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# TECHNICAL MEMORANDUM

TO: Transit Advisory Group

FROM: Jeff Rhoda

DATE: December 5, 2013

RE: I-494/I-35 Interchange Vision Layout Development - BRT Station Concepts  
S.P. 2785-330B  
SEH No. 123252 04.00

## I-494/I-35W Interchange Vision Layout Development Bus Rapid Transit (BRT) Station Concepts Development and Evaluation

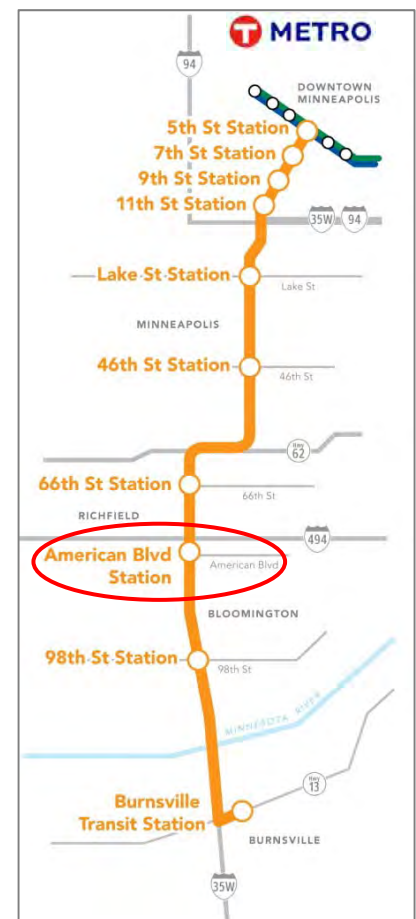
### Objective

The I-494/I-35W Interchange Vision Layout Development project is the continuation of the I-494/I-35W Interchange Preliminary Design Project completed in 2010, seeking to further refine concepts for the interchange and an I-35W BRT station to serve the American Boulevard location, as illustrated on Metro Transit’s Orange Line BRT station map to the right. The ultimate goal for this study is to determine a “Vision Layout” or the most desired concept for the I-494/I-35W interchange and BRT station development. The objective of this technical memorandum is to summarize the development and evaluation of the BRT station concepts and to recommend the most desired BRT station concept for inclusion with the Vision Layout for the interchange.

### Background

Stretching from Burnsville to downtown Minneapolis, the 16 mile corridor of I-35W has been the most heavily traveled express bus corridor since the 1970s, with approximately 14,000 daily rides. Metro Transit is currently developing the Orange Line BRT with 10 upgraded stations along I-35W, including a new station in the vicinity of the American Boulevard overpass in Bloomington.

The development of concepts for an American Boulevard BRT station began with the I-494/I-35W Interchange Preliminary Design Project. The final report for that project can be found at the following link: <http://www.dot.state.mn.us/metro/projects/i494and35winterchange/docs.html>. This project, in addition to developing new interchange concepts, developed an initial list of ten BRT station concepts, with accompanying park-and-ride site, with the goal to narrow the list to three desirable concepts for further study.



The process for narrowing the list of concepts included the creation of an evaluation matrix through input from the project's Technical Advisory Committee (TAC). The matrix included evaluation criteria based on three main categories which included: Users, Site and Operations. These three categories were further broken down into specific evaluation criteria items in order to rate each BRT concept. The ratings were based on a simple relative comparison of Positive, Neutral and Negative impacts to the defined evaluation criteria. A copy of the 2010 BRT evaluation matrix is included on page 3.

The individual TAC members completed their ratings of the concepts and then the TAC group compared these ratings, discussed individual variations in ratings and determined agreed final ratings of the evaluation matrix.

The three concepts identified through the 2010 evaluation matrix ratings for further review included:



#### **Online I-35W at American Boulevard**

Includes a single platform station in the I-35W median with weaving bus movement (accommodates bus right side enter/exit), vertical circulation to American Blvd. and widening of the American Blvd. bridge to accommodate bus pullout areas on each side of the bridge.

*Image is an example rendering of the I-35W and 46<sup>th</sup> Street BRT Station, which is now in operation.*



#### **Online I-35W south of American Boulevard**

Includes a dual side platform station (eliminates weaving movement) in the I-35W median located between American Blvd. and 82<sup>nd</sup> St. and vertical circulation to an overhead pedestrian skyway (from a parking structure located off the right-of-way).

*Image is an example rendering from another BRT project.*



#### **Off line I-35W T Bus Ramp between 82<sup>nd</sup> St. and American Boulevard**

Includes a bus ramp located in the I-35W median between American Blvd. and 82<sup>nd</sup> St. connecting to an overpass bridge of southbound I-35W which leads to a transfer station and parking structure west of 35W, located off the interstate right-of-way.

*Image is an example photo from another BRT project location.*

The completion of the 2010 study recommended these three BRT station concepts to move forward for future study and determination of the most desired concept for inclusion with the future interchange layout. In addition, all three station concepts were determined to be compatible with potential interchange layouts under consideration.

2010 BRT Station Evaluation Matrix

ALTERNATIVES EVALUATION MATRIX (RELATIVE COMPARISON - NOT ABSOLUTE)															
Ratings Key: <span style="color: green;">●</span> Positive <span style="color: yellow;">●</span> Neutral <span style="color: red;">●</span> Negative															
BRT Concept Alternatives	User Criteria					Site Criteria				Operational Criteria					
	Proximity to 35W	Transfer Time	Safety	Walking Distance	Unique Accommodations	Park and Ride Availability / Convenience	Transit Oriented Development Potential	Proximity to American Blvd	Existing Land Use / Land Availability	Expandability	Right-of-Way Required	Bus Travel Time	Bus Transfer Efficiency	Special Operations	Coordination with Other Transit Services
1A 82nd St. In-Line 35W Site A, P&R	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
1B 82nd St. In-Line 35W Site B, P&R	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
1C American Blvd. In-Line 35W Site C, P&R	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
1D American Blvd. In-Line 35W Site D, P&R	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
2A Off-Line West of 35W Site A or C, P&R	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
2B Off-Line 82nd St. Ramps Site A, P&R	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
3A T (Bus) w/ Off-Line Site D Trans. Facil. Site C BRT/Local Trans. Facil. and P&R	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
3B T (Ped) w/ In-line (center crossover) 35W Site C Local Trans. Facil. and P&R	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
3C T (Ped) w/ In-line (center) 35W Site C Local Trans. Facil. and P&R	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
3D T (Ped) w/ In-line (center offset) 35W Site C Local Trans. Facil. and P&R	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

BRT Alternatives Evaluation Criteria

**User Criteria**  
*Proximity to 35W* - Location of the BRT station to the 35W mainline.  
*Transfer Time* - Amount of time to complete a transfer from a local bus from a transit stop to BRT station platform.  
*Safety* - Based on occurrence of potential conflict points/crossings for pedestrians and buses.  
*Walking Distance* - Distance from a Park-and-Ride location to the BRT station platform.  
*Unique Accommodations* - Ability of the alternative to provide additional accommodations beyond the typical BRT Station amenities.  
*Park and Ride Availability/Convenience* - Location of the park-and-ride for easy access and mobility in the user's commute route.

**Site Criteria**  
*Transit Oriented Development Potential* - Does the alternative provide the ability to incorporate transit oriented development elements.  
*Proximity to American Blvd* - Distance of the BRT Station platform from American Blvd.  
*Existing Land Use/Land Availability* - Is the BRT Station location consistent with the City's area land use plan/development plans and potentially available.  
*Expandability* - Ability to expand the facility to accommodate future transit growth.  
*Right of Way Required* - Estimated impact/magnitude of additional right-of-way required for facility.

**Operational Criteria**  
*Bus Transfer Time* - Amount of travel time for the bus between the gore points of a 35W exit ramp to the corresponding entrance ramp, including an average transfer time.  
*Bus Transfer Complexity* - The number of potential conflict points and delays between different service providers using the transit station.  
*Special Operations* - The existence of special maneuvers or traffic operations.  
*Coordination with Other Transit Service* - Ability to provide layover facilities and freeway access to other transit services besides the BRT buses.

**Freeway Criteria**  
*Compatibility with Interchange Concept* - Is the BRT Station location and footprint compatible with the interchange concepts.

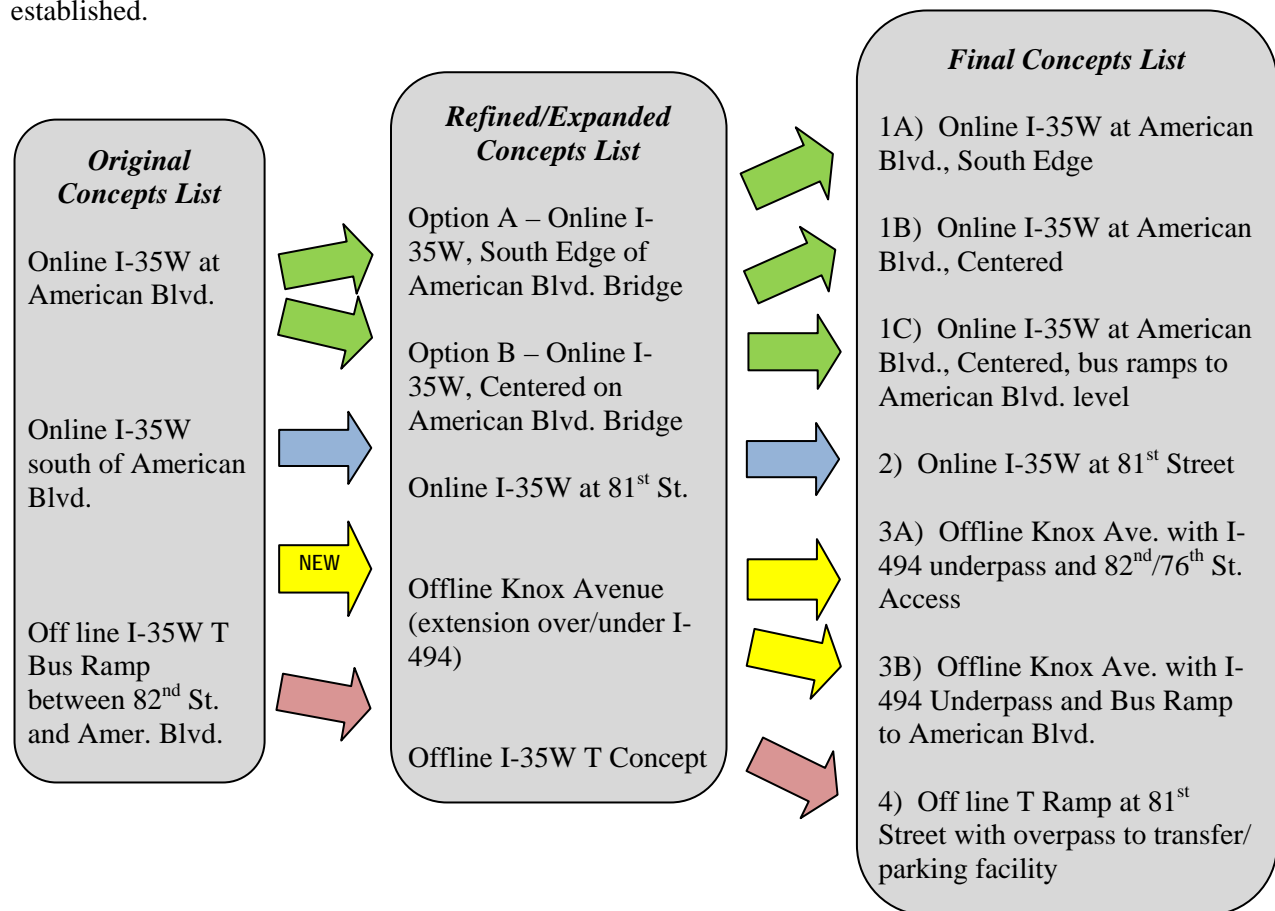


## Concepts

The development of concepts under the I-494/I-35W Interchange Vision Layout study began with the three previously established concepts from the 2010 study. Through the efforts of both the TAC and the Transit Advisory Group (TAG – a small working group comprised of members from the TAC) these three concepts were reviewed for compatibility with current objectives and interchange layouts and then expanded into a new list of concepts for consideration.

A key item for the online I-35W station concepts was the single center platform vs. dual side platforms layout. The 46<sup>th</sup> Street BRT station, operational in 2010, was built with a single center platform where the buses perform a weave movement to facilitate the right-side door access to the platform. Study of the Lake Street BRT station in 2012 determined that due to safety and operational concerns resulting from higher bus volume projections for that station, a dual side platform layout would be utilized. As a result, it was determined that an online BRT station at American Boulevard would also utilize the dual side platform layout.

