APPENDIX D
Transit Operations Analysis Supporting Documentation

Ashland Avenue
Bus Rapid Transit Project
Environmental Assessment

Memorandum

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Subject: *Transit Operations*

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Introduction

This memorandum describes the assumptions and methodologies used in the Transit Operational Analysis section of the Environmental Assessment for the Ashland Avenue Bus Rapid Transit (BRT) Project.

Project Description

The proposed Ashland Avenue BRT Project (Build Alternative) would bring a new, premium mode of transit service to CTA's highest bus ridership route along Ashland Avenue from Irving Park Road in the north to 95th Street in the south (16.1 miles). The first phase (Phase 1) of design and construction would be located between Cortland Street in the north and 31st Street in the south (5.4 miles). While construction of BRT median stations, center running bus only lanes and Transit Signal Priority (TSP) upgrades would first be constructed in this area, limited stop service would be provided throughout the entire 16.1-mile corridor at the proposed BRT station locations using existing curbside bus stops until Phase 2 is constructed. Corridor design in Phase 2 would be similar to that in Phase 1 and would include center running dedicated BRT lanes and center median stations.

A trademark of BRT is increased frequency and capacity of service compared to regular bus service. The Ashland Avenue BRT Project is anticipated to operate at between five and fifteen minute headways in peak and off-peak hours, respectively. The BRT service would operate from 4:00 a.m. to 1:00 a.m., a span of service of 21 hours per day. CTA estimates that the total number of buses required to operate BRT peak and off-peak service with the proposed headways would be 12 vehicles (peak) and four vehicles (off-peak) in each direction for the entire 16.1-mile corridor.

Existing local CTA Bus Route #9 bus service would continue to operate in a similar manner as today when Phase 1 is implemented. Due to expected ridership shifts from Route #9 to the faster and more reliable BRT service, Route #9 frequency may be adjusted once the BRT service has matured. CTA is committed to maintaining Route #9 service to provide block-by-block local access as a complement to the BRT service. This configuration of service provides benefits to customers making both local and express transit trips.

There are 35 proposed BRT station locations that would be implemented approximately every half mile and at CTA rail stations to provide faster and more reliable service in the corridor, with fewer stops than the existing bus service. Route #9 service would continue to operate, stopping at every bus stop (approximately every one-eight mile) along the corridor.

Under the Build Alternative, improvements to pedestrian crossings and enhanced access to adjacent transit facilities would be provided at station locations, with increased amenities at BRT stations compared to local bus stops. These improvements to the pedestrian environment are proposed along with complete streets design considerations (i.e., designs that consider all users of the roadway), such as special sidewalk and curb design, to create an integrated and holistic transportation network in the corridor that not only accommodates all modes, but which would accommodate all users of the transit service and pedestrian environment. CTA and CDOT have both established complete streets design guidelines that would be incorporated into final design. CDOT's *Complete Streets Chicago Design Guidelines*[1] and CTA's *Transit Friendly Design Guide*[2] would be used to ensure that the design of stations and crossing fit the form and function of adjacent land uses and roadway typologies within the corridor.

Potential benefits to the transit system as a result of the Build Alternative which are discussed within the context of this EA include:

1. Travel Time and Reliability Changes
2. Changes to Transit Patronage and Demand
3. Station Access and Circulation

The following presents the summary of findings in each of these areas. Implementation of the Build Alternative is anticipated to improve travel time, reliability and increase the number of transit users along the corridor. Station access and pedestrian circulation are also improved through implementation of median stations and enhanced pedestrian space and amenities. Increases to traffic around stations is not anticipated to result from implementation of median stations and in most cases, and increased pedestrian accessibility would be provided to account for enhanced transit use resulting from the proposed Build Alternative and address pedestrian circulation needs for passengers transferring from other adjacent rail and bus services along the corridor.

Travel Time and Reliability Changes

Three transit operational factors were estimated and evaluated to determine anticipated travel time and reliability changes, as summarized in **Table 1**. The following provides details on how

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[1] Chicago Department of Transportation, Complete Streets Chicago Design Guidelines, 2013.
http://www.cityofchicago.org/content/dam/city/depts/cdot/Complete%20Streets/CompleteStreetsGuidelines.pdf

[2] Chicago Transit Authority, Transit-Friendly Development Guide: Station Area Typology, 2009.
http://www.cityofchicago.org/dam/city/depts/zlup/Planning_and_Policy/Publications/Transit_Friendly_Development_Guide/CTA_Typology_Study.pdf

these measures were calculated and summarizes the benefits to travel time and reliability anticipated through implementation of the Build Alternative.

