



CHICAGO TRANSIT AUTHORITY

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

September 24, 2013

Subject: Requisition No. C13FT101450861
Request For Qualifications
Professional Design and Construction Services for the Engineering, Design, and
Construction of the Harrison Station Rehabilitation Project

RE: **Addendum No. 1**

All Proposers,

Attached please find Addendum No. 1 for the subject requisition.

Please note that the pre-proposal **meeting time has been changed from 10:00 a.m. to 1:00p.m.** The date of the pre-proposal meeting of September 26, 2013 and location remains unchanged. A site visit will take place at 2:00p.m.

The proposal due date of October 17, 2013 remains unchanged.

Addendum No. 1 shall be acknowledged in the cover page of the submittal. Failure to acknowledge receipt of Addendum No. 1 in your cover page may render your proposal as non-responsive.

Sincerely,

Robert Miller
General Manager, Purchasing

ADDENDUM NO. 1 - SUMMARY OF CHANGES

NO.	DRAWING NUMBER	TITLE	DESCRIPTION OF CHANGE
REQUEST FOR PROPOSALS			
1	TABLE OF CONTENTS	Section 3.2.01	Revised to reflect correct order of document
2	TABLE OF CONTENTS	Section 3.2.02	Revised to reflect correct order of document
3	TABLE OF CONTENTS	Section 3.2.03	Revised to reflect correct order of document
4	GENERAL REQUIREMENTS	Section 1.1 - second paragraph	The project budget was increased
5	GENERAL REQUIREMENTS	Section 1.2 - second paragraph	Revised reference to Exhibit A
6	GENERAL REQUIREMENTS	Section 4.3	Added "During the negotiations, CTA reserves the right to modify the project scope and budget prior to final award of this design build contract."
APPENDIX 1			
1	General Scope	1.c	Revised reference to Appendix 1
2	General Scope	3.b	Revised reference to Appendix 1
3	General Scope	4.a	Revised reference to Appendix 1
4	General Scope	4.d	Deleted "Replace emergency light fixtures"
5	General Scope	4.d	Added "Design and installation of an Emergency Lighting System throughout the entire station"
6	General Scope	4.e	Deleted "Replace inverter and panel"
6	Specific Scope	1.a.2	Revised to add a canopy/stair enclosure
7	Specific Scope	1.b.2	Deleted item
8	Specific Scope	1.b.2	Revised to add a canopy/stair enclosure
9	Specific Scope	1.b.3	Deleted item
10	Specific Scope	1.d	Added heading
11	Specific Scope	1.d.1	Added replacement of damaged asphalt
12	Specific Scope	5.a.2	Clarified light fixture scope of work
13	Specific Scope	6.a	Revised spelling of Wayfinding
14	Specific Scope	6.a.1	Revised reference to Appendix 1
15	Specific Scope	6.a.2 - second bullet point	Clarified item to be coordinated
16	Specific Scope	6.b.1 - first bullet point	Revised reference to Appendix 1
17	Specific Scope	6.b.1 - third bullet point	Revised to clarify emergency lighting requirements.
18	Specific Scope	7.a	Revised reference to Appendix 1
19	Specific Scope	7.a.1 - first bullet point	Revised spelling of Structures
20	Specific Scope	7.a.2 - third bullet point	Added specification Section 03 30 00 Cast-In-Place Concrete
21	Specific Scope	7.a.2 - third bullet point	Added specification Section 05 10 30 Structural Steel
22	Specific Scope	7.a.2 - third bullet point (Miscellaneous)	Added specification Section 08 80 00 Glass and Glazing
23	Specific Scope	7.a.2 - third bullet point (Miscellaneous)	Deleted specification SP-Master_09 40 10 Cementitious Terrazzo
24	Specific Scope	7.a.2 - fourth bullet point (Electrical)	Added specification Section 16265 DC Static Inverter
25	Specific Scope	7.a.2 - fourth bullet point (Electrical)	Added specification Section 16266 DC Power Distribution
26	Specific Scope	8.a	Revised reference to Appendix 1
27	Specific Scope	8.a.1	Revised drawing date to August 28, 2013
SPECIFICATIONS			
1	03 30 00	Cast-In-Place Concrete	Added specification section
2	05 10 00	Structural Steel	Added specification section

ADDENDUM NO. 1 - SUMMARY OF CHANGES

NO.	DRAWING NUMBER	TITLE	DESCRIPTION OF CHANGE
3	07 41 00	Metal Roof Panels	Added specification section
4	08 80 00	Glass and Glazing	Added specification section
5	16265	DC Static Inverter	Added specification section
6	16266	DC Power Distribution	Added specification section
PRELIMINARY SCOPE OF WORK DRAWINGS			
1	HA-101	Street Level Plans	Revised drawing
APPENDIX 2			
1	Financial Proposal	Bid Form	Increased "Must Not Exceed the Project Budget"

CHICAGO TRANSIT AUTHORITY
REQUEST FOR PROPOSALS (RFP)

For

**Professional Design and Construction Services for the Engineering, Design
and Construction of the Harrison Station Rehabilitation Project**

Requisition No.: C13FT101450861

Required For Use By
Chicago Transit Authority

“Technical and Financial Proposals” must be submitted in a separate envelope from “Qualifications.”

All Responses Must Be Submitted To The Authority At The Following Address:

Chicago Transit Authority
Bid Office - 2nd Floor
567 W. Lake Street
Chicago, IL 60661-1495

All Signatures to be sworn before a Notary Public

Responses Must Be Received No Later Than 3:30 P.M., Central Time, October 17, 2013. The Outside of the
Envelopes or Packages Must Clearly Indicate the Name of the Project and
Requisition Number

Confidentiality and Non-Disclosure: Firms requiring additional assistance shall only contact Jacquelyn Charleston, Manager II at (312) 681-2448, Katrina Bradley, Project Administrator at (312) 681-2448 or Robert Miller, General Manager, Purchasing at (312) 681-2428. Firms, including all team sub-consultants, who contact any other CTA personnel either verbally or in writing, concerning this solicitation package, are in violation of the procedures for this procurement and any submitted proposals may be disqualified. Prime Consultants are required to sign and submit the “RFP Non-Disclosure Statement Prime Consultant” (included in Appendix 7) with the proposal and to require all Sub-consultants to submit signed copies of the “RFP Non-Disclosure Statement Sub-Consultant” (included in Appendix 7) with the proposal.

ISSUED BY
Purchasing Department, Chicago Transit Authority
567 West Lake St., Chicago, IL 60661-1495
Ellen McCormack, Vice President, Purchasing & Supply Chain
Forrest Claypool, President
Terry Peterson, Chairman

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Addendum 1

- ATTACHMENT I: RFP Non-Disclosure Statement Prime Consultant
RFP Non-Disclosure Statement Sub-Consultant

Appendix 8 – Intentionally Omitted

Appendix 9 – Intentionally Omitted

Appendix 10 – Bid Protest Procedures

Appendix 11 - Intentionally Omitted

**Harrison Rehabilitation Project,
Requisition No.: C13FT101450861
CHICAGO TRANSIT AUTHORITY
567 West Lake Street
Chicago, Illinois 60661**

Section 1, General Requirements

1.1 Introduction

The Chicago Transit Authority (the "CTA") is soliciting proposals for furnishing Design and Construction Services with a Guaranteed Maximum Price by a Design Build Contractor (hereinafter "DBC" or "Proposer") for the engineering, design and construction of the Harrison Station (the "Station") Rehabilitation Project (the "Project"). As more specifically described in **Appendix 1** hereto, the DBC will provide all engineering and design services, labor, materials, tools, construction equipment, plant, facilities, services, safety provisions, bonds and pay all permit costs, taxes, fees and other costs necessary or required in order to complete the Project in a safe, timely and workmanlike manner. The successful Proposer and CTA will enter into a Design/Build Agreement (the "Agreement") in the form attached as **Exhibit "A"** hereto. The successful Proposer shall be required to comply with all of the terms and conditions contained in this RFP and accompanying Appendices, as well as those terms and conditions identified in the Agreement, including any attachments or exhibits to the Agreement. Capitalized terms used herein without definition shall have the meanings set forth in the Agreement (**Exhibit A**).

The budget for the Project is ~~\$4,424,704~~\$6,196,017 (the "Project Budget"), against which the guaranteed maximum price set forth in the DBC's proposal (hereinafter the "Preliminary GMP"), as well as the final guaranteed maximum price (hereinafter the "Final GMP" and as further defined below) shall not exceed. To the extent that, when established, the Final GMP is less than the Project Budget, the CTA reserves the right to use such remaining funds between the Final GMP and the identified Project Budget for issuing additional Work Orders for Work at the Station.

1.2 Procurement Process

Each Proposer will submit its qualifications, experience and capabilities to perform the scope of services described in this RFP, as well as a technical and price proposal for the scope of services. The Proposer's qualifications, experience and capabilities will be placed in one envelope clearly marked with the Proposer's name, the Project name and number, and the designation "Qualifications". The Proposer's technical and price proposal will be placed in a second envelope clearly marked with the Proposer's name, the Project name and number and the designation "Technical and Financial Proposal." The Financial Proposal shall be in the form attached as **Appendix 2** and all blanks must be filled in. In the event Proposer fails to complete all of the blanks in **Appendix 2**, Proposer's proposal will be deemed non-responsive and will be rejected. The CTA will initially open only the envelopes labeled "Qualifications" and evaluate the qualifications, experience and capabilities of each Proposer. Each Proposer meeting the requirements of this RFP with respect to qualifications, experience and capabilities will move on to the second stage of the procurement. In the second stage of the procurement, CTA will review the technical and price proposals of each Proposer meeting the requirements of this RFP with respect to qualifications, experience and capabilities.

Each Proposer shall also sign a commitment stating that it will make good faith efforts to meet the Disadvantaged Business Enterprise ("DBE") participation goals set forth in ~~Exhibit 1~~ **Exhibit A, Part 2, Article 1** and submit a written plan explaining how the Proposer intends to meet and achieve the identified DBE goals through each phase of the Project, from the preconstruction/design phase through the end of construction

(the "DBE Plan"). The plan should include the Proposer's history, experience, achievements, and a list of DBEs currently being used in its contracts. It should also include the name of an individual from the Proposer's team who will be the contact responsible for the administration and implementation of the DBE requirements. The written commitment is to include the names of proposed DBE participant(s) for the design phase.

1.3 Key Action Dates:

Project Review / Pre-bid Site Inspection: September 26, 2013

Date proposals due: October 17, 2013

Award of Design and Construction Service Agreement: November, 2013

1.4 Proposer's Cost and Ownership of the Proposals

Each Proposer responding to this RFP acknowledges and agrees that the preparation of all materials for submittal to the CTA and all presentations, related costs and travel expenses are at the Proposer's sole expense, and the CTA is not, under any circumstances, responsible for any cost or expense incurred by the Proposer.

The CTA shall retain full title to and ownership of all Proposals, including all copyright and other intellectual property rights, if any, to the unique design elements of the Proposals; provided, however, the Proposers may use and reproduce any design or other elements of a Proposal that are standard and not unique to the subject of the proposal.

All RFP documents are and shall remain the property of the CTA. Proposers are instructed to use the information contained in **Appendix 1** and in the RFP in the preparation of their Proposals and, if awarded the Agreement by the CTA, to use such information contained in **Appendix 1** and in the RFP in the implementation of the final design of the Project. No other use of the information contained in **Appendix 1** and in the RFP, or any part thereof, by any of the Proposers is authorized or permitted.

1.5 Contract Milestones and Liquidated Damages

See **Appendix 1**.

1.6 Bid Protest Procedure

CTA's protest procedures can be found in **Appendix 10** (see Chapter 15 of the document: Procurement Policy and Procedures, Version 2.1, Revised 3/8/2012.)

Any protest regarding the solicitation, evaluation or award must be submitted in accordance with these protest procedures.

FTA Bid Protest Procedure.

Under FTA Circular 4220.1, the FTA will only review those protests that claim: (1) the Authority failed to have or follow protest procedures, or that claim the Authority failed to review a complaint or protest, or (2) violations of Federal law or regulation. A protester must exhaust all administrative remedies with the Authority before pursuing a protest with the FTA. An appeal to the FTA must be received by either the FTA's Region Five office or Headquarters Office within five (5) Working Days of the date the protester knew or should have known of the alleged violation or the

protest will be waived. "Working Days" for the purposes of Part 1, Section 2.26 are all days that the FTA's Region Five office or Headquarters office are open for business.

Section 2, Scope of Work

The scope of work to be performed by the DBC will have two components: a preconstruction/design phase and a construction phase. In the construction phase, separate Work Orders will be issued under the Agreement for portions of the work as identified in the DBC's approved project approach and project schedule.

The DBC will be required to coordinate all work with other CTA projects and contractors, including CTA Facilities and Power & Way Maintenance.

This Project is funded by Near South TIF and therefore all terms and conditions of the TIF funding will be applicable to this project.

2.1 Preconstruction/Design Phase Services

The Preconstruction/Design Services will follow the DBC's approved project approach and associated project schedule. The DBC's compensation for the Preconstruction/Design Phase of services will be covered by a lump sum price for preconstruction services, including design services (bid by DBC as part of its Financial Proposal). The DBC will provide the following services to the CTA in the Preconstruction/Design Phase:

2.1.01 Construction Documents

The DBC shall design and develop the construction documents for the Project to complete the scope of construction work identified in **Appendix 1** hereto, including technical specifications and drawings, taking into account quality of materials and equipment, to ensure an efficient design and minimum lifecycle cost in accordance with the architectural and engineering guidelines identified in **Appendix 3**. The DBC shall provide the CTA with adequate information to make design decisions including, but not limited to, providing estimates, schemes, engineering calculations and recommendations regarding construction materials, methods, systems, phasing, and costs that shall provide the highest quality facility within the budget and schedule. In developing the construction documents, the DBC shall take into account construction impacts on the CTA's transit operations. The CTA shall have final approval for all construction documents. DBC shall include in its bid sufficient hours for its design consultants to review comments received from CTA on all of its submittals, as identified in **Appendix 3**, and to incorporate such comments into the next required submittal, including a disposition of comments log. The DBC shall not be entitled to any additional compensation in connection with the review and disposition of comments received during the review process.

The CTA shall provide the DBC with any drawings for the Station that the CTA is able to locate in its file; provided, however, DBC shall not rely on the CTA's ability to provide or the accuracy of any such drawings.

In developing the construction documents, the DBC shall take into account all constraints as indicated in **Appendix 1** or otherwise included in the Agreement. Construction documents shall be stamped by a structural engineer or architect, as applicable, licensed by the State of Illinois, and shall include specifications sufficient to provide for products that are typical to the CTA and can be demonstrated to have been used by the CTA at a rail station within the last five years. Forty-two (42) consecutive calendar days following the DBC NTP, the DBC shall provide a minimum of three (3) presentation boards illustrating the proposed configuration, materials and

colors of the Station. In addition to the presentation boards, the DBC shall provide a three dimensional time lapse rendering starting with the existing condition of the Station and ending with the final condition and configuration of the Station after construction is complete. Final design (100%) for the Project shall be completed within 120 consecutive calendar days after Notice to Proceed with Design is issued to the DBC by the CTA. CTA may, with the DBC's concurrence, issue Notice to Proceed for Construction prior to the completion of Final Design for construction of all or a portion of the Project based on the design submittals prepared by the DBC and approved by the CTA as of the date of such Notice to Proceed for Construction.

As described in **Appendix 3**, the DBC shall prepare sealed and signed Issued for Permit documentation for all scopes of Work for which the CTA has historically obtained permits. Permit documentation shall include all calculations, worksheets, applications and inspection reports required to secure permits for the work from all agencies having regulatory authority over the construction of the proposed improvements. In the City of Chicago this shall include, but not be limited to, the Chicago Department of Buildings (DOB), Chicago Department of Transportation (CDOT), Mayor's Office for People with Disabilities (MOPD), Chicago Department of Housing and Economic Development (DHED), Chicago Department of Water Management (CDWM) and other City departments having regulatory authority over the work. The DBC shall participate in pre-intake meetings with permit regulatory agencies, permit intake meetings, permit review meetings, and preparation of corrections based upon permit review comments from regulatory agencies. The DBC shall make all permit corrections in accordance with City of Chicago Standards or other regulatory agencies as applicable.

2.1.02. Phasing and Scheduling; Project Schedule

The DBC shall provide a critical path method ("CPM") schedule in a format approved by CTA and described in the Agreement, including substantial and final completion dates for the Station. All construction activities in the approved schedule shall include productivity estimates. Updated schedule submittals shall be coordinated with updated cost estimates as required hereunder. To the extent that any duration increases for a proposed Work Order within the overall Project Schedule, the DBC shall provide value engineering or increased productivity proposals, including all necessary design services, to bring the schedule duration back to the original Project Schedule. To the extent that these submitted proposals are not acceptable to the CTA in regard to an individual Work Order, the DBC shall provide value engineering or other increased productivity proposals, including all necessary design services, for all other Work Orders proposed for the total Project.

DBC shall provide phasing and project schedule analysis for the Project, including flagging requirements, track access occurrences and other impacts to CTA operations consistent with the constraints set forth in **Appendix 1** hereto. The DBC shall develop the Project Schedule, which shall commence on the date the CTA executes the Agreement and shall end on the date of final completion of construction for the Station. The Project Schedule shall include, but not be limited to, selection of consultants, all phases of design, plan check for code compliance, constructability check, award, contracting, construction, punch list, and close-out. The initial Project Schedule shall be submitted to the CTA no later than fourteen (14) days following the date the CTA executes the Agreement. Once accepted by the CTA, the DBC shall update the Project Schedule on a bi-weekly basis and submit it to CTA for approval. The DBC shall also develop and include in the trade contractors bid sets that portion or subset of the Project Schedule that applies to that trade.

2.1.03. Constructability Review

The DBC shall check the documents for completeness and coordination and make recommendations to the CTA.

2.1.04. Cost Control Management

DBC shall prepare and evaluate a total cost estimate in a format approved by CTA for the Project as described in **Appendix 1** and evaluate the estimate against the Project Budget. The total cost estimate shall be broken down by each Work Order associated with the DBC's approved project approach and shall be updated to reflect any substantive change, and in no case less than every two (2) weeks unless otherwise agreed upon by the CTA. Updated cost estimates shall be submitted with bi-weekly updated Project Schedules. To the extent that any cost estimate increases for a proposed Work Order, the DBC shall provide value engineering proposals, including all necessary design services, to bring the costs in line with the Project Budget. To the extent that these are not acceptable to the CTA in regard to an individual Work Order, the DBC shall provide value engineering proposals, including all necessary design services, for all other proposed Work Orders for the total Project. The initial Project cost estimate shall be provided to the CTA within twenty-one (21) days after execution of the Agreement by the CTA and notice thereof to DBC. DBC shall also update its cost estimate and evaluate the updated cost estimate against the Project Budget prior to submitting each Work Order proposal to the CTA. Such updated cost estimate shall be submitted to the CTA as part of each Work Order proposal. The Work Order proposal cost shall be established by multiplying the DBC's overhead and profit factor by the sum of (i) the agreed-upon cost to perform the scope of work described in the Work Order proposal (other than the cost for work to be self-performed by the DBC) and (ii) the cost, calculated on the basis of **Appendix 4** attached hereto, of any work described in the Work Order proposal (excluding engineering, design, scheduling, project management, coordination and supervision), to be self-performed by DBC, including without limitation, the furnishing of any tools, materials or equipment.

2.1.05. Develop Subcontractor/Trade Contractor Bid Packages

The DBC shall develop trade contractor bid packages in conjunction with the approved project approach and Project Schedule and to support each associated Work Order. Following approval by the CTA of the construction documents for a specific scope of work or for all work within the Station, the DBC shall develop the most logical, competitive, seamless and distinct trade contractor bid packages with all work in the Station, or particular scope included in the packages. The DBC shall also establish a DBE goal, as appropriate, for each bid package. All of the proposed construction work included in the approved construction documents for the Station or any scope of work shall be included in trade contractor packages for bid. To the extent the DBC wishes to self-perform any work included in a trade contractor bid package, the DBC shall submit a cost for such work (for comparison and cost analysis purposes) in advance of soliciting trade contractor bids on such package. The cost for any such self-performed work shall be calculated in accordance with **Appendix 4**. In no event shall the DBC self-perform more than fifty percent (50%) of the work identified on **Appendix 1** hereto. The schedule for bidding the trade contractor bid packages shall be included in the Project Schedule. The DBC may also consider the advance procurement of long lead time materials which may be treated and bid as a trade contractor work package. The DBC shall include a contingency in its financial proposal, and shall not require it as part of the trade contractors' bids. The DBC shall also not cause the trade contractors to include any construction contingency or allowances in their bids. The DBC shall obtain the review and approval of the CTA of the proposed trade contractor bid documents and their agreements.

2.1.06. Identify and Qualify Subcontractors and Solicit Bids and Trade Contracts

With the concurrence of the CTA, the DBC shall pre-qualify trade contractors as Subcontractors based on qualifications, experience, financial viability (including insurance and bonding capability) and safety, including the trade contractor's lost workday incident rate and recordable incident rate, utilizing a prequalification questionnaire form similar to the attached **Appendix 5**. A notice of the opportunity to pre-qualify shall be published by the DBC at least once in an English language daily newspaper of general circulation in the Chicago metropolitan area at least ten (10) business days in advance of the deadline for submission of trade

contractor prequalification questionnaires and shall be posted on the CTA's website and further advertised by utilizing an e-Blast in B2GNOW. The DBC shall identify a minimum of three (3) qualified Subcontractors for each trade bid package and shall provide the CTA with a list of all qualified Subcontractors. The list of qualified Subcontractors shall include certified DBE subcontractors. The DBC shall maintain and provide to the CTA documentation regarding all communications with the DBEs including, without limitation, information regarding dates of communication, individuals involved in each communication, name of the primary contact person at the DBE, information requested of and/or provided to the DBE, and the reasons for the DBE's qualification or disqualification. Each qualified Subcontractor shall be given the opportunity to bid on each trade work package for which it is qualified. The DBC shall provide the CTA with a copy of each trade contract bid received by DBC for each trade work package, or, in the event that a Subcontractor declines to bid on a trade work package for which it is qualified, a letter from such Subcontractor documenting its decline to bid.

2.1.07. Subcontracting

The DBC shall conduct all bidding for trade contracts and other subcontracted work by sealed bid. The DBC shall review and evaluate each bidder's response to the DBE requirements in accordance with the Special Conditions, Disadvantaged Business Enterprise Commitment set forth in each bid package. The CTA shall maintain oversight of the DBC's activities to ensure that they are conducted consistent with 49 CFR Part 26. The DBC shall hold all trade contracts and shall be responsible for ensuring that the Subcontractors perform all of their obligations and duties thereunder. The CTA shall have no obligations or responsibilities with respect to Subcontractors, other than those imposed by law. Unless otherwise agreed by the CTA in order for the DBC to meet the goals of this RFP, the DBC shall accept the lowest responsive sealed bid for each trade contract work package. The DBC shall warrant that the construction documents are free of ambiguities and conflicts and that the Subcontractor bid packages include all of the scope of work identified in the approved construction documents other than work to be self-performed by the DBC.

Upon request by CTA, the DBC shall provide verification of its compliance with the trade contractor and trade package qualification and bid requirements.

2.1.08. Permits

The DBC shall obtain all permits and pay all permit fees related to the Project prior to beginning construction. Costs for obtaining permits and permit fees shall be considered part of DBC's overhead and shall not be separately reimbursed as a cost under a Work Order.

2.2 Construction Phase Services.

The DBC shall use its best efforts to construct the Project in an expeditious and economical manner consistent with the best interests of the CTA. Construction phase services shall be performed only as authorized by Work Orders issued under a process more particularly described in the Agreement. The DBC shall provide all pricing, management, design drawings, shop drawings, documents, Work, materials, supplies, parts (to include system components), transportation, plant, supervision, labor, and equipment needed to complete the Work Orders. The DBC shall provide quality assurance as specified in strict accordance with the Agreement. The DBC shall also be responsible for site safety as well as site preparation and cleanup.

2.2.01. Conduct Preconstruction Conference

Upon acceptance by the CTA of a Work Order proposal as specified in the Agreement, the CTA's project manager and the DBC shall co-conduct a preconstruction conference for such Work Order with the

Subcontractors and other appropriate CTA staff. The preconstruction conference services by the DBC include preparation of meeting agenda, preparation of job procedures for clarifications, change orders, shop drawings, progress payments, field testing and inspection, safety, and preparation and distribution of preconstruction conference notes.

2.2.02. Update the Project Schedule

The DBC shall update the Project Schedule initially developed in the Preconstruction/Design phase to reflect any substantive change and in no case less than every two weeks unless agreed upon by the CTA. As the Project Schedule is updated and when activities are complete, the DBC shall provide actual versus estimated productivity rates unless the CTA agrees in advance that these are unnecessary for particular activities. Updated Project Schedule submittals shall be coordinated with updated cost estimates. Cost estimates should reflect comparison of estimated costs to actual. In regard to the updated Project Schedule and to the extent that any duration increases for a proposed or accepted Work Order within the overall Project Schedule, the DBC shall provide value engineering or increased productivity proposals as described in Section 2.1.02. In order to provide a comprehensive Project Schedule, the DBC shall coordinate and receive input from the CTA and the Subcontractors for compliance with the individual requirements of each portion of the project and the overall Project Schedule.

In a format approved by the CTA, in addition to the Project Schedule, the DBC will provide a summary dashboard of the Project Schedule and cost estimates following any substantive change in cost or schedule and in no case less than every two (2) weeks for each Work Order proposed and underway in relation to the overall project completion. The report will also summarize and provide sufficient detail regarding any proposed value engineering or increased productivity proposals that are underway relative to either an individual Work Order or the overall Project. The DBC shall submit the biweekly construction progress report to CTA.

2.2.03. Review Monthly Progress Payment Requests

The DBC shall submit one payment request, prepare a current overall schedule of values for review and approval by the CTA, and submit one invoice per month to the CTA for approval and payment that has been pre-approved by the CTA's project manager. An approved Project Schedule is required for the processing of each invoice.

2.2.04. Project Cash Flow

The DBC shall provide monthly updated cash flow requirement projections for each month of construction.

2.2.05. Report Monthly Construction Progress

The DBC shall prepare a monthly construction progress report, summarizing the progress of construction and key issues currently pending. The report will indicate construction progress and summarize the current cash flow projections. The DBC shall submit the monthly construction progress report to the CTA's project manager.

2.2.06. Make Presentations

The DBC shall assist the CTA's project manager in making presentations regarding construction progress to the CTA at regular intervals throughout the project. The DBC shall prepare occasional presentations to other organizations as requested by the project manager regarding construction issues of special importance.

2.2.07. Provide Field Office and Equipment

The DBC shall provide all necessary field office facilities, including, but not limited to utilities, furnishings, office equipment and parking for the staff of the DBC, its Subcontractors and the CTA's construction manager. The cost of providing the field office and equipment shall be considered part of DBC's overhead. The field office facilities shall be located within one-half mile of the Project site.

2.2.08. Provide Necessary Personnel

The DBC shall provide all necessary on-site management, supervisory, and clerical staff for the proper management of the construction as part of the DBC's overhead.

2.2.09. Additional Design

After approval by CTA of (i) the construction drawings for any particular scope of work and (ii) the related Work Order proposal, to the extent additional design work is required as a result of Unforeseen Conditions encountered during construction, the CTA shall reimburse the DBC for the DBC's actual costs incurred for any revisions to the construction drawings necessary to address the Unforeseen Conditions. Additional requirements relating to a request for reimbursement for these costs by the DBC will be addressed in the Agreement.

2.2.10 As-Built Drawings

The DBC shall monitor and verify as a requisite for progress payments that the Subcontractors are maintaining as-built drawings. The DBC shall also prepare as-built drawings for any self-performed work. The CTA's construction manager will also monitor and verify as-built drawings as a prerequisite for progress payments. The DBC shall compile the as-built drawings and submit them at the end of the project to the CTA for review, approval and further processing by the CTA and the CTA's construction manager. In addition, the DBC shall incorporate the as-built drawings into CAD drawing files. This work shall be considered part of the lump sum fee associated with the Preconstruction/Design Phase.

2.2.11 Closeout Project

The DBC shall prepare a recommendation for final acceptance of the project after the DBC and the Subcontractors have corrected deficient work and satisfied all contract conditions. The DBC shall prepare final payment request and final report. The DBC shall also provide a complete set of contract files to the CTA. This shall include, but not be limited to, as-built drawings, operation and maintenance manuals, additional materials, and warranties.

2.3 Guaranteed Maximum Price

The proposal submitted by each Proposer shall include a preliminary guaranteed maximum price for performance and completion of the entire scope of work identified in **Appendix 1** (the "Preliminary GMP"). The Preliminary GMP shall represent the maximum aggregate cost to provide and perform all of the services necessary to design and construct the Project within the time periods set forth in the Project Schedule.