Through the development of layouts for these expanded concepts, key features and impacts were identified which allowed the concepts to be further refined and a final list of seven station concepts was established.



The following pages provide a general description of the final concepts, including noted special features, a basic Pros and Cons comparison for each along with a layout sketch.



BRT Station Concept Routes

I-35W Concepts: 1A, 1B, 1C, 2 and 4

Knox Ave. Concepts: 3A and 3B

## Concept 1A

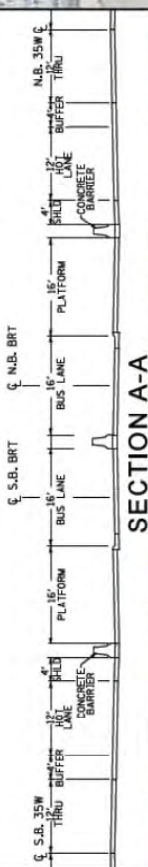
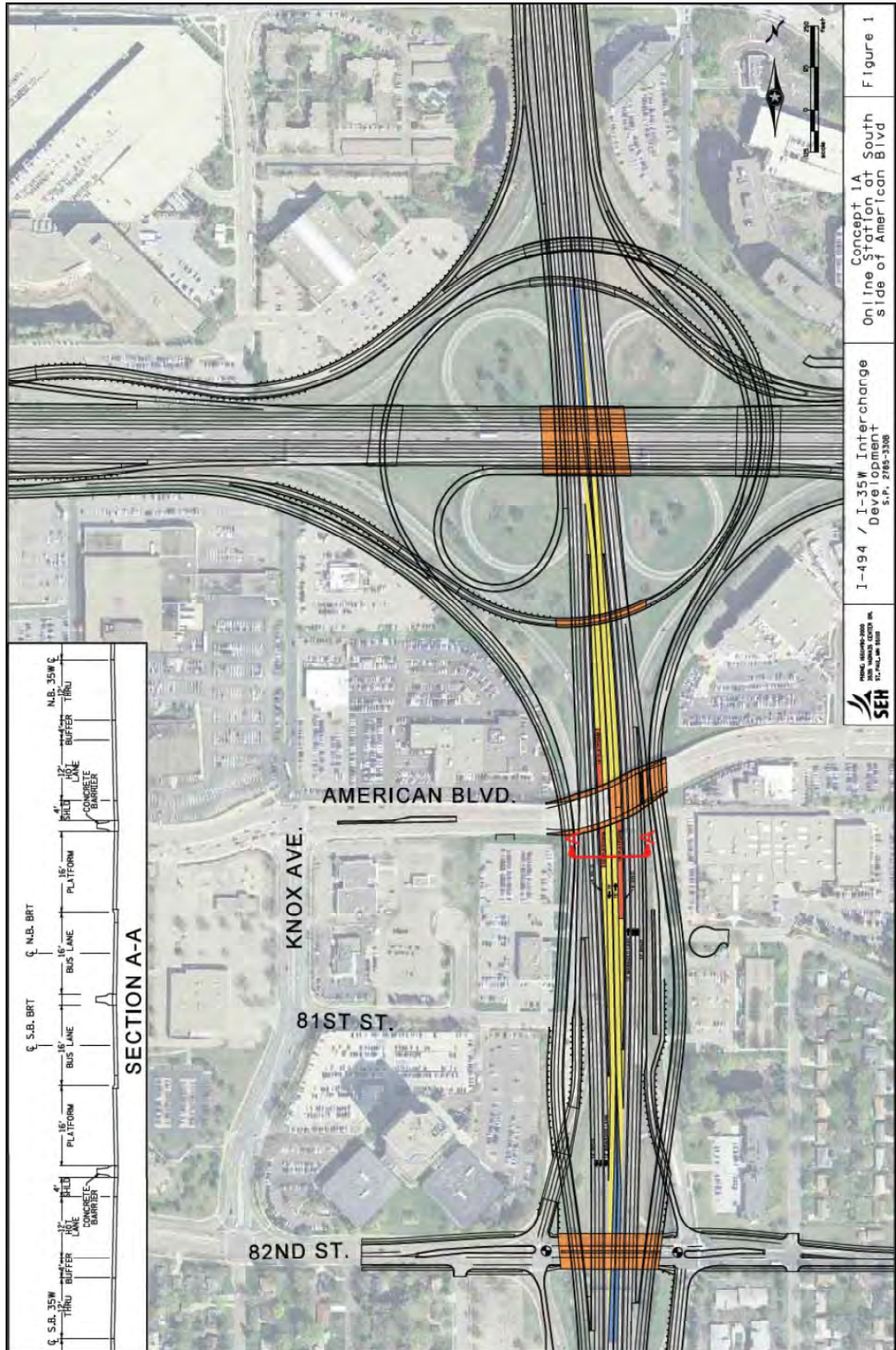
### Online I-35W at American Blvd., South Edge


Center median transit lanes with outside dual transit platform areas to facilitate access for existing right-side bus doors. Platforms elevation at I-35W roadway level. Vertical circulation towers at each platform, including stairs and elevator, between the I-35W roadway and the American Boulevard bridge sidewalk level. Platforms positioned to facilitate one set of vertical circulation towers on the south edge of the American Boulevard bridge structure. Southern edge positioning provides potential connection to an overhead skywalk structure from the platforms to Pedestrian waiting area on platforms positioned in advance of the tower structures, necessitating the offset platforms positions. American Blvd. bridge widened to facilitate bus stop lane.

Pros	Cons
Access to BRT routes on both I-35W and American Blvd.	Noise levels at I-35W platforms
Short transfer distance for users	Requires modifications to east half of American Blvd. bridge due to I-35W median widening
Efficient for bus operations	Vertical towers on south side only limit ease of pedestrian access
	AM peak merge movement from an American Blvd. median station to the ramp stations at 66 <sup>th</sup> St. would be very difficult
	Online 35W bus routes stopping at American Blvd. may choose to not stop at 66 <sup>th</sup> St., leaving Richfield with no BRT stops.

**Concept 1A Layout Sketch - Online I-35W at American Blvd., South Edge**

Note: Sketch layouts developed using the I-494/I-35W Turbine interchange concept and include improvements to the 82<sup>nd</sup> St. interchange to address ramp spacing on I-35W. BRT related improvement shown in yellow and blue colors. BRT platforms shown in orange. Bridge structures impacted by the BRT station improvements are shown in orange.




  
 PREPARED BY: SEH
   
 PROJECT NO.: 2009-000
   
 DATE: 12/05/13
   
 I-494 / I-35W Interchange Development
   
 S.P. 2765-3308
   
 Concept 1A
   
 Online Station at South Side of American Blvd
   
 Figure 1



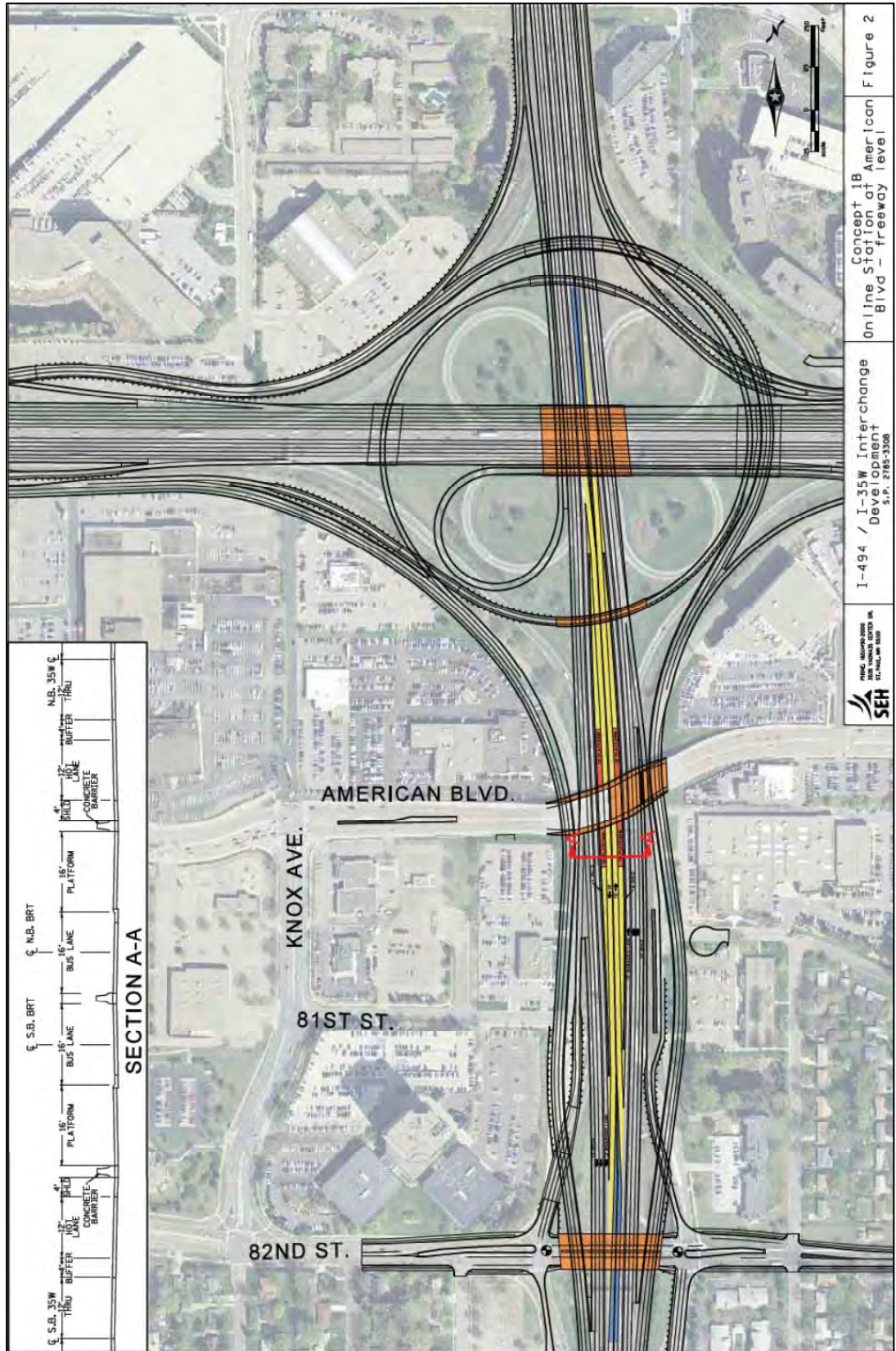
## Concept 1B

### Online I-35W at American Blvd., Centered

Center median transit lanes with outside dual transit platform areas to facilitate access for existing right-side bus doors. Platforms elevation at I-35W roadway level. Vertical circulation towers on the north and south sides of American Blvd. bridge for each platform area. Towers include stairs and elevator between the I-35W roadway and the American Boulevard bridge sidewalk level. Platforms generally centered below American Blvd. bridge structure. American Blvd. bridge deck widened to facilitate bus stop lane in each direction.

