires, CTA reserves the right to purchase any or all of the subsequent options prior to the expiration dates. The exercising of options shall be deemed timely if notice is issued by the Authority in accordance to Section 34.II – Notice, General Specifications on or before the calendar day timeframe indicated in the column headed "OPTION EXERCISE TIMEFRAME".

The price for any or all of the additional cars and replacement units shown for all options shall be the purchase price for the two-car unit on each option at the time of the Bid submission date.

OPTION 1

50 CARS (25 TWO-CAR UNITS)

OPTION EXERCISE TIMEFRAME

1120 DAYS AFTER CONTRACT EFFECTIVE DATE

PRICE PER TWO-CAR UNIT

\$_

(FIGURES)

(WORDS)

DOLLARS

Signature of Authorized Official

7000-12

SECTION II – BIDDING FORM (continued)

PART 2 - Optional Purchases Continued

OPTION 2

50 CARS (25 TWO-CAR UNITS)

OPTION EXERCISE TIMEFRAME

1240 DAYS AFTER CONTRACT EFFECTIVE DATE

PRICE PER TWO-CAR UNIT

(FIGURES)

\$

DOLLARS

(WORDS)

OPTION 3

100 CARS (50 TWO-CAR UNITS)

OPTION EXERCISE TIMEFRAME

1340 DAYS AFTER CONTRACT EFFECTIVE DATE

PRICE PER TWO-CAR UNIT

\$_____ (FIGURES)

_DOLLARS

(WORDS)

OPTION 4

OPTION EXERCISE TIMEFRAME

100 CARS (50 TWO-CAR UNITS)

1550 DAYS AFTER CONTRACT EFFECTIVE DATE

PRICE PER TWO-CAR UNIT

(WORDS)

DOLLARS

Signature of Authorized Official

7000-12

SECTION II - BIDDING FORM (continued)

PART 2 - Optional Purchases Continued

OPTION 5

156 CARS (78 TWO-CAR UNITS)

OPTION EXERCISE TIMEFRAME

1790 DAYS AFTER CONTRACT **EFFECTIVE DATE**

PRICE PER TWO-CAR UNIT

(FIGURES)

\$

(WORDS)

DOLLARS

OPTION 6

100 CARS (50 TWO-CAR UNITS)

OPTION EXERCISE TIMEFRAME

2130 DAYS AFTER CONTRACT EFFECTIVE DATE

PRICE PER TWO-CAR UNIT

\$_ (FIGURES)

(WORDS)

DOLLARS

OPTION 7

OPTION EXERCISE TIMEFRAME

100 CARS (50 TWO-CAR UNITS)

2340 DAYS AFTER CONTRACT EFFECTIVE DATE

PRICE PER TWO-CAR UNIT

\$ (FIGURES)

(WORDS)

DOLLARS

Signature of Authorized Official

7000-12

SECTION II - BIDDING FORM (continued)

PART 2 - Optional Purchases Continued

OPTION 8

90 CARS (45 TWO-CAR UNITS)

OPTION EXERCISE TIMEFRAME

2460 DAYS AFTER CONTRACT EFFECTIVE DATE

PRICE PER TWO-CAR UNIT

\$ (FIGURES)

(WORDS)

DOLLARS

Signature of Authorized Official

7000-12

SECTION II – <u>BIDDING FORM (continued)</u> PART 2 – Continued

BID PROPOSAL BIDDING SUMMARY FORM

DESCRIPTION	EXTENDED	PRICE
Base Contract 100 Rapid Transit Cars Bid Proposal Bidding Form – Part 1 Price per Two Car Unit multiplied by 50	\$	
Option 1 - 50 Rapid Transit Cars Bid Proposal Bidding Form – Part 2 Price per Two Car Unit multiplied by 25	\$	
Option 2 - 50 Rapid Transit Cars Bid Proposal Bidding Form – Part 2 Price per Two Car Unit multiplied by 25	\$	
Option 3 - 100 Rapid Transit Cars Bid Proposal Bidding Form – Part 2 Price per Two Car Unit multiplied by 50	\$	یں کا ایک کا ایک کا ایک کا ایک کا ایک کا
Option 4 - 100 Rapid Transit Cars Bid Proposal Bidding Form – Part 2 Price per Two Car Unit multiplied by 50	\$	
Option 5 - 156 Rapid Transit Cars Bid Proposal Bidding Form – Part 2 Price per Two Car Unit multiplied by 78	\$	
Option 6 - 100 Rapid Transit Cars Bid Proposal Bidding Form – Part 2 Price per Two Car Unit multiplied by 50	\$	
Option 7 - 100 Rapid Transit Cars Bid Proposal Bidding Form – Part 2 Price per Two Car Unit multiplied by 50	\$	
Option 8 - 90 Rapid Transit Cars Bid Proposal Bidding Form – Part 2 Price per Two Car Unit multiplied by 45	\$	
TOTAL LUMP SUM BID PRICE 846 RAPID TRANSIT CARS	\$	
Signature of Authorized Official:		
Print Name and Title:		
Requisition #		
Name of Firm:	Date:	
7000-12		P-11

BIDDING FORM – PART 3

For information only, the Bidder shall state the location of the principal point(s) of engineering for manufacturing and delivery of the Series 7000 Rail Cars.

Engineering Location

City, State/Province and Country

Assembly Location

City, State/Province and Country

Signature of Authorized Official	
Print Name	
Requisition #	
Name of Firm	
Date	

7000-12

BID PROPOSAL

EXHIBIT 1

CERTIFICATIONS AND SUBMISSION FORMS

(To Be Completed and Submitted with Bid Proposal)

Buy America Certification Certification of Primary Participant Regarding Debarment Certification of Lower Tier Participant Debarment Lobbying Certification Certification Regarding a Drug Free Workplace TVM Certification Disclosure of Ownership

BID PROPOSAL EXHIBIT 1 - CERTIFICATIONS AND SUBMISSION FORMS

CERTIFICATIONS REQUIRED

The Bidder and (if selected) Contractor agrees to comply with 49 U.S.C. 5323 (j) and 49 CFR Part 661, which provide that Federal funds may not be obligated unless steel, iron, and manufactured products used in FTA-funded projects are produced in the United States, unless a waiver has been granted by FTA or the product is subject to a general waiver. Rolling stock not subject to a general waiver must be manufactured in the United States, have a 60 percent domestic content and 100% of final assembly must occur in the U.S.

A Bidder must submit the appropriate Buy America Certification with all Bids on FTA-funded contracts, except those subject to a general waiver. Bids or offers that are not accompanied by a completed Buy America Certification must be rejected as nonresponsive.

Additionally, the Bidder and (if selected) Contractor agrees to the pre-award and post-delivery audits required by 49 U.S.C. 523(m) and 49 CFR Part 663 to verify compliance and interim audits to be conducted by the Authority.

BID PROPOSAL EXHIBIT 1 - CERTIFICATIONS AND SUBMISSION FORMS

Buy America Certification

For all contracts involving the purchase of rail cars, buses, other rolling stock (including train control, communication, and traction power equipment), one of the following certifications must be completed and furnished with the Bid. Details regarding these certifications may be found in 49 C.F.R Part 661, entitled Buy America Requirements.

CERTIFICATION REQUIREMENT FOR PROCUREMENT OF RAIL CARS, BUSES, AND OTHER ROLLING STOCK (INCLUDING TRAIN CONTROL, COMMUNICATION, AND TRACTION POWER EQUIPMENT)

Certificate of Compliance with 49 USC § 5323(j) Regarding Rolling Stock

The Bidder hereby certifies that it will comply with the requirements of 49 USC 5323(j) and the regulations in 49 CFR 661.11.

Signature	•			

Name_____

Title_____

Certificate of Non-compliance with 49 USC § 5323(j) Regarding Rolling Stock

The Bidder hereby certifies that it cannot comply with the requirements of 49 USC § 5323(j), but it may qualify for an exception to the requirements pursuant to 49 USC § 5323(j)(2)(C) and the applicable regulations in 49 CFR 661.7.

Date		
Signature	 	
Company	 · · · · · · · · · · · · · · · · · · ·	
Name	 	
Title	 	

BID PROPOSAL EXHIBIT 1 - CERTIFICATIONS AND SUBMISSION FORMS

CERTIFICATION OF PRIMARY PARTICIPANT REGARDING DEBARMENT, SUSPENSION, AND OTHER RESPONSIBILITY MATTERS

The Primary Participant (applicant or potential Contractor for a major third party Contract), , certifies, by submission of this Bid,

(Company Name)

that it or its "principals" [as defined in 49 CFR 29.105(p)], to the best of their knowledge and belief:

- 1. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
- 2. Have not within a three-year period preceding this Bid been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
- 3. Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State, or local) with commission of any of the offences enumerated in paragraph (2) of this certification; and
- 4. Have not within a three-year period preceding this application/Bid had one or more public transactions (Federal, State, or local) terminated for cause or default.

THE PRIMARY PARTICIPANT (APPLICANT OR POTENTIAL CONTRACTOR FOR A

MAJOR THIRD PARTY CONTRACT) _________, (Company Name) CERTIFIES OR AFFIRMS THE TRUTHFULNESS AND ACCURACY OF THE CONTENTS OF THE STATEMENTS SUBMITTED ON OR WITH THIS CERTIFICATION AND UNDERSTANDS THAT THE PROVISIONS OF 31 USC §§ 3801 *ET SEQ*. ARE APPLICABLE THERETO.

Signature and Title of Authorized Officer

Date

Typed Name and Title of Authorized Officer

If the Primary Participant is unable to certify to any of the statements in this certification, then the Primary Participant must attach an explanation to this certification.

CERTIFICATION OF LOWER-TIER PARTICIPANT REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY, VOLUNTARY EXCLUSION, AND OTHER RESPONSIBILITY MATTERS

The Lower-Tier Participant (applicant or potential Subcontractor for a major third party Contract), , certifies, by submission of this Bid,

(Company Name)

that it and its "principals" [as defined in 49 CFR 29.105(p)], to the best of their knowledge and belief:

- 1. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal Department or agency;
 - 2. Have not within a three-year period preceding this Bid been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, state, or local) transaction or contract under a public transaction; violation of Federal or state antitrust statutes or commission of embezzlement, theft, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
 - 3. Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, state, or local) with commission of any of the offences enumerated in paragraph (2) of this certification; and
 - 4. Have not within a three-year period, preceding this application/Bid, had one or more public transactions (Federal, state, or local) terminated for cause or default.

THE LOWER-TIER PARTICIPANT (APPLICANT OR POTENTIAL SUBCONTRACTOR FOR A MAJOR THIRD PARTY CONTRACT) ______,

(Company Name)

CERTIFIES OR AFFIRMS THE TRUTHFULNESS AND ACCURACY OF THE CONTENTS OF THE STATEMENTS SUBMITTED ON OR WITH THIS CERTIFICATION AND UNDERSTANDS THAT THE PROVISIONS OF 31 USC §§ 3801 *ET SEQ.* ARE APPLICABLE THERETO.

Signature and Title of Authorized Officer

Date

Typed Name and Title of Authorized Officer

If the Lower-Tier Participant is unable to certify to any of the statements in this certification, then the Lower-Tier Participant must attach an explanation to this certification.

CERTIFICATION FOR CONTRACTS, GRANTS, LOANS, AND COOPERATIVE AGREEMENTS (LOBBYING CERTIFICATION)

The undersigned certifies, to the best of his or her knowledge and belief that:

- (1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- (2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned must complete and submit Standard Form LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions [as amended by "Government Wide Guidance for New Restrictions on Lobbying," 61 Fed. Reg. 1413 (1/19/96)]. Standard Form LLL is available via the Internet from the following URL http://www.netl.doe.gov/business/forms/new/lll.pdf.
- (3) The undersigned must require that the language of this certification be included in the award documents for all sub-awards at all tiers (including subcontracts, sub-grants, and contracts under grants, loans and cooperative agreements) and that all sub-recipients must certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 USC § 1352 [as amended by the Lobbying Disclosure Act of 1995]. Any person who fails to file required certifications must be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

[Note: Pursuant to 31 USC § 1352c(1)-(2)(A), any person who makes a prohibited expenditure or fails to file or amend a required certification or disclosure form must be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such expenditure or failure.]

The Contractor, ______, certifies or affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the Contractor understands and agrees that the provisions of 31 USC § 3801, *et seq.*, apply to this certification and disclosure, if any.

Executed this _____ day of _____, 20___.

By:

Signature of Authorized Officer

Typed Name and Title of Authorized Officer

Typed Name of Contractor

CERTIFICATION REGARDING A DRUG FREE WORKPLACE

Pursuant to the definitions regarding a Drug Free Workplace provided in the Drug-Free Workplace Act of 1988, the Illinois Drug Free Workplace Act, 30 ILCS 580/1 *et seq.*, the Illinois Substance Abuse Prevention on Public Works Projects Act, 820 ILCS 265/1 *et seq.*, the Federal Acquisition Regulation System ("FAR"), Procedures for Transportation Workplace Drug & Alcohol Testing Programs, 49 CFR 40, and Prevention of Alcohol Misuse & Prohibited Drug Use in Transit Operation, 49 CFR 655, _______ ("Contractor") certifies to the best of its knowledge and belief that it and its principals:

- 1. Maintain a workplace(s) (i.e. the site(s) for the performance of work done by the Contractor in connection with this contract) safe and free from "controlled substances" as described in the Controlled Substances Act (21 U.S.C. 812) and as further described in regulations 21 CFR 1308.11 1308.15.
- 2. Have neither been convicted, including entering a plea of 'nolo contendere,' nor had sentence imposed by any judicial body charged with the responsibility to determine violations of Federal or State criminal drug statutes.
- 3. Publish and give notice to its employees and sub-contractors that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the Contractor's workplace, and also that actions will be taken against any and all employees and sub-contractors found to be violation of same.
- 4. Provide that all employees engaged in the performance of the contract receive a copy of the above statement, that the employee will abide by the terms of this statement, and that the employee will notify the employer in writing of the employee's conviction no later than five (5) calendar days after such conviction.
- 5. Provide for appropriate action against an employee for violation of any and all of these rules and that an employee convicted of drug abuse must satisfactorily participate in a drug abuse assistance or rehabilitation program approved for such purposes by Federal, State, or local health or law enforcement or other appropriate agency.
- 6. Comply with all drug and alcohol policies, testing programs and reporting requirements set forth in 49 CFR 40 and 49 CFR 655 whenever the Contractor, its employees, or sub-contractor(s) perform one or more of the following functions considered "safety-sensitive", as defined in 49 CFR 655:
 - (1) Operating a revenue service vehicle, including when not in revenue service;
 - (2) Operating a non-revenue service vehicle, when required to be operated by a holder of a Commercial Driver's License;
 - (3) Controlling dispatch or movement of a revenue service vehicle;
 - (4) Maintaining (including repairs, overhaul and rebuilding) a revenue service vehicle or equipment used in revenue service; or
 - (5) Carrying a firearm for security purposes.
- 7. Have in place a written program which meets or exceeds the program requirements of the Illinois Substance Abuse Prevention on Public Works Projects Act (820 ILCS 265/1 et seq.) to be filed with the Authority and made available to the general public, or have in place a collective bargaining agreement which deals with the subject matter of the Illinois Substance Abuse Prevention on Public Works Projects.
- 8. Will otherwise comply with all drug and alcohol policies set forth in applicable Federal, State and local laws and regulations, including, but not limited to the Drug-Free Workplace Act of 1988, FAR, Illinois Drug Free Workplace Act, 49 CFR 40 and 49 CFR 655 in such version, prior or subsequent to amendment or revision, as is currently enforced or enforceable at and during the execution and performance of this Contract.

In addition to other remedies, the Contractor's failure to comply with any part of the requirements of the Drug-Free Workplace Act of 1988, FAR, Illinois Drug Free Workplace Act, the Illinois Substance Abuse Prevention on Public Works Projects Act, 49 CFR 40 or 49 CFR 655, may render the Contractor subject to any or all of the following: suspension of payments, termination of contract for default, suspension or debarment.

Signature and Title of Authorized Official

Date

TVM CERTIFICATION

Bidder, if a transit vehicle manufacturer, hereby certifies that it has complied with the requirements of 49 CFR Part 26.49 by submitting an annual DBE goal to the Federal Transit Administration (FTA). The goal has either been approved or not disapproved by FTA.

Bidder, if a non-manufacturer supplier, hereby certifies that the manufacturer of the transit vehicle to be supplied has complied with the above-referenced requirement of 49 CFR Section 26.49.

Requisition #

Bidder's Signature of Authorized Official

Name and Title of the Bidder's Authorized Official

Date

DISCLOSURE OF OWNERSHIP AND INTERESTS AFFIDAVIT

Every Bidder or Proposer (referred to as "Bidder") submitting a Bid or Proposal to the Authority for a Contract shall submit this Disclosure of Ownership and Interests Affidavit (hereafter Disclosure Affidavit or "Affidavit"). If the Bidder is a joint venture, the joint venture and each of the joint venture partners shall complete a Disclosure Affidavit.

Please print or type all responses clearly and legibly. If you need additional space for a response, attach extra pages. Please indicate the question to which you are responding on any extra pages you attach.

For purposes of this Disclosure Affidavit, the term "Contract" refers to the Contract, concession, agreement, modification, amendment, extension, or other section in connection with which you are submitting the Disclosure Affidavit.

After reviewing your completed Disclosure Affidavit, the Authority's General Counsel or GM, Purchasing may require additional information to achieve full disclosure relevant to the Bid, or other applications.

Requisition Number:	Bidder Name:	
	Bidder Business Ac	ddress:
Authority departments to which you ar	e submitting this form (check one)	r.
[] Purchasing	[] Other:	
The undersigned	, as	, and on behalf
(Name)	() [)	Title)
of	("Bidder" or "Contracto	or"), having been duly sworn
(Business Address)	municipal and a second s	
under oath certifies as follows:		

DISCLOSURE OF OWNERSHIP INTERESTS

Indicate below whether the Bidder is an individual or a legal entity and, if a legal entity, indicate the type of entity. Then complete Part (A), (B), (C), or (D) below as applicable. <u>All Bidders shall complete Part (E)</u>. For Bidders that are sole proprietorships, Part (E) is the only section of Part I that shall be completed. For Bidders that are joint venturers, the joint venture and each member must complete a separate form. Identify all layers of ownership if the firm has a parent firm.

- [] Individual [] Limited liability company
- [] Business corporation
- [] Not-for-Profit corporation
- [] Sole Proprietorship
- [] Partnership
- [] Joint Venture
- [] Limited Liability Partnership
- { } Other: _____

A. CORPORATIONS (FOR-PROFIT AND NOT-FOR-PROFIT)

This information must be provided for the corporation and for any parent corporation.

1. Incorporated in the State of _____.

2. List below the name and title of all officers of the corporation:

Name	Title	
3. List below the name and title of	all directors of the corporation:	
Name	Title	
	······································	

TO BE COMPLETED BY FOR -PROFIT CORPORATIONS ONLY:

1. Is the Corporation listed on the New York Stock Exchange? [] Yes [] No

If the Corporation is listed on an exchange other than the New York Stock Exchange, the name of the exchange is:

2. If there are fewer than 100 shareholders, list below the name, business address, and percentage of ownership interest of each shareholder:

Name	Business Address	Ownership Interest
	·	%
	* <u>_***</u>	%
		%

3. If there are 100 or more shareholders, list below the name, business address, and percentage of ownership interest for each shareholder who owns shares or options equal to or in excess of 5% of the ownership of the corporation:

Name	Business Address	Ownership Interest
· 		%
		······ %
		%

TO BE COMPLETED BY NOT-FOR-PROFIT CORPORATIONS ONLY:

List below the name and business address of officers, trustees and board members.

Name	Business Address	Title
· · · · ·	·	
		·····

B. PARTNERSHIPS

List below the name and business address and the percentage of ownership interest for each general, limited, or individual partner entitled to receive 5% or more of the profit derived from partnership activities. The names of all individuals in such partnerships must be listed.

Name	Business Address	Ownership Interest
		%
		%
		%

C. LIMITED LIABILITY COMPANIES

1. List below the names and titles of the officers, if any. If there are no officers, write "none":

Name	Title

2. List below the name, business address, and percentage of ownership interest of each (i) member and (ii) manager.

Name	Business Address	Ownership Interest	t
			%
			%
			%

BID PROPOSAL EXHIBIT 1- CERTIFICATIONS AND SUBMISSION FORMS

D. LAND TRUSTS, BUSINESS TRUSTS, ESTATES, AND OTHER SIMILAR ENTITIES

1. Trust name and number, or other information identifying the trust:

2. List below the name and business address of all trustees:

Name	Business Address	
		· · · · · · · · · · · · · · · · · · ·
3.	List below the name, business address, and percentage of ownership	interest of all beneficiaries:
Name	Business Address	Ownership Interest

E. ADDITIONAL INFORMATION - TO BE COMPLETED BY ALL BIDDERS

1. Is any ownership interest in the Bidder held by one or more agents or nominees on behalf of another individual or legal entity? [] Yes [] No

If Yes, list below each principal's name, business address, percentage of ownership interest, and the name of the principal's agent or nominee:

Name	Business Address	Ownership Interest	Agent/Nominee
		%	
		%	
		%	

2. Is the Bidder or any ownership interest in the Bidder, constructively controlled by another individual or legal entity, other than an agent or nominee disclosed above? [] Yes [] No

If Yes, list below the name and business address of each individual or entity possessing constructive control, the party whose interest is controlled, and the relationship between the two under which the control is or may be exercised:

Name	Business Address	Name of Party Whose Interest is Controlled	Relationship
		%	
		%	
		%	

%

%

%

BID PROPOSAL EXHIBIT 1- CERTIFICATIONS AND SUBMISSION FORMS

Is any stock or beneficial interest in the Bidder held by a corporation or other legal entity?
 [] Yes
 [] No

If Yes, each such corporation or other legal entity shall make all disclosures requested in this Disclosure Affidavit and shall certify all information provided or, in the alternative, the Bidder must complete and sign an additional Disclosure Affidavit for each such corporation or other legal entity.

4. Is any ownership interest held by a current or former CTA employee? [] Yes [] No

If Yes, provide names and amount of ownership interest:

Name	Ownership Interest	
		_ %
		%
		_ %
5.	Is any current or former CTA employee employed by the Bidder:	[] Yes [] No
	If Yes, provide name, title and areas of responsibility:	
Name	Title	Areas of Responsibility

NOTE: The information provided in this form, shall be kept current. In the event of material changes, the Bidder shall supplement this Affidavit, up to the time the Authority takes action on the Bid, or other application for which this Affidavit is being submitted.

BIDDER:

By

(If a corporation and signed by any person other than the President or Vice-President, a certified copy of a resolution or by-law authorizing such person to sign, must accompany this contract)

NOTARIZATION - REQUIRED

State of _____

County of _____

Signed and Sworn to before me on this _____ day of _____, 20___

By

(Signature of Notary Public)

(NOTARY'S SEAL)

BID PROPOSAL

EXHIBIT 2

BIDDER'S SIGNATURE PAGE

(To Be Completed and Submitted with Bid Proposal)

AND

CTA ACCEPTANCE PAGE

BID PROPOSAL EXHIBIT 2- EXECUTION BY BIDDER

BIDDER'S SIGNATURE PAGE

The undersigned hereby acknowledges having received a full set of CONTRACT DOCUMENTS (Bidding Requirements; General Conditions; Special Conditions; and all of the forms, certificates, and documents issued with the Specifications) AND ADDENDA NUMBERS:

Bidder Must Insert Addenda Numbers Here

and the undersigned agrees, if awarded the Contract, to perform the Contract in accordance with the terms and conditions of the Contract and Addenda, if any, thereto. Notice to the undersigned may be served by mailing to the address hereinafter set forth.

FURTHER, THE UNDERSIGNED, BEING DULY SWORN, DEPOSES AND STATES ON OATH THAT the undersigned has not entered into any agreement with any other Bidder or prospective Bidder or with any other person, firm, or corporation relating to the price or prices named within the undersigned's Bid, or any other Bid, or any agreement or arrangement under which any person, firm, or corporation is to refrain from bidding, or any agreement or arrangement for any act or omission in restraint of free competition among Bidders, and has not disclosed to any person, firm, or corporation the terms of the undersigned's Bid, or the price or prices named herein. As required by Section 33E-11 of the Illinois Criminal Code of 1961, as amended (the "Act"), the undersigned certifies that the below named Bidder or any agent, partner, employee, or officer of the Bidder is not barred from contracting with any unit of state or local government as a result of engaging in or being convicted of either bid-rigging in violation of Section 3, Article 33E or bid-rotating in violation of Section 4, of Article 33E of the Act, or any similar offenses of any state or the United States that contain the same elements as the offenses of bid-rigging or bid-rotating.

Bidder:

(Print or Type Name of Corporation, Limited Liability Co., Sole Proprietor, Partnership, or Joint Venture)

Business Address (Print or Type Street, City, State and Zip Code):

By:	al and a state
Signature ¹ of Authorized Officer ² , N	<i>Aanaging Member, Bidder, Partner(s)</i> ³ or Joint Venturer(s) ³
Title and Name of Signatory:	
	(Print or Type Title and Name)

- 1. Refer to §2-8 of Part I for additional instructions.
- 2. If signed by any person other than the corporate President or Vice President, a certified copy of a resolution or by-law authorizing such person to sign must accompany this Bid.
- 3. All Partners or Joint Venturers of the Firm must sign this bid unless one Partner or Joint Venturer is authorized to sign for the Partnership or Joint Venture. Use additional copies of this Attachment if more than one signatory.

State of ______County of ______

Signed and Sworn to before me by the signatory whose name appears above on this :

_____day of _____20_____(year)

(Signature of Notary Public)

CTA ACCEPTANCE PAGE

The undersigned, on behalf of Chicago Transit Authority, a Municipal Corporation of the State of Illinois, hereby accepts the foregoing bid items as identified in the Proposal.

Contract Number _____

Total Amount of Contract \$_____

Dated this ______ day of ______, 20____, at Chicago Illinois

Vice President, Purchasing

President

Approved as to form and legality, for the sole benefit of the Authority. Subject to proper authorization and execution thereof:

Attorney

Chicago Transit Authority

TECHNICAL SPECIFICATIONS

For

Rapid Transit Cars

Requisition: C13FI101372531 Specification: CTA 7000-12



2013

TECHNICAL SPECIFICATION

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SECTION 1 SCOPE AND GENERAL REQUIREMENTS

1.01 SCOPE OF SPECIFICATION

- A. These Detail Specifications cover the functional, performance, materials, construction, testing and general requirements for lightweight rapid transit passenger motor cars in two-car semi-permanently coupled units to be furnished under this Contract, and requirements for materials and training for CTA maintenance and operation of the cars.
- B. The cars will be operated in train lengths from two (2) to twelve (12) cars.
- C. The cars delivered under this Specification shall be designated as CTA's 7000 Series cars.

1.02 COMPATIBILITY WITH EXISTING CTA CARS

The cars specified hereafter shall couple mechanically with the existing CTA 2600, 3200 and 5000 Series cars and shall be compatible and operate in train with CTA 5000 Series cars.

1.03 CAR SUITABILITY TO CTA SERVICE

- A. The cars shall be suitable for the customary CTA operation, maintenance and safety practices found in all CTA facilities and for the environmental conditions found on the CTA system (including track and right-of-way) with ambient temperatures from -25°F to 110°F. Customary operation shall include continuous twenty-four hour (24 hr) operation with a start-stop cycle specified in Section 2.02, D. The Authority's standard servicing interval shall be defined to be 90 calendar days. The car systems and equipment shall be designed to have a servicing interval no less than twice the Authority's standard servicing interval, i.e., 180 calendar days.
- B. All equipment shall meet the requirements of IEEE Std. 1478 unless otherwise agreed to by the Engineer.
- C. The cars shall be electromagnetically compatible with the CTA environment, including all track and wayside signal systems, and all CTA, public and private communication or electronic systems that may be susceptible to Electromagnetic Interference (EMI) from the cars. The EMI emitted by the cars shall be in accordance with Section 9.20.

1.04 CAR MAINTENANCE AND OPERATION SUITABILITY

The cars shall be suitable for operation and maintenance by personnel of the skill levels of CTA employees. See General Specification Section 3, J.

1.05 <u>DESIGN SAFETY</u>

The cars shall have an adequate margin of safety in the design to withstand the stresses and environmental conditions that may be imposed on them under normal CTA operations and also under emergency conditions such as towing, pushing, or jacking as defined in Section 3.

1.06 CONSTRUCTION MATERIALS

Materials for the construction of the cars shall be selected to obtain the maximum strength and reliability balanced against minimum weight and reasonable cost.

1.07 CAR UNIFORMITY, USE OF NEW MATERIAL AND TESTING

All cars delivered under this Specification shall be uniform. Any changes made to systems or equipment shall be fully incorporated in all cars unless otherwise agreed to by the Engineer. All material and equipment furnished under the Contract shall be new and shall be subjected at all times during manufacture, fabrication and construction to such inspection and tests by the Engineer as will give due assurance that the terms of this Specification are being complied with in all respects.

1.08 DOCUMENTATION AND UNITS OF MEASURE

- A. All drawings, documents, reports and other applicable items submitted to the Authority shall use the customary U.S. units of measure. If drawings, tests, or other documents are prepared or conducted initially in metric units of measure, they shall also have on them the corresponding values in U.S. units of measure. Electrical/electronic symbols on all drawings from all suppliers shall conform to IEC or ANSI standards.
- B. All letters and reports shall be submitted in clear, idiomatic American English and not be a literal translation to English from another language. All letters and reports shall be submitted on standard 8-1/2x11 inch paper. All drawings shall be prepared with customary U.S. size standards.
- C. Metric sized hardware may be used only for the internal assemblies of components or equipment where it will not be removed during routine maintenance, testing or adjustment or to gain access for troubleshooting or maintenance.

1.09 STRESS ANALYSES

- A. The Contractor shall submit, after award of Contract, stress analyses of the carbody structure and trucks. The analyses shall show compliance with the strength level requirements specified herein and shall include the following:
 - 1. The loads induced in each carbody structure member shall be calculated for the externally applied loads specified herein, including the following loads: buff-end, vertical, jacking, coupling, and truck shear.
 - 2. The loads induced in the truck structure under all operating conditions, including staggered joints two-inch (2") low, shall be calculated.
 - 3. The allowable stress levels shall be defined based on the design load conditions. Fatigue conditions shall be included.
 - 4. The stress analysis of major structural members and major equipment supports shall be included to show adequate margins of safety.
 - 5. Compliance with the strength distribution along the carbody length shall also be demonstrated in the static compression test defined in Section 3.01, C.
 - 6. The analyses and reports shall follow the requirements of ASME Standard RT-2, Section 9.
 - 7. See Section 3.01, D, for collision energy absorption analysis and Section 3.02 for carbody framing strength requirements.
- B. The stress analyses shall be completed to the satisfaction of the Engineer prior to the carbody static test and truck static and fatigue qualification tests.
- C. The Contractor shall submit, after award of the Contract, complete carbody and truck dynamic analyses. The analyses shall include the following:
 - 1. Prediction of carbody bending modes and natural frequencies, which affect vehicle ride quality.
 - 2. Prediction of the pitch, roll and vertical natural frequencies of the truck frame and installed gearbox and motor assemblies. The frequencies shall be shown to have adequate damping throughout the operating speed range of the vehicle, including wheel 1/rev, rail joint and two (2) times rail joint frequencies. Load deflection and load velocity curves for the primary and secondary springs and dampers shall be provided.
 - 3. Prediction of the vertical and lateral acceleration at the truck bolster when the vehicle is negotiating level, tangent jointed and welded rail.
- D. The analysis shall verify that the vehicle is in compliance with the vehicle ride quality requirements specified herein. The weight for the empty weight analysis condition can include up to 1,500 pounds of instrumentation and test personnel weight.

1.09 <u>STRESS ANALYSES</u> (Continued)

- E. In addition, analyses shall be submitted which demonstrates that the vehicle hunting mode is stable for speeds up to and including 15 mph in excess of the maximum design speed, and which evaluate the axle steering capability.
- F. During the Pre-Bid procedures, the Bidders shall demonstrate to the satisfaction of the Engineer their capability to conduct the required analyses.

1.10 DRAWINGS

- A. The Contractor shall furnish the Engineer two (2) sets of full size paper prints of the latest revision of all Contractor and vendor/subcontractor drawings and Drawing Index within 30 days after issuance.
- B. The Contractor shall also furnish all 2D drawings as AutoCAD electronic files on CD or DVD. Two (2) copies of the discs shall be delivered to the Engineer. In addition, the Contactor shall provide two (2) copies of all Contractor and vendor/subcontractor 3D drawings with viewing software on CD or DVD.
- C. The Contractor shall provide at no cost to CTA a complete CADD station with all drawings and schematic diagrams and device tables, as defined in Section 1.11, for the cars preloaded into the CADD station hard drive. The CADD station shall include all hardware and software necessary to provide compatibility and full functionality of the Contractor's files. The CADD station, including all hardware and software shall be delivered to CTA concurrent with delivery of the first production cars.
- D. The hardware to be provided shall include all that is necessary to provide for a complete stand alone desktop publishing station capable of updating and printing drawings and schematics for the cars. A CD-ROM burner shall be included with the system. Dual side-by-side LCD monitors shall be provided, measuring a minimum of twenty-one inches (21") size. The CADD station shall be configured to allow for interfacing with the CTA Skokie Shop Engineering Office LAN and Server. The software shall include the latest full versions of AutoCAD Design Suite with 3D, Adobe Acrobat Professional, Microsoft Professional Office and other software required to provide full desktop publishing functionality and capabilities for the drawings and schematics for the cars. The hardware and software shall be reviewed by the Engineer.
- E. The drawings shall reflect the configuration and status of the cars, sub-systems and circuits of the first production cars and the Contractor shall provide updated paper print drawings and electronic files to the CTA for these documents periodically (when revisions are made due to design/part change, procedure change or error) during the production and warranty period of the Contract to allow the CTA to revise the documents and issue new copies. Manual revisions shall be supplied before or coincidental with the arrival of the altered parts or components or revised procedures.

1.11 SCHEMATIC DIAGRAMS AND DEVICE TABLES COPIES

- A. The Contractor shall furnish to the Engineer thirty (30) 8-1/2"x11" paper prints of the individual circuit schematics and device tables. The format shall preferably be 8-1/2"x11" but, for clarity of complicated circuits may be 11"x17" which are then reduced to 8-1/2"x11" for issuance. The circuits shall include interior and exterior lights, air comfort, communications, door controls, Master Controller, destination signs and other appropriate circuits as directed by the Engineer. The Contractor shall provide thirty (30) sets of revisions as they occur during the construction of the cars until the final configuration has been reached.
- B. The Contractor shall also furnish the same schematic diagrams and device tables in electronic format, as defined in Section 1.10, B.
- C. The schematic diagrams and device table copies shall reflect the configuration and status of the cars, sub-systems and circuits of the first production cars and the Contractor shall provide updated printed pages and electronic files to the CTA for these documents periodically (when revisions are made due to design/part change, procedure change or error) during the production and warranty period of the Contract to allow the CTA to revise the documents and issue new copies. Manual revisions shall be supplied before or coincidental with the arrival of the altered parts or components.

1.12 OPERATIONS, MAINTENANCE AND PARTS MANUALS

A. <u>General</u>

The Contractor shall deliver to the Engineer printed and bound manuals as defined below, and one (1) word processing/desktop publishing system including software and hardware (including color laser printer) which shall have all operations, maintenance and parts manuals, including their drawings and schematics already loaded to permit the Authority to revise and reprint the manuals. The desktop publishing systems shall also have all training manuals, instructor guides, participant guides and other documentation, as specified in Section 1.13, including presentations pre-installed and any other hardware required for the Authority to edit, revise and re-publish any training material. See Section 1.10 for additional The desktop publishing systems shall be IBM compatible and information. Windows[™] based. The system hardware and software shall be reviewed by the Engineer. The monitors shall be a minimum 21" LED flat panel type. In addition, the Contractor shall provide two (2) additional licenses for all publishing software for Authority installation on other work stations. See Section 1.13, F, 6, a, for delivery of desktop publishing systems.

1.12 OPERATIONS, MAINTENANCE AND PARTS MANUALS (Continued)

A. <u>General</u> (Continued)

There shall be four (4) comprehensive manuals delivered under this Contract:

Operator's Manual – 500 copies Running/Light Maintenance – 25 sets Heavy/Overhaul Maintenance – 15 sets Parts – 10 sets

The printed and bound sets and copies shall reflect the configuration and status of the cars, sub-systems and circuits of the first production cars, and the Contractor shall provide updated printed pages and electronic files to the CTA for these documents quarterly (when revisions are made due to design/part change, procedure change or error) during the production and warranty period of the Contract to allow the CTA to revise the documents and issue new copies. Manual revisions shall be supplied before or coincidental with the arrival of the altered parts or components or revised procedures. Each manual shall include a status sheet listing the effective dates of each page and these shall also be revised when updates are made. In addition, each revised page in the manual shall be annotated with a vertical bar in the margin to indicate where material has been added, deleted or revised. The Contractor shall develop a manual style and format guide for each type of manual, as defined above, and submit for review by the Engineer.

The Contractor shall submit as early as possible, but not later than concurrent with the delivery of the first prototype cars, ten (10) printed draft copies of the Operator's Manual and schematic diagrams and device tables, as specified in Section 1.11, and not later than ninety (90) days after delivery of the first prototype cars, three (3) printed draft copies of each of the three (3) other manuals and schematic diagrams with revised tables, as defined in Section 1.11, C, for use, review and reproduction by CTA. The Contractor shall deliver three (3) additional printed draft copies of the Parts Manuals into which the Authority will insert its lot (stock) numbers. One (1) copy will be returned to the Contractor within 365 days and the Contractor shall then insert the lot numbers into the final printed manuals and electronic software. The draft copies shall be printed on plain paper.

Final copies of the Operator's Manual shall be delivered within sixty (60) days of the delivery of the first production cars.

Final copies of the Running/Light Maintenance Manuals shall be delivered within 180 days of the delivery of the first production cars.

Final copies of the Heavy Maintenance Manuals shall be delivered within 365 days of the delivery of the first production cars.

Final copies of the Parts Manuals shall be delivered within 180 days of the Contractor receiving the draft manual with the CTA lot (stock) numbers inserted.

1.12 OPERATIONS, MAINTENANCE AND PARTS MANUALS (Continued)

B. <u>Operator's Manual</u>

The Operator's Manual shall contain all information needed for the optimum safe operation of the vehicle. It shall include general vehicle familiarization material, such as:

- 1. Location, function and operation of controls, indicators and switches.
- 2. Discussion of the propulsion system, trucks (including active suspension system), couplers, lights, air comfort system, brakes, doors, passenger communications system (including all signs and audio communications), video recorder and event recorder.
- 3. Other features of the vehicle that Rapid Transit Operators may not be in a position to control or adjust, but must have some basic knowledge.
- 4. Safety/Emergency features.
- 5. Troubleshooting/diagnostics (identify, diagnose and recovery).

The Operator's Manual shall be loose-leaf form, pocket-sized, nominal 3-5/8"x6-1/2" page size, landscape format, and use 70 pound, plasticized offset paper with a maximum of 75, two-sided (printed) pages. Cross-references and a Table of Contents shall be provided. Pages shall be 6-hole punched along the long edge. The loose-leaf binder shall have metal binder rings with locks to prevent undesired opening and to provide positive engagement when closed. Diagrams and illustrations shall not be loose or in pockets. All printed material shall be clearly reproducible by dry copying machines. Line drawings and screen displays (in color where applicable), including exploded three-dimensional (3-D) drawings, are required.

1.12 OPERATIONS, MAINTENANCE AND PARTS MANUALS (Continued)

C. <u>Maintenance Manuals</u>

1. The two types of maintenance manuals shall be divided into sixteen (16) sections as follows:

SECTION NUMBER	SECTION TITLE/DESCRIPTION
1	Introduction
2	Carbody
3	Truck System (Including active suspension)
4	Propulsion System
5	Electrical System (Including the train diagnostic system, monitoring and control system and trainlines, APS (including battery and 600 volt trainline), cab control and operating equipment, undercar and above floor)
6	Braking System
7	Coupler System
8	Side Door System
9	Air Comfort System
10	Lighting System
11	Communications/Signs System
12	Video Surveillance System
13	Event Recorder System
14	ATC/ATO
15	Hydraulic Suspension System
16	Reference Documents/Special Gauges and Tools

Each section shall have a Table of Contents. Section 16 shall include any non-proprietary engineering documents referenced or otherwise required for car maintenance, as well as all gauges and special tools, specified in Section 17.03.

Each maintenance manual shall be a separate, stand alone document.

1.12 OPERATIONS, MAINTENANCE AND PARTS MANUALS (Continued)

- C. <u>Maintenance Manuals</u> (Continued)
 - 2. The organization of the maintenance manuals shall treat the vehicle as an integrated system, not as a grouping of disassociated parts.
 - 3. Contractor and vendor supplied information shall be integrated into a unified presentation for each system addressed. For clarity of presentation the same data may be presented twice, but shall use the same views and diagrams with the same reference numbers in each manual.
 - 4. The maintenance concept shall address components to the lowest level identified in the parts manual. The manuals shall contain a detailed analysis of each component so that the maintenance personnel can effectively service, inspect, maintain, adjust, troubleshoot, repair, replace and overhaul the equipment. Where interfaces occur, a cross- reference shall be made to the appropriate location. Diagrams and exploded views shall be utilized to identify the location of parts within a sub-assembly and of that sub-assembly within each larger assembly. All printed material shall be clearly reproducible by dry copying machines.
 - 5. Each section of the manuals shall be divided in the following sub-sections and address the following topics:
 - a. Introduction This shall include the purpose of the manual, special tools and equipment and safety precautions.
 - b. General This shall include a general description of the system and specifications of the major components in the system. Interfaces with other systems shall be identified and explained.
 - c. Theory of Operation This shall include the general theory and the specifics of this system and the relationship of assemblies, subassemblies and components with an explanation and analysis of their functions to the smallest replaceable components.
 - d. Operating Procedures This shall include the locations and functional descriptions of all controls, monitors and indicators.
 - e. Troubleshooting This shall include a list in tabular format of symptoms, causes of malfunction or improper operation, and probable remedies to the smallest line replaceable component or printed circuit board level. The lists shall include all diagnostic display outputs and their complete explanation.
 - f. Logic/flow charts may be used to assist troubleshooting, but must reflect the most efficient and effective logic and not be simply tracing of schematic diagrams.

1.12 OPERATIONS, MAINTENANCE AND PARTS MANUALS (Continued)

- C. <u>Maintenance Manuals</u> (Continued)
 - 5. (Continued)
 - g. Corrective Maintenance (Terminal/Running Repair Shop) This shall include step-by-step removal, replacement and adjustment procedures to the smallest line replaceable component or printed circuit board level. Detailed procedures shall be provided to adjust any unit that has been replaced.
 - h. In addition, charts of families of consumables including attaching parts, locations, log numbers or other information, and space for notes shall be included. Consumables include carbon brushes, lamps, glass, filters, brake shoes, contact tips, fuses, heater strips, oil and other items determined by the Contractor or the Engineer as being desirable for routine maintenance activities.
 - i. Preventive Maintenance (Terminal/Running Repair Shop) This shall include a list in tabular format of all lubrication requirements, types of lubricants, frequency of application, inspection requirements and limits, component replacement and repair schedule, required adjustments, limits and tolerances, optimum test point readings and calibration charts. Complete procedures to be followed in performing the preventive maintenance as well as instructions and procedures in the use of special tools or instruments shall also be included.
 - j. Corrective Repair (Heavy Repair/Overhaul Shop) This shall include detailed troubleshooting procedures for the sub-assemblies as well as complete assemblies, step-by-step removal, overhaul, replacement and adjustment procedures to the smallest replaceable component. Detailed test and adjustment procedures shall be provided for all sub-assemblies and for the complete assemblies/units. In addition, complete procedures and instructions shall be included for the downloading of software and its verification after downloading. As part of the overhaul procedure, details for rebuilding, reclaiming or replacing all wearing or moving parts shall be included with comprehensive information on the limits and tolerances sufficient to enable the Authority to determine the best approach to follow.
 - k. Complete instructions and procedures for the use of special tools including test benches, shall also be included.
 - I. Appendix This shall include a list of reference drawings, interface drawings, circuit diagrams, symbols, and cross-references.

1.12 OPERATIONS, MAINTENANCE AND PARTS MANUALS (Continued)

- C. <u>Maintenance Manuals</u> (Continued)
 - 6. The manuals shall be printed on 8-1/2"x11" paper with fold outs 11 inches high by necessary length. Oil resistant bond paper shall be used, printed on both sides except for fold outs. The image area shall be 7"x10", unless otherwise agreed to by the Engineer. Pages shall be 3-hole punched with 4-1/4 inch center-to-center spacing with 5/16-inch holes and plastic reinforced edge.

The manuals shall be assembled into locking 'D' ring binders with heavy plasticized hinged covers suitable for shop use. The spine and cover of each binder shall identify the manual by its category, contents and car series.

- D. <u>Parts Manuals</u>
 - 1. Contractor developed and vendor supplied information shall be integrated into a unified presentation for each system addressed.
 - 2. The parts manuals shall enumerate and describe every part to the lowest level, including all electronic parts and components and those small parts and hardware items required to assemble the component after disassembly and repair or overhaul. The descriptions shall include the component name, symbol, function, rating, tolerance, actual manufacturer's name and address, actual manufacturer's part number, commercial equivalents and quantity per assembly or sub-assembly. The manuals shall contain diagrams and exploded views illustrating and indexing every removable/replaceable part. Each diagram shall be accompanied by a page listing every item in the associated diagram and providing complete ordering data for every item. This shall include all attaching hardware and small parts such as springs, clips, spacers, set screws, etc.

Diagrams and exploded views shall also be included to identify the appropriate location of parts within a sub-assembly and of that sub-assembly within the next larger assembly. All printed material shall be clearly reproducible by dry copying machines.

Each parts listing page shall include a column adjacent to the Contractor or manufacturer part number column for inclusion of the Authority's Lot (stock) Numbers.

The Contractor shall also provide an Excel spread sheet of all parts included in the illustrated parts manual. The spread sheet shall incorporate all information (columns) from the parts manuals including Figure, Item Number, and Section Number. The format of the spread sheet shall be reviewed by the Engineer.

3. The parts manuals shall be divided into the same sixteen (16) sections as the maintenance manuals described in Section 1.12, C, 1, above.

1.12 OPERATIONS, MAINTENANCE AND PARTS MANUALS (CONTINUED)

- E. <u>Parts Manuals (continued)</u>
 - 4. The parts manuals shall be printed and bound in the same manner as the maintenance manuals described in Section 1.12, C, 6, above.

1.13 TRAINING

A. <u>General</u>

- 1. The Contractor shall provide *Familiarization*, *Train-the-Trainer*, and *Classification* training on the proper techniques and procedures for car operation and maintenance to CTA personnel at CTA designated locations and facilities. This instruction shall range from system familiarization and operation to repair, maintenance and troubleshooting procedures. These courses shall be provided at locations and times, including nights, as directed by the Engineer. The Contractor shall provide a Training Coordinator at CTA whose sole responsibility is to work with CTA in developing programs, arranging schedules and identifying the prerequisites and behavioral objectives of each course. The Contractor shall replace the Training Coordinator if, in the opinion of the Engineer, the Training Coordinator's work is found unsatisfactory.
- 2. Prior to the development of training materials, the Contractor's Training Coordinator shall arrange meetings with the Engineer and CTA's Training and Instruction staff to review the specific behavioral objectives of each course, the course content and related materials. The Authority may request changes in the objectives, content and related materials as a result of this review, and the Contractor shall make such changes to the satisfaction of the Engineer at no cost to the Authority.
- 3. All instructors shall be fully capable of transmitting in-depth technical information that can be understood by participants. A detailed resume for each instructor shall be provided to the CTA for review and acceptance, ninety (90) days prior to commencement of the scheduled instruction.

The CTA will recognize an instructor as qualified when the individual:

- a. Can communicate in clear, idiomatic American English in a manner that allows the participants to understand and comprehend the material presented.
- b. Has been trained in adult teaching principles and methods and has had experience in conducting technical training courses.
- c. Has in-depth knowledge of the system under discussion, how it interfaces with other systems, the procedures for isolating faults and troubleshooting and is able to communicate that information to students in an effective manner.
- d. Has in-depth knowledge of CTA policies and procedures concerning train operation.

- 1.13 <u>TRAINING</u> (Continued)
 - A. <u>General</u> (Continued)
 - 4. The Contractor shall provide course outlines, handout materials, schematic diagram books, drawings, tests, mock-ups, cut-aways, electronic media (i.e., Microsoft PowerPoint, video), evaluation tools (tests, quizzes), and a self paced computer-based training program as described below.
 - 5. All training materials shall be developed on two (2) tracks, Operations and Maintenance. Training shall be organized as modules, which are further broken down into units of instruction. Instructional design shall follow sound adult learning principles and include behavioral objectives stated in the form of learner action/outcomes.
 - 6. Review and acceptance of all instruction materials shall be completed two (2) months prior to conducting the first (pilot) *Train-the-Trainer* training. See Section 1.13, D, below for details of the training.
 - 7. All written and performance tests shall be validated (criterion-referenced) and based on course content. Minimum accuracy for maintenance training shall be 75% on all written tests; minimum accuracy for operations training shall be 80% on all written tests, with 100% accuracy on all performance tests for both groups. Written and performance tests will be administered during each training module.
 - 8. All training materials developed/delivered electronically shall meet training industry standards to achieve content interoperability among authoring tools and Learning Management Systems (LMS). Materials shall be developed in accordance with Aviation Industry Computer-Based Training Committee (AICC) and Shareable Content Object Reference Model (SCORM) standards.
 - 9. The training shall make use of audiovisual aids, mock-ups, models and cutaways to as great an extent as practical and applicable.

1.13 <u>TRAINING</u> (Continued)

B. <u>Audience</u>

All learners will be either experienced personnel who are being introduced to the new equipment or new hires who are receiving their initial training. In the case of new hires, it can be assumed that the students will already be familiar with the general rules and procedures of the CTA as well as the basic skills associated with their job assignment.

- 1. <u>Primary Audience</u>
 - a. <u>Operations Personnel</u>
 - 1) Vehicle Operations Managers.
 - 2) Rail Instructors.
 - 3) Rail Service Supervisors.
 - 4) Switchmen.
 - 5) Rapid Transit Operators.

b. <u>Maintenance Personnel</u>

- 1) Rail Maintenance Managers.
- 2) Rail Maintenance Instructors.
- 3) Rail Car Repairers.
- 4) Engineering/Technical Services.

2. <u>Secondary Audience</u>

- a. General Managers.
- b. Training and Instruction Managers.
- c. Customer Assistant Managers.
- d. Controllers.
- e. Facilities Maintenance Personnel.
- f. System Safety and Environmental Affairs Personnel.
1.13 <u>TRAINING</u> (Continued)

C. <u>Familiarization Training</u>

Familiarization Training shall be an overview of the various car systems and subsystems (parts location and system operation) and car operation (normal in-service operation and with-defects-present conditions). The Contractor shall provide familiarization courses concurrently with the prototype car testing. The Contractor shall provide the trainees with hands-on practice of equipment operation on a prototype unit. These classes will consist of approximately 200 CTA personnel from Maintenance, Transportation, Facilities Maintenance and Training & Instruction who need to be familiar with the operation, general design and location of equipment. A total of twenty (20) classes shall be provided with no more than ten (10) trainees per class. The duration of each class shall be no longer than one (1) day.

The Contractor shall provide Familiarization Training in two (2) tracks:

1. <u>Maintenance</u>

Training shall include completing procedures for normal in-service operation, performing cut outs, preparing cars for transfer to the maintenance facility and re-railing cars.

2. <u>Operations</u>

Training shall include completing pre-departure check, normal in-service operation, yard operation, and defect conditions.

D. <u>Train-the-Trainer</u>

The Contractor shall provide initial *Train-the-Trainer* courses before providing *Classification* training for both Operations and Maintenance. The first *Train-the-Trainer* courses shall be considered pilot courses. The training shall be based on the "*Train-the-Trainer*" philosophy to prepare CTA trainers and to uncover the faults or limitations in the training programs developed. This benefits subsequent *Classification* training in that the training strategy and materials presented result in learning and successful application of knowledge and skill.

Train-the-Trainer courses shall make use of repetitive hands-on drills including preparing the car for service, in-service operation, operational checks, troubleshooting, application of all necessary tools, the actual changing of parts/components, performing adjustments and calibration of car systems and equipment. Maintenance hands-on training shall include making inspections, how to introduce faults, troubleshooting and repair procedures.

There shall be a *Train-the-Trainer* course for each training program. The training materials provided in the *Train-the-Trainer* sessions shall be the same instructor guides, participant guides, training aids and electronic media that will be used in *Classification* training.

1.13 <u>TRAINING</u> (Continued)

D. <u>Train-the-Trainer</u> (Continued)

CTA will critique the first (pilot) *Train-the-Trainer* courses for effectiveness and determine if changes are necessary in the course content and accompanying training materials. The Contractor shall incorporate all of CTA's requested changes and submit the revised course materials for review and acceptance no later than thirty (30) days after receiving CTA's comments. The remaining *Train-the-Trainer* courses and Classification Training shall not be given until the revised course materials are accepted by CTA.

Approximately ten (10) Rail Maintenance Instructors and forty (40) Rail Operations Instructors will attend the *Train-the-Trainer* courses. Three (3) classes for running/light maintenance and one (1) class for heavy maintenance and eight (8) classes for operations shall be conducted with approximately five (5) employees per class for maintenance and five (5) employees per class for operations.

The duration of the Maintenance *Train-the-Trainer* training shall be approximately two (2) times the duration of the actual *Classification* training to allow ample time for the trainees to practice procedures and gain additional information to aid them in teaching the *Classification* training courses.

The duration of the Operations *Train-the-Trainer* training shall be three (3) days.

The first (pilot) *Train-the-Trainer* courses shall commence concurrently with the delivery of the first production two-car unit.

E. <u>Classification Training</u>

- 1. <u>General</u>
 - a. The Contractor shall develop for the appropriate audience(s) the following instructor-led and computer-based courses:
 - 1) Operations.
 - 2) Maintenance (Light and Heavy Maintenance).
 - b. The Contractor shall develop two (2) tracks of maintenance instruction courses.
 - 1) TRACK #1: Heavy Maintenance/Overhaul including special tools and bench test equipment.
 - 2) TRACK #2: Light/Running Maintenance including special tools and PTUs.

- 1.13 <u>TRAINING</u> (Continued)
 - E. <u>Classification Training</u> (Continued)
 - 2. Operations Training

The Operations courses shall include the following modules:

- a. Rail Car Components (Exterior/Interior).
- b. Safety/Emergency Features.
- c. In-service Operation Including Propulsion, Brakes, Doors, Lighting, Electrical, Environmental and Communications.
- d. Operation around Maintenance Facilities and Yards.
- e. Procedures for Preparing Trains for Service.
- f. Troubleshooting (Identify, Diagnose and Correct Problems).
- g. Moving Defective Equipment.
- h. Coupling and Uncoupling.

The duration of the training is estimated to be two (2), eight-hour (8 hr) days, but may be adjusted based on the pilot training.

Twenty (20) rapid transit operators and rail service supervisors shall attend the Contractor presented Operations Classification training. Four (4) classes shall be conducted, five (5) per class. These courses will commence following acceptance by CTA of the first (pilot) *Train-the-Trainer* course and will run concurrently with the remaining *Train-the-Trainer* courses.

1.13 <u>TRAINING</u> (Continued)

- E. <u>Classification Training</u> (Continued)
 - 3. <u>Maintenance Training</u>

The maintenance courses shall include the following modules:

Training Module Topic	Heavy/Overhaul Maintenance	Light/Running Maintenance
Propulsion	10 days	4 days
Air Comfort System (including controls)	5 days	4 days
Auxiliary Power Supply Low Voltage System	3 days 2 days	3 days 1 day
Trucks, Brakes, Active Suspension	-	5 days
Active Suspension	2 days	-
Brakes	3 days	-
Trucks	1 days	-
Carbody including undercar cabling, cleating and routing	1.5 days	1.5 days
Doors (including low speed interlock)	3 days	2 days
Passenger Information System	2 days	3 days
Video System	-	1 day
Event Recorder	-	1 day
Couplers	2 days	2 days
Troubleshooting Review	3 days	5 days
Carborne Cab Signal (ATC/ATO) System	Training shall encompass both heavy and light maintenance in 5 days	
Data Trainlining and Diagnostics (including bench test equipment, special tools and PTUs)	3 days	4 days

NOTE: The length of training is subject to change pending review of detailed car and sub-system design and acceptance of course behavioral objectives.

- 1.13 <u>TRAINING</u> (Continued)
 - E. <u>Classification Training</u> (Continued)
 - 3. Maintenance Training (Continued)

Approximately 32 persons will be instructed in each module topic in these courses with approximately eight (8) trainees attending each session. The courses will commence following the acceptance by CTA of the first (pilot) *Train-the-Trainer* courses and will run concurrently with the remaining *Train-the-Trainer* courses. It is expected that these courses will extend over a total of 316, eight-hour (8 hr) days with the course for each subject presented six (6) times; four (4) times for light/running maintenance and twice for heavy/overhaul maintenance. The course for each subject is independent of any other subject's course and the personnel attending each course will, in general, be different from those attending any other course. Thus a total of 480 people may receive training in these courses.

F. <u>Deliverables</u>

1. <u>General</u>

Deliverables include Maintenance Training Manuals, Instructor Guides, Participant Guides/Manuals, electronic media (including Microsoft Office PowerPoint presentations and computer-based training programs), mock-ups and hardware/software. The Contractor shall deliver to the Authority all electronic files including MS Word files and all original artwork (native graphic files along with all required fonts) for use by CTA. Graphics/ animations shall be at the highest quality level possible.

Content of all materials shall be professionally written, complete, modern, thoroughly organized, free of grammatical and spelling errors and authentic with no extraneous or irrelevant information. All materials and training aids shall be reviewed by the CTA before conducting training.

1.13 <u>TRAINING</u> (Continued)

F. <u>Deliverables</u> (Continued)

2. <u>Maintenance Training Manuals</u>

The organization of the manuals shall treat the vehicle as an integrated system and not as a grouping of disassociated parts. The manuals shall highlight the precautions to be taken by service personnel to assure their safety while performing maintenance and servicing operations. The material in the maintenance training manuals shall be organized and indexed in the same manner as in the maintenance manuals defined in Section 1.12. The numbering of the sections shall be consistent from one type of manual to another to allow easy cross-referencing among different manuals. Each section of the maintenance training manual shall be subdivided, to the extent required by the subject matter, into the same chapters, to facilitate looking up specific topics or tasks. Coverage of the chapters shall include the following topics:

- a. General sub-systems description and operation, including how the system fits into the car and interfaces with other systems and sub-systems.
- b. Block diagrams.
- c. Signal flow diagrams.
- d. Functional schematics.
- e. Functional wiring and/or piping diagrams.
- f. Troubleshooting techniques.
- g. Microprocessor software.
- h. Lubrication and cleaning, including frequency, methods and trade identifications of recommended materials; component location and description.
- i. Inspection and maintenance standards, including wear limits, settings, and tolerances.
- j. Step-by-step installation and removal.
- k. Test and evaluation procedures.

The format of all data contained in the maintenance training manuals shall be consistent from manual to manual.

1.13 <u>TRAINING</u> (Continued)

- F. <u>Deliverables</u> (Continued)
 - 2. <u>Maintenance Training Manuals</u> (Continued)

The manuals shall contain a detailed analysis of each component so that maintenance personnel can effectively service, inspect, maintain, adjust, troubleshoot, repair, replace and overhaul the equipment. Where interfaces occur, a cross-reference shall be made to the appropriate location. Diagrams and exploded views shall be utilized to identify the location of parts within a sub-assembly and of that sub-assembly within each larger assembly.

In addition, charts of the families of consumables, including attaching parts, locations, lot numbers, or other information, and space for notes shall be included. Consumables include brushes, lamps, glass, filters, brake shoes, contact tips, fuses, heater strips, oil, and other items as determined by the Contractor or the Engineer as being desirable for routine maintenance activities.

Upon CTA's review and acceptance of the Contractor's initial training manual submittals, the manuals shall be considered as "Interim Manuals". Following the issue of each Interim Manual, the Contractor shall provide revised pages covering any changes, whether required by change of design or procedures or due to error, and these revisions shall be kept current during the term of this Contract up to and including the completion of the operation, maintenance and warranty requirements of the Contract and for three years (3 yr) thereafter. Training manual revisions shall be supplied to the CTA before or coincidental with the arrival of the altered parts or components. A new status sheet listing the effective dates of each page shall be included for each manual at the time updates are forwarded to the CTA. Each updated page shall be annotated with a vertical bar in the margin to indicate where material has been added, deleted or revised.

All training manuals shall be in loose-leaf form, and use 70 pound offset paper with plastic reinforced binding edge. Twenty-five (25) copies of the maintenance training manuals shall be delivered. All maintenance training manuals shall be standard sized and shall be produced on 8-1/2"x11" standard size pages. The image area shall be 7"x10". Pages shall be 3-hole punched, 4-1/4-inch center-to-center spacing with 5/16-inch holes. Crossreferences and a Table of Contents shall be provided in each volume. Loose-leaf metal binder rings with locks shall be used to prevent undesired opening and to provide positive engagement when closed. Diagrams and illustrations shall not be loose or in pockets. All printed material shall be clearly reproducible by dry copying machines. Line drawings, including exploded isometrics and three-dimensional (3-D) outline drawings are required.

1.13 <u>TRAINING</u> (Continued)

- F. <u>Deliverables</u> (Continued)
 - 3. Instructor Guides

Instructor Guides shall include all information, which will allow a trained CTA instructor to present the course again at a later time. They shall include as a minimum, schedules for each course, outlines for the training modules, lesson plans, durations of each module, target audience and prerequisites for each course, behavioral objectives, sequential lists of training materials, including instructions on how to present any working models or advanced technology training aids, copies of training aids for presentation (and hard copies for annotation), Inspection Checklist (Running Maintenance Program), Pre-Departure Check (Operations Program) and Skills Inventories (with answers), references to support materials, and any additional information deemed necessary for accurate reconstruction of the course.

The Lesson Plan should include instructor's notes explaining the methodology to be used for a particular section and information to be emphasized. Particular attention must be paid to safety concerns or dangers within the equipment. The lesson plan shall indicate when training aids will be used, or referred to, during the course instruction. The Instructor's Guide must note references to the Participants' Guide, see below.

For each course the Contractor shall supply 25 copies of each Maintenance Instructor Guide and 75 copies of the Operations Instruction Guide. All Instructor Guides shall be in loose-leaf form, and use 70 pound offset paper with plastic reinforced binding edge. All Instructor Guides shall be standard sized and shall be produced on 8-1/2"x11" standard size pages. The image area shall be 7"x10". Pages shall be 3-hole punched, 4-1/4-inch center-tocenter spacing with 5/16-inch holes. Cross-references and a Table of Contents shall be provided in each volume. Loose-leaf metal binder rings with locks shall be used to prevent undesired opening and to provide positive engagement when closed. Diagrams and illustrations shall not be loose or in pockets. All printed material shall be clearly reproducible by dry copying machines.

The Inspection Checklist included in the Light/Running Maintenance Instructor Guide shall follow the template currently in use at CTA. The applicable sections from the Running Maintenance and Heavy Maintenance Manuals should be included in an Appendix at the back of the Car Repairer Program Instructor's Guide and referenced within the Lesson Plan.

1.13 <u>TRAINING</u> (Continued)

- F. <u>Deliverables</u> (Continued)
 - 4. Participant Guides

Participant Guides shall be in addition to any manuals provided to participants. The guides shall include copies of any training aids used by the instructor, including the course schedule, sequential lists of training materials, Inspection Checklist (Running Maintenance Program), Pre-Departure Check (Operations Program), references to support materials, presentations, annotated schematics, selected screen shots from technology-based training, and any additional information deemed necessary.

5. <u>Training Aids</u>

Training aids shall include any PowerPoint presentations (or alternate as accepted by CTA), slides, posters, annotated enlargements of schematics, videos, working models, cut-away diagrams, cut-away views or sectioned sample hardware, custom simulators, interactive computer-based training modules, video or other appropriate technology-based training. The Contractor shall provide three-dimensional (3-D) drawings/renderings of car arrangement and major equipment in electronic format as part of the training material.

PowerPoint presentations for use with laptop computers and data projectors shall reinforce and complement content delivered in *Operations* and *Maintenance Classification* training. PowerPoint presentations shall make use of animation when depicting, for example, the workings of hydraulic, propulsion and air conditioning systems.

All illustrations/diagrams shall display the equipment in 3-D animation, as they would be seen from the viewpoint of a person actually operating the train, performing the test, troubleshooting or doing the repair. Any diagrams shall be displayed with sufficient scale and clarity to permit all to see clearly.

Training aids shall be updated with any additions or changes to the subsystems trained for the duration of this Contract including warranty period and for three years (3 yr) thereafter at no cost to the CTA.

- 1.13 <u>TRAINING</u> (Continued)
 - F. <u>Deliverables</u> (Continued)
 - 6. <u>Training Hardware and Software</u>
 - a. The Contractor shall deliver and install in the one (1) desktop publishing system as defined in Section 1.12, A, above, all software, to permit the Authority to revise and reprint all manuals, training guides and other documents. The Contractor shall also deliver any necessary equipment and software to copy and edit all digital and electronic media used in the manuals, guides, training courses and the Computer-Based Training (CBT) material. See Section 1.13, G, below for details on CBT.
 - b. The Contractor shall provide one (1) working example of each of the major sub-systems on the car for use during the training courses. These working examples may replace non-working mock-ups. Working examples are not required for equipment that is the same as used on CTA's 5000 or 3200 Rehab cars.

The working examples shall include stands and supports, ancillary components, control voltage power supplies and any other equipment, except primary power supplies, to operate the equipment in the Training Center as a "stand alone" system representative of the actual system on the car.

The working examples shall include, but not be limited to the following:

- 1) Propulsion system with controls and diagnostics and Master Controller.
- 2) Friction brake system with controls not included in the propulsion system.
- 3) No. 1 truck with working active suspension system and controls.
- 4) HVAC system with controls.
- 5) Auxiliary power supply with controls and storage battery.
- 6) Communications system with Destination and Message Signs, PA, Intercom, Pre-Recorded Announcements, GPS System, Run Number Sign, Speakers, Handsets, Microphones and controls.
- 7) Video recorder system.

- 1.13 <u>TRAINING</u> (Continued)
 - F. <u>Deliverables</u> (Continued)
 - 6. <u>Training Hardware and Software</u> (Continued)
 - b. (Continued)
 - 8) Event recorder system.
 - 9) Side door system with controls and diagnostics, low speed interlock and door control box.
 - 10) Unit and train networks: Diagnostic system, CMN, and PCN.

The equipment supplied for training purposes shall be in addition to the replacement units specified in Section 17.02. Replacement units will not be available for training purposes.

The Contractor shall submit detailed lists showing all the parts and equipment to be supplied for each of the working examples for review by the Engineer. Any additions to the lists deemed necessary to make the working examples complete and suitable for training use shall be made at no additional cost to CTA.

If the equipment is mounted on a simulated car or portion thereof, it shall be capable of being moved easily from one shop to another for mobile training.

c. The Contractor shall deliver computer-based 3-D animation/ simulation of both the hardware and software for at least the major systems/components as defined in Section 1.13, F, 6, b, above.

- 1.13 <u>TRAINING</u> (Continued)
 - F. <u>Deliverables</u> (Continued)
 - 6. <u>Training Hardware and Software</u> (Continued)
 - d. Computer-based 3-D animation must be capable of demonstrating how the system or sub-system behaves and fails when operating in the intended environment. The 3-D animations shall be able to demonstrate how to diagnose, isolate, and repair typical defects such as hydraulic leaks, trainline, communications system, door, and propulsion and brake system failures. This includes the required capability to interface with other systems where appropriate and to insert faults for troubleshooting and repair training. The animated system shall allow an instructor to insert random faults/defects and allow scoring of the troubleshooting and repair events on the basis of time used to repair or remedy the fault. Any modifications to the car shall also be incorporated into the computer-based 3-D animations.
 - e. The Contractor shall deliver four (4) laptop computers with the *Train-the-Trainer* application software pre-installed, plus four (4) latest generation data projectors for delivering additional *Train-the-Trainer* courses. These systems shall be delivered following acceptance of the first pilot *Train-the-Trainer* course. The systems shall be updated upon acceptance of each *Train-the-Trainer* course.
 - f. Following the completion of the required courses (*Familiarization* and *Classification* training) all print and electronic media (training aids, mock-ups, models, audiovisual materials, software, outlines and manuals) shall become the property of the Authority.
 - 7. The Authority will make available one (1) married pair of cars for use in the Classification training program no later than concurrently with the delivery of the first production cars.
 - 8. Delivery of the digital versions of the training courses and the Self Paced Computer-Based Training Program (CBT) shall be made within 270 days of the completion of the *Train-the-Trainer* courses.

- 1.13 <u>TRAINING</u> (Continued)
 - G. <u>Self Paced Computer-Based Training Program (CBT)</u>
 - 1. In addition to the other training aids and materials, the Contractor shall deliver a suite of computer-based training modules that allow self paced training tasks related to the car operation and maintenance. These modules shall utilize a highly interactive design that involves the student in the learning process and allows the student to acquire as near to hands-on experience as possible.

The software must be delivered with the right of unlimited use and distribution through CTA's learning management system. Deliverables shall also include all source code, and at least one (1) licensed copy of all tools used to develop the software. The source code must be documented, AICC/SCORM compliant, and sufficient supporting documentation must be provided to allow the CTA or a contracted third party to maintain it after delivery. See Section 1.13, F, 8, for delivery.

- 2. The supplier who is selected to perform this task shall demonstrate previous experience in the development of simulation-based troubleshooting CBT for rail mechanical and electrical systems and shall be presented for CTA review in accordance with the Pre-Bid procedures specified in Section 1.18.
- 3. The CBT shall be developed in two (2) tracks Car Introduction/Operations, and Maintenance.
 - a. <u>Track 1 Car Introduction/Operations</u>

The Car Introduction/Operations track is intended to familiarize operating employees and rail maintenance staff with the basics of the car's design and functions.

The Car Introduction/Operations track shall include the following modules:

- Car Overview This module shall describe the basic operating functions of the car and the major sub-systems that produce these functions.
- Car Controls and Indicators This module shall describe the location and function of the controls and indicators of the cars. This shall be further organized into those in the operator's cab, car interior and car exterior.

- 1.13 <u>TRAINING</u> (Continued)
 - G. <u>Self Paced Computer-Based Training Program (CBT)</u> (Continued)
 - 3. (Continued)
 - a. <u>Track 1 Car Introduction/Operations</u> (Continued)
 - 3) Description of Major Sub-System Components This module shall describe the components of the major sub-systems of the car and for each provide an overview of their major functions and role in car operation. This module shall include sub-systems such as propulsion control (power and braking), track brake, parking brake, doors and door controls, HVAC and controls, cab signal and speed system, passenger displays and communication system, and train diagnostics and any others deemed appropriate by the Engineer during the development of the module.
 - 4) Operator and Diagnostic Display Since the car is of a new technology design, it has operator and diagnostic displays. These will be located in the cab and integrated elsewhere within a specific sub-system. The purpose of this module is to provide a mock-up of these displays and simulate the basic functionality. This functionality would include the primary screen navigation paths and message and fault clearing if applicable. The intent is to expose both operators and maintenance staff to the complete set of messages that could appear, as well as provide descriptive information as to the conditions that cause the appearance.

There shall be two (2) versions of this module:

- (a) The first version shall deal only with those messages that would be normally encountered by the operator.
- (b) The second version shall include the operator messages plus the messages that would be encountered by the maintenance staff. This version shall be included in the Maintenance Track module and incorporated in all three (3) lessons defined below.
- 5) Operating This module shall address all operating issues. Instruction shall include preparing the train for service, normal in-service operation, operating in and around maintenance facilities, diagnosis/troubleshooting, coupling and uncoupling, and moving trains under fault conditions.

- 1.13 <u>TRAINING</u> (Continued)
 - G. <u>Self Paced Computer-Based Training Program (CBT)</u> (Continued)
 - 3. (Continued)
 - b. <u>Track 2 Maintenance</u>
 - 1) The maintenance modules are intended to teach the rail maintenance staff how to perform the preventive maintenance procedures for the cars and troubleshoot malfunctions.

The training modules for the rail maintenance staff shall be further subdivided into three (3) lessons:

- (a) Practical Overview of Operation Sections.
- (b) Preventive Maintenance.
- (c) Troubleshooting.
- 2) For each lesson there shall be a unit of instruction for each sub-system of the car. The sub-system presentations shall be further broken down as necessary to facilitate the presentation of the training material.
- 3) For each defined sub-system there shall be a tutorial that presents a practical overview of operation. This section should not be an engineering treatise on "theory of operation", but should instead focus on sub-system functioning in terms of measurement and observation commonly used in maintenance and troubleshooting. The Overview modules shall be organized in such a way that the operational relationship of systems and sub-systems is emphasized. This organization should include a system of navigation that will allow students to obtain both a global and a specific view of system functions. Each section of material should include an interactive self test that allows students to check their understanding of the material. Each wrong answer selection for any test should result in an appropriate remedial response.

- 1.13 <u>TRAINING</u> (Continued)
 - G. <u>Self Paced Computer-Based Training Program (CBT)</u> (Continued)
 - 3. (Continued)
 - b. <u>Track 2 Maintenance</u> (Continued)
 - 4) For each functional system of the cars, there shall be a module that presents the preventive maintenance procedures to be applied. Each system shall be further broken down as necessary to clearly present the relevant maintenance procedures. Each preventive maintenance procedure should be presented with a description of the title of the procedure, the schedule or criteria for when to perform it, any tools, replacement parts or test equipment required and then a tutorial that describes the procedure. The tutorial shall include images, animations or videos as necessary to provide the student sufficient information to perform the procedure. Each procedure should, at a minimum, end with a guiz to ensure the students' comprehension of the procedure. For complex procedures, intermediate guizzes should be utilized to ensure timely remediation. The quiz items should be completely interactive, with a remediation explanation or demonstration of each potential wrong answer.
 - 5) For each defined sub-system there shall be a module that allows for the practice of a number of troubleshooting scenarios. For each sub-system a simulation model is to be developed of detail sufficient to allow interjection of individual or up to four (4) simultaneous faults. The faults covered by this section should be ones that have a reasonable likelihood of occurrence and which are exemplary of the various functions of the car systems.

The student shall be presented with an opportunity to navigate through the components of the various systems, examine any required indicators, operate any necessary controls, perform any tests or measurements, and exercise any diagnostic displays for obtaining relevant information. Troubleshooting should be taught from an analytical rather than rote approach, with an emphasis on system functions, rather than flow charts to be memorized.

- 1.13 <u>TRAINING</u> (Continued)
 - G. <u>Self Paced Computer-Based Training Program (CBT)</u> (Continued)
 - 3. (Continued)
 - b. <u>Track 2 Maintenance</u> (Continued)
 - 5) (Continued)

Troubleshooting instruction should have two (2) modes: A guided Introductory Mode in which the student performs with expert assistance, and an Independent Mode, in which the student performs without guidance. In the Introductory Mode, student errors should be recognized and corrected immediately upon their occurrence. In the Independent Mode, students should be free to continue work until they have concluded their efforts or until they have committed a safety violation. Upon termination of an Independent Mode exercise, the student shall be presented with a debriefing evaluation of their performance.