2.3.1 Calculation of Preliminary GMP.

The Preliminary GMP shall be the sum of the following: (i) a fixed lump sum for design and preconstruction services for the Project ("Preconstruction/Design Services"); (ii) an amount representing the maximum aggregate costs to construct the Project, exclusive of Preconstruction/Design Services ("Construction Costs");

(iii) a fixed percentage for overhead and profit to be calculated against the Construction Costs; and (iv) a fixed percentage for contingency to be calculated against the Construction Costs. The agreed on sum for Preconstruction/Design Services shall not be subject to renegotiation after the Contract is awarded, except as permitted for changes in the scope or quality of the Project or as provided in Section 2.2.09. The fixed percentages for overhead and profit and for contingency shall be applied to the Construction Costs only, and such percentages shall not be subject to renegotiation after the Agreement is awarded. By way of example only, if a Proposer's Preliminary GMP includes 5% for contingency and \$100,000 in Construction Costs, the Proposer's contingency for purposes of the Preliminary GMP would be \$5,000. If the proposer's Final GMP (as hereinafter defined) is based on Construction Costs that are reduced to \$90,000 based on value engineering or other such measures, the Proposer's contingency (as defined herein) will remain fixed at 5%, and a final Project Contingency of \$4,500 will be set for purposes of the Project (5% of \$90,000).

The Preliminary GMP submitted by each Proposer must be based on and submitted in accordance with the requirements of this RFP, including those identified in **Appendix 1**, and shall be listed and set forth in the Form of Financial Proposal found in **Appendix 2** to this RFP. The information contained in **Appendix 1** does not indicate or describe all of the work required for the full performance and completion of the Project, and each Proposer agrees that the incompleteness of the information contained in **Appendix 1** shall not provide a basis for increasing the Preliminary GMP or the Final GMP, or for extending the Project Schedule. It is incumbent upon the Proposer to determine the architectural, structural, mechanical, electrical, plumbing and fire protection feasibility of the work to be performed in preparing its Preliminary GMP

2.3.2 Establishment of Final GMP.

The Final Guaranteed Maximum Price (the "Final_GMP") shall be established at the point at which (i) Work Order proposals (including allowances for utility costs as described under Section 2.1.08 and all costs for overhead and profit included in such Work Order proposals) necessary to complete all of the scope of work identified on **Appendix 1** hereto, and as more particularly described on the construction documents prepared by the DBC (excluding any work deleted from the Project), have been submitted to the CTA by the DBC and approved by the CTA (hereinafter referred to as the "Total Work Order Cost") and (ii) forty percent (40%) of the work identified in the accepted Work Order proposals is complete, as determined by the CTA and the CTA's construction manager. The Final GMP shall be the sum of the following: (i) the lump sum fees for preconstruction services, plus any design costs incurred by the DBC pursuant to Section 2.2.09, (ii) the Total Work Order Cost, and (iii) the "Project Contingency" (as hereinafter defined). As used herein, "Project Contingency" shall mean the product obtained, by multiplying the DBC's contingency percentage (as bid by the DBC as part of its Price Proposal) by the DBC's Construction Costs (as bid by DBC as part of its Price Proposal). In no event shall the Final GMP exceed the Project Budget. In addition, in no event shall the total dollar amount of overhead and profit, calculated with reference to the overhead and profit percentage bid by the DBC in its price proposal, received by Design/Builder under all of the accepted Work Order proposals exceed the product obtained by multiplying (i) the dollar value of the Construction Costs bid by DBC in Part 2C of its Price Proposal and (ii) the overhead and profit percentage.

2.3.3 Use of the Contingency.

Prior to the establishment of the Final GMP, any additional costs for changed work or Unforeseen Conditions arising after construction begins under any accepted Work Order proposal shall be included in a follow-on Work Order submitted to the CTA for review and approval. The DBC must give notice to the CTA of such changed work or Unforeseen Conditions in accordance with the terms set forth in the Agreement and prior to the establishment of the Final GMP. Any changed work or Unforeseen Conditions which arise before the Final GMP is established, but for which the DBC has failed to provide timely notice shall be treated as if the changed work or Unforeseen Condition arose after the Final GMP was established.

Costs for changed work or Unforeseen Conditions not directed by the CTA and that arise after the Final GMP has been established shall be charged against the Contingency. In the event that the DBC's actual final costs for construction (excluding any self-performed work which shall be valued based upon the method set forth in **Appendix 4**) are less than the total costs for construction identified in the accepted Work Orders, the Contingency will be increased accordingly. Should the DBC's actual final costs for construction be higher than the total costs for construction identified in the accepted Work Orders, the difference shall be charged against the Contingency until exhausted.

Any Contingency remaining after completion of all of the work and final acceptance of the Project shall be retained by the Authority and the Final GMP shall be reduced by such amount.

In the event that Substantial Completion of the Project does not occur 240 consecutive calendar days after the DBC NTP (Contract Milestone B), the Proposer will be subject to liquidated damages as set forth in Section I of **Appendix 1** of this RFP, and as further described in the Agreement. The awarded Proposer shall be responsible for all costs in excess of the Final GMP. Accordingly, if the Contingency is exhausted prior to completion of all of the work and final acceptance of the Project, the Proposer shall complete the Project at its sole cost and expense. In no event shall the CTA's payment and performance obligations to the DBC exceed the Final GMP.

The DBC shall warrant that the construction documents are free of ambiguities and conflicts and that the Subcontractor bid packages include all of the scope of work identified in the construction documents.

Section 3 Submittal Requirements

Submittals shall be prepared on standard size paper (8 1/2" x 11") with removable binding on the left hand side. The proposal shall contain sufficient detail to enable the CTA to evaluate it according to the criteria outlined in **Section 4 Evaluation Process and Criteria**.

Each Proposer will submit a proposal in two separate packages, with the first package ("Qualification Package") containing the Proposer qualifications, overall project experience, financial capabilities, and DBE utilization plan. The second package ("Proposal Package") will include a technical proposal including the background and experience of key personnel that will be involved with the Project, the proposed project organization, project approach, construction schedule, and a financial proposal in the form attached hereto as Appendix 2. The two submittal packages will be in separate sealed envelopes identified with the appropriate package number. **Each Proposer shall provide ten (10) copies of each submittal package.**

The cover letter must contain a commitment to provide the services described in this RFP. Each cover letter must include the name and address of your company, the requisition number, the name, title, address and telephone/fax numbers and signature of a representative of the firm who is authorized to negotiate a contract with the CTA and/or whom we may contact with questions regarding your response.

Proposers should refrain from using expensive materials for their Submittals. All Submittals become the property of the CTA and will not be returned. All costs incurred in the preparation and presentation of the proposal are the responsibility of the Proposer. Issuance of this RFP does not commit CTA to pay any cost incurred in the preparation of this proposal. Proposers are advised to adhere to the submittal requirements. Failure to comply may be cause for rejection of the submission.

3.1 Qualifications Submittal Package Content

3.1.01 Qualifications of the Firm

A. Project Experience

List at least three (3) projects completed by Proposer within the past five (5) years for which Proposer has constructed, as a general contractor, projects of a similar size and type. Provide reference information such as owner, owner's representative, location of project, and current telephone and e-mail addresses. For these projects, demonstrate experience in construction estimating and constructability review during the design phase, and quality, safety and completion of work on time and with minimal change order requests.

B. Demonstrated Experience in Alternative Procurement Methods Involving a Guaranteed Maximum Price

Provide two (2) projects completed by Proposer within the past five (5) years that demonstrate project delivery under an alternative procurement method involving a guaranteed maximum price, including the following: project engineering and design, soliciting bids, contracting with and managing multiple trade contractors consistent with the type, size and complexity of this Project. Include samples of pre-bid and post-construction schedules. Include the following:

1. A narrative project description and include the processes that were used to:
 - a. Prepare 100% design submittals for the project, including drawings and technical specifications,
 - b. Address and incorporate review and constructability issues into the design,
 - c. Provide cost estimating and value engineering, explain how issues were addressed and used to revise or develop the design to meet the project construction budget, and
 - d. Address methods used to mitigate operational impacts of construction.
2. A narrative description for the delivery method and include information that:
 - a. Details the manner that trade contractor bids were solicited and issued,
 - b. Details the qualifications of the trade work for this project type and size, and
 - c. Demonstrates the firm's ability to deliver a project on time and for the guaranteed maximum price.
 - d. Details the permitting approach for multiple bid packages.
3. Provide reference information for the project owner or the owner's representative, and that individual's roles and responsibilities and everyday interaction with your project team.

3.1.02 Financial Capability

- A. **Insurance** - Proposer must demonstrate proof of insurance or the ability to purchase insurance in the amounts required under the Request for Proposals through existing insurance or a letter from Proposer's insurance broker or carrier.
- B. **Bonding capacity** - Proposer must demonstrate ability to comply with bonding requirements identified in this RFP through letter from a surety. The Proposer shall be required to deliver to the CTA, upon execution of the Agreement, a payment bond and a performance bond securing the performance and completion of the executed Agreement and the payment of all obligations arising

under such Agreement. Such bonds shall be issued in amounts equal to one hundred percent (100%) of the Preliminary GMP. Each Proposal must be accompanied by written evidence of the Proposer's ability to procure the preceding payment and performance bonds.

- C. **Financial Resources** - Proposer shall submit audited or reviewed financial statements for the past three (3) years demonstrating financial capacity and capability to complete the Project and meet its obligations.

3.2 Proposal Package Contents

3.2.01 Project Approach

In response to the scope, constraints and other elements of the RFP, describe the proposed overall project approach. Provide a narrative that focuses on how the construction phase will be accomplished within the required Milestone Dates and within the constraints indicated in **Appendix 1** for rail system right of way access, rail station access and access to the public right of way adjacent to the station. In addition, demonstrate the project work plan for the Preconstruction/Design Phase for the Station and include at a minimum:

- A. A narrative for the approach to be used during the Preconstruction/Design Phase and include, but not be limited to, the following:
1. The approach to develop the design and construction documents with the CTA,
 2. The approach to design, design review, constructability review, estimating, value engineering and scheduling regarding construction methods, materials, systems, phasing, and costs,
 3. The process to identify opportunities for sustainable design and how the concepts for sustainability will be developed into the project,
 4. Process for developing bid packages to define distinct trade packages and provide a competitive bid environment with logical scopes of work,
 5. Provide a Quality Control plan that will be used during the Preconstruction/Design phase and include, but not be limited to, the following:
 - a. Process to identify constructability issues,
 - b. Process for reviewing the coordination of construction and staging and logistics plans,
 - c. Identifying construction detailing clarifications using trade best practices approach and previous project knowledge, and
 - d. Recommendation of alternative materials and/or methods to minimize lifecycle costs and maximize the Project Budget within the construction schedule.

An estimate of the number of hours required for design, including any required revisions based on CTA comments and permitting requirements up to and including final design.

- B. As indicated above, provide a narrative that indicates how the required scope of work will be accomplished within the constraints indicated in **Appendix 1**. In addition to the narrative, break down the work into individual construction task orders that reflect the proposed approach and which will make up the ultimate Work Orders for the Project. To

support this break down as it relates to the work on the rail right of way, provide schematic track drawings of the entire project limits indicating how the work will be phased within the constraints. In addition, and using one typical station area to illustrate the proposed approach throughout the project limits, provide schematic drawings illustrating how work will be phased at grade in the station and adjacent viaduct. Further, this narrative shall include a Quality Control plan that will be used during the Construction Phase and include but not be limited to the following:

- a. The process and key personnel that will be tasked with the review and coordination of all submittals/shop drawings,
 - b. The process and key personnel that will be tasked with assessing the craftsmanship/workmanship by all trades and verify that all materials installed are per the approved submittals and shop drawings, and
 - c. The process that will link the constructability, value engineering and cost control management processes from the Preconstruction/Design Services to the Construction Services for a seamless flow from design to construction.
- C. Provide duration of proposed closures for each phase of work. Partial station closure durations and phasing of partial station closures must be within the duration provided in **Appendix 1**.
- D. Provide closure plan for the Station including, but not limited to the following: schedule by day, manpower requirements, street closure requirements, pre-construction mobilization, and total duration.

3.2.02 Project Schedule and Project Plan

Each Proposer shall be responsible for developing and providing a Project Schedule illustrating how it intends to provide and manage the tasks and resources necessary to accomplish the work commencing with the Notice to Proceed for the Preconstruction/Design Services and ending with the completion of construction within the schedule durations as defined in the RFP. The schedule should show each major element including design and construction of each Station.

3.2.03 Qualifications of the Proposed Project Staff

Provide information for the organization of the project staff that will be used to successfully deliver this Project. Define the key personnel of each team component and how the team will be managed, the decision-making authority in the process, and the qualifications of the key personnel. At minimum, include the following:

- A. **Project Organization** – Provide an organization chart that defines the project management and staffing plan and identifies key personnel for both the Preconstruction/Design and Construction portions of the Project and include:
1. A narrative of how the staff will function during each of the respective phases and how a transition from Preconstruction/Design to Construction,
 2. Each position within the project organization and the role and responsibilities of the individuals,
 3. The number(s) of individuals that may be acting in the same position, and

4. The individual team members/position within the organization *that* will be on the project for the entire duration of the delivery or whether a specific position will not be required for the entire project delivery.

B. Personnel Experience – Each Proposer shall submit résumés demonstrating the qualifications of the key personnel defined on the organization chart for this project. Key personnel are defined as the following: Project Manager, Construction Project Manager/Superintendent, Design Lead, Safety Manager, and Quality Manager. Résumés shall include but not be limited to:

1. Experience on projects of similar size, scope, complexity and budget,
2. Experience with alternative project delivery methods,
3. Professional certifications and technical expertise,
4. Indicate whether the key personnel have worked together on previous projects and list that project information including owner contact information, and
5. Identify each key person's current commitments and their availability to begin this project. If a key person will be working multiple projects identify the percentage of time that they will be assigned to complete the project tasks on this job.

C. In-House Capabilities – Identify those trades and engineering disciplines with capabilities within the company and describe how they may be implemented on this project.

3.2.04 Financial Proposal

The Financial Proposal shall include a Lump Sum Price for Preconstruction/Design phase services, a single fixed overhead and profit percentage (which shall be inclusive of Contractor's General Conditions), a fixed contingency percentage (used to establish the Contingency), and Construction Costs. These price elements shall be used to establish the Preliminary GMP. These amounts shall be listed in the Form of Financial Proposal attached as **Appendix 2** to this RFP.

3.2.05 CTA Certifications and Disclosure; Disadvantaged Business Enterprise Commitments

Sign and include all forms and certifications attached in **Appendix 7**, including: Disclosure of Ownership, Primary Participant and Lower Tier Debarment, Lobbying, Drug Free Workplace, Non-Disclosure Agreements for Prime and Sub-contractors.

Include a commitment stating that Proposer will make good faith efforts to meet the Disadvantaged Business Enterprise ("DBE") participation goals set forth in **Exhibit A, Part 2, Article 1** and submit a written plan explaining how the Proposer intends to meet and achieve the identified DBE goals through each phase of the Project, from the preconstruction/design phase through the end of construction (the "DBE Plan"). The plan should include the Proposer's history, experience, achievements, and a list of DBEs currently being used in its contracts. It should also include the name of an individual from the Proposer's team who will be the contact responsible for the administration and implementation of the DBE requirements. The written commitment is to include the names of proposed DBE participant(s) for the design phase.

Section 4 Evaluation Process and Criteria

It is the policy of the CTA that the selection of the DBC to provide professional design and construction services for this Project is based on the quality of the Proposer as demonstrated by its competence and experience, and on the cost to provide the satisfactory performance of the services required to complete the work set forth in **Appendix 1** to this RFP.

4.1 Qualifications Submittal Evaluation

Pass/Fail basis. Only those Proposers whose Qualifications Submittal passes all qualification requirements as described in Section 3.1 above will proceed to the Technical Submittal evaluation.

4.2 Proposal Package Evaluation

In reviewing and evaluating the Proposal Package, CTA will consider the following factors, which are listed in descending order of relative importance.

1. Technical Project Approach
2. Project Schedule and Project Plan
3. Qualification of Proposed Project Staff
4. Financial Proposal

Based on the evaluation of qualified proposals, CTA will initiate negotiations with those firms deemed to be in the competitive range. At the conclusion of negotiations, Best and Final Offers (BAFOs) will be requested and, following receipt of any and all additional materials requested, CTA may determine a relative ranking of Proposers based on an all-inclusive evaluation.

4.3 Basis of Award

The CTA will award a contract to the responsible Proposer whose offer conforms to the requirements of the RFP and is most advantageous to the CTA, based on consideration of the criteria listed above. During the negotiations, CTA reserves the right to modify the project scope and budget prior to final award of this design build contract.

One (1) signed original and nine (9) copies of the response must be enclosed in sealed envelopes, addressed and submitted no later than 3:30 p.m., Chicago time.

By U.S. Postal Service, the Consultant shall submit copies of the proposal to this precise address:

**BID OFFICE, 2nd FLOOR
CHICAGO TRANSIT AUTHORITY
567 W. LAKE STREET
CHICAGO, ILLINOIS 60661-1498**

OR, by Overnight or hand delivery, the Consultant shall submit the proposal to:

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

**RESPONSES MUST BE RECEIVED NO LATER THAN 3:30 P.M., CHICAGO TIME,
October 17, 2013.**

The outside of each envelope or package must be labeled as follows:

**REQUISITION NO. C13FI101442777
LETTERS OF INTEREST & QUALIFICATIONS
PROFESSIONAL CONSTRUCTION PROGRAM MANAGEMENT SERVICES
CAPITAL IMPROVEMENT CONSTRUCTION PROGRAM**

APPENDIX 1

SCOPE OF CONSTRUCTION WORK

A. NOTICE

The DBC shall provide design and construction services to the CTA for the upgrade of the Harrison Red Line Station. The DBC will provide all engineering and design services, permits, labor, materials, tools, construction equipment, plant, facilities, services, safety provisions, bonds and pay all permit costs, taxes, fees and other costs necessary or required in order to complete the Project in a safe, timely and workmanlike manner.

B. SCOPE OF WORK

The Chicago Transit Authority (CTA) Red Line, commonly referred to as the State Street Subway, runs through Chicago's Central Business District and was originally constructed approximately 70 years ago. The Harrison Red Line Station, opened in 1943, has an annual ridership of over 1.36 million passengers. The two main entrances are located on State Street south of Harrison Street and are commonly referred to as the Harrison Street entrances. In 2009, the auxiliary entrance on the southwest corner of State Street and Polk Street was reopened. The scope of construction work to rehabilitate the Harrison Red Line station includes waterproofing, water infiltration management, and customer facing improvements that will bring the station up to a state of good repair.

GENERAL SCOPE

The Harrison Station is not currently accessible to people with disabilities and this project will not result in an accessible station. However, certain elements will be upgraded to improve conditions including new tactile edge, improved lighting, an upgraded way finding systems that includes braille signage, and a new accessible turnstile. The DBC is responsible for designing and constructing station elements that will not result in the requirement for a fully accessible station.

The DBC shall coordinate design and construction activities with work by others including fare collection equipment and digital signage and advertising screens.

It is the goal of CTA to upgrade the stations as follows:

1. Waterproofing at street to mezzanine, mezzanine, mezzanine to platform, and platform levels.
 - a. Prevent water infiltration on the negative side of the structure.
 - b. Manage water infiltration utilizing, but not limited to,
 1. Gutter and drainage systems at stairs, walls, joints and cracks in concrete structure and at wall/floor intersections.
 2. Station walls with a drainage cavity and gutter at the base.
 3. Station drainage system. Rod/repair existing drains to City sewers and modify as required for an operational drainage system
 - c. Refer to ~~Exhibit B~~ Appendix 1, Sewer and Main Leak Tests Report, for preliminary investigation of the source of water infiltration. It is not the goal of CTA to mitigate the source of water infiltration.

2. Customer Facing Improvements
 - a. Floor finishes
 1. Replace mezzanine and platform floor finish systems.
 - Granite
 2. Stairs
 - Restore finish of concrete treads and risers
 - Replace broken terra cotta nosings and tile.
 - Stainless steel handrails.
 - b. Wall finishes
 1. Structural Glazed Facing Tile (SGFT) (8"x8")
 2. Ceramic tile (8"x8")
 - c. Ceiling finishes
 1. Prepare and paint
3. Signage and wayfinding system at street to mezzanine, mezzanine, mezzanine to platform, and platform levels.
 - a. Infrastructure for digital signage and advertising
 - b. CTA Signage Plan scope included with the Preliminary Scope of Work drawings (see Exhibit C Appendix 1)
4. Lighting improvements at street to mezzanine, mezzanine, mezzanine to platform, and platform levels.
 - a. Upgrade station lighting system to comply with CTA Design Criteria Chapter 10, Electrical (see Exhibit B Appendix 1).
 - b. Replace older lighting fixtures (with new high-output fixtures), conduit and wiring
 - c. Upgrade existing energy efficient lighting in good condition
 - d. ~~Replace emergency light fixtures~~
 - e. ~~Replace inverter and panel~~ Design and install Emergency Lighting System throughout the station.
5. Fare control equipment upgrades and modifications
6. Platform furnishings
7. Hazardous waste identification and mitigation for hazardous materials impacted by the scope of work.
8. The existing communication and camera systems will remain. If required, coordinate temporary relocation with CTA. Any required temporary relocation will be performed by the DBC.

SPECIFIC SCOPE

1. Street Level
 - a. Harrison East Stair Entrance:
 1. Replace concrete sidewalk (Compass rose to remain)
 2. ~~Provide plexiglass splash shield on curb side of railing (Galvanized railing and Granite base to remain).~~ Provide canopy/stair enclosure
 - b. Harrison West Stair Entrance:

1. Replace deteriorated concrete curb and sidewalk (Compass rose to remain)
2. ~~Replace plexiglass splash shield on curb side of railing (Galvanized railing to remain).~~
3. ~~Repair granite base at NE and SW corners~~
2. Provide canopy/stair enclosure.

c. Polk Stair Entrance:

1. Replace deteriorated concrete curb
2. Replace damaged vandal-shield at glass panels on metal/glass stair enclosure

d. Miscellaneous

1. Replace damaged areas of asphalt pavement.

2. Street to Mezzanine Vertical Access:

a. Harrison East Stair:

1. Walls:
 - Provide new wall finish system (including new gutter at stair stringer)
2. Treads and Risers:
 - Restore finish of concrete treads and risers and replace damaged quarry tile nosings.
3. Ceiling:
 - Prepare and paint concrete
4. Miscellaneous
 - Provide stainless steel handrails
 - Prepare and paint existing security gates
 - Replace drain grates with stainless steel type
 - Provide power and data (conduit and cables) for double-sided digital advertising screen. Screen and installation of screen by CTA.

b. Harrison West Stair:

1. Walls:
 - Provide new wall finish system (including new gutter at stair stringer)
2. Treads/Risers:
 - Restore finish of concrete treads and risers and replace damaged quarry tile nosings
3. Ceiling:
 - Reconstruct damaged concrete structure at mezzanine ceiling intersection
 - Repair any noticeable cracks
 - Prepare and paint concrete
4. Miscellaneous:
 - Provide stainless steel handrail
 - Prepare and paint existing security gates
 - Replace drain grates with stainless steel type
 - Provide power and data (conduit and cables) for double sided digital advertising screen. Screen and installation of screen by CTA.

c. Polk Stair:

1. Walls:

- Provide new wall finish system (including new gutter at stair stringer)
 - 2. Treads/Risers:
 - Restore finish of concrete treads and risers and replace damaged quarry tile at nosings and landings.
 - 3. Ceiling:
 - Prepare and paint concrete
 - 4. Miscellaneous:
 - Replace drain grates with stainless steel type
3. Mezzanine Level:
- a. Harrison Mezzanine
 - 1. Walls:
 - Provide new wall finish/gutter system
 - Replace all customer facing doors and frames with stainless steel type
 - Replace access door with stainless steel type
 - 2. Floor:
 - Provide new floor finish system
 - 3. Ceiling:
 - Prepare and paint concrete
 - Provide ceiling system in Fare Collection area to conceal conduits
 - Confirm feasibility with minimum CTA headroom
 - 4. Fare Collection Equipment
 - Turnstiles
 - Provide power and data (conduit and cable) for the new End Cabinet that is required for the installation of the TWA. CTA will provide the new TWA and End Cabinet.
 - Modify existing stainless steel barriers and provide new stainless steel barriers as required for installation of new TWA
 - Roto-Gates
 - Remove one (1) painted steel roto-gate and provide and install two (2) new stainless steel roto-gates
 - Clean and polish stainless steel
 - 5. Miscellaneous:
 - Remove bike racks (do not replace)
 - CA Kiosk
 - Temporarily relocate as required to provide new floor finish system
 - Clean and polish after reinstallation
 - Replace drain grates with stainless steel type
 - b. Polk Mezzanine:
 - 1. Walls:
 - Provide new wall finish/gutter system
 - 2. Floor:
 - Provide new floor finish system
 - 3. Ceiling:
 - Paint concrete
 - 4. Miscellaneous
 - Fare Collection Equipment

- High Barrier Gates (HBG)
 - Replace curved plexiglass panel in both HBG's
 - Clean and polish stainless steel HBG's
- Stainless steel barriers:
 - Clean and polish
- Replace drain grates with stainless steel type

4. Mezzanine to Platform Vertical Access:

a. Harrison Escalator/Stairwell:

1. Walls:
 - Provide new wall finish/gutter system
2. Stair:
 - Remove detectable warning surface at mezzanine floor and replace with new mezzanine floor finish system
 - Repair damaged quarry tile on treads and risers
 - Remove detectable warning surface at landings and replace with quarry tile
3. Escalator:
 - Clean and polish stainless steel (escalator equipment is not to be rehabilitated)
4. Ceiling:
 - Prepare and paint concrete

b. Polk Stairwell:

1. Walls:
 - Provide new wall finish including gutter at stair
2. Stair:
 - Restore finish of concrete treads and risers and replace damaged quarry tile at nosings and landings.
3. Ceiling:
 - Prepare and paint concrete
 - Lighting: Clean existing fixtures. Replace ballast and relamp with high-output T-8 tubes. Replace lens with new.
 - Confirm existing lighting levels and provide new lighting levels per CTA standards

5. Platform Level:

a. Outbound and Inbound Track Tubes:

1. Repair noticeable cracks/joints. Paint area of repaired cracks ~~only~~.
2. ~~Existing lighting to remain~~ Clean existing light fixtures.

b. Platform Tube:

1. Floor:
 - Provide new floor finish system
 - Replace existing metal access panels with panels to accept new floor finish
 - Prepare and paint existing gates at both ends of the platform
2. Tactile Tile
 - Replace tiles at platform edge

3. Ceiling:
 - Vault:
 - Prepare and paint entire concrete vault
 - Prepare and paint steel columns and soffits
 4. Furnishings: All the following furniture is to be removed as required and reinstalled for the construction of the new floor finish system.
 - Trash Containers:
 - Clear plastic bag assembly to remain
 - Benches:
 - Provide six (6) benches
 - Gap Filler enclosures (3)
 - Clean and polish existing stainless steel
 - Recycling Bins (2)
 - Each bin to remain as is
6. Miscellaneous:
- a. Signage and ~~way finding~~ Wayfinding
 1. Replace signage throughout the entire station. The DBC shall review the signage drawings found in ~~Exhibit C~~ Appendix 1 (included with the Preliminary Scope of Work drawings) and modify as required to coordinate with the DBC design.
 2. The DBC will provide the following:
 - Power and data (conduit and cables) for the double-sided digital advertising screens. DBC shall also provide power and data (conduit and cables) for the existing Train Tracker sign at the Harrison mezzanine if it is temporarily relocated.
 - The DBC shall coordinate all Wayfinding and Digital Advertising Signage including but not limited to ~~with CTA~~ the temporary relocation of the Train Tracker sign. CTA will relocate the Train Tracker sign.
 3. CTA will provide the following:
 - Providing the double-sided digital advertising screens and final connections of the screens
 - Providing and final connection of the Train Tracker sign.
 - b. Electrical
 1. The DBC shall provide all power and lighting as described above and as follows.
 - Upgrade all lighting throughout the entire station including all existing conduit and wiring.
 - All lighting layouts to comply with CTA Design Criteria Chapter 10, Electrical (see ~~Exhibit B~~ Appendix 1).
 - Replace electrical panels
 - ~~Install Emergency Light Fixtures with Inverter and new panel.~~ Design and install AC Emergency Lighting system powered by the existing 600 Volt DC electrical system including but not limited to the following:
 - AC emergency light fixtures, conduit and wiring
 - DC Transfer Switch
 - DC Inverter
 - ELP panel
 - Remove all abandoned and/or unused conduit.

c. Fare Collection System

1. The DBC shall provide the following:
 - Power and data (conduit and wiring) for the temporary and permanent installations of the fare collection equipment including removal of temporary power and data (conduit and wiring)
 - Coordination of the installation of the temporary and permanent installations of the fare collection equipment.
2. CTA will provide the following:
 - Permanent removal and temporary relocation of fare equipment
 - New TCVM/Ventra Vending Machines, TWA/End Cabinet
 - Temporary fare collection equipment
 - Installation of new and temporary fare collection equipment including final power and data connections

d. Hazardous Materials

1. The DBC shall identify and mitigate hazardous materials impacted by the scope of work including but not limited to:
 - Asbestos
 - Lead Based Paint
 - Mercury-containing electronics
2. The DBC shall be responsible for related waste management plan(s) to address handling and disposal of hazardous and/or special waste.

