



*AMERICAN PLANNING ASSOCIATION – WISCONSIN CHAPTER*

# **Using Value Analysis to Assist Transit System Planning, Design, Implementation & TOD**



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# **Spirit of Value Analysis**

- Measure twice
- Cut once



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## **HNTB Transit Value Analysis Studies**

- Minneapolis/St. Paul Metro Green Line Extension
- Aspen VelociRFTA-BRT
- Detroit Street Car
- Chicago CTA – Your New Blue Line
- Chicago CTA – Red/Purple Line Modernization
- Seattle Sound Transit
- Indianapolis eBRT



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## **HNTB Transit Design**

- Milwaukee Streetcar:  
(<http://www.themilwaukeeestreetcar.com/>)
- San Antonio VIA Metropolitan Transit
- San Diego MTS
- Los Angeles Metro Rail Crenshaw/LAX
- Denver Airport Hotel and Transit Center
- Chicago Transit Authority Wilson Station



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# **Value Analysis:**

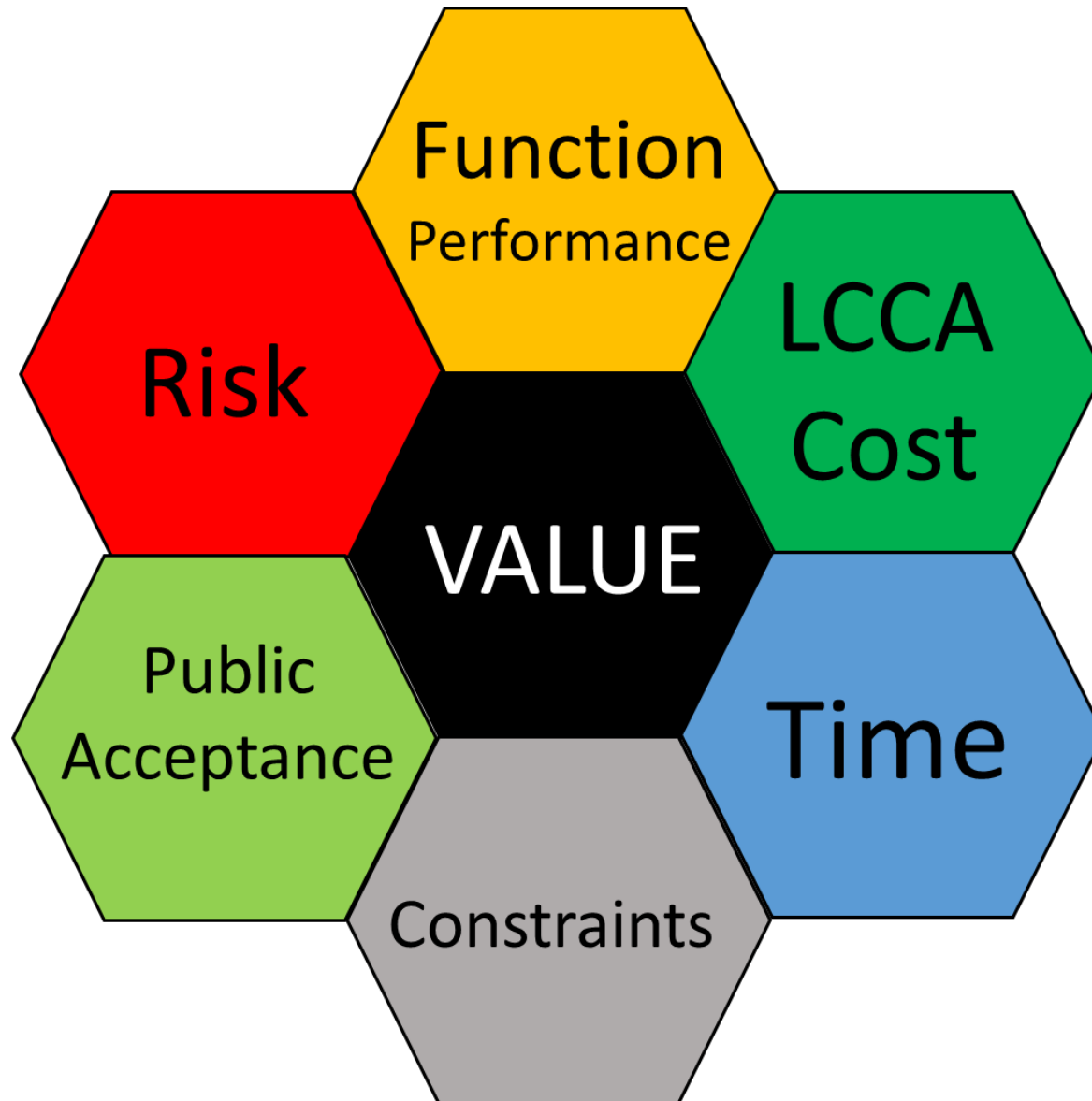
- Value Planning
- Value Engineering
- Value Methodology



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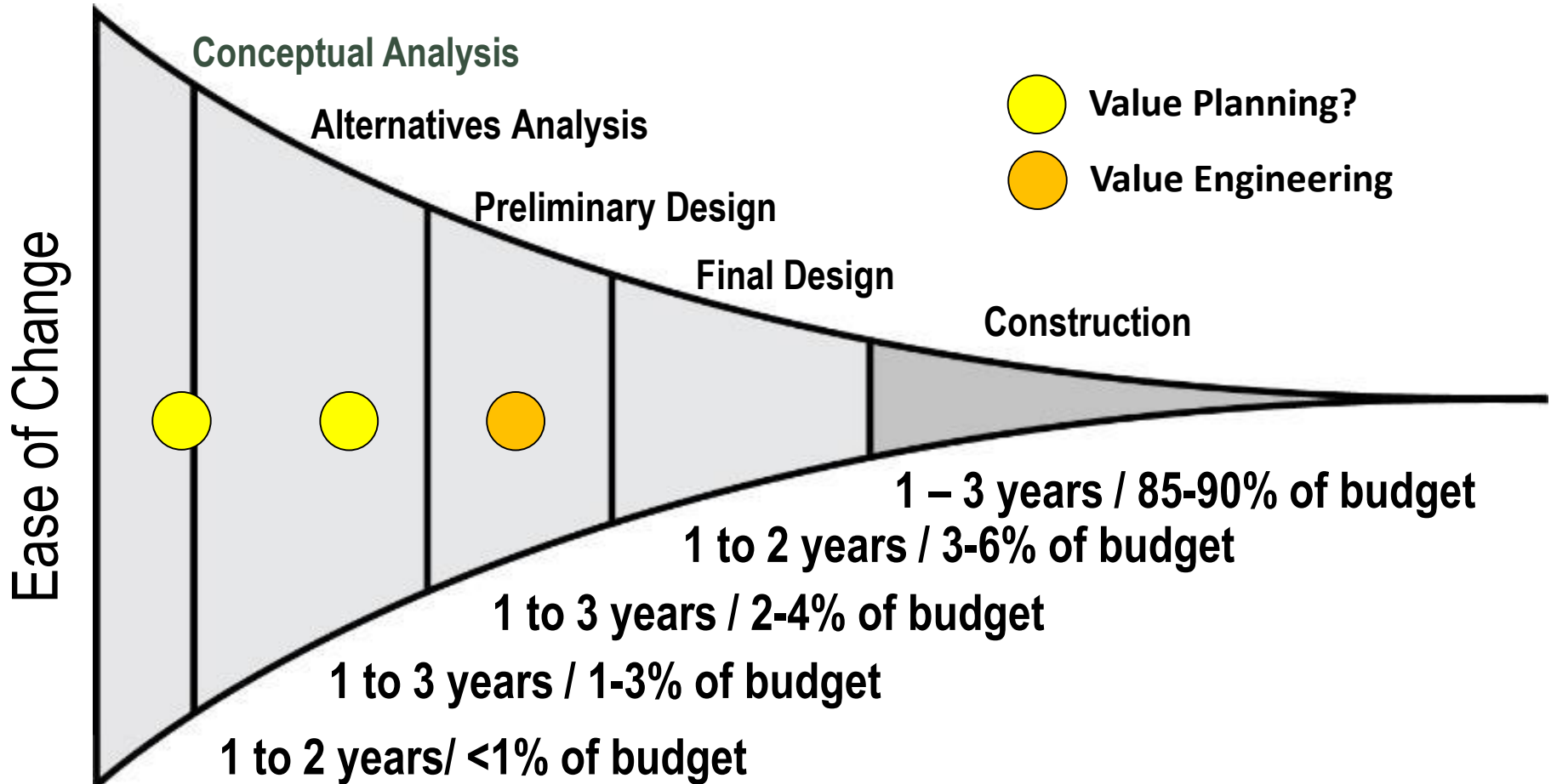
# Value Analysis Goals

- Assist Planning and Design Team
- Analyze Functions
- Improve Performance
- Reduce Costs
- Identify Risks



# When to do VA/VE?

## Project Schedule and Budgets





# Spend time and money on what?



Project Schedule	2012								2013				
	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
PMT Meeting	*	*		*		*		*			*		
Public/Agency Involvement													
-Public Open House							*						
-Council Meeting for Municipal Consent											*		
-Douglas County Commissioner Meeting											*		
-Newsletters							*						
Utility Location Collection													
Draft Scoping Report				*									
Final Scoping Report						*							
Value Engineering (VE) Study													
Early Notification Letter			*										
Draft CATEX													
Final CATEX													
Preliminary and Final Survey													
Sketch Planning/Identify Preferred Alternates				*									
Preliminary Geometric Layout/Cost Estimate													
Agency Review of Preliminary Layout													
Final Geometric Layout/Cost Estimate													



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**Then, what is the *VALUE* of transit?**





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## **Benefits of Transit**

- Reduced roadway congestion
- Reduce fuel consumption
- Improved air quality
- Reduced sprawl
- Reduced road and parking demand
- Increased property values & tax revenues
- Improved travel options



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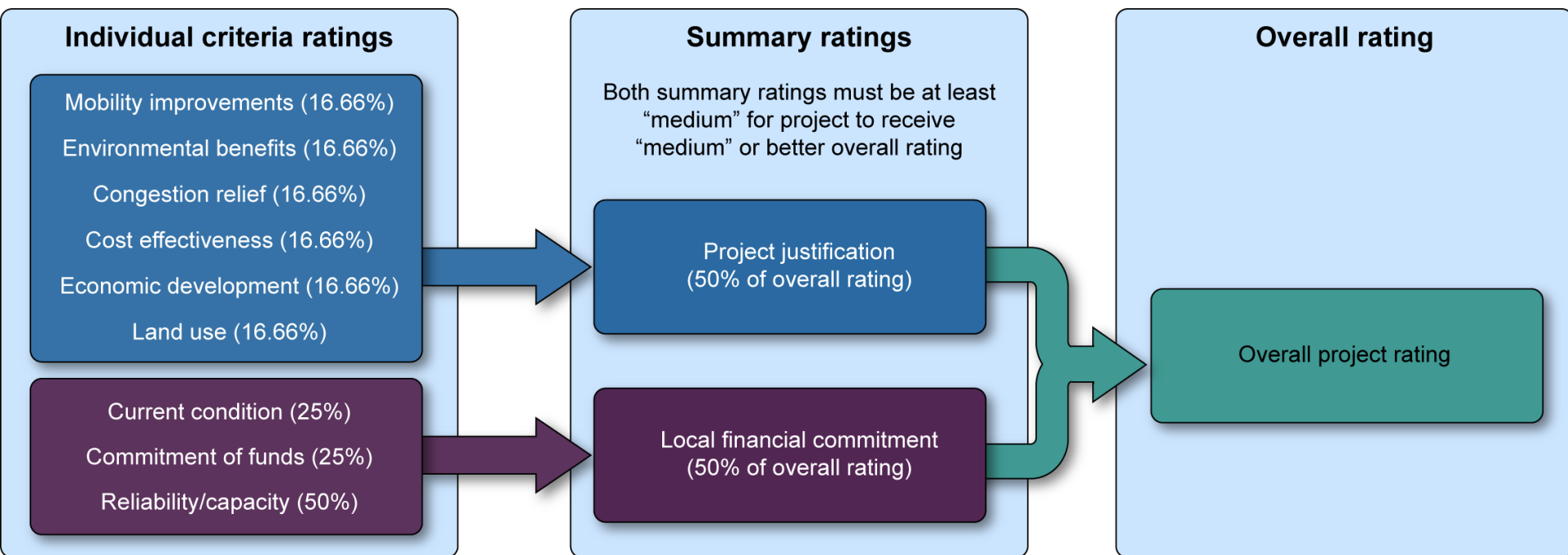
# **Congestion Hierarchy Choices**

- Change Route
- Change Time
- Change Mode
- Don't Make the Trip



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# NEW STARTS EVALUATION CRITERIA



Source: GAO analysis of Federal Transit Administration information. | GAO-15-70



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# **Transit Oriented Development and New Start Evaluation**

## **Criteria**

- Mobility Improvement
- Environmental Benefit
- Congestion Relief
- Cost Effectiveness
- Economic Development
- Land Use