<b>Pros</b>	<b>Cons</b>
Access to BRT routes on both I-35W and American Blvd.	Noise levels at I-35W platforms
Short transfer distance for users	Requires modifications to east half of American Blvd. bridge due to I-35W median widening
High efficiency for bus operations	AM peak merge movement from an American Blvd. median station to the ramp stations at 66 <sup>th</sup> St. would be very difficult
Towers on both sides of bridge provides best pedestrian access	Online 35W bus routes stopping at American Blvd. may not also stop at 66 <sup>th</sup> St., leaving Richfield with no BRT stops

**Concept 1B Layout Sketch - Online I-35W at American Blvd., Centered**





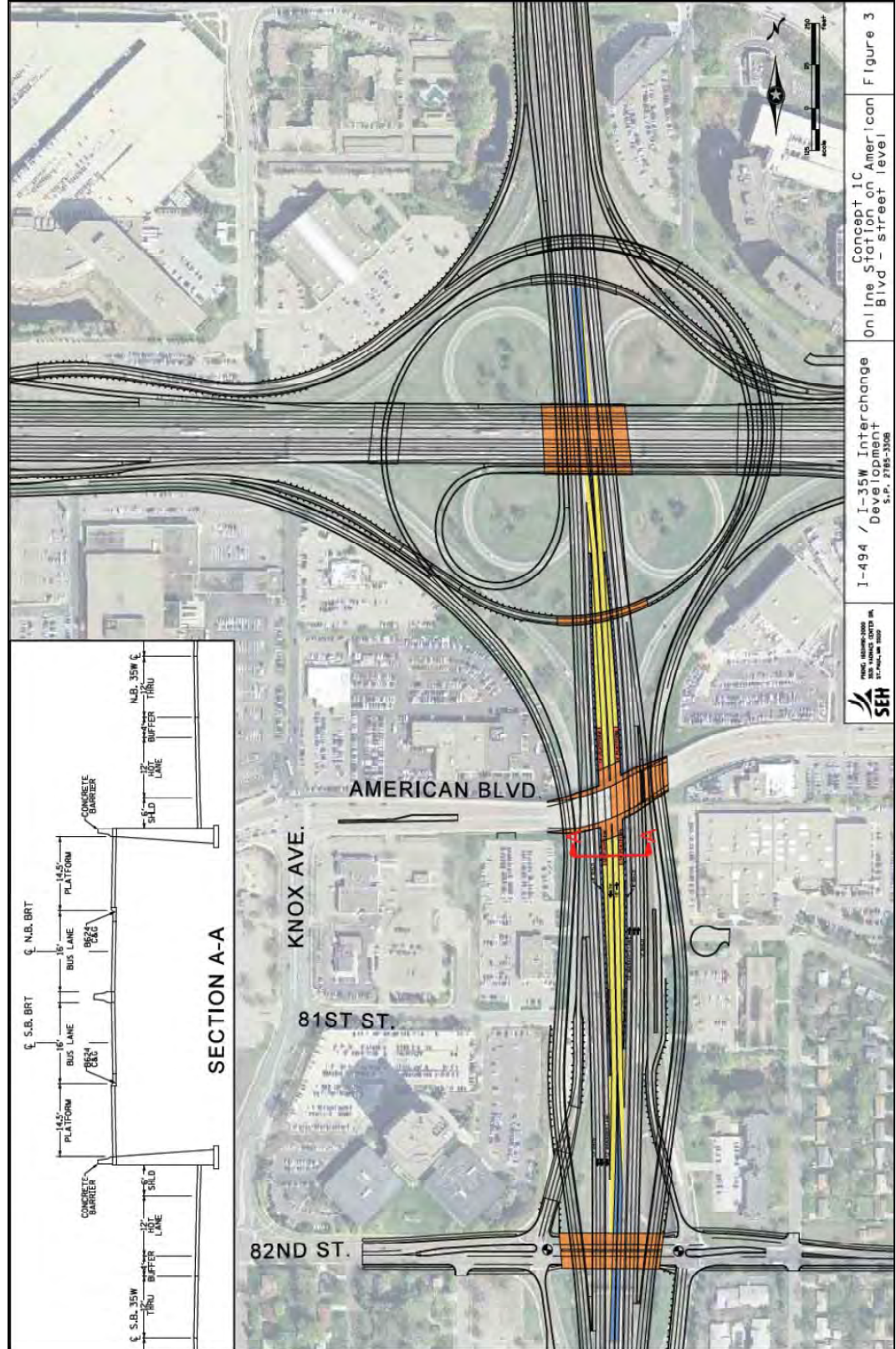
## Concept 1C

### Online I-35W at American Blvd., Centered, Bus Ramps to American Blvd. Level

Center median transit lanes with outside dual transit platform areas to facilitate access for existing right-side bus doors. Platforms elevation at American Blvd. bridge level with bus ramps to/from I-35W north and south of American Blvd. Platforms positioned on both sides of American Blvd. to allow far side or near side stops for buses. Traffic signal on American Blvd. bridge to provide transit priority. American Blvd. bridge deck widened to facilitate bus stop lane in each direction.

<b>Pros</b>	<b>Cons</b>
Direct access to BRT routes on both I-35W and American Blvd.	Requires modifications to east half of American Blvd. bridge due to I-35W median widening
Shortest transfer distance for users	Minor delays to American Blvd. traffic from new signal for bus priority
High efficiency for bus operations	AM peak merge movement from a median American Blvd. station to the ramp stations at 66 <sup>th</sup> St. would be very difficult
Ramps help with bus acceleration and deceleration to/from station platform areas	Online 35W bus routes stopping at American Blvd. may not also stop at 66 <sup>th</sup> St., leaving Richfield with no BRT stops
Eliminates vertical circulation between stations	

**Concept 1C Sketch Layout - Online I-35W at American Blvd.,  
Centered, Bus Ramps to American Blvd. Level**



## Concept 2

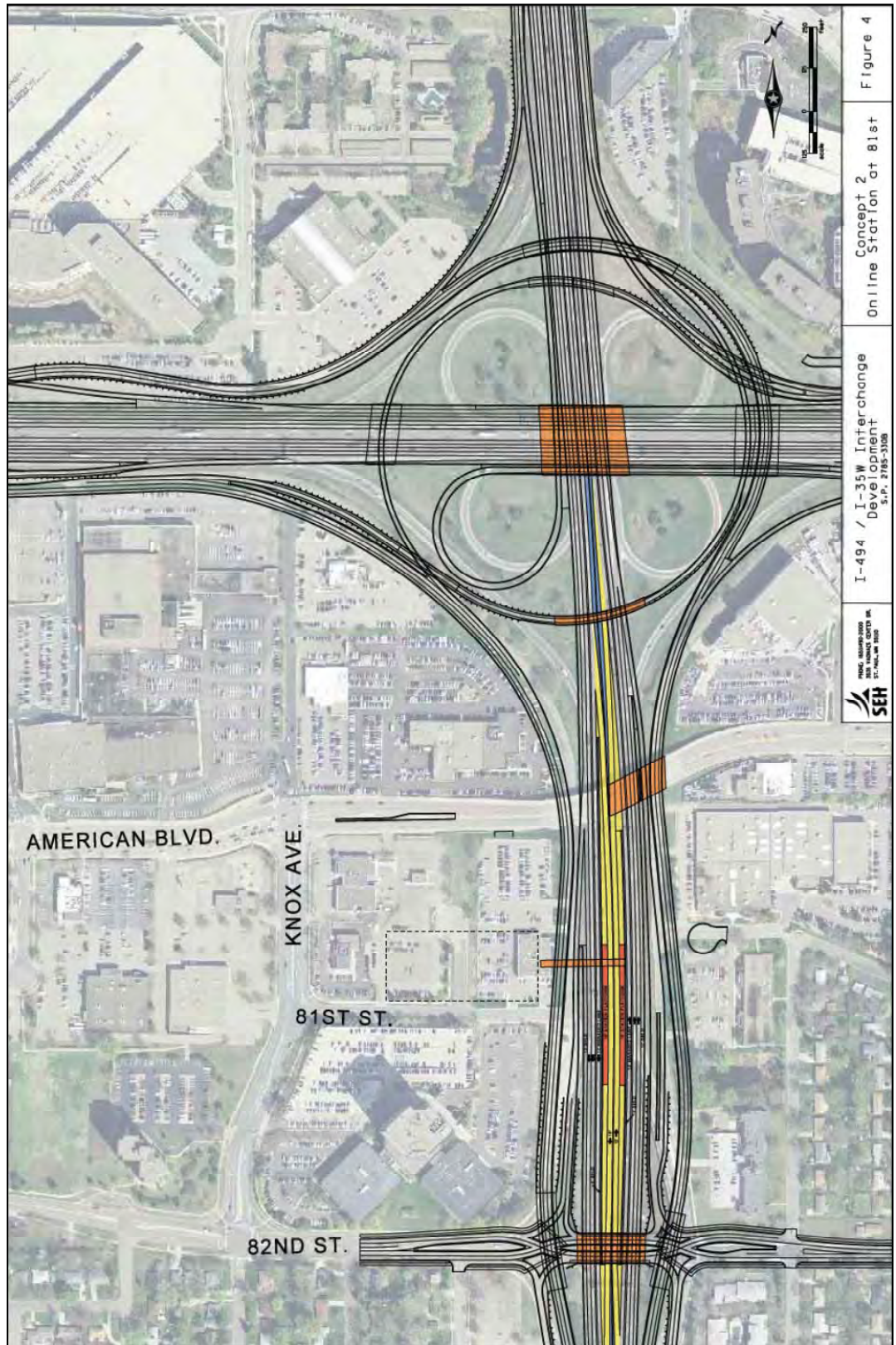
### Online I-35W at 81<sup>st</sup> Street, Pedestrian Skywalk to Parking Facility

Center median transit lanes with outside dual transit platform areas to facilitate access for existing right-side bus doors. Platforms elevation at I-35W roadway level. Vertical circulation towers at each platform, including stairs and elevator, to skywalk bridge structure across southbound I-35W. Skyway extends west to potential park-and-ride structure.

Pros	Cons
Efficient bus operations on I-35W	Noise levels at I-35W platforms
Access to BRT route on I-35W from parking structure to platforms through skywalk giving protection from weather conditions	Requires modifications to east half of American Blvd. bridge due to I-35W median widening
	Longer transfer distance for users
	Dependent on parking facility close to I-35W
	AM peak merge movement from an median station to the ramp stations at 66 <sup>th</sup> St. could be very difficult
	Online 35W bus routes stopping at 81 <sup>st</sup> Street station may not also stop at 66 <sup>th</sup> St., leaving Richfield with no BRT stops



**Concept 2 Layout Sketch - Online I-35W at 81<sup>st</sup> Street,  
Pedestrian Skywalk to Parking Facility**



## Concept 3A

### Offline Knox Ave. with I-494 underpass and 82<sup>nd</sup>/76<sup>th</sup> St. Access

BRT transit route which deviates from the I-35W corridor approximately 1,000 ft. west to Knox Avenue on the local street network to more directly serve the Transit Oriented Development (TOD) area of the Penn American District. Transit stations (two pairs) positioned along Knox Avenue near American Boulevard and another near 76<sup>th</sup> Street. Requires extension of Knox Avenue south from the Best Buy/Dick's Sporting Goods properties beneath I-494 to American Boulevard. The Knox Avenue extension segment would function primarily as a transit corridor; however, general purpose traffic may also be incorporated into this corridor. Access to the Knox Avenue transit corridor will be from the existing 76<sup>th</sup> Street and 82<sup>nd</sup> Street interchanges. Transit Signal Priority would be utilized through existing signalized intersections.

<b>Pros</b>	<b>Cons</b>
Shorter walk distances to rider destinations from stations	Longer travel times for Orange Line
Station locations significantly increase walkshed for existing sidewalk network	Ridership of other providers may not warrant utilization of this station
Serves both Bloomington and Richfield	May require an additional bus to maintain service along the route
Noise levels much lower compared to online stations	Major impacts to traffic on I-494 during construction
Improved FTA funding eligibility	Private property acquisition required
Reduces I-35W footprint on right of way	Could trigger eminent domain action
American Blvd. bridge not impacted	Access to private properties impacted
Eliminates vertical circulation between stations	Routes stormwater to already challenging Penn Avenue area
Provides local street connection (if general purpose traffic allowed) which may help with congestion at Penn and Lyndale Avenue intersections	Transit route through flood-prone American Blvd. and Knox Avenue intersection
Station placement closer to center of Penn American District	Relocation of large watermain
Ability to locate park-and-ride closer to transit station	Adds complexity to implementation of Orange Line
Improves pedestrian and bicycle access to Penn American District	Reduces development benefits east of I-35W
Provides safe link for regional bicycle network across I-94	
Removes merge condition on I-35W between stations	