7. Design Guidance Documents

a. The following Design Guidance Documents can be found in ~~Exhibit B~~ Appendix 1

1. Original Contract Drawings
 - Contract S-10A, Stations and Auxiliary ~~Structures~~ Structures, dated February, 1940 (45 sheets)
 - Contract F-1, F-2 and F-3, Station Finishes, dated July, 1941 (91 sheets)
2. Specifications
 - Signage
 - SP_Master_10 42 50_Vitreous Enameled Steel Signs
 - SP_Master_10 42 60_Illuminated Signs
 - SP_Master_10 42 70_Fiberglass Embedded Sign
 - SP_Master_10 42 90_Tactile and Braille Signs
 - Waterproofing
 - SP-Master_07 16 00_Crystalline Cementitious Waterproofing Coating – DRAFT
 - Miscellaneous
 - SP_Master_03 30 00_Cast-In-Place Concrete
 - SP_Master_04 80 00_Masonry
 - SP_Master_05 50 00_Metal Fabrications
 - SP-Master_05 50 10_BarriersHigh Barrier Gates
 - SP_Master_05 10 30_Structural Steel
 - SP Master_07 41 00_Metal Roof Panels
 - SP-Master_08 13 00_StainlessSteelDoorsand Frames
 - SP_Master_08 80 00_Glass and Glazing

- SP-Master_09 30 05_Tiling-Exterior
 - SP-Master_09 30 10_Tactile Tile
 - ~~SP-Master_09 40 10_Cementitious Terrazzo~~
 - SP-Master_09 60 00_Stone Flooring and Compass Rose
 - SP-Master_09 90 00_Painting
 - Electrical
 - Section 16265 DC Static Inverter
 - Section 16266 DC Power Distribution
 - SP-Master_26 01 00_General Provisions
 - SP-Master_26 03 00_Electrical Demolition
 - SP-Master_26 05 00_Raceways and Boxes
 - SP-Master_26 10 00_Basic Electrical Materials and Methods
 - SP-Master_26 12 30_Wires Cables Splices Terminations
 - SP-Master_26 14 10_Wiring Devices
 - SP-Master_26 17 00_Local Control
 - SP-Master_26 17 50_Local Control Panels
 - SP-Master_26 19 00_Grounding
 - SP-Master_26 19 50_Identification
 - SP-Master_27 47 00_Panelboards
 - SP-Master_26 50 10_Lighting Fixtures
 - SP-Master_26 95 00_Electrical Testing
 - 3. Reports
 - Sewer and Water Main Leak Tests Report, dated July 10, 2013
 - 4. Cut Sheets
 - Standard Bench
 - Double-Sided Digital Advertising Screen
 - 5. Photos
 - Harrison Existing Conditions
 - Harrison Design Guidelines
 - 6. Design Criteria
 - Chapter 10, Electrical
8. Preliminary Design Drawings
- a. The following Preliminary Design Drawings can be found in ~~Exhibit C~~ Appendix 1
1. Preliminary Scope of Work dated ~~July 30~~ August 28, 2013.
- C. TIME PERIOD REQUIREMENTS
- Achieve Final Acceptance of all contract work within 330 calendar days after Award of Design and Construction Service Agreement.
- D. CONTRACT MILESTONES
1. Milestone A: Achieve substantial completion of all scope, in the following areas, within 197 calendar days after Award of Design and Construction Service Agreement.
- Polk Mezzanine
 - Polk Entrance and Stair
 - Stairs from Polk Mezzanine to platform

2. Milestone B: Achieve substantial completion of all remaining contract work within 240 calendar days after Award of Design and Construction Service Agreement.
3. Milestone C: Achieve Final Acceptance of all contract work within 330 calendar days after Award of Design and Construction Service Agreement.

E. **ALLOWABLE TRACK ACCESS & WORK TRAIN OCCURRENCES**

The CTA will provide, at no cost to the Design Build Contractor (hereinafter "DBC"), the following Track Access Occurrences in order to complete all work included in the contract scope.

1. Nightly Single Track with a work train on the Northbound track (Northbound track out of service from 15th to Grand):

Each occurrence = 2300 to 0400 hours (5 hour duration)

CTA will provide a work train on the NB track with two (2) flat cars during a scheduled Single Track to facilitate delivery and removal of equipment to/from the platform. The work train flat cars will be made available at the CTA 63rd lower yard for at least eight (8) hours prior to and eight (8) hours after each occurrence to allow the Contractor to load or unload equipment and materials. The quantity of work train occurrences shall be proposed in the project approach and limited as defined in Section G below. Failure to unload a work train within eight (8) hours after a track access occurrence may result in the assessment of Liquidated Damages as specified in Section I.

F. **STATION CLOSURES**

CTA will allow partial and full station closures of Harrison Station to perform contract work within the Harrison Station facility as approved by the Authority.

The scope of work to be performed during station closures shall be identified by the Proposer in the project approach and shall not exceed the constraints defined in Section G below. All contract work within each phase area must be substantially completed prior to proceeding with any subsequent phase.

1. Polk Entrance & Mezzanine Closure

The CTA will allow one (1) continuous closure of the Polk Street Entrance and Polk Mezzanine provided no phased work is occurring concurrently at the Harrison Entrances or Harrison Mezzanine. A minimum of 425 linear feet of platform adjacent to the Harrison Mezzanine stairs and escalator is to remain unobstructed during any Polk Street Entrance and/or Mezzanine closures during 8-car rail service. The work to be performed at the Polk Mezzanine must be phased to allow for continuous use of the Harrison Station platform throughout construction. The Harrison Station facility must remain operational at all times with the exception of approved weekend station closures as approved by the Authority.

2. Harrison Entrance & Mezzanine Closure

The CTA will allow one (1) continuous closure of the Harrison Mezzanine and East and West Entrances provided no phased work is occurring concurrently at the Polk Entrance or Mezzanine. A minimum of 425 linear feet of platform adjacent to the Polk Mezzanine

stairs is to remain unobstructed during any Harrison Entrance and/or Mezzanine closures during 8-car rail service. The work to be performed at the Harrison Mezzanine must be phased to allow for continuous use of the Polk Entrance and Station platform throughout construction. The Harrison Station facility must remain operational at all times with the exception of approved weekend station closures as approved by the Authority.

Contractor's work must not interfere with CDOT or CTA operations. No single tracking events, work outside of barricaded or hoarding areas will be allowed during rush hour, holidays or special events. Use of CTA toilets is prohibited.

All areas of construction are to be fully barricaded and locked. Graffiti within construction limit lines shall be removed within 24 hours. Barricade and hoarding area wall design, construction and installation must withstand 30 PSF wind loads (100 mph). DBC is required to submit detailed design prior to barricade construction for Authority review and approval. All lumber must be fire retardant treated and painted with fire resistant (rated) paint. Staging and lay-down area is extremely limited. It is the DBC's responsibility to work with adjacent property owners to obtain staging and laydown areas as needed. No additional compensation or time will be awarded due to limited staging and lay-down area.

Contractor must provide and maintain temporary signage, lighting and speaker system (existing systems may act as temporary if not in conflict with new construction) until new systems are fully operational. Existing systems cannot be removed until temporary signage, lighting and speaker system is approved and functioning. The DBC must provide graphic signs other than what is shown on drawings warning the public of hazard areas. Signs shall be placed at each barrier opening of a hazardous location. CTA signage must not be removed until existing finish removal is scheduled and new finishes and/or signage is ready for installation. Approved temporary signage is acceptable. Removed signage must be replaced within twelve (12) hours.

DBC to protect all existing CTA equipment, train signals, berthing markers and panels such as station ID signs, etc. during cleaning waterproofing, and painting work.

Constraints regarding scheduling and sequencing of partial station closures at Harrison Station are defined in Section G below.

G. CONSTRAINTS

1. Track Access Occurrence & Work Train Constraints

- a. Station platform must remain open and useable for 8-car service at all times except during allowable re-berthing periods for 4-car rail service.
- b. Track access occurrences may not be allowed to occur under this contract simultaneously with any other track access occurrences on the Red Line.
- c. The quantity of Track Access occurrences with work Trains shall be limited as follows:
 - o Nightly Single Tracks with work trains shall not exceed ten (10) occurrences.

2. Track Access Occurrence Constraints

- a. Station platform must remain open and useable for 8-car service at all times except during allowable re-berthing periods for 4-car rail service and approved Station Closures.

3. Flagging and Construction Work Zone Constraints

- a. Dependent upon the DBC's means and methods of performing contract work on or adjacent to the Right of Way, Flagging may be required by the Authority. The Authority will provide a maximum of 450 flagger shifts and 60 infrastructure shifts at no cost to the DBC for performance of contract work. Costs for any flagging shifts in excess of 450 flagger shifts shall be borne by the DBC. Flagging required by CTA during any specified Track Access Occurrence or Work Train Occurrence will be provided by the Authority at no cost to the Contractor and not counted towards the 450 flagger shifts.

4. Re-Berthing

- a. Re-berthing of eight (8) rail car trains may be requested to either end and either side of the platform.
- b. From late evening to early morning when four (4) rail car trains are in operation, re-berthing may be requested to perform work on the center areas of platform.

5. Station Closure Constraints:

a. Harrison Mezzanine & Entrance Work:

Any closure of the Harrison Mezzanine and East and West Entrances must be for one continuous period not exceeding forty-two (42) consecutive calendar days for all phases and shall start at 0400 hours on a Monday to perform all scope in the following areas:

- Harrison Mezzanine
 - East and West Entrance/Stairways to Harrison Mezzanine
 - Escalator and Stairs from Harrison Mezzanine to platform
- i. Any proposed closure on the West stairway entrance to Harrison Mezzanine must not occur during the Jones College Prep 2013-2014 or 2014-2015 school years. Students currently begin classes on Monday, August 26, 2013 and end on Tuesday, June 10, 2014 and dates are subject to change.
 - ii. All station amenities, such as, but not limited to fare control equipment, kiosks, vending machines, Chicago Fire Department box and trash receptacles may be relocated but must remain accessible at all times when station is in service.
 - iii. Relocation of fare control equipment and any vending machines shall be performed by CTA or its Contractor. The proposed phasing plan must identify any proposed relocations within the project approach.

- iv. Relocation of CFD box must be coordinated by Proposer with CFD.
- v. Escalator shall not be used to convey materials or equipment
- vi. Areas of construction to be fully barricaded and locked.

b. Polk Mezzanine & Entrance Work:

- i. Any closure of the Polk Mezzanine and Entrance must be for one continuous period not exceeding forty-two (42) consecutive calendar days for all phases and shall start at 0400 hours on a Monday to perform all scope in the following areas:
 - Polk Mezzanine
 - Stairway to Polk Mezzanine
 - Stairs from Polk Mezzanine to platform
- ii. Areas of construction to be fully barricaded and locked.
- iii. Relocation of fare control equipment and any vending machines shall be performed by CTA or its Contractor. The proposed phasing plan must identify and any proposed relocation within the project approach.

c. Platform Level work:

- i. The DBC must submit a detailed platform staging plan for approval by the Authority prior to beginning work.
- ii. A minimum of 425 lf of continuous platform must remain in operation at all times and have access to either the Polk or Harrison Entrances.
- iii. Any work outside full height barricades must be executed to allow continuous use of the Northbound and Southbound platform for a 425 foot 8-car Red Line train during 8-car service.
- iv. Any work outside full height barricades must be executed to allow continuous use of the Northbound and Southbound platform for a 225 foot 4-car Red Line train during 4-car service.
- v. Re-berthing may be requested by the DBC on an active track to allow portions of work to be performed on the platform provided the minimum platform lengths defined above are maintained and at least a 5' wide continuous walk way is available adjacent to any hoarding or barricaded construction area for Northbound and Southbound service.
- vi. Areas of construction are to be fully barricaded and locked.
- vii. Any track level work shall be completed under flagmen protection.

5. Weekend Harrison Station Closure

- a. The quantity of Weekend Harrison Station closures shall be limited as follows:
 - Weekend Harrison Station closures shall not exceed four (4) occurrences.
 - Each Weekend Harrison Station closure shall begin at 2200 hours on Friday and end at 0400 Monday.
 - No weekend station closures will be allowed during special events and national holidays listed in specification section 01 35 00.

6. Allowable Work Hours

- a. Work will not be allowed during rush hours outside of barricaded areas.
- b. Platform work that is wholly within an existing or constructed barricade area maybe conducted during any hours as long as work, in the opinion of the Authority does not interfere with the public's use of the facility or CTA operations.
- c. DBC shall notify the Authority two weeks prior to beginning each phase of work.
- d. Platform berth markers shall be relocated and installed by CTA via the use of Infrastructure Shifts provided in the contract.

H. CONSTRUCTION SLOW ZONES

The DBC shall plan and coordinate the work to minimize the quantity of track access occurrences and re-berthing limits required for any proposed occurrences.

I. LIQUIDATED DAMAGES FOR DBC DELAY

The DBC will be liable for liquidated damages for the time that the DBC causes a delay in returning the system to normal operational service after any Track Access Occurrence, station closure(s), or scheduled special transit operation, including the time required to process the checklist to return the track to service per Specification Section 01 35 00. The time requirements and the amount of liquidated damages are listed below. Any such amounts shall be payable as liquidated damages.

The Authority shall recover liquidated damages by deducting the amount thereof out of any monies due or that may become due the DBC, and if said monies are insufficient to cover said damages then the DBC shall pay the amount due upon demand from the CTA.

1. Failure of the DBC to return any of the tracks back to service after each authorized Track Access Occurrence scheduled for DBC's work:
 - From 1 minute up to the first 29 minutes delayed:
Liquidated Damages: \$5,000.00

- In addition, from 30 minutes up to the first 59 minutes delayed:
Liquidated Damages: \$5,000.00
 - For each additional hour, or fraction thereof, thereafter delayed:
Liquidated Damages: \$30,000.00 per hour.
2. Failure of the DBC to complete Milestone A by the prescribed day and time shall result in assessment of Liquidated Damages per calendar day in the amount of \$2,900.00
 3. Failure of the DBC to complete Milestone B by the prescribed day and time shall result in assessment of Liquidated Damages per calendar day in the amount of \$4,600.00
 4. Failure of the DBC to complete Milestone C by the prescribed day and time shall result in assessment of Liquidated Damages in the lump sum amount of \$150,000.00
 5. Failure to unload any work train flat cars provided by CTA within 8 hours after any track access occurrence shall result in the assessment of Liquidated Damages in the amount of \$7,000.00 per occurrence.

J. PUNCH LIST

The DBC is required to complete all punch list work within thirty (30) calendar days after receipt of notice of substantial completion from the Authority for each milestone. The CTA reserves the right to complete punch list work not performed by the DBC within the thirty (30) calendar day period and deduct the cost of such work from the Final GMP.

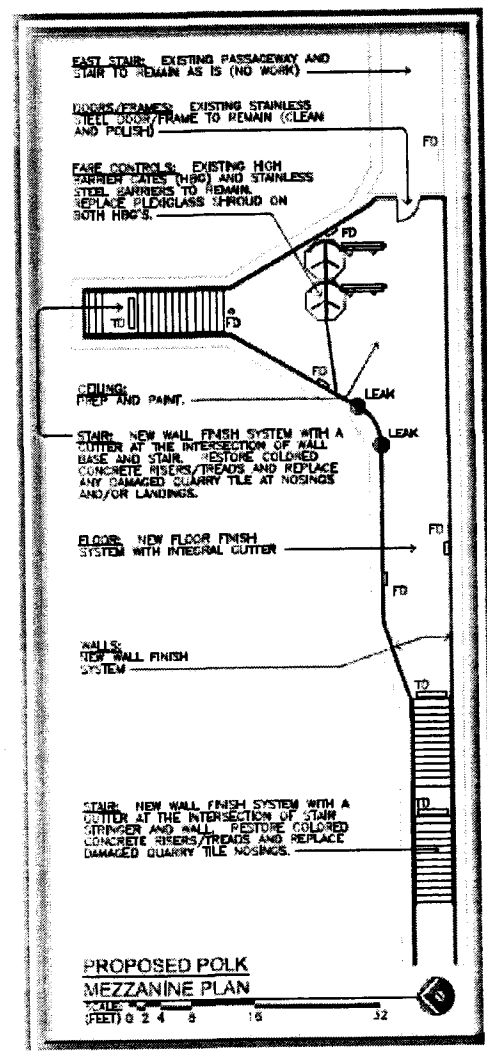
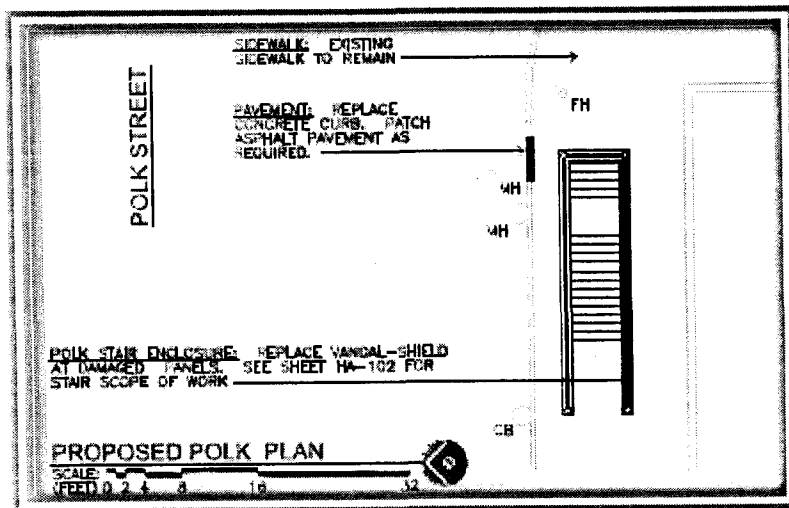
K. PROPOSED PHASING

The conceptual phasing plans as specified herein represent a conceptual plan for performing contract work while maintaining CTA operations at the Harrison Entrance, Polk Entrance and station platform.

It is not the intent of the conceptual phasing plan to spell out every detail of work or to define the means and methods or materials involved in the phasing except as may be required by the Authority. It is the DBC's responsibility to coordinate the various phases to assure the efficient, timely and safe progression of work. The Proposer may provide a detailed alternate phasing plan reflecting completion of all contract work meeting all constraints in the Proposer's technical project approach.

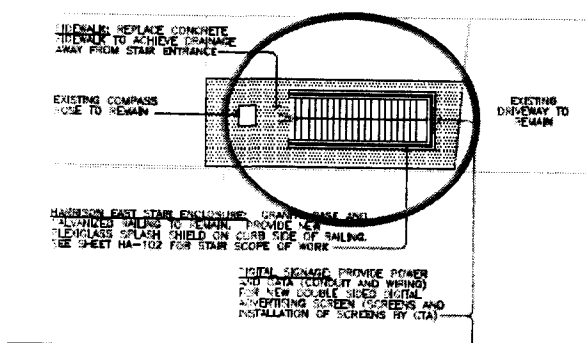
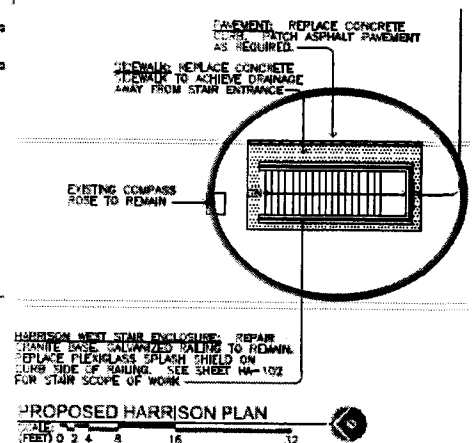
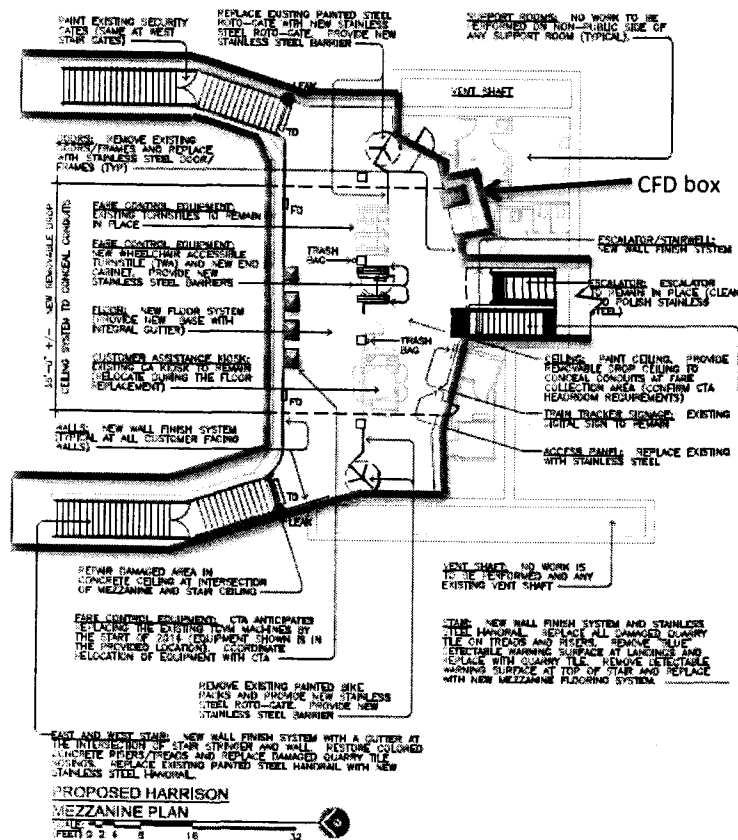
1. Polk Entrance and Polk Mezzanine Scope (Phase 1):

- All stairways at Harrison must be open and available for use during any partial station closures at the Polk Entrance and Mezzanine.
- Partial station closure shall not exceed forty-two (42) continuous calendar days.
- Plans provided below do not reflect the final scope of work and are for information purposes only.



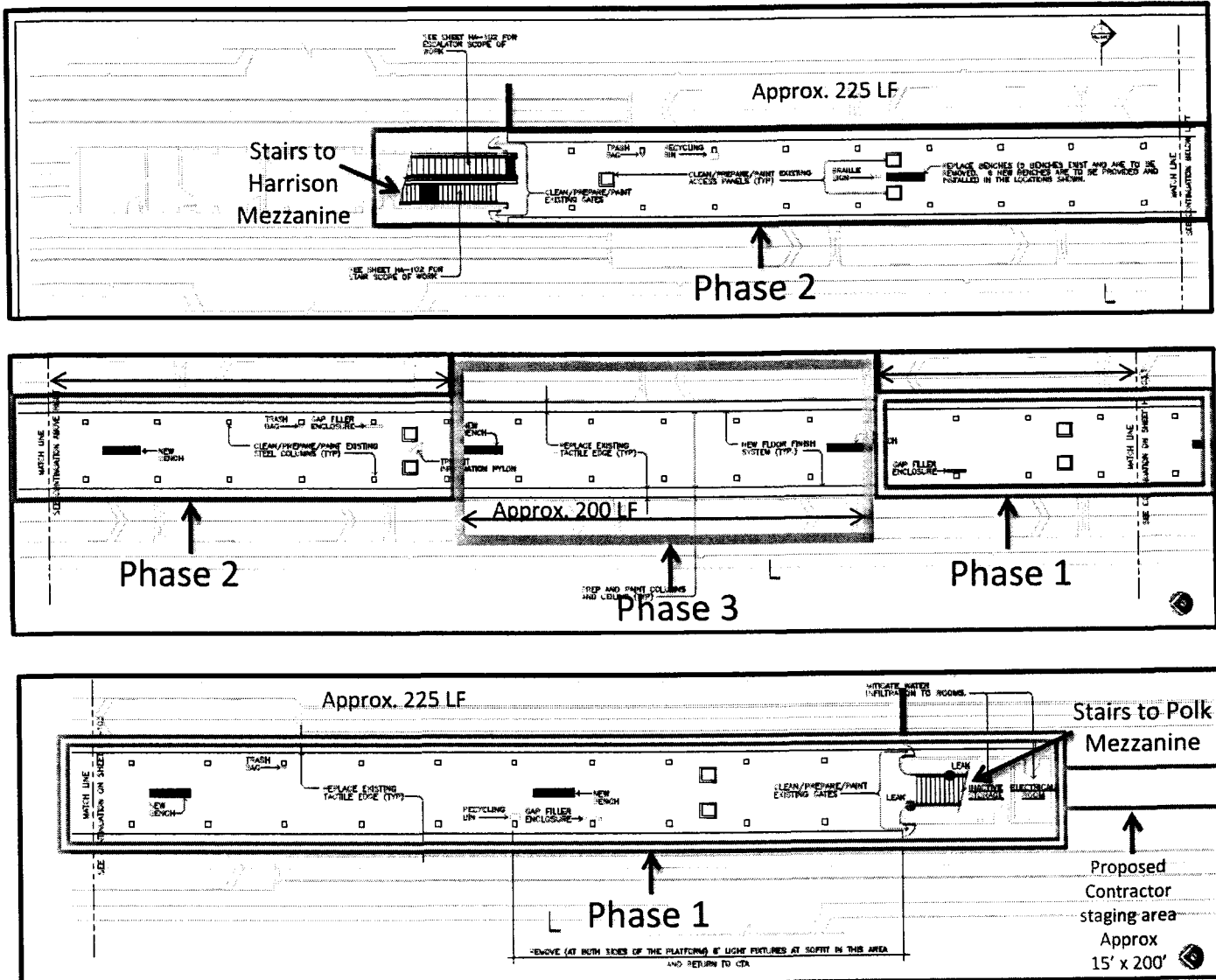
2. Harrison Entrance and Harrison Mezzanine Area of Scope (Phase 2):

- a. All stairways at Polk must be open and available for use during any partial station closures at the Harrison Entrance and Mezzanine.
- b. Partial station closure shall not exceed forty-two (42) continuous calendar days.
- c. Plans provided below do not reflect the final scope of work and are for information purposes only.



3- Platform Scope (Phase 1, 2 & 3):

- a. Proposed Contractor staging area is approximately 15' x 200' as noted below
- b. A maximum of four (4) Weekend Harrison Station closures may be proposed to perform scope of work located in the center 200 LF section of the platform.
- c. Plans provided below do not reflect the final scope of work and are for information purposes only



SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and other specification sections apply to this section.

1.02 SUMMARY

- A. This Section specifies requirements for cast-in-place concrete. The work under this Section shall consist of furnishing all labor, materials, and equipment required to provide and install the cast-in-place concrete structures shown on the drawings and including formwork; joint filler; expansion, contraction or isolation joints; water stops; embedded items; vapor retarder; concrete sealer and all other appurtenant work required to complete this work. The concrete work includes slabs on grade, structural slabs, concrete topping slab, concrete steps, concrete foundations, footings, piers and other concrete structures.
- B. Furnish all sampling and testing as required for qualification of proposed materials and establishment of design mixes and performing field testing of all concrete by a qualified testing laboratory acceptable to the Authority and engaged by and at the expense of the Contractor.
- C. Related Sections: The following sections contain requirements that relate to this Section.
1. Section 01 45 80 - Testing and Inspection Service
 2. Section 31 20 00 - Earthwork
 3. Section 03 20 00 - Concrete Reinforcement
 4. Section 07 10 10 - Membrane Waterproofing

1.03 STANDARDS

- A. Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:
1. Standard Specifications.
 2. American Concrete Institute (ACI).
 3. American Society for Testing and Materials (ASTM).
 4. Illinois Department of Transportation (IDOT) Standard Specification for Road and Bridge Construction.
- B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.
1. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 2. ASTM C33 - Standard Specification for Concrete Aggregates.
 3. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 4. ASTM C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
 5. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
 6. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.
 7. ASTM C150 - Standard Specification for Portland Cement.

8. ASTM C156 - Standard Test Method for Water Retention by Concrete Curing Materials.
9. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
10. ASTM C172 - Practice for Sampling Freshly Mixed Concrete.
11. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
12. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
13. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
14. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
15. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
16. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
17. ASTM C979 - Color Pigment for Concrete.
18. ASTM C1064 - Test Method for Temperature of Freshly Mixed Portland Cement Concrete.
19. ACI 117, "Standard Tolerances for Concrete Construction and Materials."
20. ACI 211.1, "Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete."
21. ACI 301, "Specifications for Structural Concrete for Buildings."
22. ACI 304, "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete."
23. ACI 305, "Hot Weather Concreting."
24. ACI 306, "Cold Weather Concreting."
25. ACI 308, "Standard Practice for Curing Concrete."
26. ACI 309, "Standard Practice for Consolidation of Concrete."
27. ACI 318, "Building Code Requirements for Reinforced Concrete."
28. ACI 347, "Recommended Practice for Concrete Formwork."

