S.P. 1308.29 TH 8 IMPROVEMENT PROJECT (HIGHWAY 8 - LET'S GET MOVING)

VALUE ENGINEERING REPORT

Chisago County, MN

SEPTEMBER 2020

FINAL

benesch

DEPARTMENT OF TRANSPORTATION

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DEPARTMENT OF TRANSPORTATION

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EXECUTIVE SUMMARY

E.1 Project Description

A Value Engineering workshop was conducted on Trunk Highway (TH) 8 in Chisago County (S.P. 1308.29) from August 10 to August 13, 2020. The final presentation was presented on the morning of the August 13 (Section 8). Each team member was in their respective location but networked together through video platforms.

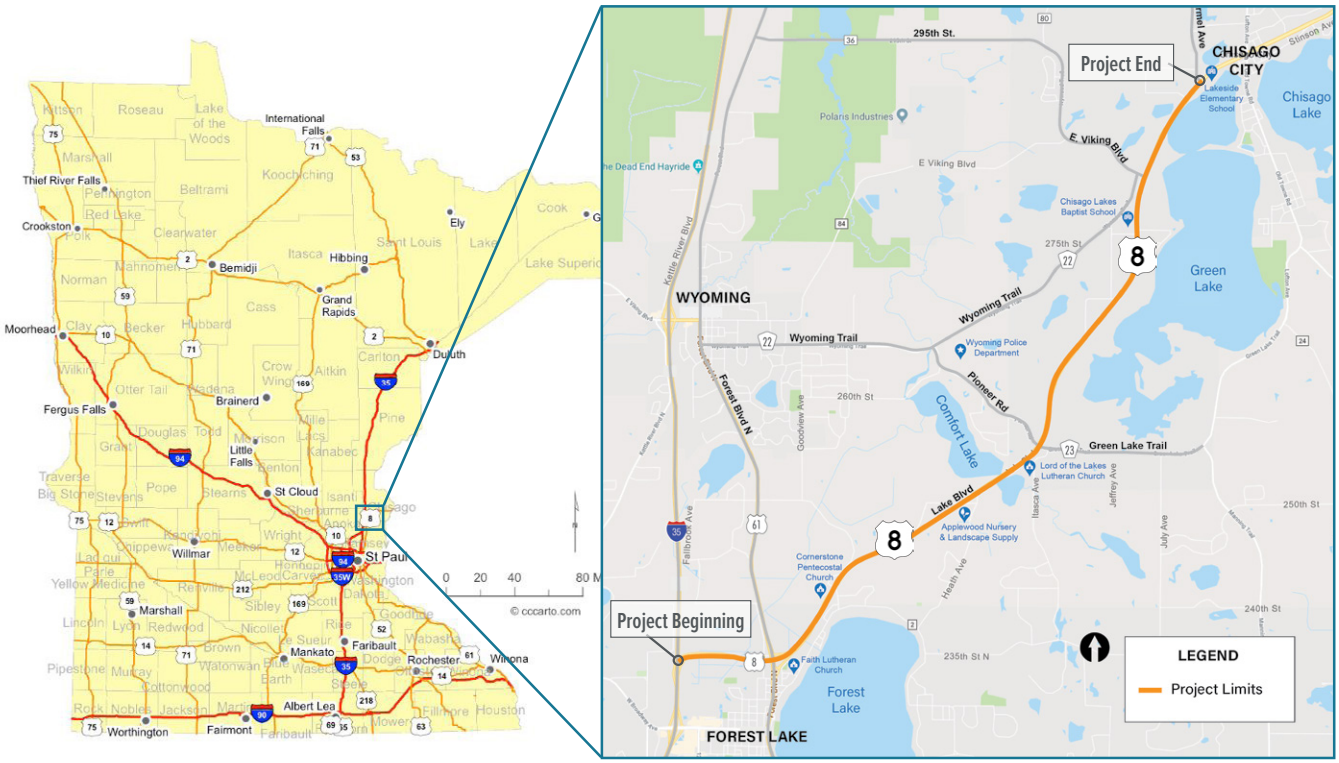


Exhibit E.1: TH 8 - Let's Get Moving Project Location Map

The project is 8.1 miles long and addresses concerns with capacity, corridor access, and potential development. The limits start at the west end at the interchange with I-35. The western limits are Karmel Avenue in Chisago City. The work entails resurfacing where TH is four lanes wide. The remaining two-lane segment is reconstructed with four lanes and a raised median. Access is reduced from 57 to eight points, most being intersection with either signals, stop controlled, or RCUTS.

The project's estimated construction cost is $44.5 million in 2018 dollars. Construction is planned for 2023 through 2024. The estimate provided to the VE team is included in Appendix A and discussion of the cost breakdown including function cost is in Section 3.

VE Study Summary

Project Cost: $44,500,000

Number of Recommendations: 11

Recommended Cost Savings: $20,995,500

Recommended Cost Added: $(706,400)

Number of Recommendations Accepted: 7

Accepted Recommendations Cost Savings: $20,148,000

Accepted Recommendations Cost Added: ($599,000)

Total VE Team Members: 12

MnDOT Team Members: 5

Benesch Team Members: 5

FHWA Team Members: 2

The six-phase job plan for VE was followed by the facilitation team from Alfred Benesch & Company (Benesch). The VE team was composed of engineers from Minnesota Department of Transportation (MnDOT), Federal Highway Administration (FHWA) and Benesch. As a part of the Information Phase, the first phase of the job plan, a presentation explaining the project was made by representatives from Chisago County, MnDOT, and SRF Engineering, the design firm. A discussion of the Information Phase including documentation of stakeholders and their expectations are shown in Section 2.

In addition to the cost evaluation, function analysis was performed. The functions are shown in Section 3 along with the Customer Function Model which shows the project's functions and their relationship to one another according to the understanding of the VE Team.

The speculated ideas for project alternatives are documented in Section 4. One hundred forty-four ideas were generated and subsequently screened for feasibility. Section 5 shows the screened list with the ideas rejected and the reason for removal. Concepts from the screened ideas were further evaluated for benefits to the project in the absence of cost before advancing to the proposal stage.

Section 6 shows detailed discussion of the proposals along with their advantages, limitations, and cost impacts. The following summarizes the proposals.

PROPOSAL 1 The project's design speed was set at 60 miles per hour (MPH). Proposal P1 looks at appropriately reducing the design speed for homogenous segments. The impacts to the typical sections based on the lower design speeds is also documented.

PROPOSAL 2 Discusses substituting an RCUT intersection at Greenway Avenue for the planned signalized intersection.

PROPOSAL 3 Heath Avenue and Hamlet Avenue intersections are near each other within the corridor and are planned to be retained as two-way stop-controlled intersections. Proposal P3 looks at closing both intersections and creating one in the middle at the existing intersection of TH 8 with Hazel Avenue.

PROPOSAL 4 The Pioneer Road intersection is planned to be retained as signalized. Proposal P4 explores replacing the As Given signalized intersection with an RCUT.

PROPOSAL 5 Looks at converting the James Avenue intersection to right-in/right-out RCUTs and closing the intersection of TH 8 with 276th Street.

PROPOSAL 6 Also documents substituting an RCUT for the planned signalized intersection at Viking Boulevard.

PROPOSAL 7 At the east edge of Chisago City and the eastern limits of the project, Proposal P7 documents the evaluation of a roundabout at the Karmel Avenue intersection instead of a stop-controlled intersection.

PROPOSAL 8 At the western end of the project between the I-35 and TH 61 interchanges, TH 8 is scheduled to have eastbound lanes milled and overlaid. Proposal P8 documents restriping the two-lane eastbound section to one lane between the interchanges.

PROPOSAL 9 Documents the idea of using a mini roundabout on Greenway Avenue off mainline TH 8 where several local roads converge.

PROPOSAL 10 The project includes a multi-use path on the west side of TH 8. Proposal P10 explains the idea of substituting pervious pavement for the ten-foot-wide asphalt path.

PROPOSAL 11 Explains the idea of stopping the construction of the four-lane highway at Pioneer Road with a mill and overall for pavement to the east.

Exhibit E.2 summarizes the proposals and their cost impacts. The maximum potential cost avoidance is the sum of the recommended proposals except for Proposal P11. Because P11 is descoping. If P11 is accepted, Proposals P5 and P6 and a portion of P1 would not be done. Because Proposals P7 and P10 are validations, they are not included in the Maximum Cost Avoidance calculation.

PROPOSAL SUMMARY

Pro. No.	Description	As Given	VE Proposal	Change*	Recommendation
P1	Typical Section Modifications	$22,700,000	$16,205,000	$6,495,000	Recommended
P2	RCUT at Greenway	$250,000	$47,000	$203,000	Recommended
P3	Combine Heath & Hamlet to One Intersection with RCUTs	$2,497,000	$2,243,000	$254,000	Recommended
P4	RCUT at Pioneer	$856,500	$464,000	$392,500	Recommended
P5	RI/RO RCUT at James Avenue/Remove 276th	$2,820,000	$1,700,000	$1,120,000	Recommended
P6	RCUT/restrict through movement at Viking intersection	$939,000	$686,000	$253,000	Recommended
P7	Roundabout at Karmel	$77,700	$561,100	-$483,400	Validation
P8	Stripe One Lane w/ Shoulder on EB 8 between I-35 & 61	$1,036,000	$1,030,000	$6,000	Recommended
P9	Mini-Roundabout on Greenway	$270,000	$386,000	-$116,000	Recommended
P10	Substitute Pervious Pavement for Bituminous Pavement Trail	$1,084,000	$1,191,400	-$107,400	Validation
P11	End Four Lane Section at Pioneer	$15,105,000	$2,831,000	$12,274,000	Recommended
			Total Construction Cost Avoidance**	**$8,606,500**	

* Increases in cost are expressed as negative. Positive values indicate a reduction in cost.
** Total Construction Cost avoidance is sum of recommended proposals except for Proposal P11.

Exhibit E.2: Summary of the proposals for TH 8

Disclaimer

The cost differences developed are based on the design information provided to the VE Team and should not be considered absolute cost savings guarantees; but rather indicators of potential value magnitudes requiring further detailed engineering as the project develops.

1 INTRODUCTION

1.1 Project Description

Chisago County has partnered with the Minnesota Department of Transportation (MnDOT) for constructing improvements to Trunk Highway (TH) 8 from Interstate 35 to Chisago City. As a trunk highway, MnDOT is concerned with maintaining the quality of the infrastructure of the highway and, in particular, restoration of the pavement. As a growing region north of the Minneapolis/St. Paul metro area, the County and other local officials have recognized a need for additional capacity on the highway and access control. The latter requires balance with potential development along the corridor. The partnership has resulted in the eight-mile-long TH 8 - Let's Get Moving project.

A Value Engineering (VE) study was commissioned by MnDOT for the TH 8 project with Alfred Benesch & Company (Benesch) serving as the facilitator and providing a portion of the VE Team members. The workshop was conducted virtually from August 10 to August 13, 2020 with the final presentation made the morning of August 13th. The team consisted of subject matter experts from MnDOT, Federal Highway Administration (FHWA) and Benesch.

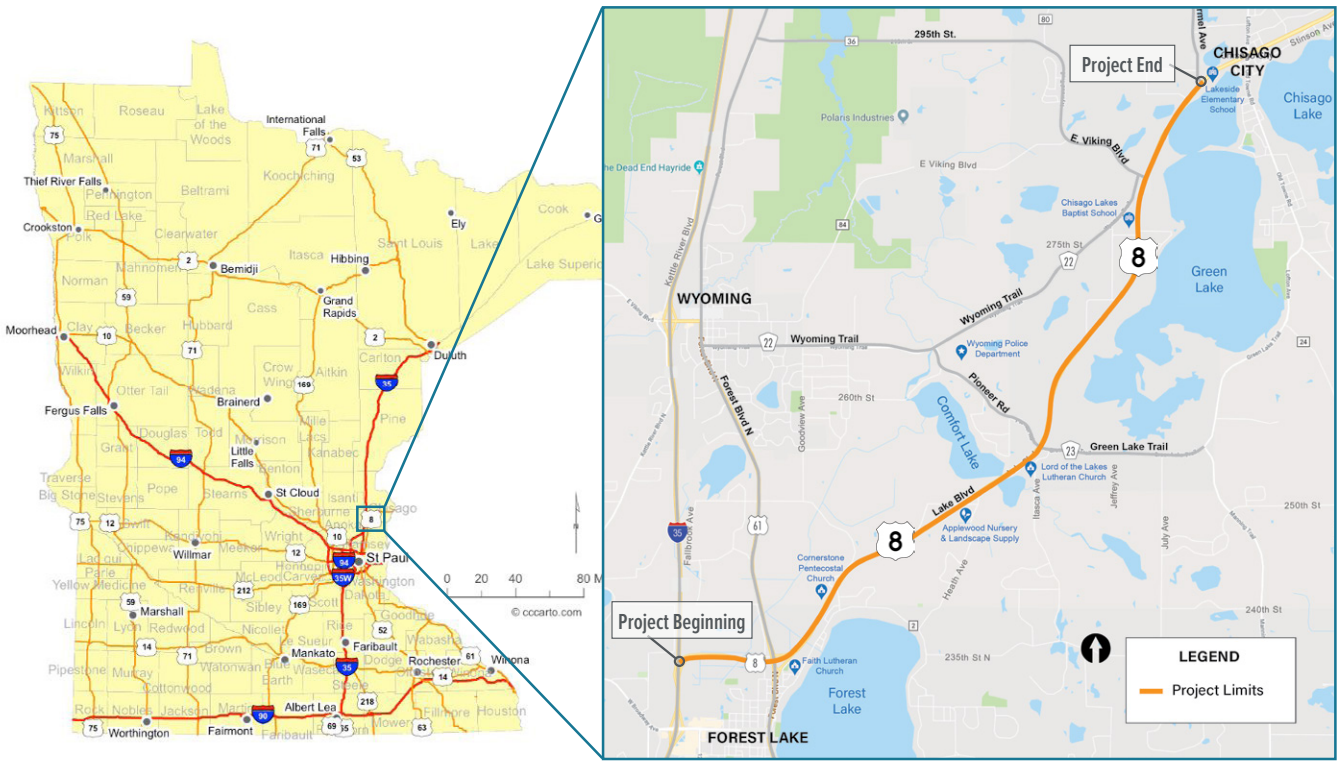


Exhibit 1.1: TH 8 - Let's Get Moving Project Location Map

The TH 8 project scope includes a mill and overlay of the hot mix asphalt (HMA) surface from the I-35 interchange (the project's beginning) to just east of the TH 61 interchange. This length of work is just over 4,900 linear feet and includes the ramps at the two interchanges but does not include the bridges. This region of the highway is also four lanes wide. The existing four lane highway is approximately 7,200 linear feet in length before transitioning into a two-lane highway. The project also includes reconstruction of the four lanes beyond the mill and overlay section and adding two more lanes where only two exist. The overall project is 8.1 miles in length and has 57 existing access points along the corridor. The Project, using local road improvements, frontage roads, and backage roads, reduces the access points to eight. Except for three private drives, the access points are intersections. While traffic control recommendations at the intersections were not finalized at the time of the study, most were planned to be either stop controlled, signalized or Restricted Crossing U-Turn (RCUT) intersections. A ten-foot-wide multi-use trail is also proposed on the north side of TH 8 starting on Forest Road just west of TH 61 and terminating at Viking Boulevard. The trail is intended to provide future connectivity to other trails nearby.

Traffic on the corridor was measured at 22,700 vehicles per day in 2017. It is projected to increase to 28,400 vehicles per day in 2040. The increase is attributed to commuter traffic to and from the Twin Cities and the potential for development along the corridor.

The project's construction cost in 2018 dollars is estimated at $44.5 million with approximately $8 to $10 million budgeted for local road improvements of TH 8.

Challenges for the study include improving the geometry of the project and recommending the right improvements to the intersections along the corridor. Construction staging and the maintenance of traffic were additional concerns, because of limited parallel routes for detours. Finally, construction of the highway between lakes and near wetlands with minimal environmental impact was also a project challenge.

1.2 Value Engineering Scope

The scope of the assignment was to perform a value engineering study following the SAVE International model. The Alternatives' potential cost savings, performance and stakeholder acceptance were compared with functions to assure that value was preserved or enhanced. This process was conducted over a 3 1/2 day period with the presentation of the findings on August 13, 2020.

1.3 Value Engineering Process

The study was conducted utilizing value engineering techniques. Value engineering advocates a team-oriented, systematic approach. This systematic approach is embodied in the job plan (Exhibit 1.2). The job plan has several phases and imposes a set of rules that must be adhered to for each phase. The rules may appear to be simple, but they are vital to the success of the value planning process. This section describes the typical job plan and explains the rules of the job plan and the reasoning behind them.

The ultimate goal of a VE Study is to carefully transform the needs and desires for a project into functions. The VE Team then speculates about ideas for all functions and develops a solution that scores high on performance, with a reasonable acceptance and cost. At the end, VE efforts result in a solution that satisfies owners, users and stakeholders. The VE Team keeps the following three principles in mind when determining value:

1. Every action is required or desired by someone (Stakeholders)
2. Every action has a reason or purpose (Function)
3. The cost of each action must be justified within the limits of constraints (Function Cost)

INFORMATION PHASE

The purpose of the Information Phase is to gain an understanding of the project and the stakeholders who will be affected. The information phase can be summarized as follows:

- Review all relevant project information, including description and scope of work
- Identify owners, users and stakeholders
- Identify constraints, needs and desires of owners, users and stakeholders

FUNCTION ANALYSIS PHASE

- Using Stakeholder constraints, needs and desires, develop project related functions
- Determine the task, basic function(s) and supporting functions
- Estimate the cost of project elements and each critical function
- Analyze owner and Stakeholder attitudes toward each function

SPECULATION PHASE

The purpose of the Speculation Phase is to identify ideas that will perform the project functions or will enhance performance or acceptance at a reasonable cost.

EVALUATION PHASE

The purpose of the Evaluation Phase is to identify the most outstanding Alternatives for further development. This identification is accomplished through a series of screening processes that sort ideas by comparison and combination. Using these ideas, Alternatives are developed. These Alternatives are then rated for performance, acceptance and cost.

DEVELOPMENT PHASE

The purpose of the Development Phase is to add information that facilitates selection of a preferred Alternative. This is accomplished by comparing the remaining Alternatives. The following rules are considered during the Development Phase:

- Recognize ideas that may be unique
- Conduct research, as required, to provide additional information
- Analyze weaknesses of selected Alternatives and provide improvements

The VE Team was asked to review the As Given design and its cost estimates to determine if cost savings could be identified without compromising the main purpose (the Task) of the project.

VE Workshop Schedule	
Monday 8/10/20	Information Phase Function Analysis and Cost
Tuesday 8/11/20	Speculation Phase Evaluation Phase – Screening Development Phase
Wednesday 8/12/20	Development Phase cont.
Thursday 8/13/2020	Presentation Phase

Exhibit 1.2 depicts the process from needs and desires of stakeholders to the project solution, using the VE Job Plan.

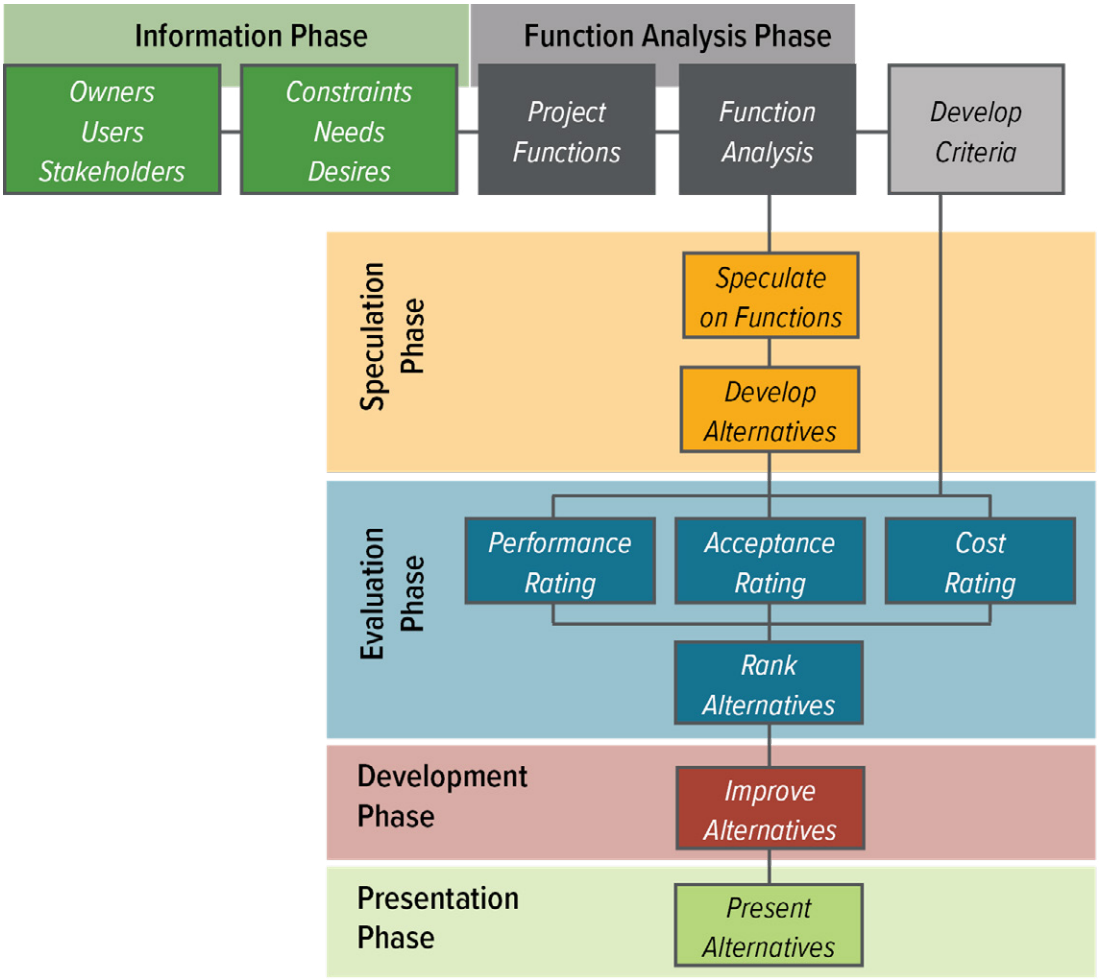


Exhibit 1.2 : Job Plan flow diagram

2 INFORMATION PHASE

2.1 Introduction

The first step in Value Engineering is to understand the Purpose and Need of the project:

What Is It?

The question can be answered in two steps:

1. Identify owners, users, and other stakeholders.
2. List their constraints, needs and desires.

Among the rules that govern the Information Phase are the following:

- Do not speculate
- Do not judge
- Understand the problem

Prior to the study, the VE Team was provided with design reports, preliminary cost estimates, roadway plans, and other documentation to familiarize themselves with the project. On the first day, the VE Team met with the Project Team. A presentation on the project was provided by the Design Team. An attendance sheet of those participating in the meeting is included in Appendix B.

The VE Team began the study by determining owners, users, and stakeholders for the project. Constraints, needs, and desires were also defined on day one of the study.

2.2 Description of Owners, Users and Stakeholders

In general, everyone involved in a project is a stakeholder. However, during this part of the Information Phase, they are grouped separately as owners, users and stakeholders, as defined below.

These groupings help the VE Team better understand what the project does and what it should do. In subsequent sections, the owners, users and stakeholders will be referred to only as stakeholders.

2.3 Owners, Users and Stakeholders

OWNERS
THOSE WHO:

1. Own the project
2. Fund the project
3. Share in the funding
4. Represent the owner's interests
5. Manage the project for the owner

USERS
THOSE WHO:

1. Use the project
2. Operate the project
3. Maintain the project

STAKEHOLDERS
THOSE WHO ARE:

1. Financially affected by the project
2. Environmentally concerned about the project
3. Disturbed by a required change in habits or recreation

2.4 List of Owners, Users and Stakeholders

The following is a list of owners, users and stakeholders identified by the VE Team.

OWNERS

1. Chisago County
2. MnDOT
3. FHWA
4. Chisago City
5. City of Wyoming
6. City of Forest Lake

USERS

7. Commuter Traffic
8. Weekend Traffic
9. Eastbound Traffic
10. Westbound Traffic
11. Vacationers
12. Cyclists
13. Pedestrians
14. Freight Traffic
15. Regional Traffic
16. Local Traffic
17. Agricultural Traffic
18. Chisago City Public Works
19. MnDOT Maintenance
20. Local Maintenance

STAKEHOLDERS

21. Community Churches
22. Chisago County Lake Improvement District
23. MnDOT Office of Freight & Commercial Vehicle Operations
24. Emergency Medical Services (EMS)
25. Washington County
26. Minnesota DNR
27. Comfort Lake/Forest Lake Watershed District
28. Minnesota Pollution Control Agency
29. USACE
30. Residents
31. Businesses
32. Public Utilities
33. Contractor
34. Fire Department
35. School Districts
36. Board of Water and Soil Resources
37. Chisago Soil and Water Conservation District
38. Lakes Recreational Users

2.5 Constraints, Needs and Desires

Each stakeholder expects something from the project. Stakeholder expectations were then grouped into constraints, needs and desires, as defined in Section 2.6.

CONSTRAINTS:

1. Legal requirements
2. Standards of the owner
3. Physical site conditions
4. Stakeholder commitments

NEEDS

1. Expectations that must be fulfilled if constraints are not violated
2. Limitations or restrictions that are imposed by stakeholders but which can be violated (the degree of violations will be considered in the evaluation of Alternatives)

DESIRES

1. Expectations that should be fulfilled if cost is not a factor

There are several points to keep in mind in identifying the Stakeholder constraints, needs and desires. First, the majority of constraints are prescribed by law, applicable codes and standards. These constraints are too numerous to be listed for each VE Study. Constraints listed are those imposed by a Stakeholder or by a code or standard that applies strictly to this project. Secondly, design criteria are described as a constraint, need and desire. Lastly, needs and desires are generally not executable. They are generally visions of what the project should do.

2.6 List of Constraints, Needs and Desires:

CONSTRAINTS:

1. Comply with ADA requirements
2. No impact to transmission lines
3. Storm water outlet location elevations

NEEDS:

4. Improve vehicle safety
5. 12-foot-wide lanes
6. Construct a 10-foot-wide multi-use trail
7. Control local and private access to TH 8
8. Performance based practical design
9. Maintain one lane in each direction (DC)
10. Maintain business and residents' access (DC)
11. Maintain local road traffic to TH 8 (DC)
12. Reasonable business and resident access to TH 8
13. Reasonable local road traffic access to TH 8
14. Reduce the number of right angle crashes
15. Minimizing maintenance
16. Accommodate drainage structures with vertical profile
17. Four-lane section from I-35 to Viking Boulevard
18. Maintain mobility
19. Improve intersection efficiency
20. Maintain current travel time

DESIRES:

21. 14-foot-wide left turn lanes
22. Pull off west of Greenway for OFCVO enforcement
23. Pull off east of CR 23 for OFCVO enforcement
24. Install Weigh-in-Motion (WIM)
25. Establish treatment areas for stormwater management
26. Avoid impacts to wetlands
27. Minimize pavement, particularly at TH 61
28. Locate trail outside MnDOT R/W
29. Accommodate fiber optic interconnect
30. Right size highway based on traffic projections
31. Implementing Vision Zero
32. 60 mph design speed
33. 20-foot-wide median
34. Eight-foot outside shoulder
35. Limit impacts to lakes
36. Limit impacts to wetlands
37. Reduce the number of rear end crashes
38. Minimize utility impacts
39. Minimize new impervious areas
40. Minimize solid surface median
41. Minimize new R/W
42. Provide a flexible design
43. Accommodate new left turn at Deer Garden Lane
44. Improve mobility

3 FUNCTION ANALYSIS PHASE

3.1 Introduction

The next step is to answer the questions:

What does it do?
What does it cost?

These are the key questions in the Function Analysis Phase and are developed by:

1. Using the constraints, needs and desires of the stakeholders.
2. Splitting each element into parts and assigning the reason for the part as functions.

Among the rules that govern the Function Analysis Phase are the following:

- Functions are expressed in two words; an active Verb and descriptive Noun
- Avoid the description or action of an element as functions

After the Information Phase the VE team worked together to define what the intent of the project is. This next phase is called the Function Analysis Phase. This is a collaborative process for the team as they consider what was heard earlier in the Information Phase and what was learned studying the project documents during the Pre-Workshop. The purpose of this phase is for the team to breakdown the project into components, called functions, that should describe what the project should do and not what the project is. This dissecting of the project into its functions fuels the teams understanding of what is important for the project to be successful, facilitates analysis and communication, and inspires alternative ideas that might fulfill the functions.

3.2 Function and Function Logic Diagram

Function

The VE Team developed a list of functions for the TH 8 project based on the constraints, needs and desires of the stakeholders identified in the Information Phase of the workshop. Functions are carefully defined to express the team's understanding of what is driving the project and what is the purpose of each project element. They are expressed in two words (sometimes three) as an active verb and a descriptive noun. Word selection is thoroughly discussed and intentional so that agreement is clear on what is necessary for the project to be successful, and abstract enough so that creativity and innovation is maximized.

The goal of the Function Logic Phase of a VE Workshop is to develop an understanding of what the project must do.

It is important for the team to analyze from the Project's point of view. As an upgrade effort, this project addresses several issues related to improvements as well as restoration for the highway. Consequently, functions like *Right Size Facility* and *Restore Infrastructure* were selected by the team. This contrasts with a new highway where functions like *Route Traffic* or *Create Connectivity* might have been more prominent. The project's func-

tions, as selected by the VE team are shown graphically in the Exhibit 3.1, the Customer Function Model.

Function Logic

The goal of the Function Analysis Phase is to categorize the functions developed by the team and assemble them in an orderly manner that facilitates analysis and communication. Categorization helps define what functions must be performed by the project in order to be successful and what functions would be nice for the project to fulfill if constraints are not violated and/or cost is not a factor. The analysis and subsequent diagramming help the team have perspective on how the functions are related to each other. Applying costs to the functions in a future step, allows mismatches and opportunities for value to be observed and evaluated. It is important to note that from the stakeholders' perspective, all the functions are important and must be respected, however, some functions are basic to the project and some enhance the project, making it better and more appealing to stakeholders. Together, they make the project successful. Later in the VE process, the VE Team speculated on different ways to accomplish these functions.

The Customer Function Model in Exhibit 3.1 shows the teams perspective on the functions and their relationships to each other. The model can be described in three main components: The Task, the Basic Functions, and the Enhancing Functions. The Task is the one function that represents the reason for the project. Basic Functions, however, represent the minimum or essential things the project must perform in order to fulfill the Task. The Basic Functions, operating alone, will not result in a successful project. The Enhancing Functions are also necessary to improve dependability, convenience, acceptance to stakeholders, and attractiveness to stakeholders.

TASK

In classifying functions, the team expresses its logical reasoning for the function. The main driving force for the TH 8 project is to *Improve Mobility*. This is the Task of the project. The highway's corridor exists and functions to a certain level. However, there are identified needs that will improve the performance of the corridor with respect to traffic. These include the restoration of the infrastructure, improving capacity and improving operations.

Defining *Improve Mobility* as the task may give a global reason for the project but it does not define the details of what the project should do. Consequently, the following Basic and Enhancing Functions more fully round out what the project is intended to do based on the VE Teams understanding of the project.

BASIC

As Basic Functions, *Improve Operations*, and *Restore Infrastructure* were identified by the team as supporting the task and essential to delivering it. Supporting the *Improve Operations* function are the two subordinate functions that answer the question "How do we Improve Operations?" It is accomplished by the functions *Improve Progression* and *Improve Capacity*. It should be noted that these functions are not the only important functions nor are they the priority functions. They will deliver a successful project if the functions below are integrated into the project.

DEPENDABLE

The highway can be considered dependable if the designed improvements fulfill the functions *Right Size Facility, Reduce Crashes*, and *Manage Runoff*. Other supporting functions related to these are shown in the Customer Function Model, Exhibit 3.1. These supporting functions answer the question "How?" the function will be fulfilled. For example, how is the function *Reduce Crashes* accomplished? In Exhibit 3.1, it is accomplished by the functions *Minimize Conflicts, Manage Access*, and *Improve Sight Distance*. A logic check for the function model structure can be made by asking the question "Why?" going from right to left. For example, why do we *Store Vehicles. Separate Traffic* and *Separate Modes*? The answer in Exhibit 3.1 is the function *Minimize Conflicts*. Likewise, why do we *Minimize Conflicts*? The answer is to *Reduces Crashes* and subsequently, *Enhance Dependability*. Finally, How do we *Manage Runoff*? We do it through the functions *Collect Stormwater* and *Convey Stormwater*.

CONVENIENT

The next classification is how the project maintains and improves the convenience of the users of the highway. These users include but are not limited to traffic, maintenance crews and construction contractors. *Facilitate Maintenance, Facilitate EMS*, *Minimize Duration* (During Construction or DC) and *Manage Traffic* (DC) are all functions that contribute to making the project more convenient. The functions along with their supporting functions are shown in Exhibit 3.1.

IMPROVE ACCEPTANCE

While dependability and basic functions are typically quantifiable, improve acceptance functions are somewhat subjective. Following through with commitments, optimizing the construction time, maintaining sensitivity to adjacent property owners and complying with environmental regulations all manifest themselves with Improve Acceptance functions. As a result, *Comfort User, Facilitate Construction, Minimize Impacts, Restore Confidence* and *Protect Environment* are important functions in this category. *Comfort User* is supported by the functions *Inform User* and *Create Buffer*. *Facilitate Construction* is supported by *Reduce Delays* (DC) and *Minimize Waste*. Finally, *Restore Confidence* is supported by *Connect Communities, Improve Walkability* and *Improve Bikeability*. These functions and their relationship to one another are shown in Exhibit 3.1.