This debriefing shall include recognition of successful actions as well as notice of failures to find faults, performance of unnecessary repairs or replacements and the violation of any safety rules.

6) In all troubleshooting activities, the response of car systems and sub-systems shall faithfully simulate the effects of faults and student actions.

H. <u>Training for Changes</u>

When determined by the Engineer during the warranty period that Contractor initiated system retrofits or modifications alter the operation, maintenance, repair or troubleshooting practices or techniques, the Contractor shall arrange to provide additional courses on the affected systems. These courses shall be presented to the Authority's Training & Instruction Department Personnel and other Technical Support Groups (i.e. Engineering Staff, Technical Services, and Quality Inspection). These courses shall include the modified and/or updated training aids or, if required, new training aids, which shall become the property of the Authority after training is complete.

1.14 CAR HISTORY BOOKS

A. The Contractor shall keep a history book for each car and shall ship the book for each car to the Engineer at the same time the car is shipped from the Contractor's plant. The history book shall contain the list and location of all serial-numbered components including circuit cards and other assemblies that are line replaceable and the serial numbers for that car; certified copies of the hydraulograph pressure charts for wheels, gear boxes and bearings; the ammeter and voltmeter charts and accelerometer charts from the car performance tests; the certified weight slips; and a copy of any documents relative to shipping the car.

Copies of test procedures are not required in the history books.

- B. The Contractor shall also provide to the Authority the serialization log in electronic format as comma delimited text files. The first row shall be a header record listing the name/description of each attribute separated by commas and the subsequent rows shall be the attributes as comma separated records. The name/description of the attributes are 100 alphanumeric characters, and the attributes are 20 alphanumeric characters. No commas, single or double quotes shall be used in any of the entries. The Dates shall be formatted as MM/DD/YYYY. The Contractor shall submit a sample of the log for review by the Engineer. If changes are required to make the log compatible with CTA's MMIS, they shall be made at no cost to the Authority.
- C. All serialized components and assemblies shall, unless otherwise agreed to by the Engineer, also be equipped with a bar code tag that shall give the manufacturer's name and part number, or part identification (as listed in the parts catalog), and the serial number. The code used shall be coordinated with the Authority to ensure it is compatible with the MMIS. The tags shall be applied in such a manner that they will remain in place regardless of ambient or device temperature; water, oil or grease submersion; or other environmental factors for at least five years (5 yr) from date of car acceptance. The location of the bar code tag on each unit shall be accessible for scanning to the extent possible when the unit is installed on the vehicle. The bar code tag locations shall be reviewed by the Engineer.

1.15 PHOTOGRAPHS AND PHOTO BOOKS

- A. The Contractor shall take photographs as directed by the Engineer and shall permit and assist the Engineer in taking photographs of the cars in various stages of progress. The photographs will be taken during all stages of the work for use by the Engineer to identify installation and details otherwise inaccessible and for other purposes related to this Contract. Contractor supplied photographs shall be uncompressed digital images of no less than 6 Megapixel size unless otherwise agreed to by the Engineer. The Contractor shall furnish to the Authority two (2) 8"x10" prints of those images selected by the Engineer and two (2) CD or DVD copies of all photographs as high quality uncompressed files with text descriptions and index. Based on previous Contracts, approximately two hundred (200) photographs will be required.
- B. The Contractor shall also print one hundred (100) photo books using high quality laser process, using full page photographs (8"x10" on an 8-1/2"x11" page), each labeled with appropriate identification captions. The photo books shall include an index for all pages and be spiral bound.

1.16 SUBCONTRACTOR IDENTIFICATION AND EVALUATION

Subcontractors proposed to supply the following components/subsystems shall be identified by the prospective Bidders and evaluated by the Authority in accordance with Pre-Bid procedures as specified in Section G of the Instructions to Bidders.

- 1. Side, end, and operator's cab doors.
- 2. Side door operator, control system and upper tracks.
- 3. Window sash.
- 4. Floor panels.
- 5. Passenger and operator seats.
- 6. Carbody shell.
- 7. No. 1 end coupler system and No. 2 end drawbar system.
- 8. All light fixtures, interior and exterior.
- 9. All cab control, switch, and indicator panels.
- 10. Undercar air comfort package.
- 11. Air comfort control system.
- 12. Auxiliary Power Supply System.
- 13. Battery.

1.16 <u>SUBCONTRACTOR IDENTIFICATION AND EVALUATION</u> (Continued)

- 14. Horn.
- 15. Propulsion System.
- 16. Friction brake system.
- 17. Track brakes.
- 18. Trucks.
- 19. Active suspension system.
- 20. ATC/ATO System.
- 21. Unit and Train Network and Diagnostics Systems (see Section 15.01, A, 4).
- 22. Car Communications System.
- 23. Video System.
- 24. Event recorder.
- 25. CBT Training.
- 26. Automatic Passenger Counter.

1.17 SUPPLY OF CONSUMABLE ITEMS

- A. The Contractor shall furnish all consumable items, not currently stocked by the Authority, during the prototype car test period.
- B. The Contractor shall furnish the Authority with a one year (1 yr) supply of all consumable items for one hundred (100) cars where the consumable item is not currently stocked by the Authority. Such supply of all consumable items shall be delivered to the Authority before the first production cars have accumulated 6,000 miles of operation but in no case more than thirty (30) days after acceptance by the Authority. New consumable items shall also be identified to the Authority as early as practicable in order that the Authority may initiate stocking procedures.

1.18 SOFTWARE REQUIREMENTS

A. The Contractor shall provide two (2) complete sets of back-up/restore software for each type of PC system supplied under this Section. In addition, the disks for the operating system and all installed software shall be provided.

B. The Contractor shall deliver any required licenses in CTA's name. The Contractor shall update the software and documentation throughout the life of the contract, including the warranty period, at no cost to CTA.

1.19 FIRE PERFORMANCE

The design of the car and all combustible materials used for the construction of the cars shall meet the fire performance requirements of NFPA-130:2003, Standard for Fixed Guideway Transit and Passenger Rail Systems, Chapter 8, Vehicles, and references.

The Contractor shall submit, within 180 days from NTP, a list of all combustible materials that will be used for construction of the cars. The list of combustible materials shall include the material, its application and the estimated quantity to be used. The Contractor shall submit any changes in the combustible materials list to the Engineer for review and approval before the new material is used.

The Contractor shall provide test reports from an independent laboratory, for all combustible materials. The test reports shall be not more than 5 years old and shall be submitted to the Engineer.

A. Heat Load

The Contractor shall submit prior to delivery of the first production cars, a heat hazard load analysis and the hourly release rate for a car.

B. <u>Smoke and Flammability</u>

Applicable materials used in the cars shall be tested to demonstrate compliance with the smoke and flammability requirements as specified by NFPA-130:2010, Table 8.4, Test Procedures and Performance Criteria for the Flammability and Smoke Emissions Characteristics. The most restrictive requirements shall govern.

In accordance with ASTME 119, test procedures, latest revision, the floor panel shall pass a minimum 30 minute endurance period at AW3 loading.

Materials such as primary or secondary suspension parts that are unable to meet smoke, flammability and functional requirements or materials that are applied in small quantities shall be submitted to the Engineer.

C. <u>Toxicity</u>

Materials and products having high toxic products of combustion shall not be used.

All combustible materials used in the car construction, except materials used in small quantities as agreed to by the Engineer, shall be tested for toxicity using NFPA 269 - Standard Test Method for Developing Toxic Potency Data for Use in Fire Hazard Modeling or Boeing Specification Support Standard BSS-7239.

1.19 <u>FIRE PERFORMANCE (CONTINUED)</u>

Materials shall meet the following maximum toxic gas release limits:

- Carbon Monoxide (CO) 3,500 ppm
- Hydrogen Fluoride (HF) 200 ppm
- Nitrogen Dioxide (NO₂) 100 ppm
- Hydrogen Chloride (HCL) 500 ppm
- Hydrogen Cyanide (HCN)
 150 ppm
- Sulfur Dioxide (SO₂) 100 ppm

1.20 <u>SYSTEM SAFETY</u>

A. <u>System Safety Plan</u>

The Contractor shall prepare a plan to implement and maintain a comprehensive System Safety Program (SSP) in accordance with MIL-STD-882D - Department of Defense, Standard Practice for System Safety. The plan for the SSP shall be submitted for Engineer review within 120 days from NTP.

B. <u>Safety Reporting Requirements</u>

The Contractor shall submit copies of Material Safety Data Sheets (MSDS) for all appropriate materials to the Engineer.

C. <u>Hazard Identification and Analysis</u>

The Contractor shall identify all failure-induced and normal operating (non-failure condition) hazards in accordance with FTA guidelines found in DOT-FTA-MA-26-5005-00-01 - Hazard Analysis Guidelines for Transit Projects. Hazards shall be compiled into a list and submitted for review by the Engineer prior to delivery of the first production car.

The Contractor shall perform hazard analyses on all hazards identified in the hazard lists. Analyses shall demonstrate that the vehicle conforms to provisions of the Specification and that all identified hazards are either eliminated, or reduced to levels of risk agreed to by the Authority.

Electrical circuit failure mode analyses performed as part of a hazard analysis shall include a sneak circuit analysis.

Analyses shall be performed for both single and multiple-unit configurations. Analyses shall identify all design errors and maintenance errors that could result in unsafe conditions.

1.20 <u>SYSTEM SAFETY</u> (CONTINUED)

C. <u>Hazard Identification and Analysis</u> (Continued)

Existing hazard analyses of like equipment operating under like conditions may be offered, with the agreement of the Engineer, in lieu of performing a complete analysis of proposed equipment.

D. <u>Fire and Life Safety</u>

All vehicle components, subsystems, and systems shall be designed for the following:

- 1. The prevention of fire.
- 2. Protection of the general public, CTA personnel, and emergency response personnel from injury due to fire, smoke, explosion, or panic due to these occurrences.
- 3. Protection of system elements from damage by fire or explosion.
- 4. Ability to quickly evacuate passengers and the Operator from the vehicle.

1.21 SOFTWARE CERTIFICATION AND CONTROL

The Contractor, as the vehicle system and software integrator, shall prepare an integrated Software Development Plan. The plan shall be submitted for Engineer review prior to review of the first software controlled subsystem.

This plan shall include a schedule showing the tasks involved in the development of the software, validation testing, and the delivery of submittals. The schedule shall include the Contractor's tasks for the verification of supplier deliverables including all documentation.

The following activities shall be included in the software validation process:

- A. Definition of the verification and validation tasks for the integration of the subsystems into the entire system, especially the system descriptions, system design documentation, system type tests including diagnostics, and code walk-throughs of all software programs. Each task shall have a written procedure. This definition should include the tasks recommended in IEEE Standard 1012 - Standard for Software Verification and Validation or other Contractor proposed standard.
- B. Establishment of a review process of the required supplier documentation to assure all relevant requirements are met.

1.21 SOFTWARE CERTIFICATION AND CONTROL (CONTINUED)

- C. The Contractor or his subsystem supplier shall develop a configuration control system for tracking software changes from the commencement of the vehicle subsystem Qualification Testing phase until acceptance of the entire fleet. All software shall be identified by its subsystem, a name and a version number.
- D. A final software verification and validation report shall be submitted for Engineer review prior to the delivery of the first production car.

1.22 SYSTEM PTU APPLICATION AND DIAGNOSTIC SOFTWARE

- The PTU Application and Diagnostic Software for each Microprocessor controlled system shall include, but not be limited to, the following characteristics:
- A. A single application for each system developed on and for use with the latest Windows® operating system.
- B. Each system PTU Application shall be user friendly, such that persons who are not familiar with the system or have minimal computer skills can easily use the application (maximize the use of graphical user interfaces; clean and uncluttered screens; resizable windows). The PTU software shall be a stand alone application that shall not be dependent on the software of the unit being monitored. When software revisions are made to the various systems, no changes shall be required to the PTU software to function properly.
- C. Shall have at least two (2) levels of access, an open User level with no password required and an Engineering level where a password is needed for access. The Engineering level will allow access to all the PTU application functions. The User level allows access to limited PTU functions for viewing and monitoring, downloading and saving of event logs, testing of system operation and changing car number, date and time. These levels are independent of any Windows log in passwords or user groups.
- D. The application shall include, but not be limited to, the following functionalities and characteristics:
 - 1. Event data downloading, event and snapshot viewing, saving of the event log, resetting restrictive event lockouts and clearing the event log.
 - 2. Recording of fault events shall also save a snapshot of the system operating parameters at least three (3) seconds before the fault event and two (2) seconds after the fault event. At least twenty (20) snapshots shall be stored before overwriting the first one. Every effort shall be made to maximize the number of snapshots that can be saved.
 - 3. Snapshots and event logs shall have the car number, date, and time of the fault saved in each log.

1.22 <u>SYSTEM PTU APPLICATION AND DIAGNOSTIC SOFTWARE</u> (CONTINUED)

- 4. Ability to create user defined triggers to record longer event records (snapshots) of at least 20 seconds duration.
- 5. Real time viewing and recording of system operation. Real time recording shall run indefinitely until stopped by the user or the PTU has run out of available storage.
- 6. Chart recording/Oscilloscope function to graph system parameters and variables. There must also be provisions to save, print and view saved graphs. Graphs shall be saved in a standard format.
- 7. The recording sampling rate shall be maximized in order to capture short time duration transient events. The recording sampling rate should be no greater than 50 msec.
- 8. The data shall be displayed at a rate as close to the recording rate as possible.
- 9. Manual testing of the system and exercising of individual system components, such as contactors.
- 10. Display and adjust system performance parameters, event parameters and event lockout parameters that are PTU adjustable.
- 11. Downloading of software updates to each system.
- 12. Displaying the Car number, Date and Time and software version for each system and Mileage in the propulsion system.
- 13. Display of PTU menus and screens when not connected ("Offline mode") for training and assistance.
- E. Saved files shall have a default file name that is in a "data" subdirectory of the application software. The default file name should reflect the subsystem, i.e. Doors or APS, car number and Date and Time the file was saved. The file name may be changed manually at the time it is saved.
- F. The PTU application directory structure shall be named appropriately to identify the system to which it applies.

1.22 SYSTEM PTU APPLICATION AND DIAGNOSTIC SOFTWARE (CONTINUED)

- G. Diagnostic help files shall be linked to the "Help" menu in each system application. These files shall include, but not be limited to: the fault number, fault description, the set and reset parameters or conditions for each fault, operating parameters and their normal operating ranges, possible fault causes and diagnostic steps leading to fault repair. These help files shall be easily revised by CTA. Embedding help files in the code of the application software shall not be permitted. If possible, a graphical functional representation (e.g. block diagram) of each system or part of each system being diagnosed shall be included. Reference material shall also be included in the help files.
- H. All PTU application software and its functionality for each system shall be reviewed by the Engineer.

SECTION 2 DIMENSIONS AND WEIGHTS

2.01 <u>DIMENSIONS</u>

Α.	Length of car on	center line over anti-climbers	48'-0"
В.	Length of a two-o	car unit over coupler faces	96'-6"
C.	Distance center-	to-center of trucks	33'-8"
D.	Track gauge, nor	minal	4'-8-1/2"
E.	Truck wheel base	e (maximum)	6'-6"
F.	Wheel diameter		
	1. New whe	el, nominal	28"
	2. Worn whe	eel, at condemning	26"
G.	Width of car exte	rior (maximum)	9'-4"
H.	Width of carbody floor covering lev	v exterior at top of vel (maximum)	8'-8"
I.	Distance betwee	n coupled cars (at the anticlimbers)	3"±1/2"
J.	Width of car exte	rior at corner posts	8'-8"
K.	Height of light ca	r roof from top of running rail	12'-0"±1/2"
L.	Height of car at top of side door threshold from top of running rail		
	1. Secondar (backup	ry suspension fully raised level)	3'-9-1/2" max. at AW0 3'-7-1/2" min. at AW3
	2. Secondar	ry suspension at running level	3'-8-1/8" max. at AW0 3'-7-1/2" min. at AW3
	3. Secondar	ry suspension at platform level	3'-6-1/4" +5/8"/-1/4"
M.	Height of bottom rail with threshold	of side sill from top of running d height at 3'-9-1/2"	2'-11-1/2"
N.	Door opening he	ight (minimum)	6'-4"
0.	Headroom, over	aisle (minimum)	6'-9"
P.	Height of center running rail with t	line of coupler face from top of threshold height at 3'-9-1/2"	2'-3-3/8"±1/4"

2.02 DESIGN REQUIREMENTS

A. <u>Train Length</u>

Two cars, minimum (2 min).

Twelve cars, maximum (12 max).

B. <u>Seating Capacity</u>

38 passengers minimum.

- C. <u>Curve Negotiation</u>
 - 1. Horizontal

Minimum radius: 85'-0".

2. <u>Vertical</u>

The car shall negotiate vertical curves where the horizontal center line of the coupler head tilts four degrees (4°) either above or below the horizontal center line of the coupled heads on level track.

D. <u>Duty Cycle</u>

For purposes of sizing cables, estimating heat input and temperature rise, evaluating propulsion and braking performance with and without a receptive rail, as well as any other items or systems where duty cycle affects design, all car systems shall be assumed to be operated continuously, in trains of any length over a full range of wheel wear, with a nominal seated passenger load as specified in Section 2.03, A, unless otherwise specified, on level track, and in accordance with the maximum performance rates specified in Section 10.02, B, 4.

- 1. <u>Short Distance</u>
 - a. A short distance series of stops shall consist of eighteen (18) start-stop cycles with a one-half-mile (1/2-mi) distance between stops, followed by ten (10) start-stop cycles with a one-fourth-mile (1/4-mi) distance between stops, followed by eighteen (18) start-stop cycles with a one-half-mile (1/2-mi) distance between stops.

2.02 <u>DESIGN REQUIREMENTS</u> (Continued)

- D. <u>DUTY CYCLE</u> (CONTINUED)
 - 1. <u>Short Distance</u> (Continued)
 - b. A start-stop cycle shall consist of:
 - 1) Accelerate at maximum rate to maximum attainable speed within the specified distances.
 - Decelerate at maximum service rate to zero miles per hour (0 mph).
 - 3) Stop for fifteen seconds (15 sec).
 - 4) Proceed to next start-stop cycle.
 - c. The train shall stop for ten minutes (10 min) at the completion of each short distance series of stops, before proceeding to the next series.
 - d. The short distance series of stops shall be repeated continuously for ten hours (10 hrs).

2. Long Distance

- a. A long distance series of start-stop cycles shall consist of thirty (30) stops with a one-mile (1-mi) distance between stops.
- b. A start-stop cycle shall consist of:
 - 1) Accelerate at maximum rate to maximum attainable speed within the specified distance.
 - Decelerate at maximum service rate to zero miles per hour (0 mph).
 - 3) Stop for fifteen seconds (15 sec).
 - 4) Proceed to next start-stop cycle.
- c. The train shall stop for five minutes (5 min) at the completion of each long distance series of stops, before proceeding to the next series.
- d. The long distance series of stops shall be repeated continuously for ten hours (10 hrs).

2.02 DESIGN REQUIREMENTS (Continued)

- D. <u>Duty Cycle</u> (Continued)
 - 3. <u>Short Distance Reduced Performance</u>
 - a. A train of any length with up to fifty percent (50%) of the propulsion and brake equipment disabled shall be able to complete eighteen (18) start-stop cycles with one-half-mile (1/2-mi) between stops, followed by ten (10) start-stop cycles with one-fourth-mile (1/4-mi) between stops, followed by eighteen (18) start-stop cycles with one-half-mile (1/2-mi) between stops.
 - b. A stop-start cycle shall consist of:
 - 1) Accelerate at the maximum attainable rate to the maximum attainable speed.
 - 2) Decelerate at the maximum attainable service rate to zero miles per hour (0 mph).
 - 3) Pause for 15 seconds (15 sec).
 - c. Only one (1) series of stops shall be required.
 - d. Propulsion system over-temperature protection may reduce performance to keep equipment temperature within allowable limits.
 - 4. Long Distance Reduced Performance
 - a. A train of any length with up to fifty percent (50%) of the propulsion and brake equipment disabled shall be able to complete sixty (60) start-stop cycles with a one-mile (1-mi.) distance between stops.
 - b. A stop-start cycle shall consist of:
 - 1) Accelerate at the maximum attainable rate to the maximum attainable speed.
 - 2) Decelerate at the maximum attainable service rate to zero miles per hour (0 mph).
 - 3) Pause for 15 seconds (15 sec).
 - c. Only one (1) series of stops shall be required.
 - d. Propulsion system over-temperature protection may reduce performance to keep equipment temperature within allowable limits.

2.02 <u>DESIGN REQUIREMENTS</u> (Continued)

- D. <u>Duty Cycle</u> (Continued)
 - 5. <u>Towing</u>

A train with maximum load shall be capable of starting on a four-percent (4%) grade and pushing or towing another train of equal length and load with inoperative propulsion and brake equipment for one-half (1/2) mile, and then continue on level track for an additional two miles (2 mi), and then for an additional ten miles (10 mi) with both trains empty, without damage to equipment. The train shall accelerate and decelerate at maximum attainable rates, and proceed at maximum attainable speed.

Propulsion system over-temperature protection may reduce performance to keep equipment temperature within allowable limits.

2.03 WEIGHT AND CERTIFIED WEIGHT SLIPS

A. <u>Weight Specification</u>

The reference weights per car shall be as follows:

Passenger weight shall be calculated at 175 lbs per person.

Maximum Light Weight (AW0)	55,500 lbs
Nominal Seated Passenger Weight	7,200 lbs
Nominal Reference Weight with Seated Load (AW1)	62,700 lbs
Nominal Maximum Passenger Weight	23,100 lbs
Nominal Reference Weight with Maximum Load (AW3)	78,600 lbs

B. <u>Weight Uniformity</u>

The total weight of each car shall be within seven hundred and fifty pounds (750 lbs) of the total weight of each other car.

C. <u>Weight Distribution</u>

The car equipment shall be so arranged that the weight borne by each wheel of a light car shall be as nearly as possible the same as the weight borne by each other wheel. The cars shall be balanced side to side to preclude uneven wheel wear, and front to back to reduce wheel spins and slides.

A maximum differential of five hundred pounds (500 lbs) wheel-to-wheel within a car shall be permitted. The Contractor shall estimate the weight on each wheel and present this data to the Engineer, and shall measure on one (1) A-car and on one (1) B-car, selected from the first ten (10) cars, to verify the estimate.

2.03 WEIGHT AND CERTIFIED WEIGHT SLIPS (Continued)

D. <u>Estimated Weights</u>

Bidders shall furnish with their Bid an estimated weight of the complete car. The estimate shall be itemized to show the individual weights of the principal components by major system in the A- and B-car, consisting of: carbody shell, seating, air comfort equipment, propulsion and brake equipment, body-mounted electrical equipment, drawbar and coupling equipment, and trucks.

E. <u>Weights of Bodies and Trucks</u>

The Contractor shall transmit to the Engineer a record of the weights of five (5) each complete, ready-to-run, A- and B-cars, and of ten (10) each complete No. 1 and No. 2 trucks, including motors, gears, brake equipment, suspension elements, and current collection equipment, ready to run.

F. Weight Slips

The Contractor shall transmit to the Engineer the certified and witnessed weight slip of each car, complete, ready-to-run, as part of the car history.

SECTION 3 CARBODY

3.01 GENERAL

A. <u>Material</u>

The carbody and underframe shall be of a lightweight stainless steel construction throughout, except where other materials are specified. Stainless steel shall be as specified in Section 12.02, C.

The body bolster and end underframe, including end sill, shall be made of low-alloy, high-tensile steel, and be reviewed by the Engineer.

The No. 1 end exterior shall be fabricated of fiberglass-reinforced plastic (FRP) (see Section 12.01, Y). The carbody No. 1 end structure shall be designed to meet the specified strength and stiffness requirements without utilizing the fiberglass end as a load carrying structure.

B. <u>Strength Requirements</u>

The carbody structure shall be designed to withstand a static force of 200,000 pounds exerted on the face of the anti-climber without permanent visual deformation of the structure. The anti-climber and end sill supporting it shall be capable of withstanding the 200,000 pound static force with any possible engagement of opposing anti-climbers, including one (1) rib engagement.

C. <u>Static Compression Test</u>

One (1) of the first five (5) carbody structures selected by the Contractor, without interior equipment, shall be statically loaded with the equivalent weight of the not-yet-installed equipment. The structure shall then be loaded in compression at the anticlimber to 200,000 pounds with and without the equivalent weight of the maximum passenger load. The force shall be applied to an area four-inches (4") high and twenty-four inches (24") wide at the center line of the car and on the horizontal center line of the anti-climber. Stresses shall be measured at the locations reviewed and agreed to by the Engineer, and records of the completed test results shall be furnished to the Authority. Test procedures shall be reviewed and witnessed by the Engineer. All strain gauges shall be applied prior to any static load. Under maximum vertical static load, no measured stress shall exceed fifty percent (50%) of the yield strength of the material used.

SECTION 3 CARBODY (Continued)

3.01 <u>GENERAL</u> (Continued)

D. Car Behavior Under Collision Conditions-Crash Energy Management

The car structure specification items preceding and following this paragraph have as their intent, the design of a car with maximum energy absorbing capability within the general strength parameters indicated. The desired behavior is the crushing of the structure at the extreme ends first, with crush progressing toward the bolster. It is also intended that the entire end stay together and remain attached to the roof and floor, even though it is bent or buckled. This should result in pulling down the end of the roof in a severe collision. The design of the car shall be such as to make telescoping of one car into another virtually impossible. Special care shall be exercised in design and execution of all structural welds to ensure maximum weld integrity under collision conditions. The principles of ASME Standard RT-2 shall be applied to the design and construction of this car to the extent practicable without creating a car that is stronger or stiffer or heavier than existing CTA rapid transit cars.

The Contractor shall submit, after award of Contract, analyses and reports following the requirements of ASME Standard RT-2, Section 9, to demonstrate compliance with the energy absorption requirements of this section and the requirements of Sections 3.02, 3.03, and 3.04. The analyses shall be conducted in conjunction with the Stress Analyses specified in Section 1.09, A. The analyses shall be completed to the satisfaction of the Engineer prior to the carbody static compression test.

If there are conflicts between the requirements of this specification and those of ASME Standard RT-2, the Contractor shall bring them to the attention of the Engineer for resolution. In general, the requirements of this specification shall supersede the ASME standard in order to insure compatibility of these cars and those with which they will run in trains in service.

E. <u>Clearance</u>

Under all conditions, including failure of the active suspension system, equipment and enclosures which are hung under the car shall have sufficient clearance over running and third rails, under all dynamic operating conditions found in CTA service. Equipment that extends over the third rail on tangent track or curves shall be at least thirteen-inches (13") above the running rails. The carbody and attached equipment shall be designed to provide necessary clearances for the trucks, drawbar and coupler equipment, and cable arrangements. Space must be provided for maintenance of all undercar equipment, including cover removal from all undercar enclosures.

F. <u>Undercar Ducts</u>

Ducts with adequate access and clean-out openings shall be provided for distribution of air for the air comfort system and traction motor ventilation. All ducts shall be free of weld splatter and sharp edges, and air ducts shall be air- and watertight.

SECTION 3 CARBODY (Continued)

3.01 <u>GENERAL</u> (Continued)

G. <u>Underfloor Equipment Mounting</u>

All underfloor equipment and boxes shall be mounted using supports fabricated of stainless steel or alloy steel adequately protected against corrosion. These supports and their attachments to the equipment or box and to the car structure shall be capable of resisting a 5 g longitudinal acceleration of the supported item without permanent deformation.

Bolts in tension shall not be used to support underfloor equipment unless otherwise agreed to by the Engineer on a case by case basis.

H. Jacking and Pushing Locations

The carbody structure shall be designed so that jacks may be used for lifting the body, with trucks attached, at jacking locations along both sides and at both ends of the car. It shall be possible to jack the car any place under both end sills and under both side sills for a distance of approximately sixteen-inches (16") on either side of a point, thirteen feet, four-inches (13'-4") from the center of the car. It shall be possible to push the car about the shop with a shop truck provided for that use. This truck may push the car on either end sill or any corner of the car. This shall be possible without deformation or other damage to the carbody or grab handles.

I. Barriers, Gutters and Drains

Water deflecting barriers shall be installed at each end of the roof and gutters shall be installed over the No. 2 end door and for the full length on each side of the car with drain holes at the various deadlight areas. Drain holes shall not be located above grab handles. Drains shall also be provided to carry away any water which may enter air intakes.

J. Sharp Edges and Snags

The exterior of the car shall be free of any sharp edges or snags that may injure persons or damage car washer brushes.

The car interior and all other components, sub-assemblies and structure, whether exposed to passengers or not, shall be completely de-burred and free of any sharp edges or snags that may injure persons or damage clothing.

SECTION 3 CARBODY (Continued)

3.01 <u>GENERAL</u> (Continued)

K. <u>Pilot</u>

Each No. 1 end shall be equipped with a small, under coupler pilot as used on CTA's 5000 Series Cars. The attachment to the end sill shall allow easy removal and replacement of the pilot frame.

The pilot blade shall be flexible cotton-rubber laminate "Fabreeka" as used on CTA's 5000 Series cars.

The design shall be the same as on CTA's 5000 Series cars to allow interchangeability, and shall be reviewed by the Engineer.

L. <u>Configuration</u>

The carbody shall be configured in general per CTA Drawing R-1-606, Page DR-1. The sides shall be smooth "deadlight" finish above the belt rail, and corrugated below the belt rail. The pitch and depth of the corrugations shall be the same as on CTA's 3200 or 5000 Series cars, and shall be reviewed by the Engineer.

The fiberglass end cap may be recessed on both corners where the safety spring hooks are attached similar to that on CTA's 3200 Series cars, or may be a continuous curve as on CTA's 5000 Series cars.

The car ends shall be located as close to the ends of the end sills as practical to reduce the gap between coupled cars and minimize the area available to stand.
- 3.01 <u>GENERAL</u> (Continued)
 - M. <u>Esthetic Design Exterior and Interior</u>
 - 1. During the Pre-Bid process, each Bidder shall submit at least three alternate design concepts for the front end cap of the car including color renderings. The concepts shall show alternate shapes and configurations for the end cap and color schemes for both the end cap and sides. The concepts shall retain all functional aspects of the car as specified, but shall offer alternate appearances. Maintainability, both routine and damage repair, must be considered in the designs.
 - 2. During the Pre-Bid process, each Bidder shall submit at least three alternate design concepts for the interior of the car including color renderings. The alternates shall include seats, windscreens, window masks, wainscots, ceiling, lighting, floor color and other interior elements that can be changed without compromising functionality, maintainability, vandal resistance or operational characteristics. The concepts shall show different combinations of colors and finishes, contours and materials including alternate concepts for wheel chair location and retention and general seating arrangement while maintaining the existing locations and sizes of the side and end doors. Reduction of floor obstructions should be addressed, but weight constraints/reduction must be considered.
 - 3. The Authority will review the alternate design concepts during the Pre-Bid phase and make a preliminary selection prior to the submittal of final Bids.
 - 4. After award of the contract during the Design Review phase, the Contractor shall prepare both interior and exterior color renderings for review and acceptance by the Authority.

3.02 FRAMING STRUCTURE

A. <u>Carbody Framing</u>

The carbody framing shall be made of stainless steel and be designed and constructed to carry the required loads and absorb properly any stress imposed when operating in the services specified without damage to the structure. The underframe, roof and side frames shall be considered as a unit in withstanding the accumulated stresses. The car structure shall have sufficient positive camber to prevent negative camber under static and dynamic conditions when the car is fully loaded. Structural design of the car shall ensure that the strength of the body structure in the longitudinal direction between bolsters shall be forty percent (40%) greater than the strength between the anti-climber and the coupler anchorage. The strength of the body structure between the strength outboard of the coupler anchorage. The underframe shall contain sufficient cross bearers to carry the floor and seat loads without noticeable flexing.

If the seat pedestals are not mounted above and bolted through structural members, sufficient reinforcement shall be provided to ensure that the strength of the floor connection meets the requirements of Section 3.07, A, 5.

Whenever any underframe member is enclosed at the bottom, preventing draining, one-half inch (1/2") drain holes shall be provided under each post to drain away water which would accumulate above the underframe members around the sides and ends of the car.

3.02 FRAMING STRUCTURE (Continued)

B. End Posts

The two (2) end posts adjacent to the door at each end of the car shall have sufficient strength and be so attached through the entire depth of the underframe end sills that under collision conditions, the posts will develop the full strength of the end underframe if struck at any location up to six-inches (6") above the top of the underframe and at any horizontal angle up to thirty degrees (30°) to either side. The attachment of the posts to the end underframe shall be capable of resisting the torsional components resulting from the application of the loads specified above.

All other end posts shall be attached through the full depth of the underframe sill so that if struck at the top to the end underframe with an inward force at any horizontal angle up to ninety degrees (90°) from longitudinal, the sills will crush back before breaking the post connections.

The attachment of all end posts at the top shall be by means of an anti-telescoping plate and shall be adequate to resist, without failure, the reactions of the members, either singly or in any possible combination, when assumed to be simple beams with free supports at their ends and loaded at a point eighteen-inches (18") above the connection to the underframe member to which they are attached with a load sufficient to develop the yield point of the material. The vertical connections of all end posts at the underframe and at the top shall be sufficient to resist the vertical forces caused by yielding of the posts under collision conditions. The anti-telescoping plate previously mentioned shall be attached to the posts and to the roof in a manner that will develop the full vertical strength of the roof in the event of yielding of the posts.

The sum of the section moduli of all end posts at one (1) end of the car shall not be less than thirty (30) cubic inches, and the sum of the section moduli of the two (2) center posts shall be approximately seventy-five percent (75%) of the total of all end posts.

Means, reviewed by the Engineer, shall be incorporated in the end post design to prevent them from becoming air ducts and transmitting outside air and noise from under the car into the ends and ceiling of the car.

3.02 FRAMING STRUCTURE (Continued)

C. <u>Side and End Frames</u>

The side and end frame structures shall be of stainless steel and be so designed and constructed that they will carry their proportion of the stresses imposed on them. All posts shall be securely welded or bolted to the underframe and roof structure in order to make the entire car frame act as one unit without any movement at the joinings. Special care shall be exercised in the attachment of the sheathing in order to obtain a finished appearance of the exterior surface. Stiffeners shall be installed on the back of the side sheets between posts, if needed, to prevent the side sheets from "oil canning". Proper reinforcements shall be installed around body openings to provide for the stresses which may be present around the openings. These reinforcements shall not affect the appearance of the cars.

All welds used to join the side walls to the underframe and to the roof shall be designed to develop at least seventy percent (70%) of the strength of the parent metal.

All joints between stainless steel and carbon steel shall be sealed in a manner reviewed by the Engineer.

D. <u>Side Sills</u>

The height of the side sills shall be minimized to provide easy access to the trucks and increase the clearance between the carbody and its equipment and the current collector and third rail. The bottom of the side sill shall, if possible, be kept in line with the bottom of the anti-climber.

The side sill design shall be reviewed by the Engineer.

E. <u>Anti-Climber</u>

A section of anti-climber shall be attached to the end sill at each end of the car. This may be made of a rolled section or a built-up section which has been reviewed by the Engineer. Compatibility with other anti-climbers on CTA vehicles is required.

The anti-climber, its attachments and the end sill to which it is attached shall be able to resist, without loss of engagement, a vertical load of 75,000 pounds, and a horizontal load of 200,000 pounds, applied by an opposing anti-climber with any possible engagement, including one (1) rib engagement. Such a load may cause local deformation of the anti-climber itself, but no deformation of the attachments or end sill.

3.03 BODY BOLSTER

The carbody bolster shall be a built-up structure of low alloy high-tensile steel having suitable properties after welding and stress relief, if used. The structure shall carry the centerplate and carbody to truck attachment. This may take the form of a cast steel king pin and center bearing of PCC type, or alternate designs reviewed by the Engineer during pre-bid meetings. The king pin, if used, shall be built into the bolster at right angles to the floor. A suitable renewable bushing shall be provided at the lower end of the king pin. The PCC king pin is shown on CTA Drawing SK-E-21563, Page DR-7.

The connection between the carbody and the trucks shall be such that the trucks will be raised with the carbody, unless intentionally detached therefrom.

The connection between the carbody and the truck at the centerplate and side bearing, if used, shall be electrically insulated.

If a removable king pin cap or other truck retention means is used, it shall be die-stamped with the car number in numerals one-half inch (1/2") high.

The connection between carbody and trucks shall be capable of resisting a vertical load of 50,000 pounds and a horizontal shear load of 150,000 pounds in all directions without yielding. The 150,000 pound load may be applied to any vertically located position between the finished floor and the center line of the axle.

3.04 <u>ROOF</u>

The carlines, purlins, and roof sheets shall be made of stainless steel. The roof sheets shall be attached to the carlines and other structural members in such a manner that they shall present a finished-appearing surface, and all joints shall be watertight. Longitudinal corrugated roof sheets will be acceptable. Water-deflectors shall be installed on the roof, arranged to prevent water which may accumulate in the roof corrugations from flowing over the end doors. The deflectors shall be two-inches (2") high, tapered at the ends to match the roof curve.

The roof design shall be such that a workman may walk and work anywhere on the roof without damage to the roof.

- 3.05 <u>DOORS</u>
 - A. <u>General</u>
 - 1. The construction of all doors shall be of stainless steel with phenolicimpregnated kraft paper honeycomb core. The honeycomb may be filled with approved acoustical and thermal insulating material. Inner and outer sheets shall be bonded to the core and shall be at least 0.048-inch thick stainless steel. All metal parts such as stiffeners and rivets shall be stainless steel. Doors, if flat, shall be flat and in plane within 3/32-inch. Door surfaces shall be free of any visible scratches, oil cans, unbonded areas or depressions. Alternate core material may be permitted with the review of the Engineer.
 - 2. Door hardware may be mounted by the Contractor on the doors. All door hardware attachment holes shall be jig-drilled by the door manufacturer.
 - 3. Internal stainless steel tapping plates shall be provided for all screws.
 - 4. Doors shall be free of spot welding depressions and sharp edges or burrs. Doors shall be equal in quality to those manufactured by the Morton Manufacturing Company.
 - 5. All outside doors shall be weather-stripped effectively on sides, bottom, and top to prevent the entrance of air, water, or dirt. Particular attention shall be paid to the end door weather-stripping to ensure they do not whistle or allow rain or snow into the car.
 - 6. Any door which may contact any object in the intended service shall have reinforcements inside the door at that area. This would include such items as doors stops and end door handles.
 - 7. The Contractor shall submit to the Engineer for review, a sample, at least twelve-inches square (12 x 12 in), showing the door construction, including an edge and reinforcements.
 - 8. All door hardware, including hinges, latches and keepers, shall be reviewed by the Engineer.

3.05 DOORS (Continued)

- B. <u>Side Doors</u>
 - 1. The side entrance doors shall be shaped to the same contour as the side of the car. The panels shall accommodate a rubber leading edge that shall interlock to provide a good weather- and noise-seal. Each opening shall be closed by means of two (2) sliding leaves. The doors shall slide into body door pockets which shall be stainless steel construction. The panels and/or the pockets shall be weather-stripped to minimize the entrance of noise, water, and dirt when the doors are closed. Brush seals, reviewed by the Engineer, shall be applied to the top and sides of the door frame. The weather-stripping shall be arranged to preclude dragging on the panels, or catching on panel edges when open or closed.
 - 2. The gap between the bottom of the rubber edges and the bottom door track shall be closed to keep out noise and water, in a manner reviewed by the Engineer.
 - 3. The upper door track and hanger, if used, shall be of the ball bearing or roller-type with full adjustment designed for use on doors hung off vertical. The design of the hanger shall be such that the eccentric loading of the door shall not act to deform the track and shall adjust itself to any misalignment of the door. Lightweight-formed metal hangers will not be acceptable.
 - 4. Door panels shall be readily removable from the track or hanger for maintenance. The entire sliding door installation shall be reviewed by the Engineer.
 - 5. Each side door header shall have a number decal affixed adjacent to the emergency opening handle hole in a location reviewed by the Engineer.
 - 6. Access panels with locking devices shall be provided to maintain door operators, linkages and hangers, as described in Section 3.09, B, 2.
 - 7. Side doors shall be glazed as shown in CTA Drawing R-1-606, Page DR-1. The glass, as specified in Section 12.05, shall be directly glazed into the door panels with rubber glazing strips as specified in Section 12.04, C.

3.05 <u>DOORS</u> (Continued)

- C. End Doors
 - 1. The end doors shall be hinged, as shown on CTA Drawing R-1-606, Page DR-1. The end doors shall have stainless steel kick plates and water sheds of at least 0.060-inch thick, attached to the lower outside portion of the doors.
 - 2. End doors shall have latches equal to J.L. Howard Type 2741.
 - 3. The inside latch handle of each end door shall be covered with a heavy duty top-hinged, spring-loaded, stainless steel cover, as on CTA's 5000 Series cars. The cover shall not rattle when closed and shall have edge protection on all exposed edges to prevent injury to anyone opening the cover. Rubber bumpers shall cushion the cover to the end door. The spring-loaded hinge shall be extra rugged to prevent damage, if the cover is opened and twisted. The entire cover and its attachment shall be reviewed by the Engineer.
 - 4. End doors shall have three (3) heavy duty stainless steel hinges with 3/8-inch diameter hinge pins equal to J.L. Howard Type 2739 A.
 - 5. Both end doors shall be equipped with a door closer having a "hold open" arm and key valve control. Closer shall have a smooth, rectangular exterior appearance equal to LCN Smoothee Type 4011.
 - 6. End doors shall be equipped with a drop sash, as described in Section 3.06, E.
 - 7. End door sash opening shall be the same size and configuration as used on CTA's 5000 Series cars.
 - 8. A stop shall be installed for each end door that prevents the door from contacting any passenger seat.

- 3.05 DOORS (Continued)
 - D. <u>Operator's Cab Door</u>
 - 1. The operator's cab door shall be arranged to swing as shown on CTA Drawing R-1-606, Page DR 1. The cab door shall have two (2) latched positions: across the aisle and closing the operator's position, as on CTA's 5000 Series cars. The door shall not rattle in either position.
 - 2. The cab door shall be equipped with a lock that shall have a spring-loaded stainless steel square bolt latch, operated by CTA's standard key, equivalent to J.L. Howard Type 2815. The lock shall positively latch the door in both positions, and shall be designed to prevent picking or jimmying. The lock shall be on the inside of the door, have a tee handle on the inside and key escutcheon plate on the outside of the door. The key escutcheon plate and flush door pull shall be fastened with rivets. Stainless steel rub rails, if needed, shall be riveted on the inside of the cab door to prevent damage by the end door latch and grab handle.
 - 3. The cab door shall be hinged with a continuous stainless steel piano hinge.
 - 4. The door shall be glazed, as specified in Section 12.05, J, 2, at a height of forty-eight and one-half inches (48-1/2") above the bottom of the door. The window opening shall have a stainless steel expanded metal guard screwed to the inside with 1/8-inch pin socket head 10-32 screws.
 - 5. A latch shall be through-bolted to the bottom corner of the cab door on the inside. This latch shall be foot operated and have a vertical spring-loaded bolt that shall engage keepers screwed to the floor. The latch and keepers shall be stainless steel. The latch shall be equivalent to J.L. Howard Type 2906. The keepers shall be set to hold the door approximately eight-inches (8") from both sides of the cab partition and from the fully closed position, and approximately one-half inch (1/2") from the passenger seat behind the cab. The latch must be released manually to swing the door past the keepers once the latch is engaged.

Keeper shims, if used, shall not exceed one-fourth inch (1/4") thickness and the keeper and shims, if used, shall be sealed to the floor covering.

- 6. The cab door shall clear the top of the latch keepers screwed to the floor by approximately one-fourth inch (1/4").
- 7. The cab door latches and keepers shall be demonstrated on the cab mockup.

3.05 DOORS (Continued)

E. <u>Cab Overhead Access Panels</u>

The three (3) cab overhead access panels shall be melamine, colored to match the car interior, and permanently bonded to stainless steel which shall be at least 0.030-inch thick. Each panel shall have a continuous stainless steel hinge and heavy duty "Velcro" type latches, mechanically attached, to hold it closed, with handles to open it and a stainless steel hold open device to keep the panel in the open position. Each panel shall also have two (2) quarter-turn fasteners with tamperproof heads to hold it closed. The heads shall be the same as on the heater guard fasteners. The latches, handles and hold open devices shall be reviewed by the Engineer.

3.06 WINDOWS

A. General

The passenger side and end windows shall be arranged similarly to that shown on CTA Drawing R-1-606, Page DR-1. The glass size, where possible, and number of windows shall be the same as on CTA's 5000 Series Cars. All windows shall be glazed as indicated in Section 12.05. It shall be arranged to change all glass from inside the car, except for the two (2) front windows and the glass over the front and side destination signs, without removing any part of the sash or car. All sash designs shall be reviewed by the Engineer.

B. <u>Cab Sliding Sash</u>

1. Each car shall have a horizontal sliding sash installed on both sides of the car at the operating position. The sash may be aluminum, but all the hardware and moving parts shall be stainless steel. The design of the sash and latch shall be reviewed by the Engineer. The sash shall be glazed into the carbody with a rubber-glazing strip. The sash shall provide a clear opening of fifteen to seventeen inches (15-17") wide at the forward end. The sash and latch shall be arranged for operation with one hand. The latch shall be located approximately one-half (1/2) of the way above the bottom of the sash unless otherwise agreed to by the Engineer. It shall not be possible to open the window from the outside. The latch keeper shall not protrude into the clear opening of the sash. The sash shall not rock or bind. The provisions to prevent rocking and binding shall receive particular attention, and shall also reduce wear on the frame and sash and shall be retained with tamperproof screws reviewed by the Engineer. Provision shall be made to prevent any interference with sash operation by any weather condition found in the Chicago area. The top and bottom of the sash shall blend into lines set by the other side windows. Provision shall be made for proper draining of the sash. Drain shall vent directly to the outside of the car.

3.06 <u>WINDOWS</u> (Continued)

- B. <u>Cab Sliding Sash</u> (Continued)
 - 2. The sash on the left side of the car shall have a lock operated by CTA's standard key as shown on CTA Drawing R-1-602, Page DR-5, incorporated in the latch as on CTA's 5000 Series cars.
 - 3. The Contractor shall submit a complete sash of each type to the Engineer for review. The sashes in their final form shall become the property of CTA as spare equipment.

C. <u>Destination Sign Window</u>

A window shall be provided above the No. 1 end door for the front destination sign. The glass, as specified in Section 12.05, shall be glazed in rubber.

D. <u>Side Body Sash</u>

All large side body window openings, except those with the side destination signs, shall be equipped with "hopper"-type sash. The uppermost nine-inches (9") shall be hinged to open inward and shall be equipped with an over-center feature to hold the hopper open and closed. The hopper, its hinge and over-center feature shall be designed to withstand pulling when open fully. The method to stop and restrain the hopper shall receive particular attention in the design. In addition, there shall be one (1) latch with handle to hold the hopper closed. A lock operated by CTA's standard key shall be incorporated in the latch design.

The hopper shall open approximately five-inches (5") at the top and shall be weather-sealed on all four (4) edges. The bottom edge shall be designed to overlap the fixed portion to protect and drain water away from the hinge.

The sash may be aluminum, but all the hardware and moving parts shall be stainless steel. The design of the sash and latch shall be reviewed by the Engineer.

The center side body windows with the side destination signs shall be equipped with a sash with a fixed upper portion glazed, as specified in Section 12.05.

The Contractor shall submit a complete sash of each type to the Engineer for review. The sash in its final form shall become the property of CTA as spare equipment.

3.06 <u>WINDOWS</u> (Continued)

E. End Door Sash

Each end door shall be equipped with a drop sash glazed into the door with a rubber-glazing strip. The sash shall be mounted from the outside of the door and shall overlap the opening in the door. The top drop section shall be approximately eighteen-inches (18") high and shall drop outside the bottom half with a clear opening of approximately twelve-inches (12"). The drop portion shall be equipped with two thumb latches which will hold the sash fully closed or half open. The sash shall be fully weather-sealed on all edges and shall be easy to lift with no rocking or binding. The provisions to prevent rocking and binding shall receive particular attention, and shall also reduce wear on the frame and sash. A lock operated by CTA's standard key shall be incorporated in the design.

The sash may be aluminum, but all its hardware and moving parts shall be stainless steel. The design of the sash and latch shall be reviewed by the Engineer. The Contractor shall submit a complete sash assembly to the Engineer for review. The sash in its final form shall become the property of CTA as spare equipment.

3.07 <u>FLOOR</u>

- A. <u>General</u>
 - 1. The Contractor shall pay particular attention in the design of the floor to include acoustical insulation and to acoustically isolate the floor to attenuate noise and vibration transmission to the car interior.
 - 2. The floor shall be designed to be a firm structure, and not ripple or flex in service or under load. All floor panel joints shall be structurally supported.
 - 3. Special care shall be taken to preclude the entrance of water to the floor and underfloor insulation to ensure long life.
 - 4. All holes in the floor covering necessary for securing interior appointments shall be filled with suitable sealer.
 - 5. The portion of the seat attachment contained in the floor shall be capable of resisting its share of the reactions resulting from two (2) one hundred fifty pound (150 lb) passengers being thrown against a seat with a longitudinal force of 4 g (1200 lbs) in either direction.

3.07 <u>FLOOR</u> (Continued)

B. Floor Panels

- 1. The floor panels shall be a phenolic composite type impervious to moisture reviewed by the Engineer.
- 2. The panels shall be securely fastened to the underframe with all joints at underframe members, with adequate acoustical and vibrational isolation. The underframe members or secondary structure supporting the floor shall not flex or bend under load.
- 3. All joints between panels and underframe shall be properly filled with a sealer before being laid. The edges of all pieces shall be sealed in a manner reviewed by the Engineer, before laying, to make them impervious to moisture.
- 4. In order to achieve the noise and vibration levels, as specified in Section 16.02, a different floor construction to that specified above will be given consideration and shall require the concurrence of the Engineer.

C. Floor Covering

- 1. The floor covering shall be skid- and wear-resistant sheet rubber compounded for low smoke emission. The material shall be flat sheet nominal 1/8-inch thick equivalent to Nora Rubber Flooring or PRF. This material shall be specifically compounded and configured to be skid-resistant when wet.
- 2. The floor covering color shall be as selected from the alternates submitted by the Contractor that coordinate with the selected interior design, but shall be a dark color that hides dust and dirt.
- 3. Floor covering shall be laid per the manufacturer's recommendations in as large pieces as possible to avoid joints. Joints that are necessary shall be placed out of traffic areas as much as possible.
- 4. No patches shall be permitted in the floor covering.
- 5. Particular care must be taken at side and end doors to seal the floor to prevent water entering the panels or working under the covering.

- 3.07 <u>FLOOR</u> (Continued)
 - C. <u>Floor Covering</u> (Continued)
 - 6. The floor covering shall have provisions for photoluminescent strips. See Section 5.08 for details of the strips.

The strips shall be installed in line with the aisle side of the transverse two (2) passenger seats.

The strips shall extend from each end door to the edge of the windscreen at the closest side door and between windscreens from side door to side door. At the locations without a windscreen, the strips in the flooring shall be continuous along the floor where the windscreens would have been located.

The means of securing the strips in the flooring and for sealing the strips shall be reviewed by the Engineer.

7. The floor covering and its arrangement shall be reviewed by the Engineer.

D. <u>Thresholds and Cab Steps</u>

- 1. The thresholds at the side doors shall be made of stainless steel with provisions to guide a sliding door. The stainless steel used shall be a skid-resistant type. The thresholds shall be designed to prevent the accumulation of dirt and water without the use of drain tubes or covered passages. Heaters shall be installed to preclude the formation of ice or accumulation of snow where it may interfere with door operation or impede the safe passage of persons. The heaters and their wiring shall be arranged for easy replacement and testing (see Section 7.02, D). The side door thresholds with their heaters and wiring and guide shall, if possible be the same as those on CTA's 5000 Series cars and shall be reviewed by the Engineer.
- 2. The end door opening at each end of the car shall have a stainless steel threshold having two (2) troughs to collect water that may work under and around the door. The stainless steel used shall be a rigidized or skid-resistant type. One (1) trough shall be under the door itself and the other shall be just inside the door and extend approximately two-inches (2") beyond the door on each side. Each trough shall be fitted with three (3) stainless steel drain pipes at least one-half inch (1/2") ID, extending through the underframe but not draining on the coupler carrier. The threshold shall be secured with flathead stainless steel bolts and nuts and fully sealed on all surfaces.

3.07 <u>FLOOR</u> (Continued)

- D. <u>Thresholds and Cab Steps</u> (Continued)
 - 3. The cab steps shall be covered with a piece of nominal 3/16-inch thick, skidresistant, ribbed or round pattern, floor covering with a backing of 24-gauge, Type 302 stainless steel, with a tapered front nosing. The covering shall be cemented and screwed to the step, see Section 3.12, G.

E. <u>Cement and Cementing</u>

The cement and procedures used to secure the floor covering shall be as recommended by the floor covering manufacturer and reviewed by the Engineer. Care must be taken in cementing to ensure 100% coverage and adhesion. No unbonded area shall be permitted.

F. Moldings

Where the floor covering reaches the sides and ends of the carbody, it shall be finished with a stainless steel sanitary cove. The molding shall be sealed and screwed-in-place. Sanitary corner pressings shall be properly fitted at all corners and completely sealed and screwed-in-place.

G. Drawbar Pin Cover

The No. 1 end drawbar pin, and No. 2 end drawbar pin if required, shall be accessible through an opening in the car floor over the pin. The opening shall be surrounded by the Drawbar Pin Cover Plate Support as on CTA Drawing R-3-502, Page DR-8.

The Drawbar Pin Cover Plate shall be as shown on CTA Drawing R-3-505, Page DR-9. Both pieces shall be cast of bronze. The floor covering must be completely sealed around the support.

3.08 INSULATION

A. Roof, Thermal

The roof shall be insulated with a layer of permanently fire-retardant insulation, having insulation properties equal to at least two-inches (2") of fiberglass, with a maximum K factor of 0.24. The insulation shall be retained in the roof sheets with suitable mechanical fasteners.

3.08 <u>INSULATION</u> (Continued)

B. <u>Side Walls, Thermal</u>

The side walls, from ceiling to floor, shall be insulated with a layer of permanently fire-retardant insulation, having insulating properties equal to at least two-inches (2") of fiberglass, with maximum K factor of 0.24. The insulation shall be retained in the side walls with suitable mechanical fasteners. The insulation shall be installed between the side sheets and the interior finish, including the ends of the car and in the operator's cab.

C. Floor, Thermal

The floor shall be insulated with a layer of permanently fire-retardant insulation, having insulating properties equal to at least one and one-half inches (1-1/2") of fiberglass, with a maximum K factor of 0.24. The insulation shall not be exposed to air flow or water. The installation shall be reviewed by the Engineer.

D. <u>Acoustic</u>

The entire car, sides, roof and floor shall be acoustically insulated, in addition to thermally insulated, to achieve interior noise levels, as specified in Section 16.02. The materials used shall be suitable for the function required.

E. <u>Fiberglass</u>

Fiberglass insulation used in areas subjected to water in normal car service (under the floor, unless totally sealed and enclosed in the floor panels, and below the window sill level) requires provisions, reviewed by the Engineer, to protect it from moisture and dirt.

F. <u>Miscellaneous</u>

- 1. Insulation used in any air stream shall have a smooth surface and shall be retained to prevent it from blocking the air flow.
- 2. Closed-cell insulation or sealed fiberglass shall be used wherever the insulation may be subjected to water in normal car service.
- 3. All insulation materials used must be reviewed by the Engineer.

G. <u>Flammability</u>

All insulation shall be tested in accordance with ASTM E162 and shall exhibit a flame spread index of 25 or less with no rapid running or dripping of flaming material.

3.09 CEILING AND SIDE LINING

A. <u>General</u>

The general interior arrangement of the car shall generally conform to CTA Drawing R-1-606, Page DR-1, and shall require the review of the Engineer.

The interior design shall provide for easy maintenance and cleaning by avoiding pockets and corners, where possible.

The interior trim shall consist of as few parts as possible, and shall have as few exposed fasteners as possible. All visible fasteners holding interior trim shall have pin socket heads. See Section 12.01, J.

No piece of interior trim shall exceed eight feet (8') in length or width.

Interior melamine panels and fiberglass window masks shall exhibit a flame spread index of 25 or less when tested in accordance with ASTM E162 with no rapid running or dripping of flaming material.

Smoke density shall not exceed 100 in 1-1/2 minutes or 200 in 4 minutes when tested in accordance with ASTM E662.

- B. <u>Details</u>
 - 1. <u>Ceiling</u>

The ceiling shall be constructed of 1/8-inch thick, thick stock, phenolic laminate-balanced melamine panels. The panels shall be colored to match the selected ceiling color, and shall have a gloss finish.

Any battens used shall be stainless steel, but the covers may be stainless steel or aluminum, colored to match their background.

The PA speakers shall be flush-mounted in the ceiling and covered with a small stainless steel perforated grill.

3.09 CEILING AND SIDE LINING (Continued)

- B. <u>Details</u> (Continued)
 - 2. Window and Side Door Pocket and Header Masks
 - a. The window masks shall be fiberglass-reinforced plastic (FRP), colored throughout (see Section 12.01, X). Any melamine used between the ceiling and the air diffuser shall be thick stock, phenolic laminate-balanced panels and shall have a high gloss finish. The masks or panels used everywhere, except at the operator's area, shall be colored in accordance with the selected color scheme. The operator's windshield and the right side sliding sash mask shall be colored to match Pantone 8C, cool gray, as used on CTA's 5000 Series cars.

Any battens used shall be stainless steel, but the covers may be stainless steel or aluminum, colored to match their background.

The side destination sign box and its mask shall be designed to blend into the contours of the window mask. The configuration of the box and its mask and its installation must be reviewed by the Engineer (see Section 14.02, L, 10).

b. The door pockets shall be covered with a mask constructed of rigidized stainless steel, per Section 12.02, C, 3, with the pattern vertical unless otherwise determined during the interior esthetic design review process. Where decals are to be installed, smooth stainless steel plates shall be installed over the rigidized. The panels shall be adequately supported to prevent drumming and oil canning, and provide a rugged, rigid assembly. The panels shall be thermally and acoustically insulated. No visible fasteners shall be used in the assembly of the mask, unless specifically agreed to by the Engineer.

The face of each mask shall contain a hinged panel secured with a lock operated by CTA's standard key. An escutcheon plate shall be provided around the key hole to protect the panel. The panel faces shall be smooth stainless steel with a 2B finish unless otherwise determined during the interior esthetic design review process. The panel may be a laminated assembly with stainless steel channels around all four (4) edges, or other design that provides the necessary rigidity and ruggedness to withstand repeated bending and slamming, while remaining flat and sealed. The panel shall be air-and watertight when closed, to effectively seal the pocket to prevent the entrance of water, air or noise into the car.

3.09 <u>CEILING AND SIDE LINING</u> (Continued)

- B. <u>Details</u> (Continued)
 - 2. <u>Window and Side Door Pocket and Header Masks</u> (Continued)
 - b. (Continued)

The panels shall be as large as possible to allow access to side door indicator lights and exterior speakers from inside the car.

Sign frames, as described in Section 5.01, B, shall also be provided.

The design and installation of the door pocket mask and hinged panel shall be reviewed by the Engineer, and shall be demonstrated on the convertible seat area mock-up. Alternate designs to accommodate the large size required will be considered.

- c. The door pocket mask, in locations without an underseat box, or where it would otherwise extend to the floor, shall also be constructed of rigidized stainless steel panels, as per Section 12.02, C, 3, with the pattern vertical. A stainless steel cove shall also be provided along the bottom edge in these locations. Care must be taken to fully insulate the door pocket area.
- d. Heater element compartments at the door pockets at the convertible seat areas shall blend with the adjacent side wall heater compartments.
- e. The side door header over each door opening shall have a tophinged removable cover incorporating a sign card rack as on CTA's 3200 Series cars and as defined in Section 5.01, A. The cover shall have coarse-threaded fasteners with easy starting provision at the bottom to retain it. The cover shall be demonstrated in the Side Door Mock-Up, as described in Section 6.08.
- f. The entire length of the upper door track or hanger on each side of the door opening shall have a removable cover to provide access. The cover shall be stainless steel with a 2B finish. The cover shall be rugged to prevent warping or bending when removed and installed. The cover shall be sealed and attached with coarsethreaded fasteners retained in the cover. These covers shall be demonstrated in, at least, the Convertible Seat Area Mock-Up, as described in Section 3.14, D.

3.09 CEILING AND SIDE LINING (Continued)

- B. <u>Details</u> (Continued)
 - 3. <u>Air Diffuser</u>

A continuous air diffuser shall be provided under all the windows in the car. The diffuser shall be made of stainless steel and shall be designed to direct the air over the windows. There shall be an internal screen to prevent debris falling into the side wall. The diffuser and screen shall be reviewed by the Engineer.

4. Wainscot

The wainscot panels shall be 1/8-inch thick, thick stock, phenolic laminatebalanced melamine. The panels shall have a gloss finish and be colored in accordance with the selected interior color scheme.

Any battens used shall be stainless steel. The covers shall also be stainless steel with a smooth brush finish.

Wherever a wainscot or melamine close off panel could be subjected to abuse by feet or would be unsupported on an edge, it shall be constructed of rigidized stainless steel, per Section 12.02, C, 3, and provided with stiffeners and rolled edges to make it rugged and inflexible.

5. Heater Guards

Side wall heater guards shall be Type 302 rigidized stainless steel, as per Section 12.02, C, 3. See Section 7.02, A, for more details.

3.10 <u>SEATS</u>

- A. <u>General</u>
 - The general shape and contour of the passenger seat shell shall be similar to that shown on CTA Drawing E-2-500, Page DR-3. The two (2) passenger seat shall be thirty-five inches (35") wide overall, except that the folding seats and the seats adjacent to the cab door may be thirty-four inches (34") wide, if required for clearance purposes, but require the consent of the Engineer. Front-to-back distance shall be approximately twenty-three inches (23"), exclusive of the handrail. The exact design and size of the seats shall be determined during the interior esthetic design review process.

- 3.10 <u>SEATS</u> (Continued)
 - A. <u>General</u> (Continued)
 - 2. Seat assemblies and components of identical seats shall be mechanically interchangeable.
 - 3. The seating arrangement and quantity of seats on each car shall be determined during the interior esthetic design review process. CTA Drawing SKE-1-092612 on page DR-1 is included as an example of CTA cars in service for general dimensional references only.
 - 4. Transverse, two (2) passenger seats shall be mounted two-inches (2") from the side wall of the car.
 - B. Single and Two Passenger Seats
 - 1. The single and two passenger seats shall consist of a one-piece shell with upholstered inserts supported by a tubular stainless steel frame. The one-piece seat shall be securely fastened to the tubular steel frame in a manner to provide structural integrity to the seat. The seats shall not squeak under load and shall not vibrate or rattle. The seat shell shall have complete peripheral support by the stainless steel frame. The gap between the side frame and the shell shall not exceed 0.090-inches.
 - 2. The seat shell shall be molded fiberglass, deeply contoured for body form and occupant retention. The shell must be molded with step down reliefs in seat and back areas to accept upholstered inserts. The relief shall be 5/16-inch in depth and contoured to provide a continuity of the overall body configuration. There shall be a minimum 1/4-inch diameter drain hole at the lowest spot on the relief to allow drainage of moisture.
 - 3. The seat shell shall be one-piece construction made of fire-resistant polyester resin, glass fiber reinforced without gelcoat. The polyester resin shall be color-pigmented throughout. The reinforcing high strength glass fibers shall be distributed throughout the seat in such manner as to avoid resin rich or resin poor sections, particularly in high stress areas.
 - 4. The seat frame shall be made of one-inch square (1 sq.in.), not thinner than eighteen (18) gauge, Type 304 stainless steel tubing with a No. 3 finish.

3.10 SEATS (CONTINUED)

- B. <u>Single and Two Passenger Seats</u> (Continued)
 - 5. The transverse seats shall be supported by single pedestals mounted at the approximate center line of the aisle side bucket seat on the two-passenger seat and on the center line of the single passenger seat. The semi-cantilevered longitudinal seats shall be supported with braces from the front edge of the seat angled back to the floor at the bottom of the heater cover . The pedestal/brace shall be Type 304 stainless steel with No. 3 finish, designed to withstand all loads and stresses applied to it. Welds shall be on the under side of the pedestal base. The pedestal base shall be so designed as to prevent the base from cutting through the floor covering. The anchorage of the pedestal to the floor shall be designed to minimize dirt accumulation. The seat frame, wall structure and seat attachment of the semi-cantilevered seats shall be designed to minimize any extra weight and shall be reviewed by the Engineer.
 - 6. Handrails, if used, shall be of 7/8-inch diameter, Type 304 stainless steel tubing with a suitable brush finish not less than eighteen (18) gauge. The handrails shall be attached to the frame in a manner equal to being telescoped into the square tubing not less than two-inches (2"). Longitudinal double and single passenger seats, and seats against walls, shall not have handrails.
 - 7. The color of the seat shell shall be selected in the esthetic design review process.
 - a. The upholstered inserts shall consist of a contoured substrate to which a vandal-resistant wool cloth fabric is bonded. The inserts shall be interchangeable with those on CTA's 5000 Series cars, unless otherwise agreed to by the Engineer. The bottom insert shall include a drain hole with metal grommet at the lowest point.
 - b. The inserts shall be attached to the seat shell with stainless steel, hex head, washer faced, self-locking 10-32 screws and 'T' nuts with blind holes where the fasteners are accessible. Where the fasteners are not accessible, the attachment shall allow the inserts to be removed and installed without tools from the front as on CTA's 5000 Series Cars.
 - c. The fabric to substrate bond shall be tested for peel (stripping) after seven (7) days of aging, in accordance with ASTM D903. Samples shall exhibit a bond strength exceeding the tensile strength of the fabric or a minimum bond strength of 25 pounds per inch width of fabric.

Test reports shall be submitted to the Engineer for review.

3.10 SEATS (CONTINUED)

- B. <u>Single and Two Passenger Seats</u> (Continued)
 - 7. (Continued)
 - d. The cloth material shall be wool, nylon and cotton with nominal eighty-five percent (85%) wool and fifteen percent (15%) nylon pile and cotton warp and weft. Thickness shall be nominally 0.18-inches. The pattern shall be selected as part of the interior esthetic design review process.
 - e. The complete insert shall be tested for optical smoke density in accordance with ASTM E662 and shall exhibit a smoke density less than 100 in one-and-one-half minutes (1.5 min), and less than 200 in four minutes (4 min). In addition, the insert shall be tested for flame spread in accordance with ASTM E162 and shall exhibit a flame spread index less than fifty (<50).

Test reports shall be submitted to the Engineer.

- 8. All seat attachment bolts shall be AISI 300 class stainless steel.
- 9. All seat backs where accessible to passengers shall be covered with a sheet of 0.018-inch minimum thickness Type 304 rigidized stainless steel as per Section 12.02, C, 3. The stainless steel sheet shall have a form in the middle of the panel to match the contour of the shell, to prevent pulling the sheet away from the seat shell. The sheet shall be held in place with the same screws that retain the back inserts, unless otherwise agreed to by the Engineer.

C. <u>Convertible Seats With Wheelchair Securement</u>

- 1. Two (2) transverse seats on each car shall be equipped with an upward folding seat, which shall have a wide jaw wheelchair clamp and double belt restraint system mounted on the fixed seat frame as on CTA's 3200 Series cars. The seats shall be the transverse seats aft of the No. 1 and No. 2 side doors, as shown on CTA Drawing R-1-606, Page DR-1.
- 2. The folding portion of the seat shall be easy to raise or lower and shall remain in the position selected until intentionally re-positioned. This seat shall use the same inserts, as specified in Section 3.10, B, 7.
- 3. The entire design of the seat and the wheelchair securement devices shall require review by the Engineer, and both seats shall be demonstrated on the mock-up.
- 4. The exact design, location and features of the wheel chair areas and the type and arrangement of the securement shall be determined during the interior esthetic design review process.

- 3.10 <u>SEATS</u> (Continued)
 - D. Passenger Seat Performance and Strength Requirements
 - 1. <u>Strength Data</u>
 - a. The supplier shall submit a test report on the seat components and structural members. The report must show test diagrams, photos of tests and load results on representative seats completely assembled and fastened to a fixture simulating the vehicle attachment. Test reports shall include static loading requirements and design capabilities and statement of inspection and compliance with Specification requirements.
 - b. All tests are subject to being witnessed by the Engineer. This submission shall be waived if the seats are the same as supplied on CTA's 5000 Series cars.
 - 2. <u>Performance Test</u>
 - a. Vertical drop impact to the seat 7-1/2 inches from the front edge and 8-inches from the aisle side with a forty pound (40 lb) weight from 6-inch, 8-inch, 10-inch and 12-inch heights, 2,000 drops for each height.
 - Swinging impact with a forty pound (40 lb) weight to the back from front and rear. Test shall include impact through 6-inch, 8-inch, 10-inch and 12-inch horizontal distances, with 10,000 strokes for each distance. The pendulum length equals thirty-six inches (36").
 - c. Horizontal deflection to the handrail Grab rail shall be subjected to repeated deflections resulting from a one hundred pound (100 lb) horizontal load placed on the handrail and then removed. The load shall be placed at the point of the maximum handrail deflection for 25,000 cycles.
 - d. The seat shall withstand the above tests without showing cracks, breaks, weld failures, permanent deformations or other signs of failures, and the permanent distortion of any part of the unit shall not exceed its prescribed limits.

- 3.10 <u>SEATS</u> (Continued)
 - D. Passenger Seat Performance and Strength Requirements (Continued)
 - 3. <u>Strength Requirements</u>

The seat shall be of sufficient strength for the service intended and the seat including attachment to the vehicle body shall be capable of withstanding the following loads:

- a. Four hundred pounds (400 lbs) per passenger vertical downward at the center of each seat bottom with permanent set not to exceed one-eighth inch (1/8").
- b. Four hundred pounds (400 lbs) per passenger vertical downward on the front edge, at the center line of each seat with permanent set not to exceed one-eighth inch (1/8").
- c. Three hundred pounds (300 lbs) horizontal, both fore and aft, to the center of the top edge of the aisle seat back with permanent set not to exceed one-eighth inch (1/8").
- d. Two hundred fifty pounds (250 lbs) at the handrail, in any horizontal direction, with permanent set not to exceed one-eighth inch (1/8").
- e. Seat attachment to floor and side structure shall be adequate to resist the load resulting from two (2) one hundred fifty pound (150 lb) passengers being thrown against the seat with a longitudinal force of 4 g (1200 lbs). The seat may distort, but shall not tear loose under these conditions.

- 3.10 <u>SEATS</u> (Continued)
 - D. Passenger Seat Performance and Strength Requirements (Continued)
 - 3. <u>Strength Requirements</u> (Continued)
 - f. The two-passenger longitudinal seats shall withstand static loads as specified below. The seats may distort, but shall not tear loose under these conditions:
 - 1) Three hundred pounds (300 lbs) horizontal applied at the stanchion support in each of the following horizontal directions, with respect to the car axis:
 - (a) Forward.
 - (b) Rearward.
 - (c) Toward wall.
 - (d) Toward aisle.
 - 2) Eight hundred thirty-three pounds (833 lbs) vertical applied upward at the stanchion support.
 - E. <u>Fiberglass Specification</u>
 - 1. <u>Composition</u> (All Percentages Shall Be By Weight)
 - a. Polyester Resin

Forty percent, minimum (40% min) - Hetron 325FS, Modar 814, or equal, fire-resistant, color-pigmented.

b. <u>Glass Fibers</u>

Twenty-two percent, minimum (22% min) - swirl mat, or equivalent, high strength random length distributed throughout the part in such a manner as to avoid resin rich or resin starved sections, particularly in high-stress area.

3.10 <u>SEATS</u> (Continued)

E. <u>Fiberglass Specification</u> (Continued)

2. <u>Physical Properties</u>

Property	Test Value	Test Method
Тюрену		restmetriod
Tensile	10.0 X 10 ³ ; psi, average-min	ASTM D638-651
Flexural Modulus	1.0 X 10 ⁶ psi, average-min	ASTM D790
Flexural Strength	20.0 X 10 ³ ; psi, average-min	ASTM D790
Moisture Absorption	0.5% maximum	ASTM D790
Flame Resistance	Flame Spread less than 35 Smoke density less than 100 in 1.5 minutes and less than 200 in 4 minutes	ASTM E162 ASTM E662
Izod Impact Resistance	15.1 lbs/in, average-min	ASTM D256
Barcol Hardness	50 average-minimum	
Specific Gravity	1.75-1.90	

3. Ball Drop Test

A sample fiberglass section shall be mounted on a test fixture, firmly supported around a six-inch (6") diameter opening. A one-pound (1 lb) solid steel ball shall be dropped twenty-four inches (24") to the top surface. The part shall show no fracture or signs of failure.

- 3.10 SEATS (Continued)
 - F. <u>Operator's Seat</u>
 - 1. A fully upholstered seat with back shall be provided in each operator's cab for use by the operator. The seat with back shall have vertical and longitudinal adjustment and shall have detents to prevent the seat from moving unexpectedly while in use. The adjustment levers shall be located and their function arranged so that they cannot be operated accidentally. The back of the seat shall be fixed so it does not tilt. Special attention must be given to the seat design to eliminate pinch points and sharp edges.
 - 2. The seat shall be hung off the back wall of the cab, as on CTA's 5000 Series cars, with no legs under the seat portion. The seat shall stay in the 'up' and down positions without hooks, and shall not change position unless moved by the operator. The cushion shall be at least four-inches (4") thick and shall have the forward corners chamfered for ease of swiveling.
 - 3. The design and installation of the seat shall be reviewed by the Engineer and be demonstrated in the mock-up.
 - 4. Cushion material shall be polymeric chloroprene LS-200 Low Smoke Neoprene Foam, Chestnut Ridge Foam "CT Safeguard". The Contractor shall submit, for review by the Engineer, data and test reports on the cushion material proposed, showing at least the following: Density, Compression Set, Flame-Resistance, Smoke Density, Toxic Gas Emission and Accelerated Aging.
 - 5. Seat covering material shall be transportation grade, brown colored vinylcoated knitted fabric. The fabric shall have a finished weight of at least thirtyeight ounces (38 oz) per linear yard. The fabric shall be fire-retardant-treated to Federal Specification CCC-A-680 (a), latest issue, Treatment A-1 and FAR Paragraph 25.853. The material shall be tested to meet the following requirements:

Property	Test Value	Test Method
Flame Time	No greater than 10 sec	FAR 25.853 (Vertical)
Burn Length	No greater than 6 inches	FAR 25.853 (Vertical)
Smoke Density	Less than 250 after 4 minutes	ASTM E662

3.10 <u>SEATS</u> (Continued)

G. Sample Seats

The Contractor shall furnish one (1) of each style of seat installed in the cars to CTA for inspection and review prior to the installation of seats in any car. The seats shall be exact duplicates of the seats proposed for the cars and shall become the property of CTA as spare parts.

