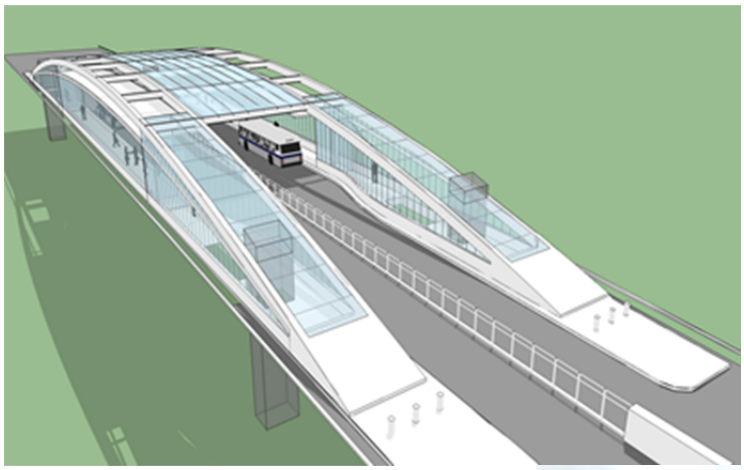
CRAVE™ Study Report



I-35W Transit/Access & Chapter 152 Bridges

Project ID 2782-278

April 15-19, 2013

Minnesota Department of Transportation
Office of Project Management and Technical Support
395 John Ireland Blvd. MS 696
St. Paul, MN 55155

Disclaimer:

The information contained in this report is the professional opinions of the team members during the CRAVE™ Study. These opinions were based on the information provided to the team at the time of the study. As the project continues to develop, new information will become available, and this information will need to be evaluated on how it may affect the recommendations and findings in this report. All costs displayed in the report are based on best available information at the time of the study and unless otherwise noted are in current year (CY) dollars.

This report was prepared by:

HDR Engineering, Inc.
701 Xenia Ave. S
Suite 600
Minneapolis, MN 55416

Table of Contents

Value Engineering Summary

- Introduction 1-1
- VE Recommendations 1-1

Introduction

- Project Background 2-1
- CRAVE™ Study Timing 2-2
- Scope of the CRAVE™ Study 2-2
- CRAVE™ Team Members 2-2

Project Description

- Introduction 3-1
- Constraints and Controlling Decisions 3-3
- Investigation Observations 3-4
- Project Schedule 3-4
- Project Cost Estimate 3-4
- Information Provided to the VE Team 3-4

Project Analysis

- Summary of Analysis 4-1
- Cost Model 4-1
- Performance Attributes 4-2
- Performance Attribute Matrix 4-3
- Functional Analysis 4-4
- Cost Risk Assessment 4-5

Speculation 5-1

Evaluation 6-1

Recommendations

- Design Considerations 7-2
- Performance Assessment 7-2
- Recommendation Summary Sheets 7-5
  - No. 1 – Active Traffic Management 7-7
  - No. 2 – Maintenance of Traffic 7-11
  - No. 3 – Retaining Walls 7-15
  - No. 4 – I-35W Braid 7-21
  - No. 5 – 26th and 28th Street Bridges 7-25
  - No. 6 – Staging I-35W at Lake Street 7-29
  - No. 7 – Selling Vendor Space 7-31

- No. 8 – Remove Glass Enclosure 7-35
- No. 9 – Remove Geothermal Wells 7-39
- No. 10 – Additional Main Stairway Handrails 7-43
- No. 11 – Shorten Lake Street Structures 7-47
- No. 12 – Design-Bid-Build 7-51

Analysis of the Results

- Risk Analysis on Response Strategies 8-1
- What-if Scenarios 8-10
- CRAVE™ Process Summary 8-11

Appendix

- CRAVE™ Process 9-1
- Value Engineering Process 9-1
- Pre-VE Study 9-2
- Value Engineering Job Plan 9-2
- Performance Based Results 9-3
- Reporting 9-6
- I-35W Transit/Access & Chapter 152 Bridges CRAVE™ One-Pager
- I-35W Transit/Access CRAVE™ One-Pager
- VE Recommendation Approval Form
- I-35W Transit/Access Only Base Cost Estimate
- Chapter 152 Bridges Base Cost Estimate
- Alternative 2 Base Cost Estimate
- I-35W Transit/Access Combined Risk Summary Sheets
- I-35W Transit/Access Only Risk Summary Sheets
- CRAVE™ Study Agenda
- CRAVE™ Workshop Attendees
- CRAVE™ Report Out

CRAVE™ Summary

Introduction

This cost risk assessment and value engineering (CRAVE™) report summarizes the events of the Study conducted for the Minnesota Department of Transportation and facilitated by HDR Engineering, Inc. The subject of the study was the I-35W Transit/Access Project, SP 2782-278, which included the I-35W Transit Center and the Chapter 152 bridges (I-35W Braid Bridge and the northbound I-35W to westbound I-94 flyover ramp) along with improvements to the adjacent roadways. The CRAVE™ study was conducted April 15-19, 2013 with the presentation of findings held April 19, 2013.

Value Summary

Original Cost:
$193.76 million

Number of Recommendations:
12

Recommended Cost Savings:
$35.44 million

Recommended Value Added:
$2.12 million

Total # of Team Members:
12

MnDOT Employees:
7

Others:
5

Facilitator:
Consultant

The primary objective of the team through application of the VE Job Plan (see Appendix) was to:

- Conduct a thorough review and analysis of the project
- Apply the principles and practices of the VE Job Plan
- Improve the value of the project through innovative measures aimed at improving the performance while reducing costs of the project
- Identify high risk areas in delivering this project
- Perform a cost risk assessment on both the baseline design and the VE-recommended design.

VE Recommendations

The recommendations are briefly described below and in detail in the Recommendations section of the report.

1. Active Traffic Management — Not Quantified

Implement innovative strategies for active traffic management and traveler information systems.

2. Maintenance of Traffic — $6.50 M in Risk Avoidance

Only maintain 3 – 11’ general purpose lanes in both directions and remove the Lake Street bus pullouts. Establish a construction zone with a posted speed limit of 45 mph.

3. Retaining Walls — $15.14 M Savings

Use mechanically stabilized earth (MSE) walls especially in fill situations. Incorporate temporary shoring into the final wall design in cut wall situations.

4. I-35W Braid — $2.12 M Added Cost

Construct Alternate 2 to replace the existing braid bridge on I-35W for the southbound traffic.

5. 26th and 28th Street Bridges **$1.22 M Savings (escalation)**

Replace the 26th and 28th Street bridges as a separate project prior to the I-35W Transit Access project.

6. Staging I-35W Traffic at Lake Street **Not Quantified**

Construct the I-35W bridges over Greenway and 31st Street with the same staging as the Lake Street bridges.

7. Selling Vendor Space **Not Quantified**

Allow portable sidewalk vendors in the plaza area.

8. Remove Glass Enclosure **$4.25 M Savings**

Eliminate glass walls that extend towards Lake Street plaza area or stage them as a future item. Eliminate inside glass wall and doors at platform level. Provide flexibility in the design to add glass walls in the future. Limit heating and cooling to elevator room and/or elevators. Remove geothermal system.

9. Remove Geothermal Wells **$0.36 M Savings**

Eliminate geothermal system and replace with a conventional system.

10. Additional Main Stairway Handrails **Minor Cost Added**

Remove existing middle handrail and add two handrails equidistant. Total number of handrails increases from 3 to 4.

11. Shorten Lake Street Structures **$0.90 M Savings**

Reduce I-35W northbound and southbound bridges by approximately 36 feet by shortening them by 18 feet at each abutment.

12. Design-Bid-Build **$7.07 M Savings**

Consider using Design-Bid-Build delivery method to allow the City, County and State to be more specific with design details such as the Transit Station.

In addition to the recommendations, the CRAVE™ Team generated several ideas that they felt were important enough to be documented as design considerations for further consideration by the project team. These design considerations are summarized in the Recommendations section of this report.

The CRAVE™ Team wishes to express its appreciation to the project design team and management for the excellent support they provided during the study. Hopefully, the recommendations and other ideas provided will assist in the management decisions necessary to move the project forward.

Ken Smith, PE, CVS
CRAVE™ Team Leader

Introduction

This report summarizes the events of the CRAVE™ Study conducted for the Minnesota Department of Transportation (MnDOT) and facilitated by HDR Engineering, Inc. The subject of the Study was the I-35W Transit/Access Project, SP 2782-278. The study was conducted April 15-19, 2013.

Project Background

The I-35W Transit/Access Project was initiated in late 2010 by Hennepin County, along with the City of Minneapolis, Metropolitan Council/Metro Transit, and MnDOT.

The I-35 Transit/Access Project involves transit- and transportation-related improvements in the vicinity of I-35W, Lake Street and the Midtown Greenway. The two primary elements include the I-35W Transit Center near Lake Street and the Chapter 152 bridges.

For the purposes of the CRAVE™ study the project was looked at as two projects.

- I-35W Transit/Access ***Only***
- I-35W Transit/Access ***Combined.***

The I-35W Transit/Access ***Only*** project includes the location and design of a transit station, quality connections for all transportation modes between Lake Street and the transit station, a high quality pedestrian/bicycle connection between Lake Street and the Midtown Greenway, and preliminary engineering for I-35W between approximately 31st Street and I-94, including a new interchange at Lake Street and reconstruction of several bridges between Lake Street and I-94.

Figure 2-1. I-35W Looking North towards Minneapolis

The I-35W Transit/Access ***Combined*** project includes all the items of work described in the previous paragraph along with the Chapter 152 bridges on I-35W. These bridges include the I-35W Braid Bridge and the northbound I-35W to westbound I-94 Flyover Ramp Bridge along with their connecting roadways.

CRAVE™ Study Timing

The CRAVE™ study is being conducted while the project is in the Environmental Assessment phase and is at less than 15% design.

Scope of the CRAVE™ Study

The scope of the study was to verify or improve concepts being proposed for the project. To accomplish this, the CRAVE™ Team:

- Conducted a thorough review and analysis of the project
- Applied the principles and practices of the VE Job Plan
- Identified alternatives to improve the value of the project through innovative measures aimed at improving the performance while reducing costs of the project
- Identified high risk areas in delivering this project
- Performed a cost risk assessment on both the baseline design and the VE-recommended design.

CRAVE™ Team Members

The CRAVE™ Team included:

- Michael Ameen — Risk Modeling
- Brad Anderson — Design
- Steve Barrett — Construction
- Scott Carlstorm — Water Resources
- Chad Casey — Design
- Gayle Gedstad — Traffic
- Carl Jensen — Planning/Transit
- Blane Long — Cost Lead/Documentation/Co-Team Leader
- Gayle Mack — Architecture
- Mark Maves — Bridge
- Jon Re — Materials
- Daniel Prather — Bridge
- Ken Smith — CRAVE™ Team Leader

Project Description

Introduction

The I-35W Transit/Access project is being led by Hennepin County in partnership with the City of Minneapolis, Metropolitan Council/Metro Transit, and MnDOT. The major items of work include a proposed transit station, a pedestrian/bicycle connection between Lake Street and the Midtown Greenway, a design concept for Lake Street, and two new ramps to/from I-35W.

The proposed two-level transit station at Lake Street will provide for transfers between north-south transit service on I-35W and east-west transit service on Lake Street (Midtown Corridor).

Figure 3-1. View of proposed Lake Street Transit Station looking east from Stevens Avenue

Other Individual project components included in this project are:

- Reconstruction of I-35W from approximately 33rd Street to I-35W/I-94 Commons to include four general purpose lanes, an auxiliary lane, and a managed lane in each direction
  - Reconstruction of the southbound entrance from 31st Street to align with the wider cross-section of I-35W (an auxiliary lane will be provided from the 31st Street entrance)
- Construction of an on-line transit station over Lake Street, with access on both sides of Lake Street, and extended north of Lake Street to provide a shorter connection to the Midtown Greenway
  - The two-level transit station will provide for transfers between north-south transit service on I- 35W and east-west transit service on Lake Street (Midtown Corridor)
- Construct off-street "green crescent" trail for pedestrians and bicyclists between the transit station and the Midtown Greenway

- Construct new exit from southbound I-35W to Lake Street with an auxiliary lane extension from southbound TH 65
  - The new ramp will exit from I-35W at approximately 28th Street, bridge over the Midtown Greenway, merge with Stevens Avenue, and intersect Lake Street. Currently, the system ramp connection from eastbound I-94 enters SB TH 65 into an auxiliary lane that terminates at about 25th Street prior to the TH 65/I-35W junction. It is proposed to eliminate the lane drop by extending the auxiliary lane to the new Lake Street exit.
    - Construct SB Exit Ramp over Midtown Greenway (Bridge No. 27W01)
  - Noise wall reconstruction north of 28th Street
    - Noise walls will be reconstructed in similar location (3rd Avenue will be impacted by wall construction but can be replaced in kind or slightly narrowed)
- Construct new exit from northbound I-35W to 28th Street
  - This component rebuilds the existing northbound 31st Street providing access to 31st Street and to Lake Street via 2nd Avenue. Direct access to 28th Street is provided via a separate exit ramp. This configuration minimizes physical impacts to the Historic Healy Block, traffic impacts to Lake Street and other local streets by allowing traffic destined for 28th Street exit directly from I-35W.
  - The 31st Street and Lake Street bridge decks will also carry the auxiliary/exit lane to the new 28th Street exit
- Replace I-35W Bridge over 31st Street (Bridge No. 9731) with:
  - 31st Street Bridge (SB I-35W) – Bridge No. 27777
  - 31st Street Bridge (NB I-35W) – Bridge No. 27822
- Replace I-35W Bridge over Lake Street (Bridge No. 9733) with:
  - Lake Street Bridge (SB I-35W) – Bridge No. 27841
  - Lake Street Bridge (Transit-way) – Bridge No. 27845
  - Lake Street Bridge (NB I-35W) – Bridge No. 27844
- Replace I-35W Bridge over Midtown Greenway (Bridge No. 27867) with:
  - Midtown Greenway Bridge (SB I-35W) – Bridge No. 27V47
  - Midtown Greenway Bridge (NB I-35W) – Bridge No. 27V48
- Replace 28th Street Bridge over I-35W (Bridge No. 27869) with Bridge No. 27W02
- Replace 26th Street Bridge over I-35W (Bridge No. 27870) with Bridge No. 27W03
- Replace Bridge No. 27871 (I-35W southbound over TH 65 northbound) with Bridge No. 27W05 "Braid Bridge" – *Must be replaced by 2018 under the Chapter 152 legislation*
  - Adjust horizontal and vertical alignment of I-35W southbound
    - Realign southbound I-35W to outside lanes
      - To reduce weaving to new Lake Street exit
      - To enable southbound buses from downtown to shift to inside lanes to center station at Lake Street
  - Adjust horizontal alignment of TH 65 southbound
    - Realignment of TH 65 southbound to left of I-35W southbound will reduce the weave for southbound I-35W traffic destined for the proposed Lake Street exit

        - Realignment is also needed to accommodate safe and efficient access to and from the transit station
- Replace Bridge No. 27842 (TH 65 northbound to I-94 westbound ramp) with Bridge No. 27W07 "Flyover Bridge" – *Must be replaced by 2018 under the Chapter 152 legislation*
    - The replacement of Bridge No. 27842 is programmed for 2018. This study will consider alternatives for replacing this structure including bridge type and alignment. An origin-destination study, traffic demand forecast, and freeway model will be used to help determine whether the bridge will remain on or near its current alignment landing on the outside of westbound I-94, or if it will be realigned to land on the inside lanes of westbound I-94. Design will be completed to a conceptual level only.
        - May require replacement of Bridge No. 27843 (TH 65 over I-94) to realign I-94 westbound travel lanes to accommodate new bridge
- Replace Bridge No. 27868 (24th Street Pedestrian over I-35W and TH 65) with Bridge No. 27W04
- Reconstruction of Lake Street from Blaisdell Avenue to 5th Avenue to include two traffic lanes and one left-turn lane in each direction on Lake Street along with bus pull-out bays under the bridge
    - Wider sidewalks and shorter crossings at the intersections
    - Curb extensions (bump-outs) are also recommended on Lake Street at the 2nd Avenue and Stevens Avenue intersections.
    - Large pedestrian plaza areas under the bridge with pedestrian-scale lighting, public art and other amenities
- Reconstruction of 2nd Avenue from south of 31st Street to 29th Street
- Reconstruction of 31st Street from Stevens Avenue to 2nd Avenue
- Reconstruction of 28th Street from Stevens Avenue to Clinton Avenue
- Reconstruction of 26th Street from Clinton Avenue to 5th Avenue
- Reconstruction of 24th Street (in the vicinity of the 24th Street Pedestrian Bridge)
- Reconstruction of Stevens Avenue from 32nd Street to north of 29th Street

Constraints and Controlling Decisions

As part of the project briefing, the CRAVE™ Team was given the following project constraints and controlling decisions that needed to be taken into account when considering possible alternatives:

- Stay within the right-of-way footprint defined in 2004
- Braid and flyover bridges require replacement by 2018
- Location of transit station
- Freeway level station side platform configuration
- Quality connection between the station and the Greenway

Additional Stakeholder issues include:

- Proposed improvements fit with surrounding neighborhoods

- Pedestrians and bicycles are well accommodated
- Ongoing operations and maintenance cost and responsibility considered
- Incorporation of public art

Investigation Observations

The first day of the workshop included a presentation from the project team. The following summarizes key project issues, project drivers, and observations identified during these sessions.

- How is the braid going to be constructed
- The frontage roads are in close proximity to I-35W
- Lots of vehicles on both the local streets and freeway
- Lots of weaving movements
- Standing water in alley ways
- Temporary drainage during construction
- A number of vehicles are using the cross streets under/over I-35W
- Is transit going to require a temporary stop during construction to replace the southbound and northbound I-35W bus pullouts adjacent to Lake Street?
- Are there places available for contractor staging and laydown?
- All the transit traffic coming from downtown is on the outside and the managed lanes are on the inside

Project Schedule

The project CRAVE™ Study is being conducted during the Environment Assessment process. The project is scheduled for a design-build project delivery with notice to proceed in July 2017. The duration of construction was assumed to be 36 months.

Project Cost Estimate

The CRAVE™ Team was provided a LWD cost estimate (opinion of cost) prior to the study for both the Transit/Access ($125.1 million) and the Chapter 152 bridge replacement ($74.8 million) projects.

Information Provided to the CRAVE™ Team

The following project documents were provided to the CRAVE™ Team for their use during the study:

Table 3-1. Information Provided to the Team

Document	Date
I-35W Transit Access - Traffic Forecast	January 2012
I-35W Transit Access - Draft Purpose and Need	February 2013
I-35W Lake Street bridges – Design Development background	April 2013
Summary for Transit Station Middle bridge	October 2012
I-35W Transit Access project – Transit Facility Design Report	January 2013
35W & Lake Street BRT Station – Pedestrian Wind Conditions and Snow Accumulation Consultation – Draft Report	November 2012
I-35W Transit Access - Transit Station Platform configuration	November 2011
Miscellaneous Cross Sections	April 2013
Miscellaneous Display boards	April 2013
Plan overlays – 24th Braid and 19th Braid	April 2013
Profiles sheets	April 2013
Cost Estimates	April 2013
I-35W/TH 62 Reconstruction (SP 2782-281) I-35W Tunnel Risk Assessment Documentation	January 2007
Construction Staging cross sections for Lake Street Bridge	April 2013

This page left intentionally blank

Project Analysis

Summary of Analysis

The following analysis tools were used to study the project:

- Cost Model
- Performance Attributes
- Performance Attribute Matrix
- Functional Analysis
- Cost Risk Assessment.

Cost Model

The Cost Lead prepared cost models from the cost estimates of the baseline which were provided by the project team. The models are organized to identify major construction elements or trade categories, the designer's estimated costs, and the percent of total project cost for the significant cost items. From the original base cost estimate the Figure 4-1 clearly demonstrates that the replacement of the bridges and reconstruction of the roadway is what is driving the cost of the project.

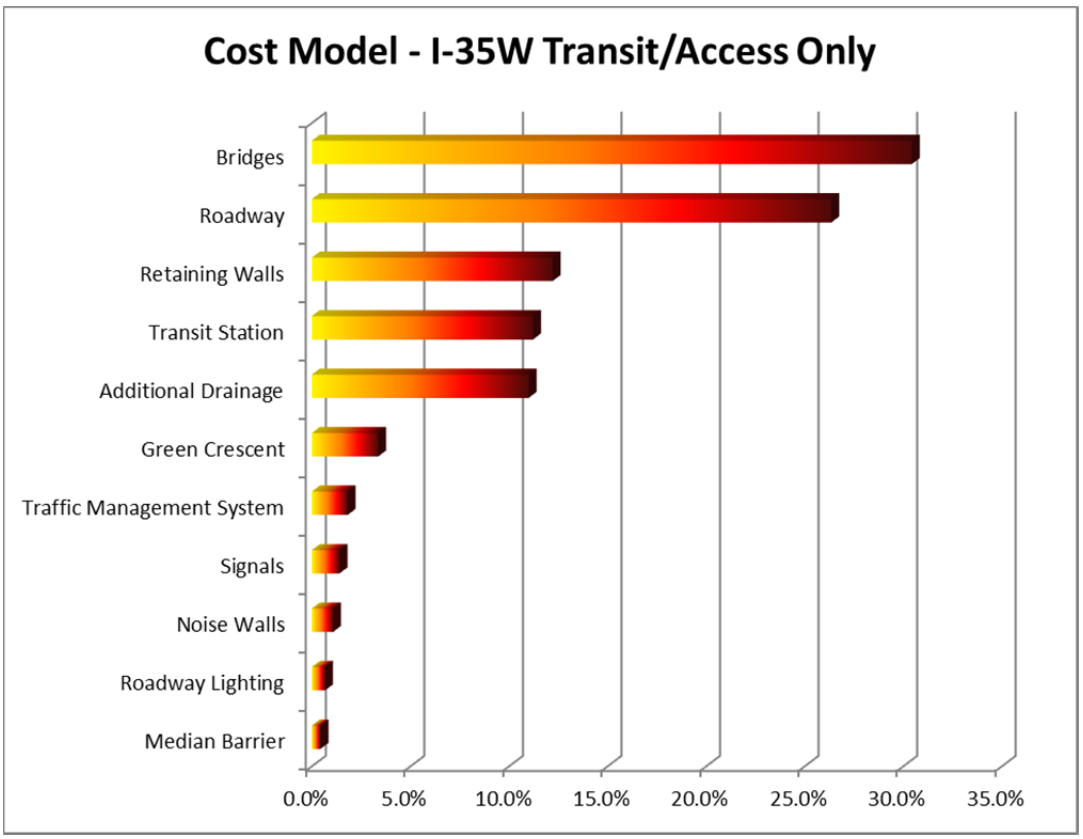


Figure 4-1. I-35W Transit/Access Only - Cost Model

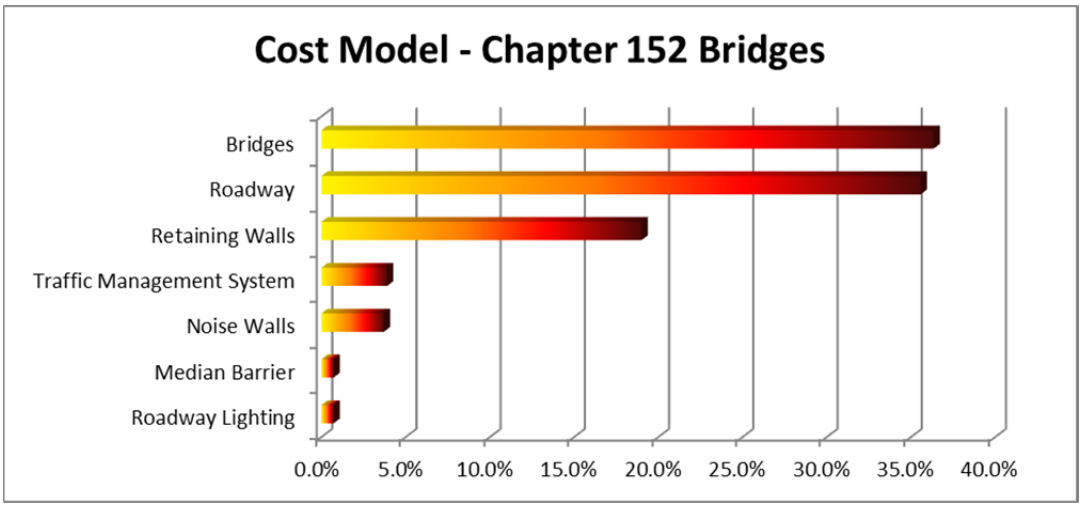


Figure 4-2. Chapter 152 Bridge Replacements - Cost Model

Performance Attributes

Performance attributes an integral part of the value engineering process. The performance of each project must be properly defined and agreed upon by the project team, CRAVE™ Team, and stakeholders at the beginning of the each workshop. These attributes represent those aspects of a project's scope and schedule that possess a range of potential values.

The CRAVE™ Team, along with the project team, identified and defined the performance attributes for this project and then defined the baseline concept as it pertains to these attributes. The following performance attributes were used throughout the workshop to identify, evaluate, and document ideas and recommendations.

Table 4-1. Performance Attributes

Performance Attribute	Definition	Baseline
Mainline Operations	An assessment of traffic operations and safety on the I-35W and TH-65 routes within the project limits including any on and off ramps. Operational considerations include level of service relative to the 20-year traffic projections, as well as geometric considerations such as design speed, sight distance, and lane and shoulder widths.	I-35W - 60 MPH Design Speed 4 – 12' General Purpose Lanes (both directions) 1 – 12' Managed Lane (both directions) 10' outside shoulders (both directions) Inside shoulders varies in widths TH-65 – 60 MPH Design Speed 2 – 12' General Purpose Lanes (both directions) 1 – 12' Auxiliary Lane (both directions) 10' outside shoulders (both directions) Inside shoulders varies in widths

Local Operations	An assessment of traffic operations and safety on the local roadway infrastructure. Operational considerations include level of service relative to the 20-year traffic projections; geometric considerations such as design speed, sight distance, lane and shoulder widths; bicycle and pedestrian operations and access.	Too many different streets to list all of them.
Maintainability	An assessment of the long-term maintainability of the transportation facility(s). Maintenance considerations include the overall durability, longevity and maintainability of pavements, structures and systems; ease of maintenance; accessibility and safety considerations for maintenance personnel.	Pre-cast concrete girder bridges Bituminous pavement Cast-in-place concrete retaining walls
Construction Impacts	An assessment of the temporary impacts to the public during construction related to traffic disruptions, detours and delays; impacts to businesses and residents relative to access, visual, noise, vibration, dust and construction traffic; environmental impacts.	Design-Build delivery method 4 lanes open to traffic in each direction
Environmental Impacts	An assessment of the permanent impacts to the environment including ecological (i.e., flora, fauna, air quality, water quality, visual, noise); socioeconomic impacts (i.e., environmental justice, business, residents); impacts to cultural, recreational and historic resources.	Construction to stay within the right-of-way limits established in 2004
Project Schedule	An assessment of the total project delivery from the time as measured from the time of the CRAVE™ Study to completion of construction.	Begin construction in July 2017 with a 36-month construction duration

Performance Attribute Matrix

A matrix was used to determine the relative importance of the individual performance attributes for the project. The Project and CRAVE™ teams evaluated the relative importance of the performance attributes that would be used to evaluate the creative ideas.

These attributes were compared in pairs, asking the question: "Which one is more important to the purpose and need of the project?" The letter code (e.g., "A") was entered into the matrix for each pair. After all pairs were discussed they were tallied (after normalizing the scores by adding a point to each attribute) and the percentages calculated.

Table 4-2. Performance Attribute Matrix

Which attribute is more important to the outcome of the project?						TOTAL	%
Mainline Operations	**A**	A/B	A	A	A	5.5	26.2%
Local Operations		**B**	B	B	B	5.5	26.2%
Maintainability			**C**	C	E	3.0	14.3%
Construction Impacts				**D**	D/F	1.5	7.1%
Environmental Impacts					**E**	4.0	19.0%
Project Schedule					**F**	1.5	7.1%
						21.0	100%

Functional Analysis

Functional analysis results in a unique view of the project. It transforms project elements into functions, which moves the CRAVE™ Team mentally away from the original design and takes it toward a functional concept of the project. Functions are defined in verb-noun statements to reduce the needs of the project to their most elemental level. Identifying the functions of the major design elements of the project allows a broader consideration of alternative ways to accomplish the functions. The costs shown are the original cost from the estimate provided to the team for comparison purposes only.

Table 4-3. Functional Analysis

Major Items	Verb	Noun	Transit/Access Only Cost	Chapter 152 Bridges Cost	Percentage of Project
Bridges	Span Replace	Roadway Bridge	$27,127,135	$20,153,232	32.7%
Roadway	Support	Load	$23,481,150	$19,726,560	29.9%
Retaining Walls	Retain	Earth	$10,890,795	$10,538,980	14.8%
Transit Station	Access	Bus	$10,000,000		6.9%
Additional Drainage	Convey	Water	$9,800,000		6.8%
Traffic Management System	Convey	Message	$1,620,000	$2,160,000	2.6%
Noise Walls	Redirect	Sounds	$962,000	$2,058,400	2.1%

Additional functions of Reduce Risk, Maintain Traffic and Separate Traffic were also considered to be important functions of the project.

Cost Risk Assessment

Introduction

In evaluating the risk for the project, a cost risk assessment/value engineering or CRAVE™ process was utilized. The cost risk assessment portion of the evaluation was used to identify the range of unexpected project costs as it relates to total project cost, as well as potential delays in schedule that might arise.

The risk assessment process includes identifying high risk areas and risk elements as threats (or opportunities where appropriate) to a project, quantifying the identified risk elements, developing appropriate risk response strategies, and quantifying the effects of the risk response strategies to be employed.

The risk assessment process quantified risk events by establishing the expected probability of occurrence and range of impacts through elicitation of information from the CRAVE™ Team. The range of impacts defines the representative distribution to be used when modeling the risk. The probability determines the relative frequency (or likelihood) of an event transpiring.

The following project assumptions were made for the various analyses:

- ***I-35W Transit/Access Only*** includes everything south of 26th Street
- ***I-35W Transit/Access Combined*** includes the I-35W Transit/Access Only project and the Chapter 152 bridges and connecting infrastructure.

Base Cost Review

One of the objectives of a cost risk assessment is to review the base cost estimate in a collaborative setting with independent expert opinion and project team members. The base cost estimate represents the project cost that can reasonably be expected if the project materializes as planned, and there is no occurrence of significant risk.

The base cost estimate is unbiased and neutral - it is neither optimistic nor conservative. The base cost includes the known and quantified items and the known but not yet quantified items or miscellaneous item allowances. The base cost estimate does not include any risks (either threats or opportunities), unknown/unknowns, or contingencies.

The project team provided a LWD estimate dated April 2013. A contingency of 10-20 percent had been established the various items within the estimate.

The estimate for this project was reviewed independently prior to the workshop. The adjusted base cost estimate was prepared in current year dollars and excluded any future cost escalation, contingency or risk. The adjusted base cost estimates reflect MnDOT historical unit prices, consideration of project location, and expert judgment.

After removal of any risk and contingencies the base cost estimates used during the cost risk assessment modeling were:

- I-35W Transit/Access ***Only*** = $122.8 million
- I-35W Transit/Access ***Combined*** = $193.8 million.

The base cost estimates are shown in the Appendix.

Uncertainty

Estimating is not an exact science; a cost estimate is an approximation of the costs comprised many elements that may not be completely or equally defined at the time the estimate is prepared. As a result, there is variability or uncertainty associated with any estimate. When applied to the project estimate, this uncertainty establishes the range that the base cost could fall within. A numerical value of uncertainty is, in essence, an estimate of the error or tolerance within the quantity or unit price of each item within the estimate.

For any given project, the level of uncertainty is directly related to its position in the project life cycle (i.e., the earlier in the project development process, the greater the uncertainty; conversely, the closer to completion, the less uncertainty).

In establishing the uncertainty ranges for each item, consideration was given to factors that might affect quantities or bid prices, such as project location (rural vs. urban), quantities (large or small), items that are difficult to construct or site constraints, methods of payments, timing of advertisement, specialty work, geotechnical and project delivery methods.

Uncertainty was established for the base cost estimate based upon the all the available information. Doing this established an uncertainty or variability in the overall base cost estimate of -11.6% and +14.3% for the I-35W Transit/Access Combined project and -11.6% and +13.7% for the I-35W Transit/Access Only project.

Project Escalation Assumptions

To account for increases in prices between the date the base cost estimate was created and when the actual work will be performed, the model for this project includes escalation rates forecast for construction, preliminary engineering and right-of-way costs.

Table 4-4. Escalation Rates

Year	Construction	Preliminary Engineering	Right-of-Way
2013	4%	4%	4%
2014	4%	4%	4%
2015	4%	4%	4%
2016	5%	5%	5%
2017	5%	5%	5%
2018 and beyond	4%	4%	4%

Baseline Risk Assessment

Next the CRAVE™ Team, along with the project team, performed a baseline risk assessment of the project. They discussed the potential risk events and elements facing the project. During the discussion of the project, the Team identified high risk elements or potential events which may occur that would impact the project. For each significant risk event that was identified, the probability of the risk and its impact to cost, schedule, or both was estimated.

For these two projects the CRAVE™ Team identified 17 active risks that pose potential schedule and/or cost threats and opportunities:

- Maintenance of traffic
- Hydraulics and drainage
- Freeway operations
- Noise walls
- 19th Braid alternative
- Differing conditions
- Wall type
- SHPO
- Construction impacts to business and residents
- I-35W Storm Tunnel rehabilitation
- ROW impacts concern
- ROW portion of 19th Braid alternative
- Municipal consent
- Maintenance issues
- Utility relocation
- Convert to Design-Bid-Build
- Value Engineering.

The Risk Analysis Sheets in the Appendix of this report have additional information on each risk.

Interpreting the Graphs

The risk analysis results are given in the form of graphs showing the relationship between cost and the probability of not exceeding that cost. Risk-based analysis provides a distribution of probabilities that a project will not exceed an estimated dollar figure. Typically, agencies report the project risk-based estimation using the 80 percent confidence interval.

The extreme values, represented by the minimum and maximum on the graph, realistically have little chance to materialize. It is common, and more realistic, to evaluate the 80 percent confidence interval (the range from the 10 percentile to the 90 percentile). See the example on the following page.

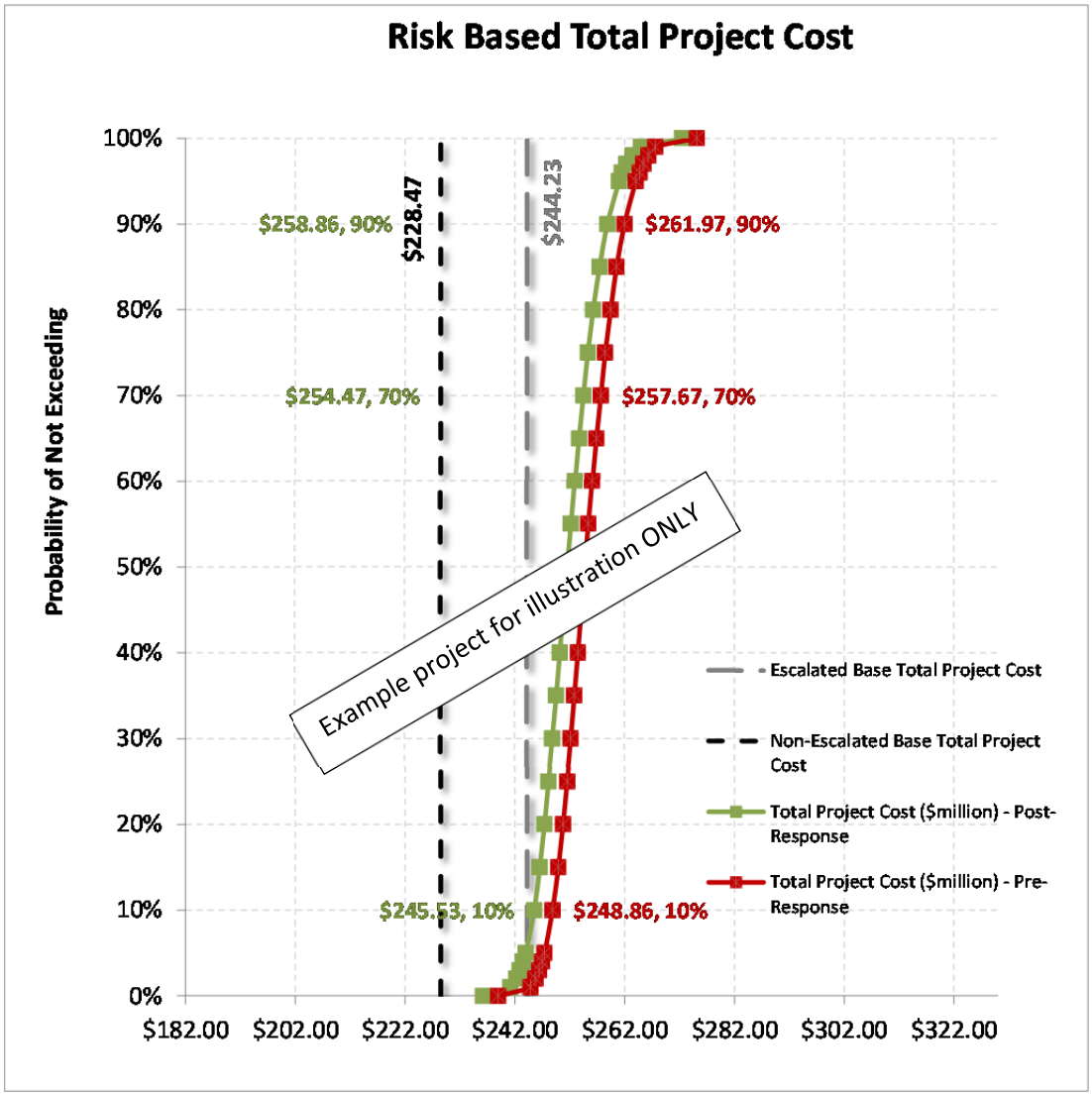


Figure 4-3. Example Risk Analysis Results

The **black** vertical dashed line (short dashes) represents the base cost in current year (CY) dollars. The base cost is the cost with out any contingencies.

The gray vertical dashed line (long dashes) represents the base cost escalated to year of expenditure (YOE) dollars.

The **red** S-curve represents the cumulative probability distribution after adding in the risks (threats and opportunities) to the base costs and their uncertainties. This S-curve represents all possible values the costs could take, expressed in YOE dollars.

The **green** S-curve represents the cumulative probability distribution after adding in the value engineering opportunities and responding to the identified risk. This "S-curve" represents all possible values the costs could take, expressed in YOE dollars.

Each graph indicates the best opinion of the cost ranges by the workshop participants at the time of the analysis.

Risk Analysis Results - Pre-Response

I-35W Transit/Access Combined

By establishing the probability of an event's occurrence and the range of impact, the expected impact to the project cost and schedule for I-35W Transit/Access Combined project was assessed. The baseline construction cost estimate was $205.00 million in CY dollars and $260.97 million in YOE dollars.

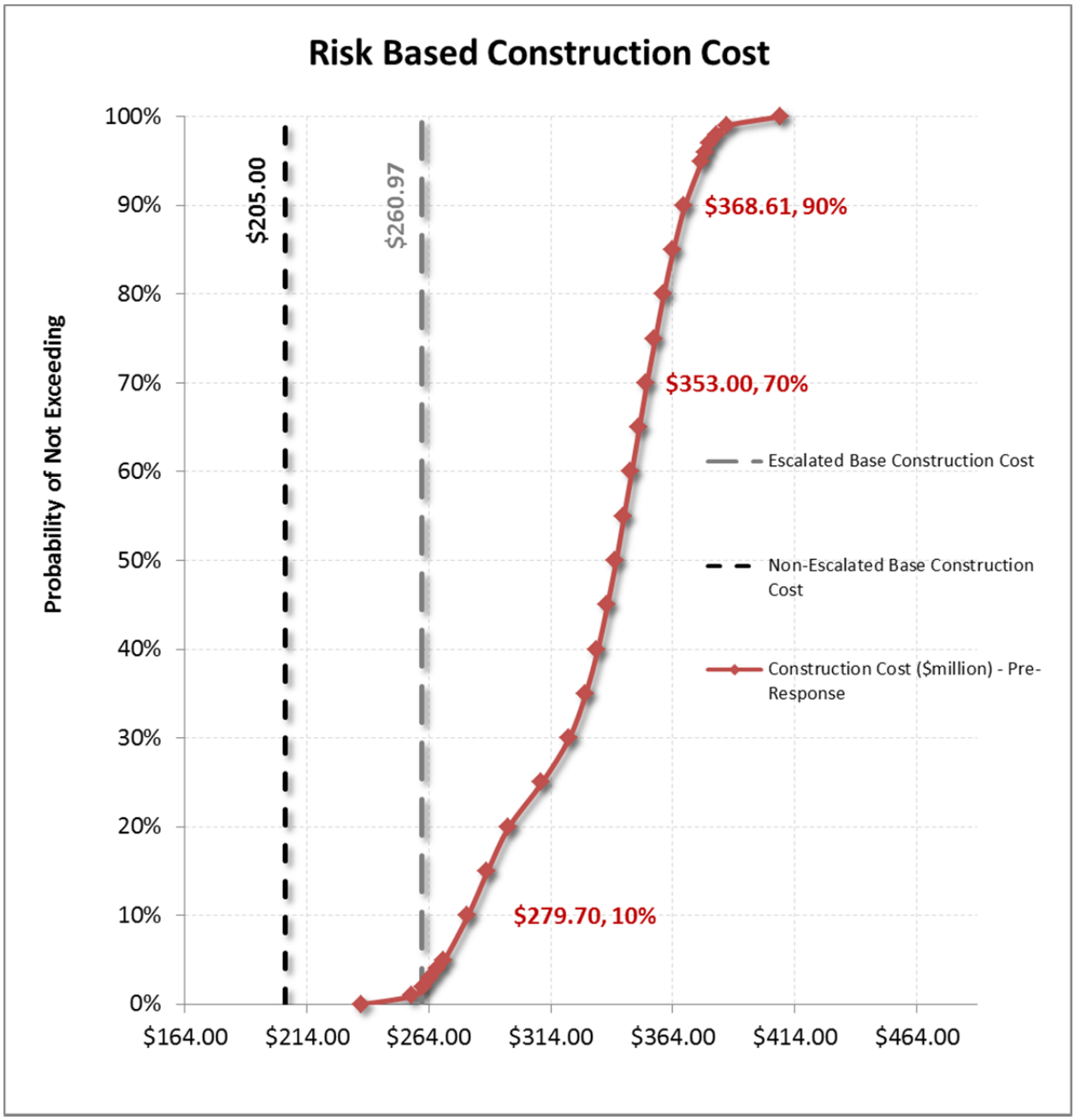


Figure 4-4. I-35W Transit/Access Combined – Construction Cost Results

The 80 percent confidence interval, described by the cost range between the 10th percentile and 90th percentile figures, reveals that the construction project cost will fall between $279.70 million and $368.61 million. There is 70 percent chance that the total project cost for this project will be less than $353.00 million in the YOE.

The baseline total cost estimate was $218.71 million in CY dollars and $277.53 million in YOE dollars.

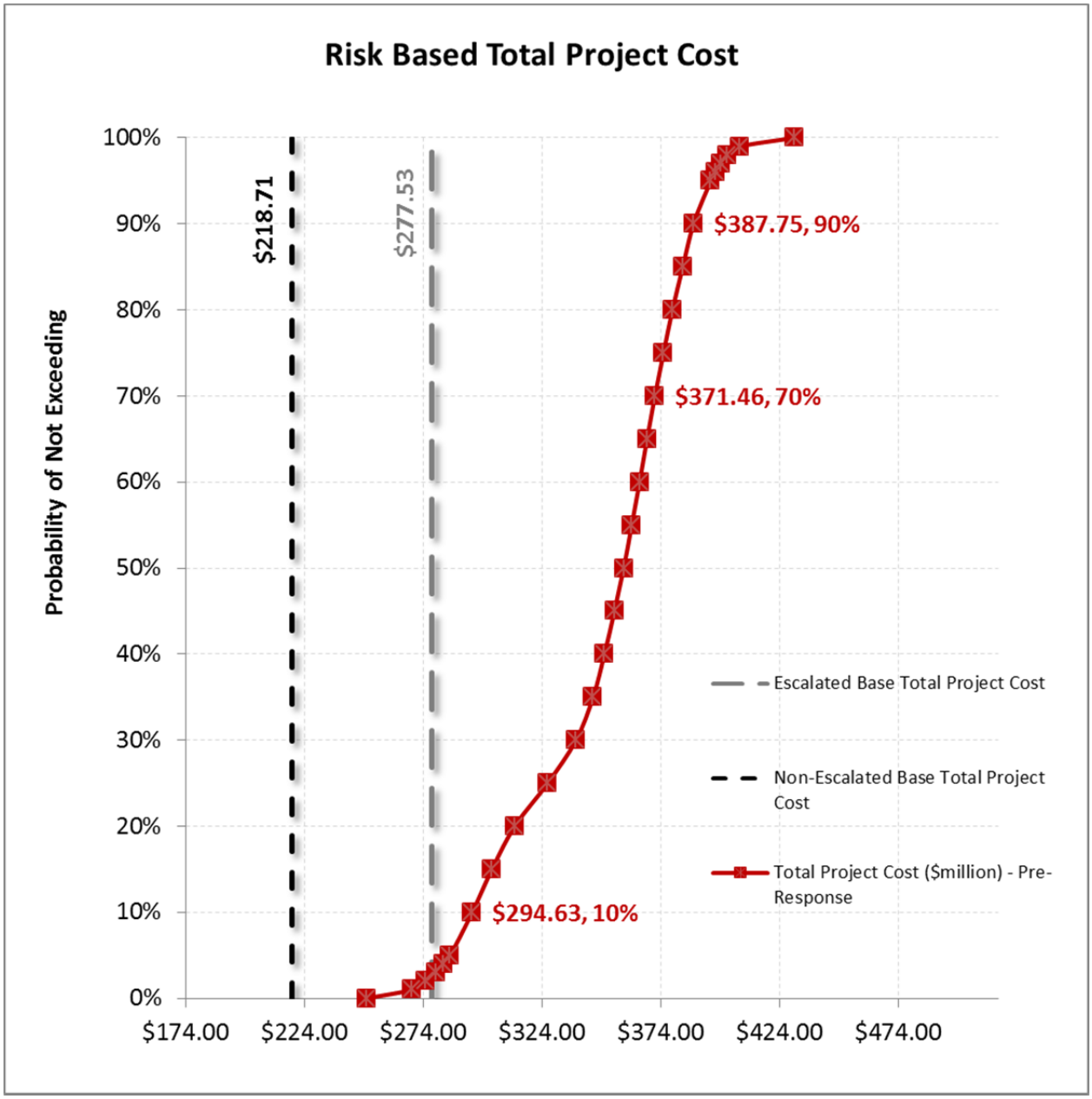


Figure 4-5. I-35W Transit/Access Combined – Total Cost Results

The 80 percent confidence interval, described by the cost range between the 10th percentile and 90th percentile figures, reveals that the total project cost will fall between $294.63 million and $387.75

million. There is 70 percent chance that the total project cost for this project will be less than $371.46 million in the YOE.

Beside construction and total cost, the construction schedule of I-35W Transit/Access Combined project was also modeled.

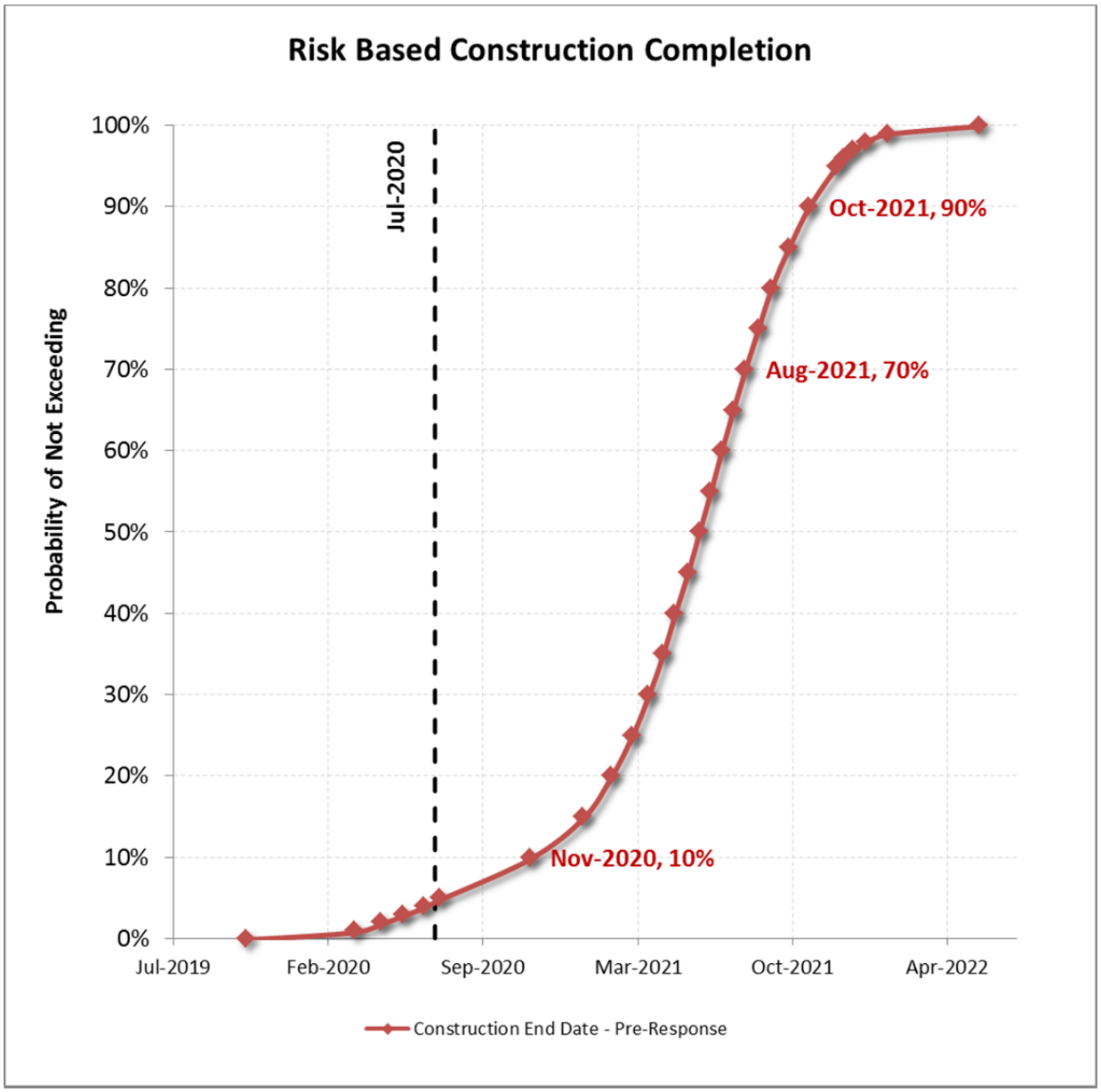


Figure 4-6. I-35W Transit/Access Combined - Construction Completion Results

The baseline schedule had I-35W Transit/Access Combined project completed on July 2020 after 36 months of construction. The 80 percent confidence interval, described by the cost range between the 10th percentile and 90th percentile figures, reveals that the completion of construction will fall between November 2020 and October 2021. There is 70 percent chance that this project will be completed before August 2021.