Table 1: Summary of Travel Time and Reliability Changes

	Average Bus Speed (mph)	Bus Travel Time (Minutes)	Bus Reliability (Seconds)
No-Build Alternative	8.7	17.2	43
Build Alternative	15.9	9.4	22
Net Change	**83%**	**45.3%**	**48.8%**

Bus Speed

Average bus speed estimates were developed based on the Build Alternative conceptual design elements and service plan and bus speed information from *Transit Cooperative Research Program (TCRP) Report 118 – Bus Rapid Transit Practitioner's Guide* (Transportation Research Board 2007). BRT service speeds for the Build Alternative were then compared to No-Build existing bus speeds along each corridor to estimate bus speed changes. Existing bus speeds for the Route #9 average 8.7 miles per hour. Implementation of the Build Alternative would increase average speed along the corridor to 15.9 miles per hour, an increase in bus speed up to 83 percent compared to existing local bus service on the corridor. Additional bus speed increases would result from buses operating in dedicated lanes, increased station spacing compared to current local bus stops, the potential for off-board fare collection to further reduce bus dwell times, transit signal prioritization improvements, left-turn removal at intersections and traffic signal optimization.

Route #9 would continue to operate in a general purpose traffic lane and stop at all existing local bus stops. Existing Route #9 average speed is 8.7 miles per hour during peak periods and is less than projected general purpose traffic average speed of 12.8 mile per hour during peak periods. Route #9 may experience minor delays associated with the reduction in general purpose traffic lanes. However, these minor impacts to local bus speeds would be offset by the significant increases in speed of the BRT service that would provide riders with more efficient options to reach their destinations.

Travel Time

The average trip length for Ashland Avenue is 2.5 miles, and is based on CTA travel survey information collected in October 2010. Average bus travel times were estimated by multiplying average trip lengths by the preliminary average bus speed estimates for the Build Alternative. Estimated travel times were then compared to existing, No-Build bus travel times along the corridor to estimate bus travel time changes, Existing travel times along the corridor are 17.2 minutes. Bus travel time under the Build Alternative is anticipated to decrease to 9.4 minutes for a typical 2.5-mile trip, representing an approximately 45 percent travel time savings for passengers of the BRT service. These time savings are realized from BRT operating in center running dedicated lanes and having fewer stops than the local bus service.

Route #9 travel time is anticipated to maintain similar travel time for riders since impacts to local bus speed are anticipated to be minimal and to be offset by the significant gains in travel time associated with the Build Alternative.

Reliability

2010 bus reliability data from CTA for existing local bus service (No-Build Alternative) was obtained for this analysis and bus reliability estimates were developed based on the conceptual design elements and service plans for the Build Alternative and using bus reliability information from *TCRP Report 118 – Bus Rapid Transit Practitioner's Guide* (Transportation Research Board 2007). These elements were compared to No-Build bus reliability along each corridor to estimate bus reliability changes. Under typical existing conditions (No-Build), additional wait time compared to published schedule is estimated at less than one minute (43 seconds). Under the Build Alternative, bus reliability is projected to increase by almost 50 percent, with extra wait times decreasing to within 22 seconds.

Route #9 will continue to operate in a general purpose traffic lane and stop at all existing local bus stops. Route #9 may experience minor delays, leading to a minor reduction in bus reliability associated with the reduction in general purpose traffic lanes. However, the impact to the overall Route #9 reliability will be less than significant due to the substantial increases to overall transit service (BRT and local bus) with the Build Alternative.

In sum, the Build Alternative would result in overall increased bus speeds and greater reliability along the corridor through the implementation of center running, dedicated lanes for the BRT service, limited stop locations for BRT service, level boarding with the potential for off-board fare collection at BRT stations to further reduce bus dwell times, TSP improvements, left-turn removal at intersections, and traffic signal optimization.

Implementation of the Build Alternative is anticipated to result in

- improved travel times,
- greater schedule reliability,
- easier transfers,
- shorter wait times,
- greater customer satisfaction,
- improved pedestrian features, and

- increased system operating efficiencies.

The BRT service would operate with frequent service which would reduce travel delays, improve transit accessibility, and enhance the land use and transportation relationship. These service improvements are expected to positively benefit transit patronage by attracting more choice riders, i.e., those that have a choice on whether to drive an automobile or use transit service but elect to take a trip on transit.

Changes to Transit Patronage and Demand

Two ridership factors were estimated and evaluated to determine potential changes to transit patronage and demand resulting from the Build Alternative, including estimated daily boarding changes and mode split changes. The sources and methodology for these estimates are included below along with a summary of benefits to transit patronage and demand resulting from the Build Alternative.