3.11 STANCHIONS, WINDSCREENS, GRAB HANDLES – INTERIOR

A. <u>General</u>

- 1. All stanchions, barriers and grab handles shall be provided as shown on CTA Drawing R-1-606, Page DR-1, or from the interior esthetic design review and as specified below. All stanchions and grab handles shall be 1-1/4 inch OD, Type 302 stainless steel tubing with a No. 3 finish, and shall be continuous in length, and shall have 1-1/2 inch minimum knuckle clearance. The stainless steel shall have a thickness of not less than 0.075-inch. Stanchion fittings and screws shall be Type 302 stainless steel with a No. 3 finish.
- 2. Where split 'T' fittings are used they shall be interchangeable with Ellcon-National, Inc., Part No. E-3281, except finish shall be No. 3, installed solid side up. All stanchions and stanchion fittings shall be smooth and free of burrs and sharp edges or corners that might injure personnel or tear clothing.
- 3. Vertical stanchion attachment to floor or seat shall be adequate to resist the longitudinal and vertical forces resulting when the stanchion is loaded horizontally with a load sufficient to cause it to bend. The method of attachment requires the review of the Engineer. The stanchions shall be free to move vertically in the ceiling and extend at least four-inches (4") above the ceiling. A Type 302 stainless steel bolt shall be installed horizontally through all vertical stanchions near the top end so that the ceiling will be distorted if stanchion bending produces more than the allowed vertical movement. The stanchions shall not rattle at the top where they pass through the ceiling.

3.11 STANCHIONS, WINDSCREENS, GRAB HANDLES – INTERIOR (Continued)

B. <u>Windscreens</u>

- 1. There shall be shaped windscreens at each side door opening except adjacent to the wheel chair locations with a vertical stanchion attached to the aisle edge, as shown in CTA Drawing R-1-606, Page DR-1. The detail design shall be determined as part of the interior esthetic design review process.
- 2. The windscreens shall be stainless steel with phenolic-impregnated kraft paper honeycomb core. The inner and outer sheets shall be bonded to the honeycomb and shall be at least 0.030-inch thick rigidized stainless steel, as per Section 12.02, C, 3, with the pattern vertical, unless otherwise determined as part of the interior esthetic design review process.
- 3. There shall be a sanitary cove or rigidized stainless steel angle along the bottom edge facing the side door opening and adjacent to the longitudinal seat. The cove shall be sealed to the windscreen and floor and secured with screws.
- 4. The windscreen shall have stainless steel tapping plates to attach the stanchion and the stainless steel edge channel. The stainless steel edge channel shall be attached by bonding and screwing.
- 5. Each windscreen shall have a tempered glass panel installed to fill the open area between the aisle stanchion and the windscreen. The glass shall be nominally 29-7/8-inches high x 16-3/4-inches wide, supported in anodized aluminum channels with neoprene rubber gaskets. The clear opening shall be nominally 29-7/16-inches x 16-1/2-inches. The glass shall not have a support channel on the vertical edge adjacent to the stanchion and shall be ground and smoothed with a rounded edge that clears the stanchion by a nominal 3-3/4-inches. The top and bottom channels shall have anodized aluminum clamps that rigidly grip the channel and stanchion. Each clamp shall have two (2) pin socket type oval head, 1/4-20 fasteners.

The rear channel shall be mounted to the windscreen using the tapped holes in the windscreen. The bottom channel shall clear the top of the windscreen by a nominal 4-1/4 inches. The top and bottom channels shall have fillers between the glass and the clamp to prevent movement of the glass in the channels.

The exact design of the glass shall be determined during the interior esthetic design review process.

6. Each side door windscreen shall have a photo-luminescent strip attached from the aisle stanchion to the side door.

The strip shall be screwed to the windscreen to clear the floor by at least one-half inch (1/2"). See Section 5.08 for details of the strip.

3.11 STANCHIONS, WINDSCREENS, GRAB HANDLES – INTERIOR (Continued)

- B. <u>Windscreens</u> (Continued)
 - 7. The entire design of windscreens and glass panels shall be reviewed by the Engineer.

C. Seat Stanchions

Vertical stanchions shall be installed on the corner of the longitudinal seats at the doors, as indicated on CTA Drawing R-1-606, Page DR-1. The stanchions shall be removable without removing the seat. The installation shall be reviewed by the Engineer.

Vertical stanchions shall be installed on the aisle corners of those cross seats indicated on CTA Drawing R-1-606, Page DR-1. The stanchions shall be removable without removing the seat. The installation shall be reviewed by the Engineer.

The exact arrangement of the vertical stanchions shall be determined during the interior esthetic design review process.

D. Horizontal Stanchions

Horizontal stanchions shall be installed connecting the vertical seat back stanchion to the door pocket mask or windscreen adjacent to the closest door opening as shown on CTA Drawing R-1-606, Page DR-1. The horizontal stanchions at the convertible seat areas shall be securely fastened to the vertical stanchion and door pocket, and supported from the roof structure by appropriately spaced vertical tubes of the same size and material as the horizontal stanchion. The horizontal stanchions shall be able to support two hundred fifty pounds (250 lbs) at each center span, simultaneously, without permanent bending. They shall also withstand swinging loads of two hundred fifty pounds (250 lbs) on each span, without permanent bending of the horizontal or vertical members, or loosening of the attachments.

The horizontal stanchions shall be mounted to clear the floor by nominally seventy-three inches (73").

Grab straps shall be attached to the horizontal stanchions. The grab straps shall be one-inch (1") wide, of PVC material, reviewed by the Engineer, and shall be securely retained to the horizontal stanchion with a locking feature to prevent loosening in service. The grab straps shall be adequately reinforced in the area of the fasteners to prevent tearing. The grab strap shall extend approximately ten-inches (10") below the bottom of the horizontal stanchion. Approximately thirty-six (36) grab straps shall be installed in each car. The final quantity and location of the grab straps shall be determined on the first prototype car.

The exact arrangement of horizontal stanchions and grab straps shall be determined during the interior esthetic design review process.

3.11 STANCHIONS, WINDSCREENS, GRAB HANDLES – INTERIOR (Continued)

E. <u>Miscellaneous Grab Handles</u>

- 1. A vertical grab handle at least thirty-six inches (36") long of Type 302 stainless steel shall be installed on both sides of the cab partition door opening at a height reviewed by the Engineer, and secured by Type 302 stainless steel bolts. The grab handles shall be angled away from the door opening to provide clearance between the handles and the cab door for a person's hand.
- 2. A vertical grab handle at least thirty-six inches (36") long shall be installed on the corner of each door pocket mask adjacent to the convertible seat areas. This handle shall be the same design as used on the cab partition and shall angle away from the window.

The grab handle shall be securely bolted with Type 302 stainless steel bolts to rigid structure behind the stainless steel mask.

The exact size and location of this grab handle shall be determined during the interior esthetic design review process.

3. A vertical grab handle at least thirty-six inches (36") long shall be installed on the door pocket adjacent to the side door opening where no windscreen is installed. The grab handle shall not project into the door opening.

The grab handle shall be securely bolted with Type 302 stainless steel bolts to rigid structure behind the stainless steel mask.

4. A horizontal grab handle (secured with Type 302 stainless steel barrel bolts) shall be installed on the inside of each end door approximately forty-four inches (44") above the floor.

3.12 OPERATING CAB

- A. An operating cab shall be located across the front end of each car as shown on CTA Drawing R-1-606, Page DR-1. The cab shall house the necessary controls and other equipment for the operation of the train, and control of the side doors.
- B. The cab shall be formed by stainless steel framing with thick stock, phenolic laminate-balanced melamine-faced stainless steel partitions, arranged as on CTA's 5000 Series cars. The melamine above the window sill level on the left side shall be colored to match the car interior. The panel(s) on the right side shall have bare stainless steel on the inside and melamine on the outside colored to match the car interior. The panel(s) the colored to match the car interior. The panel(s) is steel shall have bare stainless steel on the inside and melamine on the outside colored to match the car interior. The partition on the left side of the center aisle shall have a window glazed directly into it. The glass size shall be twenty-four by twenty-eight inches (24" x 28") with three and three-eighths inch (3-1/8") radius corners, as on CTA's 3200 Series cars, unless the cab design precludes this size and then it shall be the same size used on CTA's 5000 Series cars. The glass shall be as specified in Section 12.05.

Below the melamine panels, on the right side of the cab, the bottom nominal twelveinches (12") of the partition shall be a louvered air grill, unless otherwise agreed to by the Engineer, made of rigidized stainless steel, as per Section 12.02, C, 3. The air grill shall have a one-half inch (1/2") diameter hole located seven-inches (7") above the floor in line with the de-icer tube to mount the bulkhead fitting. Similar provisions shall be made on the left side of the cab for the de-icer tube connector. In addition, the single pin ground connector and the 40 volt power connector shall be mounted in the right side air grill. See Section 5.13, A, for details.

The hole locations and the relation of the holes to the tops of the de-icer tubes shall be reviewed by the Engineer and demonstrated in the cab mockup.

A rugged stainless steel enclosure shall be provided on the left side of the cab below the partition window. The enclosure shall be flat on top with a raised edge and rounded corners with rubber corner protectors and shall extend from the side wall to within six-inches (6") of the cab door post. The enclosure shall be fully framed and have sufficient strength to be used as a seat. A hinged door using a continuous stainless steel hinge on the wall side shall be provided for equipment access. The door shall be secured with a "Best Lock Corp" lock using a CXT-1 key. A key shall be provided for each lock and delivered separately to the Engineer.

The enclosure depth shall accommodate nineteen-inch (19"), rack-mounted equipment.

- C. Provisions shall be made for heating, ventilating and air conditioning the cab and defrosting the cab windows, as specified in Section 7.02, B, 1, and provisions shall be made for lighting, as specified in Section 8.01, D.
- D. The arrangement of all the equipment in the cab shall be based on human engineering standards to ensure good location and accessibility to accommodate all the modes of use encountered in CTA service.

3.12 **OPERATING CAB** (Continued)

- E. Equipment mounted above the cab ceiling on both sides of the aisle and above the end door shall be accessed through vertical access panels. These access panels shall be constructed as specified in Section 3.05, E.
- F. The rear cab partition shall extend from floor to ceiling across the car, but the cab ceiling shall be full height over the aisle to allow access to both side overhead compartments and to the front sign compartment. The low ceiling shall be approximately six feet, four inches (6'-4") above the floor. Special care shall be taken to provide access to the marker light sockets for relamping.
- G. A rugged step, approximately eight-inches by twenty-inches (8" x 20"), shall be placed along the side wall below both sliding sashes. The step shall be approximately eight- inches (8") above the floor. The step shall be attached to the side wall without the use of legs or supports to the floor. The side wall, for a distance of twelve-inches (12") above the step, shall be protected by a kick plate of Type 302 rigidized stainless steel at least 0.039-inch thick, as per Section 12.02, C, 3.
- H. Two (2) door control boxes shall be provided in the operating cab of each car from which the operator may operate all side doors in the train. The door control boxes shall be located on the deadlight panels adjacent to the sliding sashes. The box shall be made of stainless steel and shall also house communication equipment (see Section 6.02 for details). A separate enclosure for the Low Speed Interlock shall be mounted below the door control box on the right side of each A-car (see Section 6.05, F, for details).

3.13 CAR EXTERIOR TREATMENT

The exterior of the car shall be bare stainless steel unless determined otherwise during the exterior esthetic design review process. The stainless above the belt rail shall be "deadlight" dull finish, and the corrugated stainless steel below the belt rail and on the roof shall have a 2B mill finish. These finishes shall be used even if the car shell has "decal" coloring applied.

The fiberglass No. 1 end shall have colored gel-coat. The exact color shall be determined during the car exterior esthetic design review process as defined in Section 3.01, M. If the end cap has colored "decal" material applied, the underlying gel-coat shall match Pantone 7C, gray.

3.14 CARBODY MOCKUPS

A. <u>General</u>

The mock-ups shall use as many actual parts proposed for use on the car as possible and shall be constructed of substantial materials adequate for this purpose. Upon completion of the reviews and modifications, the Contractor shall make the mock-ups available to the Authority for training purposes. If the Authority declines any, they may be disposed of by the Contractor.

The Contractor shall make the mock-ups available for review preferably within the continental United States but at least within North America. If the mock-ups are manufactured outside North America, preliminary reviews may take place at the point of manufacture, but the final review and modifications shall take place within North America.

B. <u>Underfloor</u>

The Contractor shall construct a full scale mock-up of the underfloor of the car showing the location and arrangement of all underfloor equipment, cables, ducts, piping and any other equipment as specified or required by this Specification. The mock-up shall be reviewed by the Engineer. Changes to the mock-up and final car design shall be made as necessary at no cost to the CTA to satisfy the comments of the Engineer.

C. <u>Cab</u>

The Contractor shall construct a full size mock-up of the operator's cab showing the location and arrangement of the master controller, operator's control panel, Train Operator's Touch Screen, trouble indicator panel, bypass panel, ATC aspect display unit, run number box, windshield wiper, seat, front and side windows, cab door, heater-defroster, horn switch, steps, door control boxes, grab handles, light fixtures, both fire extinguishers, rear partition with glazing, overhead equipment, front sign box and all other cab equipment, including communications equipment, as specified or required by this Specification. The mock-up shall use as many actual parts proposed for use on the car as possible, and shall demonstrate the operation of the sliding sashes. Changes to the mock-up and final car design shall be made as necessary, at no cost to the CTA, to satisfy the comments of the Engineer.

D. <u>Convertible Seat/Wheel Chair Area</u>

The Contractor shall construct a full size mock-up of the convertible seat/wheel chair area, including car side walls, window sash, door pockets, grab handles, stanchions, light fixtures and both the convertible seats/wheel chair restraints and adjacent areas. The mock-up shall be reviewed by the Engineer. Changes to the mock-up and final car design shall be made as necessary, at no cost to the CTA, to satisfy the comments of the Engineer.

3.14 CARBODY MOCK-UPS (Continued)

E. <u>No. 1 End</u>

The Contractor shall construct a full size mock-up of the No. 1 end of the car and place it at the correct height to show the location and arrangement of the climbing steps, grab handles, coupler, end sill, safety springs and chains, pilot and end door. The mock-up shall be reviewed by the Engineer.

Changes to the mock-up and final car design shall be made as necessary, at no cost to the CTA, to satisfy the comments of the Engineer.

F. Side Door

See Section 6.08.

G. <u>Air Distribution</u>

The Contractor shall construct a full sized mock-up of the exact arrangement of the underfloor air comfort unit and all ducting and distribution to verify compliance with the requirements of Section 7.01, D, 1, and Section 7.01, E, 2 and E, 3.

H. <u>Other</u>

The Contractor may elect at his discretion to construct full size mock-ups of other areas of the car to assist in locating equipment supports, air duct and diffuser configuration, wiring harness configuration and arrangement, and side door equipment installation and arrangement or for any other purpose the Contractor may deem advisable. The Engineer reserves the right to inspect and comment on these mock-ups, as well as reviewing Drawings of the same elements.
SECTION 4 COUPLERS

4.01 GENERAL

A. <u>Material</u>

All parts of the coupler equipment shall be designed to withstand the loads and stresses specified in Sections 4.02, A and B, and Section 4.03, B. The material used shall be reviewed by the Engineer.

B. <u>Operational Standards</u>

The coupler must permit free negotiation of all curves, both horizontal and vertical, as specified in Section 2.02, C, when units are coupled with maximum mismatch due to spring deflections and wheel wear. The swing of the coupler shall be limited to maximum required by suitable stops, and under no conditions shall the coupler interfere with truck parts, wheels, cables or other underfloor equipment. The coupler equipment shall operate successfully under all weather conditions found in Chicago.

4.02 NO. 1 END COUPLER

A. <u>General</u>

The coupler equipment on the No. 1 end of a two-car unit shall be an automatic hinged head, knuckle-type, providing mechanical and electric coupling. The couplers shall be equal to Wabtec No. 060031-3002, Form 5H tightlock type. They shall mechanically couple with all Form 5 Couplers at CTA. The design of the electric coupler and its cover shall permit the coupling with all CTA cars without physical damage to either electric coupler including covers. The design of the coupler and its connection to the carbody shall be reviewed by the Engineer.

The coupler shall withstand 120,000 pounds minimum in tension and compression without yielding.

All important bearing surfaces in the drawbar and coupler shall be bushed with easily replaceable hardened steel bushings, with provisions for adequate lubrication, unless otherwise specified. Adjustable knuckles and replaceable wear plates shall be provided. The knuckle pin and its bushings shall be made of 11-14% manganese steel, unless otherwise agreed to by the Engineer.

SECTION 4 COUPLERS (Continued)

4.02 <u>NO. 1 END COUPLER</u> (Continued)

A. <u>General</u> (Continued)

The coupler carrier plate (circle bar) shall be equipped with a renewable, wear-resistant, anti-friction insert in the area that supports the drawbar. The material shall incorporate a solid lubricant system and be suited to withstand the constant sliding load of the drawbar.

Carrier plates shall be interchangeable from car-to-car.

In addition, the drawbar yoke and release ring shall be equipped with renewable, wear-resistant, anti-friction sleeves applied to take any wear caused by the motion of the drawbar yoke during draft and buff cycling. The material shall incorporate a solid lubricant system and be suited to withstand the radial loads and axial sliding of the yoke in the drawbar.

The drawbar and coupler head shall be interchangeable but need not be identical with those on CTA's 5000 Series cars.

B. Draft Gear

The No. 1 end draft gear shall be cushioned-type. It shall be capable of withstanding loads resulting from the type of service in CTA operation with reasonable margins of safety. The draft gear compression shall not exceed one-inch (1") at less than 90,000 pounds buff load. The draft gear shall have an emergency release provision which will release at a 90,000 pound buff load. The coupler, after release of the 90,000 pound release provision, shall not damage any undercar or truck equipment. The drawbar shall have an additional release provision that shall release at 120,000 pounds buff load. The coupler shall have the capability of traveling at least seventeen inches (17") to permit the carbody to deform and absorb the forces involved in a collision. The design of the release provision shall be such as to be readily identifiable and require no special tools and only minimum labor to restore the drawbar to normal operation. The draft gear and release provisions shall be reviewed by the Engineer.

Provision shall be made for the coupler anchor pin to be removed through a covered opening in the car floor. The coupler anchor pin shall have sufficient number of nylon and steel spacers above and below the coupler tailpiece to make the tailpiece tight in the clevis type anchor casting to reduce noise.

SECTION 4 COUPLERS (Continued)

4.02 <u>NO. 1 END COUPLER</u> (Continued)

B. <u>Draft Gear</u> (Continued)

An alternate design of energy absorbing draft gear will be considered provided the total stroke is equal to that specified above and the drawbar can be restored to functional condition after absorbing equal energy as easily as the shear bolt design specified above. In addition, an alternate means of drawbar attachment to the underframe will be considered provided it has support, stability, and maintenance characteristics comparable to the clevis design specified.

C. Jumper Switch

A jumper switch shall be installed on the No. 1 end of each car. The switch shall have an easily-removed cover with no wires or cable passing through it. The jumper switch and its mounting location shall be reviewed by the Engineer.

Appropriate operating levers and rods shall be provided to operate the switch from both sides of the car. The arrangement of these levers and rods shall be reviewed by the Engineer. The jumper switch shall be in the coupled position when its handle is moved away from operator's cab and uncoupled when moved toward the cab. A means, reviewed by the Engineer, shall be provided to permit adjustment of the jumper switch to maintain the desired operating characteristic. This switch shall have contacts which shall perform the functions required by this Specification. Switch shaft bearings shall not be exposed to the undercar environment.

The jumper switch shall have at least three (3) spare contacts for future use.

D. <u>Center Lock</u>

A spring-loaded pin, rotating cam release center lock device, reviewed by the Engineer, shall be installed to hold uncoupled couplers in the center of the swing. The center lock shall be released by operating the jumper switch to the coupled position. The use of flexible cables in the release mechanism is not permitted. The center lock shall be designed to hold the coupler centered equally well against forces operating from either side. The center lock shall be so designed that if it fails to release when the jumper switch is thrown, it shall override and not be damaged or do any damage. Adjustment means shall be provided to maintain proper operation of the center lock.

4.02 <u>NO. 1 END COUPLER</u> (Continued)

E. <u>Uncoupling Mechanism</u>

The No. 1 end coupler shall be arranged for manual uncoupling at the track level from the side at the left corner of the car as on CTA's 5000 Series cars. The uncoupling mechanism shall be designed to withstand the duty imposed and to operate properly under all conditions found on the CTA, and shall be reviewed by the Engineer.

The uncoupling mechanism shall be restored to the coupled condition, automatically, after each uncoupling. The upper and lower uncoupling shafts, if used, shall have square ends for positive locking. The slide lock shall be indexed in a manner, reviewed by the Engineer, to clearly show the locked position. The uncoupling chain, if used, shall be of the twisted link type to prevent catching in guides and pulleys. The chain shall be adequately supported without springs.

Every effort shall be made to minimize the force required to operate the uncoupling lever. Large diameter pulleys shall be used where the chain changes direction. The actual force shall be demonstrated on the prototype cars.

- F. <u>Electric Coupler</u>
 - 1. General

An electric coupler shall be installed under each No. 1 end mechanical coupler. The electric coupler shall have the same number and configuration of spring-loaded contacts to complete the trainwire circuits as on CTA's 5000 Series cars and be equal to Wabtec No. 060033-3002..

All contacts shall have silver faces at least 1/32-inch thick and shall be the same diameter. Provision shall be made for manual retraction of the contacts. It shall be possible to replace the electric coupler pins from the front without disassembly of the coupler. The use of tapered drive pins to make electric connection is not permitted. The manual retraction mechanism shall be easy to operate and shall retain its ease of operation when not operated for periods of up to one (1) year.

The design of the pins shall be suitable for the loads and signals to be transmitted.

4.02 <u>NO. 1 END COUPLER</u> (Continued)

- F. <u>Electric Coupler</u> (Continued)
 - 1. <u>General</u> (Continued)

The electric coupler box shall be mechanically interchangeable with CTA's 5000 Series cars.

The entire electric coupler and its details shall be reviewed by the Engineer.

2. <u>Cover</u>

The electric coupler shall have a cover to protect the electrical contacts on each electric coupler from atmospheric conditions. The cover shall open automatically when a coupling is made to any CTA car.

The outside face of the cover shall be painted orange as on CTA's 5000 Series cars.

The inside surface of the cover shall be protected while in the open position or, in some way, arranged to preclude the accumulation of snow, ice, water or dirt. The cover shall be of sturdy design that shall not deform and allow it to contact the buttons during ordinary use.

The electric coupler face shall be adequately gasketed to effectively seal the face when cars are coupled or when the cover is in the raised position.

The cover hinge bearings shall be equipped with grease fittings. The cover shall have a spring-loaded, hold-open feature which shall automatically reset when the cover is pushed down.

3. <u>Electrical Connections</u>

The electrical connections to the electric coupler shall be carried in multiple conductor cables arranged to be free of stress in all operating positions and to prevent chafing. The cables shall connect to the electric coupler and junction box or jumper switch through quick disconnects.

4.02 <u>NO. 1 END COUPLER</u> (Continued)

- F. <u>Electric Coupler</u> (Continued)
 - 4. <u>Heater</u>

The electric coupler contact block shall be equipped with a heater to prevent the accumulation of snow and ice. The heater shall be self regulating to prevent overheating.

The heater shall be powered by the car's low voltage system through a circuit breaker, P34 "ELECTRIC COUPLER HEATER", and a relay which is energized when the outside ambient temperature is below 40° F.

G. Mock-Up

The No. 1 drawbar, coupler, uncoupling mechanism, electric coupler, and electric coupler cables shall be demonstrated on the underfloor mock-up.

4.03 NO. 2 END DRAWBAR

A. General

The two (2) cars forming a semi-permanent coupled unit shall be joined by a two (2) piece drawbar having two (2) draft gears and spherelastic or self-lubricated composite greaseless spherical bearing connections to the car center sill. Appropriate provisions shall be provided to remove the anchor pin. The drawbar shall incorporate a flanged connection at the center to facilitate separation of the two (2) cars without removal of the drawbar. Adequate provisions shall be made in the design to accommodate vertical and torsional motion between the cars. The drawbar design shall provide for a minimum vertical pivoting angle of 5.5°. Adequate clearance shall be provided between drawbar anchors and all truck parts. The drawbar shall be designed to prevent rotation of the main tube in relation to the A-car. The No. 2 end drawbar arrangement and its details shall be reviewed by the Engineer.

4.03 NO. 2 END DRAWBAR (Continued)

B. Draft Gear

The drawbar draft gears shall be cushioned-type, and have an emergency release provision that shall release at 90,000 pounds to provide a total of approximately thirty-one inches (31") of free travel.

Drawbar and draft gears shall be equal to Wabtec No. 152414.

An alternate design of energy absorbing draft gear will be considered provided the total stroke is equal to that specified above, and the drawbar can be restored to functional conditions after absorbing equal energy as easily as the shear bolt design specified above.

C. <u>Safety Hanger</u>

A loop-type safety hanger shall be installed on each car under the No. 2 end drawbar, to prevent a broken or detached drawbar from dropping to the roadbed.

D. <u>Trainline Cables and Connectors</u>

The electrical connections between the two (2) semi-permanently connected cars of a unit shall be carried in multiple conductor cables supported by appropriate cable blocks attached to the drawbar and carbody.

Trainwire cables shall be arranged to be free of stress in all operating positions and to prevent chafing. Each cable shall be equipped with an in-line quick disconnect located approximately at the center of the drawbar. The cables and connectors shall be adequately supported and shall be clear of the truck and safety hanger in all positions.

E. Mock-Up

The No. 2 end drawbar, including draft gear, connection to the carbody, and trainline cables shall be reviewed by the Engineer and shall be demonstrated on the underfloor mock-up.

SECTION 5 MISCELLANEOUS CARBODY ITEMS

5.01 ADVERTISING CARD RACKS

A. Sign Card Racks

Sign card racks for eleven-inch (11") by forty-six and one-half inch (46 $\frac{1}{2}$ ") advertising media shall be installed between the ceiling and side window masks, on both sides of the car, between side door openings and from the side door openings to the No. 2 end of the car, and from the side door openings to the cab partition. In addition, angled racks with Lexan covers shall be installed over each side door opening incorporated in the door header compartment cover. The racks shall be made of stainless steel with a 4B finish. The design shall be reviewed by the Engineer. The slots for the sign retaining clips shall provide an opening 0.110", + 0.015"/-0.005", to ensure the racks are not damaged if two signs are overlapped when the clip is installed.

B. <u>Sign Card Frames</u>

1. <u>General</u>

Side door access panels shall have sign frames installed as defined below. The frames shall be stainless steel with a 4B finish. The frames and their installation shall be reviewed by the Engineer, and shall be demonstrated on the mock-up specified in Section 3.14, F.

2. <u>Twenty-One-Inch By Twenty-Two-Inch (21"x22") Frames</u>

Frames designed to accommodate signs twenty-one-inches (21") wide by twenty-two-inches (22") high shall be installed on the right-hand side door access panels at the No. 2 and No. 3 side doors, and on the right side cab partition behind the operator's position, three (3) per-car.

The sign frames on the access panels shall be located to avoid the key hole as on CTA's 3200 Series cars.

3. <u>Eleven-Inch By Seventeen-Inch (11"x17") Frames</u>

Frames designed to accommodate signs eleven-inches high by seventeeninches wide (11"x17") shall be installed on the left-hand side door access panel at the No. 1 and No. 4 side doors, two (2) per-car.

4. <u>Seventeen-Inch By Twenty-One Inch (17"x21") Frames</u>

Frames designed to accommodate signs seventeen-inches wide by twentyone-inches high (17"x21") shall be installed on the side door access panels to the right of the No. 1 and No. 4 side doors and to the left of the No. 2 and No. 3 side doors, four (4) per-car.

5.02 GUARD CHAINS AND SHIELDS

A. <u>No. 1 End</u>

- 1. Guard chain assemblies, equal to that shown on CTA Drawing R-4-565, Page DR-19, shall be installed on the right side end door post.
- Two (2), stainless steel, bolted-on loop plates, similar to CTA Drawing R-2-537, page DR-16, shall be installed on each end door post. The loop plates shall be twenty-four-inches (24") apart. The top loop plate shall be ninety inches (90") above the top of the rail with a threshold height of 3'-9-1/2". The loop plates shall be horizontal and shall be easy to change without removing the interior finish of the car.
- 3. Stainless steel shields shall be installed under the loop plates on each side of the end door to protect the fiberglass cap from damage by the guard chain assemblies. The shields shall extend seven-inches (7") beyond the eyes at the top and bottom, and wrap around the edge of the fiberglass toward the end door.
- 4. The shields shall be sealed to the fiberglass end cap and shall be sufficiently thick to preclude the need for additional mechanical fasteners.
- 5. The guard chain assemblies and their attachments may be different than specified here depending on the exterior esthetic design review, but must provide an equivalent level of protection and ease of connecting and disconnecting and ease of replacement as the specified arrangement.
- B. <u>No. 2 End</u>
 - Guard chain assemblies equal to the chain assembly portion, without the end rods shown on CTA Drawing R-4-565, Page DR-19, shall be installed, one (1) on each car. Galvanized, figure 8, removable links shall be used, in lieu of aluminum hooks, to attach the chains to the carbody eyes.
 - 2. Four (4), stainless steel bolted-on loop plates, similar to CTA Drawing R-2-537, page DR-16, shall be installed on each end door post. The loop plate bolts shall be located 66, 76, 86, and 96 inches above the top of rail with a threshold height of 3'-9-1/2".
 - 3. The loop plates shall be horizontal, and shall be easy to change without removing the interior finish of the car.

C. <u>Chain Criteria</u>

The chain shall be 5/16-inch link, welded aluminum, anodized and unpainted. Chain hooks shall also be anodized aluminum.

5.02 GUARD CHAINS AND SHIELDS (Continued)

D. <u>Strength</u>

The strength of the loop plates and their attachment shall exceed the yield strength of the chain.

The entire chain installation at both ends of the car shall be reviewed by the Engineer.

5.03 NO. 1 AND NO. 2 END PROTECTION

A. <u>General</u>

Three (3) stainless steel, bolted-on loop plates shall be attached at each corner of each car, to attach stainless steel safety springs. The loop plates shall be located twenty-inches (20"), thirty-eight inches (38"), and fifty-six inches (56") above the car floor.

The No. 1 end protection arrangements may be different than specified here depending on the exterior esthetic design review but shall provide provisions for the springs specified in Section 5.03,C, below.

B. <u>Spring Eyes</u>

The loop plates at the No. 1 end of the car shall be loop plates, similar to that shown on CTA Drawing R-2-537, Page DR-16. The plates shall be attached with oval head stainless steel screws to stainless steel tapping plates behind the fiberglass end cap. The tapping plates may be molded into the fiberglass. The tapping plates shall also have screws from the outside to retain them.

The loop plates at the No. 2 end of the car shall be similar to those on the No. 1 end loop plates, and shall be mounted with stainless steel weld studs, resilient washers, and nylon lock nuts.

C. <u>Springs</u>

The Contractor shall supply six (6) stainless springs per car, equal to that shown on CTA Drawing R-3-571, Page DR-20, for installation by CTA. The springs shall be delivered with each car.

5.03 NO. 1 AND NO. 2 END PROTECTION (Continued)

D. <u>Fiberglass Protectors</u>

Formed stainless steel shields shall be installed to protect the No. 1 end cap from scuffing by the springs, when stowed or connected to another car. The shields shall be mounted under the loop plates and extend from the bottom of the fiberglass end cap to approximately two-inches (2") above the top loop plate, and shall wrap around the corner of the cap from the edge of the vertical grab handle pocket. Depending on the design of the end cap, the shields shall extend approximately three-inches (3") behind the corner to protect the full spring recess. The protectors shall be sealed to the end cap, and the bottom edge shall be screwed to the cap as well, to prevent snagging.

E. No. 1 End Spring Stowage

The bottom spring shall be stowed behind the end sill loop step when not in use. The middle spring on the left side of the car shall hook into a loop plate at the bottom of the vertical grab handle, and the top spring shall hook into the bottom loop plate.

The loop plate at the bottom of the vertical grab handle shall be bolted to the end cap with the grab handle bolt, and shall not rotate.

F. <u>Review</u>

The entire No. 1 and No. 2 end protection provisions shall be reviewed by the Engineer.

5.04 CAR NUMBERS AND IDENTITY

A. Interior

Car numbers shall be applied on the inside of each car adjacent to the No. 2 end door and cab partition door, two (2) per-car. The numbers shall be three-inch (3") high, self-adhesive black vinyl, Helvetica Medium font.

B. <u>Operator's Cab</u>

Car numbers shall be applied to the Operator's Control Panel above the communication equipment. The numbers shall be one-inch (1") high, self-adhesive white vinyl, Helvetica Medium font.

C. In Shop

During construction in the Contractor's shop, the CTA car numbers shall be plainly visible on the cars at all times. The number may be temporarily affixed, but once assigned may not be changed.

5.04 CAR NUMBERS AND IDENTITY (Continued)

D. <u>Exterior</u>

The car number shall be applied on the outside of each car, forward of each No. 1 end side door, on the deadlight under the gutter, and aft of each No. 2 end side door, on the deadlight under the gutter. In addition, the car number shall be applied on each No. 1 end door centered on the center line of the headlights.

Car numbers, four and one-half-inches (4-1/2") high, Helvetica Medium font, shall be made of reflective black, self-adhesive vinyl, equal to 3M Scotchlite 280-85.

E. <u>Side Door/Windscreen and Passenger Intercom</u>

Embossed stainless steel car number plates shall be riveted to each right side windscreen panel sixty-inches (60") above the floor and adjacent to the passenger intercom box, as specified in Section 14.02, H, 4. The plate shall have the car number in numerals and Type II Braille embossed on it, as shown on CTA Drawing R-2-625, Page DR-6. The windscreen plate location must be independent of the interior esthetic design to provide consistency for seeing impaired persons with existing CTA cars.

F. Car Number Bar Code Plates

- 1. Three (3) bar code plates shall be installed on each car.
 - a, One plate shall be installed on the end of the No. 1 end sill under the cab windshield, behind the loop step.
 - b. One plate shall be installed on the No. 2 end sill diagonally opposite the operator's position between cars.
 - c. One plate shall be installed on the No. 1 side door left side windscreen sixty (60) inches above the floor opposite the Braille car number plate that is installed on the right side windscreen. The exact location of this plate should be independent of the interior esthetic design.
- 2. The bar code plates shall be 20 gauge, type 304 stainless steel, 4.00 inches by 2.00 inches with 0.125 inch radius corners and four (4) 0.125 inch mounting holes. The coating shall be fused ceramic compounds nominally 0.005 inches thick.
- 3. The car number bar code shall be black characters and bars on a white background. The bar code shall be Code 39 of four (4) characters.
- 4. The plates and their installation shall be reviewed by the Engineer.

5.05 FIRE EXTINGUISHERS

A. <u>Dry Chemical-Type</u>

The Contractor shall furnish an eight and one-half pound (8.5 lb), multi-purpose, cartridge-operated, dry chemical-type fire extinguisher, equal to Ansul Model 1-A-10-G, equipped with special non-kinking, hose assembly at least twenty-six-inches (26") long. The extinguisher shall have a rating of 4A-40B-C, and a range of twelve to seventeen feet (12'-17').

The extinguisher shall be die-stamped with the words "PROPERTY OF CTA" with letters approximately one-fourth-inch (1/4") high. The wording shall be stamped around the barrel of the extinguisher, approximately one-fourth-inch (1/4") up from the bottom edge of the extinguisher.

The extinguisher shall be mounted behind the operator's seat, in a vertical position, using the appropriate companion bracket. The location and mounting shall be demonstrated in the cab mock-up.

B. <u>Pump-Type</u>

The Contractor shall furnish a one and one-half gallon (1.5 gal) water-type fire extinguisher, equal to Miller-Peerless RE, copper, dome top, pump tank. The extinguisher shall be reviewed by the Engineer. This fire extinguisher shall be located in the operator's cab under the right side door control box. A stainless steel drip pan, sized to accept a one and one-half gallon (1.5 gal) pump-type extinguisher and a flat clip to catch the fire extinguisher handle, shall be provided for storage. The pan shall be sized to accommodate an extinguisher up to one-inch (1") larger in diameter, and the clip sized to accommodate an extinguisher up to two-inches (2") higher. The drip pan shall have a drain tube to the underside of the car.

5.06 CAB ACCESSORIES

A. Sun Visor

A sun visor shall be installed in each operator's cab, located to shade the operator's eyes from sunlight that may come through the cab windshield. The sun visor shall be equal to Adams and Westlake Model 111. The sun visor shall not contain any aluminum parts. The sun visor blade shall be 1/8-inch thick, black, smooth Kydex.

The sun visor, in any position, shall not interfere with cab equipment. The sun visor shall be reviewed by the Engineer, and shall be demonstrated in the cab mock-up.

B. <u>Coat Hook, Actuator Stick and Hook, and Clamp</u>

Coat hooks and an actuator stick hook shall be installed in locations in the operator's cab, as directed by the Engineer. A stainless steel clamp, the same as provided on CTA's 3200 Series cars, shall be provided to retain the bottom end of the actuator stick. Other means may be permitted with agreement of the Engineer. An actuator release stick, as shown on CTA Drawing R-2-762, Page DR-12, shall also be supplied in each car. The stick shall preferably be the longer design, but if necessary due to the friction brake manual release provisions, it may be the shorter length. If it is the shorter length, it shall be stenciled 5000-7000.

5.07 GANGPLANK AND LADDER

A. Gangplank

Each car shall be provided with a six foot (6') long, two-inch by eight-inch (2" x 8") wood gangplank. The plank shall be southern yellow pine, Grade DSS or better, finished on all four (4) sides with minimum dimensions of seven and one-half inch by one and one-half-inch by six feet $(7-1/4" \times 1-1/2" \times 6'-0")$ long. The plank shall be painted to match the car interior on one side, both ends and both edges. The other side shall be coated with a non-skid material, reviewed by the Engineer. The plank shall be located on the right of the No. 2 end door on each car as on CTA's 5000 Series cars. The plank shall be retained in stainless steel brackets similar to those on CTA's 5000 Series cars.

B. <u>Ladder</u>

A ladder with fiberglass side rails and non-skid aluminum rungs, equipped with permanently attached rigid stainless steel brackets, to engage the side door bottom track and the side sill, shall be furnished and installed at the No. 2 end of each A-car, adjacent to the gangplank.

5.07 GANGPLANK AND LADDER (Continued)

B. <u>Ladder</u> (Continued)

The ladder shall be enclosed in a stainless steel compartment with a hinged door. The door shall be framed and reinforced to make it rigid and vandal-resistant. It shall have a full-length stainless steel piano hinge and a "T" handle latch equipped with a separate locking bolt operated with CTA's standard key. The ladder shall be held in the compartment so it does not rattle and will not fall out when the door is opened. The mounting brackets may extend outside the compartment toward the rear window. The compartment shall not interfere with the removal of the heater guard nor shall it interfere with air flow from the diffuser. It shall be designed and installed without leaving gaps and holes that could be trash catchers that cannot be reached easily. The compartment frame shall be covered with rigidized stainless steel, see Section 12.02, C, 3. The rigidized stainless steel shall be riveted to the compartment frame.

The ladder shall be Type 1A-300 pound duty rating, extra heavy duty, industrial-type, equivalent to Werner Model 7100. The ladder shall be sixty-two inches (62") long with molded end caps at both ends of the side rails. The top rung shall be approximately twenty-inches (20") below the top of the side rails, and the bottom rung approximately eight-inches (8") above the bottom of the side rails, and there shall be four (4) evenly spaced rungs. The rungs shall be mounted on plates riveted to the side rails.

Stainless steel brackets shall be riveted to the side rails and be configured to latch into the side door bottom track and firmly snap onto the side sill bottom flange using rubber elements. Brackets shall be so designed to permit easy installation of the ladder, and provide toe space between the ladder and the carbody.

The design and construction of the ladder and its installation shall be reviewed by the Engineer, and demonstrated on the first car.

5.08 PHOTOLUMINESCENT STRIPS

A. <u>General</u>

Photoluminescent strips, nominally one-inch (1") wide, shall be installed along the floor and windscreens to provide a low level of illumination, to assist persons to find the side and end doors, in the absence of other lighting.

See Sections 3.07, C, 6, and 3.11, B, 6, for strip locations.

The strips shall exhibit long life with minimum loss of luminance with age and exposure to sun and UV light. The pigment used shall be equivalent to Strontium Oxide Aluminate, as supplied by International Name Plate Supplies. The strip luminance values shall meet or exceed the requirements of APTA SS-PS-002-99, Rev. 1, and shall have a useful life of at least twelve (12) years, before needing replacement for loss of light level.

5.08 PHOTOLUMINESCENT STRIPS (Continued)

B. Floor Strips

The photoluminescent strips used on the floor shall be inset in the floor covering material, with the top of the strip flush with the top of the floor covering.

The strip shall have sufficient flexibility to accommodate any floor flexing without cracking or breaking.

The strips shall be sealed in the grooves so as to become, as nearly as possible, homogeneous with the floor covering material and yet be able to be changed without damaging the floor covering.

C. <u>Windscreen Strips</u>

The photoluminescent strips attached to the windscreens shall be rigid with stainless steel backing. The strips shall have a flat center section nominally one half-inch $(1/2^{"})$ wide, and tapered edges nominally one-fourth-inch $(1/4^{"})$ wide, for a total width of one-inch $(1^{"})$. The stainless steel backing shall cover the entire width of the strip.

The strips shall be attached to the windscreens with flat head machine screws, as described in Section 3.11, B, 6.

D. <u>Review</u>

The strip materials, luminance characteristics, life, configuration, and sealing and attachment means shall be reviewed by the Engineer.

5.09 OUTSIDE GRAB HANDLES AND STEPS

A. <u>Grab Handles</u>

1. <u>General</u>

Outside grab handles shall be installed as shown on CTA Drawing R-1-606, Page DR-1, and as defined below. All outside grab handles shall be made of steel, painted black, as per Section 12.09. All grab handles shall be attached with stainless steel hardware, and shall be interchangeable from car to car.

Grab handles located on fiberglass areas shall be bolted to carbody structural members or permanently installed tapping plates, and arranged for removal and installation, from outside the car.

The exact arrangement and configuration of the grab handles on the No. 1 end of the car may change depending on the exterior esthetic design, but they shall retain the same functionality and ease of use as the specified locations, configurations and arrangements.

5.09 OUTSIDE GRAB HANDLES AND STEPS (Continued)

A. <u>Grab Handles</u> (Continued)

2. Locations

The grab handles listed below shall be provided on the outside of the car. Their location shall be reviewed by the Engineer.

- a. A vertical grab handle approximately twenty-four-inches (24") long at each corner post on the No. 1 end.
- b. A horizontal grab handle approximately eighteen-inches (18") long under each end window on the No. 1 end.
- c. A vertical grab handle approximately twenty-inches (20") long on each of the end door posts.
- d. A vertical grab handle approximately forty-eight inches (48") long, recessed in the side door post nearest the climbing step, at each side entrance door.
- e. The side door grab handle shall be nominal 1-1/4-inches OD, and the other grab handles shall be nominal 7/8-inches OD.

B. <u>Climbing Steps</u>

1. <u>General</u>

All climbing steps shall be made of stainless steel. The step area shall be upset or dimpled, or have a stainless steel anti-skid plate welded to it for antislip purposes.

All steps shall be jig-drilled to provide interchangeability. The bottom steps shall be sixteen-inches (16") above the top of the running rail, with the threshold at forty-five and one-half inches (45-1/2"). The steps shall not deflect in any direction during use.

The spacing and location of the steps shall be designed for ease of climbing.

2. <u>Side Door Steps</u>

A climbing step shall be located below each side entrance door. This step shall be located under the door, toward the center of the car. There shall be a minimum of six-inches (6") of toe space at each step.

5.09 OUTSIDE GRAB HANDLES AND STEPS (Continued)

B. <u>Climbing Steps</u> (Continued)

3. No. 1 End Climbing Steps

Steps shall be provided at both corners of the No. 1 end. Steps shall be under the end of the car, and be electrically insulated from the carbody.

The location and heights shall be demonstrated on the No. 1 end mock-up, as specified in Section 3.14, E.

C. End Sill Loop Steps

A forged steel loop step, as shown on CTA Drawing R-2-631, Page DR-17, shall be bolted to the No. 1 end sill on each side of the car. The step shall be centered on the center rib of the anti-climber. The installation shall be reviewed by the Engineer.

The step shall be painted charcoal gray, per Section 12.09, B, and the top surface shall be coated with an anti-skid material, and shall be reviewed by the Engineer.

5.10 END SILL ANTI-SLIP PLATE

The area outside the end doors shall be fitted with a stainless steel, diamond pattern antislip tread plate. This plate shall be kept one and one-fourth-inches (1-1/4") back of the outside edge of the anti-climber. The plate shall be securely fastened in place with flat-head stainless steel bolts and nuts. This area shall have a slight pitch to drain water off of the end sill. The plate shall be sealed at the edges to prevent water collecting underneath it.

5.11 TOOL LOCKER

An unpainted stainless steel locker with a top-hinged door, and a spring-loaded, over-center, toggle latch shall be provided to hold the trolley rope and the third rail shoe slippers and the wheel chock. Four (4) wood slippers and a bracket, per CTA Drawing PCC-12, Page DR-13, and one (1) wheel chock shall be provided, see Section 5.12.

The locker shall be located under the car on the right side, and be accessible from the side of the car. The door shall have a self-adhesive bright yellow reflective "T", four- inches (4") high on it.

5.12 WHEEL CHOCK

The Contractor shall supply one (1), heavy duty, short-handled, steel wheel chock, without chains, for each car.

The chocks shall be painted safety yellow, and installed in the toolbox of each car, before shipment to CTA.

Each chock shall also have the car number stenciled in black on it.

Wheel chocks shall be reviewed by the Engineer.

5.13 <u>DE-ICER PROVISIONS</u>

- A. <u>Mechanical</u>
 - 1. Each car shall be equipped with two (2) stainless tubes, nominally one-halfinch (1/2") ID, extending through the car floor inside the cab, adjacent to both cab door posts. The tubes shall extend four-inches (4") above the floor.

Under the floor, the tubes shall bend to parallel the bottom of the floor and extend outward toward the side sills. The tubes shall be kept as close to the bottom of the floor as possible, passing above conduits and wire races to within approximately one-foot (1') of each side sill. The tube bend shall be as gentle as feasible to allow plastic tubing to be threaded through. The tube ends shall be capped and sealed in a manner reviewed by the Engineer.

- 2. Each car shall be equipped with two (2) Parker 394PD bulkhead quick coupler fittings installed in the lower cab walls facing the interior of the car along with the threaded connector and the single pin connector on the right side. See Section 3.12, B.
- 3. Each car shall be equipped with standard yellow nylon ¼" O.D. tubing, SAE J844 Type A, installed both the stainless steel tubes from the bulkhead fittings to the under car. The tubing shall be terminated under the car with a ¼" to ¼" O.D. Prestomatic, brass union with the open end plugged in a manner reviewed by the Engineer.

B. <u>Electrical</u>

Each car shall be equipped with the following items:

1. One (1) 10A circuit breaker on the car circuit breaker panel labeled, P41 "DE-ICER".

- 2. One (1) threaded connector, equivalent to Amphenol MS-3102A-16S-4S, with back shell and chain retained cover mounted on the right side lower cab wall approximately eight-inches (8") above the floor facing the interior of the car. The connector shall be wired to the P41 "DE-ICER" circuit breaker, and to B minus (B-). The panel adjacent to the connector shall be labeled "DE_ICER" with an engraved metal plate, mechanically attached.
- 3. One (1) single pin connector, equivalent to Superior Electric, Supercon RP50GB, mounted on the right side lower cab wall, adjacent to the cab door post approximately eight-inches (8") above the floor facing the interior of the car. The connector shall be wired to the carbody adjacent to the connector.
- C. <u>Review</u>

Both mechanical and electrical de-icer provisions shall be demonstrated on the cab mock-up, see Section 3.14, C, and the under car tubing shall be demonstrated on the under car mock up, see Section 3.14, B.

SECTION 6 SIDE DOOR OPERATORS AND CONTROL

6.01 DOOR OPERATOR

A. <u>General</u>

Each side entrance door of two (2) leaves shall be operated by one (1) in-line electric operator. No belts or chains shall be used to perform any function in the operator. The door operator shall be mounted over the door opening. There shall be absolutely no exposed door operating mechanism which may cause injury to any part of a person's body. The side door mechanism shall have an over-center lock.

It is the intent of this Specification that, to the extent possible, the door operator shall have microprocessor control and diagnostics.

Any field lubrication required for the door operator gear box shall be readily accessible for checking and filling. No door lubricants shall run or drip on any exposed parts which passengers may contact. Sealed gear boxes without provision for field lubrication will be considered.

All motor brushes shall be accessible for inspection and changing. Maintenance free motors will be considered.

Door rubber leading edges shall be provided, as described in Section 3.05, B, 1.

All details of the side door operator and control, and side door edges, shall be reviewed by the Engineer.

B. <u>Power and Wiring</u>

All door operators and controls shall be powered by the car's low voltage power supply through a circuit breaker, P31 "DOORS". Each door operator and its controls shall also have individual circuit protection. All door wiring shall be so arranged as to not interfere with the operating linkages or any other parts under any circumstances. Door wiring and terminal boards shall not lie on the door operator base plate.

C. <u>Cam Switches/Position Sensors</u>

No cam operated switches shall be permitted without specific concurrence of the Engineer.

Any cam switches used, and all position sensors, shall be mounted to permit individual adjustment. Each cam shall be keyed to the shaft and have at least one (1) set screw. Set screws shall not be threaded into plastic. Cam switches and position sensors shall be readily accessible from the front of the compartment when the doors are in the position normally required for adjustment. All switches shall be "environmental" type to withstand outdoor environment. Each switch/sensor shall be identified, in a manner reviewed by the Engineer, to show its designation and function.

6.01 <u>DOOR OPERATOR</u> (Continued)

C. <u>Cam Switches/Position Sensors</u> (Continued)

Position sensors shall be designed to operate under the environmental conditions found at CTA, and shall be locked in position to prevent shock and vibration from changing the adjustment. Sensor targets shall be rigid and locked in position to prevent any change in adjustment due to door operation or other vibration.

D. <u>Adjustments and Timing</u>

Adjustments shall be made in accordance with Section 16.01, H.

Door motion shall be smooth and free of shock and impact. Damping shall be provided at the ends of travel of the door panel in both the opening and closing directions.

All mechanical door adjustments shall be accomplished with appropriate devices with suitable locking provisions to prevent any change in service.

E. <u>Door Operation Commands</u>

Two (2) valid, hardwired trainline signals, "DOOR UNLOCK" and "DOOR OPEN", shall be required to cause the passenger side doors to open. Loss of either, or both, signals shall cause the doors to close and lock.

The trainwire circuits shall be compatible with those on CTA's 5000 Series cars.

F. <u>Obstruction Detection</u>

Each door shall be equipped with a means to detect obstructions while the door is closing. It is the intent of this Specification that the obstruction detection system be microprocessor based. The use of pressure wave or electrical sensitive edges is not permitted.

The sensitivity of the obstruction detection system shall be as follows:

- 1. It shall detect a flat bar, one-fourth-inch (1/4") wide and three inches (3") high, held between, and perpendicular to, the door panel, as a hand might be held to stop the doors. This sensitivity shall be required everywhere along the length of the door panel leading edges.
- 2. It shall detect an object three-eighths-inch (3/8") in diameter, held between, and perpendicular to, the door panels, at all locations along the length of the door panel leading edges.
- 3. The equipment shall permit a three-inch (3") wide strip of cotton cloth to be pulled free from the leading edges of doors that are fully closed and locked.

6.01 <u>DOOR OPERATOR</u> (Continued)

F. <u>Obstruction Detection</u> (Continued)

When an obstruction is detected, the local door controls shall cause that door operator to immediately reverse, and open the doors a predetermined distance, to allow for the removal of the obstruction. The system shall be initially set to open the doors three-inches (3") beyond the point where the obstruction is no longer detected. The door shall then attempt to re-close and shall recycle on the obstruction indefinitely.

The obstruction detection sensing limits and operator reversing distance shall be Portable Test Unit (PTU) adjustable.

6.02 DOOR CONTROL BOX

A. <u>General</u>

Each car shall be equipped with two (2) door control boxes. The boxes shall be installed adjacent to the sliding sashes in the operator's cab of each car.

The boxes shall be of stainless steel construction. The exterior surface shall have a No. 3 brush finish. The cover of the box shall be easily removed without disconnecting any wires or removing any components.

The design of the entire box and all its components shall be reviewed by the Engineer, and demonstrated on the Side Door Mock-Up, as described in Section 6.08.

B. <u>Door Control Key Switch</u>

Each door control box shall be equipped with a switch and lock, operated by CTA's standard key. The switch and lock shall perform the following functions at that operating position:

- 1. Mechanically unlock the door control toggle switches.
- 2. Energize the door controls.
- 3. Energize the Communication System and illuminate and energize the TOTS in that cab. See Section 14.02.
- 4. Energize the buzzer system.
- 5. Energize the cab heaters and defroster.

6.02 <u>DOOR CONTROL BOX</u> (Continued)

B. <u>Door Control Key Switch</u> (Continued)

The key switch and lock shall be designed to require the key to be depressed before it can be turned, and to be removed, only in the "off" position. The core into which the key is inserted shall be stainless steel.

The key switch shall be located away from the microphone, and the protrusion of the key from the panel shall be minimized.

It shall not be possible to remove the key until the door control toggle switches are in the "closed" position.

One (1) key shall be supplied to the Engineer for each door control box.

C. <u>Door Control Switches</u>

Each door control box shall contain two (2) toggle-type switches. One (1) switch shall operate all the doors on that side of the train to the right of this position, and the other shall operate all the doors on that side of the train to the left.

The switches shall be recessed in an opening in the box, similar to that on CTA's 5000 Series cars. The switches shall be of rugged design to withstand squeezing together of the handles, and shall be reviewed by the Engineer.

The door control switches shall be plainly and permanently marked "LEFT" and "RIGHT", with an embossed label plate riveted to the box cover.

D. Buzzer Switch

Each door control box shall contain a buzzer push button switch colored green as on CTA's 5000 Series cars. The buzzer system is described in Section 9.06.

E. <u>Communication Equipment</u>

Each door control box shall contain the communication equipment, as specified in Section 14.02, G.

F. Low Speed Interlock Enable Light

A green light-emitting diode (LED), as specified in Section 6.05, F, 3, shall be mounted near the key switch on each box.

6.02 DOOR CONTROL BOX (Continued)

G. <u>"DOORS" Repeater Light</u>

A light, the same as that on the Operator's Indicator Panel, shall be installed in the side of the left side door control box facing the sliding sash, close to the top of the box. The lens shall be white translucent, flat face with black letters reading "DOORS". A bracket shall be installed to keep the light assembly from being removed without the use of tools. The light shall be wired in parallel with the one on the Operator's Indicator Panel.

6.03 AUXILIARY DOOR CONTROL SWITCHES

A. <u>Outside Entrance Switch</u>

An "on-off-on" outside entrance switch, reviewed by the Engineer, and operated by CTA's standard key from the outside of the car, shall be located immediately to the rear of the No. 1 and No. 2 side doors to open and close the door at that location independent of the other door control switches. The switch shall be mounted sixty-five inches (65") above the top of the rail with the active suspension system in the fully raised position.

The switch shall be arranged to open the door when rotated clockwise and to close the door when rotated counter-clockwise. The key shall only be removable when the switch is in the center (OFF) position. The switch shall be clearly and permanently marked with embossed or stamped letters, "O" and "C", to the right and left, respectively. The door may also be closed from the door control boxes, or from the manual reset switch.

The key slot opening shall be protected by a heavy duty stainless steel, springloaded, weatherproof hinged cover. Protection shall be provided to prevent the cover from being caught on the edges and deformed by car washing equipment. The cover shall be installed with the hinge at the top, and must not stay in the open position. The hinge pin and spring shall also be stainless steel, see also Section 6.06.

The switch shall be mounted from the outside of the car.

The outside entrance switch shall be demonstrated in the door mock-up, see Section 6.08.

6.03 AUXILIARY DOOR CONTROL SWITCHES (Continued)

B. <u>Emergency Door Opening Handle</u>

An emergency door opening handle, reviewed by the Engineer, shall be installed at the bottom of each door header compartment, so located that the operating handle will pull down through the bottom of the compartment. The bottom panel of the compartment shall be stainless steel. There shall be a one-eighth-inch (1/8") thick, stock phenolic laminate balanced melamine close off sheet below the stainless steel, as on CTA's 3200 Series cars or a bonded balanced melamine on stainless steel panel as on CTA's 5000 Series cars. The melamine shall be colored to match the car interior décor. This handle, when pulled down, shall unlock and partially open the door mechanically, so the door panels can be opened manually. This handle shall not require more than thirty-five pounds (35 lbs) to operate. This handle shall be equipped with CTA's standard red plastic emergency ball, CTA Drawing E-1-503, Page DR-4. The handle and hole shall be designed such that the handle will neither hang-up on the edge of the hole nor be allowed to be pushed-up inside the hole. The hole shall not be an entrance for drafts, from the door header and pockets, to the car interior. This feature shall be demonstrated on the Side Door Mock-Up, as described in Section 6.08.

A manual reset switch, reviewed by the Engineer, shall be provided so that the side doors, which have been opened by the emergency door opening handle, may be closed electrically without opening the door operator or header compartment. The doors may also be closed from the door control boxes, or from the outside entrance switch, at the doors so equipped.

Operation of the emergency door opening handle, on any door, shall place a visual flag on the car video surveillance recording, of the camera covering that door, and shall increase the recording frame rate for a set time period (see Section 14.03, C, 4).

C. <u>Door Panel Latch/Cut Out Switch</u>

 A combined door panel mechanical latch and cut out switch, operated by CTA's standard key, shall be located adjacent to each side door leaf as on CTA's 3200 & 5000 Series cars. The latch shall have detents or an overcenter feature to keep the latch in both the open and latched positions. The latch pivot shall be provided with lubrication provisions, or other means to prevent seizing. Any springs shall be protected, plated or made of stainless steel, to prevent corrosion and loss of tension, see also Section 6.06.

6.03 AUXILIARY DOOR CONTROL SWITCHES (Continued)

- C. <u>Door Panel Latch/Cut Out Switch</u> (Continued)
 - 2. The switch shall have three (3) positions "CUT OUT", "OFF", "NORMAL". The key can be removed only in "CUT OUT" or "NORMAL".

The switch/panel latch shall electrically cut out the door operator and disable the alerting light and audible signal at that individual door, bypass the door signal relay interlock at that door, and mechanically prevent the panel from opening when in "CUT OUT".

The switch shall remove low voltage power from the door operator and disable the alerting light and audible signal at that door when in "OFF", to allow the door to be manually closed, but shall not bypass the door signal relay interlock.

3. There shall be a brushed stainless steel escutcheon plate with patterned key hole, and embossed or stamped wording for each switch/panel latch, as on CTA's 3200 Series cars.

6.04 SIGNAL LIGHTS

A. <u>Outside Door Light</u>

A red signal light shall be provided on the outside of the carbody at each side door, as described in Section 8.02, E. The red light shall be powered from the circuit breaker P30 "SIGNAL LIGHTS", and be wired to be on whenever that door is not fully closed, and a master controller in the train is in an operating position.

B. <u>Operator's Door Light</u>

A signal light shall be provided on the Operator's Indicator Panel. This light shall be so wired that it will be illuminated at an operating master controller when all side doors in the train are closed and locked.

The feed for the light shall be through an interlock on the power control relay. The light shall not illuminate when the door bypass pushbutton switch is depressed (see Section 9.05, E, 5).

C. <u>"DOORS" Repeater Light</u>

See Section 6.02, G.

6.04 <u>SIGNAL LIGHTS</u> (Continued)

D. Low Speed Interlock Bypass Light

A green indicator light shall be installed adjacent to the No. 1 and No. 2 side doors in the same fixture as the outside door light and white light, see Section 8.02, E.

The light shall be wired to illuminate when the low speed interlock is bypassed.

The light shall be reviewed by the Engineer, and demonstrated in the door mock-up, as described in Section 6.08.

E. <u>Passenger Alerting Light and Audible Signal</u>

1. A surface-mounted white light shall be mounted on the bottom of the door operator compartment, adjacent to the Emergency Door Opening Handle. The light shall be mounted such that it is visible from both inside and outside an open door.

The light shall be wired to illuminate before the door starts to open and flash at a rate of two per second (2/sec) before the door starts to close until the door is fully closed. The timing and flash rate shall be adjustable. The timing shall be set initially for one-half second (1/2 sec) before opening, and one second (1 sec) before closing. See Section 8.01, F, for added details of the light fixture.

2. An audible signal shall be incorporated in the side door operating system. The signal shall sound simultaneously with the alerting light, during the door opening and closing cycles. The signal shall distinctly different in sound to differentiate the opening cycle from the closing cycle.

The audible signal shall be generated on a per door basis and delivered only at the appropriate doors. The signal chime shall be the same as on CTA's 5000 Series cars, Triton Signal, Model TB27-W, to insure consistency among all CTA cars.

3. The light and audible signal and their controls shall be reviewed by the Engineer, and demonstrated on the Side Door Mock-Up, as described in Section 6.08.

6.05 PROPULSION CONTROL INTERLOCKING

A. <u>Power Control Relay</u>

The door control circuits shall be interlocked with the propulsion motor circuits by means of a power control relay, so that power to the motors will be interrupted while any side door on any car in the train is open or unlocked. The power control relay feature shall be functional in any operative cab in a train. The power control relay shall also be interlocked with the ATC System, as described in Section 13.05.

6.05 PROPULSION CONTROL INTERLOCKING (Continued)

B. <u>Door Summary Relays</u>

A door closed summary relay, reviewed by the Engineer, shall be so connected that when all the side doors on that car are closed and a master controller in the train is turned on, its coil is energized and its contacts complete Trainwire #21, on that car. A door locked summary relay, reviewed by the Engineer, shall be so connected that when all the side doors on that car are locked and a master controller in the train is turned on, its coil is energized and its contacts complete Trainwire #23, on that car. The trainline functions shall be compatible with those on CTA's 5000 Series cars.

C. Bypass Switch

A power control relay bypass switch shall be provided to permit moving the train, in the event of side door interlock circuit failure, by electrically bypassing the power control relay contacts, or by providing a feed to energize the power control relay coil. This pushbutton switch shall be a component of the Operator's Bypass Panel, and be designed to be extremely difficult to plug. The circuitry for this pushbutton switch shall be activated by the Bypass Activator Switch, as described in Section 9.05, D.

D. <u>Door Cut Out Switch/Panel Latch</u>

See Section 6.03, C.

E. <u>Door Panel Position Sensing</u>

Means shall be provided to determine that the door panels, individually, are in the closed position. It is the intent of these Specifications that these means shall not incorporate sensing arms, pivots and springs. The devices used shall be rugged and heavy duty to ensure long life.

All aspects of Door Panel Position Sensing shall be reviewed by the Engineer, and demonstrated on the Side Door Mock-Up, as described in Section 6.08.

- F. Low Speed Interlock System
 - 1. A micro-processor based low speed interlock system, similar to that on CTA's 5000 Series cars, shall be provided to prevent any side door from being electrically opened when the train speed is above approximately three miles per hour (3 mph).
 - 2. At speeds in excess of three miles per hour (3 mph), the doors shall be able to be opened only mechanically by the emergency door opening handle, as described in Section 6.03, B.
 - 3. When the low speed interlock on each unit is in the mode to allow the doors to be opened electrically, a green LED on each door control box shall be lit. The location of the LED shall be near the key switch.

6.05 **PROPULSION CONTROL INTERLOCKING** (Continued)

- F. Low Speed Interlock System (Continued)
 - 4. A single toggle-type low speed interlock bypass switch, reviewed by the Engineer, shall be located in the left side No. 1 door pocket compartment on each A-car. This switch shall bypass the low speed interlocks, illuminate the green indicator lights described in Section 6.04, D, and cause an appropriate low speed interlock bypass indication on the Train Operator's Touch Screen (TOTS) Display panel. The cut out switch shall be visible through an opening in the door pocket mask or cover. The opening shall have a clear, mar-resistant plastic cover. The location and size of the opening and cover shall be reviewed by the Engineer. The switch shall be labeled "NORMAL" and "BYPASS", with an embossed label plate. See also Section 6.06.
 - 5. The method, circuits, indications and arrangement of components for providing these interlocks shall be reviewed by the Engineer.

6.06 DOOR POCKET AND DOOR HEADER LOCATED ELECTRICAL DEVICES

All electrical devices, switches, terminal boards, lights, etc., found in the door pockets or door header, shall be completely protected from the environment. In addition, switches shall be "environmental" type to withstand outdoor environment. Any pivots or springs shall be protected, and pivots provided with lubrication provisions, or other means, to prevent seizing. The means to provide the protection shall be reviewed by the Engineer, and demonstrated on the Side Door Mock-Up, as described in Section 6.08.

6.07 DIAGNOSTIC SYSTEM

- A. The door system on each car shall include a microprocessor based diagnostic system. The door diagnostic system(s) within each car shall be interfaced to the Control and Monitoring Network (CMN), as specified in Section 15.06. Critical door status and alarm indications shall be conveyed via the CMN to the TOTS Display panel.
- B. The system shall monitor and display such items as door open/close commands, motor current, door opening and closing times, interlock status, position and speed sensor operation, faults, and any other items deemed appropriate by the door system and low speed interlock system manufacturer(s), to determine proper operation of each door and the low speed interlock system.
- C. It is the intent of the diagnostic systems to provide the Operator with adequate information to understand the status of the door and low speed interlock systems within the train. In the event of an unintended door opening or failure of a door to close and lock when commanded, or the failure of the low speed interlock system, the Operator requires enough information to determine which car(s) and door position(s) are affected, such that the Operator can take appropriate steps to resume safe train operation as soon as possible.

6.07 <u>DIAGNOSTIC SYSTEM</u> (Continued)

- D. It is also the intent of the diagnostic systems to provide sufficient data to correctly identify the failed lowest line replaceable unit within the side door and low speed interlock systems. Alpha-numeric displays shall be provided for each door and the low speed interlock system, to assist maintenance personnel in troubleshooting and repairing defects.
- E. In addition, a receptacle shall be provided in each operator's cab to connect a PTU to access microprocessor controls in each door controller on that car or married pair beyond the built-in diagnostics. If the low speed interlock is located in the cab of the "A" car as on CTA's 5000 Series cars, the PTU receptacle may be located within its enclosure, otherwise the PTU receptacle shall be included on the cab receptacle panel. See Section 9.05, G.
- F. PTUs shall be provided, as specified in Section 17.04. See Section 1.22 for details of the diagnostic application and software.
- G. Any trouble indications/readouts shall only be reset manually. Turning off the car shall not reset or cause the loss of failure/trouble indications or the loss of information utilized by the car test equipment.
- H. Diagnostic system operation or tests shall not cause an unsafe door condition. Failures in the diagnostic system shall not interfere with the safe and normal operation of the door system. The entire diagnostic system shall be reviewed by the Engineer.

6.08 SIDE DOOR AND CONTROL BOX MOCK-UPS

The Contractor, or door operator and control box supplier, shall construct a working mock-up of one (1) side door assembly and a door control box, to demonstrate the functioning of the side door and door control box and the location of all the parts. The mock-ups shall utilize actual door panels, hangers, threshold, linkage, controls, switches and operator. The support structure should be an exact replica of that in the car, though it may be made of suitable, different materials. The structure should include the door header with access panels and ceiling or light fixture area, to be able to assess accessibility for maintenance. The mock-up shall include sufficient door pocket structure, access panels, and exterior skin with side body indicator lights, as specified in Section 8.02, E, to demonstrate re-lamping of the indicator lights from inside of the car. The mock-ups shall be reviewed by the Engineer and changes to the mock-ups and final car design shall be made, as necessary, at no cost to CTA, to satisfy the comments of the Engineer.

SECTION 7 AIR COMFORT

7.01 AIR COMFORT - GENERAL

A. <u>Air Comfort System Description</u>

- 1. The Contractor shall install a combined forced-air heating, ventilating, and aircooling system and controls. Heating shall be of the electrical resistance type, and cooling of the electro-mechanical refrigeration type. The combined system shall consist of a complete, self-contained unit, located under the car, except as otherwise specified. The air from the undercar unit shall be delivered to the carbody through insulated ducts, and discharged to the car interior and cab through openings below the car side and end windows. The interior air shall be returned to the system near the center of the car at floor level. Fresh air to the system shall be made up by opening and closing doors during normal operation. The air comfort system shall operate on 230 Vac, 3 phase and 600 Vdc, for heater elements. The air comfort system controls shall operate on the car's low voltage power supply. The car heating and air conditioning systems shall be integrated, and electrical circuitry shall be such as to allow simultaneous operation of both systems, or alternate operations to compensate for any overrun or failure of either The Contractor shall assume all responsibility for satisfactory svstem. performance in CTA service.
- 2. For sizing the heaters and air conditioner, it shall be assumed that the car is stopped for twenty seconds (20 sec) of each eighty second (80 sec) period, and that both the side doors on one (1) side are open for fifteen seconds (15 sec) of each twenty second (20 sec) period. In addition, the 600 Vdc input shall be turned off for one-second (1 sec) every five minutes (5 min) to simulate rail gaps.

SECTION 7 <u>AIR COMFORT</u> (Continued)

7.01 <u>AIR COMFORT - GENERAL</u> (Continued)

- A. <u>Air Comfort System Description</u> (Continued)
 - 3. The system shall be sized and designed to bring the average car inside temperature, measured three feet (3') above the floor and no closer than twelve inches (12") from the sides and ends within 15°F of the control temperature within one-half hour (1/2-hr) in the heating mode and within 5°F of the control temperature within one-half hour (1/2-hr) in the air conditioning mode, under the specified ambient temperature conditions when operated with the door cycling sequence defined above, with thirty (30) passengers initially, increasing to ninety (90) passengers at the end of one-hour (1 hr). Under these same conditions, the average car interior temperature shall reach 68°F in heating, and 75°F with fifty- to fifty-five percent (50-55%) RH in cooling within one-hour (1hr) of system start. The design and control of the entire air comfort system shall be such that the balance temperature throughout the car, during either heating or cooling, shall be maintained within ±3°F when measured on a horizontal plane, three feet (3') above the floor and no closer than twelve inches (12") from the sides and ends of the car. The maximum temperature differential between the ceiling and the floor of the car shall be 10°F measured no closer than twelve-inches (12") from the sides, ends, floor, or ceiling of the car with the blower fans in operation after the car interior has reached equilibrium. Temperature uniformity criteria shall not be applicable at the side door openings.
 - 4. The entire system including controls and all the details shall be reviewed by the Engineer.

SECTION 7 <u>AIR COMFORT</u> (Continued)

7.01 <u>AIR COMFORT - GENERAL</u> (Continued)

B. Operating Parameters

Inside Car Temperature	Master Controller	Air Comfort	Fan Speed	Cooling Used	Heaters Used	Mode
Above 74°F	On	On Off On	High None High	Full None Full	None None	Full Cool Off Pre-Cool
		Off	None	None	None	Off
Above 72°F	On	On Off	High	Partial	None	Mod. Cool
	Off	On On	High	Partial	None	Pre-Cool
		Off	None	None	None	Off
Above 70°F	On	On Off	High None	Partial None	Partial	Reheat Cool
	Off	On On	High	Partial	None	Pre-Cool
		Uff	None	None	None	Off
Above 65°F	On	On Off	Low	None None	None None	Vent Off
	Off	On	Low	None	None	Vent
		Off	None	None	None	Off
Below 68°F &	On	On Off	Low	None	Partial None	Part Heat
(Above 48°F	Off	On	Low	None	None	Vent
Outside)		Οπ	None	None	None	Off
Below 68°F &	On	On Off	Low	None	Full	Full Heat
(Below 48°F	Off	On	Low	None	None	Vent
Outside)		Off	None	None	None	Off
Below 36°F	On	On	Low	None	Full	Full Heat
	<u> </u>	Off	None	None	Partial	Layover
	Off	On	Low	None	Full	Heat to Layover
		Off	None	None	Partial	Layover

Note: Compressors and High Speed and Condenser Blower operation shall be inhibited when the outside temperature is below 40° F. See Section 7.01, C, 4.

SECTION 7 AIR COMFORT (Continued)

7.01 <u>AIR COMFORT - GENERAL</u> (Continued)

C. <u>Controls</u>

- 1. The air comfort system on the entire train shall be activated by a signal on the train network. The signal shall be generated, by an "ON-OFF-ON", spring return-to-off, single-pole toggle switch located on the Operator's Control Panel. A red indicator light shall be furnished, located adjacent to this switch, to indicate when the air comfort system is "ON", but only when the Master Controller in that cab is unlocked.
- 2. In the event the air comfort system is not turned off when the Master Controller is turned off, or the air comfort has been turned on without turning on a Master Controller, an automatic time out shall turn off the air comfort system. The time out shall be adjustable from at least thirty to sixty minutes (30-60 min) and set for forty-five minutes (45 min).
- 3. The feed for the entire heating, ventilating and air conditioning system control on each car shall be by means of a circuit breaker type switch, which shall also serve as the system cut out for each car, without affecting the trainwire control. The circuit breaker shall be located on the car interior circuit breaker panel and identified as P32 "AIR COMFORT".
- 4. Electro-mechanical control devices shall be used in the air comfort system for power control unless agreed to by the Engineer. Solid-state electrical devices shall be used for signal control and time delay, but require review by the Engineer.

The air comfort system on each car shall be controlled by a micro-processor based temperature controller and by separate thermostats for system lockouts and layover heat. Location and type of temperature sensors and thermostats shall be reviewed by the Engineer.

Means shall be provided to perform the following functions:

- a. Inhibit operation of the evaporator heaters when the outside ambient temperature is above 48°F.
- Inhibit operation of the compressors, high speed blowers and condenser blower when the outside ambient temperature is below 40°F.
- c. Provide layover heat when the interior car temperature is below 36°F.
- d. Provide threshold heat as specified in Section 7.02, C, and inhibit threshold heat when the outside ambient temperature is above 42°F.
- e. Inhibit floor (seat box) heat when the outside ambient temperature is above 55°F.

SECTION 7 AIR COMFORT (Continued)

7.01 <u>AIR COMFORT - GENERAL</u> (Continued)

- C. <u>Controls (Continued)</u>
 - 5. The controller on each car shall include a diagnostic system that shall be interfaced to the Control and Monitoring Network as specified in Section 15.06 to provide information on system operation and failures to the car monitoring network and the TOTS in the active cab. The exact details and displays shall be reviewed by the Engineer.

In addition, a receptacle shall be provided on the PTU receptacle panel in each operator's cab to connect a PTU to access the microprocessor controls on that car or married pair beyond the built-in diagnostics. See Section 9.05, G.

PTUs shall be provided, as specified in Section 17.04. See Section 1.22 for details of the diagnostic application and software.

The microprocessor control shall allow for adjustments and additions of setpoints and operating parameters listed in Section 7.01, B, above. The intent is to reduce short cycling and temperature oscillations that can occur as ambient temperature changes. The control shall also provide for the duty cycle of the two compressors to be equalized. Details of the control scheme shall be reviewed by the Engineer.

- 6. The air comfort system and its controls shall not place any load on the car's low voltage system while the car is laid-up with air comfort turned off except when layover heat is actually heating, unless otherwise agreed to by the Engineer.
- 7. The controls shall be specifically designed to provide sequenced starting of the evaporator and condenser fans and compressor motors to prevent overloading of the auxiliary power supply. The starting sequence shall be followed regardless of how the system was shut down or de-energized.
7.01 <u>AIR COMFORT - GENERAL</u> (Continued)

- D. Fans and Motors
 - 1. The ventilation fan motor(s) shall be operated on 230 Vac, 3 phase, 60 Hz. Fan speed shall be automatically controlled to suit the various modes of operation. The fan shall deliver to the car interior approximately 3700 cfm of filtered air at full fan speed, and approximately 2100 cfm of filtered air at low fan speed measured at the outlet of the air diffuser. The air conditioning compressors and evaporator heat shall be protected from damage in the event of a fan motor failure.
 - 2. The condenser fan motor(s) shall be operated on 230 Vac, 3 phase, 60 Hz.
 - 3. Care must be exercised in the design of these fans and motors to ensure compliance with the noise criteria specified in Section 16.02. Also see Section 12.11 for motor details.
 - 4. The direction of rotation of all fans shall be designated by embossed arrows on the fan hub and surrounding shroud.