1.04 SUBMITTALS

- A. Submit, for the Authority's review and approval, product data including the following:
1. Sources of cement and aggregates.
 2. Material Safety Data Sheets (MSDS) for all concrete components and admixtures.
 3. Air-entraining admixture. Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations, field testing methods and conformity to ASTM standards.
 4. Water-reducing admixture (plasticizer). Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations and conformity to ASTM standards.
 5. Concrete mix for each formulation of concrete proposed for use including constituent quantities per cubic yard, water-cementitious materials ratio, concrete slump, type and manufacturer of cement. The mix design shall be signed and sealed by either an Illinois Professional Engineer or Structural Engineer. The mix designs shall specify weight and type of Portland Cement, fine aggregate, coarse aggregate, brand names and amounts of chemical admixtures, range of water content, range of slump and expected compressive strength for seven, fourteen and twenty-eight days. Provide the following for each mix proposed:
 - a. Compression test results for proposed mixes. Include standard deviation data for each proposed concrete mix based on statistical records where applicable.
 - b. Curve of water-cementitious materials ratio versus concrete cylinder

- strength for each formulation of concrete proposed based on laboratory tests. The cylinder strength shall be the average of the 28 day cylinder strength test results for each mix. Provide results of 7 and 14 day tests if available.
- c. Fine aggregates – Test reports indicating conformity with ASTM standards, including sieve analysis, physical properties, and deleterious substance.
 - d. Coarse aggregates – Test reports indicating conformity with ASTM standards, including sieve analysis, physical properties, and deleterious substances.
 - e. Cements – Test reports indicating conformity with ASTM standards, including chemical analysis and physical properties for type.
 - f. Contractor shall submit documentation from the concrete suppliers indicating previous experience with the proposed mix design.
- 6. Sheet curing material. Product data including catalogue cut, technical data and conformity to ASTM standard.
 - 7. Liquid curing compound. Product data including catalogue cut, technical data, storage requirements, product life, application rate and conformity to ASTM standards. Identify proposed locations of use.
 - 8. Provide the mix design to the Authority for approval. Concrete strength shall be verified by the Contractor's testing agency. The Contractor shall submit two copies of test reports to the Authority for approval.
 - 9. Concrete stain product data, specifications and instructions for application.
 - a. Provide color charts for manufacturer's standard colors for Authority's selection and approval.
- B. The Contractor shall provide the following for review and approval: product data for materials and items including forming materials and accessories, form release agents, admixtures, patching compounds, bonding agents, joint systems, curing compounds and others as requested. Certify that each admixture is compatible with others used.
 - C. The Contractor shall submit formwork shop drawings for concrete including fabrication, erection and support procedures for the formwork to the Authority for approval. The formwork drawings shall be signed and sealed by an Illinois licensed structural engineer. Show form construction including jointing, special form joints, location and pattern of form tie placement and other items that affect concrete that is exposed visually. The Contractor shall make modifications to the procedure if required, to obtain results that are satisfactory to the Authority; however it is understood that the Authority's approval shall not relieve the Contractor from sole responsibility of obtaining satisfactory results.
 - D. Provide material certificates in lieu of material laboratory test reports, when permitted. Certificates shall be signed by the manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements.
 - E. Provide delivery tickets for all ready-mixed concrete.
 - F. Provide product data, specifications, installation instructions, installation recommendations, samples, and other information for the following, if applicable for this project:
 - 1. Adhesive for reinforcing dowels.
 - 2. Joint filler and isolation joint materials.
 - 3. Vapor retarder.
 - 4. Concrete sealer.

- 5. Slip resistant polymer overlay for floor slab.
- G. Provide compatibility test results between adjacent sealants and curing and sealing materials.
- H. As-Built requirements: Provide as-built drawings indicating actual locations and elevations of all foundations, foundation elements, openings and other features upon completion of the project.
- I. Provide two copies of test reports from the Contractor's testing agency verifying concrete strength.

1.05 QUALITY ASSURANCE

- A. Reinforced concrete shall comply with the latest ACI codes: ACI 301, Specification for Structural Concrete; ACI 304, Guide for Measuring, Mixing, Transporting, and Placing Concrete; ACI 311, ACI Concrete Inspection Manual; ACI 315, ACI Detailing Manual; ACI 318, Building Code and Commentary; and ACI 347, Guide to Formwork for Concrete. The most stringent requirement of the codes, standards, building codes and this Section shall apply when conflicts exist.
- B. Only one source of cement and aggregates shall be used on any one structure. Concrete shall be uniform in color and appearance.
- C. Testing of the following materials shall be furnished by Contractor to verify conformity with this Specification Section and the stated ASTM Standards.
 - 1. Fine aggregates for conformity with ASTM C33 - sieve analysis, physical properties, and deleterious substances.
 - 2. Coarse aggregates for conformity with ASTM C33 - sieve analysis, physical properties, and deleterious substances.
 - 3. Cements for conformity with ASTM C150 - chemical analysis and physical properties.
 - 4. Pozzolans for conformity with ASTM C618 - chemical analysis and physical properties.
- D. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the job for each type of concrete required, in compliance with ACI 318 (Chapter 4). In addition, documentation shall be provided demonstrating that the proposed concrete proportions will produce an average compressive strength at least 15% higher than the herein specified compressive strengths.
- E. Use ready-mix concrete, complying with ASTM C94 and supplied by a ready-mix source which is inspected yearly by the Illinois Department of Transportation. Delivery tickets shall note the mix designation, admixtures, time dispatched, date, project number and Contractor and shall be submitted for review by the Authority.
- F. Testing: Contractor shall arrange for and pay for an independent testing laboratory, approved by the Authority, to perform the following tests; providing a copy of all reports to the Authority for approval:
 - 1. Concrete sampling for design mix, air content and slump.
 - 2. Concrete cylinders for 7, 14, and 28 day compression strength.
 - 3. Backfill compaction testing.
 - 4. Conduct specified Source Quality Control and Field Quality Control and submit reports for all concrete work.

- G. Provide quality assurance according to Section 1020 of the IDOT Standard Specifications.
- H. See also Section 01 45 80, Testing and Inspection Service.

1.06 PROJECT CONDITIONS

- A. Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting concrete performance.
- B. Principal opening sizes and locations are indicated on the drawings. Additional smaller openings and sleeves may be required by other disciplines and shall be constructed according to details submitted to the Authority for approval.

1.07 COORDINATION

- A. Coordinate work of this section with other subcontractors to verify required dimensions and locations including for inserts, anchors, anchor bolts, plates, conduit, and other items to be embedded in the concrete or installed with the concrete.
- B. Coordinate the delivery of embedded items or items to be installed with the concrete so as to avoid delays to the installation of the new concrete work.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Cement: Store weathertight to provide protection from dampness and contamination.
- B. Aggregate: Arrange and use stockpiles to avoid excessive segregation or contamination with other materials or with other sizes of like aggregates. Do not use frozen or partially frozen aggregate.
- C. Sand: Arrange and use stockpiles to avoid contamination. Allow sand to drain to a uniform moisture content before using. Do not use frozen or partially frozen sand.
- D. Admixtures: Store in closed containers to avoid contamination, evaporation or damage. Provide suitable agitating equipment to assure uniform dispersion of ingredients in admixture solutions which tend to separate. Protect liquid admixtures from freezing and other temperature changes which could adversely affect their characteristics.
- E. Sheet Curing Materials: Store in weathertight buildings or off the ground and under cover.
- F. Liquid Curing Compounds: Store in closed containers.
- G. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 PRODUCTS

2.01 CLASS SI CONCRETE

- A. All concrete defined by this specification shall be normal weight Class SI Concrete with a minimum cured density of 145 pcf having a compressive strength as shown on the

drawings, or if not shown, as indicated herein, and conform to the requirements of Sections 503 and 1020 of the Standard Specifications.

- B. Cement: Domestic Portland cement complying with ASTM C150.
- C. Fine Aggregate: Washed inert natural sand conforming to the requirements of ASTM C33.
- D. Coarse Aggregate: Maximum size aggregate shall be $\frac{3}{4}$ inch. Well-graded crushed stone or washed gravel conforming to the requirements of ASTM C33. Grading requirements shall be as listed in ASTM C33 for the specified coarse aggregate size number.
- E. Water: Potable water free from injurious amounts of oils, acids, alkalis, salts, organic matter, or other deleterious substances.
- F. Admixtures: Admixtures shall be free of chlorides and alkalis (except for those attributable to water). Each admixture shall be compatible with all of the components in the concrete mix and shall be suitable when it is required to use more than one admixture in a concrete mix. Admixtures shall be compatible with the concrete mix including other admixtures potable water after 30 days.
 - 1. Air-Entraining Admixture: The admixture shall comply with ASTM C260. Proportioning and mixing shall be in accordance with manufacturer's recommendations.
 - 2. Water-Reducing Agent: The admixture shall comply with ASTM C494, Type A. Proportioning and mixing shall be in accordance with manufacturer's recommendations.
 - 3. Admixtures causing retarded or accelerated setting of concrete shall not be used without written approval from the Authority. When allowed, the admixtures shall be retarding or accelerating water reducing or high range water reducing admixtures.
- G. The use of calcium chloride and other chloride containing agents is prohibited.
- H. Sheet Curing Materials: Waterproof paper, polyethylene film or white burlap-polyethylene sheeting all complying with ASTM C171.
- I. Liquid Curing Compound: Liquid membrane-forming curing compound shall comply with the requirements of ASTM C309, Type 1-D (clear or translucent with fugitive dye) and shall contain no wax, paraffin, or oil. Curing compounds shall have a minimum of 18 percent solids, be non-yellowing and have a unit moisture loss no greater than 0.55 kg/m² in 72 hours as measured by ASTM C156.
- J. Concrete Sealer: Water based, odorless, colorless; that penetrates, hardens and densifies concrete surfaces and leaves a nondarkening film that protects the concrete surface from oil, water, grease, dirt and other contaminant penetration. Sealer must be compatible with any concrete admixtures, color stains, curing compounds, hardeners, and any other concrete treatments used. Sealer must meet current local VOC restrictions and be non-flammable.
 - 1. Concrete sealer to be Hydrozo 100 Plus as manufactured by BASF Chemical Company or a sealer with similar characteristics. Manufacturers of concrete sealers that may be used for this project include, but not limited to, the following:
 - a. BASF.
 - b. ChemMasters.
 - c. Custm Building Products, Aqua Mix Sealer's Choice Gold.

- d. SpecChem.
- e. TK Products.
- f. H & C Concrete Coatings.
- g. Approved Equal.

2.02 MIXES

- A. Select proportions of ingredients to meet the design strength and materials limits specified and to produce concrete having proper placability, durability, strength, appearance and other required properties. Proportion ingredients to produce a homogenous mixture which will readily work into corners and angles of forms and around reinforcement without permitting materials to segregate or allowing excessive free water to collect on the surface.
- B. Slump of the concrete shall be as measured by ASTM C143. If a high-range water reducer (plasticizer) is used, the slump indicated shall be that measured before plasticizer is added. Plasticized concrete shall have a slump ranging from 7- to 10-in.
- C. Proportion admixtures according to the manufacturer's recommendations. Two or more admixtures specified may be used in the same mix provided that the admixtures in combination retain full efficiency and have no deleterious effect on the concrete or on the properties of each other.
- D. Design mixes, when tested according to ASTM C 330, to be as indicated on the drawings, or if not indicated, provide normal weight structural concrete with 6,000 psi at 28-day compressive strength, 0.44 maximum water-cement ratio for non-air-entrained concrete and 0.35 maximum for air-entrained concrete.
 - 1. Design mix for light weight concrete to be minimum 2,500 psi at 28 days or 4,000 psi at 28 days, as selected by the Authority or as directed by the Authority otherwise. Light weight concrete mix shall have light weight aggregates conforming to ASTM C 330, have an air dry density of no more than 115 pounds per cubic foot and a 2- to 4-inch slump.
- E. Slump Limits for Normal Weight Concrete: Proportion and design mixes to result in a maximum concrete slump at point of placement of 4"; with superplasticizer the maximum concrete slump at point of deposit to be 8", maintaining 2" to 3" slump prior to addition of admixture.
- F. Portland cement for concrete to conform to ASTM C 150, Type III. Provide a minimum of 7-1/2 bags of cement per cubic yard of concrete.
- G. Normal weight aggregates to conform to ASTM C 33 unless specified otherwise. Maximum aggregate size to be 3/4 inch.
- H. Air Entraining Admixture: ASTM C 260; provide for exterior exposed concrete and as otherwise required: 5%.
- I. Water Reducing Admixture (Superplasticizer): ASTM C 494; provide for exterior exposed concrete and concrete with a water-cement ratio of 0.50 or less. Type as specified or approved by Authority. Type "A" water-reducing admixture, added in compliance with the manufacturer's recommendations - with no reduction in the specified cement content. (Type "D" water-reducing admixture may be used in lieu of Type "A" during hot weather concreting).
- J. Admixtures containing chlorides shall not be used in the concrete.

- K. Fly ash shall be used conforming to Sections 1010 and 1020.05 of the IDOT Standard Specifications. When used, the fly ash content shall be no less than 15 percent nor more than 25 percent of the total cement, by weight
- L. Adjustments to Concrete Mixes: Mix design adjustments may be requested when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by the Authority. Laboratory test data for revised mix design and strength results must be submitted to and accepted by the Authority before using in the work.
- M. No other admixtures shall be added without written approval from the Authority. The use of calcium chloride and other chloride containing agents is prohibited. Additives such as accelerators, retarders, anti washout agents (AWA) may be used if approved by the Authority.
- N. Concrete Stain: Apply stain to concrete after installation of slab according to stain manufacturer's written instructions and to create results in hardened concrete color consistent with approved mockup.

2.03 READY MIXED CONCRETE

- A. Provide ready mixed concrete in accordance with ASTM C94 and as specified. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
 - 1. If an approved high-range water-reducer (plasticizer) is used to produce plasticized concrete, the maximum time interval shall not exceed 90 minutes.
 - 2. Do not use concrete in the work if it undergoes initial set or is not deposited within 90 minutes after the water is introduced. Do not add water to unworkable concrete at delivery end unless the testing laboratory accepts the procedure.
- B. Provide an official ticket for each ready mix truck delivery indicating all pertinent data for that load.

2.04 FORMWORK MATERIAL

- A. General: Forms to provide continuous, straight, smooth, exposed surfaces. Furnish forms in largest practicable sizes to minimize number of joints.
- B. Wood Forms:
 - 1. Finish No. 1 (for concealed below-grade concrete) exterior plywood B-B concrete form Class II PS-1-74.
 - 2. Finish No. 2 (for smooth exposed concrete) exterior type, resin coated plywood, high density concrete form overlay, Class I, PS-I-74.
- C. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches to the plane of the exposed concrete surface. Provide ties that, when removed, will leave holes not larger than 1 inch in diameter in the concrete surface.
- D. Form release agent: A non-staining form release agent shall be used on all form work. Form release agent used shall not damage form liner.

2.05 WATERSTOP

- A. Waterstop to be flexible rubber waterstop, CECRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections and directional changes.

- 1. Manufacturers:

- a. Greenstreak.
 - b. Progress Unlimited, Inc.
 - c. Williams Products, Inc.
 - d. Approved equal.

- 2. Profile: Flat, dumbbell with center bulb unless shown otherwise.

- 3. Dimensions: 6 inches by 3/8 inch thick unless shown otherwise.

2.06 JOINT FILLER

- A. Expansion Joint Filler: Bituminous preformed joint filler conforming to ASTM D 1751. Strips to be full depth of concrete and 3/4" thick unless noted otherwise.

2.07 ISOLATION JOINT

- A. Isolation joints are to be 1/2 inch wide.
- B. Isolation joint material to be BASF expansion joint filler and Sonolastic SL-2 (or approved equal).

2.08 REINFORCING MATERIALS

- A. Refer to Section 03 20 00, Concrete Reinforcement, of these specifications for concrete reinforcing materials.

2.09 RELATED MATERIALS

- A. Vapor Retarder: Provide vapor retarder that is resistant to deterioration when tested according to ASTM E154 such as polyethylene sheet not less than 6 mils thick.
- B. Latex Bonding Agent: Provide Bonding Agent per manufacturer's recommendations when placing new cast-in-place concrete against existing concrete. Bonding Agent shall comply with ASTM C1059, Type 11 – exterior use.
- C. Curing and Sealing Compounds: Clear concrete curing and surface sealing compound complying with ASTM C309, Type I, Class A; water-based acrylic coating.
- D. Concrete wall surface sealer shall meet the requirements of IDOT Standard Specifications Section 1026, Concrete Sealer. Sealer to be BASF Hydrozo 100 Plus or equal.
- E. Provide slip resistant polymer overlay for new concrete floor slab.

PART 3 EXECUTION

3.01 PREPARATION

- A. Determine that subgrades, excavations, and other surfaces where concrete is to be placed are of proper bearing capacity, of solid material, undisturbed, of proper compaction if filled.

- B. Determine that excavations are of proper size, at proper depth, and properly located.
- C. Excavations and subgrades where concrete is to be placed must be clean and dry.

3.02 FORMS

- A. Forms shall be constructed so that the completed concrete structures conform to the shape, lines and dimensions of the members as shown on the Drawings, within tolerances allowed by the Standard Specifications. They shall be properly braced or tied together to maintain position and shape. Forms shall be made sufficiently tight to prevent leakage of mortar. Provide for openings, offsets, recesses, chamfers, blocking, anchorages, inserts and other features required in the work. Provide for thickened slabs where shown or required of proper width and depth and provide required recesses in the slab.
- B. Provide openings in concrete formwork to accommodate work of other trades. Coordinate with all other trades.
- C. Forms and adjacent surfaces to receive concrete to be clean and free of old concrete, grease and debris.
- D. The formwork shall be removed when the concrete is strong enough to withstand any applied forces and permission has been obtained from the Authority.
- E. Form ties shall be non-exposed cone type and shall be spaced as shown on the drawings or as approved by the Authority. All cones shall be filled with concrete after removal of the formwork.
- F. The Contractor is required to use a surveyor to properly locate the formwork, including elevations.
- G. The Contractor shall use smooth surfaced forms with tight joints for any concrete work that will remain exposed to view, either partially or fully; as determined prior to installation of the forms.

3.03 PLACING REINFORCEMENT

- A. See Section 03 20 00, Concrete Reinforcement. Reinforcement to be clean and free of rust, scale, dirt, and ice. Accurately position, support, and secure reinforcement. Place reinforcement to maintain minimum coverages for concrete protection. Install bars and welded fabric in longest lengths practicable, lapping at all splices. Offset laps to prevent continuous laps in either direction.
- B. Reinforcement shall have the following minimum cover, unless noted otherwise:
 - 1. Surfaces not formed: 3 inches.
 - 2. Formed surfaces in contact with soil or water: 3 inches.
 - 3. Formed surfaces not in contact with soil or water: 2 inches.
- C. Corner bars matching interior and exterior wall face horizontal bars shall be provided at all wall intersections. See drawings.
- D. All lap splices are to be ACI Standard Class B tension lap splices. Where bars of different sizes lap, provide lap splice length for the larger bar.
- E. Where dowels are indicated but not sized, provide dowels that match size and location of main reinforcement and lap splice with the main reinforcement.

- F. Grouted reinforcing anchors shall be Hilti HY-150 Max. Adhesive or an equal system approved by the Authority.
- G. The Contractor is to notify the Authority when reinforcement bars are installed. Placement of concrete shall not commence until the Authority has inspected and approved the reinforcement placement.

3.04 JOINTS

- A. Construction Joints: Locate and install construction joints as shown on the drawings or so they do not impair the strength or appearance of the structure, as acceptable to the Authority.
- B. Provide keyways at least 1-1/2 inches deep in construction joints between walls and footings. Bulkheads designed and accepted for this purpose may be used for slabs.
- C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.
- D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- E. Isolation joints between new concrete and existing concrete, shall be filled with a premolded joint filler and sealing compound.
- F. Only those construction joints shown on the drawings will be allowed unless approved otherwise by the Authority.

3.05 EXPANSION JOINTS

- A. Provide expansion joints at all intersections with other slabs, at existing elements, vertical surfaces, at abutments with other structures, and at other locations where indicated or required. Expansion joints to be 3/4" unless noted otherwise. Expansion joints to be continuous and for the full depth of the concrete except for space for sealant.

3.06 ISOLATION JOINTS

- A. Provide isolation joints where shown or required. Isolation joints to be 1/2" unless noted otherwise. Isolation joints to be continuous and for the full depth of the concrete except for a 1/4" space for sealant.

3.07 WATERSTOPS

- A. Install waterstops where shown or required to form a continuous diaphragm. Install in longest lengths practical. Support and protect exposed waterstops during progress of the work. Field fabricate joints in waterstops by sealing according to manufacturer's written instructions.
- B. Waterstops shall be secured in place by splitting the concrete form. The center bulb shall be centered in the joint. While concrete is being placed the concrete shall be thoroughly vibrated to insure complete embedment of the ribbed flanges.

3.08 VAPOR RETARDER

- A. Place vapor retarder under concrete slabs and other at- or below-grade applications. Use

largest available sheets. Overlap edges and seal as recommended by manufacturer.

3.09 INSTALLING EMBEDDED ITEMS

- A. General: Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.
- B. All exposed concrete corners shall be broken with a 3/4" x 3/4" chamfer or should match existing or adjacent work.
- C. Place steel plates, angles, anchor bolts, plate and nelson stud assemblies, etc. as shown into concrete before it sets. Position embedded anchor bolts using templates.
- D. Unless otherwise shown or approved, conduits and pipes embedded within a slab, wall or beam shall have a maximum outside dimension no greater than one third the overall thickness of the slab, wall or beam; and spacing shall be greater than or equal to three diameters or widths on center.
- E. Provide continuous water stops at each construction joint of any concrete element exposed to soil or water below grade. Provide a 1 1/2 inch by 3 1/2 inch continuous key at each joint requiring water stops.
- F. Electrical and communication conduits shall not be placed in concrete without prior approval by the Authority.

3.10 PREPARING FORM SURFACES

- A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.
- B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.
- C. All exposed concrete edges shall have a 3/4 inch chamfer.

3.11 MEASURING MATERIALS

- A. Concrete shall be composed of portland cement, fine aggregate, coarse aggregate, water and admixtures as specified and shall be produced by a concrete mixing plant acceptable to the Authority. All constituents, including admixtures, shall be batched at the plant.
- B. Measure materials for batching concrete by weighing in conformity with and within the tolerances given in ASTM C94 except as otherwise specified.
- C. Measure the amount of free water in fine aggregates within 0.3 percent with a moisture meter. Compensate for varying moisture contents of fine aggregates. Record the number of gallons of water as-batched on printed batching tickets.

3.12 MIXING AND TRANSPORTING

- A. Concrete shall be ready-mixed concrete; no hand-mixing will be permitted. Clean each transit mix truck drum and reverse drum rotation before the truck proceeds under the batching plant. Equip each transit-mix truck with a continuous, nonreversible, revolution counter showing the number of revolutions at mixing speeds.

- B. Ready-mix concrete shall be transported to the site in watertight agitator or mixer trucks loaded not in excess of their rated capacities as stated on the name plate.
- C. Keep the water tank valve on each transit truck locked at all times. Any addition of water must be directed by the Authority. Added water shall be incorporated by additional mixing of at least 35 revolutions. All added water shall be metered and the amount of water added shall be shown on each delivery ticket.
- D. All central plant and rolling stock equipment and methods shall comply with ACI 318 and ASTM C94.
- E. Select equipment of size and design to ensure continuous flow of concrete at the delivery end. Metal or metal-lined non-aluminum discharge chutes shall be used and shall have slopes not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20 feet long and chutes not meeting slope requirements may be used if concrete is discharged into a hopper before distribution.
- F. Retempering (mixing with or without additional cement, aggregate, or water) of concrete or mortar which has reached initial set will not be permitted.
- G. Handle concrete from mixer to placement as quickly as practicable while providing concrete of required quality in the placement area. Dispatch trucks from the batching plant so they arrive at the work site just before the concrete is required, thus avoiding excessive mixing of concrete while waiting or delays in placing successive layers of concrete in the forms.
- H. Furnish a delivery ticket for ready mixed concrete to the Authority as each truck arrives. Each ticket shall provide a printed record of the weight of cement and each aggregate as batched individually. Use the type of indicator that returns to zero after a batch is discharged. Clearly indicate the weight of fine and coarse aggregate, cement and water in each batch, the quantity delivered, the time any water is added, and the numerical sequence of the delivery. Show the time of day batched and time of discharge from the truck. Indicate the number of revolutions of the truck mixer.
- I. Temperature and Mixing Time Control:
 - 1. In cold weather, do not allow the as-mixed temperature of the concrete and concrete temperatures at the time of placement in the forms to drop below 40 degrees F.
 - 2. If water or aggregate has been heated, combine water with aggregate in the mixer before cement is added. Do not add cement to mixtures of water and aggregate when the temperature of the mixture is greater than 90 degrees F.
 - 3. In hot weather, cool ingredients before mixing to maintain temperature of the concrete below the maximum placing temperature of 90 degrees F. If necessary, substitute well-crushed ice for all or part of the mixing water.
- J. The maximum time interval between the addition of mixing water and/or cement to the batch and the placing of concrete in the forms with concrete agitated shall not exceed the following:
 - 1. If the air or concrete temperature (whichever is higher) is between 80 to 90 Degree F, the maximum time shall not exceed 45 minutes.
 - 2. If the air or concrete temperature (whichever is higher) is between 70 to 79 Degree F, the maximum time shall not exceed 60 minutes.
 - 3. If the air or concrete temperature (whichever is higher) is between 40 to 69 Degree F, the maximum time shall not exceed 90 minutes.

If an approved high-range water-reducer (plasticizer) is used to produce plasticized concrete, the maximum time interval shall not exceed 90 minutes.

- K. Concrete Stain: Apply concrete stain to installed cured concrete according to manufacturer's written instructions for areas to receive stained concrete. Verify locations for color concrete. Concrete to be stained to be clean, dry and cured. Mix stain and apply as directed by manufacturer. Follow manufacturer's recommendations for installation

3.13 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. No concrete shall be placed without 24-hour advance notice to the Authority nor before the formwork and setting of reinforcement has been inspected and approved by the Authority.
- C. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.
- D. Verify that all formwork completely encloses concrete to be placed and is securely braced prior to concrete placement. Remove ice, excess water, dirt and other foreign materials from forms and exposed concrete joints. Voids in sleeves, inserts, etc., shall be filled temporarily with readily removable material to prevent entry of concrete. Confirm that reinforcement and other embedded items are securely in place. Have a competent workman at the location of the placement who can assure that reinforcing steel and embedded items remain in designated locations while concrete is being placed. Sprinkle semi-porous subgrades or forms to eliminate suction of water from the mix. Seal extremely porous subgrades in an approved manner.
- E. Deposit concrete as near its final position as possible to avoid segregation due to rehandling or flowing. Place concrete continuously at a rate which ensures the concrete is being integrated with fresh plastic concrete. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials or on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within the section. If the section cannot be placed continuously, place construction joints as specified or as approved.
- F. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
 - 1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.
 - 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.

- G. Consolidate concrete by mechanical vibration, puddling, spading, rodding or forking so that concrete is thoroughly worked around reinforcement, embedded items and openings and into corners of forms. Puddling, spading etc. shall be continuously performed along with vibration of the placement to eliminate air or stone pockets which may cause honeycombing, pitting or planes of weakness.
- H. Vibrators are to be used to consolidate properly placed concrete but shall not be used to move or transport concrete in the forms. Vibration shall continue until:
 - 1. Frequency returns to normal.
 - 2. Surface appears liquefied, flattened and glistening.
 - 3. Trapped air ceases to rise.
 - 4. Coarse aggregate has blended into surface, but has not disappeared.
- I. Pumping of concrete will be permitted. Use a mix design and aggregate sizes suitable for pumping and submit for approval.
- J. Remove temporary spreaders from forms when the spreader is no longer useful. Temporary spreaders may remain embedded in concrete only when made of galvanized metal or concrete and if prior approval has been obtained.
- K. Do not place concrete for supported elements until concrete previously placed in the supporting element (columns, slabs and/or walls) has reached adequate strength.
- L. Where surface mortar is to form the base of a finish, especially surfaces designated to be painted, work coarse aggregate back from forms with a suitable tool to bring the full surface of the mortar against the form. Prevent the formation of excessive surface voids.
- K. All exposed concrete edges shall have a $\frac{3}{4}$ inch chamfer.
- M. Provide concrete footings, walls, slabs, steps, pits, thickened slabs, piers for light poles and bollards, and other concrete installations as shown on the drawings. Form and provide for pockets for rails, trench drains, and drop concrete at doors as shown on the drawings. Provide dowels where new concrete meets existing as detailed on the drawings.

3.14 COLD WEATHER CONCRETING:

- A. "Cold weather" is defined as a period when for more than 3 successive days, the average daily outdoor temperature drops below 40 degrees F. The average daily temperature shall be calculated as the average of the highest and the lowest temperature during the period from midnight to midnight.
- B. Cold weather concreting shall conform to ACI 306.1 and with the applicable provisions of the Standard Specifications. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
- C. Discuss a cold weather work plan with the Authority. The discussion shall encompass the methods and procedures proposed for use during cold weather including the production, transportation, placement, protection, curing and temperature monitoring of the concrete. The procedures to be implemented upon abrupt changes in weather conditions or equipment failures shall also be discussed. Cold weather concreting shall not begin until the work plan is acceptable to the Authority.
- D. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture

temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.

