City of Wheat Ridge

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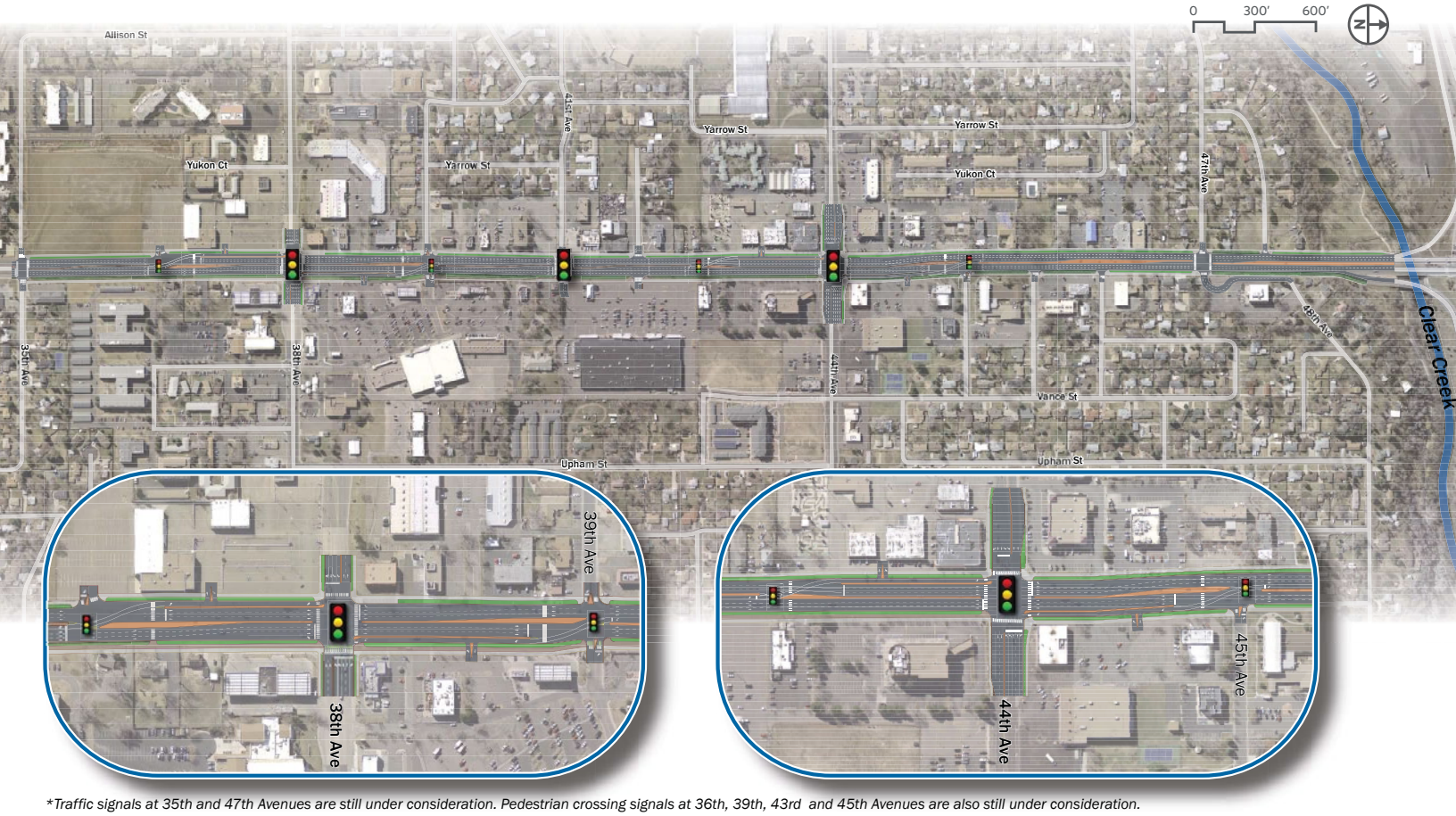
FINAL

Wadsworth Boulevard Widening

Value Engineering Study Report



*Traffic signals at 35th and 47th Avenues are still under consideration. Pedestrian crossing signals at 36th, 39th, 43rd and 45th Avenues are also still under consideration.

AECOM Imagine it. Delivered.

September 2018

Quality information

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Revision History

Revision	Revision date	Details	Authorized	Name	Position

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1. Executive Summary

1.1 Introduction

A 3.5-day Value Engineering (VE) Study was undertaken for the Wadsworth Boulevard Widening Project. The scope of work for the VE Study was the Environmental Assessment level design for the widening of Wadsworth Boulevard between 35th Avenue and I-70.

The 3.5-day Value Engineering Workshop was held from April 30th to May 3rd, 2018 at City of Wheat Ridge City Hall located at 7500 W 29th Ave, Wheat Ridge, CO 80033. The VE Study was undertaken in accordance with the Colorado Department of Transportation (CDOT) Value Engineering Guidelines as well as the SAVE International Value Engineering Job Plan, which includes three stages: (1) Pre-Workshop, (2) Workshop, and (3) Post-Workshop.

The workshop portion of the VE Study followed the six-phase VE Job Plan consisting of: (1) Information Phase, (2) Function Analysis Phase, (3) Creative Phase, (4) Evaluation Phase, (5) Development Phase, and (6) Presentation Phase. A detailed description of the VE Study process is provided in **Section 4** of this report.

The Pareto Cost Model developed for the project, which indicates where the high costs are in the project based on the cost estimate provided by HDR, is provided in **Appendix A**. The results of the Function Analysis Phase is provided in **Appendix B**. Ideas generated and evaluated during the Creative Phase and Evaluation Phase are provided in **Appendix C**. The attendees to the May 3rd, 2018 VE Report-out Presentation are provided in **Appendix D**.

1.2 Project Overview

The City of Wheat Ridge is studying the environmental impacts and preparing conceptual design plans for transportation improvements on Wadsworth Boulevard between 35th Avenue and I-70 (www.ci.wheatridge.co.us/wadsworth). This project currently is at the Environmental Assessment (EA) level design for improvements to traffic congestion and safety issues, multi-modal solutions, and identified related environmental issues and mitigation measures. Improvements are to widen Wadsworth Boulevard between 35th and 48th Avenues to six travel lanes, to provide additional turn lanes at key congested intersections, and to install medians to better manage access. A key feature of the project is the reconfiguration of the major intersections at 38th and 44th Avenues into Continuous Flow Intersections or CFI's. Bicycle and pedestrian facilities are also included (**Figure 1**). Construction is projected to begin in 2019.

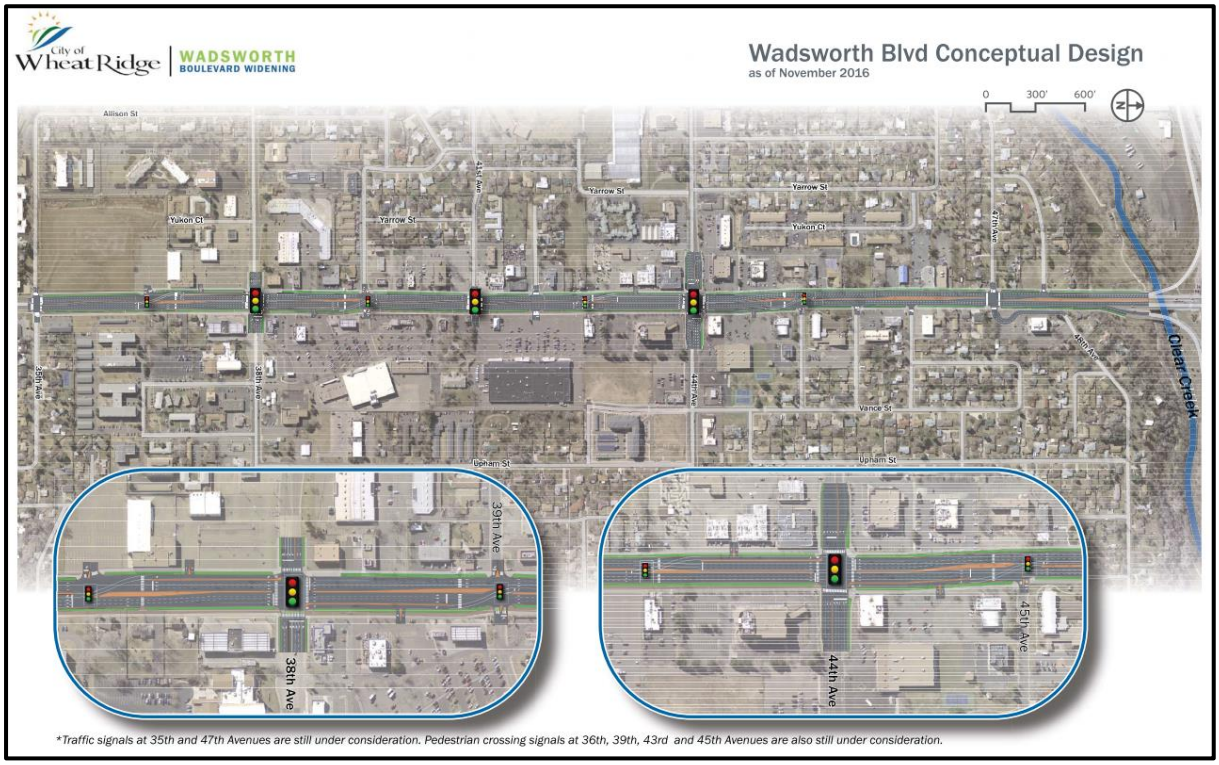


Figure 1: Wadsworth Boulevard Conceptual Design

1.3 VE Team

The VE Team was composed of a multidisciplinary team of subject matter experts. The VE Team members are listed in **Table 1.**

Table 1: VE Team Members

Name	Role	Company
Tammy Dow	VE Team Leader	AECOM
Paul Scherner	Traffic	CDOT
Jeffrey Hampton	Construction	CDOT
Gary Huber	Design	CDOT
Russ Higgins	Construction	City of Wheat Ridge
Steve McQuilkin	Design	AECOM
Darin Freeman	Structures	HDR

1.4 Highlights of the VE Study

During the Creative Phase of the VE Workshop, the VE Team brainstormed as many ways as possible to improve value in the project, generating **70** ideas. The results of the Wadsworth Boulevard Widening Value Engineering Study are presented in **19** VE Proposals, which are individual alternatives for elements of the project. These VE Proposals are documented in **Section 5** of this report and were developed from selected creative ideas as discussed in **Section 4**. In addition, there are **23** Design Comments for which definitive proposals could not be made or quantified at the time of the VE Study. The number of VE Proposals and Design Comments by Value Target Area are summarized in **Table 2**.

Table 2: VE Proposals and Design Comments by Value Target Area

Value Target Area	No. of VE Proposals	No. of Design Comments
Corridor (C)	9	5
35th to 38th (35/38)	1	5
38th to 39th (38/39)	0	2
39th to 44th (39/44)	1	3
44th to I-70 (44/I-70)	8	8
Total	**19**	**23**

Table 3 presents a summary of the ideas developed into VE Proposals and Design Comments. The cost estimates for the VE Proposals were developed using the information provided in *Appendix D. Detailed Statement of Work, Project Cost and, Schedule of the 2017 TIGER Grant Application, Wadsworth Boulevard Widening Project.* The cost savings provided in **Table 3** include right-of-way and construction costs but do not include any potential savings in demolition costs. In **Table 3**, only the ideas developed as VE Proposals and Design Comments are provided. The complete list of creative ideas and their evaluation is provided in the Summary of Creative Ideas and Evaluation Table in **Appendix C** of this report.

Table 3: Summary of VE Proposals and Design Comments

VE Proposal / Design Comment No.	Idea No.	Description	Construction Cost ((Savings) or Additional)
VE-1	C-2	Use a multi-use trail on the east side of the corridor in lieu of separate bike and ped facilities	$778,196
VE-2	C-3	Permanent easement in lieu of purchasing right-of-way throughout the project	$2,090,414
VE-3	C-5	Use asphalt in lieu of concrete throughout the project	$828,348
VE-4	C-6	Reduce median width throughout the corridor	1 ft. median reduction = $266,000 2 ft. median reduction = $536,000
VE-5	C-7	Reduce width of amenity area throughout the corridor	$1,453,684
VE-6	C-12	Use asphalt in lieu of concrete throughout the project on the sidewalks throughout the corridor	$145,890
VE-7	C-14	Reduce project limits	$9,514,517
VE-8	C-16	Replace trees with bushes	$192,804
VE-9	C-19	Eliminate ABC from under cycle track and sidewalks	$155,381
VE-10	35/38-11	Eliminate the ped islands at the 38th and Wadsworth intersection	$200,491
VE-11	39/44-10	Eliminate the exclusive right turn lanes	$276,715

VE Proposal / Design Comment No.	Idea No.	Description	Construction Cost ((Savings) or Additional)
		on the east and west legs and the westbound leg of 38th	
VE-12	44/I-70-6	Reconfigure 48th Avenue into a cul-de-sac with limited access	$154,367
VE-13	44/I-70-7	Tier the retaining wall on the west and east side (Walls 2W and 12E)	$64,000
VE-14	44/I-70-8	Shift Wadsworth to the east in order to keep existing wall on West side (Wall 2W)	$980,000
VE-15	44/I-70-10	Reduce the sidewalk width to 5 feet in front of the Johnson Park	$61,658
VE-16	44/I-70-11	Use existing inlet in Johnson Park with water quality vault	$146,000
VE-17	44/I-70-13	Consider soil nail walls instead of caisson wall on the east side north of 48th	$70,000
VE-18	44/I-70-16	Use off-ramp from Wadsworth onto 48th and eliminate the frontage road	$821,511
VE-19	44/I-70-21	Split the drainage system at Johnson Park	$47,000
DC-1	C-1	Add advance signage to the intersections throughout the corridor	-
DC-2	C-8	Widen the lane for the displaced left turn lane throughout the corridor	-
DC-3	C-10	Taper the median nose throughout the corridor	-
DC-4	C-13	Add transit signal priority throughout the corridor	-
DC-5	C-17	Investigate a business district to maintain the amenity zones	-
DC-6	35/38-3	Eliminate the right-in-right-out for the new development on the west side of the corridor	-
DC-7	35/38-4	Run a right-turn overlap with left turn at CFI crossover separation at all CFI crossover locations	-
DC-8	35/38-8	Increase the radius of the secondary compound curve and extend the median nose downstream on the southeast and northwest corners of the 38th and 44th and Wadsworth	-
DC-9	35/38-9	On south 38th, extend the median to cover the right-in right-out	-
DC-10	35/38-10	Move the stop bars further south at the	-

VE Proposal / Design Comment No.	Idea No.	Description	Construction Cost ((Savings) or Additional)
		cross over	
DC-11	38/39-2	Right-in only at the dental office	-
DC-12	38/39-4	Consolidate the two adjacent driveways on the west side of the corridor	-
DC-13	39/44-1	Increase the length of the southbound and northbound left turns at 41st	-
DC-14	39/44-4	Extend CFI median south and modify the driveway	-
DC-15	39/44-9	Add raised median eastbound at 44th	-
DC-16	44/I-70-1	Investigate the reverse curves northbound between 44th and 45th	-
DC-17	44/I-70-2	Consolidate the two adjacent driveways on the east side of the corridor between 44th and 45th and put on the property line	-
DC-18	44/I-70-3	Use the existing north access for Red Lobster	-
DC-19	44/I-70-4	Eliminate Discount Tires access on Wadsworth	-
DC-20	44/I-70-14	Increase the length of the southbound and northbound left turns at 47th	-
DC-21	44/I-70-15	At 47th, reconfigure to 3/4 in both directions	-
DC-22	44/I-70-20	Change sidewalk with backside footer to stand alone block wall	-
DC-23	44/I-70-22	Revise the driveway to Walgreens to a right-in only	-

1.5 Disclaimer

A 3.5-day VE Study was undertaken for the Wadsworth Boulevard Widening Project. VE Studies are working sessions for the purpose of developing and proposing alternative ideas for projects. As such, the VE Proposals and Design Comments were developed as far as time and resources would allow during the 3.5-day workshop and are based on the information provided to the VE Team at the time of the workshop. The VE Proposals and Design Comments are conceptual in nature and are not intended as final designs. Detailed feasibility and final design development of any VE Proposals and Design Comments presented herein, should they be accepted, remain the responsibility of the City, CDOT and the design team. VE Team members have not and will not sign or seal any VE Proposals and Design Comments contained in this report as certifiable engineering or architectural designs.

The cost estimates for the VE Proposals were developed using the information provided in *Appendix D. Detailed Statement of Work, Project Cost and, Schedule of the 2017 TIGER Grant Application, Wadsworth Boulevard Widening Project.* The cost estimates prepared for this VE Study were developed solely for comparing the costs of VE Proposals to the functional equivalent in the base

case design. The VE Team had limited time and resources to prepare cost estimates for each VE Proposal. Therefore, these cost estimates are not recommended to be used for budgeting or construction purposes. The City, CDOT and the design team should more accurately quantify any savings and additional costs of the VE Proposals they accept.

The VE Team takes no responsibility for the implementation of the VE Proposals relative to code compliance or coordination. The VE Team does not in any way guarantee the potential monetary savings.

2. Implementation Action

2.1 VE Proposals and Design Comments Summary and Disposition

Table 4 presents the results of the City's, CDOT and the design team's disposition for each of the VE Proposals. The cost savings provided in **Table 4** include right-of-way and construction costs but do not include any potential savings in demolition costs.

Table 4: VE Proposals and Design Comments Summary and Disposition Table

VE Proposal No.	Description	Construction Cost (Savings)	Incorporate Now	Incorporate Later	Reject	Comment
Pursue the below ideas and incorporate them into the design prior to the EA						
VE-1	Use a multi-use trail on the east side of the corridor in lieu of separate bike and ped facilities	$778,196	X			Increase walk width to 12' from 38th to 44th, saves 7' of ROW, demo, etc.
VE-4	Reduce median width throughout the corridor	$536,000	X			Reduce by 2' except at ped crossings
VE-5	Reduce width of amenity area throughout the corridor	$1,453,684	X			Reduce to 8', saves 3' of ROW, etc.
VE-12	Reconfigure 48th Avenue into a cul-de-sac with limited access	$154,367	X			A combination of these two ideas to provide separate 3/4 movements for 47th and 4800 Wadsworth north of 47th and access to, and maybe from, 48th
VE-18	Use off-ramp from Wadsworth onto 48th and eliminate the frontage road	$821,511	X			
VE-13	Tier the retaining wall on the west and east side (Walls 2W and 12E)	$64,000	X			A combination of these 3 ideas to reduce retaining wall costs at north end, add switchback on both sides on slopes
VE-14	Shift Wadsworth to the east in order to keep existing wall on West side (Wall 2W)	$980,000	X			
VE-17	Consider soil nail walls instead of caisson wall on the east side north of 48th	$70,000	X			
VE-15	Reduce the sidewalk width to 5 feet in front of the Johnson Park	$61,658	X			Reduce sidewalk width to 8' w/ 2' amenity zone from JeffCo MH north

VE Proposal No.	Description	Construction Cost (Savings)	Incorporate Now	Incorporate Later	Reject	Comment
	TOTAL	**$4,919,416**				
Pursue the below ideas and wait to incorporate them into the design after the EA						
VE-9	Eliminate ABC from under cycle track and sidewalks	$155,381		X		Further evaluation needed
VE-19	Split the drainage system at Johnson Park	$47,000		X		Keep existing 48" pipe for larger flows only
	TOTAL	**$202,381**				
Do not purse the below ideas						
VE-2	Permanent easement in lieu of purchasing right-of-way throughout the project	$2,090,414			X	Not City standard and not advantageous to property owner
VE-3	Use asphalt in lieu of concrete throughout the project	$828,348			X	Life Cycle Cost higher for asphalt
VE-6	Use asphalt in lieu of concrete throughout the project on the sidewalks throughout the corridor	$145,890			X	Not City standard
VE-7	Reduce project limits	$9,514,517			X	Last resort
VE-8	Replace trees with bushes	$192,804				Not City standard
VE-10	Eliminate the ped islands at the 38th and Wadsworth intersection	$200,491			X	Need for ped refuge and queue
VE-11	Eliminate the exclusive right turn lanes on the east and west legs and the westbound leg of 38th	$276,715			X	Need operationally due to lane imbalance with shared lane
VE-16	Use existing inlet in Johnson Park with water quality vault	$146,000			X	Use VE-19 instead
	TOTAL	**$13,395,179**				

3. Project Background

3.1 Purpose and Need

The purpose of this project is to transform Wadsworth Boulevard from 35th Avenue to I-70 into a multimodal facility that enhances regional mobility, provides local accessibility, and supports the vision of a liveable, walkable mixed use corridor.

The needs are:

- Lack of adequate capacity
  - Design provides 6 through lanes, new north and south right turn lanes, CFI intersection features at 38th and 44th
  - Improves travel time over 2040 No Action alternative at 38th from an average of 130 seconds of delay to an average of 47 seconds of delay
  - 52% improvement in traffic throughput
- Lack of access management
  - No existing raised medians other than north and south of 44th and just north of 38th
  - Raised medians are proposed throughout the length of the Project. Number of accesses are reduced from about 70 to about 50 – with most of those being right in / right out
- Lack of multimodal access and accommodations
  - Currently sidewalks only exist in a couple short segments and do not connect to all bus stops. This project provides continuous ADA compliant 8 to 10' wide sidewalks from 35th Avenue north to the I-70 Interchange and the Clear Creek Trail
  - RTD is about to double the frequency of the Route 76 to provide more frequent service between the West Line and Gold Line. This project provides new shelters and transit amenities
  - No bicycle facilities currently exist. The project will provide a two-way cycle track behind the curb on the east side, consistent with the recommendation of the city's adopted bicycle and pedestrian master plan. It will provide connections to the 35th Avenue route connection into Denver and the regional Clear Creek Trail
- Safety concerns
  - Most accidents are rear-end crashes on the corridor, predominantly caused by congestion. The project will greatly improve traffic flow to reduce the likelihood of these crashes
  - The only other high crash location is 39th, which will become signalized. The new medians will also eliminate over 30 left-out locations and will signalize every other location that does allow left turns.

3.2 Base Case Design

In April 2016, the City of Wheat Ridge initiated an Environmental Assessment (EA) study and Access Management Review for the widening of Wadsworth Boulevard. The study will review environmental impacts associated with transportation improvements planned for Wadsworth Boulevard between 35th Avenue and I-70.

The EA will be Phase 1 of a three-part project to prepare for the widening of Wadsworth Boulevard, with construction projected to begin in 2019. This work builds off of a Planning and Environmental Linkage (PEL) Study for Wadsworth that was completed in 2015 with input from the local community. The major components of the proposed project are to reconstruct the street to a 6-lane section; provide better bicycle, pedestrian, and transit facilities; manage driveway access to the street; and,

provide enhanced amenity zones along the corridor, particularly in the City Center section between W. 38th and W. 44th Avenues.

During the early stages of the EA for the Wadsworth Widening project, the Colorado Department of Transportation (CDOT) voiced concern over the number of signalized intersections described in the original 2015 Planning and Environmental Linkages (PEL) Study, which was intended to be the design basis for the EA.

This concern led the City to consider alternative design options for the corridor to better align the goals of the City with the needs of CDOT. Of the designs considered, a simple version of a Continuous Flow Intersection (CFI) for both 38th and 44th Avenues seems to meet CDOT and the City's objectives best by helping to reduce congestion while improving the corridor's ability to serve drivers, bikes, pedestrians, and transit. CFIs are innovative intersection designs that are increasingly being used around the country. In Colorado, they can be found in Durango, Loveland, and will soon be built in both Douglas and Arapahoe Counties.

The Final Recommended Alternative for the PEL consists of (see **Figures 2 and 3**):

- 3 lanes of traffic in each direction
- Raised medians
- Wide sidewalks
- Wide tree lawn
- 2-way cycle track from 35th to 44th
- Additional traffic signals with pedestrian crossings

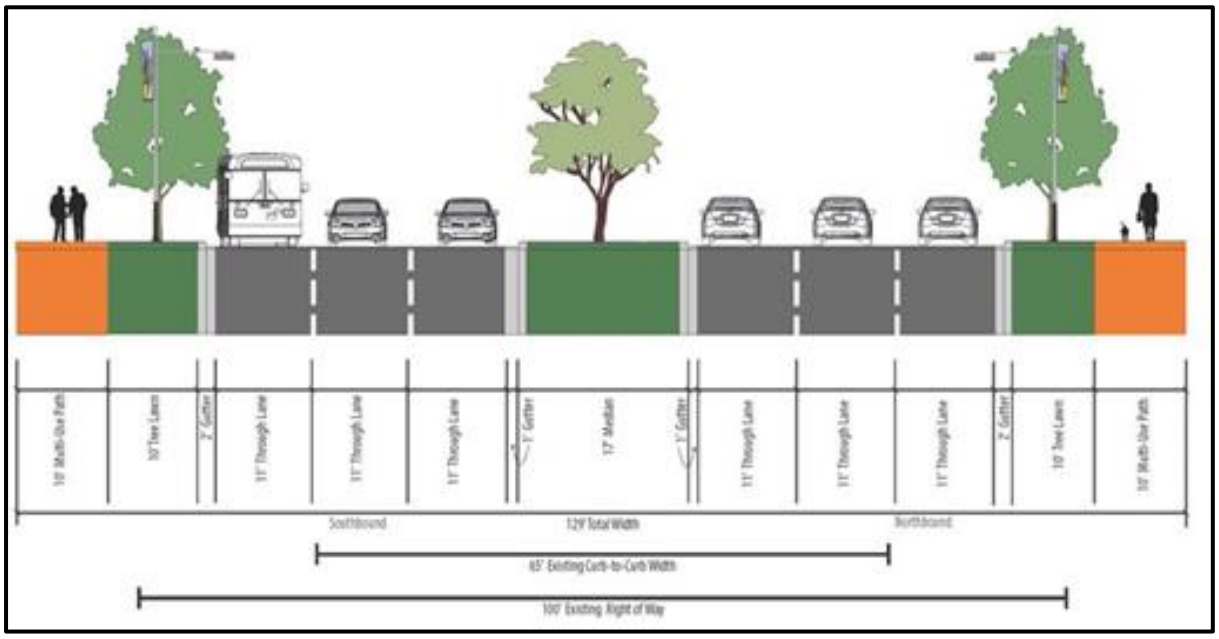


Figure 2: Cross Section North of 44th Avenue

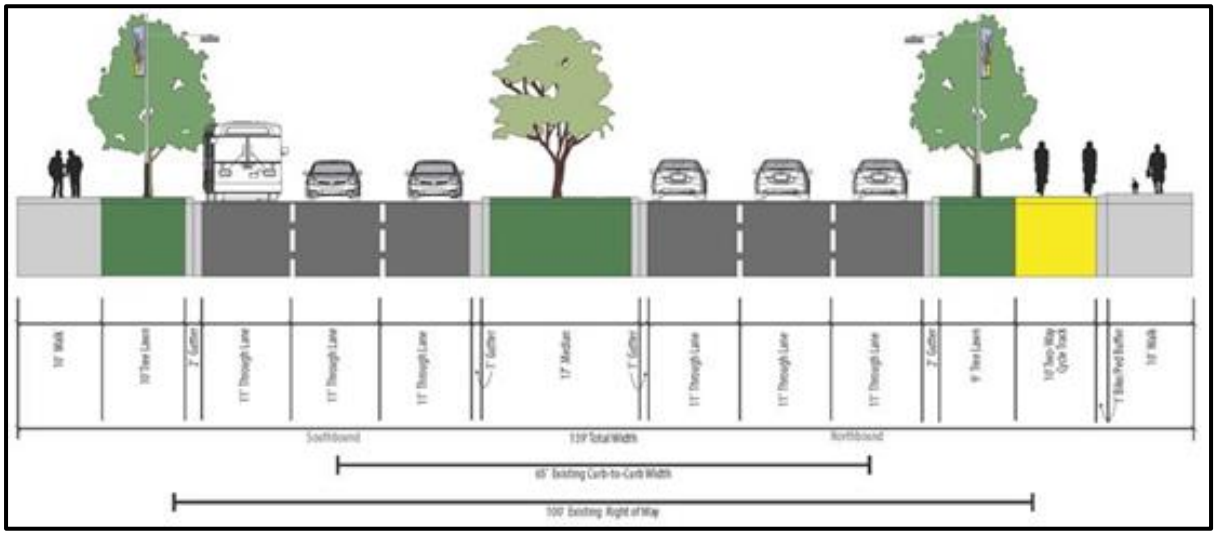


Figure 3: Cross Section South of 44th Avenue

The layout for the proposed CFI is provided in **Figure 4**. The CFIs consist of:

- Displaced left turns
- Thru and turning movements on Wadsworth go at same time
- Cross-over signal 600' before main intersection
- Signalized left turns
- Pedestrian crossings at cross-over signals

The left turns proposed for the CFIs are illustrated in **Figure 5** and the proposed pedestrian crossings are provided in **Figure 6**. The proposed Clear Creek Trail Connection is provided in **Figure 7**.