E. <u>Ducts and Air Diffusers</u>

- 1. All air ducts and fan housings shall be suitably insulated to prevent heat and noise exchange. Insulation in the air stream, where used, shall have a smooth skin or protection so that dirt cannot be accumulated or embedded in the insulation or erode the insulation. Insulation inside ducts shall also be appropriately mechanically retained to prevent lifting by the air stream. Removable access panels shall be provided to permit easy cleaning of the ducts. The duct design shall preclude the entrance of water from the car's interior or exterior.
- 2. The ducts shall be designed to deliver air to the carbody window sill air diffusers. The distribution of air shall be to the ends of the car as well as both sides in such quantity as to achieve the temperature distribution defined in Section 7.01, A, without areas of very low or very high air flow in the car. The air flow along the diffusers shall be even in each section of diffuser. The design of the air diffuser shall be such that it can easily cleaned and not offer any maintenance problems. There shall be no objectionable hot or cold spots or drafts.
- 3. The operating cab area must receive adequate air flow to meet the heating and cooling requirements specified. The right side window air diffuser in the operator's cab shall be equipped with a manual adjustment to regulate the flow of air. This adjustment shall be easy to operate and shall not rattle. The design of the adjustment requires review by the Engineer.
- 4. Each air duct connection between the carbody and the undercar resiliently mounted air comfort package shall be airtight and have provision for adjustment to maintain airtightness without affecting any other air duct connection.

7.01 <u>AIR COMFORT - GENERAL</u> (Continued)

- E. <u>Ducts and Air Diffusers</u> (Continued)
 - 5. The return air ducts between the carbody connection and undercar unit shall be made of unpainted stainless steel with 2B finish.
 - 6. A heat deflector/baffle shall be installed, if needed, on the return air plenum adjacent to the traction resistors to protect the plenum insulation from resistor heat. The baffle shall be a laminated assembly of two stainless steel sheets separated by modified closed cell silicone foam insulation on fiberglass at least 1/16" thick.
- F. <u>Filters</u>

Return and condenser air filters shall be provided as part of the undercar air comfort package. The return air filters shall be a heavy duty, fire-retardant disposable type, equal to Farr 3030. The filters shall be sized as large as possible to minimize pressure drop and maximize time between changes. See Section 7.03, B, 6, for the condenser air filters.

- G. <u>Testing of System</u>
 - On one (1) of the first six (6) completed cars, the Contractor shall conduct "Hot Room" and "Cold Room" tests, to ensure compliance with the design conditions specified. The equipment shall demonstrate its ability to operate normally and at full capacity at design conditions, as per Sections 7.01, A, 7.02, A, and 7.03, A. The air conditioning system shall also be tested to demonstrate its ability to operate continuously with 105°F ambient and 135°F condenser air temperatures.
 - 2. The air conditioning system shall also be tested to demonstrate its ability to successfully withstand operating in 105°F ambient with a solid horizontal platform running the full length on both sides of the car at floor height three-inches (3") from the car side, and having a vertical wall five feet-six-inches (5'-6") from the car center line extending from the platform down to the bottom of the running rail. Under these conditions, the system may cycle as a result of high head pressures but shall suffer no deleterious effects after twelve hours (12 hrs) of continuous operation.
 - 3. The equipment shall be designed to fulfill these conditions without shortening normal life or damaging the motor insulation. This compliance must be established before shipment of any production cars.
 - 4. The test procedure shall be reviewed by the Engineer. After review of the test results by the Engineer, the balance of the cars shall be functionally tested by the Contractor at his plant, and the system shall be run to ensure proper function and operation.

7.01 <u>AIR COMFORT - GENERAL</u> (Continued)

- G. <u>Testing of System</u> (Continued)
 - 5. Each undercar air comfort unit shall be tested by the manufacturer at his plant, using a test set up which shall demonstrate the proper functioning of the components.
- H. <u>Maintenance Equipment</u>

The air conditioning maintenance tools and equipment, in the quantities specified herein, shall be provided by the Contractor in addition to special tools specified in Section 17.03.

- 1. Five (5) Master Gauge Sets, consisting of suction and discharge pressure gauges, manifold and two (2) valves, and three (3) charging lines with appropriate fittings. Test gauges shall be sent separately to the Engineer.
- 2. Five (5) Maintenance Kits, consisting of a halide leak detector, special tools, valve wrenches, fin rakes, oil test kit, oil filling pump, etc. The contents of these kits shall be reviewed by the Engineer.
- 3. Five (5) sets of portable equipment to pump-down and evacuate the refrigeration system and for refrigerant recycling. The equipment shall be reviewed by the Engineer.

7.02 <u>HEATING</u>

A. <u>General</u>

It shall be the responsibility of the Contractor to install the necessary wattage of electric heat and control devices and circuitry to meet the requirements of Section 7.01, A, with an outside ambient temperature of 0°F, when the car is operated in accordance with Section 7.01, A. Sidewall and threshold heaters shall operate from 600 Vdc, unless otherwise agreed to by the Engineer. Air Comfort unit heaters shall operate from 230 Vac.

1. Part of the heater elements shall be located in the undercar air comfort system unit, see Sections 7.03,B,7 and 7.03,F, and the remaining portion shall be located behind Type 302 rigidized stainless steel heater guards running the full length of each side and end of the car, except at the door openings. The heater guard shall have a sloping top to prevent accumulation of dirt and shall have easily removable sections at each heater element to permit cleaning and replacing of defective heater elements. Car seats or other items of interior appointment shall not interfere with the removable heater covers. The design of the heater guard shall be such that water entering it shall not be allowed to flow onto the heater elements and shall drain clear of the enclosure.

- 7.02 <u>HEATING</u> (Continued)
 - A. <u>General</u> (Continued)
 - 2. The heater covers shall be securely held in place with stainless steel tamperresistant, quarter-turn fasteners, as on CTA's 3200 Series cars, retained in the covers. One (1) key/tool to fit the tamper-resistant fastener shall be supplied for each car, and delivered separately to the Engineer.
 - 3. The side wall heater elements shall be connected in at least two (2) series circuits and distributed through the car so as to provide proper heat distribution. Each series circuit shall be separately protected.
 - 4. During layover, the side wall heater elements shall be operated as required to maintain layover temperatures without the use of blower fans.
 - 5. Protection shall be provided to remove power from the heater elements in the side wall and undercar unit in the event of overheating. Overheat protection thermostats shall be of the self-reset type.

Care must be exercised in selecting temperature values and locations for the overheat protective devices to preclude tripping under normal operating and shutdown conditions.

6. The operating cab shall be heated in the same manner as the car. The cab temperature shall be maintained within ±3°F of the car average temperature. This requirement shall be met without the use of the cab heater or defroster units, but with the use of the cab manual air flow adjustment device, as needed.

B. <u>Cab Heater and Defroster</u>

1. A one kiloWatt (1 kW) cab defroster unit, reviewed by the Engineer, shall be provided to perform windshield defrosting. It shall be housed in a stainless steel enclosure and shall be located to not interfere with the operator's foot or leg space.

It shall be remotely controlled by means of switches on the operator's control panel, a contact in the Master Controller, a contact on the door control box key switches, and a contactor on the auxiliary panel under the car. The heater shall operate on 600 Vdc, and shall not operate unless the fan motor is operating. Protection shall be provided to remove power from the heater elements in the event of overheating. Overheat protection thermostats shall be of the self reset type.

The defroster fan shall operate on the car's low voltage power supply. The air from the cab defroster fan shall be directed over the operator's windshield for defrosting. The defroster fan shall operate independently of the cab or car heat when the Master Controller is unlocked or a door control key switch is turned on in that cab.

7.02 <u>HEATING</u> (Continued)

- B. <u>Cab Heater and Defroster</u> (Continued)
 - 2. A one kiloWatt (1 kW) cab heater-blower unit, reviewed by the Engineer, shall be provided to supplement the cab heat called for in Section 7.02, A. The location shall be determined at the cab mock-up, as specified in Section 3.14, C. It shall operate and be remotely controlled in the same manner as the defroster, but utilizing only one (1) "ON-OFF" switch and a contact in the Master Controller. It shall incorporate the same overheat protection feature as the defroster.

The fan shall operate the same as the defroster fan, but all the air shall be directed across the floor. Air distribution shall favor the aisle and operator's work area.

C. <u>Threshold Heaters</u>

Each side door bottom door track shall be equipped with a heating element reviewed by the Engineer. The heater and its controls shall be designed to preclude the accumulation of ice and snow that would hinder the normal operation of the side doors while the cars are in service. The system shall also assure normal door operation within five minutes (5 min) of turning the air comfort system on following stabilization under layover condition.

The arrangement of the heating elements shall be such as to permit easy removal and replacement without removing the side door panels or door pocket masks, see also Section 3.07, D, 1. The threshold heat shall be inhibited when the outside ambient temperature is above 42°F. A self-resetting overheat thermostat shall also be provided.

D. <u>Heating Elements</u>

Electric heater elements shall be equal to those of E.L. Wiegand Company or General Electric Co. Side wall heaters shall be the finned-strip type. Undercar unit heaters may be either finned stainless steel strip type or finned stainless steel tubular type. The threshold heaters shall be molded to the side door threshold plates. Side wall heater elements shall be, to the greatest extent possible, the same size and type as used on CTA's existing cars. The size, type and rating of elements shall be reviewed by the Engineer.

E. <u>Heater Wiring and Insulation</u>

Wiring to all heater elements shall be reviewed by the Engineer. The wire type used shall be as specified in Section 12.06, A. Wire shall be attached to all heater elements, except threshold elements, with Eaton Tenz-Nuts, or equivalent. All heater elements shall be mounted on secondary insulators.

7.03 AIR CONDITIONING

A. <u>General</u>

 It shall be the responsibility of the Contractor to install the necessary capacity of electro-mechanical refrigeration to air condition each car to meet the requirements of Section 7.01, A, with ambient outside temperature of 105°F DB and 80°F WB, and with 450 cfm of fresh air provided during the door cycling as specified in Section 7.01, A, 2.

The system shall continue to operate with condenser air 30°F above design conditions without damage to any part of the system.

- 2. The control circuitry, devices and thermostats shall provide for full cooling above 74°F, partial cooling between 72°F and 74°F, partial cooling with reheat, between 70°F and 72°F, and to shut down the air conditioning below 70°F.
- 3. The operator's cab shall be air conditioned in the same manner as the car. The cab temperature shall be maintained within +0°F/-5°F of the average car temperature. This requirement shall be met without the use of the cab heater or defroster units, but with the use of the cab manual airflow adjustment as needed.
- 4. The system shall be designed to use refrigerant R-407C, unless otherwise agreed to by the Engineer.
- 5. The copper tubing used in both the condenser coil and the evaporator coil shall be internally rifled to improve heat transfer.
- 6. The supplier of the air conditioning equipment shall provide sufficient documentation to allow CTA to purchase motors, fan assemblies, refrigerant compressors, relays, and contactors directly from the manufacturers. In addition, the supplier shall specifically require the manufacturers to sell the components parts to the CTA, and shall provide documentation of the requirement and concurrence by the manufacturers.
- B. <u>Compressor -Condenser-Evaporator Unit</u>
 - 1. A compressor-condenser-evaporator unit utilizing two (2) compressorcondenser assemblies shall be mounted on a steel frame located under the floor and supported on vibration absorbing mounts.
 - 2. A sealed control box shall be mounted on the unit in an easily accessible location and contain the control devices and apparatus for the unit, including circuit breakers, relays, contactors and terminal boards. The entry points shall not be in the top of the box. The cover shall be completely gasketed and have stainless steel latches of the spring-loaded, over-center type. The design of the box and cover shall preclude water dripping or running onto internal devices, even with the cover opened.

7.03 <u>AIR CONDITIONING</u> (Continued)

- B. <u>Condenser–Compressor–Evaporator Unit</u> (Continued)
 - 3. All circuits shall be plug connected to the undercar unit. The connectors shall be as specified in Section 9.02, J. The manual control switches, high and low pressure protection switches and shut-off valves with test gauge ports for suction and discharge lines shall be located on each side of the unit adjacent to the motor-compressor unit which they control.
 - 4. The manual control switches shall have a "TEST" position to bypass the temperature controls as well as an "AUTO" position and an "OFF" position. These switches shall be housed in weatherproof boxes and the switches shall be the sealed environmental type for outdoor application.
 - 5. The high and low pressure switches shall be plug connected to the wiring harness.
 - 6. The condensers on each side of the unit shall have covers that shall be easily removable without the use of tools. The cover latches shall be stainless steel compression spring draw latch type. In addition, the covers shall be designed to throw the test switches into "AUTO" position when they are latched closed.
 - 7. The covers shall also be fitted with internal disposable filters to prevent accumulation of large debris to minimize clogging by dust and dirt. The filters shall comply with FMVSS Standard 302 for flammability. The condenser covers shall also be equipped with external pre-filters that cover the face and the four (4) sides of the grill. The material shall be polyester screen with a mesh size of 250 microns (60 U.S. Mesh size) and an open area of 37%. Filter design and material shall be reviewed by the Engineer.
 - 8. Easily removed access panels shall be provided to permit cleaning and maintaining of all internal parts of the unit. Electric heaters, the condenser coils, the evaporator coil and expansion valves shall have complete access for easy and thorough cleaning and maintenance from under the car. Particular attention shall be given to protecting the evaporator heater electrical terminals and the low and high voltage terminal boards adjacent to the evaporator heater elements from sustaining damage from the condensate liquid.
 - 9. All electrical components shall be identified with permanent labels, mechanically attached, reviewed by the Engineer.

7.03 <u>AIR CONDITIONING</u> (Continued)

C. <u>Compressors and Motors</u>

The compressors shall be of rugged, fully hermetic, scroll design suitable for rapid transit service and equipped with start unloading. The compressor motors shall operate on 230 Vac, 3 phase, 60 Hz. The compressors, as installed, shall be a standard, domestically available model.

The compressor shall be equipped with Rotalok fittings and coupled to the refrigerant piping through vibration isolators to prevent strain on the piping from compressor vibration. The isolators shall be arranged to allow compressor replacement without disturbing any piping.

D. <u>Condenser Details</u>

The condensers shall be vertically mounted in the undercar unit. The condenser coils shall have copper tubes and copper fins of 0.008" to 0.010" thickness with a maximum of eight (8) fins per inch and have a suitably protected steel coil casing. The condensers shall have a total face area of at least eight square feet (8 sq. ft.) to ensure low noise operation. The condensers shall be covered per Section 7.03, B, 6 and 7.

Condenser air shall be drawn from the side of the car and discharged under the car.

The condenser outlet air grill shall be equipped with a safety switch that precludes the operation of the fan with the grill removed.

E. <u>Evaporator Details</u>

The evaporator coil shall be mounted in the undercar unit. The filtered air shall pass through the evaporator coils and heater elements to be discharged into the air distribution system. The evaporator coils shall have copper tubes with aluminum fins of 0.008"-0.010" thickness with a maximum of nine (9) fins per inch.

The face area of the evaporator shall be at least five square feet (5 sq. ft.), and coil face air velocity shall be low to prevent moisture carry-over into the air duct. The coil shall be divided for modulation with the two (2) sets of tubes interlaced to produce even temperature at the outlet to the carbody. A drip pan shall be provided beneath the evaporator coil. The drip pan shall be made of stainless steel with splash angles and a drain system to carry away condensate. The drip pan and drain system shall be under positive pressure. See also Section 7.03,B,7.

7.03 <u>AIR CONDITIONING</u> (Continued)

F. <u>Evaporator Heater</u>

There shall be installed electric heater elements adjacent to the outlet of the evaporator coil. The heater elements shall be finned stainless steel tubular type with secondary insulators mounted on a stainless steel frame easily removed from under the car. The heaters shall be powered by 230 Vac, 3 phase, and may be divided into multiple circuits to facilitate control of the car interior temperature. The capacity shall be determined during the heating analysis, but is expected to be 18kW as on other CTA cars.

Protection shall be provided to preclude the operation of the evaporator heaters without normal blower fan operation. The protection devices shall be reviewed by the Engineer.

See also Sections 7.02,C,5 and 7.03,B,8.

G. <u>Refrigeration Equipment Details</u>

A receiver shall be mounted close to each condenser. The size shall be reviewed by the Engineer. The receiver shall have inlet and outlet valves. There shall be two (2) sight glasses for determining the liquid level in the receiver. These sight glasses shall be readily visible from outside the unit and shall have floating ball level indicators.

There shall be a filter drier in the refrigerant line and a moisture indicator. The filter drier shall be equipped with "Rotalok" fittings and inlet and outlet valves. The filter drier installation shall be arranged for easy replacement of the filter drier from outside the unit. The moisture indicator shall be located for easy inspection from outside the unit.

Special care must be taken in design of the refrigeration equipment to address overload conditions that may occur due to overcharging, dirty condenser coils and other system problems. The system must be designed to continue operating, though at less than full rated capacity, in the event abnormal conditions exist for long periods of time. Provisions must be included to limit the effects of high temperatures and overloading, to maximize the heat transfer and discharge from condensers, to prevent motor stalling and overloading when restarting compressors and to coordinate compressor motor circuit breaker rating and motor protection circuitry to prevent breaker tripping unless actual motor defects occur.

SECTION 8 LIGHTING

8.01 INTERIOR LIGHTING

A. Light Control

The interior lights on the entire train shall be activated by a signal on the train network. The signal shall be generated by an on-off-on, spring-return-to-off, single-pole, toggle switch located on the Operator's Control Panel. A red indicator light shall be installed adjacent to this switch to indicate when the interior lights are on, but only when the Master Controller in that cab is unlocked.

In the event the interior lights are not turned off when the Master Controller is locked up, or the interior lights have been turned on without unlocking a Master Controller, an automatic time out shall turn off the interior lights. The time out shall be adjustable from thirty minutes (30 min) to sixty minutes (60 min), and shall be initially set for forty-five minutes (45 min).

The electrical feed for the control of the interior light system on each car shall be by means of a circuit breaker. The circuit breaker shall also serve as the system cut out for each car without affecting trainline control. The circuit breaker shall be located on the car interior circuit breaker panel and shall be identified as P35 "INTERIOR LIGHTS".

The control apparatus for the interior lights, except as specified, shall be located on one panel as specified in Section 9.05, B. All interior lights shall be operated from the car's low voltage power system.

B. <u>Power Supply</u>

All interior lights shall be powered by the car's low voltage power system. LED arrays shall be fused with exterior fuses unless otherwise agreed to by the Engineer. Fuses shall be easily changed from the front of the fixture. The LED arrays shall be reviewed by the Engineer.

8.01 INTERIOR LIGHTING (Continued)

C. Light Fixtures

1. <u>General</u>

All light fixtures shall be constructed to prevent the entry of dust, insects, and water, and all lenses shall be fully sealed on all edges to prevent the entry of dust and insects.

The lenses shall be hinged to allow access to the LED arrays and fuses.

The lenses shall have a full metal frame and shall be retained with captive stainless steel coarse-threaded fasteners with easy starting provision.

The main style of fixtures/lighting shall be demonstrated on the convertible seat mock-up, and the door area fixtures shall be demonstrated on the side door mock-up.

2. <u>Main Car Lighting</u>

The main car lighting fixtures, if used, shall be continuous strip-type, mounted to the car ceiling above the seats on both sides of the aisle from the cab partition to the No. 2 end of the car, as on CTA's 5000 Series cars. The fixtures shall have polycarbonate lenses which shall effectively mask the visibility of the individual LEDs and ensure the lighting is distributed evenly without bright or dark spots. The lenses shall be divided into convenient lengths for ease of maintenance.

If no stand alone fixtures are used and the lighting is integrated into the ceiling and side wall design, special care shall be given to protecting the LED arrays and providing for their easy cleaning. No pockets or crevices that could hold dust or insects shall be permitted. Provisions shall also be made for the changing of individual arrays.

3. <u>Side Door Lighting</u>

There shall be additional flush-mounted LED light fixtures in the side door areas to provide additional lighting in the side door areas and provide emergency lighting. See Section 8.01, E.

The fixture lens frames shall be constructed of anodized, brushed aluminum. They shall be designed and constructed to prevent warping and breakage of corner joints. The lenses shall be mechanically retained within the frames and shall be sealed on all edges.

8.01 INTERIOR LIGHTING (Continued)

- C. <u>Light Fixtures</u> (Continued)
 - 4. Light Intensity

The interior lighting shall provide an average of twenty-three foot- candles (23 fc) of lighting when energized at the normal operating voltage. The intensity shall be measured at the seated passengers' reading plane, thirty-three inches (33") above the floor on a 45° angle at each passenger's seat. No location shall have a level less than fifteen foot-candles (15 fc). These levels shall be demonstrated on one of the prototype cars. All test readings shall be made without the aid of any external lighting.

5. LED Arrays

The Contractor shall furnish and install all LED arrays required on the car.

The LEDs shall develop a color temperature equivalent to fluorescent cool white when energized at the normal operating voltage. Light intensity and color temperature shall remain as constant as possible over the entire operating voltage range specified in Section 9.01, A. Provisions shall be made to protect the LEDs from voltages outside the normal operating range.

The LEDs and the arrays shall be reviewed by the Engineer.

6. Intercom Locator Light

The lens of the light fixture, if used, or the light array located immediately above the passenger intercom unit shall be tinted blue in a manner reviewed by the Engineer and demonstrated in the door mock-up, see Sections 6.08 and 3.14, F.

D. <u>Cab Lights</u>

1. <u>General</u>

All lights shall be reviewed by the Engineer and demonstrated on the cab mock-up.

2. Operator's Light

The operating cab shall have a high intensity LED light in the Operator's work area as on CTAs 5000 Series cars. This light shall be controlled by a switch on the Operator's Control Panel. The cab light fixture shall be designed to spread light throughout the cab work area.

8.01 INTERIOR LIGHTING (Continued)

- D. <u>Cab Lights</u> (Continued)
 - 3. Overhead Lights

The operating cab shall also have a flush-mounted LED fixture mounted on the left side. The fixture shall provide equivalent light level to two (2) twenty-four inch (24") lamps. The lens shall extend approximately one-inch (1") below the level of the ceiling to provide light throughout the area. The lens shall have an aluminum frame and be hinged with a continuous hinge. It shall be retained with captive, coarse-threaded machine screws.

This light shall be controlled with the other main car lights and an interlock to turn the light off when the Master Controller is turned "ON".

E. <u>Emergency Lights</u>

Four (4) LED flush-mounted fixtures at the side doors at both ends of the car and the operating cab LED fixture shall be designated as emergency lights and shall remain on in the absence of low voltage power supply output. The remainder of the lights in the car shall automatically shut off after thirty seconds (30 sec) following the loss of low voltage power supply output.

F. <u>Passenger Alerting Light</u>

A surface-mounted light visible both inside and outside the car shall be installed on the bottom panel of each side door header adjacent to the Emergency Door Opening Handle. See Section 6.04, E, for details of its operation. The lens shall be designed to spread the light across the door opening. The light shall be high intensity, white LED assemblies. The light shall be reviewed by the Engineer.

SECTION 8 LIGHTING (Continued)

8.02 EXTERIOR LIGHTING

A. Light Control

The exterior lights shall be activated by a signal on the train network. The signal shall be generated by an on-off-on, spring-return-to-off, single-pole toggle switch located on the Operator's Control Panel. A red indicator light shall be installed adjacent to this switch, to indicate whenever the exterior lights are on.

Turning on a Master Controller shall also turn on the exterior lights. Exterior lights cannot be turned off while any Master Controller is turned on.

In normal operation, all exterior lights on the front and the rear of the train shall be correctly displayed. Exterior lights shall not be illuminated between coupled cars.

In the event the exterior lights are not turned off when the Master Controller is turned off, or the exterior lights have been turned on without turning on a Master Controller, an automatic time out shall turn off the exterior lights. The time out shall be adjustable from at least thirty minutes (30 min) to sixty minutes (60 min). The time out shall be preset for forty-five minutes (45 min).

The feed for the exterior light system on each car shall be by means of a circuit breaker. The circuit breaker shall also serve as the system cut out for each car without affecting trainline control. The circuit breaker shall be located on the car interior circuit breaker panel and shall be identified as P24 "EXTERIOR LIGHTS".

All exterior lights shall be operated from the car's low voltage power system.

SECTION 8 LIGHTING (Continued)

8.02 EXTERIOR LIGHTING (Continued)

B. <u>Headlights</u>

Two (2) headlights shall be mounted on the No. 1 end of the car, one (1) below each end window. The headlight lamps shall be 38 V, 60W, PAR 46 sealed-beam lamps with water clear lenses and special narrow beam angle. The lamp filaments shall be mounted vertically to minimize the horizontal beam spread onto an adjacent track.

The headlight fixture shall be stainless steel and shall have a positive index system to ensure the installation of the lamp with filament vertical. The headlight fixture shall have no additional glassware over the sealed-beam lamp. The fixture shall permit changing of lamps from outside the car without tools. The headlight lamp retaining ring shall be hinged and shall be retained by a captive coarse-threaded, pin socket head screw. Relamping the fixture shall not change the headlight adjustment. The fixture shall be reviewed by the Engineer and may be different than specified above to blend with the exterior esthetic design, but shall retain the features specified.

The headlights shall be wired to be on whenever the car is at the end of a train and the Master Controller in that car is unlocked. The headlights shall also be turned on and the communications system activated by the key-operated switch located near the top of the Operator's Control Panel, see Section 9.05, C. The taillights shall not be on under the above conditions, except as specified.

The headlights shall be adjusted to strike the right-hand running rail 250 feet ahead of the end sill of the car on level, tangent track. The Contractor shall construct a durable lightweight gauge to align the headlights. The gauge shall be used at a distance of twelve feet (12') from the end sill of the car. At the completion of the car order, the gauge shall be refurbished and shall become the property of CTA. This gauge shall also have marks to verify taillight alignment.

C. Taillights

Two (2) taillights shall be mounted on the No. 1 end of the car, one (1) below each end window, outboard of the headlights. The taillight lamps shall be red LED assemblies interchangeable with and equivalent to PAR 46 sealed-beam lamps having red lenses, 60 PAR 46 2/R. The assemblies shall be designed and mounted horizontally to provide maximum visibility on curves. The taillight fixtures shall be stainless steel and have a positive index system to ensure the correct installation of the LED assembly. The fixture shall permit changing of lamps from outside the car without tools. The taillight lamp retaining ring shall be hinged and shall be retained by a captive coarse-threaded pin socket head screw. Relamping the fixture shall not change taillight adjustment. The fixtures and lamps shall be reviewed by the Engineer. The fixture may be different than specified above to blend with the exterior esthetic design, but shall retain the features specified.

8.02 EXTERIOR LIGHTING (Continued)

C. <u>Taillights</u> (Continued)

The taillights and the red marker lights shall be wired to be "ON" whenever the car is at the rear end of a train with the exterior lights turned "ON", and on both ends of the train when all Master Controllers are locked up. The taillights shall also be turned on as specified in Section 9.05, D, 4, b.

The taillight fixture shall be constructed and installed to permanently align the taillights parallel to the longitudinal axis of the car. The headlight adjustment gauge shall have marks to verify the above alignment.

D. Marker Lights

The marker lights shall consist of four (4) individual fixtures, reviewed by the Engineer, mounted in the carbody above each No. 1 end window. Each lens shall be of spread-type, colored glass, arranged horizontally from each side of the car inward, as follows: Red, Yellow, Green, and Clear. The marker lamps shall be colored LED assemblies having equivalent intensity to type 8-95, 40 V, 20W incandescent bulbs. Particular attention shall be given to the means for replacing the LED assemblies from inside the car, see Section 3.12, F, for details. The marker light fixtures may be different than specified above to blend with the exterior esthetic design, but shall retain the features specified.

When all Master Controllers are locked up and the exterior lights are on, the two (2) red marker lights shall be displayed.

The marker lights shall be wired so that marker light and destination sign readings are correlated with run number signs and message system, see Section 14.02, I.

The white marker lights shall flash on for one second (1 sec) and off for one second (1 sec), whenever the three-position switch on the Operator's Control Panel is in "EXPRESS" as specified in Section 14.02, I, 3, c, and the Master Controller in that car is turned "ON".

E. <u>Side Body Indicator Lights</u>

Indicator light fixtures, reviewed by the Engineer, shall be located adjacent to each side door as shown on CTA Drawing R-1-606, Page DR-1. The fixtures at the No. 1 and No. 2 side doors shall have three (3) lenses colored red, white and green from top to bottom. The fixtures at the No. 3 and No. 4 side doors shall have four (4) lenses colored red, yellow, blue, and white from top to bottom. The lenses shall be used in lieu of incandescent lamps. The assemblies shall have double contact, bayonet bases. The fixtures shall be arranged to be relamped from inside of the car.

8.02 <u>EXTERIOR LIGHTING</u> (Continued)

E. <u>Side Body Indicator Lights</u> (Continued)

The fixtures shall be sealed to the carbody to keep out water. The lenses shall be retained to prevent their theft. The visible part of the fixture shall be stainless steel, to match the surrounding skin.

The sockets shall be a weather tight, heavy duty, automotive type with a twist lock. The electrical connections to the socket shall be through weatherproof, in-line, automotive connectors.

The indicator arrangement shall be demonstrated on the side door mock-up as specified in Section 6.08.

SECTION 9 ELECTRICAL EQUIPMENT

9.01 <u>GENERAL</u>

A. Low Voltage DC Operating Parameters

All low voltage, nominal 37.5 Vdc, operated devices shall be capable of operating continuously and performing their functions over a continuous operating voltage range of 23.0 to 42.5 Vdc, as designated in Table 4 of IEEE Std. 1476-2000, except as otherwise specified, measured at the load.

All low voltage devices shall withstand input voltage transients in accordance with the requirements of IEEE Std. 1476-2000 and thereafter operate properly when the voltage is within the range of 23.0 to 42.5 Vdc.

B. <u>High Voltage DC Operating Parameters</u>

All high voltage, nominal 600 Vdc, operated devices shall be capable of operating continuously and performing their function over a continuous operating voltage range of 400 to 800 Vdc measured at the main knife switch.

All high voltage devices shall be compliant with and tested to meet the transient overvoltage requirements of IEC-61287-1, Section 2.1.1.9.d, Supply Line Overvoltages. In addition they shall withstand all car and wayside generated voltage excursions up to 1000 Vdc for a minimum of five seconds (5 sec) and up to +3000 Vdc for up to five hundred microseconds (500 µsec) duration without sustaining any damage or interruption of operation.

C. <u>Alternating Current Operating Parameters</u>

All ac operated devices shall be capable of operating continuously and performing their functions over a range of $\pm 10\%$ from a nominal 230 Vac, and $\pm 10\%$ from a nominal 60 Hz, when measured at the auxiliary inverter output.

D. <u>Device Protection</u>

Adequate protection shall be provided for all devices against all voltage and frequency variations to be found on the CTA system and/or developed by the car equipment. All contactor and relay coils, except the emergency relay, shall be suppressed with an appropriate device, and shall be reviewed by the Engineer.

E. Bus Bars

There shall be no exposed bus bars other than ground or B-. Bus bars other than ground or B- shall be insulated in a manner reviewed by the Engineer unless otherwise agreed to by the Engineer. Bus bars shall be copper.

9.01 <u>GENERAL</u> (Continued)

F. Fuse Covers

Any covers over fuses or exposed conductors, if used, shall have at least 0.030-inch of insulation attached to them on the surfaces exposed to the fuses or conductors.

G. <u>Fuses and Fuse Holders</u>

All fuses shall be reviewed by the Engineer and shall be mounted in fuse holders, unless otherwise agreed to by the Engineer. All fuse installations shall be reviewed by the Engineer.

H. <u>Use of Wood</u>

The use of wood for fuse blocks, insulating blocks, mounting blocks or wire cleats is not permitted.

I. <u>Carbody and Truck Ground Connections</u>

All ground connections shall be made to the major framework of the carbody or truck. Current carrying ground connections shall not be made to boxes and shall be made to copper pads. The copper pads shall be at least 1/8-inch thick and shall be attached to supporting structure by brazing.

Where copper ground pads are attached to structural stainless steel members, they shall have a carbon steel intermediate. Ground lugs shall be through bolted to the pads.

J. <u>Circuit Protection</u>

Circuit breakers shall be used in lieu of fuses to feed all low voltage dc and 230 Vac circuits except where specified. Circuits shall be individually protected unless otherwise specified.

All circuit breakers shall be sized to protect the smallest current-rated conductor in the circuit, not including conductors on devices or electronic components where the component itself acts as a fuse.

Fuses shall be used to protect 600 Vdc circuits, unless otherwise specified. 600 Vdc fuses shall be of the indicator type equivalent to LittelfuseType IDSR.

9.01 <u>GENERAL</u> (Continued)

K. <u>Undercar Control Panels</u>

All undercar control panels shall be front wired. Panels shall be made of a fireretardant material that cannot be damaged by electrical flashes or heating of components attached to them.

All devices, relays, contactors, fuses, switches and other such items shall be clearly and permanently identified with nameplates or other suitable means reviewed by the Engineer. All wires and terminals shall be clearly and permanently identified in a manner reviewed by the Engineer. All terminals and studs shall be designed to be tightened from the front of the panel. All fuse nameplates shall also contain the type and rating of fuse.

Special attention shall be placed on the attachment of devices to the panel to insure the inserts or studs cannot become loose.

L. <u>Undercar Equipment Enclosures</u>

Undercar equipment enclosures shall be stainless steel and grounded to the carbody unless otherwise agreed to by the Engineer. Enclosures for 600 Vdc equipment, such as the 600 Vdc trainline contactor, may be of molded fiberglass with the review and consent of the Engineer.

The design of undercar enclosures shall be reviewed by the Engineer and be demonstrated on the undercar mock-up.

All undercar equipment enclosures, except the battery box, shall be coated white, with insulating paint or powder coating, on the inside. Enclosures containing 600 Vdc devices shall, if steel, also be protected from power arcs on all interior surfaces, including cover, with at least 0.030-inch of fire-resistant insulation, unless otherwise agreed to by the Engineer. The enclosures shall also be adequately ventilated to prevent the buildup of gases that could allow a flashover. The enclosures shall have removable covers. The boxes shall be sealed to prevent the entrance of water. Positive stops shall be provided to prevent over-compression of the seals.

9.01 <u>GENERAL</u> (Continued)

L. <u>Undercar Equipment Enclosures</u> (Continued)

Boxes along the sides of the car shall be set back from the side so that the covers are at least one-inch (1") back of the side sill to minimize water running and dripping onto the covers. The boxes shall have bottom drain holes equipped with stainless steel cotter pins.

All undercar equipment enclosures, including battery box, shall have over center compression spring draw latches to retain the door and covers unless otherwise agreed to by the Engineer. All latches require the review of the Engineer.

Cover and door hinges shall be of rugged, functional design. Covers shall be easy to remove and install without deformation or damage to the cover or the hinge. Hinges require the review of the Engineer.

All covers shall have both the Contractor's drawing or part number and the OEM part number and car number stenciled on the inside.

M. Insulation Standard

All electrical device coils and windings shall be treated to be impervious to moisture. Separators, barriers, and encapsulation material shall be of NEMA Class F material or better or meet the temperature requirements of Class F insulation.

N. <u>High Voltage Equipment Standard</u>

All high voltage, 600 Vdc or 230 Vac, control equipment and devices shall be of the electric railway type, equal to that manufactured by General Electric Company, Vapor Corporation, Secheron, Bombardier or Siemens.

O. Flash Over Distance - Current Collector

Special provision shall be made to provide at least fourteen-inches (14") clearance between any part of the current collector assembly that is at 600 Vdc potential and any object that is at ground potential. Clearance shall be demonstrated on the truck mock-up. If clearance cannot be achieved, shields shall be provided and demonstrated on the truck mock-up.

P. Power Return to Third Rail

Within 200 msec of the third rail being de-energized or the car leaving the third rail, no equipment or device on the car shall return any power to the third rail or cause the third rail shoes to be at a potential above zero. These conditions shall prevail unless otherwise specified. See also Section 10.03, I.

9.01 <u>GENERAL</u> (Continued)

Q. <u>Circuit Breakers</u>

All circuit breakers shall have a center trip position unless the breakers control a device or function that will cause a Blue Light indication if not operating or unless agreed to by the Engineer. All circuit breakers shall be selected to preclude tripping due to current excursions found in regular service. Rating and time delay shall take into account the frequency of motor starts as well as current and time durations and operating temperature of the breaker and its surroundings. All circuit breakers shall be reviewed by the Engineer.

R. <u>Auxiliary System Low Voltage Relays</u>

All low voltage, 37.5 Vdc relays used in the auxiliary systems, including the air comfort system, shall be reviewed by the Engineer.

S. <u>Arc Protection</u>

Any part of the car which might be contacted by the arc from a contactor shall be covered with an appropriate electrical insulation at least 0.030-inch thick.

T. <u>Use of Diodes</u>

The use of diodes for circuit isolation, signal division or backfeed prevention shall be discouraged. Diodes having any contact with trainline or carbody wiring outside an electronic system shall have PIV of not less than three (3) times their circuit voltage or one thousand volt (1000 V), whichever is greater, and shall have a current rating at least 200% larger than needed. Diodes in these situations shall be reviewed by the Engineer.

U. Opto-Couplers

Opto-Couplers may be used to isolate sensitive electronic circuits from trainline and carbody wiring. See Section 9.01, T, above.

V. <u>Electronic Circuit Sensitivity</u>

Electronic circuits that utilize trainline or carbody wiring signals shall be particularly designed to be immune to leakage, spikes, surges and other variations that regularly occur and shall not recognize any spurious voltage resulting from leakage or induction as a valid signal. The steps taken to meet these requirements shall be reviewed by the Engineer.

W. <u>Electromagnetic Interference</u>

The Contractor shall ensure that electrical and electronic systems furnished under this contract shall operate in their operational environments without either suffering or causing harm because of unintentional electromagnetic interference, radiated and/or conducted.

9.01 <u>GENERAL</u> (Continued)

X. <u>Shipping Protection</u>

The packaging of replaceable assemblies shall be designed to protect the assembly such that it can be transported without being damaged when set down on any face or from having objects set on it on any face.

Y. Parasitic Loads and Load Shedding

The low voltage powered equipment and the low voltage system shall be designed to minimize parasitic loads on the battery when the car is turned off. Means shall be provided to shed loads when 600 Vdc is not applied to the car and the car is turned off in order to prevent the battery from discharging below the minimum needed to restart the car after at least 16 hours when it is turned off without 600 Vdc applied for at least 16 hours and be able to start when the car is turned off without 600 Vdc is applied to the shop power plug or a third rail shoe.

The means to accomplish this shall be reviewed by the Engineer.

9.02 CAR WIRING

A. <u>Wire Size</u>

Wires for control and auxiliary circuits shall not be smaller than No. 16 AWG. Special care shall be taken to provide physical protection for No. 16 AWG wire to prevent damage while pulling or damage from vibration, especially at terminals. Wiring for interconnection of various pieces of special apparatus such as the event recorder, communication and video system, ATC/ATO system and air comfort system controls may be of different sizes, stranding and shielding as recommended by the various manufacturers.

All wiring smaller than No. 16 AWG shall require review by the Engineer. Electronic card wiring shall be no smaller than No. 26 AWG and electronic panel wiring shall be no smaller than No. 22 AWG.

B. <u>Wire Harnesses and Layout</u>

Insofar as practical, all wiring shall be fabricated on the bench into convenient units and installed as prefabricated groupings in standardized locations.

C. <u>Wire Segregation</u>

Wires carrying different types of current or having different potentials shall not be carried in the same conduits or in unsegregated ducts or be cabled together. ATC/ATO wiring shall be run in separate galvanized steel conduits.

D. <u>Wire Markers</u>

All wires shall be plainly and permanently marked within one-inch (1") of each termination with wire tags. All wires, except those wholly within equipment boxes, shall also be marked with a continuous stamping at intervals not exceeding six-inches (6"), unless otherwise agreed to by the Engineer. All terminals of all terminal boards and all studs shall be clearly and permanently marked with a marker showing the designation of the wires to be attached to each terminal. Each terminal board shall have a unique identifying number.

Wire markers shall be white with black lettering. Wire markers and marking and terminal board marking shall be reviewed by the Engineer.

All wires on any terminal shall have the same designation. When more than one (1) wire carries the same designation, e.g. B-, each wire shall also carry a unique numeric identifier. Each wire shall have only one (1) designation between circuit-interrupting or power-consuming devices.

9.02 <u>CAR WIRING</u> (Continued)

E. <u>Wire Conduits, Ducts and Looms</u>

All underfloor wires and cables except ATC wiring, shall be carried in stainless steel ducts. ATC wiring shall be carried in rigidly supported galvanized steel conduit. Wires of No. 4 AWG, or larger, may be cleated under the car. See Section 12.07, H. Wire ducts shall be free of sharp edges and foreign material. Ducts shall have retainers to hold the wires in the duct when the cover is removed. Duct covers shall be weathertight and attached with heavy duty twistlock fasteners captive in the cover.

All 600 Vdc wiring above the car floor shall be carried in segregated conduit.

Flexible conduit may be used to carry wires to resiliently mounted or insulated equipment. Application of flexible conduit shall be reviewed by the Engineer.

Seal washers shall be used where conduits enter boxes or enclosures. The use of extra sealer is not permitted.

The open end of all conduits that come through the floor shall extend at least sixinches (6") above the floor. Wiring in loom or prefabricated harnesses may be used above the floor. Any conduit or duct that does not have both ends at atmospheric pressure shall be sealed at one end to prevent air passing through it.

F. <u>Wire Physical Protection</u>

Where any wires enter a conduit or duct, or pass through any partition, rubber or phenolic bushings, or plastic or metal bell mouths, shall be provided to prevent abrasion of the insulation. Where wires pass through partitions or any metal plate, the protection shall prevent chafing on either side of the partition or plate. All conduit ends shall be reamed before installation to remove sharp edges and burrs. Open or loom wiring must have protection wherever it could come in contact with edges of car structure to prevent chafing or cutting. All protection must be installed before wiring is installed.

Where watertight cable glands are used, they shall be equipped with seal washers between the gland body and the panel through which they pass. The use of extra sealer is not permitted. Cable glands shall be sized to clear the cable terminations or they shall be mounted on gasketed mounting plates to permit removal without reterminating the cables.

9.02 <u>CAR WIRING</u> (Continued)

F. <u>Wire Physical Protection</u> (Continued)

Open cleated cables shall be routed to minimize cables crossing each other. In areas of cable congestion such as on the trucks and adjacent to undercar equipment or where cables or harnesses connect objects that move relative to each other such as the carbody and trucks, particular attention shall be given to prevent cable to cable or cable to object chafing. Neoprene sleeves, Ty-Wrap separators and other means shall be used as required. These measures shall be demonstrated on the mock-ups, if possible, or on the prototype cars and trucks and shall be reviewed by the Engineer. Any changes required shall be made at no cost to CTA. All cars shall be carefully monitored during construction to ensure all measures are installed and no chafing conditions develop.

G. <u>Wire Protection from Heat</u>

No wiring, duct or conduit shall be installed over or in close proximity to propulsion-control resistors. Heat shields reviewed by the Engineer may be used. See Section 12.06, C, for cable insulation requirements.

H. Junction Boxes

All junction boxes shall be stainless steel unless otherwise specified herein or agreed to by the Engineer. Junction boxes for the ATC/ATO system shall be carbon steel, of rugged design and arranged for easy access to and removal of wires from the terminal boards. Terminal boards shall be located and spaced from the sidewalls and top and bottom of the box so that spare wires and wire loops can be secured above the terminal boards and not interfere with access to the terminals, or obscure the terminal markings.

Junction boxes shall be watertight.

Junction box covers shall seal the box and shall be secured with heavy duty twist-lock fasteners captive in the cover.

9.02 <u>CAR WIRING</u> (Continued)

I. Spare Wires

Multiple conductor cable shall have at least ten percent (10%) spare conductors. No cable shall have less than one spare. If shielded wires are used in a multiple conductor cable, at least one of the spares shall be shielded.

One spare twisted, shielded pair shall be installed from the No. 1 end junction box to the No. 2 end junction box on each car and shall be connected to a spare twisted shielded pair in the No. 2 end trainline cables. In addition, five (5) spare low voltage wires shall be installed from the No. 1 end junction box to the No. 2 end junction box on each car and shall be connected to appropriate spare wires in the No. 2 end trainline cables. A spare Ethernet CAT6 cable shall be installed from a location adjacent to the unit and ring switches in each car to the same location in the other car of each married pair including a spare cable between No. 2 ends.

All conduits and ducts shall be sized to accommodate at least twenty percent (20%) more wires than installed.

J. <u>Plugs and Connectors</u>

All plugs and connectors for wiring No. 8 AWG or smaller, unless otherwise agreed to by the Engineer, shall be multi-pin, cylindrical, with positive lock bayonet coupling and visual indication of full mating to improve ease of removal and reduce wiring problems. See also Section 7.03, B, 3.

The connectors shall be equivalent to connectors manufactured by ITT Veam CIR series.

Plugs and connectors for Ethernet/IP circuits or network signals shall be metal, heavy duty, D coded M12 or Harting type suitable for applications on a vibrating object and shall be reviewed by the Engineer. Standard commercial plastic connectors and plugs are not permitted.

All plugs shall have heavy duty strain reliefs. All plugs under the car shall be watertight and have extra strain relief provisions.

Twist-lock plugs and receptacles equal to Hubbell 2421 and 2426 with protective boots shall be used to connect the carbody mounted blower motors.

All plugs and connectors shall be reviewed by the Engineer.

K. <u>PTU Plugs and Receptacles</u>

The receptacles applied to each micro-processor controlled system for PTU access to the controls and the plugs applied to the cables of the PTUs to connect to the car systems shall be standardized on all systems. They shall be rugged, heavy duty suitable for application on a rail car and reviewed by the Engineer.

9.03 AUXILIARY POWER SUPPLY SYSTEM

- A. <u>General</u>
 - 1. An Auxiliary Power Supply System shall be furnished on each car. The Auxiliary Power Supply System shall consist of an auxiliary inverter to operate all alternating current loads, e.g., all blower motors, air conditioning compressors and convenience outlets; a low voltage power supply to operate propulsion controls, dc lighting, door system and other low voltage systems on the car; and a battery charger to maintain the battery on the car.
 - 2. The Auxiliary Power Supply System shall be designed to operate under all environmental conditions found under a CTA rail car which include salty slush from grade crossings and expressway medians. The Auxiliary Power Supply System enclosure(s) shall protect internal devices from dirt, grease, water, water vapor and snow. High voltage elements shall be isolated from the cooling air stream.
 - 3. The enclosure(s) shall be carbon steel colored charcoal gray on the outside and white on the inside, or stainless steel colored white on all enclosed inside surfaces. The means to render the required colors shall be reviewed by the Engineer.

Covers shall be removable and have heavy duty functional hinges and large hollow type gaskets with ample range of compression to insure complete sealing with stops to prevent over compression.

Covers shall have a rugged combined interlock-bypass switch to prevent unit operation and discharge the filter capacitors when any cover is open unless the switch is placed in the bypass position (pulled out). The bypass shall be reset by closing the covers. The covers shall be equipped with compression spring draw latches.

The cover design, hinges, seals, interlock-bypass switches and cover latches shall be reviewed by the Engineer.

- 4. Auxiliary Power Supply System components supplied from 600 Vdc shall be self-protected from third rail voltage variations and transients as specified in Section 9.01, B.
- 5. EMI emissions emanating from the Auxiliary Power Supply System, when combined with all other sources on the car, shall comply with Section 9.19. The Contractor shall perform system safety assurance of EMI emissions; see Section 9.19, D.
- 6. The auxiliary inverter, the LVPS, and the battery charger may share input protective devices and a line filter.

9.03 <u>AUXILIARY POWER SUPPLY SYSTEM</u> (Continued)

- A. <u>General</u> (Continued)
 - 7. Filter Capacitors
 - a. Filter capacitors shall have a fifteen year (15 yr) minimum design life.
 - b. Inrush current shall be limited when connecting to the 600 Vdc supply. The means and current in-rush limit shall be reviewed by the Engineer. See also Section 10.03, E, 2.
 - c. Discharge circuitry shall be provided to automatically discharge the capacitors to less than 50 volts in less than 10 seconds when any hinged cover of the enclosures containing high voltage capacitors or equipment connected to them is opened. The power switching devices may be used for this purpose.
 - d. The capacitors shall have permanent parallel resistors which will discharge the capacitors within twenty minutes (20 min), independent of the controlled discharge circuitry.
 - e. All doors and covers of enclosures containing high voltage capacitors or equipment connected to them shall have labels, reviewed by the Engineer, warning of the hazard from charged capacitors.
 - 8. A dead battery start feature shall be provided directly from the 600 Vdc line to start operation of the Auxiliary Power Supply System, in the absence of low voltage power. The dead battery start supply shall remain off when it is not activated. See also Section 9.05, F, 2.
 - 9. The auxiliary inverter, low voltage dc supply and battery charger shall be provided with suitably located test points to facilitate troubleshooting, checking and adjustment of the entire system as well as individual elements of each system. These test points may also be utilized by the on-car test sets, see Section 9.11, but must be clearly and permanently identified.

9.03 <u>AUXILIARY POWER SUPPLY SYSTEM</u> (Continued)

- A. <u>General</u> (Continued)
 - 10. Line replaceable units, except magnetic units such as transformers and inductors, shall not weigh more than fifty pounds (50 lb).
 - 11. The Auxiliary Power Supply System enclosure(s) may be convection air cooled or force ventilated with air drawn from under the car. Ventilation fans may be thermostatically controlled. Fans shall be driven by brushless motors.

Air intakes shall be screened and positioned to minimize ingestion of snow, water, and debris and recirculation of heated exhaust air from the inverter or other equipment. Suitable baffling and drains shall be provided.

- 12. Multi-pin-cylindrical bayonet connectors and network connectors shall be used to connect the wiring, No. 8 AWG and smaller. The connectors shall comply with Section 9.02, J.
- 13. Board-mounted relays shall not be used to control contactors.
- 14. Electronic control equipment shall be segregated from power equipment except for power semiconductor drive circuits. Control circuitry and control voltage sources shall be optically or transformer isolated from power circuitry and high voltage sources.
- 15. All controls shall be housed within the enclosure. All control circuit boards shall be mounted in an easily accessible rack, unless otherwise agreed to by the Engineer.
- 16. A block diagram of the Auxiliary Power Supply system shall be submitted pre-bid.
- 17. The system, including auxiliary inverter, low voltage power supply and battery charger, its arrangement and packaging, installation, ratings and diagnostics shall be reviewed by the Engineer.
- 18. The Auxiliary Inverter and LVPS shall not operate when the car is shut down and the battery charger is commanded ON. See Section 9.03, D, 1, e.
- 19. See Section 9.15 for microprocessor requirements.
- 20. The Contractor shall develop and manage a comprehensive test program for the Auxiliary Power Supply System. The program shall ensure that the auxiliary power supply system and all its components meet all the design and performance requirements, including diagnostics.

9.03 AUXILIARY POWER SUPPLY SYSTEM (Continued)

- A. <u>General</u> (Continued)
 - 21. The auxiliary power supply system shall also be tested in combined tests with the propulsion system for electromagnetic compatibility as specified in Section 9.19, F, 1.
 - 22. The Contractor shall develop the test procedure for each of the required tests and submit them for review by the Engineer prior to conducting the tests. The test procedures shall include instrumentation, forms to be used to record test data, detailed methods of data reduction, all formulas used and pass-fail criteria.
- B. <u>Auxiliary Inverter</u>
 - 1. <u>General</u>

The auxiliary inverter unit shall be microprocessor controlled and utilize IGBTs for power conversion.

IGBTs shall be selected and applied to operate at no more than seventy percent (70%) of their breakdown capabilities.

IGBTs shall be selected and applied in such a manner that a minimum twenty year (20 yr) design life shall be obtained.

The auxiliary inverter shall be arranged to operate whenever a Master Controller, or the air comfort system is turned on.

2. <u>Ratings</u>

- a. Auxiliary Inverter Input:
 - 1) 400 Vdc to 800 Vdc for continuous operation at maximum load.
 - 2) 350 Vdc to 400 Vdc for operation at reduced output.
 - 3) 800 Vdc to 1200 Vdc operation for reduced time, decreasing to five seconds (5 sec) at 1000 Vdc and two seconds (2 sec) at 1200 Vdc.
 - 4) Below 350 Vdc and above 1200 Vdc, operation shall be inhibited.

9.03 <u>AUXILIARY POWER SUPPLY SYSTEM</u> (Continued)

- B. <u>Auxiliary Inverter</u> (Continued)
 - 2. <u>Ratings (Continued)</u>
 - b. Auxiliary Inverter Output
 - 1) The nominal, steady state, output shall be 3 phase, 60 Hz ±5%, 230 V±5%, line-to-line, ungrounded, sine wave and single phase, 60 Hz, 120 V, 40A, ungrounded.
 - 2) Three (3) phase, 60 Hz, 230 V power outputs shall be conditioned to produce an output waveform which can be used by standard commercially available motors or electronic components without any adverse impacts on audible noise, reliability, lifespan, or maintenance requirements.
 - 3) Convenience outlets, specified in Section 9.14 and 18.35, shall be supplied from the auxiliary inverter 3 phase output through a step-down transformer. The single phase ac shall be properly conditioned to allow its use directly to power standard personal computers, recording and other types of instrumentation without damage to the equipment and errors in the data collection.
 - 4) Capacity shall be based on load requirements established by a qualified load analysis which reflects continuous as well as starting loads including convenience outlets. The analysis and capacity calculation shall be performed using IEEE Std. 1476-2000 for guidance.
 - 5) Transient voltage drops shall not exceed twenty (20%) percent, when starting any individual ac motor or motor group.
 - 6) Particular attention shall be given to insuring that the starting of the AC loads following any mode of shut down does not cause the auxiliary inverter output voltage to collapse or fall below "fault" limits. See also Section 7.01, C, 7.

9.03 <u>AUXILIARY POWER SUPPLY SYSTEM</u> (Continued)

- B. <u>Auxiliary Inverter</u> (Continued)
 - 3. <u>Design Features</u>
 - a. Galvanic Isolation

There shall be galvanic isolation between the 600 Vdc input circuits and the output circuits.

This requirement may be waived for 230 Vac output, if weight or space benefits can be demonstrated to the Engineer, provided that the loads connected to the non-isolated output are designed to withstand the maximum inverter output voltages including transients and those caused by inverter failures without adverse impacts on reliability, lifespan and maintenance requirements.

b. Blue Light Indication

Failure of the auxiliary inverter shall activate a Blue Light indication as specified in Section 10.09, and shall be displayed on the diagnostic event display as specified in Section 9.03, E, and the Train Operator's Touch Screen (TOTS) as specified in Section 15.09.

The Contractor shall provide a list of fault events, for Engineer review, that cause a Blue Light indication.

C. <u>Low Voltage Power Supply (LVPS)</u>

- 1. <u>General</u>
 - a. The LVPS shall be a micro-processor controlled regulated power supply.
 - b. Power semiconductors shall be selected for a minimum twenty year (20 yr) design life.
 - c. The LVPS shall operate independently of the auxiliary inverter, but shall start when the auxiliary inverter starts or when the car interior lights are turned on.
 - d. The output of the LVPS shall be connected to the car loads whenever the supply is operating.
 - e. There shall be galvanic isolation between the 600 Vdc circuits and the output circuits to preclude 600 Vdc entering the low voltage circuits.

9.03 <u>AUXILIARY POWER SUPPLY SYSTEM</u> (Continued)

- C. <u>Low Voltage Power Supply (LVPS)</u> (Continued)
 - 2. <u>Ratings</u>
 - a. Input

The input to the LVPS shall be 600 Vdc, as specified in Section 9.03, B, 2, a.

- b. Output
 - Output shall be 37.5±1.0 Vdc over an output current range of fifteen percent to one hundred percent (15-100%) rated load of a single car. Design of the low voltage power supply system shall promote load sharing between LVPSs.
 - 2) The output shall be filtered to keep voltage ripple and noise to less than 0.3 percent at any load.
 - The LVPS shall have sufficient capacity to supply all low voltage dc requirements on two (2) cars. A minimum of two hundred Ampere (200A) continuous capability shall be provided.
 - 4) Capacity shall be based on load requirements established by a qualified load analysis which reflects continuous as well as intermittent loads. The analysis and capacity calculation shall be performed using IEEE Std. 1476-2000 for guidance.

3. Design Features

- a. Low voltage loads shall be transferred to the battery when the LVPS is not operating. This may be accomplished with the use of reverse bias diodes. The battery shall not be floated on the output of the LVPS.
- b. Particular attention must be given to preventing the train going dead and an ATC penalty brake application occurring due to a momentary loss of low voltage power when the LVPSs on both cars of a married pair shut down simultaneously.

9.03 <u>AUXILIARY POWER SUPPLY SYSTEM</u> (Continued)

- C. <u>Low Voltage Power Supply (LVPS)</u> (Continued)
 - 3. <u>Design Features</u> (Continued)
 - c. The LVPS shall be equipped with circuitry to sense its proper functioning. If the power supply fails to function properly a White Light indication shall be actuated as specified in Section 9.08.

A list of fault events that cause a White Light indication shall be reviewed by the Engineer.

- D. <u>Battery Charger</u>
 - 1. General
 - a. The battery charger shall be microprocessor controlled.
 - b. The power semiconductors shall be selected for a minimum twenty year (20 yr) design life.
 - c. There shall be galvanic isolation between the 600 Vdc input circuits and the output circuits to preclude 600 Vdc power entering the low voltage circuits.
 - d. The battery charger shall automatically start when the auxiliary inverter starts.
 - e. The battery charger shall also automatically start when the car is turned "OFF", and 600 Vdc is present, and the voltage at the battery terminals drops below 27.0 ± 0.5 Vdc. Automatic "turn on" of the battery charger shall be PTU adjustable from 25.0 Vdc to 32.0 Vdc. The battery charger shall be capable of charging the battery and supporting all layover loads. The battery charger shall turn itself "OFF" when the battery is fully charged.

9.03 <u>AUXILIARY POWER SUPPLY SYSTEM</u> (Continued)

- D. <u>Battery Charger</u> (Continued)
 - 2. <u>Ratings</u>
 - a. Input

The input to the battery charger shall be 600 Vdc, as specified in Section 9.03, B, 2.

- b. Output
 - 1) The battery charger output characteristics shall be designed to maintain the battery in a charged condition to meet the requirements of Section 9.04, A.
 - 2) Temperature compensation shall be provided.
- c. Output capacity shall be based on load requirements established by a qualified load analysis which reflects the battery charging requirements as well as layover loads. The analysis and capacity calculation shall be performed using IEEE Std. 1476-2000 for guidance. Battery charging capacity and charging characteristics shall be reviewed by the Engineer.

3. <u>Design Features</u>

- a. The battery charger shall have current limiting to prevent overcharging or overheating in the event of shorted cells in the battery. The maximum charging current shall be a value recommended by the battery manufacturer.
- b. The battery charger shall automatically select the appropriate charging mode as recommended by the battery manufacturer.
- c. The battery charger shall have circuitry within it to sense its proper functioning. If the battery charger fails to function properly, a white light indication shall be actuated as specified in Section 9.08.

A list of fault events that cause a White Light indication shall be reviewed by the Engineer.

d. The battery charger shall interface with a temperature sensor located on the battery, see Section 9.04, G, to provide temperature compensated charging characteristics as recommended by the battery manufacturer.
9.03 AUXILIARY POWER SUPPLY SYSTEM (Continued)

- E. <u>Diagnostics</u>
 - 1. The Auxiliary Power Supply System shall include a self-diagnostic package that shall monitor and report on all three (3) functions, auxiliary inverter, LVPS and battery charger. This diagnostic package shall require no special skill or knowledge to operate and understand. All aspects of this package shall be reviewed by the Engineer and changes that are found to be needed during the prototype car tests and warranty period shall be made at no cost to CTA.

The diagnostic package shall include a feature that creates a series of data files that store all the real time monitored elements such as voltages and currents, contactor positions, input and output signals, and command and response signals as well as date, time and car number. The files shall be recorded at each system CPU clock cycle or at a rate of once every fifty milliseconds (50 msec), whichever is faster, for a period of at least three seconds (3 sec) before, and two seconds (2 sec) after each logged event. At least twenty (20) sets of files (snapshots) shall be saved before overwriting the first one. Every effort shall be made to maximize the number of snapshots that can be stored.

- 2. Event display(s) to assist field personnel in identifying the problem devices, card or sub-system shall be provided in the APS unit.
- 3. Event displays shall be an alphanumeric or numeric display, not individual LEDs, with separate scrolling and reset buttons and an indication of microprocessor operation in the form of a blinking LED (heartbeat). A display test function shall be part of the diagnostics accessed through the scroll buttons. A separate reset button shall also be provided to reset the event display and the system inhibits/lockouts.

The display elements shall be not less 0.5 inches high for easy reading. An explanation of the display readings shall be provided adjacent to the display in a permanent form, reviewed by the Engineer.

The event codes shall be no more than four (4) characters. The event codes shall be reviewed by the Engineer.

Event displays and their functioning shall be specifically reviewed by the Engineer.

4. The onboard unit shall be able to display at least 999 events recorded by the microprocessor since a previous reset action.

9.03 <u>AUXILIARY POWER SUPPLY SYSTEM</u> (Continued)

- E. <u>Diagnostics</u> (Continued)
 - 5. Events recorded by the microprocessor shall be divided into restrictive and non-restrictive classifications.
 - a. Restrictive events shall result in inhibiting appropriate functions following a set number of occurrences, shall cause a Blue Light (see Sections 10.09, A and F) and shall be communicated to the maintenance screens of the TOTS via the CMN.
 - b. Non-restrictive events shall only be recorded and shall not inhibit operation.

The classification of all events and inhibit quantities shall be reviewed by the Engineer.

- 6. Faults other than those reviewed and agreed to by the Engineer shall not be classified as an auxiliary inverter failure and shall not cause Blue Light indications. Failures other than those specified in Section 9.08, and reviewed and agreed to by the Engineer shall not cause White Light indications.
- 7. The diagnostic system for the Auxiliary Power Supply System shall interface with Control and Monitoring Network (CMN) as specified in Section 15.06. Car specific White Light indications shall be displayed on the TOTS.

9.03 <u>AUXILIARY POWER SUPPLY SYSTEM</u> (Continued)

- F. <u>Test Units and Equipment</u>
 - 1. Portable Test Units (PTU)
 - a. The Contractor shall furnish semi-rugged Portable Test Units (PTU) as specified in Section 17.04, to access microprocessor controls beyond the built-in diagnostics. See also Section 1.23.
 - b. The PTU shall perform the following functions:
 - 1) Fault event display and reset.
 - 2) System inhibit/lockout reset.
 - 3) Manual test of the system and devices.
 - 4) Data memory display of system operation both before and after a fault shutdown of the system (snapshots-real time recording of system operation). See Section 9.03, E, 1. In addition, it shall be possible to create snapshots by setting snapshot parameter levels to trigger a memory function of system operation. These recordings shall be of at least twenty second (20 sec) duration. This function shall be reviewed by the Engineer.
 - 5) Real time monitoring and recording of system performance and operation.
 - 6) Download of data from car to PTU memory/storage for later analysis.
 - 7) Display and adjust system performance parameters, fault event parameters and fault lockout parameters that are adjustable.
 - 8) Download software from PTU to the Auxiliary Power Supply System.
 - 9) Display car number, date and time.
 - 10) Provide thorough descriptions of each fault with possible causes and detailed troubleshooting and corrective action.
 - c. Appropriate levels of security shall be incorporated to prevent unauthorized access to and erasure of various functions and information. The security levels and their contents, the passwords used and their method of storage and change shall be reviewed by the Engineer.

9.03 <u>AUXILIARY POWER SUPPLY SYSTEM</u> (Continued)

- F. <u>Test Units and Equipment</u> (Continued)
 - 2. <u>Shop Test Equipment</u>
 - a. The Contractor shall provide test equipment as specified in Section 9.11 and 17.03.
 - b. The Contractor shall furnish Maintenance and Parts Manuals, for all Test equipment, as specified in Section 9.11.

3. PTU Receptacles

- a. The PTUs shall plug into a test receptacle located in the auxiliary power supply adjacent to the display panel and a receptacle located in the operator's cab. The PTU shall access all modules and all diagnostics and monitoring as well as parameter and program and data downloading for the entire auxiliary power supply system from one receptacle.
- b. The receptacles shall be coordinated with other systems and shall be reviewed by the Engineer. See also Section 9.05, G.

9.04 STORAGE BATTERY

- A. <u>Specification</u>
 - 1. <u>Description and Capacity</u>
 - a. Each car shall be equipped with a nickel-cadmium storage battery reviewed by the Engineer.
 - b. The battery shall have twenty-five (25) individual cells.
 - c. The required capacity shall be determined by a qualified load analysis taking into account the expected state of charge as well as the continuous and intermittent loads encountered. The capacity calculation shall be performed using IEEE Std. 1568-2003 for guidance and shall be reviewed by the Engineer.
 - The battery capacity shall be sufficient to provide one-andone-half hours (1.5 hr) of car operation without LVPS or battery charger output on any car in the train, but with 600 Vdc present, to allow train movement.
 - 2) These requirements shall be met with the battery solution temperatures per IEEE Standard 1568-2003, with an end voltage of 25.0 Vdc measured at the battery.

9.04 <u>STORAGE BATTERY</u> (Continued)

- A. <u>Specification</u> (Continued)
 - 1. <u>Description and Capacity</u> (Continued)
 - c. (Continued)
 - 3) These requirements shall be met over a normal service life of not less than 10 years.
 - Ten percent (10%) design margin shall be included in the capacity calculations unless otherwise agreed to by the Engineer.
 - d. The battery must not lose more than twenty percent (20%) of capacity when stored idle for one month (1 mo) under fully-charged condition at $65^{\circ}F \pm 5^{\circ}F$.
 - 2. <u>Watering Interval</u>

The battery shall not require watering more often than once every six months (6-mo).

3. <u>Cold Temperature Protection</u>

The battery shall survive -20°F solution temperature for forty-eight hours (48 hr) at zero volts (0 V) per cell (full discharge) and suffer no physical damage.

4. <u>Recharge Capability-Partial Discharge</u>

The battery shall be able to recharge to eighty percent (80%) of rated capacity using the car-charging system, from one volt (1 V) per cell in a maximum of five hours (5 hr) while car is in normal service with a full range of solution temperatures per IEEE Standard 1568-2003 at the start of recharge. The rate of discharge to achieve the one volt per cell shall be equivalent to the load profile used to obtain the one-and-one half (1.5) hour capacity of car operation specified above.

5. <u>Recharge Capability-Full Discharge</u>

The battery shall be able to recharge to eighty percent (80%) rated capacity, using car-charging system, from zero volts (0 V) per cell in a maximum of eight hours (8 hr) while car is in normal service with a full range of solution temperatures per IEEE Standard 1568-2003 at the start of recharging. The rate of discharge to achieve the zero volts per cell shall be equivalent to the load profile used to obtain the one-and-one half (1.5) hour capacity of car operation specified above.

9.04 STORAGE BATTERY (Continued)

- A. <u>Specification</u> (Continued)
 - 6. Definition of Failure

A failed cell is one which does not achieve a capacity of rated less one percent (\leq 1%) per year over the warranty period from a fully-charged condition within two (2) cycles or has suffered a mechanical failure.

7. <u>Physical Requirements</u>

The cell cases shall be stainless steel.

The cells shall have hinged top caps.

8. <u>Battery Arrangement</u>

The battery shall be arranged in five (5) sets of five (5) individual cells each. The separators between cells and sets shall be treated to be fire-retardant. Trays shall be fire-retardant. The B+ and B- connections shall be located at the front end of the end trays.

The battery as a whole shall be carried in a heavy duty stainless steel, roll-out cradle carried on heavy duty ball bearing slides. The cradle shall be arranged to roll-out, against stops, far enough to completely expose the tops of all the cells and shall be designed to be lifted from below by a forklift truck while changing batteries. The cradle shall be easy to roll out and shall not require more than one person to manipulate it.

B. <u>Battery Grounding</u>

The B- battery cable shall be grounded to the car frame only once near the battery box to facilitate isolation of all B- wiring.

C. <u>Battery Disconnect Switch</u>

A battery disconnect switch shall be provided in both the B+ and B- battery leads to isolate the battery from all carbody wiring. The switch shall be adjacent to the battery and housed in an appropriate stainless steel enclosure that is easily accessible from the side of the car.

The switch and its box shall be reviewed by the Engineer and demonstrated on the undercar mock-up.

D. <u>Battery Trainline</u>

The low voltage systems on each married pair shall be connected to each other married pair through a "Battery Trainline" (BTL). The BTL shall be fed from each car's low voltage buss through an appropriate fuse and balancing resistor and shall be carried through multiple pins in each electric coupler. The BTL shall be disconnected from the electric coupler when the jumper switch is in the uncoupled position.

9.04 STORAGE BATTERY (Continued)

E. <u>Battery Handling</u>

Batteries shall be shipped to the Contractor and stored and recharged, if necessary, in accordance with battery manufacturer's recommendations.

F. Battery Box

A stainless steel battery box and cover shall be installed. The box shall have provisions for adequate ventilation and drainage. The cover shall be easily removable and retained by compression spring draw latches. The design of the box, cradle, cover and latches shall be similar to that on CTA's 5000 Series cars and shall be reviewed by the Engineer.

G. <u>Temperature Sensor</u>

A temperature sensor shall be located on the battery, as specified in Section 9.03, D, 3, d. Temperature sensors shall be interchangeable with those supplied on CTA's 3200 or 5000 Series cars.

9.05 CONTROL PANELS

A. <u>Air Comfort Panel</u>

The panel shall have mounted on it the necessary relays, contactors, circuit breakers, fuses and other apparatus to control the operation of the air comfort system on the car.

Contactors of suitable size shall be furnished to close and open the high voltage circuits. The high voltage contactors shall have low voltage operating coils for remote control. The layout of the enclosure, panel and apparatus thereon, shall be as required by the type of controls furnished on the car. The use of plug-in type devices is permitted only with specific review by the Engineer. A suitable circuit breaker shall be installed on this panel connected to interrupt the 600 Vdc feed from the main knife switch to all auxiliary circuits, except the Auxiliary Power Supply System. Opening this breaker shall, however, cause the Auxiliary Power Supply System to shut down.

B. Lighting Control Panel

The panel shall have mounted on it the necessary relays, contactors, circuit breakers, fuses and other apparatus to control the operation of lighting on the car.

The layout of the enclosure, panel and apparatus thereon, shall be as required by the type of controls furnished on the car. The use of plug-in type devices is permitted only with specific review by the Engineer.

The arrangement and location of the lighting panel shall be reviewed by the Engineer.

9.05 <u>CONTROL PANELS</u> (Continued)

- C. <u>Operator's Control Panel</u>
 - 1. A smooth faced, black anodized aluminum switch panel shall be located in the cab to the left of the Master Controller in a location reviewed in the cab mock-up. The panel and all apparatus mounted thereon shall be reviewed by the Engineer. The panel shall be a door, hinged on the left edge and shall be able to rotate one-hundred and eighty degrees (180°) from the closed to the open position. The panel shall be able to be fully opened without interference from any cab accessories. The layout of the face of the panel shall be similar to that on CTA's 5000 Series cars. The following items shall be mounted on this panel:
 - a. Toggle switches for the 37.5 Vdc circuits:
 - a. Exterior Lights
 - b. Interior Lights
 - c. Air Comfort
 - d. Windshield Heater
 - e. Cab Defroster Heat
 - f. Cab Defroster Blower
 - g. Cab Light
 - h. Auxiliary Cab Heater/Blower
 - i. One (1) Spare
 - b. Four (4) red "ON" indicator light lenses adjacent to the associated toggle switches for exterior lights, interior lights, air comfort and windshield heater. The indicator lights shall be activated only when the Master Controller in that cab is turned on except the indicator light for exterior lights which shall remain lit while the exterior lights are turned on. Red LED clusters shall be used instead of incandescent bulbs and shall be replaceable from the rear of the panel.

9.05 <u>CONTROL PANELS</u> (Continued)

- C. <u>Operator's Control Panel</u> (Continued)
 - 1. (Continued)
 - c. A three (3) position, 37.5 Vdc rotary switch for the control of the marker lights, destination signs and message signs as specified in Section 14.02, I, 3, c.
 - 1) The switch shall be heavy duty with heavy duty knob, knob retaining provisions and knob stop pins.
 - 2) The position labels, left-to-right, shall be "EXPRESS", "NORMAL" and "NOT IN SERVICE".
 - d. White buzzer push button switch, see Section 9.06 for details.
 - e. Windshield washer/wiper switch as specified in Section 9.09, B. The windshield washer/wiper switch shall be equivalent to a Cole Hersee No. 75600 series switch.
 - f. Communication system equipment as specified in Section 14.02, F.
 - g. Key-operated switch for emergency operation of headlights and communication systems including the Train Operator's Touch Screen. Key shall not be able to be removed when it is in the "ON" position.
 - h. Five (5) circuit breaker switches labeled, left to right P3, P4, P5, P6 and P11. The actual number of circuit breakers and their designations and functions shall be determined during design reviews. These devices shall be located behind a spring-loaded cover plate at the top of the panel. Location to be reviewed in the cab mock-up.
 - i. Smart Card reader, as specified in Section 15.08.
 - 2. The panel face shall be engraved and the letters filled with white plastic or epoxy to identify each item mounted on the panel.
 - 3. The push button switches shall be mounted from the back of the panel, and the face of the buttons shall be flush with the face of the panel.

9.05 <u>CONTROL PANELS</u> (Continued)

- D. <u>Operator's Bypass Panel</u>
 - 1. An Operator's Bypass Panel shall be installed in each Operator's cab in the cab ceiling in a location reviewed in the cab mock-up. The panel and all apparatus mounted thereon shall be reviewed by the Engineer. The panel shall be smooth faced, black anodized aluminum hinged at the forward edge to tilt down for maintenance.

All access to the internal parts of the Operator's Bypass Panel shall be secured by tamperproof screws with one-eighth-inch (1/8") pin socket heads.

The panel face shall be engraved and the letters filled with white plastic or epoxy to identify or label the items mounted on the panel.

- 2. The ATC Audible Alarm shall be mounted behind the panel and shall be completely inaccessible to all unauthorized persons.
- 3. The layout of the panel shall be similar to that on CTA's 3200 Series cars.
- 4. The panel shall have mounted on it the following devices:
 - a. Bypass Push Button Switches

Three (3) push button switches with an electrical hold-in feature shall be mounted on the face of the panel. The push buttons shall be designed to be highly resistant to plugging. All servicing of these switches shall take place from the back of the panel and no parts shall be removable from the face of the panel. Circuits shall be such as to preclude interference between any bypass function and other bypass functions or car systems. The bypass push button switches shall be functional only at an operating Master Controller and only when the bypass activator switch is in the activate position. The electrical hold-in feature shall be canceled each time the train is stopped and shall not be re-established until the friction brakes have been released.

