I-805/47th Street BRT Alternatives Project

Final Technical Memorandum

Rail Facilities

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1. INTRODUCTION

This rail facilities technical memorandum addresses the existing rail facilities and impacts to them based upon the proposed BRT alternatives on I-805 to provide connection to the existing 47th Street LRT station, and local bus service.

This memorandum summarizes the evaluation process used to determine the impacts due to each alternative and outlines appropriate measures needed to further evaluate the preferred alternatives that are selected for further evaluation.

2. PROJECT LOCATION AND DESCRIPTION

2.1 Project Location
The proposed project is located along the I-805 corridor, just west of the existing 47th Street LRT station, located in the City of San Diego. This section of the rail corridor is used by Metropolitan Transit System (MTS) and San Diego and Imperial Valley Railroad (SDIY) freight service. Most of the proposed project is within the MTS railroad right-of-way (ROW), or State of California ROW. However, some alternatives under consideration may require ROW acquisition.

2.2 Project Description
Within the project reach, the MTS Eastbound and Westbound tracks cross I-805 on existing 2-span cast-in-place (CIP) box girder structures with spans from 130 feet to 151 feet.

The existing tracks crossing the interstate are on the east end of a 4 degree curve, which is superelevated at 3 inches to accommodate a design speed of approximately 45 miles per hour.

The existing 47th Street LRT station was recently reconstructed to accommodate low floor LRV service as part of the MTS Low Floor Improvements Program. The station is currently compliant with all accessibility requirements; however, portions of the platform deviate from the SANDAG design criteria, Sections 3.3.1.3 and 3.3.1.6 (C), as it lies partially in a horizontal and vertical sag curve.

2.3 Adjacent Projects
The following projects (or future projects) are adjacent to the I-805 BRT/47th Street project, of which SANDAG will coordinate with during the detailed alternatives review of this project.

- I-805 Managed Lanes
3. ASSESSMENT AND INVESTIGATION REQUIREMENTS

3.1 Design Criteria
The draft SANDAG design criteria, dated January 18, 2010 will be used in evaluating the impacts of the alternatives. In addition, all alternatives shall meet applicable requirements specified by American Railway Engineering and Maintenance-of-Way Association (AREMA), and California Public Utilities Commission (CPUC).

A few key points from the SANDAG Design criteria, Section 3.2.3, “Platform Geometry,” in regards to LRT stations are as follows:

- Platforms shall be located on tangent track with no superelevation.
- LRT Platforms shall be 360 feet in length to accommodate a four-car train, shall be a uniform 8 inches above top of rail, and shall be 2 percent maximum longitudinal and cross slope gradient.
- The platforms shall be a minimum of 15 feet in width, with at least 8 feet clear space at the loading edge of the platform.

Refer to figures 3.1 and 3.2 for typical station layout details.

FIGURE 3-1 TYPICAL STATION LAYOUT
CPUC General Orders further define the requirements for each alternative, including:

- G.O. No. 26-D, Regulations governing clearances on railroads and street railroads with reference to side and overhead structures, parallel tracks, crossings of public roads, highways, and streets.

- G.O. No. 75-D, Regulations Governing Standards for Warning Devices for At-Grade Highway-Rail Crossings

- G.O. No. 88-B, Rules for Altering Public Highway-Rail Crossings

- G.O. No. 95, Overhead electric line construction

- G.O. No. 143-B, Design, construction and operation of light rail transit systems
3.2 Project Constraints
The project is constrained along the MTS railroad corridor by available right of way, and the existing structures and station adjacent to the proposed BRT station. Accommodating the proposed BRT improvements may have the following project constraints:

- MTS right-of-way limits;
- Minimum separations of structures;
- Separation of new structures to existing structure(s) during construction;
- Maintenance of train schedules and speeds; and
- Maintenance of existing operation and minimize impacts.

3.2.1 Right-of-Way Boundaries
Railroad right-of-way width within the project limits is estimated to vary between 50 ft and 240 ft, based upon available SANGIS data, and as-built track drawings. A good portion of the right-of-way within the project limits is owned by MTS or the State of California; most track alignment alternatives considered will stay within the railroad right-of-way, with the exception of the potential LRT station relocation to the west side of I-805. It should be noted that Record of Survey (ROS) data is not available within the project footprint.