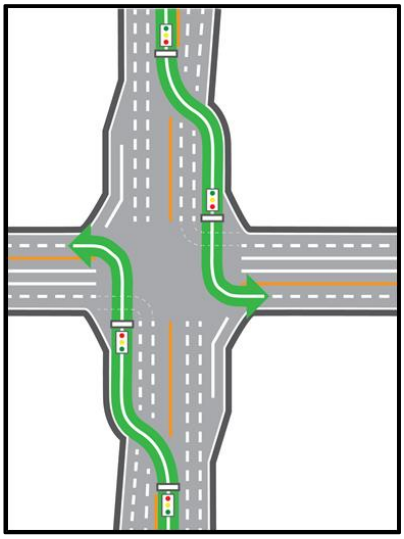


Figure 4: Layout of the CFI designs being considered for the intersections of Wadsworth and 38th and 44th Avenues.

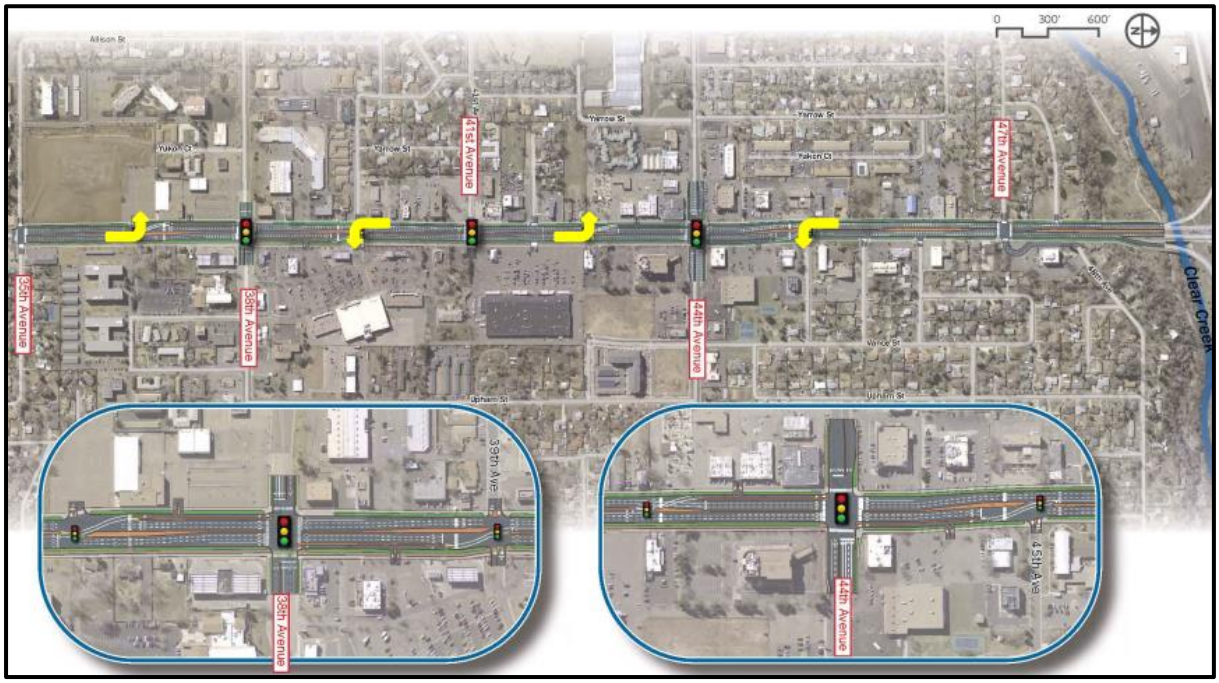


Figure 5: Proposed CFI Left Turns

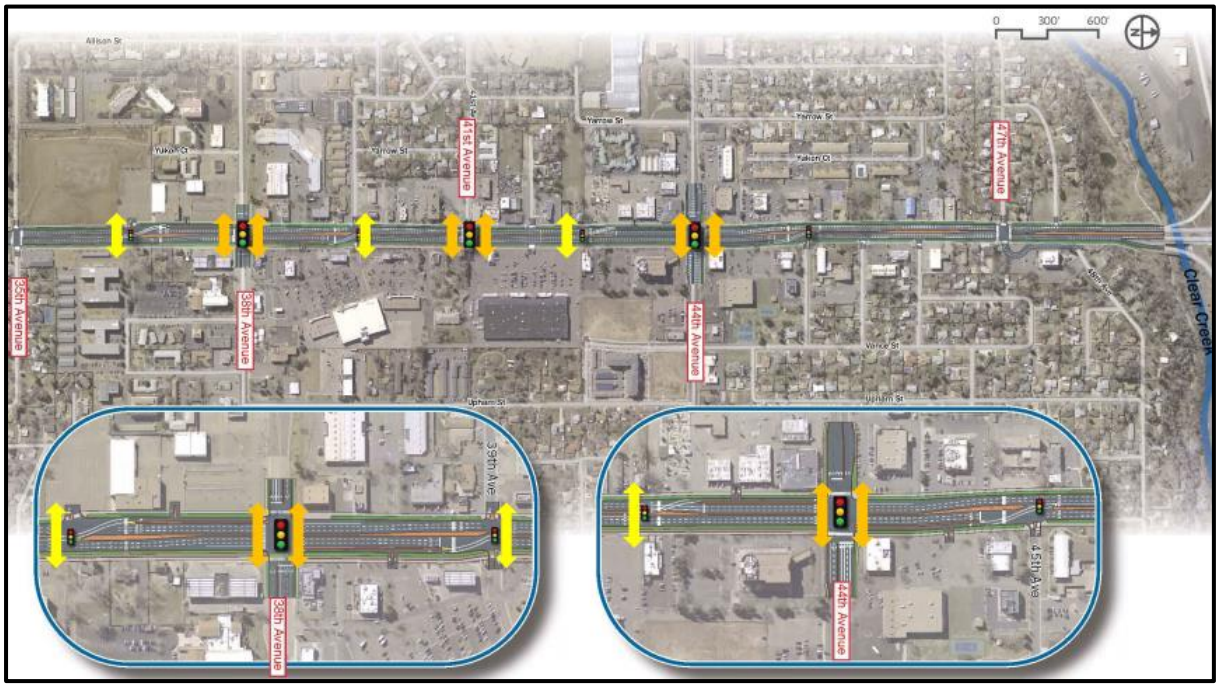


Figure 6: Proposed Pedestrian Crossings

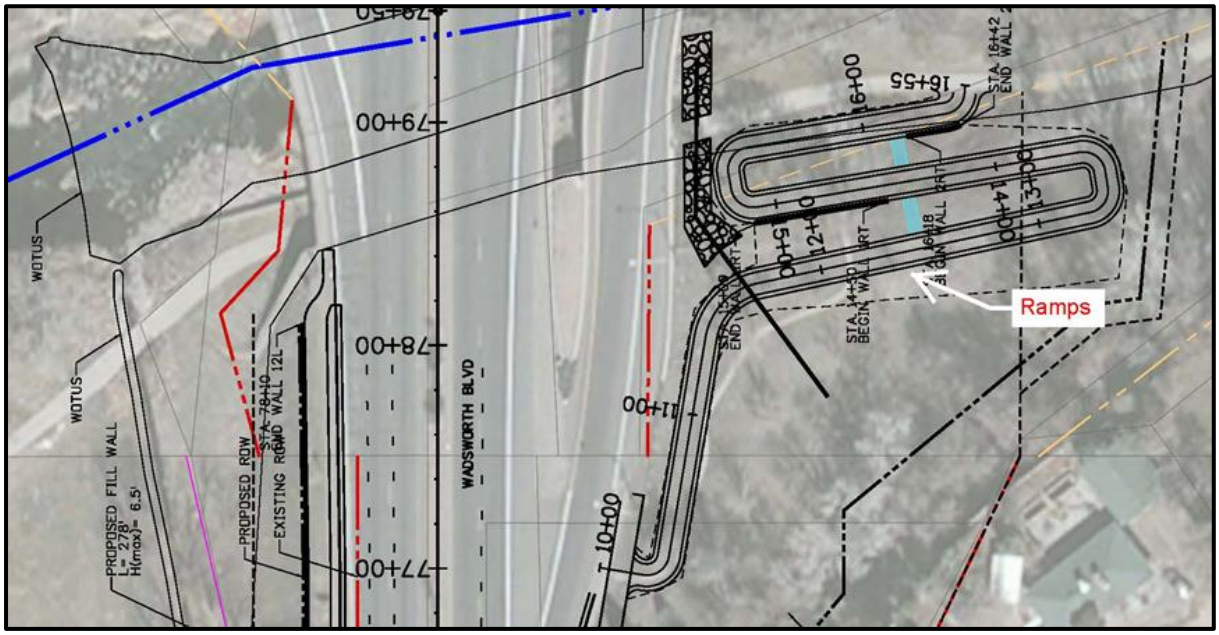


Figure 7: Proposed Clear Creek Trail Connection

4. Value Engineering Process

4.1 Introduction

A 3.5-day Value Engineering (VE) Study was undertaken for the Wadsworth Boulevard Widening Project. Value Engineering is a systematic process, undertaken by a multi-disciplinary team to analyse the functions of a project to satisfy users' needs while improving value. The VE Team identifies critical project functions and evaluates how those functions are proposed to be met in the base case design. Alternative ways are considered to achieve the equivalent functions while increasing the value of the project. The focus of a VE Study is on increasing value rather than simply reducing costs.

The Value Engineering Study was undertaken based on the CDOT Value Engineering Guidelines as well as the SAVE International Value Engineering Methodology, which includes three stages: (1) Pre-Workshop, (2) Workshop, and (3) Post-Workshop, as outlined in the following sections. **Figure 8** illustrates the activities undertaken in each stage of the VE Job Plan.

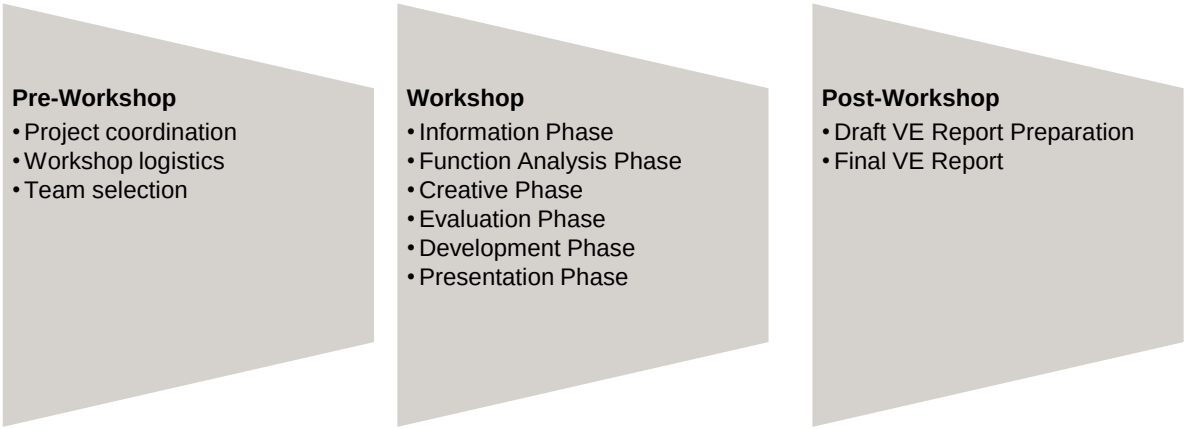


Figure 8: Value Engineering Job Plan

4.2 Pre-Workshop Stage

In the Pre-Workshop Stage, the workshop logistics were determined (i.e., location, duration, dates, agenda, etc.); team members were identified and invited to participate in the workshop; the venue and travel arrangements were finalized; base case information was gathered and compiled; base case information and the agenda were distributed to the VE Team prior to the workshop; and, all required information for the completion of the workshop was gathered/completed (i.e., materials, workshop spreadsheets, etc.).

During the Pre-Workshop Stage, a Pareto Cost Model was generated based on the cost estimate provided in *Appendix D. Detailed Statement of Work, Project Cost and, Schedule of the 2017 TIGER Grant Application, Wadsworth Boulevard Widening Project.* Pareto's Law of Distribution states that 80% of the project costs are found in 20% of the project elements. The Pareto Cost Model is developed to:

- Organize the costs to be understood effectively;
- Identify major costs elements; and,
- Help focus the VE Team efforts on project elements with the most potential for value improvement.

The Pareto Cost Models developed are included in **Appendix A.**

4.3 Workshop Stage

During the workshop portion of the VE Study, the Job Plan was followed. The Job Plan is an organized approach for finding alternatives to improve value. The workshop follows an agenda that details the Job Plan and utilizes a multi-disciplinary team to arrive at the VE Team proposals for implementation.

The workshop portion of the Value Engineering Study was undertaken based on the CDOT Value Engineering Guidelines as well as the SAVE International Value Engineering Methodology, which includes the six phases illustrated in **Figure 9**. The activities undertaken in these six phases are described in the following subsections.

Figure 9: Six-Phase VE Job Plan

4.3.1 Information Phase

The VE Team Leader welcomed the VE Team members to the workshop and followed with a brief kick-off presentation after introductions. The purpose of the kick-off presentation was to provide an overview of the Value Engineering Methodology in order for all VE Team members to understand the process to be followed during the VE Workshop. The agenda for the 3.5-day workshop as well as the Pareto Cost Model were also discussed. The Pareto Cost Model developed during the Pre-Workshop Stage was presented (**Appendix A**).

The purpose of this phase is for the VE Team to obtain a thorough understanding of the project's objectives, design, controlling decisions, issues, constraints, etc. by reviewing the project's documents, drawings, cost estimate, and schedule. After the kick-off presentation, the VE Team discussed the scope of work in the base case design. Following the presentation of the base case design, the VE Team, in addition to City, CDOT and design team staff, undertook a site visit (**Figure 10**). The site visit was invaluable as it provided the VE Team with further understanding of the project.

Figure 10: Site Visit

4.3.2 Function Analysis Phase

Function Analysis transforms the project elements into functions. A function is an expression of what something needs to do without defining how it should be done. Functions are defined in verb-noun

statements to reduce the needs of the project to their most elemental level. Identifying the functions of the project provided the VE Team with an understanding of the functions required for the Wadsworth Boulevard Widening Project. Once the functions were identified, the VE Team developed a Function Analysis Systems Technique (FAST) Diagram. The results of the Function Analysis Phase, as well as further information on the development of the FAST Diagram, are provided in **Appendix B**.

4.3.3 Creative Phase

A VE Team's diverse background most often enhances the creative portion of the VE Workshop, and this VE Workshop was no exception. The facilitator's intent was to create an atmosphere in which team members would be willing to think creatively and "outside the box."

During the Creative Phase, the VE Team brainstormed as many ways as possible to improve value in the project. A positive environment was maintained during the brainstorming session. This phase of the study was conducted as a free flow of ideas session where no idea was a bad idea and no explanations were sought or allowed. The VE Team was looking for quantity and association of ideas that would improve the value in the project. The more ideas generated, the more likely a "breakthrough" idea would be identified that would improve value.

Many of the ideas brought forth in the Creative Phase were a result of work done in the Information Phase and in the Function Analysis Phase. The resulting list of ideas was evaluated during the Evaluation Phase. A complete list of the creative ideas is provided in the Summary of Creative Ideas and Evaluation Table provided in **Appendix C**.

4.3.4 Evaluation Phase

The purpose of this phase is to evaluate the ideas generated during the Creative Phase. The VE Team critically viewed each of the ideas generated during the Creative Phase of the workshop to determine whether the ideas were likely to improve the value of the project.

A "Carried Forward" (CF) or a "NCF" (Not Carried Forward) scoring system was used to evaluate the ideas. A "Design Comment" (DC) score was given to the ideas that the VE Team thought had potential to improve value but did not have the information or time to fully explore the idea. Only ideas that scored a "CF" or "DC" were evaluated further during the Development Phase. The results of the Evaluation Phase are provided in the Summary of Creative Ideas and Evaluation Table provided in **Appendix C**.

4.3.5 Development Phase

VE Team members were assigned the CF and DC ideas to develop into VE Proposals or Design Comments based on their areas of expertise. The developer was instructed to use the entire team as a resource in the development of the idea. VE Proposals and Design Comments were developed as far as time and resources would allow during the VE Workshop.

Each VE Proposal included a summary of the base case design, a description of the suggested change, a list of advantages and disadvantages of the VE Proposal compared to the base case design, a brief narrative comparing the base case design with the VE Proposal, and a comparison of the costs associated with the base case design relative to the proposed change. Sketches of the base case and proposed design were also provided, if applicable. Design Comments were also developed to the same level of detail as the VE Proposals, but no costs were estimated. The completed VE Proposals and Design Comments are provided in **Section 5** of this report.

4.3.6 Presentation Phase

The preliminary results of the VE Study were presented to City, CDOT, FHWA and design team staff in the morning of May 3rd, 2018. The list of presentation attendees is provided in **Appendix D**.

4.4 Post-Workshop Stage

The Post-Workshop activities for this project include:

- **Draft VE Report:** Prepare and submit the Draft VE Report, which provides a complete documentation of the VE Study; and,
- **Final VE Report:** Finalization of the Draft VE Report based on the comments received.

5. VE Proposals and Design Comments

5.1 Introduction

During the Creative Phase, the VE Team brainstormed as many ways as possible to achieve the project's functional requirements by generating **70** creative ideas. The results of the Wadsworth Boulevard Widening Project VE Study are presented in **19** VE Proposals and **23** Design Comments. A summary of the results of the Evaluation Phase are presented in **Table 5**.

Table 5: Summary of Evaluation Phase Results

Value Target Area	No. of Ideas	No. of VE Proposals	No. of Design Comments	No. of Ideas Dismissed	No. of Ideas Developed with Others	No. of Ideas Already Being Done	No. of Ideas Dropped During Develop-ment
Corridor (C)	19	9	5	4	0	1	0
35th to 38th (35/38)	11	1	5	2	1	2	0
38th to 39th (38/39)	8	0	2	3	3	0	0
39th to 44th (39/44)	10	1	3	2	4	0	0
44th to I-70 (44/I-70)	22	8	8	3	1	1	1
Total	**70**	**19**	**23**	**14**	**9**	**4**	**1**

5.2 Organization of VE Proposals and Design Comments

This section contains the complete documentation of the VE Proposals and Design Comments that resulted from the VE Study. The idea from which the VE Proposal or Design Comment began is provided. The complete list of creative ideas and their evaluation is provided is in the Summary of Creative Ideas and Evaluation Table provided in **Appendix C** of this report.

Each VE Proposal is documented by a separate write-up that includes:

- A description of both the original design and proposed change;
- A list of advantages and disadvantages;
- Discussion/justification, where appropriate;
- Sketches, where appropriate;
- Calculations; and,
- Cost estimates for both the original design and proposed change.

Each Design Comment, which was developed, is documented by a separate write-up that includes:

- A description of both the original design and proposed change;
- A list of the advantages and disadvantages;
- Discussion/justification, where appropriate; and,
- Sketches, where appropriate.

Value Engineering Studies are working sessions for the purpose of developing and proposing alternative ideas for the project. As such, the VE Proposals and Design Comments were developed as far as time and resources would allow during the 3.5-day workshop and are based on the information provided to the VE Team at the time of the workshop. The VE Proposals are conceptual in nature and not intended as final designs. Detailed feasibility and final design development of any VE Proposals and Design Comments presented herein, should they be accepted, remain the responsibility of the City, CDOT and the design team. VE Team members have not and will not sign or seal any VE Proposals and Design Comments contained in this report as certifiable engineering or architectural designs.

The cost estimates for the VE Proposals were developed using the cost estimate provided in *Appendix D. Detailed Statement of Work, Project Cost and, Schedule of the 2017 TIGER Grant Application, Wadsworth Boulevard Widening Project.* Right of way costs were taken from the Wadsworth ROW Cost Estimate Spreadsheet dated March 2, 2018, and were generally based upon a unit cost of $25 per square foot. The cost savings provided include right-of-way and construction costs but do not include any potential savings in demolition costs. The cost estimates prepared for this VE Study were developed solely for the purpose of comparing the costs of VE Proposals to the functional equivalent in the base case. The VE Team had limited time and resources to prepare cost estimates for each VE Proposal. Therefore, these cost estimates are not recommended to be used for budgeting or construction purposes. The City, CDOT and the design team should more accurately quantify any saving/additional costs of the VE Proposals they accept.

5.3 Acceptance of VE Proposals and Design Comments

This report includes VE Proposals and Design Comments that could enhance the value of this project. These VE Proposals and Design Comments should be evaluated individually, as they require additional design, cost estimating, and/or evaluation prior to implementation. Consideration should be given to the areas of a VE Proposal or Design Comment that are acceptable, and only those parts should be implemented. Any VE Proposal or Design Comment can be accepted in whole or in part.

The VE Proposals and Design Comments were developed based on the information provided to the VE Team prior to and during the workshop. As the design proceeds, new information may become available, and this information should be evaluated for potential impacts on the VE Proposals and Design Comments.

5.4 VE Proposals

The **19** VE Proposals developed by the VE Team are presented in this section. They are discussed in the order in which they are listed in **Table 2**.

VE PROPOSAL VE-1	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: C-2** **Date: May 1, 2018**
DESCRIPTION OF VE PROPOSAL: **Use a multi-use trail on the east side of the corridor in lieu of separate bike and ped facilities**	**Page No. 1 of 2** **Prepared By: Russ Higgin/Stephen McQuilkin**

ORIGINAL DESIGN:
The 10 foot wide two way cycle track is from the 35th Ave to 44th Ave.

PROPOSED DESIGN:
Remove the two way cycle track from 35th to 44th and widen the proposed sidewalk to a 12 foot wide shared path.

ADVANTAGES:

- Saves costs on construction, right of way and future maintenance

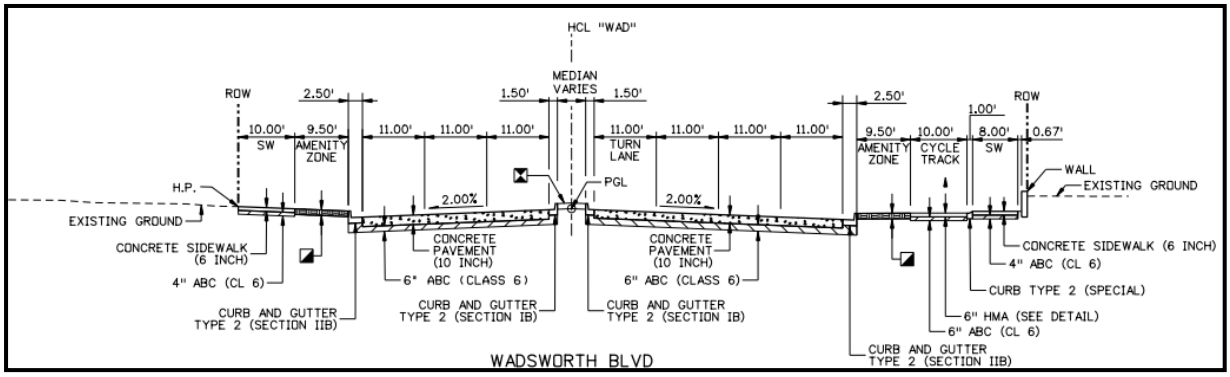
DISADVANTAGES:

- Does not provide separate pedestrians and bicycle facilities

DISCUSSION/JUSTIFICATION
The current Wadsworth corridor north and south of this project does not have any separate cycle tracks. The proposed connection to the Clear Creek Regional Trail is proposed as a shared use facility. The only continuous east west bike facility that currently connects to Wadsworth in Wheat Ridge is at 32nd Ave.

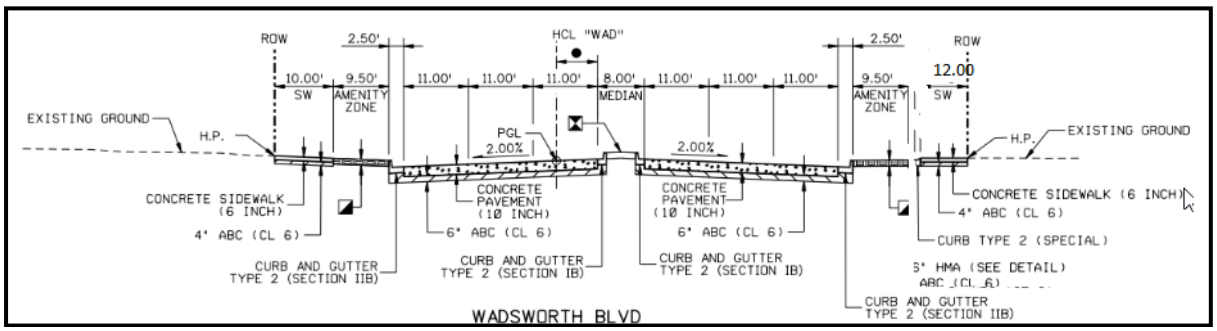
SUMMARY OF COST ANALYSIS	
	Construction Cost
ORIGINAL DESIGN	$1,149,741.72
PROPOSED DESIGN	$371,546.17
ESTIMATED SAVINGS	**$778,195.55**

ORIGINAL DESIGN SKETCH:



VE PROPOSAL VE-1	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: C-2** **Date: May 1, 2018**
DESCRIPTION OF VE PROPOSAL: **Use a multi-use trail on the east side of the corridor in lieu of separate bike and ped facilities**	**Page No. 2 of 2** **Prepared By: Russ Higgin/Stephen McQuilkin**

PROPOSED CHANGE SKETCH:



Construction Item		Current Design			Proposed Design		
Item	**Units**	**No. of Units**	**Cost / Unit**	**Total**	**No. of Units**	**Cost / Unit**	**Total**
Cycle Track HMA	Ton	1,393	$127.31	$177,342.83			
Concrete Share Use	SY				1,689	$52.51	$80,632.86
Class 6 6”	CY	703.7	$31.83	$22,398.89			
Class 6 4”	CY				185.8	$31.83	$5,913.31
Right of Way	SF	38,000	$25	$950,000	11,400	$25	$285,000
Total				$1,149,741.72			$371,546.17
						Net Cost Avoidance	**$778,195.55**

VE PROPOSAL VE-2	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: C-3** **Date: May 2, 2018**
DESCRIPTION OF VE PROPOSAL: **Permanent easement for amenity zone and sidewalks in lieu of purchasing right-of-way throughout the project**	**Page No. 1 of 2** **Prepared By: Gary Huber and Stephen McQuilkin**

ORIGINAL DESIGN:
City of Wheat Ridge will buy all right-of-way (ROW) for the amenity zone and sidewalks (everything back of curb) and maintain these amenity zones and sidewalks and outside amenities.

PROPOSED DESIGN:
Update city codes to allow for permanent easements on private properties to be used by the City of Wheat Ridge for amenity zones, sidewalks and related amenities and in return, the City will maintain these amenity zones and sidewalks.

ADVANTAGES:
- Reduced ROW costs, with property easement costs at roughly two-thirds of full acquisition;
- Owner can include this distance for setbacks and landscape area and as a larger parcel qualifies for more development at the county level; and,
- Owner doesn't have to worry about maintenance

DISADVANTAGES:
- City would need to add language to city code to allow this to happen and explain all possible maintenance and future costs;
- Property easements may have limitations on some obstacles, such as utility vaults;
- There may be other utilities in this property easement under these sidewalks, so utility companies will be able to maintain their utilities by coordination with owner. This may or may not require permits; and,
- City may have to replace sidewalk when owner renovates their property or changes access.