9.05 <u>CONTROL PANELS</u> (Continued)

- D. <u>Operator's Bypass Panel</u> (Continued)
 - 4. (Continued)
 - a. Bypass Push Button Switches (Continued)
 - 1) One (1) switch (rear or top) shall be labeled "STEM", and shall be provided with a plastic push button, amber colored throughout. An amber indicator LED assembly with miniature bayonet base and amber lens shall be mounted to the right of the push button labeled "STEM", and shall be wired to illuminate whenever the push button switch is pressed with the BAS activated. Operation of the "STEM" switch shall bypass emergency relay circuits to keep all the emergency relays in the train energized.
 - 2) The second switch (middle) shall be labeled "DOOR" and shall be provided with a plastic push button, green colored throughout. A green indicator LED assembly with miniature bayonet base and green lens shall be mounted to the right of the push button labeled "DOOR", and shall be wired to illuminate whenever the push button switch is pressed with the Bypass Activator Switch (BAS), specified in Section 9.05, D, 4, b activated.

Operation of the "DOOR" switch shall:

- (a) Interrupt the feed to the door light on the Operator's Indicator Panel.
- (b) Provide a direct feed to the power control relay coil to allow train operation in the event of a failure in the door interlock, signal relay, Coast Contactor or power control relay circuits without loss or compromise of other systems.
- (c) Bypass the Coast Contactor circuits.

9.05 <u>CONTROL PANELS</u> (Continued)

- D. <u>Operator's Bypass Panel</u> (Continued)
 - 4. (Continued)
 - a. Bypass Push Button Switches (Continued)
 - 3) The third switch (forward or bottom) shall be labeled "ATC" and shall be provided with a plastic push button, red colored throughout. A red indicator LED assembly with miniature bayonet base and red lens shall be mounted to the right of the push button labeled "ATC" and shall be wired to illuminate whenever the push button switch is pressed with the BAS activated.

Operation of the "ATC" switch shall bypass both the ATC system interface with the propulsion system (over speed penalty brake) and the ATO sub-system interface with the propulsion system (coast command) to allow manual operation of the train and shall modify the operation of the audible alarm in accordance with Section 13.02. Separate contacts shall be used for each bypass function and to modify the audible alarm operation.

b. Bypass Activator Switch (BAS)

A two-position switch, operated by the CTA's standard key, shall be mounted at the top (rear) of the panel. The panel shall be labeled "NORMAL" and "ACTIVATE" corresponding to the two (2) switch positions. The key switch shall be designed to require the key to be pushed in before it can be turned and to be removed only in the "NORMAL" position. No parts shall be removable from the front of the panel. The switch shall operate with a snap action to ensure the switch does not stay between positions. The switch shall be arranged on the panel to minimize the protrusion of the key from the face of the panel.

When in the "ACTIVATE" position, this switch shall energize all bypass push buttons on the bypass panel, turn on the red taillights on that car, and light a red LED assembly with red lens on the rear of the cab rear bulkhead. When in the "NORMAL" position, this switch shall disconnect the bypass push buttons and remove the auxiliary feed to the taillights and the indicator light.

9.05 <u>CONTROL PANELS</u> (Continued)

- E. <u>Operator's Indicator Panel</u>
 - 1. The Operator's Indicator Panel shall be located on the left side of the cab in a location reviewed in the cab mock-up. The panel and all apparatus mounted thereon shall be reviewed by the Engineer.
 - 2. The panel shall contain four (4) indicator lights, two (2) with colored lenses, and the control reset push button switch. The sockets and the colored lenses shall be similar to those on the Bypass Panel with tamperproof lenses and relamped only from the rear. Suitable dropping resistors shall be provided to dim the colored lights to avoid glare in a darkened cab and retain visibility in daylight. The two (2) message lights shall be the same as on CTA's 5000 Series cars equipped with LED assemblies and require the review of the Engineer. The face of the panel shall be smooth black anodized aluminum. The panel face shall be engraved and the letters filled with white plastic or epoxy to identify the two (2) colored indicator lights and push button.
 - 3. One (1) lens shall be blue, and the panel below the light shall be labeled "PROPULSION SYSTEM". This light is lighted as described in Section 10.09. It shall light only in the operating cab.
 - 4. One (1) lens shall be white translucent, and the panel below the light shall be labeled, "AUX. SYSTEMS" "IF REMAINS ON, CALL RAIL CONTROLLER". This light is lighted as described in Section 9.08. It shall light only in the operating cab.
 - 5. One (1) lens shall be a white translucent, flat face with black letters reading "DOORS". This light shall light when the power control relay is energized as described in Section 6.05, A. It shall light only in the operating cab.
 - 6. One (1) lens shall have a black, opaque, flat face with white translucent letters reading "BRAKES". This light shall light when any friction brake on the train is applied. It shall light in all cabs on a train when any one (1) Master Controller is "ON".
 - 7. A rear mounted, flush white push button switch labeled "CONTROL RESET". It shall operate as described in Section 10.09.

9.05 <u>CONTROL PANELS</u> (Continued)

F. <u>Car Circuit Breaker Panel</u>

A car circuit breaker panel reviewed by the Engineer shall be installed in each Operator's cab in the cab ceiling.

The layout of the panel shall be reviewed by the Engineer and demonstrated in the cab mock-up. The following items shall be mounted on the panel:

1. The following circuit breaker switches, labeled as follows:

P9 -	Windshield Wiper/Washer	P34 -	Electric Coupler Heater
P12 -	Active Suspension Control	P35 -	Interior Lights
P14 -	Track Brake Control	P41 -	De-Icer
P15 -	Truck No. 1 Track Brakes	P42 -	Horn (B-car only)
P16 -	Truck No. 2 Track Brakes	P43 -	Signs 1
P24 -	Exterior Lights	P44 -	Communication System
P30 -	Signal Lights	P45 -	Cab Heat and Defroster
P31 -	Door Control and Buzzer	P46 -	ATC (B-car only)
P32 -	Air Comfort	P49 -	Signs 2

P-37, 38 and 39 - Control and Monitoring Network including TOTS

Other circuit breakers may be included as required.

In addition, space for five (5) single-pole circuit breakers shall be provided.

- 2. A manual start push button. The button shall be clearly and permanently marked with an engraved label mechanically attached reading "APS MANUAL START". The button shall be connected to provide for starting the Auxiliary Power Supply System directly from the 600 Vdc line in the absence of low voltage power. The button shall be insulated and protected to preclude the possibility of electrical shock.
- 3. The Control Cut Out Switch, as specified in Section 10.09, J.
- 4. All devices shall be identified with engraved mechanically attached labels having black letters on a white background.

9.05 <u>CONTROL PANELS</u> (Continued)

G. <u>PTU Connections and Cab Panel</u>

- 1. A panel, reviewed by the Engineer, shall be provided in each operator's cab which shall have mounted on it the PTU receptacles for the microprocessor controlled systems. The panel shall be mounted in the cab overhead area accessible through one of the hinged access panels. The panel shall be demonstrated in the cab mockup.
- 2. The connectors for the PTUs shall be identified with the system name in a manner reviewed by the Engineer.
- 3. The Contractor may propose an Ethernet based diagnostic system that will connect all the diagnostic ports and have one connector in each operator's cab. The system may be limited to one car or one married pair and need not be a full train network.

H. <u>ATC Aspect Display Unit</u>

The ATC speed indicator and aspect lights shall be mounted in an appropriate box on the left side of the Operator's cab. The box shall be tilted and angled to provide complete visibility for a seated or standing operator and shall have a sun shield adjacent to the windshield as on CTA's 5000 Series cars. The box shall be mounted to keep the largest possible area of the cab windshield free of obstruction. For details, see Section 13.08.

9.05 <u>CONTROL PANELS</u> (Continued)

I. <u>Train Operator Touch Screen (TOTS)</u>

The Train Operator Touch Screen as specified in Section 15.09, shall be located between the Master Controller and windshield. The TOTS shall be tilted and angled for ease of viewing. The TOTS shall be shielded to minimize sun glare and reflected light that may impair clear viewing of the screen and operation of the touch buttons.

The location of the TOTS shall be demonstrated in the cab mock-up. The configuration of the TOTS shall be reviewed by the Engineer.

J. Operator Control Interface

The Operator's Control Interface (OCI) for the pre-recorded announcement system shall be displayed on the bottom left corner of the TOTS. OCI displays and operation shall be equivalent to the OCI on CTA's 5000 Series cars.

K. <u>R6.4 Push Button Switch</u>

See Section 13.19, for a description of this switch and its location.

9.06 BUZZER SYSTEM

A buzzer system consisting of a buzzer and push buttons shall be installed in each cab. The push button located on the Operator's Control Panel shall be operative at all times. The push buttons on the door control boxes are described in Section 6.02. The buzzer system shall be connected through all cars in a train and all buzzers shall sound when the system is actuated. The buzzer system shall draw its power from the car's low voltage power supply through P31 "DOOR CONTROL BUZZER". The location of the buzzer shall be demonstrated in the cab mock-up.

9.07 <u>HORN</u>

An electronic horn, reviewed by the Engineer, shall be installed under the floor of the car, at the No. 1 end. The horn shall draw its power from the car's low voltage power supply through P42 "HORN" unless otherwise agreed to by the Engineer. The horn shall be operated by a floor-mounted, waterproof foot switch located in the Operator's cab. It shall be possible to change the switch from inside the car. The switch and its location shall be reviewed by the Engineer and demonstrated in the cab mock-up. The horn shall deliver a sound level of at least 100 dBA at one-hundred feet (100') from the end sill of the car.

Horn electronics shall be mounted in the low ceiling area of the B-car unless otherwise agreed to by the Engineer. Special care shall be taken to prevent the horn from interfering and causing false indications on the ADU or the car networks.

9.08 WHITE LIGHT TROUBLE INDICATOR SYSTEM

A trouble indicator system shall be provided to indicate the failure of the battery charger and/or LVPS. The white light system shall be functional only when a Master Controller in the train is turned on. White lights shall be located on the Operator's Indicator Panel, per Section 9.05, E, and outside the car adjacent to the No. 3 and No. 4 side doors, per Section 8.02, E. The cab light shall light only when the Master Controller in that cab is turned on and the outside white lights shall remain lit until reset by maintenance personnel.

The white light system shall be powered from the car's low voltage power supply through P30 "SIGNAL LIGHTS". The white light system and its components require review by the Engineer.

White light faults shall be displayed on the diagnostic event display as specified in Section 9.03, E and on the TOTS as specified in Section 15.09.

9.09 WINDSHIELD WIPER, WASHER AND HEATER

A. <u>Windshield Washer/Wiper Power Supply</u>

The windshield wiper motor and washer pump shall be powered by a heavy duty, commercially available, 37.5 Vdc-to-12 Vdc converter. The power for the converter shall be fed from the car low voltage system through the P9 "WINDSHIELD WIPER/WASHER" circuit breaker. Internal fuses shall be not be permitted in the converter. The circuit shall be activated by turning on the Master Controller in that cab. The power supply and its location shall be reviewed by the Engineer.

B. <u>Windshield Wiper</u>

Each operator's windshield shall be equipped with a multi-speed, 12 Vdc, heavy duty automotive type windshield wiper with intermittent feature reviewed by the Engineer. The windshield wiper control switch shall be a plug connected rotary switch located on the Operator's Control Panel. The panel shall be labeled as appropriate. The switch shall have "OFF/PARK", "HIGH, "LOW", "SHORT DELAY" and "VARIABLE DELAY" positions, equal to Cole-Hersee 75600-02.

The wiper shall be heavy duty with pantograph arm and blade of appropriate length to wipe the area of the glass used by a standing or sitting operator. On high speed, the wiper shall make seventy-five complete cycles per minute (75 cpm) on wet glass with the LVPS operating. On low speed, the wiper shall make approximately thirty-five complete cycles per minute (35 cpm) on wet glass. On "SHORT DELAY", the wiper shall make less than five complete cycles per minute (<5 cpm). On "VARIABLE DELAY", the wiper delay shall be adjustable by the operator. The adjustment range shall be from approximately five to twenty-five complete cycles per minute (5-25 cpm). When the control switch is turned off, the wiper shall automatically park at the left-hand end of the stroke as viewed from inside the cab.

9.09 <u>WINDSHIELD WIPER, WASHER AND HEATER</u> (Continued)

C. <u>Windshield Washer</u>

Each operator's windshield shall be equipped with a 12 Vdc, heavy duty windshield washer. The washer control shall be part of the windshield wiper control switch on the Operator's Control Panel.

There shall be two (2) nozzles mounted above the windshield to direct the fluid over the entire area swept by the windshield wiper blade.

The washer fluid shall be contained in an easily changed plastic container with integrated pump and at least one gallon (1 gal) capacity. A stainless steel drain pan shall be provided draining to the outside of the car. The filler shall have a tethered, twist-on cap.

The washer and its installation shall be reviewed by the Engineer, and demonstrated in the cab mock-up.

D. <u>Windshield Heater</u>

Each operator's windshield shall be equipped with electric heating elements embedded in the glass assembly. The heat producing elements shall be sized to prevent the accumulation of ice from freezing rain, snow or mist, and shall be self-regulating to prevent burnout, if left turned on in the summer. The heat producing element shall be as nearly transparent as possible and shall not introduce any distortion in the view through the windshield at any angle.

The heater shall be powered from the 120 Vac, 60 Hz, single phase power from the auxiliary inverter through circuit breaker P73 "WINDSHIELD HEATER POWER". The heater and its controls shall be controlled by a toggle switch, with accompanying red indicator light, on the Operator's Control Panel labeled "WINDSHIELD HEATER". The heater/controls and indicator light shall be activated by turning on the Master Controller in that cab.

The heating provisions and ratings as well as the controls shall be reviewed by the Engineer.

9.10 PRINTED CIRCUIT CARDS

All printed circuit cards used shall be of the plug-in type except where agreed to by the Engineer.

Plug-in printed circuit cards shall be designed with keyed plugs and sockets to prevent the insertion of the wrong card in any socket. Exposed pin type plugs shall not be permitted. Each card shall be labeled and the card rack identically labeled to identify in which location each card belongs. In addition, each card shall have a permanently affixed serial number and bar code.

All cards shall be coated both front and rear with a clear protective coating that can be readily removed for testing and repair.

The components on all cards shall be adequately tied down to prevent failure of leads due to vibration.

A sample of each manufacturer's printed circuit cards shall be submitted to the Engineer for review of general construction.

9.11 ELECTRONIC SYSTEM TESTERS

- A. The Contractor shall supply, except as otherwise specified or agreed to, the following test equipment with complete operating instructions/documentation, for the checking and adjustment of printed circuit cards/boards and power modules/assemblies in each system on the car, and for the checking and adjustment of each complete system as installed on the car:
 - 1. One (1) bench test set with all standard cards, meters, oscillators, high and low voltage power supplies, load banks to simulate full load and/or other equipment necessary for complete verification of operation and for adjustment of the cards/boards and power modules/assemblies in each system. See also Section 17.03.
 - 2. Ten (10) test sets for on-car system testing with all required meters, oscillators and/or other equipment necessary for the complete verification of operation and for adjustment of the systems. The on-car system test sets shall be specifically designed for the verification and adjustment of those systems or elements of systems that are not monitored or tested by the PTU specified in Section 17.04.
 - 3. Five (5) complete printed sets and two (2) CD/DVD ROMs of the instructions/ documentation, including Maintenance and Parts Manuals with each test set. Alternate sources for batteries, discs and other consumables shall be identified in the documentation provided.

9.11 <u>ELECTRONIC SYSTEM TESTERS</u> (Continued)

- B. Two (2) of each type of the on-car test sets shall be delivered concurrently with the prototype cars. The remainder of the required on-car test sets shall be delivered within 180 days of the delivery of the first production cars.
- C. The bench test sets shall be delivered within two years (2 yr) of the delivery of the first production cars.
- D. During the prototype car test period and during the period of warranty on the systems in which the test sets are used, the Contractor shall arrange to update the test equipment and operating instructions/documentation without charge to CTA to incorporate all changes made on the cards and systems.
- E. Two (2) complete back-up/restore copies of the software for all microprocessor controlled equipment shall be provided.
- F. The test equipment including instructions and procedures shall be reviewed by the Engineer.

9.12 SPEED SENSORS

- A. Heavy duty, shock- and vibration-resistant magnetic speed sensors shall be installed for all systems. The provisions for connecting the speed sensor to the carbody wiring shall receive special attention to preclude cable and connector problems.
- B. The propulsion speed sensors shall be equipped with leads molded into the sensor body with an integral strain relief unless otherwise agreed to by the Engineer.
- C. The ATC speed sensors installed on the No. 1 axle gearbox shall be equipped with leads molded into the sensor body with an integral strain relief. The leads shall be wired directly to the truck-mounted ATC junction box.
- D. The door low speed interlock speed sensor installed on the No. 1 axle gearbox on each A-car shall be equipped with molded leads and integral strain relief. The leads shall be wired directly to the truck-mounted ATC junction box.
- E. All speed sensors, to the extent possible, shall be mechanically and electrically interchangeable.
- F. All speed sensors and their installation shall be reviewed by the Engineer.

9.13 600 VDC AUXILIARY POWER TRAINLINE

A. <u>General</u>

A separate, isolated 600 Vdc trainline system, reviewed by the Engineer, shall be installed and wired between each car of a married pair to feed the auxiliary load on both cars from the third rail shoes of either car. The circuitry shall be designed to preclude any backfeed to the third rail shoes and propulsion circuits.

B. <u>Details</u>

- 1. The trainline shall be sized to carry all the 600 Vdc auxiliary loads for both cars of a married pair.
- 2. Basic backfeed prevention shall be accomplished by means of a diode or diode assembly properly sized and rated for the voltage and load of both cars of a married pair. Suitable protection shall be provided to suppress spikes that may damage the diode(s).
- 3. An isolation contactor, controlled by the presence of 600 Vdc power at the third rail shoes, shall be provided on each car to disconnect the auxiliary loads from the third rail shoes of that car when 600 Vdc power is not present on that car.
- 4. The backfeed prevention diode(s), isolation contactor and spike suppressors shall be mounted in a fiberglass box the same as the contactor box on CTA's 3200 Series cars unless otherwise agreed to by the Engineer.
- 5. The trainline cable shall be cleated under the car and shall have a combined fuse-switch box under the car at the No. 2 end equipped with a single pole connector, knife switch and fuse, the same as on CTA's 5000 Series cars.
- 6. The inter-car jumper shall be equipped with a single pole connector, the same as on CTA's 5000 Series cars, in accordance with Section 9.02, J, on each end and be cleated to the drawbar and underframe in such a manner as to preclude any chafing. The inter-car jumper length shall be such as to permit negotiation of curves without stretching or stressing the connectors. The inter-car jumper cable shall be specifically selected for both flexibility and long life under constantly flexing conditions and may utilize construction and insulation different from that specified for other cables. Additional physical protection may be required to ensure long service life.
- 7. All aspects of this installation, including the connectors and switch box, shall be reviewed by the Engineer.

9.14 CONVENIENCE OUTLETS

Each car shall be equipped with two (2) grounded, duplex, 120 Vac, 20A receptacles. The receptacles shall be located in heavy duty weatherproof boxes with spring-loaded, gasketed, locking stainless steel covers mounted on the traction motor blower seat boxes. The outlet boxes shall face the ends of the car and be centered near the top of the seat box under the seat overhang. Two (2) keys per cover shall be provided to the Engineer. All covers shall be keyed alike. The outlets and their installation shall be reviewed by the Engineer.

9.15 MICROPROCESSORS

A. <u>General</u>

This Section shall apply to the microprocessors applied in any system on the car including but not limited to: Door Control, Low Speed Interlock, Propulsion, Braking, Active Suspension System, Auxiliary Power Supply System, Automatic Train Control, Event Recorder, Communications (Message System and Interior Signs) and Destination Signs.

B. <u>Application Features</u>

- 1. The microprocessor control shall be reprogrammable from the portable test units without removing devices or cards unless specifically agreed to by the Engineer.
- 2. The PTU software shall be a stand alone application that shall not be dependent on the software in the unit being monitored. When software revisions are made to the various systems, no changes shall be required to the PTU software to function properly.
- 3. The CPU and associated logic packages shall be housed in an EMI shielding metal enclosure. Access shall be gained by quick-acting fasteners which do not require special tools to operate. It shall not be necessary to remove PROM's from the circuit in order to reprogram them unless specifically agreed to by the Engineer.

9.15 MICROPROCESSORS (Continued)

- B. <u>Application Features</u> (Continued)
 - 4. All signals applied to the microprocessor and all outputs from the inputoutput port shall be through isolation buffers located external to the microprocessor. The buffers shall:
 - a. Protect and isolate the microprocessor from damage due to over voltage, under voltage, voltage transients, shorts and opens.
 - b. Perform necessary voltage translations.
 - c. Remove noise and undesired signals.
 - d. Limit, process, discriminate and format those signals, such as speed sensor input, display drivers and code rate input, which due to their nature might cause an excessive amount of throughput for the microprocessors.
 - 5. Batteries, if used, shall not be soldiered to PC boards, but mounted in holders reviewed by the Engineer.
 - 6. Only one (1) battery shall be permitted per system unless explicitly agreed to by the Engineer. Multi-processor systems shall be designed to share batteries to prevent battery proliferation.
 - 7. Batteries shall be readily available within the USA.
 - 8. Non-volatile memory shall not require batteries or other devices requiring periodic replacement.

9.15 MICROPROCESSORS (Continued)

C. <u>Software</u>

The microprocessor software shall be structured to clearly identify and provide all of the following functions:

- 1. Initialization Routines that are required to restart the microprocessor and prepare the hardware for correct operation.
- Discrete Logic Functions A separate and distinct routine for each and every major logic function, or signal processing, that the microprocessor system is to perform.
- 3. Executive Routines which link the subroutines into a system.
- 4. Self-Check and Monitor Routines within the normal flow and operation of the microprocessor system which continually perform a self-check and provide an external indication of the operational status and provide an indication of data values.
- 5. Diagnostics Routines which will not disrupt the normal program flow or timing but provide diagnostic information of system operation.
- D. <u>Software Support</u>

All non-commercial, project specific software shall be placed in escrow and shall become the property of CTA should the OEM or its successors cease to support it. The escrow period shall be a minimum of twenty years (20 yr).

E. <u>Clock Synchronization</u>

Free running clocks for all microprocessor based systems shall be synchronized with the GPS clock specified in Section 15.05.

9.16 EVENT RECORDER

A. <u>General</u>

- 1. The event recorder specified shall comply in general with IEEE Standard 1482.1-1999, IEEE Standard for Rail Transit Event Recorders.
- 2. The Inputs defined in Table 1, required event recorder signals, shall be modified as defined below to be applicable to CTA rail vehicles. Additional signals shall be recorded as specified below and as determined during design reviews and the final list shall be reviewed by the Engineer. Signals shall be transmitted to the event recorder on the train network.
- 3. The event recorder shall be powered from the car's low voltage system through circuit breaker P48 "EVENT RECORDER", located adjacent to the recorder.
- 4. One (1) recorder shall be installed in each married pair of cars, located in the No. 3 door aft seat box of the B-car. See Section 14.03, C, for details of the installation.
- 5. The recorder in each married pair shall be activated when either Master Controller in that pair of cars is turned on (Reverser in Forward or Reverse and Main Handle not in "Off") or the cars are turned on from another married pair via trainline.

Once turned on, the recorder shall remain operating for five minutes (5 min) after the cars are turned off.

- 6. Embedded batteries shall be carried in holders that do not require any soldering to change the battery unless explicitly agreed to by the Engineer.
- 7. Suppliers of event recorders called for in this Specification shall submit for review by the Engineer sufficient evidence to establish that they have had adequate successful experience in the design and manufacture of this type of equipment for use on rapid transit or railroad properties.

The Engineer will not permit any supplier who, in his opinion, has not had adequate experience or whose equipment and apparatus lacks a record of successful rapid transit or railroad service operation.

- 8. The Contractor shall supply PTU software for accessing the event recorder data and performing other functions. The PTUs shall be as described in Section 17.04.
- 9. The recorder communication shall be redundant to the trainline network(s) to ensure a continuous recording of commands and statuses of the train operation in case one link fails.

9.16 <u>EVENT RECORDER</u> (Continued)

B. Inputs

The inputs from IEEE 1482.1, Table 1 shall be modified and expanded as follows:

Input No. Event Recorder Required Signals

- 1. Time, including date (YYYY:MM:DD:HH:MM:SS).
- 2. System/subsystem times, (any times originated by systems generating required signals).
- 3. Master Controller operating handle position including "Dead Man" status.
- 4. Track brake contactor activation signal.
- 5. HPCU output pressure (both cars of the married pair).
- 6. Traction motor torque signal, one (1) reading per truck.
- 7. Propulsion and Braking network commands and trainwires.
- 8. Propulsion speed sensor signal converted to actual speed in mph.
- 9. All emergency trainwires including track brakes .
- 10. Odometer (to 50 ft. resolution).
- 11. Master Controller reverser position.
- 12. Active cab.
- 13. Cab signal inputs from ATC system. See Section 13.22 and Section 13.23 for required signals.
- 14. All door control trainline status.
- 15. Wheel spin/slide correction activation on each car of the married pair.
- 16. Door summary and lock relay status.
- 17. Outside yellow light status on each car of married pair.
- 18. No motion relay status.
- 19. STEM bypass status.
- 20. Door bypass status.
- 21. ATC bypass status.
- 22. Bypass activator switch status.
- 23. Door cut out (each door on married pair).
- 24. Side door passenger emergency opening status (each door on married pair).

9.16 <u>EVENT RECORDER</u> (Continued)

- B. Inputs (Continued)
 - 25. Side door closed and locked status (each door on married pair).
 - 26. Car number independent of other systems.
 - 27. Smart Card employee ID number.
 - 28. GPS location.
 - 29. Third Rail Voltage.
 - 30. Four (4) spare inputs.

9.17 EVENT AND VIDEO RECORDERS HEATER CONTROL

A. The event and video recorders may require heating and/or cooling in order to meet the specified operating parameters over the temperature range found inside the equipment enclosure.

The heaters and/or fans and their controls shall be powered from the car's low voltage system through circuit breaker P33 "RECORDER HEATERS".

- B. The control system shall be designed to minimize current draw when the car is turned "OFF".
- C. The entire temperature control system shall be reviewed by the Engineer.

9.18 ELECTRIC COUPLER HEATER CONTROL

The electric coupler heater and control, as specified in Section 4.02, F, 4, shall be powered from the car's low voltage system through circuit breaker P34 "ELECTRIC COUPLER HEATER" and operate when the ambient temperature is below 38°F.

9.19 EMI/EMC REQUIREMENTS AND GUIDELINES

A. <u>General</u>

Electrical, electronic, and communications systems and sub-systems shall operate in the Authority's transit system environment with cars neither suffering nor causing electromagnetic interference which may impact the system operation, safety, or other wayside installations because of conducted, induced or radiated emissions.

The Contractor shall employ all of the design techniques and construction methods necessary to control and prevent carborne electromagnetic interference (EMI) from affecting the operation of cars, including existing cars, and wayside systems. The use of ancillary equipment if necessary for mitigation of EMI shall be reviewed by the Engineer.

Emissions from all carborne sources on the car, when combined, shall not exceed the limits specified herein. Unless otherwise specified, carborne sources shall be considered on a car, a married pair and a train basis, as specified in Section 2.02, A, whichever is more restrictive.

Vehicle emissions shall not interfere in any way with the safety-critical operation of the existing CTA train control system, in particular, with the wayside trip stop 60 Hz power frequency (PF) signaling system and the audio frequency (AF) Automatic Train Control (ATC) system including wayside and carborne elements of the associated systems.

Vehicle radiated emissions shall not interfere in any way with radio/wireless communication systems used by CTA and the surrounding community, including the 2.4 GHz and 5.0 GHz spread-spectrum bands.

A vehicle EMI/EMC Control Plan shall be developed early in the vehicle design and submitted for review by the Engineer.

The requirements for control of EMI apply to all onboard car equipment including the propulsion and auxiliary power systems.

9.19 EMI/EMC REQUIREMENTS AND GUIDELINES (Continued)

B. <u>Vehicle EMI Limits</u>

Conducted EMI (CE) current limits are specified for the 600 Vdc supply input at the third rail, both per car and per train (maximum 12 cars).

Inductive EMI (IE) voltage limits are specified per car, undercar, rail-to-rail.

Cab signal interference (CSI) limits are vehicle emissions specified per car as equivalent cab signal rail current at the car ATC antenna coils.

Radiated EMI (RE) limits are specified vehicle RF field intensity levels along the wayside and consider both individual car and maximum train emission levels.

Specified emission limits are from all car electrical sub-systems taken both individually and in any combination.

Emission levels shall be measured in the laboratory, on a test track, and at CTA on the prototype cars.

Tests and measurements shall be performed using applicable U.S. DOT test procedures as specified in Section 9.19, F, 2.

The existing CTA train control system is based on single and double rail track circuits operating at 60 Hz and audio frequency joint-less track circuits operating above 1500 Hz with cab signaling at 4550 Hz and Overspeed protection. Future installations to this system may include interference-tolerant audio-frequency (AF) track circuits (2 KHz–20 KHz) and radio-based train control (RBTC) utilizing the 2.4 GHz or 5 GHz spread-spectrum band.

9.19 EMI/EMC REQUIREMENTS AND GUIDELINES (Continued)

- B. <u>Vehicle EMI Limits</u> (Continued)
 - 1. <u>Conducted EMI</u>

Conducted EMI (CE) shall not exceed:

<u>Per Train</u>	Per Car	<u>Frequencies</u>
4.0A RMS	1.0A RMS	55 Hz to 65 Hz , the PF Band
200mA RMS	40mA RMS	1500 Hz to 1700 Hz, the AF Band
100mA RMS	20mA RMS	1700 Hz to 20 kHz, the AF Band

Qualification measurements for car CE shall be taken near a low network impedance location such as near a substation. For normalizing test data, assume the car sees a 50 μ H equivalent network impedance from the 600 Vdc third rail including substation impedance.

Train CE limits for line filter design and emission analysis, shall be taken away from minimum network impedance locations. For the PF Band, for normalizing data, assume a train sees a 200 μ H equivalent network impedance approximately 500 feet away from a third rail substation. For the AF Band, assume a 100 μ H equivalent network impedance approximately 200 feet away from a sub-station. Deterministic, nonstatistical circuit analysis methods shall be used for all calculations.

Maximum levels, which occur at locations in proximity to substation feeds, may be approximated in the laboratory by using a power source with low source impedance relative to car input impedance (e.g., bypass capacitor for ac short circuit) at the specified emission frequencies.

9.19 EMI/EMC REQUIREMENTS AND GUIDELINES (Continued)

- B. <u>Vehicle EMI Limits</u> (Continued)
 - 2. Inductive EMI

Inductive EMI (IE), measured open-circuit, shall not exceed: 100 mV RMS @ 55 Hz to 65 Hz

20 mV RMS @ 1500 Hz to 1700 Hz

14 mV RMS @ 1700 Hz to 20 kHz with the following inband restrictions:

10 mV RMS @ 1900 +/- 60 Hz (1840 Hz - 1960 Hz)

10 mV RMS @ 2100 +/- 60 Hz (2040 Hz - 2160 Hz)

10 mV RMS @ 2320 +/- 60 Hz (2260 Hz - 2380 Hz)

10 mV RMS @ 2580 +/- 60 Hz (2520 Hz - 2640 Hz)

10 mV RMS @ 2820 +/- 60 Hz (2760 Hz - 2880 Hz)

10 mV RMS @ 3100 +/- 60 Hz (3040 Hz - 3160 Hz)

10 mV RMS @ 3370 +/- 60 Hz (3310 Hz - 3430 Hz)

10 mV RMS @ 3660 +/- 60 Hz (3600 Hz - 3720 Hz)

10 mV RMS @ 3900 +/- 60 Hz (3840 Hz - 3960 Hz)

To achieve these limits, especially in the more restricted bands, selection and vital frequency management of braking chopper and traction inverter switching frequency harmonics may be considered only if, by engineering design analysis and power lab testing of CTA prototype Power Conversion Units, it can be shown that a broadband AF limit of 10 mV RMS, 1500 Hz - 20 kHz cannot be achieved. While selection and vital checking of switching frequencies of the Auxiliary Power Supply System can also be considered, these frequencies should be chosen to fall outside of CTA signaling bands (e.g. above 20 KHz)

Undercar braking resistors are a potential major source of IE emissions. To reduce total undercar IE levels, the undercar braking resistors for each braking chopper should be physically separated from each other. Low inductance brake resistor grids shall be used.

9.19 EMI/EMC REQUIREMENTS AND GUIDELINES (Continued)

- B. <u>Vehicle EMI Limits</u> (Continued)
 - 2. <u>Inductive EMI</u> (Continued)

Measurement of undercar IE emissions shall include the effect of the traction motor as assembled to the wheel/axle assembly and installed in a truck. High emission levels caused by frameless motor designs, axle notches and flux saturation shall be considered. Individual IE loop tests of the traction motors shall be conducted. In addition to a horizontal simulated rail loop test, a vertical simulated wheel/axle/rail loop test shall be performed.

3. <u>Cab signal interference (CSI)</u>

The maximum CSI equivalent rail current at the output of the cab signal antenna coils shall be limited to:

25 mA RMS @ fCAB = 4550 +/- 100 Hz (4450 Hz – 4650 Hz)

Where fCAB = cab signal frequency used by the CTA AF train control system.

Cab signal interference (CSI) at the undercar cab signal receiver coils due to magnetic flux sources on the vehicle are a major concern. The primary source of CSI interference is the magnetic flux from traction motors and associated cabling. The induced voltage in the receiver coils appears as a corresponding "rail-equivalent current" at the cab signaling frequency. The design guidelines specified in Section 9.19, B, 2, apply. "Rail-equivalent current" versus cab signal receiver coil voltage can be easily determined using standard cab signal calibration techniques such as injecting a known current level into the running rails or test loop and measuring receiver coil voltage.

Initial CSI testing shall be performed as part of the propulsion system qualification testing specified in Section 10.01, P. In addition to the separate unit tests, a combined test of the complete vehicle propulsion and auxiliary power supply systems shall be performed as specified in Section 9.19, F, 1. Measurements shall be made using actual ATC antenna coils properly oriented with respect to test traction motor and cabling.

9.19 EMI/EMC REQUIREMENTS AND GUIDELINES (Continued)

B. <u>Vehicle EMI Limits</u> (Continued)

4. Radiated EMI

Radiated emissions shall be measured 15 meters from the track centerline. Radiated EMI shall not exceed the following values, when plotted, straight line, on a semi-log scale, $dB\mu V/m/MHz$ versus log frequency:

122 dB above 1 $\mu\text{V/m/MHz}$ at 10 KHz to 84 dB above 1 $\mu\text{V/m/MHz}$ at 30 MHz.

58 dB above 1 μ V/m/MHz from 30 MHz to 88 MHz.

68 dB above 1 µV/m/MHz from 88 MHz to 1000 MHz.

68 dB above 1 μ V/m/MHz from 1 GHz to 6 GHz.

These limits apply to both maximum individual car and train levels.

In addition to vehicle radiated EMI limits, vehicle onboard equipment shall be compatible with the communication systems used by CTA including data radios specified in Section 15.10, CTA mobile radios and CTA handheld radios.

In the cellular telephone band, the vehicles shall have operational compatibility with passenger cellular phones and with cellular repeater sites located on or adjacent to CTA property.

To assess radio-based train control (RBTC) compatible operation in 2.4 GHz and 5.0 GHz spread-spectrum bands, radiated emission measurements shall be performed to quantify emission levels of the car pulse/transient broadband noise. Emissions shall be measured both at 3 meters from the track centerline and at a typical RBTC receive antenna location on the vehicle. Emission goals are:

60 dB above 1 µV/m/MHz from 2400 MHz to 2483.5 MHz

60 dB above 1 µV/m/MHz from 5725 MHz to 5850 MHz

This field intensity level corresponds to a received level of approximately -85dbm in a 1 MHz bandwidth, assuming 0 db receive antenna gain.

9.19 <u>EMI/EMC REQUIREMENTS AND GUIDELINES</u> (Continued)

- B. <u>Vehicle EMI Limits</u> (Continued)
 - 4. <u>Radiated EMI</u> (Continued)

Low frequency magnetic and RF field levels within the car passenger area shall be minimized to prevent adverse interference with passenger electronic devices including portable computers and medical aids such as pacemakers.

If the vehicle design uses large air-core inductors, they shall be located such that operating compatibility and performance is not compromised. Although acceptable field strengths are not specified, existing field strengths for CTA vehicles with solid-state traction shall be used as a benchmark to establish a comparison.

C. <u>Vehicle Input Impedance Limits</u>

Vehicle input impedance, at the third rail, for all electrical sub-systems, taken individually or in combination, shall be inductive above 50 Hz to avoid resonances with utility power lines and signaling frequencies, i.e. input impedance resonant frequency shall be less than 50 Hz. Minimum vehicle input impedance per car must be equivalent to 1 mH, i.e., 377 milliohms reactive at 60 Hz power line frequency.

D. <u>EMI/EMC Control Plan</u>

The Contractor shall submit an EMI/EMC Control Plan in accordance with APTA SS-E-010-98-Standard for the Development of an Electro-Magnetic Compatibility Plan for review by the Engineer. A draft shall be submitted no later than 60 days after NTP with a final copy submitted 30 days after receipt of CTA comments. The EMI/EMC Control Plan shall document the Contractor's approach for ensuring that specified EMI/EMC requirements are met. The EMI/EMC Control Plan shall be part of any subsystem procurement document for any subsystem that may contribute to EMI/EMC emissions or be affect by such emissions.

Periodic progress reports on EMI/EMC shall be submitted throughout the vehicle design, construction and test process as agreed to by the Engineer. The reports shall include both Contractor and subcontractor progress.

The EMI/EMC Control Plan shall describe the Contractor's methodology and approach to EMI/EMC mitigation. Equipment design, analysis, and testing shall verify that the equipment performance and compatibility within the car, with CTA cars and with wayside equipment is met.

9.19 EMI/EMC REQUIREMENTS AND GUIDELINES (Continued)

D. <u>EMI/EMC Control Plan</u> (Continued)

EMI/EMC mitigation activities shall be seamlessly integrated into the Contractor's overall system engineering process, including preliminary design and final design reviews of critical sub-systems.

An FMECA shall be performed for all susceptible car electrical sub-systems to identify and reconcile potential safety-related faults related to EMI/EMC. As part of the vehicle EMI/EMC analysis, potential problem areas shall be identified with mitigation techniques. System safety assurance of EMI emissions within specified limits at safety-critical frequencies shall be provided by a combination of FMECA, EMI emission detection, integrity checking of vehicle input line filter components, and vital checking of other critical system parameters such as the brake chopper and inverter switching frequencies.

Initial and subsequent EMI/EMC design and safety analysis reports shall be submitted as agreed to by the Engineer. Applicable design, analysis, and test data from previous projects extrapolated to CTA requirements may be used to demonstrate EMI/EMC compliance for the CTA application.

In addition to laboratory testing, satisfactory performance and compatible operation shall be verified during test track and on-site testing of the prototype cars.

E. <u>General EMI/EMC Design and Mitigation Guidelines</u>

Where ever possible, EMI emissions shall be suppressed at the source. Filtering, shielding, modulation techniques, frequency coordination, balancing, isolation, and grounding may be used to assure adequate signal-to-noise ratios for safe and reliable operation of all equipment.

Electrostatic and magnetic shielding methods may be used to minimize the effect of stray emissions on susceptible circuits. Interconnecting power and signal cables shall be physically separated. Trainline wiring and cabling shall be arranged to minimize induction into trainline circuits due system transients.

The following additional guidelines shall be followed by the Contractor:

1. The undercar equipment shall be arranged to mitigate the effects of magnetic flux causing induced voltages to appear rail-to-rail. Sources of high magnetic flux shall be placed as high as possible above a running rail or located within shielded enclosures. Where possible, the magnetic core axis of the individual EMI sources, including reactors and transformers, brake resistors, and interconnecting power cabling should be arranged perpendicular to the running rails. Undercar inductive EMI levels shall be carefully monitored throughout the car design, power lab and on-site testing at CTA, to either confirm acceptable emission levels or to allow for undercar layout changes.

9.19 EMI/EMC REQUIREMENTS AND GUIDELINES (Continued)

- E. <u>General EMI/EMC Design and Mitigation Guidelines</u> (Continued)
 - 2. The traction motors and associated cabling shall be designed and arranged to mitigate cab signaling interference resulting from the proximity of the traction motors and cabling to cab signal receiver coils. Where possible, traction motor cabling shall be routed inboard from the vehicle's lead traction motors to undercar locations between the trucks. Terminal boxes on traction motors shall be arranged to maximize the distance to the nearest receiver coils.

F. <u>EMI/EMC Test Requirements</u>

1. <u>General</u>

The Contractor's test program shall include power lab testing, test track tests, and on-property carborne and wayside signaling system EMC tests. Power lab conducted/inductive EMI testing of one complete vehicle propulsion and auxiliary power supply system shall be performed. For a single propulsion inverter system this test shall include propulsion control and protection devices, line filter, propulsion inverter, four traction motors, braking resistors and auxiliary power supply unit(s). For a dual propulsion inverter system, equipment for this test may be limited to one truck set of propulsion equipment along with the auxiliary power supply unit(s). The physical layout of the underfloor mounted equipment and cabling for this test shall be as close as possible to the actual under floor arrangement. The test set-up shall simulate all propulsion and auxiliary system operating conditions.

All testing, including the on-property testing of the initial vehicles, shall use applicable EMI test procedures as defined in Section 9.19, F, 2, below. The Contractor shall produce and submit for review by the Engineer, specific test plans, test methods, test instrumentation and configurations, methods of data analysis and reduction, and accept/reject criteria based on the EMI limits as shown in Section 9.19, B.

2. <u>EMI Test Procedures</u>

Vehicle EMI emission measurements shall be performed using the following applicable test procedures:

- a. Conducted Interference in Rapid Transit Signaling Systems Volume II: Suggested Test Procedures (UMTA-MA-060153-85-6).
- b. Inductive Interference in Rapid Transit Signaling Systems Volume II Suggested Test Procedures (UMTA-MA-06-015-85-8).
- c. Radiated Interference in Rapid Transit Systems Volume II: Suggested Test Procedures (UMTA-MA-06-0153-85-11).
SECTION 9 <u>ELECTRICAL EQUIPMENT</u> (Continued)

9.20 VEHICLE IDENTIFICATION AND ANNUNCIATION SYSTEM

A. <u>General</u>

- 1. An inductive vehicle identification and annunciation system, equal to and compatible with the system on CTA's 5000 Series cars shall be installed on each married pair. The system shall consist of a carborne transponder equal to Tagmaster Model S1470. The system shall be powered from the car's low voltage system through a circuit breaker on the "A" Car Circuit Breaker Panel labeled P37 "Monitoring 1". The system shall be energized by turning on a Master Controller in either car of a married pair.
- 2. All connections to car wiring and between units shall be made through connectors as specified in Section 9.02, J, unless otherwise agreed to by the Engineer.
- 3. All aspects of the Vehicle Identification and Annunciation System shall be completely tested and made fully operational by the Contractor in his plant, see Section 16.01, X.
- 4. The entire Vehicle Identification and Annunciation System shall be reviewed by the Engineer.
- 5. All equipment shall be designed for operation in the rapid transit car climatic and shock and vibration environment. Exterior mounted equipment shall be completely sealed to be impervious to water, snow, salt water and salty slush.
- 6. The system shall operate properly and reliably when the vehicle passes the way side transmitter/receiver at speeds of up to 70 mph.

B. <u>Equipment Installation</u>

- 1. The transponder shall be mounted below the No. 2 end drawbar at the mid-point.
- 2. The control/interface unit shall be mounted in the cab equipment locker, unless otherwise agreed to by the Engineer.

SECTION 9 <u>ELECTRICAL EQUIPMENT</u> (Continued)

9.20 VEHICLE IDENTIFICATION AND ANNUNCIATION SYSTEM (Continued)

C. <u>Operation</u>

- 1. The transponder on the vehicle shall respond to the way side interrogator which is sending a signal approximately 40 times per second. The interrogator shall require two (2) equal messages from the vehicle before performing any further processing.
- 2. The vehicle shall transmit the following information to the way side interrogator:
 - a. Run number with prefix digit from the operator log in to the car communication system. See Section 14.02, I, 3, b.
 - b. Active cab car number from the network. .
 - c. Operation of each of the bypass functions, STEM, Doors and ATC. See Section 9.05, D.
 - d. Operation of the R6.4 switch. See Section 13.19.
 - e. Origin and Destination from the operator log in the car communication system. See Section 14.02, I, 3, b.
- 3. The system shall be capable of transmitting at least three (3) additional data codes for future use.

SECTION 9 <u>ELECTRICAL EQUIPMENT</u> (Continued)

9.20 VEHICLE IDENTIFICATION AND ANNUNCIATION SYSTEM (Continued)

- D. <u>Test Equipment</u>
 - 1. The Contractor shall supply five (5) sets of hand held readers similar to those supplied for CTA's 5000 Series cars and reviewed by the Engineer. These units shall be delivered within 180 days of the delivery of the first production cars.
 - 2. The Contractor shall supply one (1) stand alone bench test unit complete with all required commercial and specialized test equipment, simulation equipment, test procedures, test software, fixtures, cables, extender boards and interface units completely wired and tested for testing the carborne equipment. The bench test unit shall utilize a combination of schematics, test equipment, written test procedures and test fixtures to be able to identify defective parts down to the component level. The bench test unit shall utilize the latest technology; highest quality equipment at the time of delivery to CTA. The unit and its components shall be delivered to the Engineer within one (1) year of the delivery of the first production cars.

This requirement shall be waived if the existing CTA bench test unit can be modified to work with the new equipment supplied on this contract. The Contractor shall update/modify the existing CTA bench test unit, if required, at no cost to CTA as necessary.

- 3. Any modifications required in any of the test equipment as a result of changes in the car identification system equipment or software subsequent to the delivery of these items to CTA shall be made to them at no cost to CTA.
- 4. All test equipment and software shall be reviewed by the Engineer.

9.21 AUTOMATIC PASSENGER COUNTER SYSTEM

- A. Each car shall be equipped with an automatic passenger counting system. System shall take accurate counts of passengers within each car.
- B. System shall be interfaced with run number, door opening/closing signals, station location and other data required to provide route and station specific boarding and alighting data. Method of data capture/storage, reporting and analysis shall be reviewed by the Engineer.
- C. Passenger counting shall report real time passenger loads on a periodic basis to the AVM system specified in Section 15.11 and shall be viewable on the TOTS maintenance screens.
- D. Details of entire system shall be reviewed by the Engineer during design review.

SECTION 10 PROPULSION SYSTEM

10.01 <u>GENERAL</u>

- A. The Propulsion System shall be the latest, state-of-the-art, microprocessor based, IGBT ac inverter type with internal fault monitoring and self-diagnostics, see Sections 10.10 and 1.22. The system shall be service-proven in North American rail transit service of equivalent severity to that specified herein.
- B. Each car shall be fitted with four (4), 3 phase, asynchronous, ac induction traction motors to power all axles on the car, and a complete control system for their operation.
- C. Either a dual or single inverter propulsion system will be considered.
 - 1. A dual inverter system shall accommodate wheel diameter variation of not less than 1% between wheels on a truck. There shall be no restrictions placed on wheel diameters between trucks.
 - 2. A single inverter system shall accommodate wheel diameter variation of not less than 2% between all wheels on a car.
- D. Traction inverters and control system shall be designed to permit operation of one (1) inverter with the other inverter disabled.
- E. Motors, brakes, controls and all related equipment and apparatus shall be designed and manufactured to provide an adequate margin of capacity and safety for the operation intended. The system shall also be designed to prevent excessive maintenance or service interruptions under the weight and other specifications given herein along with the duty cycles specified in Section 2.02, D, and the operating and performance characteristics specified in Section 10.02, B.
- F. The full physical and functional integration of the various elements of the Propulsion System is the responsibility of the Contractor. The Contractor shall coordinate all aspects of the propulsion and braking systems to provide seamless operation of all suppliers' equipment.
- G. Adequate protection shall be provided for all devices in the Propulsion System against voltage variations to be found on the CTA system and/or developed by the car equipment. See Section 9.01, B.
- H. The Propulsion System shall provide continuously variable tractive effort control as specified herein.
- I. Electric braking shall be the primary brake at all speeds. Electric braking shall be rheostatic and regenerative with priority being given to regeneration. Regenerative, rheostatic and friction brake systems shall be designed to individually meet the requirements of Section 10.02, B, 4. The friction brake design shall be capable of providing a minimum of two (2), "Maximum Service Brake", friction only stops, from 70 mph without damaging any equipment. Friction brakes shall supplement the electric brakes for the final stop.

10.01 <u>GENERAL</u> (Continued)

- J. The friction brake system shall be controlled by the Propulsion System.
- K. The Propulsion System shall regenerate into the third rail during electric braking so long as the third rail is receptive. Resistors shall be used for electric braking when the third rail is non-receptive.
- L. EMI emissions of the Propulsion System combined with the emissions of all other operating systems on the car shall comply with Section 9.20. The Contractor shall submit as part of their Bid, lab and field EMI test data from an existing product extrapolated to the installation on the CTA vehicle to demonstrate the ability to achieve EMI/EMC compliance.
- M. The Contractor shall perform an FMECA, see Section 9.19, D, on all Propulsion System circuits.
- N. The Propulsion System, friction brake system, propulsion control and associated details shall be reviewed by the Engineer.
- O. Fuses shall not be used in the propulsion power circuits unless otherwise agreed to by the Engineer.
- P. Qualification tests shall be performed on one propulsion system and all its components to confirm that the system meets all design and performance requirements of the specification including duty cycles specified in Section 2, range of operating voltages, climatic conditions, noise emission, shock and vibration, EMI and maintainability. A combined test with auxiliary power supply system as specified in section 9.19,F,1, shall also be included in these tests.

Should equipment similar to previous contract be supplied on this contract, the Engineer at his sole discretion may accept qualification tests performed earlier, provided that the performance and environmental requirements are also comparable.

- Q. The Contractor shall develop the test procedures for each of the required tests and submit them for review by the Engineer prior to conduction the tests. The test procedures shall include instrumentation, forms to be used to record data, detailed methods of data reduction, all formulas used and pass-fail criteria.
- R. Dynamometer tests shall be performed to verify the thermal capacity of the friction brake system.

10.02 OPERATING CONDITIONS AND PERFORMANCE REQUIREMENTS

A. <u>Operating Conditions</u>

1.	Average Voltage	550 Vdc for motoring
		650 Vdc for regenerative braking
2.	New wheel diameter	28 inches
3.	Minimum number of cars in train	2
4.	Maximum number of cars in train	12
5.	Grade resistance	0

6. The train resistance shall be calculated using the Davis formula under the above conditions.

B. <u>Performance Requirements</u>

The performance specified herein shall be accomplished with a fully completed and equipped married pair with a load not exceeding 1,500 pounds per car of personnel and instrumentation.

All performance requirements shall be achieved with a 550 Vdc third rail voltage.

For conditions below 550 Vdc third rail voltage, the base speed may be reduced proportionally to the voltage reduction, but maximum tractive effort shall not be reduced. For conditions below 500 Vdc third rail voltage, the maximum tractive effort shall be reduced to minimize under-voltage shutdowns. Operation under these conditions shall not cause damage to the equipment.

The propulsion system shall not adjust performance based on passenger loads.

1. <u>Accelerating Capability</u>

A two-car unit shall be capable of accelerating to a speed of at least thirty miles per hour (30 mph) in fourteen seconds (14 sec), and to a speed of at least sixty miles per hour (60 mph) in sixty seconds (60 sec) on level tangent track. This capability shall be achieved with a 550 Vdc third rail voltage and with the average propulsion current draw per car not exceeding 600A for a period of fifteen seconds (15 sec).

The cars shall have a balance speed under the same conditions of at least seventy miles per hour (70 mph).

10.02 **OPERATING CONDITIONS AND PERFORMANCE REQUIREMENTS** (Continued)

- B. <u>Performance Requirements</u> (Continued)
 - 2. <u>Maximum Speed Limiting</u>

Each car shall be equipped with Portable Test Unit (PTU)-adjustable maximum speed-limiting circuitry. Initial setting of the maximum speed-limiting function shall be fifty-five miles per hour (55 mph).

3. <u>Minimum Speed Limiting</u>

Each car shall be equipped with PTU-adjustable minimum speed-limiting circuitry for operation through the car wash and for other similar purposes. The low speed limiting mode shall be in effect when the Master Controller is in the "MINIMUM POWER" position. Initial setting of the minimum speed-limiting function shall be three miles per hour (3 mph).

4. Acceleration and Deceleration Rates

The rates shown below are instantaneous values and shall be continuously variable from maximum to minimum power and from minimum to maximum service brake. Maximum and minimum rates shall be PTU-adjustable.

Rates shown below shall apply to a dry, level tangent track and shall include all train resistance.

MASTER CONTROLLER POSITION	ACCELERATION/ DECELERATION RATES	COMMENTS
"MAXIMUM POWER"	2.8 ±0.1 mphps	During the constant rate portion of the performance curve.
"MINIMUM POWER"	0.3 mphps	PTU-adjustable from 0.3 mphps to 1.0 mphps.
"COAST"		Free wheeling.
"MINIMUM SERVICE BRAKE"	0.5 mphps	Electric Brake: PTU-adjustable from 0.3 mphps to 1.0 mphps.
	0.5 - 1.0 mphps	Friction Brake
"MAXIMUM SERVICE BRAKE"	2.8 ±0.1 mphps	From maximum speed to electric brake fade out then supplement by friction brakes to stop.
"EMERGENCY BRAKE"	2.8 ±0.1 mphps plus 2.5 ±0.1 mphps plus Track Brake	Electric Brake Friction Brake

Rolling resistance shall not exceed 0.3 mphps on each car measured individually.

10.02 OPERATING CONDITIONS AND PERFORMANCE REQUIREMENTS (Continued)

- B. <u>Performance Requirements</u> (Continued)
 - 5. <u>Jerk Limit</u>

The rate of change of acceleration and deceleration shall be limited under all conditions other than emergency braking. The rate of change shall be PTU-adjustable between 1.0 mphpsps and 3.0 mphpsps. The initially setting shall be 2.0 mphpsps.

6. <u>Characteristic Curves and Simulations</u>

The Contractor shall submit, pre-bid, the following information to demonstrate an understanding of the operating and performance requirements of this Section and the duty cycles specified in Section 2.02, D:

- a. Speed, power and acceleration/deceleration vs. time curves.
- b. Line current, motor current and voltage vs. speed curves.
- c. Tractive/braking effort per car, train resistance and acceleration/ deceleration vs. speed curves.
- d. Duty cycle runs summary data showing motor RMS current, average speed and time.
- e. All performance characteristics shall be calculated for a light car with a 1,500 pound load on level, tangent track and new wheels.

10.02 ACCELERATION AND BRAKING CONTROLS

- A. <u>General</u>
 - 1. The power electronics and controls for the solid state traction inverter unit(s) shall be housed in the Propulsion Control Unit(s) (PCU).
 - 2. All Propulsion Control Unit enclosures and their internal arrangements shall be identical.
 - 3. The Propulsion Control Units may share common control electronics, protective devices, input devices, and line filter or its elements. Shared components shall not be included in the Propulsion Control Unit enclosures.

10.03 ACCELERATION AND BRAKING CONTROLS (Continued)

- A. <u>General</u> (Continued)
 - 4. Any equipment subject to damage from water, snow, ice, dirt, or heat shall be adequately protected.
 - 5. All undercar equipment enclosures shall meet the requirements of Section 9.01, L, and Section 12.09.
 - 6. The operating voltage range of all devices required by this Section shall be as described in Section 9.01, A, B, and C.

B. <u>Control Electronics</u>

- 1. Control electronics shall be microprocessor based and shall comply with Section 9.15, for microprocessor application and standards. Control programs shall be stored in non-volatile memory.
- 2. The propulsion control electronics shall be arranged in two (2) distinct levels:
 - a. An acceleration and braking control unit for each car (a car control unit).
 - b. A traction inverter/braking chopper control unit for each Propulsion Control Unit.
- 3. The control electronics shall receive commands from the Propulsion Control Network (PCN) as specified in Section 15.07, and interpret these commands for control of the traction inverters/braking choppers and friction brakes.
- 4. Train direction change shall be provided by phase rotation reversal. Reversal logic shall respond to trainline direction commands generated by the Master Controller reverser key in the active cab as specified in Section 10.08, C.
- 5. The Propulsion System shall self-protect from train direction changes while the train is in motion.
- 6. The control electronics shall continuously monitor critical parameters of the Propulsion System operation and detect and shall protect the equipment from incorrect or potentially damaging or hazardous conditions.

10.03 ACCELERATION AND BRAKING CONTROLS (Continued)

- B. <u>Control Electronics</u> (Continued)
 - 7. The control electronics shall perform diagnostic and fault monitoring for the Propulsion System, see Section 10.10. The control electronics shall communicate with the Control and Monitoring Network (CMN) as specified in Section 15.06, for the exchange of data.
 - 8. The control electronics shall include wheel spin-slide protection and dead rail detection functions, see Sections 10.03, I, and 10.03, J.
 - 9. The control electronics shall include an electronic odometer function with permanent non-volatile memory. The odometer shall be reset/disabled by the PTU only at the highest customer security level. The control electronics shall communicate the total number of miles accumulated by the car via the CMN to the Train Operator's Touch Screen (TOTS), specified in Section 15.09. The TOTS shall display car mileage to the nearest mile and shall have a minimum of eight (8) digits. The actual car mileage shall be PTU readable.

The control electronics shall also include an Energy Consumption meter function. This meter shall communicate via the CMN to the TOTS the total car energy consumed, including auxiliary power; total energy not regenerated and total energy regenerated. The meters shall be readable and resettable via the PTU.

- 10. Electronic control equipment shall be segregated from power equipment except for power semiconductor drive circuits.
- 11. Control circuitry and control voltage sources shall be optically or transformer isolated from power circuitry and high voltage sources.
- 12. The control electronics shall be securely mounted in environmentally protected enclosures with adequate provisions for maintainability and safety. Special attention shall be given to the design to provide easy access to, and installation and removal of control apparatus.

10.03 ACCELERATION AND BRAKING CONTROLS (Continued)

- C. <u>Propulsion Control Units</u>
 - 1. The PCU shall have two (2) major elements:
 - a. <u>The Traction Inverter</u>

The traction inverter(s) shall convert the 600 Vdc into a variablevoltage, variable-frequency, 3 phase ac voltage, and shall provide this ac voltage to the traction motors. Torque developed by the traction motors shall be controlled by varying the output frequency and voltage.

b. <u>The Braking Chopper</u>

The braking chopper shall modulate the electrical energy delivered to the braking resistors. During partial line receptivity, the braking choppers shall direct the excess energy to the braking resistors. The braking chopper shall operate to maximize the energy returned to the line.

- 2. Each PCU shall be capable of being cut out.
 - a. The PCU cut out shall be automatic for repeated system faults or manual by a cut out switch located in the operator's cab.
 - b. Cut out of one PCU shall not affect the operation of the car or any other system.
 - c. When a PCU is cut out, the motors for that PCU shall free wheel in either direction.
 - d. Cut out shall be annunciated on the TOTS in the active cab, see Section 10.09.
- 3. PCU enclosures shall be force-ventilated by blowers which take in air above the floor of the car, as specified in Section 10.06. Blowers shall be mounted on vibration absorbers. The installation shall be reviewed by the Engineer. High voltage elements shall be isolated from the cooling air stream.
- 4. IGBTs shall operate at no more than seventy percent (70%) of their breakdown capabilities.
- 5. IGBTs shall have a minimum design life of twenty years (20 yrs) under the duty cycles specified in Section 2.02, and performance specified herein.
- 6. The PCU shall be capable of operating continuously over the input voltage operating parameters, specified in Section 9.01, B.

10.03 ACCELERATION AND BRAKING CONTROLS (Continued)

- C. <u>Propulsion Control Units</u> (Continued)
 - 7. The PCU enclosures shall meet the requirements of Section 9.01, L, and Section 12.09, A and B, except that they may be carbon steel in lieu of stainless steel. All low voltage wires shall be plug connected. Plugs shall be as specified in Section 9.02, J, unless otherwise agreed to by the Engineer.

D. Braking Resistors

- 1. Braking resistors shall be sized for continuous operation under the duty cycles specified in Section 2.02, D, and the brake rates specified in Section 10.02, B, 4, without any dependency on regenerative braking.
- 2. Type, configuration and arrangement of the braking resistors shall be selected and designed to meet the EMI/EMC requirements of Section 9.19.
- 3. The braking resistors shall be mounted under the car.
- 4. The braking resistors shall be convection cooled.
- 5. Heat from the braking resistors shall be so directed to prevent damage to adjacent equipment and cabling. Heat shields shall be provided, as required, to protect the car floor, air duct insulation, wiring and other equipment from resistor heat.
- 6. The braking resistors shall be protected from wheel wash.
- 7. The braking resistors shall be insulated from their frames and the frame insulated from the carbody. Each level of insulation shall be rated for no less than 2000 Volts unless agreed to by the Engineer.
- 8. Resistor grid insulators shall be of a design, material and arrangement, which are easily cleanable.
- E. Input Filter
 - 1. <u>General</u>

The PCUs shall be protected by input filter(s). The input filters shall be LC circuits with the resonant frequency such that the EMI/EMC requirements of Section 9.19 are met.

10.03 ACCELERATION AND BRAKING CONTROLS (Continued)

- E. <u>Input Filter</u> (Continued)
 - 2. <u>Filter Capacitors</u>
 - a. Filter capacitors shall have a fifteen year (15 yr) minimum design life.
 - b. Input filter capacitors shall be provided with a charging contactor and charging resistor that shall limit charging current and input filter voltage overshoot to values that will not cause failure or deterioration of any car components or nuisance activation of carborne or wayside protective devices. The charging curve, current vs. time shall be submitted, pre-bid, for review by the Engineer.
 - c. Controlled discharge circuitry shall be provided to automatically discharge the capacitors to less than 50 V in less than ten seconds (10 sec) when any hinged cover of the enclosures containing high voltage capacitors or equipment connected to them is opened. The braking chopper may be used for this purpose.
 - d. The capacitors shall have permanent parallel resistors which shall discharge the capacitors to below 50 Vdc within twenty minutes (20 min), independently of the controlled discharge circuitry.
 - e. All doors and covers of the enclosures containing high voltage capacitors or equipment connected to them shall have labels warning of the hazard from charged capacitors. Covers shall have a rugged combined interlock-bypass switch to prevent operation of the equipment and discharge the filter capacitors when any cover is open. The switches shall have a bypass feature when pulled out to allow the equipment to operate normally. Closing the cover shall reset the switch. The switches shall be reviewed by the Engineer.

3. Filter Inductor

- a. The filter inductor shall be mounted under the car and shall be adequately shielded.
- b. The filter inductor shall be mounted on insulators.
- c. The filter inductor shall be adequately protected from wheel wash.
- d. The filter inductor coils shall be treated to be impervious to moisture, as specified in Section 9.01, M.
- F. <u>High Speed Circuit Breaker</u>
 - 1. The Propulsion System shall be protected by a High Speed Circuit Breaker (HSCB).

10.03 ACCELERATION AND BRAKING CONTROLS (Continued)

- F. <u>High Speed Circuit Breaker</u> (Continued)
 - 2. Incoming 600 Vdc power to the Propulsion System and outgoing regenerated power shall pass through the HSCB.
 - 3. The HSCB shall be sized to handle its continuously rated current and to interrupt the maximum fault current without damage to itself or surrounding equipment.
 - 4. The HSCB shall be mounted in an adequately ventilated, insulated compartment, and shall have secondary insulation. The arc chute for the HSCB shall be specifically designed to contain the arc and vent outside the ventilated enclosure.
 - 5. The cover(s) for the HSCB enclosure shall be easily removable without disturbing the arc chute. Cables entering the HSCB enclosure shall be carried in watertight fittings. No direct air path shall exist from the HSCB enclosure to any other enclosure.
 - 6. Low voltage interlocks shall be completely isolated and insulated from 600 Vdc circuits.
- G. <u>Line Contactor(s)</u>
 - 1. A line contactor shall be provided for each PCU to connect and disconnect it from the primary power supply during normal operations and isolate a failed PCU.
 - 2. The line contactor's capability shall be coordinated with HSCB capability.
 - 3. The line contactor shall be capable of interrupting current in both directions.
 - 4. The arc chute(s) for the line contactor(s) shall be designed to contain the arc and vent outside the enclosure.
- H. <u>Electric Braking</u>
 - 1. Electric brake shall be rheostatic and regenerative with priority being given to regeneration.
 - 2. Electric brake rates shall be continuously variable as specified in Section 10.02, B, 4.
 - 3. The electric brake control system shall continuously monitor line voltage on each inverter cycle, shall supply to the line the maximum amount of energy possible, and shall divert excess energy to the braking resistors.

10.03 ACCELERATION AND BRAKING CONTROLS (Continued)

- H. <u>Electric Braking</u> (Continued)
 - 4. When regeneration is not possible or is disabled (by PTU), electric brake energy shall be dissipated by the braking resistors as specified.
 - 5. Maximum line voltage during regeneration shall be PTU-adjustable from 650 Vdc to 800 Vdc. Initial setting shall be 750 Vdc at the third rail.
 - 6. Failure of electric braking shall result in the friction brake system automatically providing the requested braking effort as specified in Section 10.02, B, 4.
 - 7. All performance requirements of regenerative braking shall be achieved with a third rail voltage of 650 Vdc.
- I. Rail Gap and Dead Rail Protection
 - 1. A rail gap/dead rail detector shall be provided on each car. The detector circuit shall detect rail gaps and sudden loss of third rail power.
 - 2. The detector shall prevent current flow from the car into a section of dead third rail. Current flow shall be interrupted by disconnecting each PCU from the car current collectors. See Section 9.01, P.
 - 3. The detector shall incorporate a continuous or regular self test function to ensure its integrity.
- J. <u>Wheel Spin and Slide Protection</u>
 - 1. The Propulsion System shall incorporate a spin-slide detection and correction function for protection against wheel spins in acceleration and against wheel slides in braking.
 - 2. The spin-slide function shall take maximum advantage of the inherent slip correction characteristics of the ac drive to minimize spin-slide protection intervention.
 - 3. Tractive and electric braking effort during wheel spin/slide correction shall be modulated on a per inverter basis. Slide protection for friction brakes shall be on a per-car basis.
 - 4. Random and synchronous wheel spins and slides shall be detected at all speeds in acceleration and braking.
 - 5. The wheel spin-slide function shall operate with all wheel sizes, new through condemning, and shall periodically self-calibrate wheel speed to compensate for wheel wear.

10.03 ACCELERATION AND BRAKING CONTROLS (Continued)

- J. <u>Wheel Spin and Slide Protection</u> (Continued)
 - 6. At a coefficient of adhesion of 0.05 or greater, the efficiency of the wheel slip system shall be at least 80 percent (80%) in acceleration and braking over the speed range between maximum speed and 3 mph.

The wheel slide efficiency shall be defined as the ratio of the actual braking rate to the theoretical braking rate from brake entry speed to a lower speed. The spin efficiency shall be defined as the ratio of the actual accelerating rate to the theoretical accelerating rate, from an initial speed to a higher speed. The theoretical distance rate is that which is obtained by continuously utilizing the available track adhesion. Efficiency shall be calculated over the slip-affected portions of operation.

- 7. Upon detection of a spin the Propulsion System shall quickly, without jerk limit, reduce the tractive effort. Power to the motors shall not be reduced excessively, but sufficiently so that the subsequent increase in tractive effort will be met by increasing adhesion in order to prevent damage to the wheels. As soon as spin is corrected, the tractive effort shall be increased at a rate consistent with achieving the maximum performance with jerk limit.
- 8. Upon detection of an incipient slide (slip) the Propulsion System shall quickly, without jerk limit, reduce the braking effort and apply the track brakes. The braking effort shall not be reduced excessively, but sufficiently so that subsequent increase in braking effort will be met by increasing adhesion in order to prevent slides and resulting damage to the wheels and to minimize stopping distance. As soon as the condition is corrected the track brakes shall be de-energized and the electric braking effort shall be increased at a rate consistent with achieving the maximum performance without exceeding the specified jerk limit. The track brake function during wheel slip-slide correction shall be PTU-selectable.

The wheel slide function shall be user-selectable. Selection shall be "CONTINUOUS" and "TIME-OUT". Time-out shall be on a per detection/correction basis and adjustment shall be between zero and twenty seconds (0-20 sec) and shall be initially set at five seconds (5 sec). After time out, full requested braking effort shall be applied. The time period shall be adjustable by PTU. Final settings shall be determined on the prototype cars.

- 9. Activation of the wheel spin-slide function during emergency brake applications shall be PTU-selectable and shall initially be set "ON".
- 10. Failure of the wheel spin-slide system shall not prevent cars from responding to commanded tractive and braking efforts.

10.03 ACCELERATION AND BRAKING CONTROLS (Continued)

K. <u>Cab Signal Interface</u>

1. <u>General</u>

The Propulsion System shall interface with the cab signal system as specified in Section 13.03, Section 13.05 and Section 13.23.

2. Coast Command

The Propulsion System shall interface with the ATO Sub-System of the ATC system to receive a coast command signal in coordination with the allowable speed. See Section 13.23 for details. The coast command function and its implementation shall be reviewed by the Engineer.

3. Overspeed Penalty Brake

The Propulsion System shall apply maximum service brake rate when the cab signal system requests a penalty brake application as specified in Section 13.03. Overspeed penalty brake application shall be accomplished by de-energizing the Dead Man Relay or its equivalent.

L. <u>Door Control Interface</u>

The Propulsion System shall interface with the door control system, as specified in Section 6.05, A, to inhibit propulsion while any side door in a train is open or unlocked.

M. <u>Smart Card Interface</u>

The Propulsion System shall be inhibited until receipt of a valid Smart Card login. This feature shall be PTU-selectable. See also Section 15.08.

10.04 KNIFE SWITCH

- A. The main knife switch shall be of the single-pole, double-throw type.
- B. In the normal operating position, the 600 Vdc supply shall be connected to the main motor circuits and to the auxiliary circuits, including 600 Vdc trainline, through separate contacts. In the non-operating position, the switch shall connect the auxiliary circuits to a 5/8-inch diameter split test plug onto which a 600 Vdc jumper may be connected to permit operation of the auxiliaries without 600 Vdc on the third rail shoes.

10.04 KNIFE SWITCH (Continued)

- C. The switch shall be equipped with quick break blades as required. A fuse holder and fuse shall be provided in this switch to protect the wire to the auxiliary circuits. It shall not be possible to close the cover on the switch if it is in the non-operating position. The switch box shall be adequately protected from wheel wash to protect the switch in the event the car is operated with the switch box cover open. The switch shall be mounted in such a manner that the handle can be reached from either a pit or from along side the car. The test plug shall be arranged for use from along side the car.
- D. The main knife switch shall be mounted in a fiberglass box with a cover equipped with compression spring draw latches. The switch and its box shall be supplied by the manufacturer of the Propulsion System.

10.03 TRACTION MOTORS

- A. <u>General</u>
 - 1. Each axle shall be individually driven by a 3 phase asynchronous motor of the squirrel-cage type of appropriate rating for the performance and operating conditions specified in Section 10.02, and the duty cycles specified in Section 2.02.
 - The traction motor shall be designed in accordance with IEC Standard 349-2, Electric Traction-Rotating Electrical Machines for Rail and Road Vehicles-Part 2: Electronic Converter-Fed Alternating Current Motors. The motor shall have a safe speed that meets the requirements of Section 6.3 of IEC 349-2.
 - 3. All traction motors shall be identical and fully interchangeable.
 - 4. The traction motor shall be force-ventilated. Cooling air shall be provided by blowers which take in air near the roof of the car, as specified in Section 10.06. Traction motors shall comply with noise requirements of Section 16.02.
 - 5. The traction motor shall be designed to accommodate wheel diameter difference requirements of Section 10.01, C, over the full range of wheel wear.
- B. <u>Details</u>
 - 1. The maximum safe motor speed shall not be less than 6,000 rpm.
 - 2. Rotors and cooling fans shall be dynamically balanced so that the maximum unbalance of a rotor or a rotor/cooling fan assembly shall be within 0.5-inch-ounce. Balancing shall be with permanently attached ferrous metal correction weights.

10.05 TRACTION MOTORS (Continued)

- B. <u>Details</u> (Continued)
 - 3. The traction motor coupling flange, if shrunk in place, shall be provided with locking washer and hex head nut, unless otherwise agreed to by the Engineer.
 - 4. The motor shall operate within the Class H temperature range designated in Table 1 of IEEE Std. 11-2000 with Class C winding insulation. Motor temperature may increase to the thermal class of the insulation under the conditions specified in Sections 2.02, D, 3, 4 and 5. Motor over-temperature protection shall be provided. Sensors embedded in the motor winding shall not be used.
 - 5. The completed motor frame with insulated stator coils shall be vacuumpressure impregnated (VPI). The varnish shall be compatible with CTA's Sterling Y-770 polyester varnish.
 - 6. Motors with stator core stacks that are not completely shielded shall have no discontinuities in the stator flux flow.
 - 7. Motor bearings shall have grease fittings so located as to allow convenient servicing from below with the motor mounted in the truck.
 - 8. Motor bearings shall be insulated to prevent current flow through them.
 - 9. Motor shall be equipped with ground brush(es) on the shaft to prevent voltage build up and discharge through the bearings. The brush(es) and installation shall be reviewed by the Engineer.
 - 10. Motor disconnects shall be located such that they shall be easy to disconnect with the motor in the truck and the truck under the car and shall also be securely retained. The arrangement of cables, cleats and disconnects shall be demonstrated on the truck mock-up.
 - 11. The motor interconnect arrangement with the PCU shall be reviewed by the Engineer and demonstrated on the underfloor mock-up.
 - 12. The motor-gearbox coupling shall be a grease lubricated, split type. Particular care must be taken to insure that lip and "O" ring seals are protected during motor installation to prevent damage and subsequent grease leakage. The coupling design, including seals, shall be reviewed by the Engineer.

10.04 PROPULSION SYSTEM VENTILATION

- A. Traction motors shall be ventilated by blowers which take in air near the roof of the car. One (1) blower shall be provided for each truck to cool two (2) traction motors. Output air from these blowers may be shared to supply cooling air to PCUs or a separate blower may be provided for each PCU taking air from above the floor.
- B. The air ducts in the sides of the car shall be totally segregated from the door pockets and sealed to prevent drawing air from the door pocket or car interior. The widened area adjacent to the door pockets and the narrowed windows are shown on CTA Drawing R-1-606, Page DR-1. Air ducts shall have appropriate clean-out openings.
- C. The blowers shall be supported on vibration absorbing mounts and shall be easily accessible for servicing. Particular attention must be given to the design and assembly of the blower installation to insure the mounts are evenly loaded to prevent noise and vibration from developing. The installation shall be reviewed by the Engineer.
- D. Blower motors shall be 3 phase 230 Vac, heavy duty, TEFC, powered by the car's 230 Vac supply through circuit breakers P51 and P52. Additional circuit breakers shall be provided, as required, see Section 9.01, J, and Section 12.11.
- E. In the event of a ventilation failure, power shall be removed from the affected propulsion system; however, one more stop with electric brakes shall be possible. Upon the request for power, a Blue Light trouble indication shall occur and require the affected propulsion system(s) to be cut out.
- F. The carbody to traction motor flexible ducts shall incorporate mechanical means to prevent collapse when fully expanded or pulled off axis. The ducts shall be impervious to the heat, dirt, snow and other elements found under the cars and shall be reviewed by the Engineer.
- G. The ventilation ducting arrangement shall be reviewed by the Engineer.