I-35W Transit/Access Only

By establishing the probability of an event's occurrence and the range of impact, the expected impact to the project cost and schedule for I-35W Transit/Access Only project was assessed. The baseline construction cost estimate was $137.48 million in CY dollars and $175.01 million in YOE dollars.

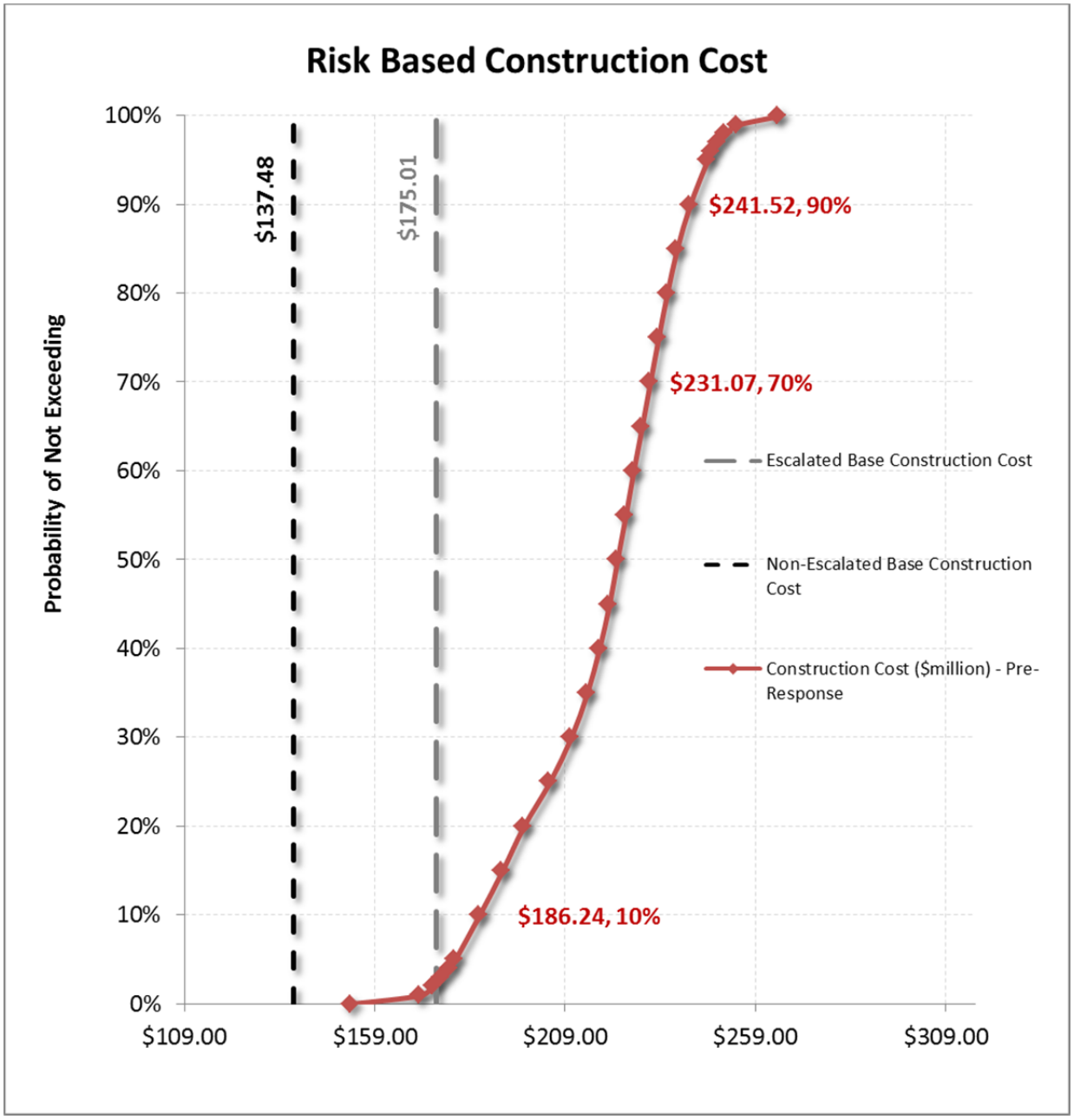


Figure 4-7. I-35W Transit/Access Only - Construction Costs Results

The 80 percent confidence interval, described by the cost range between the 10th percentile and 90th percentile figures, reveals that the project construction cost will fall between $186.24 million and $241.52 million. There is 70 percent chance that this project cost will be less than $231.07 million in the year of expenditure.

The baseline total cost estimate was $147.76 million in CY dollars and $187.21 million in YOE dollars.

Figure 4-8. I-35W Transit/Access Only - Total Costs Results

The 80 percent confidence interval, described by the cost range between the 10th percentile and 90th percentile figures, reveals that the total project cost will fall between $198.43 million and $255.97 million. There is 70 percent chance that this project cost will be less than $244.92 million in the year of expenditure.

Beside construction and total cost, the construction schedule of I-35W Transit/Access Only project was also modeled.

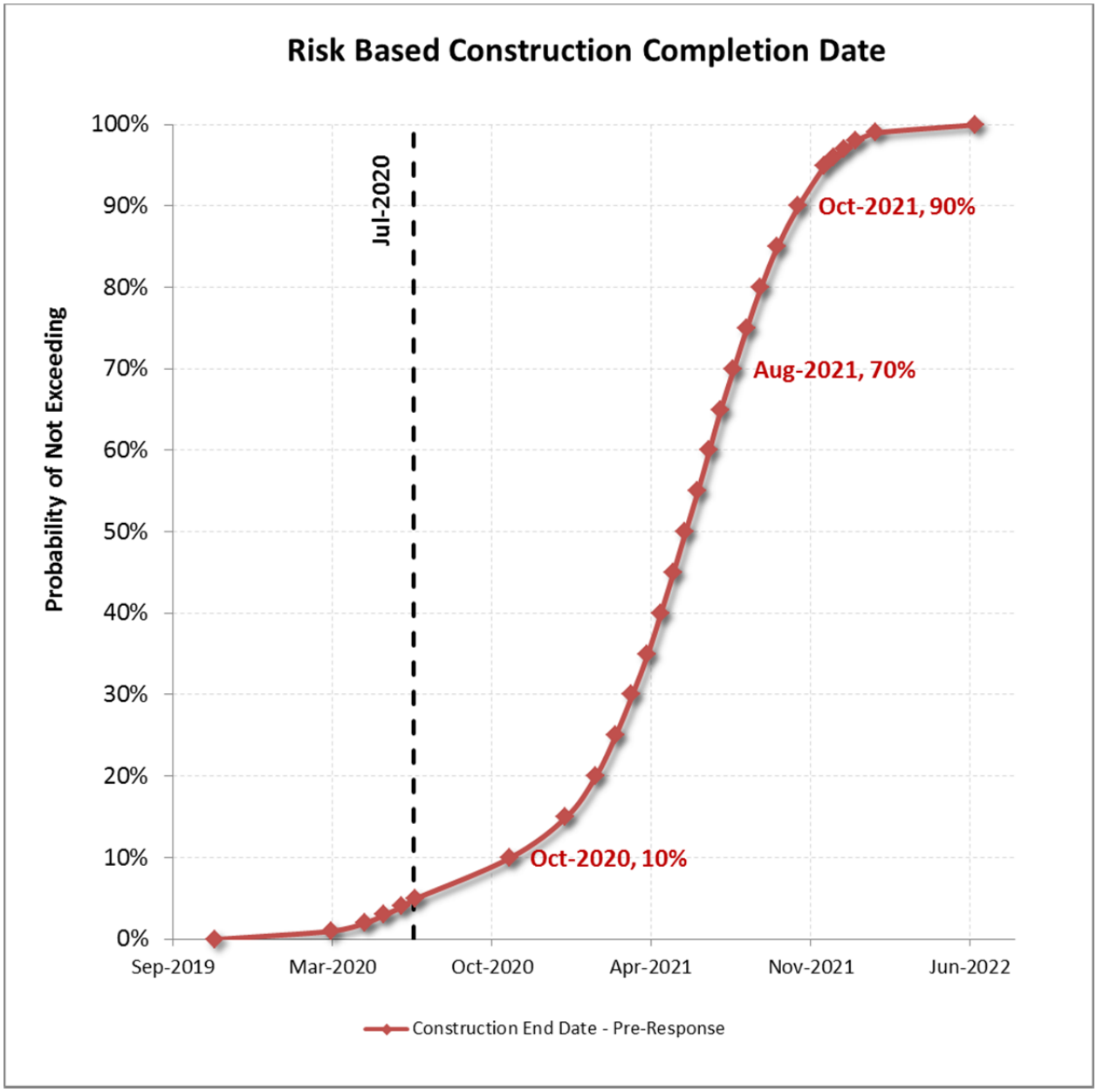


Figure 4-9. I-35W Transit/Access - Construction Completion Results

The baseline schedule had the I-35W Transit/Access Only project completed in July 2020 after 36 months of construction. The 80 percent confidence interval, described by the cost range between the 10th percentile and 90th percentile figures, reveals that the completion of construction will fall between October 2020 and October 2021. There is 70 percent chance that this project will be completed before August 2021.

Top Risk Factors

After the risks were identified, the CRAVE™ Team focused on responding to those risks that were the most likely to happen or which held a significant impact if the risk event occurs. Using the information portrayed in the tornado diagrams, the highest risk elements received the most focus.

The tornado diagrams for the top risks impacting cost and schedule for each project are shown in the following figures.

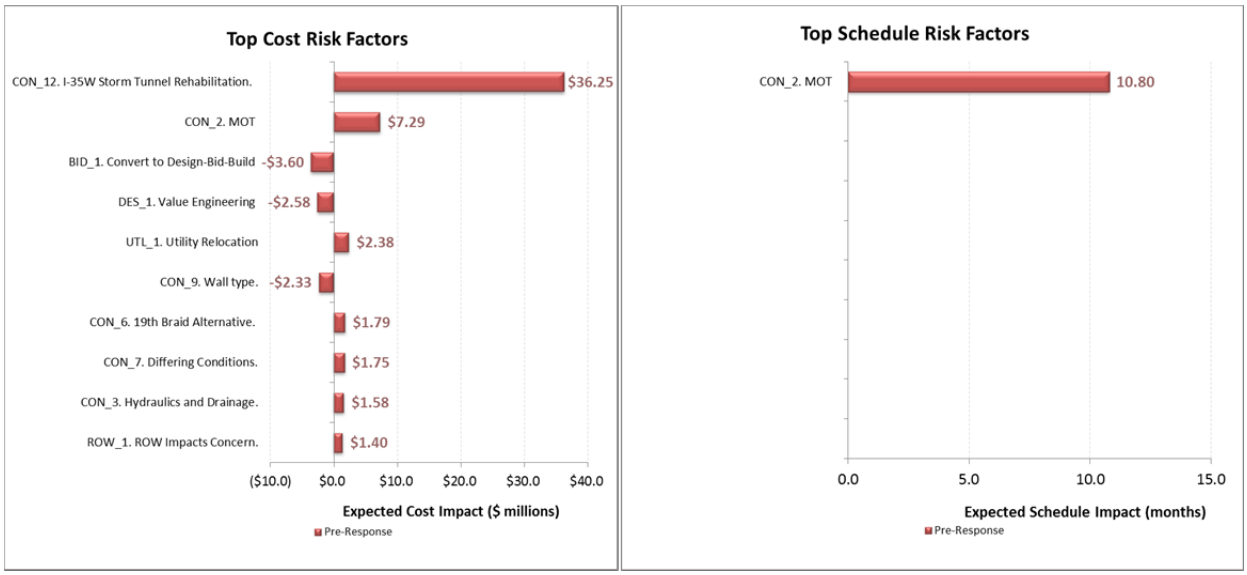


Figure 4-10a. I-35W Transit/Access Combined – Pre-Response Tornado Diagrams

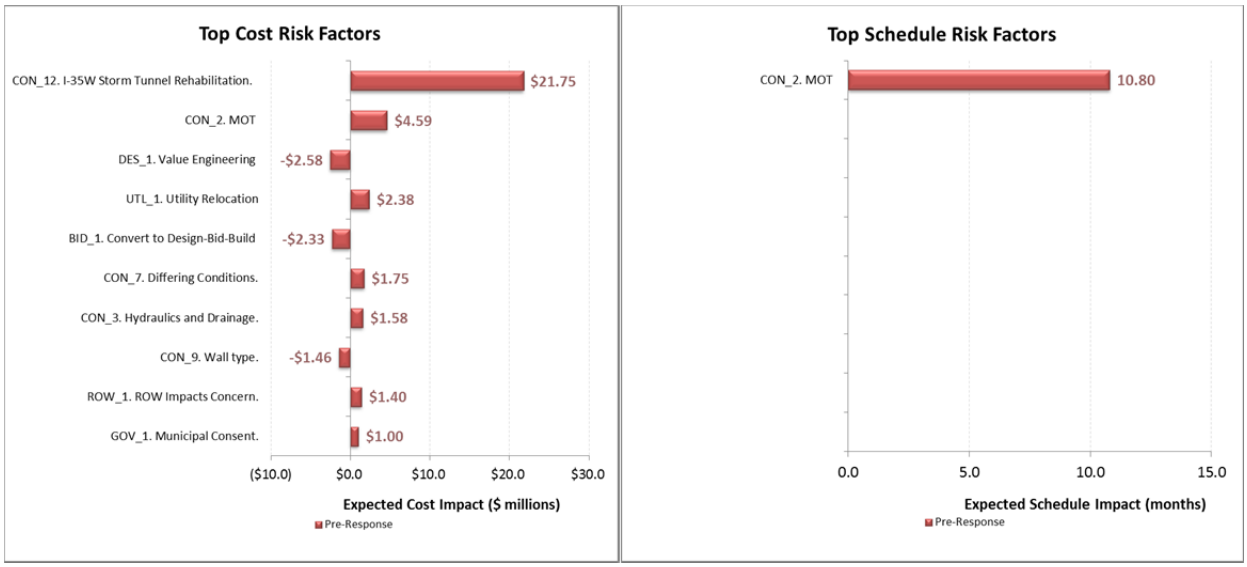


Figure 4-10b. I-35W Transit/Access Only – Pre-Response Tornado Diagrams

For risks that did not have a VE recommendation, the CRAVE™ Team Leader, Risk Lead and the Project Manager determined the appropriate risk response strategies for the remaining high risk areas.

The next step was to determine the appropriate risk response strategies for the identified high risk areas. Four risk response strategies, are considered when addressing threat risks. Those strategies are to avoid, accept, transfer, or mitigate the risk.

Avoiding a risk may cost more money up front, but may prevent or reduce a more significant impact.

Accepting a risk means that there is not much that can be done or relatively little benefit in addressing the risk.

Transferring a risk allows for the risk owner to move the liability of the risk to another party that is better able to respond to the risk.

Mitigation of a risk addresses risk by reducing the likelihood of the risk occurring or lessen the impact through proactive efforts.

Each of the risks that were identified had a unique response strategy developed to address it, as well as the identification of the risk owner. Identifying a risk response and risk owner, along with review intervals for the risk, a framework for a risk management plan is established. This allows proactive management of risk throughout the life of the project.

Speculation

During the speculation or creative phase of the VE Job Plan, the CRAVE™ Team brainstormed ideas on how to perform the various functions. These ideas were based on the available information given to them at the time of the study, taking into consideration the constraints and controlling decisions that were also given to them. The ideas listed below coincide with each function being considered.

Function: Maintain/Separate Traffic (I-35W and Lake Street)

- Close bus stops on I-35W at Lake Street during construction
- Keep all three bridges (Lake Street) at the same profile elevation
- Use one big bridge at Lake Street
- Use cast-in-place box for all three bridges
- Temporary widen NB or SB bridges to accommodate MOT
- Reduce GP, AUX and Managed lanes from 12' to 11' wide through transit center
- Reduce number of open lanes during construction to 3 in each direction
- Do not use the managed shoulder during construction
- Lower speed limit during construction to 45 MPH
- Construct Greenway and 31st bridges at the same time
- Use tub girders for all three bridges at Lake Street
- Maintain the existing I-35W profile through Lake Street
- Allow the Design-Builder the flexibility to select any bridge/any profile (performance spec)
- Allow the vertical clearance within the transit portion of the Lake Street bridge to accommodate buses (less than 16.5')
- Use reversible lanes on I-35W for MOT
- Use active traffic management techniques during construction to reduce the number of vehicles on the roadways
- Replace 1 GP lane with a HOV lane during construction
- Reduce all lanes to 11' during construction
- Use MSE walls when ever possible
- Use temporary shoring with permanent facing (soldier piles) (cut walls)
- Use Design-Bid-Build delivery method.

Function: Access Buses

- Add switchback to stairways (add a landing)
- Reduce the number of elevators
- Lock the bathrooms outside of normal transit hours (safety consideration)
- Eliminate the bathrooms
- No public restrooms

- Use entryways to bathrooms that don't have doors
- Eliminate the glass on lower section
- Sell vendor space
- Undulate the ceiling to soften feel
- Move doors closer to Lake Street
- Eliminate stairs and elevators and use ramps
- Design lower level to develop into an interior building in the future (phased approach)
- Use concrete barrier to separate buses within station.

Function: Maintain/Separate Traffic (Local Traffic 26th & 28th)

- During construction make 26th and 28th streets two-way traffic
- Allow Design-Builder to use accelerated bridge construction techniques on 26th and 28th
- Use Franklin and Lake as detours, then close 26th and 28th bridges at the same time
- Use reversible lanes on 26th and 28th
- Construct 26th and 28th first and at the same time (pedestrian bridge too)
- Construct 26th and 28th as a separate contract before the rest.

Function: Replace Bridge (Braid and Flyover area)

- Construct the new braid bridge on the same alignment (temporary widen existing as needed for MOT)
- Construct Alternative 2
- Construct Alternative 2 but bring I-35W southbound traffic in the middle not outside
- Construct flyover alternative
- Utilize the space of frontage road for MOT for reconstruction of I-35W
- Braid bridge only spans northbound I-35W and keep downtown traffic on the outside
- Construct Alternative 2 but bring I-35W southbound traffic in the middle not outside. Have the flyover to northbound I-94 be a left exit
- Construct a truss
- Construct the braid bridge to the south of existing
- Close TH-65 during the reconstruction of the braid bridge (flyover too)
- Repair the flyover bridge in the same location as existing
- Don't replace the TH-65 bridge
- Construct an loop ramp to replace braid
- Construct TH-65 over the NB-WB I-94 ramp
- Construct TH-65 over the NB-WB I-94 ramp and pull braid back to north of Franklin under TH-65
- Widen the frontage roads into TH 65 and keep I-35W in the middle.

Function: Reduce Risk

- Managed Lanes – Avoid, do not construct them
- Managed Lanes – Accept, add them into the project
- Utility Relocations – Mitigate, subsurface utility locate and update the base costs
- Additional Drainage – Avoid, do not construct anything additional
- Additional Drainage – Mitigate, construct an off-site pond
- Additional Drainage – Mitigate, construct a number of stormwater vaults
- Additional Drainage – Mitigate, pipe the water down the Greenway
- Right-of-Way Impacts – Avoid, stay within the established footprint
- Right-of-Way Impacts – Mitigate, narrow the lanes across the frontage roads and I-35W
- Right-of-Way Impacts – Avoid, don't construct the ramps
- Right-of-Way Impacts – Mitigate, narrow the shoulders on the ramps
- Right-of-Way Impacts – Mitigate, move the billboard
- Differing Site Conditions – Transfer, the risk to the Design-Builder
- Differing Site Conditions – Share, cap the amount at $1 million
- Wall Types – Mitigate, use MSE in fill sections
- Wall Types – Mitigate, combine noise walls with retaining walls
- SHPO – Mitigation, preconstruction survey of historic properties and then monitor during construction
- SHPO – Mitigation, meet with SHPO with the current design and get their concurrence.

This page is left intentionally blank

Evaluation

Although each project is different, the evaluation process can be thought of in its simplest form as a way of combining, evaluating, and narrowing ideas until the CRAVE™ Team agrees on the proposals to be forwarded.

Taking into consideration the constraints and controlling decisions, the Team discussed each idea and documented the advantages and disadvantages. Each idea was then carefully evaluated with the CRAVE™ Team reaching consensus on the overall rating of the idea (zero through five).

High-rated ideas (four or higher) were developed further; those that were considered to be equivalent to the baseline (rated three) were documented as design considerations. Low-rated ones (two or lower) were dropped from further consideration. However, the team provided a short description and justification to support a low rating. The rating values are shown below:

5 = Great Opportunity
4 = Good Opportunity
3 = Design Consideration (comparable to project team's approach)
2 = Minor Value Degradation
1 = Major Value Degradation
0 = Fatal Flaw (unacceptable impact or doesn't meet the project purpose and need)

= Advanced as recommendation

= Forwarded as design consideration

= Dropped from future consideration

Function: Maintain/Separate Traffic (I-35W and Lake Street)

#	Description	Advantages	Disadvantages
MT-1	Close bus stops on I-35W at Lake Street during construction	▪ The current flyer stop space can be used for MOT ▪ May reduce construction duration	▪ The surrounding communities may not have another option ▪ May require a circuitous route by transit to get on/off I-35W

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
	👎		👍	👎	👍

Rating:	Justification/Comments/Disposition:
4	*Moved to further development*

#	Description	Advantages	Disadvantages
MT-2	Keep all three bridges at Lake Street at the same profile elevation	▪ Flexibility of MOT staging ▪ May reduce construction duration	▪ Passengers and traffic at same level (limits visibility) ▪ Aesthetics are degraded ▪ May have impacts to falsework/embankment ▪ Impacts with raising I-35W profile ▪ Municipal consent

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
			👍 👎	👎	👍

Rating: 3	Justification/Comments/Disposition:
	Design Consideration - May reduce flexibility in bridge design (temporary closures between bridge types).

#	Description	Advantages	Disadvantages
MT-3	Use one big bridge at Lake Street	▪ More flexibility for MOT ▪ Larger bridge would be more stable for canopy and transit station ▪ Aesthetics ▪ May shorten construction duration	▪ Eliminate natural light under bridge (2’ 3” gaps) ▪ Over design outside bridges ▪ Increased cost? ▪ Natural ventilation ▪ Reduces acoustics

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
		👍	👍	👎	👍

Rating: 2	Justification/Comments/Disposition:
	Dropped from further consideration

#	Description	Advantages	Disadvantages
MT-4	Use cast-in-place box for all three bridges	▪ Aesthetics	▪ Over design outside bridges ▪ Increased cost/duration ▪ May not be able depending on MOT staging

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
		👎	👎	👍	👎

Rating: 2	Justification/Comments/Disposition:
	Dropped from further consideration

#	Description	Advantages	Disadvantages
MT-5	Temporary widen NB or SB bridges to accommodate MOT	▪ Allows each new bridge to be constructed whole (no joints in deck) ▪ May be able to get 4 lanes of traffic each way during construction ▪ Could reduce schedule ▪ Reduces MOT cost risk	▪ May not be able to get 4 lanes each way during construction ▪ Increased cost?

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
		👍	👍		👍

Rating: 4	Justification/Comments/Disposition:
	Moved to further development - This will work on all three overcrossings (31st, Lake & Greenway)

#	Description	Advantages	Disadvantages
MT-6	Reduce GP, AUX and Managed lanes from 12' to 11' wide through transit center (permanent configuration)	▪ Reduces width of mainline bridges ▪ Could reduce right-of-way impacts ▪ Reduces cost	▪ FHWA approval ▪ Route continuity ▪ Horizontal geometry

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
👎			👍	👍	

Rating: 3	Justification/Comments/Disposition:
	Design Consideration - There are currently 11' managed lanes on I-35W and should be considered to minimize impacts if needed.

#	Description	Advantages	Disadvantages
MT-7	Reduce number of open lanes during construction to 3 each direction	▪ More flexibility with MOT ▪ More space for contractor operations ▪ Reduces cost ▪ Reduces construction duration	▪ Increased congestion during construction

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
			👍		👍

Rating: 5	Justification/Comments/Disposition:
	Moved to further development - May be the only way to construct braid bridge

#	Description	Advantages	Disadvantages
MT-8	Do not use the managed shoulder during construction	▪ Additional space for MOT ▪ May reduce construction duration	▪ Shortens the managed lane during construction ▪ Lost revenue

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
			👍		👍

Rating: 4	Justification/Comments/Disposition:
	Moved to further development

#	Description	Advantages	Disadvantages
MT-9	Lower speed limit during construction to 45 MPH (Design MOT for 45 MPH)	▪ Could reduce length of crossovers and transitions ▪ Lowers speeds adjacent to work zones	▪ May requires a speed study ▪ May effect traffic operations during construction

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
			👍		

Rating: 4	Justification/Comments/Disposition:
	Moved to further development - Use dynamic speeds within the construction work zone. Enforcement is difficult with little or no shoulders.

#	Description	Advantages	Disadvantages
MT-10	Construct Greenway and 31st Street bridges at the same time as Lake Street	▪ Takes advantage of MOT shifts	▪ None noted

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
			👍		

Rating: 3.5	Justification/Comments/Disposition:
	Moved to further development – This maybe the baseline idea?

#	Description	Advantages	Disadvantages
MT-11	Use tub girders for all three bridges at Lake Street	▪ Aesthetics ▪ Improve acoustics ▪ Eliminates falsework for middle bridge ▪ May improve vehicle/pedestrian traffic on Lake during construction ▪ May reduce structure depth	▪ Not typical within the region ▪ May not work with transit center (stairwells and elevators) ▪ May not pass municipal consent ▪ May increase cost?

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
			👍	👍	👍

Rating: 3	Justification/Comments/Disposition:
	Design Consideration - May be a suitable alternative for the outside bridges but may be fatally flawed for middle bridge because of stairwells and elevators

#	Description	Advantages	Disadvantages
MT-12	Maintain the existing I-35W profile through Lake Street	▪ Ease of MOT ▪ Would not require raising of roadway section ▪ Reduces height of retaining walls & noise walls ▪ Makes staging easier ▪ Reduces cost	▪ Would require a different bridge type with a shallower depth

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
			👍		

Rating: 4	Justification/Comments/Disposition:
	Moved to further development - Middle bridge may still require cast-in-place outside of Lake Street span

#	Description	Advantages	Disadvantages
MT-13	Allow the Design-Builder the flexibility to select any bridge/any profile (performance spec)		

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating: 3	Justification/Comments/Disposition:
	Design Consideration

#	Description	Advantages	Disadvantages
MT-14	Allow the vertical clearance within the transit portion of the Lake Street bridge only high enough to accommodate buses (less than 16.5')	▪ Could reduce the height of the arch ▪ Would reduces the glazing (glass) walls ▪ Would reduce the area needed to be heated/closed ▪ Reduces cost	▪ May reduce the aesthetic height of the arches ▪ May need to route trucks through during emergencies

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
				👎	

Rating: 2	Justification/Comments/Disposition:
	Dropped from further development

#	Description	Advantages	Disadvantages
MT-15	Use reversible lanes on I-35W for MOT	▪ Reduces needed lanes by 1 (12') during construction ▪ More flexibility during construction	▪ Operation cost of zipper barrier and machine ▪ Not very crash worthy barrier

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating: 3	Justification/Comments/Disposition:
	Design Consideration - Number of lanes to be determined. Not a large difference in directional split, especially in PM. May work well in spot locations but not for entire project.

#	Description	Advantages	Disadvantages
MT-16	Use active traffic management techniques during construction to reduce the number of vehicles on the roadways	▪ May reduce # of vehicles going through the work zone	▪ May increase cost

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
			👍		

Rating: 3.5	Justification/Comments/Disposition:
	Moved to further development – Maybe the baseline idea?

#	Description	Advantages	Disadvantages
MT-17	Replace 1 GP lane with a HOV lane during construction	▪ May reduce # of vehicles going through the work zone	▪ May increase cost ▪ Reduces level of service for GP lanes

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating: 3	Justification/Comments/Disposition:
	See Idea MT-16 on Active Traffic Management

#	Description	Advantages	Disadvantages
MT-18	Reduce all lanes to 11' during construction	▪ Provides additional width for staging	▪ Introducing some horizontal geometry

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
			👍		

Rating: 4	Justification/Comments/Disposition:
	Moved to further development - Currently being used on most Metro area projects

#	Description	Advantages	Disadvantages
MT-19	Use MSE walls whenever possible	▪ Reduces cost ▪ Reduces construction duration?	▪ Requires space behind the wall to construct (usually 75% of height) ▪ Added maintenance cost

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
		👎	👍		👍

Rating: 4	Justification/Comments/Disposition:
	Moved to further development

#	Description	Advantages	Disadvantages
MT-20	Use temporary shoring with permanent facing (soldier piles) (cut walls)	▪ Reduces cost ▪ Reduces construction duration ▪ Less impacts on frontage roads ▪ May reduce impacts to utilities	▪ May require tie-backs ▪ Long term maintenance?

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
		👎	👍		👍

Rating: 4	Justification/Comments/Disposition:
	Moved to further development

#	Description	Advantages	Disadvantages
MT-21	Use Design-Bid-Build delivery method	▪ Reduce cost ▪ May reduce overall project schedule ▪ Don't have to secure all construction funds to proceed with design ▪ Municipal consent ▪ All constraints could be adhered to	▪ Losing contractor innovation ▪ May not have funding to complete design

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating: 4	Justification/Comments/Disposition:
	Moved to further development - Ample time between now and NTP (July 1, 2017)

Function: Access Buses (Transit Station)

#	Description	Advantages	Disadvantages
AB-1	Add switchback to stairways or additional landing	▪ Provides a resting spot to pedestrians ▪ Minimizes unused space behind the stairs	▪ Aesthetics ▪ Design was created to accommodate escalators in the future

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
				👍	

Rating: 4	Justification/Comments/Disposition:
	Moved to further development - Perhaps an additional set of railings would assist in narrowing the aspect of the stairs.

#	Description	Advantages	Disadvantages
AB-2	Reduce the number of elevators (one on each side)	▪ Reduces cost ▪ Reduces maintenance	▪ Would require some transit users that use the elevator to cross Lake Street ▪ Loss of redundancy

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
	👎	👍			

Rating: 3	Justification/Comments/Disposition:
	Design Consideration - Possibly phase in additional elevators in the future

#	Description	Advantages	Disadvantages
AB-3	Lock the bathrooms outside of normal transit hours (safety consideration)	▪ Operational issues	

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating:	Justification/Comments/Disposition:
	The baseline is for staff only use

#	Description	Advantages	Disadvantages
AB-4	Eliminate the bathrooms		

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating:	Justification/Comments/Disposition:
	The baseline is for staff only use

#	Description	Advantages	Disadvantages
AB-5	No public restrooms		

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating:	Justification/Comments/Disposition:
	The baseline is for staff only use

#	Description	Advantages	Disadvantages
AB-6	Use entryways to bathrooms that don't have doors		

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating:	Justification/Comments/Disposition:
	The baseline is for staff only use

#	Description	Advantages	Disadvantages
AB-7	Eliminate the glass on lower section or plaza/mezzanine (open)	▪ Reduces cost ▪ Reduces maintenance ▪ No need for central heating/HVAC (geo-thermal wells)	▪ Eliminates the indoor plaza for the community ▪ Municipal consent ▪ Reduces aesthetics

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
			👍	👎	

Rating: 4	Justification/Comments/Disposition:
	Moved to further development - Could be phased in over time – not required for the function of the transit station

#	Description	Advantages	Disadvantages
AB-8	Sell vendor space	▪ Vendors could supply additional security within the transit center ▪ Generates revenue from lease	▪ This would require public bathrooms ▪ The electrical switchgear, etc. will need to be up sized ▪ The HVAC is currently only sized for 30 people

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating: 4	Justification/Comments/Disposition:
	Moved to further development

#	Description	Advantages	Disadvantages
AB-9	Undulate the ceiling on the lower level within the glass area	▪ Reduces noise (softens the acoustics)	▪ Increases cost

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating: 3	Justification/Comments/Disposition:
	Design Consideration

#	Description	Advantages	Disadvantages
AB-10	Move doors closer to Lake Street	▪ None noted	▪ Increases area that would need heating etc. ▪ Increases cost

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating: 2	Justification/Comments/Disposition:
	Dropped from further consideration

#	Description	Advantages	Disadvantages
AB-11	Eliminate stairs and elevators and use ramps	▪ Reduces cost ▪ Reduces maintenance ▪ Many users would not want to use the elevator	▪ The ramps would be very long to accommodate ADA ▪ Municipal consent

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating: 2	Justification/Comments/Disposition:
	Dropped from further consideration

#	Description	Advantages	Disadvantages
AB-12	Design lower level to be developed into an interior building in the future	▪ Reduces initial capital cost	▪ Increase capital costs later ▪ Municipal consent

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating: 3	Justification/Comments/Disposition:
	Design Consideration

#	Description	Advantages	Disadvantages
AB-13	Use concrete barrier to separate buses within station	▪ Reduced maintenance ▪ Provides positive separation between opposing lanes of traffic	▪ Increased cost ▪ Aesthetics ▪ Visibility ▪ Barrier would need extra space (1'-2')

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
		👍			

Rating: 3	Justification/Comments/Disposition:
	Design Consideration - Baseline assumes a metal railing per the image given to the team

#	Description	Advantages	Disadvantages
AB-14	Include a generator to supply backup power for the elevators	▪ May be code mandated	▪ Increased cost ▪ Requires space ▪ maintenance

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
	👍	👎			

Rating: 4	Justification/Comments/Disposition:
	Moved to further development – Determined to not be required

#	Description	Advantages	Disadvantages
AB-15	Remove the trellis above the metal roof	▪ Reduces cost ▪ Reduces maintenance	▪ Aesthetics

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
		👍			

Rating: 3	Justification/Comments/Disposition:
	Design Consideration

#	Description	Advantages	Disadvantages
AB-16	Move the elevators/stairs closer to the street	▪ Would reduce the length of all three bridges ▪ Would make transit users more visual ▪ Would bring in more natural light to the lower level	▪ Would reduce the size of the plaza ▪ May reduce the number of buses that can stage on I-35W ▪ Would require redesigning pedestrian movements within the transit center

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating:	Justification/Comments/Disposition:
5	*Moved to further development*

#	Description	Advantages	Disadvantages
AB-17	Shorten the bridges and move the elevators/stairs behind the abutments	▪ May reduces cost	▪ Complicates the bridge design ▪ Access through abutment

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating:	Justification/Comments/Disposition:
4	*Moved to further development*

#	Description	Advantages	Disadvantages
AB-18	Shorten the outside bridges to only the length needed and remove façade walls	▪ Reduces cost	▪ Aesthetics ▪ Increases distance to Greenway by a few feet

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating:	Justification/Comments/Disposition:
4	*Moved to further development*

#	Description	Advantages	Disadvantages
AB-19	Remove geothermal wells	▪ Reduces cost ▪ Reduces maintenance ▪ Reduces risk during construction	▪ Will affect LEED points

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
		👍			

Rating: 4	Justification/Comments/Disposition:
	Moved to further development

Function: Maintain/Separate Traffic (Local Traffic 26th and 28th)

Baseline: Construct bridges one-half at a time to keep traffic open

#	Description	Advantages	Disadvantages
ST-1	During construction make 26th and 28th streets two-way traffic so that one bridge at a time could be closed	▪ Maintains local traffic ▪ Eliminates a joint on the deck ▪ Reduces cost ▪ Reduces construction duration	▪ Restripe/signal/signs the local streets ▪ May lose some efficiency on the mainline for MOT replacing bridges at different times

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
		👍	👍👎		👍

Rating: 3	Justification/Comments/Disposition:
	Design Consideration

#	Description	Advantages	Disadvantages
ST-2	Allow Design-Builder to use accelerated bridge construction techniques on 26th and 28th		

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating:	Justification/Comments/Disposition:
	Baseline if Design-Build

#	Description	Advantages	Disadvantages
ST-3	Use Franklin and Lake as detours, then close 26th and 28th bridges at the same time	▪ Reduces construction duration ▪ Increases construction efficiency	▪ Municipal consent ▪ High ADT on these two streets would add to congestion to local streets ▪ Could hinder emergency response vehicles

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
			👍👎		👍

Rating: 3	Justification/Comments/Disposition:
	Design Consideration

#	Description	Advantages	Disadvantages
ST-4	Use reversible lanes on 26th and 28th – assumes that one bridge is closed while it is replaced	▪ May improve efficiency	▪ Restripe/signal/signs the local streets ▪ May lose some efficiency on the mainline for MOT replacing bridges at different times ▪ May increase cost ▪ Municipal consent

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
			👍👎		

Rating: 2	Justification/Comments/Disposition:
	Dropped from further consideration

#	Description	Advantages	Disadvantages
ST-5	Construct 26th and 28th as first order of work (pedestrian bridge too)	▪ Eliminates the pinch points for MOT	

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
			👍		

Rating: 4	Justification/Comments/Disposition:
	Moved to further development

#	Description	Advantages	Disadvantages
ST-6	Construct 26th and 28th as a separate contract ahead of the transit access project	▪ Public relations to assist with east-west local connections	▪ Add construction administration costs ▪ Temporary tie-ins between contracts ▪ Increased construction duration

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
			👍		👎

Rating: 3	Justification/Comments/Disposition:
	Design Consideration

Function: Replace Bridge (Braid & Flyover area)

#	Description	Advantages	Disadvantages
RB-1	Construct the new braid bridge on the same alignment (temporary widen existing as needed for MOT)		

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating: 0	Justification/Comments/Disposition:
	Existing bridge is a concrete box – fatally flaw

#	Description	Advantages	Disadvantages
RB-2	Construct Alternative 2	▪ Improved geometrics of I-35W southbound ▪ Improves geometrics TH-65 ▪ Lowers the profile of I-35W to allow for a future overcrossing at 24th ▪ Eliminates vertical clearance issues at Franklin Street	▪ Requires reconstruction of Franklin Street Bridge ▪ Increases cost ▪ Adds in another bridge over I-35W southbound ▪ MOT challenges ▪ May increase right-of-way needs

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
👍	👍	👍	👍👎	👎	

Rating: 4	Justification/Comments/Disposition:
	Moved to further development

#	Description	Advantages	Disadvantages
RB-3	Construct Alternative 2 but bring I-35W southbound traffic in the middle not outside	▪ Allows TH-65 southbound to remain in current location ▪ Potential driver expectancy ▪ Creates a right side on-ramp to I-35W	▪ Creates a weave for the buses to access managed lanes heading southbound from downtown ▪ May reduce horizontal curvature below design speed

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
👎					

Rating: 3.5	Justification/Comments/Disposition:
	Combine with RB-2 for further evaluation

#	Description	Advantages	Disadvantages
RB-4	Construct Flyover Alternative	▪ Creates a right side on-ramp ▪ Improved geometry ▪ FHWA approval ▪ Driver expectations ▪ Removes construction of bridge over bridge	▪ Increased weaving movements ▪ May require additional auxiliary lanes ▪ Higher profile?

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
👎			👍		

Rating: 2	Justification/Comments/Disposition:
	Dropped from further consideration - This is basically the current condition which has a weaving problem

#	Description	Advantages	Disadvantages
RB-5	Utilize the space of frontage road for MOT for reconstruction of I-35W		▪ Impacts/access to property abutting frontage roads

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating: 0	Justification/Comments/Disposition:
	Fatally Flawed - Not possible because of the difference in the grades of the freeway and the frontage roads.

#	Description	Advantages	Disadvantages
RB-6	Braid bridge only spans northbound I-35W and keep downtown traffic on the outside	▪ Allows TH-65 southbound to remain in current location ▪ Potential driver expectancy ▪ Creates a right side on-ramp to I-35W ▪ Improves MOT	▪ Creates a weave for the buses to access managed lanes heading southbound from downtown

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
👎			👍		

Rating:	Justification/Comments/Disposition:
2	*Dropped from further consideration - Similar to existing conditions*

#	Description	Advantages	Disadvantages
RB-7	Construct Alternative 2 but bring I-35W southbound traffic in the middle not outside. Have the flyover to northbound I-94 be a left exit		

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating:	Justification/Comments/Disposition:
	See Idea RB-3

#	Description	Advantages	Disadvantages
RB-8	Construct a truss for the braid		▪ Existing condition remains

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating:	Justification/Comments/Disposition:
	Same disadvantages as Idea RB-6

#	Description	Advantages	Disadvantages
RB-9	Construct the braid bridge to the south of existing	▪ May provide more space for MOT (bridge constructed offline)	▪ May affect the final geometrics of TH-65 and braid bridge ▪ May conflict with replacement of pedestrian bridge location ▪ Geometrics conflict with 26th Street bridge replacement

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
👎	👎		👍		

Rating: 2	Justification/Comments/Disposition:
	Dropped from further consideration

#	Description	Advantages	Disadvantages
RB-10	Close TH-65 during the reconstruction of the braid bridge (flyover too)	▪ Improves MOT	▪ Increased congestion during construction ▪ Municipal consent

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating: 0	Justification/Comments/Disposition:
	Fatally Flawed – To much traffic to close

#	Description	Advantages	Disadvantages
RB-11	Repair the flyover bridge in the same location as existing	▪ Reduces cost ▪ Reduces MOT ▪ Maintains right side on-ramp ▪ FHWA approval ▪ Driver expectations	▪ Does not improve weaving movements

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating: 1	Justification/Comments/Disposition:
	Dropped from further consideration - Not a historical bridge show repairing may not be allowed under chapter 152

#	Description	Advantages	Disadvantages
RB-12	Don't replace the TH-65 bridge	▪ Reduces cost	▪ Doesn't accommodate new flyover bridge

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating: 1	Justification/Comments/Disposition:
	Dropped from further consideration - This bridge needs to be lengthened to accommodate the widening/shifting of westbound I-94 because of the relocation of the flyover bridge

#	Description	Advantages	Disadvantages
RB-13	Construct a loop ramp to replace westbound to southbound movement (braid)		

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating: 0	Justification/Comments/Disposition:
	Fatally flawed – would require too much right-of-way

#	Description	Advantages	Disadvantages
RB-14	Construct TH-65 over the NB-WB I-94 ramp (flyover)		▪ Increased profile grades for TH-65 (large vertical curve) ▪ Increase the length of the TH-65

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule
👎					

Rating: 1	Justification/Comments/Disposition:
	Dropped from further consideration

#	Description	Advantages	Disadvantages
RB-15	Construct TH-65 over the NB-WB I-94 ramp and pull braid back to north of Franklin under TH-65	▪ None noted	▪ Would not be able to get under Franklin or TH-65

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating:	Justification/Comments/Disposition:
0	*Fatally Flawed – Not enough room*

#	Description	Advantages	Disadvantages
RB-16	Widen the frontage roads into TH-65 and keep I-35W in the middle	▪ None noted	▪ Creates a weaving problem for the buses ▪ Add a large amount of congestion within the neighborhoods

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating:	Justification/Comments/Disposition:
1	*Dropped from further consideration -*

Function: Reduce Risk

#	Description	Advantages	Disadvantages
RR-1	Managed Lanes – Avoid, do not construct them		

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating:	Justification/Comments/Disposition:
	As of 4/17/2013 this work has been added to the scope of the project by e-mail by John Griffith (Extend limits of project to 43rd Street on I-35W to close the gap in the southbound managed lanes.)

#	Description	Advantages	Disadvantages
RR-2	Managed Lanes – Accept, add them into the project		

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating:	Justification/Comments/Disposition:
	As of 4/17/2013 this work has been added to the scope of the project by e-mail by John Griffith (Extend limits of project to 43rd Street on I-35W to close the gap in the southbound managed lanes)

#	Description	Advantages	Disadvantages
RR-3	Utility Relocations – Mitigate, subsurface utility locate and update the base costs	▪ More accurate cost estimate ▪ More accurate project schedule ▪ Reduces change orders	

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating: 4	Justification/Comments/Disposition:
	Establish as a risk response strategy

#	Description	Advantages	Disadvantages
RR-4	I-35W Storm Tunnel Rehabilitation – Avoid, do not construct anything additional		▪ May not get project approval

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating: 3	Justification/Comments/Disposition:
	Detailed risk response strategies need to be created to mitigate this risk

#	Description	Advantages	Disadvantages
RR-5	I-35W Storm Tunnel Rehabilitation – Mitigate, construct an off-site pond to treat for the added impervious from this project	▪ Reduces cost of risk ▪ Treats for quality & quantity	▪ Location? ▪ Could added additional base cost ▪ Requires additional right-of-way

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating: 3	Justification/Comments/Disposition:
	Detailed risk response strategies need to be created to mitigate this risk

#	Description	Advantages	Disadvantages
RR-6	I-35W Storm Tunnel Rehabilitation – Mitigate, construct a number of stormwater vaults pond to treat for the added impervious from this project	▪ Reduces cost of risk ▪ Treats for quantity	▪ Location? ▪ Could added additional base cost ▪ Doesn't treat for quality (would require grit chambers)

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating: 3	Justification/Comments/Disposition:
	Detailed risk response strategies need to be created to mitigate this risk

#	Description	Advantages	Disadvantages
RR-7	I-35W Storm Tunnel Rehabilitation – Accept, construct needed infrastructure to expand the existing system	▪ Fixes the regional stormwater issues	▪ Unsure of where funding comes from

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating: 3	Justification/Comments/Disposition:
	Detailed risk response strategies need to be created to mitigate this risk

#	Description	Advantages	Disadvantages
RR-8	I-35W Storm Tunnel Rehabilitation – Mitigate, pipe the water down the Greenway	▪ Close proximity to project	▪ Would require right-of-way or easement ▪ Profile grades

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating: 3	Justification/Comments/Disposition:
	Detailed risk response strategies need to be created to mitigate this risk

#	Description	Advantages	Disadvantages
RR-9	Right-of-Way Impacts – Avoid, stay within the established footprint	▪ Doesn't increase costs ▪ Doesn't increase impacts	

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating:	Justification/Comments/Disposition:
	Detailed risk response strategies need to be created to mitigate this risk

#	Description	Advantages	Disadvantages
RR-10	Right-of-Way Impacts – Mitigate, narrow the lanes across the frontage roads and I-35W	▪ Reduces cost ▪ Reduces right-of-way impacts	▪ Reduces geometry

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating:	Justification/Comments/Disposition:
	Detailed risk response strategies need to be created to mitigate this risk

#	Description	Advantages	Disadvantages
RR-11	Right-of-Way Impacts – Avoid, don't construct the proposed 28th street ramps	▪ Reduces cost ▪ Reduces right-of-way impacts ▪ FHWA Approval (IAR)	▪ Municipal consent

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating:	Justification/Comments/Disposition:
	Detailed risk response strategies need to be created to mitigate this risk

#	Description	Advantages	Disadvantages
RR-12	Right-of-Way Impacts – Mitigate, narrow the shoulders on the 28th Street ramps	▪ Reduces cost ▪ Reduces right-of-way impacts	▪ FHWA approval (IAR)

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating:	Justification/Comments/Disposition:
	Detailed risk response strategies need to be created to mitigate this risk

#	Description	Advantages	Disadvantages
RR-13	Right-of-Way Impacts – Mitigate, move the billboard	▪ Provides space	▪ Increased cost

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating:	Justification/Comments/Disposition:
	Detailed risk response strategies need to be created to mitigate this risk

#	Description	Advantages	Disadvantages
RR-14	Differing Site Conditions – Transfer, give the risk to the Design-Builder		▪ Will increase cost

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating: 1	Justification/Comments/Disposition:
	Contractors don't take risk they price it

#	Description	Advantages	Disadvantages
RR-15	Differing Site Conditions – Share, cap the amount at $1 million	▪ Not paying an undisclosed amount you are paying	▪ You will pay the $$$

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating: 1	Justification/Comments/Disposition:
	Contractors don't take risk they price it

#	Description	Advantages	Disadvantages
RR-16	Differing Site Conditions – Mitigate, additional subsurface site investigation for rubble	▪ Reduces construction change orders	▪ Added preconstruction costs ▪ May not locate all

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating: 3	Justification/Comments/Disposition:
	Include in Risk Management see Risk CON-7

#	Description	Advantages	Disadvantages
RR-17	Wall Types – Mitigate, use MSE in fill sections	▪ Reduces cost	▪ May work depending on length of straps and ability to maintain traffic ▪ If used, may preclude utilities

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating:	Justification/Comments/Disposition:
	Moved to further development

#	Description	Advantages	Disadvantages
RR-18	Wall Types – Mitigate, combine noise walls with retaining walls		

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating:	Justification/Comments/Disposition:
	Baseline

#	Description	Advantages	Disadvantages
RR-19	SHPO – Mitigation, preconstruction survey of historic properties and then monitor during construction	▪ Sets the baseline ▪ May avoid change orders	▪ Adds preconstruction cost

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating:	Justification/Comments/Disposition:
	Detailed risk response strategies need to be created to mitigate this risk

#	Description	Advantages	Disadvantages
RR-20	SHPO – Mitigation, meet with SHPO with the current design and get their concurrence	▪ Reduces risk	▪ SHPO wants to see final design

Mainline Operations	Local Operations	Maintainability	Construction Impacts	Environmental Impacts	Project Schedule

Rating:	Justification/Comments/Disposition:
	Detailed risk response strategies need to be created to mitigate this risk

This page is left intentionally blank

Recommendations

The VE Recommendations are presented as written by the team during the VE Study. While they have been edited from the VE report to correct errors or better clarify the recommendation, they represent the CRAVE™ Team's findings during the Study. The following table is a summary of all recommendations generated and their impact to the project.