**Concept 3A Layout Sketch - Offline Knox Ave. with I-494 underpass and 82<sup>nd</sup>/76<sup>th</sup> St. Access**

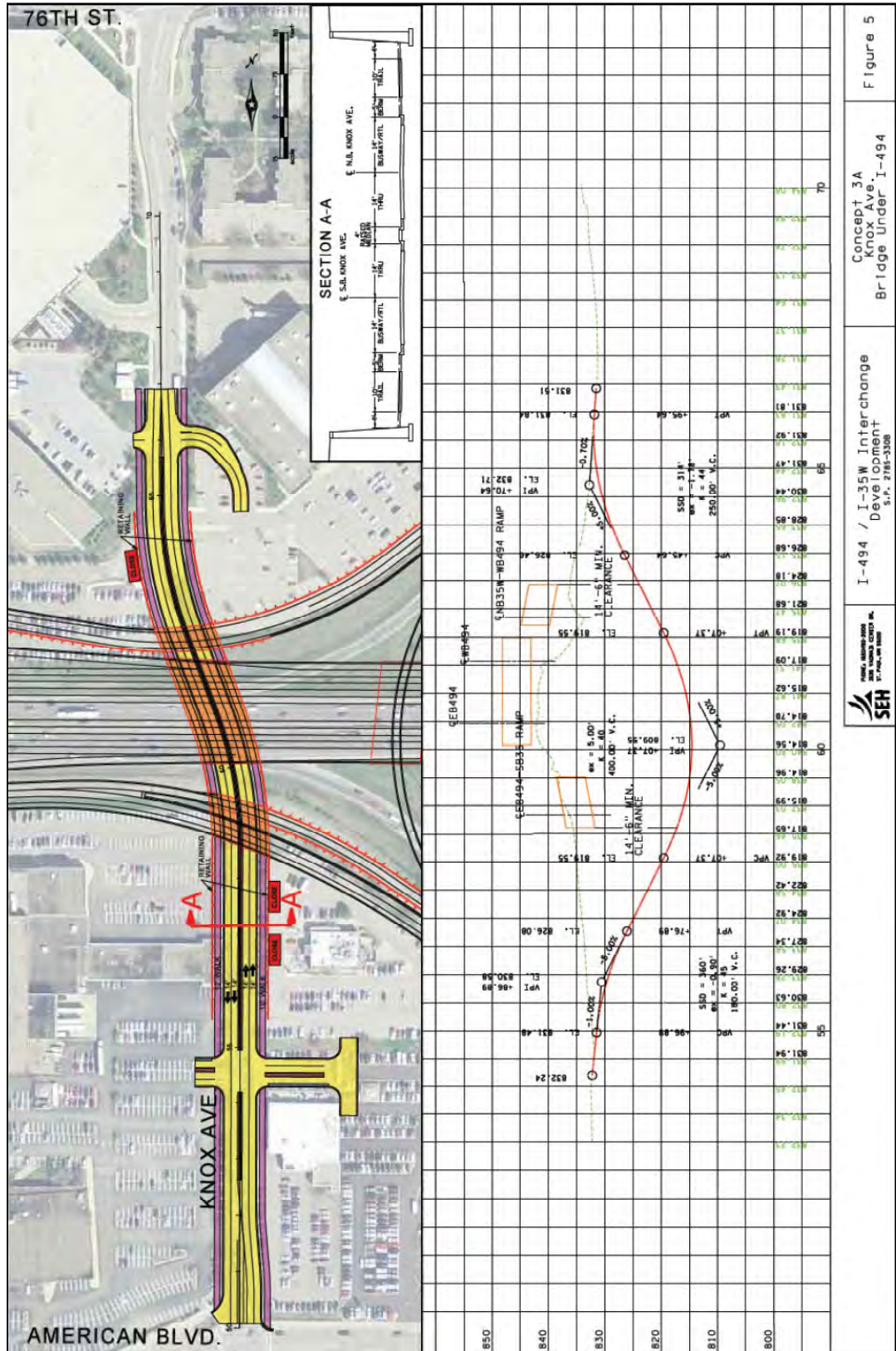


Figure 5

Concept 3A  
Knox Ave.  
Bridge Under I-494

I-494 / I-35W Interchange  
Development  
S.P. 218-338





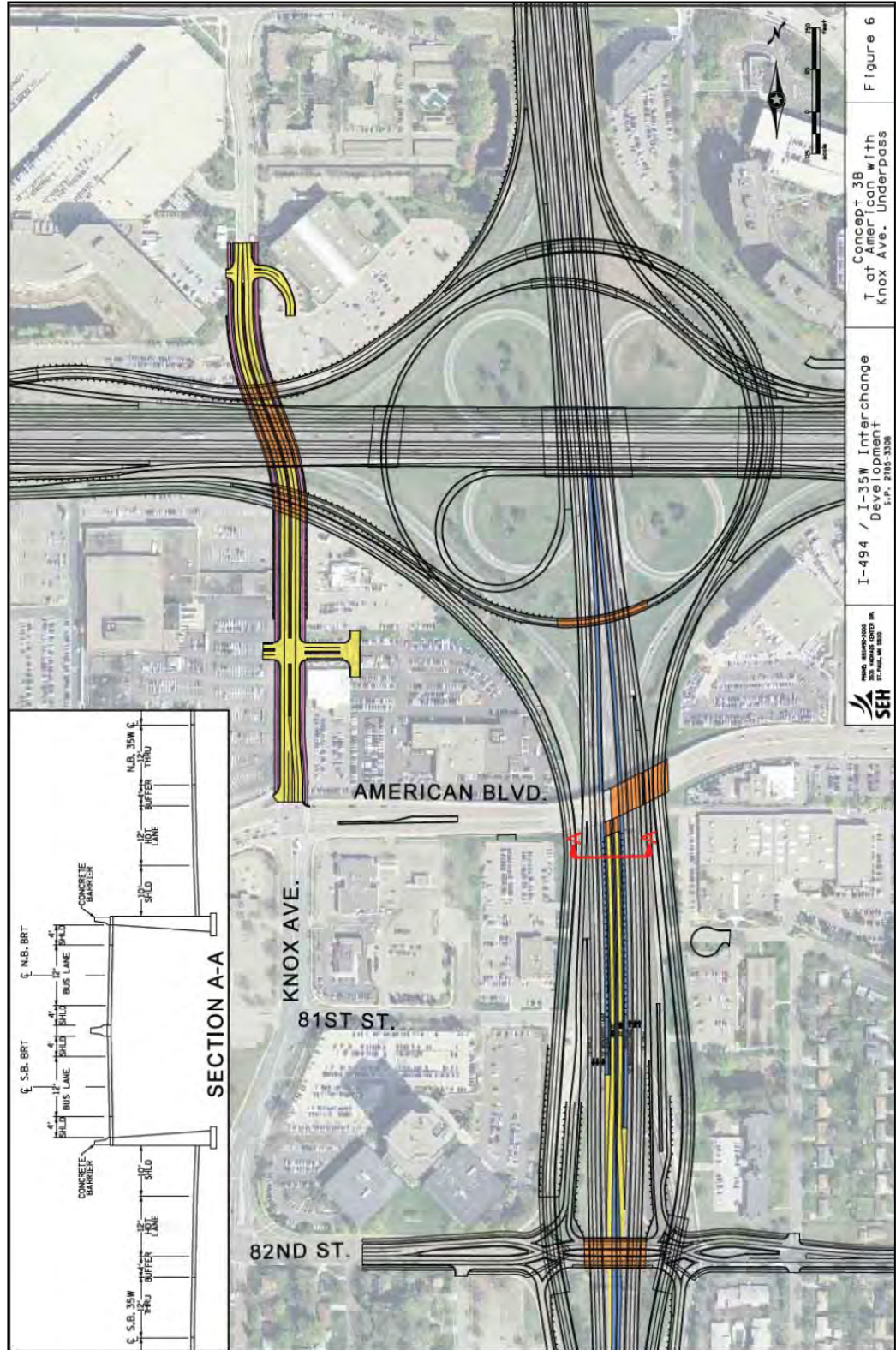
## Concept 3B

### Offline Knox Ave. with I-494 Underpass and Bus Ramp to American Boulevard

BRT transit route which deviates from the I-35W corridor approximately 1,000 ft. west to Knox Avenue on the local street network to more directly serve the Transit Oriented Development (TOD) area of the Penn American District. Transit stations (two pairs) positioned along Knox Avenue near or on American Boulevard and another on Knox Avenue near 76<sup>th</sup> Street. Requires extension of Knox Avenue south from the Best Buy/Dick's Sporting Goods properties beneath I-494 to American Boulevard. The Knox Avenue extension segment would function primarily as a transit corridor; however, general purpose traffic may also be incorporated into this corridor. Access to the Knox Avenue transit corridor will be from the existing 76<sup>th</sup> Street on the north and a new I-35W median bus ramp connection at the American Blvd. bridge on the south. A new traffic signal would be installed on the American Blvd. bridge, plus Transit Signal Priority would be utilized through existing signalized intersections.

Pros	Cons
Station locations significantly increase walkshed for existing sidewalk network	Requires modifications to east half of American Blvd. bridge due to I-35W median widening
Serves both Bloomington and Richfield	Longer travel times for Orange Line
Shorter walk distances to rider destinations from stations	May require an additional bus to maintain service along the route
Noise levels much lower compared to online stations	Ridership of other providers may not warrant utilization of this station
Reduces I-35W footprint on right of way	Major impacts to traffic on I-494 during construction
Improved FTA funding eligibility	Private property acquisition required
Potential to locate park-and-ride in Richfield	Could trigger eminent domain action
Improves travel time in comparison to Concept 3A	Access to private properties impacted
Ability to locate park-and-ride closer to transit station	Routes stormwater to already challenging Penn Avenue area
Provides local street connection (if general purpose lane allowed) which may help with congestion at Penn and Lyndale Avenue intersections	Transit route through flood-prone American Blvd. and Knox Avenue intersection
Improves pedestrian and bicycle access to Penn American District	Relocation of large watermain
Eliminates vertical circulation between stations	Higher construction costs with impacts to both I-494 and I-35W
Provides safe link for regional bicycle network across I-94	Significantly higher cost for minimal savings in travel time
Removes merge condition on I-35W between stations	Adds complexity to implementation of Orange Line
	Reduces development benefits east of I-35W

### Concept 3B Layout Sketch - Offline Knox Ave. with I-494 Underpass and Bus Ramp to American Boulevard



## Concept 4

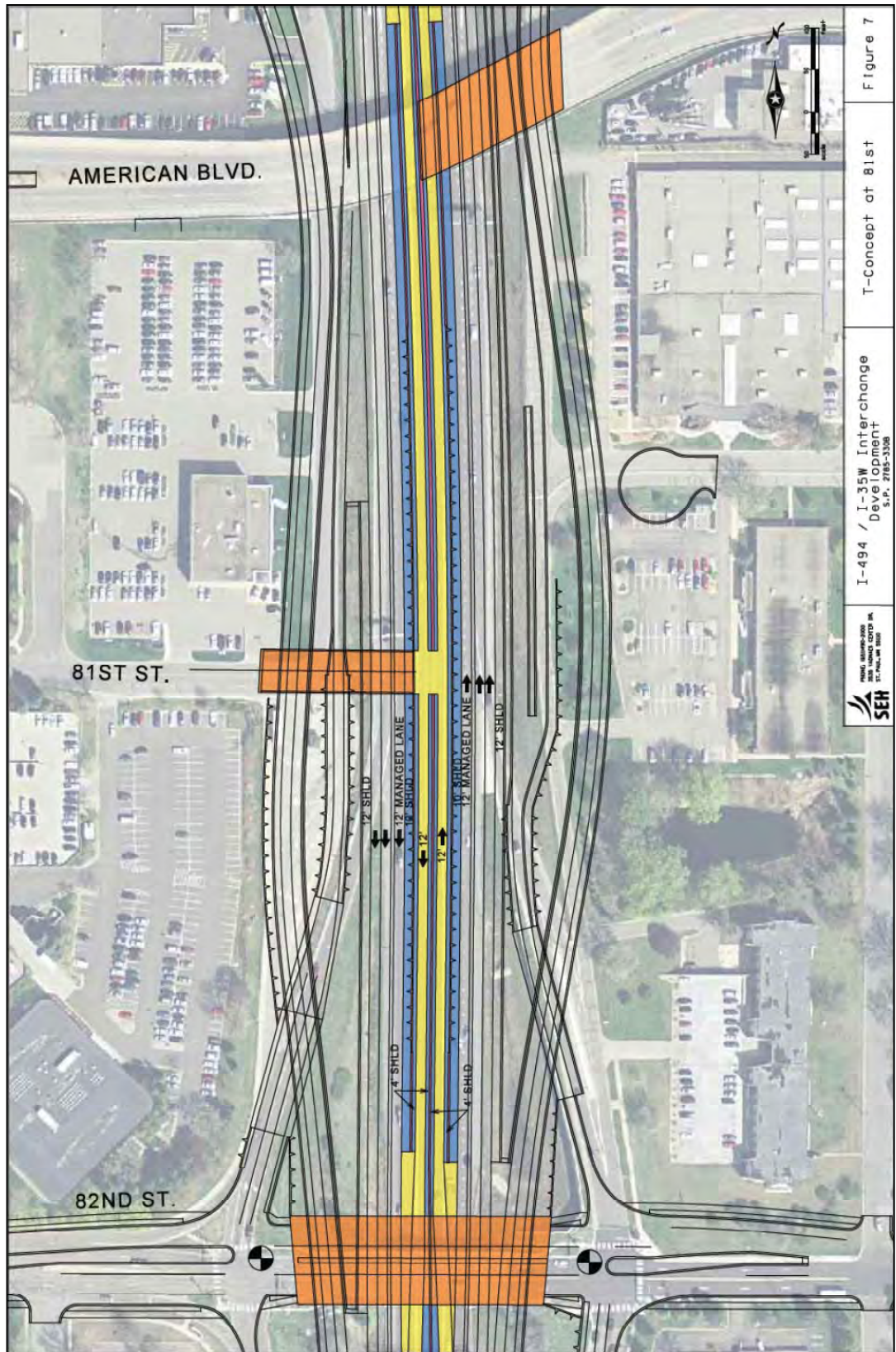
### Offline T Ramp at 81<sup>st</sup> Street with Overpass to Transfer/Parking Facility

Bus ramp in I-35W center median, position at 81<sup>st</sup> St. for both northbound and southbound transit access, elevates to transit bridge structure over southbound I-35W. Transit bridge extends west to potential park-and-ride structure.