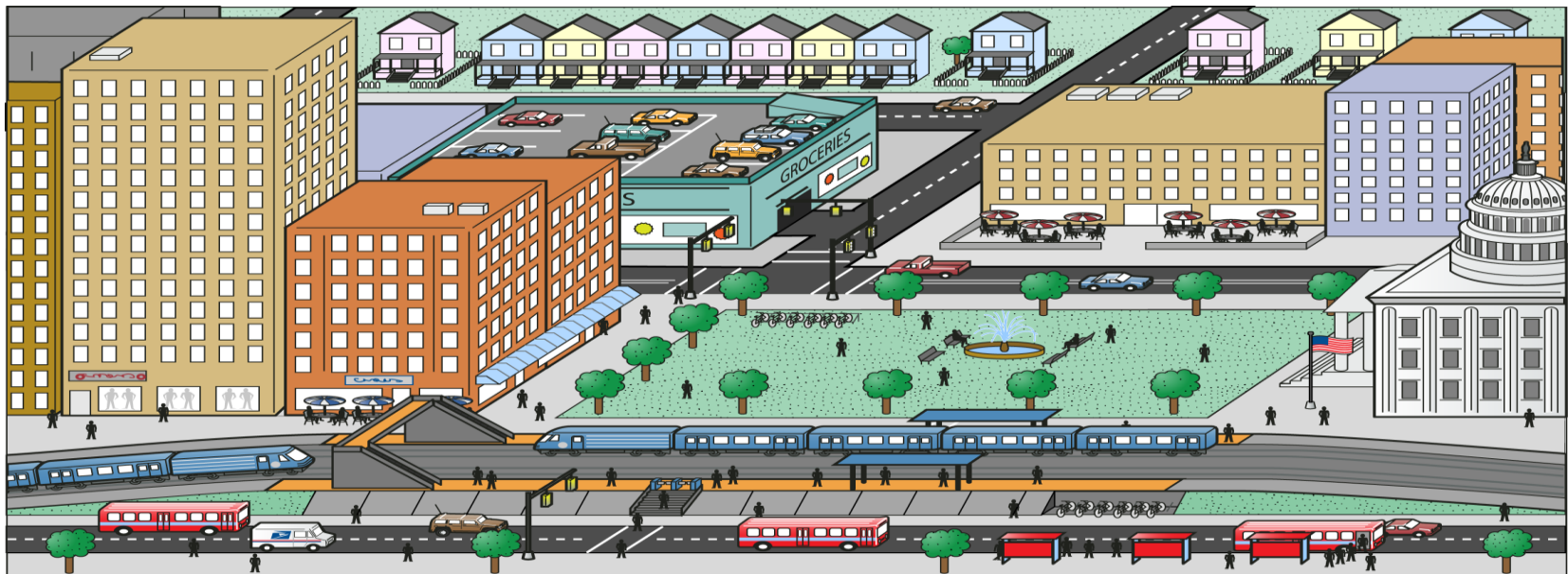
## **Value Functions**

- Improve Mobility
- Benefit Environment
- Offer Travel Options
- Optimize Cost
- Enhance Economy
- Optimize Land Use



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# Transit Oriented Development COMMON FEATURES



Features (generally encompass multiple city blocks up to a half mile from a transit station)

 <p><b>Transit station, such as a light rail station, that is part of a transportation network</b> allows residents to access the region's neighborhoods, destinations, and centers, thereby promoting transit use</p>	 <p><b>Open spaces</b> to include transit-plazas, small parks or regional open spaces</p>	 <p><b>High-quality walking environments and streetscape</b> that allow people to take care of some of their daily needs by walking or biking</p>	 <p><b>Includes moderate- to high-density mix</b> of residential, commercial, employment, and civic/ cultural developments</p>	 <p><b>Includes residential buildings</b> that can vary from small-lot single family/ duplex/ townhome units to high-rise multifamily units</p>	 <p><b>Offers mixed use and employment developments</b> that can vary from mid- to high-rise residential over commercial to low-to-high-rise office/commercial</p>
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# **Constraints to Transit Oriented Development**

- Demand for nearby real estate
- Available land for development
- Resident's support
- High costs
- Difficult financing
- Difficult local review and approvals
- Unsupportive local population
- Design of transit stations
- Multi-modal interfaces





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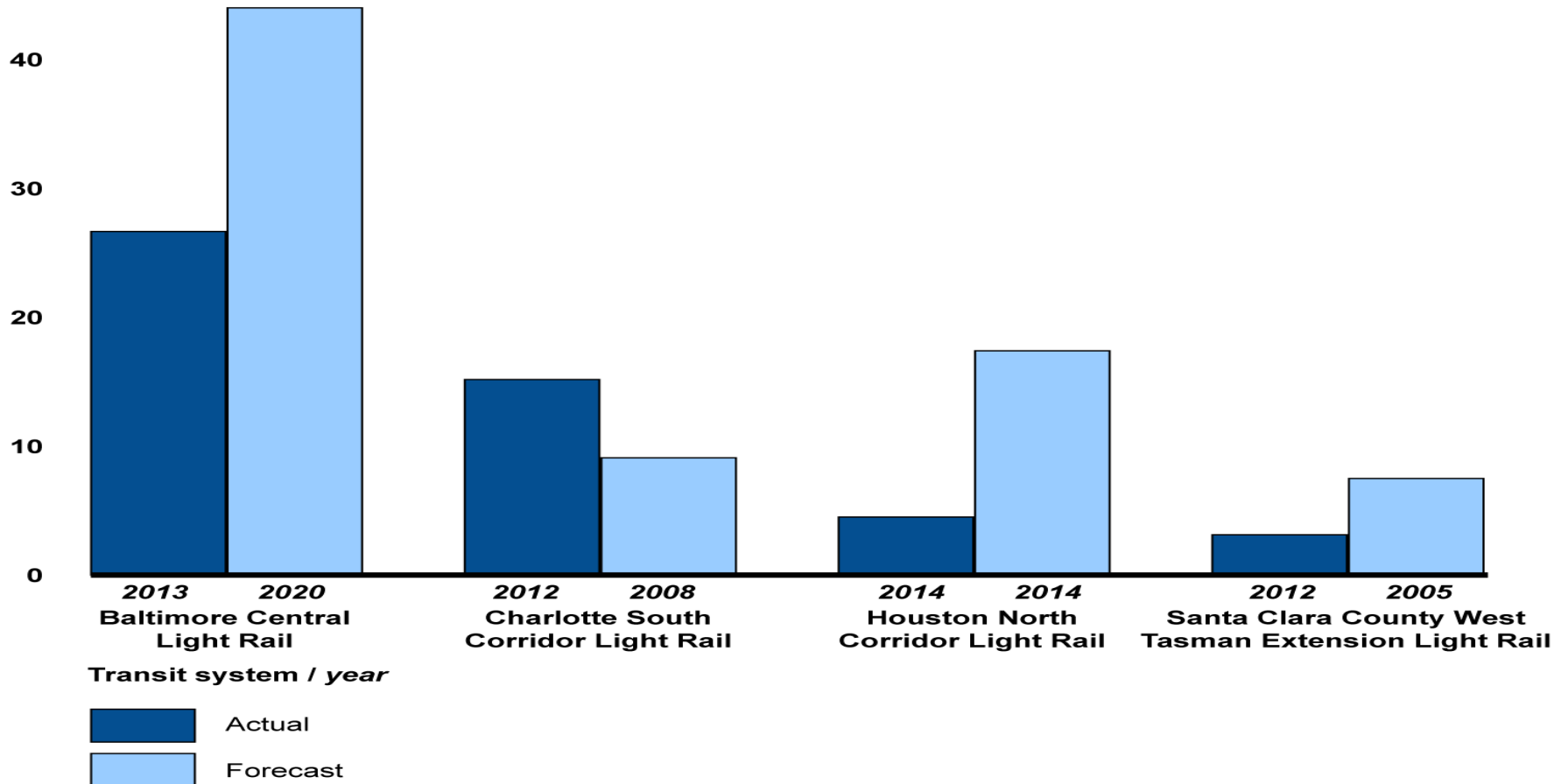
# Three Commonly Perceived Criteria for Transit Success

- Ridership
- Ridership
- Ridership

# Actual and Forecast Average-Weekday Ridership of Selected New Starts-Funded Light Rail Projects

Average weekly ridership (in thousands)

50



Sources: The National Transit Database, Maryland Transit Administration, Houston Metro, Santa Clara Valley Transportation Authority, and the Federal Transit Administration. | GAO-15-70



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# Can Value Analysis Assist Transit Planning and TOD? Perhaps.



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# **Value Engineering Process**

Share Information

Components & Functions

Brainstorm Ideas

Evaluate Ideas

Develop Recommendations



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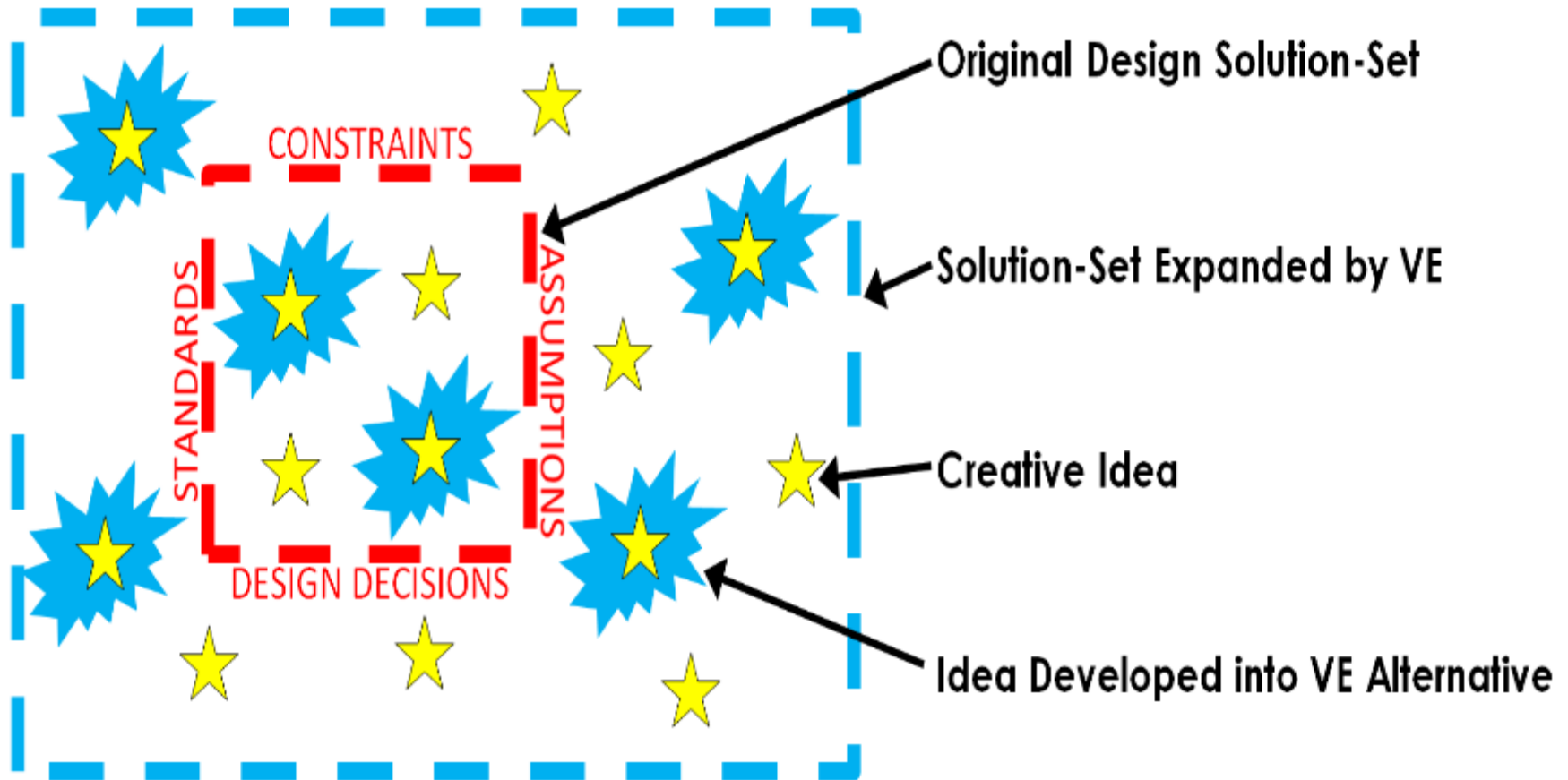
# **Value Analysis Goals and Objectives**

- Assist the Planning and Design Teams
- Expand Solutions
- Challenge Constraints
- Clarify Misunderstandings
- Identify Components
- Analyze Functions
- Structure Collaboration
- Infuse Expertise
- Expand Knowledge



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# Expand Solutions





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**Again, what is Value?**

$$\text{Value} \sim \frac{\textit{Performance}}{\text{Cost, Risk, Time}}$$





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# **Value Analysis Case Study Rail Transit Engineering Design**







# Value Engineering Workshop

## Presentation of VE Recommendations

February 20, 2015



# Today's Topics

- Value Engineering (VE) Workshop
- Recommendations based on available cost data
- Design Suggestions
- VE Change in Cost