10.05 FRICTION BRAKES

- A. <u>Track Brakes</u>
 - 1. Four (4) electromagnetic track brakes reviewed by the Engineer shall be provided on each car. Each truck shall be equipped with two (2) electric track brakes connected in parallel. Track brakes shall be controlled by a suitable push button switch, with a solid red plastic push button, mounted on the operator's console. The button shall be mounted on a 0.125-inch thick stainless steel plate with engraved and filled letters reading "TRACK BRAKE". Track brakes shall also be energized when the Master Controller is in the "EMERGENCY BRAKE" position. Track brakes shall be controlled by Trainwire #14 so all track brakes throughout the train are energized, except that the slide detection and correction system applies the track brakes on a per-car basis, see Section 10.03, J.

10.07 FRICTION BRAKES (Continued)

- A. <u>Track Brakes</u> (Continued)
 - 2. Each car shall have a solid state track brake contactor or contactors with suitable circuit protection. Each truck set of brakes shall have a separate circuit breaker. The circuit breakers shall be mounted in the car circuit breaker panel in the operator's cab. The track brakes are powered from the car's low voltage power supply through circuit breakers P15 "TRUCK NO. 1 TRACK BRAKES" and P16 "TRUCK NO. 2 TRACK BRAKES".
 - 3. The track brake suspension shall provide vertical adjustment to maintain rail clearance and shall have longitudinal and transverse stops with replaceable wear plates.
 - 4. Track brakes shall be interchangeable with those on CTA's 5000 Series cars. The vertical suspension arrangement shall incorporate a rubber bushing at the bottom and shall be as shown on CTA Drawing R-1-1112, Page DR-21.

B. Friction Brakes

- 1. Four (4) spring-applied, hydraulic released disc brakes per car shall be provided. The discs shall be mounted on each gearbox assembly. The disc brake system and its details shall be reviewed by the Engineer.
- 2. Friction brakes shall be fail-safe, requiring power to release.
- 3. Friction brakes rates shall be as called for in Section 10.02, B, 4, from an entry speed of thirty miles per hour (30 mph).
- 4. An electric friction brake release circuit shall be provided to release the friction brakes while the Propulsion System on the car is cut out and the emergency relay is energized, see also Section 10.09, J.
- 5. A heavy duty manual friction brake release mechanism shall be provided to release each friction brake from both sides of the car. The mechanism shall permit quick release or re-application of the brake with a force of forty-five pounds (45 lb) or less. The handles of the manual release mechanism shall be permanently colored bright yellow. A scheme similar to that on CTA's 5000 or 3200 Series cars shall be provided to visually indicate whether a friction brake is cut in or cut out by looking at the manual release handle. The manual release mechanism and visual indicator shall be reviewed by the Engineer and demonstrated on the truck mock-up.
- 6. Heat generated during braking shall not cause damage to or shorten the life of seals and gaskets on the gearbox or caliper.
- 7. Discs shall be balanced to within 0.5-inch-ounce. Correction shall be made by means of removing metal from the outer periphery of the disc by grinding.

10.07 FRICTION BRAKES (Continued)

- B. <u>Friction Brakes</u> (Continued)
 - 8. The brake caliper shall have an automatic slack adjuster to ensure proper operation without manual adjustment as the lining wears. Provisions shall be included to limit slack adjuster travel to prevent internal locking or jamming if both brake pad assemblies are missing.
 - 9. The brake shall be mounted to the gearbox with at least four (4) bolts with safety wires. Resilient mounting shall be incorporated in the design of the operating mechanism to isolate it from the high levels of shock and vibration found in the gearbox axle assembly.
 - 10. Each brake shall have switches or other means to indicate when the brake is applied or cut out. They shall be wired to operate the yellow indicating lights as described in Section 10.07, C, 5.
 - 11. Friction pads shall be interchangeable mechanically and functionally with those on CTA's 5000 Series cars, unless otherwise agreed to by the Engineer. The caliper mounting bracket shall be cast iron or steel while the caliper body shall be cast aluminum.
 - 12. The hydraulic power to release the friction brakes shall be developed by a continuously running pump powered from the car's low voltage system through circuit breaker P5 which shall also power the friction brake release circuits. The pump motor shall be of the brushless dc type. The pressure shall be regulated by an electric solenoid valve within the unit. The unit shall incorporate filters to ensure that oil leaving the pump contains no foreign material that is injurious to the system. A high pressure filter shall be located between the pump output and the solenoid valve.

This hydraulic power unit shall, if possible, be identical in mounting and shall have similarly located connection points to the unit used on CTA's 3200 Series cars and use as many of the same consumable parts as possible.

- 13. The system shall incorporate an isolation valve that shall shut off oil flow to each end of the car individually if a line is ruptured or broken. The valve shall be located adjacent to the hydraulic power unit or incorporated into the unit to protect the maximum length of line. The isolation valve, if separate from the power unit, shall connect to the hydraulic power unit through a quick disconnect, the same as used on CTA's 3200 Series cars.
- 14. The hydraulic fluid used in the brake systems shall be reviewed by the Engineer, as shall the cleanliness requirements of the oil in the system needed to maintain system operation. The fluid shall be the same Shell Arctic Tellus 32 as used on CTA's 5000 Series cars.

10.07 FRICTION BRAKES (Continued)

- B. <u>Friction Brakes</u> (Continued)
 - 15. Provisions shall be provided at each caliper to bleed the lines following caliper or pump changes. Self-sealing disconnects may, with concurrence of the Engineer, be provided at each caliper to minimize the amount of bleeding needed. An inline filter shall be installed at each caliper inlet.
 - 16. Caliper and hydraulic power unit electrical connections shall be made through bayonet connectors as specified in Section 9.02, J.
 - 17. Truck-carried hydraulic lines shall be routed away from the current collector area and carbody lines shall be routed as far from 600 Vdc electric cables and connectors as possible. Truck-carried hydraulic lines shall be jacketed with silicone rubber hose. Carbody lines shall be similarly jacketed in areas deemed necessary by the Engineer during the underfloor mock-up review.
 - 18. A hydraulic pressure test point shall be provided at the hydraulic power unit to permit checking the output pressure. The pressure check attachment shall incorporate a hydraulic quick disconnect, the same as on CTA's 3200 Series cars.
 - 19. A hydraulic quick disconnect shall be provided at each truck. The hydraulic truck quick disconnect shall be mounted on the carbody. All hydraulic quick disconnects shall be reviewed by the Engineer.
 - 20. The hose from the brake caliper to the truck frame shall have a flush face/dry break quick disconnect at each end. The disconnects shall be compatible and interchangeable with Staubli N007-305-07 and N007-304-07.
- C. Brake Control
 - 1. Friction brake rates shall be continuously variable as specified in Section 10.02 B, 4, and shall be controlled by the Propulsion System. The friction only brake rates with the Master Controller in the "MINIMUM SERVICE BRAKE" and "MAXIMUM SERVICE BRAKE" positions shall be measured from an entry speed of thirty miles per hour (30 mph).
 - 2. Normal service stops shall be made with electric brake which shall maintain the rate to approximately three miles per hour (3 mph). As the electric brake fades, the friction brake shall be smoothly blended in to complete the stop and hold the train. The blending shall be controlled by the Propulsion System and the characteristics shall be PTU-adjustable. There shall be a "soft stop" feature to reduce jerk as the train stops. The exact settings shall be determined on the prototype cars.
 - 3. In the event of a failure of electric brakes on one (1) truck, friction brakes shall operate as if electric brakes are fully functional.

10.07 FRICTION BRAKES (Continued)

- C. <u>Brake Control</u> (Continued)
 - 4. In the event of a complete electric brake failure on a car, friction brakes shall automatically apply at the same rate as called for by the Master Controller and maintain the rate to a complete stop.
 - 5. Operation of the friction brakes shall be indicated by the brake indicating lights on the Operator's Indicator Panel and in the three (3)-light assembly adjacent to the No. 3 and No. 4 side doors outside the car and on a per-car basis, via the CMN, on the TOTS in the active cab.
 - 6. The lights shall light when any Master Controller in a train is turned on. The lights outside a car shall light when any brake on that car is applied or manually cut out. If a brake is cut out, the lights outside the car shall remain lit as long as a Master Controller is turned on.
 - 7. The light on the Operator's Indicator Panel shall light when any brake on a train is applied, but shall not light when a brake is manually cut out.

10.07 FRICTION BRAKES (Continued)

- D. <u>Emergency Relay Circuit</u>
 - 1. An emergency relay loop circuit shall be provided in each two-car unit and by extension in a train of any length. An emergency brake application shall take place in the event of any opening of the emergency relay circuit such as:
 - Train separation.
 - Opening of track trip switch.
 - Opening of Passengers' or Operator's Emergency Switch.
 - Placing Master Controller handle in "EMERGENCY BRAKE" position.
 - Opening due to broken wires.
 - 2. An opening of the emergency relay circuit shall cut off traction power and cause a brake application consisting of maximum full service electric brake rate plus 2.5 mphps friction brake rate. If full electric brake is not available, for any reason, the friction brake rate will be the maximum full service rate.
 - 3. There shall be a Passengers' Emergency Switch with spring return reviewed by the Engineer located in each car at the No. 2 end in a location reviewed by the Engineer. The operating handle shall be equipped with a CTA standard red ball, CTA Drawing No. E-1-503, Page DR-4.
 - 4. There shall be an Operator's Emergency Switch with spring return reviewed by the Engineer located in each operator's cab in a location reviewed by the Engineer and demonstrated in the cab mock-up. The operating cord of transparent red vinyl with wire center shall be equipped with a CTA standard red ball, CTA Drawing No. E-1-503, Page DR-4.
 - 5. There shall be a Track Trip Switch with spring return mounted on the front left corner of each No. 1 truck. See Section 11.03, I, for details.

10.08 MASTER CONTROLLER

- A. <u>General</u>
 - 1. A Master Controller shall be provided in each operator's cab. The Master Controller shall be supplied as a single integrated unit. Connection to car wiring shall utilize connector(s), as specified Section 9.02, J.
 - 2. The Master Controller shall interface with the Propulsion Control Network (PCN) as specified in Section 15.07, and shall provide train control commands controlling train tractive effort. Means shall be provided to prevent more than one (1) Master Controller to control the train simultaneously.
 - 3. The top of the Master Controller shall be plainly and permanently marked to indicate the positions of the operating handle. The face shall be smooth, black anodized aluminum with lettering engraved and filled with white plastic or epoxy except for the "MAXIMUM SERVICE BRAKE" position shall be indicated with yellow.
 - 4. If the Master Controller has a removable top cover or mask, it shall be possible to remove the mask without removing any cab trim or equipment. It shall also be designed to prevent any object from entering and jamming the Master Controller.
 - 5. If escutcheon plates are used, they shall be 0.125-inch thick stainless steel with engraved and filled numbers and letters. They shall be free of any sharp edges.
 - 6. Any objects, which may enter the operating handle or reverser key slots, shall safely fall clear of the operating mechanism without jamming the Master Controller.
 - 7. The Master Controller and its housing shall be reviewed by the Engineer and demonstrated in the cab mock-up.
- B. <u>Operating Handle</u>
 - 1. The Master Controller shall control both acceleration and braking with a single handle. The operating handle shall be equipped with a "DEAD MAN" feature which will shut off power and apply maximum service brake rate when released in any operating position except "EMERGENCY". After a "DEAD MAN" brake application or an emergency brake application, the controller handle must be moved to the "MAXIMUM SERVICE BRAKE" position to reset the brakes and restore normal operation.

10.08 MASTER CONTROLLER (Continued)

- B. <u>Operating Handle</u> (Continued)
 - 2. The Master Controller operating handle shall be designed and positioned for left-hand or right-hand operation with equal comfort. The operating handle shall move linearly forward and rearward. Power positions shall be activated by a forward motion of the controller operating handle, with progressively increasing acceleration and speed. The "COAST" position shall be in the middle between the "POWER" and "BRAKE" positions. Moving the handle rearward from the middle position shall command braking with progressively increasing rates. In the rear most position the emergency brake shall be applied.
 - 3. The "DEAD MAN" feature shall be of a twist-type. The twist feature shall not require any awkward or uncomfortable position or motion of the hand when initially grasping the handle. The "DEAD MAN" feature shall be highly resistant to deliberate attempts to defeat its operation.
 - 4. The operating handle design shall minimize strain and fatigue on the operator. The spring force required by detents, see Section 10.08, D, 3, handle length, handle travel between detents, and other operational characteristics shall be demonstrated in the cab mock-up.

C. <u>Reverser Mechanism and Key</u>

- The reverser mechanism shall be operated by CTA's standard reverser key, Westinghouse Air Brake Company's No. A529107, or General Electric 41B556018P1, and shall have three (3) positions, marked "REVERSE", "OFF", and "FORWARD". "FORWARD" shall be the position closest to the windshield. If the operating handle is in the "OFF" position and the Reverser Key is in "OFF", the Master Controller will be turned off and the key may be removed.
- 2. It shall not be possible to remove the reverser key unless the Master Controller is turned off.
- 3. One (1) key shall be provided for each Master Controller and shipped separately to the Engineer. Reverser keys shall be investment cast stainless steel.
- 4. The reverser key slot shall be of such design that it shall not be possible for a key to fall into the controller. The key slot shall be protected by stops to prevent the key handle from damaging/elongating the slot in "FORWARD" or "REVERSE" positions.
- 5. The reverser mechanism shall be easy to operate and shall not bind.

10.08 MASTER CONTROLLER (Continued)

- D. <u>Operating Mechanism</u>
 - 1. The Master Controller operating handle shall have seven (7) positions marked from forward (closest to the windshield) to rear: "MAXIMUM POWER", "MINIMUM POWER", "COAST", "MINIMUM SERVICE BRAKE", "MAXIMUM SERVICE BRAKE", "EMERGENCY BRAKE", and "OFF".
 - 2. The Master Controller shall provide infinitely variable control of initial acceleration rate and tractive effort between the "MINIMUM POWER" and "MAXIMUM POWER" positions and infinitely variable braking rate and braking effort between the "MINIMUM SERVICE BRAKE" and "FULL SERVICE BRAKE" positions. The propulsion system shall produce acceleration and braking effort linearly proportional to the operating handle position.
 - 3. Detents shall be provided in the "OFF", "EMERGENCY BRAKE", and "COAST" positions. It shall require substantial force to overcome the detent for "EMERGENCY BRAKE" to prevent accidental operation when moving the controller handle quickly from power or coast to maximum service brake. The ends of "MAXIMUM POWER", "EMERGENCY BRAKE", and "OFF" positions shall be limited by mechanical stops.
 - 4. It shall be necessary to depress a button on the controller to permit moving the operating handle into the "OFF" position. The button shall have a label attached to the controller reading "OFF POSITION RELEASE". The button need not be flush with the top surface of the Controller and cannot be in a position that obstructs the use of the Controller handle by a right- or left-handed operator.
- E. <u>Switches and Encoders</u>
 - 1. The Master Controller shall use cam operated switches of modular construction to carry out its digital controlling functions and shall be reviewed by the Engineer.
 - 2. Analog functions shall be generated by directly-driven encoder(s).

10.09 BLUE LIGHT TROUBLE INDICATOR SYSTEM

- A. A Blue Light System reviewed by Engineer designed to indicate failures in the Propulsion System and Auxiliary Power Supply System in any car of the train shall be provided. The blue lights shall be located on the Operator's Indicator Panel and on the outside of the car in the four (4) light assemblies adjacent to the No. 3 and No. 4 side doors. The blue lights on the operator's indicator panel shall be lit only when the Master Controller is turned on. The blue lights outside the affected car shall remain lit, having once come on, until reset by repair personnel, except as specified.
- B. An audible alarm bell shall be located in each operator's cab and shall sound when the blue light on the indicator panel is lit. The location and type of bell shall be reviewed by the Engineer and demonstrated in the cab mock-up.
- C. The Control Reset Push Button switch shall be located on the Operator's Indicator Panel, as specified in Section 9.05, E, 7. It shall be functional only when the Master Controller is in the "EMERGENCY BRAKE" position.
- D. The outside blue lights shall be powered from the car's low voltage power supply through P30 "SIGNAL LIGHTS". The cab blue light shall be powered from P3 "POWER CONTROL".
- E. An event display panel as defined in Section 10.10, and reviewed by the Engineer, shall be provided on each car, located in the Propulsion System car control unit. It shall be designed to distinguish the cause of the blue light indication. The panel shall incorporate a switch which when operated shall cancel the outside blue light and reset the displayed event.
- F. In the event of a Propulsion System or Auxiliary Power Supply System fault, the blue light on the Operator's Indicator Panel shall light, the audible alarm shall sound, the outside blue lights on the car with the failed equipment shall light and there shall be an indication of the car number with the failed equipment displayed on the TOTS. Operation of the Control Reset Push Button in the active cab with the Master Controller in the "EMERGENCY BRAKE" position shall acknowledge the fault, turn off the audible alarm, turn off the cab blue light and turn off the outside blue lights (unless the car is cut-out). The TOTS then shall reflect the current status.
- G. The Contractor shall develop a list of the Propulsion System fault events triggering blue light indications. Only major failures or defects in the Propulsion System that restrict the operation of the Propulsion System shall cause a blue light. Faults other than those reviewed and agreed to by the Engineer shall not cause blue light indications. Under no circumstances shall a wheel spin or slide be indicated as a failure on the Blue Light System.
- H. The Contractor shall develop reset and fault isolation actions, as well as hardware and software provisions for their implementation. The Contractor shall impose a limit to the number of resets within a given time period.

10.09 BLUE LIGHT TROUBLE INDICATOR SYSTEM (Continued)

- I. Once the allowable number of resets has been reached and the Master Controller has not been locked up during the time between resets, it shall not be possible to reset again and the failed equipment shall be automatically cut out. The cab blue light shall remain on and the audible alarm shall continue to sound until the failed equipment is cut out. The actions taken shall be displayed on the TOTS. Once the failed equipment is cut out, the cab blue light and the audible alarm shall be shut off, while the outside blue lights shall remain lit, being turned off only by repair personnel.
- J. A rotary control switch as specified in Section 9.05, F, 3, shall be also provided for manual cut out of the car propulsion-braking circuits and control. This switch shall be located in the car circuit breaker panel. A set of contacts on the switch shall electrically release the friction brakes as long as the emergency relay is energized and the car is turned on.

The switch shall have two (2) positions identified with permanent labels as follows from left to right:

- 1. "CUT IN".
- 2. "CUT OUT".

The "CUT OUT" position of the switch shall be displayed on the TOTS.

If the switch is cut out after a trouble indication, it shall provide a permanent outside blue light; if it is cut out without a trouble indication, the outside blue lights will go out if the switch is cut in.

10.10 DIAGNOSTICS

A. The Propulsion System shall include a built-in diagnostic package that shall monitor and report on the operation of the system. This diagnostic package shall require no special skill or knowledge to operate and understand. All aspects of this package shall be reviewed by the Engineer and changes that are found to be needed during the prototype car tests and warranty period shall be made at no cost to CTA.

The diagnostic package shall include a feature that creates a series of data files that store all the real time monitored elements such as voltages and currents, contactor positions, input and output signals, and command and response signals as well as date, time and car number. The files shall be recorded at least once every fifty milliseconds (50 msec), for a period of at least three seconds (3 sec) before, and two seconds (2 sec) after each logged event. At least twenty (20) sets of files, snapshots, shall be saved before overwriting the first one. Every effort shall be made to maximize the number of snapshots that can be stored.

10.10 DIAGNOSTICS (Continued)

- A. (Continued)
 - 1. The system shall have an event display to assist field personnel in identifying the problem devices, card, or sub-system within the system.

The event display shall be an alphanumeric or numeric display, not individual LEDs, with separate scrolling and reset buttons and an indication of microprocessor operation in the form of a blinking LED (heartbeat). A display test function shall be part of the diagnostics accessed through the scroll buttons. The separate reset button shall reset the event display and reset the system inhibits/lockouts.

The display elements shall be as large as possible for easy reading. An explanation of the display readings shall be provided adjacent to the display in a permanent form, reviewed by the Engineer.

The event codes shall be no more than four (4) characters.

The event display and its functioning shall be specifically reviewed by the Engineer.

- 2. The onboard unit shall be able to display at least 999 events recorded by the microprocessor since a previous action.
- B. Events recorded by the microprocessor shall be divided into restrictive and non-restrictive classifications.
 - 1. Restrictive events shall result in inhibiting appropriate functions following a set number of occurrences and shall be communicated to the maintenance screens of the TOTS via the CMN.
 - 2. Non-restrictive events shall only be recorded and shall not inhibit control operation.

The classification of all events and inhibit quantities shall be reviewed by the Engineer.

10.10 DIAGNOSTICS (Continued)

- C. The Contractor shall furnish rugged Portable Test Units (PTUs) as specified in Section 17.04, to access the microprocessor controls beyond the onboard diagnostics. The PTU shall perform the following functions:
 - 1. Fault event display and reset.
 - 2. System inhibit/lockout reset.
 - 3. Manual test of the system and devices.
 - 4. Data memory display of system operation both before and after fault shutdown of the system (snapshots), see Section 10.10, A. In addition, it shall be possible to create snapshots (real time recording of system operation) by setting snapshot parameter levels to trigger a memory function of system operation. These recordings shall be of at least twenty seconds (20 sec) duration. This function shall be reviewed by the Engineer.
 - 5. Real-time monitoring and recording of Propulsion System performance and operation.
 - 6. Download of data from the car to PTU memory/storage for later analysis.
 - 7. Display and adjust Propulsion System performance parameters, fault event parameters and fault lockout parameters that are adjustable, including wheel diameter value used for automatic calibration of the car speed.
 - 8. Download software from PTU to Propulsion System.
 - 9. Display car number, mileage, date and time.
- D. Appropriate levels of security shall be incorporated to prevent unauthorized access to and erasure of various functions and information. The security levels and their contents and the passwords used shall be reviewed by the Engineer.
- E. The Contractor shall provide bench test equipment for use in the main shop to test, adjust and repair individual boards and the entire microprocessor control unit. These shop units shall be complete as specified in Section 9.11.

The Contractor shall furnish instructions/documentation, including Maintenance and Parts Manuals, for all test equipment, as specified in Section 9.11.

F. The PTUs shall plug into test receptacles located in the car control unit adjacent to the display panel and in the operator's cab. See Section 9.05, G. These requirements shall be demonstrated in the cab mock-up.

SECTION 11 TRUCKS

11.01 <u>GENERAL</u>

Each car shall have two (2) four-wheel swiveling trucks with a six-foot, six-inch (6'-6") wheelbase. These trucks shall provide smooth riding at speeds up to at least seventy miles per hour (70 mph), shall be as lightweight as consistent with safety and shall be easy and economical to maintain. The Contractor in selecting the truck design must consider all the dynamic forces acting on the truck in CTA service. The truck design and mounting of all equipment shall not result in vibration of such amplitude, or frequency, that a harmful resonant condition will be created with respect to wheel revolutions, or other rotating components for normal operating speed ranges.

The truck frame shall be of weldment construction. Primary and secondary suspension shall be provided. The truck design shall concentrate on a smooth ride, minimum unsprung weight, maximum equalization and minimum noise and vibration. Equalization shall be accomplished by primary springs and frame deflection or other means accepted by the Engineer. The design shall minimize shock-induced loading on the truck frame mounted components.

All trucks shall be suitable for use under any car and as a No. 1 or No. 2 end truck.

All parts on all trucks shall be interchangeable from truck to truck.

All major structural welding on trucks shall be one-hundred percent (100%) magnaflux inspected.

All elements of the truck design and its appurtenances shall be reviewed by the Engineer.

11.02 DESIGN REQUIREMENTS

A. <u>Truck Capacity</u>

Trucks shall be designed to carry a center plate load based upon car builder estimated car body, equipment and maximum passenger loading. The design centerplate load shall not be less than 30,000 pounds. All truck members shall have the necessary strength and fatigue resistance with ample safety factor to resist all stresses which may develop in service when operated with the design maximum centerplate load at speeds up to seventy miles per hour (70 mph).

SECTION 11 TRUCKS (Continued)

11.02 DESIGN REQUIREMENTS (Continued)

B. <u>Truck Clearance</u>

It is the Contractor's responsibility to provide the necessary clearance between the trucks and the car body and all its parts, and between the trucks and the track and structure under all operating and loading conditions including wheel wear.

The minimum clearance above the top of the running rail (except directly over the rail) shall be two and one-half-inches (2-1/2") with worn wheels, after allowance for full spring deflection. Between the truck and car body, adequate clearance shall be provided for operation, body-truck cabling, and the necessary space for inspection, maintenance, and repair.

C. <u>Wheel Gauge</u>

The wheel gauge shall be AAR Standard for four foot, eight and one-half inches (4'-8-1/2") gauge track.

11.03 DESIGN FEATURES

A. <u>Wheels</u>

Wheels shall be twenty-eight inch (28") diameter rolled steel, Class C fully heattreated and quenched with treads of AAR Standard cylindrical contour.

Wheels shall be machined per CTA Drawing R-4-1053, Page DR-15, and then be shot-peened. One-half-inch (1/2") diameter damping rings shall be provided for all wheels and shall be shipped separately to the Authority as directed by the Engineer.

Wheels shall be mounted on the axles at pressure between fifty (50) and seventy-seven (77) tons. A hydraulograph record shall be made of each wheel pressed on. To be acceptable, the graph obtained shall correspond with those shown as "acceptable, or "ideal" in Association of American Railroads Wheel and Axle Manual, Section G, II, "Wheel Press Practice" Rule 1E1. The original hydraulograph records or certified copies shall become the property of the Authority. Wheels shall be mounted to AAR wheel gauge dimensions and tolerances. Wheels on the same axle shall be within the same tape of the same diameter and the eccentricity or run out of the tread shall not exceed 0.030-inch when measured with the wheels assembled on the axle.

Wheel bore finish and axle wheel seat finish shall be so selected that wheels can be dismounted and re-mounted on the same axle at least three (3) times without press-on force falling below fifty (50) tons. The Contractor shall demonstrate compliance by mounting and demounting a wheel three (3) times. The wheel and axle chosen shall be from among the first ten (10) production wheels and axles. Wheel bore finish shall be reviewed by the Engineer.

SECTION 11 TRUCKS (Continued)

11.03 <u>DESIGN REQUIREMENTS</u> (Continued)

A. <u>Wheels</u> (Continued)

AAR Specification M-107, latest issue, and ASTM A504, latest issue, shall cover the chemical and physical requirements, heat treatment and temperature regulations for Class C heat-treated wheels. ASTM A25, latest issue, shall cover permissible variations in dimensions and all other requirements.

Copies of all certificates from the wheel manufacturer shall be furnished to the Engineer.

The wheel serial numbers shall be in the series 70-XXXX. Wheel numbers shall be stamped on the inside of the rim in numbers 1/2-inch in height.

Wheel weight shall not exceed 530 pounds each.

B. <u>Axles</u>

Axles shall be of hollow tubular design and have a nominal diameter of five inches (5"). They shall be made of AISI-5150 steel, hot rolled, oil quenched and tempered equal to AAR Specification M-101, latest issue. They shall be subcritically quenched after rough machining. Bored in lieu of hot rolled axles may be used with the concurrence of the Engineer. The ends of the axles shall have 60° countersunk lathe centers, drilled 1-11/64" by 3-1/2" deep, tapped 1-1/4" -7, 2B fit, by 2-3/4" deep, and shall be protected by washers and hex head cap screws, $1-1/4" - 7 \times 2"$ long, full thread. These bolts need not be Grade 5. Cold rolled relief grooves shall be provided. All axle finishes shall be reviewed by the Engineer.

The serial numbers shall be in the series 70-XXXX and marking of the axles shall be in accordance with AAR Specifications. Copies of all certificates from the axle manufacturer shall be furnished to the Engineer.

C. Journal Bearings

Journal bearings shall be 5-1/2" x 10" AP anti-friction tapered roller bearings with solid seal wear rings and premium non-vented seals without provision for field lubrication equal to Timken Type HDL and shall be interchangeable with those used on CTA's 5000 & 3200 Series cars. Installation shall require the approval of the bearing manufacturer and shall be reviewed by the Engineer. The bearings shall be adequately protected against the passage of electric current through them.

SECTION 11 TRUCKS (Continued)

11.03 <u>DESIGN REQUIREMENTS</u> (Continued)

D. <u>Ground Brush</u>

A ground brush box, brush(es) and axle ground ring shall be provided on each axle. The ground brush box shall be insulated from all other truck parts. Insulated negative cables shall be provided between the car body, truck and the ground brush box.

The truck frame shall be grounded as required in Section 9.01, I. No traction current shall pass through any truck frame member.

The ground brush ring shall be steel. The ground brush shall be compatible with the ground brush ring and shall be carefully designed and controlled to preclude grooving of the ring.

E. <u>Gear Box Assembly</u>

Each axle shall be equipped with a single piece, quill type gear box assembly. The gear box assembly shall be reviewed by the Engineer. The gear box shall be of the single reduction type providing traction motor mounting parallel to the axle. Gears shall run in an oil bath housing designed to provide adequate lubrication to gears and bearings. Drain plugs shall be magnetic with hexagon recessed heads and shall require review by the Engineer. Filler holes and caps or plugs shall be located for easy access and filling and shall require review by the Engineer. Filler holes and inspection covers shall be coordinated to prevent the overfilling of the gear unit if a side inspection opening is used as a filling hole.

At least two (2) inspection openings shall be provided on each gear box to inspect gears and bearings. Non-metallic gaskets shall be used at all inspection covers and shall be equal to Type 3, Grade P344A as described in ASTM D1170, latest issue. After each gear box is completely assembled, it shall be flushed out with clean oil, refilled and run on a test stand in both directions and checked for noise, gear lift, oil leaks and heating. All seals must be of a type to effectively prevent oil leakage. The seals must have a life equal to other gear box components.

Each gear box shall have provision for two magnetic pick-ups equivalent to Electrocorp part number 725806CBL, as used on CTA's 5000 & 3200 Series cars, reading the bull gear teeth. All gear boxes shall be interchangeable.

Gear box assemblies shall be free of vibration and objectionable noise under any condition of load, speed or temperature.

Brake caliper mounting holes shall preferably be through holes in lieu of tapped holes. If tapped holes are used, the mounting bosses for mounting the brake caliper shall be designed with sufficient wall thickness around the tapped holes to permit repair of stripped holes by the use of threaded repair inserts.
11.03 **DESIGN REQUIREMENTS** (Continued)

F. <u>Truck Frames</u>

The frames shall be accurately machined and have tramming marks above and below each journal bearing housing. The difference between the diagonals of the truck shall not exceed 1/8-inch. Equalization shall provide three-inches (3") of wheel lift. When any wheel is lifted two-inches (2"), its loading shall not increase more than twenty percent (20%). Flat surfaces of approximately twenty-four square inches (24 sq. in.) in area shall be provided on the underside of the journal housings for use in jacking the trucks and a light car body. The pad location shall require review by the Engineer to ensure compatibility with jacking equipment. Provision shall be made for mounting all truck components on all trucks.

Truck frame to bolster connection shall be capable of resisting a vertical load of 50,000 pounds and a horizontal sheer load of 150,000 pounds in all directions.

G. <u>Bolster</u>

The bolster shall be of weldment construction. The center plate and truck retention means shall be of PCC type with kingpin or of an alternate design reviewed by the Engineer during the Pre-Bid meetings. If alternate material is proposed for the center plate it shall be reviewed by the Engineer. If the PCC type of center plate is used, it shall have a removable member as shown on CTA Drawing SKE-70962, Page DR-10, to facilitate setting initial car height and shimming. If an alternate design is used, means shall be provided to easily shim the car height. The means shall be reviewed by the Engineer. All shims shall be stainless steel.

An elastomeric member shall be included in the center bearing to isolate the truck bolster and car body. The bearing shall have an appropriate number of rubber and steel layers with rubber on the top and bottom to allow the truck to negotiate an 85 foot radius curve without tearing the rubber layers or slipping at the top or bottom. The bearing material and design shall be reviewed by the Engineer. If side bearings are used, they shall also be isolated with an elastomeric element to prevent any metal to metal paths from the truck frame to the carbody.

If a PCC style bolster is used, it shall have a bottom wear sleeve. The sleeve shall be cotton phenolic laminate interchangeable with those on CTA's 5000 & 3200 Series cars.

Truck bolster to truck frame and truck bolster to car body connection shall be capable of resisting a vertical load of 50,000 pounds and a horizontal sheer load of 150,000 pounds in all directions.

The longitudinal truck forces between the frame and bolster shall be transmitted by rubber cushioned traction rods.

11.03 <u>DESIGN REQUIREMENTS</u> (Continued)

G. <u>Bolster</u> (Continued)

The bolster shall have vertical stops so that when the car body is lifted off, no forces are carried through the secondary suspension system elements.

Lateral stops shall be incorporated to limit bolster lateral motion relative to the truck frame to nominally 1/2-inch each side of center.

A roll bar shall be provided, if required, to stabilize the bolster and improve the ride quality. The roll bar, its bearings and attachments shall be subjected to testing along with the truck frame and bolster as outlined in Section 11.07, and such additional fatigue testing as necessary to prove its integrity.

H. <u>Suspension System</u>

1. <u>General</u>

The vehicle suspension shall consist of two (2) major elements, passive primary suspension elements and a secondary suspension with height adjustment system. All aspects of the total vehicle suspension system shall be reviewed by the Engineer.

2. <u>Primary Suspension</u>

Passive, rubber primary suspension elements shall be provided adjacent to the journal bearings. These elements shall utilize rubber in compression and shear without relative motion between the rubber and metal parts where they meet.

Particular care must be taken in the design of the primary suspension to provide softness for equalization and curve negotiation without allowing the track trip switch to move statically or dynamically enough to exceed its operating range of $\pm 1/2$ -inches.

11.03 <u>DESIGN REQUIREMENTS</u> (Continued)

H. <u>Suspension System</u> (Continued)

3. <u>Secondary Suspension System</u>

a. <u>General</u>

The secondary suspension system shall be a hydraulic suspension which during normal operation will position the car height in the raised or lowered position as determined from propulsion and door commands. As an alternate the secondary suspension system may be steel coils and rubber elements similar to those on CTA's 3200 Series cars with a hydraulic system to position the carbody in the lowered position as determined from propulsion and door commands. Sensors shall determine the distance from the truck bolster to the truck frame. The system shall also include auxiliary suspension elements, if required, to maintain car floor height in the raised position in the event of a hydraulic system failure.

The system shall provide and maintain the floor height as specified in Section 2.01, L.

The system shall be microprocessor controlled on a per-car basis and provide car-floor height maintenance and adjustment. The system may also provide vertical and horizontal damping and horizontal centering.

b. <u>Operation</u>

The suspension system shall use sensors which read the distance from the bolster to the truck frame with an electronic controller to command changes in the hydraulic pressure to attain the distance to the pre-determined set-point.

The level control shall be activated when the bolster to truck frame distance has changed by $\pm 3/16$ -inch from the set point. The deactivation "dead band" around the set point shall not exceed $\pm 1/16$ -inches.

Automatic level control shall operate as follows:

When the car speed is less than three miles per hour (3 mph) and there are no propulsion commands and the doors are commanded "OPEN", the system shall maintain the lowered car-floor height set point continuously and immediately adjust to keep car-floor height within tolerance of the set points as car load varies.

11.03 <u>DESIGN REQUIREMENTS</u> (Continued)

H. <u>Suspension System</u> (Continued)

3. <u>Secondary Suspension System</u> (Continued)

- b. <u>Operation</u> (Continued)
 - 2) When the car is moving at greater than three miles per hour (3 mph) or when a propulsion command is present the system shall release and allow the secondary suspension to bring the car floor height to the raised position.
 - 3) During the lowering and raising operation, the maximum acceleration shall not exceed 0.2g and the jerk shall not exceed 0.3g/sec measured anywhere on the floor within the car.
 - 4) In case of failure within the hydraulic system, the auxiliary suspension elements shall position car floor height to the raised position.

c. <u>Hydraulic and Mechanical Elements</u>

The hydraulic and mechanical elements shall include, but not be limited to:

- Telescoping suspension legs will support and position the height of the truck bolster. The suspension legs may provide horizontal centering forces and lateral cushioning.
- 2) Accumulators, if required, for each truck with orifice blocks to provide spring rate and damping.
- 3) Hydraulic power unit powered from the 230 Vac, 3-phase system. This unit shall supply the hydraulic pressure for the suspension system and shall include the pump and motor, reservoir, "up" and "down" solenoid valves and system accumulator.
- 4) Cylindrical hydraulic shock absorbers for vertical and lateral damping, if needed. Shock absorber curves shall be submitted to the Engineer for information.

11.03 <u>DESIGN REQUIREMENTS</u> (Continued)

- H. <u>Suspension System</u> (Continued)
 - 3. <u>Secondary Suspension System</u> (Continued)
 - d. <u>Electronic Elements</u>
 - 1) Level/Position Sensors
 - (a) The sensors shall be electronic devices in preference to electro-mechanical devices.
 - (b) The sensor setting shall not drift with changes in temperature, as specified in Section 1.03, B. The sensors shall be adequately protected from all environmental conditions.
 - (c) The sensors shall be set initially by mechanical adjustment with subsequent adjustments for wheel wear/turning and primary suspension settling performed electronically as a parameter in the microprocessor via the Portable Test Unit specified below.
 - 2) Electronic Controller
 - (a) The controller shall be a microprocessor based unit that shall comply with the requirements of Section 9.15.
 - (b) The controller shall have built in diagnostics and a fault display. The display may be alpha-numeric or LED array and shall be used for the first level of trouble shooting. Additional diagnostics shall be accessed from the PTU specified below. See Section 1.22 for diagnostic software requirements.
 - 3) Test Equipment
 - (a) A bench tester, as specified in Section 9.11, shall be supplied.
 - (b) Portable Test Units (PTU), as specified in Section 17.04, shall be supplied to access the microprocessor for diagnostics, parameter setting and other functions with appropriate security levels.

11.03 DESIGN REQUIREMENTS (Continued)

I. <u>Track-Trip Switch</u>

Each truck shall have an electrically-insulated mounting support for attaching a track-trip switch at the forward left hand corner when the truck is used in the No. 1 position. Each No. 1 truck shall have a track-trip switch installed on the insulated mount.

The inside of the trip switch lever shall be thirty-four and thirteen-sixteenth-inches (34-13/16") from the centerline of the truck and its bottom two and three-fourthsinches (2-3/4") above the running rail. A serrated height adjustment shall be provided on the trucks so that the height can be adjusted in one-fourth-inch (1/4") increments. The trip switch shall be mounted in such a manner that the switch shall function properly regardless of truck spring deflections. Track-trip switch design and construction shall be equal to Wabtec A-3 Emergency Trip Switch and shall be reviewed by the Engineer.

J. <u>Current Collection Equipment</u>

Each No. 1 truck shall be equipped with current collection equipment with sleet scrapers on both sides. Each No. 2 truck shall be equipped with current collection equipment without sleet scrapers. The current collectors and sleet scrapers shall be as shown on CTA Drawing R-5-1016, Page DR-2. The current collector beam-mounting brackets shall provide positive height adjustment in one-fourth-inch (1/4") steps. The beams shall be mounted in such a manner that the shoes shall maintain proper contact with the third rail regardless of truck spring deflections. Proper care shall be taken to seal joints between pieces and around bolts for weather-resistance and electrical creepage.

The design of the collector equipment and mounting shall be such that the failure in any manner of a third rail shoe or support shall not cause the lifting of any wheel on the truck.

K. <u>Wear Plates</u>

There shall be no metal to metal wear plates except at the track brakes unless agreed to by the Engineer. Wear plates or stops, where used, shall be arranged for easy renewal, and shall be eleven to fourteen percent (11-14%) manganese steel.

11.04 CASTING MANUFACTURE AND MATERIAL

Cast steel components shall be made of readily commercially available alloys that have a low carbon content to permit weld repairs. The physical and mechanical properties of the cast steel shall be compatible with design stresses established by the truck manufacturer as assuring safe operation. See also Section 12.02, B.

11.05 PAINTING AND NUMBERS

A. <u>Truck Painting</u>

All truck components shall be given a full coat of primer before assembly. After assembly, each truck shall be given two (2) coats of aluminum, or similar color, paint. Inside surfaces of truck frames and castings, if open, shall be painted. All grease fittings, insulators, linkages, threads which are for adjustment, and wearing surfaces shall be masked before painting. Truck wiring shall not be painted.

B. <u>Truck Numbering</u>

Each truck shall be equipped with a metal plate giving the serial number of the assembled truck.

11.06 MOTOR SAFETY HANGERS

Safety hangers shall be provided to support the traction motors in the event that any failure of traction motor suspension takes place. The safety hanger shall not support any weight of the motor until a failure has occurred. Safety hanger design and construction shall be reviewed by the Engineer.

11.07 TRUCK TESTING

A. <u>General</u>

The truck supplier shall conduct static, dynamic and fatigue tests of the frame to establish the validity of the design. One complete truck frame, including the journal bearing housings, and a truck bolster shall be subjected to the testing outlined below. Dummy axles, journal bearings, secondary suspension and associated hardware shall be supplied as required.

Production primary suspension elements need not be employed during the fatigue test.

11.07 TRUCK TESTING (Continued)

B. <u>Static Test</u>

Static test loading shall include a vertical load equal to at least two hundred percent (200%) of the normal truck load and loads in other directions which shall equal in magnitude the highest loads encountered in normal service. The proposed arrangement and magnitude of the loadings for these tests shall be submitted to the Engineer for review.

Using standard experimental stress analysis technique, areas of stress concentration shall be located. Strain gauges shall be positioned at known strain points and at other points at the discretion of the supplier and readings taken to determine that stresses are within the design requirements for principal loadings encountered in service. An adequate number of strain gauges shall be applied at the points of stress concentration.

C. <u>Fatigue Test</u>

A fatigue test using mean vertical loads equal to the maximum car weight with maximum passenger load, 23,100 pounds, and corresponding lateral, longitudinal and accessory support loadings shall be performed. The proposed arrangement and magnitude of the loadings for this test shall be submitted to the Engineer for review. The test shall run for at least six million cycles, but more if the supplier so requires or desires.

D. <u>Dynamic Shake Test</u>

A dynamic shake test shall be conducted on the first production truck. This test shall include vertical and lateral frequency sweeps up to minimum frequency of 20 Hz. Frequency response curves shall be determined for all truck appurtenances such as ATC pick ups, track trip switches and current collector beams. The test shall verify that no resonances occur in the frequency range of wheel-rail induced inputs or in the range that could reasonably be expected to exist from rail joints or other conditions found on the CTA track. Particular attention must be paid to the ATC coil brackets and coil clamps. Frequencies in excess of 20 Hz may be needed to find the resonances of these items.

Any resonances found that could exist in actual service shall be de-tuned. The object of this test is to discover possible premature failures of the frame, the appurtenances or their attachments and correct this condition before the trucks are placed in service.

11.08 TRUCK MOCK-UP

The Contractor shall construct after Award of Contract a full scale mock-up of the truck depicting location and arrangement of all truck mounted equipment and the complete electrical wire and hydraulic line installation. The mock-up shall use as many actual parts proposed for use on the trucks as possible and shall be constructed of substantial material adequate for this purpose. The mock-up shall be configured to permit the evaluation of the static and dynamic clearances existing between truck-mounted components and car body-mounted components during normal and failed conditions and between the truck and car body and side sill to evaluate accessibility for maintenance and operation. The mock-up shall be reviewed by the Engineer. Changes to the mock-up and final arrangement shall be made as necessary at no cost to CTA to satisfy the comments of the Engineer.

SECTION 12 MATERIALS AND WORKMANSHIP

12.01 <u>GENERAL</u>

- A. All material entering into the construction of these cars shall be of first-class quality. All workmanship shall be high grade and shall conform to the best manufacturing practices in all respects.
- B. All materials shall conform to ANSI, ASTM, Federal Specifications or other standards as agreed to by the Engineer. Cases of conflict between specifications shall be brought to the Engineer for review.
- C. All tests shall be conducted using U.S. customary units of measure or shall be translated and reported in U.S. customary units.
- D. All materials intended for use in these cars shall be marked or stored to be readily identified and shall be adequately protected during handling and storage during all stages of manufacturing.
- E. Lumber shall be thoroughly air seasoned or kiln dried; shall be straight grained; and shall be free from rot, knots, checks and other defects which may impair its strength or durability or mar its appearance. Lumber shall be dressed on all sides to full dimensions. Wood of any type shall be used only where specified.
- F. All screws, bolts, nuts and washers shall conform to applicable ANSI standards and shall be zinc plated unless stainless steel. Stainless steel hardware shall be 18-8 type. Plating shall be in accordance with the following:

Zinc Electrodeposited Coating: ASTM B633, latest revision, Class Fe/Zn 5, Type II.

- 1. All hardware of one-fourth-inch (1/4") diameter or larger shall have National Coarse threads. Exceptions may be permitted, but require review by the Engineer.
- 2. All hardware used shall be SAE J429f, Grade 5 or better, unless stainless as indicated in the chart below. Exceptions may be permitted, but require review by the Engineer.

	Nominal Size 5/16" or less	NOMINAL SIZE 3/8"	NOMINAL SIZE GREATER THAN 3/8"
Screws, Cap screws, Bolts, Nuts	Stainless Only	Stainless or Grade 5	Grade 5 or Better
Flat washers, Lock washers	Stainless Only	Stainless Only	Grade 5 or Better

12.01 <u>GENERAL</u> (Continued)

- F. (Continued)
 - 3. Bolts used with nylon insert lock nuts shall be sized to extend at least two full threads through the locking ring but shall not be longer than the next standard length.
 - 4. All bolts and cap screws shall have the head marked to indicate grade in accordance with SAE J429f.
 - 5. All nuts shall be marked to indicate grade in accordance with SAE J995b or Industrial Fastener Institute IFI-100, Paragraph 5, for prevailing-torque type steel locknuts.
 - 6. All hardware, bolts, cap screws, washers and nuts, used together shall be of the same grade.
- G. Components, plates, shields or other parts which may be removed for maintenance shall not be secured with self-tapping or sheet metal type fasteners including speed nuts or J-nuts. The use of push-on "Tinnerman" type nuts is not permitted without review by the Engineer.
- H. Components, plates, shields or other parts which may be removed for repair or maintenance shall be interchangeable with each other identical item on each car.
- I. Visible interior fasteners such as those retaining interior panels, door hardware, grab handles, speaker grills and other components prone to theft shall have tamperproof pin-in-head hex socket type reviewed by the Engineer. Sizes shall be standardized to the extent practical.
- J. All bolts, nuts, cap screws and machine screws shall be locked to prevent loosening in service. Lock washers shall not bear against flat washers, but shall bear against non-rotating surfaces. The use of "Locktite" is not permitted without review by the Engineer.
- K. Screws shall be driven in a manner to preclude damage to the drive recess. No screws with damaged, burred or rounded out drive recesses shall be permitted.
- L. Manufacturer's trademarks shall not be visible to passengers or crew members except as specified. The Contractor's builder plate shall be located in a location selected by the Engineer and shall be permanently attached to the inside of the car. The plate design shall be reviewed by the Engineer.
- M. Rivet and bolt holes shall be accurately located and aligned. When necessary during assembly, holes may be reamed round to specified size in position. Rounding out holes or elongating holes during assembly to effect alignment is not permitted.

12.01 <u>GENERAL</u> (Continued)

- N. Hand-driven steel rivets shall be driven hot and shall completely fill the holes. Rivets may be cold driven when adequate mechanical equipment is available. All exposed heads of rivets shall be free from rings, fins, pits and burns. If aluminum rivets are used, they shall be anodized in accordance with Alumilite Specification No. 204.
- O. Huck rivets may be used with review by the Engineer.
- P. Joints shall be properly fitted, whether exposed or concealed, and the surfaces that are joined together shall be given a protective coating to prevent corrosion. All exterior joints and seams shall be permanently weathertight. The means and products used shall be reviewed by the Engineer. The car design shall, to the greatest extent possible, avoid exterior joints and seams that require the application of sealer or calk. Anti-rattle tape, if used in joints, shall not exceed one layer in thickness.
- Q. All bolts or rods, if not stainless steel, passing through wood shall be coated with paint over those parts imbedded in the wood.
- R. Chrome plating, if used, shall conform to the latest revision of ASTM Specification B456.
- S. All stainless steel parts shall be attached with stainless steel screws or fasteners.
- T. All visible bolts and screws used on the interior of the cars shall be stainless steel.
- U. The use of adhesives in the assembly of the cars or their component parts, except as specified, is not permitted unless explicitly reviewed by the Engineer.
- V. All parts shall be free from sharp edges and burrs that might injure persons or damage clothing.
- W. Fiberglass reinforced plastic, where used, shall be permanently fire resistant. The formulation and application of the fiberglass reinforced plastic shall be reviewed by the Engineer. All fiberglass reinforced plastic parts shall be color pigmented throughout, unless specifically agreed to otherwise.

12.01 <u>GENERAL</u> (Continued)

- X. The fiberglass No. 1 end shall be produced by the hand lay-up process with colored gel-coat on the visible surfaces. The gel-coat color shall match Pantone 7c, Gray, unless otherwise agreed to during the exterior esthetic design process. The fiberglass shall have molded in steel reinforcements at all carbody connections. The material of the fiberglass No. 1 end shall be 65% by weight fire-resistant filled polyester. The glass fibers shall be 25-30% by weight chopped strand mat, one-inch (1") minimum length, and woven roving. The fiberglass shall have a basic construction of four (4) plys of one and one-half-ounce per square foot (1-1/2-oz./sq. ft.) chopped glass mat and one (1) ply of twenty-four-ounces per square foot (24 oz./sq. yd.) woven roving giving a nominal thickness of 0.19-inch. Additional thickness and reinforcement shall be used where required. The entire fiberglass No. 1 end shall be reviewed by the Engineer.
- Y. The attachment of car interior trim, finish and appurtenances shall be accomplished, insofar as possible, without the use of exposed fasteners.

12.02 <u>STEEL</u>

A. <u>Structural</u>

Non-stainless steel shall be low-alloy-high-tensile steel reviewed by the Engineer.

- B. <u>Castings</u>
 - 1. Steel castings shall be commercially sound throughout. Castings shall be 100% Radiographically and Magnaflux tested according to the latest ASTM standards during the First Article inspection and on a periodic basis. The Engineer reserves the right to cut up one or more castings of each shape from time to time to determine the character of the metal in parts not exposed by the various machine operations. The Contractor shall prepare a Quality Assurance plan for castings, including destructive and non-destructive methods and sampling rates, which shall be reviewed by the Engineer.
 - 2. All steel castings used in the truck structure shall be made as specified in Section 11.04.
 - 3. The king pin and base thereof which form part of the body shall be made of electric furnace steel that conforms to ASTM Specification A-148, latest revision. The steel shall have the following minimum physical properties:

Tensile Strength	80,000 psi
Yield Strength	50,000 psi
Elongation in 2-inches	22%
Reduction in Area	30%

- 12.02 STEEL (Continued)
 - B. <u>Castings</u> (Continued)
 - 4. The upper center bearing member may be either a steel casting or forging, heat treated to produce the physical properties as above. After heat treatment, the bearing surface shall be finished ground.
 - 5. Steel or iron castings used in locations not referred to herein shall be selected for composition and characteristics best suited to the application by the manufacturer or Contractor concerned, shall require the review of Engineer and shall use readily commercially available alloys.
 - C. <u>Stainless Steel</u>
 - 1. Stainless steel for carbody structure and exterior skin shall be of the low carbon Type 201L, 301L, 301LN, or 304L, especially suited to welded assemblies with less than 0.024% sulfur and phosphorous. Stainless steel not assembled by welding shall be of the 300 class unless otherwise agreed to by the Engineer.
 - 2. Buffing and polishing of stainless steel, where required, shall be done in a manner approved by the supplier of the steel.
 - 3. Where rigidized stainless steel is used, it shall match Rigidized Metals Corp. pattern 2-WL, with 2B finish and be 300 Series. The pattern shall be horizontal unless otherwise specified.

12.03 <u>ALUMINUM</u>

- A. All aluminum used, if not anodized, shall be completely painted or powder coated on all surfaces, color to be selected by the Engineer.
- B. Wherever aluminum contacts any other material, it shall be isolated and the joint shall be sealed with suitable materials.
- C. Aluminum shall be used only where specified or where explicitly accepted by the Engineer.

12.04 <u>RUBBER</u>

- A. <u>General</u>
 - 1. All rubber specified herein shall be so compounded and cured that it will perform satisfactorily in car operation at any temperature which may be encountered, and shall have an expected service life of 15 years while being consistent with obtaining the other characteristics specified.
 - 2. Unless otherwise specifically stated herein, all tests shall be conducted according to the latest revisions of ASTM test procedures for rubber goods. Certified copies or results of all tests shall be furnished to the Engineer.
 - 3. Specimens shall be tested at least two (2) days after manufacture.
 - 4. For all parts made by curing (bonding) rubber to metal, any separation between metal and rubber occurring when the part is used in normal service and according to the manufacturer's recommendation shall be considered as caused by a defect of material and/or workmanship.

B. <u>Rubber Door Edges</u>

Material and design of rubber door edges shall require review by the Engineer, see Sections 6.01, F and 3.05, B, 1.

- C. Rubber Door and Window Seals and Rubber Glazing Strips
 - 1. All rubber for door and window seals and glazing strips shall be extruded from an appropriate rubber and be free from defects in material and workmanship. The type of rubber shall be reviewed by the Engineer.
 - 2. The glazing strips shall be installed with the joint at the top of the window except at the end door drop sashes where the joint shall be at the bottom.

- 12.04 <u>RUBBER</u> (Continued)
 - C. <u>Rubber Door and Window Seals and Rubber Glazing Strips</u> (Continued)
 - 3. The rubber glazing strips shall be of such design that they will hold the glass or sash in the car and be watertight without the use of sealers or filler materials.
 - 4. The glazing strips shall be pre-sized with a vulcanized butt joint.
 - 5. Durometer shall be selected to obtain the best combination of qualities for change out in hot and cold temperatures and retention and sealing of the glass or sash.

12.04 <u>GLASS</u>

- A. All glass, except as otherwise specified, shall be safety glass, one-fourth inch (1/4") thick, of the laminated plate or float type, consisting of two pieces of glass bonded with a tinted plasticized polyvinyl butyral resin membrane of a nominal 0.030-inch thickness and resistant to ultra-violet light and visible light and heat.
- B. When an individual pane is laid on a truly flat surface, the glass shall not indicate a bow of more than 0.030-inch per lineal foot.
- C. The overlap of one sheet of glass with respect to the other at the edge shall not exceed 1/32-inch. Corners and burrs shall be ground smooth and all edges shall be seamed or swiped.
- D. Each pane shall be the same color as each other pane and each pane shall be of uniform color throughout when examined over a white background.
- E. All panes of laminated glass shall be so nearly free from haze that the laminated glass shall have approximately the same clarity as a pane of the same nominal thickness of plate glass when viewed against a north light.
- F. Panes containing unbonded areas (let-goes) shall not be used.
- G. All glazing shall meet the standards and pass the tests prescribed in the ANSI's latest revision of American Standard Z-26.1 "Safety Code for Safety Glass for Glazing Motor Vehicles Operating on Land Highways."
- H. All glass except the No. 1 end passenger and operator windows and the cab door glass may be Type AS-1, AS-2 or AS-3.
- I. Each pane of safety glass shall have a Manufacturer's etched trademark. The glass shall be installed so that the trademark is in the lower right-hand corner and facing the interior of the car.

12.05 GLASS (Continued)

- J. All safety glass shall be neutral gray with forty-four percent (44%) visible light transmission, except as specified below:
 - 1. The operator's windshield and No. 1 end passenger window shall be clear impact resistant glass as specified in Section 12.05, K.
 - 2. The cab door glass shall be Margard-MR5000, or equivalent, neutral gray with nominal twenty-five percent (25%) visible light transmission, and shall be 15-3/8" x 13-3/8" (+0, -1/16-inch) with corner radii of two and eleven-sixteenth-inches (2-11/16").
 - 3. The glass outside the side and front destination signs shall be one-fourth inch (1/4") clear tempered safety glass.
 - 4. The glass in the back cover of the side destination sign shall be as specified in Section 14.02, L.
 - 5. The glass in the cover of the illuminated map shall be as specified in Section 14.02, K.
 - 6. The windscreen glass shall be one-quarter inch (1/4") clear tempered safety glass.
- K. The operator's windshield glass and No. 1 end passenger's window glass shall be high strength, impact resistant, laminated material meeting FRA, Type I requirements and reviewed by the Engineer. The material shall consist of two (2) layers of tempered glass separated by a layer of polyvinyl butyral and may have a third layer of annealed glass as the innermost layer. The overall thickness shall by approximately nine-sixteenth-inch (9/16"). The operator's glass shall also be heated as specified in Section 9.09, D. The method and design of installation shall carefully consider the weight of the glazing material and the forces to be exerted on it, and shall require review by the Engineer.

12.05 WIRE AND CABLE

A. <u>Conductor Material and Sizes</u>

- 1. All conductors shall be of tin plated, soft annealed copper and shall have the properties and characteristics specified in ASTM B3 or B33, latest revision.
- 2. Wire sizes and stranding used in the construction of the cars shall conform to ASTM and AAR Specifications. Only the following ASTM and AAR designated wire sizes and stranding shall be used unless otherwise agreed to by the Engineer for a specific application.

Size AWG	MINIMUM NUMBER OF STRANDS	MAXIMUM CONTINUOUS DESIGN CURRENT
16	19	10
12	37	20
8	37	45
6	61	60
4	97	80
2	150	105
0	275	145
00	325	160
000	450	190
0000	550	220
263MCM	650	245

Traction motor circuit cable ratings may exceed the above-specified values on the recommendation of the traction system manufacturer.

B. <u>Separator</u>

A paper separator shall be used between the copper wires and the insulation if the insulation is of the type that will flow into the conductors when the wire is manufactured.

12.06 <u>WIRE AND CABLE</u> (Continued)

C. Insulation

- 1. For wires of nominal No. 8, No. 12 and No. 16 gauge, the insulation shall be ethylene tetrafluoroethylene [ETFE] fluoropolymer per ASTM D3159, latest issue or irradiated cross-linked polyolefin [XLPO]. The insulation shall be clean stripping, so the conductor is not damaged. ETFE insulation thickness for nominal No. 8 gauge shall be 0.030-inch minimum; for nominal No. 12 gauge insulation shall be 0.025-inch thick, minimum; and for nominal No. 16 gauge the insulation shall be 0.020-inch thick, minimum.
- 2. For carbody wires nominal No. 8 gauge and smaller used in nominal 37.5 Vdc or 120/230 Vac circuits, the insulation shall have at least a 600 V rating. For carbody wires larger than nominal No. 8 gauge, and for carbody wires used in nominal 600 Vdc circuits, the insulation shall be irradiated cross-linked polyolefin with 2000 V rating.
- 3. Motor leads and truck cables and truck to carbody cables shall have neoprene jacketed EPR rubber insulation with a continuous temperature rating of at least 194°F (90°C).
- 4. Wire insulated with ETFE fluoropolymer or irradiated cross-linked polyolefin [XLPO] shall have a continuous temperature rating of 257°F (125°C), minimum.
- 5. In locations subjected to high temperatures, wire of No. 6 gauge or smaller shall have silicone rubber, glass braid covered insulation or filled TFE insulation with a temperature rating at least of 500°F (260°C). Wires larger than No. 6 gauge shall have a high temperature fiberglass reflective sleeve equal to Thermo-Trex by TPC Wire and Cable applied over the standard XLPO insulation.
- 6. The ETFE and XLPO insulation material shall have a UL flammability rating of SE-O. The wire must pass the UL vertical flame test and ASTM D635.

12.06 <u>WIRE AND CABLE</u> (Continued)

D. Insulation Color

- 1. The insulation shall be colored throughout, and the colors shall be durable and shall have no deleterious effect on the finished product.
- 2. Wires of No. 8 gauge and smaller shall be colored as follows:
 - a. Wires used in the ATC circuits shall be colored orange.
 - b. Wires used in the nominal 37.5 Vdc circuits shall be colored white.
 - c. Wires used in the nominal 120/230 Vac circuits shall be colored medium blue.
 - d. Wires used in the nominal 600 Vdc circuits shall be colored black or gray.

E. <u>Carbody Multiconductor Cable</u>

- 1. All carbody multiconductor cable shall be reviewed by the Engineer.
- 2. Wire sizes and shielding shall be as required by the subsystem supplier whose equipment is being interconnected and coordinated with the car builder. Conductor insulation and shielding shall be selected for flexibility, durability and suitability for the application.
- 3. The outer jacket shall be neoprene or XLPO.
- 4. Color coding shall be per IPCEA No. S-19-81, NEMA WC-3, Section 5.6.2.1, Method 1, Table 2, including second tracer color for cables over 21 conductors in size.

12.06 <u>WIRE AND CABLE</u> (Continued)

F. <u>Trainline Cable</u>

- 1. All trainline cable shall be reviewed by the Engineer.
- 2. Unshielded conductors shall be No. 12 gauge soft annealed copper per ASTM B3 with 65 strands (Class K) as called for in ASTM B8.
- 3. Shielded conductors may be smaller gauge and shall require the review of the Engineer.
- 4. Conductor insulation shall be selected for flexibility, durability and suitability for the application.
- 5. Color coding shall be per IPCEA No. S-19-81, NEMA WC-3, Section 5.6.2.1, Method 1, Table 2, including second tracer color for cables over 21 conductors.
- 6. The outer jacket shall be neoprene.
- 7. An identification tape showing the name of the cable manufacturer and, desirably, the year that the cable was made shall be included just under the cable sheath. The markings shall appear at approximately one foot intervals.
- 8. The conductors shall be formed into a core and a Mylar tape separator shall be supplied.
- 9. Lay-up, lay length, and sheath tightness shall be designed for constant flexing of the cable.

G. <u>Shielded Cable</u>

- 1. Shielding shall be tinned copper braid.
- 2. Mylar tape wrap shall not be used.
- 3. Jacket shall be neoprene.
- 4. Shielded cables wholly within equipment enclosures may have alternate construction.
- 5. All shielded cable shall be reviewed by the Engineer.
- H. <u>Ethernet Cable</u>

Ethernet cables shall be of suitable construction for use in rail cars and shall be reviewed by the Engineer.

12.06 <u>WIRING</u>

A. <u>General</u>

- 1. The work shall be performed by or under the direction of experienced personnel. Appropriate tools for skinning insulation, cutting, tinning, soldering and attaching mechanical or compression type terminals to conductors shall be utilized.
- 2. Care must be taken in removing insulation from the conductor to avoid nicking of the wire strands.
- 3. Wire in ducts and conduits shall be free of kinks and insulation abrasions.
- 4. Pulling compound, if used, shall be non-conductive, non-odorous and not attract vermin or attack the insulation.
- 5. Conductors which may be subjected to motion relative to the terminal shall be supported by suitable means to preclude breakage of the conductor or the terminal.
- 6. Wires or cables which may be subject to motion relative to connectors, pickup coils and other apparatus shall have strain relief provisions installed to prevent conductor fatigue, connector pin wear and connector shell damage. In addition, in areas of known vibration such as gear boxes, traction motors and pickup coils extra precautions shall be taken to secure the cables to relieve any stress that might be applied to the cables or devices.
- 7. Sufficient slack shall be left to provide strain relief any time a wire is pulled through a compartment.
- 8. A service loop sufficient for two reterminations shall be provided for all wires No. 8 gauge or smaller terminating on a terminal board.
- 9. Harnesses secured with Nylon Ty-Wraps shall have the Ty-Wraps trimmed and located to eliminate any hazard to personnel from sharp edges. Ty-Wraps shall be applied with the proper tool to prevent damage to wire insulation.
- 10. Wire harnesses shall not lie on the bottom of any enclosures.

12.07 <u>WIRING</u> (Continued)

B. <u>Truck Wiring</u>

1. Ground Leads

Flexible ground leads shall be provided from the carbody to both axle ground brush boxes of each truck and from each major truck frame member to the ground brush box on both axles.

Terminals on the gear box shall be of heavy duty cast swedge type, forming a square or hexagon shaped collar.

2. <u>Cable Securement and Protection</u>

Truck wiring, including shoe-tie cable, ground and motor leads shall be carried on the truck frame in silicone rubber cleat blocks, insofar as possible, to reduce to a minimum any movement of cables between truck parts. The cables shall be securely fastened and routed to minimize the use of protective sleeving. Protective sleeves for cables shall be made of neoprene.

Clamps for attaching cables to the truck frame, where used, shall have suitable insulated sleeves. Where jack knife connectors are used, these connectors shall be protected with heat shrink tubing and silicone rubber sleeves, with the ends of the sleeves securely fastened to the cables. Each installation shall be reviewed by the Engineer.

All truck cables shall have clamps to secure the cable insulation near the terminal connections to prevent flexing and stressing the cable strands as they enter the terminals.

Wiring on all trucks shall be uniform.

See also Section 9.02, F.

3. <u>Shoe-Tie Cables</u>

The two (2) current collectors on each truck shall be connected together with a single shoe-tie cable. From one of the current collector fuses, another single cable shall connect to the carbody wiring through a jack knife connector.

12.07 <u>WIRING</u> (Continued)

C. Solder and Soldering

- 1. Solder shall be at least equal to that designated as SAE No. 1, Class B. A flux of non-corrosive, non-conductive type shall be applied immediately before soldering. Any flux remaining after soldering shall be removed.
- 2. Ends of conductors to be soldered shall be thoroughly cleaned and tinned by immersion in molten solder. Care must be exercised to prevent burning the insulation and excessive flowing of the solder along the conductor.

D. Insulating Tape

Insulating tape shall be a polyvinyl chloride electrical tape having unrestrictive qualification under Specification MIL-1-7798A, 0.007-inch overall thickness.

E. <u>Terminals</u>

Solderless terminals for wires No. 8 gauge and smaller shall be equal to Amp, PIDG type and for larger than No. 8 gauge shall be made of seamless, tubular copper and be equal to Amp, Ampower II type, unless otherwise specified.

All terminals shall be attached without exposing conductors between insulation and terminals unless specifically agreed to otherwise by the Engineer.

F. Jack Knife Connectors

Jack knife connectors shall be reviewed by the Engineer. Exposed conductors are not acceptable.

- G. <u>Splicing and Taping</u>
 - 1. Splicing including tee splicing of conductors is not permitted.
 - 2. A conductor shall not be taped onto another conductor.
- H. <u>Cleat Blocks</u>

Cleat blocks on the truck and carbody shall be of molded silicone rubber with spacer tubes molded in each piece to prevent over tightening and with appropriate stainless steel support and backing plates. Every effort shall be made to use the same cleat blocks as on CTA's 2600 Series Rehab, 3200 Series or 5000 Series cars.

12.08 WELDING

A. The Contractor shall be responsible for the quality of all welding, and all welders employed in the making of welds on structures or products built under these Specifications.

All welding practice shall be in accordance with the applicable requirements and recommendations of the American Welding Society (AWS), the ASME and the SAE. Requirements and recommendations of the AWS for new bridges shall have precedence over those for new buildings.

- B. The Engineer shall have the right to require the making of test welds by any operator to determine his ability to produce satisfactory welds of any given type. The Engineer shall also have the right to require the making of test welds to settle any question which may arise as to the suitability of any welding method or procedure used during production. The recommendations of the American Welding Society as contained in the latest revision of their "Standard Qualification Procedure" shall be followed in the making of tests and the settlement of other questions which may arise hereunder regarding the welding practices.
- C. Welders employed in the making of welds on structures or products built under this Specification shall make only those welds for which they have been qualified in accordance with the requirements of the AWS, or other equivalent qualifying procedure reviewed by the Engineer. Records of welder qualification tests shall be made available for review by the Engineer, if requested.
- D. Before welding of any sort is started, parts to be joined shall be properly cleaned. All corrosion or rust, oil, water, paint or other foreign matter shall be removed by an appropriate process or method.
- E. All parts which are to be joined by welding shall be adequately supported in proper interrelation by tables, jigs or fixtures.
- F. Welding rod or wire or filler metal shall be chosen with respect to make, type and size by Contractor or manufacturer.
- G. In case a question shall arise regarding the suitability of electrodes, shielding material or filler metal for the work covered by these Specifications, the latest revision of the joint American Welding Society and ASTM tentative specifications for Welding Electrodes and Rods shall govern.

12.08 <u>WELDING</u> (Continued)

- H. Penetration of weld metal into the bottoms of angles and vees, and fusion at these points shall be complete. Weld metals shall run into the base metal at the finished surface of the weld in a smooth curve approximating tangency to the surface of the base metal so as to avoid sudden change of section and resultant concentration of stress.
- I. The method used in depositing the weld metal shall be chosen to minimize warpage and locked-up stresses. To this end, tack welding, skip welding, offset welding and other devices and sequences well known in the art shall be used where necessary.
- J. The end underframe assemblies, truck frames and truck bolsters shall be normalized after welding. Any exceptions require review by the Engineer. When the base metal contains 0.3 percent carbon or less, this shall be done by heating the structure slowly in a furnace to a temperature of 1100°F to 1200°F, holding for one hour per inch (1 hr/in) of thickness at that temperature, then cooling slowly to at least 250°F before removal from the furnace. When the carbon content of the base metal is above 0.3 percent, the annealing temperature shall be 1425°F to 1475°F.
- K. Finished welds, which have a thickness greater than one-fourth inch (1/4"), shall be made with at least two (2) beads. The scale shall be completely cleaned off the underlying bead and surrounding metal after cooling and before the next bead is deposited.
- L. Spot welding and seam welding to produce welds which carry structural stresses, as for example those fastening side sheets to structural members, shall be done only with equipment fitted with time, current and pressure control. The Contractor or manufacturer shall determine experimentally, or in other acceptable fashion, the proper setting of the controls and shall then provide against unauthorized changes. Overheating of spot or seam welds that produce tips or burn throughs or severe discoloration shall not be permitted.

Ring welding to produce welds which carry structural stress shall require review by the Engineer.

The size, shape and surface conditions of the electrodes required to give satisfactory welding and acceptable finish shall be determined similarly and a complete record made thereof. Thereafter, the electrodes shall be dressed to these conditions as frequently as the character of the work requires.

The Contractor or manufacturer shall so treat surface marks resulting from welding as to minimize all visible defects in the finished surface.

12.08 <u>WELDING</u> (Continued)

- M. The welding of stainless steel or aluminum shall be done in accordance with recommendations of the manufacturers of the materials being welded.
- N. Single bevel welds shall not be used in joining any structural members of the car unless the specific application is reviewed by the Engineer. If permitted, single bevel welds must make use of a back-up strip or be welded from both sides and be performed in accordance with recommendations of the American Welding Society.

12.09 PAINT AND PAINTING

A. <u>General</u>

All areas needing paint shall be thoroughly cleaned, given one (1) coat of primer and one (1) coat of finish paint. Powder coating may be used in lieu of paint with the review of the Engineer. The Engineer shall specify color. All coating applications shall comply with manufacturer's recommendations. All coating applications shall be done in an area free from dust and contaminants and any coated surface which shows the presence of dirt or dust shall not be acceptable. Any coated surface which shows the presence of dirt or dust or runs or "orange peel" shall not be acceptable and shall be recoated at the Contractor's expense.

B. <u>Underframe and Undercar Equipment</u>

All non-stainless steel portions of the underframe and non-stainless steel undercar equipment shall be colored gloss charcoal gray matching DuPont 826Y84814 or DuPont Centari Dark Gray gloss.

12.10 DECALCOMANIA

The Contractor shall furnish and install all decalcomania transfers listed below. The location shall be designated by the Engineer and demonstrated on the mock ups and prototype cars. Changes in location or wording shall be made at no additional cost to the Authority if they are determined to be needed on the mock ups or prototype cars. Decal and safety sign configurations shall be supplied by the Engineer. See Sections 3.05, B, 5 and 5.04, A, B, and D for side door numbers and car numbers and locations.

Two (2) samples of each decal shall be supplied to the Engineer for review before any are applied to the cars.

All decalcomania shall be applied according to the manufacturer's recommendations.

The following decals shall be supplied and applied:

- A. <u>Standard Pressure Sensitive Material</u>
 - 1. TO OPEN DOORS IN EMERGENCY Located adjacent to each side door emergency opening handle, four (4) per-car.
 - 2. NO SMOKING Two (2) per-car, in locations selected by the Engineer.
 - 3. NO SMOKING SYMBOL Located on the passenger emergency switch cover at the No. 2 end of the car and on the right side of the cab partition above the ad frame, two (2) per-car.
 - 4. FOR YOUR PROTECTION Located on the door pocket to the right of the No. 1 and No. 4 side doors, two (2) per-car.
 - 5. WARNING, DO NOT CROSS Located on the outside of each end door window fixed portion, two (2) per-car.
 - 6. FOR YOUR SAFETY Located to the right and below the window in the cab door, on the outside, one (1) per-car.
 - 7. WHEELCHAIR SYMBOL Located outside the No. 1 and No. 2 side doors forward of the door, two (2) per-car.
 - 8. PRIORITY SEATING Located below the "For Your Protection" decals, Item 4, two (2) per-car.
 - 9. PRIORITY SEATING LIFT SEAT Located on the wainscot panel adjacent to the door pocket forward of each convertible seat with the arrow pointing toward the seat, two (2) per-car.

12.10 DECALCOMANIA (Continued)

- A. <u>Standard Pressure Sensitive Material</u> (Continued)
 - 10. EMERGENCY USE ONLY Located adjacent to the passenger intercom box, two (2) per-car.
 - 11. FRICTION BRAKE MANUAL RELEASE ARROW (if used) Located on the side sill on the center line of each truck, four (4) per car.
 - 12. END DOOR HANDLE Located on each door handle cover, two (2) per-car.
 - 13. BICYCLE Located outside to the rear of the No. 1 and No. 2 side doors, two (2) per-car.
 - 14. RADIO CALL CODES Located to the right and below the window in the cab door on the inside, one (1) per-car.
 - 15. SURVEILLANCE CAMERA Located adjacent to the NO SMOKING decal, No. 2, two (2) per-car.
 - 16. US FLAG Located forward of the No. 1 and No. 2 Side Doors, two (2) per car.
 - 17. CTA WEBSITE Located above the No. 3 Side Door, one per car, unless changed during the exterior esthetic design process.
 - 18. CTA LOGO Located below the cab sliding sash window, two (2) per car, unless changed during the exterior esthetic design process.
 - 19. 600 VOLT TRAINLINE ISOLATION SWITCH Located on the side sill adjacent to the isolation switch box, one per car.

B. <u>Photoluminescent Background Material</u>

- 1. STAND CLEAR OF DOOR Located on the outside of the window glass on each side door panel, eight (8) per-car.
- 2. STOP SIGN Located on the inside of each end door, two (2) per-car.
- 3. EMERGENCY EVACUATION Located in the frames on the door pocket to the right of the No. 1 and No. 4 side doors and to the left of the No. 2 and No. 3 side doors, four (4) per-car.
- 4. PASSENGER INTERCOM USE Located adjacent to the passenger intercom box, two (2) per-car. This decal has raised letters and Grade 2 Braille text. Only the raised text shall be photoluminescent.

The photoluminescent pigment shall be equal to Strontium Oxide Aluminate as supplied by International Name Plate Supplies.

12.11 AUXILIARY ELECTRIC MOTORS

Motors of the "T" frame design shall have a service factor of at least 1.10.

All ac motors shall have integrally cast or extruded bases in lieu of formed sheet steel and weldment bases.

All ac motors shall be TEFC unless otherwise agreed to by the Engineer.