Table 7-1. Summary of Recommendations

#	Description	Cost Savings	Cost Added	Performance
1	Active Traffic Management	NQ		10%
2	Maintenance of Traffic	$6.50 M		6%
3	Retaining Walls	$15.14 M		6%
4	I-35W Braid		($2.12 M)	27%
5	26th and 28th Street Bridges	$1.22 M		6%
6	Staging I-35W at Lake Street	NQ		1%
7	Selling Vendor Space	NQ		4%
8	Remove Glass Enclosure	$4.25 M		20%
9	Remove Geothermal Wells	$0.36 M		7%
10	Additional Main Stairway Handrails	minor		5%
11	Shorten Lake Street Structures	$0.90 M		0%
12	Design-Bid-Build	$7.07 M		0%

NQ = Not quantifiable at this time

The cost comparisons reflect a difference or delta between the baseline design and the VE Recommendation. As the project progresses, these values can be updated to reflect actual implemented results. The values shown are adjustments to base construction costs only. These values include a markup of 30% which is the ***cumulative*** value of the following items:

- Mobilization 5%
- Pre-Construction (up to NTP) 6%
- Pre-Construction (Design-Builder) 10%
- Construction Engineering 8%

Note that the value shown for Recommendation #2 is a reduction in the expected value of an identified risk to the traffic staging and the value shown for Recommendation #5 is the savings in escalation as a result of advancing the construction of these two bridges. The remaining values shown are the differences in base construction costs only as calculated during the CRAVE™ Study.

Design Considerations

In addition to the recommendations above, the CRAVE™ Team generated a number of ideas that they felt were important enough to be documented and should be further considered by the project team.

- Keep all three bridges at Lake Street at the same profile elevation
- Reduce all lanes from 12' to 11' wide through transit center (permanent configuration)
- Use tub girders for all three bridges at Lake Street
- Allow the Design-Builder the flexibility to select any bridge/any profile (performance spec)
- Use reversible lanes on I-35W for MOT
- Reduce the number of elevators (one on each side)
- Undulate the ceiling on the lower level within the glass area
- Design lower level to be developed into an interior building in the future
- Use concrete barrier to separate buses within station
- Remove the trellis above the metal roof
- During construction make 26th and 28th Streets two-way so that one bridge at a time could be closed
- Use Franklin and Lake as detours, then close 26th and 28th bridges at the same time

Performance Assessment

As the CRAVE™ Team developed alternatives; the performance of each was rated against the original design concept or baseline. Changes in performance are always based upon the overall impact to the total project. Once performance and cost data have been developed by the CRAVE™ Team, the net change in value of the VE recommendations can be compared to the original design concept.

In order to compare and contrast the potential for value improvement, individual recommendations are compared to the baseline project for all attributes. For this exercise the baseline was given a score of 5. The resulting value improvement scores allow a way for MnDOT to assess the potential impact of the VE recommendations on total project value.

VALUE MATRIX												
I-35W Transit/Access Project												
Attribute	Attribute Weight	Concept	Performance Rating										Total Performance
			1	2	3	4	5	6	7	8	9	10	
Mainline Operations	26.2	Baseline					5						131
		1						6					157
		2					5						131
		3					5						131
		4								8			210
		5					5						131
		6					5						131
		7					5						131
		8					5						131

VALUE MATRIX													
I-35W Transit/Access Project													
Attribute	**Attribute Weight**	**Concept**	**Performance Rating**										**Total Performance**
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
		9					5						131
		10					5						131
		11					5						131
		12					5						131
Local Operations	26.2	Baseline					5						131
		1					5						131
		2					5						131
		3					5						131
		4						6					157
		5					5						131
		6					5						131
		7					5						131
		8						6					157
		9					5						131
		10						6					157
		11					5						131
		12					5						131
Maintainability	14.3	Baseline					5						71
		1					5						71
		2					5						71
		3				4							57
		4						6					86
		5					5						71
		6					5						71
		7					5						71
		8									9		129
		9						6					86
		10					5						71
		11					5						71
		12					5						71
Construction Impacts	7.1	Baseline					5						36
		1							7				50
		2							7				50
		3								8			57
		4						6					43
		5							7				50
		6						6					43
		7					5						36
		8						6					43
		9							7				50
		10					5						36
		11					5						36
		12					5						36

VALUE MATRIX													
I-35W Transit/Access Project													
Attribute	**Attribute Weight**	**Concept**	**Performance Rating**										**Total Performance**
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
Environmental Impacts	19.0	Baseline					5						95
		1					5						95
		2					5						95
		3					5						95
		4					5						95
		5					5						95
		6					5						95
		7						6					114
		8					5						95
		9					5						95
		10					5						95
		11					5						95
		12					5						95
Project Schedule	7.1	Baseline					5						36
		1						6					43
		2							7				50
		3								8			57
		4						6					43
		5							7				50
		6					5						36
		7					5						36
		8						6					43
		9						6					43
		10					5						36
		11					5						36
		12					5						36

Understanding the relationship of cost, performance, and value of the project baseline and VE concepts is essential in evaluating VE recommendations. Comparing the performance and cost suggests which recommendations are potentially as good as or better than, the project baseline concept in terms of overall value.

OVERALL PERFORMANCE		Performance (P)	% Change Performance	Cost (C)	% Change Cost	Value Index (P/C)	% Value Improvement
	Baseline	500		$193.8		2.58	
1	Active Traffic Management	548	10%	$193.8	0%	2.83	10%
2	Maintenance of Traffic	529	6%	$193.8	0%	2.73	6%
3	Retaining Walls	529	6%	$178.6	8%	2.96	15%
4	I-35W Braid	633	27%	$195.9	-1%	3.23	25%
5	26th & 28th Street Bridges	529	6%	$189.5	2%	2.79	8%
6	Staging I-35W Traffic @ Lake St.	507	1%	$193.4	0%	2.62	2%
7	Selling Vendor Space	519	4%	$195.9	-1%	2.65	3%
8	Remove Glass Enclosure	598	20%	$189.5	2%	3.15	22%
9	Remove Geothermal Wells	536	7%	$193.4	0%	2.77	7%
10	Additional Main Stairway Handrails	526	5%	$193.8	0%	2.72	5%
11	Shorten Lake St. Structures	500	0%	$192.9	0%	2.59	0.5%
12	Design-Bid-Build	500	0%	$186.7	4%	2.68	4%

Recommendation Summary Sheets

Based on the evaluation process, individual recommendations were developed. Each recommendation consists of a summary of the original concept, a description of the suggested change, a listing of its advantages and disadvantages, a brief narrative that includes justification, sketches, photos, assumptions, calculations (where applicable) and performance measure ratings as developed by the CRAVE Team.

This page is left intentionally blank

VE Recommendation No. 1 Active Traffic Management	IDEA NO. MT15, MT16, MT17

Baseline

Assume that conventional methods of work zone traffic management and public relations would be utilized to reduce number of vehicles in work zone.

Recommendation

Implement advanced and innovative strategies for active traffic management and traveler information systems.

Advantages	Disadvantages
▪ Reduce congestion and improve the flow of traffic through the work zone ▪ Provide more accurate information about the roadway network for commute selection ▪ Give the power to the roadway users to take a more vested interest in their mode and routes selection ▪ Greater public satisfaction with project	▪ Increased cost to implement new technologies ▪ Reduces level of service for general purpose lanes with HOV and reversible lanes ▪ Added effort to implement strategies by public agencies ▪ Troubleshooting new technologies to fit the purposes of this project

Cost Summary	Cost
Baseline	Non-quantifiable (no existing or projected cost values)
Recommendation	
Cost Savings	

FHWA Functional Benefit

Safety	Operations	Environment	Construction	Other
✓			✓	

VE Recommendation No. 1 Active Traffic Management	IDEA NO. MT15, MT16, MT17

Discussion/Sketches/Photos

Implement advanced and innovative strategies for active traffic management and traveler information systems. For active traffic management, consider a high occupancy vehicle (HOV) lane, public transit options, park-n-rides, and/or a reversible lane on TH-65 to fully utilize available space and to increase the ratio of passengers per vehicle. The goal with these strategies would be to increase the capacity with decreased roadway space.

Figure 7-1. Active Traffic Management

Utilize innovative technologies and more robust traveler information systems that build upon current public relations and intelligent transportation system (ITS) strategies. One concept is smart-phone programs that roadway users can update with real-time roadway information. The goal is to empower the traveling public to take a vested interest in their daily commute and to better communicate where there is available capacity on the roadway network to fully utilize the transportation system.

- Better use of available roadway space and increased capacity
  - Effective use of park-n-rides along the I-35W corridor
  - Reversible lane on TH 65 near the downtown area that can be used to better facilitate the directional peak traffic
  - Consider an HOV lane on I-35W through the construction zone that will encourage higher passengers per vehicles and ride sharing programs

- Prohibit Trucks in the work zone during rush hours

- Modify commuter behavior
  - Provide realistic commute times and delay along the I-35 corridor during construction
  - Added incentive to use public transit and reduced fares to encourage peak period ridership
  - Encourage flexible work schedules and commuting times
  - Promote work at home opportunities for downtown commuters
  - Encourage alternate routes to downtown
  - Ride sharing
  - Encourage a Transit Reward program to increase ridership

7-2. Park & Ride Lot

Figure 7-3. Smart Phone Application

- Traveler Information Systems
  - Improved collaboration with existing news and media outlets
  - Added 511 features to improve the existing MnDOT system and travel time information
  - Implement Smart-phone and portable media device applications that roadway users can update to provide more real-time traffic conditions

VE Recommendation No. 1 Active Traffic Management			IDEA NO. MT15, MT16, MT17
PERFORMANCE MEASURES **Attributes and Rating Rationale for Recommendation**	**Performance**	**Baseline**	**Recommendation**
Mainline Operations ▪ Benefits may be seen after the project has been completed: o Chance to improve existing park-n-ride facilities and ride sharing programs o Allow commuters to continue to be engaged with smart-phone travel time programs o Modify commuter behavior to continue to work at home or travel at nonpeak hours	Rating	5	6
	Weight	26.2	
	Contribution	131	157
Local Operations ▪ No change to baseline	Rating	5	5
	Weight	26.2	
	Contribution	131	131
Maintainability ▪ No change to baseline	Rating	5	5
	Weight	14.3	
	Contribution	71	71
Construction Impacts ▪ Lessen work zone congestion ▪ Reduce potential conflicts between workers and traveling public ▪ Better utilize available roadway capacity and transit options ▪ Increase commuter satisfaction and project perception	Rating	5	7
	Weight	7.1	
	Contribution	36	50
Environmental Impacts ▪ No change to baseline	Rating	5	5
	Weight	19.0	
	Contribution	95	95
Project Schedule ▪ Reduce conflicts and congestion may allow for better construction staging	Rating	5	6
	Weight	7.1	
	Contribution	36	43
Total Performance:		**500**	**548**
Net Change in Performance:			**10%**

VE Recommendation No. 2 Maintenance of Traffic	IDEA NO. MT-1, MT-7, MT-8, MT-9, MT-18

Baseline

Maintain at 55 mph the same currently existing number of lanes during construction (4 – 12' general purpose lanes southbound and 4 – 12' general purpose lanes plus a 12' managed shoulder northbound). No shoulders are assumed. Maintain the Lake Street bus pullout on I-35W.

Recommendation

During construction only maintain 3 – 11' general purpose lanes in both directions and close the I-35W bus pullouts adjacent to Lake Street. Establish a construction zone with a posted speed limit of 45 mph.

Advantages	Disadvantages
▪ Reduce temporary construction costs ▪ Reduce construction duration ▪ Provides more flexibility with staging ▪ Lower speed provides greater worker and driver safety	▪ Capacity ▪ Increased congestion ▪ Local system impacts ▪ Loss of transit stop

Cost Summary	Cost
Baseline	$7.3 M (expected value of identified risk)
Recommendation	$0.8 (reduces impact of risk)
Cost Savings	$6.5 M (of overall risk avoidance)

FHWA Functional Benefit

Safety	Operations	Environment	Construction	Other
			✓	

VE Recommendation No. 2 Maintenance of Traffic	IDEA NO. MT-1, MT-7, MT-8, MT-9, MT-18

Discussion/Sketches/Photos

The baseline maintenance of traffic (MOT) provides 4 – 12' general purpose lanes southbound and 4 – 12' general purpose lanes plus one 12' managed shoulder northbound on I-35W at 55 MPH. Looking at the capacity needs and expectant traffic, it appears more than is necessary.

The narrow right-of-way and need to keep traffic moving within this tight corridor creates many challenges to the reconstruction of the roadway and bridges. Reducing the design speed to 45 MPH is more suitable through the construction zone because of the reduced shoulders and sight distance while providing greater worker and driver safety.

Reducing the number of lanes from 4 to 3 general purpose each way along with narrowing them from 12' to 11' will reduce width of the MOT impacts by up to 30'. This will reduce construction MOT costs and should also reduce the duration of the project while providing added flexibility in routing I-35W traffic through the construction zone.

Figure 7-4. Looking north from the existing southbound bus pullout

Maintaining the existing I-35W bus pullouts at Lake Street will be problematic because of need to maintain pedestrian access through the construction work zone along the interstate. Maintenance of these bus pullouts would require them to be reconfigured with every change in traffic configuration during construction.

VE Recommendation No. 2 Maintenance of Traffic	IDEA NO. MT-1, MT-7, MT-8, MT-9, MT-18

Figure 7-5. Construction Zone on Interstate

Assumption: A risk was identified for MOT of $3.0 M to $15.2 M with a most likely of $7.6 M, with a probability of 50% (expected value of $7.3 M). This risk was added because of the challenges in maintaining traffic at the baseline level. Acceptance of this recommendation would avoid or greatly reduce this risk.

VE Recommendation No. 2 Maintenance of Traffic			IDEA NO. MT-1, MT-7, MT-8, MT-9, MT-18
PERFORMANCE MEASURES **Attributes and Rating Rationale for Recommendation**	**Performance**	**Baseline**	**Recommendation**
Mainline Operations ▪ No change to baseline	Rating	5	5
	Weight	26.2	
	Contribution	131	131
Local Operations ▪ No change to baseline	Rating	5	5
	Weight	26.2	
	Contribution	131	131
Maintainability ▪ No change to baseline	Rating	5	5
	Weight	14.3	
	Contribution	71	71
Construction Impacts ▪ Reduce the number of lanes during construction from 4 – 3 ▪ Reduces posted speed during construction (55 MPH to 45 MPH) ▪ Provides added flexibility and room for contractor ▪ Eliminates transit stop ▪ Reduces impacts to frontage roads	Rating	5	7
	Weight	7.1	
	Contribution	36	50
Environmental Impacts ▪ No change to baseline	Rating	5	5
	Weight	19.0	
	Contribution	95	95
Project Schedule ▪ This should reduce overall construction duration by providing more space for the contractor to work in.	Rating	5	7
	Weight	7.1	
	Contribution	36	50
	Total Performance:	**500**	**529**
	Net Change in Performance:		**6%**

VE Recommendation No. 3 Retaining Walls	IDEA NO. MT-19, MT-20

Baseline

Baseline assumes standard cast-in-place retaining walls. This would include utilizing structure excavation requiring temporary shoring for some of the walls.

Recommendation

Consider mechanically stabilized earth (MSE) walls especially in fill situations. Consider incorporating the temporary shoring into the final wall design in cut wall situations.

Advantages	Disadvantages
▪ Cost of construction ▪ Reduces construction duration ▪ Reduce excavation and associated Utility impacts. ▪ Fewer frontage road traffic impacts	▪ Space consideration for utilities within the tie back or strap zone. ▪ Some uncertainty in Minnesota over long term performance

Cost Summary	Cost
Baseline	$25.26 M
Recommendation	$13.61 M
Cost Savings	$11.65 M x 30% markup = $15.14 M

FHWA Functional Benefit

Safety	Operations	Environment	Construction	Other
			✓	✓

VE Recommendation No. 3 Retaining Walls	IDEA NO. MT-19, MT-20

Discussion/Sketches/Photos

The baseline design utilizes fill-style cast-in-place concrete retaining walls to accomplish widening in the elevated sections of I-35W between 28th St and 32nd St, and along the fills for the southbound I-35W braid bridge and northbound I-35W to westbound I-94 flyover bridge.

Mechanically stabilized earth, or MSE walls, for these fills may reduce the project cost and provide for faster construction. The reinforcement zone for these walls would be contained within the roadway section and existing right-of-way.

Figure 7-6. MSE Wall showing tie-backs

Figure 7-7. MSE wall used as a bridge abutment

MSE walls have been installed on other sections of the I-35W corridor in the TH 62 commons section. Drawbacks for this option are that the reinforcement zone would impact the available space for underground utilities and there are some uncertainties within MnDOT about the long-term performance of MSE walls.

The baseline design uses cut-style cast-in-place (CIP) retaining walls to accomplish widening of I-35W in the depressed section between Franklin and 28th Street. It appears that temporary shoring will be required for most of these walls due to the close proximity of the frontage roads and limited right-of-way. This recommendation is to utilize the temporary shoring as the permanent structural wall with a non-structural façade.

In cut wall locations it is recommended to use a top down temporary shoring system such as an h-pile lag wall. Advantages for this recommendation are reduced construction cost and reduced construction time.

VE Recommendation No. 3 Retaining Walls	IDEA NO. MT-19, MT-20

During construction H-piles would also be more conducive to install through buried rubble when compared to steel sheet piling. Experience on adjacent projects has found widespread buried rubble in the I-35W corridor, with a history of changed condition claims from the contractor.

Figure 7-8. H-Pile wall

VE Recommendation No. 3 Retaining Walls	IDEA NO. MT-19, MT-20

Assumptions/Calculations

The baseline estimate has a unit bid price of $85/SF for all retaining walls within the project. Because of the narrow work area an assumption is made that cut walls along I-35W will need shoring to install them at a cost of $25/SF. The cost of shoring cost was assumed to be part of the LWD portion of the roadway items which includes miscellaneous item allowance.

Item Description	Unit	Baseline			Recommendation		
		Qty	Unit Cost	Total	Qty	Unit Cost	Total
Cast-in-Place Walls (fill walls)	SF	128,899	$85	$10.95 M			
MSE Walls (fill walls)	SF				128,899	$50	$6.45 M
Cast-in-place wall (cut walls)	SF	130,109	$85	$11.06 M			
Temporary Shoring for cut walls	SF	130,109	$25	$3.25 M			
H-piles with concrete facade	SF				130,109	$55	$7.16 M
Totals		**Baseline**		**$25.26 M**	**Recommendation**		**$13.61 M**
						Cost Savings	**$11.65 M**

VE Recommendation No. 3 Retaining Walls			IDEA NO. MT-19, MT-20
PERFORMANCE MEASURES **Attributes and Rating Rationale for Recommendation**	**Performance**	**Baseline**	**Recommendation**
Mainline Operations ▪ No change to baseline	Rating	5	5
	Weight	26.2	
	Contribution	131	131
Local Operations ▪ No change to baseline	Rating	5	5
	Weight	26.2	
	Contribution	131	131
Maintainability ▪ Some concerns with long term maintenance of MSE walls	Rating	5	4
	Weight	14.3	
	Contribution	71	57
Construction Impacts ▪ Cut wall alternate should reduce impacts and access restrictions on local frontage roads ▪ H-pile lag wall option for cut walls will reduce the noise and vibration impacts to the adjacent neighborhoods.	Rating	5	8
	Weight	7.1	
	Contribution	36	57
Environmental Impacts ▪ No change to baseline	Rating	5	5
	Weight	19.0	
	Contribution	95	95
Project Schedule ▪ Reduces construction duration for both cut and fill walls.	Rating	5	8
	Weight	7.1	
	Contribution	36	57
Total Performance:		**500**	**529**
Net Change in Performance:			**6%**

This page is left intentionally blank

VE Recommendation No. 4 I-35W Braid	IDEA NO. RB-2

Baseline

Reconstruct the I-35W Braid Bridge for the southbound traffic adding an auxiliary lane for the proposed Lake Street off-ramp.

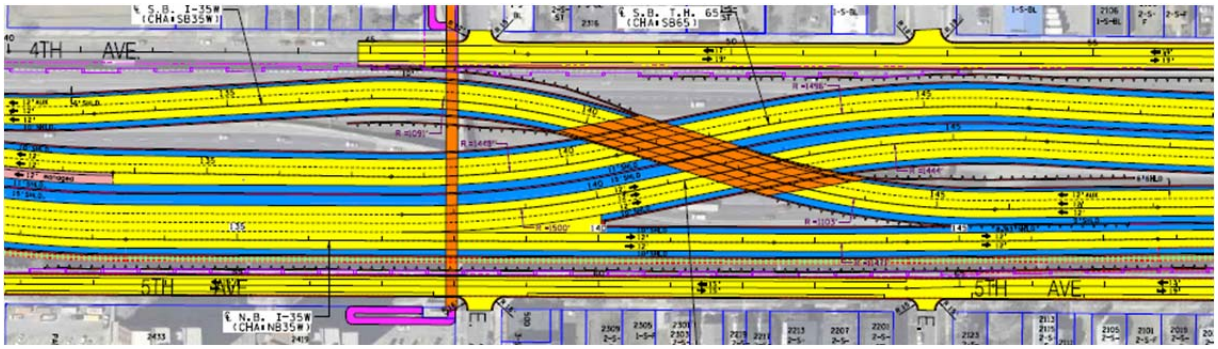


Figure 7-9. Proposed Braid Bridge on I-35W

Recommendation

Construct Alternate 2 to replace the existing braid bridge on I-35W for the southbound traffic.

Advantages	Disadvantages
▪ Improved geometrics of southbound I-35W ▪ Improves geometrics TH-65 ▪ Lowers the profile of I-35W to allow for a future overcrossing at 24th ▪ Eliminates vertical clearance issues at Franklin Street ▪ Reduces height of pedestrian bridge replacement	▪ Requires reconstruction of Franklin Street bridge ▪ Increases cost ▪ May increase right of way impacts

Cost Summary	Cost
Baseline	$70.96 M (See appendix for base cost estimates)
Recommendation	$72.06 M
Cost Added	$2.12 M including markups

FHWA Functional Benefit

Safety	Operations	Environment	Construction	Other
	✓		✓	✓

VE Recommendation No. 4 I-35W Braid	IDEA NO. RB-2

Discussion/Sketches/Photos

The current design (baseline) alignment provides an undesirable reverse curve for the horizontal alignment which is similar to the existing alignments for southbound I-35W and north & southbound TH-65 (see the image on previous page). The horizontal curvature of the baseline design and the added vertical curve at the same location provides undesirable geometrics which has an impact on design speed, driver expectancy and freeway operations.

Alternative 2 (shown below) provides improved geometry, both horizontally and vertically with an increase in project costs because of the replacement of the Franklin Street bridge.

With this alternative both directions of TH-65 cross over southbound I-35W. A new bridge is constructed over I-35W for the northbound movement to I-694. The same number of lanes existed for TH-65 and I-35W as in the baseline design.

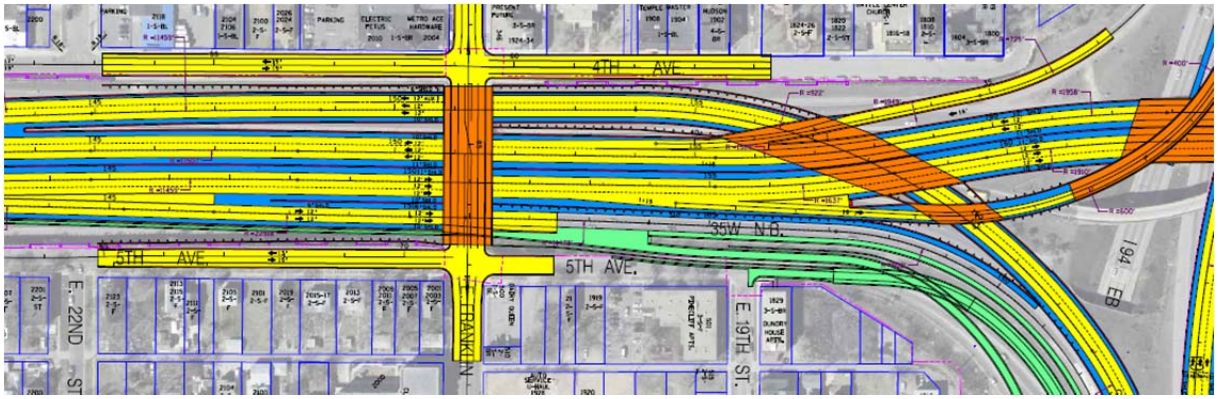


Figure 7-10. Alternative 2

The replacement of the Franklin Bridge also provides an increase to the vertical clearance.

Alternative 2 should have benefits during construction as well. The construction of the "braid bridge" was considered to be very problematic by the CRAVE™ Team. The team was unable to determine how to stage the construction of the braid bridge and its embankments and keep traffic flowing.

VE Recommendation No. 4 I-35W Braid	IDEA NO. RB-2

A modification to Alternative 2 was created during the final hours of the CRAVE™ Study (see image below). While the CRAVE™ Team did not have ample time to fully look at this alterative it was felt that this idea would provide additional room for contractor operations and maintenance of traffic (MOT).

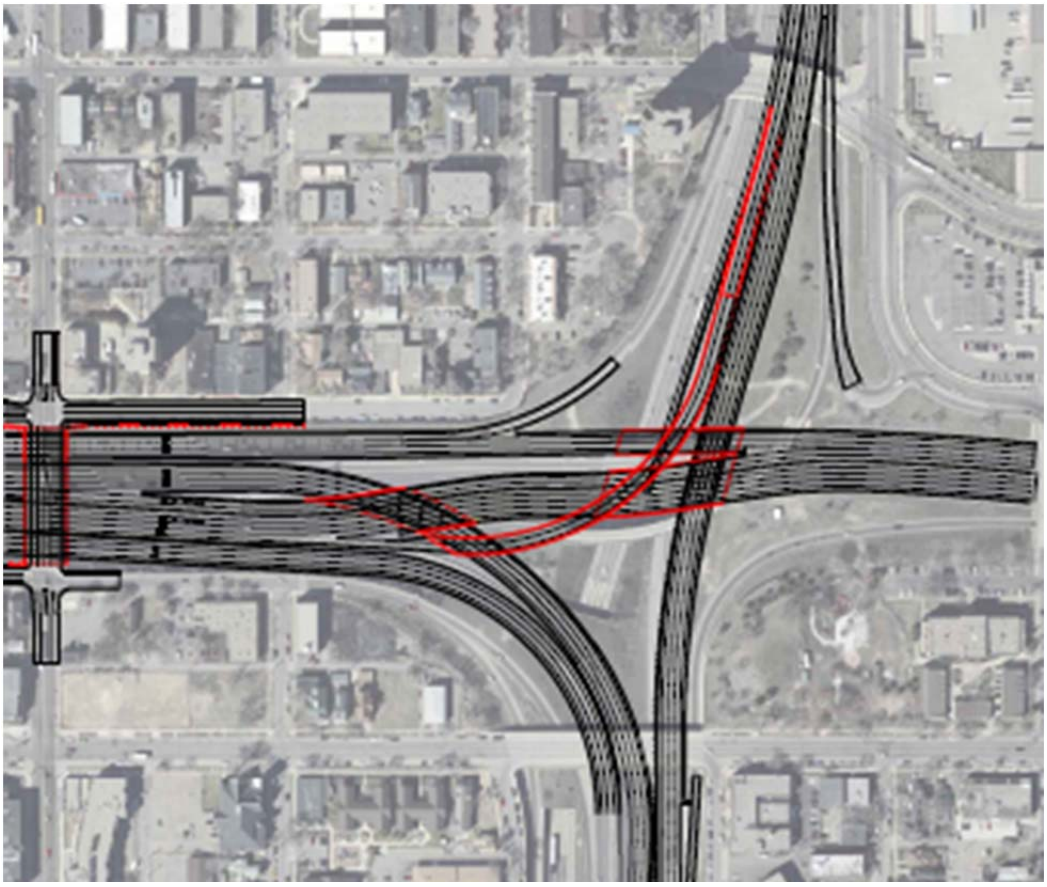


Figure 7-11. Alternative 5

In this new alternative (Alternative 5) southbound I-35W only crosses northbound TH-65. This allows southbound TH-65 to remain on the outside where it currently exists. A managed or bus lane is added to southbound TH-65 and splits the inside to allow the buses coming from the downtown area to stay against the median so they do not have to weave between this interchange and the proposed Lake Street Transit Center.

VE Recommendation No. 4 I-35W Braid			IDEA NO. RB-2
PERFORMANCE MEASURES **Attributes and Rating Rationale for Recommendation**	**Performance**	**Baseline**	**Recommendation**
Mainline Operations ▪ Removes S-curves from I-35W and TH-65 (eliminates braid) ▪ Improves horizontal curvature on southbound I-35W ▪ Lengthens southbound managed lane (I-35W)	Rating	5	8
	Weight	26.2	
	Contribution	131	210
Local Operations ▪ Replaces Franklin Street bridge ▪ Extends southbound managed lane (TH-65)	Rating	5	6
	Weight	26.2	
	Contribution	131	157
Maintainability ▪ Improves sight distance for maintenance	Rating	5	6
	Weight	14.3	
	Contribution	71	86
Construction Impacts ▪ Improves MOT during construction ▪ Provides more space for contractor operations	Rating	5	6
	Weight	7.1	
	Contribution	36	43
Environmental Impacts ▪ No change to baseline	Rating	5	5
	Weight	19.0	
	Contribution	95	95
Project Schedule ▪ Reduces construction duration	Rating	5	6
	Weight	7.1	
	Contribution	36	43
Total Performance:		**500**	**633**
Net Change in Performance:			**27%**

VE Recommendation No. 5 26th and 28th Street Bridges	IDEA NO. ST-5

Baseline

Replace the 28th Street bridge as part of the I-35W Transit/Access project.

Replace the 26th Street bridge as part of the Chapter 152 bridge replacement project.

Recommendation

Replace the 26th and 28th Street bridges as a separate project prior so they are completed before the I-35W Transit/Access project.

Advantages	Disadvantages
▪ Facilitates east-west flow while 31st and Lake Street are being reconstructed ▪ The longer spans will facilitate maintenance of traffic during the transit access project ▪ May improve public relations ▪ May get more competitive bids by creating a smaller bridge project in 2015 (two years sooner) ▪ Similar advantages as the accelerated construction of the Maryland Bridge on I-35E Cayuga project. ▪ Savings in escalation	▪ This will extend the construction period ▪ May increase construction administration costs ▪ Public acceptance

Cost Summary	Cost
Baseline	$13.20 M
Recommendation	$11.98 M
Cost Savings	$1.22 M (escalation only)

FHWA Functional Benefit

Safety	Operations	Environment	Construction	Other
		✓	✓	✓

VE Recommendation No. 5 26th and 28th Street Bridges	IDEA NO. ST-5

Discussion/Sketches/Photos

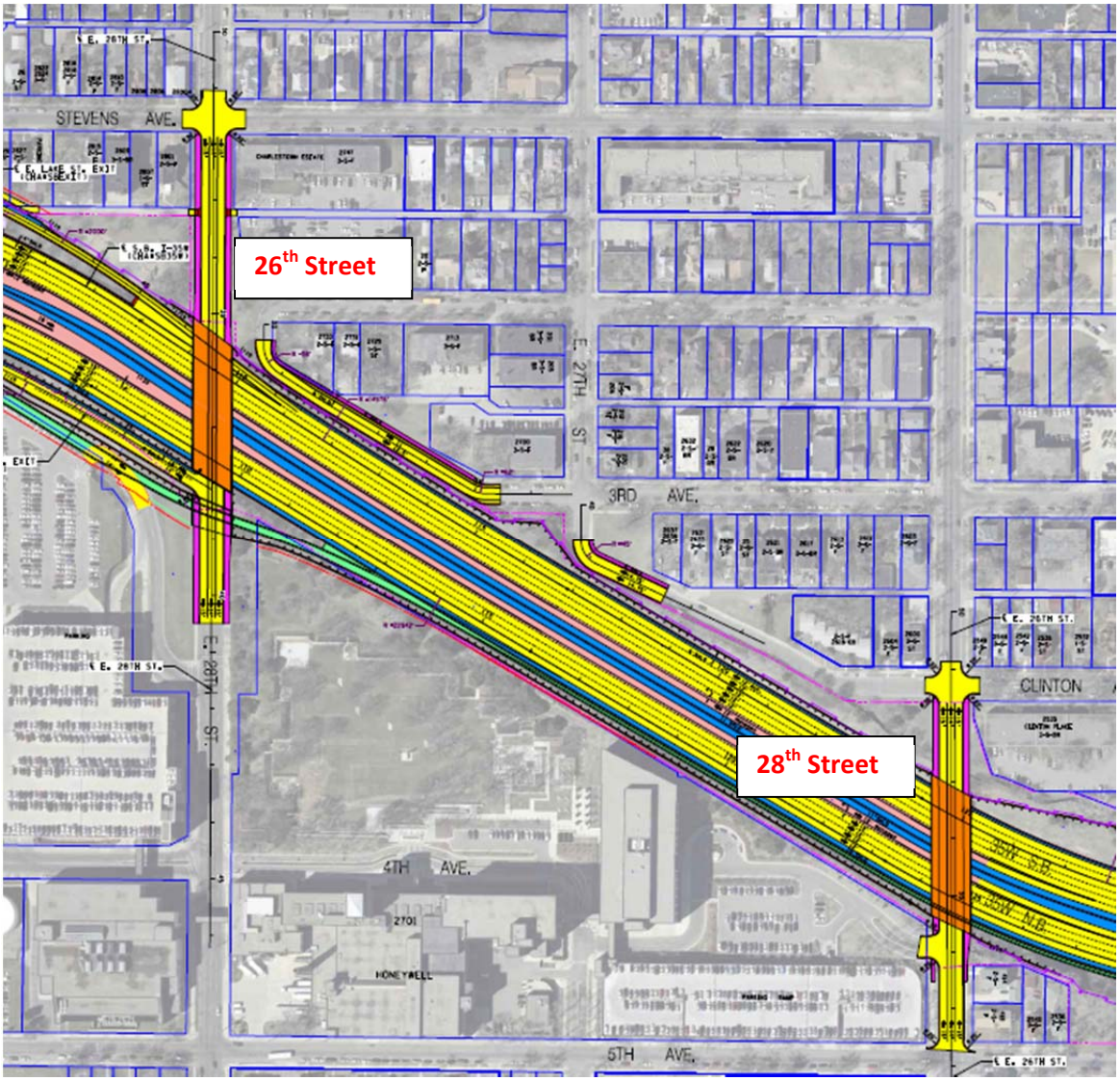


Figure 7-12. I-35W at 26th Street & 28th Street

The drawing above indicates the location of the 26th Street and 28th Street overpasses.

These bridges should be considered for advanced construction in 2015, two years prior to commencement of the I-35W Transit/Access project.

Advanced bridge construction could aid maintenance of traffic and aid the community by providing reliable east/west links within the City, which may facilitate Municipal Consent.

Letting a separate project may result in additional construction administration costs, but the bids should be lower because it's a smaller project let two years before the main project (escalation savings and additional bidders).

VE Recommendation No. 5 26th and 28th Street Bridges	IDEA NO. ST-5

Assumptions/Calculations

The possibility of increased construction administration costs of two separate contracts will be offset equally by lower bids (reduced escalation) associated with a smaller project that is let 2 years before the main project.

Item Description	Unit	Baseline			Recommendation		
		Qty	Unit Cost	Total	Qty	Unit Cost	Total
Removal – 26th Street Bridge	SF	15,735	$10	$157,348	15,735	$10	$157,348
26th Street Bridge	SF	20,639	$195	$4,024,574	20,639	$195	$4,024,574
Removal – 28th Street Bridge	SF	15,735	$10	$141,387	15,735	$10	$141,387
28th Street Bridge	SF	18,915	$195	$3,688,425	18,915	$195	$3,688,425
Related roadway costs	10%			$800,000			$800,000
Maintenance of Traffic	5%			$400,000			$400,000
30% markup (PE, CE, Mob)	30%			$2,763,520			$2,763,520
Escalation (2-yrs, 2015-2017)	5%			$1,227,464			
Totals		**Baseline**		**$13,202,718**	**Recommendation**		**$11,975,254**
						Cost Savings	**$1,227,464**

VE Recommendation No. 5 26th and 28th Street Bridges			IDEA NO. ST-5
PERFORMANCE MEASURES **Attributes and Rating Rationale for Recommendation**	**Performance**	**Baseline**	**Recommendation**
Mainline Operations ▪ No change to baseline	Rating	5	5
	Weight	26.2	
	Contribution	131	131
Local Operations ▪ No change to baseline	Rating	5	5
	Weight	26.2	
	Contribution	131	131
Maintainability ▪ No change to baseline	Rating	5	5
	Weight	14.3	
	Contribution	71	71
Construction Impacts ▪ Aids maintenance of traffic during larger project. ▪ Facilitates east/west community access during construction	Rating	5	7
	Weight	7.1	
	Contribution	36	50
Environmental Impacts ▪ No change to baseline	Rating	5	5
	Weight	19.0	
	Contribution	95	95
Project Schedule ▪ Will reduce duration of I-35W Transit/Access project	Rating	5	7
	Weight	7.1	
	Contribution	36	50
Total Performance:		**500**	**529**
Net Change in Performance:			**6%**

VE Recommendation No. 6 Staging I-35W Traffic @ Lake Street	IDEA NO. MT-5, MT-10

Baseline

A baseline traffic staging was presented to the CRAVE™ Team for the replacement of I-35W @ Lake Street.

Recommendation

Expand the traffic staging plan to include the reconstruction of the I-35W bridges over Greenway and 31st Street using the same staging as planned for the Lake Street bridges.

Advantages	Disadvantages
▪ Coordinated staging of traffic for both northbound and southbound I-35W ▪ Appears to be the most straightforward MOT scheme	▪ None noted

Cost Summary	Cost
Baseline	Not Quantified
Recommendation	
Cost Savings	

FHWA Functional Benefit

Safety	Operations	Environment	Construction	Other
			✓	

VE Recommendation No. 6 Staging I-35W Traffic @ Lake Street			IDEA NO. MT-5, MT-10
PERFORMANCE MEASURES **Attributes and Rating Rationale for Recommendation**	**Performance**	**Baseline**	**Recommendation**
Mainline Operations ▪ No change to baseline	Rating	5	5
	Weight	26.2	
	Contribution	131	131
Local Operations ▪ No change to baseline	Rating	5	5
	Weight	26.2	
	Contribution	131	131
Maintainability ▪ No change to baseline	Rating	5	5
	Weight	14.3	
	Contribution	71	71
Construction Impacts ▪ Facilitates traffic staging	Rating	5	6
	Weight	7.1	
	Contribution	36	43
Environmental Impacts ▪ No change to baseline	Rating	5	5
	Weight	19.0	
	Contribution	95	95
Project Schedule ▪ No change to baseline	Rating	5	5
	Weight	7.1	
	Contribution	36	36
Total Performance:		**500**	**507**
Net Change in Performance:			**1%**

VE Recommendation No. 7 Selling Vendor Space	IDEA NO. AB-8

Baseline

No vendors are currently identified or under lease for occupancy in the large public space at the Lake Street level.

Recommendation

Allow portable sidewalk vendors in the plaza area as an enhancement to the community.

Advantages	Disadvantages
▪ Vendors could supply additional security within the transit center ▪ Generates revenue from lease ▪ Adds vitality to the area	▪ May encourage undesirable mid-block crossings to purchase goods on the other side of the street ▪ May require the addition of bathrooms ▪ May require the addition of water fountains

Cost Summary	Cost
Baseline	Not Quantified
Recommendation	
Cost Savings	

FHWA Functional Benefit				
Safety	Operations	Environment	Construction	Other
		✓		

VE Recommendation No. 7 Selling Vendor Space	IDEA NO. AB-8

Discussion/Sketches/Photos

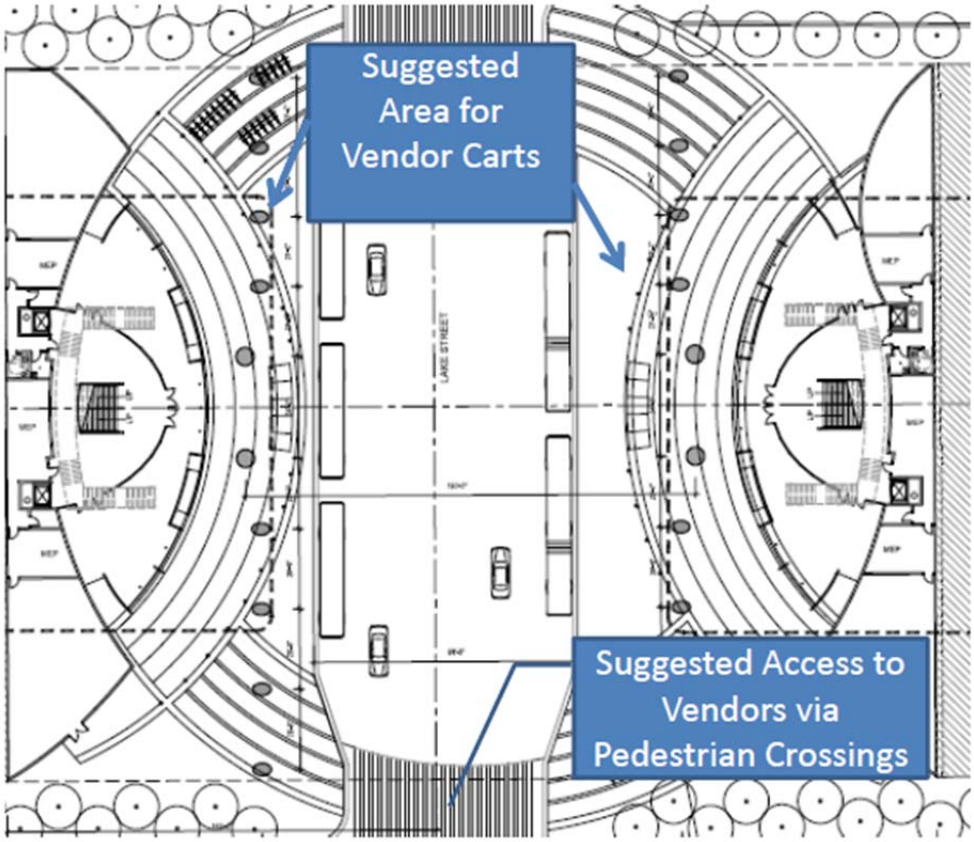


Figure 7-13. Possible locations for Sidewalk Vendors

There is ample plaza space to allow portable vendors to set up and sell goods, if allowed, in the suggested spaces. Allowing vendors to set up and sell goods would allow additional revenue to be generated from the public space, with minimal capital cost, and would enhance the use of the plaza as the gateway to the destinations in the community.

Access to the plazas could be at the pedestrian ramps or over the curbs which may require vendors to provide their own ramps if the curbs are raised.

Assumptions/Calculations

Assumed the funding sources would allow the sale of goods in the plaza area.

Assumed local ordinances would allow the sale of goods in the plaza area.

Assumed all vendors would be required to clean and maintain their space.

Assumed vendors would either enter plaza at pedestrian ramps or provide own ramps to access plaza over curb.

Assumed there would be enough public demand for these services.

Assume the vendors would be self contained.

VE Recommendation No. 7 Selling Vendor Space			IDEA NO. AB-8
PERFORMANCE MEASURES **Attributes and Rating Rationale for Recommendation**	**Performance**	**Baseline**	**Recommendation**
Mainline Operations ▪ No change to baseline	Rating	5	5
	Weight	26.2	
	Contribution	131	131
Local Operations ▪ No change to baseline	Rating	5	5
	Weight	26.2	
	Contribution	131	131
Maintainability ▪ No change to baseline	Rating	5	5
	Weight	14.3	
	Contribution	71	70
Construction Impacts ▪ No change to baseline	Rating	5	5
	Weight	7.1	
	Contribution	36	36
Environmental Impacts ▪ Amenities would add value as a destination ▪ Increases the presence in the area, adds passive security	Rating	5	6
	Weight	19.0	
	Contribution	95	114
Project Schedule ▪ No change to baseline	Rating	5	5
	Weight	7.1	
	Contribution	36	36
Total Performance:		**500**	**519**
Net Change in Performance:			**4%**

This page is left intentionally blank

VE Recommendation No. 8 Remove Glass Enclosure	IDEA NO. AB-7

Baseline

Stairs, lobbies and elevators are located within glass enclosure that extends out towards Lake Street. Stairs and elevators are located within enclosed glass structure at platform level. Transit Station heating and air conditioning system is supported by a geothermal system.

Recommendation

Eliminate the glass walls that extend towards Lake Street plaza area and the inside glass wall and doors at platform level.

Remove the geothermal heating system and reduce heating and cooling to elevator room and/or elevators.

Advantages	Disadvantages
▪ Reduces cost for heating/cooling ▪ Reduces maintenance ▪ Reduces construction cost for glass ▪ Limit heating/cooling to elevators	▪ Eliminates indoor area for community ▪ May influence municipal consent ▪ Reduces aesthetics ▪ Will affect LEED points if geothermal system is removed

Cost Summary	Cost
Baseline	$3.49 M
Recommendation	$0.22 M
Cost Savings	$3.27 x 30% Markup = $4.25 M

FHWA Functional Benefit

Safety	Operations	Environment	Construction	Other
✓			✓	

VE Recommendation No. 8 Remove Glass Enclosure	IDEA NO. AB-7

Discussion/Sketches/Photos

If needed the CRAVE Team recommends that significant savings can be found by reducing amount of glass walls (glazing) within the Transit Center. Removing these walls will greatly reduce not only the capital cost of this project but will also reduce the maintenance and operations cost of the facility after it is opened to the public.

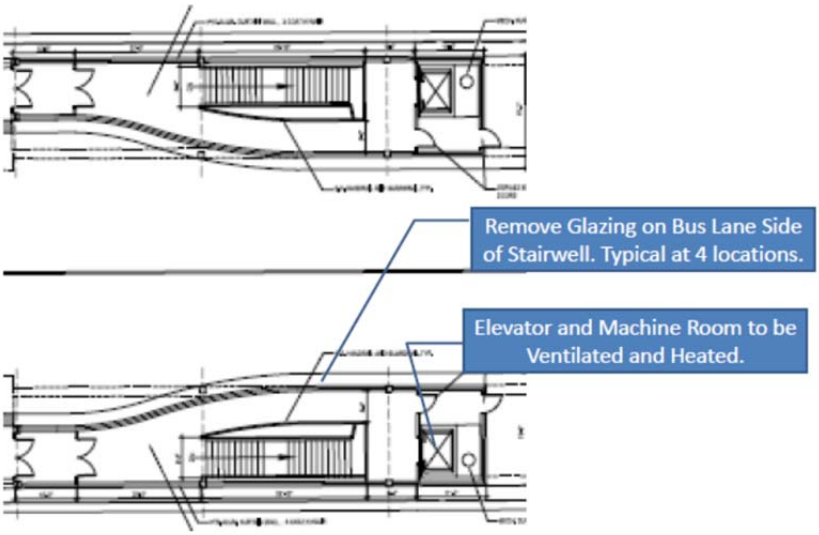


Figure 7-14. Upper Level Scope of Work for Removal of Glazing

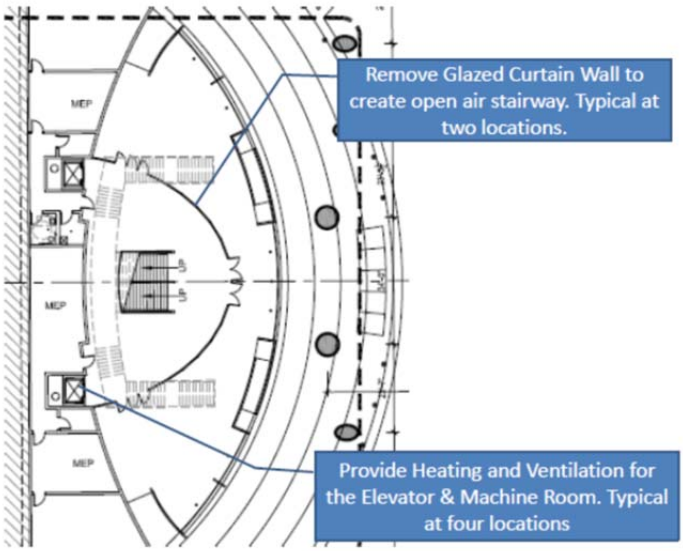


Figure 7-15. Remove Enclosed Lobby

VE Recommendation No. 8 Remove Glass Enclosure	IDEA NO. AB-7

Assumptions/Calculations

Elevator and equipment room will still need to be heated/cooled with a much smaller system.

Assuming designers can provide flexibility in the design to add glass walls in the future.

Assuming a savings of heated/cooling space of 90%.

Elimination of glass walls and all glass doors at Lake Street and the glass walls and doors at the platform level will result in an overall project savings (30% of cost of center)

Geothermal system will no longer be needed and can be replace by a small system.

Item Description	Unit	Baseline			Recommendation		
		Qty	Unit Cost	Total	Qty	Unit Cost	Total
Curtain Wall Glazing & Doors	EST	30%	$10,000,000	$3,000,000			
Geothermal System	SF	8,380	$58	$486,040			
Heating & Ventilation to Elevators & Machine Room	LS				1	$10,000	$10,000
Conventional HVAC System	SF				8,380	$25	$209,500
Totals		**Baseline**		**$3,486,040**	**Recommendation**		**$219,500**
						Cost Savings	**$3,266,540**

VE Recommendation No. 8 Remove Glass Enclosure			IDEA NO. AB-7
PERFORMANCE MEASURES **Attributes and Rating Rationale for Recommendation**	**Performance**	**Baseline**	**Recommendation**
Mainline Operations ▪ No change to baseline	Rating	5	5
	Weight	26.2	
	Contribution	131	131
Local Operations ▪ Improves Pedestrian Flow	Rating	5	6
	Weight	26.2	
	Contribution	131	157
Maintainability ▪ Less glass surfaces and mechanical systems to maintain/repair ▪ Reduction of operational energy costs	Rating	5	9
	Weight	14.3	
	Contribution	71	129
Construction Impacts ▪ Less infrastructure to build	Rating	5	6
	Weight	7.1	
	Contribution	36	43
Environmental Impacts ▪ No change to baseline	Rating	5	5
	Weight	19.0	
	Contribution	95	95
Project Schedule ▪ Reduction of schedule due to less scope	Rating	5	6
	Weight	7.1	
	Contribution	36	43
Total Performance:		**500**	**598**
Net Change in Performance:			**20%**

VE Recommendation No. 9 Remove Geothermal Wells	IDEA NO. AB-19

Baseline

Transit Station heating and HVAC provided with a geothermal system.