ATTRACT STAKEHOLDERS

Attracting stakeholder functions appeal to the visual aspects of the project or conveys a favorable image. It draws new stakeholders to the project. With the attention to accommodating future development and landscaping, the functions *Attract Development* and *Improve Aesthetics* were selected as Attract Stakeholder functions. Likewise, the emphasis on preserving the lakes and other roadside views led to the function *Maintain Viewshed*.

Value is defined as fulfilling the project functions that are needed to make the project work and sell. Basic and dependability functions make it work while Convenience, Improve Acceptance, and Attract Stakeholders help to sell or promote acceptance of the project.

Further explanation of the functions is covered as part of the explanation for allocating cost to each function.

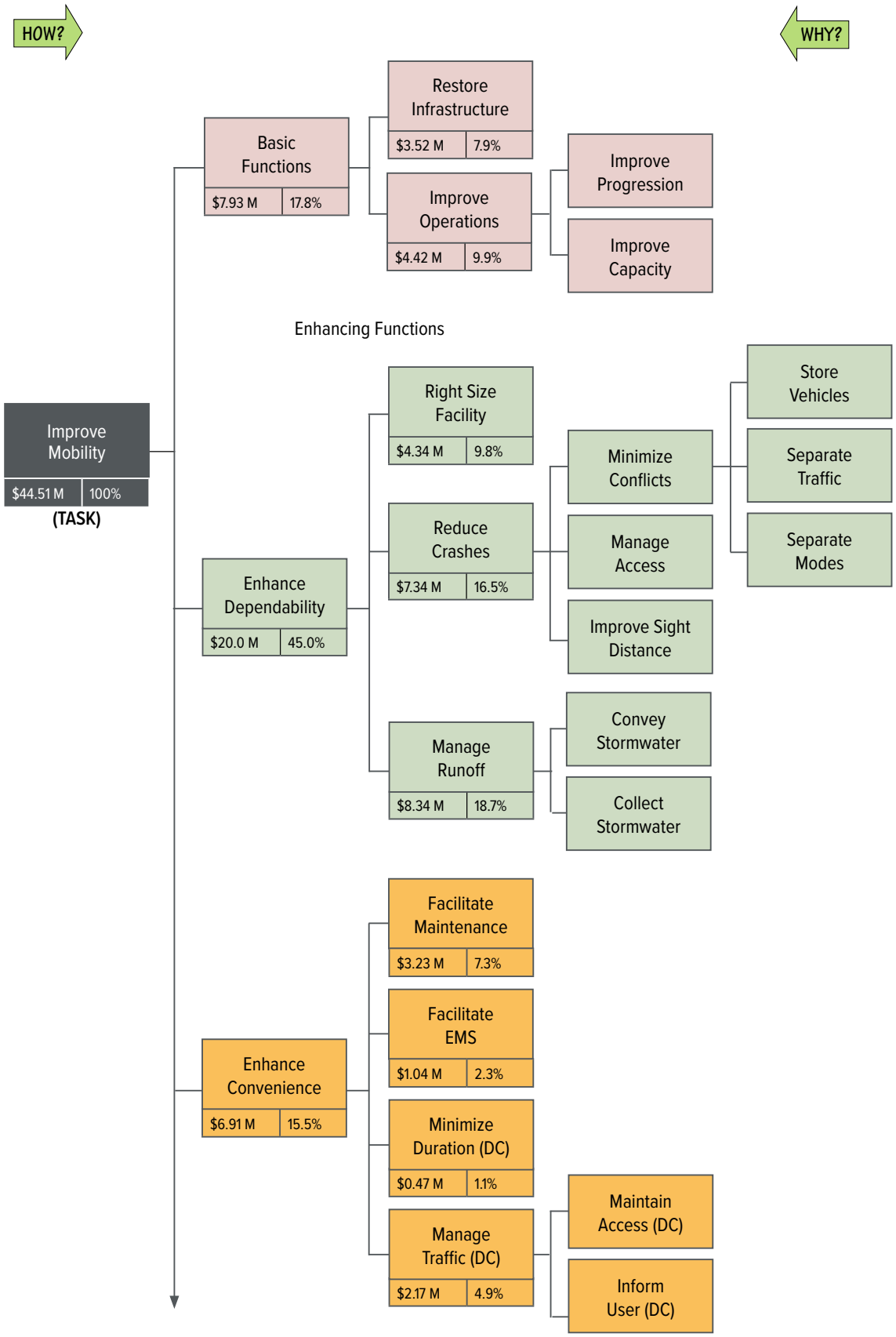


Exhibit 3.1: Function Logic Cost Diagram

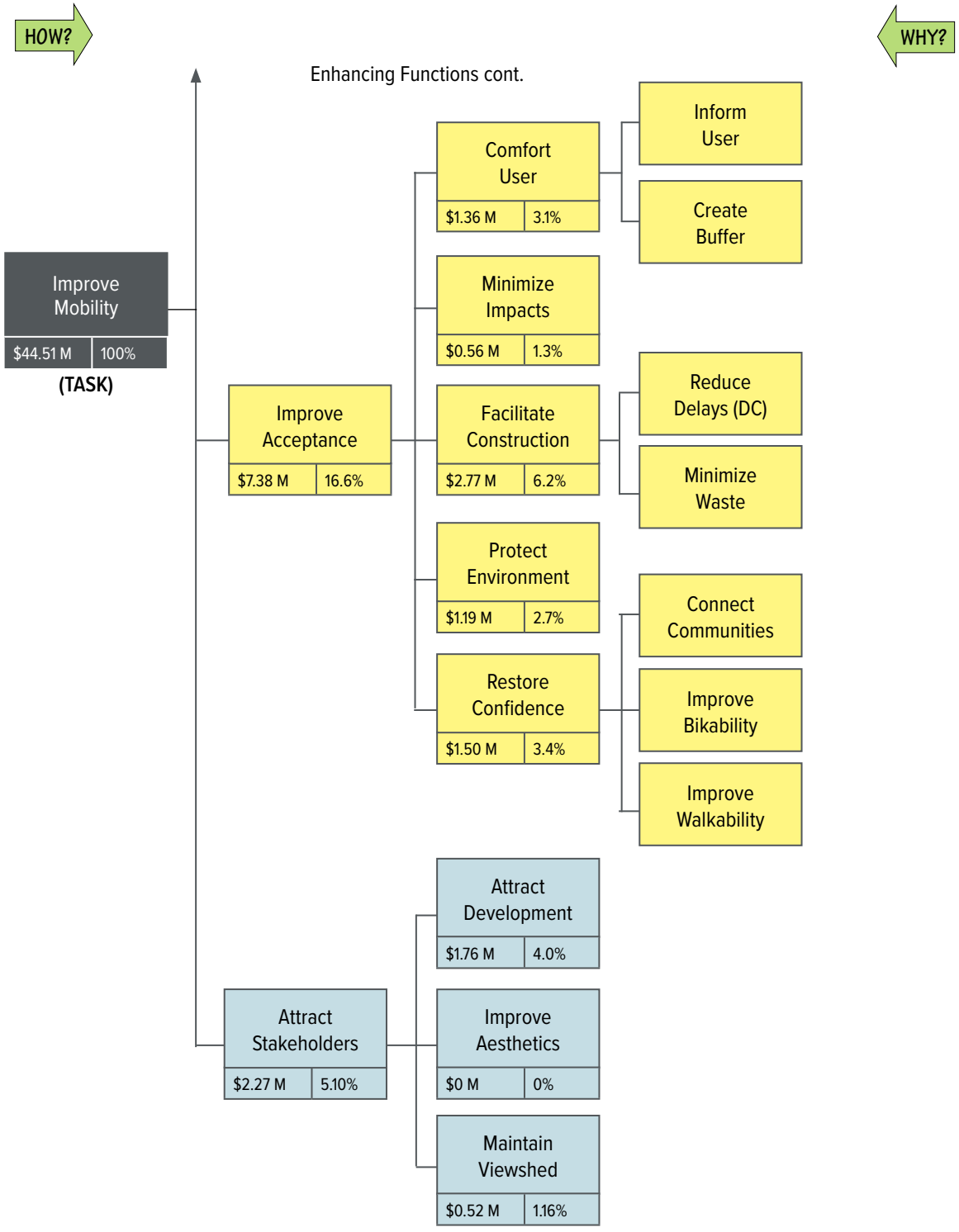


Exhibit 3.1: Function Logic Cost Diagram (cont.)

3.3 As Given Cost Analysis

The project's 2018 construction cost estimate was in the amount of $44.5 million. The detailed cost estimate provided to the VE team is included in Appendix A. Key to the VE process is a clear understanding of the project costs and why the dollars are being spent. This understanding also helps inform the functions of the project. They answer the question "Why are we spending these dollars?"

Determining where large dollars are being spent can also provide inspiration for speculation on alternatives. To facilitate this analysis the cost estimate was grouped and rolled into larger cost elements. For example, the line items Mainline Pavement and 2" Mill and Overlay were rolled into the element Paving. Likewise, other items were rolled into the project elements listed in Exhibit 3.2.

ELEMENT	COST/$1,000
Trail Lighting	$16
Signing & Striping	$293
Landscaping	$301
Utility Agreements	$750
Trail	$839
Turf Establishment & Erosion Control	$1,076
Temporary Pavement & Drainage	$1,203
Mobilization	$1,504
MOT	$1,542
Curb & Gutter	$1,852
Signals	$2,000
R/W	$3,300
Median	$4,499
Drainage	$4,517
Earthwork	$5,943
Contingencies and Unknowns	$6,480
Paving	$8,396

Exhibit 3.2: TH 8 - Let's Get Moving Element Costs

Pareto's Law states that 80% of the project cost will be consumed in 20% of the project items. In the case of the TH 8 project, the highest cost items are shown at the bottom of the table and include Paving, Contingencies and Unknowns, Earthwork, Drainage, Median, Right-of-Way, Signals and Curb & Gutter. The Pareto diagram in Exhibit 3.3 graphically shows the highest cost items to the lowest. The costs are expressed per $1,000.

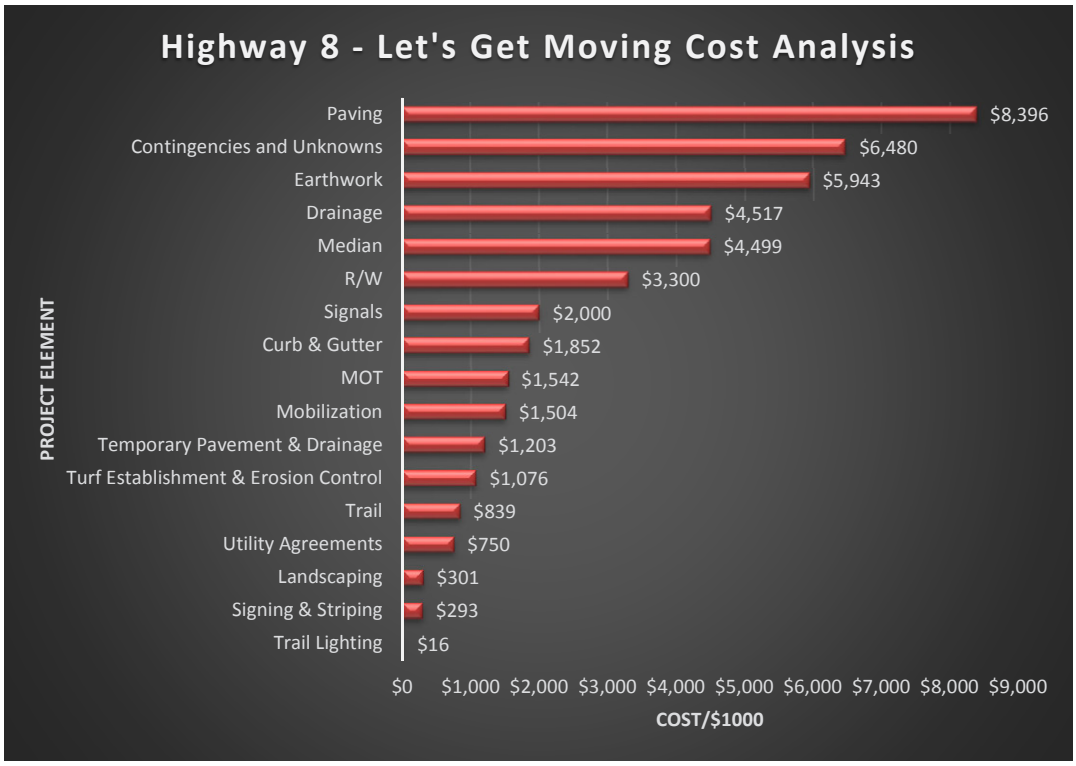


Exhibit 3.3: Pareto diagram showing the highest cost items to the lowest

Because this project is early in its design development eight of the seventeen project elements consume 80 percent of the projects. As the project is developed and the estimate because more granular, the costs should come more into alignment with the 80/20 percent Pareto Theory.

3.4 Function Cost

Using the element costs, As Given dollars are also distributed among the project functions for further evaluation and identification of mismatches. One benefit of this analysis is to determine which functions are receiving a disproportionate amount of money. These functions and their associated project elements represent opportunities for improving value.

Just under 18 percent of the project cost is being spent to fulfill the Basic functions of *Improve Operations* and *Restore Infrastructure*. Of those functions, slightly more is going to *Improve Operations*. Around 45 percent of the cost is dedicated to the Dependability functions. *Manage Runoff* and *Reduce Crashes* are the two higher costing functions in this classification. Drainage, the median and right-of-way contribute to the higher cost for these functions. Exhibit 3.4 provides a breakdown of the project element costs and their functions. In addition, the functions costs are also presented in the Customer Function model shown in Exhibit 3.1.

MnDOT - Highway 8

Improve Mobility		Basic Functions		Enhance Dependability		
Elements	Cost	Improve Operations	Restore Infrastructure	Right-Size Facility	Manage Runoff	Reduce Crashes
Trail Lighting	$ 16,000	$ -	$ -	$ -	$ -	$ -
Signing & Striping	$ 292,500	$ -	$ -	$ -	$ -	$ 58,500
Landscaping	$ 300,706	$ -	$ -	$ -	$ -	$ -
Utility Agreements	$ 750,000	$ -	$ -	$ -	$ -	$ -
Trail	$ 839,420	$ -	$ -	$ -	$ -	$ -
Turf Establishment & Erosion Control	$ 1,076,477	$ -	$ -	$ -	$ -	$ -
Temporary Pavement & Drainage	$ 1,202,826	$ -	$ -	$ -	$ -	$ -
Mobilization	$ 1,503,532	$ -	$ -	$ -	$ -	$ -
MOT	$ 1,542,119	$ -	$ -	$ -	$ -	$ -
Curb & Gutter	$ 1,852,250	$ -	$ -	$ -	$ 1,852,250	$ -
Signals	$ 2,000,000	$ 1,000,000	$ -	$ -	$ -	$ 1,000,000
R/W	$ 3,300,000	$ 330,000	$ -	$ 825,000	$ 1,320,000	$ 825,000
Median	$ 4,498,870	$ -	$ -	$ -	$ -	$ 3,374,153
Drainage	$ 4,516,509	$ -	$ -	$ -	$ 4,516,509	$ -
Earthwork	$ 5,943,106	$ 1,010,328	$ 1,188,621	$ 1,188,621	$ -	$ 594,311
Contingencies and Unknowns	$ 6,480,224	$ 648,022	$ 648,022	$ 648,022	$ 648,022	$ 648,022
Paving	$ 8,395,900	$ 1,427,303	$ 1,679,180	$ 1,679,180	$ -	$ 839,590
Total	$ 44,510,441	$ 4,415,653	$ 3,515,824	$ 4,340,824	$ 8,336,782	$ 7,339,576
		9.9%	7.9%	9.8%	18.7%	16.5%
		$7,930,000		$20,020,000		
		17.8%		45.0%		

Exhibit 3.4: Function cost (As Given).

MnDOT - Highway 8

Improve Mobility		Enhance Convenience			
Elements	Cost	Facilitate Maintenance	Facilitate EMS	Minimize Duration (DC)	Manage Traffic (DC)
Trail Lighting	$ 16,000	$ -	$ -	$ -	$ -
Signing & Striping	$ 292,500	$ -	$ -	$ -	$ -
Landscaping	$ 300,706	$ -	$ -	$ -	$ -
Utility Agreements	$ 750,000	$ -	$ -	$ -	$ -
Trail	$ 839,420	$ -	$ -	$ -	$ -
Turf Establishment & Erosion Control	$ 1,076,477	$ -	$ -	$ -	$ -
Temporary Pavement & Drainage	$ 1,202,826	$ -	$ -	$ -	$ -
Mobilization	$ 1,503,532	$ -	$ -	$ 150,353	$ 300,706
MOT	$ 1,542,119	$ -	$ -	$ -	$ 1,542,119
Curb & Gutter	$ 1,852,250	$ -	$ -	$ -	$ -
Signals	$ 2,000,000	$ -	$ -	$ -	$ -
R/W	$ 3,300,000	$ -	$ -	$ -	$ -
Median	$ 4,498,870	$ -	$ -	$ -	$ -
Drainage	$ 4,516,509	$ -	$ -	$ -	$ -
Earthwork	$ 5,943,106	$ 1,069,759	$ 297,155	$ -	$ -
Contingencies and Unknowns	$ 6,480,224	$ 648,022	$ 324,011	$ 324,011	$ 324,011
Paving	$ 8,395,900	$ 1,511,262	$ 419,795	$ -	$ -
Total	$ 44,510,441	$ 3,229,044	$ 1,040,962	$ 474,364	$ 2,166,837
		7.3%	2.3%	1.1%	4.9%
		$6,910,000			
		15.5%			

Exhibit 3.4: Function cost (As Given) cont.

MnDOT - Highway 8

Improve Mobility		Improve Acceptance				
Elements	Cost	Comfort Users	Facilitate Construction	Minimize Impacts	Restore Confidence	Protect Environment
Trail Lighting	$ 16,000	$ -	$ -	$ -	$ 16,000	$ -
Signing & Striping	$ 292,500	$ 234,000	$ -	$ -	$ -	$ -
Landscaping	$ 300,706	$ -	$ -	$ -	$ -	$ -
Utility Agreements	$ 750,000	$ -	$ 187,500	$ 562,500	$ -	$ -
Trail	$ 839,420	$ -	$ -	$ -	$ 839,420	$ -
Turf Establishment & Erosion Control	$ 1,076,477	$ -	$ -	$ -	$ -	$ 861,182
Temporary Pavement & Drainage	$ 1,202,826	$ -	$ 1,202,826	$ -	$ -	$ -
Mobilization	$ 1,503,532	$ -	$ 1,052,473	$ -	$ -	$ -
MOT	$ 1,542,119	$ -	$ -	$ -	$ -	$ -
Curb & Gutter	$ 1,852,250	$ -	$ -	$ -	$ -	$ -
Signals	$ 2,000,000	$ -	$ -	$ -	$ -	$ -
R/W	$ 3,300,000	$ -	$ -	$ -	$ -	$ -
Median	$ 4,498,870	$ 1,124,718	$ -	$ -	$ -	$ -
Drainage	$ 4,516,509	$ -	$ -	$ -	$ -	$ -
Earthwork	$ 5,943,106	$ -	$ -	$ -	$ -	$ -
Contingencies and Unknowns	$ 6,480,224	$ -	$ 324,011	$ -	$ 648,022	$ 324,011
Paving	$ 8,395,900	$ -	$ -	$ -	$ -	$ -
Total	$ 44,510,441	$ 1,358,718	$ 2,766,810	$ 562,500	$ 1,503,442	$ 1,185,193
		3.1%	6.2%	1.3%	3.4%	2.7%
		$7,380,000				
		16.6%				

Exhibit 3.4: Function cost (As Given) (cont.).

MnDOT - Highway 8

Improve Mobility		Attract Stakeholders		
Elements	Cost	Attract Development	Maintain Viewshed	Improve Aesthetics
Trail Lighting	$ 16,000	$ -	$ -	$ -
Signing & Striping	$ 292,500	$ -	$ -	$ -
Landscaping	$ 300,706	$ -	$ -	$ 300,706
Utility Agreements	$ 750,000	$ -	$ -	$ -
Trail	$ 839,420	$ -	$ -	$ -
Turf Establishment & Erosion Control	$ 1,076,477	$ -	$ -	$ 215,295
Temporary Pavement & Drainage	$ 1,202,826	$ -	$ -	$ -
Mobilization	$ 1,503,532	$ -	$ -	$ -
MOT	$ 1,542,119	$ -	$ -	$ -
Curb & Gutter	$ 1,852,250	$ -	$ -	$ -
Signals	$ 2,000,000	$ -	$ -	$ -
R/W	$ 3,300,000	$ -	$ -	$ -
Median	$ 4,498,870	$ -	$ -	$ -
Drainage	$ 4,516,509	$ -	$ -	$ -
Earthwork	$ 5,943,106	$ 594,311	$ -	$ -
Contingencies and Unknowns	$ 6,480,224	$ 324,011	$ -	$ -
Paving	$ 8,395,900	$ 839,590	$ -	$ -
Total	$ 44,510,441	$ 1,757,912	$ -	$ 516,002
		4%	0%	1.16%
		$2,270,000		
		5.10%		

Exhibit 3.4: Function cost (As Given) (cont.).

3.5 Function Analysis

Exhibit 3.5 shows a summary of the function classification distribution. Cost for the Basic Functions and Dependability Functions is about 63 percent which is somewhat high (typically 50 percent) for highway projects. The cost of the Convenience Functions is about 16.5 percent which is somewhat lower than the norm of 25 percent. The Acceptance and Attract Stakeholders Functions are at 16.6 and five percent, respectively.

Summary

FUNCTIONS	ALLOCATED COSTS	PERCENTAGE	NORM
Basic Functions	$7,930,000	17.84%	20%
Enhancing Functions			
Enhance Dependability	$20,020,000	45.0%	30%
Enhance Convenience	$6,910,000	15.5%	25%
Improve Acceptance	$7,380,000	16.6%	15%
Attract Stakeholders	$2,270000	5.10%	10%

Exhibit 3.5: Function cost summary

4 SPECULATION PHASE

4.1 Introduction

Following the function and cost analysis, the next step is to answer the question:

What else will do the job?

This is the key question in the Speculation Phase and may be carried out in at least three ways:

1. Random
2. By function
3. By project element

Among the rules that govern the Speculation Phase of a VE Study are the following:

- Criticism is ruled out
- Quantity is wanted
- Combinations and improvements are sought

4.2 List of Ideas

Below is a list of the ideas generated by the VE Team during the Speculation Phase.

IDEAS			
1	Resurface highway	13	Two lane roundabouts
2	Reduce median width	14	Replace median barrier with six-foot wide raised median
3	Narrow median east of 61 - maintain current width	15	Auxiliary Lane between Goodview Circle and direction ramp
4	Landscape median	16	Eliminate Curb along TH 8
5	Improve intersection capacity	17	Drain water away from center pavement
6	Roundabouts	18	Reduce design speed
7	RCUTs	19	End 4 lane section further west
8	Two-lane mainline with RCUTs	20	End 4 lane section at Pioneer
9	Right-in-right outs (RI/RO)	21	End 4 lane section at Viking
10	RI/RO at James Ave/Juneau Ct.	22	Two lane with passing lanes (Super 2)
11	64' center line spacing rural section	23	Snow fence
12	Local roundabouts at Greenway and local roads	24	Widen ditch to manage snow (snow traps)

25	Living snow fence
26	Negotiate with farmers to manage snow
27	Reduce turn lane widths
28	Reduce lane widths
29	Three-lane section
30	Median bio-swales
31	Resurface existing pavement and widen one lane north and south
32	Reuse existing road for one bound
33	Mountable curb medians
34	Eliminate one lane EB from I-35 to 61, add second lane at 61
35	Provide snow storage
36	Wider shoulders for snow
37	Provide depression in median to store snow
38	Reconfigure TH 61 EB on-ramp to parallel acceleration configuration
39	Remove gas station drive near 61 EB on-ramp
40	Lower profile at pinch point to provide more width
41	Lower profile near wetlands to provide more width
42	Construct bridge in vicinity of lakes
43	Retaining walls at lakes
44	Sheet pile walls at lakes
45	Ped bridge at lakes
46	Detour traffic - full closure
47	Replace guardrail near bridge
48	Provide clear zone instead of guardrail
49	Flatten slopes to 4:1
50	Install cable guard rail in median
51	Install cable guard rail and narrow median
52	Barrier wall separation for trail
53	Add bike lanes to TH 8
54	Install sidewalk on both sides of TH 8
55	Reduce widths of frontage road intersections
56	Four lane section median barrier wall widened out only at intersections for turn lanes
57	Upgrade R/W fence
58	Reduce buffer between roadway and trail
59	Trail boardwalk at lakes
60	Provide ped crossings at legal crossings
61	Construct one bound of traffic at a time
62	Construct one direction off- line while maintain existing road
63	Construct all local road facilities first
64	Construct local roads under separate contract
65	Temporary widen to the north and build south half of new section
66	Split project at Green Lake Trail
67	Use Wyoming Trail for Detour
68	Split project into three sections
69	Install rumble strip on shoulder
70	Install center line rumble strip
71	RI/RO at private drives
72	RI/RO with mountable curb for AG vehicles
73	Reversible lane during construction
74	Permanent reversible lane
75	73 with zipper barrier
76	Adjust horizontal curves for improved sight distance
77	Free right turn at Green Lake Trail for NB TH 8
78	Use Green Lake Trail for detour
79	Use 97 to 95 for detour
80	Use 97 to 95 for freight detour

* DC = During Construction

81	Roundabouts with bypass lanes
82	Close Goodview Circle access and redirect to Greenway Ave
83	Driveway at station 565+00 make right-in only
84	RCUT w/o central left turns
85	Remove drive at 565+00
86	RCUT at Greenway Ave instead of 4 phase signal
87	RI/RO at Hamlet Ave
88	Use two-mile access spacing
89	Four-lane undivided section
90	Five-lane section
91	Roundabout at Karmel
92	Green Lake intersection closed to TH 8 during construction
93	Four lane section with six-foot-wide mountable median
94	No left turns during construction
95	Advance warning on NB I-35 and 61 for congestion on TH 8
96	Michigan left
97	Alternative water treatment
98	Rain gardens
99	Bio-swales
100	Constructed wetlands for treatment
101	Forebays for treatment
102	Pervious pavement on trail
103	Oversize pipes for subsurface detention
104	Vaults for subsurface detention
105	Add lane and drop lane at Viking
106	Detention/treatment basins between trail and TH 8 with smaller outfall pipes
107	Install traffic adaptive signals
108	Shift highway alignment for new construction and use existing for MOT
109	Install advance signal beacons
110	Ped bridge across TH 8
111	Ped tunnel under TH 8
112	Combine ped tunnel with bridge at lakes
113	Eliminate local road at Heath and use RCUT
114	Remove barrier between roadway and trail at pinch point
115	Lane drop at intersections with only two lanes at lake pinch point
116	Combine Hamlet and Heath into one intersection
117	Maintain existing cross section at lake
118	Reroute trail from TH 8 to Pioneer Road, Wyoming Trail, and Sunrise Prairie Trail
119	Relocate Pioneer Road intersection to north
120	Offset Pioneer and Green Lake and build green T intersections
121	Build green T at Viking
122	Build green T at Greenway
123	Eliminate intersection at 276th Street
124	Have developers pay for new intersection at James
125	Diamond intersection at Pioneer with Right-Ins only
126	Eliminate short horizontal curves
127	Reduce profile change to minimize earthwork
128	Two-lane divided
129	Two-lane divided with alternating passing lanes
130	CFI at all intersections with one continuous lane
131	Carry section at Ellen Lake east with only one transition
132	Consolidate access with better use of frontage and backage roads
133	Variable centerline spacing
134	Build intersections first
135	Build intersections in conjunction with local road improvements
136	Double wide intersection - four lane intersection on two lane road

137	Build to Pioneer Trail
138	Prioritize segments for phased construction
139	Detour NB and SB separately
140	Three-lane section with controlled access
141	Barrier wall to separate trail with limited R/W
142	Combine 54 & 118
143	Install sidewalk on one side of TH 8 and combine with 118
144	Utilize smart street lighting at intersections

5 EVALUATION PHASE

5.1 Introduction

Evaluate the performance, acceptance and cost of the Alternatives:

Will it work?
Will it be acceptable?
Can we afford it?

Evaluation can be:

1. As simple as judging with advantages and limitations.
2. A detailed matrix rating for performance, acceptance and cost. In addition, measuring the sensitivity of the above ratings.

Among the rules that govern the Evaluation Phase are the following:

- Do not speculate
- Do not jump to conclusions
- Prepare to explain the conclusion

SCREENING JUSTIFICATION

R1	Violates Constraint
R2	Not Feasible
R3	Too Expensive
R4	Low Public Acceptance
R5	Low Benefit
R6	Duplicate Idea
R7	High Cost/Low Benefit
R8	Outside Scope/Beyond Study Area
R9	Low Agency Acceptance
R10	Lack of Detailed Information
R11	Environmental Complications
R12	High Risk Solution
R13	Adverse Schedule Impact
S	Selected for further consideration
AG	As Given

Exhibit 5.1: Codes for Justification of Screening Results

The objective of the Evaluation Phase is to identify the most outstanding Alternatives for further development. This is accomplished through a process of screening and ranking. Alternatives are developed using the ideas generated during the Speculation Phase and evaluated by comparison with the As Given Design.

5.2 Screening

Ideas generated during the Speculation Phase were not subject to criticism. This is done to promote free thinking. The next step is initial screening. At this time, each idea is reviewed and either selected for further consideration or rejected. In addition, ideas that violate project constraints are eliminated. Listed in Exhibit 5.1 are the justifications for the screening results. Below are the results of the screening process.