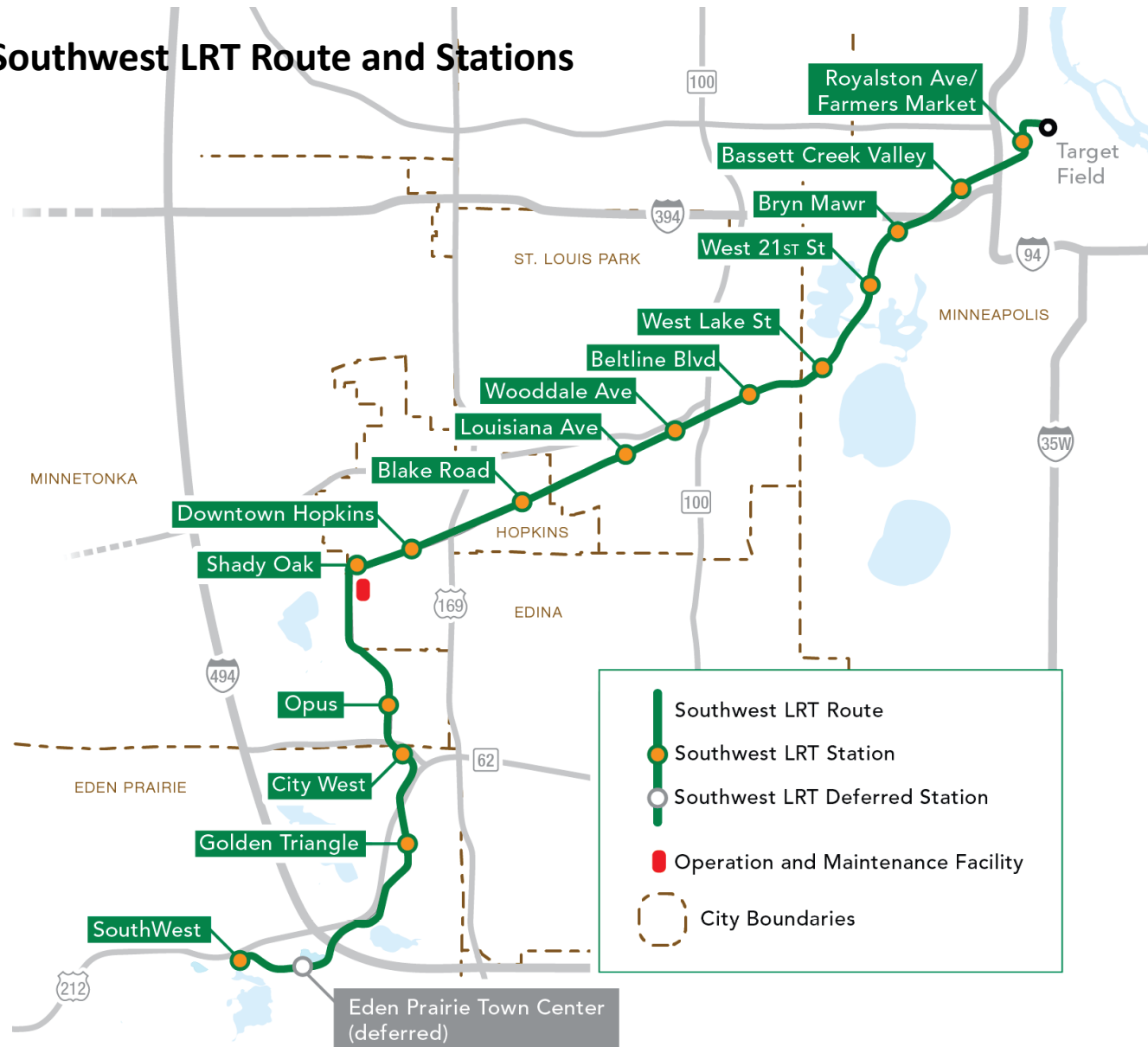


# Value Engineering (VE) Workshop

- Tuesday through Friday
- VE Team: HNTB and transit agencies
  - DART
  - Utah Transit Authority
  - LA Metro
  - RTD Denver
- Followed formal process as recommended by AASHTO
- Evaluated 46 ideas – Ten recommendations, 36 design suggestions



# Map of Southwest LRT Route and Stations



# Southwest LRT at a Glance

- Service Commences: 2021
- 14.5 Miles
- 15 Stations
- 37% Increase in employment –
  - 92,400 local
  - 145,900 downtown
- \$1.8 Billion
- 34,000 Boardings by 2040



# The Most Critical Factor of the VE Study



# Alignment Layout Area





# Structure Analysis Team





# VE Recommendations

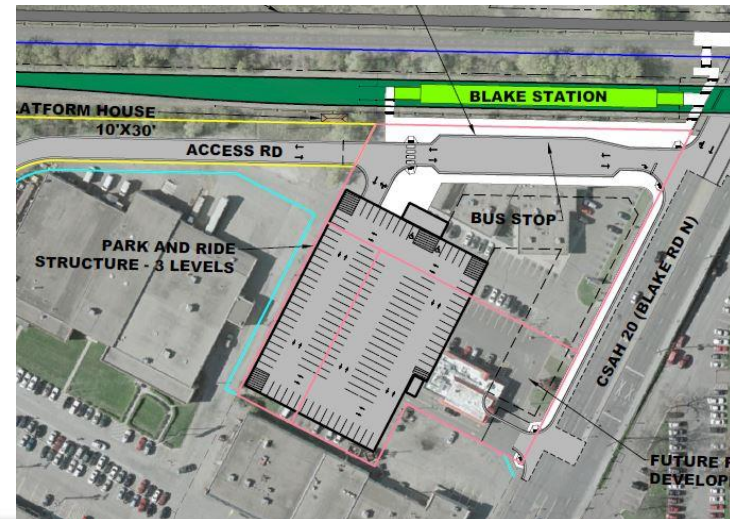
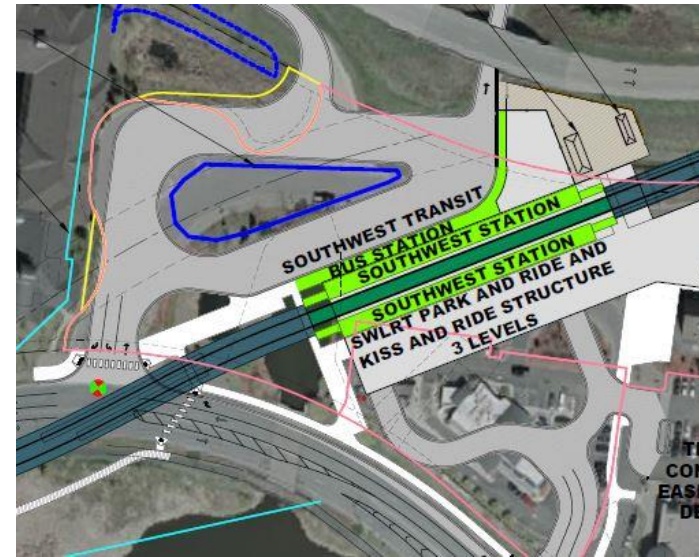
Easier to manage what you can measure.

# VE Recommendations: Potential Change in Cost

Rec. #	Category	Topic	(Savings) or Increased Cost
1	Constructibility	Reduced size of initial capacity and phased construction of P&R structures and surface lots to accommodate need	(\$12,128,000)
2	Operations	Construct tail tracks at Mitchell Station	\$1,188,000
3	Operations	Construct siding/pocket track W of Wooddale Station	\$517,000
4	Signals	Full control at seven identified crossings (reference sheet)	\$2,520,000
5	Structures, Trackwork	Revise LRT bridge over FR near Royalston: structure type and track design	\$400,000
6	Structures	Review FR structure design at Louisiana Station	\$212,000
7	TPSS	Number and location of TPSS throughout project	(\$6,190,000)
8	Tunnel	TH 62 tunnel: bulleted list of recommendations	(\$5,000,000)
9	Tunnel	Kenilworth tunnel: bulleted list of recommendations	(\$12,200,000)
10	Stations	Review station functions, geometry, and access	\$0
		Potential Change in Cost Total	(\$30,681,000)

# R-1: Phased Construction of Park & Ride Capacity

## Savings (\$12,128,000)



# R-1: Phased Construction of Park & Ride Capacity

SWLRT - Average Weekday SWLRT Boardings by N

DRAFT - 07/15/14

**2010 vs 2030**

Station	PNR Spaces	PNR Demand	PNR Demand
Mitchell	900	303	930
Southwest	440	29	386
Eden Prairie TC Alt	160	164	158
Golden Triangle	271	13	276
City West	190	393	167
Opus	98	47	80
Shady Oak	480	370	365
Hopkins	0	0	0
Blake	477	273	408
Louisiana	261	227	268
Wooddale	-	0	0
Beltline	559	448	525
West Lake	-		
21st Street	-		
Penn	-		
Van White	-		
Royalston	-		
SWLRT Subtotal	3,836	2,267	3,562
CBD Stations			
Central Corridor Stations			
Total			

Projected Boardings

19,202  
(56%)

34,236

## Idea Development Worksheet

### RECOMMENDATION 1 Part 1

IDEA: 2

**DESCRIPTION:** Evaluate phased construction of park and ride structures.

**DEVELOPED BY:** Patrick Watz; Keith Powley; Greg Thorpe

**CHECKED BY:** Patrick Watz; Keith Powley; Greg Thorpe

#### LIFE CYCLE COST SUMMARY:

COST			
Item	Initial Cost	Future Cost	Total Costs
Original Design	\$26,541,000	\$0	\$26,541,000
Proposed Change	\$17,353,000	\$0	\$17,353,000
<b>Change of Cost: Increase or (Savings)</b>	<b>(\$9,188,000)</b>	<b>\$0</b>	<b>(\$9,188,000)</b>

\*Initial costs could include construction and real estate. Future costs could include programmed reconstruction, estimated repairs, or significant operating costs. Use the detailed cost estimating spreadsheet to identify and estimate items.

#### DESCRIBE ORIGINAL DESIGN OR CONCEPT IN TERMS OF PERFORMANCE AND COST:

Park and rides appear to be sized for 2030 ridership.

#### DESCRIBE PROPOSED IDEA IN TERMS OF PERFORMANCE AND COST:

Opening day ridership and subsequent park and ride demand for some locations are significantly lower than 2030 demand. In particular Mitchell Road, Southwest, and Blake have significantly lower projected park and ride demand in 2010 and likely on initial revenue service date in 2019. In one case, City West, the park and ride demand in 2010 exceeds the 2030 projections and the planned capacity - this should be reviewed. This station ridership and park and ride demand may need to be reevaluated to confirm the park and ride demand on opening day. For structured park and rides where the 2010 projected demand is significantly less than the planned capacity, a phased implementation may be desired whereby foundations are sized to accommodate the expansion of future parking decks.

#### JUSTIFICATION:

##### Advantages:

- Reduced initial capital costs
- Reduced O&M costs
- Reduced impervious construction and impact to runoff and storm collection requirements
- Reduced public perception and risk of empty lots / no riders

##### Disadvantages:

- Need to fund future expansion through local fund or separate federal grants
- Opening day park and ride demands may exceed initial built capacity



**COST ESTIMATE (round totals to nearest \$1000):**

**Original Construction Cost Estimate**

Item No.	Description	Unit	Unit Price	Quantity	Est. Cost
1	Mitchell Road Parking Structure	stall	\$12,000.00	950	\$11,400,000
2	Southwest Station Parking Structure	stall	\$12,000.00	430	\$5,160,000
3	City West Parking Structure (costed as structured PNR - should be surface - change unit cost)	stall	\$12,000.00	100	\$1,200,000
4	Blake Road Park & Ride Station (structure)	stall	\$18,256.59	481	\$8,781,420
<i>Subtotal</i>					\$26,541,420
					Say \$26,541,000

**Original Operation, Maintenance & Programmed Reconstruction Costs**

					\$0
					\$0
					\$0
<i>Subtotal</i>					\$0
					Say \$0
<b>Total</b>					Initial Cost Estimate \$26,541,000

**Idea Construction Cost Estimate**

Item No.	Description	Unit	Unit Price	Quantity	Est. Cost
1	Mitchell Road Parking Structure	stall	\$14,400.00	475	\$6,840,000
2	Southwest Station Parking Structure	stall	\$13,184.67	287	\$3,779,605
3	City West Parking Structure	stall	\$3,000.00	100	\$300,000
4	Blake Road Park & Ride Station (structure)	stall	\$20,061.40	321	\$6,433,021
<i>Subtotal</i>					\$17,352,626
					Say \$17,353,000

**Future Operation, Maintenance & Programmed Reconstruction Costs**

					\$0
					\$0
					\$0
<i>Subtotal</i>					\$0
					Say \$0
<b>Total</b>					Idea Cost Estimate \$17,353,000

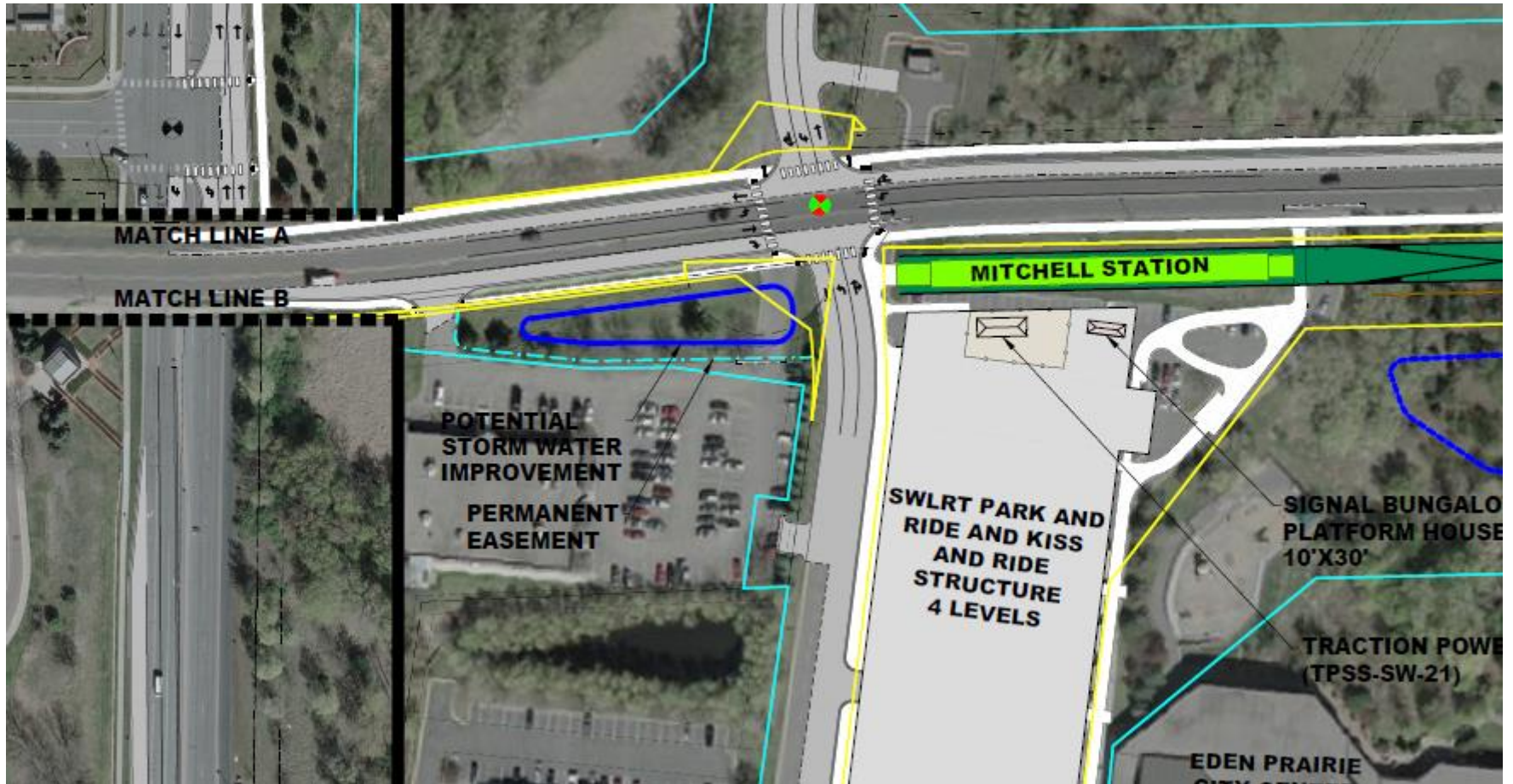
**SKETCHES (attach additional sheets as needed):**

**SUPPLEMENTAL INFORMATION (attach additional sheets as needed):**

**FINAL RECOMMENDATION:**

The VE team recommends reevaluation of opening day ridership and a phased implementation of structured park and rides. The foundations should be designed to accommodate future demand in 2030/2040. The costs are based on 2014 unit costs carried by the project - no escalation, professional services or contingency are included in this evaluation.