Recommendation

Eliminate the geothermal system and replace with a conventional heating/cooling system.

Advantages	Disadvantages
▪ Reduce capital cost ▪ Reduce maintenance ▪ Reduce risk during construction	▪ Will affect LEED points if geothermal system is removed ▪ May increase operating costs

Cost Summary	Cost
Baseline	$0.49 M
Recommendation	$0.21 M
Cost Savings	$0.28 M x 30% markup = $0.36 M

FHWA Functional Benefit

Safety	Operations	Environment	Construction	Other
			✓	✓

VE Recommendation No. 9 Remove Geothermal Wells	IDEA NO. AB-19

Discussion/Sketches/Photos

There are a total of 56 individual geothermal wells that will need to be drilled under the sidewalks along Stevens Avenue adjacent to the Transit Center.

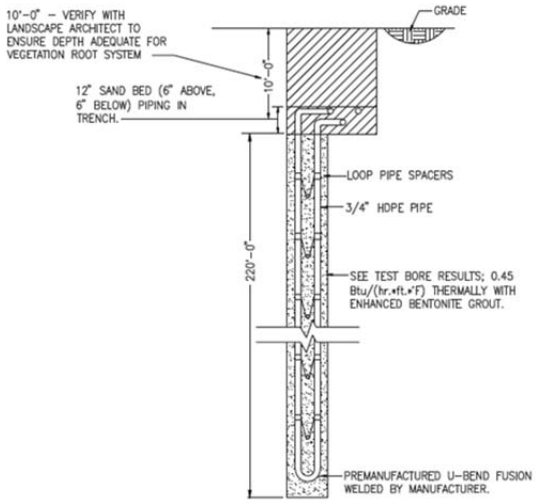


Figure 7-16. X-Section of Geothermal Well

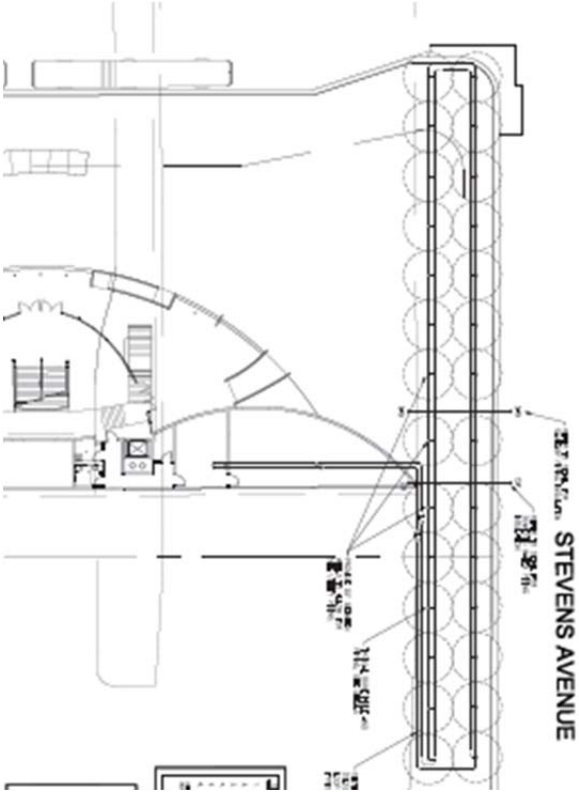


Figure 7-17. Plan View of Geothermal Well

By removing the need to drill 220' into the ground for the vertical piping needed for the geothermal wells a subsurface risk can be avoided. (i.e., multiple drilling may result in hitting ruble, contaminated soil, etc.).

Cost assumptions are based upon the original design estimate.

Item Description	Unit	Baseline			Recommendation		
		Qty	Unit Cost	Total	Qty	Unit Cost	Total
Geothermal System	SF	8,380	$58	$486,040			
Conventional HVAC System	SF				8,380	$25	$209,500
Totals		**Baseline**		**$486,040**	**Recommendation**		**$209,500**
						Cost Savings	**$276,540**

VE Recommendation No. 9 Remove Geothermal Wells			IDEA NO. AB-19
PERFORMANCE MEASURES **Attributes and Rating Rationale for Recommendation**	**Performance**	**Baseline**	**Recommendation**
Mainline Operations ▪ No change to baseline	Rating	5	5
	Weight	26.2	
	Contribution	131	131
Local Operations ▪ No change to baseline	Rating	5	5
	Weight	26.2	
	Contribution	131	131
Maintainability ▪ Conventional systems are more common	Rating	5	6
	Weight	14.3	
	Contribution	71	86
Construction Impacts ▪ Less risk for drilling wells, 28 on each end, 56 total	Rating	5	7
	Weight	7.1	
	Contribution	36	43
Environmental Impacts ▪ No change to baseline	Rating	5	5
	Weight	19.0	
	Contribution	95	95
Project Schedule ▪ Would help project schedule ▪ Less time for installation	Rating	5	6
	Weight	7.1	
	Contribution	36	43
Total Performance:		**500**	**536**
Net Change in Performance:			**7%**

This page is left intentionally blank

VE Recommendation No. 10 Additional Main Stairway Handrails	IDEA NO. AB-1

Baseline

Stairs from ground floor to mezzanine are long and wide with little support for pedestrians. Baseline number of handrails is 3 (two on the outside and one center handrail).

Recommendation

Remove existing center handrail and add two handrails equidistant. This will increase the number of handrails from 3 to 4.

Advantages	Disadvantages
▪ Helps prevent/minimize falls ▪ Limits liability/exposure to claims	▪ Minimal cost ▪ Adds resistance/barrier for a rush of pedestrian traffic trying to use stairs

Cost Summary	Cost
Baseline	$5,550
Recommendation	$7,400
Cost Added	$1,850 x 30% markup = $2,405

FHWA Functional Benefit

Safety	Operations	Environment	Construction	Other
				✓

VE Recommendation No. 10 Additional Main Stairway Handrails	IDEA NO. AB-1

Discussion/Sketches/Photos

International Building Code Section 1012.8 Intermediate Rails:

"Stairways shall have intermediate handrails located in such manner so that all portions of the stairway width required for egress capacity are within 30" of a handrail."

The baseline design results in a 7'-6" distance between the handrails. This makes the number of railings in baseline minimally acceptable per code but not desirable. The additional cost is negligible in relationship to the entire project. Claims could result from accidents occurring on the stairs which, additional handrails would mitigate this risk.

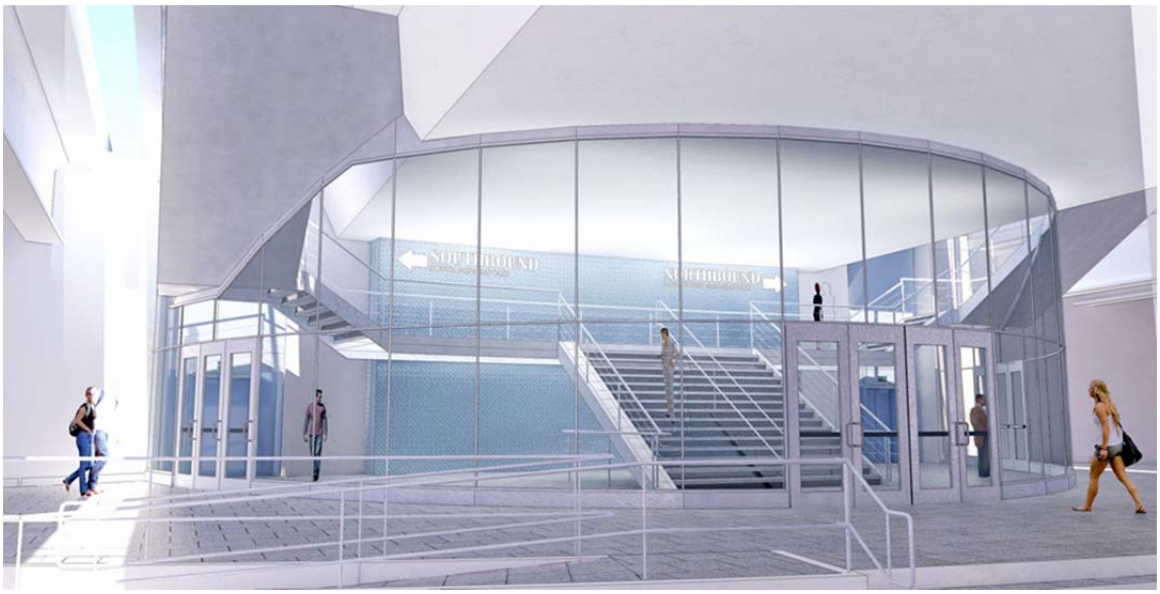


Figure 7-18. Artist's Rendition of Lower Level of Transit Station

Remove the center hand rail and add two other equidistant from the outside rails.

Assumptions/Calculations

Baseline has 3 rails. VE Recommendation adds 1 rail

Cost of railings per R.S. Means:

Railing, Decorative, panelized = $134/SF

Length of rail is 13.75'

Each railing costs $134 x 13.75' = $1,842.50 use $1,850/railing

VE Recommendation No. 10 Additional Main Stairway Handrails			IDEA NO. AB-1
PERFORMANCE MEASURES **Attributes and Rating Rationale for Recommendation**	**Performance**	**Baseline**	**Recommendation**
Mainline Operations ▪ No change to baseline	Rating	5	5
	Weight	26.2	
	Contribution	131	131
Local Operations ▪ Helps with individuals using the stairway	Rating	5	6
	Weight	26.2	
	Contribution	131	157
Maintainability ▪ No change to baseline	Rating	5	5
	Weight	14.3	
	Contribution	71	71
Construction Impacts ▪ No change to baseline	Rating	5	5
	Weight	7.1	
	Contribution	36	36
Environmental Impacts ▪ No change to baseline	Rating	5	5
	Weight	19.0	
	Contribution	95	95
Project Schedule ▪ No Change to baseline	Rating	5	5
	Weight	7.1	
	Contribution	36	36
Total Performance:		**500**	**526**
Net Change in Performance:			**5%**

This page is left intentionally blank

VE Recommendation No. 11 Shorten Lake Street Structures	IDEA NO. AB-16, AB-17, AB-18

Baseline

Four large unassigned spaces are located on the Lower Level to the east and west ends of the transit building. The rooms are shaped in a curving pattern and abut the bridge bearing walls.

Recommendation

Reduce I-35W northbound and southbound bridges by approximately 36 feet by shortening them by 18 feet at each abutment.

Advantages	Disadvantages
▪ Reduces cost	▪ Reduces the size of the ancillary rooms ▪ Municipal Consent (The plaza will be 18' further from Greenway

Cost Summary	Cost
Baseline	$0.93M
Recommendation	$0.24 M (Increase for cost of walls)
Cost Savings	$0.69 M x 30% Markup = $0.90 M

FHWA Functional Benefit

Safety	Operations	Environment	Construction	Other
				✓

VE Recommendation No. 11 Shorten Lake Street Structures	IDEA NO. AB-16, AB-17, AB-18

Discussion/Sketches/Photos

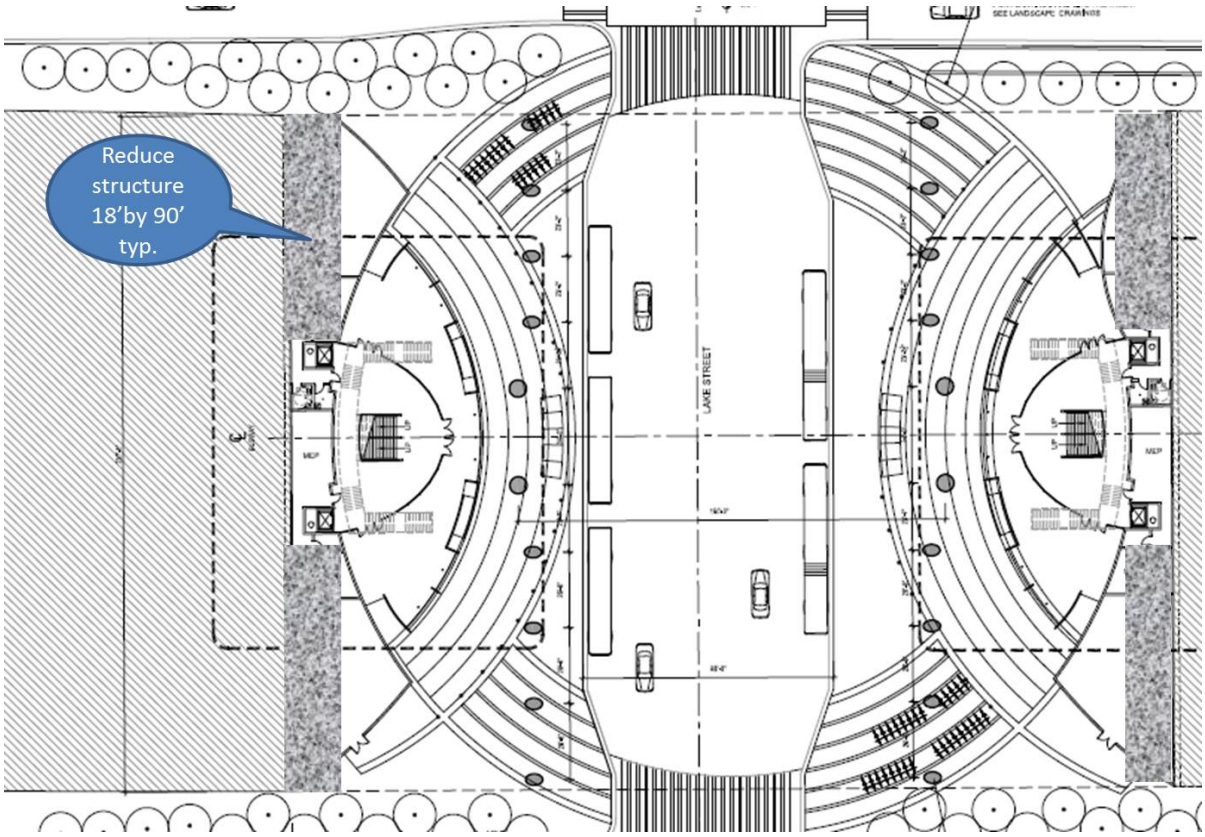


Figure 7-20. Plan view of Transit Center

The drawing above indicates a shortening of the outside bridge span by bringing the abutments in 18 feet on both the north and south ends. By implementing this change, we are significantly reducing the bridge cost, while not sacrificing aesthetics or public spaces.

The Mechanical-Electrical space which is removed can be added back into the design by central MEP Room under the Mezzanine.

The new location of the abutment walls will require the addition of retaining walls to hold back the backfill. This has been included in the cost calculations.

The proposed design modifications retains the curving storage rooms; in a smaller configuration.

VE Recommendation No. 11 Shorten Lake Street Structures	IDEA NO. AB-16, AB-17, AB-18

Assumptions/Calculations

Cost Assumptions (from baseline estimate)

East Bridge: Assumption is to reduce length by 18' on both ends. Bridge width is 76' The cost of the specific bridge is $175/sf.

West Bridge: Assumption is to reduce length on both the north and south end by 18'. Bridge width is 87'. The cost of this specific Bridge is $145.

Wing Walls: Assumption is for the construction of two wing walls at each bridge end; for total of 8 wing walls. Each wing will be 18' deep by 20' high. The cost of each wing wall is assumed to be $85/sf.

Explanation of Formula for Developing Cost Savings Analysis:

(Area of all four reduced bridge square footage) = (Total reduced area) x (Average Cost per SF of Bridge Construction) = Total Area Cost Savings.

CALCULATION:

Bridge square footage:

southbound (18' x 76') (2) = 2,736 SF

northbound (18' x 87') (2) = 3,132 SF

Retaining Wall square footage

Wing Walls: (18' x 20') (8) = 2,880 SF

Item Description	Unit	Baseline			Recommendation		
		Qty	Unit Cost	Total	Qty	Unit Cost	Total
Southbound I-35W Bridge	SF	2,736	$175	$478,800			
Northbound I-35W Bridge	SF	3,132	$145	$454,140			
Wing Walls/Retaining Wall	SF				2,880	$85	$244,800
Totals		**Baseline**		**$932,940**	**Recommendation**		**$244,800**
						Cost Savings	**$688,140**

VE Recommendation No. 11 Shorten Lake Street Structures			IDEA NO. AB-16, AB-17, AB-18
PERFORMANCE MEASURES **Attributes and Rating Rationale for Recommendation**	**Performance**	**Baseline**	**Recommendation**
Mainline Operations ▪ No change to baseline	Rating	5	5
	Weight	26.2	
	Contribution	131	131
Local Operations ▪ Patrons will need to travel 18' further to get from the greenway to the plaza.	Rating	5	5
	Weight	26.2	
	Contribution	131	131
Maintainability ▪ Less Structure to Maintain (bridge shortened) ▪ Additional Walls to Maintain ▪ Reduced size of interior rooms	Rating	5	5
	Weight	14.3	
	Contribution	71	71
Construction Impacts ▪ Less Structure ▪ More Walls	Rating	5	5
	Weight	7.1	
	Contribution	36	36
Environmental Impacts ▪ No change to baseline	Rating	5	5
	Weight	19.0	
	Contribution	95	95
Project Schedule ▪ No change to baseline	Rating	5	5
	Weight	7.1	
	Contribution	36	36
Total Performance:		**500**	**500**
Net Change in Performance:			**0%**

VE Recommendation No. 12 Design-Bid-Build	IDEA NO. MT-13, MT-12

Baseline

Assumes Design-Build delivery method with a contract letting in July 2017.

Recommendation

Consider using Design-Bid-Build delivery method to allow the City, County and State to be more specific with design details such as the Transit Station.

Advantages	Disadvantages
▪ Current July 2017 letting date allows time to develop final design prior to award ▪ Design control (especially for Transit Station) ▪ Likely reviewed more favorable for municipal consent ▪ Reduces cost	▪ Reduces opportunity contractor innovation

Cost Summary	Cost
Baseline	$193.76 M (see appendix for base cost estimates)
Recommendation	$186.69 M
Cost Savings	$7.07 M (includes markups)

FHWA Functional Benefit				
Safety	Operations	Environment	Construction	Other
				✓

VE Recommendation No. 12 Design-Bid-Build	IDEA NO. MT-13, MT-12

Discussion/Sketches/Photos

It is anticipated that stakeholders for this project will focus on the Transit Station and will be unsure of the Design-Build (DB) process. Using the Design-Bid-Build (DBB) process will assist in obtaining municipal consent for this project because the design of the Transit Station will be 100% before NTP.

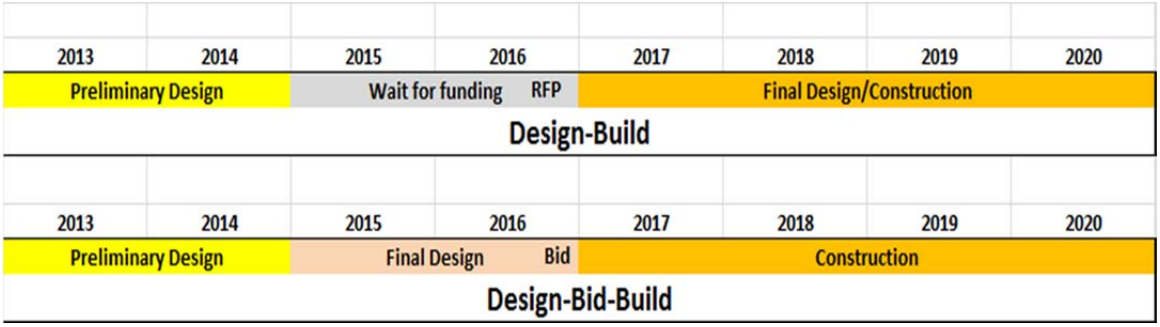


Figure 7-20. Design-Build vs. Design-Bid-Build (Schedule)

Utilizing the DBB process allows less contractor innovation as compared to the DB process but with the prescriptive nature of many on the items of work contractor innovation may be minimal.

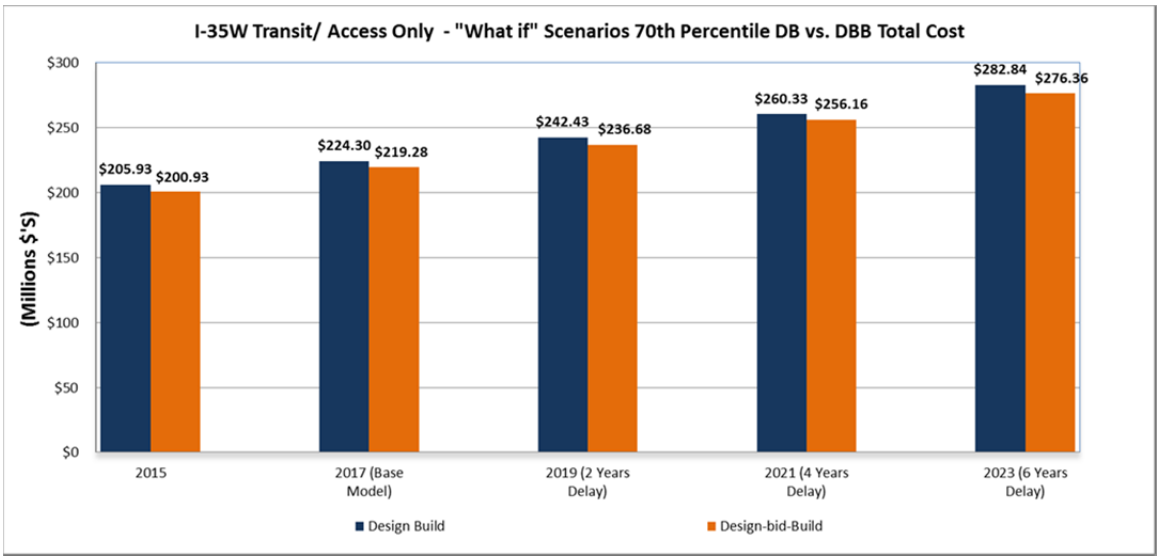


Figure 7-21. Design-Build vs. Design-Bid-Build (Cost)

The cost analysis indicates that the DBB process will save 4% (over $7 million) as compared to the DB process. The CRAVE™ Team felt the 4% savings estimate is conservative and the actual savings could approach 10%. Note: Design cost savings will increase because actual design can commence several years before letting reducing cost due to escalation, as opposed to Design-Build where design beyond 30% will not commence until contract award.

VE Recommendation No. 12 Design-Bid-Build			IDEA NO. MT-13, MT-12
PERFORMANCE MEASURES **Attributes and Rating Rationale for Recommendation**	**Performance**	**Baseline**	**Recommendation**
Mainline Operations ▪ No change to baseline	Rating	5	5
	Weight	26.2	
	Contribution	131	131
Local Operations ▪ No change to baseline	Rating	5	5
	Weight	26.2	
	Contribution	131	131
Maintainability ▪ No change to baseline	Rating	5	5
	Weight	14.3	
	Contribution	71	71
Construction Impacts ▪ No change to baseline	Rating	5	5
	Weight	7.1	
	Contribution	36	36
Environmental Impacts ▪ No change to baseline	Rating	5	5
	Weight	19.0	
	Contribution	95	95
Project Schedule ▪ Construction letting date will not change, but the design phase can commence years earlier.	Rating	5	5
	Weight	7.1	
	Contribution	36	36
		Total Performance:	**500**	**500**
		Net Change in Performance:		**0%**

This page is left intentionally blank

Analysis of Results

Risk Analysis on Response Strategies

New and innovative approaches inherently carry risk; the team identified the risks associated with these types of VE recommendations and risk response strategies.

To quantify these impacts, the VE recommendations and the response strategies were input into scenario models as opportunities or threats in terms of their likely impact, as well as the probability of the implementation of the recommendation. Risk response strategies were defined and quantified for each of the risks that were not modified by VE recommendations.

At this point, a new cumulative cost curves were generated that represented both the impacts of responding to the risk elements and partially or fully implementing the VE recommendations. By treating the VE recommendations as an opportunity to increase value through performance increases and cost reductions, it was demonstrated that further cost and schedule efficiencies could be obtained for the project.

The S-curves showing these modeled results on the following pages are based upon the following assumptions:

- ***I-35W Transit/Access Only*** includes everything south of 26th Street
- ***I-35W Transit/Access Combined*** includes the I-35W Transit/Access only project and the Chapter 152 bridges and connecting infrastructure

Additional scenarios are discussed in the What if Scenarios section.

I-35W Transit/Access Combined

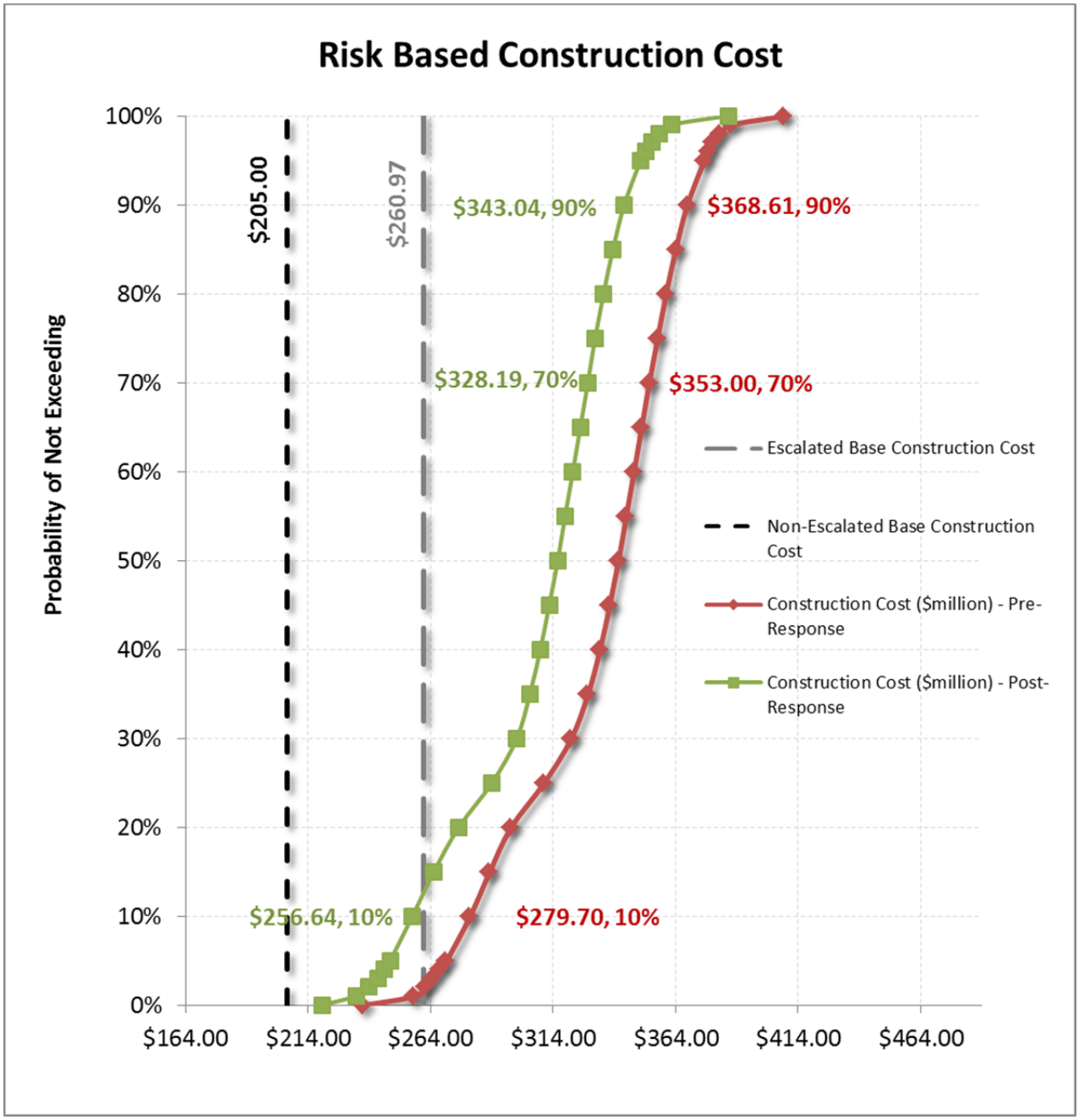


Figure 8-1. I-35W Transit/Access Combined - Construction Cost Results

Prior to value engineering and risk response, the construction costs for I-35W Transit/Access Combined project had a 70 percent chance of being less than $353.00 million YOE. With the VE recommendations and risk response strategies included, this project now has a 70 percent chance of being less than $328.19 million YOE.

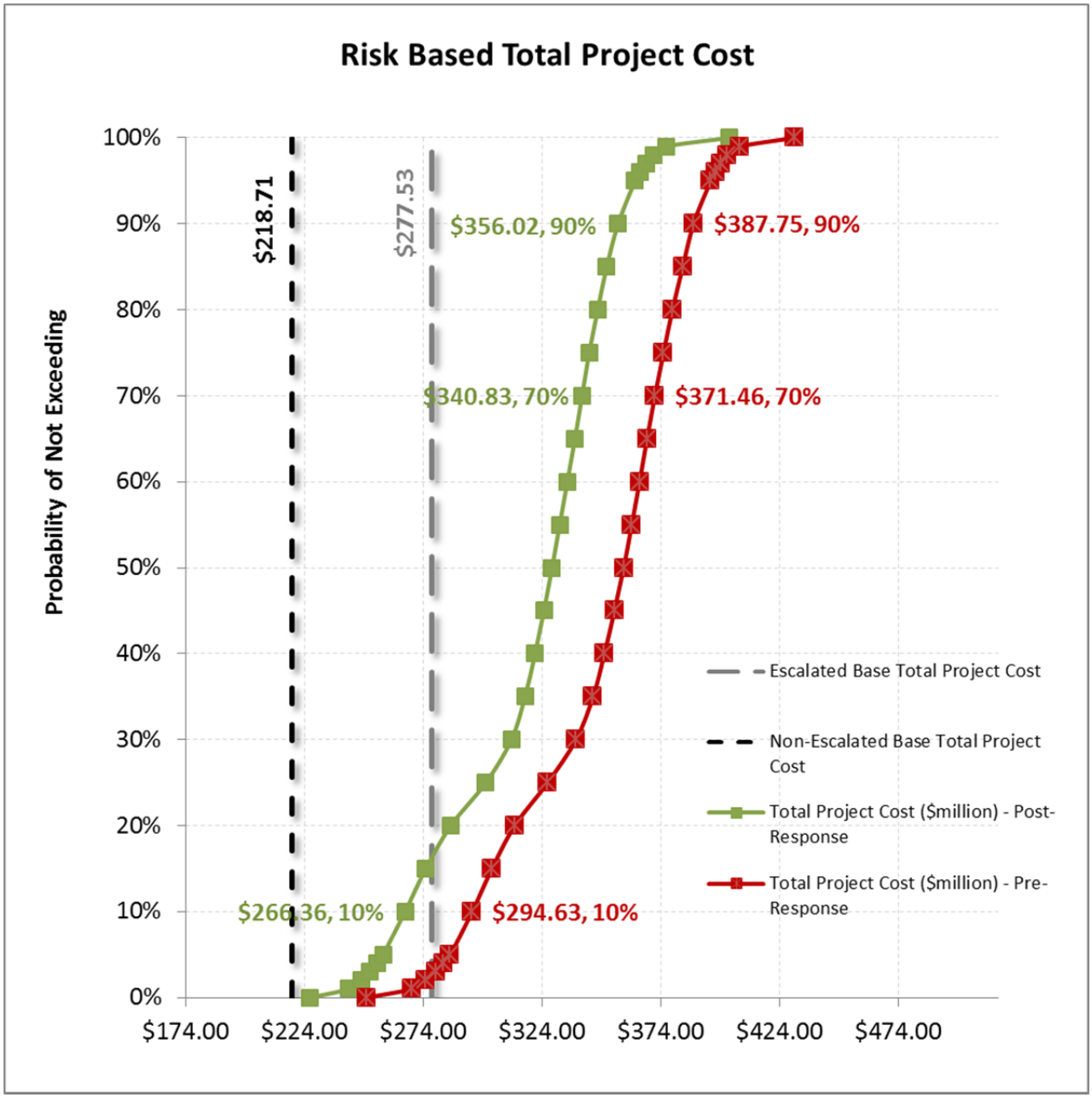


Figure 8-2. I-35W Transit/Access Combined - Total Cost Results

Prior to value engineering and risk response, the total costs for I-35W Transit/Access Combined project had a 70 percent chance of being less than $371.46 million YOE. With the VE recommendations and risk response strategies included, this project now has a 70 percent chance of being less than $340.83 million YOE.

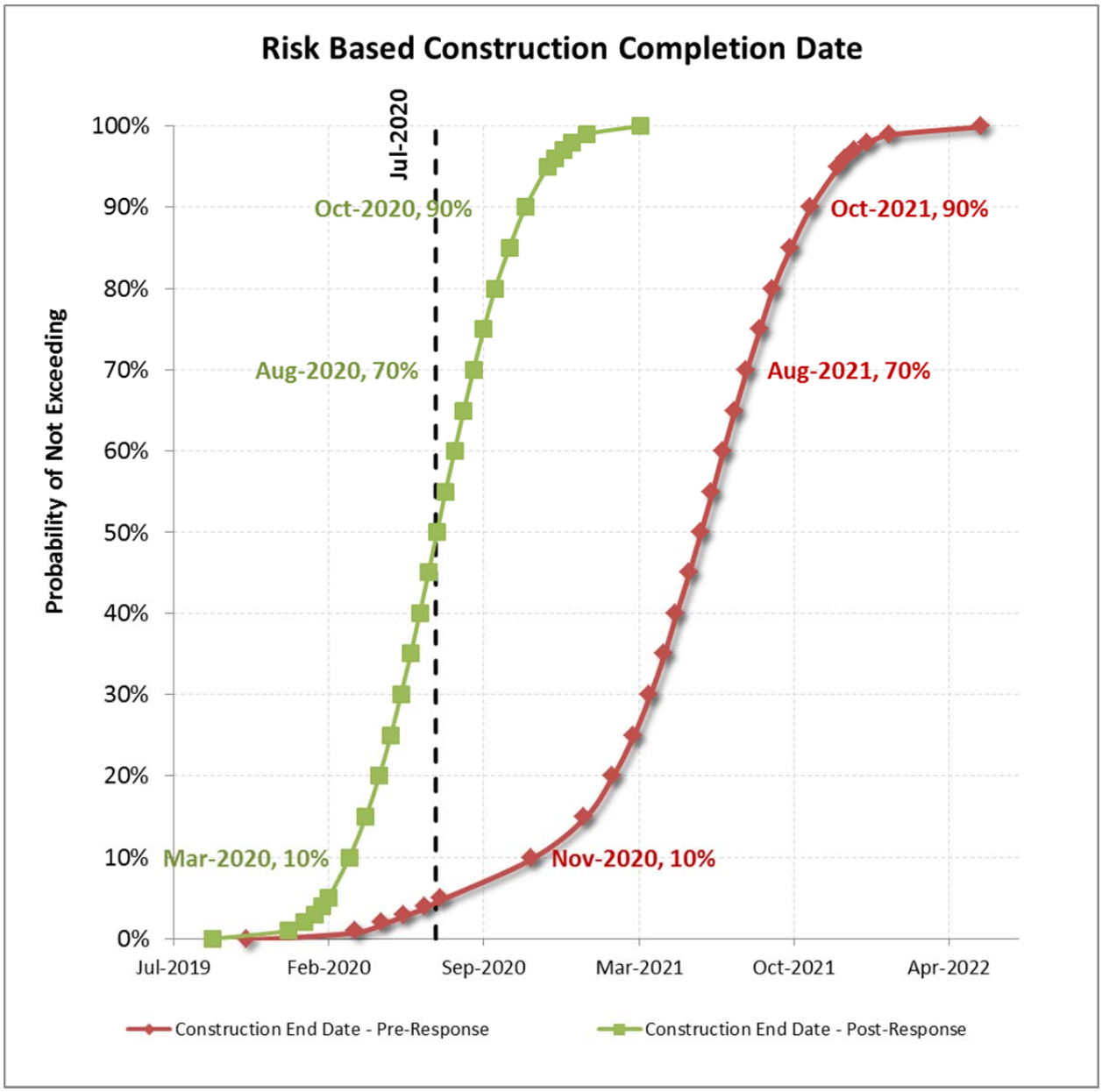


Figure 8-3. I-35W Transit/Access Combined - Construction Completion Results

Prior to value engineering and risk response, I-35W Transit/Access Combined project had a 70 percent chance of being completed prior to August 2021. With the VE recommendations and risk response strategies included, this project now has a 70 percent chance of being completed prior to August 2020.

I-35W Transit/Access Only

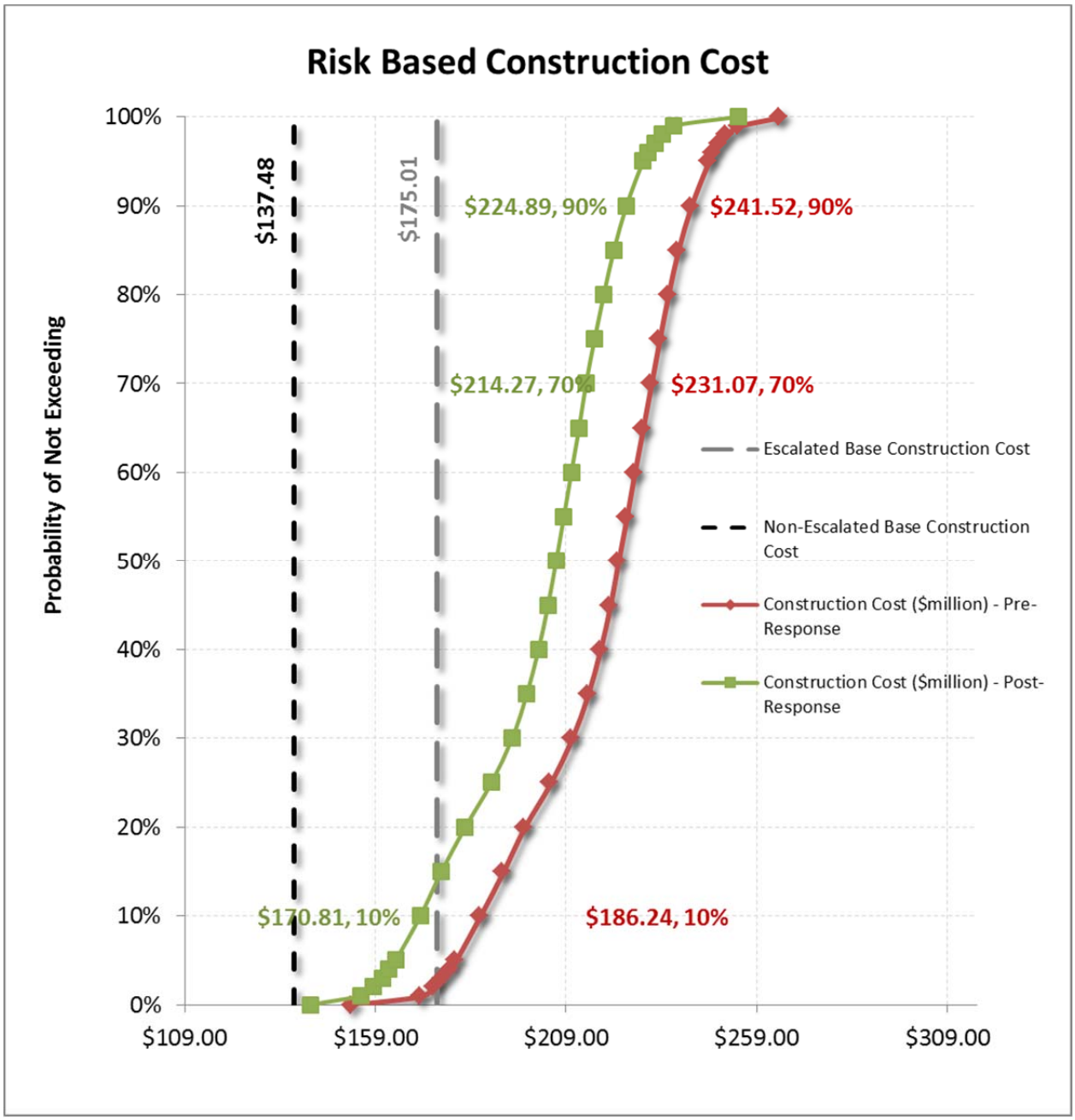


Figure 8-4. I-35W Transit/Access Only - Construction Cost Results

Prior to value engineering and risk response, the construction costs for I-35W Transit/Access Only project had a 70 percent chance of being less than $231.07 million YOE. With the VE recommendations and risk response strategies included, this project now has a 70 percent chance of being less than $214.27 million YOE.

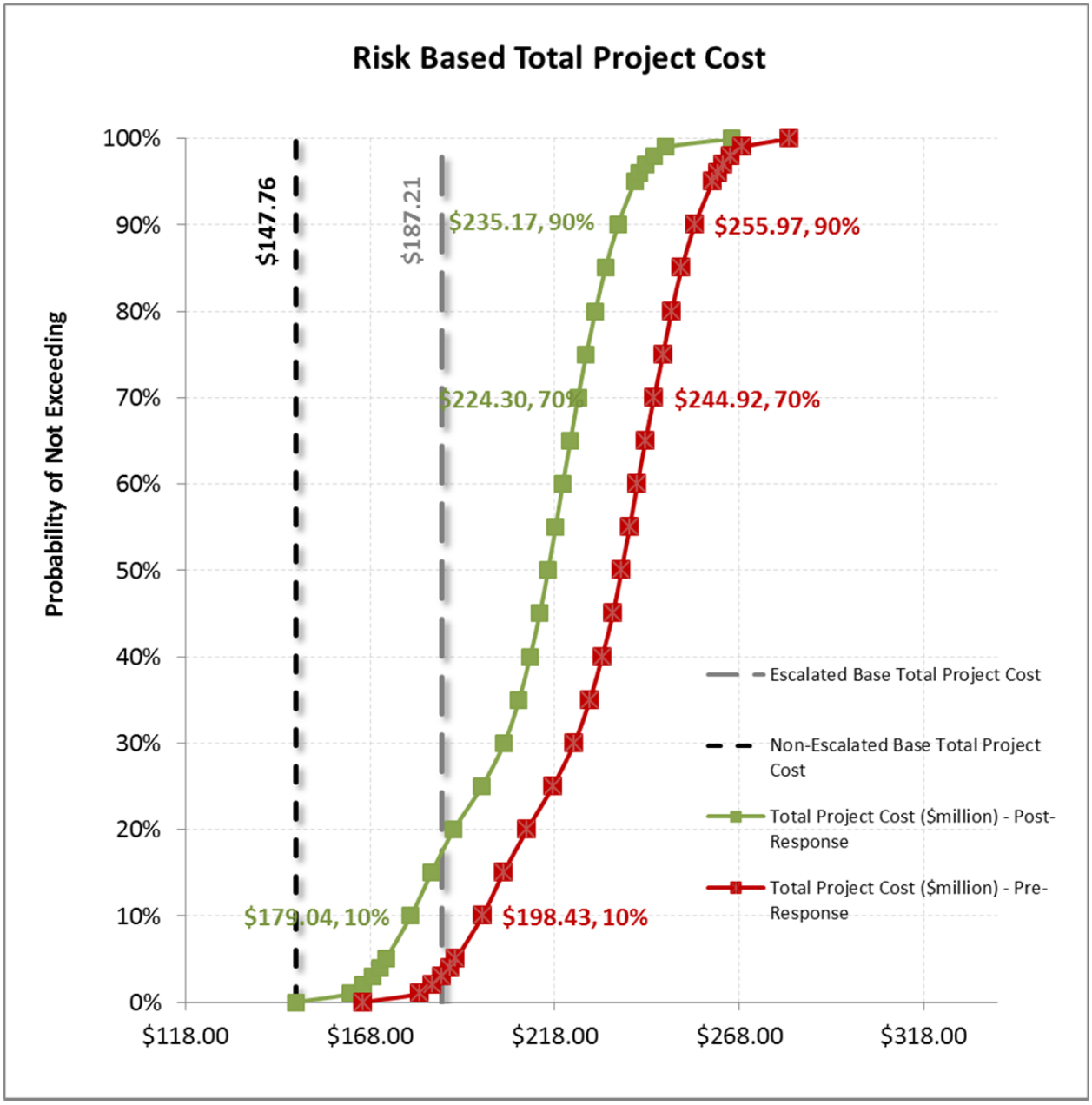


Figure 8-5. I-35W Transit/Access Only - Total Cost Results

Prior to value engineering and risk response, the total costs for I-35W Transit/Access Only project had a 70 percent chance of being less than $244.92 million YOE. With the VE recommendations and risk response strategies included, this project now has a 70 percent chance of being less than $224.30 million YOE.

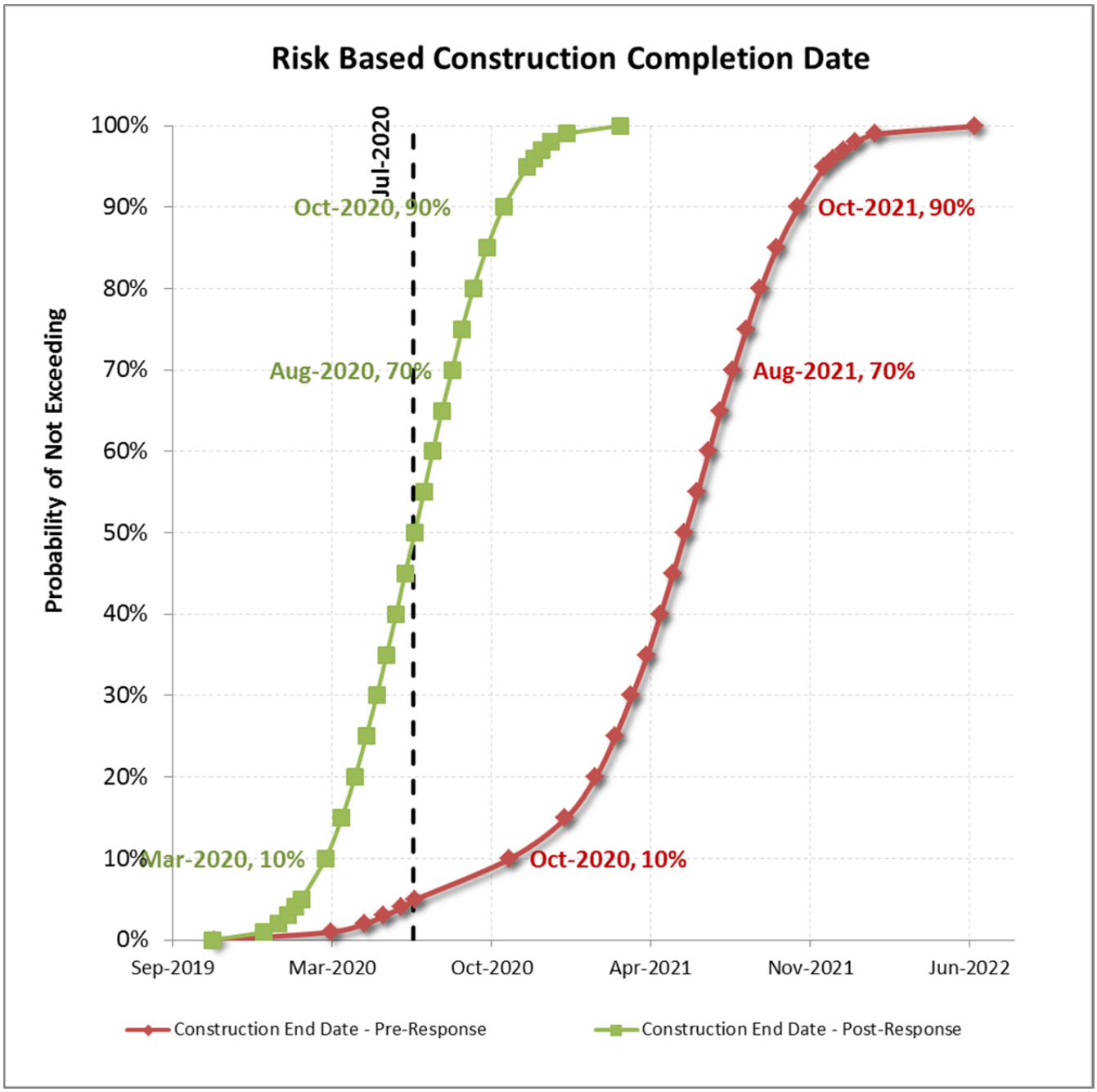


Figure 8-6. I-35W Transit/Access Only - Construction Completion Results

Prior to value engineering and risk response, I-35W Transit/Access Only project had a 70 percent chance of being completed prior to August 2021. With the VE recommendations and risk response strategies included, this project now has a 70 percent chance of being completed prior to August 2020.

Tracking, Monitoring, and Control

The expected value (likelihood multiplied by expected risk outcome) tornado diagrams below depict the actual expected values of the identified risks and help summarize the evolution the project has gone through by engaging in the CRAVE™ process. Not all risks identified require immediate management. Often, a project team needs to prioritize the risks for which it plans to develop strategies in the future in an effort to make the best use of the time available. An example would be to begin with the risks with the highest cost and schedule impacts.

Within the diagrams, the risks have the expected values plotted prior to responding to the risks and implementing the VE recommendations (red bars) and after responding to the risks and implementing VE recommendations at their expected likelihood (green bars).