<b>Pros</b>	<b>Cons</b>
Direct access to/from BRT route on I-35W from parking structure through transit bridge	Requires modifications to east half of American Blvd. bridge and the 82 <sup>nd</sup> St. interchange due to I-35W median widening
Transit station located in parking structure for rider transfers	Longer transfer distance for users
Protection from the elements	May not be utilized by other transit providers
Reduced noise	Dependent on parking facility close to I-35W
Eliminates vertical circulation between stations	Private property acquisition required
	AM peak merge movement from an median station to the ramp stations at 66 <sup>th</sup> St. could be very difficult
	Online 35W bus routes stopping at 81 <sup>st</sup> Street station may not also stop at 66 <sup>th</sup> St., leaving Richfield with no BRT stops



**Concept 4 Layout Sketch - Offline T Ramp at 81<sup>st</sup> Street with  
Overpass to Transfer/Parking Facility**



## Evaluation

An evaluation matrix was developed to compare the seven BRT station concepts and reduce the number of concepts to the three most desirable. These three concepts were further reviewed and refined by the TAG and TAC to ensure there was concurrence on the final concept layouts and ratings. In addition, planning level construction cost estimates were developed for these three concepts.

Criteria for evaluation of the final seven concepts were initially based on the previously established criteria from the 2010 study. The previous criteria were refined by the TAG and confirmed by the TAC for use in the evaluation of the final concepts list. In addition, criteria from the Federal Transit Administration (FTA) Small Starts program including cost effectiveness, existing land use patterns, transit supportive plans and policies, policy performance, economic development and congestion pricing were considered in development of the evaluation criteria.

The evaluation criteria were separated into categories for Transit Station, Bus Operations, and Transit Rider. Ratings for the evaluation utilized a comparative system of +1 for Benefit, 0 for Neutral and -1 for Negative impacts.

The summation of the ratings established an evaluation order that was utilized for reducing the number of concepts to the three most desired for further analysis. Additional review and discussion of the ratings and concept layouts by the TAG and the TAC resulted in the agreement to eliminate four of the concepts from further review. In addition, a Service Impacts Analysis of American Boulevard Station Alternatives memorandum was developed by Metro Transit (attached Appendix 1) to provide operational and service area impacts of the three most desired concepts and utilized by the two groups in their evaluation and refinement of the remaining three concepts.

The detailed results of the evaluations are shown on the following page and are summarized as follows:

No.	Concept	Overall Rating Score
1A	Online I-35W at American Blvd., South Edge	4
1B	Online I-35W at American Blvd., Centered *	4
1C	Online I-35W at American Blvd., Centered, Bus Ramps to American Blvd. Level *	4
2	Online I-35W at 81 <sup>st</sup> Street, Pedestrian Skywalk to Parking Facility *	-13
3A	Offline Knox Ave. with I-494 underpass and 82 <sup>nd</sup> /76 <sup>th</sup> St. Access	11
3B	Offline Knox Ave. with I-494 Underpass and Bus Ramp to American Boulevard	13
4	Offline T Ramp at 81 <sup>st</sup> Street with Overpass to Transfer/Parking Facility *	-15

\* Concepts eliminated from further review

**2013 BRT Station Evaluation Matrix**

I-494/I-35 Interchange Vision Layout Transit Station Location Concepts Evaluation Matrix		2013 BRT Station Evaluation Matrix																				Overall Score									
		Transit Station Criteria										Bus Operations Criteria						Transit Rider Criteria													
Concepts	Freeway Traffic Ops/Speed	Construction Cost	Competitive for Funding	Travel Time	Roadway Compatibility	Proximity to American Blvd.	Land Use	Land Availability	Expandability	RCV Required	Access	Affordable Housing	Visibility	Minimize Impacts	Maximize Development / TOD	Bus Travel Time	Bus Transfer Complexity	Special Operations	Coordination with Providers	Maintenance	Optimize Route Structure	Proximity to Destinations	Transfer Time	Personal Safety	Walking Distance	Amenities	Park & Ride	Convenience	Minimize Impact on Existing Riders	Minimize Transfers	
<b>3B</b> Offline Stations at American and 76th (Knox Ave), with underpass and T- Ramp at American	0	-1	1	0	0	1	1	-1	1	-1	0	1	0	0	1	0	1	0	0	1	1	1	1	1	1	1	1	0	1	1	13
<b>3A</b> Offline Stations at American and 76th (Knox Ave), with underpass	-1	0	1	-1	1	1	1	-1	1	-1	0	1	0	0	1	-1	1	0	0	1	1	1	1	1	1	1	1	-1	1	1	11
<b>1A</b> Online Station at American Blvd - South Edge on 35W	1	0	1	1	0	1	0	0	0	-1	1	0	1	1	0	1	0	1	1	-1	0	-1	-1	-1	-1	0	-1	1	0	4	
<b>1B</b> Online Station at American Blvd - Reconstructed Centered on 35W	1	0	1	1	0	1	0	0	0	-1	1	0	1	1	0	1	0	1	1	-1	0	-1	-1	-1	0	-1	1	0	0	4	
<b>1C</b> Online Station at American Blvd - Centered at street level	1	0	1	1	0	1	0	0	0	-1	1	0	1	1	0	1	0	1	1	-1	0	-1	-1	0	0	-1	0	0	0	4	
<b>2</b> Online Station at 81st Street	1	0	0	1	0	-1	0	0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-13	
<b>4</b> Offline T Ramp at 81st Street	-1	0	0	-1	0	-1	1	0	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	-1	1	1	1	-1	-1	-1	-15	

Rating: Benefit (+ 1), Neutral (0), Negative (- 1)



The sketch layouts of the three most desired BRT station concepts (1A, 3A and 3B) were further refined to address construction limits, lane configurations and dimensions, transit station locations, utility impacts and right of way. The refined sketch layouts were developed to reduce the impacts to I-494 and I-35W and also establish a minimalist “BRT Only” layout for the improvements and cost estimates. Geometrics for the ramp connections and spacing between I-494 and 82<sup>nd</sup> Street interchange match the existing conditions. The layouts for Concepts 3A and 3B, Knox Avenue Underpass, included a required relocation of an existing 42 inch watermain and stormwater drainage that requires routing storm sewer to the Penn Avenue pump station. The refined sketch layouts of these three concepts are included on the following pages.

Planning level construction cost estimates were developed for the three concepts identified for further review. The estimates utilized MnDOT’s basic Length-Width-Depth (LWD) worksheet format. Major construction elements were quantified along with unique project features and an estimate for right of way that includes property acquisition, access modifications and going concerns (per MN Stat. 117.186). The estimates also included a 20% Project Risk factor and 20% Engineering costs. An extra cost estimate was developed for Concept 3A to establish baseline costs for a Transit Only layout (Figure 9B) to aid in the identification of local cost participation amounts. The construction cost estimates for the three concepts are summarized as follows:

Item	Concepts			
	1A	3A – Transit Only	3A – Transit + GP	3B
Roadway	10,500,000	1,200,000	1,500,000	10,700,000
Retaining Walls	0	1,900,000	1,900,000	3,400,000
Bridge	3,500,000	3,700,000	5,600,000	9,400,000
Transit Station	8,000,000	3,000,000	3,000,000	3,000,000
TMS & TSP	1,600,000	100,000	100,000	1,800,000
Traffic Control	1,400,000	2,000,000	2,200,000	3,500,000
Utility/Drainage	300,000	6,300,000	6,300,000	6,600,000
Risk/Contingency	4,700,000	3,400,000	3,900,000	7,000,000
Engineering	5,700,000	4,000,000	4,500,000	8,500,000
<b>TOTAL</b>	<b>\$ 35,700,000</b>	<b>25,600,000</b>	<b>29,000,000</b>	<b>53,900,000</b>
Right of Way	TBD			

Notes:

Roadway – Includes mainline, shoulder, trail/sidewalk, ADA ramps and grading.

Retaining Walls – Includes mainline and sidestreet retaining walls.

Bridge – Includes mainline bridge and ramps.

Transit Station – Includes structures, HVAC, vertical circulation, lighting, dynamic signing and amenities.

TMS – Includes reconstruction of I-35W Traffic Management System (TMS), new signal and/or Transit Signal Priority (TSP).

Traffic Control – Includes traffic control/management during construction.

Utility/Drainage – Includes utility and drainage relocations and improvements to accommodate improvements.

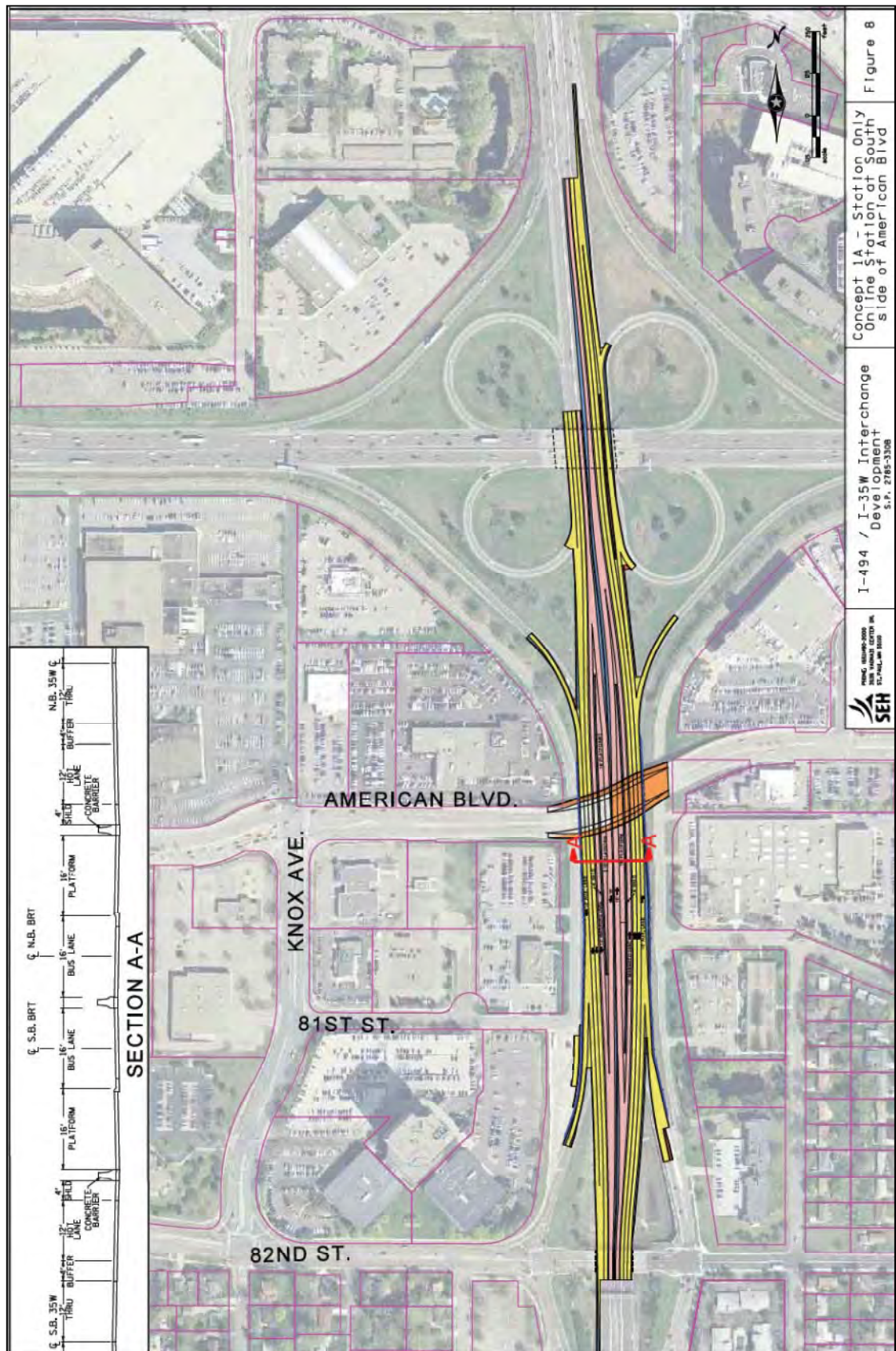
Risk/Contingency – Includes approximately 20% value of project costs for project risk.