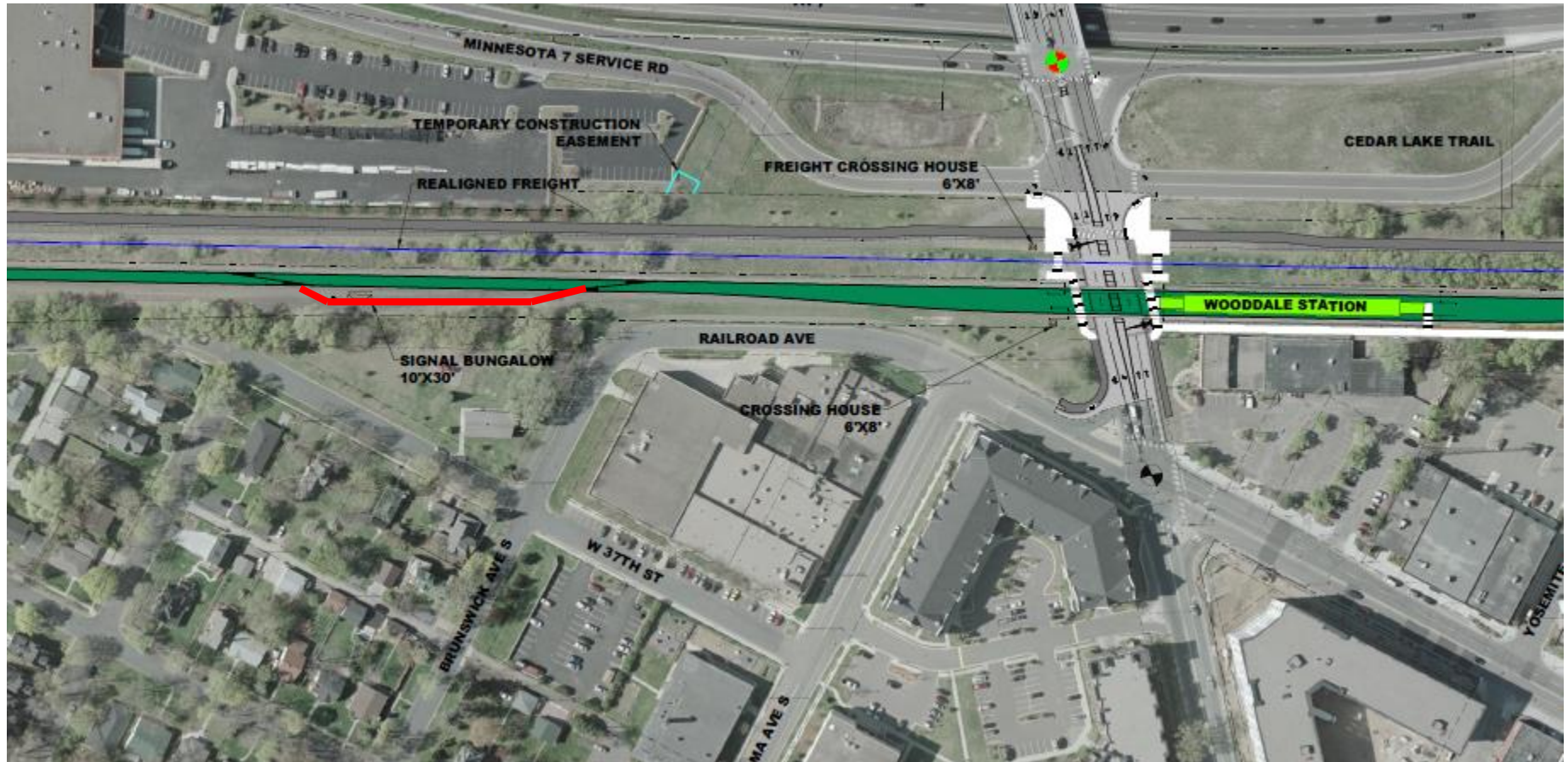
## R-2: Two 3-car Tail Tracks West of Mitchell Station Added Cost: \$1,188,000



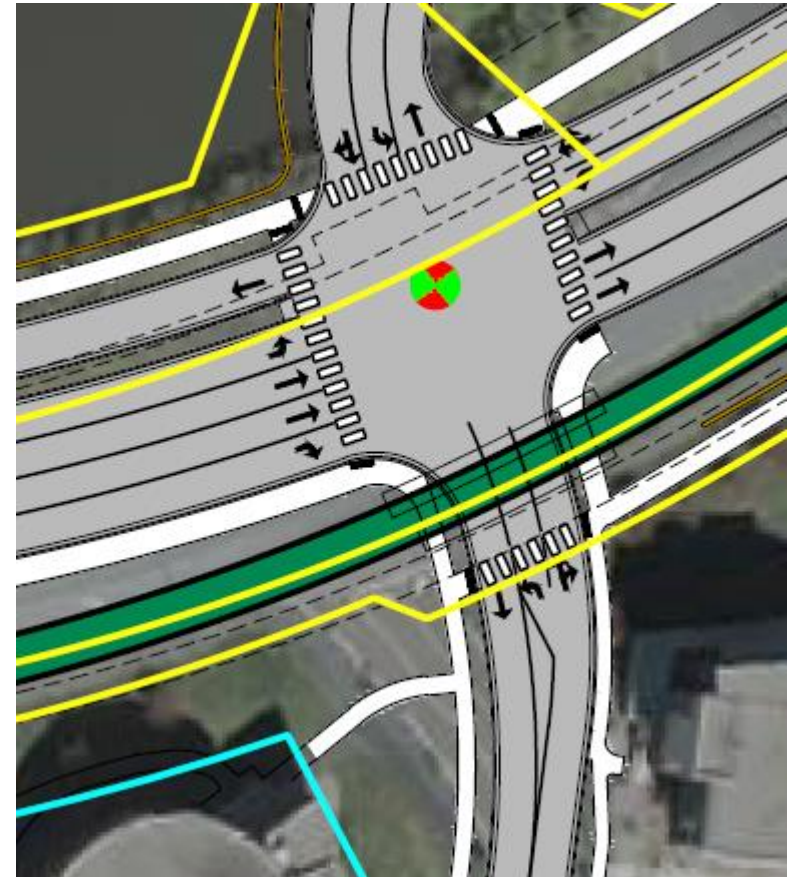
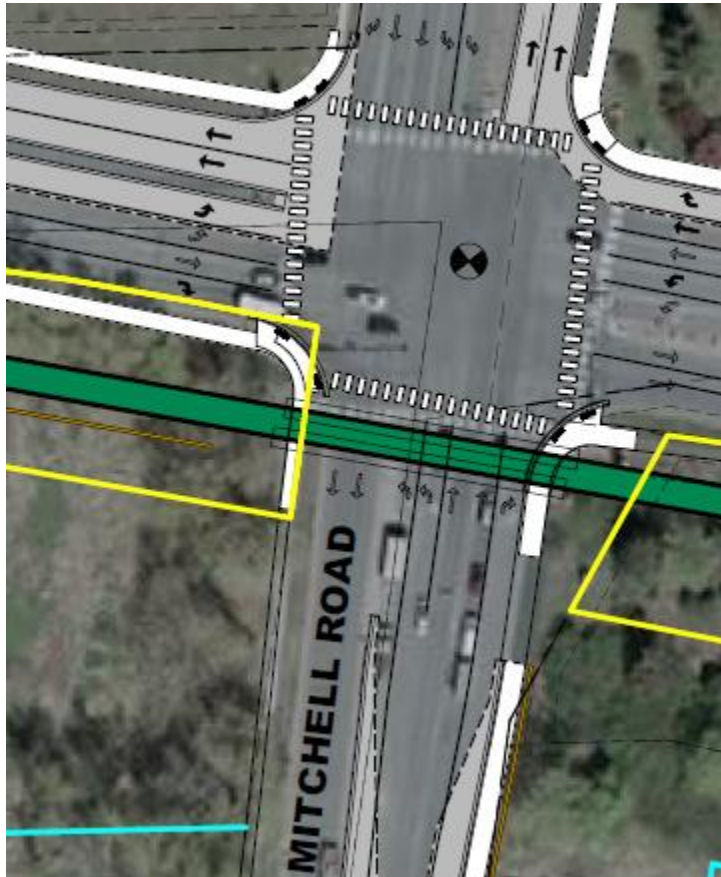


# R-3: Siding/Pocket Track West of Wooddale Station

## Added Cost \$517,000



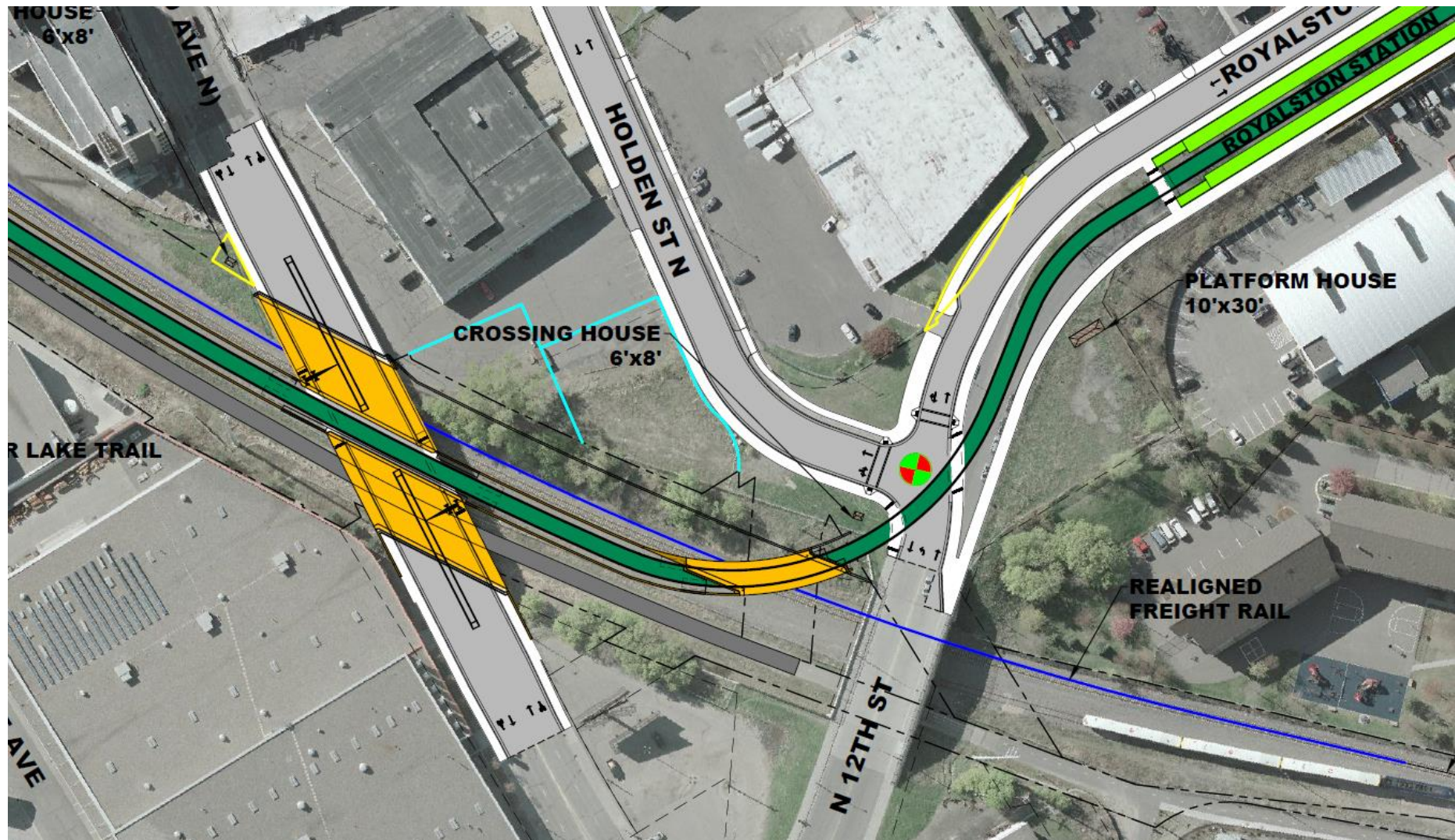
## R-4: Gates for Seven Side-Running Intersections Added Costs: \$2,520,000