3.2.2 Existing Bridge-Mounted Utilities
The existing bridge structure includes the necessary infrastructure/utilities as needed to support typical LRT operations, including a new fiber optic backbone that is both aerial and underground through the project limits.

3.2.3 Physical Constraints
- Physical Separation between Existing and New Bridge Columns - To construct the new bridge or bridges adjacent to the existing CIP box girder, while keeping the existing bridge in service, a minimum horizontal clearance will be required between the existing and new bridge columns.
- Governmental Regulations - Per CPUC regulations, track alignments must meet separation and clearance requirements as defined within CPUC General Orders, and more specifically General Order No. 26-D.
- Low income housing adjacent to the 47th Street station

3.2.4 Operational Constraints
LRT Train Service
MTS operates the Orange Line trains 7-days a week between San Diego and Santee. Minimizing impacts to operations will need to be considered.
Freight Train Service

San Diego and Imperial Valley Railroad (SDIY) is the only freight operator between San Diego and El Cajon. According to SDIY, 2-3 freight trains currently travel between San Diego and El Cajon within a 7-day period. Trains typically run one way during the week, with round trip service on Sunday nights. Freight trains generally run between midnight and 3AM. The freight design speed through the project area is 40 mph.

3.2.5 Track Design and Geometrics
Per SANDAG design criteria and CPUC General Orders, existing alignment and profile changes are limited to maintain current operational design speeds.

4. ALTERNATIVES IMPACT REVIEW ON RAIL FACILITIES

4.1 Objectives
For the BRT alternatives analysis, and their impacts on existing rail facilities, all identified engineering, environmental and constructability constraints will be further reviewed in the detailed analysis of the selected alternatives. The intention of the initial analysis was to find the alignment and profile to best accommodate the BRT alternatives, provide the best structural solutions for the bridges, including the implementation of pedestrian access across the interstate, and provide the appropriate interface between the multiple transit modes that merge at this location.

4.2 Alternatives Review

4.2.1 Alternatives Impacting Existing Greenwood Underpass
The alternatives that require reconstruction of the Greenwood Underpass are 1a, 1b, 2a, 2d, 2e, 3a, 3b, 3c, 3d, 3e, and 3f. Refer to Appendix D. Within these alternatives, the evaluation will be expanded to consider retaining the existing LRT station versus relocating the LRT station to the west (however still east of interstate) to allow a seamless transfer between the LRT and BRT modes. In addition, the relocation of the LRT station to the west side of the interstate will be evaluated to correlate to alternatives 2d, 3b, and 3e, refer to Section 4.2.3 for general details related to this relocation.

4.2.1.1 LRT Station Relocation on East Side
Each of the alternatives will carry forward the option of relocating the existing LRT station to the west up to approximately 400’ to provide a closer interface with the BRT station locations proposed. Upon review of the LRT station shift, the existing track is still within existing horizontal and vertical curves. Track realignments would be necessary in addition to profile adjustments to accommodate the new bridge structure(s) and remove or minimize the vertical curve that would exist within the proposed station footprint. Alignment and profile adjustments would be constrained by the existing 47th Street bridge to the east. The needed profile
adjustments are further explained in the structural analysis section of the memorandum. Constructing new bridge structures with these particular alternatives provides the flexibility needed to adjust the rail alignment and profile to complement the station relocation, and minor adjustments may benefit the phasing for the reconstruction of the underpass.

One potential flaw with shifting the LRT station to the east side of the new bridge structure is available ROW to accommodate the standard platform width on the south side platform (EB Track). This is applicable to alternatives 1a, 1b, 2a, 2e, 3a, 3c, 3d, and 3f. In order to accommodate this alternative, revised track alignment(s) shifting both tracks to the north may be developed to determine feasibility and constructability of shifting the platforms. Refer to Appendix A for a realignment concept. Without the alignment shift, the existing parking associated with the housing complex south of the rail corridor will be impacted.

Additional impacts to systems infrastructure (OCS and Railroad Signaling) will need to be addressed with any track alignment/profile change. New or relocated OCS and signaling elements would be required.

4.2.1.2 Existing LRT Station to Remain
Keeping the existing station in its current location takes advantage of the recent reconstruction of the LRT station as part of the MTS Low Floor Improvements Program, which brought the station in compliance to operate low floor Light Rail Vehicle (LRV) service. Any vertical or horizontal track change would be constrained at the west end of the platform to eliminate impacts to these improvements, except as noted herein. Refer to Appendix C for these realignment alternatives. (Note the alternatives detail just the westbound (WB) track for illustrative purposes.)