Engineering – Includes approximately 20% value of project costs for preliminary and final design and construction engineering.

Right of Way – To Be Determined. It is expected that right of way costs will be a larger share of Concepts 3A or 3B than of Concept 1A.

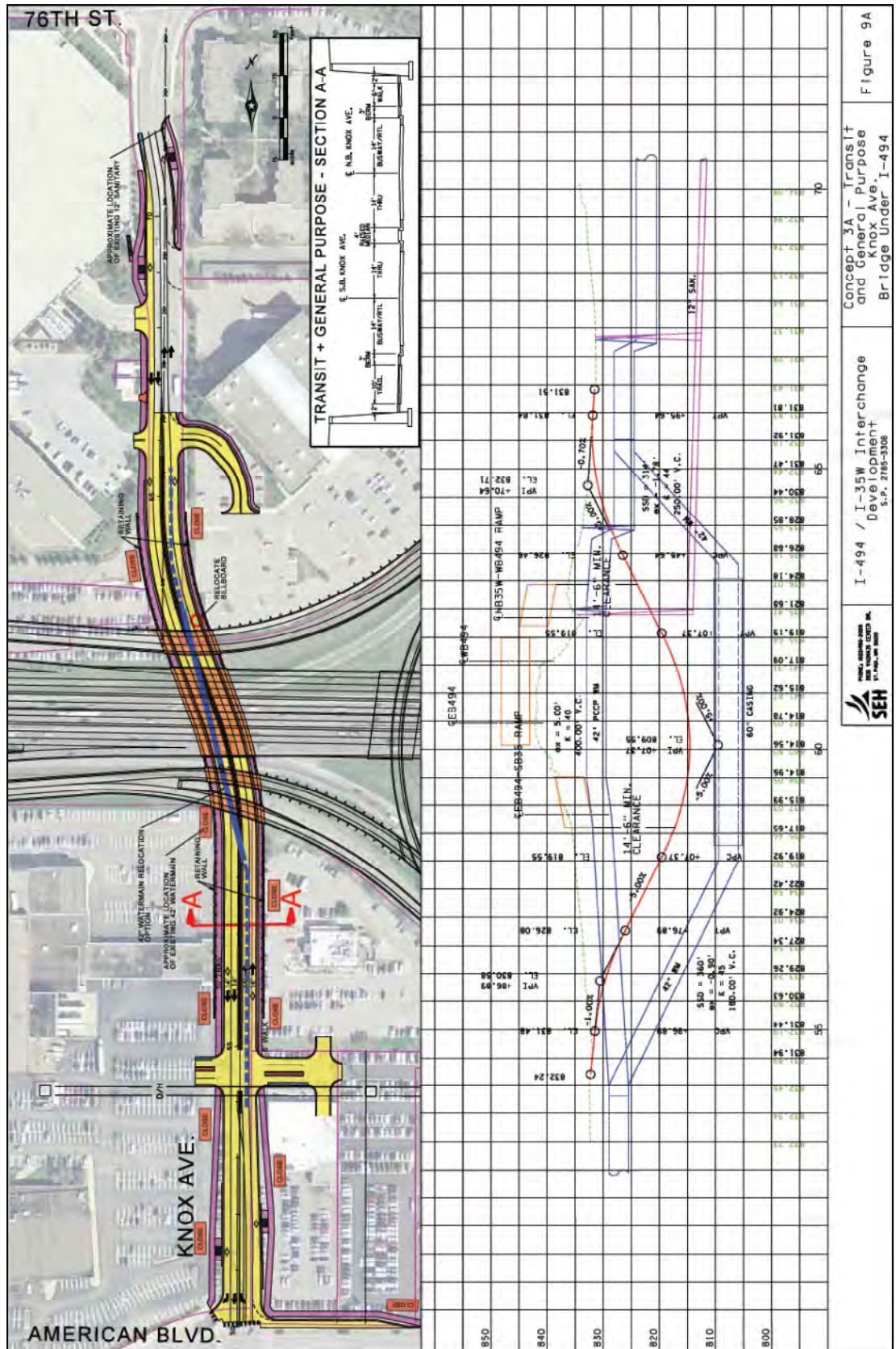
GP – Denotes general purpose traffic lanes are included in the roadway configuration of Knox Avenue.

**Concept 1A Refined Layout Sketch - Online I-35W at American Blvd., South Edge**





**Concept 3A Refined Layout Sketch - Offline Knox Ave. with I-494 underpass and 82<sup>nd</sup>/76<sup>th</sup> St. Access, TRANSIT + GENERAL PURPOSE TRAFFIC**




**SEH**  
 PUBLIC ENGINEERING AND ARCHITECTURE  
 2700 W. 100th St., Suite 100  
 Overland Park, MO 66204  
 I-494 / I-35W Interchange Development  
 S.P. 2785-3308  
 Concept 3A - Transit and General Purpose and Knox Ave. Bridge Under I-494  
 Figure 9A



**Concept 3A Refined Layout Sketch - Offline Knox Ave. with I-494 underpass and 82<sup>nd</sup>/76<sup>th</sup> St. Access, TRANSIT ONLY TRAFFIC**

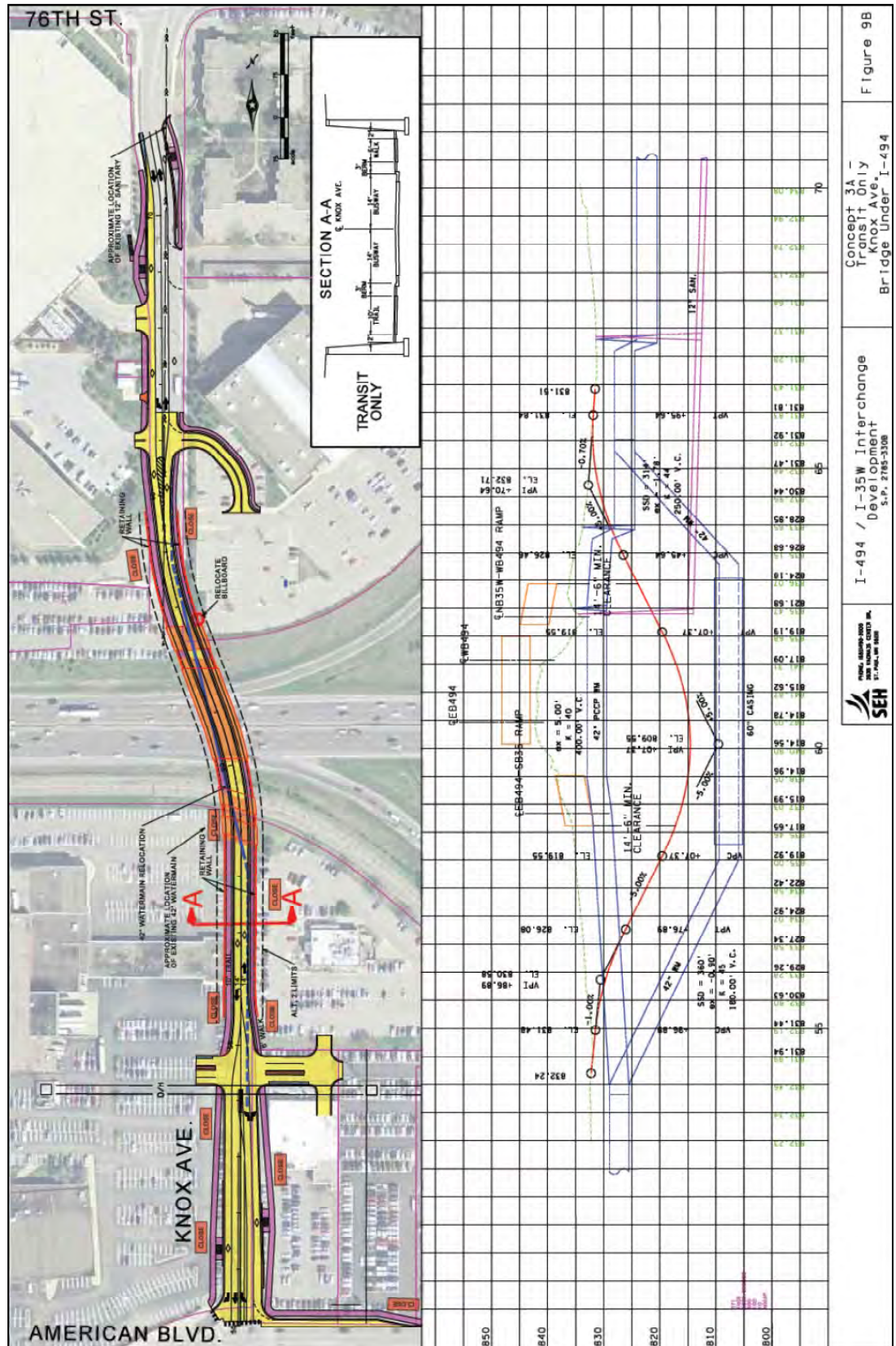
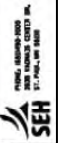


Figure 9B

Concept 3A - Transit Only Knox Ave. Bridge Under I-494

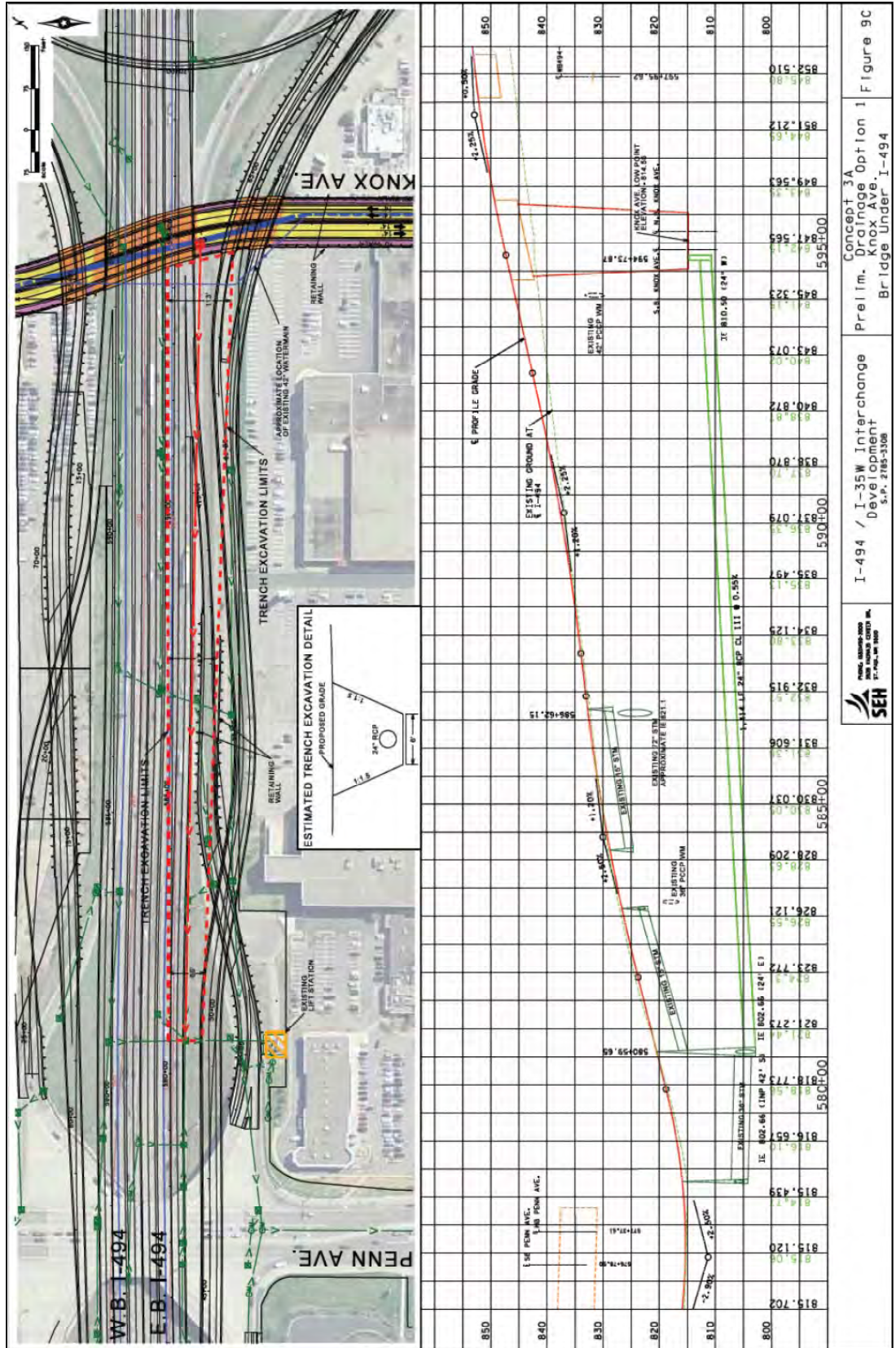
I-494 / I-35W Interchange Development S.P. 2785-3108