	IDEA	COMMENTS
1	Resurface highway	S
2	Reduce median width	S
3	Narrow median east of 61 - maintain current width	S

	IDEA	COMMENTS
~~4~~	~~Landscape median~~	~~R3~~
5	Improve intersection capacity	S
6	Roundabouts	S
7	RCUTs	S
8	Two-lane mainline with RCUTs	S
9	Right-in-right outs (RI/RO)	S
10	RI/RO at James Ave/Juneau Ct.	S
11	64' center line spacing rural section	S
12	Local roundabouts at Greenway and local roads	S
13	Two lane roundabouts	S
14	Replace median barrier with six-foot wide raised median	S
~~15~~	~~Auxiliary Lane between Goodview Circle and direction ramp~~	~~R5~~
16	Eliminate Curb along TH 8	S
17	Drain water away from center pavement	S
18	Reduce design speed	S
19	End 4 lane section further west	S
20	End 4 lane section at Pioneer	S
21	End 4 lane section at Viking	S
22	Two lane with passing lanes (Super 2)	S
23	Snow fence	DS
24	Widen ditch to manage snow (snow traps)	DS
25	Living snow fence	DS
26	Negotiate with farmers to manage snow	DS
27	Reduce turn lane widths	S
28	Reduce lane widths	S
~~29~~	~~Three-lane section~~	~~R9~~
30	Median bio-swales	DS
~~31~~	~~Resurface existing pavement and widen one lane north and south~~	~~R12~~
32	Reuse existing road for one bound	S
33	Mountable curb medians	S
34	Eliminate one lane EB from I-35 to 61, add second lane at 61	S
35	Provide snow storage	DS
36	Wider shoulders for snow	DS
~~37~~	~~Provide depression in median to store snow~~	~~R5~~

	IDEA	COMMENTS
38	Reconfigure TH 61 EB on-ramp to parallel acceleration configuration	S
~~39~~	~~Remove gas station drive near 61 EB on-ramp~~	~~R6~~
40	Lower profile at pinch point to provide more width	DS
41	Lower profile near wetlands to provide more width	DS
~~42~~	~~Construct bridge in vicinity of lakes~~	~~R3~~
43	Retaining walls at lakes	DS
44	Sheet pile walls at lakes	DS
~~45~~	~~Ped bridge at lakes~~	~~R3~~
~~46~~	~~Detour traffic - full closure~~	~~R4~~
47	Replace guardrail near bridge	AG
~~48~~	~~Provide clear zone instead of guardrail~~	~~R2~~
~~49~~	~~Flatten slopes to 4:1~~	~~R2~~
~~50~~	~~Install cable guard rail in median~~	~~R4~~
~~51~~	~~Install cable guard rail and narrow median~~	~~R4~~
~~52~~	~~Barrier wall separation for trail~~	~~R3~~
~~53~~	~~Add bike lanes to TH 8~~	~~R12~~
54	Install sidewalk on both sides of TH 8	S
55	Reduce widths of frontage road intersections	S
56	Four lane section median barrier wall widened out only at intersections for turn lanes	S
57	Upgrade R/W fence	DS
58	Reduce buffer between roadway and trail	S
~~59~~	~~Trail boardwalk at lakes~~	~~R10~~
60	Provide ped crossings at legal crossings	AG
~~61~~	~~Construct one bound of traffic at a time~~	~~R6~~
62	Construct one direction off-line while maintain existing road	S
63	Construct all local road facilities first	S
64	Construct local roads under separate contract	AG
65	Temporary widen to the north and build south half of new section	AG
66	Split project at Green Lake Trail	S
67	Use Wyoming Trail for Detour	S
68	Split project into three sections	S
69	Install rumble strip on shoulder	AG
~~70~~	~~Install center line rumble strip~~	~~R2~~
71	RI/RO at private drives	S

* DC = During Construction

	IDEA	COMMENTS
72	RI/RO with mountable curb for AG vehicles	DS
~~73~~	~~Reversible lane during construction~~	~~R12~~
~~74~~	~~Permanent reversible lane~~	~~R12~~
~~75~~	~~73 with zipper barrier~~	~~R12~~
76	Adjust horizontal curves for improved sight distance	AG
77	Free right turn at Green Lake Trail for NB TH 8	DS
78	Use Green Lake Trail for detour	S
79	Use 97 to 95 for detour	S
80	Use 97 to 95 for freight detour	S
81	Roundabouts with bypass lanes	S
~~82~~	~~Close Goodview Circle access and redirect to Greenway Ave~~	~~R4~~
83	Driveway at station 565+00 make right-in only	S
84	RCUT w/o central left turns	S
85	Remove drive at 565+00	S
86	RCUT at Greenway Ave instead of 4 phase signal	S
87	RI/RO at Hamlet Ave	S
~~88~~	~~Use two-mile access spacing~~	~~R4~~
~~89~~	~~Four-lane undivided section~~	~~R12~~
~~90~~	~~Five-lane section~~	~~R12~~
91	Roundabout at Karmel	S
92	Green Lake intersection closed to TH 8 during construction	S
93	Four lane section with six-foot-wide mountable median	S
94	No left turns during construction	S
95	Advance warning on NB I-35 and 61 for congestion on TH 8	DS
~~96~~	~~Michigan left~~	~~R6~~
97	Alternative water treatment	DS
98	Rain gardens	DS
99	Bio-swales	DS
100	Constructed wetlands for treatment	DS
101	Forebays for treatment	DS
102	Pervious pavement on trail	S
103	Oversize pipes for subsurface detention	DS
104	Vaults for subsurface detention	DS
~~105~~	~~Add lane and drop lane at Viking~~	~~R6~~
106	Detention/treatment basins between trail and TH 8 with smaller outfall pipes	DS

	IDEA	COMMENTS
~~107~~	~~Install traffic adaptive signals~~	~~R7~~
~~108~~	~~Shift highway alignment for new construction and use existing for MOT~~	~~R6~~
109	Install advance signal beacons	DS
~~110~~	~~Ped bridge across TH 8~~	~~R8~~
~~111~~	~~Ped tunnel under TH 8~~	~~R8~~
~~112~~	~~Combine ped tunnel with bridge at lakes~~	~~R7~~
113	Eliminate local road at Heath and use RCUT	S
~~114~~	~~Remove barrier between roadway and trail at pinch point~~	~~R12~~
~~115~~	~~Lane drop at intersections with only two lanes at lake pinch point~~	~~R4~~
116	Combine Hamlet and Heath into one intersection	S
~~117~~	~~Maintain existing cross section at lake~~	~~R4~~
118	Reroute trail from TH 8 to Pioneer Road, Wyoming Trail, and Sunrise Prairie Trail	S
119	Relocate Pioneer Road intersection to north	S
120	Offset Pioneer and Green Lake and build green T intersections	S
121	Build green T at Viking	S
122	Build green T at Greenway	S
123	Eliminate intersection at 276th Street	S
~~124~~	~~Have developers pay for new intersection at James~~	~~R8~~
125	Diamond intersection at Pioneer with Right-Ins only	S
126	Eliminate short horizontal curves	DS
127	Reduce profile change to minimize earthwork	DS
~~128~~	~~Two-lane divided~~	~~R5~~
~~129~~	~~Two-lane divided with alternating passing lanes~~	~~R6~~
~~130~~	~~CFI at all intersections with one continuous lane~~	~~R7~~
131	Carry section at Ellen Lake east with only one transition	DS
~~132~~	~~Consolidate access with better use of frontage and backage roads~~	~~R6~~
133	Variable centerline spacing	S
134	Build intersections first	DS
135	Build intersections in conjunction with local road improvements	DS
~~136~~	~~Double wide intersection - four lane intersection on two lane road~~	~~R12~~
137	Build to Pioneer Trail	DS
~~138~~	~~Prioritize segments for phased construction~~	~~R6~~
139	Detour NB and SB separately	DS
~~140~~	~~Three-lane section with controlled access~~	~~R5~~

	IDEA	COMMENTS
141	Barrier wall to separate trail with limited R/W	S
142	Combine 54 & 118	S
143	Install sidewalk on one side of TH 8 and combine with 118	S
144	Utilize smart street lighting at intersections	DS

Once a short list of ideas is determined, they are grouped together into broad concepts and further investigated for potential as proposals. With the development of a list of potential proposals (in the case of the TH 8 – Let's Get Moving project, eleven were identified) the concepts were further evaluated with respect to the functions of the project and criteria selected by the team related to the functions. That evaluation is summarized in Exhibit 5.2. Proposals with positive total evaluation points were advanced to the Development Phase and assigned a proposal number. Those concepts with negative total points typically are not advanced and given an X instead of a proposal number or, as is the case with Proposal 10, shown as a validation of the As Given design. Proposals with zero total evaluation points, a neutral impact to the project, are left to the discretion of the VE Team on advancement to the Development Phase. In the case of the TH 8 – Let's Get Moving project all the concepts, except Proposal 10 were considered beneficial to the project and advanced to the Development Phase.

Proposal Evaluation Rating	
Negative Impact	-1
Neutral	0
Positive Impact	1

PROPOSAL LIST EVALUATION

NO.*	PROPOSAL DESCRIPTION	PERFORMANCE CRITERIA				ACCEPTANCE CRITERIA				TOTAL EVALUATION POINTS
		Impacts to TH 8 Traffic	Improving Local Access	Impacts to Drainage	Impacts to Longevity	Constructability	Public Perception	Impact to Multi-Modal	Economic Benefits	
P1	Typical Section Modifications	0	0	1	1	0	0	0	0	2
P2	RCUT at Greenway	1	0	0	1	0	1	0	1	4
P3	Combine Heath & Hamlet to One Intersection with RCUTs	1	-1	1	0	1	-1	1	0	2
P4	RCUT at Pioneer	1	0	0	1	0	1	0	1	4
P5	RI/RO at James Avenue/Remove 276th	1	0	1	0	1	-1	1	0	3
P6	RCUT/restrict through movement at Viking intersection	1	0	0	1	0	1	0	1	4
P7	Roundabout at Karmel	1	1	0	1	-1	1	0	0	3
P8	Stripe One Lane w/ Shoulder on EB 8 between I-35 & 61	1	1	0	0	1	0	0	0	3
P9	Mini-Roundabout on Greenway	0	1	0	0	0	1	0	1	3
P10	Substitute Pervious Pavement for Bituminous Pavement Trail	0	0	1	-1	-1	0	0	0	-1
P11	End Four Lane Section at Pioneer	1	0	1	-1	1	0	-1	0	1
	RELATED FUNCTION	Improve Operations	Manage Access	Manage Runoff	Restore Infrastructure	Facilitate Construction	Restore Confidence	Improve Bikeability	Attract Development	

Exhibit 5.2: Proposal List Evaluation

6 DEVELOPMENT PHASE

6.1 Introduction

The last step before implementation is to summarize the VE recommendations:

What are the VE recommendations? Why should the recommendations be accepted?

Proposals should be clearly presented:

1. Describe As Given with sketches.
2. Present VE Alternatives.
3. Compare advantages, limitations and cost.
4. Recommend a VE Alternative or validate As Given.

Among the rules that govern the Development Phase of a VE Study are the following:

- Improve ideas
- Combine ideas
- Verify features

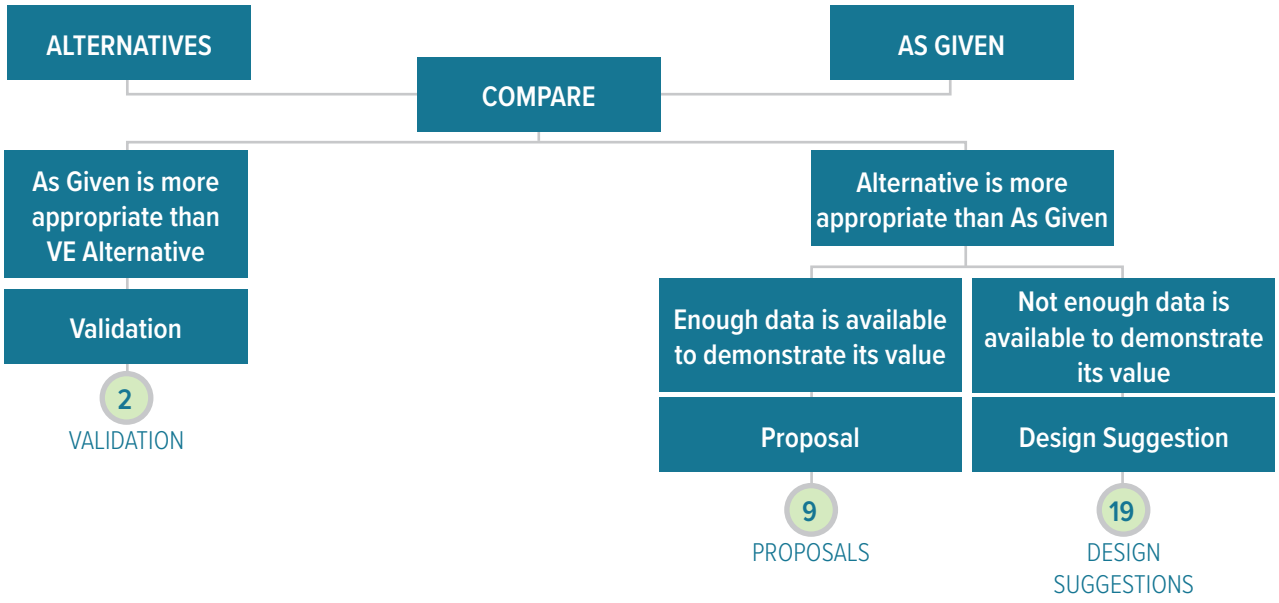


Exhibit 6.1: Development Phase flow chart

As a result of the speculation and screening process, a number of Alternatives are developed for proposals.

These alternatives are compared with the As Given. It should be noted that alternatives can be macro in scale and address the design concept or micro in scale and address individual design elements. If the As Given is considered better than the alternative then the As Given design is validated. However, if the alternative can provide value without compromising functions, then the alternative is developed into a proposal or design suggestion. A proposal is an alternative that can be supported by cost, design features and a clear advantage over the As Given design. If enough data is not available to demonstrate an alternative's value, then it is considered a design suggestion.

PROPOSAL NO. P1

Description: Modify Typical Section

Existing

TH 8 from I-35 to east of TH 61 (approximately 1.1 miles) is a four-lane roadway with 12-foot travel lanes and 10 foot shoulders, separated by a six-foot raised center median with ditches along the outside shoulders. The speed limit for this section of TH 8 is 60 mph. Average daily traffic varies from approximately 21,900 vehicles per day to 22,700 vehicles per day.

The remainder of this section of TH 8 to Karmel Avenue (approximately 7 miles) is a two-lane rural section roadway with 12-foot travel lanes and 10-foot shoulders. The speed limit is 55 mph. Existing traffic volumes vary from approximately 14,500 vehicles per day at County 36/East Viking Boulevard to approximately 19,700 vehicles per day west of Pioneer Drive. See Exhibits P1.1 and P1.2 for a depiction of the existing typical sections.

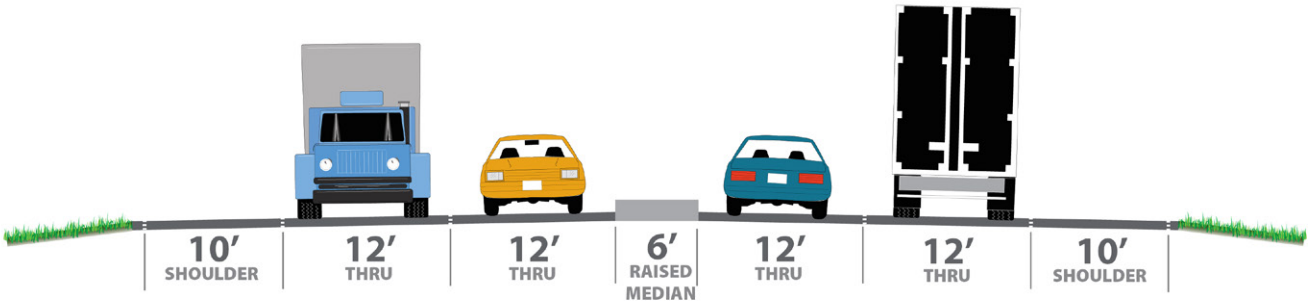


Exhibit P1.1: Existing four-lane section

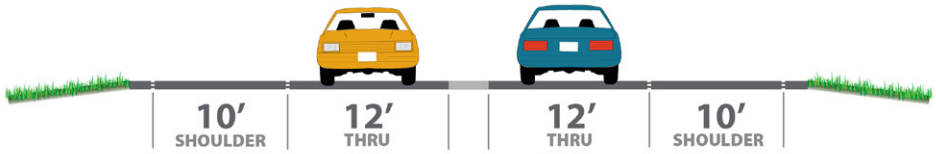


Exhibit P1.2: Existing two-lane section

As Given:

East of TH 61 to STA 876+00 (Lake Ellen/ Little Green Lake), TH 8 is proposed to be reconstructed as a four-lane divided urban roadway with a design speed of 60 mph. The inside travel lane will be 14 feet wide to face of curb, the outside travel lane will be 12 feet wide, and the outside shoulder will be 8 feet wide to face of curb. Traffic will be separated by a 20-foot-wide paved center median. A 10-foot-wide shared use trail will be built on the north side of TH 8, with a 15-foot boulevard between it and the edge of the outside shoulder. See Exhibit P1.3 for the As Given typical section.

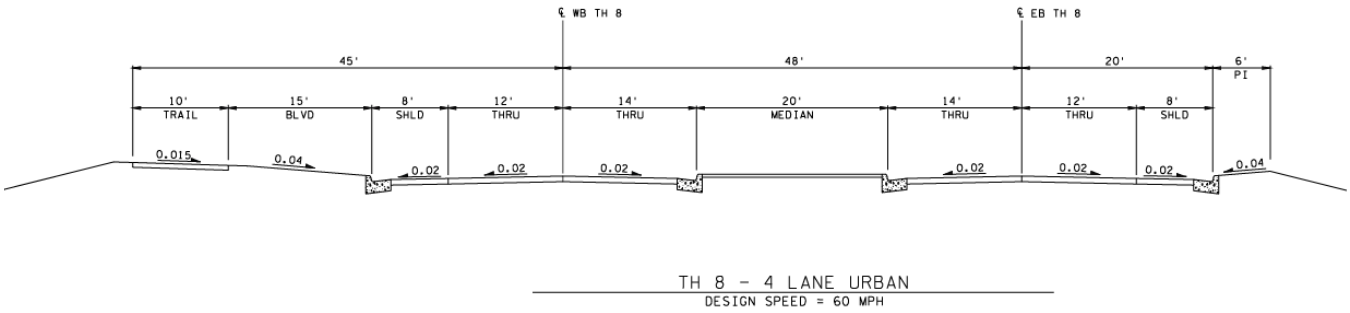


Exhibit P1.3: As Given Typical Section

In the constrained area between Comfort Lake and Little Comfort Lake, an alternative typical section is proposed, replacing the 20-foot-wide center median with a 10-foot median with barrier wall. The north side shoulder is also replaced with a 10-foot shoulder and barrier wall immediately adjacent to a 12-foot shared use trail.

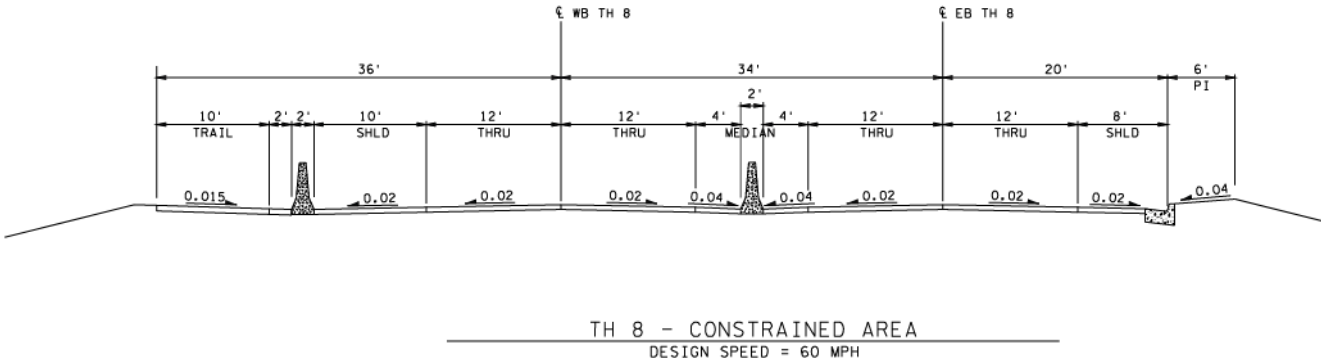


Exhibit P1.4: As Given Typical Section in Constrained Area

As Given Cost:

ITEM	UNIT	QUANTITY	PRICE	COST
Excavation	CY	308,907	$ 10.00	$ 3,090,000
Embankment	CY	154,543	$ 10.00	$ 1,540,000
Granular Subgrade	CY	69,504	$ 12.00	$ 834,000
Mainline Pavement	SY	211,839	$ 35.00	$ 7,410,000
Median	SY	42,475	$ 85.00	$ 3,610,000
Aggregate Base	CY	17,621	$ 30.00	$ 529,000
Curb and Gutter	LF	68,163	$25.00	$ 1,700,000
Drainage – Urban	LS			$ 3,960,000
			TOTAL	$ 22,700,000

Note: As Given cost was adjusted to account for STA 529+00 to STA 876+00. STA 876+00 to STA 905+00 is not included.

Exhibit P1.5 As Given Cost

VE Proposal P1: Modify Typical Section

From the Minnesota Road Design Manual, Section 2-5.06-01
"The project segment's appropriate design speed depends upon the functional classification and use, average daily traffic ADT, anticipated and desirable operating speed, terrain, and adjacent land use of the highway..... The most appropriate design speed may be a lower value that recognizes the importance of attaining maximum design flexibility and a context sensitive roadway that fits community needs and environmental constraints. Design speed values above the minimums are usually most appropriate and desirable, but the designer should not be averse to adopting lower values where significant constraints or opportunities exist. The designer must carefully document all of the considerations and analyses important to the determination of the most appropriate design speed and weigh the benefits of a desired degree of safety, access, mobility, design consistency, and efficiency against the community, environmental, right of way, and cost impacts"

The As Given on TH 8 is utilizing a design speed for a 4 lane rural roadway, with cross sectional elements such as curb and gutter, and no inside shoulder which are more standard for urban cross sectional elements. These elements are being used to limit environmental, right of way and cost impacts. In addition, portions of TH 8 have a land use that is commercially more dense than a typical rural highway. In the VE proposal, the 45 mph urban section from TH 61 to Greenway Avenue was chosen because of the close spacing between existing businesses. The extents for two 50 mph urban sections were identified based on areas of environmental constraint, such as wetlands and bodies of water. In addition, future development along TH 8, as desired by the local officials, will change the adjacent land use.

STA 529+00 to STA 580+00 (TH 61 to east of Greenway Avenue)

Modify the design speed to 45 mph and use low speed environment geometrics for a four-lane divided roadway. Travel lanes will be 14-feet-wide to face of curb, and the raised median will be six-feet wide. The shoulders will be eliminated. Reduce the buffer space between the back of curb and the shared use trail to six feet. See Exhibit P1.6 for the modified typical section.

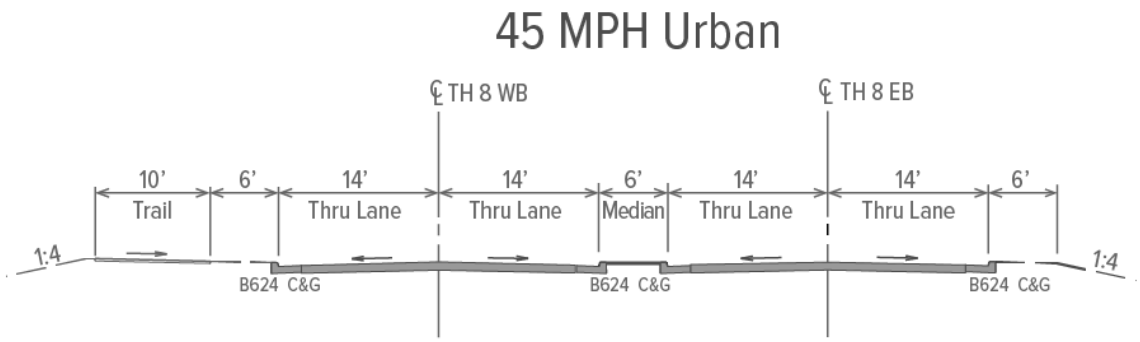


Exhibit P1.6: 45 mph Urban Typical Section

STA 580+00 to STA 591+00 and STA 659+00 to STA 680+00 (East of Greenway Avenue to west of Hamel Avenue and Heath Avenue to east of Comfort Lake)

Modify the design speed to 50 mph and use modified geometrics for a four-lane divided roadway. The inside travel lanes will be 14 feet wide to face of curb, the outside travel lanes will be 12 feet wide. The raised median will be 6 feet wide. The shoulders will be 8 feet wide to the face of curb. Reduce the buffer space between the back of curb and the shared use trail to 6 feet. See Exhibit P1.7 for the modified typical section.

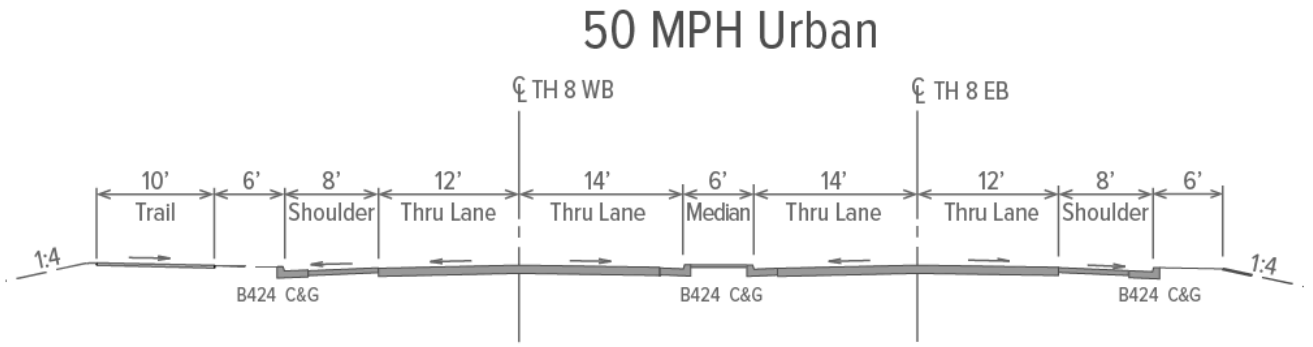


Exhibit P1.7: 50 mph Hybrid Urban Typical Section

STA 591+00 to STA 659+00 and STA 680+00 to STA 876+00 (Hamel Avenue to Heath Avenue and east of Comfort Lake to west of Lake Ellen/Little Green Lake)

Modify the design speed to 50 mph and use modified geometrics for a four-lane divided roadway. The inside travel lanes will be 14 feet wide to face of curb, the outside travel lanes will be 12-feet wide. The raised median will be six-feet wide. The north side shoulder will be eight feet wide to the face of curb, and the south side shoulder will be eight-feet wide without curb and gutter. The south side will also feature unidirectional pavement, eliminating the need for storm sewer structures and pipes. Reduce the buffer space between the back of curb and the shared use trail to six feet. See Exhibit P1.8 for the modified typical section.

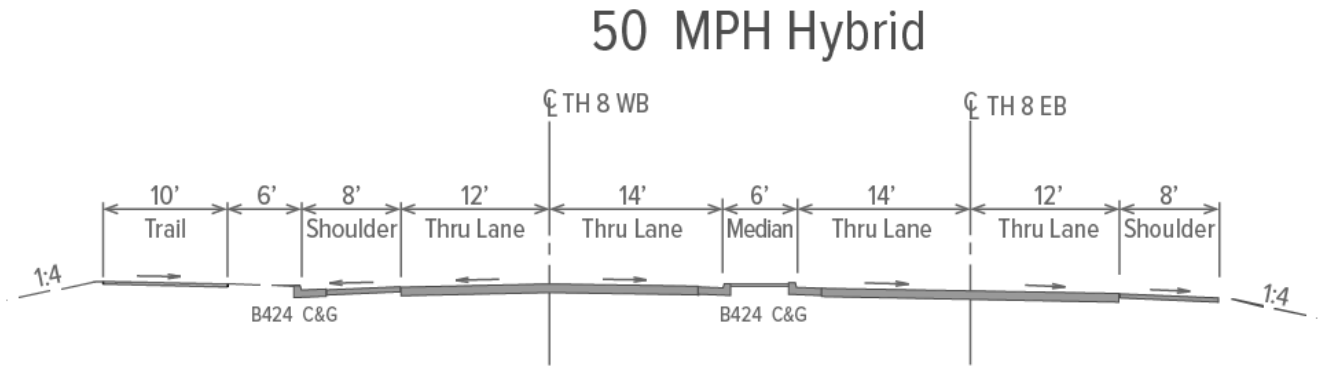


Exhibit P1.8: 50 mph Hybrid Urban Typical Section

VE Alternative P1 Cost:

STA 529+00 to STA 580+00
(TH 61 to east of Greenway Avenue)

ITEM	UNIT	QUANTITY	PRICE	COST
Excavation	CY	32,244	$ 10.00	$ 322,000
Embankment	CY	16,122	$ 10.00	$ 161,000
Granular Subgrade	CY	7,241	$ 12.00	$ 86,900
Mainline Pavement	SY	25,060	$ 35.00	$877,000
Median	SY	1,884	$ 85.00	$ 160,000
Aggregate Base	CY	1,835	$ 30.00	$ 55,100
Curb and Gutter	LF	10,079	$25.00	$ 252,000
Drainage – Urban	LS			$ 413,000
			SUBTOTAL	$ 2,327,000

Exhibit P1.9: Costs for Proposal P1 - TH 61 to east of Greenway Avenue

STA 580+00 to STA 591+00 and STA 659+00 to STA 680+00
(East of Greenway Avenue to west of Hamel Avenue and Heath Avenue to east of Comfort Lake)

ITEM	UNIT	QUANTITY	PRICE	COST
Excavation	CY	23,121	$ 10.00	$ 231,000
Embankment	CY	11,560	$ 10.00	$ 116,000
Granular Subgrade	CY	5,422	$ 12.00	$ 65,100
Mainline Pavement	SY	19,655	$ 35.00	$ 688,000
Median	SY	1,182	$ 85.00	$ 100,000
Aggregate Base	CY	1,374	$ 30.00	$ 41,200
Curb and Gutter	LF	6,324	$25.00	$ 158,000
Drainage – Urban	LS			$ 309,000
			SUBTOTAL	$ 1,708,000

Exhibit P1.10: Costs for Proposal P1 - East of Greenway Avenue to west of Hamel Avenue and Heath Avenue to east of Comfort Lake

STA 591+00 to STA 659+00 and STA 680+00 to STA 876+00
(Hamel Avenue to Heath Avenue and east of Comfort Lake to west of Lake Ellen/Little Green Lake)

ITEM	UNIT	QUANTITY	PRICE	COST
Excavation	CY	178,833	$ 10.00	$ 1,788,000
Embankment	CY	89,649	$ 10.00	$ 894,000
Granular Subgrade	CY	44,738	$ 12.00	$ 537,000
Mainline Pavement	SY	167,560	$ 35.00	$ 5,860,000
Median	SY	9,753	$ 85.00	$ 829,000
Aggregate Base	CY	11,342	$ 30.00	$ 340,000
Curb and Gutter	LF	26,088	$25.00	$652,000
Drainage – Urban	LS			$ 1,270,000
			SUBTOTAL	$ 12,170,000

Exhibit P1.11: Costs for Proposal P1 - Hamel Avenue to Heath Avenue and east of Comfort Lake to west of Lake Ellen/Little Green Lake

The total construction cost for the modified sections detailed in Exhibits P1.9, P1.10, and P1.11 is $16,205,000.

VE Alternative Proposal Evaluation

ALTERNATIVE	ADVANTAGES	LIMITATIONS
As Given	• Consistency of typical section • Widening of the typical section at the intersections would be minor • Ample room for maintenance and disabled vehicles	• Increased impacts to right of way • Increased impacts to wetlands • Additional storm sewer structures and pipes to be maintained • Additional stormwater runoff to manage
VE Alternative P1	• Decreases impacts to right of way • Decreases impacts to wetlands • Reduces number of storm sewer structures and pipes that will require maintenance • Reduces storm water runoff • Flexibility for traffic calming measures • Shorter crossing distance at traditional non-signalized intersections	• Widening of the typical sections at the intersections may be required • Reduce space for median signage • Limited room for maintenance operations and disabled vehicles in the 45-mph urban section

Exhibit P1.12: VE Alternative Proposal Evaluation

Recommendation

The VE Team recommends modifying the typical section between intersections in three segments. The recommendation enhances the performance functions *Manage Runoff* and *Restore Infrastructure*, while maintaining the acceptance functions. The recommendation provides a potential cost avoidance of $6,495,000.

Proposal Comparison Cost Table

The table below summarizes As Given, Alternative Cost and the Cost Difference between the As Given and the Alternatives.

Item	First Cost		VE Savings or Cost Avoidance (+) or Cost Added (-)
	As Given	VE Proposal	
VE Proposal P1: Modify Typical Section	$22,700,000	$16,205,000	$6,495,000

Accept: ☐ Reject: ☐ Accept for Further Review: ■

FHWA Functional Benefit

Safety	Operations	Environment	Construction	Right of Way
		✓		✓

PROPOSAL NO. P2

Description: RCUT at Greenway Avenue

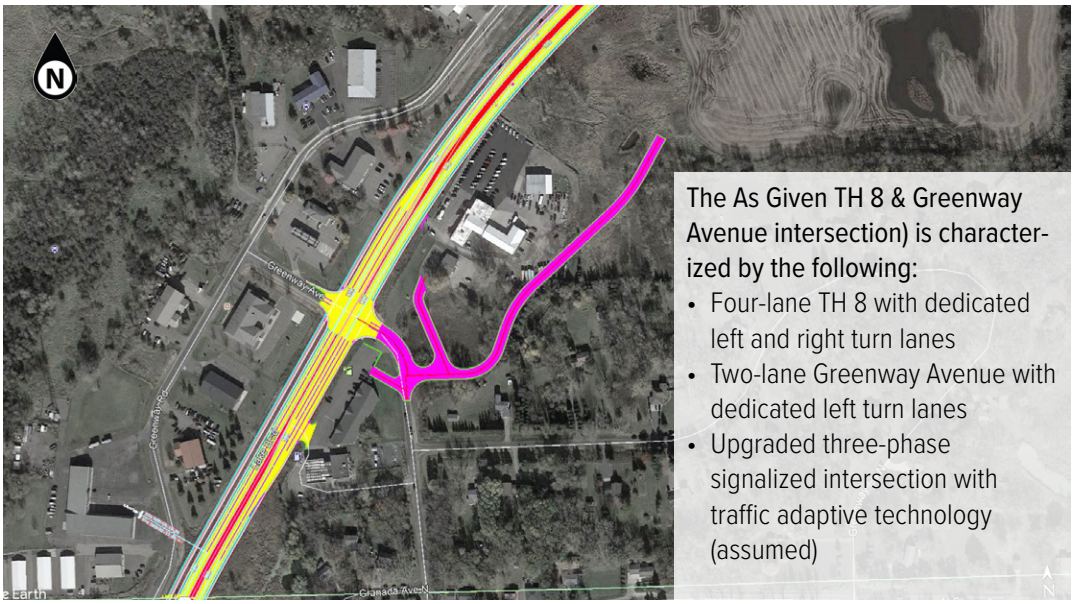
Existing:

The existing TH 8 & Greenway Avenue intersection is characterized by the following:

- Two-lane TH 8 with dedicated left and right turn lanes
- Two-lane Greenway Avenue with dedicated left turn lanes
- Three-phase signalized intersection
- Commercial development immediately adjacent to the intersection

Exhibit P2.1: Existing TH 8 & Greenway Avenue intersection

As Given:



The As Given TH 8 & Greenway Avenue intersection) is characterized by the following:

- Four-lane TH 8 with dedicated left and right turn lanes
- Two-lane Greenway Avenue with dedicated left turn lanes
- Upgraded three-phase signalized intersection with traffic adaptive technology (assumed)

Exhibit P2.2: As Given TH 8 & Greenway Avenue intersection

A conceptual Synchro traffic analysis of the intersection indicates an overall Level of Service (LOS) C in the 2040 Build PM Peak Hour condition. All of the approach LOS and movement LOS were LOS C or better. Exhibit P2.3 illustrates the volumes and intersection characteristics analyzed for the As Given condition.