All ac motors shall have standard NEMA frames with standard junction locations, standard shaft lengths and diameters, standard shaft keyways and standard horsepower ratings. Special motors will be permitted only if the system supplier specifically requires the motor manufacturer to sell the motors to CTA and provides documentation of the requirement and concurrence by the motor manufacturer.

All ac motors, their bearings, and lubrication shall be reviewed by the Engineer.

All ac motors shall have at a minimum Class F insulation.

The use of high-efficiency motors is to be avoided.

12.12 GLASS PROTECTIVE SHEETING

The Contractor shall install multi-layer protective sheeting to all passenger accessible glass and plastic glazing surfaces inside the car including the outside of the cab door glazing but excluding the operator's windshield and the right side sliding sash.

The protective sheeting shall be 19.5 mils (0.5 mm) thick, made up from four (4) individual layers of polyester film, laminated together with an optically clear acrylic adhesive between each layer and an optically clear acrylic pressure sensitive adhesive on the back, protected by a peel-off release liner.

To assist with individual layer removal, one (1) of the four corners of the protective film shall have a "Stepped Edge" feature that is equal to the 3M product option available with 3M's Scotchgard[™] multi-layer protective film for glass, 1004. The individual layers of film shall be easily separated layer-from-layer with the use of a special tool.

The sheeting shall be installed with a nominal one-eighth-inch (1/8") gap between the sheeting and the glazing rubber on all edges whether in a sash or not. The material and installation procedure shall be reviewed by the Engineer.

SECTION 13 AUTOMATIC TRAIN CONTROL

13.01 <u>GENERAL</u>

The Contractor shall furnish, install and wire on each two-car unit, a microprocessor based Automatic Train Control (ATC) System functionally equivalent to the PHW system furnished on CTA's 5000 Series cars, with the Automatic Train Operation (ATO) sub-system and forty-five miles per hour (45 mph) command specified herein.

The ATC and ATO sub-system functions shall be implemented using fail-safe, closed loop detection principles to determine the correct operation of the system.

The term "Fail-Safe" as used herein is defined as a characteristic of a system which ensures that any malfunction affecting train safety will cause the system to revert to a state that is known to be safe.

Vital relays shall be defined as any relay the function of which affects the safety of train operations.

The ATC and ATO systems shall be of the most modern type, including the latest improved designs; and the apparatus, when installed, shall provide the highest degree of safety and reliability in Rapid Transit Service. The system and apparatus shall be designed to meet all the applicable specifications of the Signal and Communication Section, AREMA. The Contractor shall submit to the Engineer for review sufficient evidence to show that the manufacturer selected has had adequate experience in the design of Rapid Transit Cab Signal Systems and in the successful manufacture of the basic railway signal equipment and apparatus, and that the type of basic railway signal equipment and apparatus which the Contractor proposes to furnish shall have been in successful Rapid Transit signal operation for a period sufficient to demonstrate that such equipment and apparatus is suitable for the service specified herein as to design, manufacture and installation.

The trainborne equipment will be organized into receiving equipment, decoders including output relays, cab signal display drivers, and speed measurement and enforcement equipment. All equipment shall be of modular construction, rugged in design and suitable for carborne shock, vibration and the environment encountered in Rapid Transit service.

The ATC and ATO systems shall operate from the car's low voltage system. It shall be capable of operating normally with an input voltage range of 18-41 Vdc. Voltages below 18 Vdc or above 41 Vdc shall not cause damage to the system.

13.02 VITAL MICROPROCESSORS

Vital microprocessors shall conform to all the requirements of this Section, as well as Section 13.12 - Solid-State Equipment.

Vital microprocessors shall utilize a vital "kill" circuit to de-energize all outputs in the event of an I/O or processor failure. The system shall attempt an automatic reset after executing safety checks when the shutdown was caused by an I/O failure. In the event that this automatic reset is unsuccessful, shutdown shall require the operator to operate the ATC bypass push button to operate the train. While operating on ATC bypass, the audible alarm shall operate intermittently as defined in Section 13.03.

Each vital sub-system shall consist of a single microprocessor with CPU, I/O ports, and memory, and shall use closed-loop feedback and continuous self-checking to maintain vital integrity. Vital system outputs shall be positively monitored with independent current or voltage sensors and compared to the requested values. A vital "kill" circuit shall be used to de-energize all outputs when the outputs fail to correspond to the required state. The applications program shall be checked for alterations to ensure that no modifications have taken place after being installed. The CPU shall be continually tested to ensure that all instructions are being executed properly and that processor integrity is being maintained.

Diagnostic checks shall act on current (fresh) data only. Memory locations used to determine the proper states of inputs and outputs shall be cleared or overwritten prior to being reused during each cycle of tests to ensure the integrity of the check. The diagnostic checks shall be an integral part of the application (train control) logic for the system.

A complete and detailed program printout of all software for each vital processor is required. The program shall be modularized in a logical and easily understood manner. Each module of the program shall be fully documented with a plain English explanation of its purposes and the method by which it is accomplished, the modules to which it is related, and the modules of which it is a part.

A description of the program functions and details with flowcharts, a programming manual and a key sheet which lists all symbols, abbreviations and other aspects of the program is also required. This shall be one of the first items submitted for review for equipment to be furnished under this Section.

A full description of, and documentation for, the compiler shall be provided. This shall be a standard commercially-available compiler reviewed and accepted by the Engineer.

The ATC subcontractor shall provide compiler software maintenance for a period of five year (5 yrs) after the delivery of the last car of this order including any options.

The vital processor system shall not use a multi-processor voting scheme to evaluate the correctness of output.

13.02 VITAL MICROPROCESSORS (Continued)

The output states of the processor shall be verified at least once every 250 ms to ensure correspondence between the actual and requested values. The vital "kill" circuit shall remove power from all vital outputs in the event an output that should be off is on. Testing of outputs shall not cause false energy to momentarily occur on a de-energized output.

Inputs shall be re-evaluated at least once every 250 ms. Continuous vital checks shall be included in the processing of inputs to ensure the data base has not been corrupted in any fashion. Checks shall be included to ensure the independence of inputs from one another.

PROM's and EPROM's used shall be checked to ensure they have been unaltered during processor execution. Check words shall be created for blocks of memory to implement these tests. Unique check words shall be assigned for each vital input and output for this purpose.

Continuous vital integrity checks shall take place to monitor the execution of the software. Asynchronous tasks shall execute properly, and synchronized tasks shall execute in the proper order. Checks shall be included to shut down the system in the event the processor is overloaded.

Power for the outputs shall be vitally controlled by a vital power controller reviewed and accepted by the Engineer. This vital power controller shall be driven by a vital clock signal generated by the processor checks and diagnostics. The vital clock signal shall pass through filters tuned to prevent a false signal from energizing the output of this device. The signal frequency shall be immune to interference from any other device on the car: i.e., power supplies, audio or code equipment, or harmonics of these devices. The vital "kill" circuit shall remove the vital energy energizing all vital outputs.

13.03 OVERSPEED OPERATION

Overspeed control shall be provided for all speeds. When an aspect changes to require a more restrictive speed and the train is exceeding that speed, or when a train exceeds the allowable speed, i.e. an overspeed condition is detected, the ATO sub-system shall command coast by de-energizing the coast relay and the operator must initiate braking action within the set overspeed reaction time at not less than 90% of the maximum service brake rate, see Section 13.23. If the operator does not respond within the set overspeed reaction time, the train shall be brought to a stop automatically by the ATC equipment at the maximum service brake rate. The automatic brake application shall not be released until the train has stopped and the Master Controller is placed in the maximum service brake position. An audible alarm shall be provided, and shall operate as shown in the chart below. The audible alarm shall be a solid-state sound emitter interchangeable with a Mallory Sonalert. The sound level shall be no greater than presently generated by the existing Sonalert and shall be demonstrated and adjusted as required on the prototype units.

When continuous sound is called for, no "pulsing" will be accepted. Intermittent operation, when called for, shall be 200 ms sounding and 4 sec, silent, plus or minus fifteen percent ($\pm 15\%$), repeating as long as the condition remains.

The audible alarm shall be mounted behind the bypass panel in the cab ceiling.

13.03 OVERSPEED OPERATION (Continued)

The overspeed reaction time shall be adjustable by the ATC Computer Aided Applications (CAA) system software over a range of 0.3 seconds to 3.0 seconds and shall be initially set at 2.5 seconds. The timer shall stop running as soon as the acknowledgement signal is received and shall reset when the actual speed is below the allowable speed.

When the train speed has decreased to meet the re-initialization speed specified in Section 13.23, the ATO sub-system shall energize the coast relay to allow the train to motor.

AUDIBLE ALARM OPERATION					
WITH	AND	AND	SONALERT SOUNDS		
No Automatic Brake Application	Overspeed Detected	No Acknowledgement (Not at least 90% of Max. Service Brake)	Continuously		
No Automatic Brake Application	Overspeed Detected	Acknowledgement (At least 90% of Max. Service Brake)	Intermittently		
No Automatic Brake Application	No Overspeed	Moving on "Rule R6.4" Indication	Intermittently		
Automatic Brake Application	Not on Bypass		Continuously		
Attempted Automatic Brake Application	On Bypass		Intermittently		
Non-Recoverable System Shutdown	Not on Bypass		Continuously		
Non-Recoverable System Shutdown	On Bypass		Intermittently		
The audible alarm shall be silent under other conditions.					

13.04 COMPATIBILITY OF SYSTEM

The cab signal system furnished on this Contract must be compatible with the existing cab signal system on the CTA. The system must be able to operate with the level of energy on the rails that the existing system uses.

The cab signal frequency shall be 4.55 KHz ± 100 Hz interrupted at:

75 cycles per min \pm 5% for 15 mph 120 cycles per min \pm 5% for 25 mph 180 cycles per min \pm 5% for 35 mph 270 cycles per min \pm 5% for 55 mph 410 cycles per min \pm 5% for 45 mph 648 cycles per min \pm 5% for 70 mph

When no recognizable coded signal is received, the ATC equipment shall interpret this as STOP. To proceed after coming to a stop, the operator must depress and release the R6.4 Push Button, see Section 13.19.

The energy level of this interrupted 4.55 KHz signal in the rail or in a loop is such as to produce a field six inches (6") above the rail head of between 1.4 milligauss and 42 milligauss at every point in the track circuit when in the "on" state. This can be measured with an air core search coil of less than one square inch (\leq 1 sq. in.) of area through a 4.55 KHz filter with above band width.

The 4.55 KHz \pm 200 cycle component of the current in the rail generated by the track detection equipment anywhere in the circuit does not exceed an instantaneous value sufficient to produce 0.15 milligauss measured six-inches (6") above rail head by the same means.

The frequency response of the system shall be as follows:

Center Frequency 4550 Hz

- 3 dB points ± 100 Hz maximum
- 60 dB points ± 600 Hz maximum
13.05 SPECIAL PROVISIONS

The trainborne cab signal system shall be so designed that removal of power from the system will not result in a change in the mode of operation: from cut out to cut in or vice versa. The trainborne cab signal system shall not require any load to remain on the battery while the car is "layed up" on live or dead third rail. The carbody shall not be used for any ATC return circuits.

A push button switch shall be provided on the Operator's Bypass Panel, as specified in Section 9.05, D, 4, a, 3), to bypass the ATC overspeed penalty brake interface, ATO sub-system coast interface to the propulsion system and to initiate operation of the audible alarm in accordance with Section 13.03.

An interlock shall be provided on the power control relay to prevent the ATC system from detecting "no motion" when the Master Controller is in a power position until the power control relay is energized.

Each readily removable unit, including but not limited to, the aspect display units, equipment racks, relays, and plug-in printed circuit boards shall have a serial number permanently affixed.

A switch shall be provided in the ATC equipment case which, when actuated by maintenance personnel, will place the ATC system into the "Self-Test" mode, as described in Section 13.15. The switch and its location shall be reviewed by the Engineer and demonstrated in the mock-up.

The ATC system shall be designed to preclude operation of the train if both Master Controllers of a married pair are turned on.

The ATC system shall be designed so that it shall not be affected by high input signals from either the pick-up coils or speed sensors.

The ATC system shall be designed so that signal detection levels, number of "good" cycles and timing are coordinated to prevent low signal levels, distortion or intermittent loss of track signal from causing a penalty stop.

Power supply capacity shall be sufficient to power both ADUs simultaneously.

The ATC system supplier shall provide as-built drawings and program listings and shall provide documentation of any and all changes made to the system during the warranty period.

13.06 RECEIVING AND DECODING

The reception and decoding equipment shall be of fail-safe design and capable of receiving and decoding the rate-coded audio frequency signals from the running rails and loops. The system shall have the capacity to decode six (6) commands (70, 55, 35, 25, and 15 mph and 45 mph). When no recognizable coded signal is received, the ATC equipment will interpret this to mean STOP. To proceed after coming to a stop, the operator must depress and release the R6.4 push-button, see Section 13.19.

Carrier frequency detection shall utilize fail-safe circuitry and equipment. If relays are required, they shall be vital relays.

Rate code detection equipment shall be of fail-safe design using no active components for relay drive or filtering. Active components may be used for decoding with the provision for cross-checks and failure detection reviewed by the Engineer.

13.07 SPEED MEASUREMENT AND ENFORCEMENT

The speed measurement and enforcement equipment shall be of fail-safe design. The speed command input shall be obtained in a manner that gives priority to the more restrictive codes.

Actual train speed determination shall be accomplished by measuring the output frequency of a sensor which monitors the rotation of gear teeth in the traction drive. Electronic circuitry of fail-safe design used to measure speed shall be continuously checked to verify its proper operation and the presence of the speed sensor.

The speed sensor shall also be checked to ensure that it will recognize gear teeth rotation. This check will be accomplished by providing a motion detection feature which will ensure the speed sensor is producing an actual velocity output.

See also Section 13.20.

Overspeed control shall be accomplished by comparing the actual train speed with the command speed. When the actual train speed is equal to or greater than the command speed, the system shall respond to an overspeed condition and start the automatic brake application process. This comparison will be adjustable to an accuracy of ± 1 mph under all environmental and wheel wear conditions. Zero speed will be determined by a fail-safe check that the train speed is less than three miles per hour (<3 mph).

13.08 ASPECT DISPLAY UNIT

An aspect display unit (ADU) shall be installed in each operator's cab on the left side as on CTA's 5000 Series cars. The aspect unit shall show the actual train speed as well as the allowable speed.

The actual train speed indicator shall be a row of LED lights corresponding to the actual train speed in single mile-per-hour increments. The maximum speed displayed shall be seventy-two miles per hour (72 mph). The display operation and appearance to the Operator shall be the same as that on the ADUs presently installed in CTA's 5000 Series cars.

The allowable speed indicator shall be a row of light bars, which shall light in a continuous line from zero to the appropriate command speed. The allowable speed display light bar segments shall be 0 - 15 mph, 15 - 25 mph, 25 - 35 mph, 35 - 45 mph, 45 - 55 mph and 55 - 70 mph. All light bars below the command speed shall be lighted.

Although the speed command display circuitry may be non-vital in design, the method of interface to the decoder shall not degrade the fail-safe performance of the decoder.

Block conditions shall be indicated by the use of colored aspects. The "Green" aspect shall be lit when the allowable speed is 70 mph or 55 mph. The "Yellow" aspect shall be lit when the allowable speed is 45 mph, 35 mph, 25 mph or 15 mph. The "Red" aspect shall be lit when no recognizable coded signal is received by the train. After a stop has been made as required by the "Red" aspect and the R6.4 activate button has been pressed, the "Rule R6.4" light shall flash and the "Red" aspect shall remain lighted, see Section 13.19.

Two (2) printed messages shall also be included: "Cab Signal Cutout" in white illuminated letters on a black background and "Rule R6.4" in black letters on a white illuminated background. When not illuminated, the printed messages shall not be readable.

The aspect display, train speed indicator, allowable speed indicator, block condition and message lights shall be housed in a single package.

The design and operation of the ADU shall be reviewed and demonstrated to the Engineer prior to production.

The cab signal aspects shall be of a translucent material lighted from within the unit. The lighting from within the unit shall be so designed that there will be no leakage of light from any aspect which could be construed as a false indication.

The lamps used in the aspect display unit shall be long lasting LED's designed for use in the environment of an operator's cab on a rapid transit car.

The incoming wires shall be in the form of a cable and shall be plug coupled to the aspect display unit with a suitable plug capable of withstanding severe vibration. The plugs shall be inaccessible with the ADU installed.

13.08 ASPECT DISPLAY UNIT (Continued)

The aspect display unit shall be so designed that external light shall cause neither a false indication nor a washout of indication.

The aspect display unit in the operating cab only shall be operable and illuminated.

Fastenings used for assembly of the unit or mounting to the car which are accessible from the outside of the unit shall be Holt head tamperproof type screws. Any fastening on the face of the unit shall have dulled surfaces to lessen unwanted light reflections.

A mock-up of the proposed aspect display unit shall be provided in the operator's cab mock-up for review by the Engineer.

The unit shall be easily removable from the car without removing or disassembling any trim or other equipment.

13.09 CAR-CARRIED EQUIPMENT CASE

The ATC equipment rack shall be mounted within its own enclosure integrated into the cab-equipment cabinet opposite the operator's position unless otherwise agreed to by the Engineer. Access shall be through a hinged stainless steel cover secured by a Best Lock Corp. lock using an uncombinated, High Security Core #1CP7WC1-626 and #1AP1WC1 key blank for each unit delivered. Cores and blanks shall be shipped to CTA and installed by CTA personnel.

13.10 SECURITY

The system shall be extremely secure so that no output function is allowed to change as a result of noise or transients which might simulate a signal. The design of the system shall be for extreme reliability and long service with minimum maintenance.

13.11 VOLTAGE PROTECTION

The design of the system shall include means of protecting the equipment from malfunctioning or damage due to voltage transients on or induced in the wiring. The equipment shall also be protected from damage from accidental over voltage or voltage reversal. Possible signals generated by other car systems, which may affect the cab signal system, shall be identified by the Contractor. Special attention shall be taken in the design of the ATC equipment and its installation to ensure that these signals will not interfere with the proper operation of the system.

13.12 SOLID-STATE EQUIPMENT

Solid-state equipment and microprocessor based equipment, where required in this Section, shall be provided by the ATC System subcontractor. Such equipment provided shall be of the most modern design and meet the highest standards of industry and all applicable specifications of the Communications and Signal Section of the Association of American Railroads. The design and materials provided shall meet the requirements of this Section.

The equipment shall be provided complete with the necessary isolation and power regulation devices to ensure its performance and reliability upon installation. The equipment design and fabrication shall be such as to make it immune from whatever noise and transients may be present; surge protection shall be provided. Solid-state equipment shall be immune to electrostatic discharges to all devices and surfaces exposed to human touch during operation or servicing.

The Equipment shall be modular in design. Plug-in type printed circuit boards shall be used wherever possible. They shall be manufactured with mechanical keying which will prevent a wrong board from being installed in an improper slot and with rugged ejectors able to withstand the stresses of multiple insertions and ejections.

The system shall incorporate continuous self-checking features to ensure that the equipment, and program, where applicable, is functioning correctly. These checks shall be integral parts of both the hardware and software to provide for a secure system. Vital processors shall not allow false information to be transmitted to external devices which will create a hazardous condition. In no case may false information persist long enough to allow an unsafe condition to occur. Visual indications, such as LED lamps, shall demonstrate that the system is functioning properly; similarly, failure and diagnostic indications shall be provided. Indications shall isolate a failure to a particular function, or to the interface between two (2) functions.

Inputs for the equipment shall be debounced and shall be electrically isolated from one another. A visual indication, such as an LED lamp, shall be provided on the input board to each input to indicate when the input is activated.

Vital outputs for the equipment shall be electrically and physically isolated from one another. A visual indication, such as an LED lamp, shall be provided on the output board for each output to indicate when the output is activated. Use of any output contact for a load in excess of its design capability is not permitted.

Labels shall be provided by each input and output indication which clearly denote the respective function of each for ease of maintenance and troubleshooting.

Relay and/or logic equivalent of all vital programs shall be furnished to show the functional relationship between inputs and outputs.

A complete computer-aided applications package (CAA), including hardware, software, and training shall be provided for programming the microprocessor-based equipment covered under this Section.

13.12 SOLID-STATE EQUIPMENT (Continued)

The CAA package shall allow, at least, but not be limited to, the same adjustments used on the CTA 5000 Series car package. The CAA package shall have the same default values and ranges used on the CTA 5000 Series car package with the addition of individual adjustments for the ATO coast speeds and coast re-initialization speeds as specified in Section 13.23. The CAA package shall not have conflicts with other software such as, but not limited to, Norton PC Anywhere, virus protection and scanning programs from Norton or McAfee, AutoCAD, Corel Suite and MS Professional Office Suite in their latest versions. The CAA package shall reside on an IBM compatible personal computer reviewed by the Engineer of the highest quality and latest technology at the time of delivery to CTA.

The package shall also include a Windows[™] based EPROM burner equal to the latest technology version of Data I/O's "Chiplab" for reprogramming the microprocessor based sub-systems.

In support of the applications package, PTU package and the vital software development system, Windows[™] Operating System, latest version, of all software shall be supplied. All software provided shall include licenses granted to the Chicago Transit Authority.

One (1) stand alone bench test unit complete with all required commercial and specialized test equipment, simulation equipment, component removal and replacement equipment, schematics, test procedures, test software, fixtures, cables, extender boards and interface units completely wired with convenient test points brought out to the front, shall be supplied for testing, by plug-in/extension/probe or better method, all ATC car equipment. The bench test unit utilizing the combination of schematics, test equipment, written test procedures, automated test procedures, and test fixtures shall be able to identify defective parts down to the component level. The bench test unit shall utilize the latest technology; highest quality equipment at the time of delivery to the CTA and all equipment supplied shall be new. The unit and its components shall be delivered to the Engineer within one year (1 yr) after delivery of the first production cars.

Any modifications to the equipment made subsequent to the delivery of these items shall also be made to them at no cost to CTA.

13.13 <u>RELAYS</u>

All relays shall be of the plug-in type, except as otherwise specified, complete with their plug boards. Relays of the same type or style shall be uniform in size and in coil resistance. The dc relays shall be plug-in relays.

Relays shall conform to the applicable specifications of the Communication and Signal Section of the Association of American Railroads. Exceptions may be permitted but require review and consent by the Engineer.

Each relay and its repeaters shall have at least one spare front and back contact.

13.14 RECEIVER COIL SWITCHING

Two (2) individual receiver coil switching devices shall be provided in the equipment case to energize the receiver coils on the lead end of a unit. These devices shall be individually controlled by a contact in the Master Controller reverser mechanism to only energize the lead coils. Both receiver coil leads shall be broken by the switch. The switching circuit shall be designed to operate at the voltage parameters specified in section 13.01. The circuit shall be designed to provide high reliability and shall not degrade the incoming signal. Switch circuit design shall be reviewed by the Engineer.

13.15 INTERNAL SYSTEM TEST AND DIAGNOSTIC FAULT RECORDING MODULE

The ATC subcontractor, as part of the Automatic Train Control system furnished under this Specification, shall provide an internal System Test Module to provide the following functions:

A. When actuated by maintenance personnel by means of the Self-Test switch, the Internal System Test Module will begin a diagnostic procedure which will check the operation of all portions of the ATC system, including the functioning of the Aspect Display Unit, overspeed control, ATO functions, R6.4 functions, acknowledging functions, and penalty brake application. Operation of the Self-Test switch shall prevent train operation.

13.15 INTERNAL SYSTEM TEST AND DIAGNOSTIC FAULT RECORDING MODULE (Continued)

- B. The Internal System Test Module shall also provide means by which maintenance personnel can, from the ATC equipment case, perform more detailed diagnostic procedures which will allow them to identify defective components or modules down to the level of individual printed circuit boards. This diagnostic capability shall include the speed sensors and pick-up coils. Speed sensor, all power supply voltages, Vital relay coil, Coast Contactor, Vital kill frequency and pick-up coil test points shall be incorporated and shall be readily accessible in the equipment case. All failures shall be recorded in an internal buffer with time/date stamp, an error code, and a Log Snapshot containing the complete I/O status of the system, system mode, direction, speed, system voltages, input voltage and bus status. This snapshot shall be a continuous series of frames taken every clock cycle of the system for a period no less than two seconds prior to through two seconds after the failure. The event codes shall be easily accessed through a board level alphanumeric display and all information shall be accessible through an external port with RS-232 or other connection reviewed by the Engineer. The system shall have the capability to store at least 3,000 events and snapshots recorded in chronological order. Recorded events shall include the operation of the self-test switch and the manual cut out switch each time a transition is made. The system shall be designed such that when the memory buffer is full, the system will continue to update, saving the most current data and overwriting the oldest. This overwriting shall not cause problems with the system or its recording ability. Any software needed for the transfer, decoding or analysis of this data shall be provided as part of the software development system Section 13.12 shall be installed in the PTU units provided under Section 17.04, B. See Section 13.17. The software shall provide for three levels of password protected administrator selected access.
- C. Any Modifications required to the internal test modules subsequent to their delivery as a result of changes in the hardware or software of the ATC system shall be made to all modules at no cost to CTA.
- D. The internal system test and diagnostic fault recording module shall, at a minimum, perform the same diagnostic self test and record the same event and fault information recorded as on the CTA 5000 Series cars. In addition, the system shall record any conflict in the coast command status between the ATO sub-system command and the propulsion system feedback signal.

13.16 PORTABLE FIELD TEST UNITS

The Contractor shall supply fifteen (15) portable digital signal processor-based testing units with pre-programmed test algorithms and serial communication interface capability, designed to test cab signal equipment in CTA's rapid transit rail cars. Three (3) units shall be delivered with the prototype cars. The remaining units shall be delivered within 180 days after the delivery of the first production cars.

The test units shall be similar in design and function to the existing units used by the CTA and shall provide 0.05% or better accuracy with stable outputs and adjustment. The portable test units shall communicate with the cab signal package to obtain the required data, measurements and statuses necessary to perform a system test and inspection. The information required shall be at least, but not limited to, the entries required on the CTA 5000 Inspection and Calibration sheets including the Coast Contactor and ATO status. The units shall be designed such that a short placed across any output for any length of time shall not cause damage to the unit. The units shall come with calibrating instructions, adjustment procedures and detailed schematics for internal circuitry. The units shall be self-contained and provided with all connecting cables and plugs and hard carrying cases.

One (1) prototype unit shall be built and delivered to the CTA for review by the Engineer before additional units are built. Any modifications requested by the Engineer shall be incorporated into the prototype at no additional cost before final acceptance and shall be included in the remaining units at no additional cost.

The test unit shall generate audio frequency sine wave signals that can drive the rail car on-board cab signal receivers and speed detection equipment (Automatic Train Control) to test for proper operation. The unit shall have a three channel output to produce one (1) cab signal and two (2) signal generator output signals simultaneously. The unit shall have three operating modes below: Basic mode, Cab signal 1 mode, and Cab signal 2 mode.

13.16 PORTABLE FIELD TEST UNITS (Continued)

The test unit shall have:

- 1. Automated testing capabilities programmable by the user along with ramp, ramp and measure, and input capabilities.
- 2. An output function that can be programmed to open or close contacts, based on specific pre-programmed input or output criteria specified by the user.
- 3. Two digital input/output ports: One (1) standard RS232 serial communications port, and one (1) general purpose eight bit input/output.
- 4. Two measurement inputs, capable of measuring AC and DC voltages and resistance. When in the input mode of operation, the inputs shall provide auto-ranging digital voltmeter or ohmmeter operation, with automatic detection of AC or DC voltages. The unit shall be capable of measuring resistance from 0.1 ohm to one (1) Megohm with an accuracy of at least 1%.
- 5. An input interface that, when connected to certain types of cab signal receivers, will provide the ability to detect when the cab signal receiver has picked up the applied code rate. The preferred location of the input interface is the front panel of the unit.

The test unit shall come pre-programmed with CTA specified values, tests and inspections. The test unit shall have a feature that allows the operator to edit and save the pre-programmed and user defaults from the front panel of the test unit using the menus available. The test unit shall be capable of storing 50 tests with pre-programmed reports to duplicate the CTA forms. The test unit must also allow the operator to enter defaults onto a PC, using included software and then load the defaults into the test unit from the PC serial port.

To provide real time feedback to the digital signal processor for output control and accuracy, all outputs shall be adjustable in real time and utilize closed loop design.

The operator's manual describing each capability and function along with setup instructions shall be provided. One copy shall be provided with each test unit provided along with an electronic copy.

The test unit shall operate from 110/120 Vac, 60 Hz. The test unit shall come with a built in circuit breaker for overload protection. The unit shall be light weight and compact in size for easy portability.

Indicators - The test unit shall come with the following LED indicators: Power Supply Status, Switch Status and Operating Mode (2 lines by 40 characters, minimum).

13.16 PORTABLE FIELD TEST UNITS (Continued)

Signal Generator Output - The Signal Generator or Speed Outputs shall produce audio frequency sine waves used to simulate the speed inputs of the Cab Signal Receiver or Automatic Train Control System. The code rate output and both speed signal outputs shall be closed loop design to provide instantaneous feed back to the digital processor, even while coding. The test unit shall be capable of generating a user adjustable cab carrier frequency of 4,550 Hz with an accuracy of at least 0.2 Hz with a maximum THD of 0.2%. The code rate generator portion shall produce the following pulses per minute (ppm) code rates at a user adjustable duty cycle from at least 20% to 90% in 1% increments. Steady (0 ppm), 75 ppm, 120 ppm, 180 ppm, 270 ppm, 410 ppm, and 648 ppm. These pulse rates shall be user adjustable in 1 ppm increments with 1 ppm accuracy.

The test unit shall be capable of generating 2 separate output frequencies referred to as Speed 1 and Speed 2. Speed 1 shall be user adjustable from at least 20 Hz to a minimum of 5 KHz in one (1) Hz increments, ranging from 0 to 5 volts rms user adjustable in 100 mV increments with an attached 50 ohm load. Speed 2 shall be user adjustable from at least 20 Hz to a minimum of 5 KHz in one (1) Hz increments, ranging from 0 to 50 volts p-p user adjustable in 100 mV increments with an attached 600 ohm load. The speed output shall be configured so that it can be instantaneously interrupted from an external switch supplied with the test unit. The speed output display shall be user configurable and adjustable in frequency, miles per hour and kilometers per hour. The speed outputs shall also have user configurable pre-sets (at least 5) to produce quick user selectable output frequencies.

The test unit shall have stored values of wheel diameters and the corresponding pulses per revolution, in a menu format, that the operator can select to establish the correct frequencies for miles or kilometers per hour outputs. The speed outputs shall have different output levels and shall be usable independently or locked together when in the MPH or KPH mode, so that the operator can adjust the output in MPH or KPH steps, and adjust both outputs simultaneously. If only one speed output is desired or needed, the other shall be capable of being turned off. The speed outputs shall be configurable to produce the correct frequencies for display and control in MPH or KPH, by setting the wheel diameter and pulses per revolution values in a separate speed setup menu. The test unit shall generate a modulated code rate at each rate defined in Section 13.04 with an output current of from 0 to 2 amps minimum in one (1) mA increments with an average 1.2 ohm load attached at the output.

13.16 PORTABLE FIELD TEST UNITS (Continued)

The unit shall have the following operating modes:

Basic Mode:	The Basic mode shall allow the user to make basic cab signal tests such as carrier frequency, code rates, and output current.
Cab Signal 1:	The Cab Signal 1 mode shall allow the user full access to all capabilities of the testing unit for the six (6) existing code rates used by CTA.
Cab Signal 2:	The Cab Signal 2 Mode shall allow the user full access to all capabilities of the testing unit for the six (6) existing code rates used by CTA and three (3) additional code rates.

The unit shall be capable of working problem free when subjected to the following environmental conditions:

Operating Temperature:	0 to +122 ^o F (-18 to +50 ^o C)
Storage:	-4 to +140° F (-20 to +60° C)
Humidity:	Up to 80% non condensing
Shock:	Up to 6g each axis
Vibration:	Up to 1g at 0-100 Hz, each axis

Test units shall be shipped with all connectors and cables required to test equipment input and output functions. Two (2) sets of Cab Signal Test Equipment calibration modules, procedures, instructions, software and specifications shall be included so that CTA can calibrate the test units in house.

Any modifications required to be made to these test units subsequent to their delivery as a result of changes in the hardware or software of the ATC system shall be made to all units at no cost to CTA.

13.17 PORTABLE TEST UNITS

The Contractor shall furnish rugged Portable Test Units (PTU) as specified in Section 17.04, to access the microprocessor controls beyond the built-in diagnostics and to access the ATC event recorder.

The PTU shall perform the following functions:

- 1. Fault event display and reset.
- 2. Manual test of controller and devices.
- 3. Data memory display of system operation both before and after a fault shutdown of the system. In addition, it shall be possible to create snapshots by setting snapshot parameter levels to trigger a memory function of system operation. This function shall be reviewed by the Engineer.
- 4. Real time monitoring and recording of system performance and operation.
- 5. Download of data from car to PTU memory/storage for later analysis.
- 6. Download software from PTU to car.
- 7. Display and adjust system fault event parameters, fault lockout parameters that are adjustable, including car identification.
- 8. Download data from the ATC event recorder.

Three levels of password protected access shall be incorporated to prevent unauthorized access to and erasure of various functions and information. The security levels and their contents and the passwords used shall be reviewed by the Engineer.

The software shall incorporate at least all the functions and capabilities of the system supplied with the CTA's 5000 Series cars.

13.18 INTERNAL EVENT RECORDER

The carborne ATC system shall incorporate an internal event recording sub-system which shall reside within the ATC card file to provide extended time for system status recordina. This system shall be separate from the Event Recorder specified in Section 9.16. The recorder shall record in "Real Time" all available Inputs, Outputs, Direction, Unit Number, Time, Date, Speed, Control Voltage, System Voltages, System Conditions, System Generated Status and up to ten (10) Additional Inputs as designated by the Engineer for a period of no less than twenty-four hours (24 hr) and shall continue to record for fifteen seconds (15 sec) after the control voltage has been removed unless otherwise agreed to by the Engineer. The recorder shall provide for multiple passwords with administrator selected access within its program (if possible) for various utilities and functions providing limitations for each as reviewed by the Engineer. The system shall also incorporate a multidirectional accelerometer to record force levels of 0.5g to at least 6g in the X, Y, and Z directions. The system shall provide for means to download all information to the PTU provided under Section 17.04. All software needed to download and utilize the information shall be provided at no additional cost and shall meet the Specifications under Section 13.17.

The Internal Event Recorder system shall include the interface software to generate at a minimum the following report types:

- Chronologically ordered event text, displaying stored events in a columnar format displaying all specific or partial details as selected by the user. This report system shall incorporate multiple search functions and speed keys for all areas. Final configuration of the system hardware, software and generated output shall be reviewed by the Engineer.
- 2. Chronologically ordered event graphing, displaying change in state events over time in a chart type format displaying all, specific or partial details as selected by the user. This report system shall incorporate multiple search functions, zoom options, multiple event marking, multiple event line coloring, event pop-up data windows when event is keyed with a mouse, event ordering, time distinction between multiple events and speed keys for all areas. Event graphing shall display speed, voltages and forces in a linear type graph with the above options. Final Configuration of the system hardware, software and generated output shall be reviewed by the Engineer.

13.19 R6.4 SWITCH AND LIGHT

A push-button switch shall be installed above the ADU as on CTA's 5000 Series cars. The switch shall have a smooth, black anodized face plate engraved and white filled reading "Activate R6.4". A white button shall activate the switch and be set in a recess to make it flush with the face of the plate. The plate shall be retained with 10-32 stainless steel, Holt head screws the same as those that retain the ADU. In the absence of valid code, the switch shall activate the flashing R6.4 light in the ADU, cause a red indicator light mounted on the top of the run number sign box to light and allow train movement at no greater than fifteen miles per hour (15 mph). The switch is functional only after a stop has been made as required by a "Red" aspect.

A red indicator light similar to that on CTA's 5000 Series cars consisting of an assembly of red LEDs behind a red lens, shall be installed on the top of the run number sign box, see Section 14.02, L.

The switch assembly, the red indicator light, both installations and the circuits used shall be reviewed by the Engineer.

13.20 SPEED SENSORS AND CABLES

The gearbox mounted speed sensors shall be installed on the No. 1 axle. The sensor design shall be suitable for installation on rail car gearboxes and shall be reviewed by the Engineer.

Speed sensor cables shall be molded into the sensor body with an integral strain relief. The cables shall be wired directly to the truck mounted junction box, also see Section 9.12.

13.21 ATC COILS AND JUNCTION BOX

Rugged, untuned ATC pick-up coils shall be installed on all cars. If additional electrical filtering is required, it shall be installed in the equipment rack. Fabreeka ATC pick-up coil supports shall also be installed to isolate the coils from the truck mounted support bracket.

The design of the support brackets shall be such that they will not fail from the severe vibration or environment of a rapid transit car truck.

An appropriate weatherproof junction box with a stud type terminal board shall be provided on the truck for connecting the receiver coil and speed sensor leads to the equipment. The lead from the junction box to the carbody shall be provided with a weatherproof plug as specified in Section 9.02, J, at the carbody end to facilitate the removal of the truck.

The pick-up coils, brackets, speed sensors and junction box shall be demonstrated on the truck mock-up.

13.22 SPECIAL PROVISIONS

The ATC system supplier shall provide a dedicated ethernet link to the main vehicle event recorder specified in Section 9.16. The supplier shall provide information to the recorder in the protocol requested by the supplier of the vehicle event recorder. Information to be supplied shall be at least: All Inputs, All Outputs, Actual Speed, Allowable Speed, ATC Mode, Acknowledge, R6.4 Acknowledge, Audible Alarm, Bypass, B2-B3, Motion, BRR Status, accelerometer values in excess of 0.5 g, date - time synchronized with that in the event recorder as stated in IEEE Standard 1482.1-1999, and car number.

13.23 ATO SUB-SYSTEM

The ATC system shall be equipped with an Automatic Train Operation (ATO) sub-system to provide a speed control interface with the propulsion system. This interface shall consist of a relay in the ATO sub-system that delivers a coast command to the propulsion system, see Section 10.03, K, 2.

The ATO sub-system shall override the propulsion system power command and cause the train to go into coast when the relay is de-energized and allow the train to motor when the relay is energized (initialized on start up or re-initialized after command coast.

The ATO sub-system shall report the relay position to the internal event recorder and shall also export this information to the car event recorder.

If the relay position does not correspond to the command signal, the ATC system shall declare a critical fault and de-energize the Brake Release Relay and energize the audible alarm. It shall be necessary to energize the ATC By-Pass in order to operate the train.

The relay driver logic shall have speed settings associated with each allowable command speed and the absence of recognizable code (R6.4). Each individual allowed speed, including R6.4, shall have a separate coast speed setting that shall be adjustable via the CAA package within a range of 5.0 mph below the command setting to 2.0 mph above the command setting. The re-initialization of the relay shall be adjustable from 6.0 mph below the command speed to 1.5 mph above the command speed. The default value for coast command shall be command speed and re-initialization speed shall be 2.0 mph below the command speed. The speed comparisons shall be adjustable to an accuracy of ± -0.2 mph under all environmental and wheel wear conditions.

13.23 ATO SUB-SYSTEM (Continued)

The ATO sub-system shall measure the rate of change (acceleration) of car speed towards the coast speed setting and shall de-energize the relay to prevent the train from reaching the coast speed setting, based on the acceleration profile. A value shall be stored for each coast speed setting, including absence of recognizable code (R6.4), to determine the time delay offset for de-energizing the relay. These values shall be adjustable via the CAA package in 0.1 second increments from 0.0 seconds to 3.0 seconds before reaching the coast speed setting, with a default value the same as on CTA's 5000 Series cars.

See Section 13.03 - Overspeed Operation for a description of the ATO sub-system operation during overspeed conditions.

When the ATC system is in the Cut Out mode from the ATC manual cut out switch the ATO sub-system shall bypass the relay contacts regardless of train speed.

The ATC bypass button shall include a separate contact to energize the relay when activated. This contact shall be in addition to the contact that bypasses the overspeed penalty brake command see Sections 9.05, D, 4, Section 10.03, K, and Section 13.05.

SECTION 14 COMMUNICATION AND VIDEO SYSTEMS

14.01 <u>GENERAL</u>

- A. The Communication and Video Systems shall be installed on the cars to provide the functions listed below. The systems shall be interoperable and compatible with those on CTAs 5000 Series cars. Refer to CTA Drawing SKR-1-092112C, Page DR-22 for a conceptual diagram of the systems. Each car shall be equipped with:
 - 1. One-way communication from the operator to passengers, public address.
 - 2. Two-way (duplex) communication between operators' positions, intercom.
 - 3. Two-way (half-duplex) communication between operator's position and passenger intercom units.
 - 4. Manually and automatically triggered, pre-recorded station and message announcements.
 - 5. Message signs inside each car to repeat the pre-recorded station and message announcements.
 - 6. Route and system map displays to show next the station stop and CTA rail system..
 - 7. Side and front destination signs.
 - 8. Run number signs.
 - 9. Video recording of the car interior and exterior.
 - 10. Wireless Data and video communication via the Data Radio/Cell Modem, see Section 15.10.
- B. All connections to car wiring and between units shall be made through connectors as specified in Section 9.02, J, unless otherwise agreed to by the Engineer.
- C. All aspects of the carborne Communication and Video Systems shall be completely tested and made fully operational by the Contractor in his plant, see Sections 16.01, P and V.
- D. The entire Communication and Video Systems including their component parts, location and mounting, operation and programming shall be reviewed by the Engineer.
- E. All equipment shall be designed for operation in the rapid transit car climatic and shock and vibration environment.
- F. Equipment shall withstand any transient voltages, which may appear during operation of the car and be immune to EMI/EMC, noise, ripple and other interference on the power, control and signal wires.

14.01 <u>GENERAL</u> (Continued)

- G. The carborne equipment shall meet, as a minimum, all the requirements of IEC 60571, latest edition, "Rules for electronic equipment used on rail vehicles", unless otherwise specified, and shall be tested accordingly. In the event that actual car operating conditions exceed the limits prescribed in the IEC standards, the equipment provided shall meet the most severe conditions.
- H. Audio quality for all types of public address (pre-recorded and manual) and intercom messages shall be at least 80 to 10,000 Hz \pm 3 dB with a signal to noise ratio of no less than 60 dB.

14.02 COMMUNICATION SYSTEM

A. <u>General</u>

The Communication System shall provide the following:

- 1. One-way communication from the operator to passengers, public address (PA).
- 2. One-way communication from the control center to passengers (both audio and text), public address for remote communications.
- 3. Two-way (duplex) communication between operators' positions, operator intercom (IC).
- 4. Two-way (half-duplex) communication between operator's position and passenger intercom units (PIU).
- 5. Conversion of analog audio signals to digital format.
- 6. Manually and automatically triggered, pre-recorded station and message announcements.
- 7. Message signs inside each car to repeat the pre-recorded station and message announcements.
- 8. Illuminated rail system route maps to display the next station stop.
- 9. Side and front destination signs.
- 10. Run number signs.
- 11. Control of the marker lights.

The Communication System shall interface with the Control and Monitoring Network (CMN) specified in Section 15.06, for the exchange of data, both trainline and within the unit (married pair) and with the Data Radio specified in Section 15.10 for the transmission of data and video to the wayside and from the wayside to the train. See also Sections 14.02, B, 5, 14.02, C, 5 and 14.03, A, 4.

14.02 <u>COMMUNICATION SYSTEM</u> (Continued)

The Communication System shall interface with the Ethernet network as shown on CTA Drawing SKR-1-092112A, Page DR-11, and CTA Drawing SKR-1-092112C, Page DR-22.

The Communication System shall interface with the Data Radio specified in Section 15.10, for the exchange of data.

All equipment shall be designed, constructed and installed to allow easy access for removal and maintenance.

- B. <u>Communications Control Unit (CCU)</u>
 - 1. The CCU shall be a fully integrated, microprocessor controlled, unit designed and configured for long life of its component parts and for easy diagnostics, troubleshooting, reprogramming and component replacement. All CCUs shall be fully interchangeable.
 - 2. The CCU shall be the central control and signal processor for the Communication System on each car or married pair.
 - 3. The CCU in the car or married pair with the active cab shall be the "Master" unit for the train. All other CCUs in the train shall function as a "Slave". Communication between all CCUs in the train shall be through digital signals via the CMN as specified in Section 15.06. Provision shall be made to prevent more than one CCU in a train from serving as a "Master" unit.
 - 4. The "Master" CCU shall use the Global Positioning System (GPS) receiver, see Section 15.05, in its unit (married pair) to determine train position, time and date. Inputs from all other GPS receivers in the train shall be inhibited.
 - 5. The CCU shall interface with the data radio, see Section 15.10, for data exchange, including remote audio and text message, system interrogation and data file update.
 - 6. Input and output data shall be transmitted utilizing an error detection and correction scheme to assure security and accuracy of the transmission throughout the train.
 - 7. The CCU shall be equipped with at least two (2) spare data ports.
 - 8. Activation of the Communication System shall be accomplished when the master controller is turned "ON" or when the emergency headlight/communications switch is in the "ON" position, or when any door control box is turned "ON".

14.02 <u>COMMUNICATION SYSTEM</u> (Continued)

- B. <u>Communications Control Unit (CCU)</u> (Continued)
 - 9. The system shall be powered from the car's low voltage system through circuit breaker P44, "COMMUNICATION SYSTEM".
 - 10. Power interruptions of up to 50 msec shall not cause the system to reinitialize.
 - 11. The CCU shall have a method to test all the sub-systems controlled by the CCU. A self-test routine shall be available. The triggering of the self-test and testing routines shall be done through the maintenance screens of the TOTS and PTU and shall be reviewed by the Engineer. The self-test shall include a lamp test to verify the operation of all system lamps and sign LEDs.
 - 12. The CCU shall have self-diagnostic capability and memorize faults occurring in the CCU and in all the other controlled systems. Faults shall be recorded with reference data such as: car number, time, date, location. Fault memory shall have the capacity of storing at least five hundred (500) faults, stored in a first-in, first-out sequence. The self-diagnostics shall be capable of identifying the faulty electronic circuit and indicate the electronic module to be replaced. This information shall be stored in the memory fault, together with the fault log and retrievable with the use of the PTU. See Sections 1.22 and 17.04.
 - 13. The CCU with amplifier shall be installed in the cab equipment locker or above the cab ceiling of each car unless otherwise agreed to by the Engineer.
- C. <u>CCU Programming and Setup</u>
 - 1. The CCU shall be programmed, initially setup, and tested by the Contractor prior to shipping the car.
 - 2. The Contractor shall perform any required mapping of the CTA system for the GPS system.
 - 3. The Contractor shall furnish complete hardware, software and training for the CTA to program all aspects of the system including, but not limited to: routes, marker lights, voice messages and visual messages and maps. Hardware shall include, but not be limited to, an IBM PC compatible computer of the latest model and 21" flat panel monitor, audio equipment, including microphone and speakers, and all associated hardware and configuration software required to perform all programming aspects of the system.
 - 4. On-board reprogramming shall be accomplished through a single step download transfer between a USB key or the PTU and the non-volatile memory in the "Master" CCU. Other methods may be proposed, but shall require review by the Engineer. The controller in the "Master" CCU shall subsequently transfer the downloaded data to the other CCU of the unit and, if in a train, to all other CCUs of the train.

14.02 <u>COMMUNICATION SYSTEM</u> (Continued)

- C. <u>CCU Programming and Setup</u> (Continued)
 - 5. Remote reprogramming shall be accomplished through the use of the data radio, see Section 15.10. The remote system data transfer methodology shall be reviewed by the Engineer.
 - 6. Whenever a train is assembled, the "Master" CCU shall verify the database of all other CCUs in the train. If a more recent version of the database is found on any of the train's CCUs, then all the CCUs of the train shall be automatically updated to the latest version.
- D. <u>PA/IC Amplifier</u>
 - 1. The PA/IC amplifier shall receive inputs from the Operator's Communication Control Panel, Door Control Boxes in the cab, analog input jack in each cab and from the Passenger Intercom Units.
 - 2. The PA/IC amplifier may drive the speakers in one or both cars of the married pair. The speakers of the lead married pair or any pair of cars where a Door Control Box or Emergency Headlight/Communication switch is turned on shall be driven by a direct analog output to prevent digitization delays from interfering with manual announcements.
 - 3. Frequency response of the amplifier shall be in the range of 80 to 10,000 Hz, \pm 2 dB, with a maximum of three percent (3%) total harmonic distortion. Reprocessing or other techniques for altering the response curve outside the amplifier to improve the efficiency of speech shall be permitted according to the manufacturer's discretion.
 - 4. Hum and noise levels shall be not less than 50 dB below rated output.
 - 5. Provisions shall be made for the following inputs, each with its own level adjustment unless otherwise agreed to by the Engineer. The adjustments shall be made by PTU and shall provide for fine adjustment of the level within a limited range of \pm 6 dBC measured at the interior speakers.
 - a. Operator's Handset.
 - b. Microphones on the door control boxes.
 - c. Passenger Intercom Unit.
 - d. Pre-Recorded Announcements.
 - e. One line level analog input with separate input jack in each operator's cab. The jack shall be located on the Operator's Communication Panel. This input shall be muted when a PA announcement is being made either from the pre-recorded system or manually.

14.02 COMMUNICATION SYSTEM (Continued)

- D. <u>PA/IC Amplifier</u> (Continued)
 - 6. The power output of the PA audio amplifier(s) shall be no less than five (5) watts continuous per speaker being driven in order to insure sufficient undistorted volume on the seven (7) interior and four (4) exterior speakers on each car. The power output may vary 3 dB from normal over the temperature extremes as specified in Section 1.02, B.
 - 7. Amplifier inputs or outputs may be open circuited or short-circuited without damage to the amplifier. Reverse polarity protection shall be provided. See Section 9.01, D.
 - 8. Separate volume control shall be provided for the interior speakers and for the exterior speakers. Speaker volume shall be PTU-adjustable. Initial settings shall be as specified in Section 16.01, P, and verified on the prototype cars. See also Section 14.02, I, 3, d, 3).
- E. Loudspeakers and Baffles
 - Each car shall be equipped with seven (7) appropriately spaced interior speakers for the public address system. The speakers shall have a measured on-axis response at four (4) feet with one Watt (1 W) input at 400 Hz of at least 90 dB. The frequency response shall be within ±5 dB from 80 to 8500 Hz. The power handling capacity shall be at least eight Watts (8 W). The speakers shall be equipped with small perforated grille colored to match the ceiling panels. The grilles shall be reviewed by the Engineer.

All interior speakers, with the exception of the one in the operator's cab, shall be identical.

- 2. Each car shall be equipped with four (4) weatherproof exterior speakers. These speakers shall be mounted adjacent to each side door as shown on CTA Drawing R-1-606, Page DR-1. The housing and grille shall be stainless steel.
 - a. The housings shall be sealed to prevent water from entering the door pocket.
 - b. The speakers shall be equal to University type MM-2F and be mechanically interchangeable with those used on CTA's 5000 Series cars.
- 3. Each operator's cab shall be equipped with a small speaker to allow the operator to easily hear PA messages. The location and design of the speaker shall minimize the likelihood of feedback when the handset or door control box microphones are used to make PA announcements.

14.02 COMMUNICATION SYSTEM (Continued)

F. <u>Operator's Communications Panel</u>

- 1. A Communication Panel, reviewed by the Engineer, shall be located in each operator's cab on the Operator's Control Panel. The panel shall be used by the operator for manually initiated PA announcements and for IC communications.
- 2. Special care must be taken to ensure adequate volume levels without background noise or hum on the operator's intercom speaker.
- 3. The panel shall be smooth black anodized aluminum and all labeling shall be white filled, engraved lettering. The control panel assembly shall be designed, constructed and installed to allow easy removal for maintenance. The communications panel shall include:
 - a. Coiled cable handset with push-to-talk switch equal to Motorola 40C83985F1 and integral hang-up facility.
 - A heavy duty four (4) position mode selection switch, manual selection, detent type, with positions labeled from left-to-right:
 "OPERATOR INTERCOM", PASSENGER INSIDE-OUTSIDE",
 "PASSENGER INSIDE ONLY", and "PASSENGER INTERCOM". The switch shall have a rectangular knob with stop pins mounted through the panel.
 - c. A speaker shall be provided in each Operator's Communications Panel for intercom communications. This speaker shall have a volume control that cannot be turned off or below audibility. The knob shall have stop pins to prevent damage to the control. The speaker shall be protected with a rugged vandal resistant stainless steel perforated grille.
 - d. A red LED to signal incoming passenger intercom messages.
 - e. Line level analog input jack.

G. <u>Door Control Box</u>

1. Door Control Boxes shall be located as specified in Section 6.02. The Door Control Boxes shall be used by the Operator and other CTA personnel for manually initiated PA announcements.

14.02 COMMUNICATION SYSTEM (Continued)

- G. <u>Door Control Box</u> (Continued)
 - 2. Each door control box shall have a surface-mounted high impedance dynamic-type microphone for public address use. The microphone shall be provided with a stainless steel enclosure and be heavy duty and vandal resistant. The microphone shall be specifically designed to ensure intelligibility of speech and to minimize background noise while effectively picking up the operator's speech.

The microphones shall be angled to face the window. Two (2) rugged "pushto-talk" switches shall be installed at each microphone position. One shall activate the public address system inside and outside speakers, and the other shall activate inside speakers only. The switches and microphone shall be mounted on an independent panel to allow the cover to be removed without disturbing any wiring or switches. The panel shall have black filled engraved labels for the two push switches. The top one shall be labeled "INT. / EXT. SPEAKERS" and the bottom one shall be labeled "INTERIOR SPEAKERS".

The panel and its components shall be reviewed by the Engineer and demonstrated on the cab mockup.

- 3. Each door control box shall also have installed a vertically oriented series of five (5) pushbuttons to activate five (5) functions of the Pre-Recorded Announcements.
 - a. The buttons shall be located on the side of the box adjacent to the opening sash and shall be located at the same height as the opening in the front of the box for the toggle switches.
 - b. The buttons shall be housed in a stainless steel enclosure attached to the door control box cover with pin socket head machine screws.

The button assembly shall be plug connected and arranged so that the door control box cover can be removed without disassembling the button enclosure.

c. <u>See Section 14.02, I, 3, f for additional details.</u>

H. <u>Passenger Intercom</u>

1. Passenger intercom shall utilize the handset in the operator's cab, the speaker dedicated to intercommunication use in the operator's cab and the passenger intercom unit and shall be designed to provide communication between any operator's cab in which the master controller is turned on or when the emergency headlight/ communications switch is in the on position or when any door control box is turned "ON", and any passenger intercom unit.

14.02 COMMUNICATION SYSTEM (Continued)

- H. <u>Passenger Intercom</u> (Continued)
 - 2. Special care must be taken to ensure adequate volume levels without background noise or hum on the operator's intercom speaker and on the speaker in the passenger intercom box. The volume level shall be PTU-adjustable.
 - 3. Each car shall be equipped with two (2) passenger intercom units (PIU) consisting of a microphone-speaker, two LEDs and a push button housed in a stainless steel enclosure.
 - 4. The PIUs shall be mounted on the door pocket access panels adjacent to the wheel chair seats. The activating push button shall be nominally forty-five inches (45") above the floor.

An embossed stainless steel plate shall be permanently attached adjacent to the intercom box. The exact location shall be determined on the mock-up. The plate shall have the car number in numerals and type II Braille embossed on it per CTA Drawing R-2-625, Page DR-6.

The push button shall be polished stainless steel 1-1/4 inches in diameter and present the same appearance as that on the Intercom Units presently in service on all CTA rail cars. The button shall be slightly recessed as on existing units and shall be surrounded with a 1/4 inches high, red colored circular hard anodized Teflon coated aluminum escutcheon ring.

When the PIU is activated by pushing the button, a green LED shall light on the face of the PIU and a tone shall be generated that is transmitted to the speakers on the operator's communication panel and in the PIU. In addition, a red LED shall be displayed on the Operator's Communication Panel and on the Train Operator's Touch Screen (TOTS), see Section 15.09. A visual flag shall be placed on the car video surveillance recording of the camera covering the PIU area See Section 14.03, C, 4.

When the operator responds to the incoming message, another tone of a different frequency shall be transmitted to the speakers on the Operator's Communication Panel and in the PIU and a red LED shall light on the PIU.

When the operator releases the handset switch, the PIU green LED shall light and the red LED go out and the first tone shall sound again.

If no further messages are sent from either location, the system shall time out and the TOTS display shall also be cancelled. Time out shall be PTUadjustable and initially set at 10 seconds. Usage of the PIU shall be recorded as an event by the CCU.

14.02 <u>COMMUNICATION SYSTEM</u> (Continued)

- I. Pre-Recorded Announcement and Message Sign Control
 - 1. Pre-recorded announcements, all message signs and the marker lights shall be controlled and monitored by the CCU. The "Master" CCU shall trigger the pre-recorded announcements resident in each "Slave" CCU. Pre-recorded announcements, marker light configuration and sign displays shall be coordinated.

The Contractor shall arrange for the re-recording of all CTA station and special announcements as currently in use. CTA will provide the message text and sequence lists. There are currently about 1000 individual messages in use.. The Contractor shall be responsible for any editing, conversions, volume/tone adjustments required to make the recordings compatible with the system.

During the design review phase the Contractor shall provide a sampling of actual CTA messages recorded by a minimum of four (4) professional voiceover artists for CTA review. CTA will select one of the artists to make the final recordings.

It is expected that up to 100 additional new recordings will be required during the development phase and through the warranty period. CTA will provide announcement lists and formats and sequence lists for the additional messages. The Contractor shall submit the recorded announcements to CTA for review prior to incorporating the changes in the system.

It is anticipated that three (3) review cycles will be necessary for both the base messages and the additional messages to reach final message configuration.

- 2. In addition to the CCU, pre-recorded announcements and message signs shall interface with and/or be controlled by the following components:
 - a. Operator's Control Interface (displayed on the TOTS).
 - b. Remote Keypads.
 - c. Destination Sign Rotary Switch, see Section 14.02, L, 6.
 - d. Ambient Noise Sampling Microphone.

14.02 <u>COMMUNICATION SYSTEM</u> (Continued)

- I. <u>Pre-Recorded Announcement and Message Sign Control</u> (Continued)
 - 3. The pre-recorded announcements and message signs shall include the following inputs, controls and outputs:
 - a. The "Master" CCU shall utilize the GPS receiver to identify the approach, arrival and departure for each individual station. Whenever the GPS receiver is unable to determine the train location, the "Master" CCU shall utilize distance calculation, using "Dead Reckoning."
 - b. "Log-On", route designation and run number shall be input via the TOTS.
 - c. A three (3) position rotary switch installed on the Operator's Control Panel shall be used to select the mode of operation of the prerecorded announcements, destination signs, marker lights and message signs. The positions shall be (left-to-right): "EXPRESS", "NORMAL" and "NOT IN SERVICE". See Section 9.05, C, 1, c, for switch description.
 - 1) <u>EXPRESS</u>

The interior visual message signs shall flash the "EXPRESS" message, which shall be on for one second and off for one second, adjustable. The destination signs shall display "EXPRESS". In addition, the two (2) white marker lights on the head car shall flash one second on and one second off whenever the "EXPRESS" position is selected and the master controller in that car is turned on. Automatic triggering of the audio announcements shall be inhibited.

2) <u>NORMAL</u>

All signs, marker lights and announcements shall function normally.

3) <u>NOT IN SERVICE</u>

The front and side destination signs shall display "NOT IN SERVICE" and the interior visual message signs shall display date and time and the two (2) white marker lights on the head car shall be illuminated. Automatic triggering of the audio announcements shall be inhibited.

14.02 <u>COMMUNICATION SYSTEM</u> (Continued)

- I. <u>Pre-Recorded Announcement and Message Sign Control</u> (Continued)
 - 3. (Continued)
 - d. The CCU shall store all required messages in non-volatile memory. Storage shall have sufficient capacity to handle all station announcements for the entire CTA Rapid Transit System (145 stations at present with at least four (4) announcements per station per route), standard safety and public service announcements (10 at present) with a capacity for 50% future expansion. In no case shall the supplied memory shall be less than 30 megabytes.
 - 1) Audio output quality shall be at least 80 to $10,000 \text{ Hz} \pm 3 \text{ dB}$ with a signal to noise ratio of no less than 60 dB.
 - 2) Audio output shall be transmitted to the PA system through a digital output port except in the married pair with an active cab. See Section 14.02, D, 2.
 - 3) The CCU shall provide the selection of the Inside or Inside/Outside speakers, manually from the TOTS and automatically as a programmable function. Outside speaker levels shall be PTU-adjustable for selected stations and for selected hours of the day. See also Section 14.02, D, 8.
 - 4) The CCU shall sense the ambient noise in its car and adjust the audio output level to compensate. Audio output shall be automatically adjusted before each announcement is made.
 - 5) The CCU shall drive the message signs, destination signs, the illuminated rail system map and the run number sign. The output to the signs and maps within a car shall be via dedicated wiring unless otherwise agreed to by the Engineer.

14.02 <u>COMMUNICATION SYSTEM</u> (Continued)

- I. <u>Pre-Recorded Announcement and Message Sign Control</u> (Continued)
 - 3. (Continued)
 - e. An Operator's Control Interface (OCI) shall be provided in each operator's cab through the TOTS. The OCI image in the TOTS shall have similar appearance and functionality to the present Operator Control Interface of CTA's 5000 Series cars.
 - 1) The OCI shall be the interface between the operator and the CCU.
 - 2) The display shall include at least four (4) lines by 20 characters of alphanumeric information. Characters shall be no less than 5.5 mm high and different height characters may be used for different screens.
 - 3) The OCI shall be menu-driven for all functions and the key legends shall correspond to the functions being performed.
 - 4) The OCI shall have displays for login, route selection, and other functions as well as for the announcements and key labels. The announcements shall be displayed in advance to their being played through the PA system.
 - 5) The OCI shall test all the sub-systems controlled by the CCU. Testing routines for each sub-system and the means of access to the testing routines shall be the same as on CTA's 5000 Series cars and shall be reviewed by the Engineer. See Section 16.01, P.
 - 6) The pre-recorded announcements shall have both automatic and manual operation. Selection between the two (2) modes of operation shall be possible through the OCI.
 - 7) In the automatic mode, once the operator has performed the login, the announcement system shall proceed automatically to the station announcements. The same messages shall be displayed on the OCI screen, as in the manual mode, as the system selects them for the announcement.

14.02 COMMUNICATION SYSTEM (Continued)

- I. <u>Pre-Recorded Announcement and Message Sign Control</u> (Continued)
 - 3. (Continued)
 - e. (Continued)
 - 8) In the manual mode, there shall be scroll, repeat and skip functions that will allow selection of a message by the operator and also pre-set message selection from the keypads. Messages shall be triggered by the operator pressing the "Next" key on the keypad. The display shall automatically scroll to the next message when the "Next" key is pressed. Selection of a pre-set message shall cause it to be displayed. Before playing, the pre-set message shall be preceded by a series of three (3) alerting tones and the flashing of the message signs as on the 5000 Series cars. After playing, the display shall return to the next sequential message unless the repeat function is selected. The repeat function shall cause the message to be repeated every four (4) minutes until canceled. The timing shall be adjustable through the OCI parameters screen.
 - 9) The Operator shall be able to manually trigger the doorclosing announcement through the keypad.
 - 10) Manual selection of Inside/Outside speakers shall be made on the OCI in both manual and automatic mode and on the door control box by a button that shall toggle between the two selections. The label on the OCI display shall change visibly when the mode is changed, in both manual and automatic mode. The default selection, in the manual mode, shall be: Inside. Outside speakers shall be turned off, once turned on, by pressing the "NEXT" key for a new message. Pressing "PREV" "ACT" or "DOOR" shall not cause the exterior speakers to be turned off.

14.02 <u>COMMUNICATION SYSTEM</u> (Continued)

- I. <u>Pre-Recorded Announcement and Message Sign Control</u> (Continued)
 - 3. (Continued)
 - f. Each door control box, two (2) per-car, shall have installed a vertically oriented series of five (5) push buttons to activate five (5) functions of the system.
 - The buttons shall be located in a separate stainless steel enclosure fastened to the side of the box adjacent to the opening sash and shall be located at the same height as the opening in the front of the box for the toggle switches.
 - 2) The buttons shall be individual metal elements activating individual durable, long life switches with tactile feedback. The individual switches shall be easy to change and shall have no exposed fasteners.
 - 3) The buttons shall be permanently marked to indicate their function.
 - 4) The buttons shall be labeled from top to bottom:
 - EXTR PREV ACT NEXT DOOR
 - 5) The buttons shall activate the function or message as follows:

EXTR - The outside speakers in the same manner as the button on the OCI.

PREV - The message before the one just given.

ACT - The actual message just given.

NEXT - The next message scrolled to in normal sequence.

DOOR - A message to stand clear of the doors.

The use of the PREV and ACT buttons shall not cause the system to scroll. The use of the NEXT button shall cause the system to scroll and cancel the outside speakers, if turned on.

14.02 COMMUNICATION SYSTEM (Continued)

J. <u>Electronic Message Signs</u>

- 1. Each car shall have two (2) ADA-compliant electronic visual message signs installed. One shall be located on the bulkhead over the No. 2 end door and the other shall be located on the cab partition over the door opening.
- 2. The sign reading area shall be nominally eight-inches (8") high and twentyeight inches (28") long, suitable for two (2) lines of characters.
- 3. The enclosure shall be no more than three-inches (3") deep, with the length and height to suit the enclosed equipment.
- 4. The sign mounting shall be designed with no visible fasteners, but shall permit the sign to be removed for cleaning or replacement.
- 5. The sign shall be plug connected with a connector as specified in Section 9.02, J.
- 6. The sign readings shall be formed by LEDs with nominal one-eighth-inch (1/8") diameter lenses designed to offer a viewing angle of 120°. The LEDs shall be spaced nominally 0.16-inches center-to-center. The color of the LEDs shall be amber.
- 7. The readings shall scroll in a manner selected by the Engineer. The scrolling speed shall be adjustable and shall be part of the message data base. Initial scrolling speed and manner shall be selected by the Engineer on the prototype cars.
- 8. The signs shall be capable of repeatedly displaying the messages. The number of repetitions shall be adjustable and shall be part of the message data base. Initial repetition rate shall be selected by the Engineer on the prototype cars.
- 9. Each pre-recorded message given for each station and each special message shall be displayed. The "Doors" message shall not be displayed. Special messages shall be preceded by all LEDs flashing on three (3) times at the same time as the three (3) alerting tones are given.
- 10. When a manual PA announcement is given, the signs shall display the time and date.
- 11. When no message is being displayed, the signs shall display the time and date.

14.02 COMMUNICATION SYSTEM (Continued)

- K. <u>Illuminated Rail System Map Display</u>
 - 1. Each car shall have a two sided CTA rail system map display installed on the ceiling in the center of the car. The CCU of each car shall control the system map.
 - 2. The display shall consist of multiple, LED-back lit monitors mounted back-toback in a vandal resistant stainless steel enclosure. The monitors and covers shall be pitched slightly downwards to provide maximum visibility to passengers and minimize reflections. Exact arrangement, including monitor sizes, and mounting shall be developed during the interior esthetic design process.
 - 3. The display shall include both a CTA rail system map and an active strip map showing the train's progression on the Line. The map shall follow the design of the existing in-car rail system map with each route shown by a colored line corresponding to the route color. The Loop shall be shown on a separate diagram as on the present map. The strip map portion of the display shall indicate current location, previous station, and the upcoming stations, including the end terminal. Design of the system map and strip map displayed shall be reviewed by the Engineer.
 - 4. The display shall have the capability of alternating the CTA rail system map with public service messages. Means of updating the electronic maps and public service messages shall be reviewed by the Engineer.
 - 5. The enclosure shall have a removable cover glazed over the full extent of the map with 7/32-inch clear, tempered float glass equipped with clear protective sheeting as specified in Section 12.12. The cover shall seal effectively to keep dirt and water out of the sign and be retained with stainless steel tamper-resistant fasteners.
 - 6. The electrical connections to the map shall be carried in connectors as specified in Section 9.02, J.

14.02 <u>COMMUNICATION SYSTEM</u> (Continued)

- K. <u>Illuminated Rail System Map</u> (Continued)
 - 7. The entire electronic system map display, and all its details, including the map design itself and the installation and housing, shall be reviewed by the Engineer.
 - 8. An electronic system map map display shall be included in the car mock-up to determine final location and orientation. Changes in the display, its housing, location, or other details as a result of the review on the mock-up shall be made at no cost to CTA.
- L. Destination and Run Number Signs
 - 1. The cars shall be equipped with full color, full matrix electronic destination signs capable of displaying alpha-numeric text and bitmap files. Destination signs shall be installed on the front and sides of each car. The signs shall be reviewed by the Engineer.
 - 2. The message areas shall be a minimum of six-inch (6") in height and be capable of two (2) line displays. Sign characters shall utilize high intensity color LEDs and shall automatically adjust intensity for ambient lighting conditions.
 - 3. Sign characters shall conform to ADA viewing requirements.
 - 4. The messages displayed shall, in general, match the appearance and colors of CTA's existing curtain signs. The Engineer will furnish the wording of each message.
 - 5. Locking devices reviewed by the Engineer shall be used to keep all sign boxes closed.
 - 6. The destination signs shall be controlled through the OCI and the three position rotary switch, see Section 14.02, I, 3, c. The electrical power feed for the signs on each car shall be by means of a circuit breaker designated P43 "SIGNS 1" and P49 "SIGNS 2", unless otherwise agreed to by the Engineer.
 - 7. The destination signs in the entire train shall be activated whenever a Master Controller in the train is turned on.
 - 8. The electrical connections to the signs shall be in connectors as specified in Section 9.02, J.

14.02 <u>COMMUNICATION SYSTEM</u> (Continued)

- L. <u>Destination and Run Number Signs</u> (Continued)
 - 9. A destination sign shall be installed above the end door at the No. 1 end of each car. An opening in the carbody of approximately seven-inches by twenty-one-inches (7" x 21") shall be provided for the sign. This opening shall be glazed per Section 12.05, J, 3. The sign box shall be of all metal construction and shall not have a front glass but shall be gasketed tightly to the carbody opening glass. The sign box shall be gasketed to exclude dust, dirt and water. The sign box design and mounting shall be such that it can be moved easily out of the way to permit cleaning of the glass and display. The front destination sign LED matrix shall be no less than 24 high by 72 wide in a matrix 6" high by 18" wide. The exact size may be changed dependent on the exterior esthetic design process, but the LED pitch shall be a small as possible to insure clearly legible sign readings.

The front destination sign's display shall be automatically turned off between coupled cars.

10. Two (2) dual faced, side destination signs shall be installed, one on each side of the car in the top of the center window. The sign display size shall be the same as the end destination signs and the LED pitch shall also be the same.

The signs shall display the same reading to both the exterior and interior of the car. The sign boxes shall be supported from hinged mounts to allow the boxes to be turned up to permit cleaning of the glass. The sign boxes shall be of all metal construction and shall not have a front glass but shall be gasketed tightly to the side window glass to exclude dust, dirt and water.

The interior mask of the sign box shall be fiberglass reinforced plastic colored throughout to match the color selected during the interior esthetic design process and shall be designed to blend into the lines of the window mask to minimize gaps.

The glass in the back cover shall be 7/32 -inch, clear tempered safety float glass set in a rubber-glazing strip. The back cover shall be gasketed to the sign to exclude dust and dirt. The cover shall be attached in a manner reviewed by the Engineer for ease of maintenance.
14.02 <u>COMMUNICATION SYSTEM</u> (Continued)

- L. <u>Destination and Run Number Signs</u> (Continued)
 - 11. A three-numeral, electronic run number sign with supplemental red indicator light, reviewed by the Engineer, shall be installed in the top right corner of the window opposite the operator's windshield. The sign shall use high-intensity amber LED technology. Sign characters shall be nominal four-inches (4") high and the LED matrix shall be no less than 16 high and 36 wide.

The sign display shall be controlled through the CCU and shall be illuminated at the front and rear of the train and turned off between coupled cars.

The sign shall be mounted with a hinge and securement that shall keep the sign tight to the glass. Rubber bumpers shall be provided to cushion impacts on contact with the glass. The sign box shall have a front glass and be gasketed to exclude dust, dirt and water.

The arrangement of the run number sign shall be reviewed in the cab mockup.

A red indicator light fully integrated into the box shall be arranged to be seen through the front windshield as on CTA's 5000 Series cars. See Section 13.19. The light shall be mounted behind the front face of the box to preclude the red lens hitting the windshield if the bumpers have compressed.

12. Signs shall be included in the mock-ups to determine actual mounting and location for installation and to assess ease of maintenance. Changes in the signs as a result of the evaluation on the car or mock-up shall be made at no cost to CTA.

14.03 VIDEO SYSTEM

- A. <u>General</u>
 - 1. A networked video surveillance system shall be installed on each car.
 - 2. The system shall be powered from the car's low voltage system through the circuit breaker labeled P47 "VIDEO RECORDER" located adjacent to the video recorder. The system on all cars shall be activated when any Master Controller in the train is turned on. The system shall continue to record for a period of time after the train is turned off. This time shall be PTU-adjustable for up to one (1) hour and shall be initially set for five (5) minutes.
 - 3. The system shall utilize digital technology to provide the highest quality color images possible. The entire system including all the elements and the installation shall be reviewed by the Engineer.
 - 4. The video system shall interface with the data radio (see Section 15.10) for transmitting video images to the wayside and for remote system interrogation.

14.03 <u>VIDEO SYSTEM</u> (Continued)

B. <u>Cameras</u>

- 1. There shall be no less than nine (9) color cameras per-car to provide coverage of each side door, the car center, each end (including the cab interior) and forward view from the Operator's position.
- 2. The cameras covering the car interior shall be as small as practical while retaining the image quality necessary to make positive identification of persons at least twelve feet (12') away. Alternate camera arrangements such as 360 degree view cameras will be considered if the coverage and image quality are equal.
- 3. The cameras shall be of the I.P. type with resolution of no less than 1024 by 768 and shall support IPv4 and IPv6. The cameras shall be capable of transmitting no less than two (2) configurable streams of video, one of which shall be multicast.
- 4. There shall be covers over the cameras to protect them from vandalism including spray paint and hammer impacts.
- 5. The cameras shall be plug connected to permit quick changing of units. The connectors shall comply with the requirements of Section 9.02, J, unless otherwise agreed to by the Engineer.
- 6. The cameras shall be rigidly mounted to prevent car vibration or shock up to 5 g in any direction from moving the camera.
- 7. The camera recording the forward view from the operator's position shall be mounted in the upper left corner of the windshield and aligned to provide a view straight ahead. The lens shall be shielded to eliminate reflections from the inside of the windshield. This camera shall show station platforms, signals and track close to the front end of the train. The camera shall be of the wide dynamic range type to compensate fore the low light levels in the subway.
- 8. The camera mounting, adjustment and wiring shall be inaccessible when the camera is installed. All fastenings used in the camera installation, which are accessible from the interior of the cab, shall be pin socket head tamperproof type reviewed by the Engineer.
- 9. A mock-up of the camera, its mounting and covering shall be included in the cab mock-up specified in Section 3.14, C, for review by the Engineer.