1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
- E. During periods of cold weather, concrete shall be protected to provide continuous warm, moist curing (with supplementary heat when required) for a total of at least 350 degree-days of curing.
1. Degree-days are defined as the total number of 24 hour periods multiplied by the weighted average daily air temperature at the surface of the concrete (e.g., 5 days at an average 70 degrees F = 350 degree-days).
 2. To calculate the weighted average daily air temperature, sum hourly measurements of the air temperature in the shade at the surface of the concrete taking any measurement less than 50 degrees F as 0 degrees F. Divide the sum thus calculated by 24 to obtain the weighted average temperature for that day.
- F. Salt, manure or other chemicals shall not be used for protection.
- G. The protection period for concrete being water cured shall not be terminated during cold weather until at least 24 hours after water curing has been terminated.

3.15 HOT WEATHER CONCRETING

- A. "Hot weather" is defined as any combination of high air temperatures, low relative humidity and wind velocity which produces a rate of evaporation estimated in accordance with ACI 305R, approaching or exceeding 0.2 lbs/sqft/hr.
- B. Concrete placed during hot weather, shall be batched, delivered, placed, cured and protected in compliance with the recommendations of ACI 305 and the additional requirements specified herein.
- C. Temperature of concrete being placed shall not exceed 90 degrees F and every effort shall be made to maintain a uniform concrete mix temperature below this level. The temperature of the concrete shall be such that it will cause no difficulties from loss of slump, flash set or cold joints.
- D. All necessary precautions shall be taken to promptly deliver, to promptly place the concrete upon its arrival at the site and to provide vibration immediately after placement.
- E. The Authority may direct the Contractor to immediately cover plastic concrete with sheet material.
- F. Discuss with the Authority a work plan describing the methods and procedures proposed to use for concrete placement and curing during hot weather periods. Hot weather concreting shall not begin until the work plan is acceptable to the Authority.
- G. Hot-Weather Placement:
1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
 3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
 4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Authority.
- H. Do not apply unbalanced loads, such as hydrostatic pressure or backfill against structural components until the concrete has attained its design strength.

3.16 CONCRETE STAIRS

- A. Pitch stair treads and landings for drainage purposes. Use minimum slope of 0.1% without reducing the thickness of the stair slabs and landings.

3.17 SLABS

- A. After suitable bulkheads, screeds and jointing materials have been positioned, the concrete shall be placed continuously between construction joints beginning at a bulkhead, edge form, or corner. Each batch shall be placed into the edge of the previously placed concrete to avoid stone pockets and segregation.
- B. Avoid delays in casting. If there is a delay in casting, the concrete placed after the delay shall be thoroughly spaded and consolidated at the edge of that previously placed to avoid cold joints. Concrete shall then be brought to correct level and struck off with a straightedge. Bullfloats or darbies shall be used to smooth the surface, leaving it free of humps or hollows.
- C. Provide tape or other approved means to separate between concrete slab that is to be stained and concrete slab that is to remain natural. Lay out straight and even joints. Verify and set dimensions and locations for extent of stained concrete.
- D. All new slabs shall be placed on minimum 6" engineered fill compacted to 95% relative density.

3.18 DOWELS BETWEEN NEW CONCRETE AND EXISTING CONCRETE

- A. At joint between new concrete slab and existing concrete, provide and install the following, unless noted otherwise:
1. Provide a $\frac{3}{4}$ " pre-formed joint filler entire joint including polysulfide sealant at top.
 2. Provide $\frac{1}{2}$ " in diameter 18" long smooth dowels 12" o.c.; drill and grout 9" into existing concrete and extend 9" into new slab.

3.19 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction.
- B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete. Repair and patch defective areas with fins and other projections completely removed and smoothed.

3.20 MONOLITHIC SLAB FINISHES

- A. Unless noted otherwise, concrete slabs to be 6" thick and reinforced with wire mesh. Provide vapor barrier under slab unless indicated otherwise.
- B. Pitch slabs to drains where drains are indicated without reducing the thickness of the slab. Minimum slope is 0.1%. Provide recesses or drop top of slab as required for finish floor materials. Verify locations.
- C. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified.
 - 3. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared and concrete has sufficiently stiffened. Finish surfaces to tolerances of F(F) 18 (floor flatness) and F(L) 15 (floor levelness) measured according to ASTM E 1155. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
- D. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view.
 - 1. After floating, begin troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces to tolerances of F(F) 20 (floor flatness) and F(L) 17 (floor levelness) measured according to ASTM E 1155. Grind smooth any surface defects.
- E. Nonslip Broom Finish: Apply a nonslip broom finish to concrete stair treads, ramps and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route.
- F. Sawing of control joints shall commence as soon as the concrete has hardened sufficiently to permit sawing without excessive raveling. All joints shall be one inch deep and sawed to the length shown on the drawing before uncontrolled shrinkage cracking takes place.

3.21 CONCRETE CURING AND PROTECTION

- A. Curing shall be in accordance with the applicable portions of Section 1020.13 of the IDOT Standard Specifications. Concrete placed in foundations shall have cured at least 14 days before structure load is placed on the concrete.
- B. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material.
- C. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
- D. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.
 - 1. Moisture Curing: Provide moisture curing by continuous water-fog spray or cover concrete surface with approved absorptive cover and thoroughly saturate cover with water. Begin wet cure as soon as concrete attains an initial set and maintain wet cure 24 hours a day.
 - 2. Sheet Material Curing: Cover entire surface with sheet material. Securely anchor

- sheeting to prevent wind and air from lifting the sheeting or entrapping air under the sheet. Place and secure sheet as soon as initial concrete set occurs.
3. Liquid Membrane Curing: Apply over the entire concrete surface except for surfaces to receive additional concrete. Curing compound shall NOT be placed on any concrete surface where additional concrete is to be placed, where concrete sealers or surface coatings are to be used, or where the concrete finish requires an integral floor product. Curing compound shall be applied as soon as the free water on the surface has disappeared and no water sheen is visible, but not after the concrete is dry or when the curing compound can be absorbed into the concrete. Application shall be in compliance with the manufacturer's recommendations. Apply curing compound on exposed interior slabs and on exterior slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation according to manufacturer's directions.

E. Specified applications of curing methods.

1. Slabs for Water Containment Structures and Chemical Spill Basins: Water curing only.
2. Slabs on Grade and Footings (not used to contain water): Water curing, sheet material curing or liquid membrane curing.
3. Structural Slabs (other than water containment): Water curing or liquid membrane curing.
4. Horizontal Surfaces which will Receive Additional Concrete, Coatings, Grout or Other Material that Requires Bond to the Substrate: Water curing.
5. Formed Surfaces: None if nonabsorbent forms are left in place 7 days. Water cure if absorbent forms are used. Sheet cure or liquid membrane cure if forms are removed prior to 7 days. Exposed horizontal surfaces of formed walls or columns shall be water cured for 7 days or until next placement of concrete is made.
6. Concrete Joints: Water cured or sheet material cured.

F. Finished surfaces and slabs shall be protected from the direct rays of the sun to prevent checking and crazing.

G. The Contractor shall provide all necessary measures to prevent any water, frost or ice from penetrating the concrete prior to and after placement of concrete and until the concrete has obtained required strength.

3.22 REMOVING FORMS

- A. General: Formwork not supporting weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.
- B. Forms shall not be removed before the concrete has attained a strength of at least 30 percent of its specified design strength. Shores shall not be removed until the concrete has attained at least 60 percent of its specified design strength and also sufficient strength to support safely its own weight and construction live loads.

3.23 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Authority.
- B. The external surface of all concrete shall be thoroughly worked during the operations of

placing in such a manner as to work the mortar against the forms to produce a smooth finish free of honeycombs and with a minimum of water and air pockets.

- C. Depressions resulting from the removal of ties, and holes left by attachments to rod or bolt anchorages, shall be carefully and neatly pointed with a mortar of sand and cement mixed in the proportions used in the concrete.
- D. Air pockets or rough areas larger than 1/2 inch diameter occurring in any surface shall be pointed as specified in the foregoing paragraph. Honeycombed areas shall be chipped out by the Contractor and inspected by the Authority before being pointed. Pointed areas mentioned in this paragraph shall then be given a normal finish in accordance with the requirements of the Standard Specifications.
- E. As soon as the forms have been stripped and the concrete surfaces exposed, fins and other projections shall be removed; clean all exposed concrete surfaces and adjoining work stained by leakage of concrete, to approval of the Authority.
- F. When patching defects in exposed surfaces the same source of cement and sand as used in the parent concrete shall be employed. Adjust color if necessary by addition of proper amounts of white cement. Rub lightly with a fine Carborundum stone at an age of 1 to 5 days if necessary to bring the surface down with the parent concrete. Exercise care to avoid damaging or staining the virgin skin of the surrounding parent concrete. Wash thoroughly to remove all rubbed matter.

3.24 CONCRETE TOPPING

- A. Provide mix and color of concrete as directed, selected and approved. Color must match color selected and be uniform for the entire project and the entire thickness of the topping.
- B. Concrete slab to be covered with topping to be clean and dry. Surface of base slab to be rough or have a scratch surface for better bonding of topping.
- C. Apply bonding agent to base slab according to bonding agent's manufacturer's recommendations and directions. Apply bonding agent to any vertical surfaces that topping will abut and surfaces where topping is placed against hardened or partially hardened topping.
- D. Provide and install wire mesh reinforcing in concrete topping slab as shown or required. Provide type and sizes of mesh and wire size as shown or required. Provide proper concrete cover, overlap ends as required and secure into place to avoid displacement during pouring operations.
- E. Install concrete topping slab to limits indicated by lowered base slab. Float finish topping slab and trowel to a smooth, uniform, level finish and to the correct height. Finish surfaces to overall values of flatness of 25 and levelness of 20.
- F. Construct joints true to line with faces perpendicular to surface plane of topping.
- G. Form weakened-plane contraction joints with power saws, 1/8" wide, when cutting action will not tear, abrade, or otherwise damage surface and before topping develops random contraction cracks.
- H. Form joints in topping over contraction joints in base slabs, unless otherwise indicated. Provide joints in both directions as recommended to eliminate surface cracking.
 - 1. Construct contraction joints for a depth equal to one-half of topping thickness.
 - 2. Joints to be straight and parallel. Follow pattern shown on drawings or as otherwise

dictated. Align with column lines or other structure elements. Do not exceed 15'-0" spacing in either direction for contraction joints.

- I. Protect freshly placed topping from premature drying and excessive cold or hot temperatures.
- J. Begin curing immediately after finishing topping, using one of the methods indicated above for curing other concrete: moisture curing, moisture-retaining-cover curing, or curing compound.

3.25 CONCRETE SEALER

- A. All exposed concrete slabs shall receive a coat of concrete sealer meeting requirements of IDOT Standard Specifications Article 1026, Concrete Sealer.
- B. Penetrating Liquid Floor Treatment: Prepare, apply and finish penetrating liquid floor treatment according to manufacturer's written instructions. Apply to all concrete floor slabs. Apply after concrete has been stained, where applicable, and stain has fully dried.
 - 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 - 2. Do not apply to concrete that is less than seven days old.
 - 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry.
 - 4. Apply a second coat in a similar manner for floors to remain exposed or if the surface is rough or porous.

3.26 SURFACE TREATMENT

- A. Exposed concrete walls shall receive a coat of concrete sealer. Apply according to manufacturer's directions and recommendations.
- B. Provide slip resistant polymer overlay for new concrete slab. Install as recommended by and directed by the manufacturer.

3.27 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. The Contractor will employ and pay for a testing laboratory to obtain sets of field control cylinder specimens during the progress of the work in compliance with ASTM C31, to perform tests and to submit test reports as directed by the Authority. See Section 01_45_80, Testing and Inspection Service. The number of sets of concrete test cylinders taken of each class of concrete placed each day shall not be less than one set per day, nor less than one set for each 150 cu yds of concrete nor less than one set for each 5,000 sq ft of surface area for slabs or walls.
 - 1. A "set" of test cylinders consists of four cylinders: one to be tested at 7 days and two to be tested and their strengths averaged at 28 days. The fourth may be used for a special test at 3 days or to verify strength after 28 days if 28-day test results are low.
 - 2. When the average 28-day compressive strength of the cylinders in any set falls below the specified design strength or below proportional minimum 7-day strengths (where proper relation between seven and 28-day strengths have been established by tests), proportions, water content, or temperature conditions shall be changed to achieve the required strengths.
- B. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
 - 1. Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed. If the

- slump is outside the specified range, the concrete shall be rejected.
2. Air Content: Test for air content shall be made daily on fresh concrete samples using test method ASTM C 173, volumetric method for lightweight or normal weight concrete or ASTM C 231, pressure method for normal weight concrete.
 3. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
 4. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
 5. Compressive-Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yd. plus additional sets for each 50 cu. yd. more than the first 25 cu. yd. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
 6. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the concrete.
 7. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.
- C. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Authority. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.
- D. Should the strengths shown by the test specimens made and tested in compliance with the previous provisions fall below the required strengths, the Authority shall have the right to require changes in proportions outlined to apply to the remainder of the work. Furthermore, the Authority shall have the right to require additional curing on those portions of the structure represented by the test specimens which failed. The cost of such additional curing shall be at the Contractor's expense. In the event that such additional curing does not give the strength required, as evidenced by core and/or load tests, the Authority shall have the right to require strengthening or replacement of those portions of the structure which fail to develop the required strength. The cost of all such core borings and/or load tests and any strengthening or concrete replacement required because strengths of test specimens are below that specified, shall be entirely at the expense of the Contractor. In such cases of failure to meet strength requirements the Contractor and Authority shall confer to determine what adjustment, if any, can be made in compliance with Sections titled "Strength" and "Failure to Meet Strength Requirements" of ASTM C94. The "purchaser" referred to in ASTM C94 is the Contractor in this Section.
- E. When the tests on control specimens of concrete fall below the specified strength, the Authority will order check tests for strengths to be made by means of typical cores drilled from the structure in compliance with ASTM C42 and C39. In the case of cores not indicating adequate strength, the Authority, in addition to other recourses, may require, at the Contractor's expense, load tests on any one of the concrete structures in which such concrete was used. Tests need not be made until concrete has aged 60 days.
- F. Compression Test Reports: In addition to reporting as outlined in ASTM C39, present the following data in tabular form and distribute after recording test results:
1. Identity of project, Contractor, supplier.
 2. Identity of mix and required strength.
 3. Pour location of sampled concrete.
 4. Slump, air content, truck number, time and date sampled, air temperature, concrete temperature, consistency.

5. Curing history.
 6. Date tested.
 7. Compressive strength.
 8. Type of fracture.
 9. Compliance with specification.
- G. At the Authority's direction, concrete shown by test not to meet the specified strength requirements shall be removed and replaced at no additional cost to the Authority.

END OF SECTION

SECTION 051030
STRUCTURAL STEEL

PART 1 GENERAL**1.01 RELATED DOCUMENTS**

- A. Drawings and Division 01 Specification sections, apply to this section.

1.02 SUMMARY

- A. This Section specifies requirements for structural steel used in the project including columns, beams, canopy and roof framing, framing for new stair opening, framing for elevator shaft, framing for escalator opening and support, etc. This work includes furnishing all labor, materials, accessories, tools and equipment required to furnish and install all structural steel including, but not limited to, fabrication, galvanizing, field erection, field preparation for painting and any other work required for a complete project.
- B. Unless noted otherwise, all new structural steel shall be galvanized. New structural steel exposed after installation shall also be coated with protective and finish coats in the field. Existing structural steel shall be field prepared and cleaned and also coated with protective and finish coats in the field.

1.03 STANDARDS

- A. The structural steel work required herein, including details, fabrication and erection, except as otherwise shown, shall comply with the provisions of the following codes, specifications and standards:
- B. "Code of Standard Practice of Steel Buildings and Bridges", AISC.
- C. "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings", AISC.
- D. All welding, inspection of welds, and testing of welds shall follow "Structural Welding Code", AWS D1.1.
- E. "Specifications for Assembly of Structural Joints Using High Strength Steel Bolts" as approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.
- F. "Handbook on Bolt, Nut and Rivet Standards", Industrial Fasteners Institute.

1.04 QUALITY ASSURANCE

- A. The Contractor is solely responsible for quality control of all the structural steel work. The Contractor shall employ, at his own expense, a qualified independent testing laboratory to conduct specified Source Quality Control and Field Quality Control and provide reports to the Authority. Information regarding the testing agency shall be submitted to the Authority for approval prior to being hired by the Contractor.
- B. Contractor shall comply with all applicable governmental codes and regulations.
- C. Structural Welding Qualification: Weld Procedures and Welding Operators shall be qualified in accordance with ANSI/AWS D1.1, using the same type of equipment and welds to be used in the work.
1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

- D. Galvanize Coating Applicator's Qualifications: Company specializing in hot dip galvanizing after fabrication and following the procedures of "Quality Assurance Manual" of the American Galvanizers Association.

1.05 TESTING

- A. The testing agency to inspect all bolted connections and welds as well as perform all other required tests.
- B. The Contractor shall employ AISC Category III Fabricator's Testing Laboratory, in addition to the requirements of the Contractor's Quality Control Plan. Reports and test results shall be supplied for the inspections and tests listed in this specification.
- C. Bolted connections shall be inspected by the Testing Agency in accordance with AISC Specifications for "Structural Joints Using ASTM A 325 or A 490 Bolts".
- D. Welding is to be inspected and tested by an independent Testing Agency. The welding shall be inspected and tested by the Testing Agency during fabrication and erection of the structural steel.
 - 1. Certify all welders and make inspections and tests as required. Record types and locations of all defects found in the work, and measures required and performed to correct such defects.
 - 2. In addition to visual inspection of all welds, magnetic particle, ultra-sonic and radio-graphic inspection shall be made of all welds. Magnetic particle inspection shall be made on the root pass and finished weld.
 - 3. The method of magnetic particle inspection shall be in accordance with ASTM E-709. Any type of crack or zone of incomplete fusion or penetration will not be acceptable.
 - 4. Radio-graphic inspection technique and standards of acceptance shall be in accordance with AWS D1.1.
 - 5. Ultra-sonic inspection shall be performed in accordance with AWS D1.1.
- E. Each bolting crew and welder shall be assigned an identifying symbol or mark and all shop and field connections shall be so identified that the inspector can refer back to the crew or person making the connection.
- F. Access to locations where material for this contract is being fabricated or produced shall be provided for the purpose of inspection and testing, including scaffolding.
- G. The Authority may inspect structural steel at the plant before shipment; however, the Authority reserves the right to reject any material, at any time before final acceptance, which does not conform to all of the requirements of the drawings and specifications.
- H. The Testing Agency shall perform the specified tests. The Testing Agency shall be independent, hired by the Contractor, approved by the Authority and paid for by the Contractor. Corrective measures, including additional and more complete testing, which may result from these tests shall be the Contractor's responsibility; all costs of which shall be paid for by the Contractor.
- I. Approved shop drawings are to be submitted to the galvanizer for his review and approval.

1.06 SUBMITTALS

- A. Shop Drawings: Submit to the Authority in accordance with the requirements of the Submittal Section of these specifications, the following:
 - 1. Complete details and schedules for the fabrication of each member, and for shop assembly of members, including connections.

2. Complete details, schedules, procedures and diagrams showing the sequence of erection.
 3. Complete shop drawings to indicate actual field-verified dimensions, elevations and details for all structural steel for this project. Shop drawings to be prepared and certified by a structural engineer licensed in the State of Illinois. Shop drawings to identify the size, location and erection details of all structural steel, connections, and all other details.
- B. Structural Calculations: Prior to fabrication of steel, furnish structural calculations with connection detail drawings for all structural steel and connections for the actual loading and conditions. Calculations shall be prepared by and sealed by the licensed structural engineer.
- C. Manufacturer's Literature: Submit to the Authority, copies of manufacturer's specifications and installation instructions for the products being supplied as well as for the welding, galvanizing, and any shop applied coats of paint; including laboratory test reports and such other data as may be required to show compliance with these specifications and specified standards.
- D. Surveys: If applicable, submit to the Authority, copies of certified survey(s) by the Contractor's registered professional engineer, showing elevations and locations of base plates and anchor bolts to receive structural steel, and showing final elevations and locations for all major members.
- E. Mill Affidavits and Certifications: Prior to fabrication of Structural Steel, the Contractor shall submit to the Authority the following certified reports for the steel for the permanent structure:
1. Mill heat analysis of chemical composition.
 2. Tension, bend and notch toughness test reports.
 3. Mill certification that all supplementary requirements have been complied with.
 4. Certification that bolts meet all ASTM requirements for the grade specified.
- F. Submit weld procedures and qualifications for approval prior to fabrication.
- G. Provide certification from the galvanizer indicating that he has reviewed the approved shop drawings and certifies that he is capable of hot dip galvanizing all members and fabrications according to all requirements.
- H. Submit to the Authority for approval all proposed galvanizing repair work, including materials and methods.

1.07 PRODUCT HANDLING

- A. Do not deliver material to the project site until the proposed method and sequence of erection has been reviewed by the Authority. Method and sequence shall be planned so as to avoid delay or damage to the work of other trades.
- B. Storage of fabricated steel at the job site shall be the responsibility of the Contractor. Material stored at the job site shall not exceed design loads on existing or newly-constructed structures so that members will not be distorted or otherwise damaged; and shall be protected against corrosion or deterioration.

PART 2 PRODUCTS

2.01 STRUCTURAL STEEL

- A. Structural steel including beams, columns, angles, channels, plates, etc. shall comply with the provisions of the ASTM specifications for A 36 material unless noted otherwise on the Drawings.
- B. Structural steel tubes shall comply with ASTM A 500 Grade B.

- C. Provide and install all miscellaneous structural steel members required for this project including lintels, leveling, plates, base plates, setting plates, etc.
- 2.02 WELDING ELECTRODES
- A. Welding electrodes shall comply with the provisions of AWS specifications A 5.1, A 5.5, A 5.17, A 5.18, and A 5.20. Weld electrodes shall be E70XX unless required otherwise.
- 2.03 BOLTS
- A. All high strength bolts, nuts and washers shall comply with the provision of ASTM A 325.
 - B. All anchor bolts, nuts and washers shall conform to the requirements of ASTM F 1554, GR 36.
- 2.04 GALVANIZING, SHOP PRIMING AND FINISHING
- A. All new structural steel members and fabrications to be hot dip galvanized conforming to ASTM A123. Galvanized steel exposed to view after installation shall also be finished with protective and finish coats in the field. See painting section of these specifications.
 - B. Existing structural steel members and fabrications will be prepared and field finished with protective and finish coats according to painting section of these specifications.
 - C. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds and abraded areas in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, complying with DOD-P-21035 or SSPC-Paint-20.
- 2.05 MISCELLANEOUS MATERIAL
- A. Miscellaneous material, accessories, grout, etc. not listed above shall be provided as specified hereinafter under the various items of work and/or as indicated on the drawings, or required for a complete structure according to specified standards.
 - B. Provide supplemental structural steel support framing for metal deck where normal deck bearing is precluded by other framing members and around openings.

PART 3 EXECUTION

3.01 GENERAL

- A. Contractor must verify all dimensions and conditions in the field prior to fabricating and erecting structural steel. Notify the Authority of any major discrepancies.
- B. Field modification of structural steel is prohibited without prior written approval of the Authority.

3.02 FABRICATION

- A. Material shall be properly marked and match-marked where field assembly is required. The sequence of shipments shall be such as to expedite erection and minimize the field handling of material.
- B. Fabricate and assemble structural steel in shop to greatest extent possible. Assemblies shall conform to the dimensions shown on the approved shop drawings.
- C. Beams shall be cambered where indicated on the Drawings.

- D. Beam connections shall be as shown or noted on the Drawings. Unless noted otherwise, standard connections shall be used.
- E. No combination of bolts and welds shall be used for stress transmission in the same face of any connection.
- F. Holes: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on shop drawings.
 - 1. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning; ream holes that must be enlarged to admit bolts. Drill holes in bearing plates.
 - 2. Weld threaded nuts to framing and other specialty items as indicated to receive other work.

3.03 WELDING

- A. Welding, filler metal, welding techniques and procedures shall be in accordance with AISC specification for the "Design, Fabrication and Erection of Structural Steel for Buildings", and AWS "Structural Welding Code" and "Filler Metal Specifications".
- B. Welding processes other than shielded metal arc and submerged arc may be used provided procedure qualification tests in accordance with the American Welding Society are made for the intended application of any such process.
- C. Built-up sections assembled by welding shall be free of warpage and all axes shall have true alignment.
- D. Welds not specified shall be continuous fillet welds, using not less than the minimum fillet as specified by AWS.
- E. All welding sequences shall be such as to reduce the residual stresses due to welding to a minimum value. If high residual stresses are present, stress relieving of joints may be required.
- F. The toughness and notch sensitivity of the steel shall be considered in the formation of all welding procedures to prevent brittle and premature fracture during fabrication and erection.
- G. Welded connections shall be detailed and designed to minimize the accumulation and concentration of thru-thickness strains due to weld shrinkage.

3.04 PREPARATION OF STEEL

- A. Perform all inspections prior to galvanizing or field finishing. For contact surfaces, roughen galvanized surfaces by means of hand wire brushing per ASTM A123. Power wire brushing is not permitted.
- B. All non-galvanized existing structural steel surfaces shall be prepared and cleaned as specified in the painting section of these specifications.
- C. Paint application shall be in accordance with paint manufacturer's printed instructions and recommendations. The fabricator shall submit paint system to be used for approval by the Authority prior to purchasing. All paint products shall be compatible products from the same manufacturer.

3.05 APPLICATION OF GALVANIZING

- A. Galvanize steel members, fabrications, and assemblies to the greatest extent possible after fabrication by the hot dip process in accordance with ASTM A 123. All structural steel

members shall have all pieces attached by welding to the greatest extent possible as shown on drawings before galvanizing. All bolted pieces shall be bolted together after galvanizing. Ream all holes as necessary prior to galvanizing.

- B. Prior to galvanizing, structural steel shall be cleaned of all mill scale, rust, spatter, slag or flux deposit, oil, dirt and other foreign material.
- C. Dip all structural steel members and metal fabrications assuring a sufficient coating of all surfaces, including corners, joints, holes, and other surfaces.
- D. Long steel members and large fabrications too large for a single dip in the galvanizing vat, shall be dipped in two applications to assure all surfaces are thoroughly and fully coated.
- E. Galvanize bolts, nuts and washers and iron and steel hardware components in accordance with ASTM A 153. Oversize components, threads or otherwise allow for additional thickness of galvanizing.
- F. Safeguard products against steel embrittlement in conformance with ASTM A 143.
- G. Handle all articles to be galvanized in such a manner as to avoid any mechanical damage or any distortion.

3.06 GALVANIZING COATING REQUIREMENTS

- A. Coating Weight: Conform with paragraph 5.1 of ASTM A 123, Table 1 of A 767, or Table 1 of ASTM A 153, as applicable.
- B. Surface Finish: Continuous, adherent, as smooth and evenly distributed as possible and free from any defect detrimental to the stated end use of the coated article.
- C. Adhesion: Withstand normal handling consistent with the nature and thickness of the coating and normal use of the article.

3.07 TESTS FOR GALVANIZING

- A. Galvanizer shall inspect the entire galvanized surface to ensure compliance with ASTM requirements.
- B. Inspection and testing of hot dip galvanized coatings shall be done under the guidelines provided in the AGA publication "Inspection of Products Hot Dip Galvanized After Fabrication".
- C. Include visual examination and tests in accordance with ASTM A 123, A 767 or A 153 as applicable to determine the thickness of the zinc coating on the metal surfaces.
- D. Furnish a certificate indicating compliance with ASTM Standards and Specifications herein listed. The certificate must be signed by the galvanizer and contain a detailed description of the material processed as well as information as to the ASTM standard used for the coating.

3.08 PAINTING

- A. See painting section of these specifications.
- B. Perform all inspections prior to finishing.
- C. Galvanized steel is to be prepared per ASTM D6386 for painting.
- D. Metal fabrications may have protective and finish coats installed in the shop if approved by the Authority. Do not provide finish coats to shop or field contact surfaces or within 2" of field welds. See painting section for description of protective and finish coats for steel.

3.09 BENCH MARKS

- A. The Contractor shall employ the services of a registered professional engineer who shall establish permanent bench marks, field check all elevations, of concrete on which structural steel is to be placed and locations of anchor bolts, reporting any discrepancies to the Authority before the work proceeds.

3.10 ERECTION

- A. The Contractor shall be responsible for the accurate setting and leveling of all bearing plates or setting plates. Bearing plates or setting plates shall be leveled on steel wedges or shims unless otherwise detailed.
- B. Furnish templates, where shown, specified or called for on the drawings. Furnish shim plates or developed fills where required to obtain proper fit and alignment.