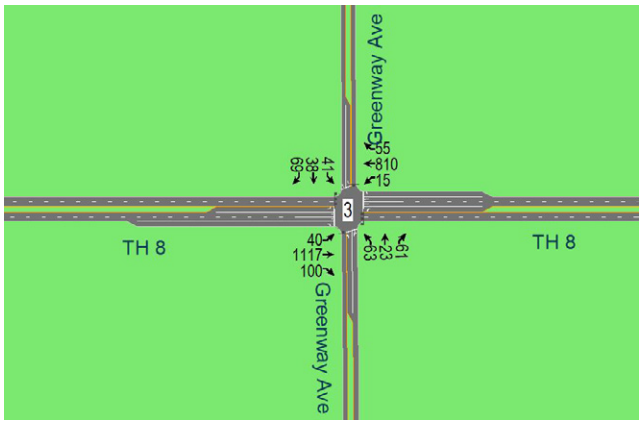


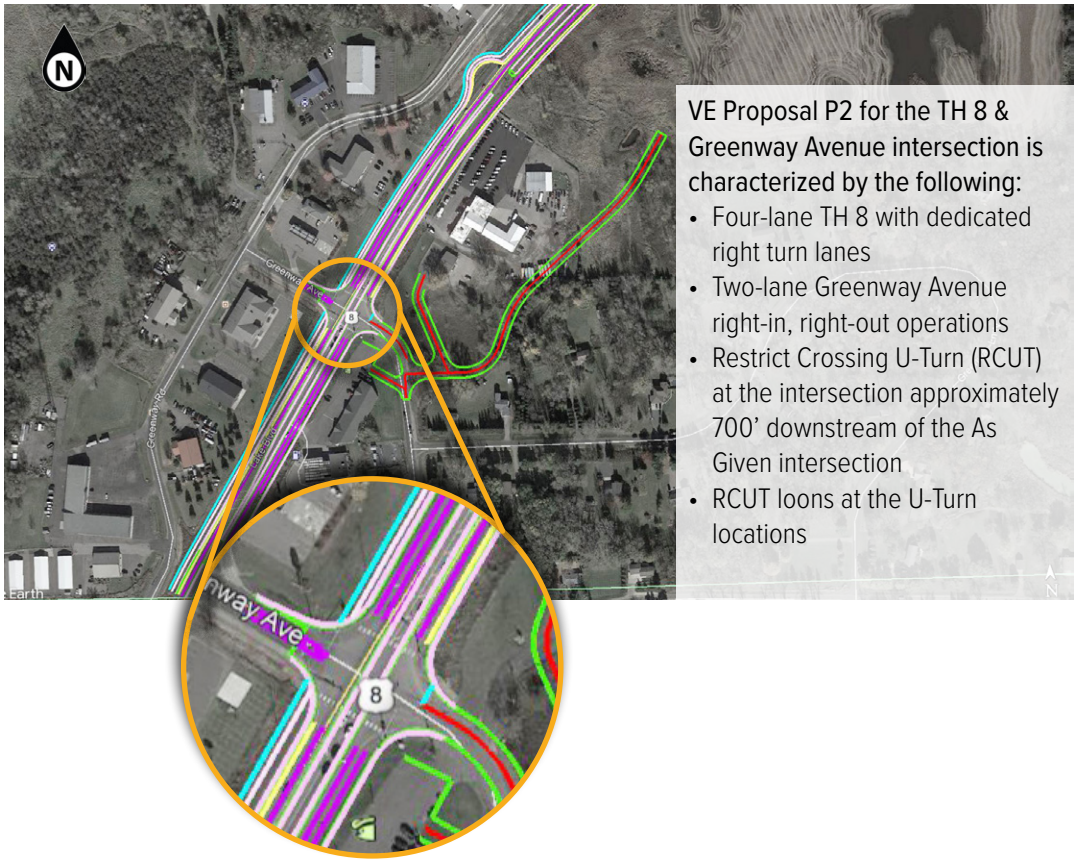
Exhibit P2.3: VE Proposal Traffic Analysis

As Given Cost:

ITEM	UNIT	QUANTITY	PRICE	EXTENSION
Signal (Permanent)	EA	1	$250,000	$250,000
			TOTAL	$250,000

Exhibit P2.4: Costs for As Given

VE Proposal P2: RCUT at Greenway Avenue



VE Proposal P2 for the TH 8 & Greenway Avenue intersection is characterized by the following:

- Four-lane TH 8 with dedicated right turn lanes
- Two-lane Greenway Avenue right-in, right-out operations
- Restrict Crossing U-Turn (RCUT) at the intersection approximately 700' downstream of the As Given intersection
- RCUT loons at the U-Turn locations

Exhibit P2.5: VE Proposal P2 - TH 8 & Greenway Avenue intersection

A conceptual Synchro traffic analysis of the intersection indicates an overall Level of Service (LOS) A in the 2040 Build PM Peak Hour condition. All of the side street turn movements LOS B or C. TH 8 traffic was not delayed. The overall LOS A was calculated by adding the delays from each of the four two-way stop-controlled intersections without accounting for additional travel time through the intersection. Exhibit P2.6 illustrates the volumes and intersection characteristics analyzed for the Proposal P2 condition.

Exhibit P2.6: VE Proposal Traffic Analysis

VE Alternative P2 Cost:

ITEM	UNIT	QUANTITY	PRICE	EXTENSION
RCUT Pavement	SY	1,350	35.00	$47,250
			TOTAL	$47,000

Exhibit P2.7: Costs for Proposal P2

VE Alternative Proposal Evaluation

ALTERNATIVE	ADVANTAGES	LIMITATIONS
As Given	• Meets driver expectation of turning at the intersection • Acceptable LOS • Access is centrally controlled • Improved multi-modal safety	• TH 8 vehicles can be stopped at the signal • Side road cross traffic • Increased conflict points (42 total) • Requires periodic retiming/other maintenance • Energy consumption
VE Alternative P2	• Reduced congestion/ Improve LOS • Reduced conflict points (18 total) • Simplifies driving task • Supports significant increase in traffic • Improved future operations • Reduced crash potential • Reduced severity of crashes potential • Many successful installations in Minnesota	• Increased commercial property impacts at U-turn movement • Increased traffic through the intersection • U-turn movements may lead to confusion • Increased travel time • Uncontrolled ped/bike movements • Potential increase in EMS response time

Exhibit P2.8: VE Alternative Proposal Evaluation

Recommendation

The VE Team recommends adopting VE Proposal P2 of installing an RCUT at the intersection of TH 8 & Greenway Avenue. The proposal benefits the performance function *Improve Operations* and the acceptance function *Restore Confidence* with a cost avoidance of $203,000.

Proposal Comparison Cost Table

The table below summarizes As Given, Alternative Cost and the Cost Difference between the As Given and the Alternatives.

Item	First Cost		VE Savings or Cost Avoidance (+) or Cost Added (-)
	As Given	VE Proposal	
VE Proposal P2 RCUT at Greenway Avenue	$250,000	$47,000	$203,000

Accepted: ☐ Rejected: ■ Accept for Further Review: ☐

FHWA Functional Benefit

Safety	Operations	Environment	Construction	Right of Way
✓	✓			

PROPOSAL NO. P3

Description: Combine Heath and Hamlet into One Intersection with RCUTS

Existing:

Hamlet Avenue is a two-lane, two-way stop-controlled roadway that forms an intersection with TH 8. The south leg is an access road to the Northwoods Humane Society. The north leg is Hamlet Avenue that terminates 935 feet north of TH 8. The only turn bay at this intersection on TH 8 is an eastbound right turn lane to the access road. See Exhibit P3.1.

Exhibit P3.1: Existing Hamlet and TH 8 intersection

Heath Avenue is a two-lane, two-way stop-controlled roadway that forms a skewed intersection with TH 8. At this intersection TH 8 has eastbound and westbound left turn bays and an eastbound right turn bay to Heath. The north leg of Heath terminates 450 feet north of TH 8 at West Comfort Drive. The south leg terminates at North Shore Drive 1.5 miles south of TH 8. See Exhibit P3.2

Exhibit P3.2: Existing Heath Avenue and TH 8 intersection

As Given:

The As Given Hamlet Avenue is a two-lane, two-way stopped-controlled intersection with left turn bays on all four legs and right turn bays on TH 8. See Exhibit P3.3 below for the As Given intersection layout.

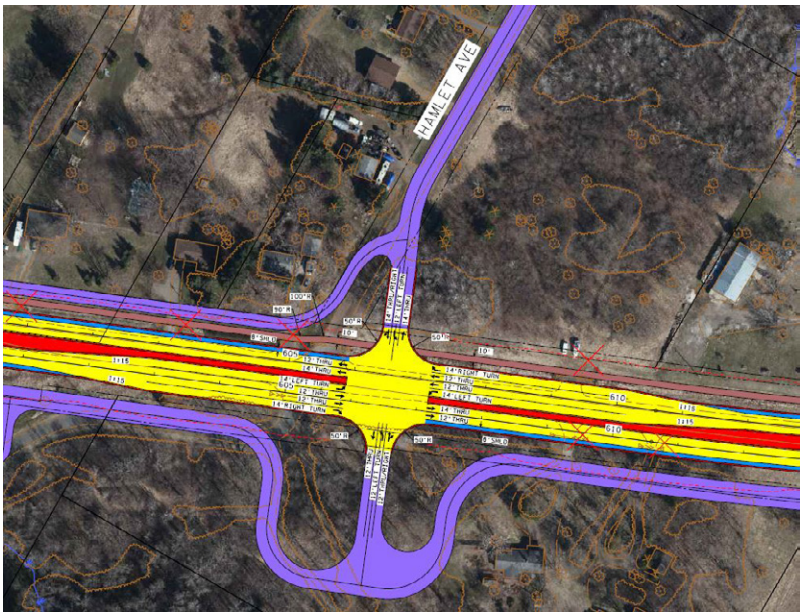


Exhibit P3.3: As Given Hamlet Avenue and TH 8 intersection

The As Given Heath Avenue intersection with TH 8 is a realigned two-way stopped-controlled intersection with left turn bays on all four legs and right turn bays on TH 8. See Exhibit P3.4 below for the As Given intersection layout.

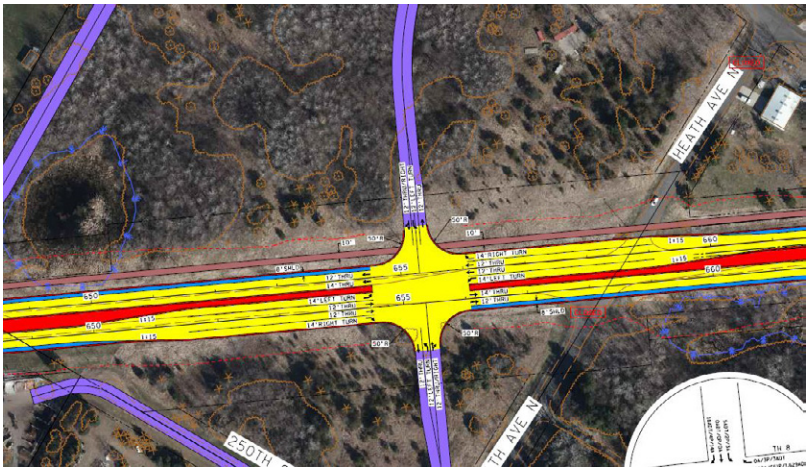


Exhibit P3.4: As Given Heath Avenue and TH 8 intersection

As Given Cost:

ITEM	UNIT	QUANTITY	PRICE	COST
Conventional Intersection	EA	1	$ 1,150,000	$ 1,150,000
Conventional Intersection	EA	1	$1,150,000	$1,150,000
Heath Reconstruction	EA	1	$ 197,000	$ 197,000
			TOTAL	$ 2,497,000

Exhibit P3.5: As Given Cost

VE Proposal P3: Combine Heath and Hamlet into One Intersection with RCUTs

Combine the proposed Hamlet Avenue and Heath Avenue intersections into one Reduced Conflict Intersection (RCUT) at Hazel Avenue.

Exhibit P3.6 shows an example of the RCUT intersection proposed at Hazel Avenue.

Exhibit P3.6: example of the RCUT intersection proposed at Hazel Avenue

VE Alternative P3 Cost:

ITEM	UNIT	QUANTITY	PRICE	COST
RCUT Intersection	EA	1	$ 1,097,000	$ 1,097,000
2000' Mainline	EA	1	$ 1,146,000	$ 1,146,000
			TOTAL	$ 2,243,000

Exhibit P3.7: Costs for Proposal P3

VE Alternative Proposal Evaluation

ALTERNATIVE	ADVANTAGES	LIMITATIONS
As Given	• Provides 2 access points • Drivers are more familiar with this type of intersection	• Thru/left movements off Hamlet/Heath must cross multiple lanes of high-speed traffic in two directions • Realigns Hamlet and reconstructs Heath to remove skews
VE Alternative P3	• Reduces the number of access points to TH 8 • Right turns only from Hazel (merge condition so no crossing of lanes) • Do not need to realign Hamlet or reconstruct Heath • Provides a 44% reduction (based on crash modification factors) in crashes compared to conventional un-signalized intersections • Improves spacing between intersections	• Reduces access to area by removing an access point • Increases drive time for thru and left turn movements from Hazel • Left and thru movements from Hazel need to make two weave movements to access U-turns

Exhibit P3.8: VE Alternative Proposal Evaluation

Recommendation

The VE team recommends combining the intersections of Heath and Hamlet Avenues into one intersection be adopted. The proposal benefits the performance function *Improve Operations* and the acceptance function *Facilitate Construction* with a total cost avoidance of $254,000.

Proposal Comparison Cost Table

The table below summarizes As Given, Alternative Cost and the Cost Difference between the As Given and the Alternatives.

Item	First Cost		VE Savings or Cost Avoidance (+) or Cost Added (-)
	As Given	VE Proposal	
VE Alternative P3:Combine Heath and Hamlet into One Intersection with RCUTS	$ 2,497,000	$ 2,243,000	$254,000

Accept: ☐ Reject: ☐ Accept for Further Review: ■

FHWA Functional Benefit

Safety	Operations	Environment	Construction	Right of Way
✓	✓		✓	

PROPOSAL NO.
P4

Description: RCUT at Pioneer Road

Existing:

The existing TH 8 & Greenway Avenue intersection is characterized by the following:

- Two-lane TH 8 with dedicated left and right turn lanes
- Two-lane Pioneer Road with dedicated right turn lanes
- Three-phase signalized intersection with advanced left turn phases for TH 8 left turns
- Commercial development (TH 8) in the northeast quadrant of the intersection

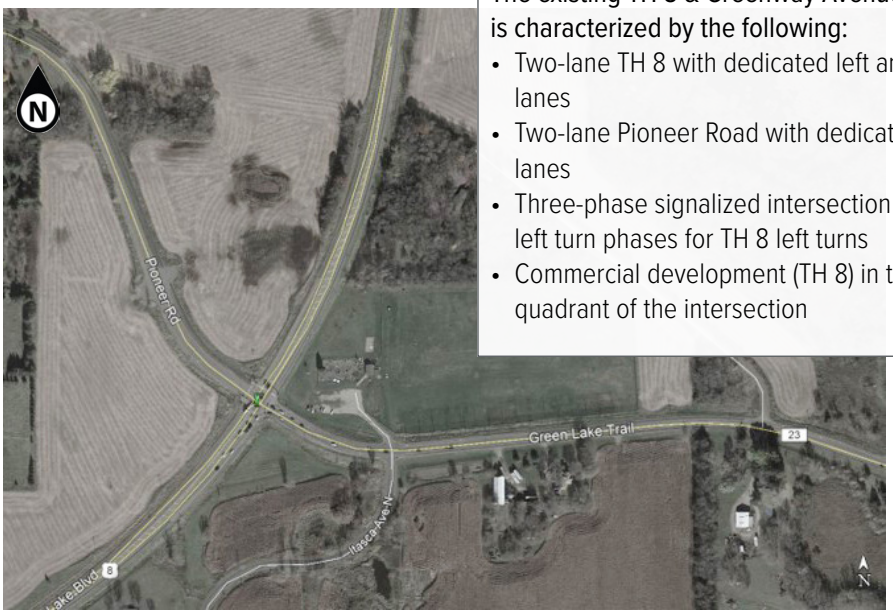


Exhibit P4.1: Existing TH 8 & Pioneer Road intersection

As Given:

The As Given TH 8 & Pioneer Road intersection is characterized by the following:

- Four-lane TH 8 with dedicated left and right turn lanes
- Two-lane Pioneer Road with dedicated left turn lanes
- Upgraded three-phase signalized intersection with traffic adaptive technology (assumed)

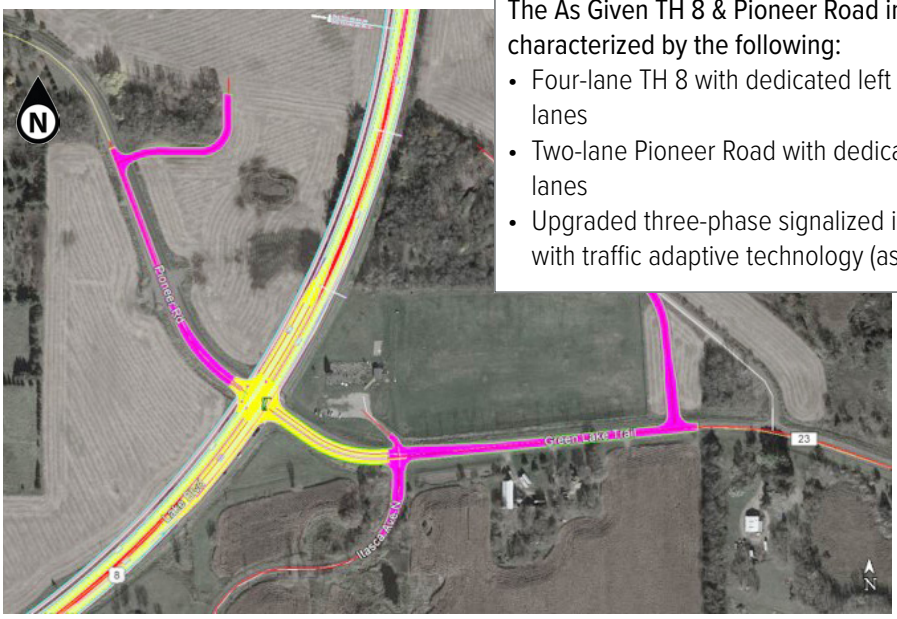
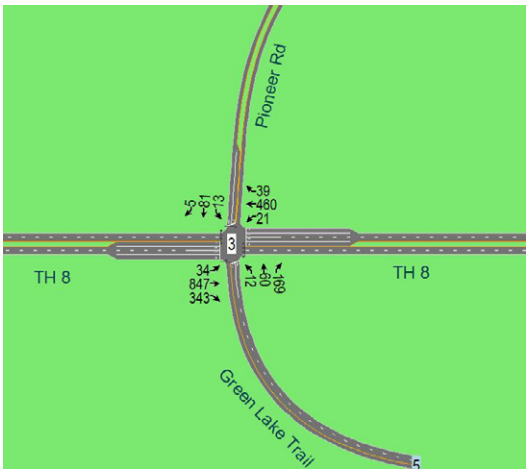


Exhibit P4.2: As Given TH 8 & Pioneer Road intersection



A conceptual Synchro traffic analysis of the intersection indicates an overall Level of Service (LOS) C in the 2040 Build PM Peak Hour condition. All the approach LOS and movement LOS were LOS C or better. Exhibit P4.3 illustrates the volumes and intersection characteristics analyzed for the As Given condition.

Exhibit P4.3: As Given Traffic Analysis

As Given Cost:

ITEM	UNIT	QUANTITY	PRICE	EXTENSION
Local Road Pavement	SY	15,200	$35	$532,000
Median	SY	500	$85	$42,500
Earth Excavation	CY	3,200	$10	$32,000
Signal (Permanent)	EA	1	$250,000	$250,000
			TOTAL	$856,500

Exhibit P4.4: Costs for As Given

VE Proposal P4: RCUT at Pioneer Road

VE Proposal P4 for the TH 8 & Pioneer Road intersection is characterized by the following:

- Four-lane TH 8 with dedicated right turn lanes
- Two-lane Pioneer right-in, right-out operation
- Relocate Pioneer intersection approximately 1,200 feet north to former alignment
- Restrict Crossing U-Turn (RCUT) at the intersection approximately 700 feet downstream of the relocated intersection
- RCUT loons at the U-Turn locations

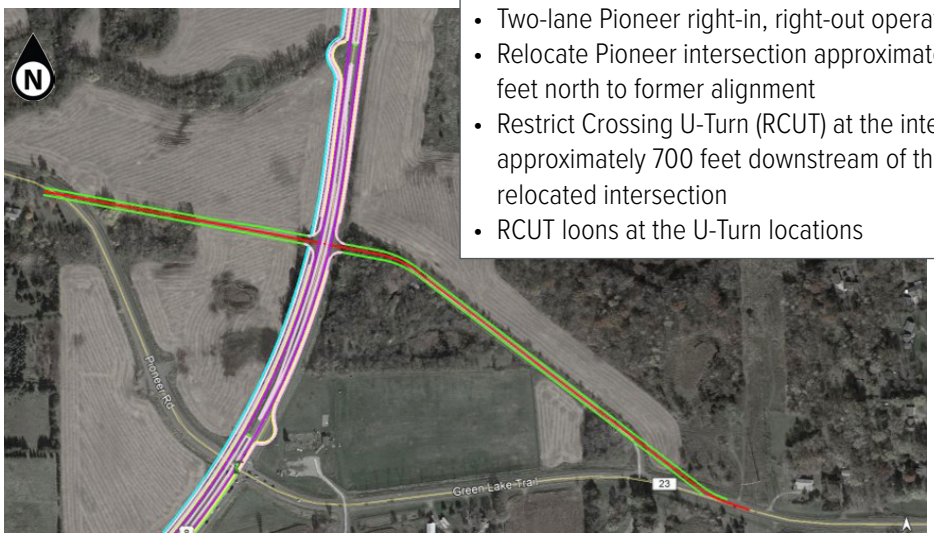


Exhibit P4.5: VE Proposal P4 - TH 8 & Pioneer Road intersection

A conceptual Synchro traffic analysis of the intersection indicates an overall Level of Service (LOS) A in the 2040 Build PM Peak Hour condition. All of the side street turn movements LOS B or C. TH 8 traffic was not delayed. The overall LOS A was calculated by adding the delays from each of the four (4) two-way stop-controlled intersection without accounting for additional travel time through the intersection. Exhibit P4.6 illustrates the volumes and intersection characteristics analyzed for the As Given condition.

Exhibit P4.6: VE Proposal Traffic Analysis

VE Alternative P4 Cost:

ITEM	UNIT	QUANTITY	PRICE	EXTENSION
Local Road Pavement	SY	11,050	$35	$386,750
RCUT Pavement	SY	1,350	$35	$47,250
Earth Excavation	CY	3,000	$10	$30,000
			TOTAL	$464,000

Exhibit P4.7: Costs for Proposal P4

VE Alternative Proposal Evaluation

ALTERNATIVE	ADVANTAGES	LIMITATIONS
As Given	• Maintains existing intersection • Meets driver expectation • Acceptable LOS • Improved multi-modal safety	• Peak-hour delays • More roads to maintain • 42 conflict points • Requires periodic re-timing/other maintenance • Energy consumption
VE Alternative P4	• Reduces congestion • 18 conflict points • Offline construction of Pioneer Road • Less local roads • Supports increase in traffic • Smaller footprint	• Increased commercial property impacts at U-turn • Increased traffic through the intersection • Increased travel time • Uncontrolled ped/bike movements • Potential increase in EMS response time

Exhibit P4.8: VE Alternative Proposal Evaluation

Recommendation

The VE Team recommends adopting VE Proposal P4 of installing an RCUT at the intersection of TH 8 & Pioneer Road. The proposal benefits the performance function *Improve Operations* and the acceptance function *Restore Confidence* with a cost avoidance of $392,500.

Proposal Comparison Cost Table

The table below summarizes As Given, Alternative Cost and the Cost Difference between the As Given and the Alternatives.

Item	First Cost		VE Savings or Cost Avoidance (+) or Cost Added (-)
	As Given	VE Proposal	
VE Proposal P4: RCUT at Pioneer Road	$856,500	$464,000	$392,500

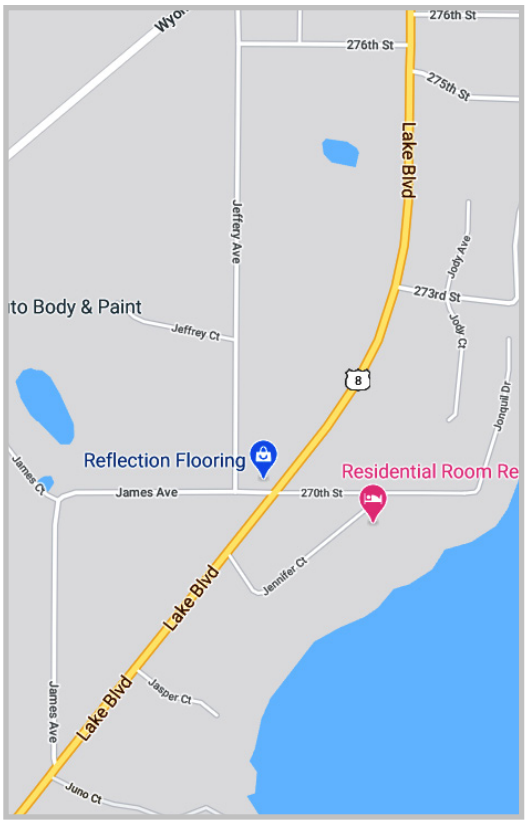
Accept: ☐ Reject: ■ Accept for Further Review: ☐

FHWA Functional Benefit

Safety	Operations	Environment	Construction	Right of Way
✓	✓		✓	

PROPOSAL NO. P5

Description: Right-In/Right-Out RCUT at James Avenue and Remove 276th Street intersection



Existing:

James Avenue / Juno Court are offset roadways that intersect with TH 8 approximately 2,500 feet from the James Avenue / 270th Street intersection with TH 8. These intersections are currently two-way stop controlled on the side roads. The intersection of 276th Street and TH 8 is approximately 6,500 feet north of the James Avenue / Juno Court intersection with TH 8. The intersection of Viking Boulevard is approximately 3,000 feet north of 276th Street. See Exhibit P5.1 for a map of the area.

Exhibit P5.1: Map of James Avenue and 276th Street Intersections

As Given:

TH 8 will be reconstructed to four lanes. The James Avenue / Juno Avenue intersection will be relocated approximately 25 to 50 feet south. The James Avenue / 270th Street Intersection will be eliminated. A series of frontage and backage roads will be constructed, connecting existing local roads to intersect with TH 8 at 276th Street. Additional frontage and backage roads will be constructed to connect Wyoming Trail to Viking Boulevard. See Exhibits P5.2, P5.3 and P5.4.

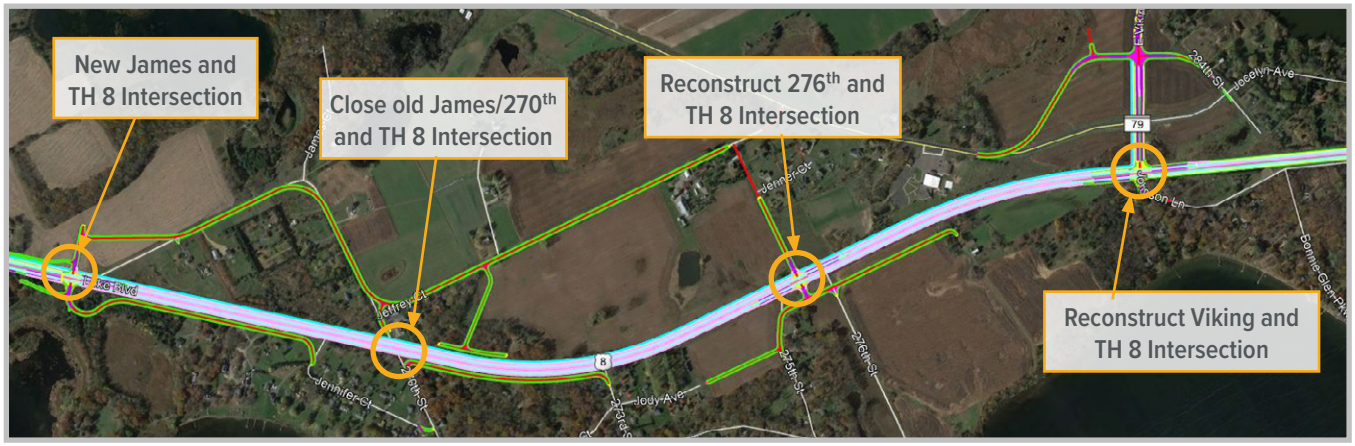


Exhibit P5.2: As Given from James Avenue to Viking Boulevard

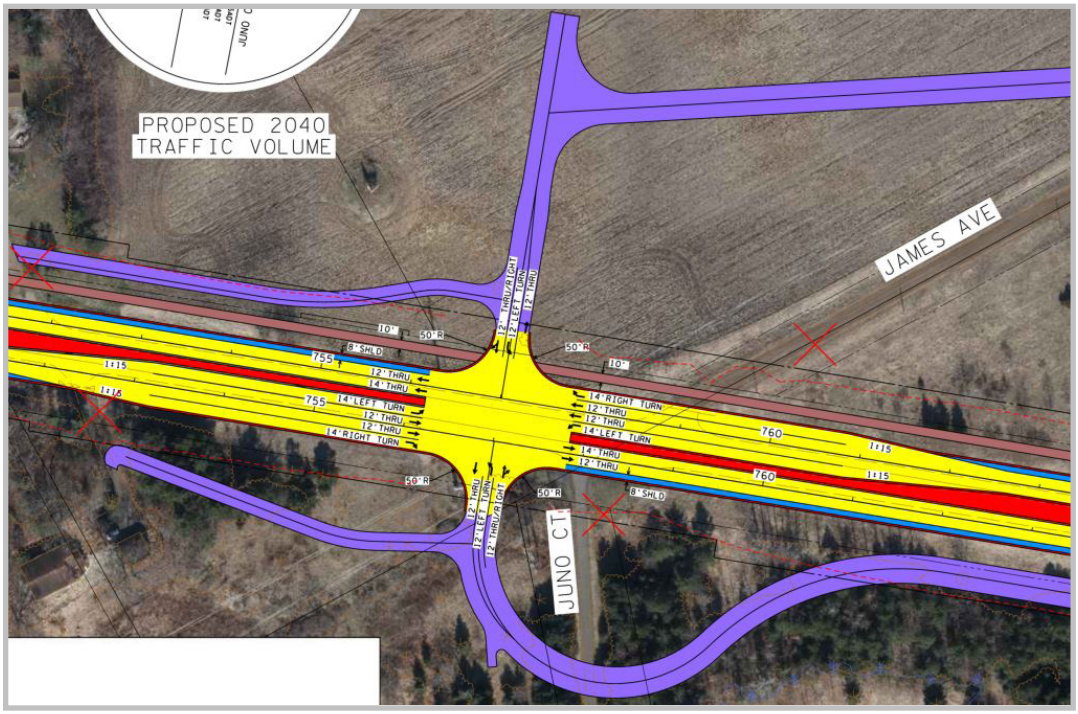


Exhibit P5.3: As Given James Avenue / Juno Court Intersection with TH 8

Exhibit P5.4: As Given 276th Street and Viking Boulevard Intersections with TH 8

The intersection spacing between 276th Street and Viking Boulevard is approximately 3,000 feet. The James Avenue / Juno Court and the 276th Street intersection will be side street stop control and the Viking Boulevard intersection will be signalized.

As Given Cost:

ITEM	UNIT	QUANTITY	PRICE	EXTENSION
Mainline Pavement	SY	3,110	$35	$ 108,850
Median	SY	31,900	$85	$ 2,711,500
			TOTAL	$ 2,820,000

Exhibit P5.5: Costs for As Given

VE Proposal P5: Right-In/Right-Out RCUT at James Avenue and Remove 276th Street intersection

The VE proposal is to improve the intersection spacing, balance and manage local intersection connections by installing an RCUT at the James Avenue / Juno Court intersection and remove the 276th Street intersection. Eliminate the access road from the private property at approximately STA 835+00 and allow right in / right out access to TH 8. This meets current MnDOT access management approaches for intersection spacing and reduces the risk of severe right-angle crashes. Additional construction of access to TH 8 would still be available at James Avenue / Juno Court and Viking Boulevard Intersections. See Exhibits P5.6, P5.7 and P5.8.

Exhibit P5.6: RCUT at James Avenue / Juno Court, Remove Intersection at 276th Street, remove access road

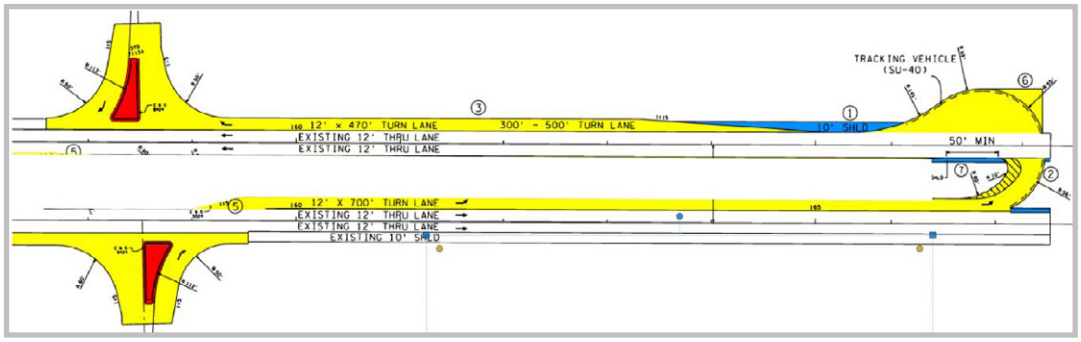


Exhibit P5.7: Typical RCUT proposed for James Avenue / Juno Court

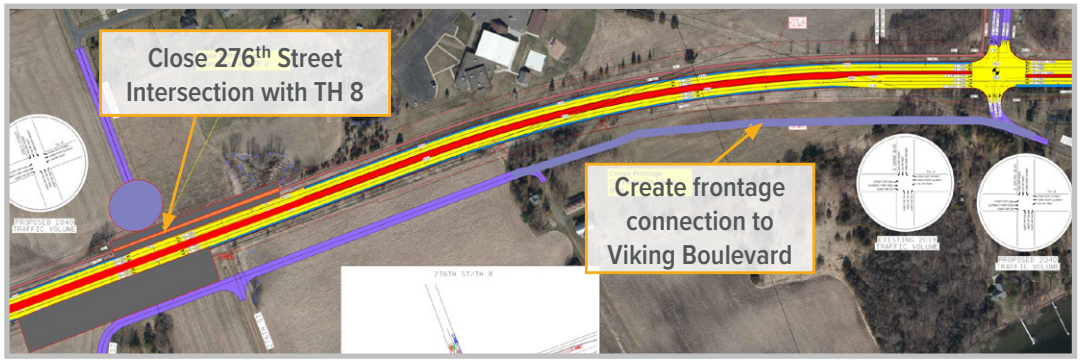


Exhibit P5.8: Remove 276th Street Intersection

VE Alternative P5 Cost:

ITEM	UNIT	QUANTITY	PRICE	EXTENSION
Mainline Pavement	SY	4000	$85	$ 340,000
Median	SY	15,950	$85	$ 1,360,000
			TOTAL	$ 1,700,000

Exhibit P5.9: Construction Costs for Proposal P5

VE Alternative Proposal Evaluation

ALTERNATIVE	ADVANTAGES	LIMITATIONS
As Given	• Provides more convenient access from side roads and residences to TH 8 • Eliminates all driveways onto TH 8	• Less than desirable intersection spacing • Does not limit left turns from stop condition • Increases conflict points
VE Alternative P5	• Eliminates all left turn movements at James/Juno and 276th. • Improves TH 8 operations by elimination of left turn • Improves TH 8 operations by elimination of one access • Provides a 44% reduction (based on crash modification factors) in crashes compared to conventional un-signalized intersections • Improves spacing between intersections • Allows local agency to control development and access control at time of future expansion	• Requires local access to be constructed for future development • Reduces convenience of access to area by removing an access point • Increases drive time for left turn movements on TH 8 • One driveway access to TH 8 remains

Exhibit P5.10: VE Alternative Proposal Evaluation

Recommendation

The VE Team recommends installing an RCUT at the James Avenue / Juno Court intersection and eliminating the 276th Street Intersection with TH 8. The recommendation enhances the performance functions *Manage Access* and *Improve Operations*, with a potential cost avoidance of $1,120,000.