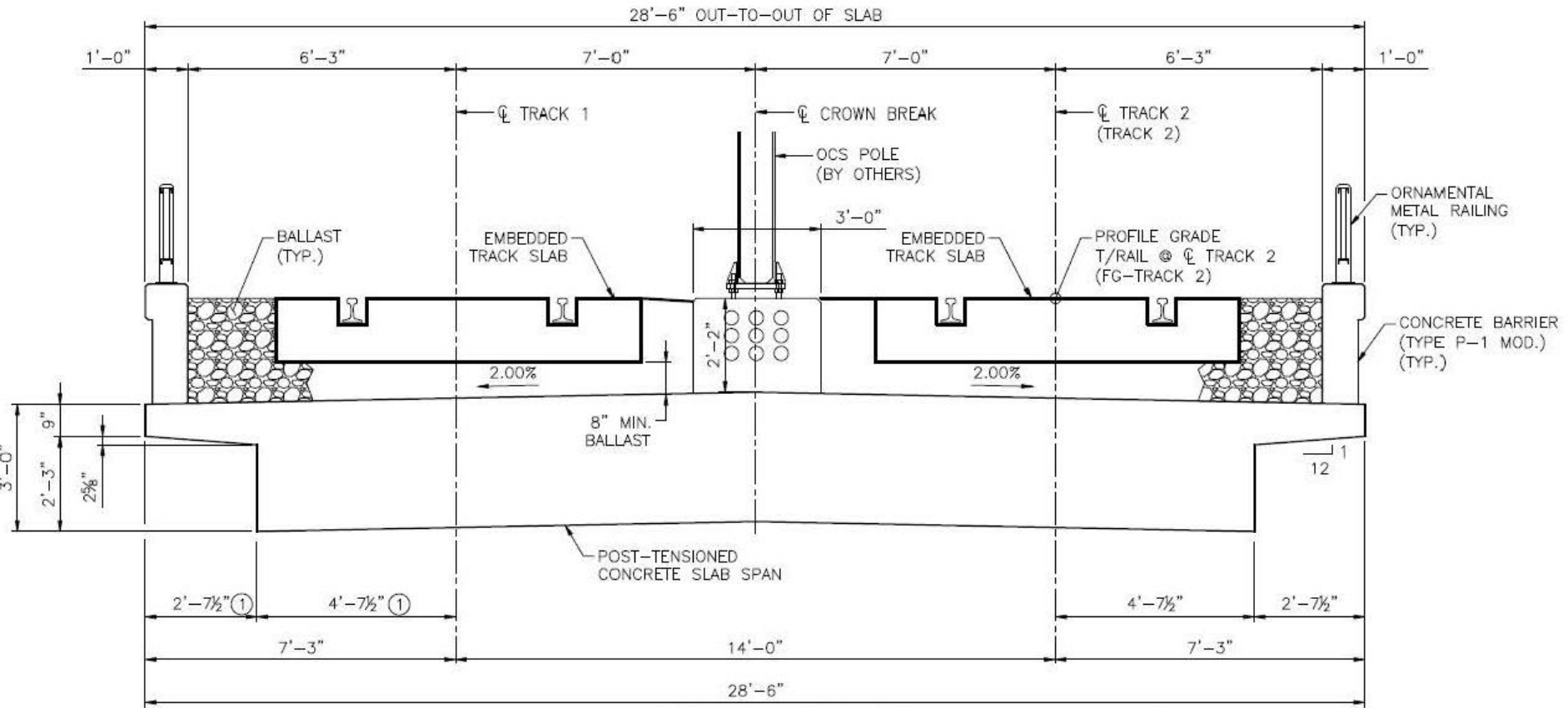


# R-5: Bridge over BNSF, Structure & Track Design

## Added Cost: \$400,000



# R-5: Bridge over BNSF, Structure & Track Design

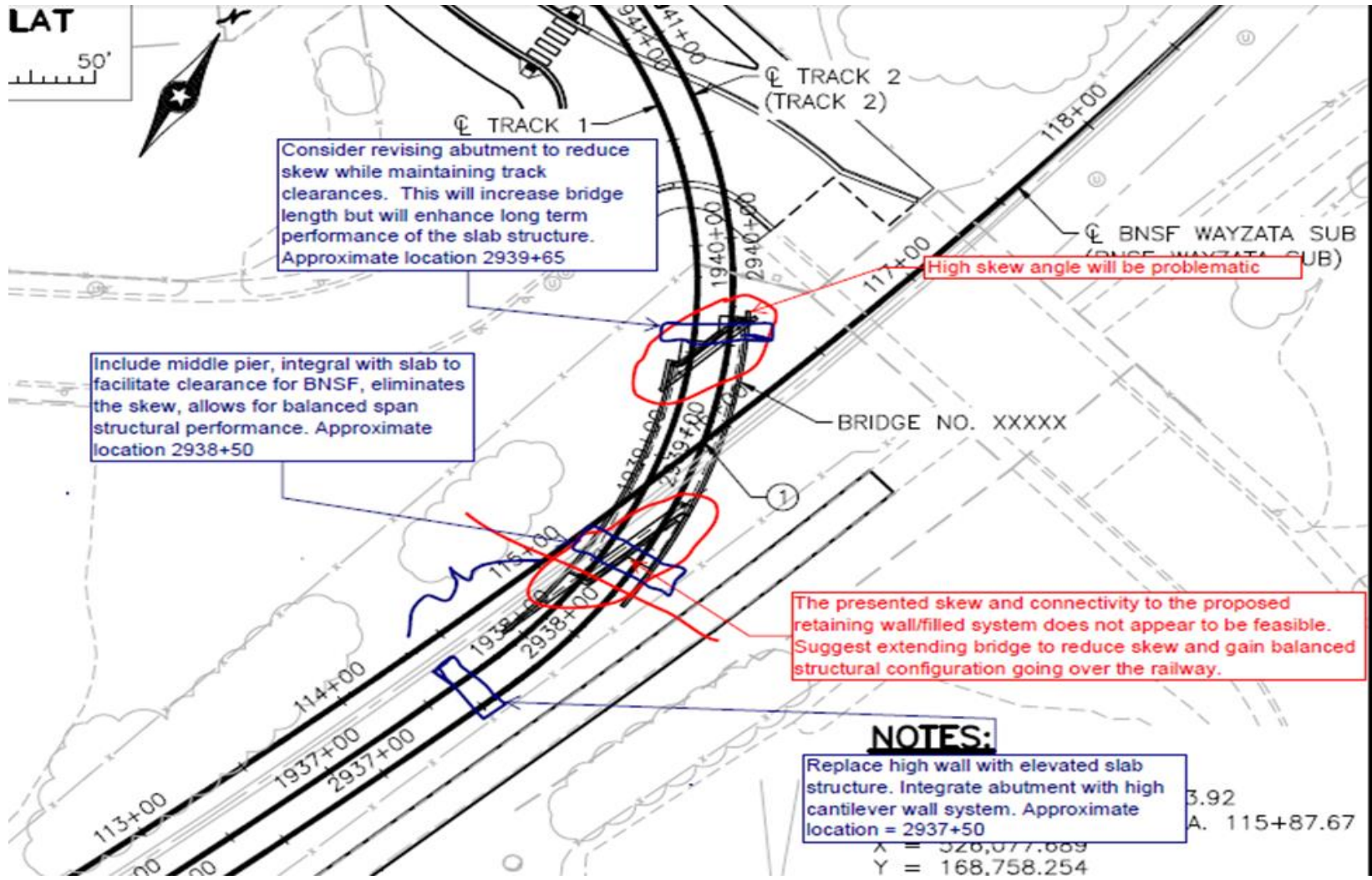


**TRANSVERSE SECTION**

① VARIES IN THE REGION NEAR THE SOUTHWEST CORNER OF THE BRIDGE.

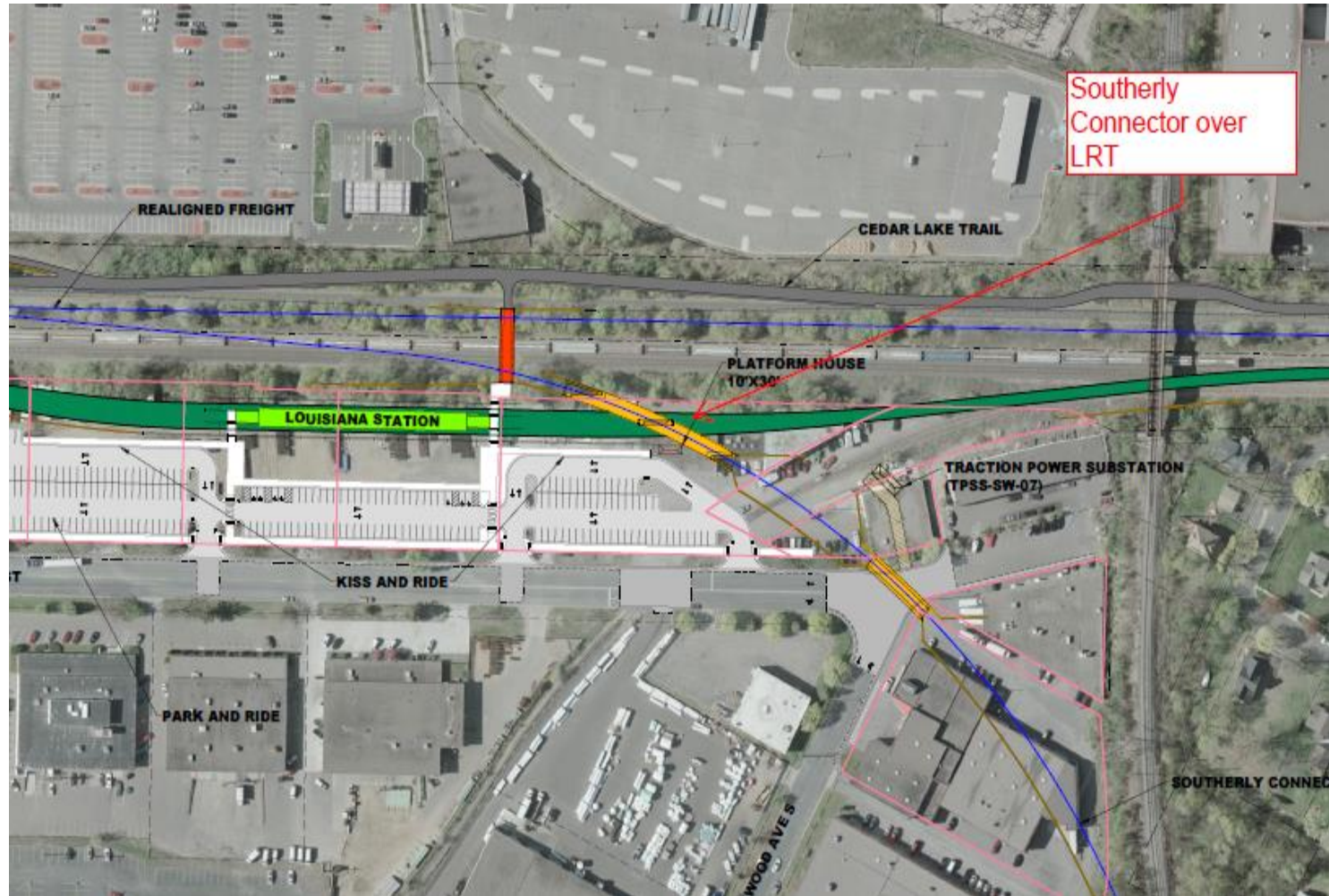


# R-5: Bridge over BNSF, Structure & Track Design



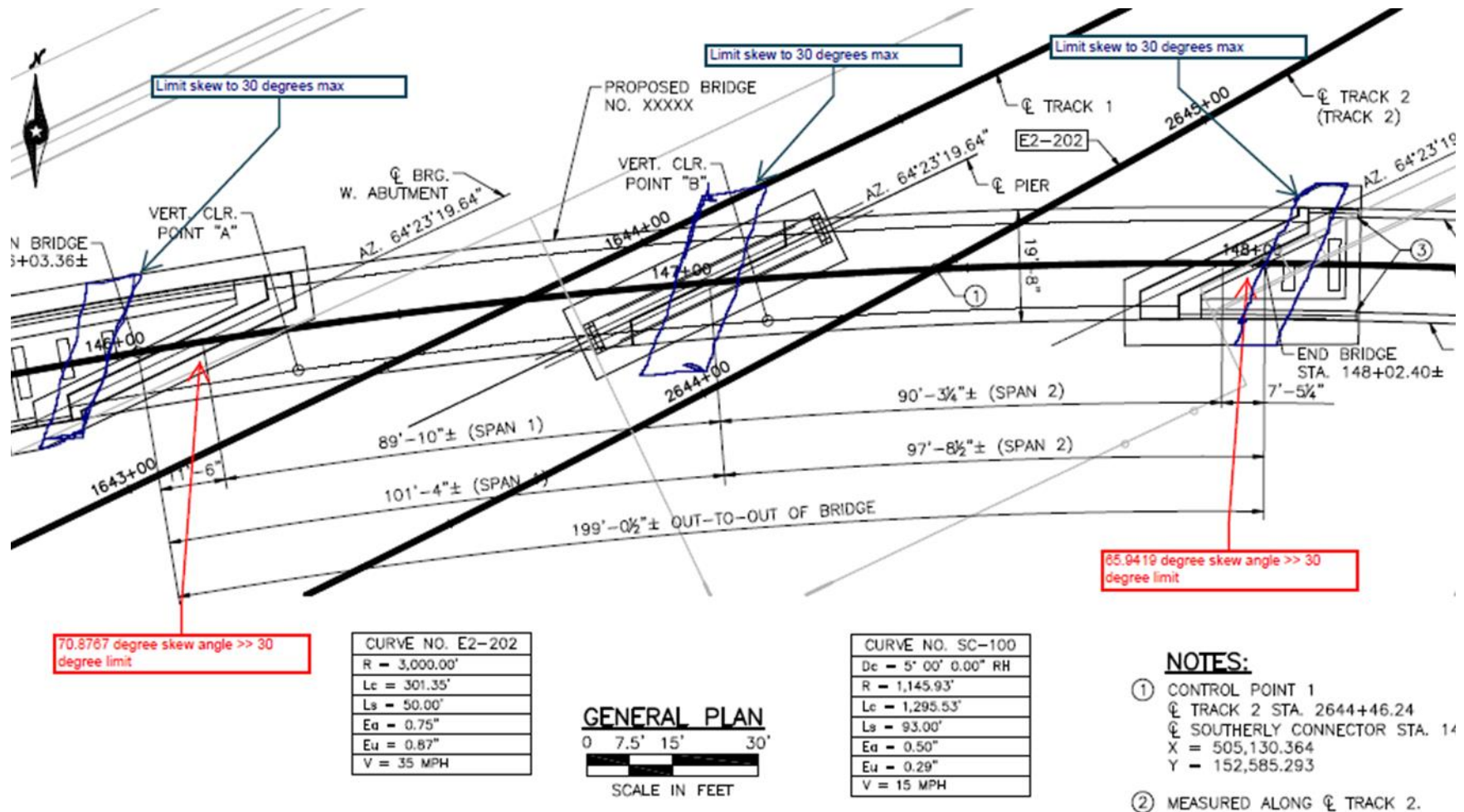
# R-6: Southerly Connector FR Bridge over LRT