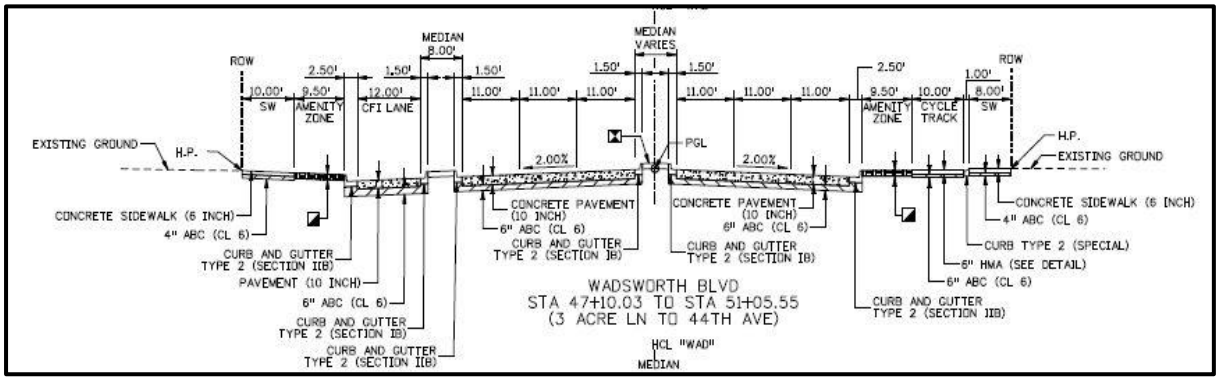
DISCUSSION/JUSTIFICATION:
Property easements will be a benefit to this project as they are a lower cost overall. Property easements are approximately two-thirds the cost of full ownership, but would also require city code be updated to include the language (city's cost of which is not included in this proposal).

SUMMARY OF COST ANALYSIS	
	Construction Cost
ORIGINAL DESIGN	$6,273,750
PROPOSED DESIGN	$4,183,336
ESTIMATED SAVINGS	**$2,090,414**

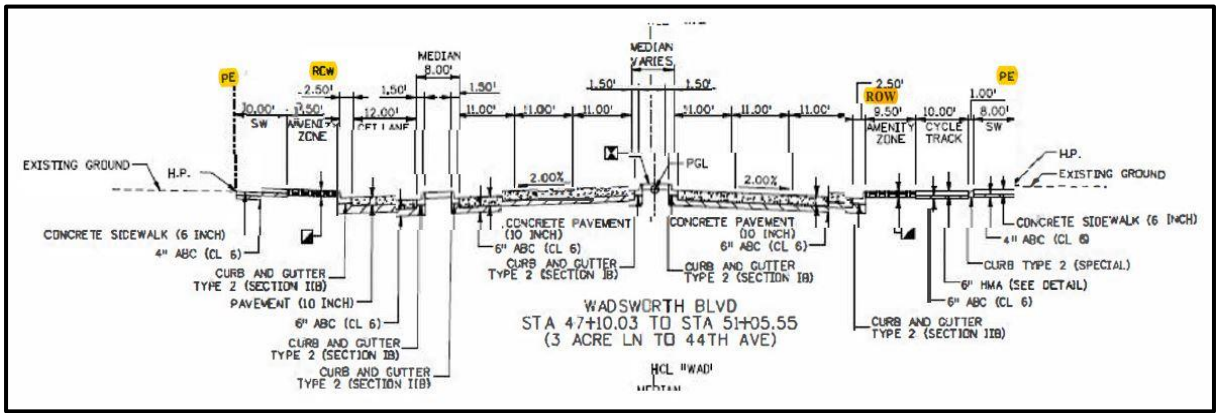
Assume dimensions of sidewalks and amenity zones are:
Length (Rt): Sta. 10+50 to Sta. 57+50 = 4700 ft, Length (Lt) 1300 ft. farther
Width (Lt): 10+9.5 = 19.5 ft and Width (Rt): 9.5+10+1+8 = 28.5 ft, so Total Width = 48 ft
Area = (4700 * 48) + (1300 * 19.5) = 250,950 SF

VE PROPOSAL VE-2	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: C-3** **Date: May 2, 2018**
DESCRIPTION OF VE PROPOSAL: **Permanent easement for amenity zone and sidewalks in lieu of purchasing right-of-way throughout the project**	**Page No. 2 of 2** **Prepared By: Gary Huber and Stephen McQuilkin**

ORIGINAL DESIGN SKETCH:



PROPOSED CHANGE SKETCH:



Cost is based upon 2/3 of full cost or $16.67 per SF

Construction Item		Current Design			Proposed Design		
Item	**Units**	**No. of Units**	**Cost / Unit**	**Total**	**No. of Units**	**Cost / Unit**	**Total**
ROW at $25	SF	250,950	$25	$6,273,750	250,950	$16.67	$4,183,336
Total				$6,273,750			$4,183,336
						Net Cost Avoidance	**$2,090,414**

VE PROPOSAL VE-3	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: C-5** **Date: May 1, 2018**
DESCRIPTION OF VE PROPOSAL: **Use asphalt in lieu of concrete throughout the project**	**Page No. 1 of 2** **Prepared By: J. Hampton**

ORIGINAL DESIGN:
The original pavement design depicts a 10-inch thick Concrete Pavement section throughout the project.

PROPOSED DESIGN:
Using the provided pavement design report, the proposed design change would include a 7.5-inch thick HMA Pavement section throughout the project. There is no proposed change to base materials as a 6-inch section of ABC Class 6 is required for both.

ADVANTAGES:
- Reduction in upfront construction costs;
- Allows more flexibility in construction phasing; and,
- Significantly less construction time due to cure time associated with concrete

DISADVANTAGES:
- Increased future maintenance costs; and,
- Significant future impacts to motorists for multiple maintenance cycles

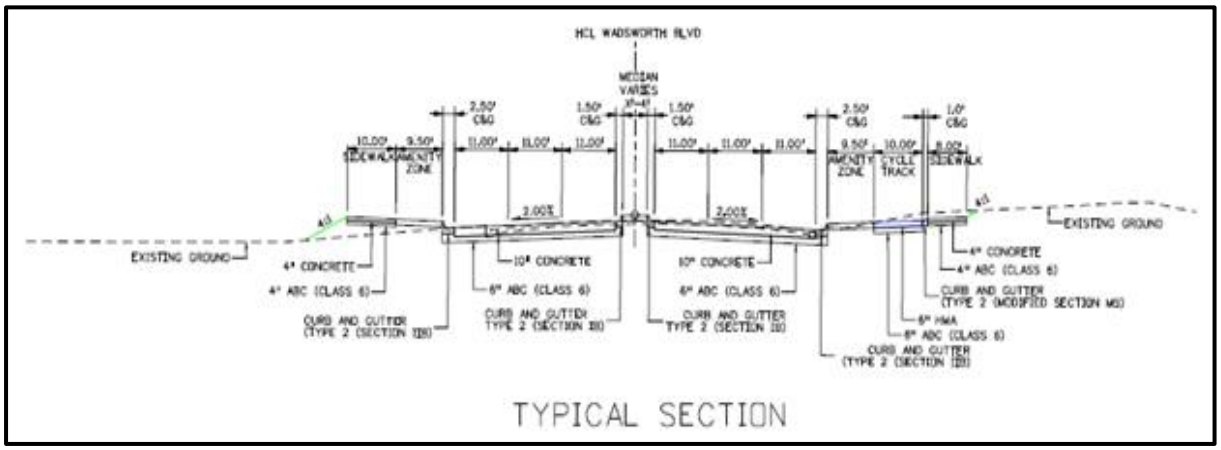
DISCUSSION/JUSTIFICATION:
The largest benefit for using asphalt in-lieu of concrete pavement throughout the corridor is the initial cost savings of materials. The Pavement Design Report information is shown below which includes an initial cost savings at installation. However, it is highly recommended that the Life Cycle Cost Analysis information be taken into consideration as the future maintenance costs outweigh the initial cost savings.

There are no net effects on system or facility performance and no changes to specifications would have to be made.

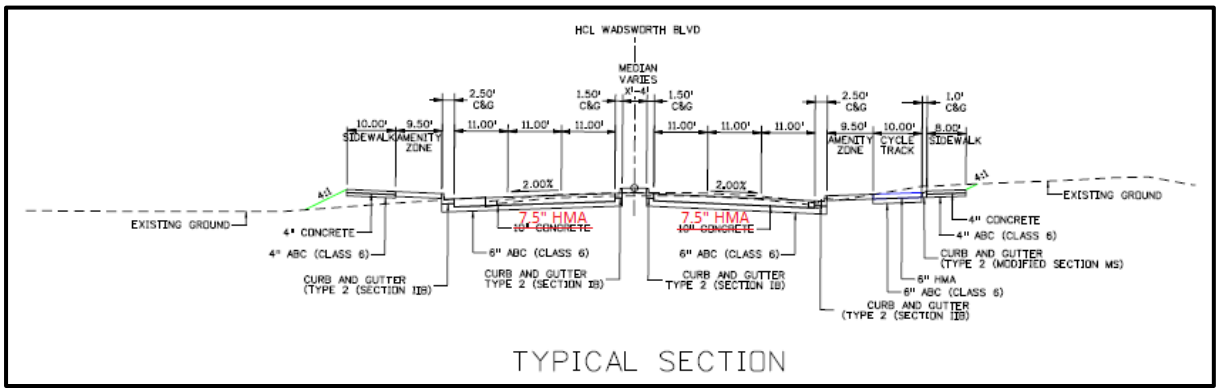
SUMMARY OF COST ANALYSIS	
	Construction Cost
ORIGINAL DESIGN	$4,319,834
PROPOSED DESIGN	$3,491,486
ESTIMATED SAVINGS	**$828,348**

VE PROPOSAL VE-3	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: C-5** **Date: May 1, 2018**
DESCRIPTION OF VE PROPOSAL: **Use asphalt in lieu of concrete throughout the project**	**Page No. 2o f 2** **Prepared By: J. Hampton**

ORIGINAL DESIGN SKETCH:



PROPOSED CHANGE SKETCH:



Construction Item		Current Design			Proposed Design		
Item	**Units**	**No. of Units**	**Cost / Unit**	**Total**	**No. of Units**	**Cost / Unit**	**Total**
Concrete Pavement 10 Inch	LS	1	$4,319,834	$4,319,834	0	$4,319,834	$0
HMA Pavement 7.5 Inch	LS	0	$3,491,486	$0	1	$3,491,486	$3,491,486
Total				$4,319,834			$3,491,486
						Net Cost Avoidance	**$828,348**

VE PROPOSAL VE-4	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: C-6** **Date: May 1, 2018**
DESCRIPTION OF VE PROPOSAL: **Reduce median width throughout the corridor**	**Page No. 1 of 3** **Prepared By: Stephen McQuilkin**

ORIGINAL DESIGN:
Proposed median width along the corridor is variable depending upon the roadway geometry and turn lane requirements. Original design is generally based upon a minimum 8 ft. median width increasing to 19 ft. when combined with an opposing left-turn lane and increases to as much as 30 ft. in conjunction with back-to-back left-turn lanes. Median width along CFI left turn lane is also 8 ft.

PROPOSED DESIGN:
In order to reduce the ROW footprint, this VE idea proposes to reduce the median width by 1 to 2 feet for the entire length of the corridor.

ADVANTAGES:
- Reduced ROW footprint and ROW cost; and,
- Reduced cost of median landscaping and cover material

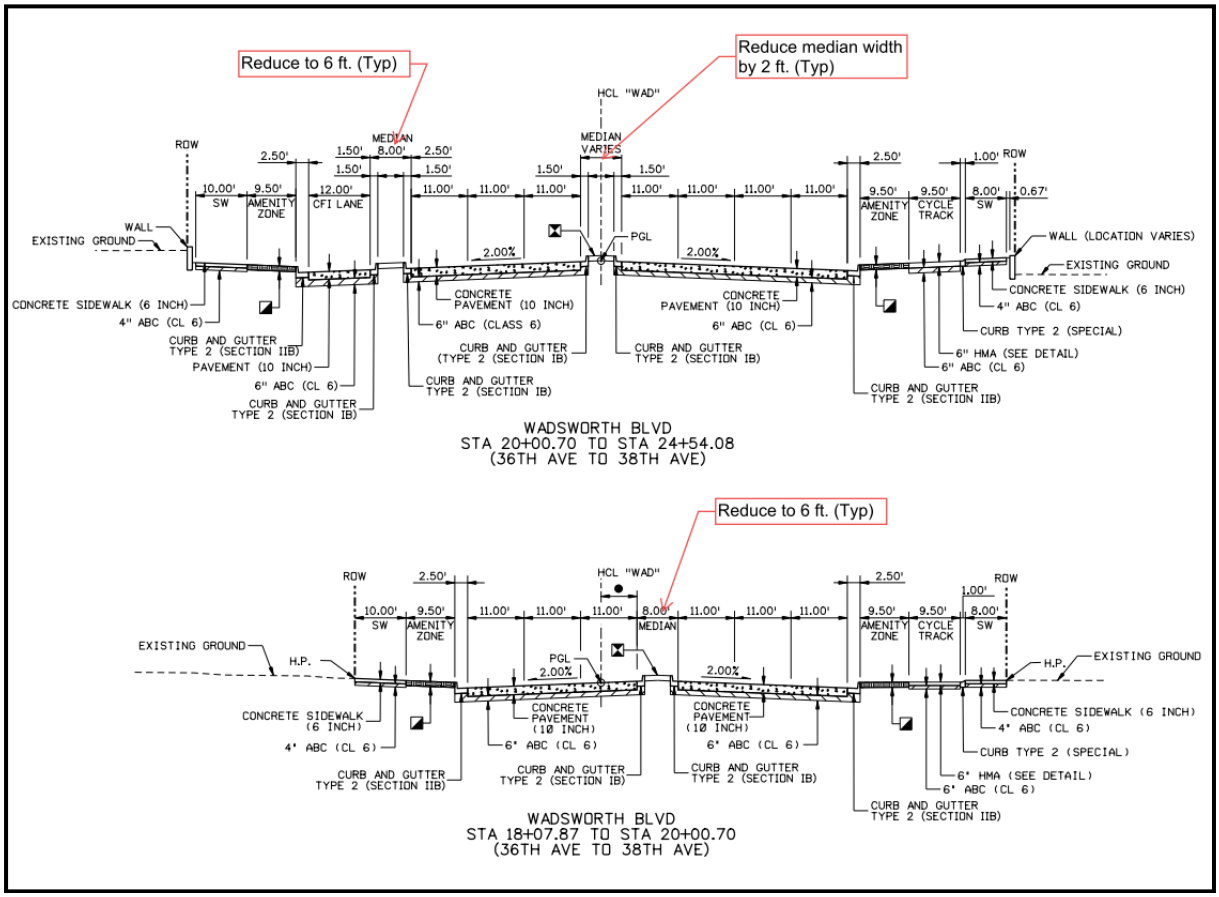
DISADVANTAGES:
- Less room for aesthetic treatment;
- Less separation between opposing roadways; and,
- Less room for signing and other roadway appurtenances

DISCUSSION/JUSTIFICATION:
6 ft. median is adequate per CDOT standards. The reduced median width will accommodate scaled-back landscaping and amenities outlined in other VE Proposals and Design Comments.

SUMMARY OF COST ANALYSIS	
	Construction Cost
ORIGINAL DESIGN	
PROPOSED DESIGN	
ESTIMATED SAVINGS	**1 ft. median reduction = $266,000** **2 ft. median reduction = $536,000**

VE PROPOSAL VE-4	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: C-6** **Date: May 1, 2018**
DESCRIPTION OF VE PROPOSAL: **Reduce median width throughout the corridor**	**Page No. 2 of 3** **Prepared By: Stephen McQuilkin**

PROPOSED CHANGE SKETCH:



1 ft. Median Reduction

Construction Item		Current Design			Proposed Design		
Item	**Units**	**No. of Units**	**Cost / Unit**	**Total**	**No. of Units**	**Cost / Unit**	**Total**
Right of Way	SF				-7,700	$25.00	$192,500
Median Cover Material	SF				-3,700	$7.43	$25,491
Landscaping (Estimated)							$48,000
Total							$266,000
						Net Cost Avoidance	**$266,000**

VE PROPOSAL VE-4	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: C-6** **Date: May 1, 2018**
DESCRIPTION OF VE PROPOSAL: **Reduce median width throughout the corridor**	**Page No. 3 of 3** **Prepared By: Stephen McQuilkin**

2 ft. Median Reduction

Construction Item		Current Design			Proposed Design		
Item	**Units**	**No. of Units**	**Cost / Unit**	**Total**	**No. of Units**	**Cost / Unit**	**Total**
Right of Way	SF				-15,400	$25.00	$385,000
Median Cover Material	SF				-7,400	$7.43	$54,982
Landscaping (Estimated)							$96,000
Total							$536,000
						Net Cost Avoidance	**$536,000**

Assumptions: Costs based upon unit prices from cost estimate included with the TIGER Grant application.

VE PROPOSAL VE-5	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: C-7** **Date: May 1, 2018**
DESCRIPTION OF VE PROPOSAL: **Reduce width of amenity area throughout the corridor**	**Page No. 1 of 2** **Prepared By: J. Hampton**

ORIGINAL DESIGN:
The original design depicts a 9.5-foot wide amenity zone throughout the corridor on both sides of Wadsworth.

PROPOSED DESIGN:
Decrease the amenity zone throughout the corridor to a minimum of 6 feet wide, which is the requirement for the DRCOG Funding.

ADVANTAGES:
- Reduction in ROW/Easement costs;
- Reduction in impacts to private property;
- Reduction in landscape materials/installation costs;
- More room for construction project phasing; and,
- Less future maintenance area

DISADVANTAGES:
- Reduction in area shrinks the buffer between motorists and pedestrians; however, a curb is typically considered the barrier and there is currently not an existing amenity area along the corridor; and,
- Reduction in area limits type of landscaping allowable; however, it was indicated to the VE Team that the businesses do not want trees in the amenity area and the City has difficulty maintaining them

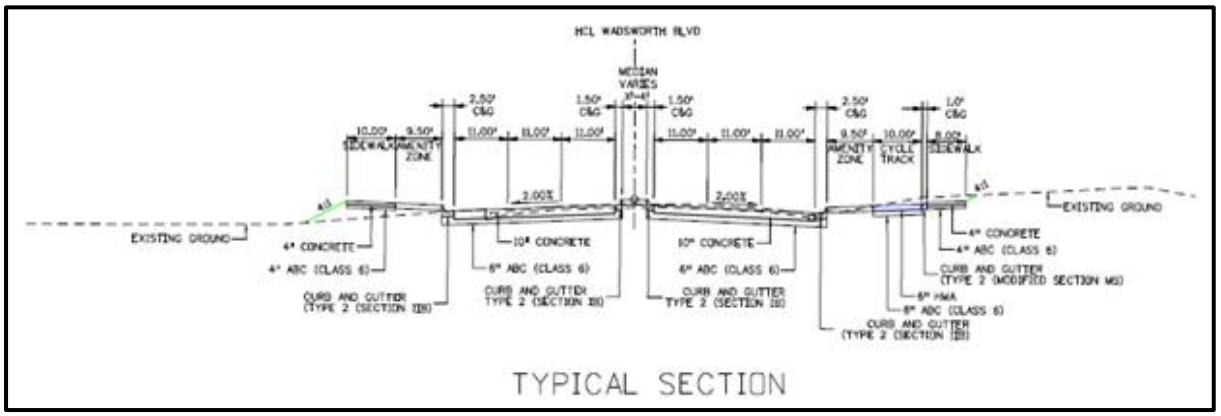
DISCUSSION/JUSTIFICATION:
The largest benefit for the reduction of the amenity zone is the cost benefit of reducing ROW needs by 7 feet total for the length of the corridor. This reduces the overall cost of the project. The original design called for 19 total feet of Amenity Zone and the proposed design requires 12 total feet. This is a 27% reduction in the square footage for the Amenity Zone in the length of the corridor. This 27% reduction was applied to the Landscape and Irrigation estimated cost.

There are no net effects on system or facility performance and increases safety of motorists by removing potential hazards from the clear zone.

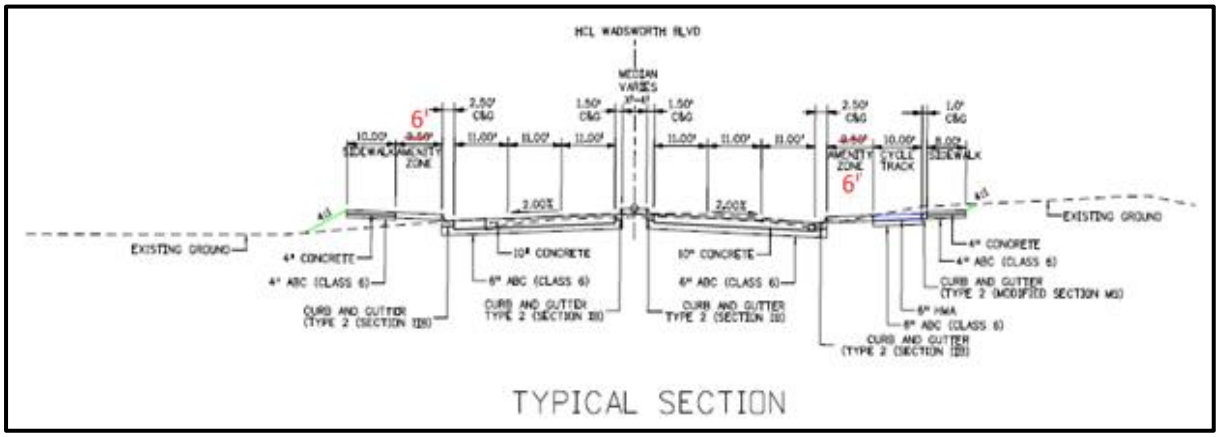
SUMMARY OF COST ANALYSIS	
	Construction Cost
ORIGINAL DESIGN	$4,204,983
PROPOSED DESIGN	$2,751,299
ESTIMATED SAVINGS	**$1,453,684**

VE PROPOSAL VE-5	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: C-7** **Date: May 1, 2018**
DESCRIPTION OF VE PROPOSAL: **Reduce width of amenity area throughout the corridor**	**Page No. 2 of 2** **Prepared By: J. Hampton**

ORIGINAL DESIGN SKETCH:



PROPOSED CHANGE SKETCH:



Construction Item		Current Design			Proposed Design		
Item	**Units**	**No. of Units**	**Cost / Unit**	**Total**	**No. of Units**	**Cost / Unit**	**Total**
Landscape and Irrigation	LS	1	$964,108	$964,108	0.73	$964,108	$703,799
ROW@$25/sqft	SF	129,675	$25	$3,241,875	81,900	$25	$2,047,500
Total				$4,204,983			$2,751,299
						Net Cost Avoidance	**$1,453,684**

VE PROPOSAL VE-6	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: C-12** **Date: May 1, 2018**
DESCRIPTION OF VE PROPOSAL: **Use HMA instead of PCC for sidewalks**	**Page No. 1 of 2** **Prepared By: Darin Freeman**

ORIGINAL DESIGN:
Currently, all sidewalks are proposed to be Portland Cement Concrete.

PROPOSED DESIGN:
Use asphalt in lieu of concrete on the sidewalks throughout the corridor.

ADVANTAGES:
- Hot Mix Asphalt (HMA) could potentially come in at a lower cost compared to Portland Cement Concrete (PCC);
- According to City staff, HMA is somewhat easier to repair and maintain;
- HMA can flex with ground settlements, preventing the issue of separated joints due to heaving soils; and,
- HMA is already in heavy use throughout the corridor in adjoining parking lots.

DISADVANTAGES:
- HMA might not be considered as aesthetically pleasing as PCC; and,
- HMA generally has a lower service life

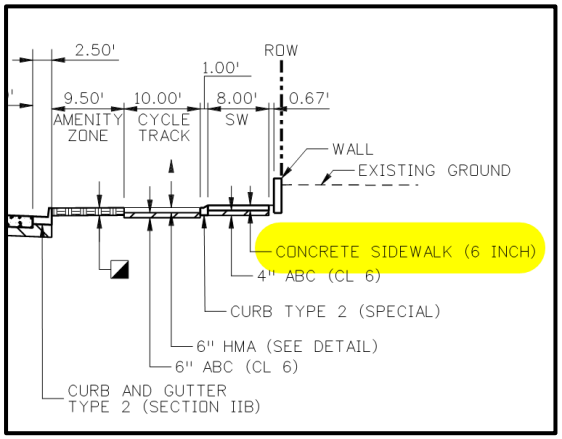
DISCUSSION/JUSTIFICATION:
Given the significant amount of existing Hot Mix Asphalt surface currently surrounding the corridor, it may be advantageous from a cost perspective to use HMA. Based on the cost estimate provided in the TIGER Grant Application, the cost of HMA averages about $120 per ton. The calculation assumes that the 6" concrete is replaced with 6" HMA. Review of 2017 CDOT cost data indicates that the cost of HMA could even get as low as $80 per ton, but for comparison purposes, this discussion uses the values already assumed by the designers.

SUMMARY OF COST ANALYSIS	
	Construction Cost
ORIGINAL DESIGN	$911,250
PROPOSED DESIGN	$765,360
ESTIMATED SAVINGS	**$145,890**

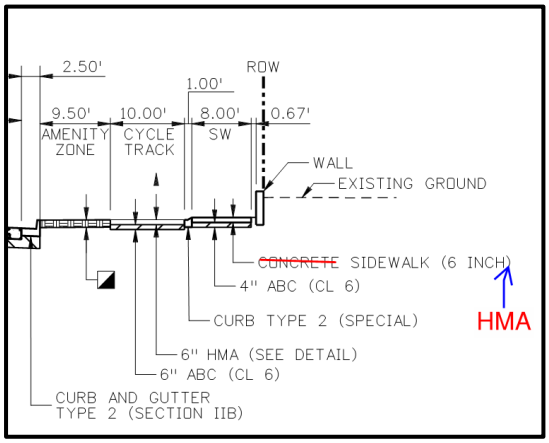
20,250 x $45/SY = $911,250
20,250x9x0.5 = 91,125 Cubic ft x 140/2000 = 6378 tons @ $120 per ton = $765,360

VE PROPOSAL VE-6	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: C-12** **Date: May 1, 2018**
DESCRIPTION OF VE PROPOSAL: **Use HMA instead of PCC for sidewalks**	**Page No. 2 of 2** **Prepared By: Darin Freeman**

ORIGINAL DESIGN SKETCH:



PROPOSED CHANGE SKETCH:



Construction Item		Current Design			Proposed Design		
Item	**Units**	**No. of Units**	**Cost / Unit**	**Total**	**No. of Units**	**Cost / Unit**	**Total**
Concrete Sidewalk (6 Inch)	SY	20,250	$45	$911,250			
Hot Mix Asphalt (Grading SX)(75)(PG 58-28)					6,378	$120	$765,360
Total				$911,250			$765,360
						Net Cost Avoidance	**$145,890**

VE PROPOSAL VE-7	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: C-14** **Date: May 1, 2018**
DESCRIPTION OF VE PROPOSAL: **Reduce project limits**	**Page No. 1 of 4** **Prepared By: J. Hampton**

ORIGINAL DESIGN:
The original design depicts construction of three lanes and intersection improvements from 35th Avenue to Interstate 70 on Wadsworth Boulevard (SH 121).

PROPOSED DESIGN:
Decrease the original design length of the project, moving the northern limit from Interstate 70 to 46th Avenue (Sta. 64+60). The multi-use path may still have to be constructed to complete DRCOG requirements.

ADVANTAGES:
- Reduction in overall project costs to allow beginning construction on a large portion of the project now compared to waiting for additional funding;
- Reduction in impacts to private property; and,
- Reduction in full property takes for ROW

DISADVANTAGES:
- Potentially creates bottleneck from 46th Avenue to Interstate 70; however, it was indicated to the VE Team that the traffic impacts would be minimal through that area based on current traffic counts;
- Potentially creates a situation where a future project continues impacts to the travelling public in this area; and,
- Reduction in costs stated as “Advantages” will be incurred with a future project; future funding will be needed.

DISCUSSION/JUSTIFICATION:
The largest benefit for the reduction of the project limits is the initial cost benefit. This is a reduction of the project by approximately 1/3 of a mile. The reduction in cost allows construction to begin on the 38th and 44th intersections and the median improvements to improve traffic through the corridor. Pedestrian improvements will be completed to increase the pedestrian safety in the corridor.

If accepted, the design would have to be completed through the 46th Avenue intersection and specifications updated accordingly. Drainage design would have to be reviewed and an interim situation designed for drainage to the north. The DRCOG requirements for the corridor would also have to be reviewed to ensure any changes to the multi-use path to the Clear Creek connection would be acceptable. This reduction in limits still assumes that the remainder of the project will be completed as designed.