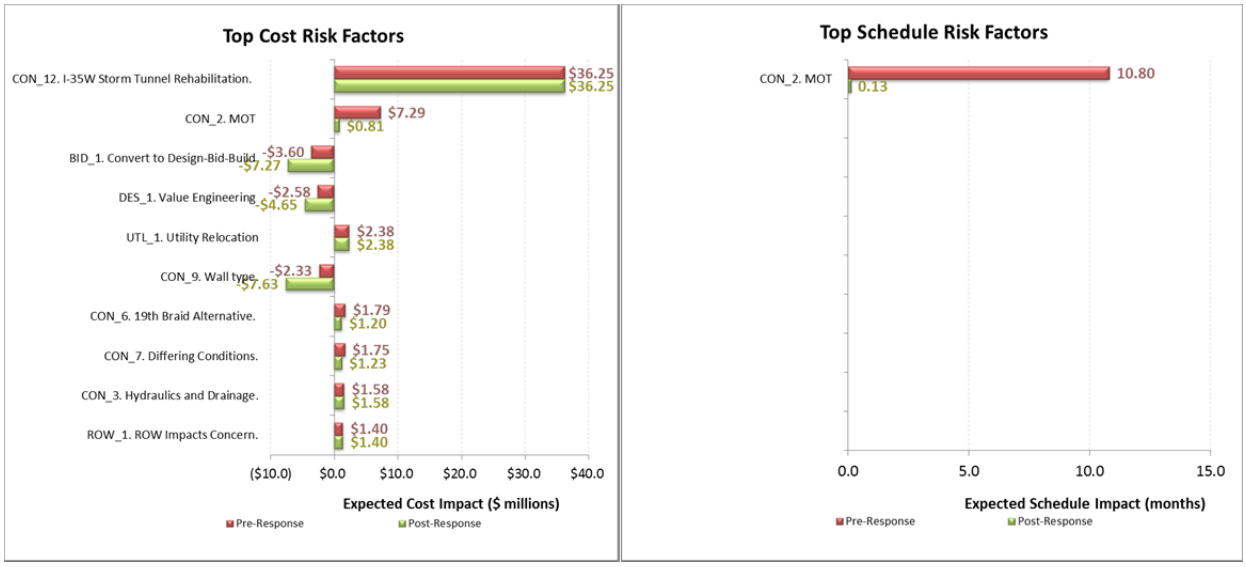


Figure 8-7a. I-35W Transit/Access Combined - Post-Response Tornado Diagrams

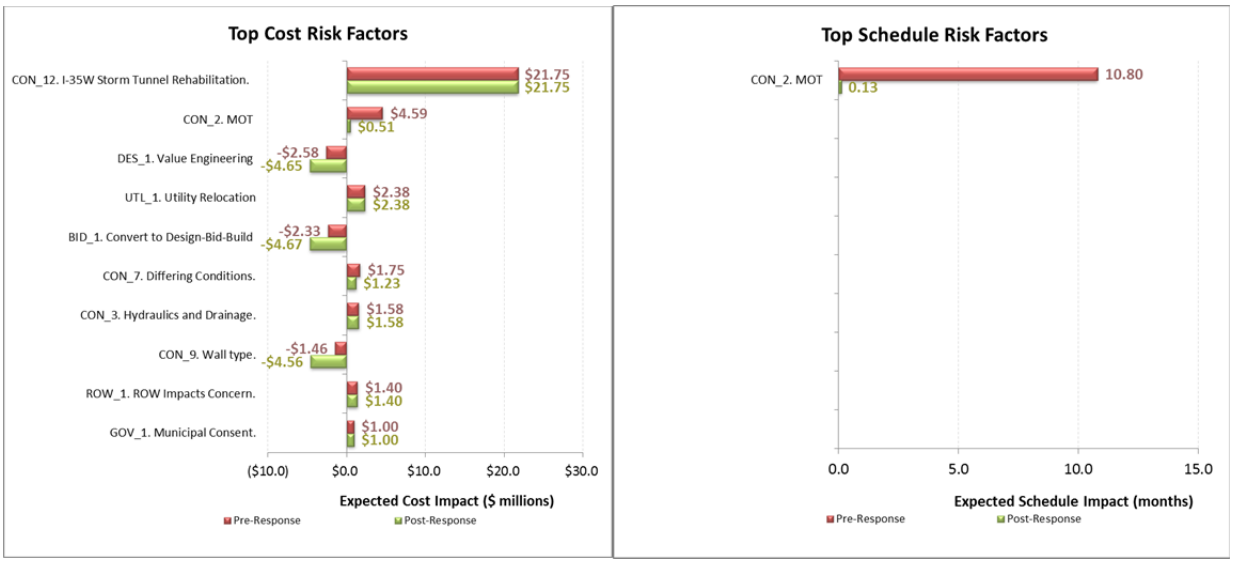


Figure 8-7b. I-35W Transit/Access Only - Post-Response Tornado Diagrams

By engaging in this cost risk analysis process to evaluate the project, the overall expectations of cost and schedule were quantified in relation to identified risks, the associated impacts of those risk elements, the use of a Risk Management Plan to respond to those risk elements, and impacts to the project bottom line of creating value for the project.

Through this process, value can simultaneously be created for the project through the VE portion of the workshop, while risks can be proactively monitored and controlled to reduce potential impacts to the project cost and schedule.

The risk register provided in the Appendix can serve as a risk tracking tool and contains columns for risk response and planning. The project team should assign a "risk owner" to track and record the effectiveness of the strategies and any changes to the project risk profile, as follows:

- Document the response action by describing the action, the work activities it will affect, and the cost of the response action.
- Identify the person(s) responsible for successful implementation of the response action.
- Document whether response actions have a positive or negative effect on achieving project objectives in the Risk Management Plan.
- Consider the time impacts of the response action and how the risk response may affect the overall project and/or other risks.

What If Scenarios

To assist with decisions on how implementation of VE recommendation affects cost and schedule, scenarios were developed and modeled separately.

I-35W Transit/Access Only

- Scenario 1: What if funding is available two years earlier (2015)
- Baseline: (2017)
- Scenario 2: What if funding is delayed for two years (2019)
- Scenario 3: What if funding is delayed for four years (2021)
- Scenario 4: What if funding is delayed for six years (2023)

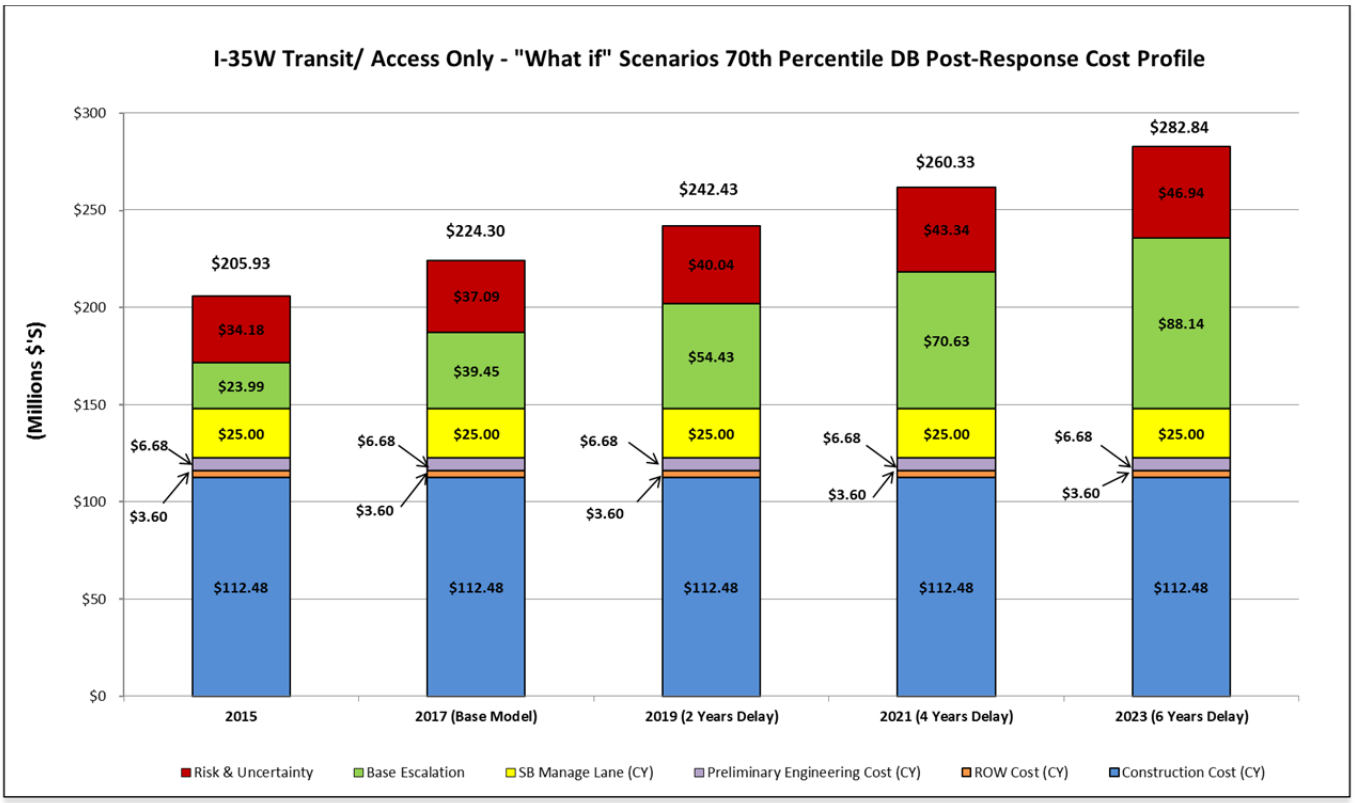


Figure 8-8. Scenario Models

Note: 2017 is considered the base year.

CRAVE™ Process Summary

The cost risk analysis provided an evaluation of the estimated project total cost and schedule and included four major steps.

The first step was to establish a base cost and schedule and then identify and quantify the major risk elements and how they impact cost and schedule. The second step was to identify how to respond to the highest likelihood and impact risk elements. The third step was to quantify the effects of implementation of the risk response strategies. The final step was to quantify the effects on project cost and schedule by implementing the VE recommendations.

The information provided by a CRAVE™ Study gives valuable tools to project managers to help them deliver a successful project on time and within budget. When a multi-disciplined team of experts is assembled in a workshop environment, maximum benefit can be achieved by using this combined cost risk assessment/value engineering process.

This page is left intentionally blank

Appendix

CRAVE™ Process

Step 1: Baseline Risk Assessment

a) Review baseline cost
b) Review baseline schedule
c) Identify risks related to baseline project
d) Assess and quantify risks in terms of project's cost and schedule

Step 2: Value Engineering & Risk Response

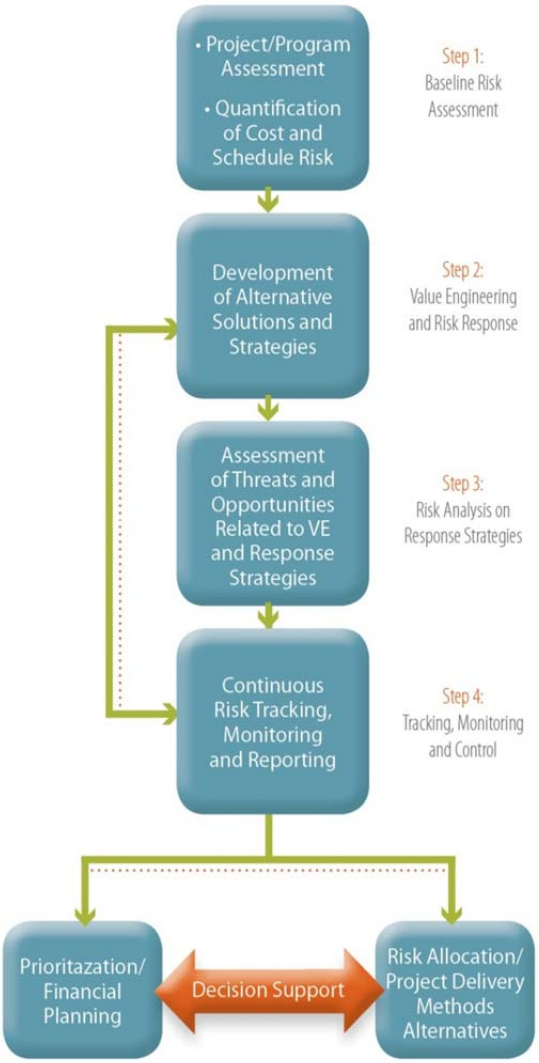
a) Develop value engineering recommendations that further mitigate or avoid high risk elements
b) Develop recommendations that add value by modifying project scope and/or schedule

Step 3: Risk Analysis on Response Strategies

a) Identify risks related to response strategies
b) Assess and quantify threats and opportunities in terms of project's cost and schedule

Step 4: Tracking, Monitoring, and Control

a) Identify risk owners, monitoring frequency
b) Continuously update risk management plan
c) Document and report progress
d) At key milestones, update cost and schedule



Value Engineering Process

Value Engineering (VE) is a systematic process using a multidisciplinary team to improve the value of a project through the analysis of its functions. The VE process incorporates, to the extent possible, the values of design; construction; maintenance; contractor; state, local and federal approval agencies; other stakeholders; and the public.

The primary objective of a VE Study is value improvement. The value improvements might relate to scope definition, functional design, constructability, coordination (both internal and external), or the schedule for project development. Other possible value improvements are reduced environmental impacts, reduced public inconvenience, or reduced project cost.

Pre-VE Study

Prior to the start of a VE Study, the Project Manager, VE Team Leader, and the State VE Coordinator carry out the following three activities:

- Initiate Study
  - Prepare Workshop request
  - Define VE Study scope, objective and goals
  - Define study timing
- Organize Study
  - Conduct Pre-Study meeting
  - Select team members
  - Pre-elicit risks (if applicable)
    - Identify performance attributes (if applicable)
- Prepare Data
  - Collect and distribute data
  - Prepare cost models
  - Prep for study

All of the information gathered prior to the CRAVE™ Study is given to the team members for their use.

Value Engineering Job Plan

The Value Engineering Job Plan was employed in analyzing the project. This process is recommended by SAVE International and is composed of the following phases:

Information - The objective of this phase was to obtain a thorough understanding of the project's design criteria and objectives by reviewing the project's documents and drawings, cost estimates, and schedules.

Functional Analysis - The purpose of this phase was to identify and define the primary and secondary functions of the project. A Functional Analysis System Technique (FAST) was used to quickly define the functions of the project.

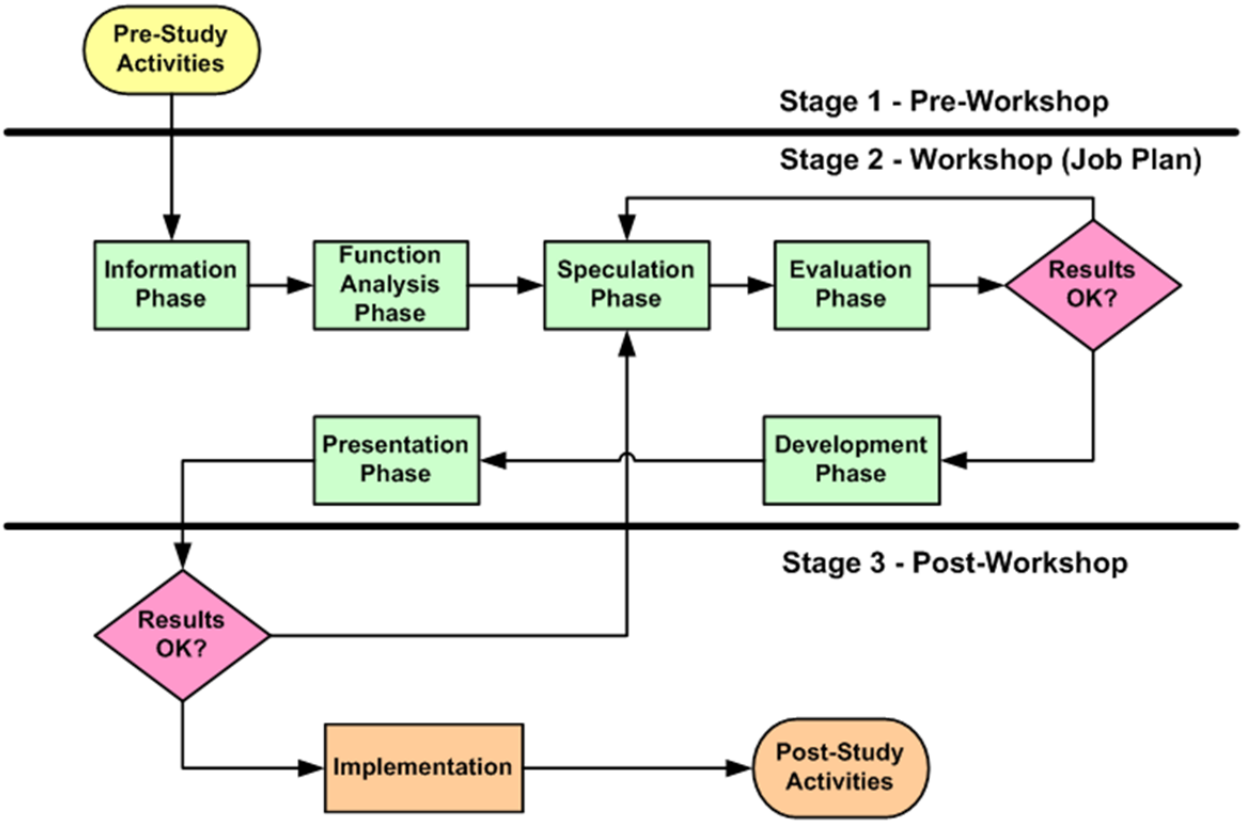
Creative/Speculation - During this phase the team employed creative techniques such as team brainstorming to develop a number of alternative concepts that satisfy the project's primary functions.

Evaluation - The purpose of this phase was to evaluate the alternative concepts developed by the CRAVE™ Team during the brainstorming sessions. The team used a number of tools to determine the qualitative and quantitative merits of each concept.

Development - Those concepts that ranked highest in the evaluation were further developed into VE recommendations. Narratives, drawings, calculations, and cost estimates were prepared for each recommendation.

Presentation - The CRAVE™ Team presented their finding in the form of a written report. In addition, an oral presentation was made to the owner and the design team to discuss the VE recommendations.

Implementation/Resolution - Evaluate, resolve, document and implement all approved recommendations.



Performance Based Results

Using performance attributes process is an integral part of the value engineering process. This process provides the cornerstone of the VE process by providing a systematic and structured means of considering the relationship of a project's performance and cost as they relate to value. Project performance must be properly defined and agreed upon by the stakeholders at the beginning of the value study. The performance attributes and requirements developed are then used throughout the study to identify, evaluate, and document alternatives.

Introduction

The methodology described herein measures project value by correlating the performance of project scope and schedule to the project costs. The objective of this methodology is to prescribe a systematic, structured approach to study and optimize a project's scope, schedule, and cost.

Value engineering has traditionally been perceived as an effective means for reducing project costs. This paradigm only addresses one part of the value equation, oftentimes at the expense of overlooking the role that VE can play with regard to improving project performance. Project costs are fairly easy to

quantify and compare through traditional estimating techniques. Performance is not so easily quantifiable.

The VE Team Leader will lead the team and external stakeholders through the methodology, using the power of the process to distill subjective thought into an objective language that everyone can relate to and understand. The dialog that develops forms the basis for the VE Team understanding of the performance requirements of the project and to what degree the current design concept is meeting those requirements. From this baseline, the VE Team can focus on developing alternative concepts that will quantify both performance and cost and contribute to overall project value.

Performance based value engineering yields the following benefits:

- Builds consensus among project stakeholders (especially those holding conflicting views)
- Develops a better understanding of a project's goals and objectives
- Develops a baseline understanding of how the project is meeting performance goals and objectives
- Identifies areas where project performance can be improved through the VE process
- Develops a better understanding of a VE recommendation's effect on project performance
- Develops an understanding of the relationship between performance and cost in determining value
- Uses value as the true measurement for the basis of selecting the right project or design concept
- Provides decision makers with a means of comparing costs and performance (i.e., costs vs. benefits) in a way that can assist them in making better decisions.

Methodology

The application of performance based value engineering consists of the following steps:

1. Identify key project (scope and delivery) performance attributes and requirements for the project
2. Establish the hierarchy and impact of these attributes upon the project
3. Establish the baseline of the current project performance by evaluating and rating the effectiveness of the current design concepts
4. Identify the change in performance of alternative project concepts generated by the study
5. Measure the aggregate effect of alternative concepts relative to the baseline project's performance as a measure of overall value improvement

The primary goal of value engineering is to improve project value. A simple way to think of value in terms of an equation is as follows:

$$Value = \frac{Performance}{Cost}$$

Assumptions

Before embarking on the details of this methodology some assumptions need to be identified:

- The methodology described in the following steps assumes the project functions are well established. Project functions are "the what" the project delivers to its users and stakeholders; a good reference for the project functions can be found in the environmental document's purpose and need statement. Project functions are generally well defined prior to the start of the value study. In the event that project functions have been substantially modified, the methodology must begin a new from the beginning (Step 1).

Step 1 – Determine the Major Performance Attributes

Performance attributes can generally be divided between Project Scope components (Highway Operations, Environmental Impacts, and System Preservation) and Project Delivery components.

It is important to make a distinction between performance attributes and performance requirements. Performance requirements are mandatory. All performance requirements MUST be met by any idea being considered.

Performance attributes possess a range of acceptable levels of performance. For example, if the project was the design and construction of a new bridge, a performance requirement might be that the bridge must meet all current seismic design criteria. In contrast, a performance attribute might be Project Schedule which means that a wide range of alternatives could be acceptable that had different durations.

The VE Team Leader will initially request that representatives from project team and external stakeholders identify performance attributes that they feel are essential to meeting the overall need and purpose of the project. Usually four to seven attributes are selected. It is important that all potential attributes be thoroughly discussed.

The information that comes out of this discussion will be valuable to both the VE Team and the Project Owner. It is important that the attribute be discretely defined, and they must be quantifiable in some form. By quantifiable, it is meant that a useable scale must be delineated with values given on a scale of 0 to 10. A "0" indicates unacceptable performance, while a "10" indicates optimal or ideal performance. The vast majority of performance attributes that typically appear in transportation value studies have been standardized. This standardized list can be used "as is" or adopted with minor adjustments as required. Every effort should be made to make the ratings as objective as possible.

Step 2 – Determine the Relative Importance of the Attributes

Once the group has agreed upon the project's performance attributes, the next step is to determine their relative importance in relation to each other. This is accomplished through the use of an evaluative tool termed in this report as the "Performance Attribute Matrix."

This matrix compares the performance attributes in pairs, asking the question: "An improvement in which attribute will provide the greatest benefit to the project relative to purpose and need?" A letter code (e.g., "a") is entered into the matrix for each pair, identifying which of the two is more important. If a pair of attributes is considered to be of essentially equal importance, both letters (e.g., "a/b") are entered into the appropriate box. This, however, should be discouraged, as it has been found that in practice a tie usually indicates that the pairs have not been adequately discussed.

When all pairs have been discussed, the number of "votes" for each is tallied and percentages (which will be used as weighted multipliers later in the process) are calculated. It is not uncommon for one attribute to not receive any "votes." If this occurs, the attribute is given a token "vote", as it made the list in the first place and should be given some degree of importance.

Step 3 – Establish the Performance "Baseline" for the Original Design

The next step is to define the baseline as it pertains to each performance attribute. The baseline is then given a score of 5 on a scale of 0 to 10 for each attribute.

Step 4 – Evaluate the Performance of the VE Recommendations

Once the performance of the baseline has been established for the original design concept, it can be used to help the VE Team develop performance ratings for individual VE recommendations as they are developed during the course of the value study. The Performance Measures form at the back of each recommendation is used to capture this information.

It is important to consider the recommendation's impact on the entire project, rather than on discrete components.

Step 5 – Compare the Performance Ratings of Recommendations to the "Baseline" Project

The last step in the process is to develop the performance ratings for the original design concept. The VE Team groups the recommendation into a scenario (or scenarios) to provide the decision makers a clear picture of how the recommendations fit together into possible solutions. At least one scenario is developed to present the VE Team's consensus of what should be implemented. Additional scenarios are developed as necessary to present other combinations to the decision makers that should be considered. The scenario(s) of VE recommendations are rated and compared against the original concept. The performance ratings developed for the VE Scenarios are entered into the matrix, and the summary portion of is completed. The summary provides details on net changes to cost, performance, and value, using the following calculations.

- % Performance Improvement = Δ Performance VE Strategy / Total Performance Original Concept
- Value Index = Total Performance / Total Cost (in Millions)
- % Value Improvement = ΔValue Index VE Strategy / Value Index Original Concept.

Reporting

Following the CRAVE™ Study, the Team Leader assembles all study documentation into the draft/final reports:

- Publish Results – Prepare a draft and a final CRAVE™ Study Report; distribute printed and electronic copies as needed.

The CRAVE™ Study is complete when the report is issued as a record of the CRAVE™ Team's analysis and development work, as well as the project team's implementation dispositions for the recommendations.

Cost Risk Assessment & Value Engineering

I-35W Transit/Access & Chapter 152 Bridges

Project Description

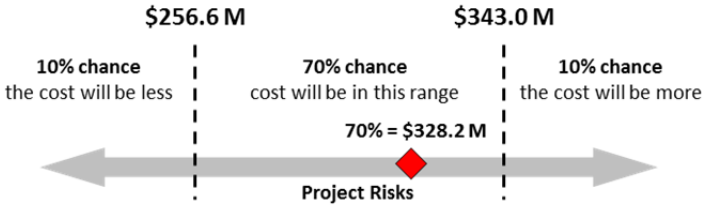
The I-35W Transit/Access Project is being led by Hennepin County in partnership with the City of Minneapolis, Metropolitan Council/Metro Transit, and MnDOT.

The major items of work include a proposed transit station, a pedestrian/bicycle connection between Lake Street and the Midtown Greenway, a design concept for Lake Street, and two new ramps to/from I-35W.

The proposed two-level transit station at Lake Street will provide for transfers between north-south transit service on I-35W and east-west transit service on Lake Street.

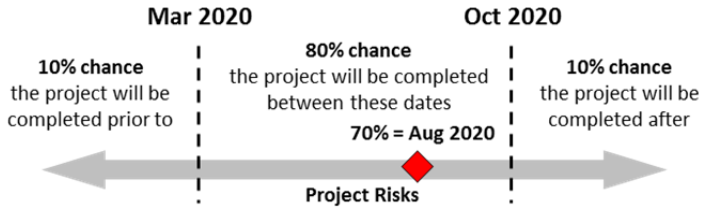
Additional work includes the Chapter 152 bridge project on I-35W. These bridges include the I-35W Braid Bridge and the northbound I-35W to westbound I-94 Flyover Ramp Bridge along with their connecting roadways.

Total Project Cost Range



(opinion of probable construction cost range as of April 2013 CRAVE™)

Project Completion Schedule Range



(opinion of probable construction completion range as of April 2013 CRAVE™)

Goals and Objectives

The goals and objectives of the project are:

- Effectively integrate transit, freeway (mobility), and local access
- Complete the Lake Street area interchange
- Provide community benefit through arterial, collector, and local street improvements
- Meet transit/MnPASS objectives and address freeway system issues
- Create opportunities for the community
- Replace the aging bridges as part of the Chapter 152 program

Key Assumptions

- Project delivery method is Design-Build
- Funding is currently available for preliminary design
- Stay within the right-of-way footprint defined in 2004
- Construction start in July 2017
- Construction duration is 36 months

Key Project Risks

- Maintenance of traffic
- Hydraulics and Drainage
- Freeway Operations
- Noise Walls
- 19th Braid Alternative
- Differing Conditions
- Wall type
- SHPO
- Construction Impacts to Business and Residents
- I-35W Storm Tunnel Rehabilitation
- ROW Impacts Concern
- ROW Portion of 19th Braid Alternative
- Municipal Consent
- Maintenance Issues
- Utility Relocation
- Design-Bid-Build delivery
- Value Engineering

Level of Project Design

Low	Medium	High
■		

April 2013

This page is left intentionally blank

Cost Risk Assessment & Value Engineering

I-35W Transit/Access

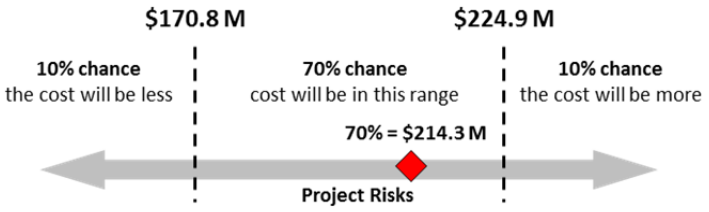
Project Description

The I-35W Transit/Access Project is being led by Hennepin County in partnership with the City of Minneapolis, Metropolitan Council/Metro Transit, and MnDOT.

The major items of work include a proposed transit station, a pedestrian/bicycle connection between Lake Street and the Midtown Greenway, a design concept for Lake Street, and two new ramps to/from I-35W.

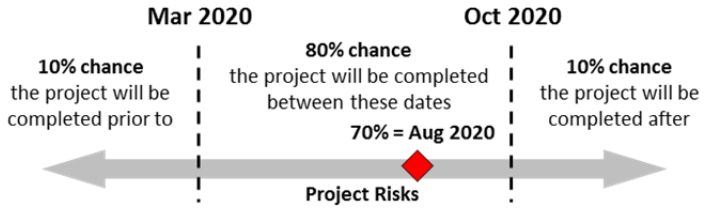
The proposed two-level transit station at Lake Street will provide for transfers between north-south transit service on I-35W and east-west transit service on Lake Street.

Total Project Cost Range



(opinion of probable construction cost range as of April 2013 CRAVE™)

Project Completion Schedule Range



(opinion of probable construction completion range as of April 2013 CRAVE™)

Goals and Objectives

The goals and objectives of the project are:

- Effectively integrate transit, freeway (mobility), and local access
- Complete the Lake Street area interchange
- Provide community benefit through arterial, collector, and local street improvements
- Meet transit/MnPASS objectives and address freeway system issues
- Create opportunities for the community

Key Assumptions

- Project delivery method is Design-Build
- Funding is currently available for preliminary design
- Stay within the right-of-way footprint defined in 2004
- Construction start in July 2017
- Construction duration is 36 months

Key Project Risks

- Maintenance of traffic
- Hydraulics and Drainage
- Freeway Operations
- Noise Walls
- 19th Braid Alternative
- Differing Conditions
- Wall type
- SHPO
- Construction Impacts to Business and Residents
- I-35W Storm Tunnel Rehabilitation
- ROW Impacts Concern
- ROW Portion of 19th Braid Alternative
- Municipal Consent
- Maintenance Issues
- Utility Relocation
- Design-Bid-Build delivery
- Value Engineering

Level of Project Design

Low	Medium	High
■		

April 2013

Minnesota Department of Transportation

This page is left intentionally blank

Value Engineering Recommendation Approval Form

Project: I-35W Transit/Access & Chapter 152 Bridges Project - SP 2782-278

VE Study Date: April 15-19, 2013

	Recommendation	- Accept - Reject - AFR (Accept for further review)	Reason (Or use the pages at the end of this memo)	FHWA Functional Benefit					Estimated Savings ($million)	Added Cost ($million)
				Safety	Operations	Environment	Construction	Other		
1	Active Traffic Management	AFR		x			x			
2	Maintenance of Traffic	AFR*	* AFR with reservations: Added user delay should not exceed 10 minutes; Team will need to consider capacity and lane continuity needed for connections to/from downtown, I-94 & NB 35 north of the mainine merge/diverge point				x		$ 6.50	
3	Retaining Walls	AFR					x	x	$ 15.14	
4	I-35W Braid	AFR			x		x	x		$ 2.12
5	26th & 28th Street Bridges	AFR	2015 construction is questionable due to financing and potential conflict with other capital projects in the area			x	x	x	$ 1.22	
6	Staging I-35W @ Lake Street	Accept					x			
7	Selling Vendor Space	AFR	Subject to City land use review and permitting processes			x				
8	Remove Glass Enclosure	Reject	The Metropolitan Council's adopted Transitway Guidelines and Station and Support Facility Design Guidelines recommend enclosure for a station of this size and use. This is also consistent with the amenity provided at 46th street station and other BRT facilities in the region with Lake Street station projected for significantly greater ridership. The enclosure is important for customer comfort as well since transit customers could spend several minutes waiting in the station. For example, southbound headways can be between 15 and 30 minutes in the PM. The enclosure also provides significant noise abatement from freeway traffic. At the 46th street station the freeway noise level can be greater than 90 decibels. Additionally, the concept has been developed with significant public input and support for the enclosure - not providing it would be a violation of community trust and expectations for the facilty	x			x		$ 4.25	
9	Remove Geothermal Wells	AFR	Long term operating and maintenance costs need to be considered.				x	x	$ 0.36	
10	Additional Main Stairway Handrails	AFR						x		

Value Engineering Recommendation Approval Form

Project: I-35W Transit/Access & Chapter 152 Bridges Project - SP 2782-278
VE Study Date: April 15-19, 2013

	Recommendation	- Accept - Reject - AFR (Accept for further review)	Reason (Or use the pages at the end of this memo)	FHWA Functional Benefit: Safety	Operations	Environment	Construction	Other	Estimated Savings ($million)	Added Cost ($million)
11	Shorten Lake St. Structures	AFR	The baseline concept has been developed and fully vetted with the public and is considered a important element of the project. Project team analysis determined that when substructure and superstructure costs are estimated independently the cost differential (potential savings) is reduced to $310,000 for the shortened bridges rather than $900,000.					x	$ 0.90	
12	Design-Bid-Build	Accept						x	$ 7.07	
			Total for 12 recommendations	2	1	2	8	7	$ 35.44	$ 2.12
			Total for 2 accepted recommendations	0	0	0	1	1	$ 7.07	$ -

Please provide justification if the value engineering study recommendations are **not** approved or are implemented in a modified form.
MnDOT is required to report Value Engineering results annually to FHWA. To facilitate this reporting requirement, a Value Engineering Recommendation Approval Form is included in the Appendix of this report. If the region elects to reject or modify a recommendation, please include a brief explanation of why. Please complete the form and return it to Minnie Milkert, MnDOT State Value Engineer, MS 696

Signature Project manager

7/22/13
Date

Mark R. Dierling
Name (please print)

FHWA Functional Benefit Criteria
Each year, State DOT's are required to report on VE recommendations to FHWA. In addition to cost implications, FHWA requires the DOT's to evaluate each approved

Safety: Recommendations that mitigate or reduce hazards on the facility
Operations: Recommendations that improve real-time service and/or local, corridor, or regional levels of service of the facility.
Environment: Recommendations that successfully avoid or mitigate impacts to natural and or cultural resources.
Construction: Recommendations that improve work zone conditions, or expedite the project delivery.
Other: Recommendations not readily categorized by the above performance indicators.

I-35W Transit/Access Project Only

					Unit Cost					Quantity					Total Cost		
Item	Description	Area	Depth	Unit	Low	Under	Base	Over	High	Low	Under	Base	Over	High	Under	Base	Over
I-35W NB HOT Lane	Southern project Limits to 31st Streeet	10,402	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	2.02	-5%	2.13	5%	2.24	$252,938	$283,290	$313,110
I-35W NB Lanes	Southern project Limits to 31st Streeet	32,898	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	6.40	-5%	6.74	5%	7.08	$800,375	$896,420	$990,780
I-35W NB (28th Street Auxiliary Lane	Southern project Limits to 31st Streeet	10,437	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	2.03	-5%	2.14	5%	2.25	$254,125	$284,620	$314,580
NB Transit Station Pavement	Southern project Limits to 31st Streeet	4,918	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.95	-5%	1.00	5%	1.05	$118,750	$133,000	$147,000
NB I-35W left shoulder	Southern project Limits to 31st Streeet	2,428	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.14	-5%	0.15	5%	0.16	$17,813	$19,950	$22,050
NB I-35W Right Shoulder	Southern project Limits to 31st Streeet	1,278	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.08	-5%	0.08	5%	0.08	$9,500	$10,640	$11,760
NB I-35W Exit Ramp to 31st Street	Southern project Limits to 31st Streeet	11,937	9.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.61	-5%	1.69	5%	1.77	$200,688	$224,770	$248,430
2nc Avenue Pavement	Southern project Limits to 31st Streeet	7,759	6.0	LWD	$125,000	-6%	$133,000	2%	$135,000	0.69	-5%	0.73	5%	0.77	$86,688	$97,090	$103,478
2nd Avenue Shoulder	Southern project Limits to 31st Streeet	2,718	6.0	LWD	$125,000	-6%	$133,000	2%	$135,000	0.24	-5%	0.25	5%	0.26	$29,688	$33,250	$35,438
I-35W SB HOT Lane	Southern project Limits to 31st Streeet	16,524	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	3.22	-5%	3.39	5%	3.56	$402,563	$450,870	$498,330
I-35W SB Lanes	Southern project Limits to 31st Streeet	58,737	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	11.45	-5%	12.05	5%	12.65	$1,430,938	$1,602,650	$1,771,350
SB Transit Station Pavement	Southern project Limits to 31st Streeet	11,102	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	2.16	-5%	2.27	5%	2.38	$269,563	$301,910	$333,690
SB I-35W Right Shoulder	Southern project Limits to 31st Streeet	6,985	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.42	-5%	0.44	5%	0.46	$52,250	$58,520	$64,680
SB I-35W left shoulder	Southern project Limits to 31st Streeet	4,334	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.26	-5%	0.27	5%	0.28	$32,063	$35,910	$39,690
31st Street Entrance Ramp to SB I-35W	Southern project Limits to 31st Streeet	6,277	9.0	LWD	$125,000	-6%	$133,000	2%	$135,000	0.85	-5%	0.89	5%	0.93	$105,688	$118,370	$126,158
Stevens Avenue Pavement	Southern project Limits to 31st Streeet	13,916	6.0	LWD	$125,000	-6%	$133,000	2%	$135,000	1.24	-5%	1.31	5%	1.38	$155,563	$174,230	$185,693
Stevens Avenue Shoulder	Southern project Limits to 31st Streeet	3,313	6.0	LWD	$125,000	-6%	$133,000	2%	$135,000	0.29	-5%	0.31	5%	0.33	$36,813	$41,230	$43,943
31st Street Pavement		18,281	6.0	LWD	$125,000	-6%	$133,000	2%	$135,000	1.64	-5%	1.73	5%	1.82	$205,438	$230,090	$245,228
31st Street Shoulder		2,272	6.0	LWD	$125,000	-6%	$133,000	2%	$135,000	0.20	-5%	0.21	5%	0.22	$24,938	$27,930	$29,768
I-35W NB HOT Lane	31st Street to Lake Street	6,832	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.33	-5%	1.40	5%	1.47	$166,250	$186,200	$205,800
I-35W NB Lanes	31st Street to Lake Street	20,505	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	3.99	-5%	4.20	5%	4.41	$498,750	$558,600	$617,400
I-35W NB (28th Street Auxiliary Lane	31st Street to Lake Street	5,128	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.00	-5%	1.05	5%	1.10	$124,688	$139,650	$154,350
NB Transit Station Pavement	31st Street to Lake Street	6,868	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.33	-5%	1.40	5%	1.47	$166,250	$186,200	$205,800
NB Transit Station left shoulder	31st Street to Lake Street	5	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.00	-5%	0.00	5%	0.00	$0	$0	$0
NB Transit Station Right Shoulder	31st Street to Lake Street	6,568	7.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.68	-5%	0.72	5%	0.76	$85,500	$95,760	$105,840
NB I-35W left shoulder	31st Street to Lake Street	1,708	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.10	-5%	0.10	5%	0.11	$11,875	$13,300	$14,700
NB I-35W Right Shoulder	31st Street to Lake Street	855	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.05	-5%	0.05	5%	0.05	$5,938	$6,650	$7,350
2nc Avenue Pavement	31st Street to Lake Street	15,465	6.0	LWD	$125,000	-6%	$133,000	2%	$135,000	1.39	-5%	1.46	5%	1.53	$173,375	$194,180	$206,955
2nd Avenue Shoulder	31st Street to Lake Street	2,758	6.0	LWD	$125,000	-6%	$133,000	2%	$135,000	0.25	-5%	0.26	5%	0.27	$30,875	$34,580	$36,855
I-35W SB HOT Lane	31st Street to Lake Street	6,825	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.33	-5%	1.40	5%	1.47	$166,250	$186,200	$205,800
I-35W SB Lanes	31st Street to Lake Street	20,466	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	3.98	-5%	4.19	5%	4.40	$497,563	$557,270	$615,930
SB Transit Station Pavement	31st Street to Lake Street	6,868	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.33	-5%	1.40	5%	1.47	$166,250	$186,200	$205,800
SB Transit Station left shoulder	31st Street to Lake Street	1,394	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.08	-5%	0.08	5%	0.08	$9,500	$10,640	$11,760
SB Transit Station Right Shoulder	31st Street to Lake Street	5,639	7.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.59	-5%	0.62	5%	0.65	$73,625	$82,460	$91,140
SB I-35W Right Shoulder	31st Street to Lake Street	3,314	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.19	-5%	0.20	5%	0.21	$23,750	$26,600	$29,400
SB I-35W left shoulder	31st Street to Lake Street	2,133	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.12	-5%	0.13	5%	0.14	$15,438	$17,290	$19,110
Stevens Avenue Pavement	31st Street to Lake Street	15,931	6.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.43	-5%	1.50	5%	1.58	$178,125	$199,500	$220,500
Stevens Avenue Shoulder	31st Street to Lake Street	2,155	6.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.19	-5%	0.20	5%	0.21	$23,750	$26,600	$29,400
Lake Street Pavement		70,923	6.0	LWD	$125,000	-6%	$133,000	5%	$140,000	6.37	-5%	6.71	5%	7.05	$796,813	$892,430	$986,370
I-35W NB HOT Lane	Lake Street to Midtown Greenway	7,966	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.55	-5%	1.63	5%	1.71	$193,563	$216,790	$239,610
I-35W NB Lanes	Lake Street to Midtown Greenway	23,903	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	4.66	-5%	4.90	5%	5.15	$581,875	$651,700	$720,300
I-35W NB (28th Street Auxiliary Lane	Lake Street to Midtown Greenway	9,120	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.78	-5%	1.87	5%	1.96	$222,063	$248,710	$274,890
NB Transit Station Pavement	Lake Street to Midtown Greenway	7,991	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.55	-5%	1.63	5%	1.71	$193,563	$216,790	$239,610
NB Transit Station left shoulder	Lake Street to Midtown Greenway	0	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.00	-5%	0.00	5%	0.00	$0	$0	$0
NB Transit Station Right Shoulder	Lake Street to Midtown Greenway	6,323	7.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.66	-5%	0.69	5%	0.72	$81,938	$91,770	$101,430

I-35W Transit/Access Project Only

					Unit Cost					Quantity					Total Cost		
Item	Description	Area	Depth	Unit	Low	Under	Base	Over	High	Low	Under	Base	Over	High	Under	Base	Over
NB I-35W left shoulder	Lake Street to Midtown Greenway	1,967	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.11	-5%	0.12	5%	0.13	$14,250	$15,960	$17,640
NB I-35W Right Shoulder	Lake Street to Midtown Greenway	414	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.02	-5%	0.02	5%	0.02	$2,375	$2,660	$2,940
2nc Avenue Pavement	Lake Street to Midtown Greenway	12,116	6.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.08	-5%	1.14	5%	1.20	$135,375	$151,620	$167,580
2nd Avenue Shoulder	Lake Street to Midtown Greenway	4,225	6.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.38	-5%	0.40	5%	0.42	$47,500	$53,200	$58,800
I-35W SB HOT Lane	Lake Street to Midtown Greenway	8,012	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.56	-5%	1.64	5%	1.72	$194,750	$218,120	$241,080
I-35W SB Lanes	Lake Street to Midtown Greenway	24,028	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	4.67	-5%	4.92	5%	5.17	$584,250	$654,360	$723,240
SB Transit Station Pavement	Lake Street to Midtown Greenway	8,033	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.56	-5%	1.64	5%	1.72	$194,750	$218,120	$241,080
SB Transit Station Right Shoulder	Lake Street to Midtown Greenway	4,087	7.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.43	-5%	0.45	5%	0.47	$53,438	$59,850	$66,150
SB I-35W Right Shoulder	Lake Street to Midtown Greenway	2,002	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.11	-5%	0.12	5%	0.13	$14,250	$15,960	$17,640
SB I-35W left shoulder	Lake Street to Midtown Greenway	5,282	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.31	-5%	0.33	5%	0.35	$39,188	$43,890	$48,510
Stevens Avenue Pavement	Lake Street to Midtown Greenway	18,872	6.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.69	-5%	1.78	5%	1.87	$211,375	$236,740	$261,660
Stevens Avenue Shoulder	Lake Street to Midtown Greenway	1,839	6.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.16	-5%	0.17	5%	0.18	$20,188	$22,610	$24,990
I-35W NB HOT Lane	Midtown Greenway to Limits of Transit/Access I	32,559	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	6.35	-5%	6.68	5%	7.01	$793,250	$888,440	$981,960
I-35W NB Lanes	Midtown Greenway to Limits of Transit/Access I	96,849	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	18.88	-5%	19.87	5%	20.86	$2,359,563	$2,642,710	$2,920,890
NB Transit Station Pavement	Midtown Greenway to Limits of Transit/Access I	10,198	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.99	-5%	2.09	5%	2.19	$248,188	$277,970	$307,230
NB I-35W Right Shoulder	Midtown Greenway to Limits of Transit/Access I	16,020	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.96	-5%	1.01	5%	1.06	$119,938	$134,330	$148,470
NB I-35W left shoulder	Midtown Greenway to Limits of Transit/Access I	22,558	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.35	-5%	1.42	5%	1.49	$168,625	$188,860	$208,740
I-35W SB HOT Lane	Midtown Greenway to Limits of Transit/Access I	33,182	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	6.46	-5%	6.80	5%	7.14	$807,500	$904,400	$999,600
I-35W SB Lanes	Midtown Greenway to Limits of Transit/Access I	97,916	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	19.09	-5%	20.09	5%	21.09	$2,385,688	$2,671,970	$2,953,230
SB Transit Station Pavement	Midtown Greenway to Limits of Transit/Access I	5,489	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.06	-5%	1.12	5%	1.18	$133,000	$148,960	$164,640
SB I-35W Right Shoulder	Midtown Greenway to Limits of Transit/Access I	5,844	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.34	-5%	0.36	5%	0.38	$42,750	$47,880	$52,920
SB I-35W left shoulder	Midtown Greenway to Limits of Transit/Access I	21,159	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.26	-5%	1.33	5%	1.40	$157,938	$176,890	$195,510
I-35W SB Auxiliary Lane	Midtown Greenway to Limits of Transit/Access I	22,464	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	4.37	-5%	4.60	5%	4.83	$546,250	$611,800	$676,200
28th Street Exit Ramp from NB I-35W Pavemen	Midtown Greenway to Limits of Transit/Access I	15,574	9.0	LWD	$125,000	-6%	$133,000	5%	$140,000	2.10	-5%	2.21	5%	2.32	$262,438	$293,930	$324,870
28th Street Exit Ramp from NB I-35W Right Shl	Midtown Greenway to Limits of Transit/Access I	587	9.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.08	-5%	0.08	5%	0.08	$9,500	$10,640	$11,760
28th Street Exit Ramp from NB I-35W Left Shsl	Midtown Greenway to Limits of Transit/Access I	1,904	9.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.26	-5%	0.27	5%	0.28	$32,063	$35,910	$39,690
Wells Fargo Access		3,854	6.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.34	-5%	0.36	5%	0.38	$42,750	$47,880	$52,920
SB I-35W Exit Ramp to Lake Street Pavement	Midtown Greenway to Limits of Transit/Access I	6,710	9.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.90	-5%	0.95	5%	1.00	$112,813	$126,350	$139,650
SB I-35W Exit Ramp to Lake Street Right Shoul	Midtown Greenway to Limits of Transit/Access I	1,823	9.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.24	-5%	0.25	5%	0.26	$29,688	$33,250	$36,750
SB I-35W Exit Ramp to Lake Street Left Should	Midtown Greenway to Limits of Transit/Access I	596	9.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.08	-5%	0.08	5%	0.08	$9,500	$10,640	$11,760
Stevens Avenue Pavement	Midtown Greenway to Limits of Transit/Access I	716	6.0	LWD	$125,000	-6%	$133,000	2%	$135,000	0.06	-5%	0.06	5%	0.06	$7,125	$7,980	$8,505
Stevens Avenue Right Shoulder	Midtown Greenway to Limits of Transit/Access I	263	6.0	LWD	$125,000	-6%	$133,000	2%	$135,000	0.02	-5%	0.02	5%	0.02	$2,375	$2,660	$2,835
Stevens Avenue Left Shoulder	Midtown Greenway to Limits of Transit/Access I	464	6.0	LWD	$125,000	-6%	$133,000	2%	$135,000	0.04	-5%	0.04	5%	0.04	$4,750	$5,320	$5,670
Alley	Midtown Greenway to Limits of Transit/Access I	2,350	6.0	LWD	$125,000	-6%	$133,000	2%	$135,000	0.21	-5%	0.22	5%	0.23	$26,125	$29,260	$31,185
28th Street Pavement	Midtown Greenway to Limits of Transit/Access I	30,558	6.0	LWD	$125,000	-6%	$133,000	2%	$135,000	2.75	-5%	2.89	5%	3.03	$343,188	$384,370	$409,658
3rd Avenue South	Midtown Greenway to Limits of Transit/Access I	13,676	6.0	LWD	$125,000	-6%	$133,000	2%	$135,000	1.23	-5%	1.29	5%	1.35	$153,188	$171,570	$182,858
Clinton Ave. Pavement	Midtown Greenway to Limits of Transit/Access I	4,905	6.0	LWD	$125,000	-6%	$133,000	2%	$135,000	0.44	-5%	0.46	5%	0.48	$54,625	$61,180	$65,205
I-35W SB Auxiliary Lane	From 26th to 94 Commons	66,783	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	13.02	-5%	13.70	5%	14.39	$1,626,875	$1,822,100	$2,013,900
		Length	Width														
I-35W over 31st. Street (Removal)	Bridge	128.6	141.3	SF	$10	0%	$10	200%	$30	18,171	0%	18,171	0%	18,171	$181,712	$181,712	$545,135
I-35W over Lake Street (Removal)	Bridge	144.7	166.4	SF	$10	0%	$10	200%	$30	24,071	0%	24,071	0%	24,071	$240,708	$240,708	$722,125
I-35W over Midtown Greenway (Removal)	Bridge	174.8	140.1	SF	$10	0%	$10	200%	$30	24,489	0%	24,489	0%	24,489	$244,895	$244,895	$734,684
28th Street over I-35W (Removal)	Bridge	249.8	56.6	SF	$10	0%	$10	200%	$30	14,139	0%	14,139	0%	14,139	$141,387	$141,387	$424,160