## Added Cost: \$212,000





## R-6: Southerly Connector FR Bridge over LRT



# R-7: Quantity and Location of TPSS

**Savings: (\$6,190,000)**

## Traction Power Sub-Station Design Locations

TPSS	Name	Chainage	Distance in Feet	Mileage Between TPSS
21	Mitchell	202500		
20	Technology	204300	1800	0.34
19	Southwest	208200	3900	0.74
18	Town Center	211300	3100	0.59
17	Prairie Center	215600	4300	0.81
16	Flying Cloud	221800	6200	1.17
15	Shady Oak	225700	3900	0.74
14	City West	229400	3700	0.70
13	Opus	233200	3800	0.72
12	Feltl	238200	5000	0.95
11	Shady Oak	242600	4400	0.83
10	Hopkins	251800	9200	1.74
9	Jackson	255700	3900	0.74
8	Minnehaha	259500	3800	0.72
7	Louisiana	264700	5200	0.98
6	100	269400	4700	0.89
5	East Beltline	274000	4600	0.87
4	Cedar Lake	278800	4800	0.91
3	Kenilworth	284200	5400	1.02
2	394	287700	3500	0.66
1	94	292200	4500	0.85
12 C	Target Field*		4500	0.85

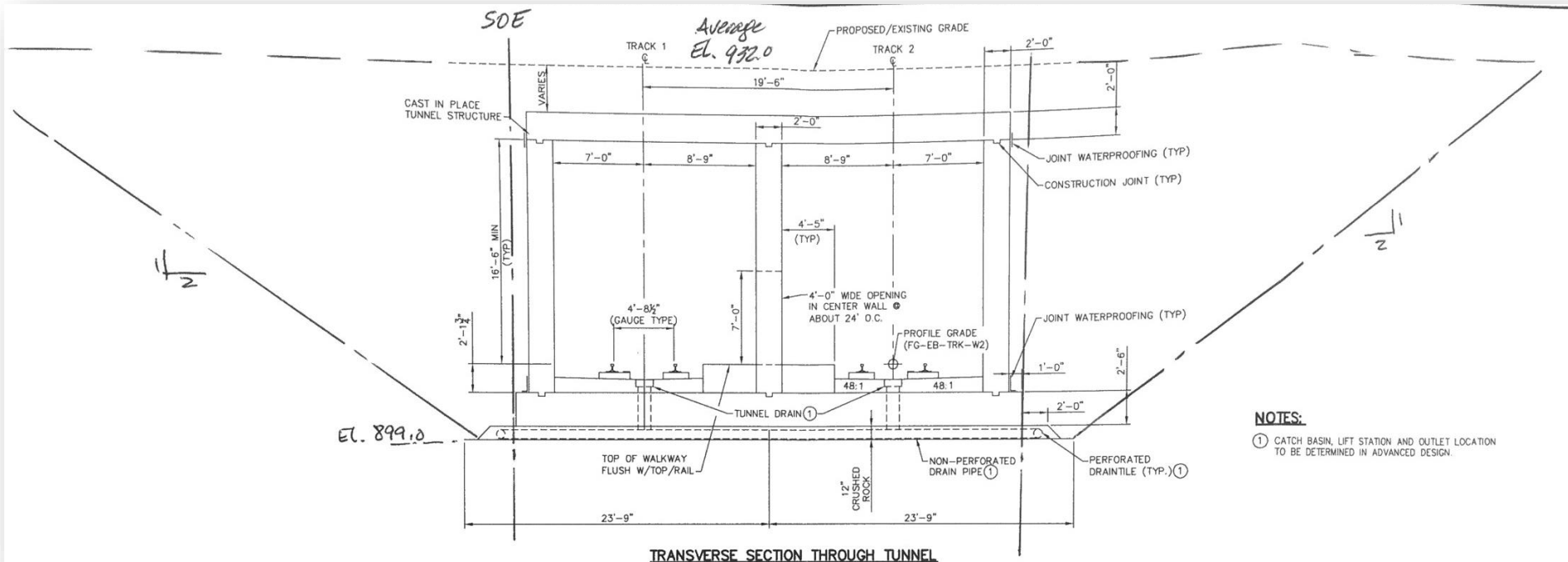
\* - Estimated distance from TPSS 1 (94) to Target Field TPSS



**Savings: (\$6,190,000)**

## Recommendations

1. Support of excavation in lieu of open cut
2. Assess use of precast T-beams for roof structure



# R-8: Design and Constructability of TH 62 Tunnel

## Design Suggestions

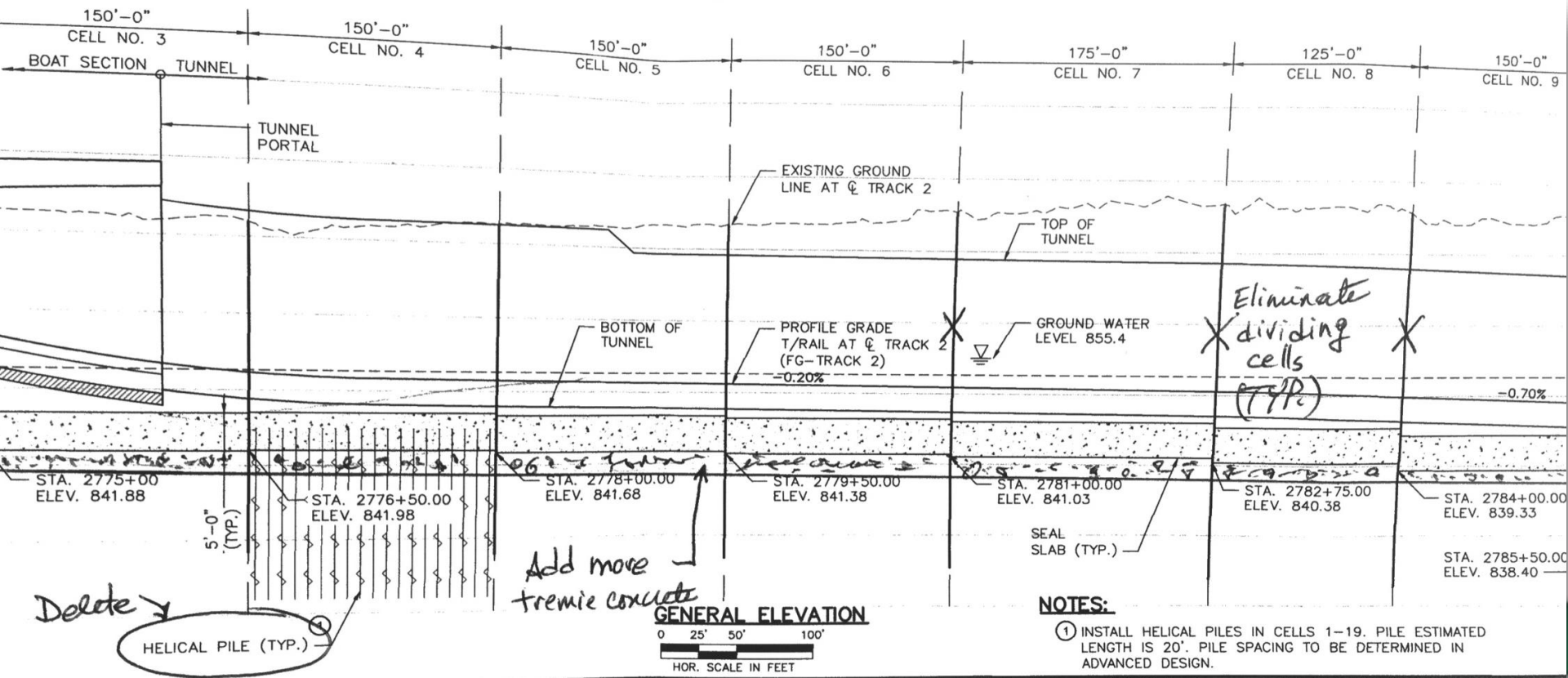
1. Consistent design of TH 62 and Kenilworth tunnels: space planning, layout configuration, structural system, FLS elements, etc.
2. Waterproofing over the top slab to be extended 3 ft on each wall
3. Low point sump/pump facility
4. FLS elements to meet NFPA 130
5. Design the structure to resist fire loads or fireproof the structure

# R-9: Design & Constructability of Kenilworth Tunnel

**Savings: (\$12,200,000)**

## Recommendations

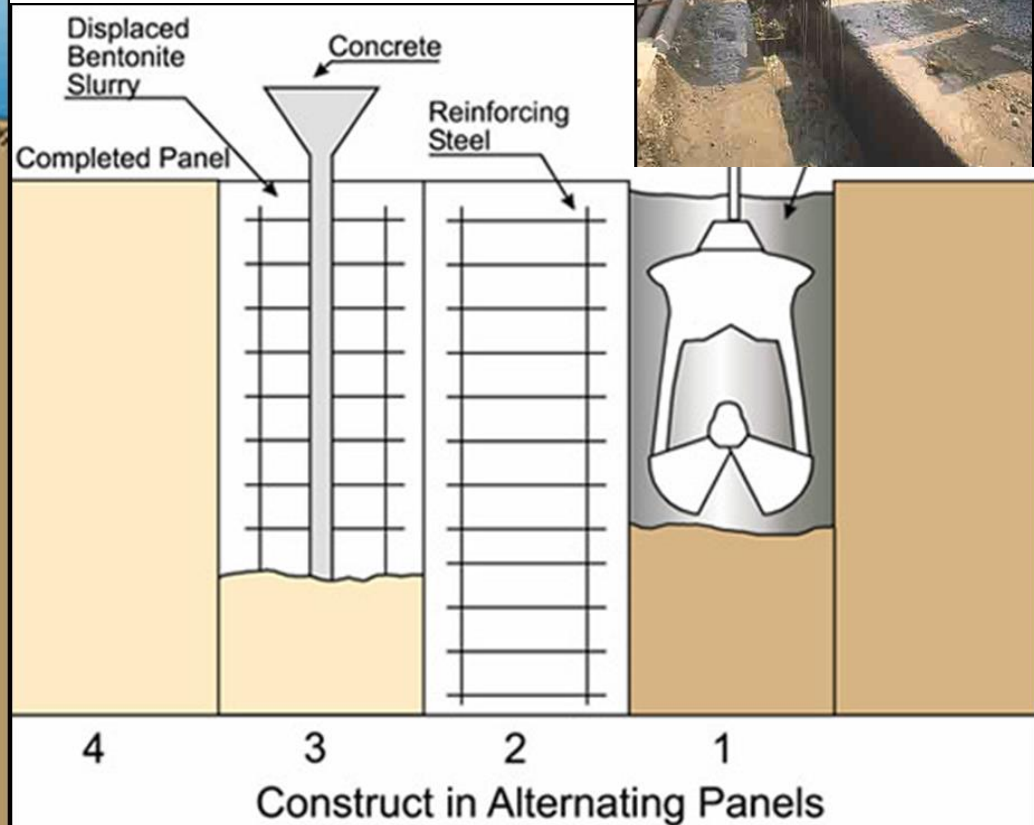
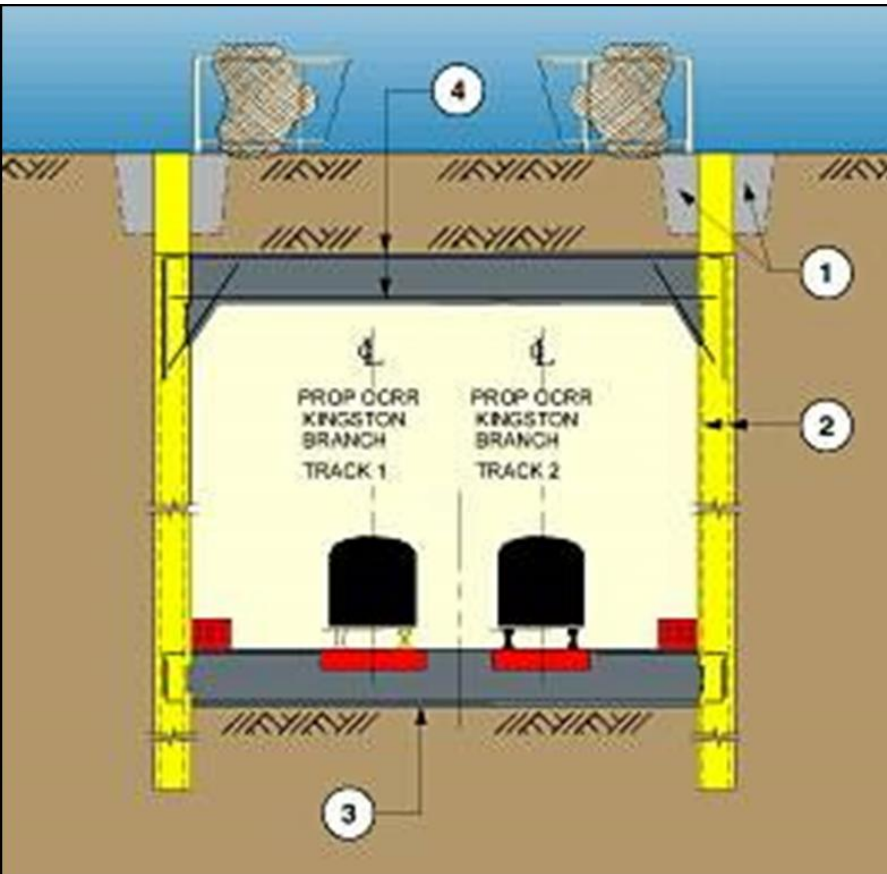
1. Use trench construction with tremie concrete plug in lieu of cellular construction
2. Replace helical piles with additional tremie concrete