Proposal Comparison Cost Table

The table below summarizes As Given, Alternative Cost and the Cost Difference between the As Given and the Alternatives.

Item	First Cost		VE Savings or Cost Avoidance (+) or Cost Added (-)
	As Given	VE Proposal	
VE Proposal 5: Right-In/Right-Out RCUT at James Avenue and Remove 276th Street intersection	$ 2,820,000	$ 1,700,000	$1,120,000

Accept: ☐ Reject: ☐ Accept for Further Review: ■

FHWA Functional Benefit

Safety	Operations	Environment	Construction	Right of Way
✓	✓			

PROPOSAL NO. P6

Description: RCUT at Viking Boulevard

Existing:

TH 8 is a two lane highway that intersects with Viking Boulevard. The intersection has turn lanes and is signal controlled. See Exhibits P6.1.

Exhibit P6.1: TH 8 and Viking Boulevard intersection

As Given:

TH 8 will be reconstructed to a four- lane facility with the intersection at Viking Boulevard re-built as a signalized intersection. The intersection of Wyoming Trail / Jocelyn Avenue with Viking Boulevard will be removed and a new intersection with a re-aligned Wyoming Trail / 284th Street will increase spacing between the intersections on Viking Boulevard. TH 8 at Viking Trail will have dedicated right and left- turn lanes. See Exhibit P6.2 for the As Given Viking Boulevard and TH 8 intersection. The two-phase signalized intersection would have a 2040 Level of Service of C in the PM peak hour. See Exhibit P6.3 for PM traffic volumes.

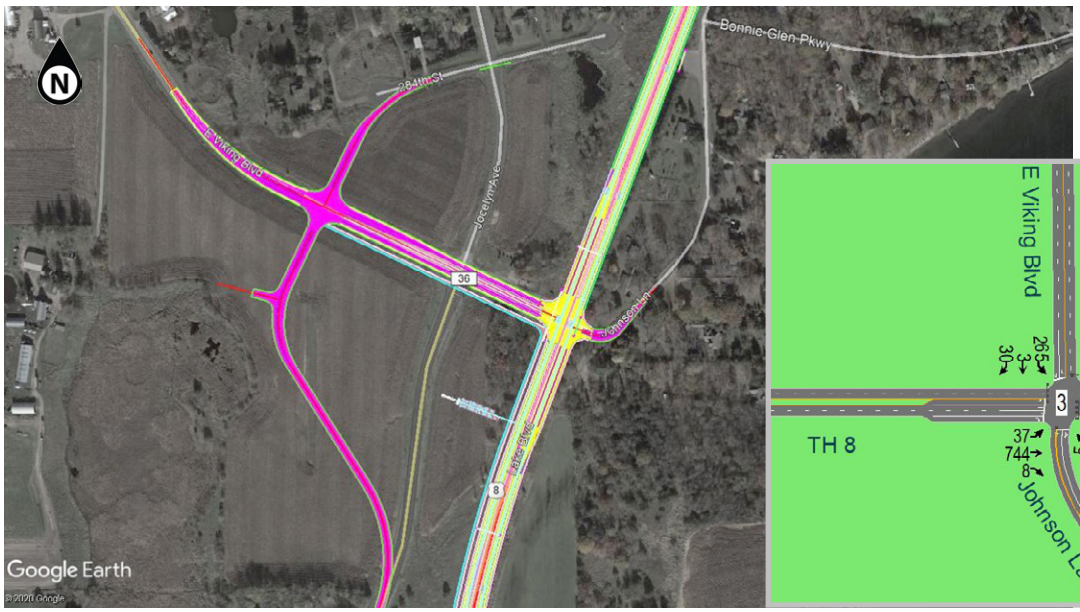


Exhibit P6.2: Viking Boulevard and TH 8 Intersection

Exhibit P6.3: 2040 PM Traffic Volumes

As Given Cost:

ITEM	UNIT	QUANTITY	PRICE	EXTENSION
Local Road Pavement	SY	19,690	$ 35	$689,000
Signal (Permanent)	EA	1	$250,000	$250,000
			TOTAL	$ 939,000

Exhibit P6.4: As Given Cost

VE Proposal P6: RCUT at Viking Boulevard

Restrict the Viking Boulevard thru movement and install an RCUT along TH 8. This would create four, two-way stop controlled intersections with a 2040 PM peak Level of Service of A. See Exhibit P6.5 for the Viking Boulevard intersection RCUT, and Exhibit P6.6 for the traffic volume distribution.

Exhibit P6.5: RCUT at TH 8 and Viking Boulevard

Exhibit P6.6: RCUT at TH 8 and Viking Boulevard Operation Analysis

VE Alternative P6 Cost:

ITEM	UNIT	QUANTITY	PRICE	EXTENSION
Local Road Pavement	SY	18,270	$ 35	$639,000
RCUT Pavement	SY	1,350	$ 35	$47,000
			TOTAL	$ 686,000

Exhibit P6.7: Costs for Proposal P6

VE Alternative Proposal Evaluation

ALTERNATIVE	ADVANTAGES	LIMITATIONS
As Given	• Meets driver expectation of turning at the intersection • Acceptable LOS • Less driver decisions • Improved multi-modal safety	• TH 8 vehicles can be stopped at the signal • Increased conflict points (42 total) • Required periodic re-timing / maintenance • Increased energy consumption
VE Alternative P6	• Reduced congestion • Improved LOS • Reduced conflict points (18) • Improved future operations • Reduced crash potential • Additional land needed is agricultural / undeveloped • Many successful installations in Minnesota	• Additional right of way required • Increased traffic through the intersection • Increased travel time • Uncontrolled ped/bike movements • Potential increase in EMS response time.

Exhibit P6.8: VE Alternative Proposal Evaluation

Recommendation

The VE Team recommends installing an RCUT at the Viking Boulevard and TH 8 intersection. This proposal enhances the performance functions *Improve Operations*, and *Manage Access*, the acceptance function of *Attract Development*, with a potential cost avoidance of $253,000

Proposal Comparison Cost Table

The table below summarizes As Given, Alternative Cost and the Cost Difference between the As Given and the Alternatives.

Item	First Cost		VE Savings or Cost Avoidance (+) or Cost Added (-)
	As Given	VE Proposal	
VE Proposal 6: RCUT at Viking Boulevard	$939,000	$686,000	$253,000

Accept: ☐ Reject: ■ Accept for Further Review: ☐

FHWA Functional Benefit

Safety	Operations	Environment	Construction	Right of Way
✓	✓			

PROPOSAL NO. P7

Description: Roundabout at Karmel Avenue

Existing:

The existing TH 8 & Greenway Avenue intersection (Exhibit P7.1) is characterized by the following:

- Two-lane TH 8 with dedicated left and right turn lanes
- Two-lane Karmel Avenue with dedicated right turn lanes
- Two-way stop controlled intersection
- Commercial development immediately adjacent to the intersection

Exhibit P7.1: Existing TH 8 & Greenway Avenue intersection

As Given:

The As Given TH 8 & Karmel Avenue intersection (Exhibit P7.2) is characterized by the following:

- Two-lane TH 8 with dedicated left and right turn lanes
- Two-lane Karmel Avenue with dedicated left turn lanes
- Two-way stop controlled intersection

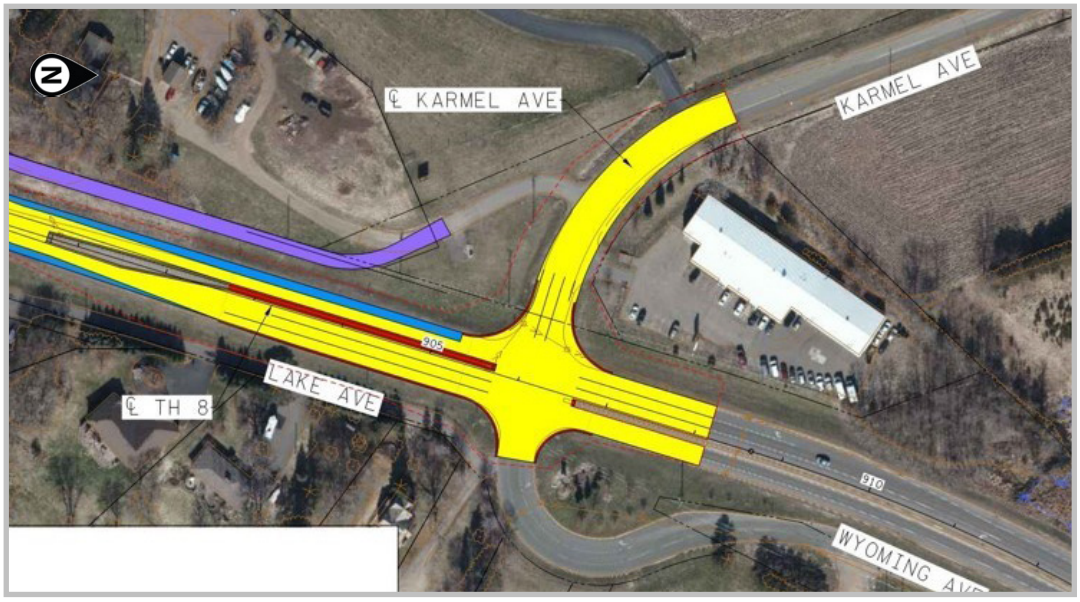


Exhibit P7.2: As Given TH 8 & Karmel Avenue intersection

A conceptual Synchro traffic analysis of the intersection indicates an overall Level of Service (LOS) A in the 2040 Build PM Peak Hour condition. All of the approach LOS and movement LOS were LOS C or better except for the northbound and southbound left/thru lanes, which is LOS F. Exhibit P7.3 illustrates the volumes and intersection characteristics analyzed for the As Given condition.

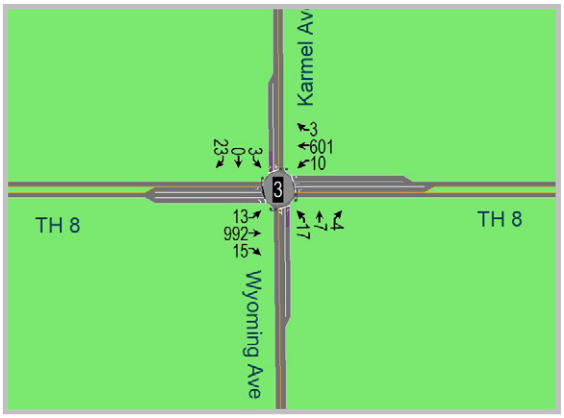


Exhibit P7.3: As Given Traffic Analysis

As Given Cost:

ITEM	UNIT	QUANTITY	UNIT PRICE	TOTAL
Pavement	SY	2,050	$35	$71,750
Medians	SY	70	$85	$5,950
			TOTAL	$77,700

Exhibit P7.4 As Given Cost

VE Proposal P7: Roundabout at Karmel Avenue

VE Proposal P7 for the TH 8 & Karmel Avenue intersection (Exhibit P7.5) is characterized by the following:

- Two-lane TH 8
- Two-lane Karmel Avenue
- Roundabout operation with 115-foot inscribed diameter

Exhibit P7.5: VE Proposal TH 8 & Greenway Avenue intersection

Exhibit P7.6: VE Proposed Traffic Analysis

VE Alternative P7 Cost:

ITEM	UNIT	QUANTITY	UNIT PRICE	TOTAL
Pavement	SY	4,030	$35	$141,100
Medians	SY	2,000	$85	$170,000
Roundabout	LS	1	$250,000	$250,000
			TOTAL	$561,100

Exhibit P7.7: Costs for Proposal P7

VE Alternative Proposal Evaluation

ALTERNATIVE	ADVANTAGES	LIMITATIONS
As Given	• Meets driver expectation of turning at the intersection • Acceptable intersection LOS • TH 8 traffic does not stop	• Unacceptable LOS for side street • Increased conflict points (32 total)
VE Alternative P7	• Reduced conflict points (8 total) • Reduced crash potential • Potentially less severe crashes • Motorist familiar with design • Less maintenance costs	• Intersection LOS degrades • Increased property impacts at intersection • Uncontrolled ped/bike movements • Slows down TH 8 traffic through intersection

Exhibit P7.8: VE Alternative Proposal Evaluation

Recommendation

Validation ✓

The VE Team validates the As Given two-way stop-controlled intersection. The proposed roundabout has little impact to the intersection Level of Service and would require traffic on TH 8 to slow.

Proposal Comparison Cost Table

The table below summarizes As Given, Alternative Cost and the Cost Difference between the As Given and the Alternatives.

Item	First Cost		VE Savings or Cost Avoidance (+) or Cost Added (-)
	As Given	VE Proposal	
VE Proposal 7: Roundabout at Karmel Avenue	$77,700	$561,100	-$483,400

Accept: ☐ Reject: ☐ Accept for Further Review: ■

FHWA Functional Benefit

Safety	Operations	Environment	Construction	Right of Way
			✓	✓

PROPOSAL NO. P8

Description: Stripe One Lane with Shoulder on Eastbound TH 8 between I-35 and TH 61

Existing:

The ramp from northbound I-35 to eastbound TH 8 exits I-35 as a one lane ramp, and then transitions to two lanes. These two lanes are carried through the TH 61 interchange, where the TH 61 on- ramp merges onto eastbound TH 8. Lane changes and merging conditions at the point of transition from a high-speed freeway facility to a signalized arterial facility is causing congestion and vehicle crashes. The Purpose and Need Statement states this segment of roadway from TH 61 to Greenway Avenue is the shortest segment evaluated and has the highest crash rate. See Exhibit P8.1 for a depiction of the existing condition.

Exhibit P8.1: I-35, TH 61 and TH 8 Interchanges

As Given:

The section of TH 8 between I-35 and TH 61 will be resurfaced and re-striped to maintain the existing two-lane configuration.

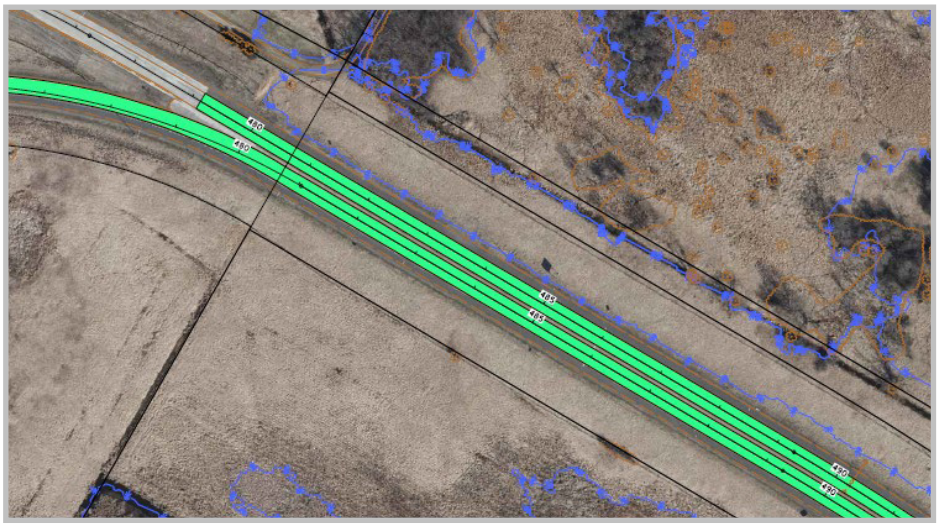


Exhibit P8.2: TH 8 between I-35 and TH 61

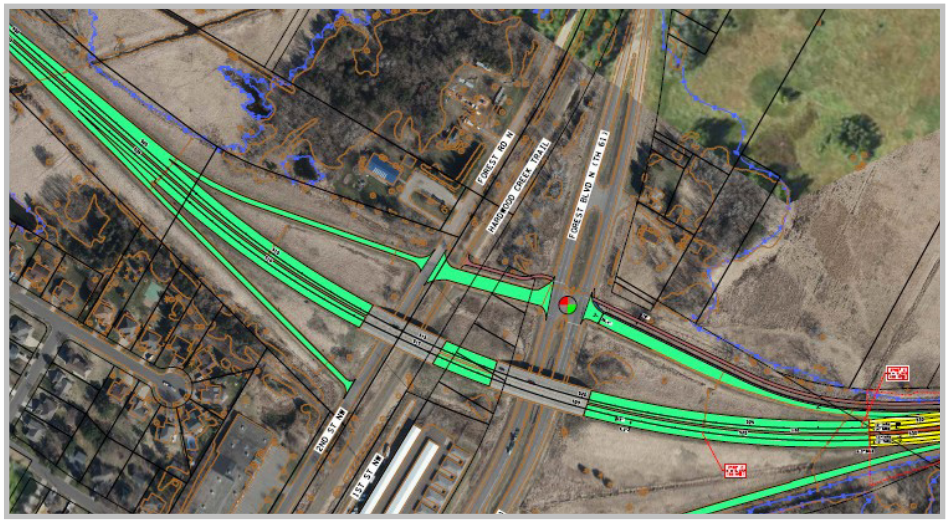


Exhibit P8.3: TH 8 and TH 61 Interchange

As Given Cost:

ITEM	UNIT	QUANTITY	UNIT PRICE	TOTAL
Mill and Overlay				$1,000,000
Sign and Striping				$36,000
			TOTAL	$1,036,000

Exhibit P8.4: As Given Cost

VE Proposal P8: Stripe One Lane with Shoulder on EB TH 8 between I-35 and TH 61

Resurface and re-stripe eastbound TH 8 from I-35 to the TH 61 eastbound on- ramp to one lane with a wide outside shoulder. See Exhibits P8.5 and P8.6. The eastbound TH 61 on ramp to TH 8 will add the second lane.

Changing the current eastbound freeway segment to a one lane facility will improve safety and traffic flow from TH 61 to Greenway Ave. The current one lane off-ramp from Northbound I-35 to TH 8 would continue to TH 61. The ramp from TH 61 northbound and southbound would remain the same and become a lane add and begin the eastbound TH 8 future four lane section. The on-ramp to TH 8 from TH 61 would remain in its current configuration with either a parallel or tangent on- ramp design.

This modification would reduce conflict in the merge area approaching the Greenway intersection and local access drives at the point where the road currently transitions from a high-speed free-way section to full access arterial design. It would also help slow approach speeds and aggressive behaviors due to conflicting design messages to drivers.

Based on current traffic data and future traffic growth on this segment no negative impacts should occur on I-35.

TRAFFIC VOLUME – US 8 EASTBOUND	EXISTING PM PEAK	FUTURE PM PEAK	V/C
I-35 ramp to EB TH 8	1200 vph	1450 vph	.80
TH 8 EB between I-35 and TH 61	950 vph	1150	.80
TH 61 ramp to EB TH 8	200 vph	250	.17
TH 8 EB between TH 61 and Greenway Ave	1150 vph	1400	.39

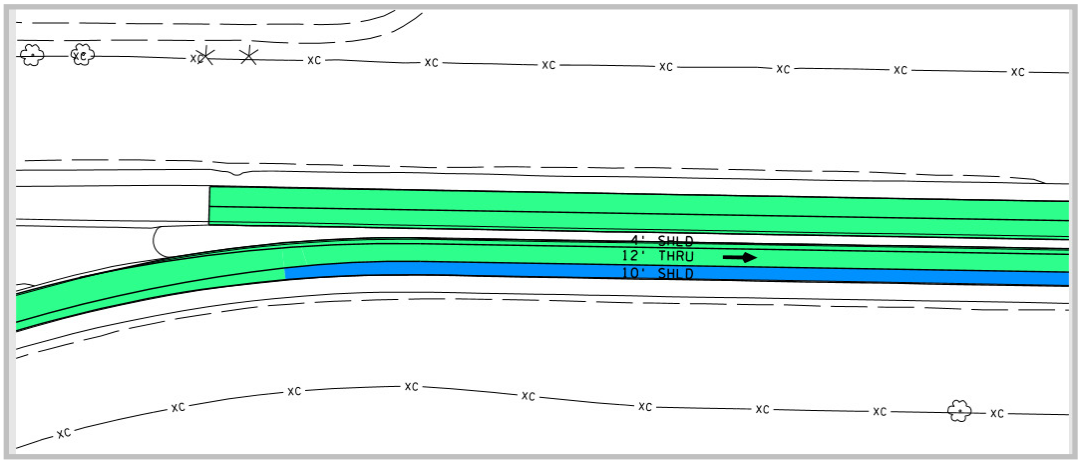


Exhibit P8.5: Eastbound TH 8 from I-35 to TH 61

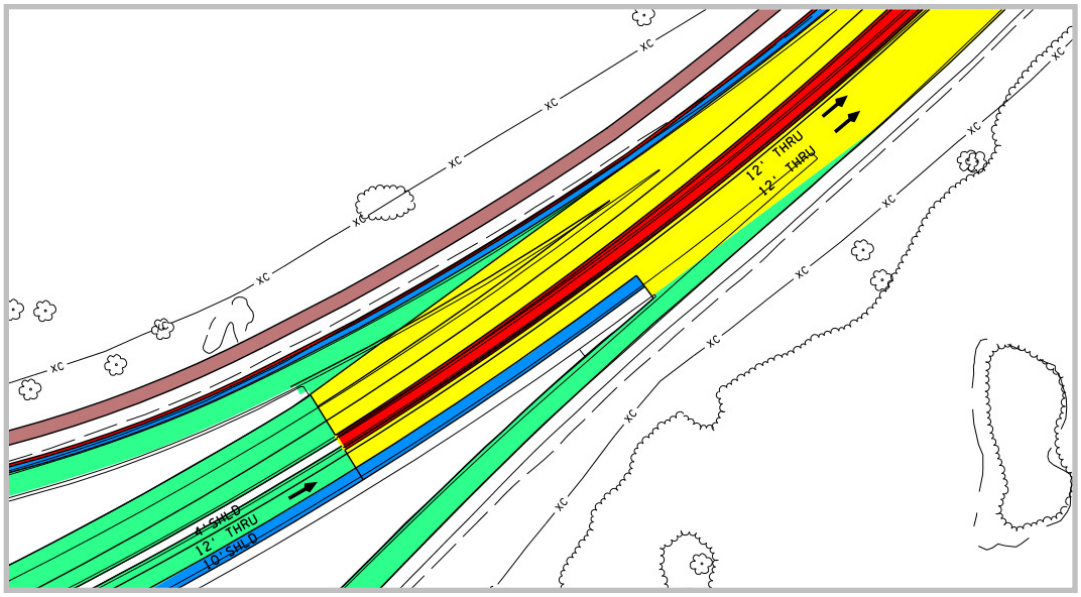


Exhibit P8.6: Eastbound TH 8 at TH 61 on ramp

VE Alternative P8 Cost:

ITEM	UNIT	QUANTITY	UNIT PRICE	TOTAL
Mill and Overlay				$1,000,000
Sign and Striping				$30,000
			TOTAL	$1,030,000

Exhibit P8.7: Cost for Proposal P8

VE Alternative Proposal Evaluation

ALTERNATIVE	ADVANTAGES	LIMITATIONS
As Given	• Maintains existing design	• Wide section due to merge segment • Access to gas station/strip mall creates lane change / turbulence in freeway to arterial transition area
VE Alternative P8	• Improved flow on TH 8 with a more natural transition to a signalized roadway by deleting short high-speed freeway section • Reduce weaving of EB TH 8 and merging TH 61 traffic approaching driveway access and Greenway turn movements • May better align with future expansion of I-35 north of TH 8 • Meets current and projected traffic volumes	• May reduce current facility capacity

Exhibit P8.8: VE Alternative Proposal Evaluation

Recommendation

The VE Team recommends reconfiguring the segment of eastbound TH 8 from I-35 through the TH 61 Interchange. The recommendation enhances the performance functions *Improving Operations* and *Managing Access*, and the acceptance function of *Facilitate Construction* with a nominal cost avoidance of $6,000.

Proposal Comparison Cost Table

The table below summarizes As Given, Alternative Cost and the Cost Difference between the As Given and the Alternatives.

Item	First Cost		VE Savings or Cost Avoidance (+) or Cost Added (-)
	As Given	VE Proposal	
VE Proposal 8: Stripe One Lane with Shoulder on EB TH 8 between I-35 and TH 61	$1,036,000	$1,030,000	$6,000

Accept: ☐ Reject: ☐ Accept for Further Review: ■

FHWA Functional Benefit

Safety	Operations	Environment	Construction	Right of Way
✓	✓			

PROPOSAL NO.
P9

Description: Mini-Roundabout on Greenway Ave N

Existing:

TH 8 is classified as a Principal Arterial – Other and is a two-lane highway that intersects with Greenway Ave which is classified as a Major Collector west of TH 8 and a local road east of TH 8. At the intersection of TH 8 and Greenway Ave, TH 8 has dedicated left and right turn lanes. Greenway Ave has a shared Thru/Right Turn Lane and a dedicated Left Turn Lane. See Exhibit P9.1 for the Existing Condition at TH 8 and Greenway Ave.

Exhibit P9.1: TH 8 and Greenway Ave intersection

As Given:

The As Given is reconstruction of TH 8 to a four-lane roadway with dedicated left and right turn lanes. The intersection at TH 8 and Greenway Ave would remain signalized. Addition of local roads to connect adjacent properties east of TH 8 is planned. These properties previously had direct access on to TH 8 which is now removed in the As Given condition. Right-In-Right-Out driveway is planned at the business on the southeast corner onto TH 8. See Exhibit P9.2 for the As Given TH 8 and Greenway Ave intersection.

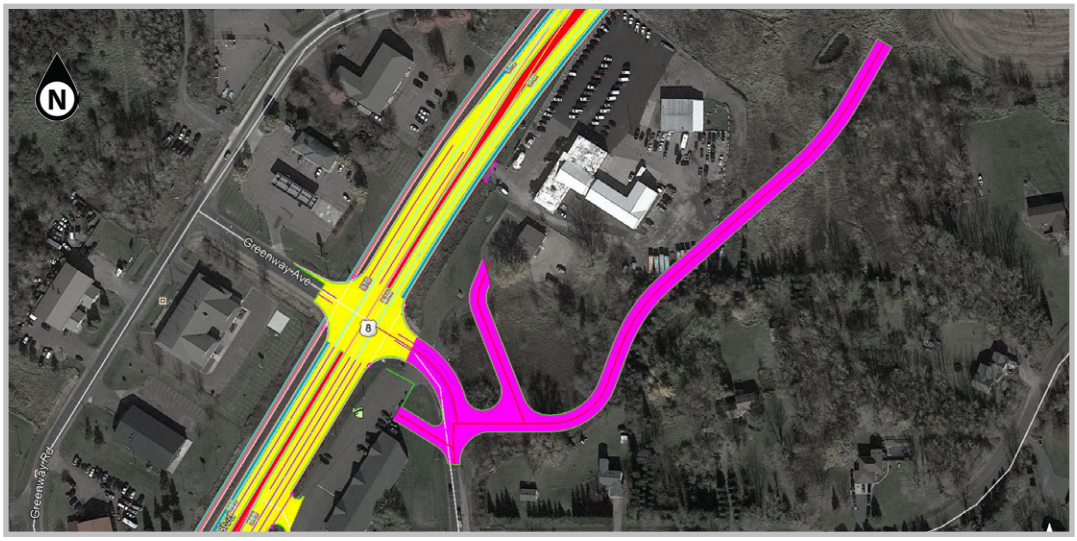


Exhibit P9.2: TH 8 and Greenway Ave Intersection (Local Road Improvements)

ITEM	UNIT	QUANTITY	UNIT PRICE	TOTAL
Local Road Pavement	SY	7,200	$35.00	$252,000
Earth Excavation	CY	1,800	$10.00	$18,000
			TOTAL	$270,000

Exhibit P9.3 As Given Cost

VE Proposal P9: Mini-Roundabout on Greenway Ave N

Proposal P9 focuses on the local road improvements east of TH 8 and maintains the As Given condition along TH 8. The two closely spaced intersections that were proposed in the As Given design would be combined into one roundabout with a 90-foot inscribed diameter with a fully traversable central island. The leg of Greenway Ave intersecting with TH 8 would be realigned to be perpendicular to TH 8, which will add storage length for turning movements. Right-In-Right-Out driveway at the business on the southeast corner from TH 8 would be modified to be Right-In only. See Exhibit P9.4 for the Proposal P9 Mini-Roundabout on Greenway Ave N.

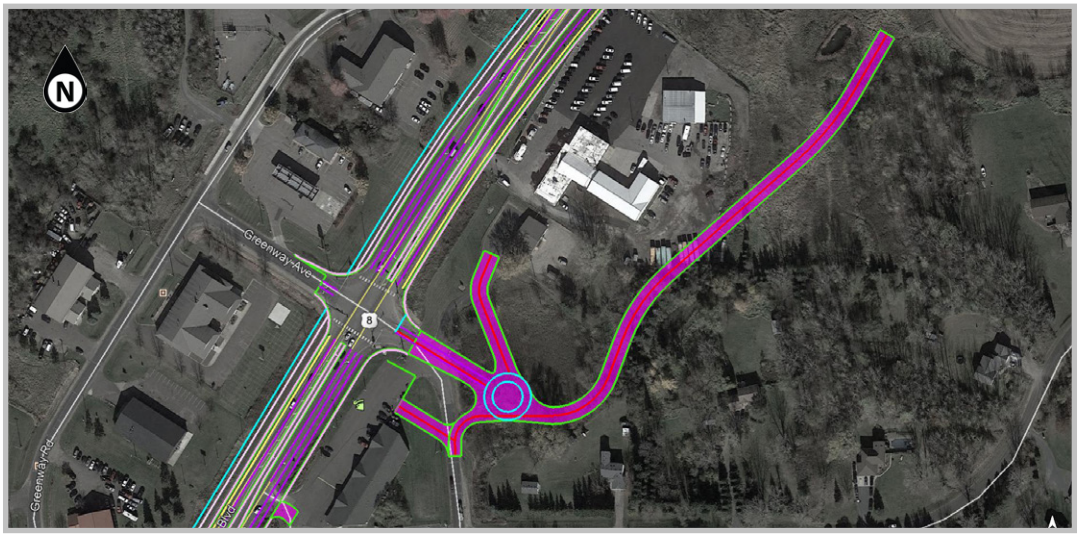


Exhibit P9.4: Mini-Roundabout on Greenway Ave N

VE Alternative P9 Cost

ITEM	UNIT	QUANTITY	UNIT PRICE	TOTAL
Local Road Pavement	SY	6,340	$35.00	$221,900
Earth Excavation	CY	1,410	$10.00	$14,100
Mini-Roundabout	L SUM	1	$150,000	$150,000
			TOTAL	$386,000

Exhibit P9.5 VE Alternative P9 Cost

VE Alternative Proposal Evaluation

ALTERNATIVE	ADVANTAGES	LIMITATIONS
As Given	• New full depth pavement section • Lower maintenance cost	• High number of conflict points (32) • Shorter storage length
VE Alternative P9	• Increased storage length for Greenway • Reduced conflict points (8) • Potentially less severe crashes • Improved Sight distance	• Traversable center island may be misused

Exhibit P9.6: VE Alternative Proposal Evaluation

Recommendation

VE Team recommends that the Mini-Roundabout be adopted. While the proposal has a cost increase, the proposal offers better value through the performance function of *Manage Access* and the acceptance function of *Attract Development*.

Proposal Comparison Cost Table

The table below summarizes As Given, Alternative Cost and the Cost Difference between the As Given and the Alternatives.

Item	First Cost		VE Savings or Cost Avoidance (+) or Cost Added (-)
	As Given	VE Proposal	
VE Proposal 9: Mini-Roundabout on Greenway Ave N	$270,000	$386,000	-$116,000

Accept: ☐ Reject: ☐ Accept for Further Review: ■

FHWA Functional Benefit

Safety	Operations	Environment	Construction	Right of Way
✓	✓			

PROPOSAL NO. P10

Description: Substitute Pervious Pavement for Trail

Existing:

There is no existing trail. Bicyclists and pedestrians must travel on TH 8 shoulders.