I-35W Transit/Access Project Only

					Unit Cost					Quantity					Total Cost		
Item	Description	Area	Depth	Unit	Low	Under	Base	Over	High	Low	Under	Base	Over	High	Under	Base	Over
I-35W over 31st Street	Bridge - Precast conc girder			SF	$200	-7%	$215	7%	$230	20,182	-5%	21,244	5%	22,306	$4,036,360	$4,567,460	$5,130,426
I-35W over Lake Street NB	Bridge - Precast conc girder			SF	$135	-7%	$145	10%	$160	26,273	-5%	27,656	5%	29,039	$3,546,882	$4,010,120	$4,646,208
I-35W over Lake Street SB	Bridge - Precast conc girder			SF	$150	-14%	$175	14%	$200	22,968	-5%	24,177	5%	25,386	$3,445,223	$4,230,975	$5,077,170
I-35W over Lake Street Transit	Bridge - Concrete box girder			SF	$250	-9%	$275	9%	$300	20,835	-5%	21,932	5%	23,029	$5,208,850	$6,031,300	$6,908,580
I-35W NB over Midtown Greenway	Bridge - Precast conc girder			SF	$200	-13%	$230	9%	$250	11,980	-5%	12,610	5%	13,241	$2,395,900	$2,900,300	$3,310,125
I-35W SB over Midtown Greenway	Bridge - Precast conc girder			SF	$200	-13%	$230	9%	$250	9,132	-5%	9,613	5%	10,094	$1,826,470	$2,210,990	$2,523,413
SB Exit Ramp over Midtown Greenway	Bridge - Precast conc girder			SF	$175	-10%	$195	8%	$210	3,963	-5%	4,172	5%	4,381	$693,595	$813,540	$919,926
Stevens Avenue over Midtown Greenway	Bridge - Precast conc girder			SF	$135	-10%	$150	7%	$160	0	-5%	0	5%	0	$0	$0	$0
SB Exit ramp over TH 65 (a portion of the braid	Bridge - Precast conc girder			SF	$150	-14%	$175	14%	$200	3,658	-5%	3,851	5%	4,044	$548,768	$673,925	$808,710
28th Street over I-35W	Bridge - Precast conc girder			SF	$175	-10%	$195	8%	$210	17,969	-5%	18,915	5%	19,861	$3,144,619	$3,688,425	$4,170,758
Drainage	Above normal project needs			LS	$8,800,000	-10%	$9,800,000	10%	$10,800,000	1	0%	1	0%	1	$8,800,000	$9,800,000	$10,800,000
Roadway Lighting	1 mile * $200,000/ mile + 2 interchanges * $$200,000/interchange)			LS	$550,000	-8%	$600,000	17%	$700,000	1	0%	1	0%	1	$550,000	$600,000	$700,000
Signal Systems	5 Signals at $250,000/signal			EA	$225,000	-10%	$250,000	10%	$275,000	5	0%	5	0%	5	$1,125,000	$1,250,000	$1,375,000
Transit Station				LS	$9,000,000	-10%	$10,000,000	10%	$11,000,000	1	0%	1	0%	1	$9,000,000	$10,000,000	$11,000,000
Green Crescent				LS	$2,750,000	-8%	$3,000,000	8%	$3,250,000	1	0%	1	0%	1	$2,750,000	$3,000,000	$3,250,000
		Height	Length														
Noise Wall	SB I-35W south of 31st Street (354 LF * 20 LF *	20	354		$20	0%	$20	25%	$25	7,080	0%	7,080	0%	7,080	$141,600	$141,600	$177,000
Noise Wall	SB I-35W from Greenway to 28th Street (585 LF	20	585		$20	0%	$20	25%	$25	11,700	0%	11,700	0%	11,700	$234,000	$234,000	$292,500
Noise Wall	SB I-35W from 28th Street Bridge to North (146	20	1466		$20	0%	$20	25%	$25	29,320	0%	29,320	0%	29,320	$586,400	$586,400	$733,000
Retaining Wall	NB Right from Southern Limits to 31st Street Br	16	411		$80	-6%	$85	6%	$90	6,247	-5%	6,576	5%	6,905	$499,776	$558,960	$621,432
Retaining Wall	SB Right from Southern Limits to 31st Street Br	14	354		$80	-6%	$85	6%	$90	4,708	-5%	4,956	5%	5,204	$376,656	$421,260	$468,342
Retaining Wall	NB Right from 31st Street to Lake Street (410 L	22	410		$80	-6%	$85	6%	$90	8,569	-5%	9,020	5%	9,471	$685,520	$766,700	$852,390
Retaining Wall	SB Right from 31st Street to Lake Street (409 L	22	409		$80	-6%	$85	6%	$90	8,548	-5%	8,998	5%	9,448	$683,848	$764,830	$850,311
Retaining Wall	Transit Station Right South Side of Lake Street	8	136		$80	-6%	$85	6%	$90	1,034	-5%	1,088	5%	1,142	$82,688	$92,480	$102,816
Retaining Wall	Transit Station Left South Side of Lake Street (	8	91		$80	-6%	$85	6%	$90	692	-5%	728	5%	764	$55,328	$61,880	$68,796
Retaining Wall	SB I-35W Exit Ramp to Lake Street (300 LF * 1	18	300		$80	-6%	$85	6%	$90	5,130	-5%	5,400	5%	5,670	$410,400	$459,000	$510,300
Retaining Wall	SB I-35W between Lake Street and Midtown Gr	28	482		$80	-6%	$85	6%	$90	12,821	-5%	13,496	5%	14,171	$1,025,696	$1,147,160	$1,275,372
Retaining Wall	Transit Station Right North Side of Lake Street	8	207		$80	-6%	$85	6%	$90	1,573	-5%	1,656	5%	1,739	$125,856	$140,760	$156,492
Retaining Wall	Transit Station Left North Side of Lake Street (	8	224		$80	-6%	$85	6%	$90	1,702	-5%	1,792	5%	1,882	$136,192	$152,320	$169,344
Retaining Wall	NB I-35W between Lake Street and Midtown Gr	16	483		$80	-6%	$85	6%	$90	7,342	-5%	7,728	5%	8,114	$587,328	$656,880	$730,296
Retaining Wall	SB I-35W Exit Ramp North of Greenway (270 L	7	270		$80	-6%	$85	6%	$90	1,796	-5%	1,890	5%	1,985	$143,640	$160,650	$178,605
Retaining Wall	NB I-35W Exit Ramp to 28th Street Left (457 LI	18	457		$80	-6%	$85	6%	$90	7,815	-5%	8,226	5%	8,637	$625,176	$699,210	$777,357
Retaining Wall	NB I-35W Exit Ramp to 28th Street Right (323 L	12	323		$80	-6%	$85	6%	$90	3,682	-5%	3,876	5%	4,070	$294,576	$329,460	$366,282
Retaining Wall	SW quadrant of 28th Street and I-35W (67 LF *	16	67		$80	-6%	$85	6%	$90	1,018	-5%	1,072	5%	1,126	$81,472	$91,120	$101,304
Retaining Wall	NB I-35W Right from 28th Street Bridge North (	15	1487		$80	-6%	$85	6%	$90	21,190	-5%	22,305	5%	23,420	$1,695,180	$1,895,925	$2,107,823
Retaining Wall	SB I-35W Right from 28th Street Bridge North (	20	1466		$80	-6%	$85	6%	$90	27,854	-5%	29,320	5%	30,786	$2,228,320	$2,492,200	$2,770,740
TMS - Traffic Management System	TMS Special ILCS ($1,500,000/mile * 0.9 Miles)		0.9		$1,250,000	-17%	$1,500,000	17%	$1,750,000	0.9	0%	0.9	0%	0.9	$1,125,000	$1,350,000	$1,575,000
TMS - Traffic Management System	TMS Regular ($300,000/mile *0.9 miles)		0.9		$275,000	-8%	$300,000	8%	$325,000	0.9	0%	0.9	0%	0.9	$247,500	$270,000	$292,500

I-35W Transit/Access Project Only

					Unit Cost					Quantity					Total Cost		
Item	Description	Area	Depth	Unit	Low	Under	Base	Over	High	Low	Under	Base	Over	High	Under	Base	Over
Median Barrier	Southern Project Limits to 31st Street (708 LF. * $69.00/LF)		708		$60	-13%	$69	9%	$75	708	0%	708	0%	708	$42,480	$48,852	$53,100
Median Barrier	31st Street to Lake Street (1212 LF * $69.00/LF)		1212		$60	-13%	$69	9%	$75	1,212	0%	1,212	0%	1,212	$72,720	$83,628	$90,900
Median Barrier	Lake Street to Midtown Greenway (1432 LF * $69.00/LF)		1432		$60	-13%	$69	9%	$75	1,432	0%	1,432	0%	1,432	$85,920	$98,808	$107,400
Median Barrier	Midtown Greenway to 26th Street (2315 LF * $69.00/LF)		2315		$60	-13%	$69	9%	$75	2,315	0%	2,315	0%	2,315	$138,900	$159,735	$173,625
														Sub Total #1	**$81,257,852**	**$91,930,705**	**$104,538,615**
														Project Uncertainty	**-11.6%**		**13.7%**
Miscellaneous Item Allowance															$0	$0	$0
														Subtotal #2	**$81,257,852**	**$91,930,705**	**$104,538,615**
Mobilization	For non Roadway Items											5%			$3,014,627	$3,422,478	$3,932,472
														Subtotal #3	**$84,272,479**	**$95,353,183**	**$108,471,087**
Preliminary Engineering	Up to NTP											6%			$5,056,349	$5,721,191	$6,508,265
Preliminary Engineering	Design-Builder											10%			$8,427,248	$9,535,318	$10,847,109
Construction Engineering												8%			$6,741,798	$7,628,255	$8,677,687
														Subtotal #4	**$104,497,874**	**$118,237,946**	**$134,504,148**
Stipend												$320,000			$960,000	$960,000	$960,000
Managed Lane Project															$25,000,000	$25,000,000	$25,000,000
Right of Way															$3,200,000	$3,600,000	$4,000,000
														Project Total	**$133,657,874**	**$147,797,946**	**$164,464,148**

Chapter 152 Bridges

					Unit Cost					Quantity					Total Cost		
Item	Description	Area	Depth	Unit	Low	Under	Base	Over	High	Low	Under	Base	Over	High	Under	Base	Over
26th Street Pavement	26th Street to of Project	21,330	6.0	LWD	$125,000	-6%	$133,000	2%	$135,000	1.91	-5%	2.01	5%	2.11	$238,688	$267,330	$284,918
I-35W NB HOT Lane	26th Street to of Project	5,179	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.01	-5%	1.06	5%	1.11	$125,875	$140,980	$155,820
I-35W NB Lanes	26th Street to of Project	123,549	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	24.07	-5%	25.34	5%	26.61	$3,009,125	$3,370,220	$3,724,980
NB I-35W left shoulder	26th Street to of Project	32,835	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.97	-5%	2.07	5%	2.17	$245,813	$275,310	$304,290
NB I-35W Right Shoulder	26th Street to of Project	21,978	7.0	LWD	$125,000	-6%	$133,000	5%	$140,000	2.30	-5%	2.42	5%	2.54	$287,375	$321,860	$355,740
I-35W SB HOT Lane	26th Street to of Project	11,449	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	2.22	-5%	2.34	5%	2.46	$277,875	$311,220	$343,980
I-35W SB Lanes	26th Street to of Project	69,918	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	13.62	-5%	14.34	5%	15.06	$1,702,875	$1,907,220	$2,107,980
SB I-35W Right Shoulder	26th Street to of Project	23,099	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.38	-5%	1.45	5%	1.52	$172,188	$192,850	$213,150
SB I-35W left shoulder	26th Street to of Project	20,810	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.24	-5%	1.31	5%	1.38	$155,563	$174,230	$192,570
TH 65 NB Pavement	From Split to tie in	95,975	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	18.71	-5%	19.69	5%	20.67	$2,338,188	$2,618,770	$2,894,430
TH 65 NB Right Shoulder	From Split to tie in	16,999	7.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.78	-5%	1.87	5%	1.96	$222,063	$248,710	$274,890
TH 65 NB Left Shoulder	From Split to tie in	24,953	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.49	-5%	1.57	5%	1.65	$186,438	$208,810	$230,790
TH 65 SB Pavement	From Split to tie in	125,230	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	24.41	-5%	25.69	5%	26.97	$3,050,688	$3,416,770	$3,776,430
TH 65 SB Right Shoulder	From Split to tie in	24,220	7.0	LWD	$125,000	-6%	$133,000	5%	$140,000	2.54	-5%	2.67	5%	2.80	$317,063	$355,110	$392,490
TH 65 SB Left Shoulder	From Split to tie in	36,913	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	2.21	-5%	2.33	5%	2.45	$276,688	$309,890	$342,510
EB I-94 to SB I-35W Ramp Pavement	From 11th Avenue Exit through 4th Avenue Enterar	1,728	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.33	-5%	0.35	5%	0.37	$41,563	$46,550	$51,450
NB TH 65 to WB I-94 Ramp Pavement		10,484	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	2.04	-5%	2.15	5%	2.26	$255,313	$285,950	$316,050
NB TH 65 to WB I-94 Left Shoudler		6,222	7.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.65	-5%	0.68	5%	0.71	$80,750	$90,440	$99,960
NB TH 65 to WB I-94 Right Shoudler			7.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.00	-5%	0.00	5%	0.00	$0	$0	$0
I-94 EB Left Shoulder		12,390	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.74	-5%	0.78	5%	0.82	$92,625	$103,740	$114,660
I-94 WB Pavement		114,633	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	22.34	-5%	23.52	5%	24.70	$2,793,000	$3,128,160	$3,457,440
I-94 WB Right Shoulder		14,203	7.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.48	-5%	1.56	5%	1.64	$185,250	$207,480	$229,320
I-94 WB Left Shoulder		24,599	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.47	-5%	1.55	5%	1.63	$184,063	$206,150	$227,850
4th Avenue Entrance Ramp		12,773	10.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.91	-5%	2.01	5%	2.11	$238,688	$267,330	$295,470
4th Avenue Pavement		48,776	6.0	LWD	$125,000	-6%	$133,000	2%	$135,000	4.38	-5%	4.61	5%	4.84	$547,438	$613,130	$653,468
5th Avenue Pavement		52,363	6.0	LWD	$125,000	-6%	$133,000	2%	$135,000	4.70	-5%	4.95	5%	5.20	$587,813	$658,350	$701,663
Franklin Avenue Pavement			6.0	LWD	$125,000	-6%	$133,000	2%	$135,000	0.00	-5%	0.00	5%	0.00	$0	$0	$0
		Length	Width														
26th Street over I-35W (Removal)		278.0	56.6	SF	$10	0%	$10	200%	$30	15,735	0%	15,735	0%	15,735	$157,348	$157,348	$472,044
I-35W Southbound over TH 65 NB (Removal)		363.4	35.7	SF	$10	0%	$10	200%	$30	12,973	0%	12,973	0%	12,973	$129,734	$129,734	$389,201
Ped at 24th Street over I-35WNB, TH 65, and STS (Removal)		462.6	9.5	SF	$10	0%	$10	200%	$30	4,395	0%	4,395	0%	4,395	$43,947	$43,947	$131,841
I-94 Westbound on Ramp over I-94 & TH 65 (Removal)		534.1	25.4	SF	$10	0%	$10	200%	$30	13,566	0%	13,566	0%	13,566	$135,661	$135,661	$406,984
Franklin Ave over 35W/65 (Removal)		285.2	66.3	SF	$10	0%	$10	200%	$30	0	0%	0	0%	0	$0	$0	$0
TH 65 over I-94 (Removal)		227.3	90.8	SF	$10	0%	$10	200%	$30	20,639	0%	20,639	0%	20,639	$206,388	$206,388	$619,165
26th Street over I-35W				SF	$175	-10%	$195	8%	$210	19,607	-5%	20,639	5%	21,671	$3,431,207	$4,024,574	$4,550,864
24th Street pedestrian Bridge over I-35W and TH 65				SF	$160	-11%	$180	8%	$195	16,802	-5%	17,686	5%	18,570	$2,688,272	$3,183,480	$3,621,209
Franklin Avenue over I-35W / TH 65				SF	$175	-10%	$195	8%	$210	0	-5%	0	5%	0	$0	$0	$0
SB I-35W over TH 65 (braid bridge)				SF	$225	-10%	$250	10%	$275	12,987	-5%	13,670	5%	14,354	$2,921,963	$3,417,500	$3,947,213
NB Exit Ramp to WB I-94				SF	$225	-10%	$250	10%	$275	16,642	-5%	17,518	5%	18,394	$3,744,473	$4,379,500	$5,058,323
Extend Portland Ave Tunnel				SF	$225	-10%	$250	10%	$275	0	-5%	0	5%	0	$0	$0	$0
TH 65 over I-94				SF	$165	-6%	$175	11%	$195	24,293	-5%	25,572	5%	26,851	$4,008,411	$4,475,100	$5,235,867

Chapter 152 Bridges

					Unit Cost					Quantity					Total Cost		
Item	Description	Area	Depth	Unit	Low	Under	Base	Over	High	Low	Under	Base	Over	High	Under	Base	Over
Roadway Lighting	1 mile * $200,000/ mile + 1 interchanges * $$200,000/interchange)			LS	$350,000	-13%	$400,000	13%	$450,000	1	0%	1	0%	1	$350,000	$400,000	$450,000
		Height	Length														
Noise Wall	SB I-35W North of 26th Street (2590 LF * 20 LF. * $	20	2590		$20	0%	$20	25%	$25	49,210	-5%	51,800	5%	54,390	$984,200	$1,036,000	$1,359,750
Noise Wall	NB I-35W from 26th Street North (2556 LF * 20 LF	20	2556		$20	0%	$20	25%	$25	48,564	-5%	51,120	5%	53,676	$971,280	$1,022,400	$1,341,900
Retaining Wall	SB I-35W North of 26th walls: 990' x 18' @ $85/S	18	990		$80	-6%	$85	6%	$90	16,929	-5%	17,820	5%	18,711	$1,354,320	$1,514,700	$1,683,990
Retaining Wall	NB I-35W North of 26th walls: 172' x 16' @ $85/S	16	172		$80	-6%	$85	6%	$90	2,614	-5%	2,752	5%	2,890	$209,152	$233,920	$260,064
Retaining Wall	SB I-35W South of Franklin walls: 1010' x 20' @ $	20	1010		$80	-6%	$85	6%	$90	19,190	-5%	20,200	5%	21,210	$1,535,200	$1,717,000	$1,908,900
Retaining Wall	NB I-35W South of Franklin walls: 1832' x 20' @ $	20	1832		$80	-6%	$85	6%	$90	34,808	-5%	36,640	5%	38,472	$2,784,640	$3,114,400	$3,462,480
Retaining Wall	SB I-35W South of Braid Left Side walls: 284' x 2	20	284		$80	-6%	$85	6%	$90	5,396	-5%	5,680	5%	5,964	$431,680	$482,800	$536,760
Retaining Wall	SB I-35W North of Braid Left side walls: 368' x 16'	16	368		$80	-6%	$85	6%	$90	5,594	-5%	5,888	5%	6,182	$447,488	$500,480	$556,416
Retaining Wall	SB I-35W North of Braid Right side walls: 503' x 2	20	503		$80	-6%	$85	6%	$90	9,557	-5%	10,060	5%	10,563	$764,560	$855,100	$950,670
Retaining Wall	Ramp A North of SB35W Right side walls: 400' x	20	400		$80	-6%	$85	6%	$90	7,600	-5%	8,000	5%	8,400	$608,000	$680,000	$756,000
Retaining Wall	Ramp A North of SB35W Left side walls: 363' x 2	20	363		$80	-6%	$85	6%	$90	6,897	-5%	7,260	5%	7,623	$551,760	$617,100	$686,070
Retaining Wall	Ramp A along WB I-94 Right side walls: 314' x 2	14	314		$80	-6%	$85	6%	$90	4,176	-5%	4,396	5%	4,616	$334,096	$373,660	$415,422
Retaining Wall	Ramp A along EB I-94 Left side walls: 378' x 20'	14	378		$80	-6%	$85	6%	$90	5,027	-5%	5,292	5%	5,557	$402,192	$449,820	$500,094
TMS - Traffic Management System	TMS Special ILCS ($1,500,000/mile * 1.2 Miles)		1.2		$1,250,000	-17%	$1,500,000	17%	$1,750,000	1.2	0%	1.2	0%	1.2	$1,500,000	$1,800,000	$2,100,000
TMS - Traffic Management System	TMS Regular ($300,000/mile *1.2 miles)		1.2		$275,000	-8%	$300,000	8%	$325,000	1.2	0%	1.2	0%	1.2	$330,000	$360,000	$390,000
Median Barrier	North of 26th (5141 LF * $69.00/LF)		5141		$60	-13%	$69	9%	$75	5,141	0%	5,141.0	0%	5,141	$308,460	$354,729	$385,575
Median Barrier	I-94 (667 LF * $69.00/LF)		667		$60	-13%	$69	9%	$75	667	0%	667.0	0%	667	$40,020	$46,023	$50,025
														Sub Total #1	**$48,987,452**	**$55,437,924**	**$63,969,124**
														Project Uncertainty	**-11.6%**		**15.4%**
Miscellaneous Item Allowance															$0	$0	$0
														Subtotal #2	**$48,987,452**	**$55,437,924**	**$63,969,124**
Mobilization	For non Roadway Items											5%			$1,568,723	$1,785,568	$2,111,341
														Subtotal #3	**$50,556,174**	**$57,223,493**	**$66,080,465**
Preliminary Engineering	Up to NTP											6%			$3,033,370	$3,433,410	$3,964,828
Preliminary Engineering	Design-Builder											10%			$5,055,617	$5,722,349	$6,608,047
Construction Engineering												8%			$4,044,494	$4,577,879	$5,286,437
														Subtotal #4	**$62,689,656**	**$70,957,131**	**$81,939,777**
Right of Way																	
														Project Total	**$62,689,656**	**$70,957,131**	**$81,939,777**

Alternative 2

					Unit Cost					Quantity					Total Cost		
Item	Description	Area	Depth	Unit	Low	Under	Base	Over	High	Low	Under	Base	Over	High	Under	Base	Over
26th Street Pavement	26th Street to of Project	21,330	6.0	LWD	$125,000	-6%	$133,000	2%	$135,000	1.91	-5%	2.01	5%	2.11	$238,688	$267,330	$284,918
I-35W NB HOT Lane	26th Street to of Project	5,179	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.01	-5%	1.06	5%	1.11	$125,875	$140,980	$155,820
I-35W NB Lanes	26th Street to of Project	123,549	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	24.07	-5%	25.34	5%	26.61	$3,009,125	$3,370,220	$3,724,980
NB I-35W left shoulder	26th Street to of Project	32,835	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.97	-5%	2.07	5%	2.17	$245,813	$275,310	$304,290
NB I-35W Right Shoulder	26th Street to of Project	21,978	7.0	LWD	$125,000	-6%	$133,000	5%	$140,000	2.30	-5%	2.42	5%	2.54	$287,375	$321,860	$355,740
I-35W SB HOT Lane	26th Street to of Project	11,449	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	2.22	-5%	2.34	5%	2.46	$277,875	$311,220	$343,980
I-35W SB Lanes	26th Street to of Project	69,918	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	13.62	-5%	14.34	5%	15.06	$1,702,875	$1,907,220	$2,107,980
SB I-35W Right Shoulder	26th Street to of Project	23,099	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.38	-5%	1.45	5%	1.52	$172,188	$192,850	$213,150
SB I-35W left shoulder	26th Street to of Project	20,810	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.24	-5%	1.31	5%	1.38	$155,563	$174,230	$192,570
TH 65 NB Pavement	From Split to tie in	95,975	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	18.71	-5%	19.69	5%	20.67	$2,338,188	$2,618,770	$2,894,430
TH 65 NB Right Shoulder	From Split to tie in	16,999	7.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.78	-5%	1.87	5%	1.96	$222,063	$248,710	$274,890
TH 65 NB Left Shoulder	From Split to tie in	24,953	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.49	-5%	1.57	5%	1.65	$186,438	$208,810	$230,790
TH 65 SB Pavement	From Split to tie in	125,230	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	24.41	-5%	25.69	5%	26.97	$3,050,688	$3,416,770	$3,776,430
TH 65 SB Right Shoulder	From Split to tie in	24,220	7.0	LWD	$125,000	-6%	$133,000	5%	$140,000	2.54	-5%	2.67	5%	2.80	$317,063	$355,110	$392,490
TH 65 SB Left Shoulder	From Split to tie in	36,913	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	2.21	-5%	2.33	5%	2.45	$276,688	$309,890	$342,510
EB I-94 to SB I-35W Ramp Pavement	From 11th Avenue Exit through 4th Avenue Enterar	1,728	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.33	-5%	0.35	5%	0.37	$41,563	$46,550	$51,450
NB TH 65 to WB I-94 Ramp Pavement		10,484	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	2.04	-5%	2.15	5%	2.26	$255,313	$285,950	$316,050
NB TH 65 to WB I-94 Left Shoudler		6,222	7.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.65	-5%	0.68	5%	0.71	$80,750	$90,440	$99,960
NB TH 65 to WB I-94 Right Shoudler			7.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.00	-5%	0.00	5%	0.00	$0	$0	$0
I-94 EB Left Shoulder		12,390	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	0.74	-5%	0.78	5%	0.82	$92,625	$103,740	$114,660
I-94 WB Pavement		114,633	13.0	LWD	$125,000	-6%	$133,000	5%	$140,000	22.34	-5%	23.52	5%	24.70	$2,793,000	$3,128,160	$3,457,440
I-94 WB Right Shoulder		14,203	7.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.48	-5%	1.56	5%	1.64	$185,250	$207,480	$229,320
I-94 WB Left Shoulder		24,599	4.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.47	-5%	1.55	5%	1.63	$184,063	$206,150	$227,850
4th Avenue Entrance Ramp		12,773	10.0	LWD	$125,000	-6%	$133,000	5%	$140,000	1.91	-5%	2.01	5%	2.11	$238,688	$267,330	$295,470
4th Avenue Pavement		48,776	6.0	LWD	$125,000	-6%	$133,000	2%	$135,000	4.38	-5%	4.61	5%	4.84	$547,438	$613,130	$653,468
5th Avenue Pavement		52,363	6.0	LWD	$125,000	-6%	$133,000	2%	$135,000	4.70	-5%	4.95	5%	5.20	$587,813	$658,350	$701,663
Franklin Avenue Pavement			6.0	LWD	$125,000	-6%	$133,000	2%	$135,000	0.00	-5%	0.00	5%	0.00	$0	$0	$0
		Length	Width														
26th Street over I-35W (Removal)		278.0	56.6	SF	$10	0%	$10	200%	$30	15,735	0%	15,735	0%	15,735	$157,348	$157,348	$472,044
I-35W Southbound over TH 65 NB (Removal)		363.4	35.7	SF	$10	0%	$10	200%	$30	12,973	0%	12,973	0%	12,973	$129,734	$129,734	$389,201
Ped at 24th Street over I-35WNB, TH 65, and STS (Removal)		462.6	9.5	SF	$10	0%	$10	200%	$30	4,395	0%	4,395	0%	4,395	$43,947	$43,947	$131,841
I-94 Westbound on Ramp over I-94 & TH 65 (Removal)		534.1	25.4	SF	$10	0%	$10	200%	$30	13,566	0%	13,566	0%	13,566	$135,661	$135,661	$406,984
Franklin Ave over 35W/65 (Removal)		285.2	66.3	SF	$10	0%	$10	200%	$30	0	0%	0	0%	0	$0	$0	$0
TH 65 over I-94 (Removal)		227.3	90.8	SF	$10	0%	$10	200%	$30	20,639	0%	20,639	0%	20,639	$206,388	$206,388	$619,165
26th Street over I-35W				SF	$175	-10%	$195	8%	$210	19,607	-5%	20,639	5%	21,671	$3,431,207	$4,024,574	$4,550,864
24th Street pedestrian Bridge over I-35W and TH 65				SF	$160	-11%	$180	8%	$195	16,802	-5%	17,686	5%	18,570	$2,688,272	$3,183,480	$3,621,209
Franklin Avenue over I-35W / TH 65				SF	$175	-10%	$195	8%	$210	0	-5%	0	5%	0	$0	$0	$0
SB I-35W over TH 65 (braid bridge)				SF	$225	-10%	$250	10%	$275	12,987	-5%	13,670	5%	14,354	$2,921,963	$3,417,500	$3,947,213
NB Exit Ramp to WB I-94				SF	$225	-10%	$250	10%	$275	16,642	-5%	17,518	5%	18,394	$3,744,473	$4,379,500	$5,058,323
Extend Portland Ave Tunnel				SF	$225	-10%	$250	10%	$275	0	-5%	0	5%	0	$0	$0	$0
TH 65 over I-94				SF	$165	-6%	$175	11%	$195	24,293	-5%	25,572	5%	26,851	$4,008,411	$4,475,100	$5,235,867

Alternative 2

					Unit Cost					Quantity					Total Cost		
Item	Description	Area	Depth	Unit	Low	Under	Base	Over	High	Low	Under	Base	Over	High	Under	Base	Over
Roadway Lighting	1 mile * $200,000/ mile + 1 interchanges * $$200,000/interchange)			LS	$350,000	-13%	$400,000	13%	$450,000	1	0%	1	0%	1	$350,000	$400,000	$450,000
		Height	Length														
Noise Wall	SB I-35W North of 26th Street (2590 LF * 20 LF. * $	20	2590		$20	0%	$20	25%	$25	49,210	-5%	51,800	5%	54,390	$984,200	$1,036,000	$1,359,750
Noise Wall	NB I-35W from 26th Street North (2556 LF * 20 LF	20	2556		$20	0%	$20	25%	$25	48,564	-5%	51,120	5%	53,676	$971,280	$1,022,400	$1,341,900
Retaining Wall	SB I-35W North of 26th walls: 990' x 18' @ $85/S	18	990		$80	-6%	$85	6%	$90	16,929	-5%	17,820	5%	18,711	$1,354,320	$1,514,700	$1,683,990
Retaining Wall	NB I-35W North of 26th walls: 172' x 16' @ $85/S	16	172		$80	-6%	$85	6%	$90	2,614	-5%	2,752	5%	2,890	$209,152	$233,920	$260,064
Retaining Wall	SB I-35W South of Franklin walls: 1010' x 20' @ $	20	1010		$80	-6%	$85	6%	$90	19,190	-5%	20,200	5%	21,210	$1,535,200	$1,717,000	$1,908,900
Retaining Wall	NB I-35W South of Franklin walls: 1832' x 20' @ $	20	1832		$80	-6%	$85	6%	$90	34,808	-5%	36,640	5%	38,472	$2,784,640	$3,114,400	$3,462,480
Retaining Wall	SB I-35W South of Braid Left Side walls: 284' x 2	20	284		$80	-6%	$85	6%	$90	5,396	-5%	5,680	5%	5,964	$431,680	$482,800	$536,760
Retaining Wall	SB I-35W North of Braid Left side walls: 368' x 16'	16	368		$80	-6%	$85	6%	$90	5,594	-5%	5,888	5%	6,182	$447,488	$500,480	$556,416
Retaining Wall	SB I-35W North of Braid Right side walls: 503' x 2	20	503		$80	-6%	$85	6%	$90	9,557	-5%	10,060	5%	10,563	$764,560	$855,100	$950,670
Retaining Wall	Ramp A North of SB35W Right side walls: 400' x	20	400		$80	-6%	$85	6%	$90	7,600	-5%	8,000	5%	8,400	$608,000	$680,000	$756,000
Retaining Wall	Ramp A North of SB35W Left side walls: 363' x 2	20	363		$80	-6%	$85	6%	$90	6,897	-5%	7,260	5%	7,623	$551,760	$617,100	$686,070
Retaining Wall	Ramp A along WB I-94 Right side walls: 314' x 2	14	314		$80	-6%	$85	6%	$90	4,176	-5%	4,396	5%	4,616	$334,096	$373,660	$415,422
Retaining Wall	Ramp A along EB I-94 Left side walls: 378' x 20'	14	378		$80	-6%	$85	6%	$90	5,027	-5%	5,292	5%	5,557	$402,192	$449,820	$500,094
TMS - Traffic Management System	TMS Special ILCS ($1,500,000/mile * 1.2 Miles)		1.2		$1,250,000	-17%	$1,500,000	17%	$1,750,000	1.2	0%	1.2	0%	1.2	$1,500,000	$1,800,000	$2,100,000
TMS - Traffic Management System	TMS Regular ($300,000/mile *1.2 miles)		1.2		$275,000	-8%	$300,000	8%	$325,000	1.2	0%	1.2	0%	1.2	$330,000	$360,000	$390,000
Median Barrier	North of 26th (5141 LF * $69.00/LF)		5141		$60	-13%	$69	9%	$75	5,141	0%	5,141.0	0%	5,141	$308,460	$354,729	$385,575
Median Barrier	I-94 (667 LF * $69.00/LF)		667		$60	-13%	$69	9%	$75	667	0%	667.0	0%	667	$40,020	$46,023	$50,025
														Sub Total #1	**$48,987,452**	**$55,437,924**	**$63,969,124**
														Project Uncertainty	**-11.6%**		**15.4%**
Miscellaneous Item Allowance															$0	$0	$0
														Subtotal #2	**$48,987,452**	**$55,437,924**	**$63,969,124**
Mobilization	For non Roadway Items											5%			$1,568,723	$1,785,568	$2,111,341
														Subtotal #3	**$50,556,174**	**$57,223,493**	**$66,080,465**
Preliminary Engineering												12%			$6,066,741	$6,866,819	$7,929,656
Construction Engineering												8%			$4,044,494	$4,577,879	$5,286,437
														Subtotal #4	**$60,667,409**	**$68,668,191**	**$79,296,558**
Right of Way																	
														Project Total	**$60,667,409**	**$68,668,191**	**$79,296,558**

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Combined

Sub-Project: .

I-35W Storm Tunnel Rehabilitation.

Risk ID: . . CON 12

Risk Trigger:

Pre-Response Quantification

Probability
75%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$30.000	$50.000	$60.000	**$36.250**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
3.00	6.00	12.00	**4.88**

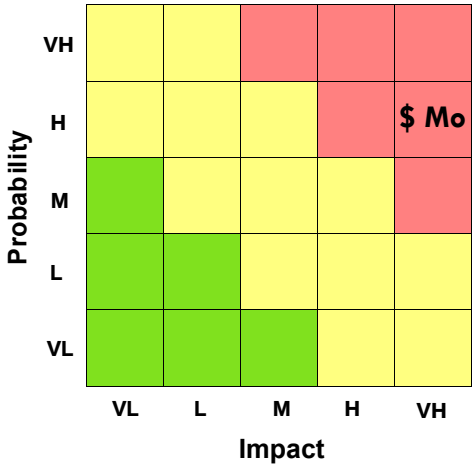
Project Risk Rank
1

Program Risk Rank
1

The high end is rehabilitation of the regional Storm water system, which is outside of the project limits. An estimate from 2007 is $60 M. Also an issue with water quality. The decision is not currently on the critical path, but this needs to be considered a high priority.

Cost: Threat

Schedule: Threat



Post-Response Quantification

Probability
75%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$30.000	$50.000	$60.000	**$36.250**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
3.00	6.00	12.00	**4.88**

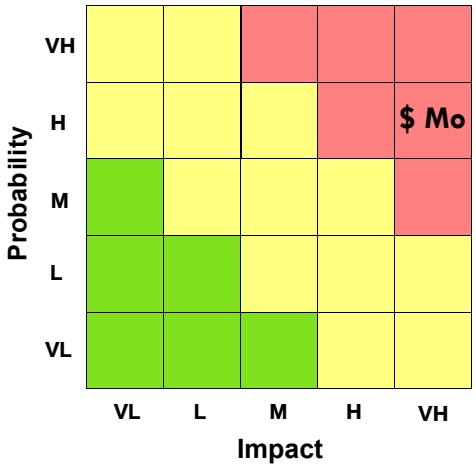
Cost To Mitigate
$0.000

Strategy
Mitigation

Develop interim or short-term storm water control strategies for phased released into a down stream Conveyance System. Develop a comprehensive funding strategy to pay for a regional Conveyance system.

Cost: Threat

Schedule: Threat



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Combined

Sub-Project: .

MOT

Risk ID: . . CON 2

Risk Trigger:

Pre-Response Quantification

Probability
90%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$3.000	$7.600	$15.200	**$7.290**

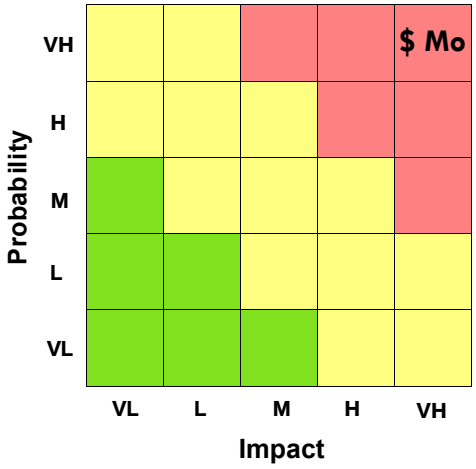
Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
6.00	12.00	18.00	**10.80**

Project Risk Rank
2

Program Risk Rank
2

Maintain 4 lanes SB and 5 lanes NB on I-35W South of the Braid Bridge. 26 and 28 are one-way pairs; replacing those structures will require additional traffic control. - Low = 2% of the Construction Cost. - High = 10% of the Construction Cost. - Most Likely = 5% of the Construction Cost.

Cost: Threat
Schedule: Threat



Post-Response Quantification

Probability
10%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$3.000	$7.600	$15.200	**$0.810**

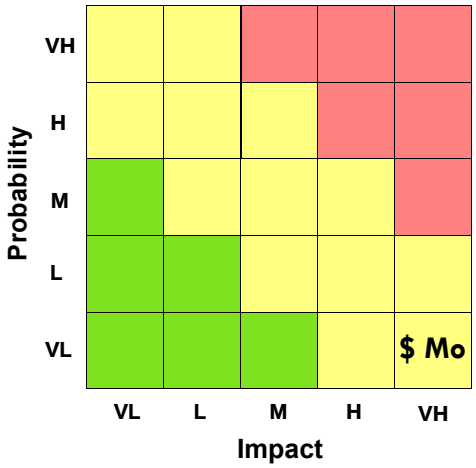
Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.50	1.00	3.00	**0.13**

Cost To Mitigate
$0.000

Strategy
Mitigation

Implement VE Recommendations # 1 & 2 Mitigates this risk

Cost: Threat
Schedule: Threat



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Combined

Sub-Project: .

Convert to Design-Bid-Build

Risk ID: . . BID 1

Risk Trigger:

Pre-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
($7.200)	($7.200)	($7.200)	**($3.600)**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

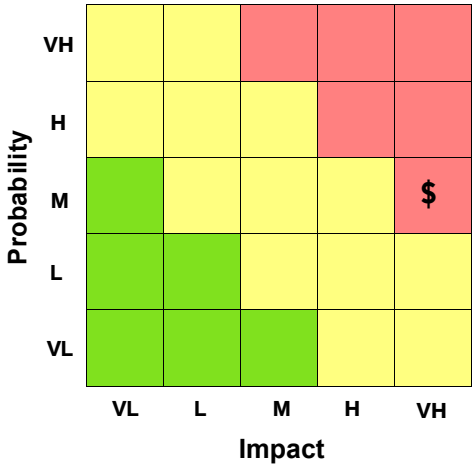
Deliver the Project using Conventional Design-Bid-build

Project Risk Rank
3

Program Risk Rank
3

Cost: Opportunity

Schedule: No Risk



Post-Response Quantification

Probability
100%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
($7.800)	($7.200)	($7.000)	**($7.267)**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

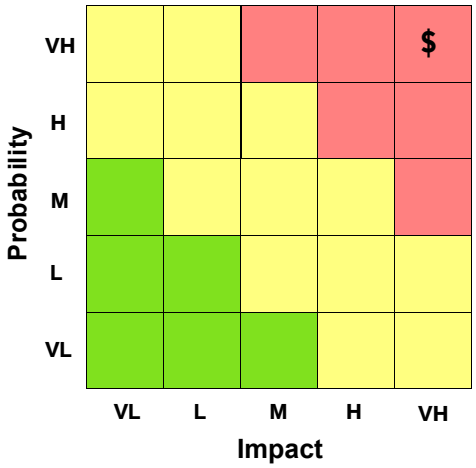
Implement VE Recommendation #12, and Develop DBB Packages.

Cost To Mitigate
$0.000

Strategy
Exploit

Cost: Opportunity

Schedule: No Risk



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Combined

Sub-Project: .

Value Engineering

Risk ID: . . DES 1

Risk Trigger:

Pre-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
($10.000)	($5.000)	($1.000)	**($2.583)**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

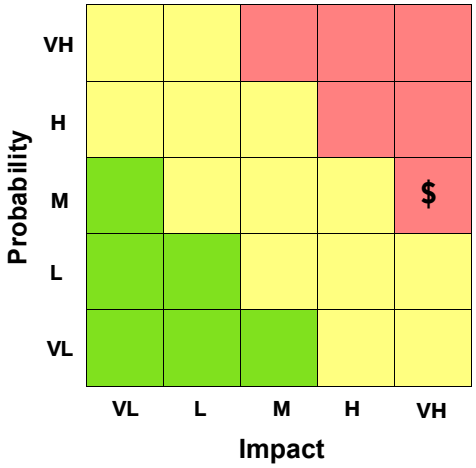
Value Engineering typically can reduce cost and time.

Project Risk Rank
4

Program Risk Rank
4

Cost: Opportunity

Schedule: No Risk



Post-Response Quantification

Probability
75%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
($7.000)	($6.300)	($5.000)	**($4.650)**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

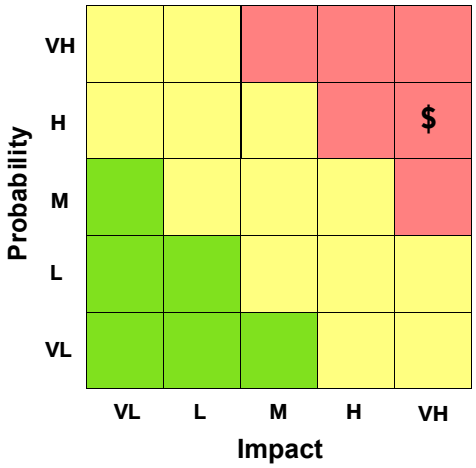
Value Engineering Recommendations # 8 (Remove Glass and Closure), # 9 (Remove Geothermal Wells), and # 11 (Shorten Lake Street Structures).

Cost To Mitigate
$0.000

Strategy
Exploit

Cost: Opportunity

Schedule: No Risk



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Combined

Sub-Project: .

Utility Relocation

Risk ID: . . UTL 1

Risk Trigger:

Pre-Response Quantification

Probability
75%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$2.000	$3.000	$5.000	**$2.375**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

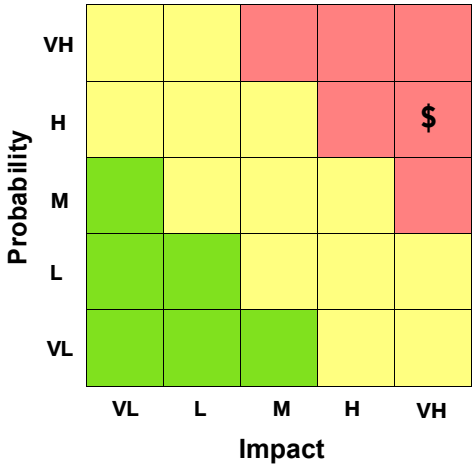
Project Risk Rank
5

Program Risk Rank
5

No utility relocation has been identified in the base cost estimate. Added cost for fiber and public utility relocation.

Cost: Threat

Schedule: No Risk



Post-Response Quantification

Probability
75%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$2.000	$3.000	$5.000	**$2.375**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

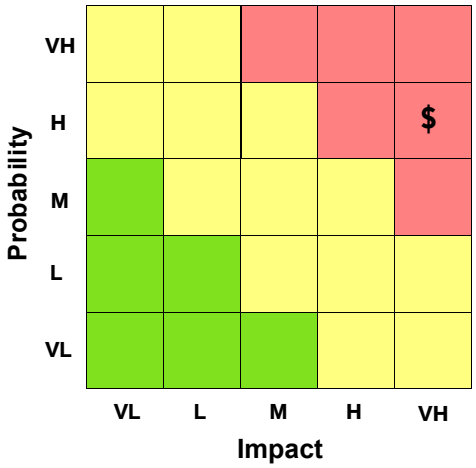
Locate existing Utilities

Cost To Mitigate
$0.000

Strategy
Acceptance

Cost: Threat

Schedule: No Risk



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Combined

Sub-Project: .

Wall type.

Risk ID: . . CON 9

Risk Trigger:

Pre-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
($6.000)	($5.000)	($2.000)	**($2.333)**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

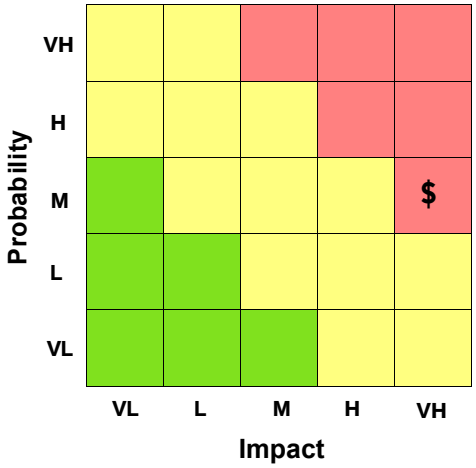
An opportunity to incorporate temporarily shoring into permanent wall type.

Project Risk Rank
6

Program Risk Rank
6

Cost: Opportunity

Schedule: No Risk



Post-Response Quantification

Probability
75%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
($15.500)	($10.000)	($5.500)	**($7.625)**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

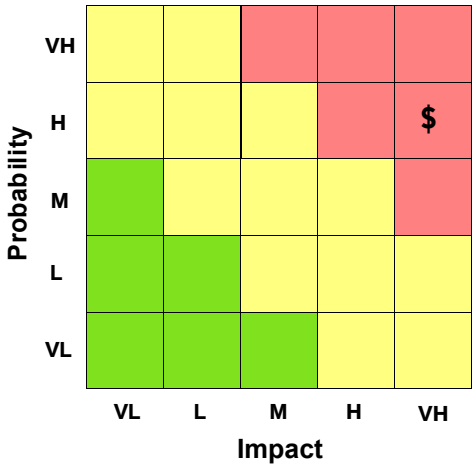
Implement VE Recommendation # 3 Wall Types.

Cost To Mitigate
$0.000

Strategy
Exploit

Cost: Opportunity

Schedule: No Risk



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Combined

Sub-Project: .

19th Braid Alternative.

Risk ID: . . CON 6

Risk Trigger:

Pre-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$2.500	$3.500	$5.000	**$1.792**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

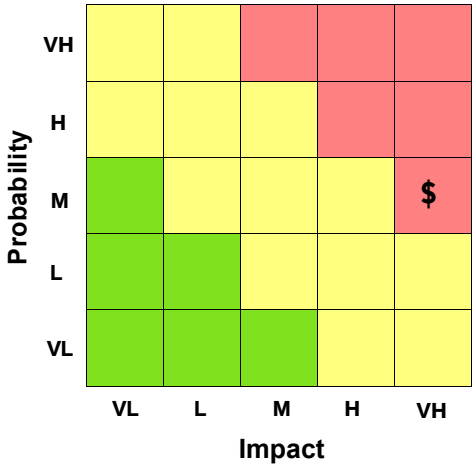
Project Risk Rank
7

Program Risk Rank
7

The risk is; a profile of Franklin is rising and it's connection to the existing access, including rebuilding Franklin St. under crossing. Additional dollars to added width to Franklin.

Cost: Threat

Schedule: No Risk



Post-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$1.000	$2.100	$5.000	**$1.200**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

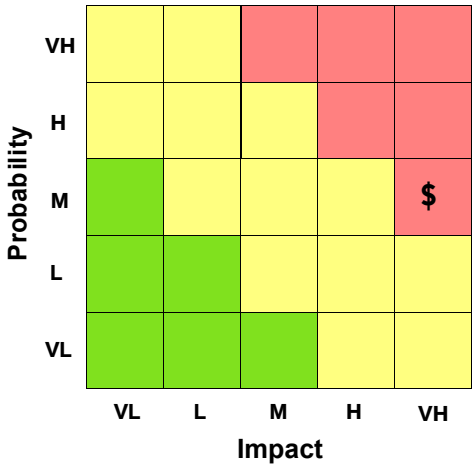
Cost To Mitigate
$0.000

Strategy
Mitigation

Implement VE # 4 Revises the 19th Ave Braid, and can reduce the Likelihood of this risk.

Cost: Threat

Schedule: No Risk



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Combined

Sub-Project: .

Differing Conditions.

Risk ID: . . CON 7

Risk Trigger:

Pre-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$1.000	$3.000	$8.000	**$1.750**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

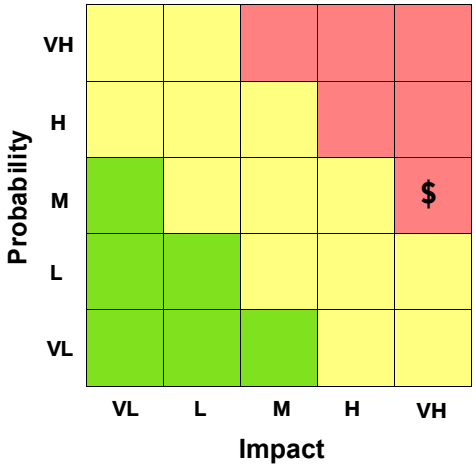
Project Risk Rank
8

Program Risk Rank
8

The cross town project ran into a number of foundations and other rubble under the roadway. Retaining walls may require sheet piling to construct.