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 STATE ENGINEERING  
 317 PARKWAY EAST  
 ST. PAUL, MN 55102



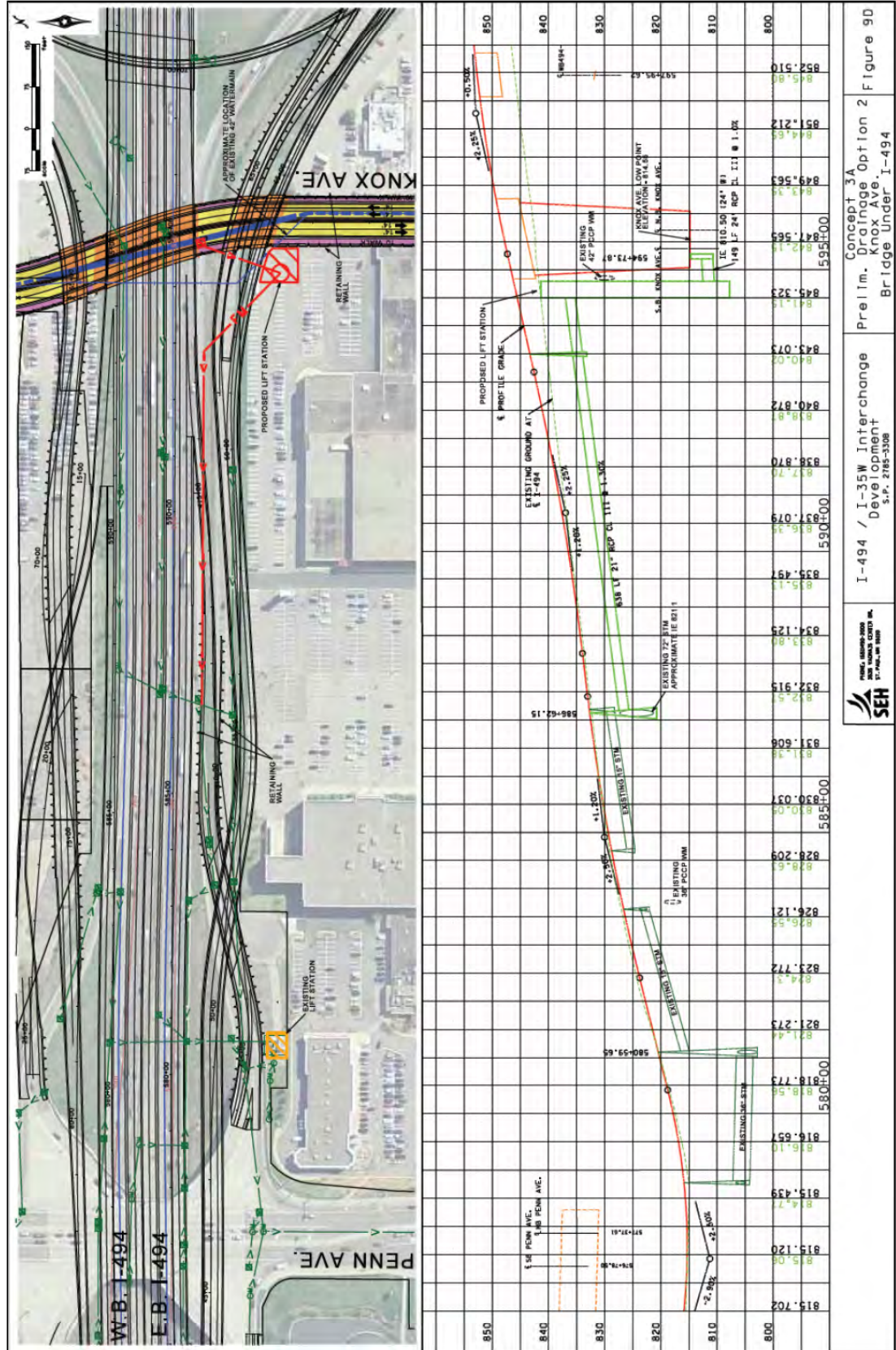
**Concept 3A Refined Layout Sketch - Offline Knox Ave. with I-494 underpass  
 and 82<sup>nd</sup>/76<sup>th</sup> St. Access, PRELIMINARY DRAINAGE OPTION 1**




**I-494 / I-35W Interchange Development**  
 S.P. 2185-3108  
 Concept 3A Drainage Option 1  
 Prelim. Knox Ave, I-494  
 Bridge Under I-494  
 Figure 9C



**Concept 3A Refined Layout Sketch - Offline Knox Ave. with I-494 underpass and 82<sup>nd</sup>/76<sup>th</sup> St. Access, PRELIMINARY DRAINAGE OPTION 2**

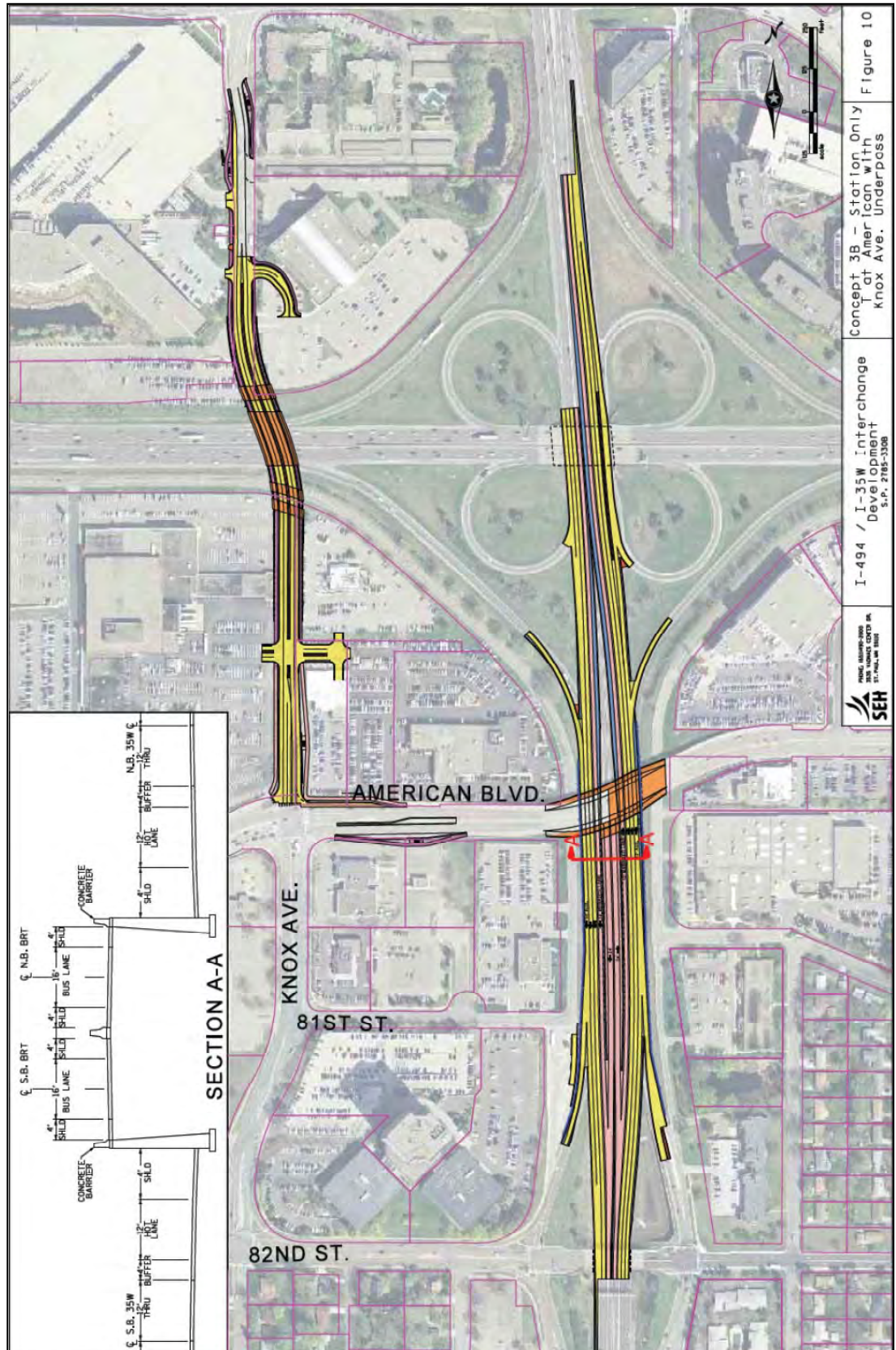


I-494 / I-35W Interchange  
Development  
S.P. 2788-3308

Concept 3A  
Prelim. Drainage Option 2  
Knox Ave.  
Bridge Under I-494  
Figure 9D



**Concept 3B Refined Layout Sketch - Offline Knox Ave. with I-494  
Underpass and Bus Ramp to American Boulevard**



## Public Involvement

The process for development and evaluation of the BRT station concepts also involved public involvement efforts that included a project update at worksession meetings for the City Councils of both Bloomington and Richfield and a Public Open House meeting.

The worksession presentations to the City Councils were conducted on September 23<sup>rd</sup> and 24<sup>th</sup> by representatives from MnDOT, Metro Transit and SEH. The presentations provided an update of the project objectives, schedule, interchange concepts under consideration (Turbine and Clovermill) and general overview of the BRT station locations (Online I-35W and Knox Avenue alignments).

The Open House Meeting was held on October 3<sup>rd</sup> at St. Richard's Catholic Church in Richfield. The meeting provided information to stakeholders on recent study activities and gathered input on the two interchange concepts, the BRT station alignments and potential station locations. More than 80 citizens attended the meeting, with sign-in and comments cards providing documentation of the meeting.

## Findings

The BRT station portion of the I-494/I-35W Interchange Vision Layout Development study included the identification of viable BRT station concepts, evaluation of the concepts through agreed criteria and ratings and special analysis for service impacts which led to the selection of the three most desired station concepts:

1A - Online I-35W at American Blvd., South Edge

3A - Offline Knox Ave. with I-494 underpass and 82<sup>nd</sup>/76<sup>th</sup> St. Access

3B - Offline Knox Ave. with I-494 Underpass and Bus Ramp to American Boulevard

The refinement of these three concepts, development of construction cost estimates, public involvement feedback and further review and discussion by both the TAG and TAC led to the determination of the most desired BRT station concept.