As Given:

Proposed separated, 10' bituminous trail on the west side of TH 8. See Exhibits P10.1 and P10.2 for the typical section and cross section of the bituminous trail.

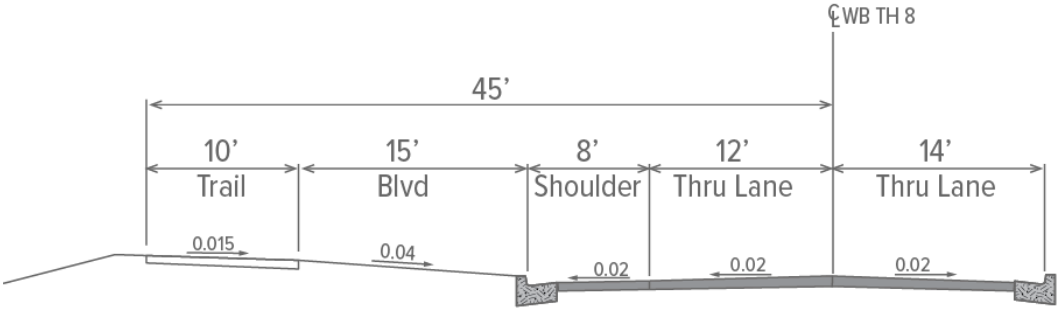


Exhibit P10.1: Westbound As Given TH 8

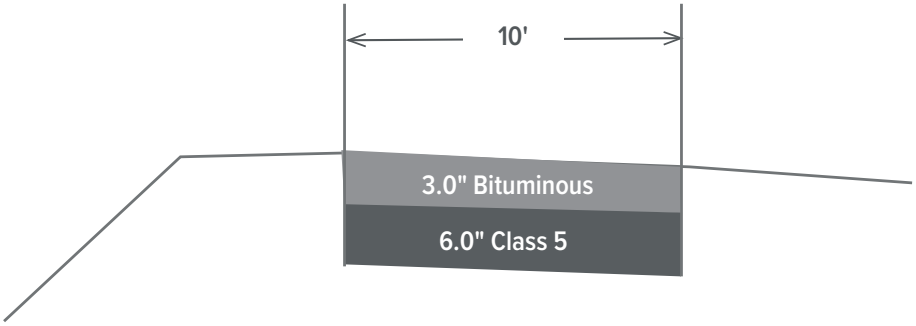


Exhibit P10.2 Cross Section of Bituminous Trail

As Given Cost:

ITEM	UNIT	QUANTITY	UNIT PRICE	TOTAL
Bituminous Trail – 3"	SY	41,971	$ 20.00	$839,000
Aggregate Base – 6"	CY	6,995	$ 30.00	$210,000
Water Quality Ponds	Each	1	$ 35,100	$35,100
			TOTAL	$1,084,100

Exhibit P10.3 As Given Cost

VE Proposal P10: Substitute Pervious Pavement for Trail

Construct separated, 10' trail with porous asphalt. See Exhibit P10.4 for proposed cross section.

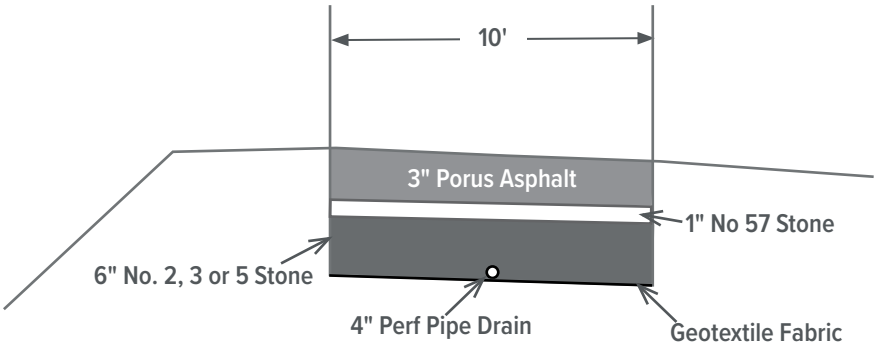


Exhibit P10.4: Proposal P10 Cross Section

VE Alternative P10 Cost:

ITEM	UNIT	QUANTITY	UNIT PRICE	TOTAL
3" Porous Asphalt	SY	41,971	$ 20.00	$839,000
7" Aggregate Base	CY	8,161	$ 30.00	$245,000
4" Perf Pipe Drain	LF	4,197	$ 6.88	$28,900
Geotextile Fabric	SY	41,971	$ 1.87	$78,500
			TOTAL	$1,191,400

Exhibit P10.5: Costs for Alternative P10

VE Alternative Proposal Evaluation

ALTERNATIVE	ADVANTAGES	LIMITATIONS
As Given	• Improves walkability/bike-ability	• Creates large amount of new impervious surface
VE Alternative P10	• Improves walkability/bike-ability • Minimizes total new impervious surface • Less stormwater treatment needs • Less runoff flowing to TH 8 C&G	• Higher maintenance costs • Shorter pavement lifespan

Exhibit P10.6: VE Alternative Proposal Evaluation

Recommendation

Validation

This proposal validates the As Given condition. The stormwater benefits do not outweigh the maintenance efforts and lifespan for permeable pavement on this project.

Proposal Comparison Cost Table

The table below summarizes As Given, Alternative Cost and the Cost Difference between the As Given and the Alternatives.

Item	First Cost		VE Savings or Cost Avoidance (+) or Cost Added (-)
	As Given	VE Proposal	
VE Proposal 10: Substitute Pervious Pavement for Trail	$1,084,000	$1,191,400	-$107,400

Accept: ☐ Reject: ■ Accept for Further Review: ☐

FHWA Functional Benefit

Safety	Operations	Environment	Construction	Right of Way
		✓		

PROPOSAL NO.
P11

Description: End Four Lane Section At Pioneer

Existing:

Two lane rural section with turn lanes at select access points.

Exhibit P11.1: Existing two lane section with turn lanes

As Given:

Proposed four lane divided roadway urban section. See Exhibits P11.2 and P11.3.

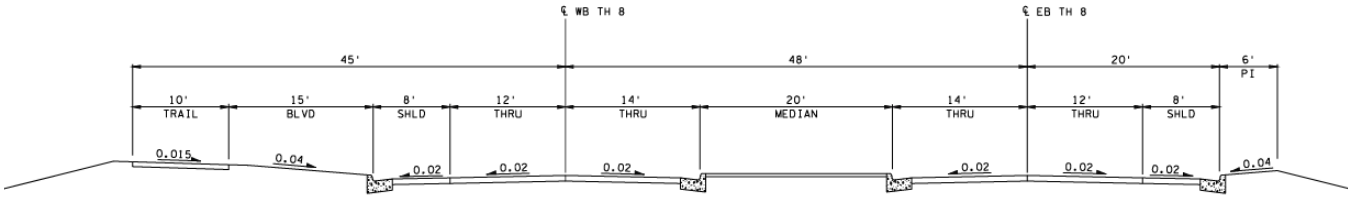


Exhibit P11.2: TH 8 Four Lane Urban Typical Section

Exhibit P11.3: As Given TH 8 at Pioneer Road

As Given Cost

Given the nature of the high level design cost provided to the team, an average cost per mile for paving and grading, drainage and utilities, signing and striping along with the estimated cost for a permanent and temporary signal at one intersection were used to determine the As Given cost. See Exhibit P11.4.

ITEM	UNIT	QUANTITY	UNIT PRICE	TOTAL
Paving and Grading	MI	3.75	$3,100,000	$11,625,000
Drainage and Utilities	MI	3.75	$800,000	$3,000,000
Signals	Intersection	1	$330,000	$330,000
Signing and Striping	MI	3.75	$40,000	$150,000
			TOTAL	$15,105,000

Exhibit P11.4: As Given Cost

VE Proposal P11: End Four Lane Section At Pioneer

The VE team was informed during the information phase there was a parallel design for a mill and overlay project on this corridor. This proposal is to divide the full reconstruction project in half by ending the four-lane section just east of Pioneer Road (shown in red) and continue with milling and overlaying on the remaining east section of TH 8 (shown in blue). See Exhibit P11.5. Most of the traffic issues on TH 8 are addressed with the full reconstruction, widening and access reduction between TH 61 and Pioneer Road. Traffic volume, in 2017, west of Pioneer Road on TH 8 is 22,700 (28,400 in 2040) vehicles per day, while east of Pioneer Road it drops to 14,500 (19,500 in 2040) vehicles per day. This proposal essentially becomes a stand-alone proposal because, if adopted, it would have a full impact on Proposals P5 and P6 and partial impact on Proposal P1.

A significant portion of the new construction east of Pioneer Road is for attracting new development in the area. If construction is deferred to a later time, these new developments can share in the cost of improving the infrastructure in the corridor from Pioneer Road to Karmel Avenue. Should funding become an issue for this project, this is a solution the project team can consider.

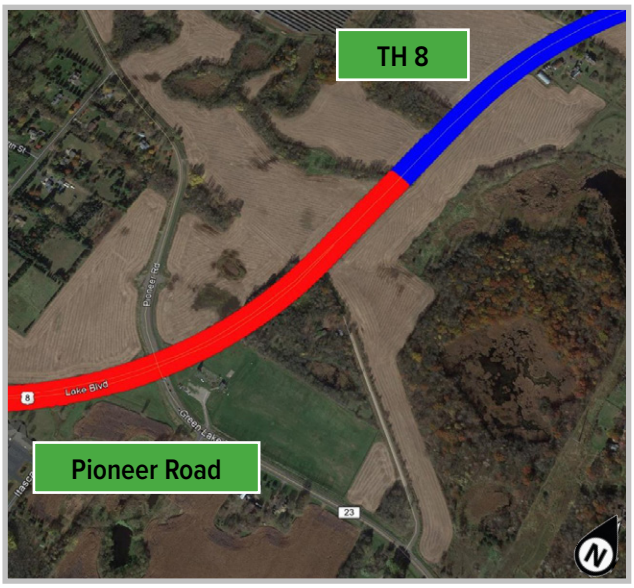


Exhibit P11.5: Proposed ending of four lane section east of Pioneer Road.

VE Alternative P11 Cost

For comparison to the As Given cost, the average cost per mile was used for a three-inch mill and overlay with striping. MnDOT provided an estimated cost of $375,000 per lane mile, including shoulders, for milling and overlaying this corridor. See Exhibit P11.6.

ITEM	UNIT	QUANTITY	UNIT PRICE	TOTAL
3" Mill and Overlay	MI	3.75	$750,000	$2,812,500
Drainage and Utilities	MI	0	$800,000	$0
Signals	Intersection	0	$330,000	$0
Striping	MI	3.75	$5,000	$18,750
			TOTAL	$2,831,000

Exhibit P11.6 VE Alternative P11 Cost

VE Alternative Proposal Evaluation

ALTERNATIVE	ADVANTAGES	LIMITATIONS
As Given	• New full depth and width pavement section • Local road development for future growth • Lower maintenance cost	• Longer construction duration
VE Alternative P11	• Shorter construction duration • Allows for cost sharing with future developers • Majority of traffic impacts addressed with half the construction • Reduced water treatment requirements	• Higher maintenance cost • Access points not reduced east of Pioneer Road • Full length of bituminous trail may not be constructed

Exhibit P11.7: VE Alternative Proposal Evaluation

Recommendation

VE Team recommends ending the four lane section of TH 8 at Pioneer Road be adopted. The proposal offers better performance because most traffic issues are addressed east of Pioneer Road and there are few water quality requirements west of Pioneer Road with a mill and overlay. This proposal enhances the performance functions *Improve Operations* and *Manage Runoff*. The acceptance function *Facilitate Construction* will be improved with a shorter construction time. The projected construction cost avoidance is $12,274,000.

Proposal Comparison Cost Table

The table below summarizes As Given, Alternative Cost and the Cost Difference between the As Given and the Alternatives.

Item	First Cost		VE Savings or Cost Avoidance (+) or Cost Added (-)
	As Given	VE Proposal	
VE Proposal 11: End Four Lane Section At Pioneer	$15,105,000	$2,831,000	$12,274,000

Accept: ☐ Reject: ☐ Accept for Further Review: ■

FHWA Functional Benefit

Safety	Operations	Environment	Construction	Right of Way
		✓	✓	✓

6.3 Design Suggestions

In addition to the 9 proposals and two validations, the VE team provided the 19 design suggestions below. Design suggestions are ideas that the VE Team felt would benefit the project but did not have adequate data to evaluate and demonstrate value as a proposal.

DS1 Eliminate Short Horizontal Curves

Where short horizontal curves are proposed, lengthen the curves to improve rideability, construction, and sight distances.

DS2 Advance Signal Beacons

Evaluate the use of signal beacons in advance of intersections without a minimum of 715 feet of continuous view of at least two approach signals for the thru movement at the intersection. This additional signage could assist in reducing rear-end and secondary crashes along TH 8.

DS3 Free Right Turn at Green Lake Trail for Eastbound TH 8

With 343 vehicles turning from eastbound TH8 to eastbound Green Lake Trail during the afternoon peak hour, a free right turn movement at that intersection could improve level of service.

DS4 Create a Right-In Only Drive at Station 565+00

Just west of Greenway Drive a driveway is proposed to access the business on the corner. With access to the business provided off Greenway Drive, converting the drive off TH 8 to a right-in only drive could provide better access control and benefit the traffic movements on TH 8.

DS5 Create a Right-In/Right-Out Drives at Station 734+00

Two private driveways with access to TH 8 are proposed west of James Avenue. To provide benefits to TH 8 flow and minimize conflict points, prohibiting left turns out of the drives could be beneficial. This can be accomplished by continuing the raising center median in front of the drives resulting in a right-in/right-out scenario.

DS6 Utilize Mountable Curbs Where Appropriate to Accommodate Agriculture Vehicles

With a heavy agricultural use along the corridor, strategically using mountable curbs would provide benefits to large farm vehicles.

DS7 Advance Warning of Congestion on TH 8

Install an advance warning system on I-35 northbound and TH 61 northbound, alerting drivers to congestion on eastbound TH 8. This system can be used during construction, and also be a functioning element of traffic management after construction. This warning system could be especially helpful during recreational peak periods on Friday afternoon/evening by encouraging drivers to use alternate routes.

DS8 Install Smart Street Lighting

Emerging technologies can provide benefits to the corridor. In particular, smart street lighting can provide sustainability benefits. Smart streetlights adapt to detected movements from cars, pedestrians, and bicyclists and dim when no activity is detected.

DS9 Lower TH 8 profile to create more width at pinch points and wetlands

Provided the roadway still meets OHWL freeboard requirements, the road profile can be lowered to allow for more roadway surface width without additional impact to DNR public waters, floodplains, or wetlands.

DS10 Introducing walls to project lakes and maintain roadway width

Walls would minimize overall impact width because there is less need for a back slope to tie in. Elevation can be lowered while the wall stabilizes slope.

DS11 Utilizing alternative treatment methods:

- Raingardens
  - Raingardens are depressed areas in the landscape that collect water runoff. Runoff is treated as it infiltrates in the garden. Raingardens could be placed in the TH 8 median or at a low point just off the roadway.
- Bio-swales
  - Similar to a raingarden, bio-swales use vegetation or mulch to infiltrate and treat stormwater as it travels through a gently sloped channel/swale. They can also be placed in locations such as in medians and ditches along the roadway.
- Constructed wetlands
  - Constructed wetlands are artificial wetlands that can be used to treat runoff. They treat runoff by utilizing the natural process of wetland vegetation, soils and their associated microbial assemblages to improve water quality.
- Forebays
  - Forebays are generally upstream from a larger water body and act as a pretreatment basin/pool. There are DNR public waters and wetlands along TH 8. Forebays can be used to attenuate flows, and provide pretreatment to runoff.
- Oversize pipes or vaults for subsurface detention
  - Subsurface detention can be used to help attenuate flows to meet rates in areas where it is difficult/no space to construct treatment ponds. Projects need to meet rates anywhere water leaves the project site.

DS12 Detention/treatment basins between trail and TH 8 with smaller outfall pipes

Per the provided typical section, there is a distance of 15 feet between TH 8 edge of pavement and the shared-use trail. Basins could be constructed between the two to treat or attenuate flows.

DS13 Staging Considerations

The proposed staging of the TH 8 work is a workable and effective approach. There may be an opportunity to reduce or eliminate the temporary work around Pioneer Road. It appears there may be adequate width to build permanent roadway and shift traffic rather than place them on temporary pavement.

DS14 **Assuming a full build out of the project**

Another option to consider is breaking the project up into segments. With a multi-year project, this may allow for full completion of roadway segments each year and improve the performance and maintenance over any winter shutdown periods and keep traffic off any temporary alignment over the winter months. General thoughts would be Stage 1: complete local roadways along west portion of project. Stage 2: Complete west portion of TH 8 while completing east portion of local road system. Stage 3: Complete east portion of TH 8.

DS15 Build Intersections First

Before rebuilding the mainline of TH 8, improving the intersections first could provide flexibility with access to the local road network and maintenance of traffic during construction in subsequent phases.

DS16 Build Local Road Facilities and Intersections Ahead of Time

Building the local road system and all or a portion of the intersections at the new local connections and roadway intersections could provide benefits during construction. By doing so, the maintenance of access points is simplified, the flexibility of shifting traffic around at the intersections is increased, and overall quality should be improved by reducing the amount of piecemeal work.

DS17 Alternate Routes Eastbound and Westbound

During construction of the project, the motoring public may benefit from avoiding delays caused by construction. There are two routes that can be promoted as alternates, one for eastbound TH 8 traffic and the other for westbound.

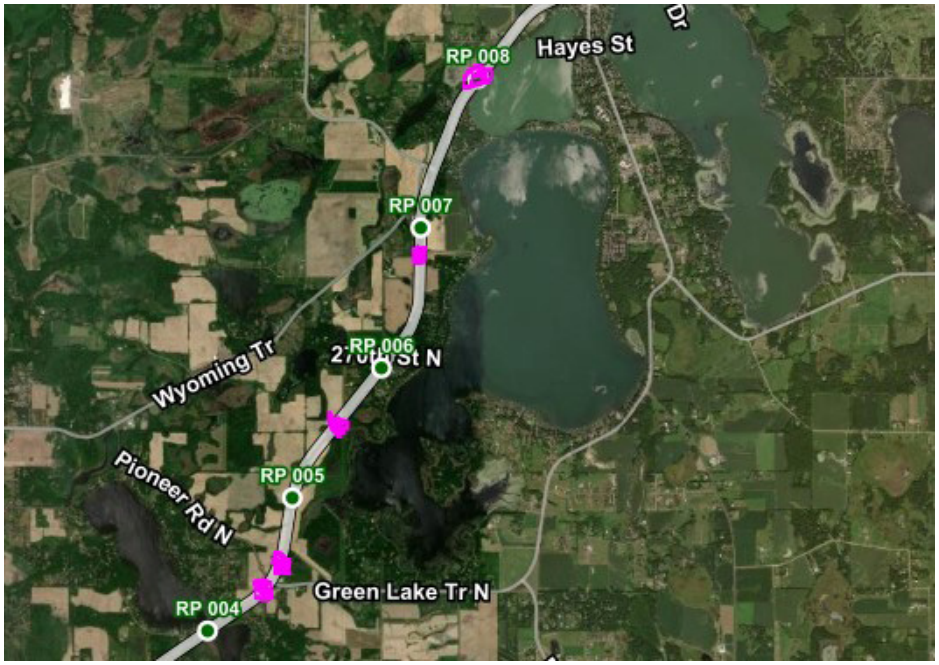
For eastbound TH 8 traffic, vehicles can take TH 97 east to TH 95, then TH 95 north back to TH 8. It was stated there may be a future construction project on TH 97; therefore, this routing would have to be coordinated. For westbound vehicles, two options may be available. The first scenario has vehicles taking CSAH 14 north to CSAH 19 west, then CSAH 19 west to I-35 south. The second scenario has vehicles taking East Viking Lane to Wyoming Trail (CSAH 22), then west on CSAH 22 to TH 61 south. This route will have to be coordinated with the construction improvements on TH 8 taking place between Karmel Avenue and East Viking Boulevard along with local road improvements to Wyoming Trail.

An alternate that may be considered for either direction can include the following: TH 97 to Manning Trail north, Manning Trail to Green Lake Trail north, then Green Lake Trail to Lofton Avenue/Old Towne Road. This route could be used for the reverse direction. It is noted that this route does pass through residential areas of Chisago City.

DS18 Strategically Manage Snow

There are five locations identified with concerns of snow drifting within the project limits:

- 4.408 for Trap #50044
- 4.736 for Trap #50027
- 5.681 for Trap #50126
- 6.86 for Trap #50103
- 8.007 for Trap #50052 near Lake Ellen



To manage and mitigate the snow drifting, the team suggests the following where appropriate:

- Living Snow Fence – blend in with the natural area
- Snow traps – provide buffer
- Negotiation with farmers to manage snow – a win-win solution
- Widen shoulders for adequate snow storage room and maintenance operations
- Additional right of way to correct these snow traps will be needed

DS19 Upgrade Right Of Way Fence

Near the TH 61 Bridge, the right of way fence is an older standard. The team suggests updating the right-of-way fence to new and accepted standards.

7 CONCLUSION

7.1 Conclusion

Nine proposals and two validations were developed for the TH 8 – Let's Get Moving project. They are summarized in Exhibit 7.1 along with their cost impacts. Each of the As Given and VE alternative costs for each proposal and validation were calculated based on the line items in the 2018 estimate provided to the VE team and 2019 bid tabulations provided by MnDOT.

Total Construction Cost Avoidance is the sum of the recommended proposals except for Proposal P11, ending the Four Lane Section at Pioneer Road instead of Karmel Avenue. Proposal P11 overlaps with several of the other proposals. If Proposal P11 is accepted, Proposals P5 and P6 and a portion of Proposal P1 would not be applicable. Finally, with Proposals P7 and P10 as validations there is no need to include them in the Total Construction Cost Avoidance.

PROPOSAL SUMMARY

Pro. No.	Description	As Given	VE Proposal	Change*	Recommendation
P1	Typical Section Modifications	$22,700,000	$16,205,000	$6,495,000	Recommended
P2	RCUT at Greenway	$250,000	$47,000	$203,000	Recommended
P3	Combine Heath & Hamlet to One Intersection with RCUTs	$2,497,000	$2,243,000	$254,000	Recommended
P4	RCUT at Pioneer	$856,500	$464,000	$392,500	Recommended
P5	RI/RO RCUT at James Avenue/Remove 276th	$2,820,000	$1,700,000	$1,120,000	Recommended
P6	RCUT/restrict through movement at Viking intersection	$939,000	$686,000	$253,000	Recommended
P7	Roundabout at Karmel	$77,700	$561,100	-$483,400	Validation
P8	Stripe One Lane w/ Shoulder on EB 8 between I-35 & 61	$1,036,000	$1,030,000	$6,000	Recommended
P9	Mini-Roundabout on Greenway	$270,000	$386,000	-$116,000	Recommended
P10	Substitute Pervious Pavement for Bituminous Pavement Trail	$1,084,000	$1,191,400	-$107,400	Validation
P11	End Four Lane Section at Pioneer	$15,105,000	$2,831,000	$12,274,000	Recommended
			Total Construction Cost Avoidance**	**$8,607,500**	

* Increases in cost are expressed as negative. Positive values indicate a reduction in cost.
** Total Construction Cost avoidance is sum of recommended proposals except for Proposal P11.

Exhibit 7.1: Summary of the proposals for TH8

7 CONCLUSION

With the acceptance of this report, the Project Team can review each proposal and choose to Select, Reject, or Accept for Further Review.

Disclaimer

The cost differences developed are based on the design information provided to the VE Team and should not be considered absolute cost savings guarantees; but rather indicators of potential value magnitudes requiring further detailed engineering as the project develops.

8 PRESENTATION PHASE

8. 1 Introduction

Prepare to convince decision makers to accept the study results:

How do we present our recommendations?
What are the road blocks?

Presentation is client driven:

1. Common practice is an informal report on the last day of the workshop
2. A Power Point presentation improves the understanding of the VE Proposals

Among the rules that govern the Presentation Phase are the following:

- Do not assume that ideas are good
- Demonstrate their worth

8. 2 Presentation

The following presentation was made to the Project Team and other stakeholders on Thursday August 13, 2020 virtually. Those attending are listed in Appendix B.

1

RECOGNITION

We express our thanks to all project partners.

NAME	AGENCY
○ Joe Triplett	Chisago County
○ Dmitry Tomasevich	MnDOT
○ Minnie Milkert	MnDOT
○ Scott Meier	MnDOT
○ Brian Johnson	SRF Engineering
○ Leif Garnass	SRF Engineering

DEPARTMENT OF TRANSPORTATION

benesch

2

VALUE ENGINEERING TEAM

Team Member	Company	Expertise
Mo Alsharbini	Benesch	Highway/Geometrics
Chuck Bartlett	Benesch	Facilitator
Joe Campbell	FHWA	Highway Planning
Christina Caouette	MnDOT	Water Resources
Dave Cuthbertson	Benesch	Construction
Eric Embacher	MnDOT	Construction
Bryce Fossand	MnDOT	Water Resources
Jim McCarthy	FHWA	Innovative Intersection Design
Kevin Sommers	MnDOT	Traffic
Al Tomaselli	Benesch	Traffic/Geometrics
Brian Wifler	MnDOT	CO Geometrics
Amanda Zacharias	Benesch	Asst. Facilitator/Civil

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PRESENTATION OBJECTIVES

- Report VE Findings
- Provide details of the VE process and explain the reasoning behind our recommendations
- Improve the quality of our final report by collecting your initial impressions of the proposals
- No decisions have to be made today

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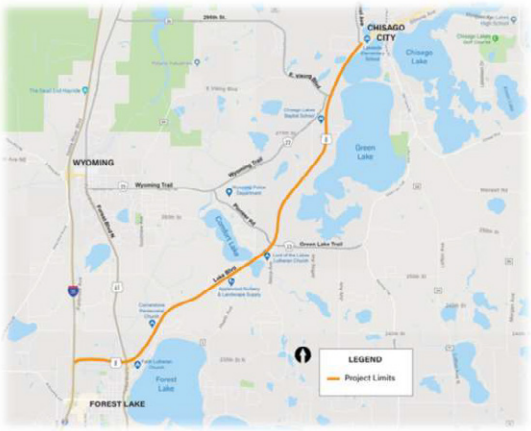
PROJECT OVERVIEW

- Reconstruction of two-lane to four lane highway
- 8.1 Miles from Forest Lake (I-35) to Karmel Avenue in Chisago City
- 22,700 AADT existing (2017)
- 28,400 AADT forecast (2040)
- 57 Access points reduced to eight at approximately one mile spacing
- $44.5 million construction cost (2020 dollars)



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VE WORKSHOP SCHEDULE

Monday 8/10/20	Information Phase Function Analysis and Cost
Tuesday 8/11/20	Speculation Phase Evaluation Phase – Screening Development Phase
Wednesday 8/12/20	Development Phase cont.
Thursday 8/13/2020	Presentation Phase

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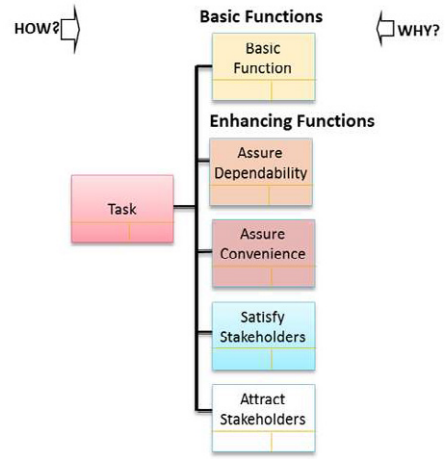
FUNCTION MODEL (FUNCTION CLASSIFICATION)



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HIGHWAY 8 – PROJECT FUNCTIONS

Task: Improve Mobility

Basic Functions
Restore Infrastructure
Improve Operations

Enhancing Functions

Dependability
Right Size Facility
Reduce Crashes
Manage Runoff

Convenience
Facilitate Maintenance
Facilitate EMS
Minimize Duration (DC)
Manage Traffic (DC)

Improve Acceptance
Facilitate Construction
Minimize Impacts
Restore Confidence
Comfort Users
Protect Environment

Attract Stakeholders
Attract Development
Improve Aesthetics
Maintain Viewshed

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FUNCTION ANALYSIS

As Given Cost	$44.5 Million	
Basic Functions:	$7.93 Million	17.8%
Enhancing Functions		
Enhance Dependability	$20.0 Million	45.0%
Enhance Convenience	$6.91 Million	15.5%
Improve Acceptance	$7.38 Million	16.6%
Attract Stakeholders	$2.27 Million	5.1%

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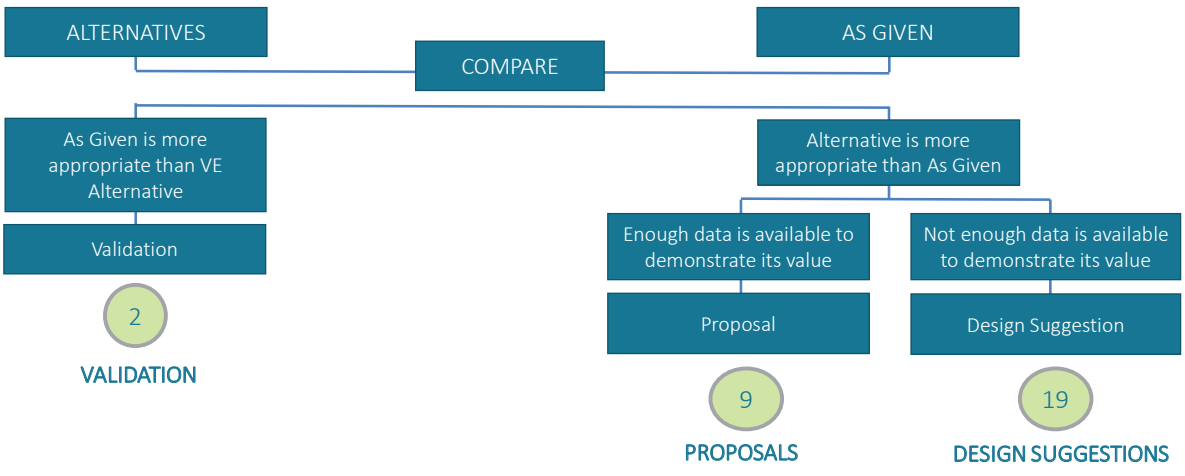
PROPOSAL DEVELOPMENT



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PROPOSAL P1

Reduce Design Speed and Modify Typical Section

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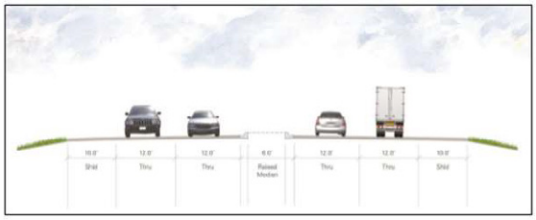
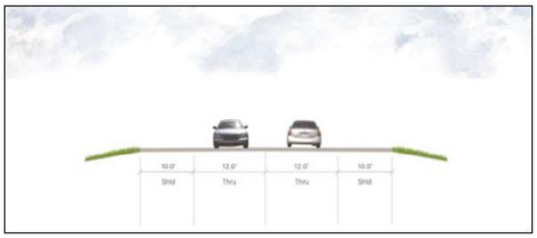
PROPOSAL P1 – EXISTING



Existing 4 Lane Section



Existing 2 Lane Section

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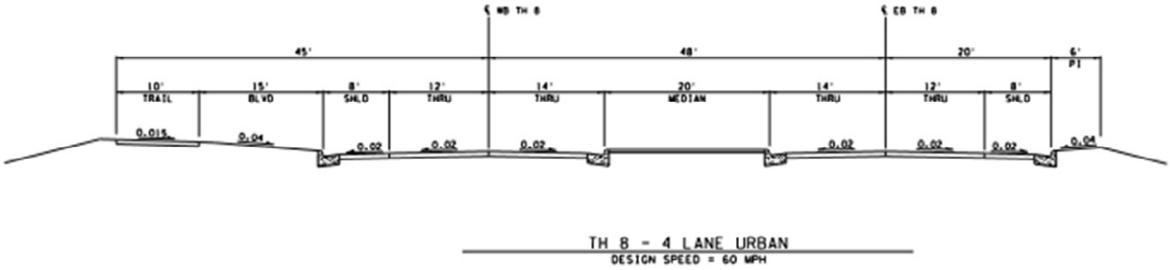
PROPOSAL P1 – AS GIVEN



4 Lane Divided Urban Roadway – 60 MPH Design Speed

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PROPOSAL P1 AS GIVEN COSTS

Description		Unit	Quantity	Unit Price	Extension
Excavation		CY	308,907	$ 10.00	$ 3,089,075
Embankment		CY	154,543	$ 10.00	$ 1,544,533
Granular Subgrade		CY	69,504	$ 12.00	$ 834,050
Mainline Pavement		SY	211,839	$ 35.00	$ 7,414,372
Median		SY	42,475	$ 85.00	$ 3,610,338
Aggregate Base		CY	17,621	$ 30.00	$ 528,623
Curb and Gutter		LF	68,163	$25.00	$ 1,704,070
Drainage – Urban		LS			$ 3,961,520
					$ 22,686,580

As Given Cost:
Note: As Given cost was adjusted to account for STA 529+00 to STA 876+00. STA 876+00 to STA 905+00 is not included.