# R-9: Design & Constructability of Kenilworth Tunnel

## Recommendations

3. Slurry walls for support of excavation, cut-off walls, and permanent structural wall



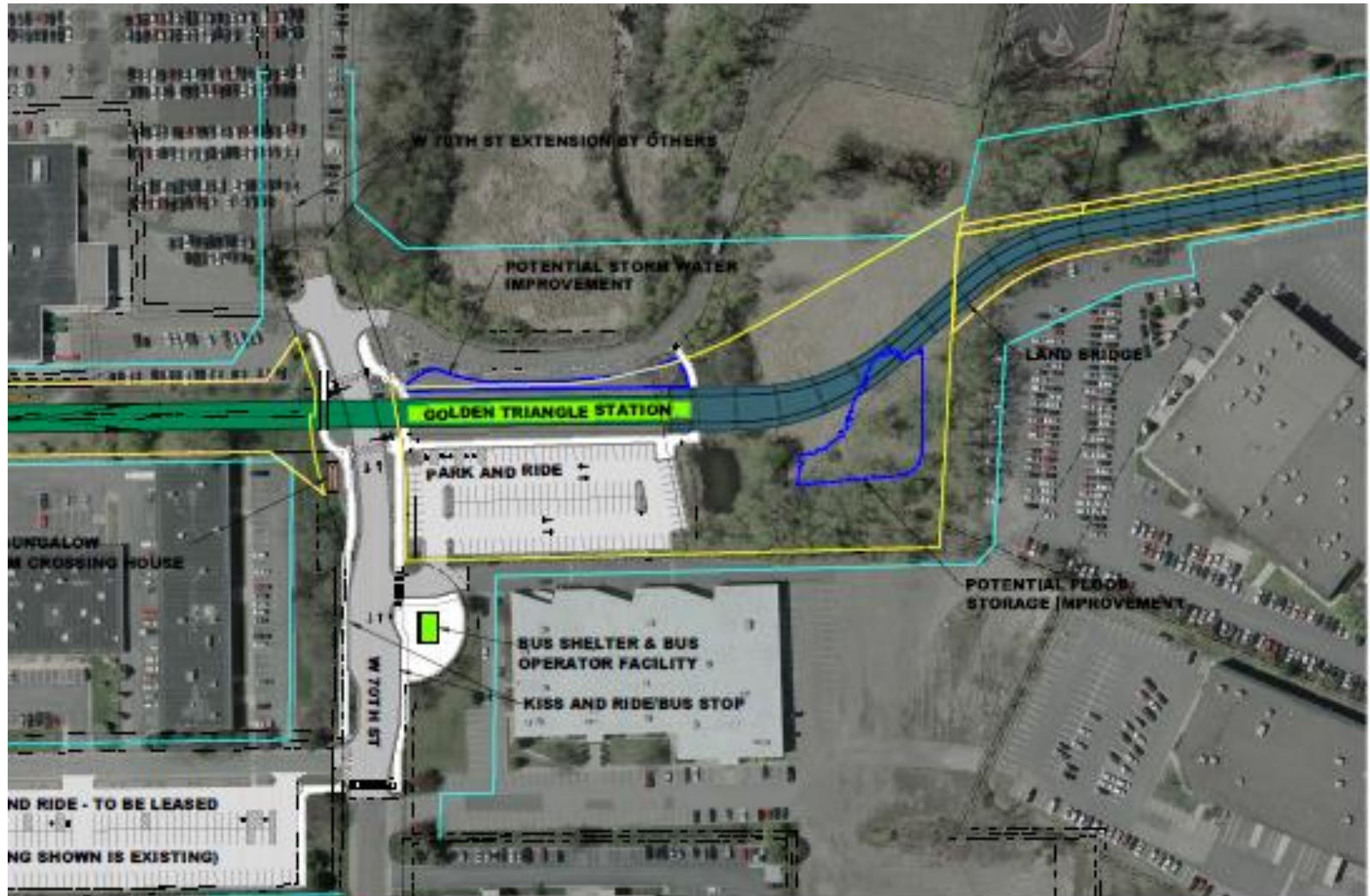
# R-9: Design & Constructability of Kenilworth Tunnel

## Design Suggestions

1. Relocate benches to center wall and provide cross-passages with sliding fire doors between tubes at 250' to meet NFPA 130
2. Sump/pump at low point
3. Reduce center wall thickness – limited load on wall
4. Assess unbalanced loads due to FR on one side of tunnel structure
5. Design the tunnel structure to resist the fire load or provide fire proofing
6. Provide geotechnical base line report (GBR) as contract document for all tunnel/underground work



## R-10: Stations' Function, Geometry, and Access



# Design Suggestions

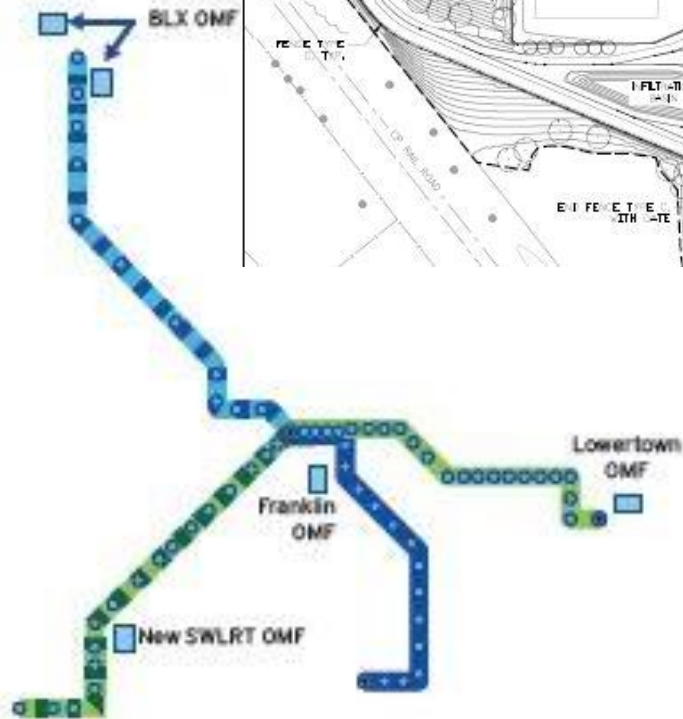
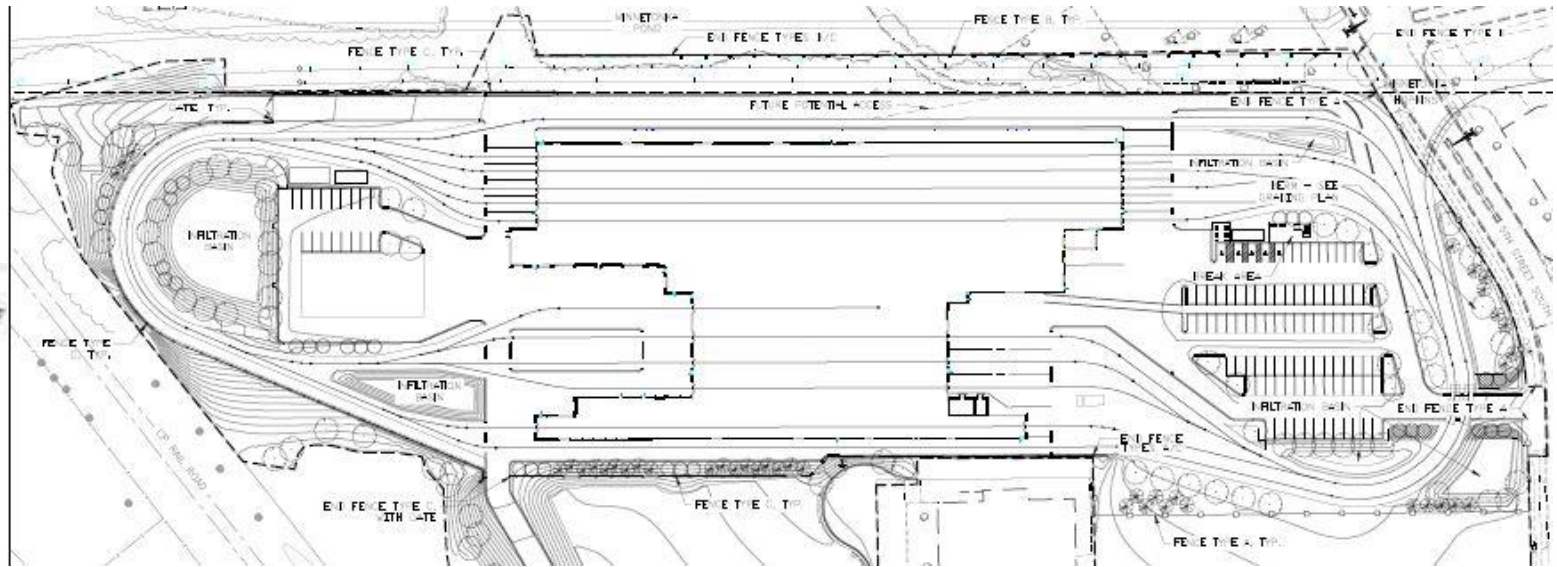