Cost: Threat

Schedule: No Risk



Post-Response Quantification

Probability
35%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$1.000	$3.000	$8.000	**$1.225**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

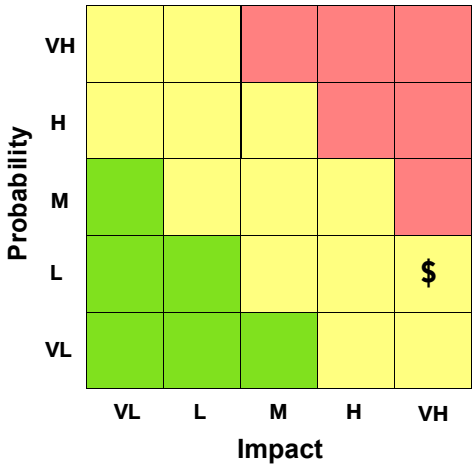
Cost To Mitigate
$0.000

Strategy
Mitigation

Mitigate with additional subsurface site investigation to rubble.

Cost: Threat

Schedule: No Risk



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Combined

Sub-Project: .

Hydraulics and Drainage.

Risk ID: . . CON 3

Risk Trigger:

Pre-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$2.000	$3.000	$5.000	**$1.583**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

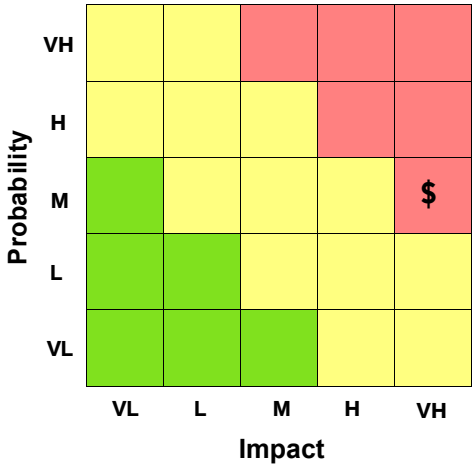
Project Risk Rank
9

Program Risk Rank
9

Base Cost assumed $9.8 M . Preliminary Design is yet to be completed. The Risk is; $9.8M might not be enough to complete the stormwater systems.

Cost: Threat

Schedule: No Risk



Post-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$2.000	$3.000	$5.000	**$1.583**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

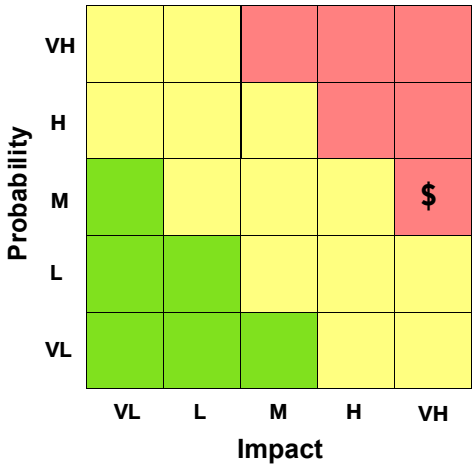
Cost To Mitigate
$0.000

Strategy
Acceptance

Accepted risk reserve storm water quality.

Cost: Threat

Schedule: No Risk



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Combined

Sub-Project: .

ROW Impacts Concern.

Risk ID: . . ROW 1

Risk Trigger:

Pre-Response Quantification

Probability
75%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$1.000	$1.800	$3.000	**$1.400**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

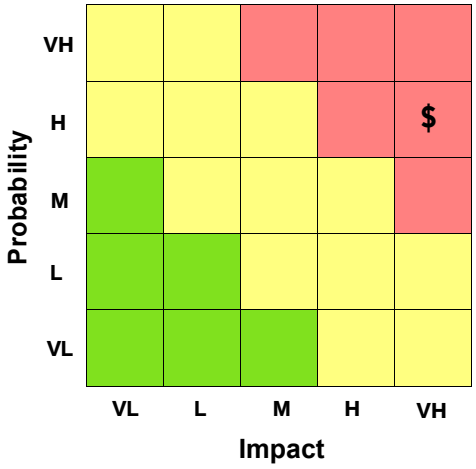
Project Risk Rank
10

Program Risk Rank
10

$3.6M in the base estimate. Most impacts are along SB I-35W between 31st and 28th. Impacts to businesses, billboards, accesses, residential areas, small park (non 4(f)), partial impacts with re-configuration of 3rd Ave.

Cost: Threat

Schedule: No Risk



Post-Response Quantification

Probability
75%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$1.000	$1.800	$3.000	**$1.400**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

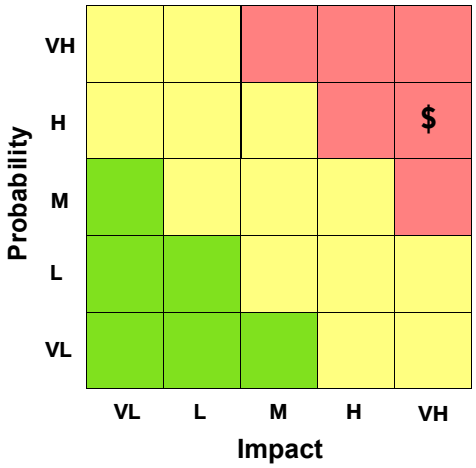
0

Cost To Mitigate
$0.000

Strategy
Acceptance

Cost: Threat

Schedule: No Risk



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Combined

Sub-Project: .

Maintenance Issues.

Risk ID: . . MNT 1

Risk Trigger:

Pre-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$1.000	$2.000	$3.000	**$1.000**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

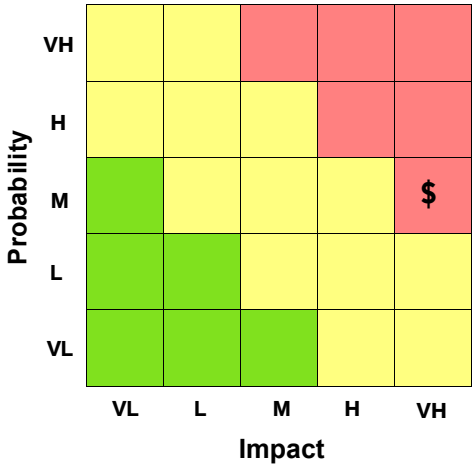
Added cost for automatic de-icing systems and snow storage areas that are not currently in the base.

Project Risk Rank
11

Program Risk Rank
11

Cost: Threat

Schedule: No Risk



Post-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$1.000	$2.000	$3.000	**$1.000**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

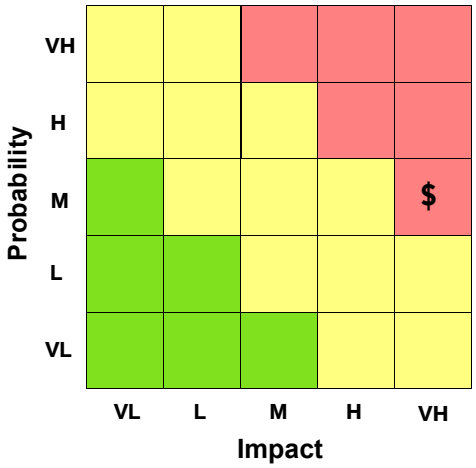
Work with MnDot Maintenance to develop a O&M agreement.

Cost To Mitigate
$0.000

Strategy
Acceptance

Cost: Threat

Schedule: No Risk



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Combined

Sub-Project: .

Municipal Consent.

Risk ID: . . GOV 1

Risk Trigger:

Pre-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$1.000	$2.000	$3.000	**$1.000**

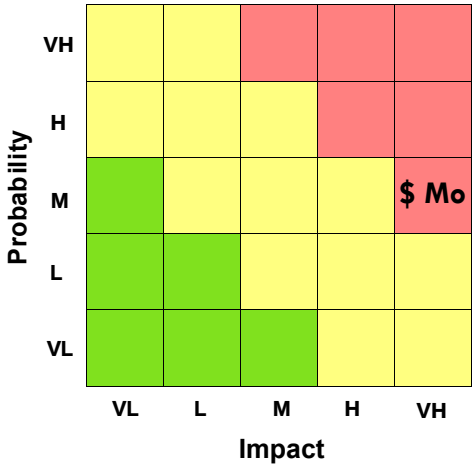
Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
1.00	3.00	6.00	**1.58**

Project Risk Rank
11

Program Risk Rank
11

City of Minneapolis and Hennepin County both have to give Consent. NB exit to 28th St. The city, state, FHWA may not want it, but the county wants it. Also temporarily impacts during construction. 4th Ave to WB on Ramp is a concern as well. Primary access for emergency vehicle into the tunnel. Pedestrian access through construction areas. Visual & Public Art/ Enhancements/ Livability improvements, could be up to 1% (Excluding the transit center) - includes potential added scope for 2nd and Stevens. The local elected officials will change. O&M negotiations could add time/cost. Schedule Impacts are not currently on the project critical path.

Cost: Threat
Schedule: Threat



Post-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$1.000	$2.000	$3.000	**$1.000**

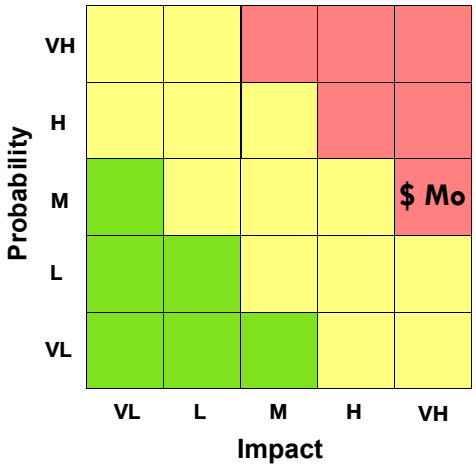
Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
1.00	3.00	6.00	**1.58**

0

Cost To Mitigate
$0.000

Strategy
Acceptance

Cost: Threat
Schedule: Threat



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Combined

Sub-Project: .

Freeway Operations.

Risk ID: . . CON 4

Risk Trigger:

Pre-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$1.000	$2.000	$3.000	**$1.000**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

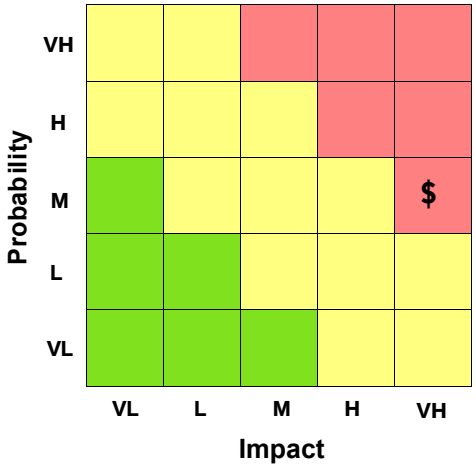
Project Risk Rank
11

Program Risk Rank
11

The Geometric needs of system to system interchange may change. Traffic model has not been completed yet. May need to include additional improvements. EB to SB: most likely: $2M. The risk is; FHWA will not accept NB to WB ramp configuration.

Cost: Threat

Schedule: No Risk



Post-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$1.000	$2.000	$3.000	**$1.000**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

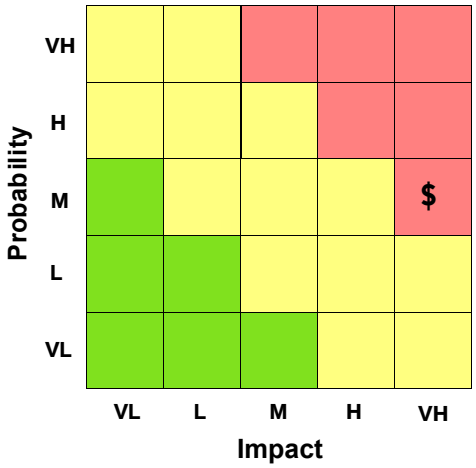
Cost To Mitigate
$0.000

Strategy
Acceptance

Do additional operational analysis to obtain FHWA approval.

Cost: Threat

Schedule: No Risk



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Combined

Sub-Project: .

SHPO

Risk ID: . . CON 10

Risk Trigger:

Pre-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$1.000	$2.000	$3.000	**$1.000**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

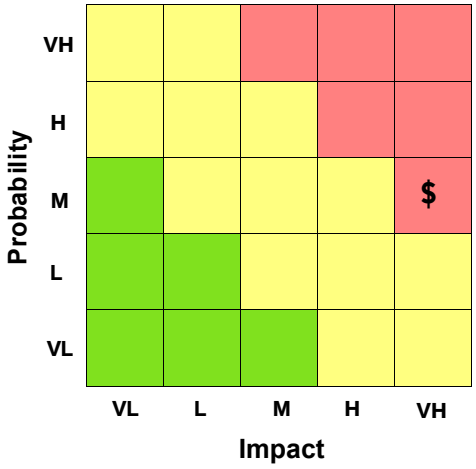
Project Risk Rank
11

Program Risk Rank
11

Number of historic properties, the SHPO Process could hold up the record of decision, or require added costly mitigation. They could require changes in traffic patterns. ROD is expected March of 2014. Must have SHPO approval prior to ROD. Greenway Bridges may require added cost. Current Schedule has enough flood to absorb some delays.

Cost: Threat

Schedule: No Risk



Post-Response Quantification

Probability
25%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$1.000	$2.000	$3.000	**$0.500**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

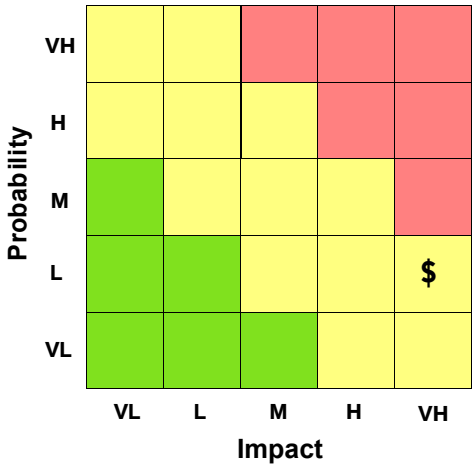
Cost To Mitigate
$0.000

Strategy
Mitigation

Pre-Constructor Survey of historic property then monitor during construction. Meeting with SHPO to get their concurrent on design.

Cost: Threat

Schedule: No Risk



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Combined

Sub-Project: .

Noise Walls.

Risk ID: . . CON 5

Risk Trigger:

Pre-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$1.500	$2.000	$2.500	**$1.000**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

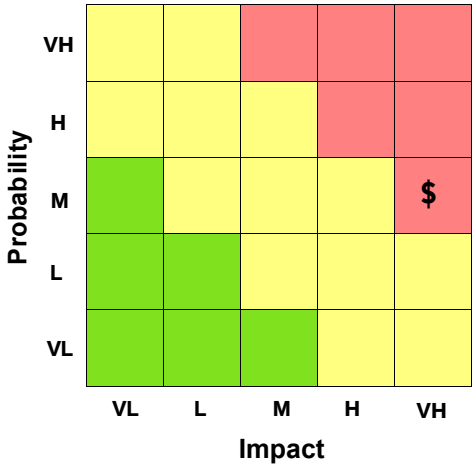
Project Risk Rank
11

Program Risk Rank
11

The risk is; another 2,000 feet of noise wall will need to be added South of 32nd St. on the North Side of the SB I-35. Another location for noise wall is West Side of I-94 North of System Interchange. (2,000 feet).

Cost: Threat

Schedule: No Risk



Post-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$1.500	$2.000	$2.500	**$1.000**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

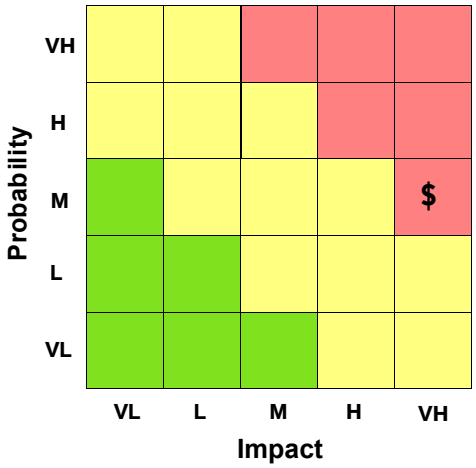
Cost To Mitigate
$0.000

Strategy
Acceptance

Complete the Noise Analysis.

Cost: Threat

Schedule: No Risk



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Combined

Sub-Project: .

ROW Portion of 19th Braid Alternative.

Risk ID: . . ROW 2

Risk Trigger:

Pre-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$0.500	$1.000	$1.500	**$0.500**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

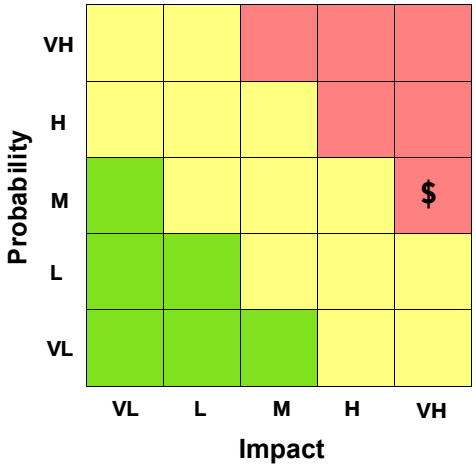
Project Risk Rank
16

Program Risk Rank
16

The risk is; a profile of Franklin is rising and it's connection to the existing access - including rebuilding Franklin St. under crossing. Additional dollars to added width to Franklin.

Cost: Threat

Schedule: No Risk



Post-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$0.500	$1.000	$1.500	**$0.500**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

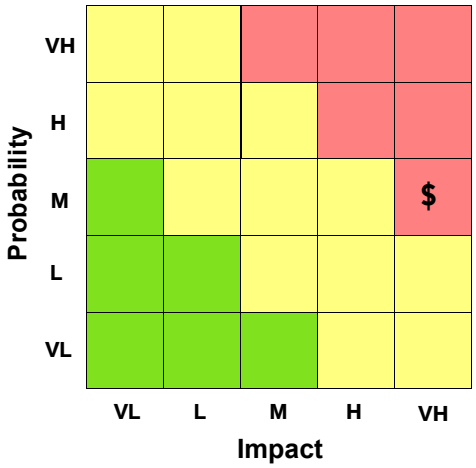
0

Cost To Mitigate
$0.000

Strategy
Acceptance

Cost: Threat

Schedule: No Risk



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Combined

Sub-Project: .

Construction Impacts to Business and Residents.

Risk ID: . . CON 11

Risk Trigger:

Pre-Response Quantification

Probability
95%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$0.300	$0.400	$0.500	**$0.380**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

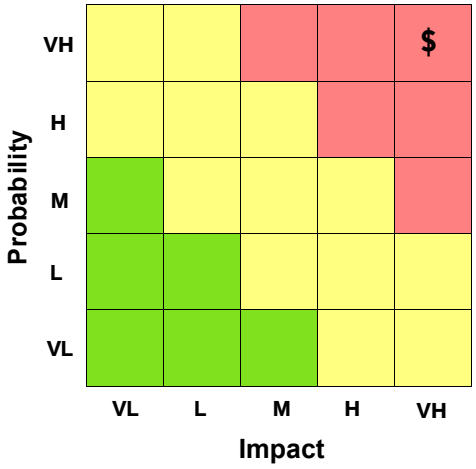
Project Risk Rank
17

Program Risk Rank
17

A number of temporarily noise abatement practices may be deployed. Some of these will be added cost to abatement in the base.

Cost: Threat

Schedule: No Risk



Post-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$0.300	$0.400	$0.500	**$0.200**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

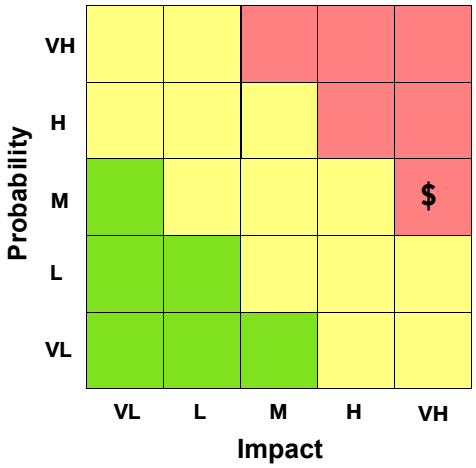
Cost To Mitigate
$0.000

Strategy
Mitigation

Early Construction of Permanent Noise Walls.

Cost: Threat

Schedule: No Risk



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Only

Risk ID: CON 12

Sub-Project: *I-35W Storm Tunnel Rehabilitation.*

Risk Trigger:

Pre-Response Quantification

Probability
75%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$18.000	$30.000	$36.000	**$21.750**

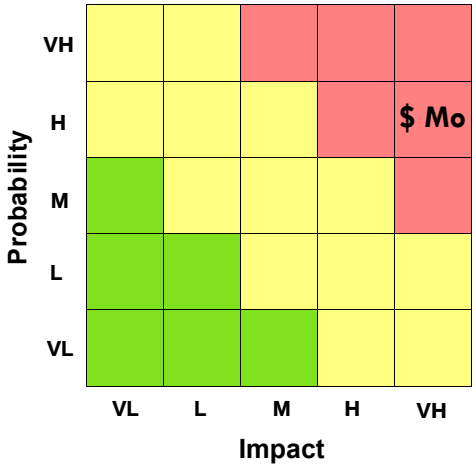
Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
3.00	6.00	12.00	**4.88**

Project Risk Rank
1

Program Risk Rank
1

The high end is rehabilitation of the regional Storm water system, which is outside of the project limits. An estimate from 2007 is $60 M. Also an issue with water quality. The decision is not currently on the critical path, but this needs to be considered a high priority. 60% of the $60M Tunnel is a portion to this project.

Cost: Threat
Schedule: Threat



Post-Response Quantification

Probability
75%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$18.000	$30.000	$36.000	**$21.750**

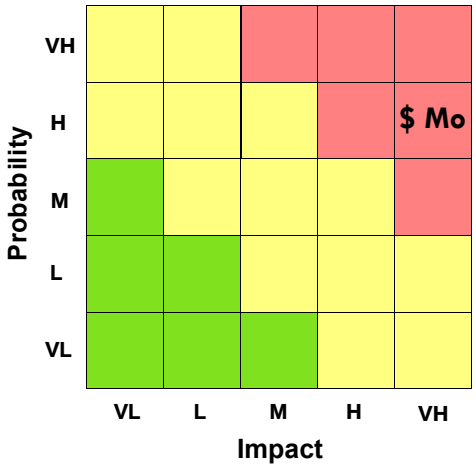
Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
3.00	6.00	12.00	**4.88**

Cost To Mitigate
$0.000

Strategy
Mitigation

Develop interim or short-term storm water control strategies for phased released into a down stream Conveyance System. Develop a comprehensive funding strategy to pay for a regional Conveyance system.

Cost: Threat
Schedule: Threat



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Only

Sub-Project: *MOT*

Risk ID: CON 2

Risk Trigger:

Pre-Response Quantification

Probability
90%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$1.900	$4.800	$9.500	**$4.590**

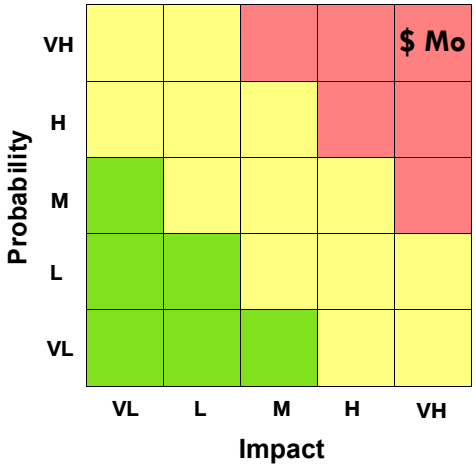
Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
6.00	12.00	18.00	**10.80**

Project Risk Rank
2

Program Risk Rank
2

Maintain 4 lanes SB and 5 lanes NB on I-35W South of the Braid Bridge. 26 and 28 are one-way pairs; replacing those structures will require additional traffic control. - Low = 2% of the Construction Cost. - High = 10% of the Construction Cost. - Most Likely = 5% of the Construction Cost.

Cost: Threat
Schedule: Threat



Post-Response Quantification

Probability
10%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$1.900	$4.800	$9.500	**$0.510**

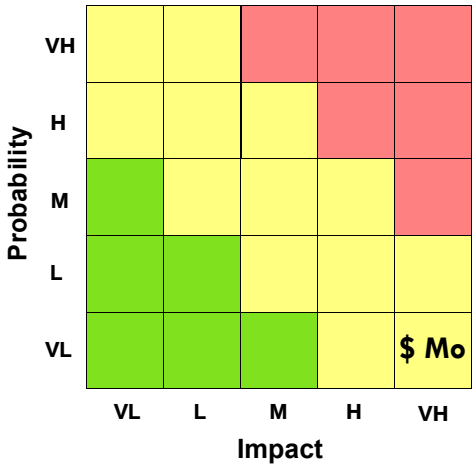
Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.50	1.00	3.00	**0.13**

Cost To Mitigate
$0.000

Strategy
Mitigation

Implement VE Recommendations # 1 & 2 Mitigates this risk

Cost: Threat
Schedule: Threat



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Only

Risk ID: DES 1

Sub-Project: *Value Engineering*

Risk Trigger:

Pre-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
($10.000)	($5.000)	($1.000)	**($2.583)**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

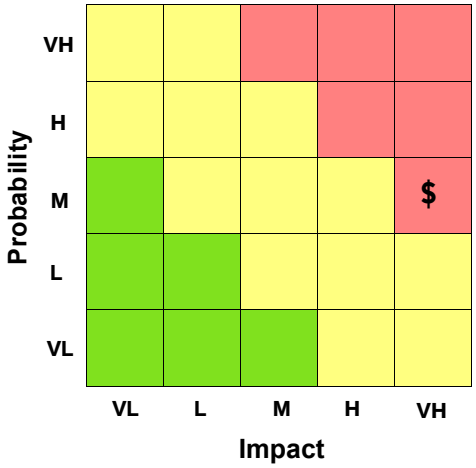
Value Engineering typically can reduce cost and time.

Project Risk Rank
3

Program Risk Rank
3

Cost: Opportunity

Schedule: No Risk



Post-Response Quantification

Probability
75%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
($7.000)	($6.300)	($5.000)	**($4.650)**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

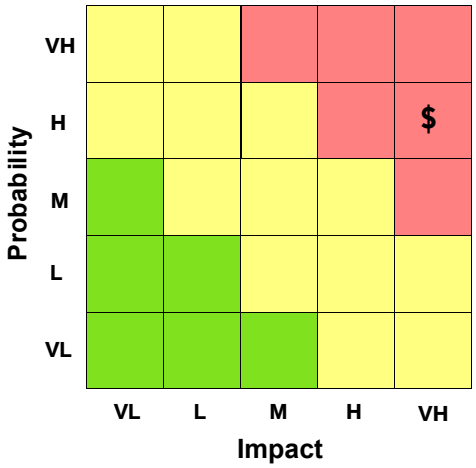
Value Engineering Recommendations # 8 (Remove Glass and Closure), # 9 (Remove Geothermal Wells), and # 11 (Shorten Lake Street Structures).

Cost To Mitigate
$0.000

Strategy
Exploit

Cost: Opportunity

Schedule: No Risk



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Only

Risk ID: UTL 1

Sub-Project: *Utility Relocation*

Risk Trigger:

Pre-Response Quantification

Probability
75%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$2.000	$3.000	$5.000	**$2.375**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

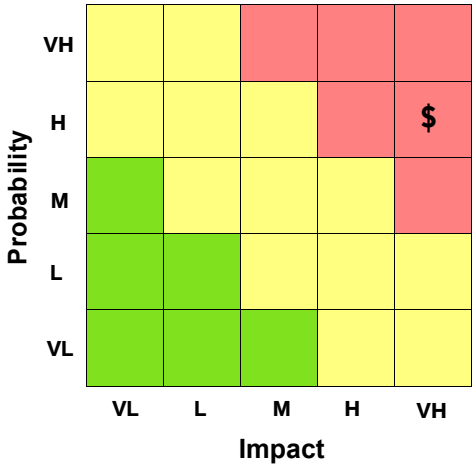
No utility relocation has been identified in the base cost estimate. Added cost for fiber and public utility relocation.

Project Risk Rank
4

Program Risk Rank
4

Cost: Threat

Schedule: No Risk



Post-Response Quantification

Probability
75%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$2.000	$3.000	$5.000	**$2.375**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

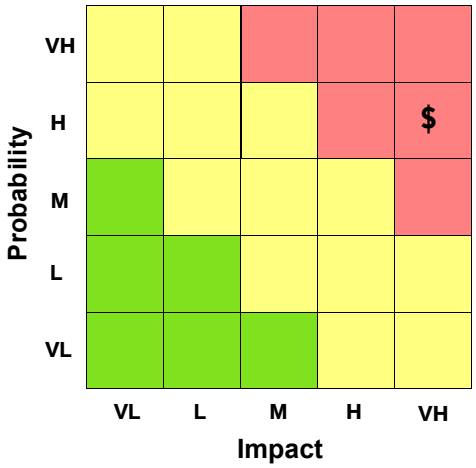
Locate existing Utilities

Cost To Mitigate
$0.000

Strategy
Acceptance

Cost: Threat

Schedule: No Risk



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Only

Sub-Project: *Convert to Design-Bid-Build*

Risk ID: BID 1

Risk Trigger:

Pre-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
($6.000)	($4.500)	($4.000)	**($2.333)**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

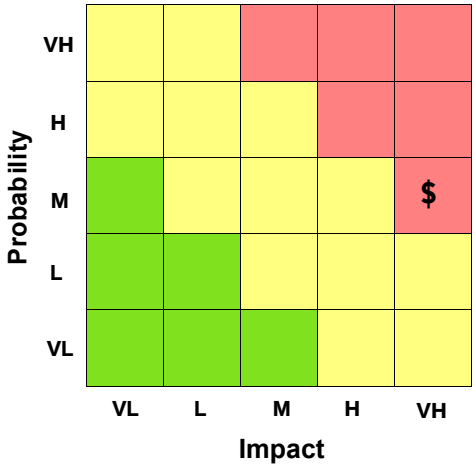
Deliver the Project using Conventional Design-Bid-build

Project Risk Rank
5

Program Risk Rank
5

Cost: Opportunity

Schedule: No Risk



Post-Response Quantification

Probability
100%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
($6.000)	($4.500)	($4.000)	**($4.667)**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

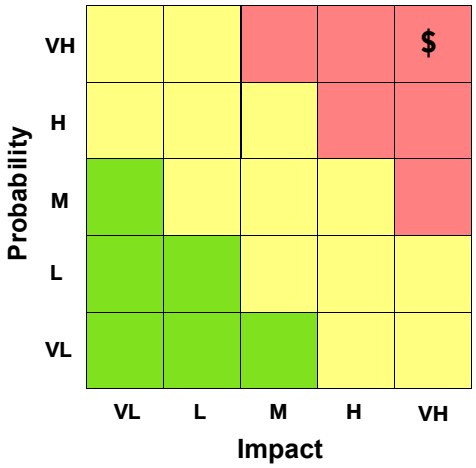
Implement VE Recommendation #12, and Develop DBB Packages.

Cost To Mitigate
$0.000

Strategy
Exploit

Cost: Opportunity

Schedule: No Risk



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Only

Sub-Project:

Risk ID: CON 7

Differing Conditions.

Risk Trigger:

Pre-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$1.000	$3.000	$8.000	**$1.750**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

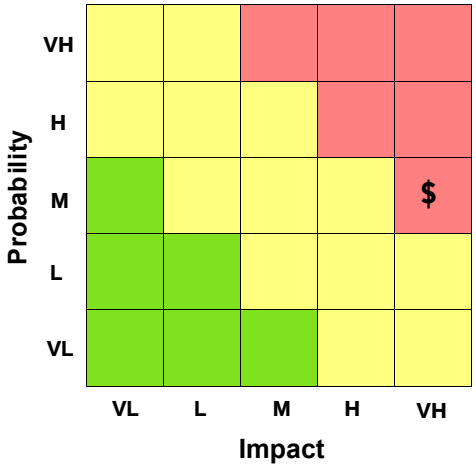
Project Risk Rank
6

Program Risk Rank
6

The cross town project ran into a number of foundations and other rubble under the roadway. Retaining walls may require sheet piling to construct.

Cost: Threat

Schedule: No Risk



Post-Response Quantification

Probability
35%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$1.000	$3.000	$8.000	**$1.225**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

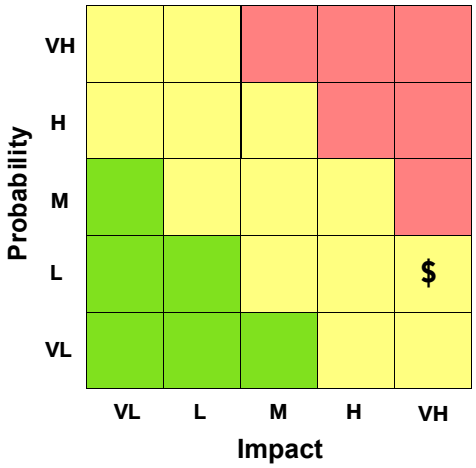
Cost To Mitigate
$0.000

Strategy
Mitigation

Mitigate with additional subsurface site investigation to rubble.

Cost: Threat

Schedule: No Risk



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Only

Risk ID: CON 3

Sub-Project: *Hydraulics and Drainage.*

Risk Trigger:

Pre-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$2.000	$3.000	$5.000	**$1.583**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

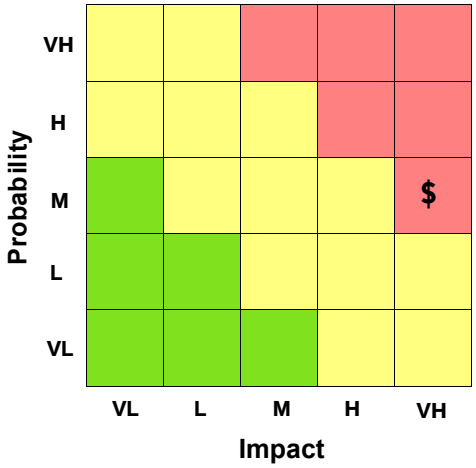
Project Risk Rank
7

Program Risk Rank
7

Base Cost assumed $9.8 M . Preliminary Design is yet to be completed. The Risk is; $9.8M might not be enough to complete the stormwater systems.

Cost: Threat

Schedule: No Risk



Post-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$2.000	$3.000	$5.000	**$1.583**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

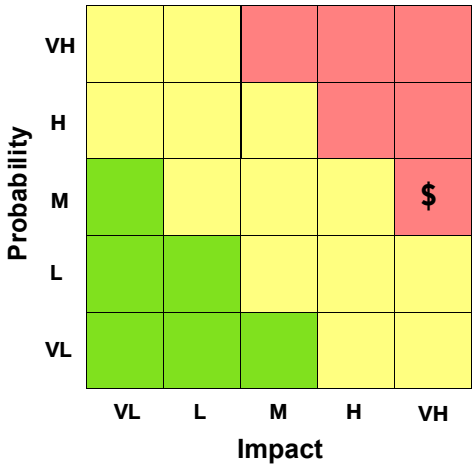
Cost To Mitigate
$0.000

Strategy
Acceptance

Accepted risk reserve storm water quality.

Cost: Threat

Schedule: No Risk



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Only

Risk ID: CON 9

Sub-Project:

Wall type.

Risk Trigger:

Pre-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
($4.000)	($3.000)	($1.500)	**($1.458)**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

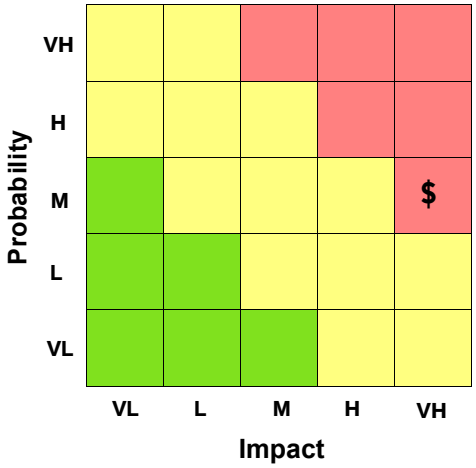
An opportunity to incorporate temporarily shoring into permanent wall type.

Project Risk Rank
8

Program Risk Rank
8

Cost: Opportunity

Schedule: No Risk



Post-Response Quantification

Probability
75%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
($10.000)	($6.000)	($2.500)	**($4.563)**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

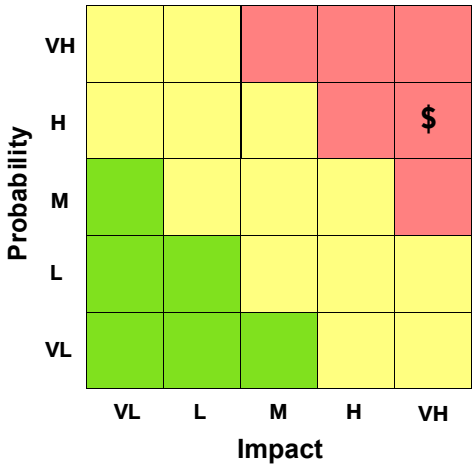
Implement VE Recommendation # 3 Wall Types.

Cost To Mitigate
$0.000

Strategy
Exploit

Cost: Opportunity

Schedule: No Risk



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Only

Risk ID: ROW 1

Sub-Project:

ROW Impacts Concern.

Risk Trigger:

Pre-Response Quantification

Probability
75%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$1.000	$1.800	$3.000	**$1.400**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

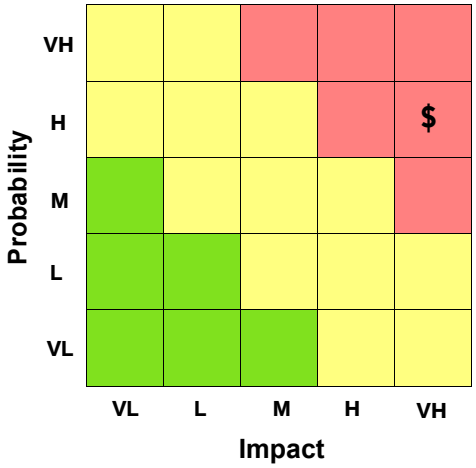
Project Risk Rank
9

Program Risk Rank
9

$3.6M in the base estimate. Most impacts are along SB I-35W between 31st and 28th. Impacts to businesses, billboards, accesses, residential areas, small park (non 4(f)), partial impacts with re-configuration of 3rd Ave.

Cost: Threat

Schedule: No Risk



Post-Response Quantification

Probability
75%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$1.000	$1.800	$3.000	**$1.400**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

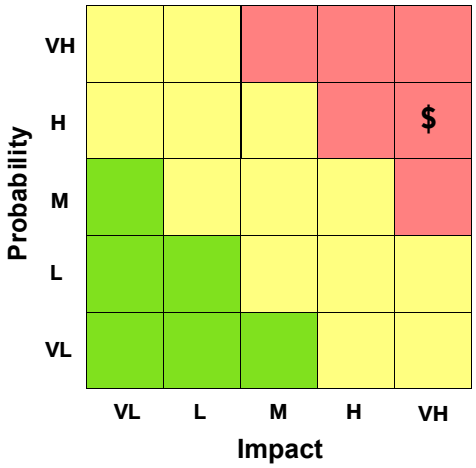
0

Cost To Mitigate
$0.000

Strategy
Acceptance

Cost: Threat

Schedule: No Risk



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Only

Risk ID: CON 10

Sub-Project: *SHPO*

Risk Trigger:

Pre-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$1.000	$2.000	$3.000	**$1.000**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

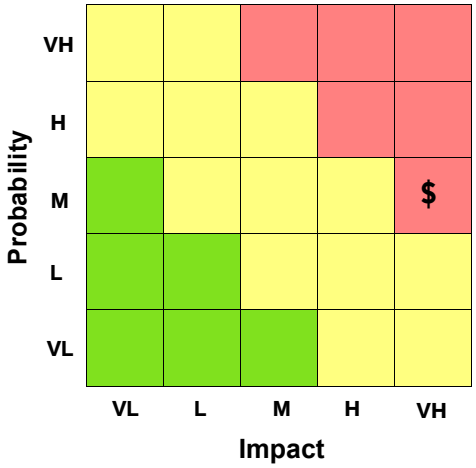
Project Risk Rank
10

Program Risk Rank
10

Number of historic properties, the SHPO Process could hold up the record of decision, or require added costly mitigation. They could require changes in traffic patterns. ROD is expected March of 2014. Must have SHPO approval prior to ROD. Greenway Bridges may require added cost. Current Schedule has enough flood to absorb some delays.

Cost: Threat

Schedule: No Risk



Post-Response Quantification

Probability
25%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$1.000	$2.000	$3.000	**$0.500**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

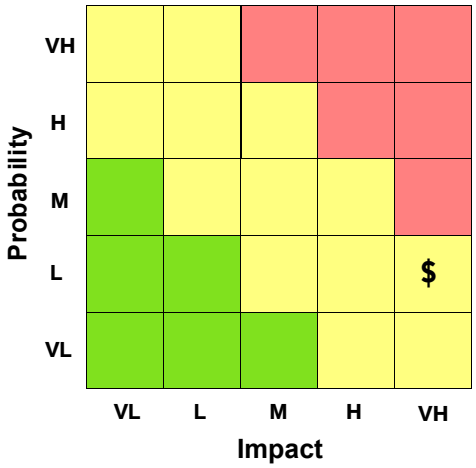
Cost To Mitigate
$0.000

Strategy
Mitigation

Pre-Constructor Survey of historic property then monitor during construction. Meeting with SHPO to get their concurrent on design.

Cost: Threat

Schedule: No Risk



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Only

Risk ID: GOV 1

Sub-Project:

Municipal Consent.

Risk Trigger:

Pre-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$1.000	$2.000	$3.000	**$1.000**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
1.00	3.00	6.00	**1.58**

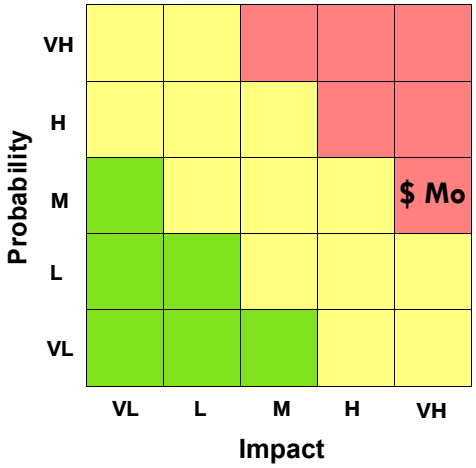
Project Risk Rank
10

Program Risk Rank
10

City of Minneapolis and Hennepin County both have to give Consent. NB exit to 28th St. The city, state, FHWA may not want it, but the county wants it. Also temporarily impacts during construction. 4th Ave to WB on Ramp is a concern as well. Primary access for emergency vehicle into the tunnel. Pedestrian access through construction areas. Visual & Public Art/ Enhancements/ Livability improvements, could be up to 1% (Excluding the transit center) - includes potential added scope for 2nd and Stevens. The local elected officials will change. O&M negotiations could add time/cost. Schedule Impacts are not currently on the project critical path.

Cost: Threat

Schedule: Threat



Post-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$1.000	$2.000	$3.000	**$1.000**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
1.00	3.00	6.00	**1.58**

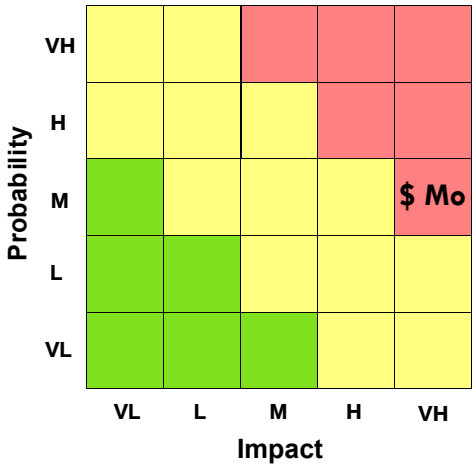
0

Cost To Mitigate
$0.000

Strategy
Acceptance

Cost: Threat

Schedule: Threat



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Only

Sub-Project:

Risk ID: MNT 1

Risk Trigger: *Maintenance Issues.*

Pre-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$0.500	$1.000	$1.500	**$0.500**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

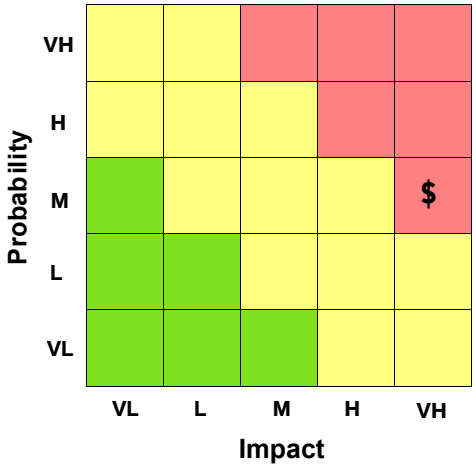
Added cost for automatic de-icing systems and snow storage areas that are not currently in the base.ystem for Transit Center Lake Street only.

Project Risk Rank
12

Program Risk Rank
12

Cost: Threat

Schedule: No Risk



Post-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$0.500	$1.000	$1.500	**$0.500**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

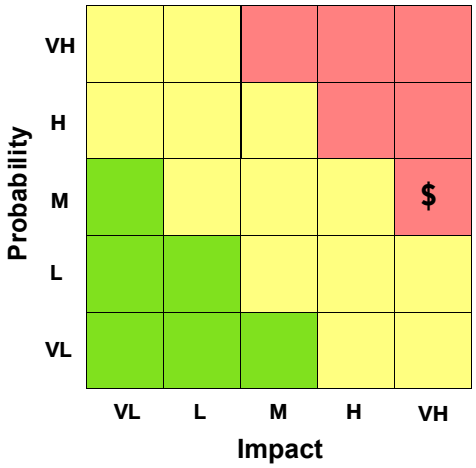
Work with MnDot Maintenance to develop a O&M agreement.

Cost To Mitigate
$0.000

Strategy
Acceptance

Cost: Threat

Schedule: No Risk



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Only

Risk ID: CON 5

Sub-Project: *Noise Walls.*

Risk Trigger:

Pre-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$0.750	$1.000	$1.250	**$0.500**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

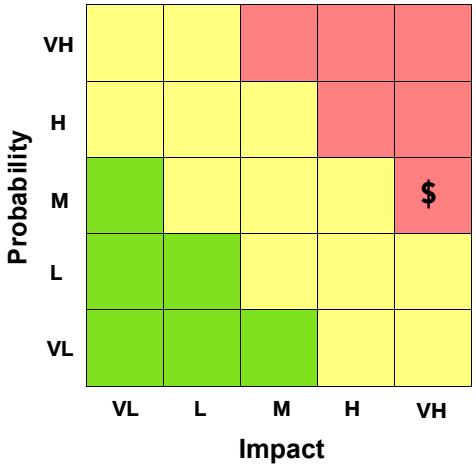
Project Risk Rank
12

Program Risk Rank
12

The risk is; another 2,000 feet of noise wall will need to be added South of 32nd St. on the North Side of the SB I-35.

Cost: Threat

Schedule: No Risk



Post-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$0.750	$1.000	$1.250	**$0.500**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

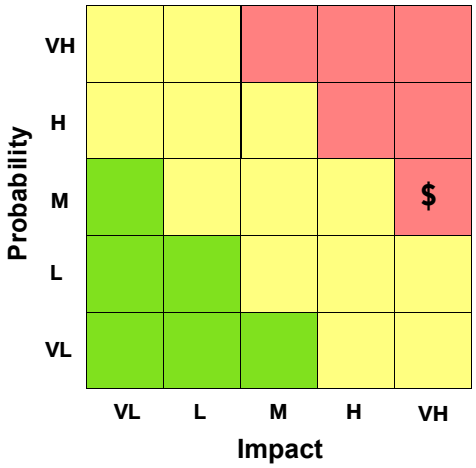
Cost To Mitigate
$0.000

Strategy
Acceptance

Complete the Noise Analysis.

Cost: Threat

Schedule: No Risk



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Risk Summary Sheet

Status: Active

Project: I-35W Transit/Access Only

Risk ID: CON 11

Sub-Project:

Construction Impacts to Business and Residents.

Risk Trigger:

Pre-Response Quantification

Probability
95%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$0.300	$0.400	$0.500	**$0.380**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

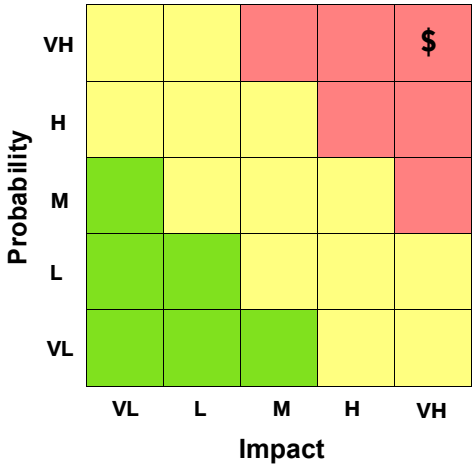
Project Risk Rank
14

Program Risk Rank
14

A number of temporarily noise abatement practices may be deployed. Some of these will be added cost to abatement in the base.

Cost: Threat

Schedule: No Risk



Post-Response Quantification

Probability
50%

Min ($M)	Most Likely ($M)	Max ($M)	Event Cost Expected Value Impact ($M)
$0.300	$0.400	$0.500	**$0.200**

Min (MO)	Most Likely (MO)	Max (MO)	Schedule Expected Value Impact (MO)
0.00	0.00	0.00	**0.00**

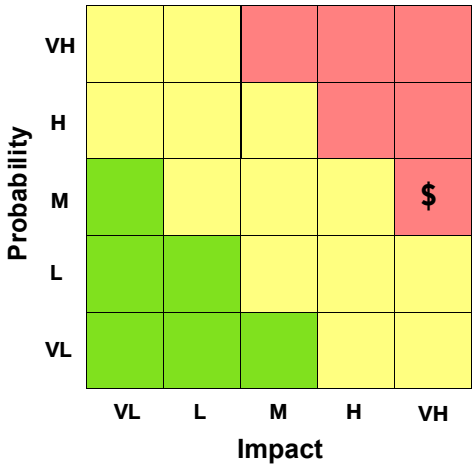
Cost To Mitigate
$0.000

Strategy
Mitigation

Early Construction of Permanent Noise Walls.