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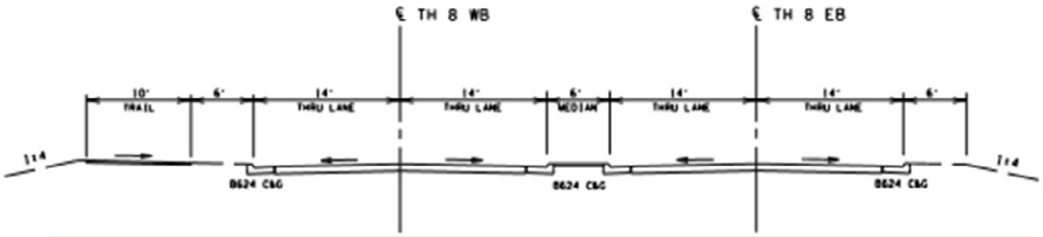
VE PROPOSAL P1

45 MPH URBAN



Suburban Environment – Sta. 529+00 to Sta. 580+00
(Highway 61 to east of Greenway Avenue)

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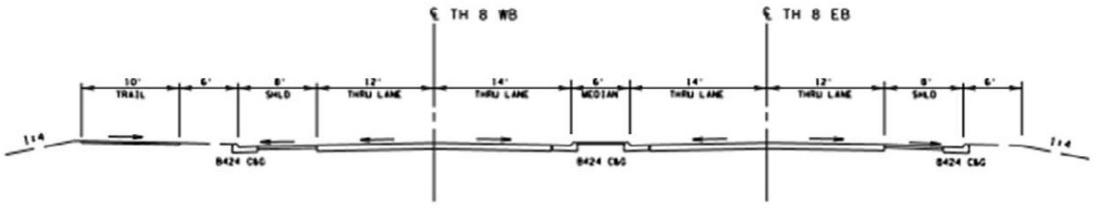
VE PROPOSAL P1

50 MPH URBAN



4 Lane Divided – Sta. 580+00 to Sta. 591+00 & 659+00 to 680+00
(East of Greenway Avenue to west of Hamel Avenue and Heath Avenue to east of Comfort Lake)

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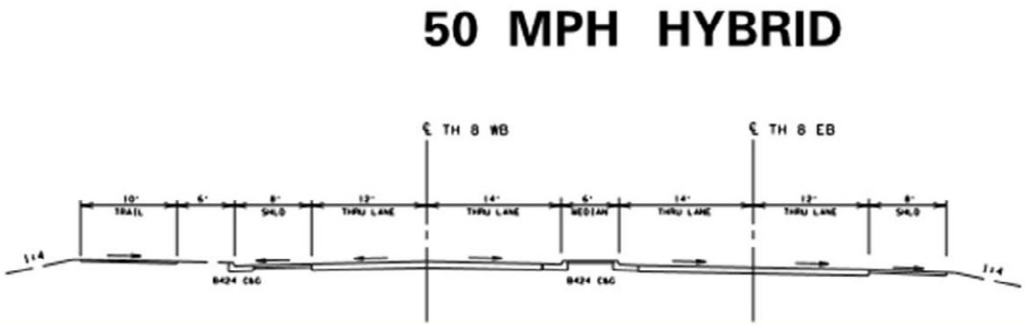
VE PROPOSAL P1



4 Lane Divided – Sta. 591+00 to Sta. 659+00 & 680+00 to 876+00
(Hamel Avenue to Heath Avenue and east of Comfort Lake to west of Lake Ellen/Little Green Lake)

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PROPOSAL P1 COST EVALUATION

Description		Unit	Quantity	Unit Price	Extension
Excavation		CY	234,199	$ 10.00	$ 2,341,990
Embankment		CY	117,099	$ 10.00	$ 1,170,992
Granular Subgrade		CY	57,402	$ 12.00	$ 688,834
Mainline Pavement		SY	212,275	$ 35.00	$ 7,429,644
Median		SY	12,820	$ 85.00	$ 1,089,729
Aggregate Base		CY	14,552	$ 30.00	$ 436,584
Curb and Gutter		LF	42,491	$25.00	$ 1,062,297
Drainage – Urban		LS			$ 1,996,000
					$ 16,217,000

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PROPOSAL P1 COST EVALUATION

As Given Cost	$22,687,000
Proposal Cost	$16,217,000
Change in Cost	$6,470,000

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PROPOSAL P1 EVALUATION

ALTERNATIVE	ADVANTAGES	LIMITATIONS
As Given	• Consistency of typical section • Minor widening at intersections • Room for maintenance and disabled vehicles	• Impacts to Right of Way • Impacts to wetlands • Additional stormwater runoff and storm system
Proposal	• Decreases impacts to Right of Way • Decreases impacts to wetlands • Reduces stormwater runoff and storm system • Flexibility for traffic calming • Shorter crossing distance	• Widening at intersections may be required • Reduce space for median signage • Limited room for maintenance operations and disabled vehicles in the 45 mph urban section

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RECOMMENDATION

Recommendation

The VE Team recommends modifying the typical section between intersections in three segments. The recommendation enhances the performance functions *Manage Runoff* and *Restore Infrastructure*, while maintaining the acceptance functions. The recommendation provides a potential cost avoidance of $6,470,000.

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Design Suggestion

- Eliminate short horizontal curves

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PROPOSAL P2

RCUT at Greenway Avenue

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PROPOSAL P2 – EXISTING

- 2-lane with turn lanes
- Signalized (3-phase)

TH 8 & Greenway Avenue

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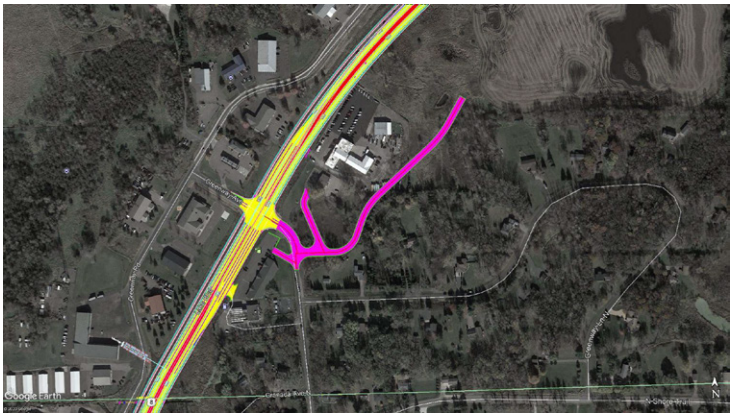
PROPOSAL P2 – AS GIVEN

- Widen to 4 Lanes
- Upgrade Signal



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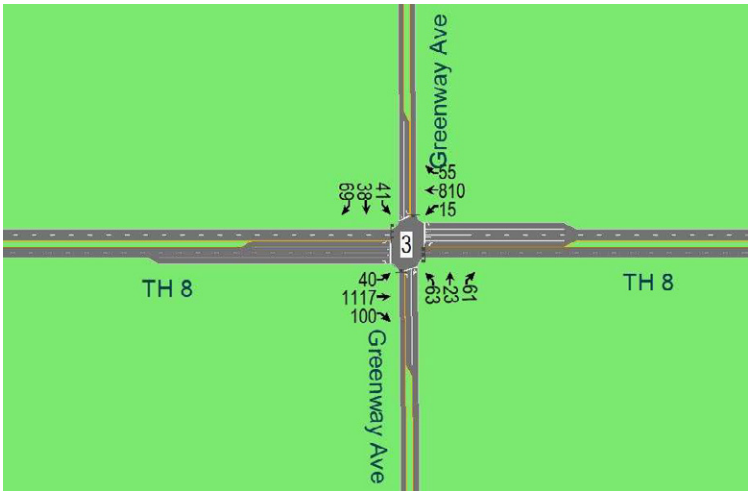
PROPOSAL P2 – AS GIVEN

- 3-phase Signal
- Intersection LOS C (2040 PM)



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PROPOSAL P2 AS GIVEN COST

	Quantity	Unit	Unit Cost	Total Cost
Signal	1	LS	$250,000	$250,000
Subtotal				$250,000

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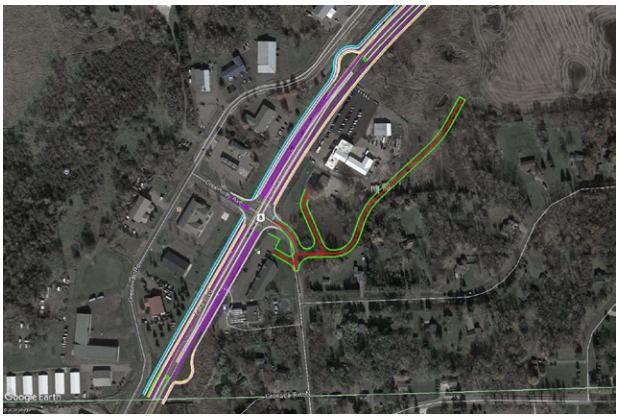
VE PROPOSAL P2 – RCUT

- Widen to 4 lanes
- Restricted Crossing U-Turn (RCUT) at intersection



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VE PROPOSAL P2 – RCUT

- 4 – 2-way stop control intersections
- Intersection LOS A (2040 PM)*

*Sum of all intersection delays – does not include increase in travel time

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VE PROPOSAL P2 COST

Item	Quantity	Unit	Unit Cost	Total Cost
RCUT Pavement	1350	SY	$35.00	$47,250
Subtotal				$47,250
CALL				$48,000

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PROPOSAL P2 COST EVALUATION

As Given Cost	$250,000
Proposal Cost	$48,000
Change in Cost	$202,000

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PROPOSAL P2 EVALUATION

ALTERNATIVE	ADVANTAGES	LIMITATIONS
As Given	• Meets driver expectation • Acceptable LOS • Access is centrally controlled • Improved multi-modal safety	• TH 8 vehicles stopped at the signal • Side road cross traffic • Increased conflict points • Requires periodic retiming / maintenance • Energy consumption
VE PROPOSAL	• Reduced congestion/LOS • 18 conflict points • Supports future increase in traffic • Reduced crash potential • Familiarity	• Property impacts at U-turn movement • Increased traffic through the intersection • Uncontrolled ped/bike movements • Potential increase in EMS response time

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RECOMMENDATION

VE Team recommends construction of a RCUT be adopted.

The proposal offers better value through Performance (P), Acceptance (A) and Cost (C):

1. Improved Highway 8 Traffic (P)
2. Improved Longevity (P)
3. Public Perception (A)
4. Long-term Economic Benefits (A)
5. Cost Reduction is $202,000 (C)

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Design Suggestion

- Install advance signal beacons ahead of signalized intersections
  - Locations where 715’ continuous view of signal heads not present

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PROPOSAL P3

Combine the Hamlet Avenue and Heath Avenue 2-Way Stop Controlled intersections into 1 Reduced Conflict Intersection at Hazel Avenue

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PROPOSAL P3 – EXISTING

Hamlet Avenue

Heath Avenue

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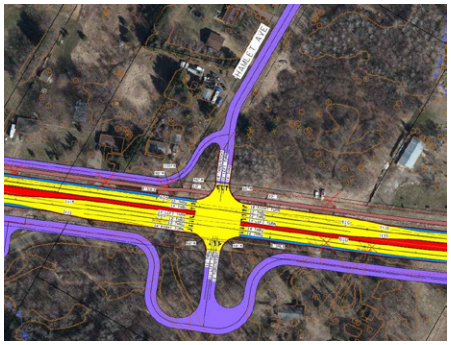
PROPOSAL P3 – AS GIVEN – Hamlet Ave.

Roadway:
- 2-Way Stop Controlled
- Left Turn Bays on all 4 Legs
- Right Turn Bays on TH 8
- Trail Crosses North Leg
- Realigned to Remove Skew



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PROPOSAL P3 – AS GIVEN – Heath Ave.

Roadway:
- 2-Way Stop Controlled
- Left Turn Bays on all 4 Legs
- Right Turn Bays on TH 8
- Trail Crosses North Leg
- Reconstruct to Remove Skew

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PROPOSAL P3 AS GIVEN COSTS

Item	Quantity	Unit	Unit Cost	Total Cost
Conventional Intersection - Hamlet				$1,153,000
Conventional Intersection - Heath				$1,153,000
Heath Reconstruction				$197,000
Subtotal				$2,503,000

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VE PROPOSAL P3 – RCI at Hazel Ave.

Roadway:

- Reduced Conflict Intersection
- Full Access to Hazel from TH 8
- Right Turn Only from Hazel
- Trail Crosses North Leg

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VE PROPOSAL P3 COST

Item	Quantity	Unit	Unit Cost	Total Cost
Reduced Conflict Intersection - Hazel				$1,097,000
2000’ Mainline				$1,146,000
Subtotal				$2,243,000

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PROPOSAL P3 COST EVALUATION

As Given Cost	$2,503,000
Proposal Cost	$2,243,000
Change in Cost	$260,000

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PROPOSAL P3 EVALUATION

ALTERNATIVE	ADVANTAGES	LIMITATIONS
As Given	• Provides 2 access points • Familiarity	• Realigns Hamlet and reconstructs Heath to remove skews • Thru/left turns off Hamlet/Heath must cross multiple lanes of high-speed traffic in 2 directions
VE PROPOSAL	• Reduces the number of access points to TH 8 • Improves intersection spacing • Right turns only from Hazel • Typically provides a 44% reduction in crashes	• Reduces access in area • 2 weave movements to access U-turns • Increases drive time for thru/left turn movements from Hazel

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RECOMMENDATION

VE Team recommends the RCI at Hazel be adopted.

The proposal offers better value through Performance (P), Acceptance (A) and Cost (C):

1. Improved TH 8 Performance (P)
2. Less Construction on TH 8 (A)
3. Improved Multi-Modal Accessibility (A)
4. Cost Reduction is $260,000 (C)

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Design Suggestion

- Free right turn at Green Lake Trail for eastbound TH 8
- Create a right-in only drive at station 565+00
- Right-in-right-out drives at station 734+00

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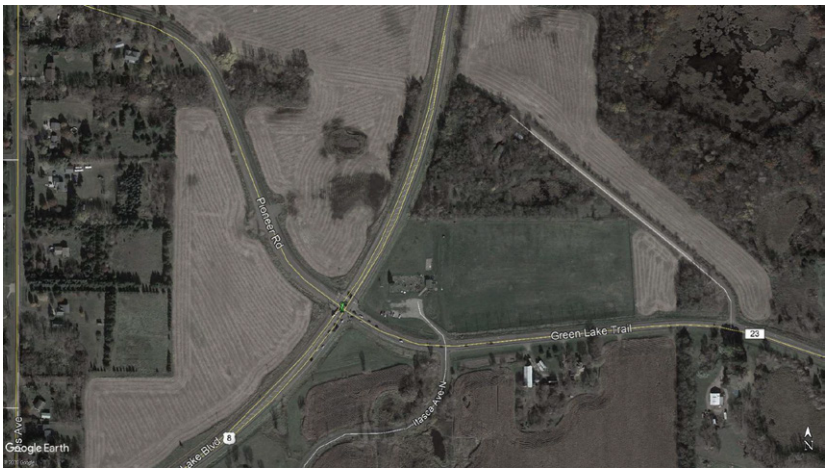
PROPOSAL P4

RCUT at Pioneer

PROPOSAL P4 – EXISTING



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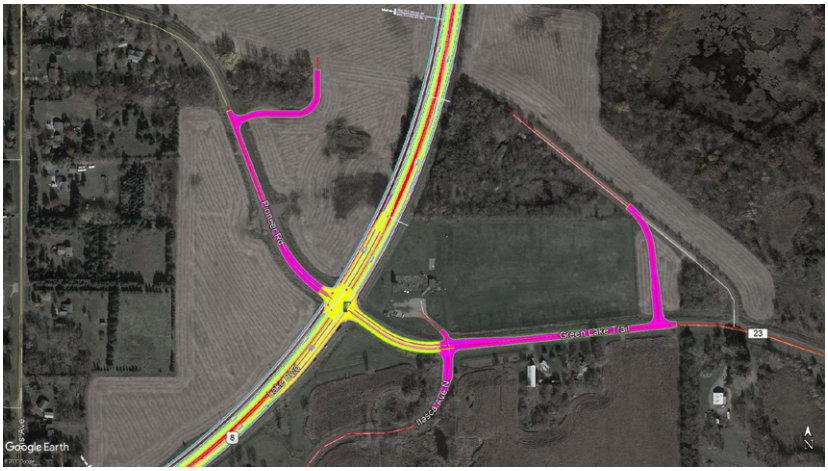
PROPOSAL P4 – AS GIVEN



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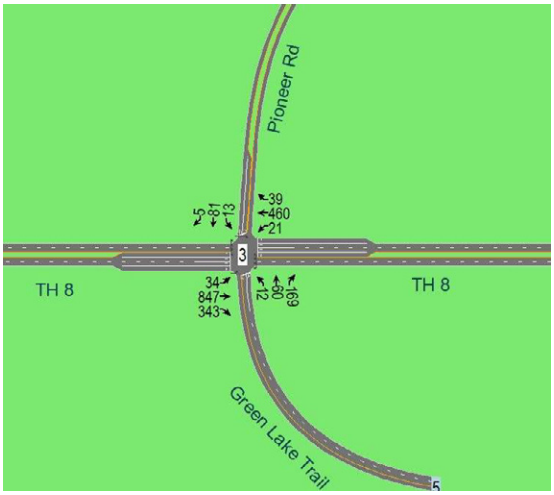
PROPOSAL P4 – AS GIVEN

- 3-phase Signal
- Intersection LOS C (2040 PM)



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PROPOSAL P4 AS GIVEN COSTS

Item	Quantity	Unit	Unit Cost	Total Cost
Local Road Pavement	15,200	SY	$35.00	$532,000
RCUT Pavement	0	SY	$35.00	$0
Median	500	SY	$85.00	$42,500
Earth Excavation	3,200	CY	$10.00	$32,000
Signal (Permanent)	1	EA	$250,000	$250,000
Subtotal				$856,500

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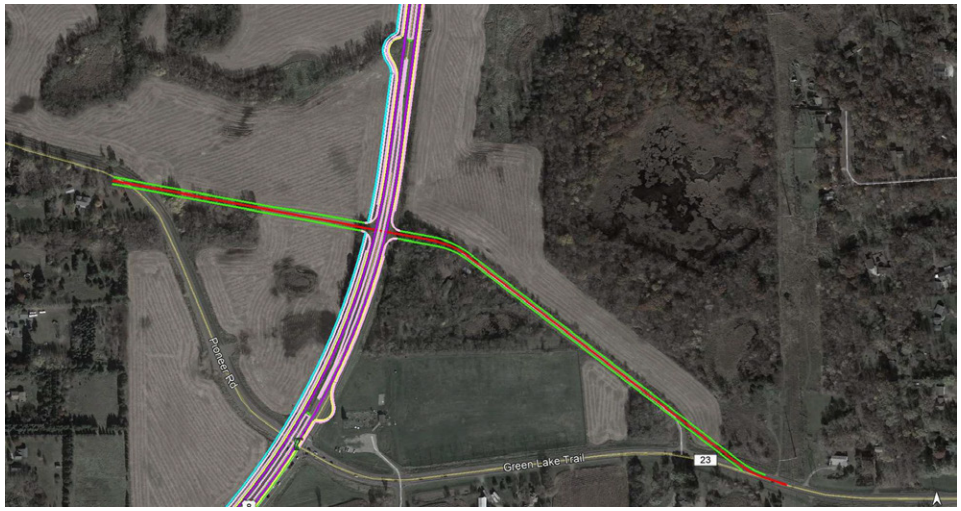
PROPOSAL P4 – RELOCATE PIONEER & RCUT



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PROPOSAL P4 – RELOCATE PIONEER & RCUT

- 4 – 2-way stop control intersections
- Intersection LOS A (2040 PM)*

*Sum of all intersection delays – does not include increase in travel time

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PROPOSAL P4 COST

Item	Quantity	Unit	Unit Cost	Total Cost
Local Pavement	11,050	SY	$35.00	$386,750
RCUT Pavement	1,350	SY	$35.00	$47,250
Medians	0	SY	$85.00	$0
Earth Excavation	3,000	CY	$10.00	$30,000
Subtotal				$464,000

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PROPOSAL P4 COST EVALUATION

As Given Initial Cost	$856,500
Proposal Initial Cost	$464,000
Change in Cost	$392,500

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PROPOSAL P4 EVALUATION

ALTERNATIVE	ADVANTAGES	LIMITATIONS
As Given	• Maintains existing intersection • Meets driver expectation • Acceptable LOS • Improved multi-modal safety	• Peak-hour delays • More roads to maintain • 42 conflict points • Requires periodic retiming/other maintenance • Energy consumption
VE PROPOSAL	• Reduces congestion • 18 conflict points • Offline construction of Pioneer Road • Less Local Roads • Supports increase in traffic • Smaller footprint	• Increased property impacts at U-turn • Increased traffic through the intersection • Increased travel time • Uncontrolled ped/bike movements • Potential increase in EMS response time

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RECOMMENDATION

VE Team recommends the RCUT be adopted.

The proposal offers better value through Performance (P), Acceptance (A) and Cost (C):

1. Improved Highway 8 Traffic (P)
2. Improved Longevity (P)
3. Public Perception (A)
4. Long-term Economic Benefits (A)
5. Cost Reduction is $392,500 (C)

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Design Suggestion

- Utilize mountable curbs where appropriate to accommodate agriculture vehicles

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PROPOSAL P5

Modify Access from James Avenue to Viking Boulevard

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PROPOSAL P5 – EXISTING

TH 8 from James Avenue to Viking Boulevard

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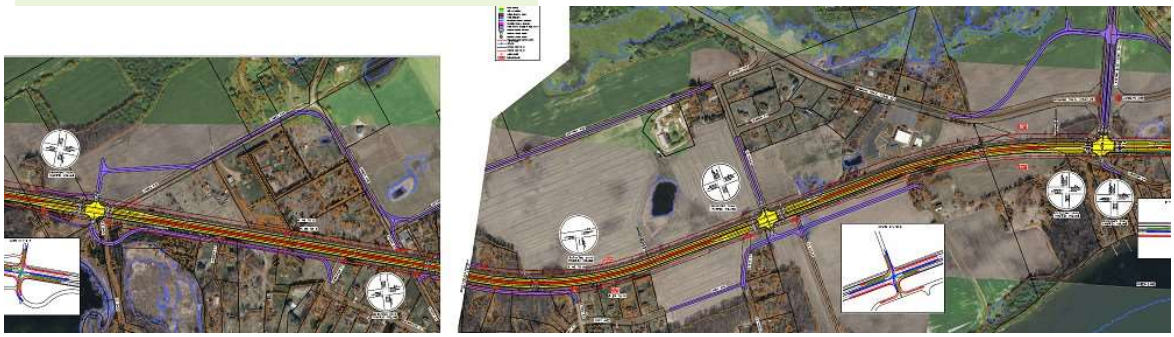
PROPOSAL P5 – AS GIVEN

- 4-lane TH 8
- 2-way stop at James
- 2-way stop at 276th Street
- Signal at Viking Boulevard



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PROPOSAL P5 AS GIVEN COSTS

Item	Quantity	Unit	Unit Cost	Total Cost
Mainline pavement	1,556	SY	$35/SY	$54,444
Median	31,889	SY	$85/SY	$2,710,555
Subtotal				$2,819,444
CALL				$2,820,000

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VE PROPOSAL P5 – ACCESS FROM JAMES TO VIKING

Roadway:

- RCUT at James Avenue
- Remove 276th Street intersection
- Reduce center raised median from Pioneer Road to Viking Boulevard

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VE PROPOSAL P5 COST

Item	Quantity	Unit	Unit Cost	Total Cost
Side road pavement	4,000	SY	$85/SY	$340,000
Median	15,944	SY	$85/SY	$1,355,278
Subtotal				$1,697,278
CALL				$1,700,000

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PROPOSAL P5 COST EVALUATION

As Given Cost	$2,820,000
Proposal Cost	$1,700,000
Change in Cost	$1,120,000

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PROPOSAL P5 EVALUATION

ALTERNATIVE	ADVANTAGES	LIMITATIONS
As Given	• Improves and controls access	• Increases conflict points • Does not minimize access
VE PROPOSAL	• Eliminate cross-traffic movements • Improves TH 8 thru movement • Potentially reduces crashes by 44% • Improves intersection spacing • Narrowing of median	• Additional local access roads • Limits direct access • Increases travel time

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RECOMMENDATION

VE Team recommends the corridor modifications between James Avenue and Viking Boulevard be adopted.

The proposal offers better value through Performance (P), Acceptance (A) and Cost (C):

1. Improved Highway 8 Traffic (P)
2. Improved Drainage Performance (P)
3. Less TH 8 Construction (A)
4. Improved Multi-modal Accessibility (A)
5. Cost Reduction is $1.12 million (C)

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PROPOSAL P6

RCUT at Viking Boulevard

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PROPOSAL P6 – EXISTING

- 2-lane section with turn lanes
- Signal controlled Intersection

TH 8 & Viking Blvd

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PROPOSAL P6 – AS GIVEN

- Proposed 4-Lane Highway 8
- Proposed Signal
- Increased Intersection spacing

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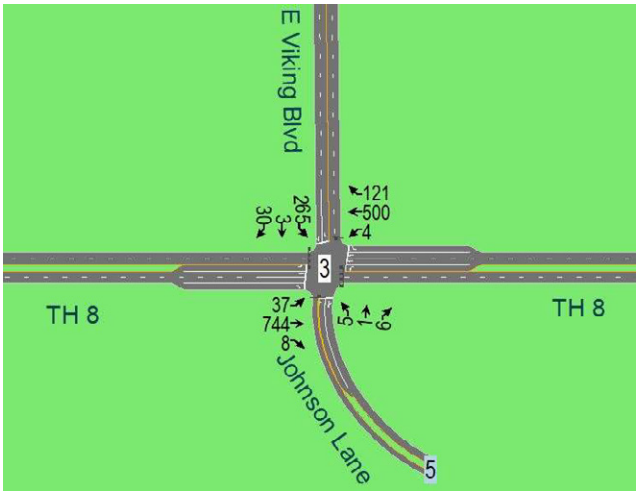
PROPOSAL P6 – AS GIVEN

- 2-phase Signal
- Intersection LOS C (2040 PM)



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PROPOSAL P6 AS GIVEN COST

Item	Quantity	Unit	Unit Cost	Total Cost
Local Road Pavement	19,690	SY	$35.00	$689,150
Signal (permanent)	1	EA	$250,000.00	$250,000
Subtotal				$939,150
CALL				$939,000

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PROPOSAL P6 – RCUT

- RCUT added along Highway 8
- Viking Blvd through movement restricted

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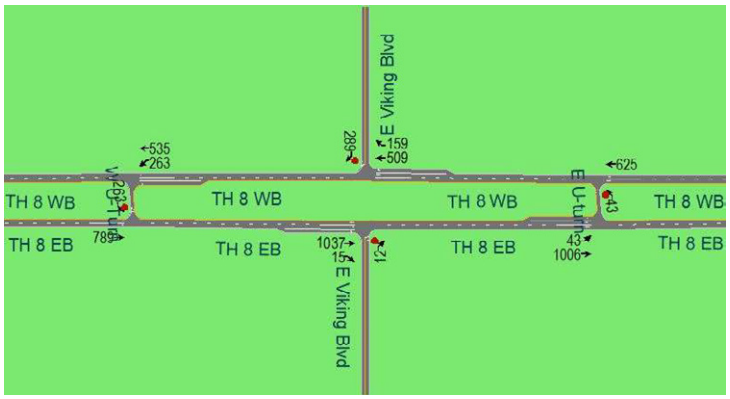
PROPOSAL P6 – RCUT

- 4 – 2-way stop control intersections
- Intersection LOS A (2040 PM)*

*Sum of all intersection delays – does not include increase in travel time



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PROPOSAL P6 COST

Item	Quantity	Unit	Unit Cost	Total Cost
Local Road Pavement	18,270	SY	$35.00	$639,450
R-Cut Pavement	1,350	SY	$35.00	$47,250
Subtotal				$736,400
CALL				$736,000

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PROPOSAL P6 COST EVALUATION

As Given Cost	$939,000
Proposal Cost	$736,000
Change in Cost	$203,000

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PROPOSAL P6 EVALUATION

ALTERNATIVE	ADVANTAGES	LIMITATIONS
As Given	• Meets driver expectation of turning at the intersection • Acceptable LOS • Less driver decisions • Improved multi-modal safety	• TH 8 vehicles can be stopped at the signal • Increased conflict points (42 total) • Requires periodic retiming / maintenance • Energy consumption
VE Alternative	• Reduced congestion/LOS • Reduced conflict points (18) • Improved future operations • Reduced crash potential • Additional land needed are agricultural/undeveloped • Many successful installations in Minnesota	• Additional Right-of-Way required • Increased traffic through the intersection • Increased travel time • Uncontrolled ped/bike movements • Potential increase in EMS response time

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RECOMMENDATION

VE Team recommends construction of a RCUT be adopted.

The proposal offers better value through Performance (P), Acceptance (A) and Cost (C):

1. Improved Highway 8 Traffic (P)
2. Improved Longevity (P)
3. Public Perception (A)
4. Long-term Economic Benefits (A)
5. Cost Reduction is $203,000 (C)

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PROPOSAL P7

Roundabout at Karmel Avenue

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PROPOSAL P7 – EXISTING

- 2-lane with turn lanes
- 2-way stop controlled

TH 8 & Karmel Avenue

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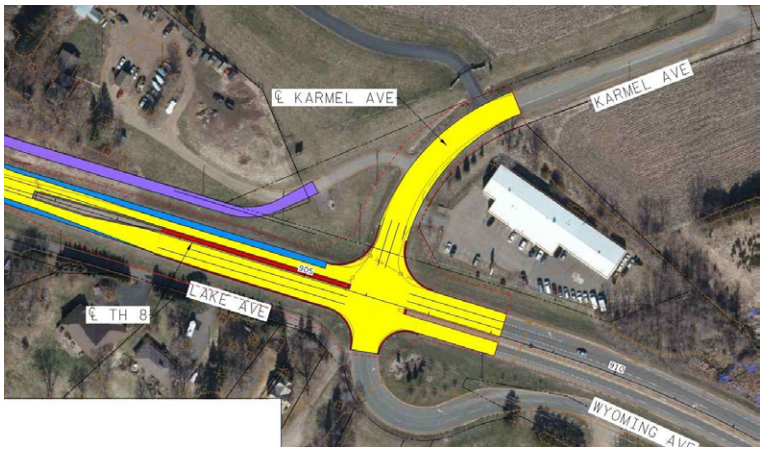
PROPOSAL P7 – AS GIVEN

- Maintain 2 Lanes
- 2-way stop controlled



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PROPOSAL P7 – AS GIVEN

- Intersection LOS A (2.1s) (2040 PM)
  - NB approach LOS F (98.5s)

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PROPOSAL P7 AS GIVEN COST

Item	Quantity	Unit	Unit Cost	Total Cost
Pavement	2,050	SY	$35.00	$71,750
Medians	70	SY	$85.00	$5,950
Subtotal				$77,700
CALL				$78,000

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VE PROPOSAL P7 – ROUNDABOUT

- One lane Roundabout at intersection (115-ft inscribed circle)

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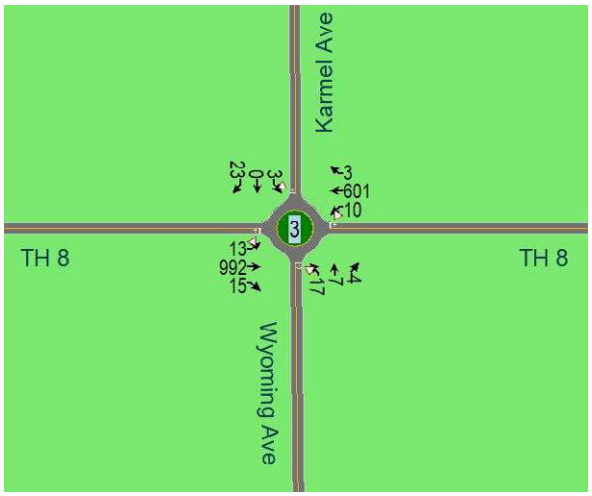
VE PROPOSAL P7 – ROUNDABOUT

- 1-lane approaches
- Intersection LOS C (15.2s) (2040 PM)



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VE PROPOSAL P7 COST

Item	Quantity	Unit	Unit Cost	Total Cost
Pavement	4,030	SY	$35.00	$141,050
Medians	2,000	SY	$85.00	$170,000
Roundabout	1	LS	$250,000.00	$250,000
Subtotal				$561,050
CALL				$561,000

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PROPOSAL P7 COST EVALUATION

As Given Cost	$78,000
Proposal Cost	$561,000
Change in Cost	-$483,000

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PROPOSAL P7 EVALUATION

ALTERNATIVE	ADVANTAGES	LIMITATIONS
As Given	• Meets driver expectation of turning at the intersection • Acceptable intersection LOS	• TH 8 vehicles can be stopped at the signal • Unacceptable LOS for side street • Increased conflict points (32 total)
VE Alternative	• Reduced conflict points (8 total) • Reduced crash potential • Potentially less severe crashes • Motorist familiar with design • Less maintenance costs	• Intersection LOS increase • Property impacts at intersection • Uncontrolled ped/bike movements • Slows down TH 8 traffic through intersection

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RECOMMENDATION

VE Team validates the As Given design.

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Design Suggestion

- Install Dynamic Message on I-35 & Highway 61 to inform drivers about condition on Highway 8 congestion, accidents, etc.