There are no net effects on system or facility performance for the portion of the corridor that will be completed. It is yet to be determined the overall impact north of 46th Avenue, but it was indicated to the VE Team that the traffic impacts would be minimal and would not increase the current issues.

VE PROPOSAL VE-7	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: C-14** **Date: May 1, 2018**
DESCRIPTION OF VE PROPOSAL: **Reduce project limits**	**Page No. 2 of 4** **Prepared By: J. Hampton**

Summary of overall cost evaluation is shown below in the Summary of Cost Analysis. This study used the cost information provided in the EA Cost Estimate Revised 03/2017. The unit prices used were the 2019 Unit Costs with confidence factors included. The overall reduction in project limits is approximately 20% of the overall length. A 20% deduction was applied to general construction items, force accounts, and items that are used on the entire corridor. Specific items that were analyzed and quantity removal included the Concrete Retaining Wall north of 47th Avenue on the west side and guardrail on the east side at 48th Avenue. The reduction in pipe lengths were counted by stationing and applied only to 18-inch pipe, the remaining pipe sizes were assumed completed in full. Inlets and manholes were counted using the provided utility drawings and reduced accordingly. ROW savings were calculated using the supplied ROW Cost Estimate, specifically comparing the total cost with assumed $30 per square foot and the total cost South of 46th Avenue at $30 per square foot.

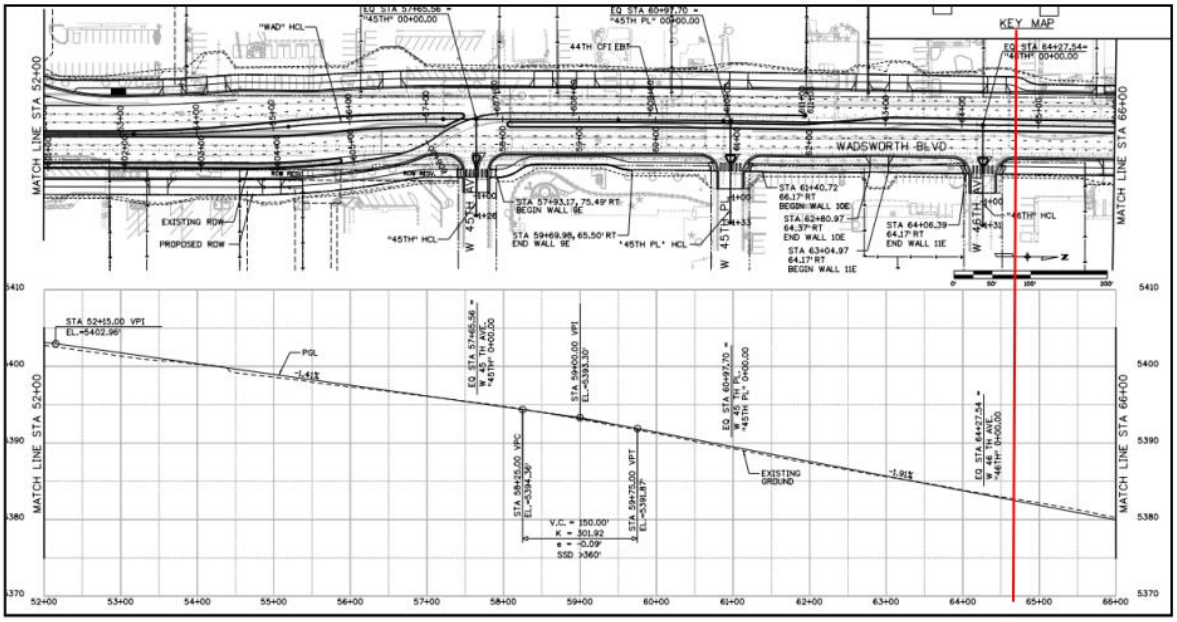
SUMMARY OF COST ANALYSIS	
	Construction Cost
ORIGINAL DESIGN	$62,363,984
PROPOSED DESIGN	$52,849,467
ESTIMATED SAVINGS	**$9,514,517**

ORIGINAL DESIGN SKETCH:

Refer to Sheet 23 and Sheet 24 from EA Plan Set

PROPOSED CHANGE SKETCH:

End Construction Limits at Approximately Sta. 64+60.



VE PROPOSAL VE-7

PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: C-14** **Date: May 1, 2018**
DESCRIPTION OF VE PROPOSAL: **Reduce project limits**	**Page No. 3 of 4** **Prepared By: J. Hampton**

Project Name: Wadsworth EA
Client: City of Wheatridge

CONCEPTUAL COST ESTIMATE

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	REVISED QUANTITY	BASE UNIT PRICE	ORIGINAL TOTAL COST	REVISED TOTAL COST	COMMENTS
201-00000	Clearing and Grubbing	L S	1	0.8	$ 148,526.00	$ 148,526	$ 118,821	
202	Unaccounted (Not Fully Quantified) Removal and Resets	L S		15%		$ 233,899	$ 190,335.01	concrete, sign panels, manholes, fire hydrants, valves
202-00000	Removal of Structures and Obstructions	L S	1	0.8	$ 148,526.00	$ 148,526	$ 118,821	
202-00010	Removal of Tree	EACH	110	88	$ 671.02	$ 73,812	$ 59,050	
202-00019	Removal of Inlet	EACH	54	43	$ 1,166.99	$ 63,017	$ 50,414	counted in street view
202-00035	Removal of Pipe	LF	8,060	6,448	$ 31.83	$ 256,526	$ 205,220	assume length of project trunkline
202-00155	Removal of Wall	LF	495	396	$ 127.31	$ 63,017	$ 50,414	area over by Safeway (knee wall); large one
202-00200	Removal of Sidewalk	SY	7,150	5,720	$ 12.73	$ 91,025	$ 72,820	
202-00203	Removal of Curb and Gutter	LF	30,140	24,112	$ 6.37	$ 191,853	$ 153,483	
202-00210	Removal of Concrete Pavement	SY	6,160	6,160	$ 12.73	$ 78,422	$ 78,422	
202-00220	Removal of Asphalt Mat	SY	90,200	72,160	$ 4.46	$ 401,911	$ 321,529	
202-00240	Removal of Asphalt Mat (Planing)	SY	12,000	9,600	$ 5.09	$ 61,108	$ 48,886	
202-00700	Removal of Light Standard	EACH	82	66	$ 572.89	$ 46,977	$ 37,581	
202-00705	Removal of Light Standard Foundation	EACH	82	66	$ 318.27	$ 26,098	$ 20,879	
202-00805	Removal of Overhead Sign Structure	EACH	1	1	$ 3,819.24	$ 3,819	$ 3,819	removal of NB Wads to EB I-70 overhead sign
202-00810	Removal of Ground Sign	EACH	156	125	$ 114.58	$ 17,874	$ 14,299	10 per block* 13 blocks
202-00828	Removal of Traffic Signal Equipment	L S	0	0	$ 12,730.80	$ -	$ -	
202-00840	Removal of Traffic Signal Pole	EACH	14	14	$ 1,082.12	$ 15,150	$ 15,150	counted
202-00842	Removal of Mast Arm	EACH	14	14	$ 254.62	$ 3,565	$ 3,565	counted
202-00848	Removal of Traffic Signal Controller and Cabinet	EACH	14	14	$ 445.58	$ 6,238	$ 6,238	counted
202-01000	Removal of Fence	LF	806	645	$ 3.18	$ 2,565	$ 2,052	assume tenth the job length
202-05030	Sawing Asphalt Material (10 Inch)	LF	1,229	983	$ 6.37	$ 7,823	$ 6,258	calculated 1 cut per edge of const * width of rdwy
203-00010	Unclassified Excavation (Complete In Place)	CY	51,800	41,440	$ 23.34	$ 1,209,002	$ 967,201	includes roadway and pond
203-00100	Muck Excavation	CY	481	385	$ 14.00	$ 6,736	$ 5,389	estimated 1% of excavation
203-01597	Potholing	HOUR	130	104	$ 274.51	$ 35,686	$ 28,549	estimated
208	Unaccounted (Not Fully Quantified) Erosion Control	L S		30%		$ 45,102	$ 36,015.33	
208-00002	Erosion Log (12 Inch)	LF	11,904	9,523	$ 5.73	$ 68,196	$ 54,557	assume 80% length of project both sides
208-00045	Concrete Washout Structure	EACH	4	3	$ 1,103.34	$ 4,413	$ 3,310	estimated
208-00051	Storm Drain Inlet Protection (Type 1)	LF	1,272	1,018	$ 6.90	$ 8,772	$ 7,017	calculated based on total length of inlet for project
208-00207	Erosion Control Management	L S	1	1	$ 68,958.50	$ 68,959	$ 55,167	estimated
210	Unaccounted Resets and Adjustments	L S				$ 200,000	$ 160,000	sign panels, manholes, fire hydrants, valves
304 - 412	Unaccounted (Not Fully Quantified) Roadway Surfacing	L S		2%		$ 147,333.42	$ 117,866.74	driveways
304-06007	Aggregate Base Course (Class 6)	CY	18,700	14,960	$ 35.01	$ 654,681	$ 523,745	
306-01000	Reconditioning	SY	111,100	88,880	$ 3.21	$ 356,545	$ 285,236	
403-00720	Hot Mix Asphalt (Patching) (Asphalt)	TON	312	250	$ 186.19	$ 58,091	$ 46,473	10% of HMA quantity
403-34721	Hot Mix Asphalt (Grading SX) (75) (PG 58-28)	TON	2,640	2,112	$ 140.04	$ 369,702	$ 295,762	
411-10255	Emulsified Asphalt (Slow-Setting)	GAL	710	568	$ 4.83	$ 3,427	$ 2,742	Calculated based on 0.1gal/sy of HMA, assume 8" HMA
412-00600	Concrete Pavement (6 Inch)	SY	0	0	$ 82.75	$ -	$ -	
412-01000	Concrete Pavement (10 Inch)	SY	78,100	62,480	$ 75.85	$ 5,924,225	$ 4,739,380	Roadway/intersection pavement
506-00218	Riprap (18 Inch)	CY	84	84	$ 137.92	$ 11,585	$ 11,585	
514-00200	Pedestrian Railing (Steel)	LF	2,334	2,334	$ 203.69	$ 475,419	$ 475,419	calculated 50% of total wall length
601	Unaccounted (Not Fully Quantified) Walls	L S		5%		$ 117,505.28	$ 67,855.16	underdrains, geotextile
601-07000	Concrete Retaining Wall	SF	14,400	14,400	$ 68.96	$ 993,002	$ 993,002	unit price assumes reinforcement, struct ex. and backfill
601-07000S	Concrete Retaining Wall (SPECIAL)	SF	9,000	0	$ 110.33	$ 993,002	$ -	caisson wall; unit price assumes reinforcement, struct ex. and backfill
601-40010	Masonry Wall	SF	6,600	6,600	$ 55.17	$ 364,101	$ 364,101	
603 - 604	Unaccounted (Not Fully Quantified) Drainage	L S		2%		$ 90,787.66	$ 88,029.37	
603-01185	18 Inch Reinforced Concrete Pipe (Complete In Place)	LF	3,504	3,066	$ 99.19	$ 347,576	$ 304,129	
603-01245	24 Inch Reinforced Concrete Pipe (Complete In Place)	LF	402	402	$ 116.70	$ 46,913	$ 46,913	
603-01305	30 Inch Reinforced Concrete Pipe (Complete In Place)	LF	384	384	$ 151.71	$ 58,256	$ 58,256	
603-01365	36 Inch Reinforced Concrete Pipe (Complete In Place)	LF	1,760	1,760	$ 198.39	$ 349,163	$ 349,163	
603-01425	42 Inch Reinforced Concrete Pipe (Complete In Place)	LF	710	710	$ 233.40	$ 165,713	$ 165,713	
603-01485	48 Inch Reinforced Concrete Pipe (Complete In Place)	LF	491	491	$ 280.08	$ 137,518	$ 137,518	
603-01545	54 Inch Reinforced Concrete Pipe (Complete In Place)	LF	1,086	1,086	$ 320.92	$ 348,522	$ 348,522	
603-01605	60 Inch Reinforced Concrete Pipe (Complete In Place)	LF	3,827	3,827	$ 373.44	$ 1,429,143	$ 1,429,143	
603-77001	Culvert Headwall (3-Sided Culvert)(Type 1)	EACH	1	1	$ 9,548.10	$ 9,548	$ 9,548	
603-77011	Culvert Wingwall (3-Sided Culvert)(Type 1)	EACH	1	1	$ 19,096.20	$ 19,096	$ 19,096	
604-19105	Inlet Type R L 5 (5 Foot)	EACH	44	39	$ 5,543.20	$ 243,901	$ 216,185	
604-19110	Inlet Type R L 5 (10 Foot)	EACH	4	4	$ 7,702.13	$ 30,809	$ 30,809	
604-19205	Inlet Type R L 10 (5 Foot)	EACH	30	25	$ 9,102.52	$ 273,076	$ 227,563	
604-19210	Inlet Type R L 10 (10 Foot)	EACH	3	3	$ 10,269.51	$ 30,809	$ 30,809	
604-19305	Inlet Type R L 15 (5 Foot)	EACH	3	2	$ 15,987.76	$ 47,963	$ 31,976	
604-19410	Inlet Type R Special (40 Foot)	EACH	4	4	$ 50,923.20	$ 203,693	$ 203,693	
604-30005	Manhole Slab Base (5 Foot)	EACH	3	3	$ 3,909.42	$ 11,728	$ 11,728	
604-30010	Manhole Slab Base (10 Foot)	EACH	19	18	$ 5,251.46	$ 99,778	$ 94,526	
604-31005	Manhole Box Base (5 Foot)	EACH	2	2	$ 6,826.89	$ 13,654	$ 13,654	
604-31010	Manhole Box Base (10 Foot)	EACH	36	36	$ 11,319.80	$ 407,513	$ 407,513	
604-31015	Manhole Box Base (15 Foot)	EACH	4	4	$ 14,003.88	$ 56,016	$ 56,016	
604-31020	Manhole Box Base (20 Foot)	EACH	2	2	$ 17,504.85	$ 35,010	$ 35,010	
604-31025	Manhole Box Base (25 Foot)	EACH	2	2	$ 23,339.80	$ 46,680	$ 46,680	
604	Water Quality Pond	L S	1	1	$ 127,308.00	$ 127,308	$ 127,308	
606-00710	Guardrail Type 7 (Style CA)	LF	330	0	$ 89.12	$ 29,408	$ -	between 48th and NB Wads

VE PROPOSAL VE-7

PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: C-14** **Date: May 1, 2018**
DESCRIPTION OF VE PROPOSAL: **Reduce project limits**	**Page No. 4 of 4** **Prepared By: J. Hampton**

608 - 609	Unaccounted (Not Fully Quantified) Sidewalk Surfacing	L S	2%			$ 51,491.91	$ 44,385.48	
608-00006	Concrete Sidewalk (6 Inch)	SY	23,100	21,518	$ 52.51	$ 1,213,086	$ 1,130,008	
608-00010	Concrete Curb Ramp	SY	77	62	$ 146.40	$ 11,273	$ 9,077	Calculate 40 ramps (counted) by 85 SF ~1.6 SY
609-21010	Curb and Gutter Type 2 (Section I-B)	LF	20,900	16,720	$ 17.50	$ 365,851	$ 292,681	
609-21020	Curb and Gutter Type 2 (Section II-B)	LF	19,800	15,840	$ 19.84	$ 392,809	$ 314,247	
610-00024	Median Cover Material (4 Inch Patterned Concrete)	SF	66,383	53,106	$ 8.91	$ 591,576	$ 473,261	measured island areas
613-30005	Light Standard and Luminaire (Pedestrian)	EACH	162	130	$ 5,728.86	$ 928,075	$ 742,460	assume one every 100' on both sides.
614 / 627	Unaccounted (Not Fully Quantified) Signing, Signals and Striping	L S		10%		$ 181,208.51	$ 179,611.56	
614-00011	Sign Panel (Class I)	SF	1,290	1,032	$ 25.67	$ 33,119	$ 26,495	assume average 8 SF per sign every 100' both sides
614-01502	Steel Sign Support (2-Inch Round)(Post & Socket)	LF	1,191	953	$ 21.64	$ 25,776	$ 20,621	assume 8' height for every 100' on both sides
614-72860	Pedestrian Push Button	EACH	5	5	$ 636.54	$ 3,183	$ 3,183	assume 1EA for locations without signal pole (crossover)
614-72863	Pedestrian Push Button Post Assembly	EACH	29	29	$ 1,273.08	$ 36,919	$ 36,919	assume assembly required on all signal poles
614	4 Legged Signalization of Intersection	EACH	3	3	$ 291,747.50	$ 875,243	$ 875,243	
614	Crossover Signalization	EACH	4	4	$ 204,223.25	$ 816,893	$ 816,893	
614-85001	Impact Attenuator	EACH	3	3	$ 31,827.00	$ 95,481	$ 95,481	both ends of Barrier Ty7 between 48th and NB Wads
619	Waterline Service	EACH	79	68	$ 3,437.32	$ 271,548	$ 233,737.49	Appertunanaces, service connections; 75 properties
620-00002	Field Office (Class 2)	EACH	1	1	$ 68,958.50	$ 68,959	$ 68,959	
620-00012	Field Laboratory (Class 2)	EACH	1	1	$ 20,687.55	$ 20,688	$ 20,688	
621-00450	Detour Pavement	SY	10,400	8,320	$ 46.89	$ 487,675	$ 390,140	Assume 12' by 6000'
625-00000	Construction Surveying	L S	1	1	$ 137,917.00	$ 137,917	$ 110,334	
626-01000	Public Information Services	L S	1	1	$ 70,019.40	$ 70,019	$ 70,019	24 month construction @ $2500/month
627-00005	Epoxy Pavement Marking	GAL	72	58	$ 75.85	$ 5,462	$ 4,369	estimated tab with striping
627-30410	Preformed Thermoplastic Pavement Marking (StopLine)	SF	1,404	1,123	$ 11.03	$ 15,491	$ 12,393	counted 30 spots * 1'x36' (avg)
	SUBTOTAL Bid Items					**$ 25,416,558**	**$ 21,279,129**	
	Force Account Items							
700-70011	F/A Partnering	F A	1	0.8	$ 26,000	$ 26,000	$ 20,800	
700-70016	F/A Fuel Cost Adjustment	F A	1	0.8	$ 65,000	$ 65,000	$ 52,000	
700-70010	F/A Minor Contract Revisions	F A	1	0.8	$ 975,000	$ 975,000	$ 780,000	
700-70019	F/A Asphalt Cement Cost Adjustment	F A	1	0.8	$ 390,000	$ 390,000	$ 312,000	Kept lower, bc $127 (2019)/tn conservative to account for oil price
700-70195	F/A Utilities and Maintenance of Field Facilities	F A	1	0.8	$ 234,000	$ 234,000	$ 187,200	
700-70380	F/A Erosion Control	F A	1	0.8	$ 65,000	$ 65,000	$ 52,000	
700-70589	F/A Environmental Health & Safety Management	F A	1	0.8	$ 26,000	$ 26,000	$ 20,800	
	SUBTOTAL Force Account Items					**$ 1,781,000**	**$ 1,424,800**	
	Additional Costs Not Tabulated							
	Sewer & Service	2%	of Bid Items			$ 508,331	$ 425,583	Pipe, appertunanaces, service connections
	Traffic Control	5%	of Bid Items			$ 1,270,828	$ 1,063,956	1.25 miles of Precast Type 7 = 6600LF*$90/LF = $594,000
	Mobilization	10%	of Bid Items			$ 2,541,656	$ 2,127,913	
	Landscape & Irrigation	5%	of Bid Items			$ 1,270,828	$ 1,063,956	
	Relocation of dry utilities	3%	of Bid Items			$ 762,496.73	$ 638,373.87	Zayo and CDOT FO
	Environmental Mitigation	8%	of Bid Items			$ 2,033,325	$ 1,702,330	noise walls, other
	Construction Engineering	10%	of Bid Items			$ 2,541,656	$ 2,127,913	
	SUBTOTAL Additional Known Costs					**$ 10,929,120**	**$ 9,150,025**	
	CONSTRUCTION TOTAL					**$ 38,126,677**	**$ 31,853,955**	
	ROW and Engineering Costs							
	Right-of-Way Acquisitions	0%	of Bid Items			$ 21,695,651	$ 18,867,600	From separate worksheet
	Preliminary and Final Engineering	10%	of Bid Items			$ 2,541,655.76	$ 2,127,912.90	for design
	SUBTOTAL Engineering					**$ 24,237,307**	**$ 20,995,513**	
	PROJECT TOTAL					**$ 62,363,984**	**$ 52,849,467**	**$ 9,514,517**

VE PROPOSAL VE-8	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: C-16** **Date: May 1, 2018**
DESCRIPTION OF VE PROPOSAL: **Replace trees with bushes**	**Page No. 1 of 3** **Prepared By: Gary Huber**

ORIGINAL DESIGN:
Place trees in Amenity Zone for length of project.

PROPOSED DESIGN:
Place bushes instead of trees for length of project.

ADVANTAGES:
- Businesses are not blocked by growth of the trees;
- Vehicles, bicyclists and pedestrians do not have to duck around tree growths;
- Utilities are not affected by tree roots;
- Topsoil for depths of trees is reduced;
- Obstacles are reduced for errant vehicles;
- Less deep watering is required for upkeep of bushes vs. trees;
- Less maintenance of bushes vs. trees; and,
- Signs are not blocked by bushes

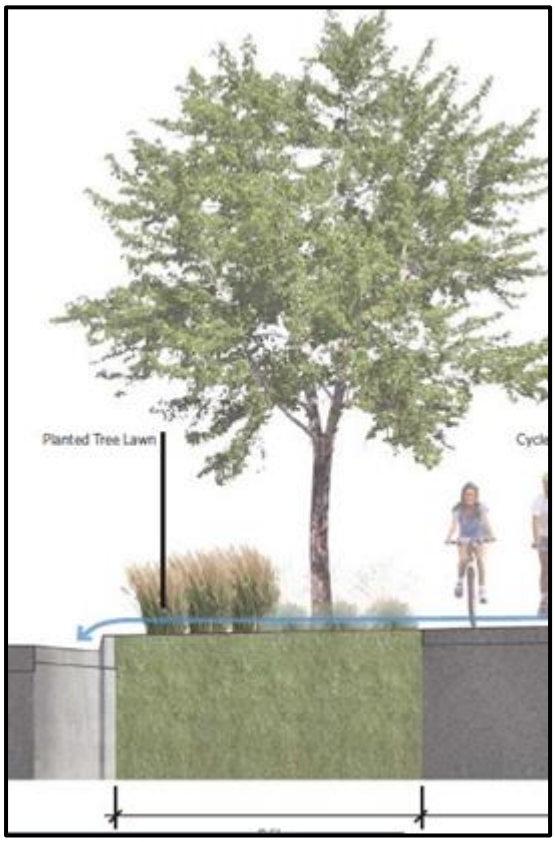
DISADVANTAGES:
- The idea of a tree city is not met;
- The terrain is not broken up as much; too much openness;
- Traffic is not slowed down because of pleasant parkway amenities;
- Urban renewal is not as green;
- Hotter environment due to lack of shade; and,
- Requires slightly more and specific irrigation

DISCUSSION/JUSTIFICATION:
The main reasons of blockage of signs by uncontrolled growth at a larger maintenance cost for water, pruning, and insecticides, lower branches impeding multimodal forms of transportation, and lower costs for construction of bushes vs trees amounts to an outstanding the benefit to this lower cost.

SUMMARY OF COST ANALYSIS	
	Construction Cost
ORIGINAL DESIGN	$964,018
PROPOSED DESIGN	$771,214
ESTIMATED SAVINGS	**$192,804**

VE PROPOSAL VE-8	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: C-16** **Date: May 1, 2018**
DESCRIPTION OF VE PROPOSAL: **Replace trees with bushes**	**Page No. 2 of 3** **Prepared By: Gary Huber**

ORIGINAL DESIGN SKETCH:



PROPOSED CHANGE SKETCH:

VE PROPOSAL VE-8

PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.:** C-16 **Date:** May 1, 2018
DESCRIPTION OF VE PROPOSAL: Replace trees with bushes	**Page No.** 3 of 3 **Prepared By:** Gary Huber

Construction Item		Current Design			Proposed Design		
Item	Units	No. of Units	Cost / Unit	Total	No. of Units	Cost / Unit	Total
Landscape & Irrigation	LS	1	$964,018	$964,018	1	$771,214	$771,214
Total				$964,018			$771,214
						Net Cost Avoidance	**$192,804**

VE PROPOSAL VE-9	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: C-19** **Date: May 1, 2018**
DESCRIPTION OF VE PROPOSAL: **Eliminate ABC from under cycle tracks and sidewalks**	**Page No. 1 of 2** **Prepared By: J. Hampton**

ORIGINAL DESIGN:
The original design depicts 4" of ABC Class 6 under sidewalks and 6" of ABC Class 6 under cycle tracks throughout the corridor on both sides of Wadsworth.

PROPOSED DESIGN:
Eliminate the ABC from under cycle tracks and sidewalks throughout the corridor.

ADVANTAGES:
- Reduction in ABC costs;
- Reduction in unclassified excavation costs; and,
- Reduction in construction time

DISADVANTAGES:
- Elimination of ABC could allow for movement in the subgrade and concrete cracking; and,
- Elimination of ABC would remove drainage layer and could potentially have water issues from adjacent amenity zone

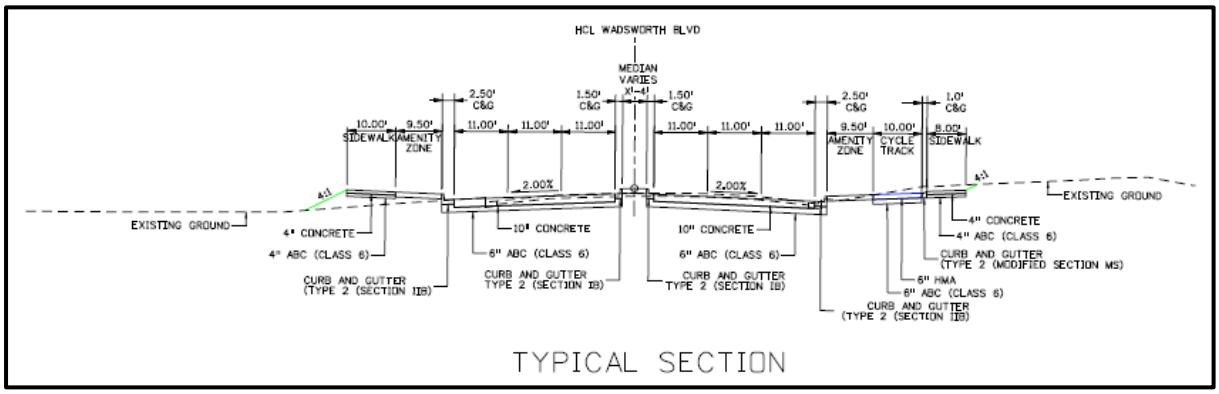
DISCUSSION/JUSTIFICATION:
The largest benefit for the elimination of the ABC layers from under the sidewalks and cycle tracks is the cost savings in reduction of ABC and unclassified excavation quantities. The potential drawback of substandard subgrade under the sidewalk is mitigated by evidence presented in the Pavement Design Report that states the soil types as silty sand and clayey sand. These soil types are stable when compacted and would provide suitable subbase for concrete sidewalk. Additionally, the drainage through sand would mitigate the potential water issues from the amenity zone.