3.11 ERECTION TOLERANCE

- A. The Contractor alone shall be responsible for the correct fitting of all structural members and for the elevation and alignment of the finished structure. Any adjustments necessary in the steel frame because of discrepancies in elevations and alignment shall be the responsibility of the Contractor.
- B. Unless otherwise noted, individual members of the structure shall be leveled and plumbed to an accuracy of 1 to 500, but not to exceed 1/2" in columns for their full height, except exterior columns and columns adjacent to elevator beams shall be accurate to 1 to 1,000 but not to exceed 1/2" for their full height. All leveling and plumbing shall be done based on the mean operating temperature of the structure. Allowances shall be made for the difference in temperature at time of erection and the mean temperature at which the structure will be when completed and in service.

3.12 CONNECTIONS

- A. Connections between members and corners shall be mitered unless approved otherwise.
- B. No welding or bolting shall be done until as much of the structure as will be stiffened by the welding or bolting has been properly aligned.
- C. Drift pins shall not be used to enlarge unfair holes in main material. Holes that must be enlarged to admit bolts shall be reamed. Burning and drifting may be used to align unfair holes in secondary bracing members only, when acceptable to the Authority.
- D. When high strength bolts or high strength bearing bolts are used, the AISC specifications shall apply including values as noted therein, and installation by either "turn of nut tightening" or with torque wrenches. In using manual torque wrenches, the required torque can be read from the wrench dial. Care should be taken that the wrench is properly calibrated. Nuts shall be in motion when torque is measured. In using power wrenches, follow the recommendations of the wrench manufacturer.

3.13 FIELD ALTERATIONS

- A. Modifications required to structural steel fabrications to facilitate proper installation including cutting, drilling or welding shall be submitted to the Authority for written approval. Provide shop drawings of the proposed modifications certified by a licensed structural engineer.
- B. Repair and touch up galvanizing upon completion of alterations, bolting, welding, etc. of fabrications of existing steel as specified in the painting section.

3.14 SOURCE QUALITY CONTROL

- A. Connection Inspection: Perform 100% visual inspection of bolted and welded connections. Examine the surfaces, size, quality and placement of each connection to verify installation in accordance with Contract documents and approved shop drawings. Measure weld length and profile for 15% of welds, selected at random.
- B. Testing of High-Strength Bolted Connections: Test with calibrated torque wrench on at least 25% of the bolts in each bolted connection, but not less than 2 bolts.
- C. Magnetic Particle Testing of Welds: Test in accordance with ASTM E 709 and include not less than the following items:
 - 1. 20% of continuity plate, end plate, and bracing gusset plate fillet welds, selected at random, final pass only.
 - 2. 100% of tension member fillet welds, e. g. hanger rod connections and other similar connections, root and final passes.
 - 3. 100% of partial penetration welds, e.g. built-up members and other similar members, root and final passes.
 - 4. 100% of built-up member fillet welds in zones of moment connections, root and final passes.
 - 5. 20% of other built-up member fillet welds, selected at random, final pass only.
 - 6. 10% of other miscellaneous fillet welds, selected at random, final pass only.

3.15 FIELD CLEANING, GALVANIZING TOUCH UP AND PAINTING

- A. Field cleaning and painting shall conform to the requirements of the painting section of these specifications, including preparation of existing surfaces, preparation of galvanized surfaces, touch-up of galvanizing and application of prime and finish coats at field welds, bolted connections, abraded areas and other areas of the exposed steel.
- B. Repair of damaged and uncoated areas of galvanized steel shall conform to ASTM A780 and as approved by the Authority.

END OF SECTION

SECTION 07 41 00
METAL ROOF PANELS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes providing all labor, materials, and equipment to provide metal roof panels and accessories of the following types:
1. New preformed pre-finished galvanized metal 1-1/2" profile standing seam roof panels.
 2. Gutters, downspouts, and other accessories.
- B. Related Sections: The following sections contain requirements that relate to this Section:
1. Division 05 Sections for structural steel framing.
 2. Division 05 Section for metal roof deck.
 2. Division 07 Section "Flashing and Sheet Metal".
 3. Division 07 Section "Joint Sealants."

1.03 REFERENCES

- A. American Iron and Steel Institute (AISC): "Specification for the Design of Cold-Formed Steel Structural Members".
- B. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): "Architectural Sheet Metal Manual".
- C. Steel Deck Institute Inc. (SDI): "SDI Design Manual for Composite Decks, Form Decks and Roof Decks".
- D. ASTM A653: Standard Specification for Steel Sheet, Zinc-Coated (galvanized) or Zinc-Iron Alloy-Coated (galvanealed) by the Hot-Dip Process.
- E. ASTM A924: Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

1.04 SYSTEM PERFORMANCE REQUIREMENTS

- A. Design Load and Deflection: Design, fabricate and install component parts so that the completed Work shall withstand inward and outward loading applied normal to the plane of metal roofing panels with deflection not exceeding 1/240 of the clear span between supports.
1. Wind Load 30 PSF.
 2. Snow Load 25 PSF.
 3. Point Load 200 Pounds.
- B. Design Factor of Safety: Design, fabricate and install component parts of Work, including roofing panels and connections, with a factor of safety not less than 1.5, such that failure of any component shall not occur at less than 1.5 times the maximum design load, except where more stringent requirements are specified. Failure is defined as breakage,

component disengagement, or permanent distortion in excess of 0.2% of the span of each member.

- C. Building Movement: Design, fabricate and install the Work to withstand building movements including thermal movements, loading deflections and similar movements. Engineer will furnish specific data on anticipated building movements as may be requested by Contractor.
- D. Thermal Movement: Design, fabricate and install the Work to withstand expansion and contraction forces resulting from a 120°F ambient temperature range of -20°F to +100°F, which may result in exterior metal surface temperature exceeding 180°F.

1.05 SUBMITTALS

- A. Product data including manufacturer's product specifications, standard details, certified product test results, installation instructions, and general recommendations, as applicable to materials and finishes for each component and for total panel system.
- B. Samples for initial selection purposes in form of manufacturer's color charts or chips showing full range of colors, textures, and patterns available for panels with factory-applied finishes.
- C. Samples for verification purposes of roof panels. Provide sample panels 12 inches long by actual panel width, in the profile, style, color, and texture indicated. Including but not limited to trim, sills, ridge pieces, gutters, flashing, clips, fasteners, fillers, closures, and other panel accessories.
- D. Furnish shop drawings for the fabrication and installation of the metal roof panel system. Prepare details at not less than 3" = 1'-0" minimum scale. Include layout plan showing roof panel lengths locations of lap joints between panels. Indicate radius required of panels. Provide shop drawings for all accessories including closure strips, supports, trim, flashing, gutters, downspouts, etc. Indicate field verified dimensions, conditions, and support for new panels. Indicate materials and finishes. Show typical details of the conditions for every member, joint, anchorage and support in the system.
- E. Structural Calculations: Furnish engineering calculations to show that maximum stresses and deflections do not exceed specified performance requirements under full design loading.
- F. Maintenance Manuals: Furnish complete manuals describing the materials, devices, and procedures to be followed in cleaning and maintaining the Work. Include manufacturer's brochures and parts lists describing the actual materials used in the work, including metal alloys, finishes, and major components. Assemble manuals for component parts into single binders identified for each system.

1.06 QUALITY ASSURANCE

- A. Standards: Comply with applicable requirements and details of AISC "Specification for the Design of Cold-Formed Steel Structural Members", SMACNA "Architectural Sheet Metal Manual" and SDI "SDI Design Manual for Composite Decks, Form Decks and Roof Decks".
- B. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances and regulations of Federal, State and Municipal authorities having jurisdiction. Obtain necessary approvals from all such authorities.
- C. Wind Uplift: Provide roof panel system including supports meeting requirements of Underwriters Laboratories, Inc. for Class 90 wind uplift resistance.

- D. Field Measurements: Where possible, prior to fabrication of panels, take field measurements of structure or substrates to receive panel system. Allow for trimming panel units where final dimensions cannot be established prior to fabrication.
- E. Structural Design: Panels must be designed to support snow and wind loads as defined by the local building code for the supports spaced as shown on the Drawings. Deck profile, type, depth, and thickness to be selected to provide superimposed design loads required and as determined using SDI Design Manual No. 30 construction loading criteria. Provide test data or calculations signed by a Structural Engineer, licensed in the state of Illinois.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver panels and other components so they will not be damaged or deformed. Package roof panels for protection against transportation damage including damage to the surface.
- B. Handling: Exercise care in unloading, storing, and erecting roof panels to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weather-tight ventilated covering. Store metal roof panels so that they will not accumulate water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

1.08 WARRANTY

- A. Warranty: Furnish 10 year written warranty from date of final acceptance, signed by the Contractor and Installer, agreeing to repair or replace Work which has leaked or otherwise failed as a result of defects in materials or workmanship. Upon notification of such defects, within the warranty period, make necessary repairs or replacement at the convenience of the Authority.
- B. Factory Finish Warranty: Furnish manufacturer's 20 year written warranty, stating that the factory applied finishes will not develop excessive fading or excessive non-uniformity of color or shade, and will not crack, peel, pit, corrode, or otherwise fail as a result of defects in materials or workmanship within the following defined limits. This warranty shall be in addition to and not a limitation of other rights the Authority may have against the Contractor under the Contract Documents. Upon notification of such defects, within the warranty period, make necessary repairs or replacement at the convenience of the Authority.
 - 1. "Excessive Fading": A change in appearance which is perceptible and objectionable as determined by the Engineer when visually compared with the original color range standards.
 - 2. "Excessive Non-Uniformity": Non-uniform fading to the extent that adjacent panels have a color difference greater than the original acceptable range of color.
 - 3. "Will Not Pit or Otherwise Corrode": No pitting or other type of corrosion, discernible from a distance of 10', resulting from the natural elements in the atmosphere at the project site.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering metal roof panel systems that may be incorporated in the work include but are not limited to the following:

1. Steel Roof Panels:
 - a. AEP-Span.
 - b. Allied Roof System.
 - c. Architectural Panels, Inc.
 - d. ASC Pacific, Inc.
 - e. Atas Aluminum Corp.
 - f. Berridge Manufacturing Co.
 - g. Building Components, Inc.
 - h. Butler Manufacturing Co.
 - i. Centria Architectural Systems.
 - j. Consolidated Systems, Inc.
 - k. Epic Metals Corporation.
 - l. Metal Building Components, Inc. (MBCI).
 - m. Merchant & Evans, Inc.
 - n. Petersen Aluminum Corp.
 - o. Roof Deck Inc.
 - p. United Steel Deck, Inc.
 - q. Vincent Metals.
 - r. Or Approved Equal.

2.02 SHEET MATERIALS

- A. Structural Quality Galvanized Steel Sheet: Hot-dip zinc-coated steel sheet complying with ASTM A 653 with G90 coating complying with ASTM A 924, Grade C or to suit manufacturer's standards. Factory formed to profile indicated pre-finished.

2.03 ROOF PANELS

- A. Standing-seam roof panels: Manufacturer's standard factory-formed lap-seam panel system designed for mechanical attachment of panels to steel deck using concealed fasteners to greatest extent possible. Comply with ASTM E 1514. Form panels of 20-gage zinc-coated steel sheets factory finished after fabrication. Roof panels shall be continuous lengths without lap seams. Provide 1-1/2" deep profile with rib spacing at 7.2" o.c. or as approved by the Authority.
 1. Galvanized and Shop Primed Steel Sheet: ASTM A 653, Structural Steel Grade 33 minimum; ASTM A 924 G90 zinc coating; cleaned, pretreated, and painted in accordance with deck and coating manufacturers' recommendations.
 2. Design Uncoated Steel Thickness: 20 gauge or as required for design loading.
 3. Span Condition: Single Span.
 4. Side laps: Deck shall have full-depth side laps that can be mechanically fastened together.
 5. Edges must be able to receive trim pieces; trim pieces by panel manufacturer.
 6. Rating: UL Classified 90 rated (wind uplift) panel assembly.
 7. Flashing and Trim: 22 ga, galvanized and finished to match panels.
 8. Fasteners: Manufacturer's standard to obtain the required performance, stainless steel, finish to match panels.
- B. Roof Panels:
 1. Primed Steel Sheet: ASTM A 653, Structural Steel Grade 33 minimum; ASTM A 924 G90 zinc coating; cleaned, pretreated, and painted in accordance with panel and coating manufacturers' recommendations.
 3. Texture: Smooth.
 4. Panel Dimension: Manufacturer's standard.
 5. Panel Depth: 2".

6. Panel Type: Continuous dovetail-shaped ribs spaced 6 1/8 inches on center.
 7. Rib Opening at Bottom: 1/2 inch.
 8. Rib Width at Top: 1 1/2 inches.
 9. Panel Cover Width: 24 1/2 inches.
 10. Design Uncoated Steel Thickness: 20 gauge or as required for design loading.
 11. Span Condition: Single Span.
 12. Side laps: Deck shall have full-depth side laps that can be mechanically fastened together.
 13. Edges must be able to receive trim pieces; trim pieces by panel manufacturer.
 14. Rating: UL Classified 90 rated (wind uplift) panel assembly.
 15. Flashing and Trim: 22 ga, galvanized and finished to match panels.
 16. Fasteners: Manufacturer's standard to obtain the required performance, stainless steel, finish to match panels.
- C. Provide all related and required matching trim, closure pieces, ridge pieces, flashing, gutter, downspout and other accessories for a complete roof system. Finish to match roof panels.

2.04 METAL FINISHES

- A. General: Apply coatings either before or after forming and fabricating panels, as required by coating process and as required for maximum coating performance capability. Panels to be pre-finished in the factory.
- B. Protect coating either by application of strippable film or by packing plastic film or other suitable material between panels in a manner to properly protect the finish.
- C. Coating system for metal roof panels:
1. Galvanized Sheet Steel, ASTM A 924.
 2. Fluoropolymer Finish, three coat system, Duragard Plus or approved equal by the Authority:
 - a. Pretreatment: Caustic etch and conversion coating, each followed by water rinse.
 - b. Primer: 0.8 ± 0.05 mil thick.
 - c. Color coat: 0.8 ± 0.05 mil 70 percent "Kynar 500" or 70 percent "Hylar 5000" polyvinylidene fluoride coat (color coat).
 - d. Finish coat: 0.8 ± 0.05 mil 70 percent "Kynar 500" or 70 percent "Hylar 5000" polyvinylidene fluoride (clear coat).
- C. All surfaces to be galvanized. All surfaces exposed to view (top, bottom, and edges) for all panels and accessories to be finished with above specified finish and finish coat over galvanizing. Color(s) for each surface as selected by Authority.

2.05 MISCELLANEOUS MATERIALS

- A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets, self-locking bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Type 300 series stainless steel fasteners.
1. Provide exposed fasteners with heads matching color of roof panel by means of plastic caps or factory-applied coating.
 - a. Provide metal-backed neoprene washers under heads of exposed fasteners bearing on weather side of panels.
 - b. Locate and space exposed fasteners in true vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for

positive seal without rupture of neoprene washer.

- B. Accessories: Except as indicated as work of another specification section, provide pre-finished components required for a complete roof panel system, including trim, sills, ridge pieces, clips, flashing, gutters, louvers, sealants, gaskets, fillers, closure strips, gutters, downspouts and similar items. Accessories as required by manufacturer of roof panel system and as shown on approved shop drawings. Match materials and finishes of panels.
1. Provide metal flashing, closure pieces, trim and other pieces to match panels to provide for water runoff and prevent leakage at changes of direction, angles, joints between panels, where panels meet walls, where panels meet gutters, and other surfaces, and other locations. Detail system and provide accessories for a water tight installation.
 2. Flexible Closure Strips: Closed-cell, self-extinguishing, expanded cellular rubber or cross-linked polyolefin foam flexible closure strips. Cut or pre-mold to match configuration of roofing panels. Provide closure strips where indicated or necessary to ensure weather-tight construction.
 2. Sealing Tape: Pressure-sensitive 100 percent solids polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape.
 3. Joint Sealant: One-part elastomeric polyurethane, polysulfide, or silicone rubber sealant as specified by the building manufacturer. Installation shall comply with requirements of Division 07, Section "Joint Sealers" of these specifications.
 4. Concealed sealants and gaskets: Manufacturer's standard.

2.06 GUTTERS AND DOWNSPOUTS

- A. Fabricate from pre-finished galvanized steel with same type of finish and color as roof panels.
- B. Form sheet metal to profile dimensions indicated, free from distortions and defects detrimental to water-tight system.
1. Seam and seal metal joints except for joints indicated by SMACNA to be welded.
- C. Provide removable debris screens for gutters as indicated, fabricated from frame and 1/4 inch mesh wire cloth of same material used for gutters or approved compatible material. Provide formed sheet metal frame on 4 sides of each screen unit. Length of screen units not to exceed 10 feet.
- D. Provide wire basket type strainers at downspouts as indicated, fabricated from wire and sheet metal of same material used for downspouts or approved compatible material.
- E. Gutter Supports: Straps of same material and finish.
- F. Downspout Supports: Straps of same material and finish.

2.07 PANEL FABRICATION

- A. General: Fabricate and finish roof system panels and accessories at the factory as required to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and dimensional requirements and with structural requirements.
- B. Curved roof panels shall be pre-formed to required radius in single piece full length panels with no seams as indicated on the Drawings. Verify radius in field for each site.

1. Coat all exposed and cut or drilled edges with rust-inhibitive coating system to match existing including galvanizing touch up repair paint and finish paint touch up.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine the areas to receive the Work and the conditions under which the Work would be performed. Contractor shall remedy conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.
- B. Steel deck to be securely installed and clean, ready to receive new metal canopy panels.

3.02 INSTALLATION

- A. General: Comply with manufacturers' instructions and specifications to achieve a watertight installation, as applicable to project conditions and supporting substrates. Anchor panels and other components of the work securely in place, with provisions for thermal and structural movement. Coordinate work with substrate installation.
 1. Field cutting of exterior panels by torch is not permitted.
 2. For panels installed with exposed fasteners, the fasteners are to be pre-finished to match panel finishes.
 3. Provide for drainage by sloping panels as indicated on drawings or as otherwise required.
- B. Align all panel edges for a straight, even line at gutter and roof edge. Fasten trim around openings and similar elements with self-tapping screws.
- C. Fastening: Fasten through material laps. Secure roof panels to metal deck according to fastening schedule, as shown on shop drawings, as recommended by manufacturer, and as required to meet code and wind requirements. Use approved fasteners of type and of sufficient length to penetrate the roof panels and secure the metal roof panels to the structure to meet all requirements.
- D. Install screw fasteners with power tools having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw, threads, or roof panels.
 1. Spacing of fasteners per manufacturer's recommendations for actual conditions and design criteria. Provide fastening along perimeters.
- E. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1 ½ inches. Lap joints to be lapped 2 inches minimum.
- F. Provide weatherproof escutcheons for pipe and conduit penetrating material, if any.
- G. Accessories: Install components as required in manufacturers' instructions for a complete roof panel system.
 1. Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to roof panel manufacturer's written instructions, mechanically fastened to roof panels.
- H. Coordinate installation of sheet metal fascia and other items at roof and as a part of the

metal roof system.

- I. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of roof panels, and support of other work.
- J. Joint Sealers: Install gaskets, joint fillers, and sealants for weatherproof performance of panel systems. Provide types of gaskets, sealants, and fillers indicated or, if not otherwise indicated, types specified by panel manufacturer.
 - 1. Provide weatherseal under ridge cap. Flash and seal roof panels at eave and rake with rubber, neoprene, or other closures to exclude weather.
 - 2. Installation shall comply with requirements of Division 07, Section "Joint Sealers" of these specifications.
- K. Provide sealant tape at lapped joints of ribbed or fluted roof sheets and between roof sheets and protruding equipment, vents, and accessories.
- L. Apply a continuous ribbon of sealant tape to clean, dry surface of the weather side of fastenings on end laps, side laps, at lapped joints of corrugated nesting-type, ribbed or fluted roof panels and elsewhere as needed to make roof sheets weatherproof to driving rains.
- M. Installation Tolerances: Shim and align panel units within installed tolerance of 1/4 inch in 20'-0" on level/plumb/slope and location/line as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.03 CLEANING AND PROTECTION

- A. Damaged Units: Touch-up marred or abraded surfaces. Replace roof panels or accessories and other components of the work that are bent, dented or otherwise have been damaged or have deteriorated beyond successful repair by means of minor repair procedures. Re-solder loose, thin, or leaking joints or connections.
- B. Cleaning: Remove temporary protective coverings and strippable films (if any) as soon as each panel is installed. Upon completion of panel installation, clean finished surfaces as specified by panel manufacturer, and maintain in a clean condition during construction.

END OF SECTION

SECTION 08 80 00
GLASS AND GLAZING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division 01 Specification sections, apply to this section.

1.02 SUMMARY

- A. Extent of glass and glazing work is indicated on drawings and schedules.
- B. Types of work include glass and glazing for:
 - 1. Doors and windows.
 - 2. Windbreaks.
 - 3. Curtain walls and entrances.
 - 4. Elevator enclosures.
 - 5. Kiosk glazing.
 - 6. Skylite or roof glazing.
- C. Provide and install a sacrificial film on both sides of all glazing except skylight and roof glazing.

1.03 RELATED DOCUMENTS

- A. The following sections contain requirements that relate to this section:
 - 1. Division 05 Section "Perforated Metal Panels".
 - 2. Division 07 Section "Joint Sealers".
 - 3. Division 13 Section "Kiosk".

1.04 REFERENCES

- A. ASTM C509 – Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.
- B. ASTM C864 – Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
- C. ASTM C920 – Standard Specification for Elastomeric Joint Sealants.
- D. ASTM C1021 – Standard Practice for Laboratories Engaged in the Testing of Building Sealants.
- E. ASTM C1036 – Standard Specification for Flat Glass.
- F. ASTM C1048 – Standard Specification for Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass.
- G. ASTM C1172 – Standard Specification for Laminated Architectural Flat Glass.
- H. ASTM C1330 – Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.

- I. ASTM D256 – Determining the Izod Pendulum Impact Resistance of Plastics.
- J. ASTM D635 – Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
- K. ASTM D671 – Standard Test Method for Flexural Fatigue of Plastics by Constant-Amplitude of Force.
- L. ASTM D785 -Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials.
- M. ASTM D1003 -Haze and Luminous Transmittance of Transparent Plastics.
- N. ASTM D1044 – Standard Test Method for Resistance of Transparent Plastics to Surface Abrasion.
- O. ASTM E548 – Standard Guide for General Criteria Used for Evaluating Laboratory Competence.
- P. ASTM E773 – Standard Test Method for Accelerated Weathering of Sealed Insulating Glass Units.
- Q. ASTM E774 – Standard Specification for the Classification of the Durability of Sealed Insulating Glass Units.
- R. ASTM E1300 -Standard Practice for Determining Load Resistance of Glass in Buildings.
- S. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: GANA'S "Glazing Manual" and "Laminated Glass Design Guide."
 - 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIRA7, "Sloped Glazing Guidelines."
 - 3. SIGMA Publications: SIGMA TM-3000, "Vertical Glazing Guidelines," and SIGMA TB-3001, "Sloped Glazing Guidelines."

1.05 DEFINITIONS

- A. Interlayer: Space between lites of a laminated-glass unit that is made of Polyvinyl Butyral Interlayer or other approved material.
- B. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
- C. Deterioration of Polycarbonate Sheet Glazing: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than breakage and practices for maintaining and cleaning the material contrary to manufacturer's written instructions. Defects include discoloration, perceptible visual distortion, materially obstructing vision through glazing, and blemishes exceeding

those allowed by referenced polycarbonate sheet glazing standard.

1.06 PERFORMANCE REQUIREMENTS

- A. Provide glass and glazing that has been produced, fabricated and installed to withstand normal thermal movement, wind loading and impact loading (where applicable), without failure including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glass and glazing materials and other defects in construction.
- B. Glass Design: Glass thicknesses indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing project loads and in-service conditions. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
 - 1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300 and to withstand all applicable loading requirements, according to the following requirements:
 - a. Specified Design Wind Loads: 20 psf.
 - b. Specified Design Snow Loads: As indicated, but not less than snow loads applicable to project, required by ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 7, "Snow Loads".
 - c. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
 - 1) Load Duration: 60 seconds or less.
 - d. Probability of Breakage for Sloped Glazing: 1 lite per 1000 for lites set more than 15 degrees off vertical and under wind and snow action.
 - 1) Load Duration: 30 days.
 - e. Maximum Lateral Deflection: For the following types of glass supported on all four edges, provide thicknesses required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch (25 mm) whichever is less.
 - 1) For monolithic-glass lites heat-treated to resist wind loads.
 - 2) For insulating glass.
 - 3) For laminated-glass lites.
- C. Heat-Treated Float Glass: ASTM C1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and conditioned indicated.
 - 1 Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise noted.
 - 2 Provide Kind HS (heat-strengthened) float glass on other than attic stock.
- D. Laminated Glass: ASTM C1172, and complying with other requirements specified and with the following:
 - 1 Interlayer: Polyvinyl Butyral of minimum 6mm thickness with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lites and

- installation.
2. Lamination Process: Laminate lites in autoclave with heat plus pressure. Fabricate laminated glass to produce glass free of foreign substances and air or gas pockets.
- E. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss. Size polycarbonate glazing panels to fit openings specified, allowing for expansion and contraction over the temperature range noted, per the manufacturer's printed instructions.
1. Temperature Change (Range): 120 degrees Fahrenheit (67 degrees Celsius), ambient; 180 degrees Fahrenheit (100 degrees Celsius), material surfaces.
- F. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
1. For laminated-glass lites, properties are based on products of construction indicated.
 2. Center-of Glass U-Values: NFRC 100 methodology using LBL-35298 WINDOW 4.1 computer program, expressed as Btu/ sq.ft. x h x degrees Fahrenheit (W/sq.m x K).
 3. Center-of-Glass Solar Heat Gain Coefficient: NFRC 200 methodology using LBL-35298 WINDOW 4.1 computer program.
 4. Solar Optical Properties: NFRC 300.
- G. Glazing Design: Glazing thicknesses indicated, if any, are minimums. See drawings and/or schedules for thicknesses for specific applications and locations. Also, manufacturer shall provide the proper thickness for each type of glazing material based on the specific application, size of lite, wind and other loads, vibration, local codes and other design factors.
- H. Polycarbonate Design: Sheet polycarbonate glazing panels are to be provided in thicknesses indicated, but not less than thicknesses and in strengths required to meet or exceed the following criteria:
1. Physical Properties:
 - a. Light Transmission: Minimum 88 percent, for clear glass, as tested under ASTM D1003.
 - b. Rockwell Hardness: Values of M70, R118 as tested under ASTM D785.
 - c. Flexural Endurance: Minimum 1000 psi, at 1800 cycles/min., at 73 degrees Fahrenheit, 50 percent RH, per ASTM D671.
 - d. Impact Strength: 12-16 ft-lbs/in., up to 125 mils, notched, as measured under ASTM D256, method A.
 - e. Flame Spread: Less than one (1) inch horizontal burn as tested under ASTM D635.
 - f. Abrasion Resistance: Values to be measured under ASTM D1044 (Z26.1) to yield no more than 4 percent haze with 100 Taber Abrasion Cycles (CS10F).
 2. Panel Sizes: Panels to be provided in single sheets where shown in steel glazing frames, i.e., no joints or breaks within individual panels unless specifically indicated.
 3. Panel Surface Treatments: Provide a combined abrasion/UV-resistant surface treatment such that the manufacturer will provide a 10 year limited warranty against yellowing, breakage, loss of light transmission and coating failure.

1.06 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data for each glazing material and fabricated glass product required, including installation and maintenance instructions.

- B. Samples: Submit, for verification purposes, 12 inch square samples of each type of glazing and interlayer material indicated, and 12 inch long samples of each color required for each type of sealant or gasket exposed to view. Install sealant or gasket sample between two strips of material representative of adjoining framing system in color. Include a sample of each laminated glass product with patterned interlayer as indicated, with opaque interlayer as indicated, and a sample of the clear glass sheet in thickness indicated.
1. Provide samples of clear, tints, opaque colors, and frit patterns for interlayer material for Authority's selection and approval for each type of interlayer material to be used.
- C. Certificate: Submit certificates from respective manufacturers attesting that glass and glazing materials furnished for project comply with requirements. Separate certification will not be required for glazing materials bearing manufacturer's permanent labels designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authorities having jurisdiction.
- D. Compatibility and Adhesion Test Report: Submit statement from sealant manufacturer indicating that glass and glazing materials have been tested for compatibility and adhesion with glazing sealants and interpreting test results relative to material performance, including specifications for primers and substrate preparation needed to obtain adhesion.
- E. Schedule of types, sizes, thicknesses, and installation methods for each size opening and location; using same designations indicated on drawings for glazed openings; and based on actual field verified dimensions and conditions.
- F. Qualification Data for Contractors: Demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses.
- G. Product Test Reports: From a qualified testing agency indicating the following products comply with requirements, based on comprehensive testing of current products:
1. Laminated glass-each of 3 panel types indicated.
 2. Polycarbonate sheet glazing.
- H. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.
- I. SWRI Validation Certificate: For each elastomeric glazing sealant specified to be validated by SWRI's Sealant Validation Program.
- J. Warranties: Special warranties specified in this Section.