Daily Boarding Changes

Daily boarding estimates were developed based on output from CMAP travel demand model runs that modeled the transportation operational conditions (headways and speeds) for Build Alternative. The No-Build Alternative modeling assumptions were based on the regional modeling inputs used for the 2010 analysis year in the air quality conformity analysis completed by CMAP in spring 2012 (C12 Q1). The No-Build Alternative model represents the existing roadway network and transit service levels. The model output was compared to No-Build daily boardings along each corridor to estimate daily boardings changes. Initial estimates of daily boardings along the Ashland Avenue corridor indicated an increase of 29 percent with implementation of the Build Alternative (for both local bus and BRT service). Refinements utilizing most current CMAP model data show that up to 41 percent increases to daily boardings could occur as a result of the project. These estimated daily boardings increases would result from increased transit capacity, speed, timing and reliability.

Mode Split

Mode split estimates (for local bus and the proposed BRT) were developed based on output from CMAP travel demand model runs that modeled the different vehicle operational conditions for the Build Alternative. The No-Build Alternative modeling assumptions were based on the regional modeling inputs used for the 2010 analysis year in the air quality conformity analysis completed by CMAP in Spring 2012 (C12 Q1). The No-Build Alternative model represents the existing roadway network and transit service levels. The model output was then compared to No-Build mode splits along the corridor to estimate transit mode split increases. CMAP data indicates an existing transit mode split of 14 percent and would increase to 26 percent as a result of implementation of the Build Alternative. Estimated transit mode split increases would result from increased transit ridership and decreased roadway traffic volume capacity.

Station Access and Pedestrian Space

Three station access and pedestrian space factors were estimated and evaluated to determine potential impacts of the Build Alternative, including pedestrian space, raised median space, and sidewalk buffers. The methodology and a summary of results are described below. In sum, these factors indicate that enhancements to overall access for pedestrians would be realized through implementation of the Build Alternative.

Pedestrian Space

Pedestrian space calculations were developed at proposed BRT station intersections along the corridor to represent net gains in sidewalk space and raised median space that could be realized by the Build Alternative and are summarized in **Table 2**. Pedestrian space calculations were developed at proposed BRT station intersections along the corridor to represent net gains in sidewalk and raised median space that could be realized by the Build Alternative. The proposed Build Alternative would expand the sidewalk width and install a median at stations by 52 percent.

Table 2: Pedestrian Space Evaluation

	No-Build	Build Alternative
Sidewalk Width on Both Sides (Ft.)	27	29
Station Median Width (Ft.)	0	12
Total Pedestrian Space Width (Ft.)	27	41
Change vs. No-Build	n/a	52%

Raised Medians

Raised medians represent the linear feet of raised medians along the corridor alignment between station locations. Raised median estimates were developed based on the conceptual roadway alignment design for the Build Alternative and are shown in **Table 3**. Raised median stations lengths are anticipated to increase by over 173 percent compared to existing conditions. Because raised medians would restrict pedestrian crossings at unsignalized intersections, mid-block crossings would be installed. At these locations, a break in the median would provide a crossing point and a refuge (waiting area) for pedestrians crossing Ashland Avenue.

Table 3: Raised Medians (Between Stations) Evaluation

	No-Build	Build Alternative
Medians (linear ft.)	29,331	80,180
Change vs. No-Build	n/a	173.4%

Sidewalk Buffers

The sidewalk buffer was assumed to be in place or to be installed along portions of the corridor where travel lanes would directly abut the sidewalk in order to provide pedestrians a landscaped streetscape barrier between traffic and the sidewalk. A parking lane would also serve as a de facto buffer, since parked vehicles and the lane itself segregate pedestrians from traffic. Sidewalk buffer length estimates (linear feet of sidewalk buffers, including parking lane and landscaping, between sidewalks and vehicle travel lanes) were developed based on the conceptual roadway alignment and intersection layout design for the Build Alternative, and results are shown in **Table 4**.

Table 4: Sidewalk Buffers Evaluation

	No-Build	Build Alternative
Sidewalk Buffers (linear ft.)	112,485	150,420
Change vs. No-Build	n/a	34%

Compared to the No-Build existing conditions along the corridor, a 34 percent increase to sidewalk buffers would be provided through implementation of the Build Alternative. These increases would enhance the pedestrian environment and support safe pedestrian circulation in the corridor.

References

Transportation Research Board. 2007. Transit Cooperative Research Program (TCRP) Report 118 – Bus Rapid Transit Practitioner's Guide. Available at: http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_118.pdf. Accessed: May 17, 2013.