14.03 <u>VIDEO SYSTEM</u> (Continued)

- C. <u>Network Video Recorder</u>
 - 1. The network video recorder shall be a separate unit. It shall be installed in the seatbox to the rear of the No. 3 side door. On the B-car, this seatbox shall also house the Event Recorder, see Section 9.16. Access to the equipment shall be from the aisle, through a rugged hinged stainless steel cover, secured by a Best Lock Corp. premium WB core using a VID-1 key.
 - 2. The network video recorder shall be a ruggedized mobile computer with embedded Windows operating system. The computer shall be compatible with and pre-configured with Teleste's Network Video recorder software. The network video recorder shall be of the latest design and shall be reviewed by the Engineer.
 - 3. The recording shall be done on a removable hard disc or solid state drive of sufficient capacity to hold a minimum of one hundred sixty eight hours (168 hr) of continuous recording from all nine (9) cameras on a car at a data rate of 6 Mbps before overwriting occurs. Recorded video shall be in a non-proprietary MPEG4 h.264 format. Frame rate shall be PTU adjustable.
 - 4. The recording shall be date and time stamped along with the camera number and car number. Date and time stamp shall be coordinated with the GPS provided data.
 - 5. A visual flag shall occur when either a side door emergency opening handle is operated or either passenger intercom is operated. When the passenger intercom is operated, the audio from that system shall also be recorded on the video recorder. When the intercom is not in use, the video recorder shall be able to record the car interior sounds from a microphone, placed near one of the cameras at the front end of the car. This audio recording capability shall be turned off or disabled when the cars are delivered, but shall be easily restored in a manner reviewed by the Engineer.
 - 6. If the recorder is temperature sensitive, the Contractor shall install heaters and blowers to ensure that the unit will operate as soon as the car is turned on with no more than one (1) minute delay as long as the car has been stored with 600 V power applied. This may require an automatic heating/cooling system. See Section 9.17.
 - 7. The hard disc or solid state drive shall be easy to change and shall be ruggedized to withstand the shock and vibration of a rail car without damage or loss of image. Removal of the drive shall require a key. The Contractor shall provide one key per recorder and shall deliver them separately to the Engineer.
 - 8. The recorder shall be shock mounted to be able to withstand and continue recording when subjected to at least 5 g shocks on any axis.

14.03 VIDEO SYSTEM (Continued)

D. <u>Remote System Interrogation</u>

- 1. The video system shall be configured for remote interrogation and download via CTA's Teleste VMX video management system,
- 2. The video system shall be configured for remote viewing. Cameras shall be individually accessible via the remote access. Format of the streaming video shall be MPEG4 h.264. Video stream shall be sent over any available connection Wi-Fi or cellular. Frame rate shall be adjusted automatically to suit the available bandwidth.
- 4. The video system shall be configured for remote download of recorded images and associated metadata to the Teleste video management system's way side servers.

E. <u>Playback Equipment</u>

- 1. The Contractor shall supply four (4) desktop video system playback units. The units shall accept the disc/solid state drive from the car recorder and be able to select playback of single or multiple cameras and adjust image size of single camera playback as well as intensity, color and contrast. The unit shall be able to transfer the camera images and audio to CD and DVD as still or video with built-in CD and DVD writers as well as output still or video images and audio to external printers or recorders.
- 2. The playback units shall utilize the highest speed CD and DVD writers available at the time of delivery of the equipment. Monitors shall be at least twenty-one inch (21") size.
- 3. The playback unit shall also perform disc maintenance functions such as memory testing, erasing and formatting.
- 4. The unit shall have audio playback so that the audio can be heard when playing back the video.
- 5. The Contractor shall proved an unlimited site license for the playback software to allow CTA to install it on additional computers.

14.04 TEST EQUIPMENT

A. <u>Portable Test Units</u>

The Contractor shall furnish Portable Test Units for the video recorder system as specified in Section 17.04, C, E, F, and G.

B. <u>System Testers</u>

The test equipment, as specified in Section 9.11 and 17.03, shall be supplied for all systems in this Section, unless otherwise agreed to by the Engineer.

SECTION 15 SERIAL TRAINLINE AND DATA COMMUNICATIONS

15.01 <u>GENERAL</u>

A. <u>Overview</u>

- 1. This Section describes the requirements for Ethernet network trainlines, Ethernet switches, unit (married pair) networks, touch screens, Data Radios and related systems. See Drawings SKR-1-092112A, Page DR-11 and SKR-092112B, Page DR-11A for conceptual block diagrams.
- 2. The Control and Monitoring Network (CMN) and the Propulsion Control Network (PCN) shall be based upon IEEE Std. 1473-E protocol. The trainline system shall be compatible with the system provided on CTA's 5000 Series cars.
- 3. Application specific software and custom designs developed for CTA shall be considered "Work for Hire" and become the property of CTA. All application specific software and designs shall be provided to CTA in computer-readable format on standard optical media. The Contractor shall provide to CTA a perpetual license, as required, for all other non-application specific software and custom designs. See also Section 9.15.D.
- 4. Bidders shall submit system block diagrams with the Bid.
- 5. The redundant Ethernet network and Data Communications System design shall be reviewed by the Engineer.
- 6. The Ethernet network and Data Communications equipment shall be powered from the car's Low Voltage System through appropriate circuit breakers and reviewed by the Engineer.

B. <u>Open Interface Design Requirements</u>

- 1. All device interfaces shall be fully open and fully exposed so as to permit network modifications and enhancements by CTA or other CTA-designated third parties without the need for additional or proprietary information.
- 2. The Contractor shall submit complete, comprehensive and detailed Compatibility and Interoperability Documentation for each network. At a minimum such network documentation reports shall include a glossary of terms, references, system description, system operation, system architecture, node object descriptions, and node installation.
- 3. All necessary application and network specific source code, hardware, and development system hardware and development system software shall be provided to CTA, as required, to enable CTA to make future system modifications without reliance on additional hardware, software or other information. Two (2) complete network development system workstations shall be provided to the Authority to permit future modifications and changes by Authority engineering staff. The development system hardware and software shall be reviewed by the Engineer.

15.01 <u>GENERAL</u> (Continued)

- B. <u>Open Interface Design Requirements</u> (Continued)
 - 4. The Contractor shall provide all hardware, software and documentation concurrent with the delivery of the first production cars. Any applicable software and/or hardware upgrades through the warranty period shall be provided by the Contractor at no additional cost to CTA.
- C. <u>Automatic Train Sequencing</u>
 - 1. A means shall be provided to automatically determine the sequence of units (married pairs) in a train.
 - 2. The means to automatically determine unit sequencing shall be considered an open interface that is fully and completely described as required per Section 15.01.B

D. <u>Network Training Courses</u>

- 1. The Contractor shall provide comprehensive "hands-on" network training classes to CTA Engineering staff. The classes shall consist of two tracks. Classes shall be conducted following the delivery of the first production cars at a mutually agreeable time and location.
- 2. The first track shall cover basic Ethernet theory, operation, function and standard networking techniques for creating and modifying IEEE Std.1473-E networks.
- 3. The second track shall be a custom class developed by the Contractor specifically to train CTA Engineering staff on how to modify and add new network devices to CTA trains and unit networks.
- 4. Following the completion of the training, the Contractor shall provide copies of all print and electronic media used in these classes.
- 5. There shall be two classes with five (5) persons in each class. The classes shall be five (5) days long with two (2) days for track 1 and three (3) days for track 2.

15.02 UNIT NETWORK REQUIREMENTS

- A. <u>General</u>
 - 1. All trainlined Ethernet communications shall be configured to ensure high system availability.
 - 2. The Train Ethernet Switches shall use two parallel Ethernet network interfaces with hot redundancy to eliminate the need for hot standby with automatic transfer. Failure of the primary network shall result in the immediate transfer to the backup system. The diagnostic system shall report whether the train is operating on the primary or backup system for maintenance purposes.
 - 3. Two separate IEEE-1473-E networks shall be provided within each unit. The implementation of the dual networks shall be in the form of Virtual Local Area Networks or other means for logical data separation agreed to by the Engineer.
 - a. The Propulsion Control Network (PCN) shall be used exclusively for tractive effort interface and direction control of the Propulsion System.
 - b. The Control and Monitoring Network (CMN) shall be used for all other networked systems.
- B. <u>Network Architecture Design Requirements</u>
 - 1. To optimize train network bandwidth, each unit (married-pair) shall be its own logical network separated via the Train Ethernet Switch.
 - 2. To facilitate network device commissioning, diagnostics, and maintenance, each unit shall have its own dedicated Unit Network Manager (UNM). The UNM functionality is performed by the Train Ethernet Switch.
 - 3. Physical network interconnections within each unit shall be via direct copper connection and connectors, as specified in Section 9.02, J.
 - 4. Trains comprised of multiple units shall communicate train networked data to adjacent unit networks via the Train Ethernet Switch which incorporates a router. The routers shall facilitate and simplify trainline communications and minimize network traffic.
 - 5. Vehicle and train network designs shall be inherently flexible and "network flat" so as to permit any existing networked device (or any future networked device) to communicate to any other device via a fully routable network architecture compliant with IEEE Std. 1473-E.

15.02 UNIT NETWORK REQUIREMENTS (Continued)

C. <u>Open Network Interface Requirements</u>

In addition to the requirements above to ensure interoperability with existing and future network interfaces, the following requirements shall be satisfied:

- 1. The communication interface of the network devices shall be described using a combination of generic and system specific Ethernet network Interface Control Documents.
- 2. The Contractor shall provide a complete list and comprehensive description of all network interconnections, including all application software, databases and/or configuration files as necessary to reproduce the network connections.
- 3. The network designs shall be based upon readily available commercial offthe-shelf hardware and software tools.
- 4. The Train Ethernet Switch shall continuously detect added or removed networked devices and automatically and dynamically reconfigure the network.
- 5. Dynamic addressing using Dynamic Host Control Protocol (DHCP) shall permit easy system upgrades without the need to alter hard-coded addresses.
- 6. It shall be possible to install any future Ethernet networked device to the network.

15.03 TRAIN ETHERNET SWITCH

A. <u>General</u>

Train Ethernet Switches shall be provided in each married pair to interface and route all network signals to redundant Ethernet networks as shown in CTA Drawing SKE-1-092112B, Page DR-11A.

B. <u>Nonproprietary Interface Requirements</u>

- 1. Ethernet Switches shall be based upon readily available commercial of-theshelf components and products.
- 2. The use of proprietary interfaces is prohibited. The Contractor shall deliver to CTA, concurrent with the first production cars, all the interface definitions and functional requirements including but not limited to:
 - a. All network data conversion, protocols, methods, schemes and techniques.
 - b. Monitoring and diagnostic information.
 - c. Generic and system specific Ethernet network Interface Control Documents.
 - d. System Functional Descriptions
 - e. Redundancy and bypass management.
 - f. Train wide clock synchronization.
 - g. Communication network control protocol.
 - h. Degraded mode management.

15.04 NETWORK MANAGEMENT

- A. <u>Overview</u>
 - 1. Each unit (married pair) shall have a dedicated Unit Network Manager (UNM) to manage all networked devices within the unit. This functionality shall be handled by the Train Ethernet Switch.
 - 2. In a multi unit train, the UNM associated with the unit in control shall take on the additional function of a Train Network Manager (TNM).

15.04 NETWORK MANAGEMENT (Continued)

B. Unit Network Manager (UNM)

- 1. The primary function of the UNM is to manage all of the networked nodes in the Control and Monitoring Network (CMN).
- 2. Each UNM shall maintain a database of all network nodes under its domain.
- 3. Each UNM shall periodically ping each network node within its unit to verify node health and shall generate an alarm when a failure has been detected.
- 3. Every UNM shall automatically identify installation of a replacement networked part and automatically bind the new part to the unit network without the need for special tools, PTU, or other equipment.
- 4. The UNM shall facilitate interfacing with internal diagnostic and monitoring system software and external hardware and software tools and systems.
- C. <u>Train Network Manager (TNM)</u>
 - 1. The TNM shall interface with the means for Train Sequencing.
 - 2. Means shall be provided to prevent the operation of the train with more than one (1) active TNM.
 - 3. Based upon the train sequence information and its associated UNM, the TNM, shall ascertain the relative location of every IEEE Std. 1473-E device in a multi-unit train.
 - 4. The device locations shall be used by the train operator and maintenance personnel to rapidly locate vehicle system failures and other problems.

15.05 GPS RECEIVER

- A. Each unit (married pair) shall include a GPS receiver to provide train position, speed, and a standard train time reference upon receipt of a valid GPS signal. The GPS receiver shall be energized when the Master Controller is turned on.
- B. GPS networked receivers shall be capable of receiving twelve (12) satellites simultaneously and have Wide Area Augmentation System (WAAS) capability.
- C. It shall be possible for any networked device on a train to subscribe to the information broadcast by the active GPS receiver.
- D. Time of Day and Date shall be displayed on the Train Operator's Touch Screen and Passenger Information Signs.
- E. All train networked devices with time of day clocks shall be automatically synchronized to the GPS train time network variable as described in Section 9.15, E, on initial power-up of the train. The ATC clock, as described in Section 13.15, shall also be synchronized with the GPS train time network variable upon each power up of the train.
- F. The GPS receiver shall utilize the four-band antenna also used by the Data Radio system. See Section 15.10, A, 4.

15.06 CONTROL AND MONITORING NETWORK CONNECTED DEVICES

The following systems and devices shall be connected to the CMN. The Contractor may propose additional systems or devices to be connected for review by the Engineer. If additional systems or devices are agreed to by the Engineer, they shall be connected at no added cost to CTA.

- A. Doors
- B. Low Speed Interlock
- C. Propulsion/Brakes
- D. Active Suspension System
- E. Event Recorder
- F. Video System
- G. Communications System
- H. Auxiliary Power Supply System
- I. ATC/ATO System
- J. GPS
- K. Smart Card Reader
- L. Air Comfort System

15.07 PROPULSION CONTROL NETWORK (PCN)

- A. Tractive Effort signals shall be based upon IEEE Std. 1473-E.
- B. Tractive Effort signals shall be communicated on the PCN portion of the Ethernet Car Network and Ethernet Train Backbone compatibly with CTA's 5000 Series cars. The PCN shall be configured as a Master/Slave network to ensure fully deterministic behavior.
- C. See Section 10.03, B, for details.

15.08 RF ID (SMART CARD) SYSTEM

- A. <u>Smart Card Reader</u>
 - 1. The Contractor shall provide in each cab an RF ID Smart Card Reader that shall read and validate industry standard ISO 14443 and the Mifare platform currently used by CTA.
 - 2. The Smart Car Reader shall be submitted to the Engineer for review.
 - 3. The mounting location for the Smart Card Reader shall be part of the Cab Mock-Up. See also Section 9.05, C.
- B. <u>Smart Card Interface</u>
 - 1. The Smart Card Reader shall interface with car systems through the Control and Monitoring Network.
 - 2. The propulsion system shall be inhibited and the TOTS shall remain blank when the master controller is turned on until a valid smart card is read. A bypass shall be provided to enable the propulsion system and TOTS without the use of a Smart Card. The bypass means and its location shall be reviewed by the Engineer.
 - 3. The Employee ID number from the Smart Card read by the Smart Card Reader shall be stored in the Event Recorder. See Section 9.16, B.

15.09 TRAIN OPERATOR'S TOUCH SCREEN (TOTS)

A. <u>General</u>

- 1. A Train Operator's Touch Screen (TOTS) shall be located in each cab and used by the Train Operator to operate the pre-recorded announcement system, set and modify destination and run number signs and assist the Train Operator in rapidly determining the status of key train systems and identifying vehicle problems. The TOTS shall display fault data from all subsystems on all cars in the train.
- 2. The user interfaces and display screens shall look the same as on CTA's 5000 Series cars unless explicitly agreed to otherwise by the Engineer.
- 3. The TOTS shall also be used to assist maintenance crews to identify failures and intermittent problems associated with devices connected to the network.
- 4. Entry into maintenance mode and access to Maintenance Screens shall require additional security consisting of both the validation of a Smart Card and entry of a valid password.
- 5. The password shall be selected by the Engineer.
- 6. The TOTS shall be located on the right side of the operator's console as on CTA's 5000 Series cars and shall have a sun shield reviewed by the Engineer. The exact location shall be determined in the cab mock-up
- B. <u>Color Display and Touch Screen</u>
 - 1. The color display and touch screen shall be a based upon service proven industry standard solid-state display and touch screen technology. The touch screen interface shall be ergonomic and facilitate easy and rapid entry of all data. Touch Screens shall provide immediate operator feedback upon data entry.
 - 2. Displays shall have a resolution of not less than 1024 by 768 picture elements and shall support 16.7 million colors.
 - 3. Display size shall be approximately 12" diagonally.
 - 4. Displayed images shall be easily viewable day and night with automatic intensity adjustment.
 - 5. The Contractor shall take all reasonable measures and use any other appropriate technique(s) to prevent sunlight and glare from reducing the visibility of the screen information.

15.10 DATA RADIO

A. <u>General</u>

- 1. The Contractor shall provide a CTA standard 12 volt Mobile Router, Utility Associates Rocket COM-H-5209 or equal, in each unit (married pair). CTA will provide information on IP addresses and configuration of routers during design reviews.
- 2. A DC to DC power supply, reviewed by the Engineer, shall be supplied to provide the 12 Volt power for the mobile router. The power supply shall be powered by the car's low voltage system through a circuit breaker on the car circuit breaker panel. The selection of this breaker shall be made during design reviews.
- 3. The USB cellular modem within the Mobile Router shall be configured and provided by CTA.
- 4. The Contractor shall install a four-band antenna equal to Mobile Mark SMW-412-3C3C3C2C that will work with the Mobile Router and the GPS system. GPS location data will be provided to the Mobile router via the CMN or through a direct connection to the GPS antenna. The location and mounting shall be reviewed by the Engineer.
- B. <u>Data Radio Interfaces</u>
 - 1. The Data Radio wired network interface shall be performed in a manner and with protocols reviewed by the Engineer.
 - 2. The interface shall interconnect the Data Radio with other vehicle systems as described below:
 - a. The Data Radio shall interface to the IEEE Std. 1473-E Control and Monitoring Network. See Section 15.11.
 - b. The Data Radio shall interface to the Communications System to facilitate the rapid uploading of new voice and text announcements to the pre-recorded announcement system and to receive announcements from the wayside. See Section 14.02, B, 5.

The Data Radio shall interface to the Video System to provide the capability of sending video images to the wayside. See Section 14.03.

15.10 DATA RADIO (Continued)

C. Data Radio and Network Security

- 1. The Contractor shall work with CTA's IT department personnel to ensure its Data Radio and network architecture is secure and shall provide all necessary hardware and software firewalls and other secure means to preclude unauthorized access to train and unit networks.
- 2. The Contractor shall submit to the Engineer for review a detailed description of the hardware and software techniques to ensure that the Wireless Network is inaccessible to all but authorized users.

15.11 AUTOMATIC MAINTENANCE DATA UPLOAD

A. <u>General</u>

The data radio shall be used to upload maintenance data, mileage information and location data to wayside servers/terminals. The system shall be designed to interface with CTA's Automatic Vehicle Monitoring system supplied on CTA's 5000 Series cars and CTA's AssetWorks Maintenance Management Information System. If it is not possible to interface with the 5000 Series AVM, Contractor shall provide the appropriate server, server software and terminal software with an unlimited site license to be installed on existing CTA computers.

B. <u>Health and Location Status</u>

The train shall send health and location information on a periodic basis. This information shall be sent every thirty (30) seconds and shall contain the following information: Train health status, run number, head car number, GPS coordinates (when available), GPS Speed, GPS Time, passenger count and other information as transmitted on CTA's 5000 Series cars. Details of the information sent in the Data Packets will be provided by CTA during design reviews.

C. <u>Fault Annunciation</u>

Blue Light, White Light, Suspension System, Air Comfort System, Door System, Video Recorder System and ATC/ATO System fault information shall be transmitted immediately (within 30 seconds) upon detection and every 30 minutes along with additional system information. The information sent in the data packets shall be the same as on CTA's 5000 Series cars when existing and shall be proposed by the Contractor for newly included or expanded systems. CTA will provide details on the information sent in the Data Packets on the 5000 Series cars during design reviews.

D. <u>Mileage Update</u>

Each married pair shall upload mileage data to CTA's MMIS system every 30 minutes.

15.12 TEST EQUIPMENT

The test equipment specified in Section 9.11 shall be supplied for all elements in this Section, unless otherwise agreed to by the Engineer.

SECTION 16 TESTS AND ADJUSTMENTS AND SHIPMENT OF CARS

16.01 TESTS AND ADJUSTMENTS

A. <u>Contractor's Facilities and Responsibilities</u>

1. The Contractor shall provide a level tangent test track of proper gauge and appropriate length and alignment to enable a car to attain a speed of at least 30 mph to permit the acceleration and deceleration and other operating tests described in this Specification to be performed on all cars. The tests at thirty miles per hour (30 mph) do not relieve the Contractor of the responsibility for meeting the performance requirements.

The test track shall be equipped with a power supply to provide 550 Vdc to 600 Vdc measured at the car during full acceleration and to absorb full regenerative braking energy from a two-car unit.

- 2. On each complete car, all working and moving parts and operating devices shall be tested, adjusted and put in proper operating condition by the Contractor.
- 3. In the event that it becomes necessary to disassemble the cars or to remove subsystems, excluding the semi-permanent drawbar, the cars shall be retested at the Contractor's expense, after reassembly, in accordance with Section 16.01, A, 1, above, before acceptance by CTA.
- 4. The Contractor shall submit test plans for each of the required tests for review by the Engineer prior to conducting the tests. The test plans shall include all test procedures, instrumentation and pass-fail criteria.

B. <u>Car Wiring Tests</u>

It is understood that in the following tests, the Contractor shall follow the recommendations of the subsystem manufacturers in the special requirements of protecting and testing all solid state components or rotating equipment.

1. Make continuity and polarity checks on all circuits after assembly and installation of all equipment.

16.01 TESTS AND ADJUSTMENTS (Continued)

- B. <u>Car Wiring Tests</u> (Continued)
 - 2. Make a direct current ground insulation test on each car as follows:
 - a. Disconnect all ground wires.
 - b. Disconnect the storage battery at its terminals.
 - c. Remove or short circuit all semiconductors.
 - d. Connect all circuits together and then apply a 600 Vdc source through an appropriate voltmeter.
 - 1) If this test shows freedom from ground connection, the ac test as described below shall be applied.
 - If this test does not show freedom from ground connection, the point or points at which such ground occurs shall be determined and proper insulation installed before the ac test is performed.
 - 3. Make an alternating current ground insulation test, as follows, on each car after separating the connection between the nominal 600 Vdc circuits, the nominal 37.5 Vdc circuits and the nominal 230 Vac circuits.
 - a. Apply for one minute (1 min) a potential of 800 Vac or 800 Vdc to all 37.5 Vdc circuits.
 - b. Apply for one minute (1 min) a potential of 2200 Vac to the 600 Vdc apparatus and circuits.
 - c. Apply for one minute (1 min) a potential of 1500 Vac to all the 230 Vac circuits.
 - In each case a circuit breaker set to open with a current slightly greater than the charging current shall be connected between the ac supply and the circuits under test. If this circuit breaker remains closed the insulation to ground shall be considered acceptable.
 - 2) All wires, cables, and/or equipment that do not meet the requirements of the test shall be removed and replaced by the Contractor. After replacement of any such defective parts, material or equipment, the car shall be retested.
 - 4. Reconnect the ground connections and storage battery, replace or remove all short circuits from semiconductors and then test all 37.5 Vdc, all 600 Vdc and all 120 Vac and 230 Vac circuits on each car for proper functioning.

16.01 <u>TESTS AND ADJUSTMENTS</u> (Continued)

C. <u>Propulsion System and Propulsion Control Network Tests</u>

- 1. Without motor current, test the propulsion system and propulsion control network of each car for correct operation by operating each Master Controller through the power positions and observing and verifying the response of the various pieces of equipment involved.
- 2. Without motor current, test the Propulsion Control Network of each car for proper operation and the relationships between braking media by operating each Master Controller through the brake positions and observing and verifying the response of the pieces of equipment involved.
- 3. Any failure to perform properly for either propulsion or brake equipment must be corrected before proceeding with the remaining tests.
- D. Friction Brake Adjustment

Adjust the friction brakes per the manufacturer's recommendations to deliver the proper deceleration rate; see also Section 10.02, B, 4.

- E. <u>Car Performance Tests</u>
 - 1. On each married pair, make acceleration tests on the test track with a recording accelerometer, a recording ammeter in the 600 Vdc input to each Propulsion Control Unit and a recording voltmeter to measure the line voltage at the knife switch. If adjustments are required to obtain the acceleration rates in Section 10.02, B, 4, these adjustments shall be made in accordance with the instructions of the propulsion system manufacturer.
 - 2. On each married pair, make two series of deceleration tests on the test track with recording accelerometer and recording ammeter and recording voltmeter to measure for full regenerative and for rheostatic brake current. Make all adjustments to obtain proper blending of the various forms of braking and the rates of deceleration specified in Section 10.02, B, 4. In addition, make "MAXIMUM SERVICE BRAKE" and 2.5 mphps friction-only stops. Care must be exercised to cool the brake discs between tests. If adjustments of the electric brake control and/or the friction brake control are required, these adjustments shall be made in accordance with the instructions of the propulsion system and friction brake control manufacturers.
 - 3. On one (1) of the prototype two-car units, make tests to confirm all requirements specified in Section 10.02, B.

16.01 TESTS AND ADJUSTMENTS (Continued)

- E. <u>Car Performance Tests</u> (Continued)
 - 4. The accelerometer used to measure the acceleration and deceleration rates shall be an electronic servo accelerometer/amplifier system driving a suitable brush type strip chart recorder or data acquisition system. The data acquisition system, if used, shall produce an acceptable graphical representation of the rates.

The system shall have switch selectable gain from 0.1 g to 50 g's per volt in a 1, 2, 5 sequence. It shall have a \pm 1% full scale accuracy with an output of \pm 1 V full scale and bias adjustment of 0 to \pm 2 g's. The system shall incorporate a low pass filter with the -3 dB point at 480 Hz and a -12 dB per octave slope below that point. The system shall have both static and dynamic capabilities. If any other accelerometer system is proposed, it shall be reviewed by the Engineer to ensure that the resulting data is comparable in readability, accuracy and conformance to actual car performance.

- 5. The performance test charts shall become the property of the Authority. If more than one (1) trace is recorded on each chart, the traces shall be widely separated with no overlapping and shall be easy to read.
- 6. All performance characteristics shall comply with the requirements of this Specification. If the car or any equipment fails to satisfy these objectives, the necessary adjustments shall be made and the cars retested. All performance tests and adjustments shall be complete and reviewed by the Engineer before authorization will be given to ship the cars.
- F. <u>Curve Test</u>

Prior to shipment of any cars to the Authority, a test shall be made on an A-and a B-car to determine truck clearance on a curve radius as specified in Section 2.02, C, 1. This shall be done by running the car around a curve of that radius or by rotating each truck the appropriate distance. Drawbars must be checked for proper swing and clearance from truck and undercar components. All cables from drawbars and trucks to carbody shall be checked for clearance, stretching and chafing. These curve tests shall be made with the suspension system at the maximum height and minimum height with a light car and with a fully loaded car, 23,100 pound load.

16.01 TESTS AND ADJUSTMENTS (Continued)

G. <u>Water Tests</u>

Each car including exterior facing under car equipment enclosures shall be subjected to a water test procedure reviewed by the Engineer. The car shall be subjected to continuous sprays from suitably located nozzles so that the car is completely covered with spray water. The pressure of the water during the test shall be no less than 45 psi at the nozzle. This test shall consist of a thirty minute (30 min) soak followed by sufficient time to locate and identify any leaks found. All leaks found during the water test shall be corrected by the Contractor in a manner reviewed by the Engineer and retested. Cars shall be retested and sealed as necessary until no leaks are found. Water tests shall be conducted at the final assembly location after installation of doors and windows, but before installation of other interior items.

H. <u>Side Door Tests and Adjustments</u>

- 1. Manually open and close the door panels, checking that panels are not binding.
- 2. Using an adjustable power supply set for 23 Vdc under load, check that each door operator moves through its complete cycle into the over center or lock position, and also moves out of the over center or lock position to the fully open position.
- 3. Check for proper emergency pull force without power. The emergency pull force should be thirty-five pounds (35 lb) or less under any conditions.
- 4. Check sealing of all panels on leading edge and around door frame. There shall be no gaps in the weather sealing and leading edges.
- 5. With 36 Vdc supplied to the door operator, check the door opening time. The time to open shall be approximately 2.0 seconds.
- 6. With 36 Vdc supplied to the door operator, it shall maintain closing time in test and in operating service of approximately 2.5 seconds. The closing operation shall be adjustable from two to three seconds (2-3 sec).
- 7. With 36 Vdc supplied, check for slamming of door panels against stops, check operator mechanism for slamming against stops and check that panels do not bounce back when fully open and fully enter the door pocket.
- 8. With 36 Vdc supplied, check for proper operation of door closing protection devices. Any obstruction for either leaf should cause the doors to reverse. When the leaves are less than one-quarter inch (1/4") apart, the doors should not reverse. See section 6.01, F.

16.01 <u>TESTS AND ADJUSTMENTS</u> (Continued)

- H. <u>Side Door Tests and Adjustments</u> (Continued)
 - 9. Check operation of door cut out switches and latches.
 - 10. Make all adjustments necessary, in accordance with the door operator manufacturer's recommendations, to bring the doors into conformance with the above Specifications.
 - 11. Check operation and adjustment of all electrical interlocks and all visual and audible signals on each car and on each married pair.
- I. End Door Adjustments
 - 1. The end door closer shall be adjusted to close the door from a fully open position in approximately five seconds (5 sec).
 - 2. The back check shall be adjusted to prevent slamming against the door stop when the door is open beyond 80°.
 - 3. The door closer shall be adjusted to give a faster speed to ensure positive latching when the door is 15° open.
 - 4. Check for complete weather sealing on all edges of the end doors.
- J. <u>Headlight Adjustment</u>

The headlights shall be adjusted in accordance with Section 8.02, B.

K. <u>Track Brake Adjustment</u>

Adjust the height of each magnetic track brake shoe to be 3/8-inch above the running rail.

L. <u>Track Trip Switch Adjustment</u>

Adjust the height of the track trip switch so that the bottom of the trip arm is 2-3/4+0, -1/4-inch above the top of the running rail.

M. <u>Contact Shoe Adjustment</u>

Adjust the height of each current collector contact shoe so the bottom contact surface is $5\pm1/8$ -inches above the top of the running rail.

16.01 TESTS AND ADJUSTMENTS (Continued)

N. <u>Air Comfort System Tests</u>

The air comfort system shall be tested in accordance with Section 7.01, H.

O. <u>ATC/ATO System Tests</u>

The ATC/ATO system shall be tested and made fully operational on each car and each married pair in accordance with Section 13. Testing shall be in accordance with the instructions of the ATC/ATO system manufacturer and shall be reviewed by the Engineer.

P. <u>Communication System Tests and Adjustments</u>

The communications system shall be tested on each married pair in accordance with Section 14 and made fully functional.

Speaker volume shall be set as follows on each married pair. All level measurements shall be made with a calibrated sound level meter.

Using the pre-recorded 1 KHz tone, set the interior speaker volume to 110 dBC \pm 3 dB measured at the speaker grille with "fast" sound level meter response.

Check each interior speaker to ensure all are working properly using prerecorded message "Please familiarize yourself"

Using the same pre-recorded tone and meter response, set the exterior speaker volume to 103 dBC \pm 3 dB measured at the speaker grille with "fast" sound level meter response.

Check each exterior speaker to ensure all are working properly using the prerecorded message "Please familiarize yourself"

Q. Coupler Tests

The No. 1 end couplers on all cars shall be demonstrated to work by performing a coupling to another car. The coupler slide lock indicator and safety latch shall be checked for proper operation along with uncoupling mechanisms.

Coupling shall be made with both knuckles open and with each one alternately closed to verify proper operation.

Check the operation of the coupler heater. See Section 9.18.

16.01 <u>TESTS AND ADJUSTMENTS</u> (Continued)

R. Carbody Height Adjustment and Suspension System Tests

The carbody height of each car shall be adjusted in accordance with Section 2.01, L. The adjustment shall be performed with the car sitting on level track.

The suspension system shall be tested and made fully operational in accordance with Section 11.03, H, 3.

S. <u>Truck Frame Tests</u>

The truck frame shall be tested in accordance with Section 11.07.

T. Carbody Compression Test

The carbody shall be tested in accordance with Section 3.01, C.

U. <u>Event Recorder Tests</u>

Event recorder operation shall be verified by downloading data that has been recorded during test track operation.

Check the operation of the event recorder heater, if used. See Section 9.17.

- V. <u>Video System Tests</u>
 - 1. The video recorder system shall be tested and made fully functional on each married pair.
 - 2. Video system operation shall be verified by recording for a period of time and activating the Passenger Intercom and each side door emergency opening handle and playing the recording on a PTU or playback unit and observing each camera operation and the flag set for each intercom activation and side door emergency opening.
 - 3. Check the operation of the event recorder heater, if used. See Section 9.17.

W. EMI/EMC Tests

The cars and individual systems shall be tested for EMI/EMC emissions in accordance with Section 9.20, F.

16.01 <u>TESTS AND ADJUSTMENTS</u> (Continued)

X. Vehicle Identification and Annunciation System Tests

The vehicle identification and annunciation system shall be fully tested and verified and made fully operational on each married pair in accordance with Section 9.21, C. Testing shall be in accordance with the instructions of the system manufacturer and shall be reviewed by the Engineer.

Y. <u>Prototype Car Tests</u>

- 1. The Contractor shall deliver ten (10) cars, five (5) semi-permanently coupled units, to the Authority. Eight (8) will be used in regular, passenger-carrying service for a minimum of nine (9) months, including complete winter and summer seasons, to evaluate all aspects of the car design and operation as specified herein before the remaining cars are shipped from the Contractor's plant. Two (2) will be used at sites determined by the Engineer, for instruction classes described in Section 1.13. The noise, vibration, high speed running and stopping and speed limiting and EMI/EMC of the cars shall be carefully tested for compliance with the Specification, at the Contractor's expense, on CTA property prior to the start of the regular, passenger-carrying service. The Contractor shall submit a test procedure for review by the Engineer and the results of all the tests shall be reviewed by the Engineer. Any deficiencies in the design or operation of the cars and their components shall be corrected before delivery of the rest of the cars begins. Any modifications to the prototypes shall be fully incorporated into all cars.
- 2. The prototype cars shall be put into regular, passenger-carrying service following all testing and modifying. The prototype cars will be operated and maintained as any other CTA cars, except efforts will be made to ensure daily operation.
- 3. The Contractor shall perform no routine maintenance on the cars at any time.
- 4. All other work performed on the cars during the test period shall be subject to the provisions of General Specification Section 20, Authority Labor, Materials and Facilities.
- 5. If a failure or malfunction occurs during the test period, it shall be fully investigated by the Contractor to determine if it resulted from a design or construction deficiency. If in the judgment of the Engineer a design or construction deficiency is found, the prototype cars shall be modified, and the cars returned to service. If, in the judgment of the Engineer, the design or construction deficiency is of a major nature and the modification affects form, fit or function the test period may be extended for up to an additional six months (6 mo) to fully test and evaluate the modifications.

16.01 TESTS AND ADJUSTMENTS (Continued)

- Y. <u>Prototype Car Tests</u> (Continued)
 - 6. Extension shall be in one month (1 mo) increments as determined by the Engineer. When the eight (8) cars have completed the nine month (9 mo) test period and any extensions thereof, the Authority shall authorize the Contractor to start delivery of the remaining cars. Successful completion of this test period shall not relieve the Contractor of responsibilities for compliance with all requirements of the Specification.
 - 7. If any of the married pairs are out of service awaiting engineering, personnel, parts or modifications for a period exceeding twenty (20) calendar days total during the nine month (9 mo) test period, the test period shall be extended by the total length of time the least-available cars were out of service to ensure adequate operational experience with all aspects of the cars.

16.02 NOISE AND VIBRATION CRITERIA

- A. <u>General</u>
 - 1. The Contractor shall devote particular attention to the design of the car, equipment and trucks to obtain quiet operation and shall ensure that the noise and vibration criteria specified herein are not exceeded. Particular attention shall be given to the designing of all equipment to ensure minimum generation of noise and vibration along the path from source to passenger.
 - 2. Vibration isolators, enclosures or baffles, acoustical absorption, carbody panels with adequate sound transmission loss or other appropriate methods shall be incorporated into the car design to adequately attenuate noise and vibration generated by wheels and rails and all car elements and equipment to ensure that the limitations on interior and wayside noise and vibration are not exceeded. Maximum permissible noise levels from some individual pieces of equipment are specified and maximum permissible interior and wayside noise and vibration levels are specified. Noise levels from equipment not specifically limited herein shall be controlled by the Contractor to ensure that the interior and wayside noise and vibration limits for the complete car are satisfied.
 - 3. The Contractor shall perform noise and vibration tests on one (1) complete A-car and one (1) complete B-car to demonstrate compliance with all specifications stated herein. All test procedures, data and results shall be submitted to the Engineer for review. The cars used for these tests shall be two of the prototype cars.

16.02 NOISE AND VIBRATION CRITERIA (Continued)

- A. <u>General</u> (Continued)
 - 4. All equipment shall be designed to eliminate rattling and resonance at all speeds up to ten percent (10%) above maximum normal running speed by the use of damping, gaskets, resilient mounts or similar methods. Included in this requirement but not limiting the generality thereof are such accessories as:
 - a. Windows. h. Lighting Fixtures and Covers.
 - b. Seats. i. Stanchions.
 - c. Wiring. j. Barriers.
 - d. Piping. k. Grab Handles.
 - e. Ventilation Ducts. I. Fire Extinguisher.
 - f. Ventilation Grills. m. Doors.
 - g. Wall Panels.
- B. <u>Noise Design Considerations</u>
 - 1. During the design and development of the car the Contractor shall make tests and calculations as required to substantiate that the noise levels of the completed car will meet these Specifications. These tests and calculations shall be witnessed and reviewed by the Engineer.
 - 2. Noise levels of all individual pieces of equipment shall be determined by tests. The overall noise levels of the complete vehicle while operating shall be calculated on the basis of these tests, taking into account the characteristics of the carbody structure, equipment mounts, and the additive effect of multiple noise sources.

16.02 NOISE AND VIBRATION CRITERIA (Continued)

C. <u>Noise Measurements</u>

1. Applicable Standards

For test and measurements the Contractor shall use a Type 2 sound level meter meeting the requirements of the latest revision to ANSI S1.4-1983(R2001), Specification for General Purpose Sound Level Meters. Where octave band or one-third (1/3) octave band measurements are specified, Contractor shall use an analyzer meeting the requirements for Class II Filters as given in the latest revision to ANSI S1.11-2004, Specification for Octave, Half-Octave and Third Octave Band Filter Sets.

Unless otherwise stated, noise herein means sound pressure level as defined in the latest revision to ANSI S1.4-1983(R2001). All noise levels listed are in decibels referred to 20 micro Pa, as measured with the 'A' weighting or the 'C' weighting network of a standard sound level meter, abbreviated dBA and dBC, respectively. Unless otherwise specified, the "slow" meter response time shall be used. Narrow band or pure tone noise shall be evaluated using one-third (1/3) octave band analysis.

Sound transmission losses specified for carbody components such as doors, floors, walls and ceilings refer to sound insulation values obtained by measurement procedures outlined in ASTM E90 (for laboratory tests of body elements) or ASTM E336 (for field tests of the complete car), except that octave band rather than one-third (1/3) octave band measurements are specified herein. Laboratory tests of carbody elements of limited size are to be used for developmental purposes only and may not be substituted for full scaled transmission loss tests on the complete car.

16.02 NOISE AND VIBRATION CRITERIA (Continued)

C. <u>Noise Measurements</u> (Continued)

2. Noise Measurement Conditions

Noise measurements to specification shall be performed in an essentially free field environment, such as outdoors with no nearby structures or reflective surface which could influence the measurements by more than 2 dB, other than standard ballast and tie road bed and the adjacent flat, clear ground.

For all tests, the levels of all sounds or vibrations other than those being evaluated shall be not less than 10 dB below the levels of the sounds or vibrations being evaluated, when measured with the same weighting network or octave band as that being used for the test.

Measurements of noise produced by equipment alone, prior to installation on the car, shall be performed with the equipment supported above the floor or ground at the approximate elevation at which it will be mounted in the car. Where auxiliary methods of driving or loading equipment, such as motors or dynamometers, are required, these devices shall be temporarily enclosed or baffled to eliminate their effect on the equipment noise being measured.

Interior noise shall be measured in a complete, fully finished car, unoccupied except for personnel required to perform the measurements and two (2) observers. Exterior noise with the car moving or stationary shall be measured at a section of standard, at-grade ballast and tie track free of railings, sound barriers or other wayside obstructions extending above the elevation of the bottom of the rail between the car and the microphone.

Interior and exterior noise measurements shall be performed with the car running on level, tangent, ballast and tie track with continuous welded rail, ground smooth. Welded rail joints along the test section shall be smooth and even on the running surface and on the gauge edge so that no abnormal noise or vibration is generated by wheels passing over the joints.

3. Narrow Band or Pure Tone Noise

The exterior noise limits set forth in Paragraphs D, 1, and D, 3, for unmounted equipment, and for condition E,1,a, and E, 1, b, 1, of the specification table, limiting noise from the complete traction systems and the mounted undercar equipment, must be reduced by three (3) dBA if significant pure tones in the range from 300 Hz to 4000 Hz are present in the noise. Pure tone noise shall be considered significant in this context if any one-third (1/3) octave band sound pressure level is five (5) dB or higher than the average of the two (2) adjacent one-third (1/3) octaves containing no pure tones or "tonal" noise.

16.02 NOISE AND VIBRATION CRITERIA (Continued)

D. Noise Limits for Equipment Prior to Installation on Car

1. Traction Motors

The noise produced by each traction motor shall not exceed 80 dBA at fifteen feet (15') in any direction from the center of the motor while operating at all speeds from zero to the equivalent of sixty miles per hour (60 mph) car speed and at loads equivalent to maximum dynamic braking in either direction. Normal cooling air ducts to be employed on the motors on the car may be installed during this test. Normal cooling airflow for the motors must be provided during this test.

2. Propulsion System Gearing

The noise produced by each propulsion system gearbox shall not create levels in excess of 81 dBA at fifteen feet (15') in any direction from the geometric center of each gearbox with gears rotating in either direction at all speeds from zero to the equivalent of sixty miles per hour (60 mph) car speed and at loads equivalent to maximum dynamic braking.

3. Undercar Equipment

The noise produced by the individual operation of all undercar equipment units, including refrigeration compressors, motors, blowers, brakes and other noise generating components, except traction motors and gears, shall not exceed 68 dBA at fifteen feet (15') in any direction from the center of the equipment while it is operating at normal conditions.

All duct work, baffles or appurtenances which form a part of the installed assembly shall be included as part of the equipment for noise tests.

16.02 NOISE AND VIBRATION CRITERIA (Continued)

E. Noise Criteria for Equipment After Installation on Car and for Complete Car

1. Noise criteria for equipment installed on the complete car and for the complete car are shown in the following table:

Condition			Interior	Exterior	Horizontal Distance From Track Centerline
a.	<u>Car</u>	Stationary on Jack			
		All traction motors, gearboxes and wheels rotating at all speeds up to 60 mph. All auxiliary equipment off except traction motor cooling blowers.		82 dBA	15 ft
b.	<u>Car</u> Trac	<u>Stationary on Ballast and Tie</u> <u>k</u>			
	1)	Each individual item of undercar equipment or each complete operating system, including the air conditioning system components operating at normal conditions. Includes starting and stopping transient noises.	65 dBA 78 dBC	68 dBA	15 ft
	2)	Simultaneous operation of all vehicle systems including air conditioning and auxiliaries except traction motors, under normal conditions.	68 dBA 80 dBC	60 dBA	50 ft

16.02 NOISE AND VIBRATION CRITERIA (Continued)

E. <u>Noise Criteria for Equipment After Installation on Car</u> and for Complete Car (Continued)

1. (Continued)

Condition			Interior	<u>Exterior</u>	Horizontal Distance From Track Centerline
c.	<u>Ca</u>	<u>Moving</u>			
	1)	Two car train moving at constant 60 mph with all vehicle systems operating simultaneously under normal conditions.		80 dBA	50 ft
	2)	Car moving at any speed up to 60 mph and under all normal conditions of acceleration, deceleration and coasting with all vehicle systems operating simultaneously under normal conditions.	70 dBA		
	3)	Full or partial application of friction brakes at low speeds, 0 to 15 mph.		75 dBA	15 ft

2. Noise Measurement Locations

Interior noise limitations apply at any point along the car centerline four and one-half feet (4.5') above the car floor and two feet (2') or more from the end walls, including inside the Operator's cab.

All exterior noise measurements shall be made with the microphone on a horizontal plane passing through the axles on both sides of the car at the horizontal distances from the track centerline shown in the Specification table. For measurements of noise produced by specific, individual pieces of equipment or operating systems, the microphone shall be located on a transverse line passing through the center of the equipment being measured. The limitation on exterior noise produced by all equipment operating simultaneously applies at the specified distance along the entire length of the car.

16.02 NOISE AND VIBRATION CRITERIA (Continued)

F. Noise Limits for Miscellaneous Equipment

1. Door Operation Noise

Noise produced by operation of all the doors on one side of the car only, shall not exceed 72 dBA using "fast" meter damping, anywhere in the car one foot or more (\geq 1 ft.) from the doors or door pockets and between three feet and six feet (3'-6') above the floor.

2. Public Address System

Noise generated by the car public address system in the standby condition shall not exceed 40 dBA when measured twelve-inches (12") away from any loudspeaker with PA auxiliary equipment energized and operating with the car electrical system.

3. Lighting System

Noise generated by fluorescent lamps, fixtures and ballasts installed in the car and energized at rated voltage and frequency, shall not exceed 48 dBA when measured one foot (1') from each lighting fixture.

- G. <u>Carbody Transmission Loss</u>
 - 1. The sound transmission loss of the carbody floor, wall and ceiling assemblies in completed form shall be adequate to achieve the interior noise level limits specified in Section 16.02, E, but in no case shall the average sound transmission loss of each characteristic section of the carbody be less than specified in the following table:

SOUND TRANSMISSION LOSSES BY OCTAVE BANDS									
Octave Band Center Frequency	Entire Floor	Walls Including Window but Excluding Doors	Ceiling or Roof	Doors					
250 Hz 500 Hz 1000 Hz 2000 Hz	27 dB 35 dB 38 dB 38 dB	23 dB 31 dB 34 dB 34 dB	23 dB 31 dB 34 dB 34 dB	14 dB 22 dB 25 dB 25 dB					

The sound transmission loss shall be averaged over each characteristic section of the carbody defined in the above section of the carbody defined in the above table, and must include the influence of all sound energy which transmits through all weak areas such as apertures, door seals, air ducts or openings for supply and return ducts.

16.02 NOISE AND VIBRATION CRITERIA (Continued)

- G. <u>Carbody Transmission Loss</u> (Continued)
 - 2. The Contractor shall, using the procedures outlines in ASTM E336, Recommended Practice for Measurement of Airborne Sound Insulation in Buildings, perform tests before delivering the cars to CTA to determine the sound transmission loss of the carbody sections. Evaluation of the sound transmission loss of each characteristic section of the completed carbody shall be done using one or both of the following procedures:

With the car located outdoors on ballast and tie, at-grade track or indoors in a space where reflected sound from nearby walls or floors will not influence the sound radiated from the carbody by more than 2 dB, the Contractor shall, using portable loudspeakers in a manner reviewed by the Engineer, create a random noise of constant level, for the frequency range encompassing the 250 Hz to 2000 Hz center frequency octave bands, with sufficient Sound Pressure Level inside the car that the noise transmitted through the carbody is at least 10 dB higher than the outside ambient SPL in each octave band and with sufficient diffusion or distribution that the sound level in the car is uniform within 3 dB at twelve-inches (12") or more from any body surface. (Achieving a uniform sound field over the car floor will require removal of the seats.) Using this procedure the carbody section sound insulation can be evaluated by using a sound level meter and octave band analyzer to measure the space average SPL inside the car in the 250, 500, 1000 and 2000 Hz center frequency octave bands and by also measuring the exterior SPL for each of these octave bands at a distance of twelve-inches (12") from all car surfaces at a sufficient number of locations to determine the average noise reduction for each characteristic body section, such as the floor, walls, roof and doors. The measurements shall include the influence of any flanking sound transmission paths at locations such as the floor/wall juncture.

The difference between the interior space average Sound Pressure Level and the average exterior Sound Pressure Level at each section is the Noise Reduction provided by the carbody sections. Noise Reduction measured in this manner is 6 dB greater than the transmission loss. The measurements must be corrected to transmission loss in accordance with procedures given in ASTM E336 in order to determine compliance with the specified minimum sound insulation of each carbody section.
16.02 NOISE AND VIBRATION CRITERIA (Continued)

- G. <u>Carbody Transmission Loss</u> (Continued)
 - 2. (Continued)

Alternatively, with the car located near highly reflective surfaces, such as over a maintenance and inspection pit, the transmission loss may be measured in accordance with the two room reverberant sound field methods indicated in ASTM E336. To create a satisfactory reverberant condition outside the car, and to define the boundaries of the space, temporary baffles or barriers, reviewed by the Engineer, shall be placed between the carbody exterior wall at the floor level and the edges of a maintenance pit, to define a closed space beneath the car for testing the car floor transmission loss. The temporary baffles both define the space from influencing paths outside the car from influencing the measurements, for example, by preventing sound transmitted through the car walls or doors from bypassing the floor during a test of the floor.

H. <u>Vibration</u>

1. Traction Motors

The vibration of any traction motor, detached and supported on resilient mountings providing at least 0.25-inch static deflection, shall not exceed 0.0015-inch peak-to-peak displacement anywhere on the motor while the motor is rotating at any speed between fifty percent (50%) and one hundred percent (100%) of maximum normal operating speed.

2. Equipment Installed on Car

Equipment and auxiliaries mounted anywhere on the car or truck shall not cause vertical or horizontal vibrations anywhere on the floor, ceiling or seat frames of the stationary car in excess of the following:

0 Hz to 1.4 Hz	0.1-inch peak-to-peak displacement
1.4 Hz to 20 Hz	0.01 g zero-to-peak acceleration
Above 20 Hz	0.03 in/sec zero-to-peak velocity

16.02 NOISE AND VIBRATION CRITERIA (Continued)

- H. <u>Vibration</u> (Continued)
 - 3. Wayside Ground Vibration

Ground-borne vibration created by operation of a two-car train at constant speed on tangent track shall not exceed the ground-borne vibration created by operation of a reference two-car train of CTA's 5000 Series cars.

Tests for vibration levels in the vertical direction shall be conducted by the Contractor at two (2) sites selected by the Engineer; one (1) site to be elevated structure with jointed rail, and one (1) site to be ballast and tie tracks with continuous welded rail. The test and reference trains shall be operated at constant speeds of 30 mph and 45 mph in both directions on the same track. Measurements with the test and reference trains shall be done at the same time at each of the test sites to assure that conditions are the same for both trains.

The tests shall be accomplished with fully completed and equipped cars with loads not to exceed 1,500 pounds of personnel and instrumentation.

Measurements of vibration at the elevated structure test site shall include, but not be limited to, measurement at the base of structure column near track centerline and on an at-grade concrete slab or sidewalk, an asphalt slab, a curb, or on a building structure at wayside distances (perpendicular to the track alignment) of 25 feet from the column centerline. At the ballast and tie track test site the tests shall include measurements of ground-borne vibration on an at-grade slab or curb, a concrete block buried in the ground or a firmly bedded tie at 25 feet and 50 feet from track centerline.

The vibration measurements shall be made with a lightweight piezo-electric accelerometer with amplifier and recording system giving uniform response, ± 1 dB, from 2.0 Hz to 600 Hz. The transducer signal shall be analyzed by one-third (1/3) and 1/1 octaves, or shall be recorded in a manner permitting such analysis.

The vibration data from each train pass by shall be analyzed in terms of rms accelerations for each one-third (1/3) octave band from 2.5 Hz to 500 Hz center frequency, and for each octave band from 4 Hz to 250 Hz center frequency using a method reviewed by the Engineer.

16.02 NOISE AND VIBRATION CRITERIA (Continued)

- H. <u>Vibration</u> (Continued)
 - 3. <u>Wayside Ground Vibration</u> (Continued)

The average vibration levels shall be determined by arithmetically averaging the one second (1 sec) period maximum levels in decibels for all of one-third (1/3) octave frequency bands within each of the following four (4) groups or sets of frequency ranges:

 Group
 Frequencies (Hz)

 1
 3.15 to 6.3

 2
 8.0 to 20

 3
 25 to 63

 4
 80 to 200

The test train average ground-borne vibration levels may not exceed those of the reference train, and the highest levels caused by the test train may not exceed those for the reference train for each of the groups of frequency ranges.

The highest levels shall be defined as the greatest or maximum 1 - second period one-third (1/3) octave band level for any one-third (1/3) octave within each group or set and will not necessarily be the same one-third (1/3) octave frequency for the test train and the reference train.

It shall be the Contractor's responsibility to perform the necessary preliminary tests and calculations during the design and development of the car as required to substantiate that the ground-borne vibration levels of the completed car will meet these requirements. It shall also be the Contractor's responsibility to conduct at his own expense the performance test necessary to show that the ground-borne vibration produced by the cars does not exceed that produced by the operation of CTA's 5000 Series cars.

16.02 NOISE AND VIBRATION CRITERIA (Continued)

- I. <u>Ride Quality</u>
 - 1. The ride quality shall be equal to or better than that of CTA's 5000 Series cars.
 - 2. It shall be the Contractor's responsibility to test the same cars used in the above Vibration Tests to ensure that the ride quality is equal to or better than that found on CTA's 5000 Series cars. CTA will supply data on the ride quality of its 5000 Series cars when new.
 - 3. The ride quality shall be recorded as vertical, lateral and longitudinal accelerations measured in an appropriate manner at an appropriate location in the car at speeds from zero to sixty miles per hour (0-60 mph). The tests shall be conducted at the same track sites used for the vibration tests.

16.03 SHIPMENT OF CARS

- A. All cars shall be shipped to the property of the Authority at Skokie Shops, 3701 Oakton Street, Skokie, IL 60076, FOB CTA track, freight included, destination.
- B. Measures and procedures to protect the cars from damage during shipment shall be reviewed by the Engineer.
- C. The Contractor shall inspect Skokie Shop and Training Center facilities or alternate site. Any additional facilities required for access and unloading including grading, paving, ramps, cranes, etc. that may be required shall be the responsibility of the Contractor. The Contractor shall be responsible for delivering each car onto the CTA's track without the participation of CTA personnel or the use of CTA tools or equipment.
- D. The Authority will allow unloading of cars between 7:00 AM and 2:00 PM, Monday through Friday, except on holidays when the shop is closed.

SECTION 17 REPLACEMENT UNITS AND SPECIAL TOOLS

17.01 GENERAL

The Contractor shall supply replacement units and special tools as detailed below. These units shall be shipped to the Authority as directed by the Engineer. If modifications are made to any unit on the cars before or after delivery to the Authority during the warranty period, they shall be incorporated into the replacement units at no cost to CTA. The delivery of these units shall be as early as practical following completion of the prototype test. All units shall be complete assemblies, painted as required, ready for installation. Prior to delivering any replacement units, the Contractor shall submit for review by the Engineer a complete listing, with manufacturer part numbers, of all the items to be supplied under Section 17.02.

Quantities of replacement units as specified in Section 17.02 below shall increase at the rate of 10% additional for each additional 25 cars, or fraction thereof, purchased under this contract beyond 100 cars. All quantities shall be rounded up to the next whole unit.

If designs and arrangements of equipment other than those specified are used on the cars, the Engineer will adjust the descriptions and quantities of the replacement units to correspond to the equipment actually supplied.

Adjustments made during pre-proposal meetings or by addenda shall not be considered as changes. If the Contractor proposes alternate designs or arrangements during the execution of the contract, part of the Contractor's proposal shall be replacement units in quantity and type comparable to those listed, which the Contractor will supply at no additional cost. If the Authority requests changes in designs or arrangements that affect the replacement units, any adjustments shall be considered as changes and shall be processed in accordance with Section 21, CHANGES, of the General Specification.

17.02 UNITS AND QUANTITIES

- 1. <u>Plug-In Circuit Cards</u>: Twenty (20) of each type in each system.
- 2. <u>Non Plug-In Circuit Cards and Electronic Modules</u>: Twenty (20) of each type in each system.
- 3. <u>Propulsion Control Unit and Control Electronics Units</u>: Ten (10) complete car sets, including all protective devices, input devices and line filters, assembled in equipment enclosures, as provided on the cars.
- 4. <u>Contactors</u>: Fifteen (15) of each type used in the propulsion system complete with arc chutes and position sensors or interlocks.
- 5. <u>Braking Resistors</u>: Ten (10) complete car sets of braking resistors, made up in assemblies, with insulators and heat shields, mounted in their enclosures, if separate.

- 6. <u>High Speed Circuit Breakers:</u> Fifteen (15) complete high speed circuit breakers with arc chutes, position sensors and other components as provided on the car.
- 7. <u>Traction Motors</u>: Fifty(50) complete traction motors with couplings.
- 8. <u>Traction Motor Rotors:</u> Ten (10) traction motor rotors.
- 9. <u>Propulsion System Ventilation Blower Units</u>: Twenty five (25) car sets of propulsion system ventilation blower units with motors, electrical connectors, fans, housings, mounting brackets, shock mounts and pressure switches.
- 10. <u>Master Controllers:</u> Ten (10) complete Master Controllers.
- 11. <u>Gearboxes</u>: Fifty (50) gearboxes without brake calipers or brake discs.
- 12. <u>Friction Brake Calipers</u>: One-hundred (100) complete friction brake caliper assemblies with brake pads, hydraulic fittings and electrical connectors.
- 13. Friction Brake Discs: Seventy five (75) friction brake discs.
- 14. <u>Friction Brake Hydraulic Power Units</u>: Twenty (20) hydraulic power units.
- 15. <u>Track Brakes:</u> Twenty five (25) track brake assemblies complete with cables, support links, support spring assemblies, bushings and hardware.
- 16. <u>Wheel-Axle-Gearbox Assemblies</u>: Twenty (20) wheel-axle gearbox assemblies complete with journal bearings, bearing housings, primary springs and gearboxes with brake discs and calipers.
- 17. <u>Complete No. 1 Trucks</u>: Sixteen (16) complete No. 1 trucks, eight (8) for Acars and eight (8) for B-cars with all speed sensors, ATC pickups, wiring, hydraulic lines, suspension system elements, connectors and current collection equipment.
- 18. <u>Complete No. 2 Trucks</u>: Sixteen (16) complete No. 2 trucks, eight (8) for A-cars and eight (8) for B-cars with all speed sensors, wiring, hydraulic lines, suspension system elements, connectors and current collection equipment.

- 19. <u>Active Suspension System:</u>
 - a. <u>Twenty five (25) hydraulic power units.</u>
 - b. Fifty (50) hydraulic cylinder assemblies.
- 20. <u>Truck Frames and Bolsters:</u> Fifteen (15) truck frame and bolster assemblies with complete secondary suspension systems, all stops, current collector supports, ATC pick-up coil brackets, roll bars, connecting links/rods and journal housings with stops and bearing clamps.
- 21. <u>Track Trip Switch:</u> Ten (10).
- 22. <u>Shock Absorbers</u>: Twenty (20) vertical and ten (10) lateral.
- 23. <u>Primary Springs:</u> Twenty (20) journal sets.
- 24. <u>Auxiliary Power Supply Systems:</u> Sixteen (16) complete car sets with all controls and contactors. Half as complete, tested, ready to install assemblies and half as kits of parts including hardware and wire harnesses.
- 25. <u>Auxiliary Power Supply System Power Modules:</u> Fifteen (15) of each type.
- 26. <u>Auxiliary Power Supply System Stand Alone Relays and Contactors</u>: Fifteen (15) of each type, complete, ready to install.
- 27. <u>Low Voltage Power Supplies</u>: Fifteen (15) mounted in the device enclosure as provided on the car.
- 28. <u>Battery Chargers</u>: Fifteen (15) mounted in the device enclosure as provided on the car.
- 29. <u>Storage Batteries</u>: Ten (10) complete storage battery assemblies with interconnecting cables and cradles, assembled ready for installation.
- 30. <u>Air Comfort Panels and Lighting Control Panels</u>: Five (5) each, complete air comfort and lighting control panels with all components and wiring (this covers all panels that control the designated functions).
- 31. <u>High Voltage Panel</u>: Five (5) complete high voltage panels (if separate from 30 above) with all components and wiring.
- 32. <u>Undercar Air Comfort Packages</u>: Fifteen (15) complete, ready to run, undercar air comfort units with all motors, fans, heaters, piping, compressors and other components including mounting brackets, shock mounts and hardware.

- 33. <u>Air Conditioning Motor-Compressor</u>: Twenty five (25) air conditioning motorcompressors.
- 34. <u>Evaporator Blower Assembly</u>: Ten (10) air comfort system evaporator blower motors with fans and mounting provisions.
- 35. <u>Condenser Blower Assembly</u>: Ten (10) air conditioner condenser blower motors with fans and mounting provisions.
- 36. <u>Micro-Processor Temperature Controller:</u> Fifteen (15), complete units.
- 37. <u>No.1 End Drawbar and Coupler</u>: Fifteen (15)complete assemblies.
- 38. <u>No.2 End Drawbar</u>: Ten (10) complete assemblies.
- 39. <u>Electric Couplers</u>: Fifteen (15) complete with cables, connectors and covers.
- 40. <u>Jumper Switch</u>: Five (5) assemblies.
- 41. <u>No. 1 End Anchor Castings</u>: Five (5) complete with pins.
- 42. <u>No. 2 End Anchor Casting</u>: Five (5), complete with pin.
- 43. <u>Car No.1 Ends</u>: Ten (10) completely painted, including chain and spring guards.
- 44. <u>Cab Sashes</u>: Fifteen (15) right side and Fifteen (15) left side with glass in addition to the sample sashes required in Section 3.06, B.
- 45. <u>End Door Sash:</u> Twenty (20) with glass in addition to the sample sash required in Section 3.06, E.
- 46. <u>Side Body Sash, Opening:</u> Twenty (20) with glass in addition to the sample sash required in Section 3.06, D.
- 47. <u>Side Body Sash, Fixed:</u> Five (5) with glass in addition to the sample sash required in Section 3.06, D.
- 48. <u>Front Destination Sign Assemblies:</u> Ten (10) complete.
- 49. <u>Double Sided Side Destination Sign Assemblies:</u> Twenty (20) complete with fiberglass covers and mounting brackets.
- 50. <u>Run Number Sign Box Assemblies:</u> Fifteen (15) with brackets and hinges.
- 51. <u>Route Map Display Assemblies</u>: Ten (10) complete.

- 52. <u>Side Door Operators:</u> Thirty (30) complete with all sensors, control and diagnostic systems, linkages and rods; including elements directly attaching to door panels as well as the upper door track.
- 53. Low Speed Interlocks: Five (5) complete units.
- 54. <u>Door Control Boxes:</u> Ten (10) of each type complete with communication equipment and repeater lights ready to install.
- 55. <u>Operator's Seat:</u> Fifteen (15) complete seats with mounts in addition to the sample seat required in Section 3.10, F.
- 56. <u>Passenger Seat Assemblies</u>: Five (5) of each type in addition to the sample seats required in Section 3.10, .
- 57. <u>Side Door Panels:</u> Ten (10) right hand and ten (10) left hand panels complete with all hangers, guides and other hardware and without glass.
- 58. <u>End Doors:</u> Ten (10) end doors with latch and latch cover, hinge(s), weather stripping, grab handle but without sash and closer. Latch cover and grab handle and their mounting hardware shall be shipped loose.
- 59. <u>End Door Latch Cover Assembly:</u> Twenty five (25) complete assemblies with installation hardware and any other loose parts ready to install.
- 60. <u>Cab Doors:</u> Ten (10) complete with hinge, all hardware, glazing and screen ready to install.
- 61. <u>ATC/ATO Pick-up Coils:</u> Thirty (30) complete with leads.
- 62. <u>ATC/ATO Pick-up Coil Brackets:</u> Twenty (20) bracket assemblies for mounting ATC pickup coils, complete but without coils.
- 63. <u>ATC/ATO Power Supplies:</u> Ten (10) complete units.
- 64. <u>ATC/ATO Equipment Modules:</u> Ten (10) complete units with all printed circuit cards, relays, filters and other equipment, suitable for direct installation on the car without additional parts.
- 65. <u>ATC/ATO Relays:</u> Five (5) each type of vital relay and five (5) each type of non-vital relay.
- 66. <u>Aspect Display Units:</u> Fifteen (15).
- 67. <u>Horns</u>: Ten (10) tone generator-amplifier units and five (5) speakers.
- 68. <u>Communications Control Unit (complete with power amplifiers)</u>: Thirty (30).

- 69. Public Address, Intercom-Amplifier-Control Unit: Thirty (30).
- 70. Passenger Intercom: Twenty (20) units.
- 71. Pre-Recorded Announcement System:
 - a. Twenty (20) system controllers with all messages loaded (if different from Item 69 above).
 - b. Twenty (20) units interior message signs complete and including any interface or interconnect modules.
 - c. Twenty (20) units complete Door Control Box Public Address Microphones.
 - d. Ten (10) right and ten (10) left hand push button assemblies for mounting on the door control boxes.
- 72. <u>Video System:</u>
 - a. Fifty (50) cameras ready to install.
 - b. One Hundred (100) camera shields or housings.
 - c. Fifteen (15) recorders with any required external heaters or blowers.
 - d. Fifty (50) hard drive assemblies ready to install.
- 73. <u>Event Recorders:</u> Fifteen (15) complete units with any required external heaters or blowers.
- 74. <u>Operator's Control Panels:</u> Fifteen (15) complete with all components and wiring, including communications equipment.
- 75. <u>Bypass Panels:</u> Ten (10) complete with all components and wiring, including ATC Sonalerts.
- 76. <u>Operator's Communication Panels:</u> Fifteen (15) complete with handset.
- 77. <u>Heated Windshield Glass:</u> Fifteen (15) ready to install.
- 78. <u>Cab Heaters and Defrosters:</u> Five (5) of each type.
- 79. <u>Windshield Wiper/Washer Systems:</u>
 - a. Ten (10) motor drive assemblies with associated speed control.
 - b. Fifteen (15) windshield washer reservoirs with integral pumps.
 - c. Ten (10) Wiper System DC-DC Power Supplies.

17.02 UNITS AND QUANTITIES (Continued)

- 80. <u>LED Lighting Modules:</u> Fifty (50) of each type.
- 81. <u>Network Devices:</u>
 - a. Train Operator Touch Screen (TOTS): Thirty (30).
 - b. Train Switch: Thirty (30).
 - c. Unit Switch: Thirty (30).
 - d. GPS Receiver: Fifteen (15).
 - e. Smart Card Reader System: Fifteen (15).
 - f. Logic Controller : Fifteen (15) of each type.
 - g. Input-Output Modules: Fifteen (15) of each type.
 - h. Data Radio: Fifteen (15).
 - i. Multiband Antenna: Fifteen (15).
 - j. Other Ethernet routers and switches: Fifteen (15) of each type.

17.03 SPECIAL TOOLS AND EQUIPMENT`

The Contractor shall furnish, unless otherwise specified or agreed to by the Engineer, twelve (12) complete sets of gauges and special tools for running maintenance concurrent with the delivery of the first production cars and one complete set of gauges and special tools for heavy maintenance no later than one (1) year after the delivery of the first production cars.

Special tools include but are not limited to any jigs, fixtures (including those needed to support and rotate assemblies for ease of access), hand tools, power tools, or other tools and equipment necessary to inspect, calibrate, adjust, maintain, repair, assemble, and disassemble the vehicle or subsystems that are not commonly available from commercial tool suppliers. PC board extenders are also considered special tools for both running and heavy maintenance. Gauges and special tools needed for maintenance and inspection shall be those devices that the Contractor refers to in the "Running Maintenance Manual". Gauges and special tools needed for repair and overhaul of the cars shall be those devices that the Contractor refers to in the "Heavy Maintenance Manual". For electronic system testers, see Section 9.11. For air conditioning maintenance equipment, see Section 7.01, I.

Special tools shall include load banks for the propulsion inverters, LVPS, Auxiliary Inverter and Battery Charger that will be able to absorb full load outputs from each of the devices.

17.03 SPECIAL TOOLS AND EQUIPMENT (Continued)

Lists, documentation and drawings related to gauges and special tools to be furnished for each system shall be included in the Preliminary Design Review Documents for each system, and shall be reviewed as part of that review. If the Engineer determines that additional types of gauges or special tools are required to properly and adequately maintain the cars, the Contractor shall add them to the lists and present complete information on them to the Engineer for review before the Final Design Review. If during the prototype car testing period, additional types of special tools or gauges are identified as being required, the Contractor shall supply them at no additional cost to the Authority.

All gauges or special tools shall be supplied along with complete manuals explaining the use of the gauge or tool and its care and maintenance including condemning limits for all gauges. The Contractor shall provide sixteen (16) printed and bound manuals for the running maintenance gauges and special tools manuals, five (5) printed and bound manuals for heavy maintenance gauges and special tools manuals and two (2) CD-ROMs including manuals for all gauges and special tools. In addition, adequate information, inclusive of manufacturing drawings and parts lists, shall be furnished by the Contractor to enable CTA to purchase or have manufactured additional gauges and special tools, beyond those furnished by the Contractor.

The Contractor shall have their own gauges and special tools necessary to manufacture, assemble and test the cars. Gauges and special tools furnished to CTA will not be available for the Contractor's use. In addition, the gauges and special tools that are used for the Contractor provided training shall be delivered to and become the property of CTA upon the completion of the training.

The Contractor shall provide two (2) complete sets of back-up/restore software for any microprocessor controlled equipment and systems furnished as part of these special tools.

17.04 PORTABLE TEST UNITS (PTU)

A. The Contractor shall furnish a total of ten(10) semi-rugged PTUs as called for in Section 6.07, Section 7.01, C, 5, Section 9.03, F, 1, Section 9.16, A, 8, Section 10.10, C, and Section 14.02, B, 12 and all other systems except ATC/ATO to access microprocessor controls beyond the built-in diagnostics. Each unit shall be loaded with all associated software to access, monitor, download data and perform other functions related to the microprocessor-controlled systems and diagnostics designed to be accessed by computer test equipment. These PTUs shall be equipped with CD/DVD writers. The Contractor shall deliver to the Authority on CD/DVD-ROM all software utilized by the PTUs. The Contractor shall also deliver any required licenses in CTA's name. The Contractor shall update the software and documentation throughout the life of the contract, including the warranty period, at no cost to CTA.

17.04 PORTABLE TEST UNITS (PTU) (Continued)

- B. The Contractor shall furnish five (5) semi-rugged PTUs as called for in Section 13.17 to access the ATC microprocessor controls beyond the built-in diagnostics and to access the built in event recorder. Each unit shall be loaded with all the associated software to access, monitor, download data and perform other functions related to the ATC system and its event recorder. These PTUs shall be equipped with CD/DVD writers. The Contractor shall deliver to the Authority on CD/DVD-ROM all software utilized by the PTUs. The Contractor shall also deliver any required licenses in CTA's name. The Contractor shall update the software and documentation throughout the life of the contract, including the warranty period at no cost to CTA.
- C. The Contractor shall furnish ten (2) semi-rugged PTUs as called for in Section 14.04, A to access the video recorder diagnostics, set-up, recorder viewing and video recording and perform set-up and diagnostics. Each unit shall be loaded with all the associated software to access, monitor, download, set parameters, view recordings and perform other functions related to the video recorder and event recorder systems. The Contractor shall deliver to the authority on CD/DVD-ROM all software utilized by the PTUs. The Contractor shall also deliver any required licenses in CTA's name. These PTUs shall be equipped with CD/DVD writers to allow the video and audio to be downloaded without removing the hard drive from the video recorder. These writers shall be the highest speed available at the time of delivery. See Paragraph G below. The Contractor shall update the software and documentation throughout the life of the contract including the warranty period at no cost to CTA.
- D. All PTUs shall be IBM compatible, self contained lap-top computers, with wireless and wired Ethernet network connectivity. These PTUs shall be of the highest quality incorporating the latest hardware technology at the time of delivery to CTA.

The specifications for the PTUs and the hardware included in each type shall be reviewed by the Engineer.

The software loaded on each type of PTU shall be reviewed by the Engineer and, except for the car system specific software, shall be the same for all types.

17.04 PORTABLE TEST UNITS (PTU) (Continued)

E. The PTUs shall be both battery and 120 VAC operated with at least eight (8) hours of continuous operation before battery recharge. The batteries shall be rechargeable and contained within the unit. Adapter/chargers shall be provided for each PTU and shall operate from 120 Volt, 60 Hz power. Battery packs shall be removable. One spare battery shall be provided with each PTU.

The PTUs shall be designed to utilize dual operating batteries.

Each PTU shall come with a fitted carrying case. The case shall also accommodate spare battery packs, adapter/chargers and all associated cables.

Each PTU shall come with all necessary interconnecting cables with appropriate connectors to plug into the specified car and equipment receptacles for each system.

- F. If designs and arrangements of lap top computers used as PTUs change to include additional devices as standard equipment or if CD or DVD standards and/or hardware change, the Contractor shall bring these changes to the attention of the Engineer who will decide how the PTUs are to be configured and equipped.
- G. Additional Portable Test Units of the type required in Paragraphs A above shall be supplied at the rate of two (2) per 100 cars or fraction thereof above the base contract unless otherwise agreed to by the Engineer. Two (2) Portable Test Units of each type shall be delivered with the first prototype cars. The remaining PTUs shall be delivered within 180 days thereafter.
- H. The Contractor shall also provide two (2) complete sets of back-up/restore software for each type of PTU supplied under this Contract. In addition, the disks for the operating system and all installed software shall be provided.

DRAWING INDEX

The following CTA Drawings, latest revisions, shall be a part of these Specifications. Do not scale drawings. Full size copies are available from the Engineer.

PRINT NO.	TITLE	PAGE NO.
SKE-1-092612	Plan & Elevation 5000 Series Rail Cars	DR - 1
R-5-1016	Current Collector Beam Assembly	DR - 2
E-2-500	Two (2) Passenger Transverse Seat	DR - 3
E-1-503	Emergency Handle Knob	DR - 4
R-1-602	Standard Key	DR - 5
R-2-625	Plate: Car Number	DR - 6
SKE-21563	King Pin	DR - 7
R-3-502	Support Frame	DR - 8
R-3-505	Cover, Drawbar Anchor Pin	DR - 9
SKE-70962	Cone Center Plate	DR - 10
SKE-1-092112A	Key Unit Network and Data Interfaces	DR - 11
SKE-1-092112B	Redundant Ethernet Networking	DR - 11A
R-2-762	Actuator Release & Sleet Cutter Stick	DR - 12
PCC-12	Wood Trolley Slipper and Bracket	DR - 13
R-1-028	Equipment Outline	DR - 14
R-4-1053	28" Steel Wheel	DR - 15
R-2-537	Keeper	DR - 16

DRAWING INDEX (Continued)

PRINT NO.	TITLE	PAGE NO.
R-2-631	Grab Handle	DR - 17
R-1-623	Bar Code Label	DR - 18
R-4-565	No. 1 End Rod and Chain Safety Assembly	DR - 19
R-3-571	Safety Spring Assembly	DR - 20
R-1-1112	Track Brake Suspension Assembly	DR - 21
SKE-1-092112C	Communications and Video Systems	DR - 22















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CAR SERIES: 3200 C.T.A. LOT NO. 4140028 2 REQUIRED PER CAR



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