1.07 QUALITY ASSURANCE

- A. Glazing Standards: Comply with specifications of Flat Glass Marketing Association (FGMA) "Glazing Manual" and "Sealant Manual" except where more stringent requirements are indicated. Refer to those publications for definitions of glass and glazing terms not otherwise defined in this section or other referenced standards.
- B. Safety Glazing Standard: Where safety glass is indicated or required by authorities having jurisdiction, provide type of products indicated which comply with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for category II materials. Subject to compliance with requirements, provide safety glass permanently marked with certification label of Safety Glazing Certification Council (SGCC) or other

certification agency acceptable to authorities having jurisdiction.

- C. **Fire-Rated Assemblies:** Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252 for door assemblies and NFPA 257 for window assemblies.
- D. **Single Source Responsibility for Glass:** To ensure consistent quality of appearance and performance, provide materials produced by a single manufacturer or fabricator for each kind and condition of glass indicated and composed of primary glass obtained from a single source for each type and class required.
- E. **Installer Qualifications:** An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).
- F. **Product Testing:** Obtain test results for product test reports in "Submittals" Article from a qualified testing agency based on testing products.
 - 1. **Glass Testing Subcontractor Qualifications:** An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E548.
 - 2. Contractor shall provide a testing subcontractor, as defined in the Division 01 section, "Reference Standards and Definitions", to perform glazing testing and monitoring thereof. Such testing and monitoring shall be performed in accordance with the Division 1 section, "Testing and Inspection Service".
- G. **Elastomeric Glazing Sealant Product Testing:** Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.
 - 1. **Sealant Testing Agency Qualifications:** An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated, as documented according to ASTM E548.
 - 2. Test elastomeric glazing sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
- H. **Preconstruction Adhesion and Compatibility Testing:** Submit to elastomeric glazing sealant manufacturers, for testing indicated below, samples of each glass type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants.
 - 1. Use manufacturer's standard test methods to determine whether priming and other specific preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - a. Perform tests under normal environmental conditions replicating those that will exist during installation
 - 2. Submit not fewer than nine pieces of each type and finish of framing members and each type, class, kind, condition, and form of glazing as well as one sample of each glazing accessory (gaskets, tape sealants, setting blocks, and spacers).
 - 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 4. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.

5. Testing will not be required if elastomeric glazing sealant manufacturers submit data based on previous testing of current sealant products for adhesion to, and compatibility with, glazing materials matching those submitted.
- I. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.
 1. Subject to compliance with requirements, permanently mark safety glass, as applicable, with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.
- J. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 50, Project Meetings.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect glass and glazing materials during delivery, storage and handling to comply with manufacturer's directions and as required to prevent scratching and edge damage to glass, and damage to glass and glazing materials from effects of moisture including condensation, of temperature changes, of direct exposure to sun, and from other causes.

1.09 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing material manufacturer or when joint substrates are wet due to rain, frost, condensation or other causes.
 1. Install liquid sealants at ambient and substrate temperatures above 40 degrees Fahrenheit (4.4 degrees Celsius).
 2. Do not install polycarbonate units when ambient and substrate conditions are above 80 degrees Fahrenheit or below 40 degrees Fahrenheit.

1.10 WARRANTY

- A. General: Warranties shall be in addition to, and not a limitation of, other rights the Authority may have under the Contract Documents.
- B. Warranty Period: Manufacturer's standard but not less than ten (10) years after date of Final Acceptance.
- C. Manufacturer's Special Project Warranty on Laminated Glass: Provide written warranty signed by manufacturer of laminated glass agreeing to furnish f.o.b. point of manufacture, freight allowed project site, within ten (10) years after date of Final Acceptance, replacements for those laminated glass units which develop manufacturing defects. Manufacturing defects are defined as edge separation, delamination, air pockets, or other imperfections which materially obstructs vision through the glass.
- D. Manufacturer's Special Warranty on Polycarbonate Sheet: Written warranty, made out to the Authority and signed by manufacturer agreeing to furnish replacements for polycarbonate sheet units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, or that yellow greater than index 7.5, within specified warranty period of 10 years from the date of Final acceptance.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include; but are not limited to, the following:

1. Heat-Treated Glass:

- a. AFG Industries, Inc.
- b. Cardinal IG.
- c. Environmental Glass Products.
- d. Falconer Glass Industries.
- e. Ford Glass Division.
- f. Guardian Industries Corp.
- g. Hordis Brothers, Inc.
- h. LOF Glass, Inc.
- i. PPG Industries, Inc.
- j. Viracon, Inc.

2. Manufacturers of Laminated Glass:

- a. Advanced Coating Technology.
- b. AFG Industries, Inc.
- c. Environmental Glass Products.
- d. Falconer Glass Industries.
- e. Ford Glass Division.
- f. Guardian Industries Corp.
- g. HGP & Affiliates, Inc.
- h. PPG Industries, Inc.
- i. Tempglass
- j. Viracon, Inc.

3. Manufacturers of glass clad polycarbonate laminate:

- a. Globe Amerada Glass.
- b. Guardian Industries.
- c. Viracon, Inc.

3. Manufacturers of patterned laminated glass:

- a. Sumiglass by American Glassmith, Inc.

4. Manufacturers of fire-rated glazing products:

- a. FireLite Plus by Nippon Electric Glass Co., Ltd. distributed by Technical Glass Products.
- b. PyroStop distributed by Technical Glass Products.
- c. SuperLite II by SAFTI Div., O'Keeffe's Inc.
- d. Pyrovue Commercial by Advanced Glass Systems Corp.

5. Manufacturers of sacrificial film products:

- a. MADICO, Inc.
- b. Approved equal.

2.02 GLASS PRODUCTS, GENERAL

- A. Primary Glass Standard: Provide primary glass which complies with ASTM C1036 requirements, including those indicated by reference to type, class, quality, and, if applicable, form, finish, mesh and pattern.

- B. Heat-Treated Glass Standard: Provide heat-treated glass which complies with ASTM C1048 requirements, including those indicated by reference to kind, condition, type, quality, class, and, if applicable, form, finish, and pattern.
- C. Sizes: Fabricate glass to sizes required for glazing openings indicated, with edge clearances and tolerances complying with specifications of glass manufacturer. Provide thicknesses indicated and/or as specified by glass manufacturer for application indicated and/or as required by code for actual conditions, sizes, and wind loads.

2.03 PRIMARY GLASS PRODUCTS

- A. Clear Float Glass: ASTM C1036, Type I (transparent glass, flat), Class 1 (clear), Quality Q3 (glazing select).
- B. Total thickness of clear float glass to be as indicated on drawings, to be as indicated on schedule at the end of this section, to meet design criteria, to meet standards indicated, and/ or to meet applicable codes; but not less than 3/8".

2.04 HEAT-TREATED (TEMPERED) GLASS PRODUCTS

- A. Heat-Treated or Tempered Glass: ASTM C1048; manufacture heat-treated glass by vertical (tong-held) or horizontal (roller hearth) process, at manufacturer's option, except provide horizontal process where indicated as "tongless" or "free of tong marks".
 - 1. Uncoated Clear Heat-Treated Float Glass: Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), kind FT (fully tempered) where indicated.
- B. Total thickness of tempered glass to be as indicated on drawings, to be as indicated on schedule at the end of this section, to meet design criteria, to meet standards indicated, and/ or to meet applicable codes; but not less than 1/4".

2.05 LAMINATED GLASS PRODUCTS

- A. Laminated Glass Products: Comply with ASTM C1172 for kinds of laminated glass indicated and other requirements specified. Refer to primary and heat-treated glass requirements relating to properties of glass products comprising laminated glass products.
- B. Glass: Two outer glass panels of clear float glass (unless specified otherwise).
- C. Interlayer: Interlayer material as indicated below, in clear or with frit pattern as noted, and of thickness indicated, with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating and installation.
 - 1. Interlayer Material: Polyvinyl Butyral sheet.
 - 2. Color and pattern of plastic interlayer: Clear or frit as specified.
 - 3. Frit (where pattern is specified): Clear (or tinted if specified) interlayer of thickness as required for the assembly to comply as a Type II safety glass material) to have square frit printed pattern, 11/16" squares on 1-1/4" spacing, aligned in a grid vertically and horizontally. Squares are the frit rather than the grid.
- D. The assembly is created by laminating the interlayer, two layers of adhesive and two glass panels; the entire assembly is then permanently bonded. The assembly shall comply as a safety laminated product meeting industry standard ANSI Z-97. 1-1984 and the Consumer Product Safety Commission Federal standard 16 CFR 1201, Category I and II. The assembly shall be both weather and ultraviolet radiation resistant.

- E. Products: Subject to compliance with requirements, provide one of the following:
1. Polyvinyl Butyral Interlayer:
 - a. Saflex, Monsanto Co.
 - b. Butacite, E.I. du Pont de Nemours & Co., Inc.
- F. Laminating Process: Fabricate laminated glass to produce glass free of foreign substances and air or glass pockets as follows:
1. Laminate clear float glass lites with polyvinyl butyral interlayer in autoclave with heat plus pressure.
- G. Total thickness of laminated glass to be as indicated on drawings, to be as indicated on schedule at the end of this section, to meet design criteria, to meet standards indicated, and/ or to meet applicable codes; but not less than 3/8"+ (Inner and outer layer of 3/16" clear float glass bonded to interlayer of 0.06" Polyvinyl Butyral).

2.06 FIRE RATED ASSEMBLIES

- A. Laminated product in the form of two lites of clear safety glazing (heat treated, tempered) with a intumescent interlayer, including a clear, fully transparent, heat-absorbing gel. Thicknesses of glazing and interlayer as required for specific application, size of lite, as required by manufacturer, as required by code, and as required to obtain required fire-rating. Frame for fire-rated assembly to be as required to maintain required fire rating.

2.07 ATTACK RESISTANT GLAZING

- A. Attack Resistant glass-clad polycarbonate laminate assembly to consist of the following:
1. 9/16 inch (.5625 inch) overall thickness consisting of:
 - a. 1/8 inch thick clear, chemically strengthened glass.
 - b. 0.050 inch clear Urethane interlayer.
 - c. 1/4 inch clear polycarbonate interlayer.
 - d. 0.50 inch clear Urethane interlayer.
 - e. 1/8 inch thick clear, chemically strengthened glass.
- B. Attack Resistant assembly to be certified to meet the following tests:
1. Weatherability Tests: Meets ANSI Z.26.1-1977 and Z.26.1a-1983 and ASTM E773 and E774.
 2. Clear Light Transmittance: 76 percent visible.
 3. Attack Resistance: Tested and certified by H.P. White Laboratories to meet Level I Forced Entry.
 4. Ballistic Protection: Tested by H.P. White Laboratories to meet Level A Ballistics Assult, 0.38 Special Handgun; 3 shots in an 8 inch circle, 158 grain lead, 20 feet.
Results: Spall; no penetration.
- C. Provide single responsibility for all phases of manufacturing, from the chemical strengthening of the raw glass through the final lamination.
- D. Manufacturer and/or trade name resistant glazing to be one of the following:
1. "Secur-Tem + Poly" as manufactured by Globe/ Aemeroda Glass Co.
 2. "Glass-Clad No. 31554 as manufactured by Guardian Industries.
 3. "Guard-View 200" as manufactured by Viracon.

4. Approved equal.

2.08 POLYCARBONATE SHEET GLAZING

- A. Where indicated on the drawings, provide and install polycarbonate glazing.
 1. Thickness: 1/4 inch nominal thickness (0.236 inch actual) unless noted otherwise.
 2. Type: With UV and abrasion or mar-resistant coating on both sides similar to GE Lexan "Margarid" MR-10, and (unless noted otherwise) with "HPW Nu-View" 0.10" thick laminate on both sides, or approved equals. Laminate and adhesives to be formulated for exterior applications. Laminate may be in lieu of scarafacial film upon approval of the Authority.
- B. Polycarbonate shall be glazed using neoprene or polyvinyl chloride "PVC" gaskets as recommended by polycarbonate manufacturer and approved.
- C. Polycarbonate shall be guaranteed against breakage, coating failure, increased haze, excessive yellowing, and loss of light transmission for a period of 10 years. Polycarbonate failing within that period shall be replaced at no cost.
- D. Polycarbonate glazing shall be pre-sized and fitted to allow for thermal expansion and contraction of the glazing material. Follow manufacturer's recommendations for handling and installing the polycarbonate.

2.09 SACRIFICIAL FILM FOR WINDOW GLAZING VANDAL PROTECTION

- A. Provide and install a sacrificial film on both sides of all glazing for vandal protection unless shown or noted otherwise. Sacrificial film not required on skylights or roof glazing.
- B. The sacrificial protective film on each side shall be one layer of Polyethylene Terathalate (PET), each layer being 2 mils thick. There shall be an acrylic pressure sensitive adhesive on the back of the film, protected by a peel-off release liner, for installation to the glass.
- C. The protective film and adhesive must be formulated and approved for exterior applications.
- D. The sacrificial protective film and adhesive shall be as manufactured by the following:
 1. MADICO, Inc.
 - a. Product Number LCL-600-XSRG for film applied to glass (laminated, tempered, float, etc.)
 - b. Product Number LCL-600-BFXSR for film applied to polycarbonate.
- E. The films must be compatible with the existing application solutions presently used by the Authority and removable by peeling off.
 1. The application solutions shall be non-toxic and contain no chemical within the formulation which is a suspected human carcinogen. The application solutions currently approved and used by the Authority are as follows:
 - a. Product number 3901249 available through Graffiti Removal, Inc., Huntington Beach, CA.
 - b. Product Number 4608 available through Midwest Marketing, Peoria, IL.
- F. Other manufacturers of films and applications solutions equal to the specified film and solutions must be submitted to the Authority for written approvals prior to bidding. Provide the Authority with certified test reports, specifications, installation/removal instructions, Material Safety Data Sheet, and samples of the proposed film and solution to demonstrate that it is equal to the specified film and solution and complies with all requirements set forth herein.

1. Samples that are judged by the Authority to be difficult to install or remove when compared to approved sacrificial protective film and application solution, or fail to function under normal operating conditions when tested in service shall be rejected.
- G. Sacrificial film products shall meet or exceed the required results of the following ANSI/SAE Z26.1 tests:
1. Test 3, Humidity Test
 2. Test 15, Optical Deviation and Visibility Test.
 3. Test 17, Abrasion Resistance (Glass-Plastics)
 4. Test 19, Chemical Resistance (Non-stressed)
 5. Test 28, Resistance to temperature change.
- H. The sacrificial film products shall also meet the following performance requirements:
1. Physical Properties:

Average Tensile Strength: Per ASTM D882	25,000 psi
Average Break Strength: Per ASTM D882	150 lbs./in. (width)
Adhesive Type:	Acrylic Pressure Sensitive

Average Peel Strength (mounted):

Per ASTM D903

For film to mounted glass	5 to 6 lbs./in. (of width)
For film mounted to plastic glazing	2.5 to 3.5 lbs./in. (of width)
 2. Solar optical properties – The sacrificial film shall meet or exceed the following solar optical properties:

Total Solar Energy;	
Average Percent Transmitted	79
Average Percent Reflected	10
Average percent Absorbed	11
Visible Light (Daylight): Average Percent Transmitted	83
Average Percent Reflected	10
"U" Factor:	
Median	1.08
Design	1.12
Percent of Ultraviolet Light Rejected	99
Shading Coefficient:	0.93
Percent Total Solar Energy	19

- I. Flame Spread and Smoke Developed: The sacrificial film shall meet or exceed a Class "A: Interior Wall and Ceiling Finish Classification as outlined in the National Fire Protection Association (NFPA) Life Safety Code 101, Section 6-5-3, when mounted to the appropriate substrate (i.e. glass) and tested and calculated per either NFPA 255 or ASTM E 84.

Class "A" Classification is as follows:

Flame Spread 0-25

Smoke Developed 0-450

- J. The sacrificial film must be able to be readily removed or peeled off by the Authority's personnel when damaged. A replacement film must be able to be installed by the Authority's personnel. As a part of this Contract, provide enough replacement material, in proper widths and for proper application (glass or plastic) to replace all the film used on this project at least once. Additional film must be available for purchase by the Authority for future replacements. As a part of this contract, provide all required equipment, supplies, and installation and removal instructions required for the Authority's personnel to perform all removal and replacement operations.

2.10 ELASTOMERIC GLAZING SEALANTS

- A. General: Provide products of type indicated and complying with the following requirements:
1. Compatibility: Select glazing sealants and tapes of proven compatibility with other materials with which they will come into contact, including glass products, interlayer of laminated glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.
 2. Suitability: Comply with specifications of sealant and glass manufacturers for selection of glazing sealants and tapes which have performance characteristics suitable for applications indicated and conditions at time of installation.
 3. Colors: Provide color of exposed sealants indicated or, if not otherwise indicated, as selected by the Authority from manufacturer's standard colors.
- B. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C920 requirements, including those for Type, Grade, Class and Uses.
1. Additional Movement Capability: Where additional movement capability is specified in the Glazing Sealant Schedule, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C719, to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements in ASTM C920 for uses indicated.
- C. One-Part Acid-Curing Silicone Glazing Sealant: Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to uses indicated, O.
- D. Subject to compliance with requirements, glazing sealants which may be incorporated in the work include, but are not limited to, the following:
1. One-Part Acid-Curing Silicone Glazing Sealant:
 - a. "Chem-Calk 1200"; Bostik Construction Products Div.
 - b. "Dow Corning 795"; Dow Corning Corp.
 - c. "SCS 1200"; General Electric Corp.
 - d. "863"; Pecora Corp.
 - e. "Rhodorsil 3B"; Rhone-Poulenc Inc.

- f. "Omniglaze"; Sonneborn Building Products Div.; ChemRex, Inc.
- g. "Proglaze"; Tremco.

- E. Glazing Sealant for Fire-Resistive Glazing Products: Identical to product used in test assembly to obtain fire-protection rating.

2.11 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C1281 and AAMA 800 for products indicated below:

- 1. AAMA 804.3 tape, where indicated.
- 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
- 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

2.12 GLAZING GASKETS

- A. Dense Elastomeric Compression Seal Gaskets: Molded or extruded gaskets of material indicated below, complying with ASTM C864, of profile and hardness required to maintain watertight seal:

- 1. Neoprene, ASTM C864.
- 2. EPDM, ASTM C864.
- 3. Thermoplastic polyolefin rubber.
- 4. Any material indicated above.

- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C509, Type II, black; and of profile and hardness required to maintain watertight seal:

- 1. Neoprene.
- 2. EPDM.

- C. Subject to compliance with requirements, manufacturers offering preformed gaskets which may be incorporated in the work include, but are not limited to, the following:

- 1. D. S. Brown Co.
- 2. Maloney Precision Products Co.
- 3. Tremco.

2.13 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated.
- B. Compatibility: Provide materials with proven record of compatibility with surfaces contacted in installation.
- C. Cleaners, Primers and Sealers: Type specified by sealant or gasket manufacturer.
- D. Setting Blocks: Neoprene, EPDM or silicone blocks as required for compatibility with glazing sealants, 80 to 90 Shore A durometer hardness.
- E. Spacers: Neoprene, EPDM or silicone blocks, or continuous extrusions, as required for compatibility

with glazing sealant, of size, shape and hardness specified by glass manufacturer to maintain glass lites in place for installation indicated.

- F. Edge Blocks: Neoprene, EPDM or silicone blocks, or continuous extrusions, as required for compatibility with glazing sealant, of size, shape and hardness specified by glass manufacturer to maintain glass lites in place for installation indicated.
- G. Compressible Filler Rods: Closed-cell or waterproof-jacketed rod stock of synthetic rubber or plastic foam, flexible and resilient, with 5-10 psi compression strength for 25 percent deflection.
- H. Cylinder Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.14 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

- A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.
- C. Grind smooth and polish exposed glass edges.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Require Glazier to inspect work of glass framing erector for compliance with manufacturing and installation tolerances, including those for size, squareness, offsets at corners; for presence and functioning of weep system; for existence of minimum required face or edge clearances; and for effective sealing of joinery. Obtain Glazier's written report listing conditions detrimental to performance of glazing work. Do not allow glazing work to proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Pre-Installation Meeting: At Contractor's direction, Glazier, sealant and gasket manufacturers' technical representatives, glass framing erector and other trades whose work affects glass and glazing shall meet at project site to review procedures and time schedule proposed for glazing and coordination with other work.
- B. Clean glazing channels and other framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to substrates. Remove lacquer from metal surfaces where elastomeric sealants are indicated for use.

3.03 INSTALLATION OF SACRIFICIAL FILM FOR WINDOW GLAZING VANDAL PROTECTION.

- A. All glazing (glass and plastic) shall have installed on both sides a sacrificial film to protect the glazing. Film to be of such a type and installed in such a manner so that it may be readily removed and a new replacement film installed by the Authority's personnel. Install the initial film under proper atmospheric condition on clean surfaces. Installation shall be without bubbles, cuts, tears, bulges, wrinkles or other imperfections. Film shall be one piece without seams or overlaps. Do not install on wet or dirty surfaces. Follow film manufacturer's directions and recommendations for installation, including environmental and temperature range.

- B. Film shall be warrantied for one year against delaminating, yellowing or other defects in materials or workmanship. Defective film or installations shall be replaced at no cost to the Authority.
- C. Film shall be installed in the factory on both sides of the glazing so that it will end at the glazing gasket and the film can be removed without cutting or removing the glazing from the frame.

3.04 GLAZING, GENERAL

- A. Comply with combined printed specifications of glass manufacturers, of manufacturers of sealants, gaskets and other glazing materials, except where more stringent requirements are indicated, including those of referenced glazing standards.
- B. Glazing channel dimensions as indicated in details are intended to provide for necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by job conditions at time of installation.
- C. Protect glass from edge damage during handling and installation; use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass with flares or bevels along one horizontal edge which would occur in vicinity of setting blocks so that these are located at top of opening. Remove from project and dispose of glass units with edge damage or other imperfections of kind that, when installed, weakens glass and impairs performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by manufacturers for installing lites.
- G. Provide spacers for glass lites where the length plus width is larger than 50 inches as follows:
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch (3 mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Remove temporary protective coating from polycarbonate, clean lite and assemble glazing unit with perforated metal as indicated on both sides. Glaze metal/polycarbonate/metal assembly into frames, with gaskets as indicated.

3.05 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening
- C. Do not remove release paper from tape until just before each glazing unit is installed.
- D. Apply heel bead of elastomeric sealant.
- E. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- F. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.06 GASKET GLAZING (DRY)

- A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Center lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Install gaskets so they protrude past face of glazing stops.
 - 1. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage to ensure that gasket will not "walk" out when installation is subjected to movement.
 - 2. Miter cut wedge-shaped gaskets at corners and install gaskets in manner specified by gasket manufacturer to prevent pull away at corners; seal corner joints and butt joints with sealant specified by gasket manufacturer.

3.07 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, in between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Tool exposed surfaces of sealants to provide a substantial wash away from glass.
- C. Provide compressible filler rods or equivalent back-up material, as specified by sealant and glass manufacturers, to prevent sealant from extruding into glass channel weep systems and from adhering to joints back surface as well as to control depth of sealant for optimum performance, unless otherwise indicated
- D. Force sealants into glazing channels to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.
- E. Tool exposed surfaces of sealants to provide a substantial "wash" away from glass. Install

pressurized tapes and gaskets to protrude slightly out of channel, so as to eliminate dirt and moisture pockets.

3.08 BUTT JOINT GLAZING

- A. Where indicated, fill butt joint between glazing with sealant. Provide blocking at vertical mullions to maintain joint dimensions.

3.09 PROTECTION AND CLEANING

- A. Protect exterior glazing from breakage immediately upon installation by use of crossed streamers attached to framing and held away from glazing. Do not apply markers to surfaces of glazing. Remove nonpermanent labels and clean surfaces.
- B. Protect glazing from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove immediately by method specified by glazing manufacturer.
- C. Examine glazing surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less often than once a month, for build-up of dirt, scum, alkali deposits or staining. When examination reveals presence of these forms of residue, remove by method specified by glass manufacturer.
- D. Remove and replace glazing which is broken, chipped, cracked, scratched, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.
- E. Wash any glazing exposed during construction activities on both faces not more than 4 days prior to date scheduled for inspections intended to establish date of substantial completion in each area of project. Wash glazing by method specified by glazing manufacturer.
- F. Remove any protective cover over sacrificial film and/or glazing just before Substantial Completion.

3.10 GLAZING SCHEDULE

- A. LAMINATED GLASS LG-1: Where glass of this designation is indicated, provided glass lites complying with the following.
 - 1. Top Lite: Type I (transparent glass, flat, float) glass.
 - a. Class 1 (clear).
 - b. Thickness: 3/16" (nominal).
 - 2. Bottom Lite: Type I (transparent glass, flat) float glass.
 - a. Class 1 (clear).
 - b. Thickness: 3/16" (nominal).
 - 3. Plastic Interlayer: 0.060 inch thick.
 - a. Interlayer Color: Clear; or
 - b. Interlayer Color: Frit pattern as noted in this section and as selected.
 - 4. Laminated glass assembly to be protected both sides with sacrificial film.

- B. POLYCARBONATE SHEET: Where glazing of this designation is indicated, provide polycarbonate sheet units complying with the following:

1. Products: Provide products by one of the following manufacturers:
 - a. General Electric ("Lexan" MR10).
 - b. Polygal ("MonoGal", as applicable)
 - c. Other domestically-manufactured polycarbonate sheet product meeting all applicable criteria in this Section.
2. Overall Unit Thickness and Thickness of Each Lite: 1/4" (0.236").
3. Physical Properties: See 1.04 (C01.).
4. Polycarbonate sheet to be protected both sides with sacrificial film.

3.11 GLAZING SEALANT SCHEDULE

- A. Medium-Modulus Neutral-Curing Silicone Glazing Sealant GS-1: Where glazing sealants of this designation are indicated, provide products complying with the following.

1. Products provide one of the following:
 - a. 756 H.P; Dow Corning.
 - b. Silglaze II; GE Silicones.
 - c. 895; Pecora Corporation.
2. Type and Grade: S (single component) and NS (nonsag).
3. Class 25.
4. Additional Movement Capability: 50 percent movement in extension and 50 percent movement in compression for a total of 100 percent movement.
5. Use Related to Exposure: NT (nontraffic).

END OF SECTION

DIVISION 16: ELECTRICAL**SECTION 16265****DC STATIC INVERTER****PART 1: GENERAL****1.01 SUMMARY**

- A. This section specifies the requirements for major items and work required for providing and installing the DC Static Inverter, complete with all components, wiring and testing. The work under this section includes furnishing all labor, tools, equipment and incidentals for complete installation of DC Static Inverter to provide complete power and functioning Essential Power Transportation System.
- B. Related Sections:
 - 1. Section 16010: General Provisions
 - 2. Section 16200: Essential Transportation System
 - 3. Section 16266: DC Power Distribution.
 - 4. Section 16450: Grounding
 - 5. Section 16195: Electrical Identification
 - 6. Section 16950: Electrical Testing
 - 7. Except as modified herein, the work must be performed in accordance with the applicable requirements of Special Conditions for Transportation Construction, and Additional Special Conditions, as well as the requirements of the General Conditions, Division 1, and this Section.

1.02 SYSTEM DESCRIPTION

- A. General:
 - 1. A microprocessor controlled on-line DC static inverter must be provided to furnish power to operate essential lighting, emergency lighting via uninterruptible power supply (UPS) system, fare control system, signal, communication loads and fire alarm system.
 - 2. Inverter must be designed to avoid the generation of objectionable audible noise and interference to communications, automatic train control (ATC) system, as well as

radio, cellular and line based telephone cable data and information systems and television reception in the vicinity. Interference is defined as any alteration of data or information being provided by that system.

3. Inverter must be mounted in a free standing cabinet installed in the ETS/UPS room. The size and shape of the cabinet must not exceed 4' w x 4'd x 7'h. Provide a separate shielded line isolation transformer as required.
4. Inverter must be an on-line system and operate continuously. Power factor correction devices and distortion filters must be provided as required.