The typical sections would have to be amended to remove this requirement. Additionally, a Project Special Provision would need to be added to amend CDOT Standard Specification Section 608.04 Bituminous Sidewalks and Bikeways, Subsection (b) *Bed Course.*

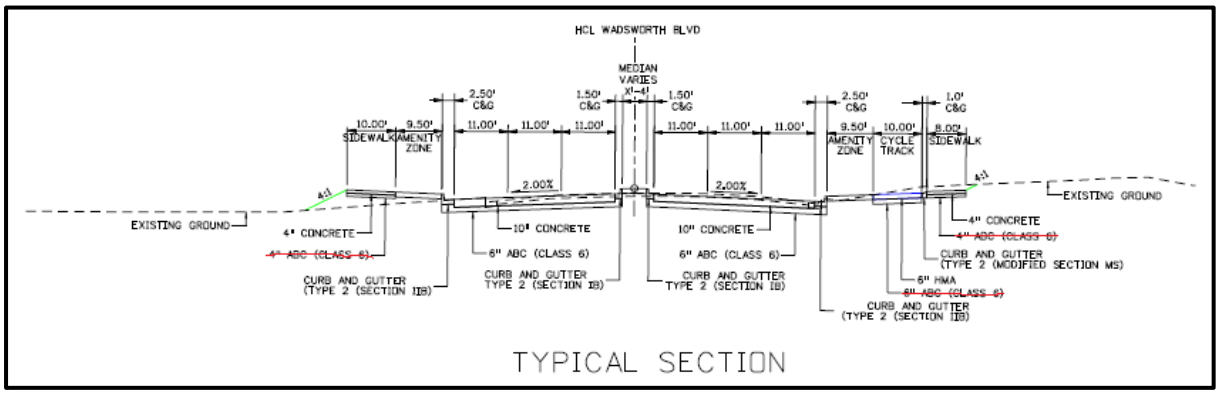
SUMMARY OF COST ANALYSIS	
	Construction Cost
ORIGINAL DESIGN	$1,156,381
PROPOSED DESIGN	$1,001,000
ESTIMATED SAVINGS	**$155,381**

VE PROPOSAL VE-9	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: C-19** **Date: May 1, 2018**
DESCRIPTION OF VE PROPOSAL: **Eliminate ABC from under cycle tracks and sidewalks**	**Page No. 2 of 2** **Prepared By: J. Hampton**

ORIGINAL DESIGN SKETCH:



PROPOSED CHANGE SKETCH:



Construction Item		Current Design			Proposed Design		
Item	**Units**	**No. of Units**	**Cost / Unit**	**Total**	**No. of Units**	**Cost / Unit**	**Total**
Unclassified Excavation (Complete in Place)	CY	32,000	$21.22	$678,976	29,069	$21.22	$616,844
Aggregate Base Course Class 6	CY	15,000	$31.83	$477,405	12,069	$31.83	$384,156
Total				$1,156,381			$1,001,000
						Net Cost Avoidance	**$155,381**

VE PROPOSAL VE-10	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 35/38-11** **Date: May 2, 2018**
DESCRIPTION OF VE PROPOSAL: **Eliminate traffic islands and right turn lanes at 38th and 44th**	**Page No. 1 of 3** **Prepared By: Steve McQuilkin**

ORIGINAL DESIGN:
Original design includes right turn lanes and traffic islands for the Wadsworth NB and SB right turns at both 38th and 44th Avenues. These right turn lanes allow for free right turns at these locations as well as provide an area of refuge for pedestrians crossing Wadsworth and also for an impromptu "Q-jump" lane for NB and SB busses at these intersections.

PROPOSED DESIGN:
Defer construction of islands and right turn lanes until future when traffic volumes warrant or when adjacent properties redevelop and obtain necessary ROW through dedication

ADVANTAGES:
- Reduced ROW and construction cost

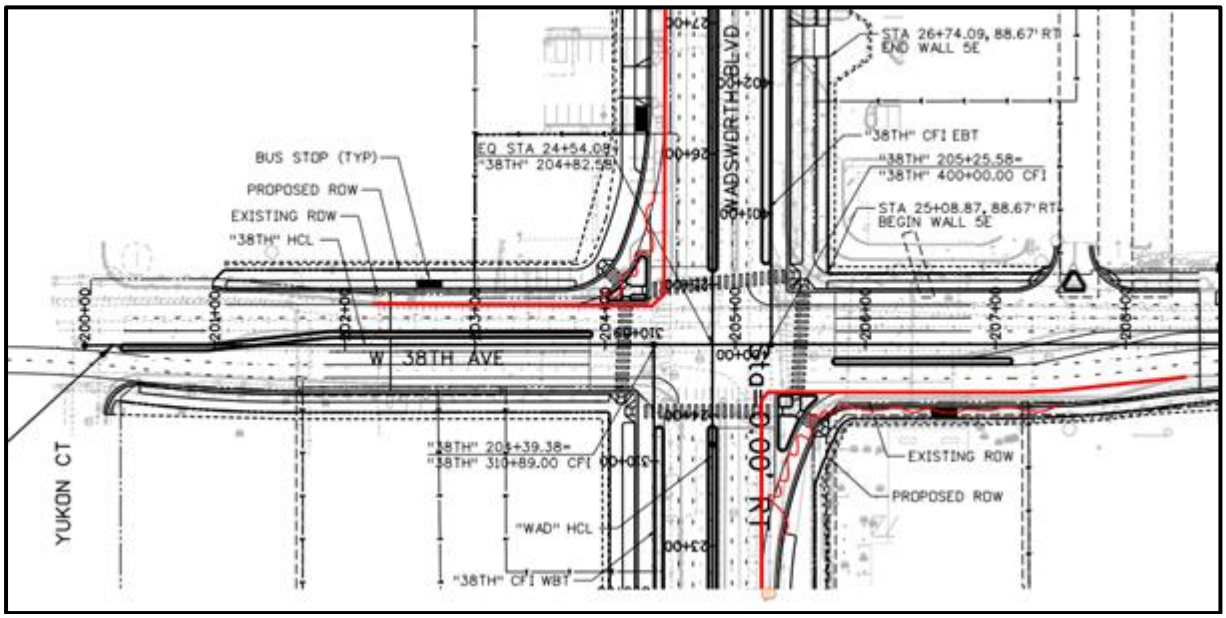
DISADVANTAGES:
- Eliminates pedestrian refuge area for crossing Wadsworth;
- Eliminates Bus "Q-jump" lane;
- Eliminates NB and SB free right turn lanes; and,
- Increase traffic signal mast arm lengths at NW and SW corners of both intersections

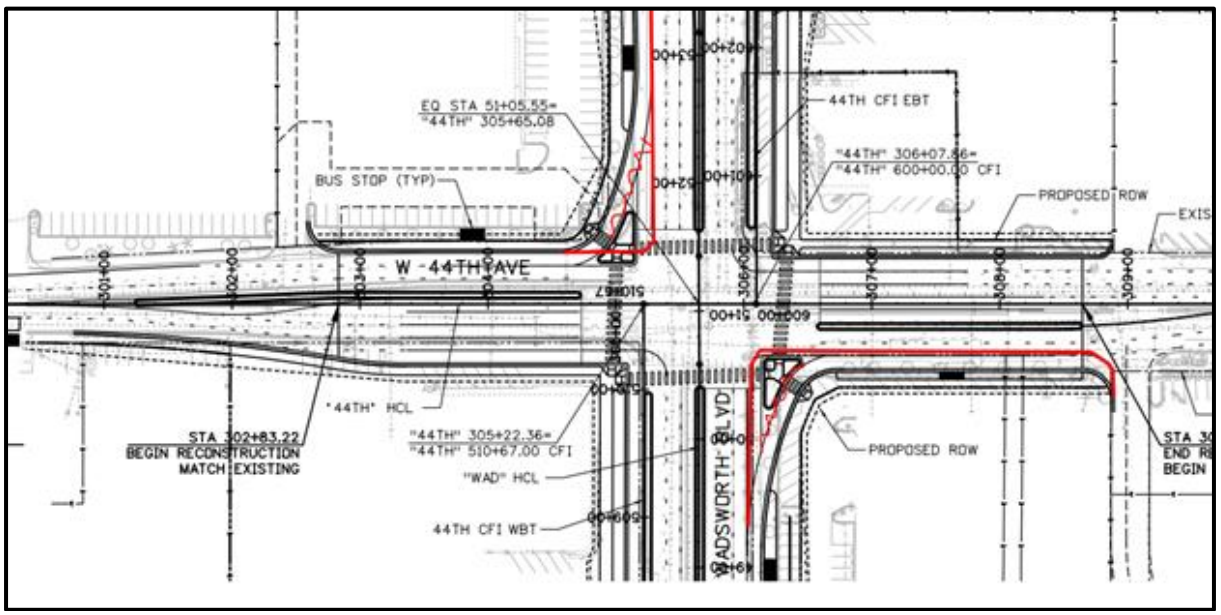
DISCUSSION/JUSTIFICATION:
This will require further discussion with the design team to determine the best way to address this potential change. Since the geometry accommodates Transit Signal Priority, which is not planned to be implemented, the current geometry does not offer any significant ped crossing reduction time across Wadsworth. A traffic operations analysis needs to be undertaken.

SUMMARY OF COST ANALYSIS	
	Construction Cost
ORIGINAL DESIGN	
PROPOSED DESIGN	
ESTIMATED SAVINGS	**$200,491**

VE PROPOSAL VE-10	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 35/38-11** **Date: May 2, 2018**
DESCRIPTION OF VE PROPOSAL: **Eliminate traffic islands and right turn lanes at 38th and 44th**	**Page No. 2 of 3** **Prepared By: Steve McQuilkin**

PROPOSED CHANGE SKETCH:





VE PROPOSAL VE-10

PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 35/38-11** **Date: May 2, 2018**
DESCRIPTION OF VE PROPOSAL: **Eliminate traffic islands and right turn lanes at 38th and 44th**	**Page No. 3 of 3** **Prepared By: Steve McQuilkin**

Construction Item		Current Design			Proposed Design		
Item	**Units**	**No. of Units**	**Cost / Unit**	**Total**	**No. of Units**	**Cost / Unit**	**Total**
ROW	SF				-5089	$25	$127,225
Median Cover Material	SF				-1594	$7.43	$11,843
Concrete Pavement	SY				-389	$69	$26,833
ABC Cl. 6	CY				-65	$32	$2,074
C&G	LF				-484	$17	$8,228
Soft Costs							$24,488
Total				$0			**$200,491**
						Net Cost Avoidance	**$200,491**

Assumptions: Costs based upon unit prices from cost estimate included with TIGER Grant application.

VE PROPOSAL VE-11	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 39/44-10** **Date: May 2, 2018**
DESCRIPTION OF VE PROPOSAL: **Eliminate the exclusive right turn lanes on the east and west legs of 44th Avenue and the east leg of 38th Avenue**	**Page No. 1 of 3** **Prepared By: Gary Huber and Russ Higgins**

ORIGINAL DESIGN:
This is a traffic engineering decision to add exclusive right turns in both directions.

PROPOSED DESIGN:
Eliminate the exclusive right turn movements at 44th in both directions and at 38th on the east leg and provide optional right and thru movements in all of these locations.

ADVANTAGES:
- Less ROW costs; and,
- Right turns cannot be free rights due to CFI lane proximity and two phase signals

DISADVANTAGES:
- Right turns will tie up the thru movement lanes; and,
- Basically, there are few improvements at the 44th Avenue intersection with Wadsworth and the 38th Avenue intersection with Wadsworth

DISCUSSION/JUSTIFICATION:
The main reasons of less cost to buy ROW and to construct such a short dedicated lane will be a benefit to this project as it will be a lower cost overall.

SUMMARY OF COST ANALYSIS	
	Construction Cost
ORIGINAL DESIGN	$276,715
PROPOSED DESIGN	$0
ESTIMATED SAVINGS	**$276,715**

Assume dimension of ROW on 38th is:
L (E): 250 ft and W: 12 ft
Area = 3,000 SF * $25/SF = $75,000 Sidewalk = 250' X 5' / 9 = 139 SY

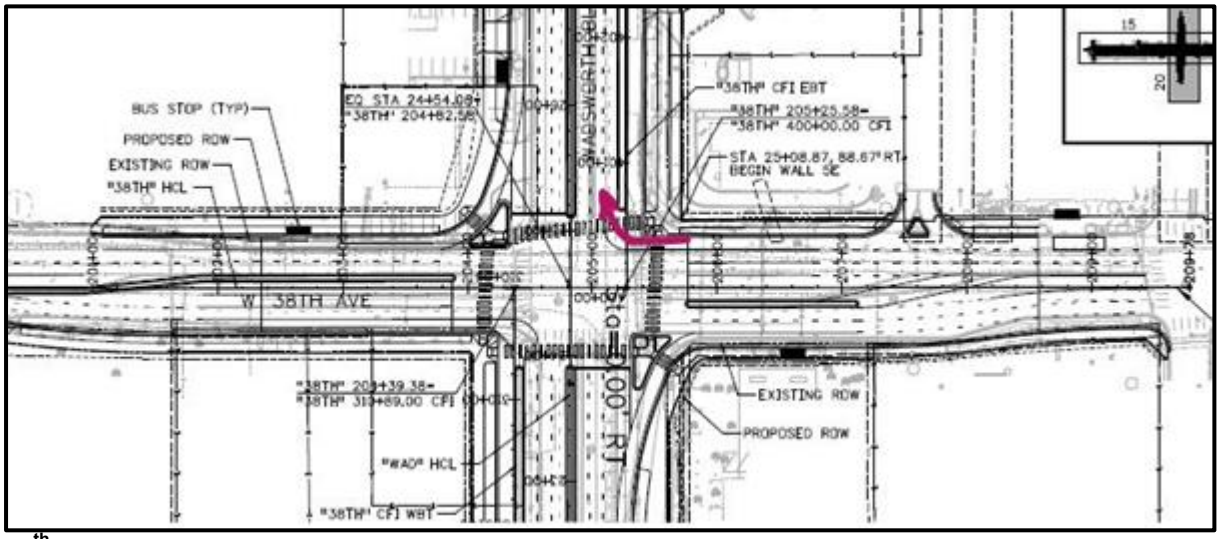
Assume dimensions of ROW on 44th are:
L (E): 300 + L (W): 300 = 600 ft
W (both): 12 ft

Area = 7,200 SF * $25/SF = $180,000 Sidewalk = 600' X 5' / 9 = 333 SY

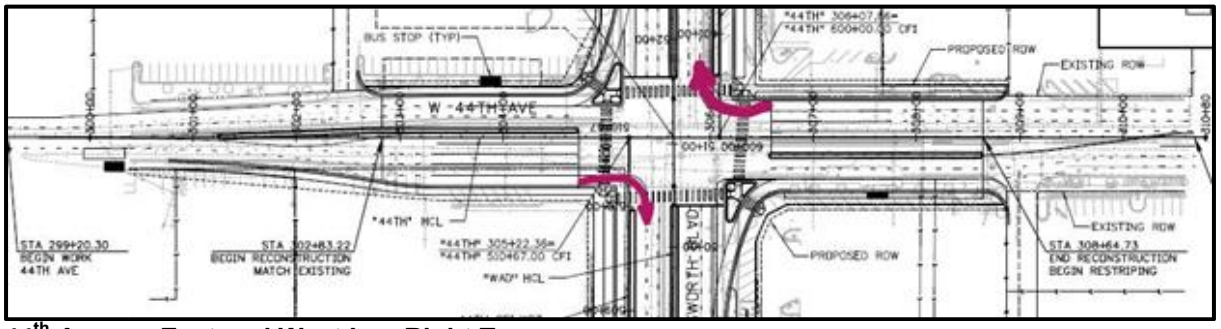
Total ROW = $255,000 Sidewalk = 472 SY

VE PROPOSAL VE-11	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 39/44-10** **Date: May 2, 2018**
DESCRIPTION OF VE PROPOSAL: **Eliminate the exclusive right turn lanes on the east and west legs of 44th Avenue and the east leg of 38th Avenue**	**Page No. 2 of 3** **Prepared By: Gary Huber and Russ Higgins**

ORIGINAL DESIGN SKETCH:

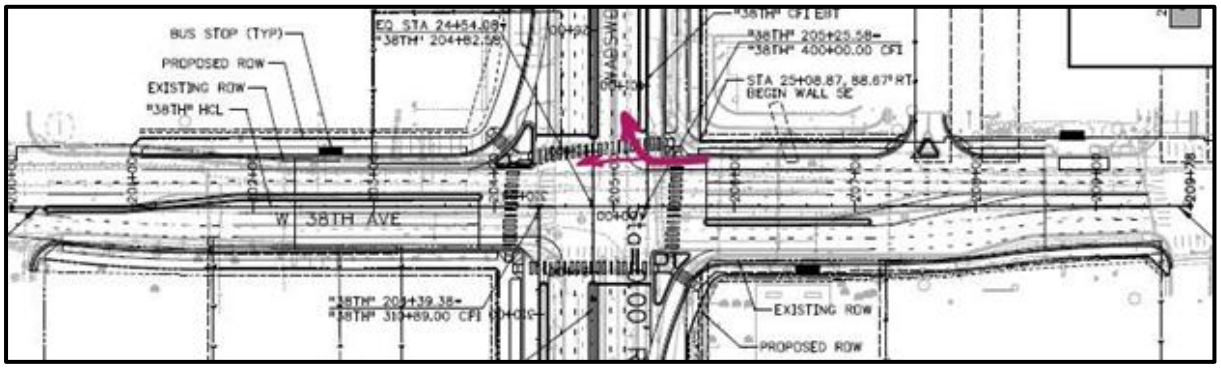


38th Avenue East Leg Right Turn Only Lane

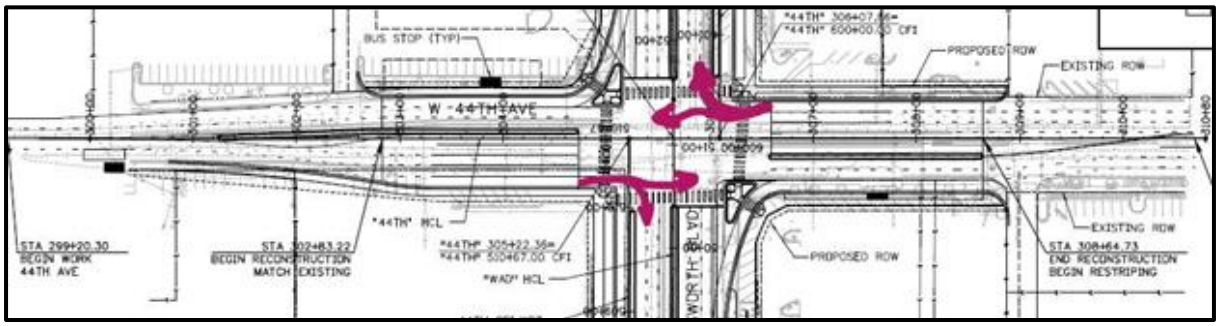


44th Avenue East and West Leg Right Turns

PROPOSED CHANGE SKETCH:



VE PROPOSAL VE-11	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 39/44-10** **Date: May 2, 2018**
DESCRIPTION OF VE PROPOSAL: **Eliminate the exclusive right turn lanes on the east and west legs of 44th Avenue and the east leg of 38th Avenue**	**Page No. 3 of 3** **Prepared By: Gary Huber and Russ Higgins**



Cost of widening is on south edge of 44th Avenue for the west turn lane and the east acceleration lane. 44th Avenue lanes would be shifted to the north by one lane in the proposed design VE proposal.

Construction Item		Current Design			Proposed Design		
Item	**Units**	**No. of Units**	**Cost / Unit**	**Total**	**No. of Units**	**Cost / Unit**	**Total**
ROW at $25	SF	10,200	$25	$180,000	0	$25	$0
Concrete Pavement	SY	800	$65	$52,000	0	$65	$0
Removal of Sidewalk	SY	333	$10	$3,330	0	$10	$0
Removal of Curb and Gutter	LF	1,200	$5	$6,000	0	$5	$0
Curb and Gutter Type 2 Sec IIb	LF	1,200	$17	$20,400	0	$17	$0
Sidewalk	SY	333	$45	$14,985	0	$45	$0
Total				$276,715			$0
						Net Cost Avoidance	**$276,715**

VE PROPOSAL VE-12	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-6** **Date: 5/1/18 Rev. 5/14/18**
DESCRIPTION OF VE PROPOSAL: **Reconfigure 48th Avenue into a Cul-de-Sac with limited access**	**Page No. 1 of 3** **Prepared By: Darin Freeman/ Steve McQuilkin**

ORIGINAL DESIGN:
48th Avenue takes a circuitous route through the 4800 Wadsworth Plaza Building Parking Lot, and requires a significant portion of their parking lot to be eliminated by the new road.

PROPOSED DESIGN:
Maintain full movement access to Wadsworth Plaza and Glazar property at the 47th Ave. intersection. Eliminate the 48th Ave. access road through the Wadsworth Plaza property and provide an additional right-in/right-out access to Wadsworth Plaza at Sta. 72+80+/-. Construct cul-de-sac at the west end of 48th Avenue to eliminate access to Wadsworth through the Wadsworth Plaza property. Local access to Wadsworth from 48th will be diverted to 44th Ave. Provide a gated emergency access between Wadsworth Plaza and 48th Ave.

ADVANTAGES:
- Eliminates frontage road being constructed immediately adjacent to the 4800 building;
- Eliminates the proposed wide curve 48th Ave. takes through the existing parking lot; and,
- Provides direct access from Wadsworth Plaza to Wadsworth Blvd.

DISADVANTAGES:
- Might be difficult to match grades going from 48th access onto Wadsworth. May need some small retaining walls to build grade in cul-de-sac and right-in/right-out access;
- Those who want to go from 48th to SB Wadsworth may be tempted to cut through 4800 Wadsworth Plaza parking lot;
- Other option to go SB on Wadsworth is to go NB on Wadsworth and do a U turn. Unfortunately, next opportunity to make a U turn is at I-70 over the Wadsworth Bridge, where left turns are currently not permitted; and,
- Still requires full ROW take at Glazar property

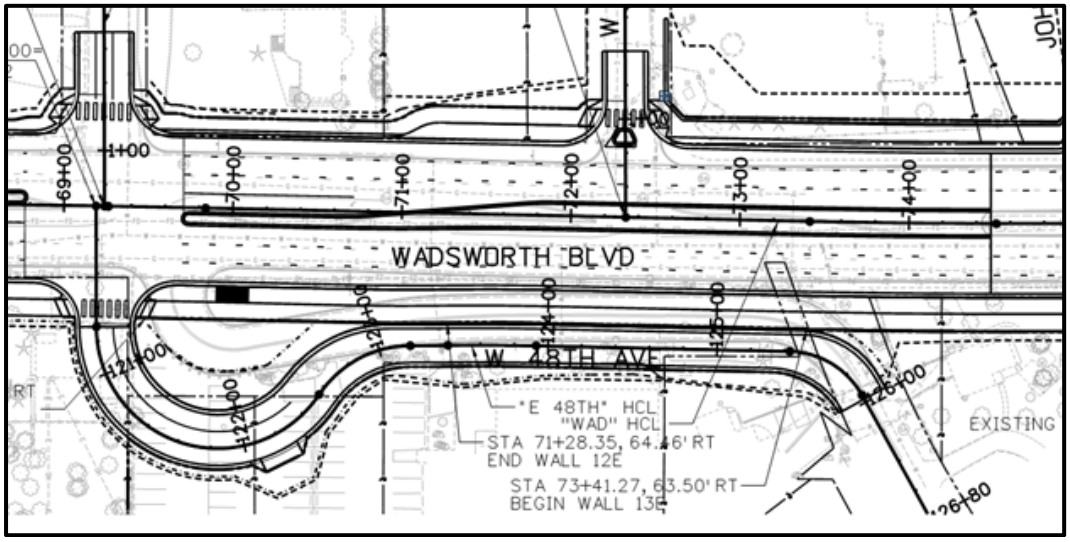
DISCUSSION/JUSTIFICATION:
The design will need to be further refined to eliminate the tight turning geometry and improve (widen) the approach width. This VE Proposal could possibly be implemented in conjunction with other VE Proposals and Design Comments. In particular, DC-23 Back-to-Back Three-Quarter access at the 47th Ave. intersection might work well with the ideas suggested as part of this VE Proposal.

This option eliminates approximately 1,080 SY of new concrete roadway and 440 LF of curb and gutter, and reduces the amount of existing HMA removal due to impacts to the existing parking lot by approximately 750 SY. The ROW acquisition take at this location is reduced by approximately $65,000. It also takes away the undesirable impacts resulting from placing the frontage road right up against the building.

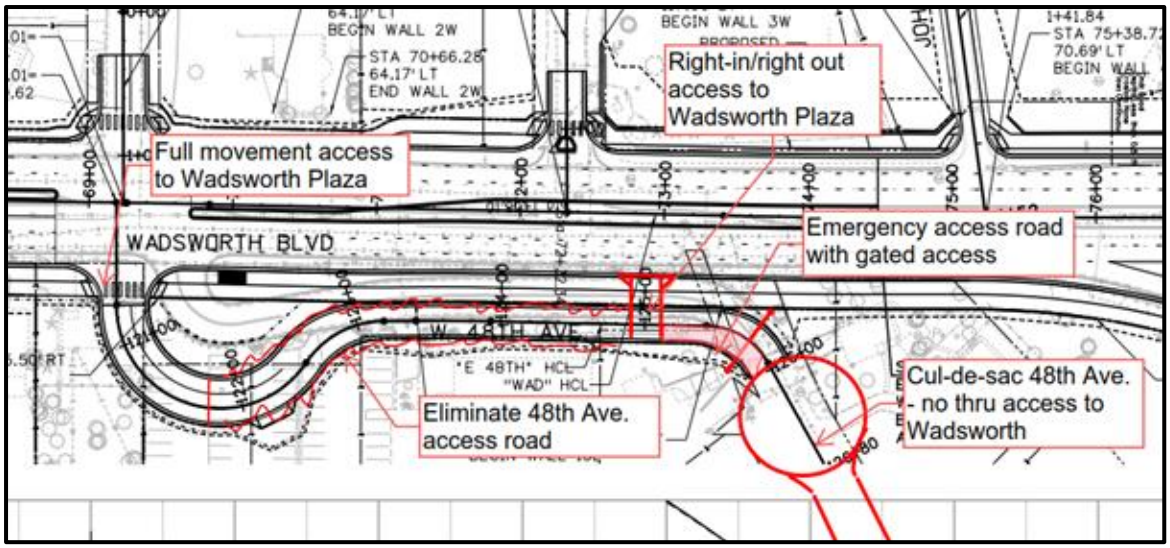
VE PROPOSAL VE-12	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-6** **Date: 5/1/18 Rev. 5/14/18**
DESCRIPTION OF VE PROPOSAL: **Reconfigure 48th Avenue into a Cul-de-Sac with limited access**	**Page No. 2 of 3** **Prepared By: Darin Freeman/ Steve McQuilkin**

SUMMARY OF COST ANALYSIS	
	Construction Cost
ORIGINAL DESIGN	$929,441
PROPOSED DESIGN	$775,074
ESTIMATED SAVINGS	**$154,367**

ORIGINAL DESIGN SKETCH:



PROPOSED CHANGE SKETCH:



VE PROPOSAL VE-12

PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-6** **Date: 5/1/18 Rev. 5/14/18**
DESCRIPTION OF VE PROPOSAL: **Reconfigure 48th Avenue into a Cul-de-Sac with limited access**	**Page No. 3 of 3** **Prepared By: Darin Freeman/ Steve McQuilkin**

Construction Item		Current Design			Proposed Design		
Item	**Units**	**No. of Units**	**Cost / Unit**	**Total**	**No. of Units**	**Cost / Unit**	**Total**
HMA Removal	SY	1,500	$3.50	$5,450	500	$3.50	$1,750
ABC (Cl. 6)	CY	252	$30	$7,560	173	$30	5,190
HMA (Gr. SX) (PG 58-28)	TON	0	$120	$0	154	$120	18,480
Curb and Gutter	LF	1,100	$16	$17,600	460	$16	7,360
Concrete Pavement (10 inch)	SY	1,511	$65	$98,215	433	$65	28,145
Concrete Driveway	SY	0	$60	$0	120	$60	7,233
Emergency Access Gate	LS				1	$1,000	1,000
Subtotal Hard Costs				$128,825			$69,158
Soft Costs (say 50%)				$64,412			$34,579
ROW Acquisition (Not incl. soft costs)			$25	$736,204		$25	$671,337
Total				$929,441			$775,074
						Net Cost Avoidance	**$154,367**

VE PROPOSAL VE-13	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-7** **Date: May 2, 2018**
DESCRIPTION OF VE PROPOSAL: **Tier the retaining wall on the west and east side (Walls 2W and 12E)**	**Page No. 1 of 3** **Prepared By: Darin Freeman**

ORIGINAL DESIGN:
Currently wall 2W is designated as a tangent caisson wall with a maximum height of 23', and wall 12E is a tangent caisson wall with a max height of 19'.

PROPOSED DESIGN:
Explore the option of adding tiers or terracing these walls in order to reduce size of caisson walls.

ADVANTAGES:
- Reduces size and thus cost of tangent caisson walls;
- Could explore changing to a soil nail wall instead of a caisson wall, since the wall is moved out from the ROW; and,
- Creates a more open look to the area and creates additional opportunities for landscaping.