Alternative ES1 shifts the new bridge structure(s) alignment to the north to allow for double track operations to be maintained during construction. However, this option would introduce speed reductions that may not be acceptable for LRT and freight operations. Alternative ES2 also shifts the new bridge structure(s) alignment to the north, but may require single track operations during construction. The speed reductions for this alternative are less restrictive due to the larger radius curve.

As mentioned, unlike the station relocation option, the track alignment/profile changes are more constrained without the additional track length available to the east end of the project to modify the existing track alignment/profile (any adjustments are constrained at the west end of the existing platform).

A preferred alternative to further evaluate if the LRT station is to remain would be a partial realignment of the trackway through the west end of the existing LRT station. This could provide a better alignment with less permanent operational impacts. This would require constructing temporary platform extensions to the east to provide the necessary platform length. Further evaluation would be required for this alternative.
If partial platform realignment and/or the needed speed reductions are found unacceptable, it would limit the options of reconstructing the bridges to approximately the same footprint as existing. Refinements will need to be considered during the further analysis to accommodate construction phasing and operational constraints.

Additional impacts to systems infrastructure (OCS and Railroad Signaling) will need to be addressed with any track alignment/profile change. New or relocated OCS and signaling elements would be required. However, this alternative has the least negative impacts to the existing system infrastructure.

4.2.2 Alternatives Retaining the Existing Greenwood Underpass

The alternatives that retain the existing Greenwood Underpass are 2b, 2c, 3g, and 3h (refer to Appendix D). Within these alternatives, the evaluation will be expanded to consider retaining the existing LRT station versus relocating the LRT station to the west (however still east of the interstate) to allow a seamless transfer between the LRT and BRT modes. In addition, the relocation of the LRT station to the west side of the interstate will be evaluated to correlate to alternatives 2b, and 3g, refer to Section 4.2.3 for general details related to this relocation.

4.2.2.1 LRT Station Relocation on East Side

Retaining the existing bridge structures provides little opportunity to modify the existing alignment or profile when coupled with the 47th Street Bridge to the east.

In shifting the platform to the east side of the existing bridge structure, it would impact the existing parking associated with the housing complex south of the rail corridor. The existing tracks are constrained such that there is no flexibility to move the tracks north to provide an adequate footprint for the relocated LRT station.

Additional impacts to systems infrastructure (OCS and Railroad Signaling) will need to be addressed with any track alignment/profile change. Considering the minimal alignment/profile changes that are possible, this should be considered a minor impact.

4.2.2.2 Existing LRT Station to Remain

Keeping the existing station in its current location takes advantage of the recent reconstruction of the LRT station as part of the MTS Low Floor Improvements Program, which brought the station in compliance to operate low floor Light Rail Vehicle (LRV) service.

Similar to the station relocation option, the track alignment/profile changes are constrained without the additional track available to the east to adjust (any adjustments are constrained at the west end of the existing platform), in addition to the constraint of the existing Greenwood undercrossing. Minor changes could be considered within the confines of the CPUC general orders.
Additional impacts to systems infrastructure (OCS and Railroad Signaling) will need to be addressed with any track alignment/profile change. New or relocated OCS and signaling elements may be required. However, this alternative has the least negative impacts to the existing system infrastructure.

4.2.3 LRT Station Relocation to West Side of Interstate

Relocation of the existing LRT station to the west side of the interstate requires significant reconstruction of the existing rail facilities. The current track is superelevated at approximately 3 inches to accommodate the design speed through the curve.

In order to accommodate an LRT platform on the west side, there are essentially two alternatives with multiple variations that will be considered (refer to Appendix B):

- Implement speed restriction to reduce needed superelevation and realign track to provide adequate tangent track, for a 360 foot platform (4 car train), or consider a deviation to implement a curved platform, with speed reductions.

- Maintain current design speed, realign track to provide adequate tangent track for a 360 foot platform (4 car train). This option will have significant impacts to existing rail infrastructure. This alternative may include deviations from current design criteria and will be documented as needed.

Alignment concepts for the Westbound (WB) track have been developed only to illustrate the impacts, based upon the various alternatives, and include the design criteria deviations and/or operational impacts and restrictions.