The TAG has reviewed the information presented in this Technical Memorandum and through discussion at their meeting on Oct. 28<sup>th</sup>, 2013 reached consensus that Concept 3A - Offline Knox Ave. with I-494 underpass and 82<sup>nd</sup>/76<sup>th</sup> St. Access is the most desired BRT station concept for inclusion in the Vision Layout for the improvements to the I-494/I-35W interchange.

jcr

Attachment: Service Impacts Analysis of American Boulevard Station Alternatives, Metro Transit

**I-494/I-35 Interchange Vision Layout Development - BRT Station Concepts**  
**Technical Memorandum**

**Appendix 1**

**Metro Transit**

**Memorandum**

**Service Impacts Analysis of American Boulevard Station Alternatives**

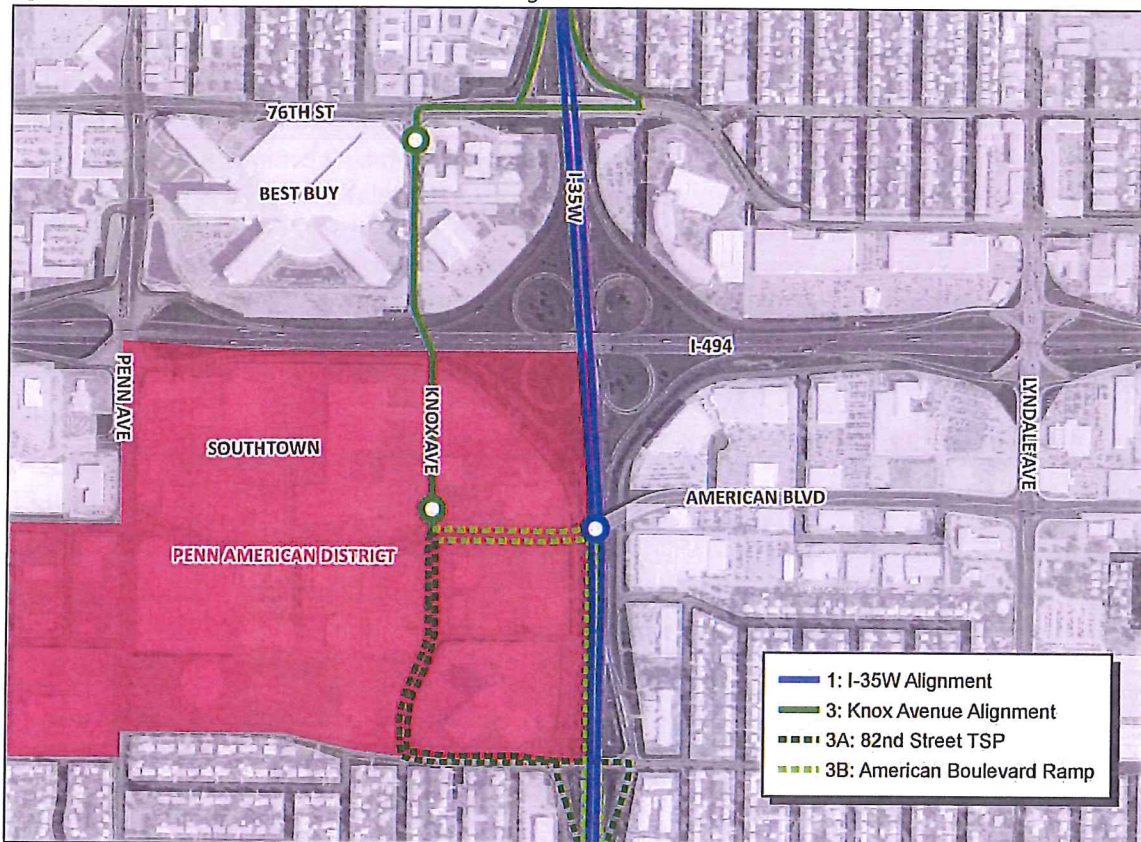


DATE: August 13, 2013  
TO: I-494/35W Vision Layout TAC  
FROM: Kate Christopherson & Christina Morrison, BRT/Small Starts Project Office  
SUBJECT: Service Impacts Analysis of American Boulevard Station Alternatives

**Background**

Three locations were evaluated for METRO Orange Line’s American Boulevard Station. The first alternative is an online station on I-35W below the American Boulevard bridge. The second alternative is an online station at 81<sup>st</sup> Street. The third alternative would consist of two offline at-grade stations at Knox Avenue and American Boulevard, and at Knox Avenue and 76<sup>th</sup> Street. Because the second alternative is not being recommended for further study, only the first and third alternatives are detailed in this Service Impacts Analysis.

Figure 1. American Boulevard Station Location and Alignment Alternatives



**Service**

The Orange Line is expected to replace the limited-stop Route 535, operating at 15-minute frequency all-day, and providing roughly 130 trips per day in this area. Some trips on I-35W express routes (e.g. Route 467) may use the station depending on station location and further transit market analysis. Metro Transit’s local and express routes will likely be restructured to support Orange Line service opening in this area.

MVTA does not currently serve this vicinity and expects to continue to run about 150 trips per day through this area (460, 464, and 465), with around one-third of those trips serving an American Boulevard Orange Line Station. Number of trips serving this station could change based on exact station location, alignment, travel time, and funding.

**Speed**

The biggest service advantage of building an online station at I-35W and American Boulevard is speed. The bus would not have pass through traffic signals in this alternative, however, run times should be further refined with field checks to determine the feasibility of merge patterns from the shoulder at 98<sup>th</sup> Street, to an online station at American, and back to the shoulder at 66<sup>th</sup> Street.

Moving the station to a Knox Avenue alignment and adding a 76<sup>th</sup> Street station adds run time to the Orange Line. Transit Signal Priority (TSP) or a dedicated transit ramp to American Boulevard can help minimize the time penalty.

In Alternative 3A, the northbound bus would exit I-35W on 82<sup>nd</sup> Street, turn left on 82<sup>nd</sup>, and turn right on Knox to stop at the Knox/American intersection. Knox Avenue would be extended under I-494 in order to connect to Richfield. BRT would stop at Knox/76<sup>th</sup> before turning right onto 76<sup>th</sup> Street and exiting back on to I-35W. Without transit-signal priority (TSP), Metro Transit estimates this route would take 11 minutes. Because only three of the seven signals would benefit from TSP, there is minimal reduction of delay with TSP.

In Alternative 3B, the northbound bus uses a center-running T-Ramp, exiting directly onto American Boulevard using a transit-only signal. The Orange Line would then turn left on American Boulevard and right onto Knox, stopping on the north side of the intersection. With or without TSP, this variation is estimated to take about 8 minutes. As with Alternative 1, feasibility of merge patterns should be checked in the field.

*Table 1 – Estimated Run Times (in Minutes), Northbound during peak hour*

		With TSP	Number of signals	Travel distance	Average speed	Speed Improvement over 535
<b>Route 535 (existing)</b>	18:00	-	14	5.7 mi	19 mph	-
<b>Alternative 1</b>	5:30	-	0	4.1 mi	44 mph	72% faster
<b>Alternative 3A</b>	11:15	11:00	7	4.7 mi	25 mph	38% faster
<b>Alternative 3B</b>	8:00	8:00	4	4.6 mi	33 mph	56% faster

*Assumptions: Existing travel time based on schedule; 20-second dwell time for bus at Orange Line station(s); 10% time savings with TSP, per signal; times rounded to nearest 15 seconds; I-35W east and west ramps (at 76<sup>th</sup> and 82<sup>nd</sup>) are coordinated; American Boulevard signal is coordinated east-west. Regional Transitway Guidelines state that BRT should be at least 20% faster than existing service.*

**Pedestrian Access**

Although there are 4,623 residents and 8,118 employees within one-half mile of Alternative 1 (see Table 2), there is little pedestrian infrastructure. Pedestrians can access Southtown Shopping Center, Genesee Apartments, Southtown Office Center, five auto dealerships, Extended Stay America Hotel, REI, and residential



homes south of 82<sup>nd</sup> Street (shown in blue on Figure 2). Best Buy Headquarters and other destinations north of I-494 would not be accessible.

Alternative 3 greatly improves pedestrian access. Adding a second station and moving the stations off the I-35W alignment brings about 8,172 additional residents and 4,990 additional employees within a half mile walk of the Orange Line. In addition to the businesses, institutions, and residences in Alternative 1, Best Buy Headquarters, Minnesota School of Business, US Bank, Penn Avenue businesses, and residential areas in Richfield are accessible in Alternative 3 (shown in green below).

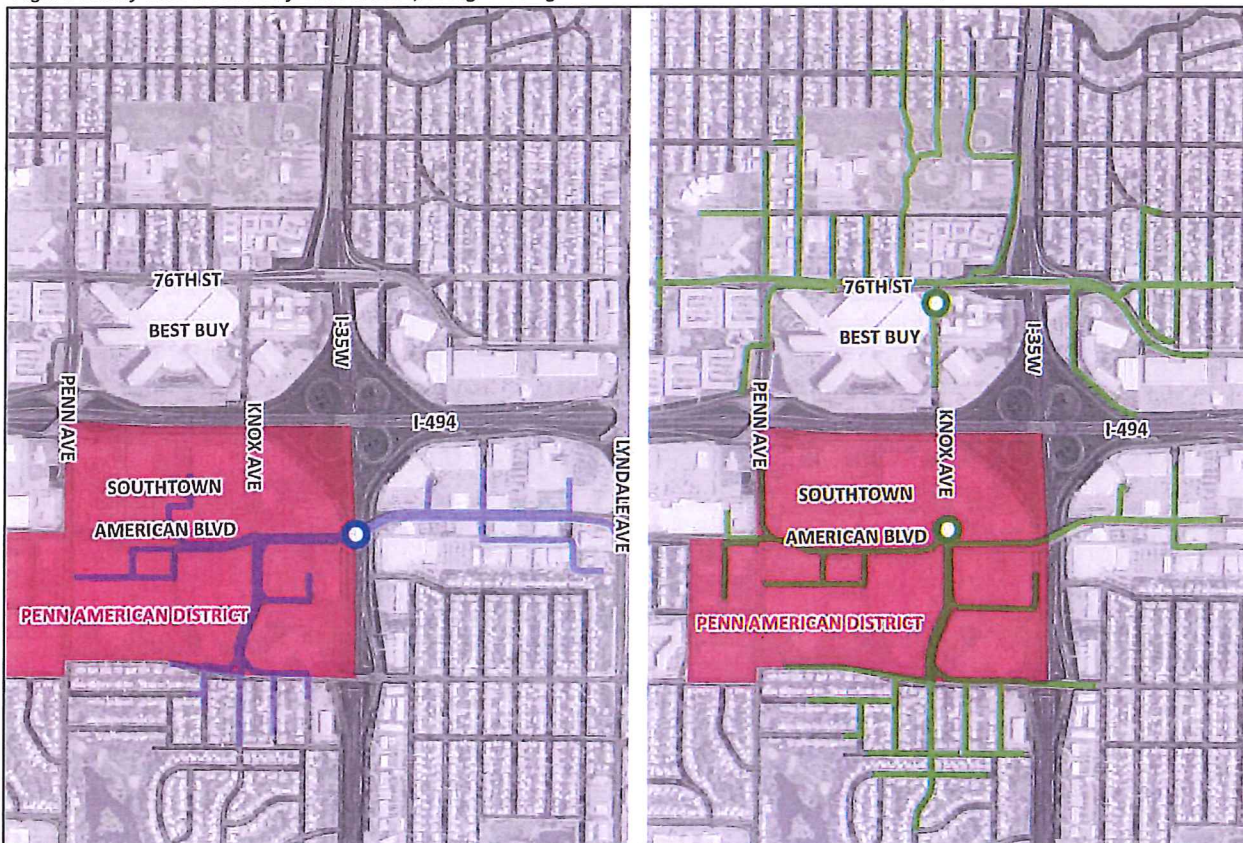
Table 2. Residents and Jobs within Half-Mile of Stations in Alternatives 1 and 3

	Alternative 1	Alternative 3
Residents*	4,623	12,795
Jobs†	8,118	13,108

\*Source: 2011 ACS Five-Year Survey

†Source: Longitudinal Employer-Household Dynamics (LEHD)

Figure 2. Half-mile walkshed from stations, using existing sidewalks



Another measure of access is to calculate the total planned trip time for bus riders, combining Orange Line travel time and walk time to their destination. This factor is particularly important in a highway BRT corridor, where destinations are not located immediately adjacent to the station. Under Alternative 1, the Orange Line



trip to American Boulevard is faster, but walk distances to major destinations are longer. Table 5 estimates some of these combined trip lengths. Alternatives 3A and 3B have different travel times depending which Orange Line station is closer to the destination (American Boulevard or 76<sup>th</sup> Street). For example, a trip from 98<sup>th</sup> Street Station to Best Buy would take about 23½ minutes using Alternative 1, or 10 minutes with Alternative 3A.

Table 5. Net Access to Sample Destinations

	Transit times 98 <sup>th</sup> St to OL Station	Walk times					
		Best Buy	Kohl's	MN School of Business	Genesee Apts	GN Resound	HOM
<b>Alternative 1</b>	3:30	19:00	10:00	25:00	10:00	17:00	7:00
<b>Alternative 3A</b>	8:00 – 9:00	1:00	6:00	5:00	6:00	15:00	10:00
<b>Alternative 3B</b>	3:30 – 5:00	1:00	6:00	5:00	6:00	15:00	10:00

**Impacts to Existing Riders**

Orange Line service should improve transit access for existing riders in the I-494/35W area, while attracting new riders. Table 3 shows Route 535 boardings at bus stops within a half mile of the proposed station locations.

Table 3. Bus stop boardings on Route 535 within Half-Mile of Stations in Alternatives 1 and 3

	Alternative 1	Alternative 3
<b>Northbound</b>	26	419
<b>Southbound</b>	11	40
<b>TOTAL</b>	37	459

Source: September 2012 Metro Transit data

In the area near 76<sup>th</sup> Street, Knox Avenue, and Penn Avenue in Richfield, the proposed relocation of the station and park-and-ride to American Boulevard and I-35W could impact a large number of existing northbound boardings. Of these, it can be assumed that about 150 boardings are riders that have driven to the park-and-ride<sup>1</sup>, and the remaining people walk or bike to the stop, or transfer from another bus.

<sup>1</sup> Knox Avenue parking utilization information from Metro Transit's 2012 Annual Regional Park-and-Ride System Report.