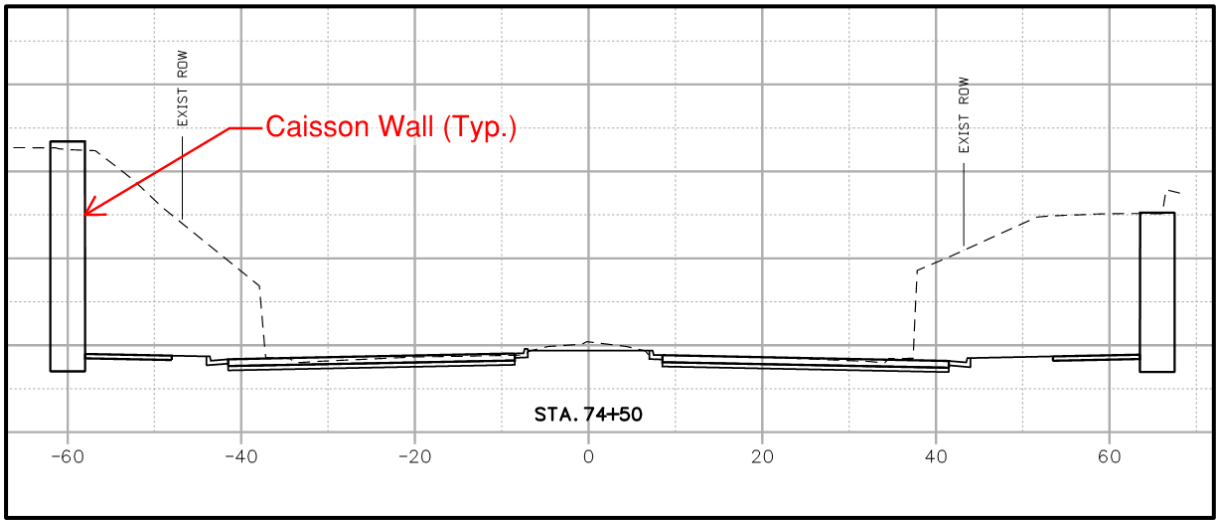
DISADVANTAGES:
- Adds an additional phase to the wall construction;
- Terraced area could become a maintenance challenge where no sidewalk exists;
- Will require a handrail for the sidewalk wherever there is an adjacent wall drop off; and,
- Will be difficult to bring sidewalk back to grade without adding stairs (non-ADA compliant).

DISCUSSION/JUSTIFICATION:
This idea is based on the premise that multiple small walls are cheaper than one big wall.

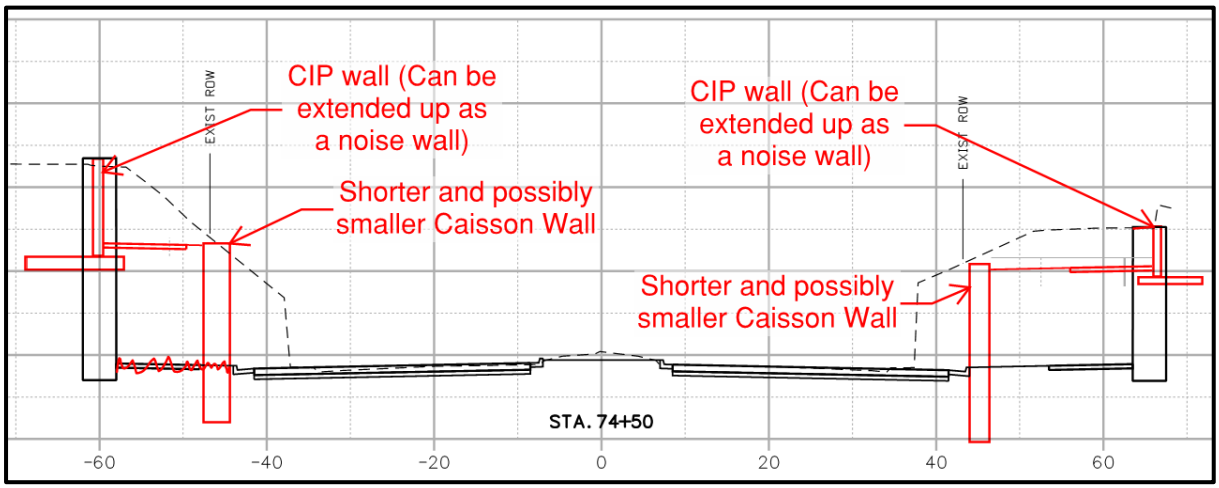
SUMMARY OF COST ANALYSIS	
	Construction Cost
ORIGINAL DESIGN	$637,500
PROPOSED DESIGN	$573,500
ESTIMATED SAVINGS	**$64,000**

VE PROPOSAL VE-13	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.:** 44/I-70-7 **Date:** May 2, 2018
DESCRIPTION OF VE PROPOSAL: Tier the retaining wall on the west and east side (Walls 2W and 12E)	**Page No.** 2 of 3 **Prepared By:** Darin Freeman

ORIGINAL DESIGN SKETCH:



PROPOSED CHANGE SKETCH:



VE PROPOSAL VE-13

PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-7** **Date: May 2, 2018**
DESCRIPTION OF VE PROPOSAL: **Tier the retaining wall on the west and east side (Walls 2W and 12E)**	**Page No. 3 of 3** **Prepared By: Darin Freeman**

Construction Item		Current Design			Proposed Design		
Item	**Units**	**No. of Units**	**Cost / Unit**	**Total**	**No. of Units**	**Cost / Unit**	**Total**
Caisson wall (Average height of 14.4', length of 280')	SF	7,500	$85	$637,500			
Shorter wall 1 (Caisson Wall)	SF				4,300	$85	$365,500
Shorter wall 2 (CIP wall)	SF				3,200	$65	$208,000
Total				$637,500			$573,500
						Net Cost Avoidance	**$64,000**

VE PROPOSAL VE-14	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-8** **Date: May 2, 2018**
DESCRIPTION OF VE PROPOSAL: **Shift Wadsworth to the east in order to keep existing wall on West side (Wall 2W)**	**Page No. 1 of 2** **Prepared By: Darin Freeman**

ORIGINAL DESIGN:
Currently wall 2W is designated as a tangent caisson wall with a maximum height of 23'. Total exposed area of 4020 SF.

PROPOSED DESIGN:
Eliminate amenity zones, narrow center median, and shift roadway CL over 13'. East wall in this area remains in current location as designed.

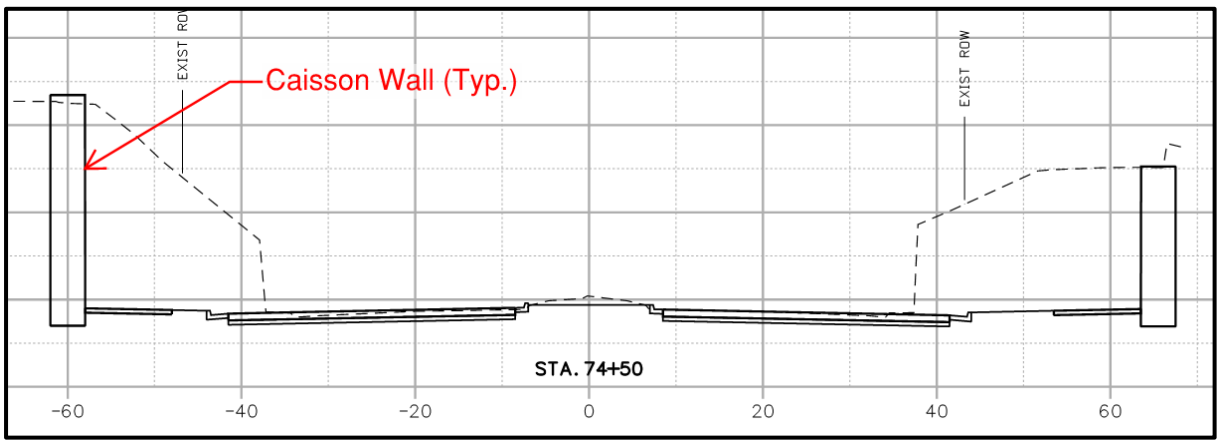
ADVANTAGES:
- Eliminates costs associated with removing existing wall to west, acquiring ROW, and constructing a caisson wall.

DISADVANTAGES:
- Might complicate tie in at existing I-70 Bridges; and,
- Might complicate re-work of 48th Ave at Wadsworth Plaza.

DISCUSSION/JUSTIFICATION:
This VE Proposal presents a way to reduce construction costs on a major element of the project (Wall 2W). Some sacrifice would need to be made in eliminating the amenity zones, but since this is already in a trench, it could be argued that the landscaping isn't as high of a priority.

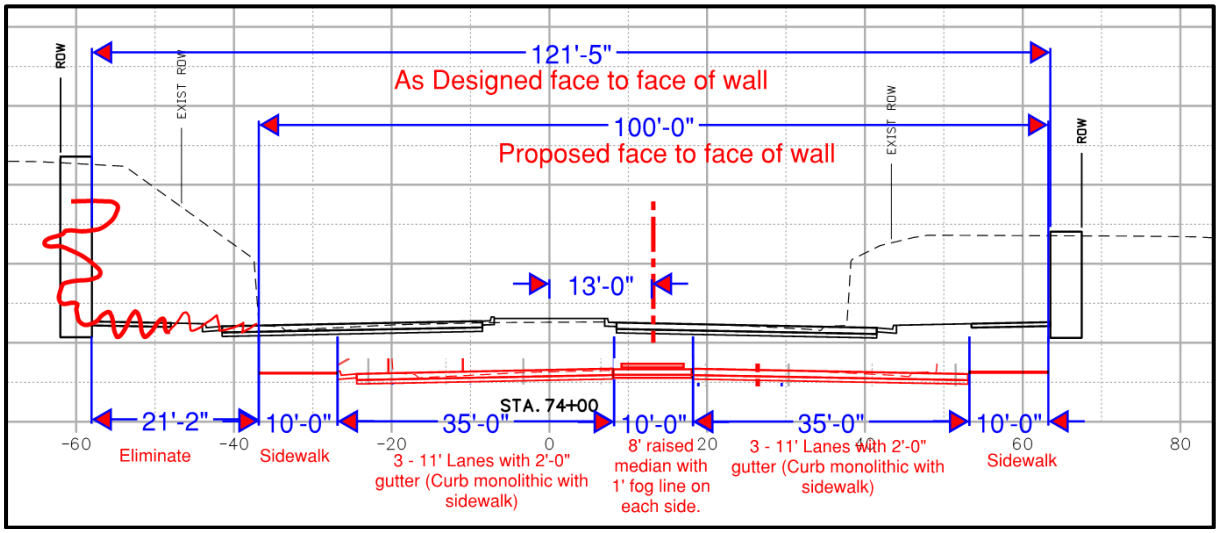
SUMMARY OF COST ANALYSIS	
	Construction Cost
ORIGINAL DESIGN	$980,000
PROPOSED DESIGN	$0
ESTIMATED SAVINGS	**$980,000**

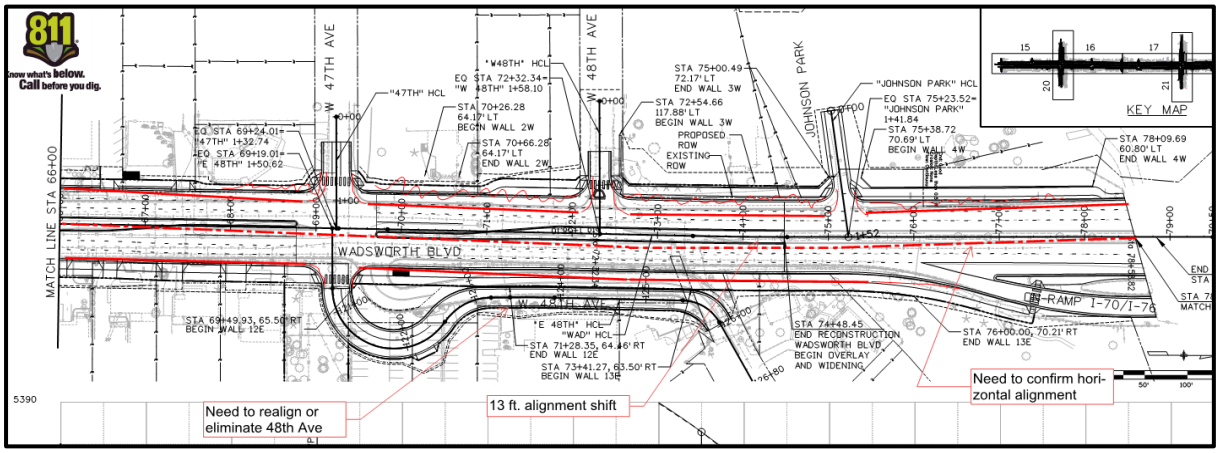
ORIGINAL DESIGN SKETCH:



VE PROPOSAL VE-14	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-8** **Date: May 2, 2018**
DESCRIPTION OF VE PROPOSAL: **Shift Wadsworth to the east in order to keep existing wall on West side (Wall 2W)**	**Page No. 2 of 2** **Prepared By: Darin Freeman**

PROPOSED CHANGE SKETCH:





Construction Item		Current Design			Proposed Design		
Item	**Units**	**No. of Units**	**Cost / Unit**	**Total**	**No. of Units**	**Cost / Unit**	**Total**
Eliminate Caisson wall	SF				7,500	$85	$637,500
Eliminate Amenity zones	SF				13,000	$10	$130,000
Eliminate ROW/Permanent Easement Acquisition	SF				8,500	$25	$212,500
Total							
						Net Cost Avoidance	**$980,000**

VE PROPOSAL VE-15	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-10** **Date: May 2, 2018**
DESCRIPTION OF VE PROPOSAL: **Reduce the sidewalk width to 5 feet in front of the Johnson Park**	**Page No. 1 of 2** **Prepared By: Paul Scherner**

ORIGINAL DESIGN:
The original design shows a 10-foot sidewalk and retaining wall along the east side of Johnson Park.

PROPOSED DESIGN:
The proposed design reduces the sidewalk width to 5 feet and reduces the height of the retaining wall.

ADVANTAGES:
- Reduces the cost of sidewalk and reduces the retaining wall requirements by approximately half; and,
- Reduces ROW impact by approximately half.

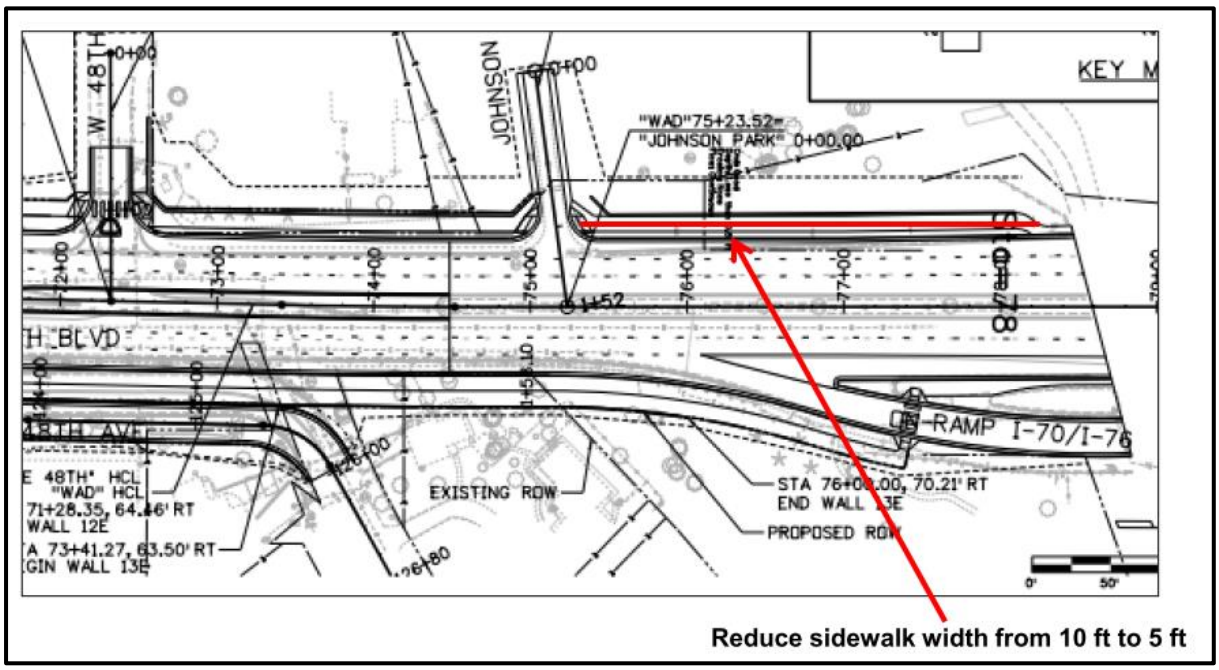
DISADVANTAGES:
- Reduces the comfort level of pedestrians and bicyclists

DISCUSSION/JUSTIFICATION:
The proposed change matches the current width of the sidewalk north of the project limits where the I-70 interchange begins.

SUMMARY OF COST ANALYSIS	
	Construction Cost
ORIGINAL DESIGN	$123,465
PROPOSED DESIGN	$61,607
ESTIMATED SAVINGS	**$61,658**

VE PROPOSAL VE-15	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-10** **Date: May 2, 2018**
DESCRIPTION OF VE PROPOSAL: **Reduce the sidewalk width to 5 feet in front of the Johnson Park**	**Page No. 2 of 2** **Prepared By: Paul Scherner**

PROPOSED CHANGE SKETCH:



Construction Item		Current Design			Proposed Design		
Item	**Units**	**No. of Units**	**Cost / Unit**	**Total**	**No. of Units**	**Cost / Unit**	**Total**
Concrete Sidewalk (6-Inch)	SY	556	$47.74	$26,543.44	278	$47.74	$13,271.72
Concrete Retaining Wall	SF	1,827	$53.05	$96,922.35	913	$53.05	$48,434.65
Total				$123,465			$61,607
						Net Cost Avoidance	**$61,658**

VE PROPOSAL VE-16	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-11** **Date: May 2, 2018**
DESCRIPTION OF VE PROPOSAL: **Use existing outlet in Johnson Park with water quality vault**	**Page No. 1 of 2** **Prepared By: Gary Huber**

ORIGINAL DESIGN:
Plans show all storm water goes under Wadsworth at the north end of project and into a water quality pond, then to Clear Creek drainage. The existing drainage outfalls into Johnson Park, which is 4F land.

PROPOSED DESIGN:
This VE Proposal would use the last stretch of pipe to the Johnson Park and rebuild the manhole connecting to it into a water quality vault. This water quality vault would collect the first half-inch sediment but allow all storm water greater than this to outfall using the existing pipe to Johnson Park.

ADVANTAGES:
- Less costs to place the 60 inch RCP under Wadsworth, which is very expensive to place;
- Still treats the biggest portion of the first one-half inch in the water quality vault on the same pipe run within CDOT ROW;
- Save all costs of trenching or boring last pipe under Wadsworth;
- No costs for the water quality pond or pipes to outfall to Clear Creek drainage; and,
- Easy to remove sediment within water quality vault.

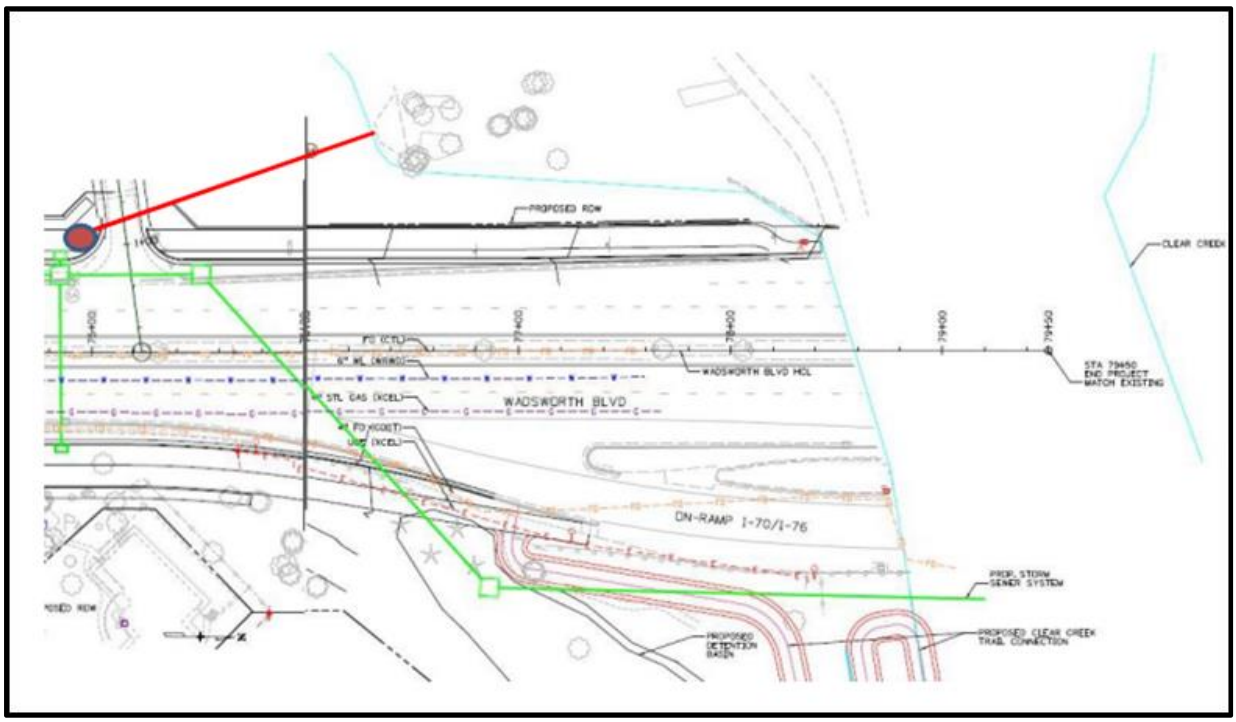
DISADVANTAGES:
- Will require IGA for maintenance of the water quality vault, including cleanout and repair. This cleanout would probably be within a lane closure where the manhole is located;
- Does not eliminate all work within Johnson Park, but allows maintenance work on the old swale to remove built up sediment, returning it to the original swale when it was built; and,
- The odd low water crossing of the bike path over a reduced height chase drain would remain.

DISCUSSION/JUSTIFICATION:
The costs of the water quality pond, the last pipe under Wadsworth, the maintenance of the water quality pond, and the outfall pipe from the WQ Pond to Clear Creek would be eliminated.

SUMMARY OF COST ANALYSIS	
	Construction Cost
ORIGINAL DESIGN	$171,000
PROPOSED DESIGN	$25,000
ESTIMATED SAVINGS	**$146,000**

VE PROPOSAL VE-16	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-11** **Date: May 2, 2018**
DESCRIPTION OF VE PROPOSAL: **Use existing outlet in Johnson Park with water quality vault**	**Page No. 2 of 2** **Prepared By: Gary Huber**

PROPOSED CHANGE SKETCH:



Construction Item		Current Design			Proposed Design		
Item	**Units**	**No. of Units**	**Cost / Unit**	**Total**	**No. of Units**	**Cost / Unit**	**Total**
Water Quality Pond	LS	1	$107,000	$107,000	0	$107,000	$0
60 Inch RCP (CIP)	LF	200	$320	$64,000	0	$320	$0
Manhole Special (35 foot)	EA	0	$25,000	$0	1	$25,000	$25,000
Total				$171,000			$25,000
						Net Cost Avoidance	**$146,000**

Assumptions on costs: From CDOT Cost Data in 2017 and the TIGER grant application estimate.

VE PROPOSAL VE-17	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-13** **Date: May 2, 2018**
DESCRIPTION OF VE PROPOSAL: **Consider a soil nailed walls instead of caisson wall on the east side north of 48th**	**Page No. 1 of 3** **Prepared By: Darin Freeman**

ORIGINAL DESIGN:
Currently wall 2W is designated as a tangent caisson wall with a maximum height of 23', and wall 12E is a tangent caisson wall with a max height of 19'.

PROPOSED DESIGN:
Explore the option of changing these to soil nail walls instead of caisson walls.

ADVANTAGES:
- Soil nail walls tend to be less expensive than caisson walls; and,
- Shotcrete facing on soil nail wall can be textured to look like natural rock or other pleasing appearance

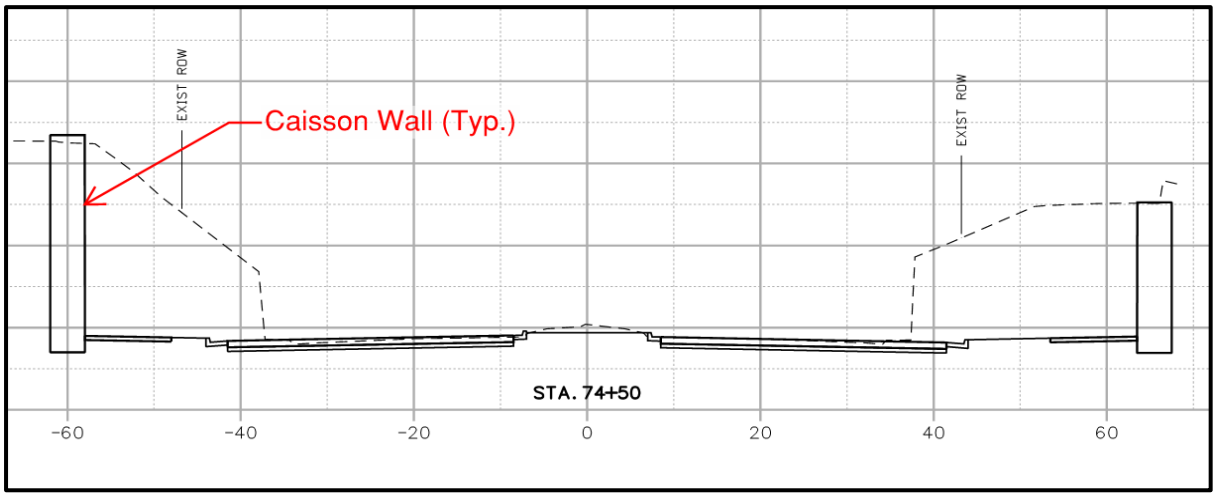
DISADVANTAGES:
- Soil nail walls do not have as long of a design life as caisson walls;
- Nails will require additional ROW acquisition or permanent easements; and,
- Additional elements placed at the top of the wall such as noise walls typically an additional independent structural support.

DISCUSSION/JUSTIFICATION:
This VE Proposal is based on the premise that soil nail walls are less expensive than caisson walls.

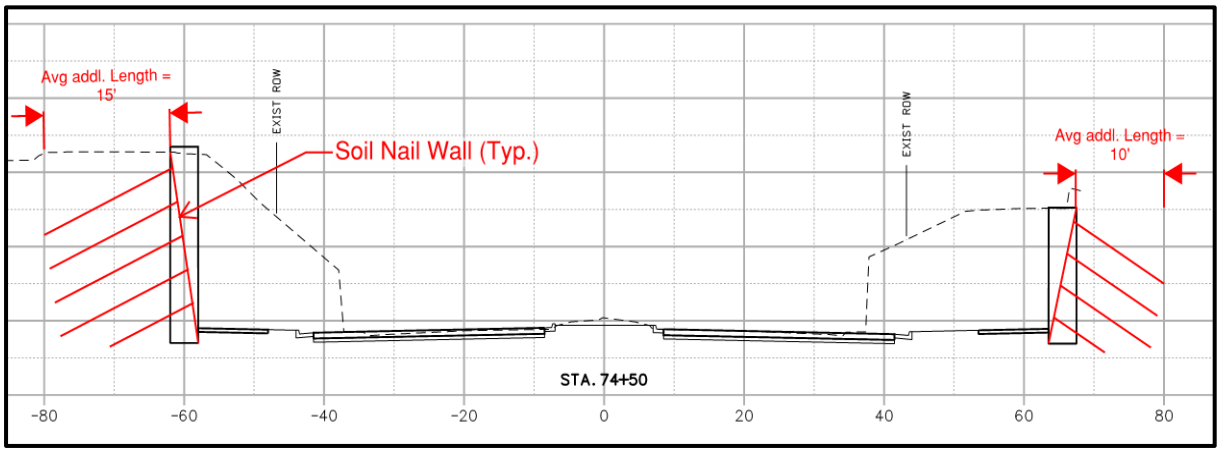
VE PROPOSAL VE-17	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-13** **Date: May 2, 2018**
DESCRIPTION OF VE PROPOSAL: **Consider soil nail walls instead of caisson wall on the east side north of 48th**	**Page No. 2 of 3** **Prepared By: Darin Freeman**

SUMMARY OF COST ANALYSIS	
	Construction Cost
ORIGINAL DESIGN	$637,500
PROPOSED DESIGN	$567,500
ESTIMATED SAVINGS	**$70,000**

ORIGINAL DESIGN SKETCH:



PROPOSED CHANGE SKETCH:



VE PROPOSAL VE-17

PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-13** **Date: May 2, 2018**
DESCRIPTION OF VE PROPOSAL: **Consider soil nail walls instead of caisson wall on the east side north of 48th**	**Page No. 3 of 3** **Prepared By: Darin Freeman**

Construction Item		Current Design			Proposed Design		
Item	**Units**	**No. of Units**	**Cost / Unit**	**Total**	**No. of Units**	**Cost / Unit**	**Total**
Caisson wall	SF	7,500	$85	$637,500			
Soil Nail Wall	SF				7,500	$60	$450,000
Additional ROW/Permanent Easement Acquisition	SF				4,700	$25	$117,500
Total				$637,500			$567,500
						Net Cost Avoidance	**$70,000**

VE PROPOSAL VE-18	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-16** **Date: 5/1/18 Rev. 5/15/18**
DESCRIPTION OF VE PROPOSAL: **Use off-ramp from Wadsworth onto 48th and eliminate the frontage road**	**Page No. 1 of 3** **Prepared By: Darin Freeman/ Steve McQuilkin**

ORIGINAL DESIGN:
48th Avenue takes a circuitous route through the 4800 Wadsworth Plaza Building Parking Lot, and requires a significant portion of their parking lot to be eliminated by the new road. The new configuration also brings 48th Ave. very close to the existing building, which may be detrimental to the tenants and property value.