Cost: Threat

Schedule: No Risk



Monitoring & Control

Risk Owner:

Risk Owner Email:

Monitoring and Control Status:

Review Comments:

Risk Aging

From Date **To Date**

Status Interval

Last Review

Risk Assignment

Next Review

Affected Projects

Date: March 27, 2013

To: **CRAVE™ Team Members**

From: Ken Smith, PE, CVS ken.l.smith@hdrinc.com

Subject: I-35W Transit Access Project
Cost Risk Assessment & Value Engineering Study (CRAVE™)

Greetings, this memo is to start laying some of the expectations for the upcoming CRAVE™ Study April 15th- 19th, 2013. I'm looking forward to working with you on this endeavor. Our hope is that this memo will provide information to you about the project and our work together.

If you have any questions, please direct them to Ken Smith via e-mail at ken.l.smith@hdrinc.com or call (360) 451-2527.

Project Information

Information from project website http://www.35lake.com/

A CRAVE™ Study is directed at reducing risk and capital and/or operating costs.

CRAVE™ Study Location

The CRAVE™ Study will be in the SEH office first floor training room located at 3535 Vadnais Center Drive, St. Paul, MN.

What to Bring

Be sure to bring your normal tools of the trade, (e.g., calculator, laptop computer, etc.). Bring a creative and open mind. CRAVE™ Studies are a lot of work, but if you bring your expertise and sense of humor you will have a good time and a rewarding experience.

Ground Rules

A CRAVE™ Study includes the use of the VE Job Plan which is a prescribed process that has been proven over many years to produce the best results. This process needs the team members to be fully engaged in the study during the week.

In order to maintain our schedule and provide the best results to the project team I would ask that we follow some basic ground rules:

1. **Please be prepared to attend all five days.** You were selected to assist on this team based on your expertise. If you can not be in attendance for the entire time then please contact me prior to the study so we can make the appropriate arrangements.

   When team members leave part way through, or come and go frequently, the CRAVE™ team can lose its momentum and cohesiveness.

2. **Please turn your cell phones to vibrate mode during the study.** Unless it is information to assist the team, please try to wait until breaks to return phone calls, check on messages or sort through e-mails.

3. **No Dress code.** I want everyone to be comfortable. The first day does include a site visit so please have the appropriate footwear. The rest of the time the appropriate dress is what some would call business casual (No ties required).

4. **If you have a laptop please bring it along.** I have found most team members are more comfortable developing their write-ups on a computer. The facility we are in will have wireless internet, however; the memory stick has become the network of choice for sharing files.
5. **Our success will be evaluated based on the level of contribution that we bring to the project.** Remember that the goal of any CRAVE™ Study is to "add value" to the project and saving money is just a by-product. We want to make recommendations based on solid engineering judgment that will result in an improved overall project with reduced risk.

I'm looking forward to working with you on this CRAVE™ Study and I really appreciate each of you blocking time out of your busy schedule to participate. Please don't hesitate to call or e-mail me if you have any questions.

Ken L. Smith, PE, CVS
Vice President

National Director Value Engineering
HDR ONE COMPANY | ***Many Solutions***
626 Columbia Street| Suite 2A|Olympia, WA | 98501
Phone: (360) 570-4415 | Fax: (360) 570-7253
Cell: (360) 451-2527 Email: ken.l.smith@hdrinc.com

Agenda

Monday, April 15nd **SEH Office – First Floor Training Room**	
8:00 am	Welcome and Introduction
8:15 am	Overview of CRAVE™ process
8:45 am	Project Team presentation of the project What are the goals and objectives? What are the constraints and controlling decisions? What are the stakeholder issues
10:00 am	Begin Risk Elicitation
12:00 pm	Lunch (provided)
12:30 pm	Site Visit
3:00 pm	Capture site visit observations
3:30 pm	Complete Risk Elicitation
4:30 pm	Define the performance attributes & Attribute weighting
5:00 pm	Adjourn for the day
Tuesday, April 16th	
8:00 am	Functional Analysis – Define functions
8:30 am	Speculation Phase
12:00 pm	Lunch (provided)
1:00 pm	Speculation Phase moving into Evaluation Phase
5:00 pm	Adjourn for the day
Wednesday, April 17th	
8:00 am	Any new ideas from overnight?
8:30 am	Evaluation
12:00 pm	Lunch (provided)
1:00 pm	Continue Evaluation Phase and move into Development Phase
2:00 pm	Design team check in and risk response strategies
5:00 pm	Adjourn for the day
Thursday, April 18th	
8:00 am	Continue development of VE recommendations
12:00 pm	Lunch (provided)
1:00 pm	Define and evaluate the performance of recommendations
3:00 pm	Revisit risks with VE recommendations
5:00 pm	Adjourn for the day
Friday, April 19th **DOT Waters Edge Facility, 176 training room**	
8:00 am	Team walk through of presentation
10:00 am	Presentation of Findings
12:00 pm	Adjourn for the week

CRAVE™ Study Process

Step 1: Baseline Risk Assessment

a) Review baseline cost
b) Review baseline schedule
c) Identify risks related to baseline project
d) Assess and quantify risks in terms of project's cost and schedule

Step 2: Value Engineering & Risk Response

a) Develop value engineering recommendations that further mitigate or avoid high risk elements
b) Develop recommendations that add value by modifying project scope and/or schedule

Step 3: Risk Analysis on Response Strategies

a) Identify risks related to response strategies
b) Assess and quantify threats and opportunities in terms of project's cost and schedule

Step 4: Tracking, Monitoring, and Control (performed post CRAVE™ study)

a) Identify risk owners, monitoring frequency
b) Continuously update risk management plan
c) Document and report progress
d) At key milestones, update cost and schedule

Pre-Study/Prep Meeting

- Validate cost estimate/project schedule

  Once the team is familiar with the project, they set out to validate the construction cost estimate. The estimate is evaluated line by line with group discussion about the unit cost for each item and the quantities involved. If the team feels that adjustments are necessary, they are made to a duplicate estimate so comparisons can be made when this task is complete. The reasons for changes are clearly documented so that the project team can understand what changed and why.

  Going through the estimate line by line gives the team a very good understanding of the intent of the project and the construction techniques that are assumed which can lead to discovering opportunities and/or risks that can be used in the Speculation Phase.

- Early Elicitation of Risks

Investigation Phase

The CRAVE™ Team begins the study by investigating the project. The project team provides a packet of information to the CRAVE™ Team on what is known about the project and what documents are available upon which they will base the development of their recommendations. Often, CRAVE™ Team want to rush right into speculating solutions before they have taken the time to acquaint themselves with the information that is already available.

Good groundwork in the Investigation Phase is important to providing viable recommendations at the end of the study. Combining the CRA with the VE investigation process encourages team building and allows the team members get to know each other and identify areas of expertise.

- Presentation of Project
- Cost Estimate/Schedule validation/review

- Risk Elicitation and Quantification

  After the estimate is validated, the team identifies the risks associated with the project team's design or the base design. Often the CRAVE™ Team Leader acts as the risk elicitor to assist the team with the identification of risks.

  It is important to fully understand what is "known" about a project. Items that are not yet known must also be addressed, including uncertainty. Uncertain events in the future can pose threats or present opportunities. When preparing early estimates, particularly for complex projects, the effects of uncertainty must be considered.

  A risk event may hold the possibility of a positive or negative effect on a project. A positive potential presents an opportunity to the project and a negative potential poses a threat to the project. These threats and opportunities can be related to both schedule and cost.

  By identifying the risks associated with the base design, the team begins to generate ideas that will not only reduce risks, but also generally reduces costs and increases the value added to the project.

- Site Visit
- Revisit Risks
- Model risks using pre-mitigated side of the Risk Tracking & Analysis Tool

  Risk Analysis is the use of available information to determine how often events may occur and the magnitude of their consequences. HDR has developed for UDOT a Risk Tracking & Analysis Tool.

  Once the base cost is established, a list of risks, called a Risk Register is created, including both opportunities and threats. The risk assessment replaces general and vaguely defined contingency with explicitly-defined risk events and includes for each their associated probability of occurrence and impact on project cost and/or schedule. This Risk Tracking & Analysis Tool allows for real time results, which are a necessity for completing this within the CRAVE™ Study duration. The new "risk-based" estimate is given in 10% through 90% confidence intervals.

  The development of a risk management plan is taken into the next phase, which is the Speculation Phase.

Speculation Phase

This phase is enhanced by adding speculation ideas on how to maximize the opportunities and reduce or eliminate the threats (risks) to the project. At the end of the speculation phase have the project team develop response strategies for those risks that are not carried into the Evaluation Phase.

During the Speculation Phase, the CRAVE™ Team brainstorms ideas that satisfy the project functions and address the identified risks. A team member can explain an idea to the rest of the team, but no evaluation is allowed at this point. Off-the-wall, out-of-the-box ideas are encouraged, as they often lead to innovative, workable solutions. The team lists all of the brainstorm ideas, even the most improbable.

While the CRAVE™ Team is brainstorming ways to improve the project, different ideas start to emerge on how to reduce or eliminate the risks that were identified during the risk solicitation.

The opportunities defined from the risk assessment are carried over into brainstorm list to be evaluated along with ideas defined by the CRAVE™ Team. Ideas are generated based off of the functions identified in the information phase; additional brainstorming is performed on the function of "Reduce Risk". The ideas are evaluated and drafted into alternatives, sometimes referred to as proposals or recommendations.

Evaluation Phase

The Evaluation Phase begins by going back through the ideas brainstormed during speculation to determine those that have fatal flaws. Ideas that are not viable will be dropped.

The team lists the advantages and disadvantages of each idea that warrants further consideration. If the disadvantages of an idea outweigh the advantages, in number or importance, that idea will not be considered further.

When all of the ideas have been evaluated, and the team still has competing ideas, the most promising may be put through an Evaluation Matrix. The evaluation matrix is used to determine which idea ranks best against selected criteria. Risk is generally used in the evaluation matrix as one of the criteria. This allows the opportunity to select the idea that results in the most significant reduction of risks.

“Reduce Risk” is one of the standard performance measures or attributes that is used during a CRAVE™ Study.

Development Phase

During the Development Phase the CRAVE™ Team Leader will typically assign a subgroup for each recommendation, to develop the appropriate documentation and descriptions.

Cost estimates are included when developing recommendations. Although the goal of any VE Program is to add value, due to the nature of highway projects and funding, we must also consider, and document, cost savings or cost added.

Within the CRAVE™ process, a final step is added to the development phase as the CRAVE™ Team revisits the risk elicitation.

- Review risk elicitation and assessment based on the recommendations from the Development Phase
  Complete the post-mitigated side of the risk management plan by adding the VE recommendations into the model

Presentation

The presentation will be enhanced since better project cost and duration data is available. The Risk Management Plan created during this process will specify what can or should be done in order to control and monitor the risk impacts on the project cost and schedule.

Post-Workshop (Implementation Plan)

The CRAVE™ Study Report will include mitigation strategies as specified by the Risk Management Plan.

Outcome

Combining these two processes, Cost Risk Assessment & Value Engineering, creates a new, enhanced CRAVE™ Study with the added benefit of a comprehensive analysis of major factors that would, or could, have an adverse effect on the final project.

The information provided by this style of CRAVE™ Study gives valuable tools to project managers to help them deliver a successful project on time and within budget.

When a multi-disciplined team of experts is assembled in a workshop environment, maximum benefit can be achieved by using this combined process.

The ultimate goal of combining these studies is to reduce or eliminate risk, which will result in improved ability to deliver projects on time and within budget.

VE Study Attendees

I-35W Transit/Access Project

2013 April					NAME	ORGANIZATION	POSITION/DISCIPLINE	TELEPHONE	
								Office	Cell
15	16	17	18	19				E-MAIL	
✓	✓	✓	✓	✓	Michael Ameen	HDR	Risk Modeling	(360) 570-7270	
								michael.ameen@hdrinc.com	
✓	✓	✓	✓	✓	Brad Anderson	MnDOT	Sr. Engineering Specialist	(651) 366-4603	
								brad.anderson@state.mn.us	
✓	✓	✓	✓	✓	Steve Barrett	MnDOT	Construction		
								steven.barrett@state.mn.us	
✓		✓	✓		Scott Carlstrom	MnDOT	Water Resources Engineer	(651) 234-7525	
								scott.carlstrom@state.mn.us	
✓	✓	✓	✓	✓	Chad Casey	MnDOT	Metro Design Engineer	(651) 234-7617	
								chad.casey@state.mn.us	
✓	✓	✓			Mark Dierling	SEH	Design PM	(651) 765-2953	(621) 819-1871
								mdierling@sehinc.com	
✓	✓	✓	✓	✓	Gayle Gedstad	MnDOT	Metro Traffic	(651) 234-7815	
								gayle.gedstad@state.mn.us	
✓					Jim Grube	Hennepin County	County Engineer	(612) 596-0300	
								james.grube@co.hennepin.mn.us	
✓					Jenifer Hager	Minneapolis	Project Manager for Mpls	(612) 673-3625	(612) 919-1069
								jenifer.hager@minneapolismn.gov	

VE Study Attendees

I-35W Transit/Access Project

2013 April					NAME	ORGANIZATION	POSITION/DISCIPLINE	TELEPHONE	
								Office	Cell
15	16	17	18	19				E-MAIL	
✓			✓		Bruce Irish	MnDOT	Water Resources Engineer	(651) 234-7534	
								bruce.irish@state.mn.us	
✓	✓	✓	✓	✓	Carl Jensen	MnDOT	Planning/Transit	(651) 234-7711	
								carl.jensen@state.mn.us	
✓	✓	✓	✓	✓	Blane Long	HDR	Cost Lead/Documentation	(360) 570-4411	(360) 742-7682
								blane.Long@hdrinc.com	
✓	✓	✓	✓	✓	Gayle Mack	SEH	Architecture		(763) 670-8256
								gmack@sehinc.com	
✓	✓	✓	✓	✓	Mark Maves	SEH	Bridge	(651) 490-2045	(651)470-1691
								mmaves@sehinc.com	
✓		✓			Minnie Milkert	MnDOT	State Value Engineer	(651) 366-4648	
								minnie.milkert@state.mn.us	
✓					Christina Morrison	Metro Transit	PM for Orange Line BRT	(612) 349-7690	
								christina.morrison@metrotransit.org	
✓					Ron Rauchle	MnDOT	Metro West Area Engineer	(651) 234-7880	
								ron.rauchle@state.mn.us	
✓	✓	✓	✓	✓	Jon Re	MnDOT	Metro Materials		
								jonathan.re@state.mn.us	

VE Study Attendees

I-35W Transit/Access Project

2013 April					NAME	ORGANIZATION	POSITION/DISCIPLINE	TELEPHONE	
								Office	Cell
15	16	17	18	19				E-MAIL	
✓	✓	✓			Daniel Prather	MnDOT	Preliminary Engineer	(651) 366-4457	
								dan.prather@state.mn.us	
✓					Krysten Saatela	MnDOT	ADA	(651) 366-4631	(651) 373-4319
								krysten.saatela@state.mn.us	
✓					Anna Schwartz	MnDOT			
								anna.schwartz@state.mn.us	
✓	✓	✓	✓	✓	Ken Smith	HDR	CRAVE™ Team Leader	(360) 570-4415	(360) 570-2527
								ken.l.smith@hdrinc.com	
✓					Dale Thomas	CH2M Hill	Bridges	(651) 365-8514	(612) 240-4044
								dale.thomas@ch2m.com	

CRAVE™ Report out

April 19, 2013

Goals and Objectives

- Effectively integrate transit, freeway (mobility), and local access
- Complete the Lake Street area interchange
- Provide community benefit through arterial, collector, and local street improvements
- Meet transit/MnPASS objectives and address freeway system issues
- Create opportunities for the community

Constraints and Controlling Decisions

- Stay within the right of way footprint defined in 2004
- Braid and flyover bridges require replacement by 2018
- Location of transit station
- Freeway level station side platform configuration
- Quality connection between the station and the Greenway

Stakeholder Issues

- Proposed improvements fit with surrounding neighborhoods
- Pedestrians and bicycles are well accommodated
- Ongoing operations and maintenance cost and responsibility considered
- Incorporation of public art

Purpose of Proposed Action

- Improve bridge structural conditions
- Improve mobility on I-35W and Lake
- Improve the safety of I-35W and I-94 by reducing the number of congestion-related crashes

Purpose of Proposed Action

- Improve the safety and capacity of Lake Street and 31st Street intersections at Stevens Avenue and 2nd Avenue
- Improve regional traffic circulation and access to and from Lake Street Area and the Twin Cities Metropolitan Area
- Improve the efficiency of existing transit operations and routes

Purpose of Proposed Action

- Improve transit patron safety and convenience appropriately planning for future system integration to better serve passengers
- Improve pedestrian linkages and multimodal connections
- Support revitalization and economic vitality and enhance the environmental quality, the urban landscape, and the sense of community in the project area

Primary Needs

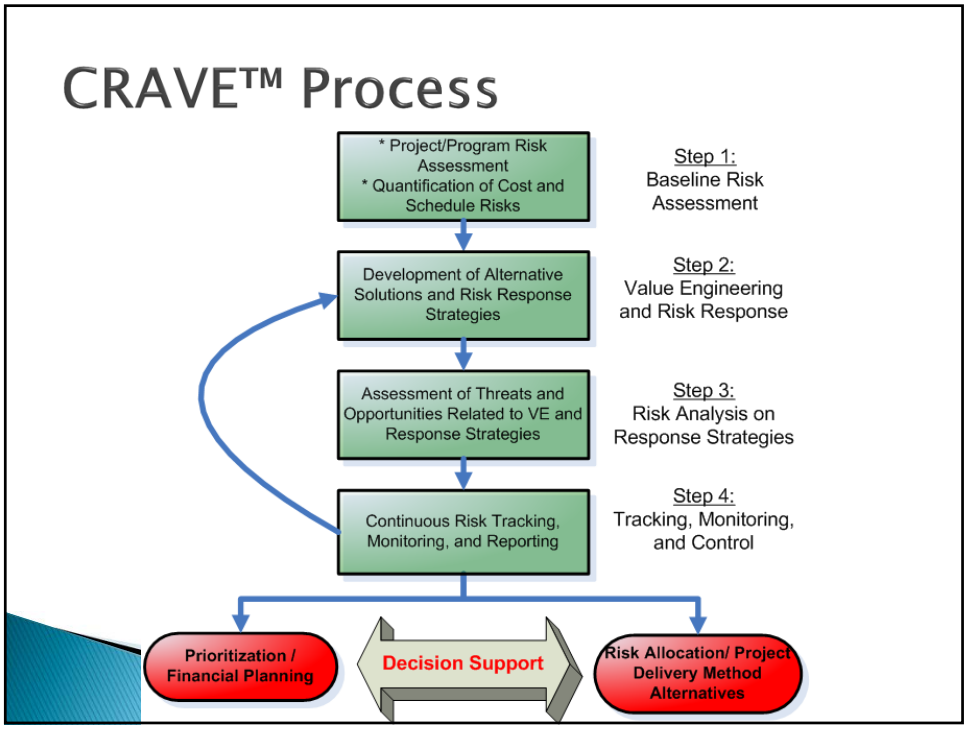
- Ensure the structural integrity of the highway transportation system and related transit infrastructure
- Provide safe (ADA-accessible) transit user access to and from the Lake Street Area
- Accommodate the Metropolitan Council's future vision for the southbound I-35W corridor

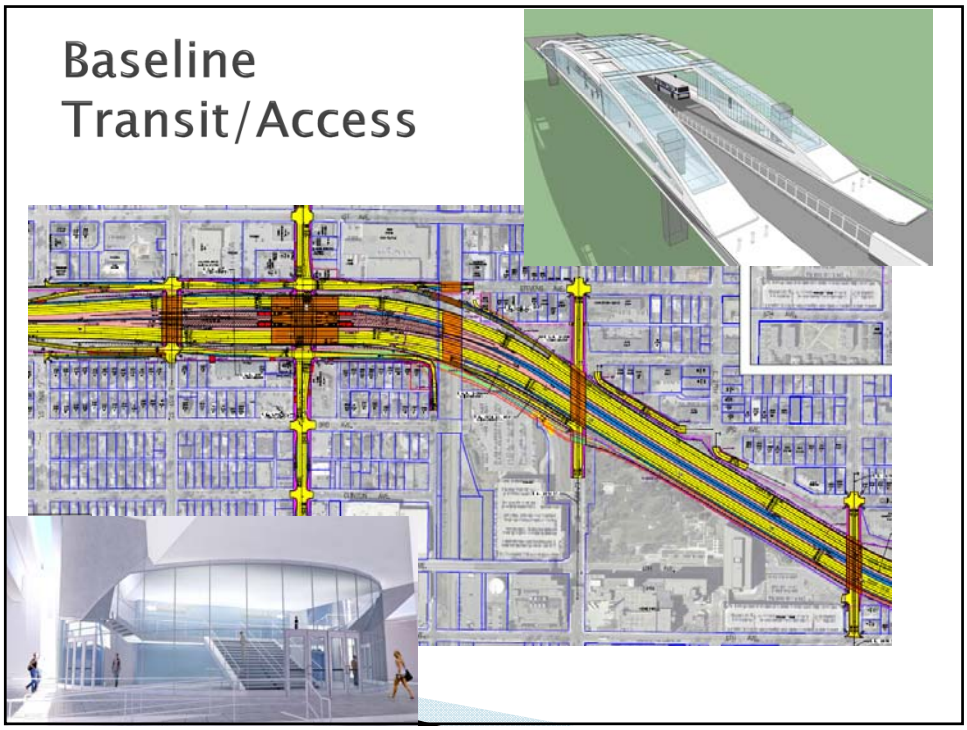
Primary Needs

- Enhance transit service efficiencies in terms of speed and reliability
- Provide safe, direct freeway access to and from the Lake Street area, including a more direct route for northbound regional traffic destined to the large traffic generators in the area
- Optimize the performance of the highway system to mitigate the impacts of congestion

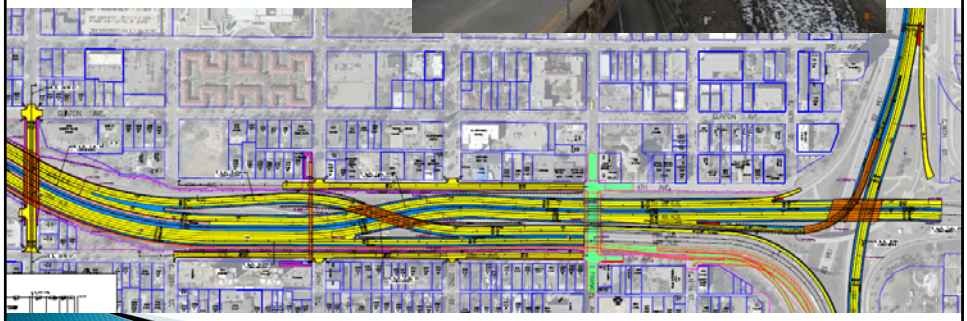
Team Members

Michael Ameen	HDR	Risk Modeling
Brad Anderson	MnDOT	Sr. Geometrics Engineer
Steve Barrett	MnDOT	Construction
Scott Carlstrom	MnDOT	Water Resources Engineer
Chad Casey	MnDOT	Metro Design Engineer
Mark Dierling	SEH	Design PM
Gayle Gedstad	MnDOT	Metro Traffic
Carl Jensen	MnDOT	Planning/ Transit
Blane Long	HDR	Cost Lead
Gayle Mack	SEH	Architecture
Mark Maves	SEH	Bridge
Minnie Milkert	MnDOT	State Value Engineer
Jon Re	MnDOT	Metro Materials
Daniel Prather	MnDOT	Preliminary Engineer
Ken Smith	HDR	CRAVE™ Team Leader

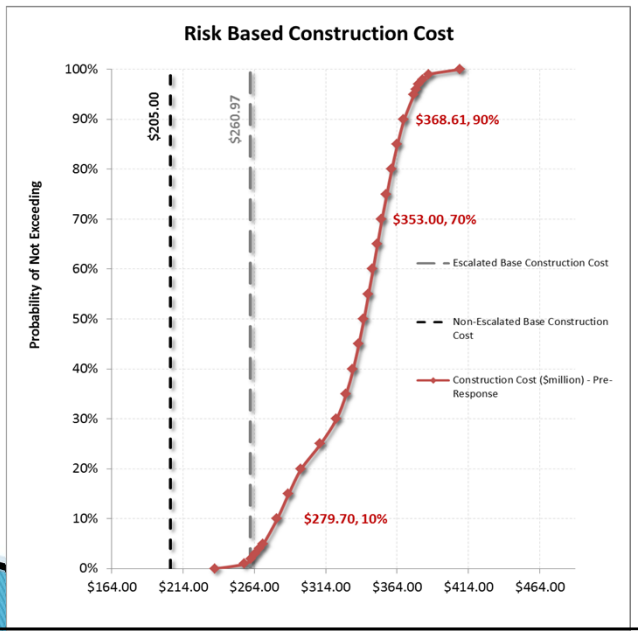

CRAVE™ Process
* Project/Program Risk Assessment
* Quantification of Cost and Schedule Risks
Step 1:
Baseline Risk Assessment
Development of Alternative Solutions and Risk Response Strategies
Step 2:
Value Engineering and Risk Response
Assessment of Threats and Opportunities Related to VE and Response Strategies
Step 3:
Risk Analysis on Response Strategies
Continuous Risk Tracking, Monitoring, and Reporting
Step 4:
Tracking, Monitoring, and Control
Prioritization / Financial Planning
Decision Support
Risk Allocation/ Project Delivery Method Alternatives


Baseline
Transit/Access

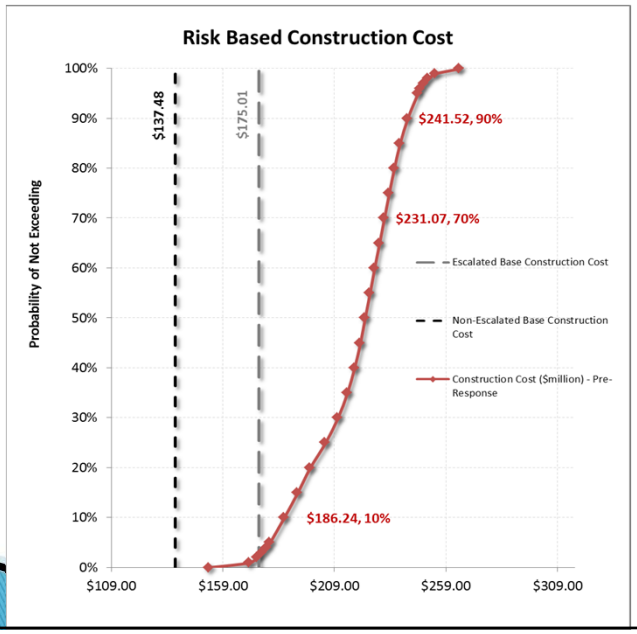
Baseline Chapter 152



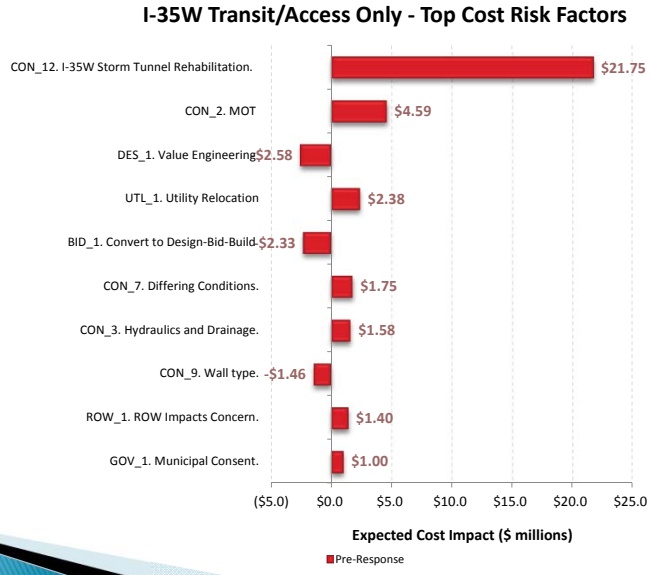
Transit/Access Combined Projects Pre-VE



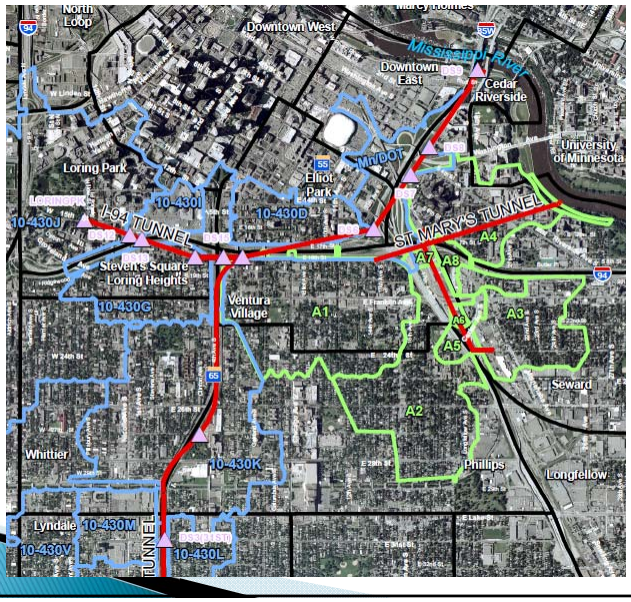
Transit/Access Only Project Pre-VE



Top Risks



Top Risk – Stormwater Tunnel



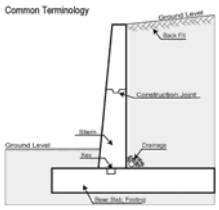
Recommendation #1
Active Traffic Management

Recommendation #2 Maintenance of Traffic (MOT)

Baseline:
- 4 lane is each direction
-12' lanes
- 55 MPH

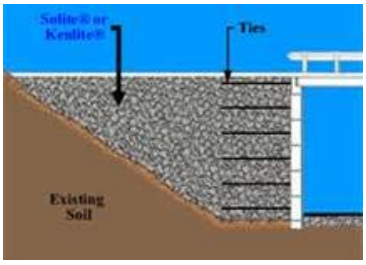
Recommendation:
- 3 lane is each direction
-11' lanes
- 45 MPH

Recommendation #3 Retaining Wall



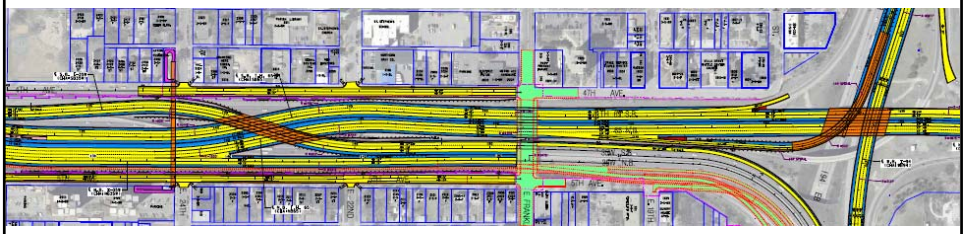
Baseline CIP Walls

Sheet pile with Fascia

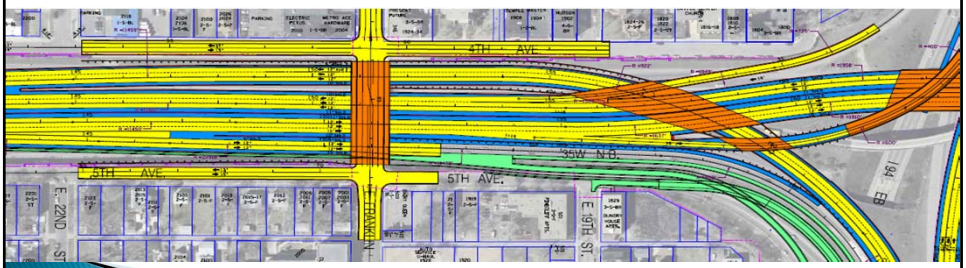


MSE for fill walls

Recommendation #4 Braid Bridge

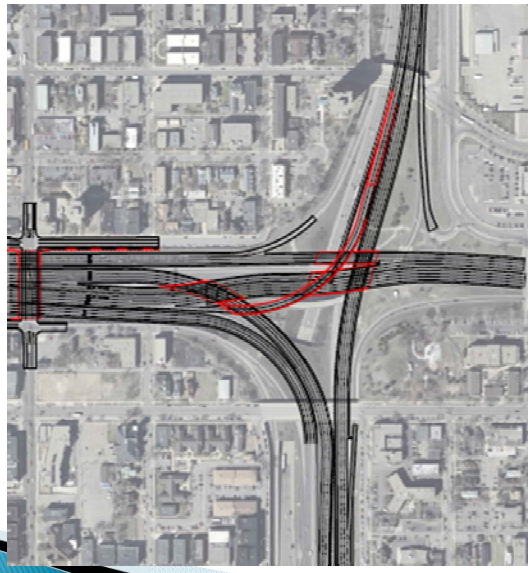


Baseline Design

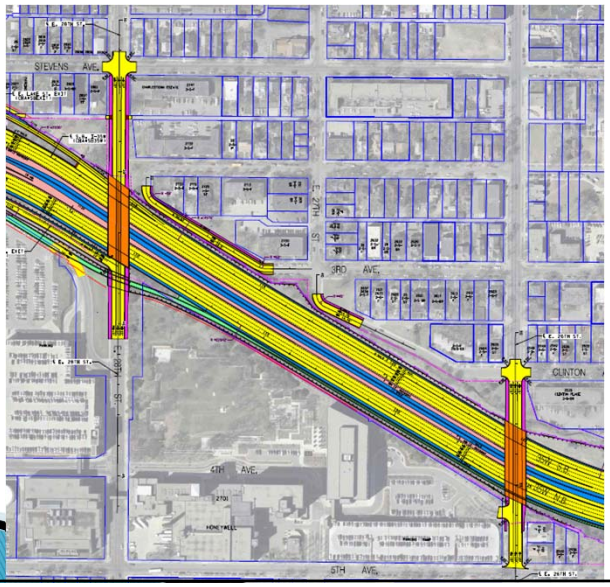


Use Alternative 2

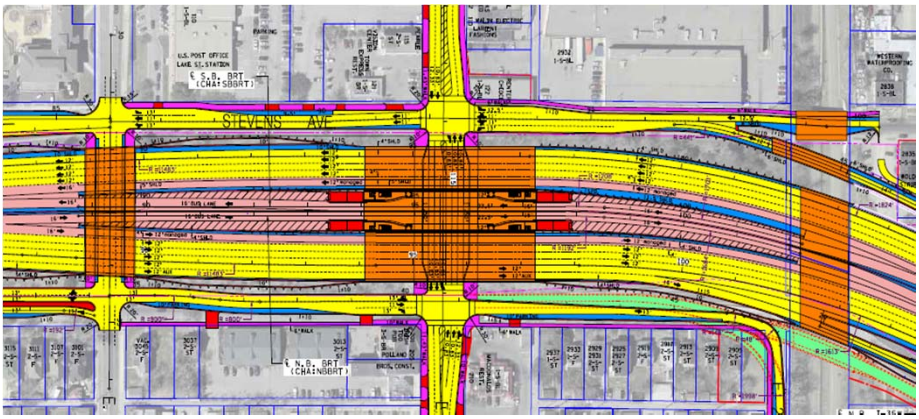
Design Consideration



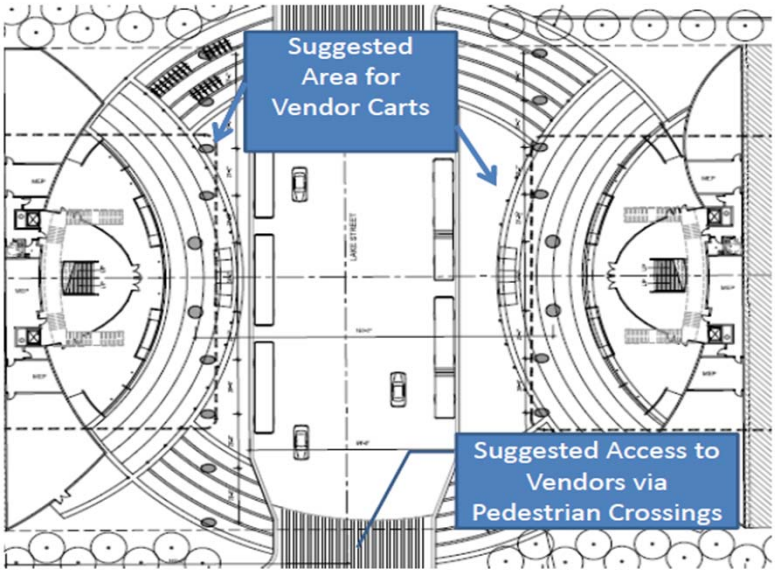
Recommendation #5
26th & 28th Street Structures



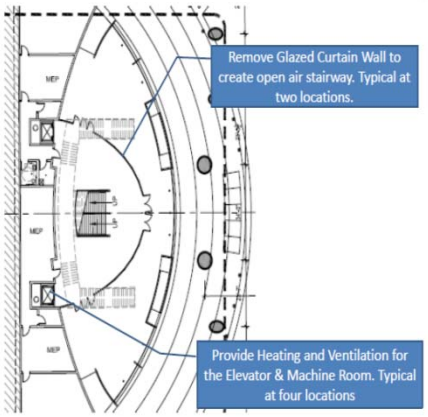
Recommendation # 6 Staging



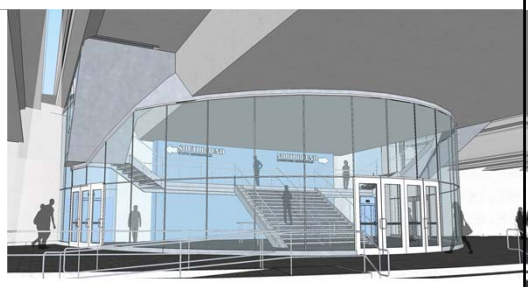
Recommendation #7 Vendor Space

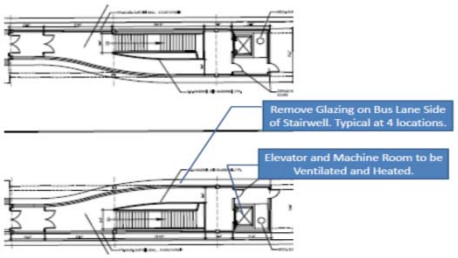


Recommendation #8 Transit Center Enclosure



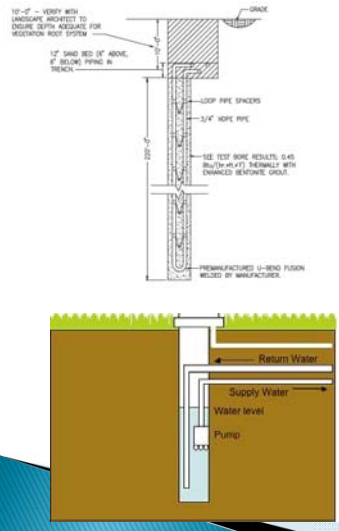
Remove Enclosed Lobby

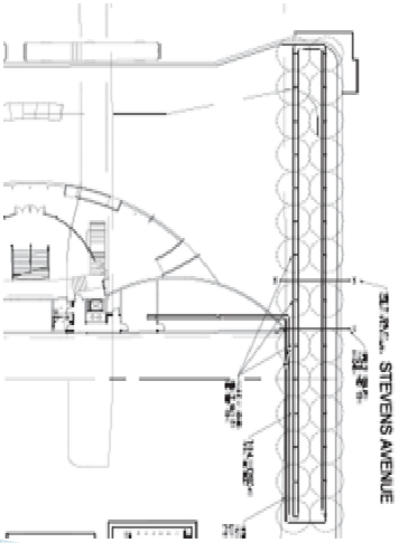




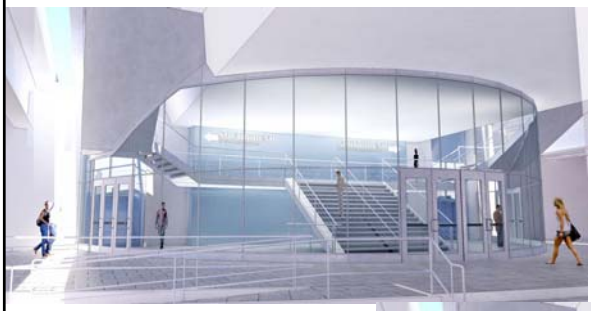
Upper Level Scope of Work for Removal of Glazing

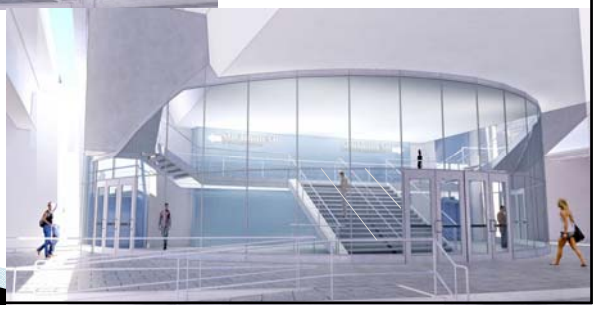
Recommendation #9
Remove Geothermal Wells



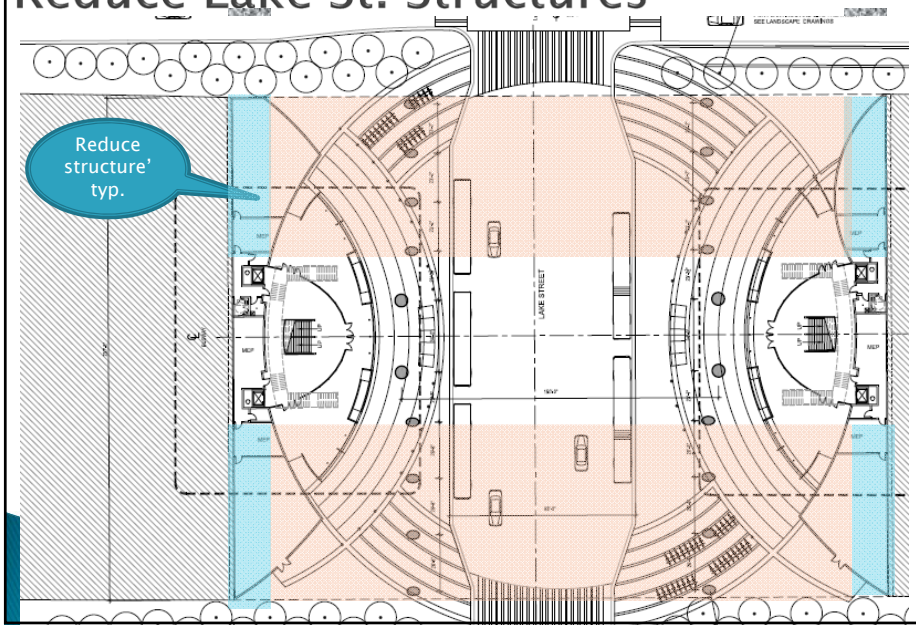


Recommendation # 10
Transit Station Stairway





Recommendation # 11
Reduce Lake St. Structures



Recommendation # 12
Use Design Bid Build Delivery

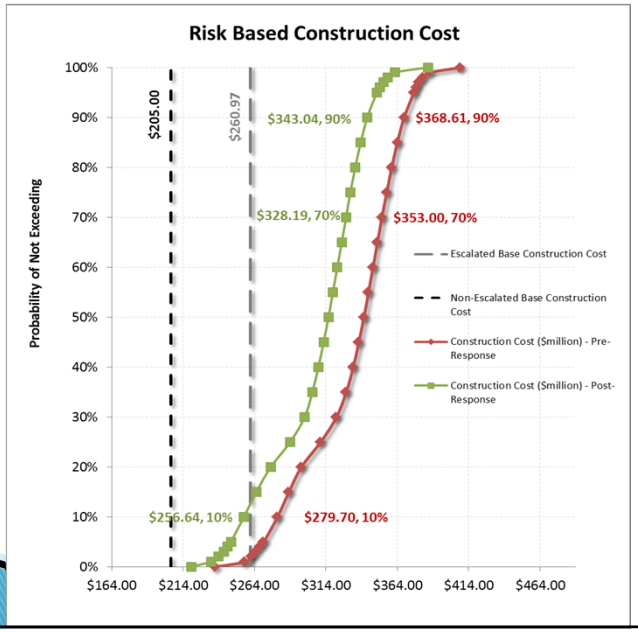
2013	2014	2015	2016	2017	2018	2019	2020
Preliminary Design		Wait for funding	RFP	Final Design/Construction			
Design-Build							

2013	2014	2015	2016	2017	2018	2019	2020
Preliminary Design		Final Design	Bid	Construction			
Design-Bid-Build							

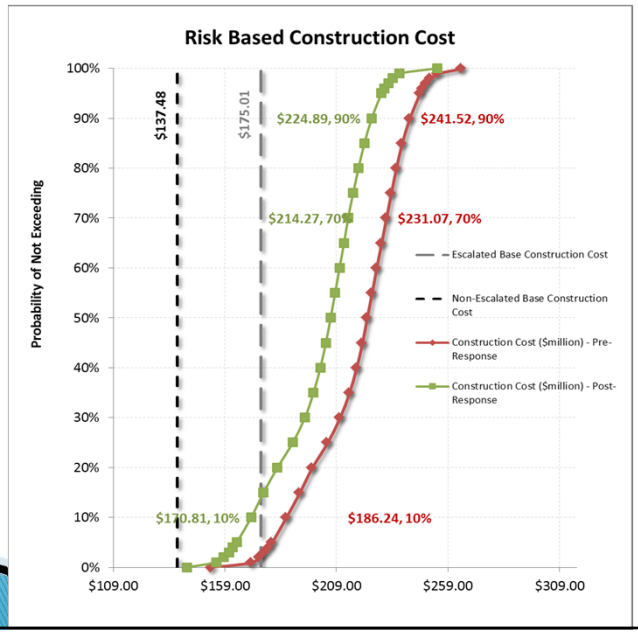
Summary of Recommendations

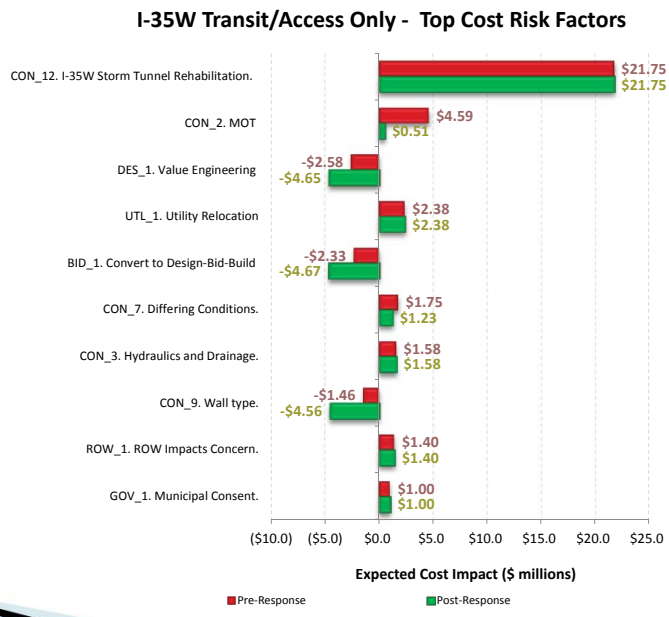
Summary of Recommendations				
#	Description	Cost Savings	Cost Added	Performance
1	Active Traffic Management	NQ		10%
2	Maintenance of Traffic	$6.50		6%
3	Retaining Walls	$15.14		6%
4	I-35W Braid		($2.12)	27%
5	26th & 28th Street Bridges	$1.22		9%
6	Staging I-35W @ Lake Street	NQ		1%
7	Selling Vendor Space	NQ		4%
8	Remove Glass Enclosure/HVAC	$4.52		20%
9	Remove Geothermal Wells	$0.36		3%
10	Add handrail to Main Stair	NQ		8%
11	Shorten Lake St. Structures	$0.90		0%
12	Design-Bid-Build	$7.07		1%

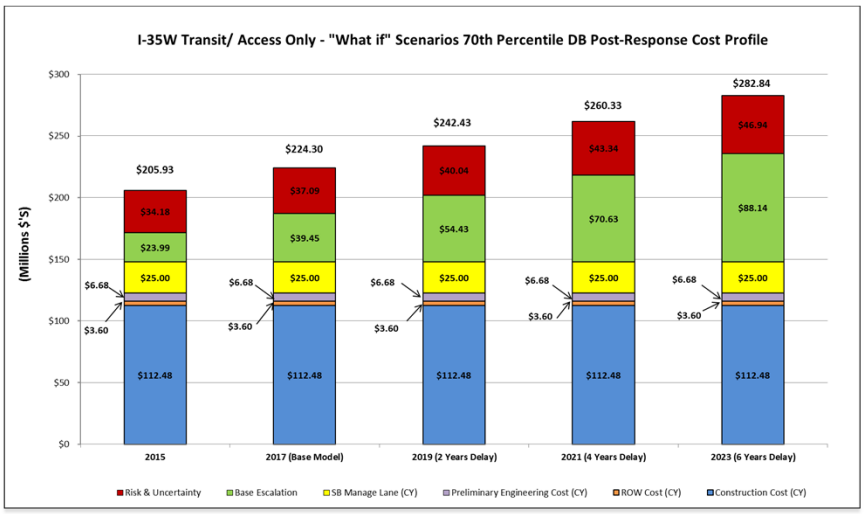
I-35W Transit/Access Combined Projects



I-35W Transit/Access Only






I-35W Transit/ Access Only - "What if" Scenarios 70th Percentile DB Post-Response Cost Profile
(Millions $'S)
$300
$250
$200
$150
$100
$50
$0
$205.93
$224.30
$242.43
$260.33
$282.84
$34.18
$37.09
$40.04
$43.34
$46.94
$23.99
$39.45
$54.43
$70.63
$88.14
$25.00
$6.68
$3.60
$112.48
2015
2017 (Base Model)
2019 (2 Years Delay)
2021 (4 Years Delay)
2023 (6 Years Delay)
Risk & Uncertainty
Base Escalation
SB Manage Lane (CY)
Preliminary Engineering Cost (CY)
ROW Cost (CY)
Construction Cost (CY)