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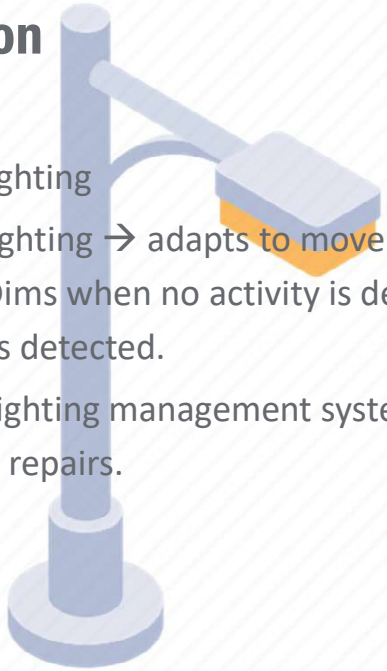
Design Suggestion

- Install Smart Street Lighting
  - Intelligent street lighting → adapts to movement by pedestrians, cyclists and cars. Dims when no activity is detected, brightens when movement is detected.
  - Create a Modern lighting management system to streamline maintenances and repairs.



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PROPOSAL P8

- Reconfigure the Eastbound TH 8 Freeway Segment into a Single Lane
- Add 2nd Eastbound Thru Lane at TH 61

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PROPOSAL P8 – EXISTING

- TH 8 starting from I-35 ramp
- Major volume to eastbound TH 8 come from I-35

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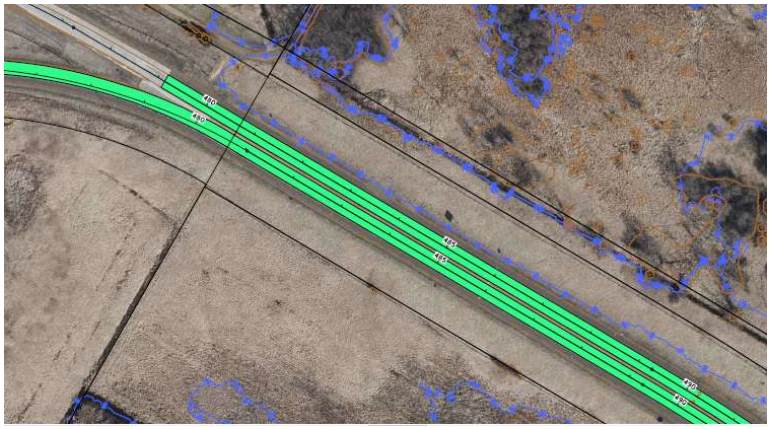
PROPOSAL P8 – AS GIVEN



- Existing I-35 ramp to eastbound TH 8 area
- Mill and overlay HMA

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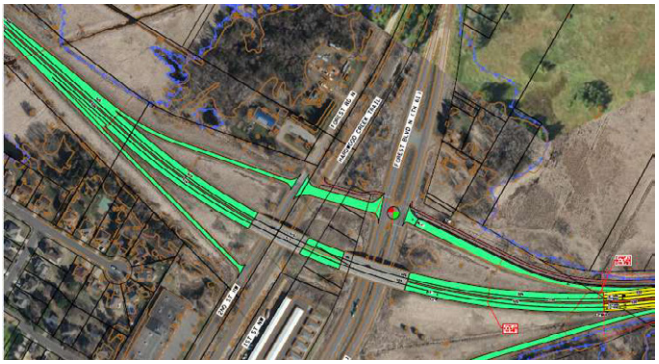
PROPOSAL P8 – AS GIVEN

- EB TH 8 Two lanes from I35 to TH61
- TH61 to EB TH 8 merge into EB TH 8
- TH 8 speed is 50 mph
- Short segment from TH61 to Greenway Ave.



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PROPOSAL P8 AS GIVEN COSTS

Item	Quantity	Unit	Unit Cost	Total Cost
Mill and Overlay				$1,000,000
Sign and Striping				$36,000
Subtotal				$1,036,000

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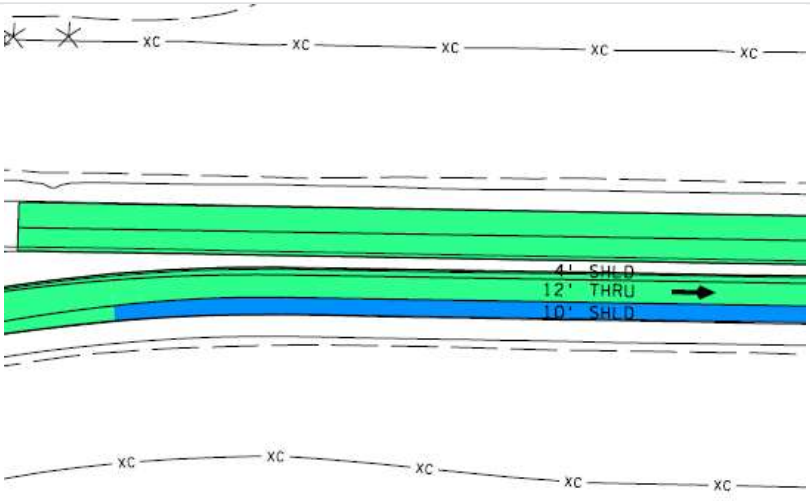
VE PROPOSAL P8 – Create One Lane Segment at the beginning of TH 8



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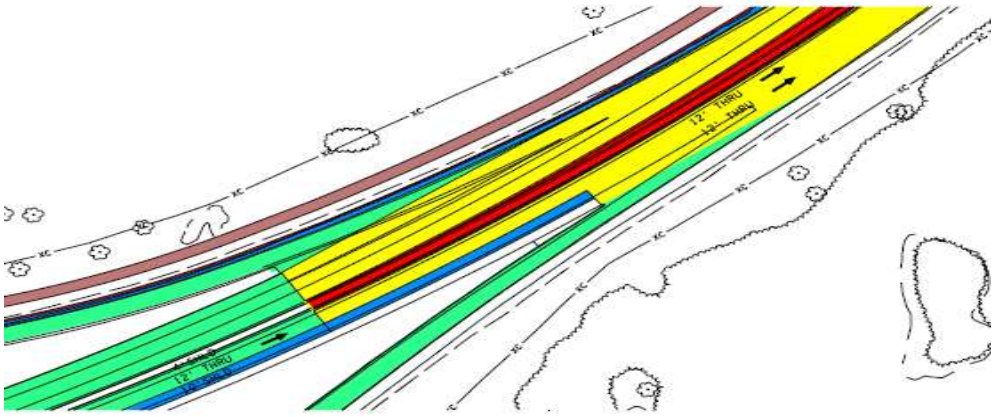
VE PROPOSAL P8 – Add 2nd EB Lane at TH 61



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VE PROPOSAL P8 COST

Item	Quantity	Unit	Unit Cost	Total Cost
Milling and Overlay				$1,000,000
Signing & Striping				$30,000
Subtotal				$1,030,000

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PROPOSAL P8 COST EVALUATION

As Given Cost	$1,036,000
Proposal Cost	$1,030,000
Change in Cost	$6,000

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PROPOSAL P8 EVALUATION

ALTERNATIVE	ADVANTAGES	LIMITATIONS
As Given	• Maintains existing design	• Access to gas station/strip mall creates lane change turbulence in freeway to arterial transition area • Wide section due to merge segment
VE PROPOSAL	• Smoother traffic flow between TH 61 and Greenway Ave • Better transition to signalized arterial road design • Reduce weaving at TH 61 ramp • Meets future traffic volume	• Appears to reduce current facility

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RECOMMENDATION

VE Team recommends to restripe eastbound Highway 8 between I-35 and Highway 61 to a one lane ramp with a wider shoulder.

The proposal offers better value by Improving Operations and Managing Access, both performance functions and improving the acceptance function Facilitate Construction with a nominal cost avoidance.

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PROPOSAL P9

Mini-Roundabout on Greenway Avenue N

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PROPOSAL P9 – EXISTING

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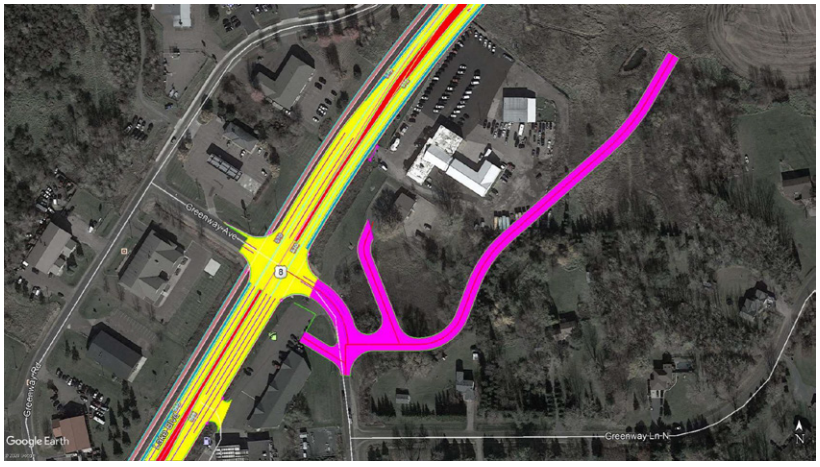
PROPOSAL P9 – AS GIVEN



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PROPOSAL P9 AS GIVEN COSTS

Item	Quantity	Unit	Unit Cost	Total Cost
Pavement	7,200	SY	$35.00	$252,000
Earth Excavation	1,800	CY	$10.00	$18,000
Subtotal				$270,000

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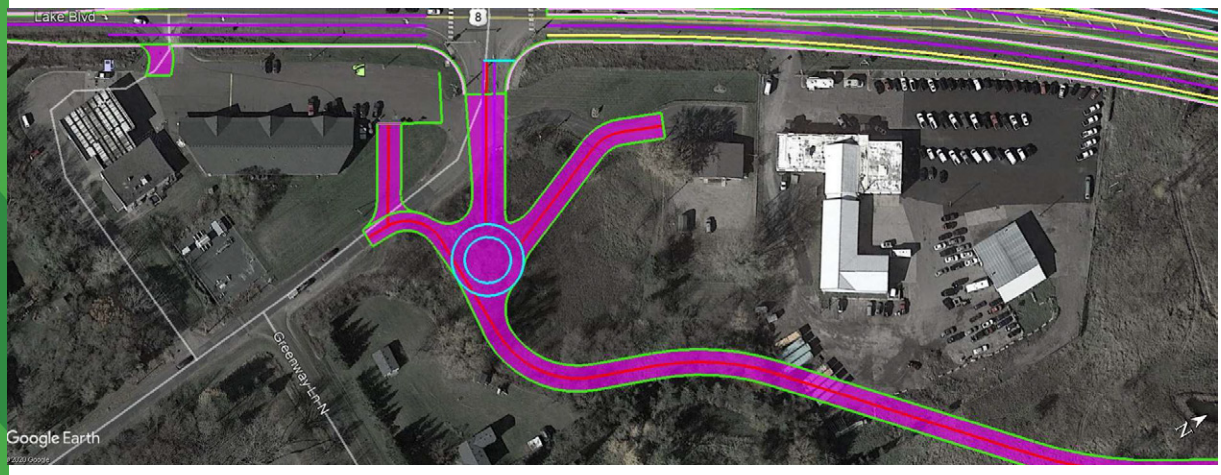
PROPOSAL P9 – Mini Roundabout



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VE PROPOSAL P9 COST

Item	Quantity	Unit	Unit Cost	Total Cost
Pavement	6,340	SY	$35.00	$221,900
Earth Excavation	1,410	CY	$10.00	$14,100
Mini-Roundabout	1	L SUM	$150,000	$150,000
Subtotal				$386,000

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PROPOSAL P9 COST EVALUATION

As Given Cost	$270,600
Proposal Cost	$386,000
Change in Cost	-$115,400

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PROPOSAL P9 EVALUATION

ALTERNATIVE	ADVANTAGES	LIMITATIONS
As Given	• New full depth pavement section • Lower maintenance cost	• Increased conflict points (32) • Shorter storage length
VE PROPOSAL	• Increased storage length for Greenway • Reduced conflict points (8) • Potentially less severe crashes • Improved Sight distance	• Higher cost due to Roundabout construction

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RECOMMENDATION

VE Team recommends Mini-Roundabout be adopted.

The proposal offers better value through Performance (P) and Acceptance (A):

1. High sustainability feature (A)
2. Least utility Disruption (P)
3. Shorter construction (A)
4. Low throw away cost (A)

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PROPOSAL P10

Substitute Pervious Pavement for Bituminous Pavement on Trail

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PROPOSAL P10 – EXISTING

No trail

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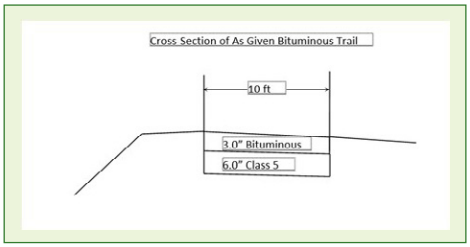
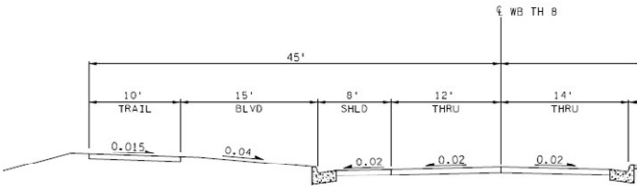
PROPOSAL P10 – AS GIVEN

Separated, 10’ Bituminous Trail:





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PROPOSAL P10 AS GIVEN COSTS

Description	Unit	Quantity	Unit Cost	Total Cost
3” Bituminous Trail	SY	41,971	$20.00	$839,000
6” Aggregate Base	CY	6,995	$30.00	$210,000
Water Quality Ponds	Each	1	$35,100	$35,000
				$1,084,000

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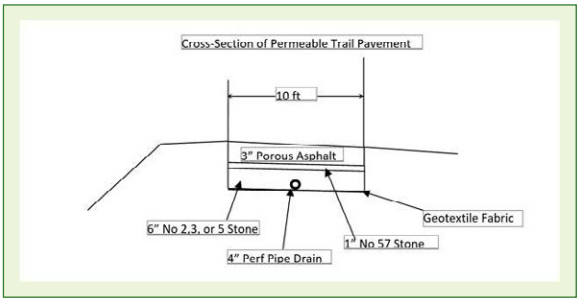
VE PROPOSAL P10– PERVIOUS PAVEMENT

Separated, 10’ Pervious Pavement (Asphalt) Trail:



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VE PROPOSAL P10 COST

Description	Unit	Quantity	Unit Price	Total Cost
3” Porous Asphalt	SY	41,971	20.00	$839,000
7” Aggregate Base	CY	8,161	30.00	$245,000
4” Perf Pipe Drain	LF	4,197	6.88	$29,000
Geotextile Fabric	SY	41,971	1.87	$79,000
				$1,192,000

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PROPOSAL P10 COST EVALUATION

As Given Cost	$1,084,000
Proposal Cost	$1,192,000
Change in Cost	-$108,000

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PROPOSAL P10 EVALUATION

ALTERNATIVE	ADVANTAGES	LIMITATIONS
As Given	• Improves walkability/bike ability	• Creates large amount of new impervious surface
VE PROPOSAL	• Improves walkability/bike ability • Minimizes total new impervious surface • Less stormwater treatment needs • Less runoff flowing to TH 8 C&G	• Higher maintenance cost • Shorter pavement lifespan • No additional public or economic benefits

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RECOMMENDATION

This proposal validates the As Given condition. The value of improved stormwater performance does not outweigh the increased upfront and maintenance costs for this proposal.

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Design Suggestion

- Lower TH 8 profile to create more width at pinch points and wetlands
- Introduce walls at lakes and maintain roadway width
- Utilize alternative treatment methods
  - Rain gardens
  - Bioswales
  - Constructed wetlands
  - Forebays
  - Oversize pipes or vaults for subsurface storage
- Detention and treatment basins between trail and TH8

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PROPOSAL P11

END FOUR LANE SECTION AT PIONEER

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PROPOSAL P11 – EXISTING

Pioneer Road and Green Lake Trail Intersection

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PROPOSAL P11 – AS GIVEN

Full Reconstruction and Widening to East of East Viking Lane

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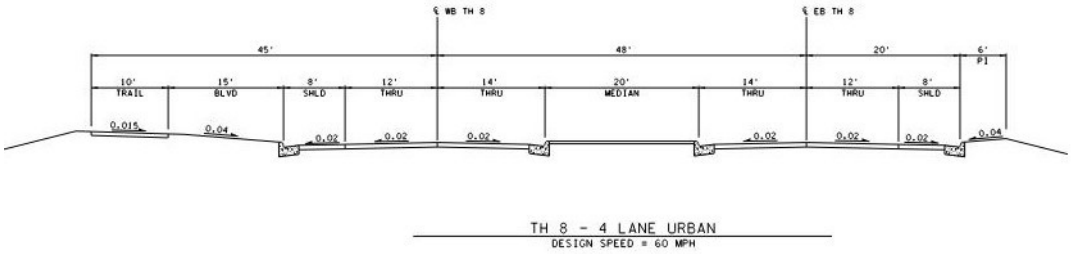
PROPOSAL P11 – AS GIVEN



TH 8 – 4 LANE URBAN
DESIGN SPEED = 60 MPH

Four-Lane Divided Roadway with Left Turn Lanes

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PROPOSAL P11 AS GIVEN COSTS

Item	Quantity	Unit	Unit Cost	Total Cost
Paving and Grading	3.75	MI	$3,100,000	$11,625,000
Drainage and Utilities	3.75	MI	$800,000	$3,000,000
Signals	1	Intersection	$330,000	$330,000
Signing and Striping	3.75	MI	$40,000	$150,000
Subtotal				**$15,105,000**

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PROPOSAL P11– END FOUR LANE SECTION AT PIONEER ROAD

Full reconstruction just east of Pioneer Road with mill and overlay of remainder of TH 8 project to the east

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PROPOSAL P11 COST

Item	Quantity	Unit	Unit Cost	Total Cost
3” Mill and Overlay	3.75	MI	$750,000	$2,812,500
Drainage and Utilities	0	MI	$800,000	$0
Signals	0	Intersection	$330,000	$0
Striping	3.75	MI	$5,000	$18,750
Subtotal				**$2,832,000**

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PROPOSAL P11 COST EVALUATION

As Given Cost	$15,105,000
Proposal Cost	$2,832,000
Change in Cost	$12,273,000

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PROPOSAL P11 EVALUATION

ALTERNATIVE	ADVANTAGES	LIMITATIONS
As Given	• New full depth and width pavement section • Local road development for future growth • Lower maintenance cost	• Longer construction duration
Proposal	• Shorter construction duration • Allows for cost sharing with future developers • Majority of traffic impacts addressed with half the construction • Reduced water treatment requirements	• Higher maintenance cost • Access points not reduced east of Pioneer Road • Full length of bituminous trail not constructed

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RECOMMENDATION

VE Team recommends Ending the Four Lane Section at Pioneer Road be adopted.

The proposal offers better value through Performance (P), Acceptance (A) and Cost (C):

1. Most traffic impacts to TH 8 are addressed in west section(P)
2. Reduced water treatment requirements (P)
3. Shorter construction (A)
4. Cost Reduction is $12.3 million (C)

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Design Suggestion

- Staging Considerations
  - Reduce temporary pavement
  - As planned ½ at a time
  - Segmented construction
- Build intersections first
- Build intersections in conjunction with local road improvements
- Encourage alternate routes for eastbound and westbound as needed

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Design Suggestion

- Manage Snow
  - Living snow fence
  - Snow traps
  - Negotiate with farmers to manage snow
  - Widen shoulders for snow
- Upgrade right-of-way fence

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VALUE IS...

Achieving higher performance with a broad acceptance at a reasonable cost.

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Highway 8 VE Study Summary

No.	Proposal	As Given	VE Proposal	Change*	Recommendation
1	Typical Section Modifications	$22,687,000	$16,127,000	$6,560,000	Recommended
2	RCUT at Greenway	$250,000	$48,000	$202,000	Recommended
3	Combine Heath & Hamlet to One Intersection with RCUTs	$2,503,000	$2,243,000	$260,000	Recommended
4	RCUT at Pioneer	$606,500	$464,000	$142,500	Recommended
5	RI/RO at James Avenue/Remove 276th	$2,820,000	$1,700,000	$1,120,000	Recommended
6	RCUT/restrict through movement at Viking intersection	$939,000	$736,000	$203,000	Recommended
7	Roundabout at Karmel	$78,000	$561,000	-$483,000	Validation
8	Stripe One Lane w/ Shoulder on EB 8 between I-35 & 61	$1,036,000	$1,030,000	$6,000	Recommended
9	Mini-Roundabout on Greenway	$270,600	$386,000	-$115,400	Recommended
10	Substitute Pervious Pavement for Bituminous Pavement Trail	$1,084,000	$1,192,000	-$108,000	Validation
11	End Four Lane Section at Pioneer	$15,105,000	$2,832,000	$12,273,000	Recommended
Total Construction Cost Avoidance **				**$8,378,100**	

* Negative change is cost increase
** Does not include Proposal 7, 10 and 11

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PROPOSAL DECISION

Once the report has been submitted Proposals will be subject to:

- Accepted
- Rejected
- Needs Further Study

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APPENDIX A

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SRF Consulting Group, Inc. | Engineers Planners Designers

ate Prepared By: SRF Consulting Group, Inc., 3/23/2020

					TOTAL	
	ITEM DESCRIPTION		**UNIT**	**UNIT PRICE**	**EST. QUANTITY**	**EST. AMOUNT**
PAVING AND GRADING COSTS						
GrP 1a	2106 Excavation - common & subgrade		cu. yd.	$10.00	335,769	$3,357,690
GrP 2a	2106 Common Embankment (CV)		cu. yd.	$10.00	167,884	$1,678,840
GrP 2d	2106 Granular Subgrade (CV)		cu. yd.	$12.00	75,548	$906,576
GrP 3a	Mainline Pavement		sq. yd.	$35.00	230,260	$8,059,100
GrP 3b	2" Mill and Overlay		mile	$336800.00	1	$336,800
GrP 4a	Median		sq. yd.	$85.00	46,168	$3,924,280
GrP 4b	New Bituminous Trail - 3"	(1)	sq. yd.	$20.00	41,971	$839,420
GrP 4c	2211 Median Aggregate Base Class 5		cu. yd.	$30.00	19,153	$574,590
GrP 5	Curb and Gutter		lin. ft.	$25.00	74,090	$1,852,250
	SUBTOTAL PAVING AND GRADING COSTS					**$21,529,546**
DRAINAGE AND UTILITIES						
Dr 3	Water Quality Ponds		each	$35,100	5	$175,500
Dr 5	Drainage - urban		20%			$4,306,000
Dr 7	Turf Establishment & Erosion Contro		5%			$1,076,000
	SUBTOTAL DRAINAGE, UTILITIES AND EROSION CONTROL					**$5,557,500**
RETAINING WALLS & OTHER MINOR STRUCTURAL COSTS						
RW 1	Box Culvert -		lin. ft.	$540	65	$35,100
	SUBTOTAL RETAINING WALLS & OTHER MINOR STRUCTURAL COSTS					**$35,100**
SIGNAL AND LIGHTING COSTS						
SGL 1	Signals (permanent)		each	$250,000	8	$2,000,000
SGL 2	Signals (temporary)		each	$80,000	8	$640,000
SGL 3	Trail Lighting		each	$8,000	2	$16,000
	SUBTOTAL SIGNAL AND LIGHTING COSTS					**$2,656,000**
SIGNING & STRIPING COSTS						
SGN 1	Mainline Signing (C&D)		mile	$35,000	7.2	$252,000
SGN 2	Mainline Striping		mile	$5,000	8.1	$40,400
	SUBTOTAL SIGNING & STRIPING COSTS:					**$292,400**
	SUBTOTAL CONSTRUCTION COSTS:					**$30,070,546**
MISCELLANEOUS COSTS						
M 1	Mobilization		5%			$1,504,000
M 2	Non Quantified Minor Items	(2)	4%			$1,203,000
M 7	Temporary Pavement & Drainage		4%			$1,203,000
M 8	Construction Traffic Control		3%			$902,000
M 9	Turf Establishment & Erosion Contro					
M 10	Landscaping		1%			$301,000
	SUBTOTAL MISCELLANEOUS COSTS:					**$5,113,000**
ESTIMATED TOTAL CONSTRUCTION COSTS without Contingency:						**$35,183,546**
1	Contingency or "risk"	(3)	15%			$5,278,000
ESTIMATED TOTAL CONSTRUCTION COSTS PLUS CONTINGENCY:						**$40,461,546**
	OTHER PROJECT COSTS:					
	UTILITY AGREEMENTS			Lump $750,000		$750,000
	R/W ACQUISITIONS			$3,300,000		$3,300,000
	DESIGN ENG. & CONSTRUCTION ADMIN.		13%	$5,260,000		$5,260,000
	SUBTOTAL OTHER PROJECT COSTS					**$9,310,000**
	TOTAL PROJECT COST (based upon 2018 bid price					**$49,771,546**
	TOTAL PROJECT COST (OPENING YEAR DOLLARS)					**$49,771,546**

APPENDIX B

ATTENDANCE LIST

The following is list of personnel who attended the SH 7 (Lower) kickoff meeting to the VE Team on August 10, 2020.

Chuck Bartlett
Brian Johnson
Tim Donovan
Julie Dresel
Eric Embacher
Bryce Fossand
Brigid Gombold
Todd Grugel
Rachel Guan
Adam Josephson
Leif Garnass
Mike Lynch
Minnie Milkert
Dale Nikkola
Ronald Rauchle
Natalie Ries
Kevin Sommers
Dmitry Tomasevich
Dave Van Deusen
Brian Wifler
Amanda Zacharis
Jim Zigman
Al Tomaselli
Dave Cuthbertson
Jason Radde
Joe Triplett
Joe C
Jim McCarthy
Phil Bergem
Scott Meier

APPENDIX B: MEETING ATTENDANCE SHEETS

The following is list of personnel who attended the final presentation on August 13, 2020.

Mohamad Alshabini
Phil Bergem
Mike Barnes
Chuck Bartlett
Christina Caouette
Todd Clarkowski
Dave Cuthbertson
Tim Donovan
Doug Carter
Julie Dresel
Jerad Daul
Eric Embacher
Kaare Festvog
Bryce Fossand
Leif Garnass
Mark Gieseke
Brigid Gombold
Rachel Guan
Brian Johnson
Adam Josephson
Eric Janssen
Svjetlana Kojic
Matt Knight
Kevin Kosobud
Mike Kruse
Rich Lamb
Jamal Love
Mike Lynch
Tigest Mamo
Jim McCarthy
Molly McCartney
Gwen Mei
Minnie Milkert
Dennis Moline
Jim Rosenow
Dale Nikkola
Jason Radde
Brad Skow
Matt Schleusner
Will Stein
Al Tomaselli
Dmitry Tomasevich
Joe Triplett
Mackenzie Turner Bargen
Dave Van Deusen
Nancy Yoo
Brian Wifler
Amanda Zacharis
Jim Zigman

APPENDIX C

Value Engineering Recommendation Approval Form

Project: Trunk Highway 8 Improvement Project (SP 1308-29)

VE Study Date: August 10 - August 13, 2020

		FHWA Functional Benefit							Agency response	
Recommendation		**Safety**	**Traffic Operation**	**Environment**	**Construction**	**Right of Way**	**Estimated Savings**	**Added Cost**	**Accept / Reject / Accept for further review**	**Reason (Or use the pages at the end of this memo)**
P1	Typical Section Modifications			X		X	$ 6,495 K		Accept for further review	Full cost savings not expected due to width needed at intersections, but will consider and further evaluate.
P2	RCUT at Greenway	X	X				$ 202 K		Reject	Long-term capacity considerations, walkability/bikeability needs, and inconsistent with future character of corridor. Details to be documented in ICE reports.
P3	Combine Heath & Hamlet to One Intersection with RCUTs	X	X		X		$ 254 K		Accept for further review	
P4	RCUT at Pioneer	X	X		X		$ 393 K		Reject	Long-term capacity considerations, walkability/bikeability needs, and inconsistent with future character of corridor. Details to be documented in ICE reports.
P5	RI/RO at James Avenue/Remove 276th	X	X		X		$ 1,120 K		Accept for further review	
P6	RCUT/restrict through movement at Viking intersection	X	X				$ 253 K		Reject	Long-term capacity considerations, walkability/bikeability needs, and inconsistent with future character of corridor. Details to be documented in ICE reports.
P7	Roundabout at Karmel				X	X		($ 483 K)	Accept for further review	While VE study noted the proposed roundabout has little impact the intersection Level of Service, and would require traffic on TH 8 to slow, the PMT has determined further evaluation is necessary.
P8	Stripe One Lane w/ Shoulder on EB 8 between I-35 & 61	X	X				$ 6 K		Accept for further review	Deferring to MnDOT for more input on this.

Value Engineering Recommendation Approval Form

Project: Trunk Highway 8 Improvement Project (SP 1308-29)
VE Study Date: August 10 - August 13, 2020

	Recommendation	FHWA Functional Benefit: Safety	Traffic Operation	Environment	Construction	Right of Way	Estimated Savings	Added Cost	Agency response: Accept / Reject / Accept for further review	Reason (Or use the pages at the end of this memo)
P9	Mini-Roundabout on Greenway	X	X					($ 116 K)	Accept for further review	Dependent on local roadway configurations.
P10	Substitute Pervious Pavement for Bituminous Pavement Trail			X				($ 107 K)	Reject	Additional costs and long-term/on-going maintenance concerns.
P11	End Four Lane Section at Pioneer			X	X	X	$ 12,273 K		Accept for further review	Dependent on project funding.
	Total for 9 recommendations	7	7	3	5	3	$ 20,996 K	($ 706 K)		
	Total for 6 accepted recommendations						$ 7,875 K	($ 599 K)		
	Total number of Design Suggestions	19								
	Total Project Cost Estimate (TPCE)	$ 49.80 M								

Let Date: 2023
Team Members - MnDOT - 5
Team Members - Consultant - 5
Team Members - FHWA - 2

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. If the District 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

Brian Johnson (SRF) for Chisago Co.
Signature Project manager

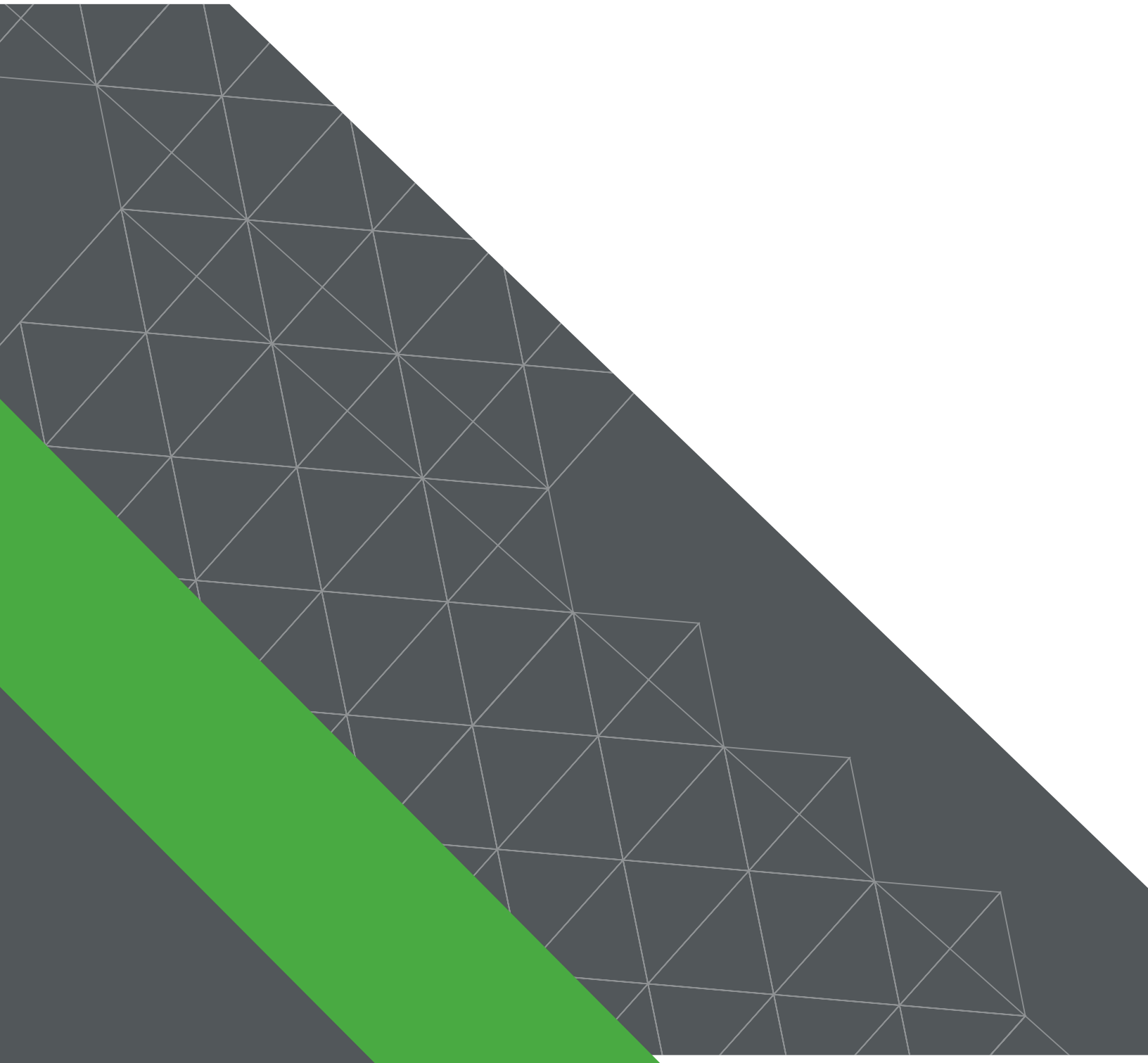
9/22/2020
Date

revised 1/22/2018

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 recommendation in terms of the project feature or features that recommendation benefits. If a specific recommendation can be shown to provide benefit to more than one feature described below, count the recommendation in **each category that is applicable**.

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.
Right of Way: Recommendations that affect property ownerships or easements.



benesch

Benesch Project Number: 0010794.00

DEPARTMENT OF TRANSPORTATION