PROPOSED DESIGN:
Use off-ramp/turn lane from Wadsworth onto 48th and eliminate the frontage road.

ADVANTAGES:
- Eliminates frontage road being constructed immediately adjacent to the 4800 building;
- Eliminates the proposed wide curve 48th Ave. takes through the existing parking lot;
- Makes connection from 48th onto Wadsworth more direct; and,
- Eliminates ROW take at Glazar property

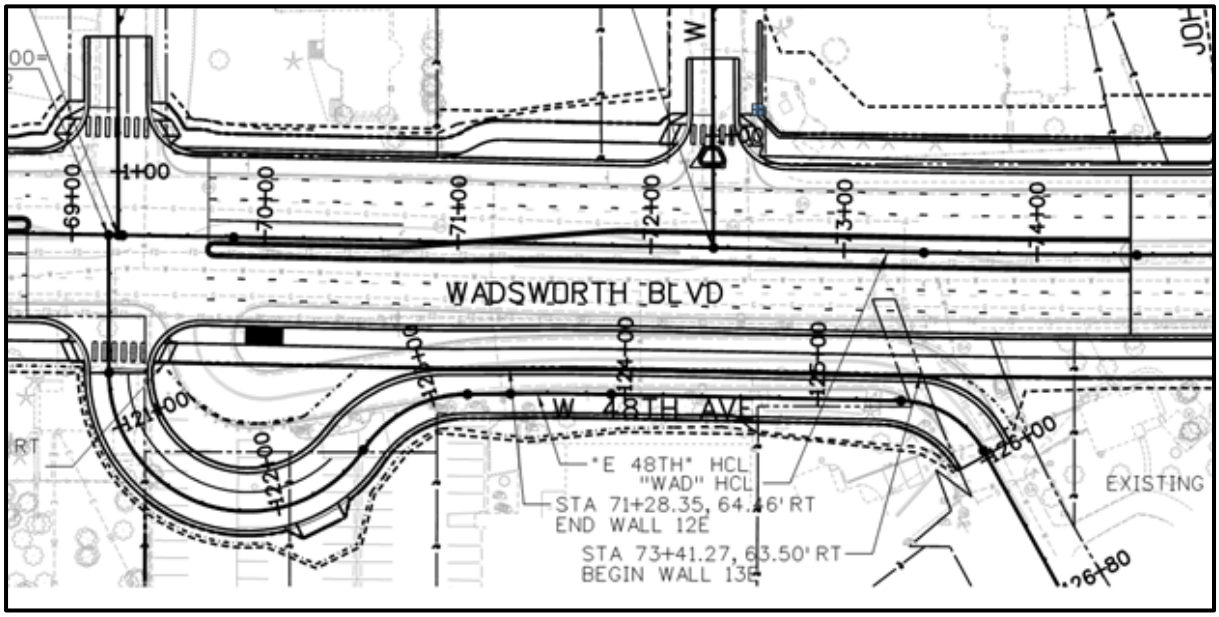
DISADVANTAGES:
- Might be difficult to match grades going from 48th onto Wadsworth. May need some small retaining walls to build grade on 48th Ave;
- Those who want to access Wadsworth from 48th will have to go a longer route through the neighbourhood to the east. This modification severely impacts access to and from the 4800 building;
- Those heading SB on Wadsworth will need to U-turn at 47th Ave to access this property; and,
- Introduces the possibility of a wrong way entry going SB in the NB lanes.

DISCUSSION/JUSTIFICATION:
This option eliminates approximately 1,000 SF of new concrete pavement HMA roadway, 940 LF of curb and gutter and reduces the amount of existing HMA removal due to impacts to the existing parking lot by approximately 750 SY. The ROW acquisition taken at this location is reduced by approximately 20,000 SF, including the full take at the Glazar property. It also takes away the undesirable impacts resulting from placing the frontage road right up against the building.

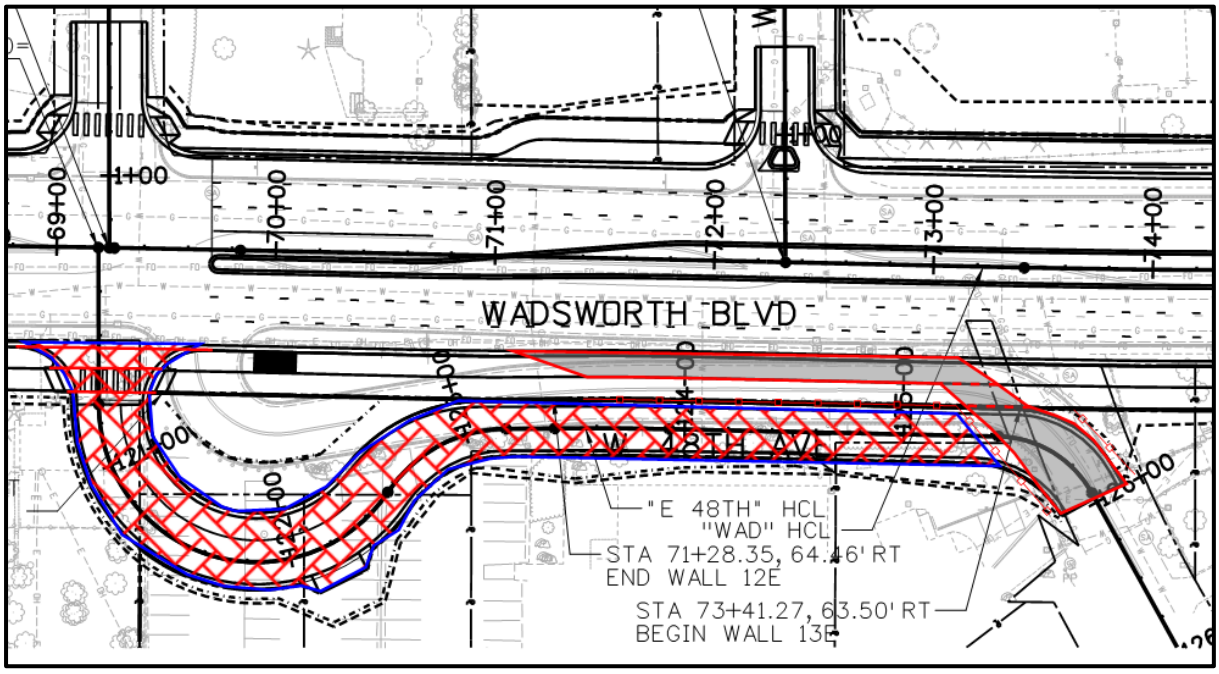
SUMMARY OF COST ANALYSIS	
	Construction Cost
ORIGINAL DESIGN	$929,441
PROPOSED DESIGN	$107,930
ESTIMATED SAVINGS	**$821,511**

VE PROPOSAL VE-18	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-16** **Date: 5/1/18 Rev. 5/15/18**
DESCRIPTION OF VE PROPOSAL: **Use off-ramp from Wadsworth onto 48th and eliminate the frontage road**	**Page No. 2 of 3** **Prepared By: Darin Freeman/ Steve McQuilkin**

ORIGINAL DESIGN SKETCH:



PROPOSED CHANGE SKETCH:



VE PROPOSAL VE-18

PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-16** **Date: 5/1/18 Rev. 5/15/18**
DESCRIPTION OF VE PROPOSAL: **Use off-ramp from Wadsworth onto 48th and eliminate the frontage road**	**Page No. 3 of 3** **Prepared By: Darin Freeman/ Steve McQuilkin**

Construction Item		Current Design			Proposed Design		
Item	**Units**	**No. of Units**	**Cost / Unit**	**Total**	**No. of Units**	**Cost / Unit**	**Total**
HMA Removal	SY	1,500	$3.50	$5,450	500	$3.50	$1,750
ABC (Cl. 6)	CY	252	$30	$7,560	84	$30	$2,520
Curb and Gutter	LF	1,100	$16	$17,600	162	$16	$2,592
Concrete Pavement (10 inch)	SY	1,511	$65	$98,215	501	$65	$32,565
Subtotal Hard Costs				$128,825			$39,427
Soft Costs (say 50%)				$64,412			$19,714
ROW Acquisition (Not incl. soft costs)			$25	$736,204		$25	$48,789
Total				$929,441			$107,930
						Net Cost Avoidance	**$821,511**

VE PROPOSAL VE-19	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-21** **Date: May 1, 2018**
DESCRIPTION OF VE PROPOSAL: **Split the drainage system at Johnson Park**	**Page No. 1 of 3** **Prepared By: Gary Huber**

ORIGINAL DESIGN:
Plans show all stormwater going under Wadsworth at the north end of project and into a water quality pond, then to Clear Creek drainage. The existing drainage outfalls into Johnson Park, which is 4F land.

PROPOSED DESIGN:
This VE Proposal would use last stretch of pipe to the Johnson Park and rebuild the manhole connecting to it so that the initial one-half inch of rainfall is routed to the east under Wadsworth in a much smaller pipe, then the excess portion of the drainage would still go into the park. This would require we maintain only the drainage swale currently in place to keep this option open. The size of the pipe under Wadsworth would be reduced to a smaller, perhaps 36-inch size, jacked to reduce impacts to traffic.

ADVANTAGES:
- Less costs to place a smaller diameter pipe (instead of a 60 inch pipe) under Wadsworth, which is very expensive to bore and probably was not captured in the original cost estimate;
- Still treats the biggest portion of the first one-half inch in the water quality pond on the east side within CDOT ROW, which pond size could possibly be reduced;
- Excess over the first half-inch is split between Johnson Park and the water quality pond so pipes are smaller and disturb Clear Creek drainage less; and,
- Does not require deep trenches across Wadsworth at a very acute angle and may allow a better nearly 90 degree angle crossing.

DISADVANTAGES:
- More design would be necessary to determine if this is a reliable way to split the drainage;
- Does not actually save all costs of boring pipe under Wadsworth;
- Still requires a water quality pond to be built on the east side;
- Does not eliminate any work within Johnson Park, but only maintenance work on the old swale to remove built up sediment, same as the new water quality pond would need in the future; and,
- The odd low water crossing of the bike path over a reduced height chase drain would remain but larger events of use might be reduced.

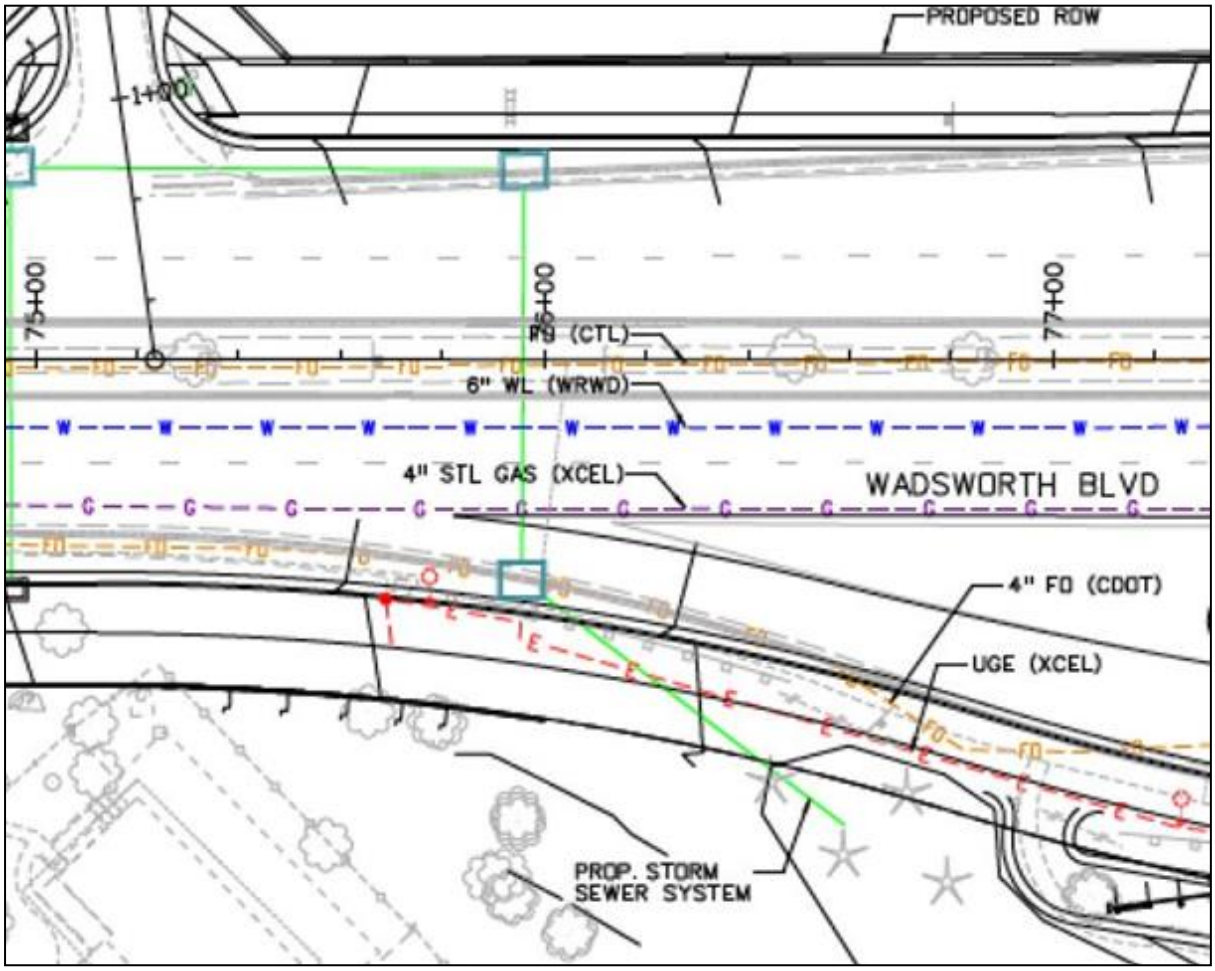
DISCUSSION/JUSTIFICATION:
The 60 inch diameter pipe bored under Wadsworth at such an acute angle within the Wheat Ridge shale layers would be reduced to a more manageable size of pipe. We estimate that perhaps a 36 inch pipe could then handle this flow. This cost does not warrant any additional time working on the 4F property maintenance.

VE PROPOSAL VE-19	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-21** **Date: May 1, 2018**
DESCRIPTION OF VE PROPOSAL: **Split the drainage system at Johnson Park**	**Page No. 2 of 3** **Prepared By: Gary Huber**

SUMMARY OF COST ANALYSIS	
	Construction Cost
ORIGINAL DESIGN	$154,400
PROPOSED DESIGN	$107,400
ESTIMATED SAVINGS	**$47,000**

ORIGINAL DESIGN SKETCH:

Manhole at Sta 74+95 Lt is the splitter box. Don't know where the existing manhole is.



VE PROPOSAL VE-19	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-21** **Date: May 1, 2018**
DESCRIPTION OF VE PROPOSAL: **Split the drainage system at Johnson Park**	**Page No. 3 of 3** **Prepared By: Gary Huber**

PROPOSED CHANGE SKETCH:
120 foot run on southbound shoulder and 80 foot run across Wadsworth can be smaller diameter pipe, say 36 inch diameter RCP.

Construction Item		Current Design			Proposed Design		
Item	**Units**	**No. of Units**	**Cost / Unit**	**Total**	**No. of Units**	**Cost / Unit**	**Total**
Manhole Box Base (25 Foot)	Each	1	$20,000	$20,000	0	$25,000	$0
Manhole Box Base (25 Foot)(Special)	Each	0	$25,000	0	1	$25,000	$25,000
60 Inch RCP (CIP)	LF	120	$320	$38,400	0	$320	$0
60 Inch RCP (CIP) (Jacked)	LF	80	$1,200	$96,000	0	$1200	$0
36 Inch RCP (CIP)	LF	0	$170	$0	120	$170	$20,400
36 Inch RCP (CIP) (Jacked)	LF	0	$775	$0	80	$775	$62,000
Total				$154,400			$107,400
						Net Cost Avoidance	**$47,000**

Assumptions on costs: From CDOT Cost Data in 2017 and before.

I believe the TIGER grant application estimate did not have a realistic price for jacking pipe, yet traffic could not get around a full open trench without removing a portion of the raised median, which is not in the plan. Jacking pipe is about 4 times more expensive than open trench, but would alleviate having to remove median and reroute traffic. Alternatively, Wadsworth could be closed for several weekends to place this, but 60 inch pipe might take all weekend to cross southbound and another all weekend to cross northbound, a much higher cost to the public.

Original price for 60 inch RCP (CIP) was $320 per LF, which is 4 times less than $1,200 per LF used above. 36 inch RCP (CIP) was $170 per LF, but $775 per LF was used as the jacking price.

Not included is removal and replacement of the median.

5.5 Design Comments

The **23** Design Comments developed by the VE Team are presented in this section. They are listed in the order in which they are provided in **Table 2**. Design Comments are ideas that in the opinion of the VE Team were good ideas, but for any number of reasons were not selected for development as VE Proposals. Design Comments can be notes to the owner and design team, documentation of various thoughts that came up during the course of the VE Workshop, a reference to possible problems, items that might need further study, or questions that the City, CDOT and designer might want to explore. These comments may have implications on project cost and schedule, but due to time constraints or other factors, the VE Team did not develop cost saving estimates for Design Comments. Some Design Comments might relate to things of which the City, CDOT and design team are already aware. Because the study was done on a design in progress, the VE Team may not have been aware of everything intended by the City, CDOT and designer. The Design Comments are presented with the intent of aiding the City, CDOT and design team in some way.

DESIGN COMMENT DC-1	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: C-1** **Date: May 2, 2018**
DESCRIPTION OF DESIGN COMMENT: **Add advance signage to the intersections throughout the corridor**	**Page No. 1 of 1** **Prepared By: Paul Scherner**

ORIGINAL DESIGN:
Signage plans not provided

PROPOSED DESIGN:
Need to somehow clearly sign advance notice of left turns at primary and secondary turns. Mount advance intersection signage in the median

ADVANTAGES:
- Provides advance notice of left turn movement(s)

DISADVANTAGES:
- None identified

DISCUSSION/JUSTIFICATION:
This will require further discussion with the design team to determine the best way to message

DESIGN COMMENT DC-2	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: C-8** **Date: May 2, 2018**
DESCRIPTION OF DESIGN COMMENT: **Widen the lane for the displaced left turn lane throughout the corridor**	**Page No. 1 of 1** **Prepared By: Paul Scherner**

ORIGINAL DESIGN:
CFI left turn lane width is 14 feet

PROPOSED DESIGN:
Widen the CFI left turn lane width to 16 feet

ADVANTAGES:
- Provides additional width to get around a disabled vehicle

DISADVANTAGES:
- Will need to occur in conjunction with a reduction in median and/or amenity widths, or adding additional roadway width

DISCUSSION/JUSTIFICATION:
The 14 foot lane width does not meet the minimum recommended 16 feet desired to accommodate bypassing a disabled vehicle.

DESIGN COMMENT DC-3	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: C-10** **Date: May 2, 2018**
DESCRIPTION OF DESIGN COMMENT: **Taper the median noses throughout the corridor**	**Page No. 1 of 1** **Prepared By: Paul Scherner**

ORIGINAL DESIGN:
The median noses appears to have blunt ends

PROPOSED DESIGN:
Vertically taper the median noses from the pavement elevation to the top of the median – use plowable end treatment detail

ADVANTAGES:
- Physically protects the median nose and will deflect plow blades

DISADVANTAGES:
- None anticipated

DESIGN COMMENT DC-4	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: C-13** **Date: May 2, 2018**
DESCRIPTION OF DESIGN COMMENT: **Add transit signal priority throughout the corridor**	**Page No. 1 of 1** **Prepared By: Paul Scherner**

ORIGINAL DESIGN:
Transit Signal Priority (TSP) is not planned at this time

PROPOSED DESIGN:
TSP is physically provided for at the CFI intersections, but not aware of signal installation.

ADVANTAGES:
- Provides buses with a protected way to merge into traffic from the right turn lane; and,
- Reduces bus blocking of the right turn lane.

DISADVANTAGES:
- May introduce a slight increase in intersection delay

DISCUSSION/JUSTIFICATION:
This will be a policy decision and will require approval and close coordination with RTD

DESIGN COMMENT DC-5	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: C-17** **Date: May 1, 2018**
DESCRIPTION OF DESIGN COMMENT: **Investigate a business district to maintain the amenity zones**	**Page No. 1 of 2** **Prepared By: Gary Huber and Russ Higgins**

ORIGINAL DESIGN:
City of Wheat Ridge maintains amenity zones for length of project.

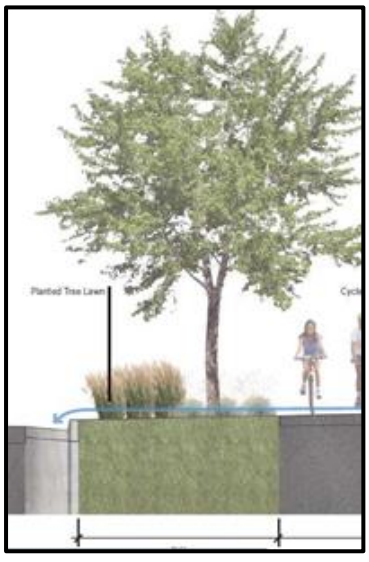
PROPOSED DESIGN:
Develop a business district or special use district to develop and maintain the amenity zone

ADVANTAGES:
- Amenity zones can be specific to business district or special use district wishes;
- Artwork and amenities not otherwise considered could be placed if approved; and,
- City would not have to do this maintenance

DISADVANTAGES:
- The business district or special use district is a separate entity, so has to fully fund maintenance and improvements;
- The business district or special use district infighting does not yield a decision of any new construction, so this area continually degrades;
- The City has to take over if the Business District or special use district defaults when maintenance / irrigation is not complete;
- There is a possibility of all vegetation dying; and,
- Accidents and vandalism yield a gray area in the city code and enforcement

DISCUSSION/JUSTIFICATION:
The main reasons of saving maintenance funding on these islands is commendable, but not a large expense. Over many years, there will be a continual effort to maintain what is constructed now, but adding new landscaping and this ongoing funding could be an urban renewal effort. There is not a clear benefit to this initial lower cost.

ORIGINAL DESIGN SKETCH:



DESIGN COMMENT DC-5	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.:** C-17 **Date:** May 1, 2018
DESCRIPTION OF DESIGN COMMENT: Investigate a business district to maintain the amenity zones	**Page No.** 2 of 2 **Prepared By:** Gary Huber and Russ Higgins

PROPOSED CHANGE SKETCH:

DESIGN COMMENT DC-6	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 35/38-3** **Date: May 1, 2018**
DESCRIPTION OF DESIGN COMMENT: **Eliminate the right-in-right-out for the new development on the west side of the corridor**	**Page No. 1 of 2** **Prepared By: Russ Higgins**

ORIGINAL DESIGN:
Right-in-right-out just north 35th on the west side Station 15+75

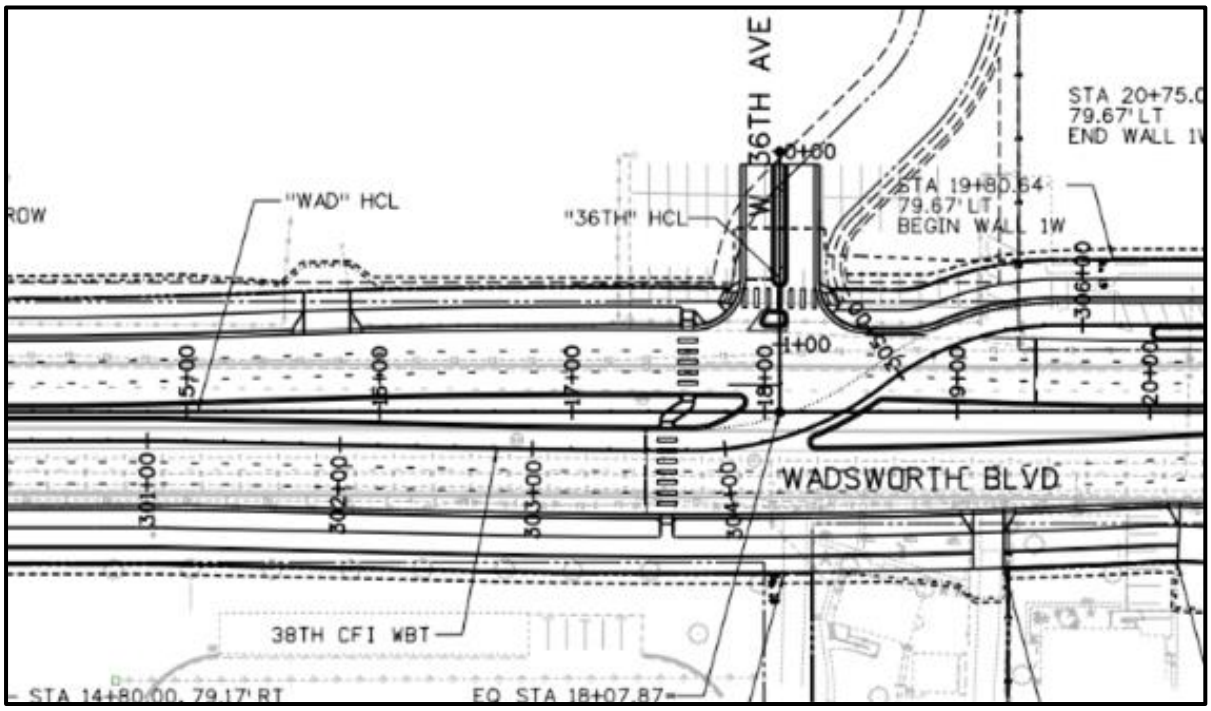
PROPOSED DESIGN:
Eliminate the driveway and utilize the driveway at Station 18+00 West 36th Ave.