1.03 SUBMITTALS

- A. Procedures: Furnish submittals in accordance with general requirements specified in Special Conditions, Section 01300 and Section 16010 of the Specifications.
- B. Shop Drawings: Furnish shop drawings for the fabrication and installation of the Work. Include floor layouts at not less than $1/8" = 1'-0"$ minimum scale showing equipment, wireways, conduit and wiring including sizes and numbers of conductors. Provide sections at not less than $1/4" = 1'-0"$ minimum scale. Show typical details of the conditions for every conduit penetration, member, joint anchorage and support in the system.
 1. Conduit layout with wire and conduit sizes and wiring diagrams.
 2. Connection diagrams for wiring each piece of equipment.
 3. Interconnection diagrams showing wiring external to each piece of equipment.
- C. Product Data: Furnish a material list with technical data documenting the primary function, quality, and performance of each system to be used in the Work, or other such primary characteristics as required by the Drawings or Specifications.
- D. Supplementary Product Literature: Furnish manufacturer's literature describing the general properties of each product to be used in the Work.
- E. Statement of Manufacturer's Review: Furnish statement in form stipulated, signed by the Contractor and Installer, stating that the Contract Document, the shop drawings and product data have been reviewed with qualified representatives of the materials manufacturers, and that they are in agreement that the selected materials and systems are proper and adequate for the application shown including compatibility with adjacent systems and materials.
- F. Statement of Application: Furnish statement in form stipulated, signed by the Contractor and Installer, stating that the Work was provided in compliance with the Contract Documents and that the installation was proper for the conditions of application and use.

- G. Record Documents: Furnish record drawings annotated with the changes made during installation of the Work so as to be a complete set of "as installed" drawings wiring diagrams.

1.04 QUALITY ASSURANCE

- A. Contractor's Quality Assurance Responsibilities: Contractor is solely responsible for quality control of the Work. Comply with the requirements specified in Section 01400.
- B. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances and regulations of Federal, State and Municipal authorities having jurisdiction. Obtain necessary approvals from all such authorities.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. General: Deliver and store materials in manufacturer's original packaging labeled to show name, brand, type, and grade. Store materials in protected dry location off ground in accordance with manufacturer's instructions. Do not open packaging nor remove labels until time for installation.

1.06 WARRANTY

- A. Special Warranties: The manufacturer must warrant the static inverter to be supplied, agreeing to repair/replace any hardware or software which has failed, or otherwise deteriorated to a condition where it cannot perform effectively as specified. The warranty period must be 3 years from the date of substantial completion, as determined by the Commissioner.

1.07 MAINTENANCE

- A. Maintenance and Operating Manuals: Furnish complete manuals describing the materials, devices and procedures to be followed in operating, cleaning and maintaining the Work. Include manufacturers' brochures and parts listed describing actual materials used in the Work. Assemble manuals for component parts into single binders identified for each system.

PART 2: PRODUCTS

2.01 ACCEPTABLE MANUFACTURES:

- A. Chloride Power Systems
- B. Advance Power Associates
- C. Toshiba or equal.

D. Hubbell or equal

2.02. DESIGN FEATURES

A. General: The inverter must be designed for a soft start and include the following features:

1. The inverter must be full IGBT (Insulated Gate Bipolar Transistor) with CVCF (Constant Voltage Constant Frequency) output by PWM (Pulse-Width Modulated) control.
2. The inverter must not require any auxiliary power source except 600 Volt DC input.
3. The inverter must self-restart on the low end when the DC voltage is increased to 450 Volt DC.
4. The inverter must operate thru an 850 Volt continuous and thru transient requirements listed in B.3 without a loss of output. The inverter must self-restart on the high end when the voltage reaches 750 Volt DC.

B. Input Requirements:

1. Input Voltage – Nominal – 600 Volt DC.
2. Operation Guarantee – 350 Volts to 850 Volts DC. (No affect/degradation on the output).
3. Input Transients – 3,000 Volts for 50 Microseconds
1,500 Volts for 20 Milliseconds
4. Input Reverse Voltage Protection: (Required)
5. The inverter must be designed in such a way that it must not feed DC voltage back to the third rail under any circumstances, and shall not affect continuous output

C. Output Requirements

1. Output Voltage – 120/208 Volts AC – 3-Phase – 60 Hz, 4 wire.
2. Voltage Regulation - + 1%.
3. Continuous Rating – 60 KVA.
4. Frequency Stability - + 1%.
5. Power Factor – 0.7 Lead or Lag.

6. Total Harmonic Distortion – 3%.
7. Efficiency – Over 90%.
8. Voltage Stability - + 5%.
9. Overload – 150% load for 30 seconds and 200% load for 5 seconds.

D. Environmental

1. Audible Noise – Less than 65 db (A) at 10 feet.
2. Operating Temperature: 20°F. to 120°F.
3. Humidity – 0 to 95% with no condensation.
4. Cooling – Forced air cooling by variable speed fan controlled by inverter temperature. (If required)
5. Location – Dirty rooms.

E. Protective Features

1. Input Voltage – Low and high DC cut-off and restart.
2. Output Voltage – Severe overload or short circuit protected by shut down with automatic restart.
3. Over temperature - The unit must shut down at preset temperature with automatic recovery at 140 deg. F. Unit temperature read only one side of the unit which has the AC bridge. Unit must attempt to start two more times. If unsuccessful after the third time unit must shut down.
4. Galvanic Isolation – Input and output isolated for galvanic isolation.

F. Safety Features:

1. Line capacitor banks must drain their charge to safe level within 2 minutes of disconnect of power.
2. The main door must be interlocked to prevent unit operation when the door is open.
3. A door interlock bypass control must be provided for maintenance. The door interlock bypass control must automatically reset when the door is closed.

4. Furnish input and output circuit breakers.

G. Diagnostic and Alarms Panel

1. Microprocess Control Panel must be provided in the front door for comprehensive diagnostics to expedite trouble shooting. LCD display with 4x4 control key pad and alarm indicators must be provided in the control panel.
2. Control panel must also have terminal blocks for remote alarms.

2.03 CABINET CONSTRUCTION

- A. The static inverter must be housed in a 12 guage steel enclosure with minimum 11 gauge welded steel frame construction.
- B. Cabinet seams must be continuously welded and ground smooth.
- C. Cabinet doors must be supported with heave-duty continuous hinge.
- D. The door must be secured with a three point latch and operated with a key operated vault handle (Key-CAT-60).
- E. Latch rods must be equipped with rollers for easier door closing.
- F. Door and enclosure are phosphatized, primed and finished in ANSI/ASA 61 grey recoatable enamel on the outside and with white enamel on the inside.
- G. A print pocket must be provided inside the door.
- H. Enclosure shall be rated NEMA 3R, and shall have a canopy for water protection.

2.04. NAMEPLATES

- A. The name of the driven equipment must appear on each switch, relay, timer and control device.
- B. Nameplates must be equipment manufacturer's standard.
- C. Nameplates must be installed to designate the purpose of all switches, timers, instruments, relays, fuses, control devices, etc.

2.05 CABLES TERMINATIONS AND TAGGING

- A. Supports must be provided for all power and control cables.

- B. Provisions must be made for all cables, primary and secondary be able to enter either from the top or from the bottom.
- C. Cable markers must be installed on both ends of all conductors both for internal and external cables. Cable markers must be the equipment manufacturer's standard.

2.06 METERS AND INSTRUMENTS

- A. Indicating instruments must be approximately 4-1/2 inches square, with long scale (approximately 250 degrees) white dials with black markings. They must be accurate within one percent at full scale deflection, must have an external zero adjustment.

Acceptable Manufacturers:

- 1. Siemens/ITE
- 2. Crompton Type K-241, or equal.

- B. Instrument and control switches. Instrument transfer switches must have an off position.

Acceptable Manufacturers:

- 1. Siemens, Electroschwitch Type W2 or equal.

- C. Provide the following devices:

- 1. Input Voltmeter
- 2. Input Ammeter
- 3. Output Voltmeter for phase – to phase and phase – to – neutral
- 4. Output Ammeter for each phase
- 5. Output Frequency Meter
- 6. Elapsed Time Meter
- 7. Watt Meter.

2.07 CONTROL DEVICES AND WIRING

- A. Control devices, local instrument cables, and wiring required on the equipment must be furnished and installed at the factory.

- B. All small wiring for control or accessory equipment must be installed in code approved wireways.
- C. Control wiring must be Number 12 AWG, minimum, except where larger size conductors are needed for current carrying requirements or incidental wiring on mass produced, pre-manufactured sub-assemblies. The conductor must be stranded copper for fixed wiring and extra flexible copper for hinged wiring. The conductors must have 600 volts, 90 degrees C, polyvinyl chloride insulation, with flameproof braid covering.
- D. All control and instrument wiring, alarm leads, and instrument transformer secondaries, for connection to external cables, must be terminated at terminal blocks. Terminal blocks must be equipment manufacturer's standard and provided for termination all small wiring.
- E. Compression type solderless copper lugs must be furnished for each terminal block for external control and instrument wires. All control wires must be terminated utilizing insulated ring type connectors. Lugs must be Burndy Catalog Number YAEV10-L36 Thomas & Betts Company, Catalog Number C1 insulated, or equal.
- F. Cable/wire markers must be installed on both ends of all conductors both for internal and external cables and must be the equipment manufacturer's standard.
- G. The assembled control equipment, wiring and connections must be insulated for a voltage of 600 volts and must be subjected to a one minute test of 2200 volts AC phase to ground at the factory, after fabrication and assembly is complete.
- H. The inverter must have output alarm contacts for remote monitoring. The following alarms must be provided:
 - 1. High temperature.
 - 2. Low input voltage.
 - 3. Low output voltage.
 - 4. Overload.

2.08 NON-LINEAR LOADING TRANSFORMERS

- A. Provide for non-linear loads with significant harmonic distortion, with UL K factor equal to 13, and meeting ANSI/NEMA ST-20 standards and UL 1561 listed.

Acceptable Manufacturers:

- 1. General Electric Co.

2. Square D Co.
3. Cutler-Hammer or equal.

B. Construction:

1. Continuous wound coil construction, with vacuum impregnation insulation system using non-moisture absorbing varnish.
2. UL recognized 220°C insulation system. Windings must be copper and must not exceed 150°C temperature rise at rated full load.
3. Universal taps, with primary containing two (2) 2.5% above nominal and four (4) 2.5% full capacity taps below nominal.
4. Full length copper electrostatic shield with an average effective coupling capacitance of 30 picofarads between primary and secondary. Electrical noise attenuation must average 120 dB common mode and 30 dB normal mode.
5. High grade grain oriented silicon steel core with flux density sufficiently below saturation point.
6. Heavy gage steel enclosure with ANSI 61 gray enamel paint finish.

2.09 SOURCE QUALITY CONTROL

A. Factory Testing:

1. Equipment must be completely assembled, wired, adjusted and tested at the factory. Rigid inspection before and after assembly must assure correctness of design and workmanship. After assembly, static inverter must be tested for operation under simulated operating conditions.
2. Complete set of tests must be performed at the factory. Test must include manufacturers standard, commercial test and tests as specified, including load testing, overload testing and load bank testing.

B. Witnessing of Factory Testing:

1. The Commissioner, as part of the Contract, must witness tests of the static inverter. The Contractor must provide a detailed test procedure outlining all test and test methods required to demonstrate that the supplied equipment must meet the requirements of this specification. Witness factory testing must not proceed until this test procedure is reviewed and approved by the Commissioner. The Contractor must provide the Commissioner with advance notice of a minimum of six weeks prior to the schedule of factory testing.

2. The Contractor must pay for living, lodging, and transportation expenses for 4 representatives of the City while engaged in witness of factory tests. Living expenses must include transportation, meals, motel or hotel (similar or equal in quality to Holiday Inn Motels) for 2 nights, and a rental car when inspection facilities are out of the City of Chicago area.

PART 3: EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine the areas to receive the Work and the conditions under which the Work would be performed. Contractor must remedy conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install the equipment in strict accordance with the approved shop drawings and the equipment manufacturer's recommendations.
- B. Make final adjustments to equipment, including verification of proper mechanical operation, verification of instrument operation, and setting of protective relays and devices.
- C. Service Commissioner:
 1. Equipment manufacturer must provide a qualified factory trained service commissioner to provide technical direction for the installation and final adjustments of the equipment.
 2. Service commissioner must certify that the equipment has been installed in accordance with the manufacturer's recommendations.
 3. Service commissioner must be available as long as his services are requested, but in any case, he is required for a minimum of one full 8-hour working day for each static inverter set.
- D. Provide 4" high steel reinforced concrete pad for mounting the static inverter.
- E. Support each wall mounted DC control panel and AC control panel from the wall with "C" shaped galvanized steel channel. Minimum separation between the equipment and the wall must be 1".

3.03 TRAINING

- A. The equipment manufacturer must provide factory technicians at the job site to provide adequate training for the City's Personnel in the proper operation and maintenance of the equipment.
- B. The training classes must be done at on-site location selected by the City. The Contractor must record training on a "High Quality DVD"
- C. The Contractor must provide all video equipment and a video recording of all training classes on a standard DVD. DVD must be submitted to the Commissioner for review.
- D. If the Commissioner determines that the DVD is not of "High Quality" for the future or refresher training, the Contractor must make another video recording of another training class at no cost to the City.
- E. A minimum of 8 manhours must be provided for each static inverter set.

3.04 FIELD QUALITY CONTROL

- A. Site Testing: Manufacturer's field service personnel must provide site testing consisting of tests of the static inverter system and associated accessories supplied by manufacturer. A full load power test and overload test must be part of the standard start-up procedure and must be accomplished without disturbing user wiring and completed prior to operation of the site critical loads from the static inverter output. Test results must be documented, signed, and dated for future reference. Furnish temporary air-cooled portable load bank, cables and materials, for testing.

3.05 ADJUSTING

- A. Upon completion of the Work repair surfaces that have been permanently stained, marred, or otherwise damaged. Replace Work which is damaged or cannot be adequately cleaned as directed.

3.06 CLEANING

- A. Upon completion of the Work, remove unused materials, debris, containers and equipment from the project site. In addition to the initial cleaning procedure required, and not more than 2 days before occupancy by the Commissioner, clean the Work as recommended by the manufacturer.

3.07 PROTECTION

- A. Protect the Work during the construction period so that it must be without any indication of use or damage at the time of acceptance.

PART 4: MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

- A. The Work of **DC STATIC INVERTER** will not be measured for payment.

4.02 PAYMENT

- A. No separate payment will be made for the work covered in this section. Payment for the Work of **DC STATIC INVERTER** will be included in the contract lump sum price as shown in the Schedule of Prices for **ELECTRICAL WORK**.

4.03 PAY ITEM ACCOUNT NUMBER

Electrical Work: 16000.100

END OF SECTION

DIVISION 16: ELECTRICAL

SECTION 16266

DC POWER DISTRIBUTION

PART 1: GENERAL

1.01 SUMMARY

- A. This section specifies requirements for the furnishing and installing of the Essential DC Transfer Switch and DC Disconnect Switches. The work under this section must include furnishing all labor, materials, tools, equipment and incidentals necessary to provide and install DC power Distribution to provide complete and functioning essential power transportation system.
- B. Related Sections:
 - 1. Section 16010: General Provisions
 - 2. Section 16050: Raceways and Boxes
 - 3. Section 16123: Wires, Cables, Splices, Terminations
 - 4. Section 16265: DC Static Inverters
 - 5. Section 16195: Electrical Identification
 - 6. Section 16450: Grounding
 - 7. Section 16950: Electrical Testing
 - 8. Except as modified herein, the work must be performed in accordance with the applicable requirements of Special Conditions for Transportation Construction, and Additional Special Conditions, as well as the requirements of the General Conditions, Division 1, and this Section.

1.02 SYSTEM DESCRIPTION

- A. Refer to Section 16200 of these Specifications.

1.03 SUBMITTALS

- A. Furnish submittals in accordance with general requirements specified in Special Conditions, Section 01300 and Section 16010 of the Specifications.

- B. Furnish shop drawings for the fabrication and installation of the Work.
- C. Furnish a material list with technical data documenting the primary function, quality, and performance of each system to be used in the Work: the load ratings or other such primary characteristics as required by the Drawings or Specifications. Furnish a listing for each of the following:
 - 1. Include certified laboratory test data on automatic transfer switches of the same design and rating as those involved, to confirm that the transfer switches operate to alternate source after the withstand current tests, with no welding of contacts.
- D. Furnish manufacturer's literature describing the general properties of each product to be used in the Work.
- E. Furnish Quality Control Testing and Inspection reports for the specified Quality Control inspections and tests.
- F. Furnish record drawings annotated with the changes made during installation of the Work so as to be a complete set of "as installed" drawings and wiring diagrams.

1.05 QUALITY ASSURANCE

- A. Contractor is solely responsible for quality control of the Work. Comply with the requirements specified in Section 01400.
- B. Comply with applicable requirements of the laws, codes, ordinances and regulations of Federal, State and Municipal authorities having jurisdiction. Obtain necessary approvals from all such authorities.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store materials in manufacturer's original packaging labeled to show name, brands, type and grade. Store materials in a protected dry location off ground in accordance with manufacturer's instructions. Do not open packaging nor remove labels until time for installation.

1.07 WARRANTY

- A. Furnish 2-year written warranty in form stipulated by Commissioner, signed by the Contractor and Installer, agreeing to repair or replace Work which has failed as a result of defect in materials or workmanship. Upon notification of such defects, within the warranty period, make necessary repairs or replacement at the convenience of the Commissioner.

1.08 MAINTENANCE

- A. Furnish complete manuals describing materials, devices and procedures to be followed in operating, cleaning, and maintaining the Work. Include manufacturers' brochures and parts lists describing actual materials used in the Work, including low voltage switchboards and other major components. Also include Record Drawings. Assemble manuals for components parts into single binders identified for each system.
- B. Furnish spare fuses at the rate of 10 percent, but not less than 3, for each size and type installed. Replace fuses blown during construction and furnish the complete supply of spare fuses to the Commissioner upon completion of the building.

PART 2: PRODUCTS**2.01 DC MANUAL TRANSFER AND DISCONNECT SWITCH**

- A. Unit must be designed for outdoor installation in a NEMA Type 3R one piece molded, waterproofed, fire-retardant fiberglass enclosures. The ambient operating temperature range is -25°F to 150°F.
- B. DC manual transfer switch must have two mechanically interlocked disconnect switches and mechanically latched contactor. Only one switch can be closed at any time. Both switches can be open at any time.
- C. Each switch for "ETS" system must be quick-break, quick make, heavy duty type, suitable for use as a manual transfer switch.
- D. The Assembly must be rated 750 VDC, 400 ampere, two (2) pole, double-throw.
- E. Each switch must be provided with arc-chutes and arc-chute cover rated at 750 VDC, 400 ampere.
- F. Each switch must be mounted on an isolated base of glass filled polyester (flame-retardant and non-tracking) Type GPO-3 material with beveled edges. All isolated base surfaces must be treated with a moisture inhibitor to prevent wicking.
- G. All parts of assembly must be adequately braced to prevent the weight of the cable from imparting twisting strains on the jaw or hinge ends and consequent misalignment of the switch.
- H. Switches shall be of bolted pressure type.
- I. Unit must be provided with provisions for pad locking in both the "Essential" and "Emergency" positions.

- J. Unit assembly must be manufactured such that no special tools are required for its maintenance.
- K. Unit assembly must have a 100,000 Ampere short circuit current withstand rating.
- L. Unit assembly shall be capable of closing at 20 times full load current and opening at 10 times full load current.
- M. The manual transfer switch shall be positively locked and unaffected by voltage variations or momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life. The switch must be mechanically interlocked to ensure only one of the possible positions – normal, or reserve.
- N. All main contacts shall be silver composition.
- O. A manual operating handle shall be provided for transfer purposes. The handle shall permit the operator to position the switch in any of two positions. The switch shall be operational with the cover door in the closed position. The handle must be located on the side of the enclosure.
- P. For ease of maintenance, all moving and stationary power contacts of the transfer switch must be capable of being inspected from the front without disconnecting the cables or removing lugs.
- Q. The manufacturers switch design must be completely interchangeable with the switch design shown on the Drawings due to the standardization of the switch installation mounting.
- R. The unit must be suitable engineered, designed and constructed for safe, proper and reliable operation without maintenance difficulties.
- S. Materials and workmanship must be of the best quality throughout. Failure to comply with this requirement is just cause for rejecting the material furnished.
- T. The assembly shall conform to the requirements of UL, and NEMA standards.
- U. Materials and Workmanship:
 - 1. The switch must be engineered, designed and constructed for safe, proper and reliable operation without maintenance difficulties.
 - 2. Materials and workmanship must be of the best quality throughout. Failure to comply with this requirement is just cause for rejecting the material furnished.

V. Testing:

1. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all the requirements of this specification including the following switching abilities.
 - a. Overload and endurance.
 - b. Temperature rise tests after the overload and endurance test to conform the ability of the transfer switches to carry their rated current within the allowable temperature limits.
2. All production units shall be subjected to a dielectric strength test per NEMA Standard ICS 1-109.21.
 - a. The complete manual transfer switch must be tested to ensure the proper operation of the individual components.
 - b. The switch must be subjected to a dielectric strength test per NEMA Standard ICS 1-109.21.
3. Upon completion of installation and prior to start-up, the operation of the system must be demonstrated to the Engineer. All conditions found unsatisfactory must be corrected. A report of the test must be provided to the Engineer for review.
4. A minimum of 4 hours training shall be provided to maintenance personnel. The operation of the system shall be explained and demonstrated. The maintenance requirements shall be presented.

W. Provide UL listed Amp-Trap form 101 fuses as manufactured by Gould-Shawmut or equal.

X. Provide door switch that prevent door from opening when equipment is energized.

Y. Acceptable Manufacturers:

1. Pringle Electric Co. or equal.

2.03 FIBERGLASS BOXES (DC EQUIPMENT)

- A. Box enclosures shall be rigid, weatherproof, and constructed from fiberglass reinforced polyester resins for use outdoors in highly corrosive atmospheres. Design shall conform, in general, to NEMA Type 3 construction.
- B. Enclosure design shall be of single or double door overlapping style, as required. Door(s) shall be fastened to main box with continuous stainless steel (S.S.) hinges, 16 gauge minimum, the full length of the door. Enclosure design shall include complete hinge concealment when door is closed. Door(s) shall be capable of opening through a 180 degree minimum swing. Overlapping door design shall be of tamperproof construction. Door(s) surface area greater than 400 square inches shall incorporate fiberglass bracing to prevent door buckling or warpage.

- C. Main box operation of enclosure shall be of one-piece construction with smooth, rounded corners, all seams sealed, and no holes or knockouts. There shall be no gasketed joints except for neoprene door gaskets which shall ensure a tight seal.
- D. Each enclosure shall have a fiberglass drip shield installed to protect door hardware from dripping water and settling dust. Drip shield shall be attached to main box using S.S. rivets and S.S. back-up washers.
- E. Each enclosure must be provided with vents of adequate size to ensure heat dissipation. Vents must be of weatherproof and temperproof design.
- F. Enclosure door(s) must include a 3-point door latching assembly to assure positive closure of door(s). Door latches must engage door(s) to box at three points (top, middle, and bottom). All latch assembly parts must be insulated with a high dielectric epoxy coating material (15 mil. minimum thickness).
- G. Enclosure door(s) must have a S.S. door locking hasp assembly, which must be attached to door/enclosure using S.S. rivets and S.S. back-up washers. Fiberglass reinforcing pads shall be provided where locking hasp assembly is attached.
- H. Each enclosure must have a removable bottom panel section for ease of cable installation and box replacement.
- I. Each fiberglass enclosure must be suitable engineered, designed and fabricated to ensure safe, proper, and reliable operation, without maintenance difficulties.
- J. Enclosures must be fabricated using a "hand lay-up" technique for application of polyester reinforced fiberglass, minimum $\frac{1}{4}$ " wall thickness throughout. Laminates used shall be forty percent (40%) glass fiber utilizing alternate layers of one (1) ounce matt and sixteen (16) ounce woven, and sixty percent (60%) resin. Resin system used shall meet Underwriter's Laboratories SAVE-1 (minimum) flammability rating.
- K. Enclosure mainbox back panel construction must consist of a $\frac{3}{4}$ " fiberglass sandwich laminate. This laminate is made up of kiln dried, end-grain balsa wood sandwiched between laminated of polyester fiberglass.
- L. Enclosure exterior finish must be Plegon 2907 Iso-gel coating (a polyester base material) of 18 to 20 mil. thickness. Color shall be OSHA safety yellow.
- M. Enclosure interior must be finished in flat white enamel.
- N. Materials and workmanship must be of highest quality throughout fabrication process. Failure to comply with this requirement shall be just cause for rejection of a bid or the material furnished.
- O. The Contractor must adhere to the following requirements:

1. Before starting of manufacturing the Contractor must submit, for approval, drawings showing all details, dimensions, and bill of material for the enclosure.
2. Above shop drawings must be to scale and show all details of construction and materials used. They shall include all miscellaneous components, complete with installation/mounting details.

PART 3: EXECUTION

3.01 FACTORY TESTING

- A. The Equipment must be completely assembled, wired, adjusted, and tested at the factory.
- B. Complete set of tests must be performed at the factory. The test must include the manufacturer's standard commercial test and specific tests as specified.

3.02 INSTALLATION

- A. The Contractor must install the equipment in strict accordance with the approved shop drawings and equipment manufacturer's recommendations.
- B. The Contractor shall make final adjustments to the equipment which shall include verification of the proper mechanical operation, verification of the instrument operation and setting of the protective devices.
- C. Each wall mounted DC control device shall be supported from the wall with "C" shaped galvanized steel channel. The minimum separation between the equipment and the wall shall be one inch.
- D. Each switch must be mounted using fiberglass channel plates.
- E. Hardware for mounting switches to the boxes must be slotted 3/8-16 by 2-1/2 inch long brass round head machine screws with brass nuts and stainless steel flat washers.
- F. Bus bar to bus bar, lug to switch pad, and lug to bus bar connection surfaces must be bright and clean and free of oxide.
- G. All contact surfaces of bus bar to bus bar or bus bar to cable lug must be silver plated. After bolted connections are made to bus bars, coat the bus joints and cable lugs with oxide inhibitor.

Acceptable manufacturers:

1. 3M Corp.
2. Burndy "Penetrox E"

- 3. Anderson Electric Joint Compound Catalog Number 155-1Q, or equal.
- H. Bus bar surface must also be silver-plated where bus bar is to be drilled to accept future cable lugs.

3.03 TRAINING

- A. The equipment manufacturer shall provide factory technicians at the job site to provide adequate training for the City's Personnel in the proper operation and maintenance of the equipment.
- B. The training classes must be done at on-site location selected by the City. The Contractor must provide a "High Quality" VHS training video tape.
- C. The Contractor must provide all video equipment and a video recoding of all training classes on a standard VHS tape. This tape shall be submitted to the Engineer for review.
- D. If the Engineer determines that the video tape is not of "High Quality" for the future or refresher training, the Contractor shall make another video recording of another training class at no cost to the City.
- E. A minimum of 4 manhours must be provided.

PART 4: MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

- A. The Work of **DC POWER DISTRIBUTION** will not be measured for payment.

4.02 PAYMENT

- A. No separate payment will be made for the work covered in this section. Payment for the Work of **DC POWER DISTRIBUTION** will be included in the contract lump sum price as shown in the Schedule of Prices for **ELECTRICAL WORK**.

4.03 PAY ITEM ACCOUNT NUMBER

Electrical Work: 16000.100

END OF SECTION

Harrison Station Design Build Project, Requisition No. C13FT101450861
Chicago Transit Authority

APPENDIX 2: FINANCIAL PROPOSAL

PART 1: PRECONSTRUCTION PHASE SERVICES

DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL PRICE
Design and Preconstruction Services	Station	1	\$	\$

Lump Sum Price for Design
and Preconstruction Services
(Part 1A)

\$ _____

PART 2: CONSTRUCTION PHASE SERVICES

Overhead and Profit Percentage (Including General Conditions)
(Part 2A) % _____

Contingency Percentage
(Part 2B) % _____

Construction Costs
(Part 2C) \$ _____

PART 3: PRELIMINARY GUARANTEED MAXIMUM PRICE

Part 1A: Lump Sum Fee:	\$
Part 2A: Overhead and Profit Factor (x) Construction Costs:	\$
Part 2B: Contingency Percentage (x) Construction Costs:	\$
Part 2C: Construction Costs	\$
Preliminary GMP	\$

(Must Not Exceed the Project Budget
of \$4,424,704 \$6,196,017)

CHICAGO TRANSIT AUTHORITY
Advertisement for Professional Services

Proposals will be received for the following by Chicago Transit Authority at the Bid Office - 2nd Floor, 567 W. Lake, Chicago, Illinois, 60661-1498, no later than 3:30 p.m. on Thursday, October 17, 2013:

Req. C13FT101450861

Request for Proposals (RFP) for Design and Construction Services for the Engineering, Design, and Construction of the Harrison Station Rehabilitation Project.

Pre-Proposal Meeting will be held on Thursday, September 26, 2013 at 10:00 a.m. at CTA Headquarters, 567 W. Lake St., Chicago, IL 60661, 2nd floor.

Site visit will be at 724 S. State Street, Chicago, IL at 12:00 p.m.

This bid proposal is in a CD format. Interested bidders may obtain copies by coming to the Bid Office, 2nd Floor, 567 W. Lake Street, Chicago, IL, 60661 for the CD.

For additional information, please contact Katrina Bradley, Procurement Administrator, 312/681-2452.

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.

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.

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 proposals 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 due date and hour for the proposals. 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 proposal or to reject any and all proposals.

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

CHICAGO TRANSIT AUTHORITY

By: Ellen McCormack
Vice President,
Purchasing

September 12, 2013