All options will require significant systems work (OCS and railroad signaling). Acceptable tolerances will be based upon other existing conditions found on the MTS system. The LRV to platform interface can reasonable accept up to 1.0 inch of superelevation and not impact the bridge plate/platform interface; however, further review of this location should be completed, based upon the given curve radius. This design is, however, substandard and would not be recommended.

The following describes various alternatives to illustrate the constraints of relocating the existing LRT station to the west side of I-805 (refer to Appendix B). (Note the alternatives detail just the westbound (WB) track for illustrative purposes.)

Alternative 1 – 360-Foot Tangent Station outside Right-of-Way

- Platform and track located to the north of the existing track.
- This alternative complies with all standards except reduction of the desirable minimum mainline curve radius from 1500 feet to 1350 feet (Section 3.3.1.4A) and the spirals do not begin or end 75 feet outside the station limits (Section 3.3.1.3).
Maintains current design speeds.
Platform is located outside the existing right-of-way. Right of way acquisition is also required for a majority of new track to the west of the proposed station.
May be able to maintain double track operations during portion of construction. Would require some single track operations.
Relocation of the existing traction power substation (TPSS) required.

**Alternative 2 – 360-Foot Tangent Station outside Right-of-Way**

- Platform and track located to the north of the existing track.
- This alternative complies with all standards except reduction of the desirable minimum mainline curve radius from 1500 feet to 1350 feet (Section 3.3.1.4A) and the spirals do not begin or end 75 feet outside the station limits (Section 3.3.1.3).
- Maintains current design speeds.
- Platform and portions of the track alignment fall outside of the existing right-of-way. Right of way acquisition required for platform, track and portion of the new bridge structure(s). Major impacts to private and other public right of way.
- May be able to maintain double track operations during majority of construction. Would require some single track operations.
- Relocation of the existing TPSS required.

**Alternative 3 – 360-Foot Curved Station, V=45 MPH**

- Platform and track located to the north of the existing track.
- This alternative has a curved platform with 1-inch superelevation and a minimum radius of 2083.68 feet, which deviates from Section 3.2.3 which states, “Stations shall be located on tangent track sections with no superelevation.” The 1-inch superelevation is similar to other MTS station platforms that are located on a horizontal curve. However, this is not a recommended deviation.
- Maintains current design speeds.
- Platform and a majority of new track are located within the existing right-of-way. Right of way acquisition required for portion of the new track west of proposed platform. Impacts to K Street in public right of way.
- Maintains double track operations during majority of construction. Would require some single track operations to finish.
- Relocation of the existing TPSS required.

**Alternative 4 – 360-Foot Curved Station, V=40 MPH**

- Platform and track located to the north of the existing track.
- This alternative has a curved platform with 1-inch superelevation and a minimum radius of 1605 feet, which deviates from Section 3.2.3 which states, “Stations shall be located
on tangent track sections with no superelevation.” The 1-inch superelevation is similar to other MTS station platforms that are located on a horizontal curve. However, this is not a recommended deviation.

- Reduces LRT speeds to 40 MPH through the horizontal curve at the station.
- Platform and track are located within the existing right-of-way.
- Single track operations required for majority of construction.
- May require modifications to existing TPSS.

**Alternative 5 – 360’ Tangent Station within Right-of-Way, V=25 MPH**

- Platform and track located to the north of the existing track within the existing right-of-way.
- This alternative complies with all standards except reduction of the desirable minimum mainline curve radius from 1500 feet to 565 feet (Section 3.3.1.4A) and the spirals do not begin or end 75 feet outside the station limits (Section 3.3.1.3).
- Reduces LRT and freight speeds to 25 MPH through the horizontal curves entering/exiting the station.
- Single track operations required for majority of construction.
- May require modifications to existing TPSS.

**Alternative EX – 360-Foot Curved Station, V=37 MPH**

- Track alignment follows the existing alignment. Existing track has a superelevation of 3”, which would be reduced to 1” at the station platform.
- This alternative has a curved platform with 1-inch superelevation and a minimum radius of 1403.16 feet, which deviates from Section 3.2.3 which states, “Stations shall be located on tangent track sections with no superelevation.” The 1-inch superelevation is similar to other MTS station platforms that are located on a horizontal curve. However, this is not a recommended deviation.
- Reduces LRT speeds to 37 MPH through the horizontal curve at the station.
- Platform and track are located within the existing right-of-way.
- Single track operation required for majority of construction.