# DS-1: Land Bridge Constructability

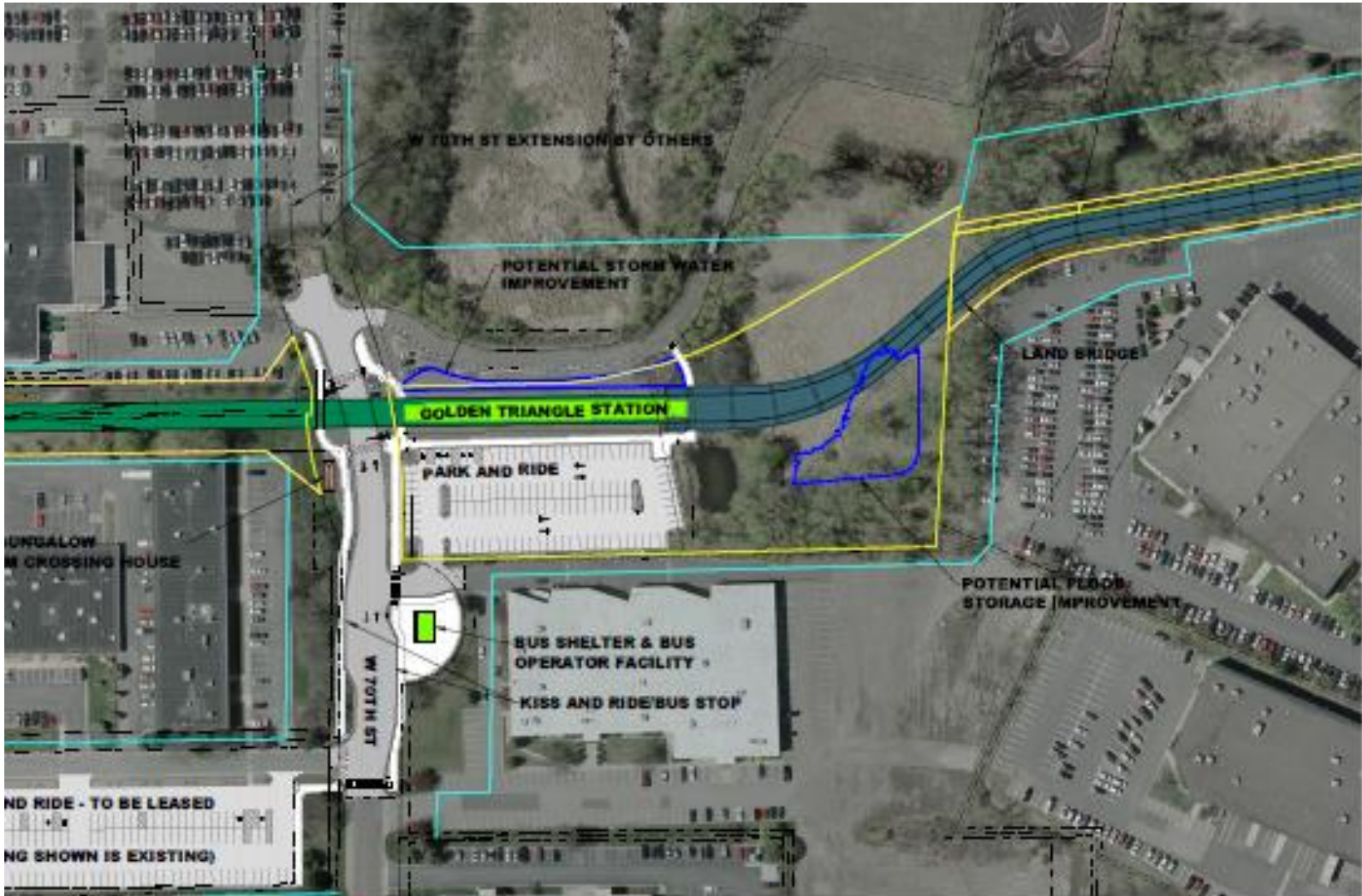




## DS-2: Systemwide OMF Evaluation

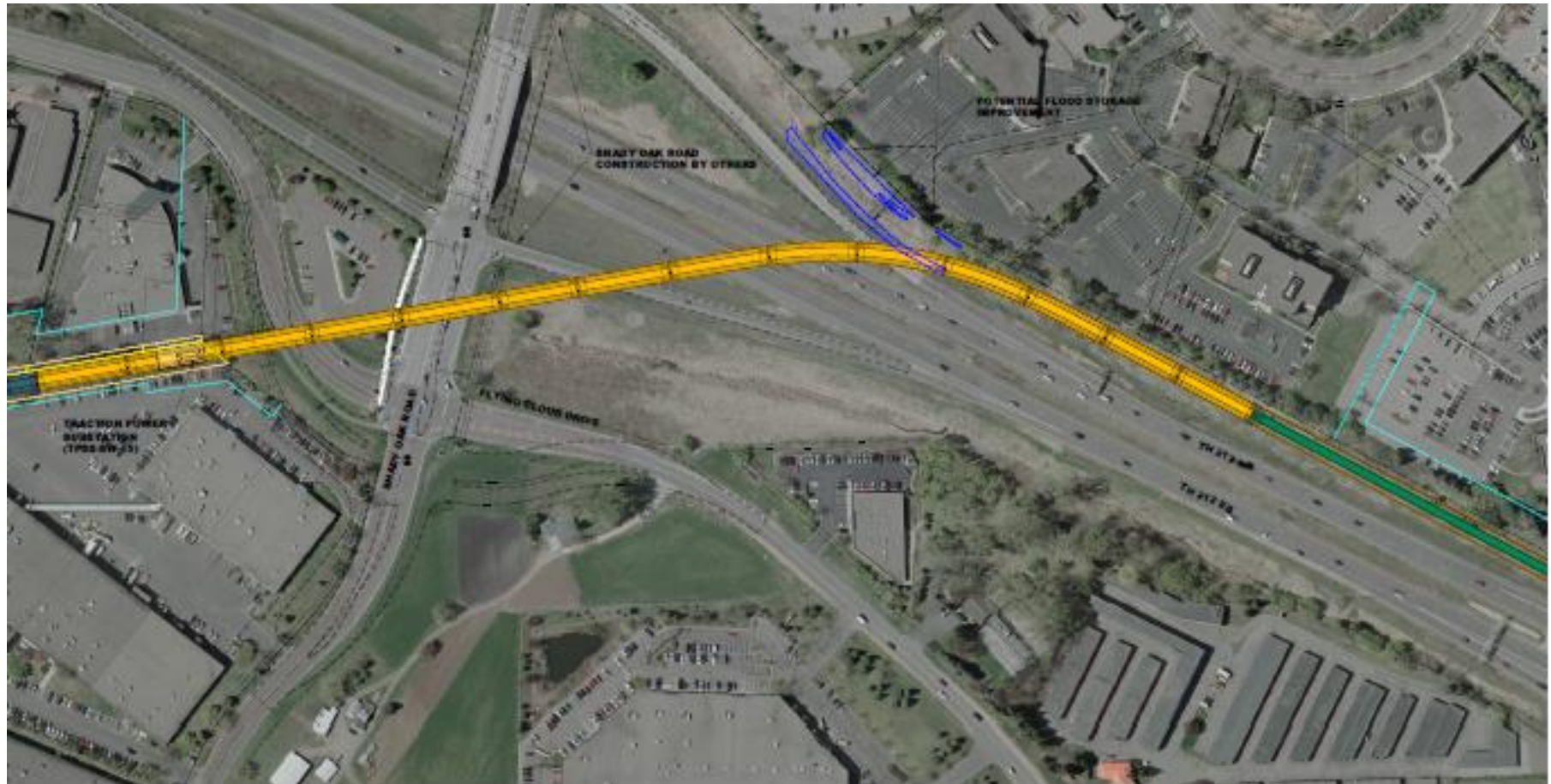


# DS-3: Validate Horizontal and Vertical Alignments



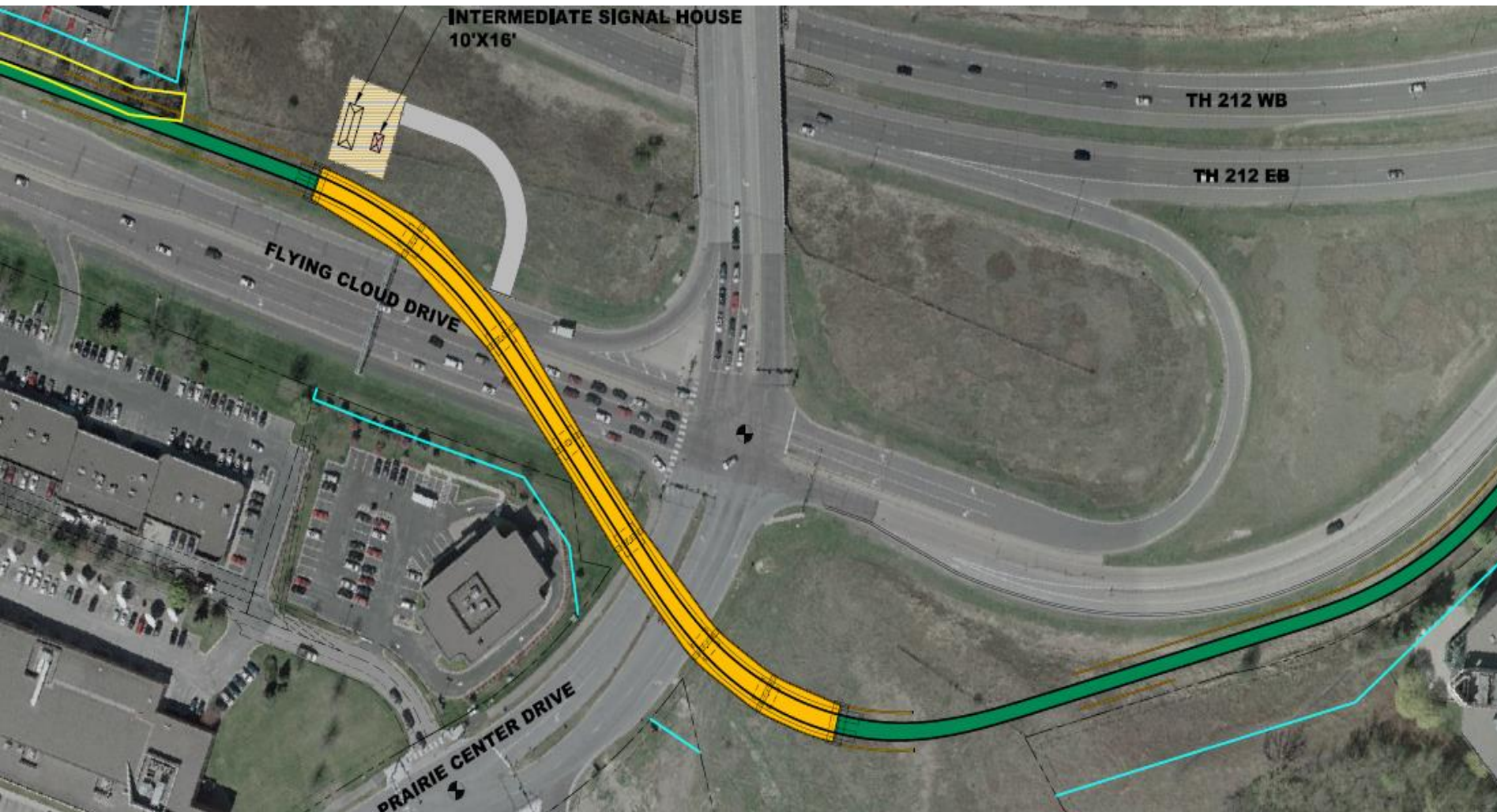


# DS-3: Validate Horizontal and Vertical Alignments

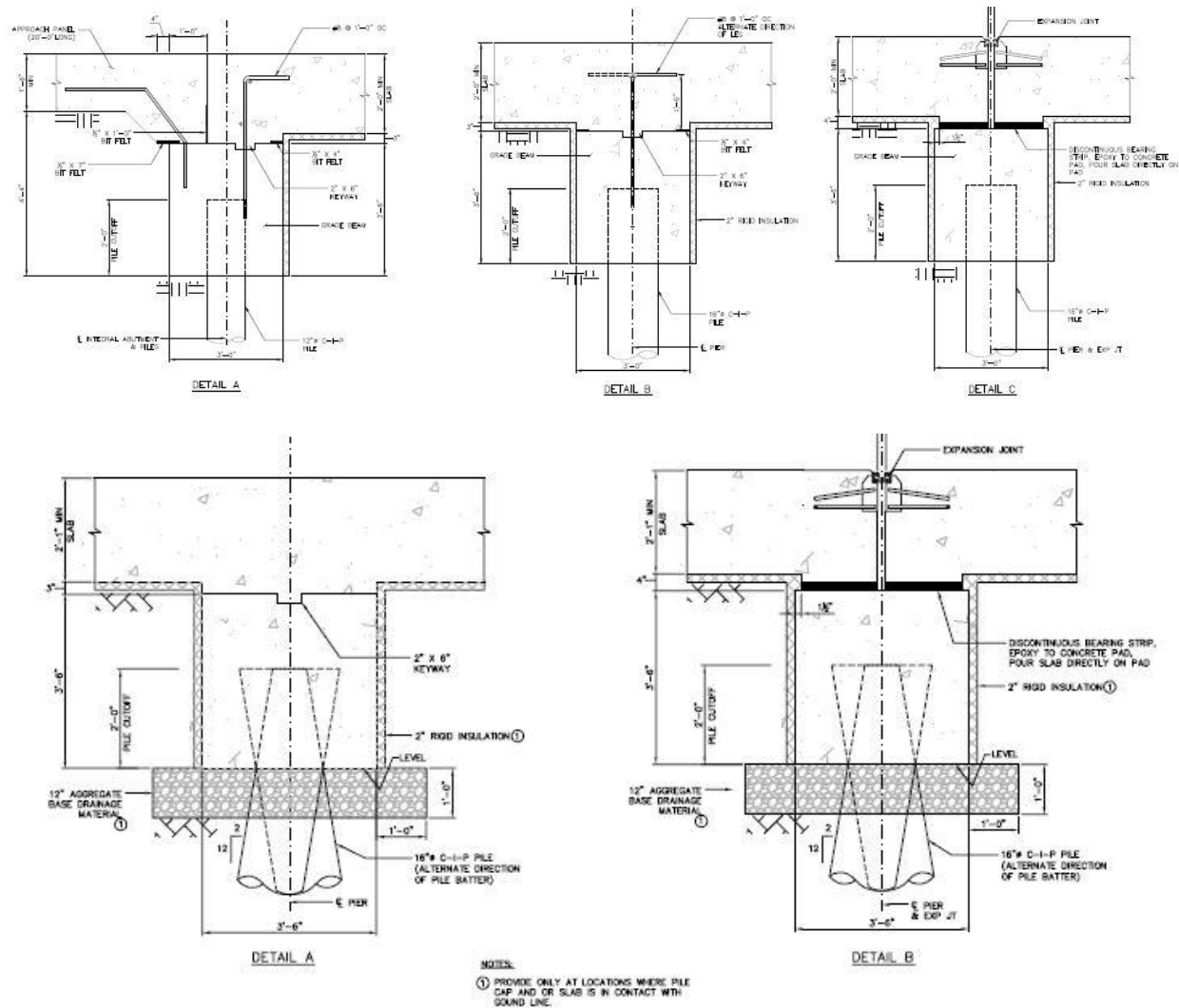




# DS-5: Valley View/Flying Cloud Dr. Bridge Alignment



# DS-6: Standardize Structure Design



# VE Recommendations: Potential Change in Cost

Rec. #	Category	Topic	(Savings) or Increased Cost
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10	Stations	Review station functions, geometry, and access	\$0
		Potential Change in Cost Total	(\$30,681,000)



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# **Use Formal Value Planning Analysis**

- Conduct a technical Value Planning Workshop
- Include other system operators on Value Planning Team
- Focus on operations
- Rigorously address ridership components
- Validate Transit Oriented Development potential
- Phase construction to match ridership
- Identify and reduce risks



# More Information

Online:

[www.SWLRT.org](http://www.SWLRT.org)

Email:

[SWLRT@metrotransit.org](mailto:SWLRT@metrotransit.org)

Twitter:

[www.twitter.com/southwestlrt](http://www.twitter.com/southwestlrt)





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United States Government Accountability Office

Report to the Chairman, Subcommittee  
on Housing, Transportation, and  
Community Development, Committee  
on Banking, Housing, and Urban  
Affairs, U.S. Senate

November 2014

# **PUBLIC TRANSPORTATION**

## **Multiple Factors Influence Extent of Transit-Oriented Development**



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# Capturing the Value of Transit

November 2008

Prepared for:  
United States Department of Transportation  
Federal Transit Administration





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# Questions?