**4.2.4 General Order 88-B Requirements**

It is recommended that all options considered for detailed analysis be shared with the CPUC, as most alternatives would require authorization from the agency prior to construction. It is anticipated that options 3a, 3b, 3c, 3d, 3e, 3f, 3g, and 3h will realize additional scrutiny due to the introduction of a new at-grade crossing, when other grade-separated options are feasible.

The CPUC continues to promote the use of grade separation where new crossings are implemented. One inherit risk with the introduction of new at-grade crossings, is that it provides
an additional access point for the general public to gain access to the right of way. The separation from any proposed BRT at-grade crossing alternative to the LRT station, existing or relocated, shall be a minimum of 50’, to conform to current SANDAG design standards and to accommodate the necessary signaling equipment.

4.2.5 Special Trackwork – Temporary and Permanent
The installation of special trackwork, temporary or permanent, will be necessary to support construction of the proposed alternatives. MTS has identified locations east and west of the project limits where the addition of facing or trailing point crossovers (facing point refers to a switch arranged such that the train faces the points as it passes them, and a trailing point refers to a switch arranged such that the points are directed away from a passing train), would increase future operational flexibility. This would then provide new universal crossover arrangements. As the alternatives are carried to detailed analysis, the location and type of crossovers will be recommended in coordination with MTS operations staff. In addition, this will necessitate systems work (overhead catenary, and signaling) to support the temporary or permanent crossovers.

5. STRUCTURAL ALTERNATIVES
The existing Greenwood Undercrossing consists of two separate bridge structures, the first constructed to support single track operations in 1975, and the second to support double track operations in 1993. In addition to evaluating the structural impacts to accommodate the proposed BRT alternatives, pedestrian access across the interstate via pedestrian bridge will be evaluated.

5.1 Background
The existing railroad bridges are approximately 287 feet in length. The structures consist of a pair of 2-span cast-in-place box girder structures with spans between 130 feet and 151 feet.
The new bridge construction may consist of one double-track structure or two single-track structures, but bridge capacity for at least one new track will be provided before the existing bridges can be demolished.

5.2 Pedestrian Crossing Options
Two alternatives will be evaluated to accommodate a proposed pedestrian crossing over I-805.

5.2.1 Attachment to Existing Structure
Attaching a lightweight pedestrian structure to the existing rail underpass crossing I-805 is feasible and should be considered an option. A concept that has been used successfully in the past uses a lightweight pedestrian deck on a steel floor beam and stringer system which extends out from the existing bridge edge and is supported by a diagonal brace down to the bottom of the existing structure. The width of these added walkways is typically 8’ to 10’, narrower than a standalone pedestrian structure. A sketch of this system based on past projects is included (see Figure 5-3). It could involve adding a lightweight cantilever structure to the side of the bridge braced off of the existing web or bottom flange and tied into the deck through the existing curb. Attaching this will require a closer look at the condition of the existing structure. Security and safety improvements on such a structure will also be further reviewed. It will also require a more detailed analysis of the structure primarily under two changed loads on the bridge:

- **Seismic Performance:** The effect on the bridge to perform with the added mass of the pedestrian structure affecting the seismic performance of the bridge. A lightweight pedestrian structure will likely not have a large effect. Additional weight saving modifications to the existing structure or trackbed could balance those changes as well.

- **Live Load:** The added pedestrian load, though cantilevered out, is small compared to the design Cooper E-80 loading of the bridge. The likelihood of a full pedestrian loading...
occurring simultaneously with a full rail loading should be taken into account when assessing the bridge. Typically it is assumed they do not occur simultaneously resulting in the rail loading continuing to govern the bridge performance. For the configuration of this proposed project that should be the case.

5.2.2 New Pedestrian Structure
A new pedestrian overcrossing would provide a more conventional and robust solution and provide for a pedestrian crossing with a more typical width of 12’ to 14’. The structure would likely be a cast-in-place (CIP) box girder structure to match the other structures along the corridor although other structure types such as steel or possibly precast girders would work as well. This structure should be considerable shallower than the adjacent rail bridge as well as have a much smaller substructure. The existing structure foundation does not extend a great deal outside of the shadow the existing structure and shouldn’t conflict with a new pedestrian structure foundation placed in the median.

If the existing underpass bridge is replaced, as would be required for some alternatives, the new pedestrian crossing should be incorporated into the new rail bridge.

5.3 Replacement of Existing Undercrossing Structure
The existing underpass structure is a pair of 2-span CIP box girder structures with span configurations of 145’-140’ in the original structure and 151’-130’ in the widened structure. Most of the proposed alternatives impact the existing abutments of the underpass structure thereby requiring replacement. To accommodate the required ultimate width of the interstate a new longer structure, approximately 45’ +/- longer on either or both ends, as compared to the existing structure, is necessary. Lengthening the spans by 33% will require additional consideration of the structure type selected. Using the same structure type as currently exists
would likely require deepening the structure by around 3’ to maintain a similar span-to-depth ratio as currently exists. Other structure types appropriate to span length of up 190’ are deck or through truss structures. To accommodate a similar span-to-depth ratio, the vertical clearance below the existing bridge and the existing track profile will be evaluated to determine an acceptable balance to achieve the needed structure depth. Prior to recommending the preferable bridge alternative an evaluation of other structure types that stay within the constraints of acceptable vertical clearance and track profile adjustment limits should be performed.

**5.4 Modifications to existing undercrossing for at-grade BRT crossing**

To accommodate an at-grade crossing on the underpass structure some minor modifications will be required. The existing curbs and fencing will be modified. Precast crossing panels will be used to form the at-grade crossing. The existing structure will need to be analyzed to account for the added mass on top of the bridge. While it is assumed that the change will not result in any required strengthening of the bridge, when detailing the crossing panels and modifications an effort to reduce weight where possible should be included.

The at-grade crossing of the BRT vehicles on the structure will not pose a significant safety risk as long pedestrian and station access is kept separate from the area of the crossing. Consideration should be given to the distance between the crossing and the platform as well as the direction of pedestrian travel to access the platform.
NOTE
RIGHT-OF-WAY SHOWN BASED ON SANJOS
MAPPING. RIGHT-OF-WAY RESEARCH TO BE
COMPLETED IN LATER DESIGN STAGES.

PLAN
SCALE 7"=100'

LEGEND:

- - - - NEW TRACK CENTERLINE
- - - - EXISTING TRACK CENTERLINE
- - - - NEW STATION PLATFORM
- - - - NEW BRIDGE STRUCTURE
- - - - RIGHT OF WAY

I-805/47TH STREET BRT/LRT

APPENDIX A
LRT STATION RELOCATION ON EAST OF BRIDGE STRUCTURE
LRT STATION RELLOCATION ALTERNATIVES

- **ALT 1**: 300' TANGENT STATION OUTSIDE RIGHT-OF-WAY
- **ALT 2**: 90° TANGENT STATION OUTSIDE RIGHT-OF-WAY
- **ALT 3**: 300' CURVED STATION R=2000, 62'-5, V=45 MPH
- **ALT 4**: 90° CURVED STATION R=400, 62'-5, V=40 MPH
- **ALT 5**: 90° TANGENT STATION WITHIN RIGHT-OF-WAY
- **ALT 6**: 300° CURVED STATION R=1400, 62'-5, V=45 MPH

- **EXISTING TRACK CENTERLINE**
- **RIGHT OF WAY**

*ONLY NS TRACK ALIGNMENT AND STATION PLATFORM SHOWN*

**NOTE:**
RIGHT-OF-WAY SHOWN BASED ON SANDIS MAPPING. RIGHT-OF-WAY RESEARCH TO BE COMPLETED IN LATER DESIGN STAGES.
1A Freeway Level, In-Line Station
Side Platforms

1B Freeway Level, In-Line Station
Center Platform

2A Mid-Level, In-Line Station
Left Hand DAR

2B Mid-Level, Off-Line Station
Flyover, West Side Platform
Tunnel Crossing Under Tracks

2C Mid-Level, Off-Line Station
Flyover, East Side Platform
Tunnel Crossing Under Tracks

2D Mid-Level, Off-Line Station
Flyover, West Side Platform
Open Crossing Under Tracks

2E Mid-Level, Off-Line Station
Flyover, East Side Platform
Open Crossing Under Tracks
I-805 47TH ST INITIAL SCREENING CONCEPTUAL ALTERNATIVES

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APPENDIX D - PAGE 2 OF 2