ADVANTAGES:
- Reduces conflict points on Wadsworth to improve safety

DISADVANTAGES:
- Impacts the new development and may increase delay time at the Lucky's entrance

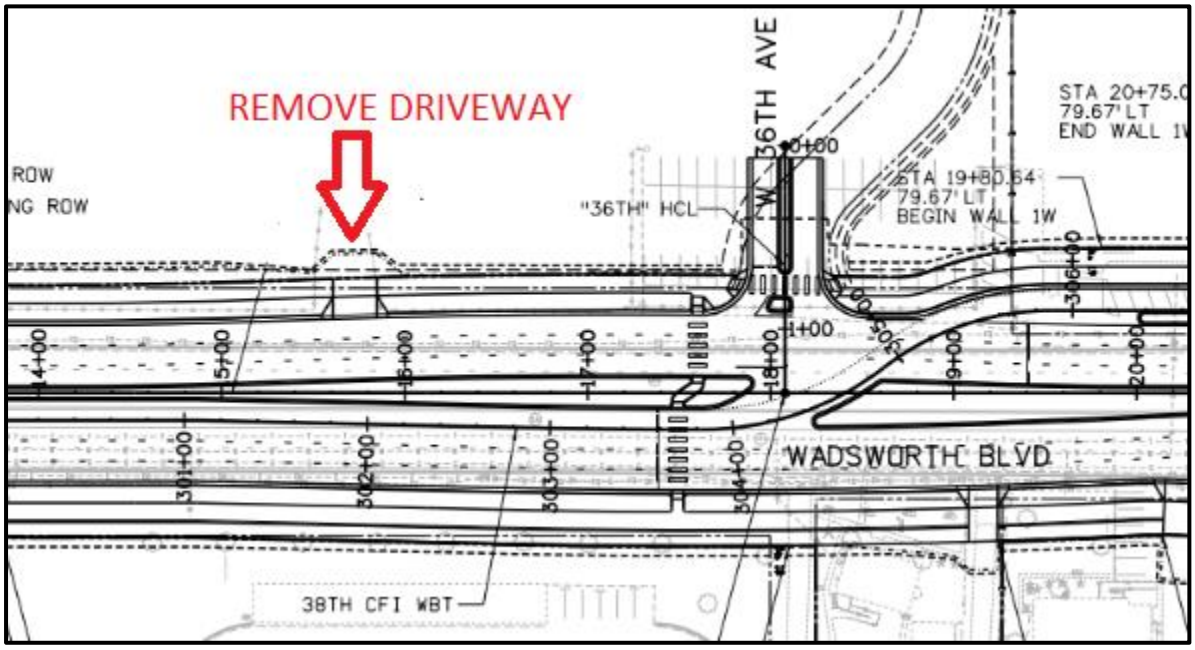
DISCUSSION/JUSTIFICATION:
Access to the apartment complex can be from 35th Ave. and the main driveway into Lucky's at station 18+00

ORIGINAL DESIGN SKETCH:



DESIGN COMMENT DC-6	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 35/38-3** **Date: May 1, 2018**
DESCRIPTION OF DESIGN COMMENT: **Eliminate the right-in-right-out for the new development on the west side of the corridor**	**Page No. 2 of 2** **Prepared By: Russ Higgins**

PROPOSED CHANGE SKETCH:



DESIGN COMMENT DC-7	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 35/38-4, 35/38-7** **Date: May 2, 2018**
DESCRIPTION OF DESIGN COMMENT: **Run a right-turn overlap with left turn at CFI crossover separation at the new proposed development**	**Page No. 1 of 1** **Prepared By: Paul Scherner**

ORIGINAL DESIGN:
Right turn overlap is not planned and is prohibited due to the pedestrian crossing

PROPOSED DESIGN:
Provide right turn overlap with the combination left turn and crossover phase

ADVANTAGES:
- Providing right turn overlap provides for a protected right turn movement. May also improve signal progression.

DISADVANTAGES:
- Removes the protected pedestrian crossing

DISCUSSION/JUSTIFICATION:
Provides a protected right turn movement, but removes the pedestrian crossing. This will probably have detrimental effects on corridor pedestrian safety and mobility.

DESIGN COMMENT DC-8	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 35/38-8** **Date: May 2, 2018**
DESCRIPTION OF DESIGN COMMENT: **Increase the radius of the secondary compound curve and extend the median nose downstream on the southeast and northwest corners of the 38th and 44th and Wadsworth**	**Page No. 1 of 1** **Prepared By: Paul Scherner**

ORIGINAL DESIGN:
The right turn secondary (smaller) radius geometry does not positively communicate a free right turn

PROPOSED DESIGN:
Increase the size of the smaller radius and extend the nose of the island further downstream

ADVANTAGES:
- Design change positively communicates a free right turn

DISADVANTAGES:
- May require additional right-of-way

DISCUSSION/JUSTIFICATION:
Provides geometry that directs motorists into the free right turn acceleration lane and improves operations and reduces delay.

PROPOSED CHANGE SKETCH:

DESIGN COMMENT DC-9	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 35/38-9** **Date: May 2, 2018**
DESCRIPTION OF DESIGN COMMENT: **On south 38th, extend the median to cover the right-in right-out**	**Page No. 1 of 1** **Prepared By: Gary Huber**

ORIGINAL DESIGN:
On 38th Avenue mainline eastbound, the raised median stops short of the first intersection to the east of Wadsworth.

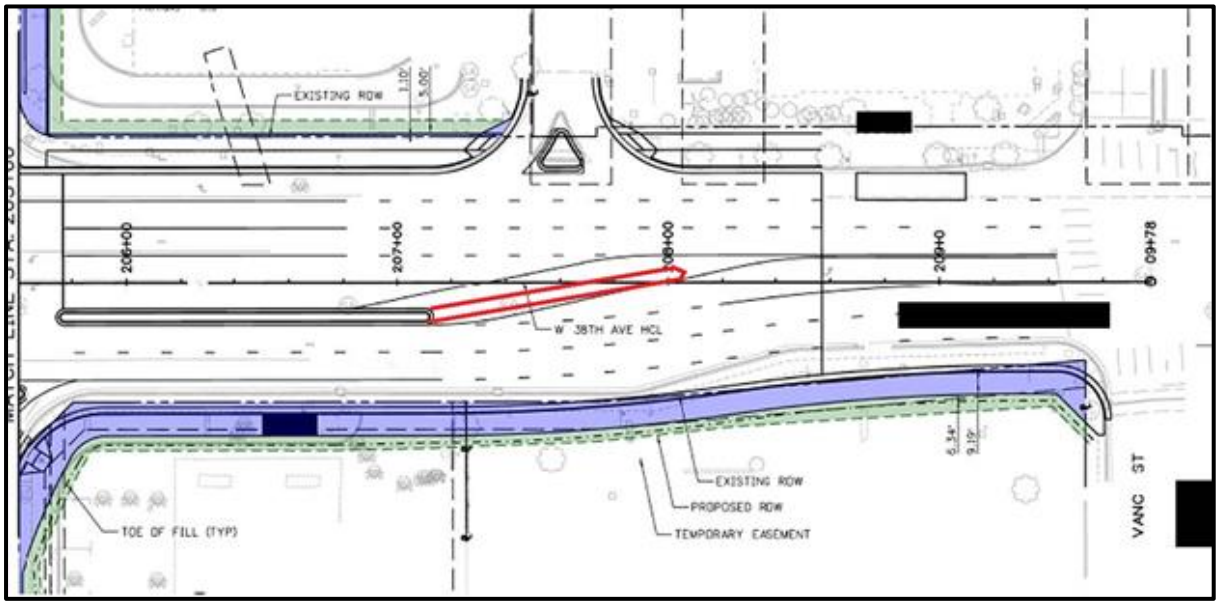
PROPOSED DESIGN:
Extend the raised median to prevent vehicles from trying to make a left into the right-in-right-out access behind Burger King.

ADVANTAGES:
- Safer to not allow vehicles to make a left into this right-in-right-out driveway;
- There is a full access intersection directly to the east; and,
- Also prevents right-out turns from behind Burger King from making a left onto 38th.

DISADVANTAGES:
- Will cost more to build the raised median farther to the east.

DISCUSSION/JUSTIFICATION:
This is a safety feature to help direct the inexperienced drivers to not take risks with the other general public.

PROPOSED CHANGE SKETCH:



DESIGN COMMENT DC-10	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 35/38-10** **Date: May 2, 2018**
DESCRIPTION OF VE DESIGN COMMENT: **Move the stop bars further south at the cross over**	**Page No. 1 of 1** **Prepared By: Paul Scherner**

ORIGINAL DESIGN:
Stop bars are too far back

PROPOSED DESIGN:
Move the stop bars forward to the median nose

ADVANTAGES:
- Reduces clearance time

DISADVANTAGES:
- None apparent

DISCUSSION/JUSTIFICATION:
Reduces clearance time, no disadvantages

DESIGN COMMENT DC-11	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 38/39-2** **Date: May 1, 2018**
DESCRIPTION OF DESIGN COMMENT: **Right-in only at the dental office**	**Page No. 1 of 2** **Prepared By: Russ Higgins**

ORIGINAL DESIGN:
Right-in-Right out Station 26+60 (Risas Dental)

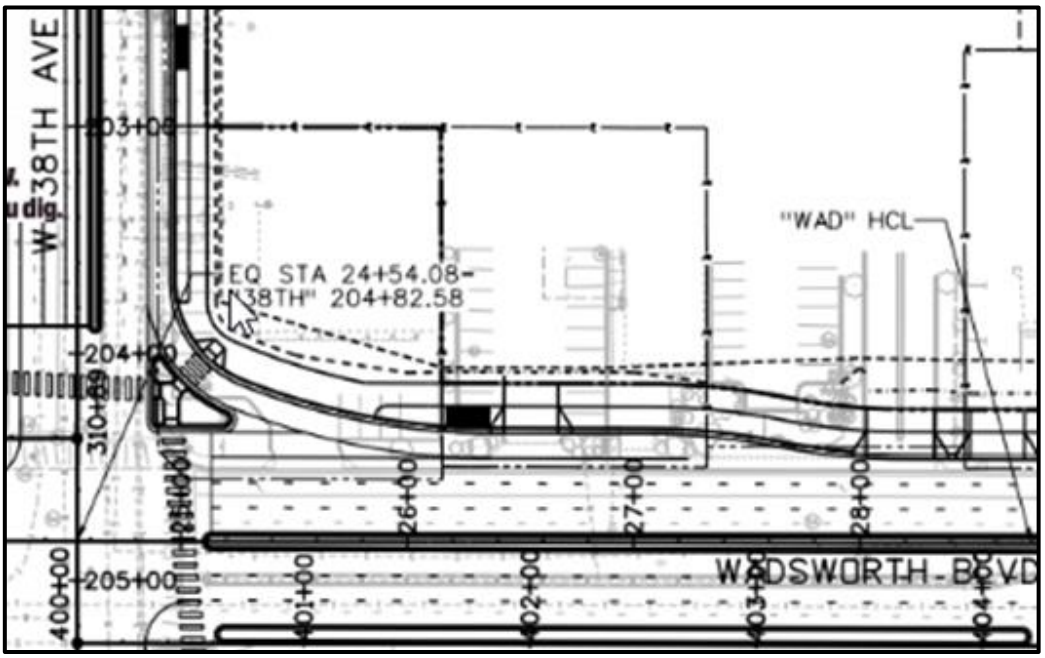
PROPOSED DESIGN:
Change the driveway to a right in only

ADVANTAGES:
- Reduces conflict points on Wadsworth to improve safety

DISADVANTAGES:
- Exiting required using the main entrance to the shopping center and may increase delay time at the entrance

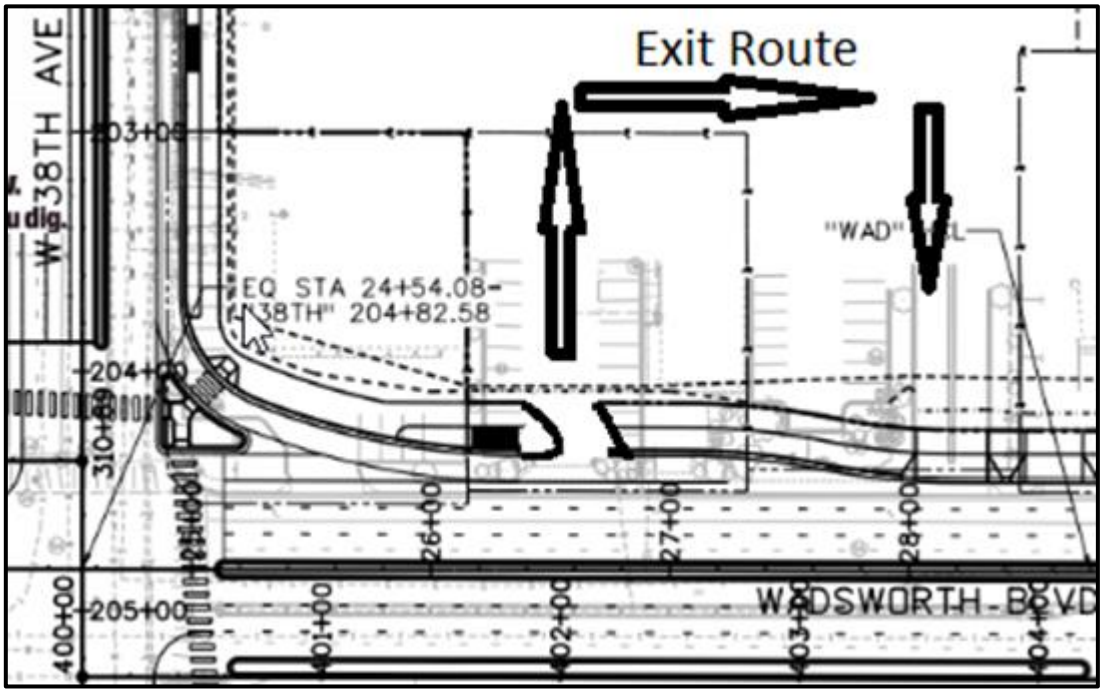
DISCUSSION/JUSTIFICATION:
The driveway enters a dedicated right turn lane for 38th and would require crossing two lanes to go south on Wadsworth. Requiring drivers to exit at the shopping entrance would improve safety.

ORIGINAL DESIGN SKETCH:



DESIGN COMMENT DC-11	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 38/39-2** **Date: May 1, 2018**
DESCRIPTION OF DESIGN COMMENT: **Right-in only at the dental office**	**Page No. 2 of 2** **Prepared By: Russ Higgins**

PROPOSED CHANGE SKETCH:



DESIGN COMMENT DC-12	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 38/39-4** **Date: May 1, 2018**
DESCRIPTION OF DESIGN COMMENT: **Consolidate the two adjacent driveways on the west side of the corridor**	**Page No. 1 of 1** **Prepared By: Russ Higgins**

ORIGINAL DESIGN:
Right-in-right-out driveway at 28+75 – Liberty Tax Mini Mall

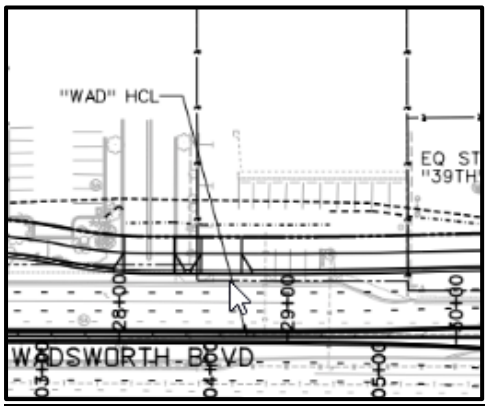
PROPOSED DESIGN:
Eliminate driveway on Wadsworth and build a new driveway from shopping center main driveway.

ADVANTAGES:
- Eliminates conflict point on Wadsworth

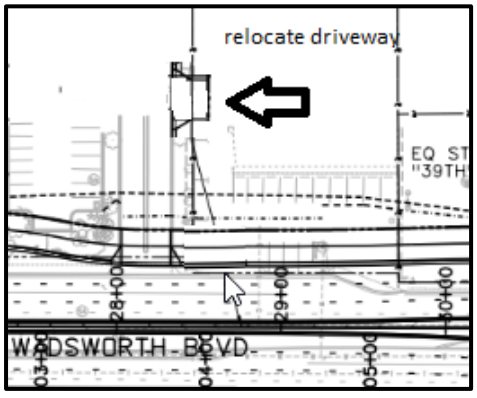
DISADVANTAGES:
- Owners feel they are losing access

DISCUSSION/JUSTIFICATION
A driveway can be provided from the main driveway to the shopping center to provide ingress and egress to the Mini mall. A second access is at the rear of the property.

ORIGINAL DESIGN SKETCH:



PROPOSED CHANGE SKETCH:



DESIGN COMMENT DC-13	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 39/44-1** **Date: May 1, 2018**
DESCRIPTION OF DESIGN COMMENT: **Increase the length of the southbound and northbound left turns at 41st**	**Page No. 1 of 1** **Prepared By: Paul Scherner**

ORIGINAL DESIGN:
Left turn lanes do not meet deceleration and storage requirements

PROPOSED DESIGN:
Lengthen left turn lanes to meet design standards

ADVANTAGES:
- Improves safety by reducing the potential for rear-end accidents

DISADVANTAGES:
- There may be constraints in lengthening the SB left turn lane at 41st depending on the queue storage requirements for the NB left turn at 44th Ave.

DISCUSSION/JUSTIFICATION:
Improves safety, meets standards

DESIGN COMMENT DC-14	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 39/44-4** **Date: May 1, 2018**
DESCRIPTION OF DESIGN COMMENT: **Extend CFI median south and modify the driveway**	**Page No. 1 of 1** **Prepared By: Russ Higgins**

ORIGINAL DESIGN:
Right-in-right-out driveway to Micro Brewery at Station 507+10 (CFI lane)

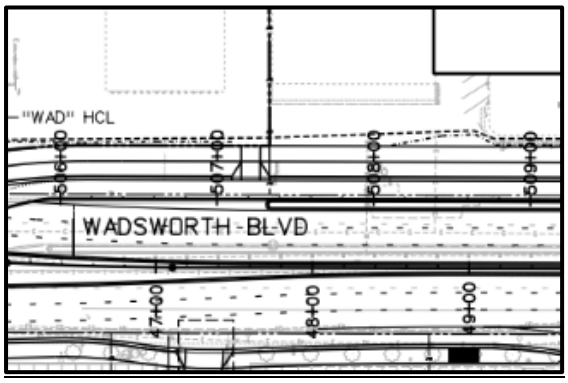
PROPOSED DESIGN:
Provide a left turn out only and extend the CFI median.

ADVANTAGES:
- Provides exit only driveway

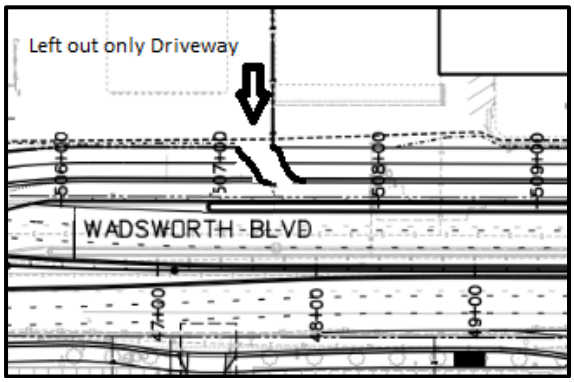
DISADVANTAGES:
- Owners feel they are losing access

DISCUSSION/JUSTIFICATION
The directional driveway discourages drivers pulling in the driveway and increases the efficiency of the CFI lane and reduces delays for vehicles wanting to turn left at 44th Ave. Extending the median avoids drivers jumping into the south bound Wadsworth lane.

ORIGINAL DESIGN SKETCH:



PROPOSED CHANGE SKETCH:



DESIGN COMMENT DC-15	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 39/44-9** **Date: May 1, 2018**
DESCRIPTION OF DESIGN COMMENT: **Add raised median eastbound at 44th**	**Page No. 1 of 1** **Prepared By: Russ Higgins**

ORIGINAL DESIGN:
West leg of 44th Ave has a narrow median

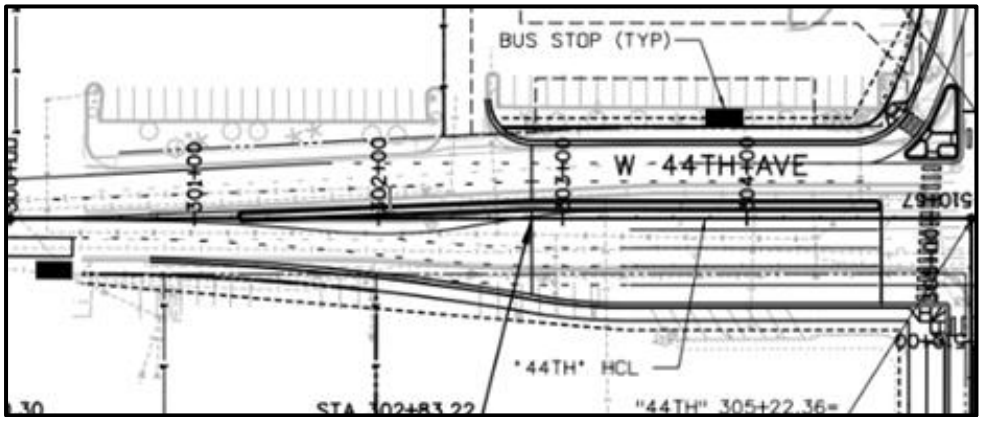
PROPOSED DESIGN:
Widen the west end of the median on 44th to direct through traffic away from the left turn lanes.

ADVANTAGES:
- Provides direction for the driver

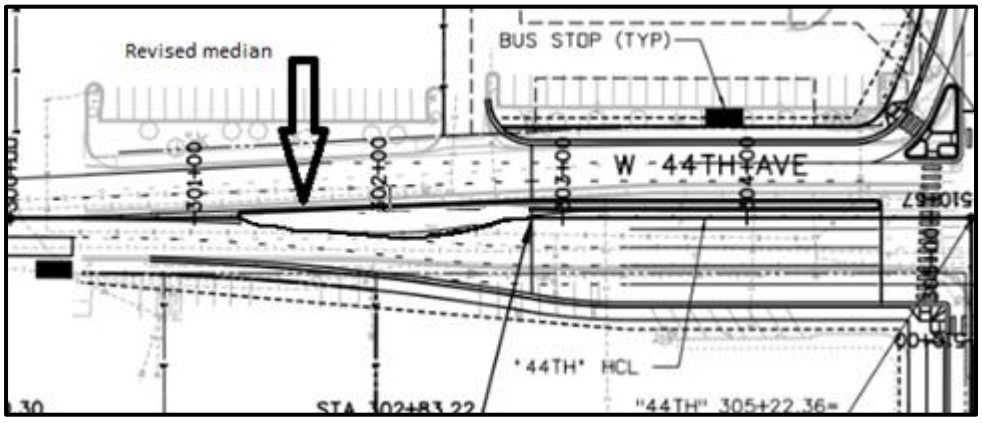
DISADVANTAGES:
- Additional maintenance of curb and median surfacing

DISCUSSION/JUSTIFICATION:
The bulb out median provides positive direction for the through traffic.

ORIGINAL DESIGN SKETCH:



PROPOSED CHANGE SKETCH:



DESIGN COMMENT DC-16	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-1** **Date: May 2, 2018**
DESCRIPTION OF DESIGN CHANGE: **Investigate the reverse curves northbound between 44th and 45th**	**Page No. 1 of 1** **Prepared By: Gary/Paul**

ORIGINAL DESIGN:
Reverse curvature seems to be at the design minimum

PROPOSED DESIGN:
Flatten (lengthen) the reverse curvature between STA 52+50 to STA 58+00 center control line

ADVANTAGES:
- Improves drivability/safety

DISADVANTAGES:
- May negatively affect the SB crossover for 44th left turn / encroach on church property

DISCUSSION/JUSTIFICATION:
There seems to be an opportunity to flatten this reverse curve, though not all of the particulars are fully understood by the VE Team. The designer may want to revisit this design feature to see if there are any opportunities to flatten this reverse curve.

DESIGN COMMENT DC-17	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I70-2** **Date: May 2, 2018**
DESCRIPTION OF DESIGN COMMENT: **Consolidate the two adjacent driveways on the east side of the corridor between 44th and 45th and put on the property line**	**Page No. 1 of 1** **Prepared By: Russ Higgins**

ORIGINAL DESIGN:
Driveway in the CFI lane Station 602+50 and 604+00

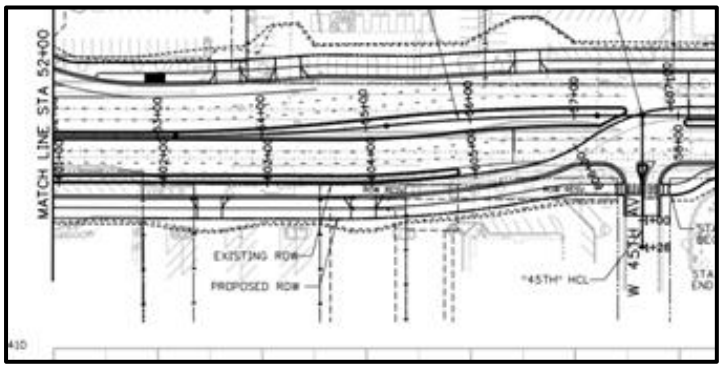
PROPOSED DESIGN:
Driveway at Station 603+50

ADVANTAGES:
- Provides only one driveway and reduces the conflict point to one location.

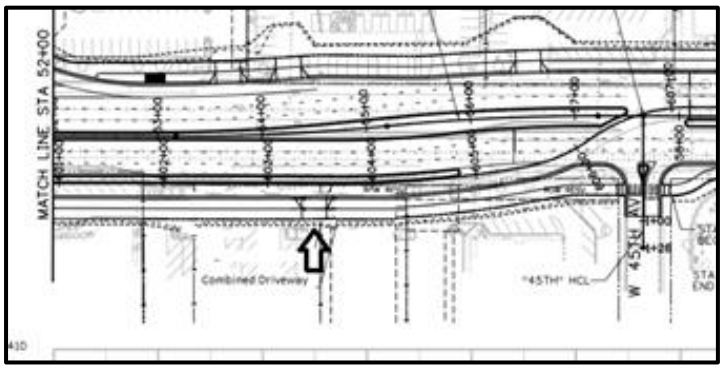
DISADVANTAGES:
- Owners feel they are losing access

DISCUSSION/JUSTIFICATION:
Consolidating the driveways into one provides for one conflict point and improves safety. Another consideration would to make this a left out only

ORIGINAL DESIGN SKETCH:



PROPOSED CHANGE SKETCH:



DESIGN COMMENT DC-18	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I70-3** **Date: May 1, 2018**
DESCRIPTION OF DESIGN COMMENT: **Use the existing north access for Red Lobster**	**Page No. 1 of 1** **Prepared By: Russ Higgins**

ORIGINAL DESIGN:
South driveway only to Red Lobster Station 54+10

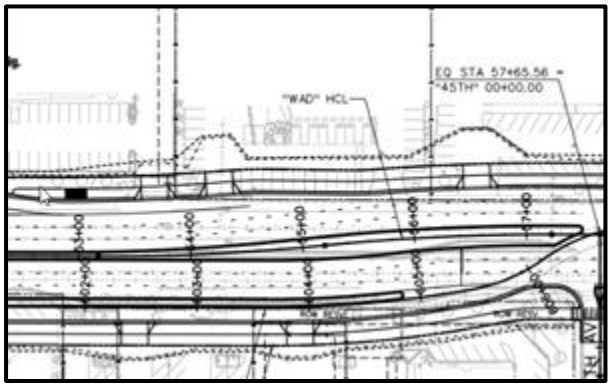
PROPOSED DESIGN:
North Driveway only to Red Lobster Station 55+90

ADVANTAGES:
- The driveway is moved out of the exclusive right turn lane.

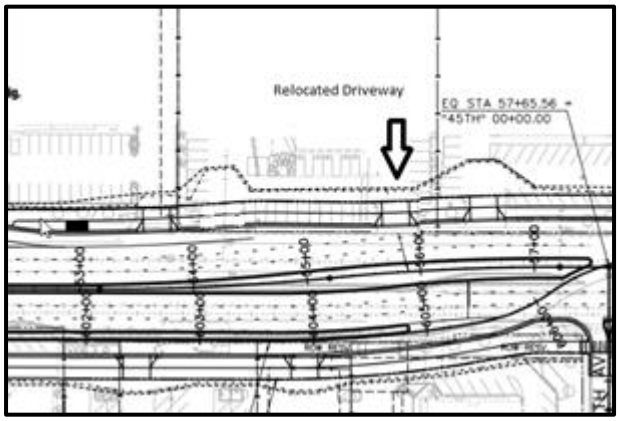
DISADVANTAGES:
- Moves the driveway closer to the property to the north

DISCUSSION/JUSTIFICATION:
Moving the driveway to the north improves safety for vehicles going south on Wadsworth.

ORIGINAL DESIGN SKETCH:



PROPOSED CHANGE SKETCH:



DESIGN COMMENT DC-19	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I70-4** **Date: May 1, 2018**
DESCRIPTION OF DESIGN COMMENT: **Eliminate Discount Tires access on Wadsworth**	**Page No. 1 of 1** **Prepared By: Russ Higgins**

ORIGINAL DESIGN:
Driveway from Wadsworth to Discount Tire Station 63+00

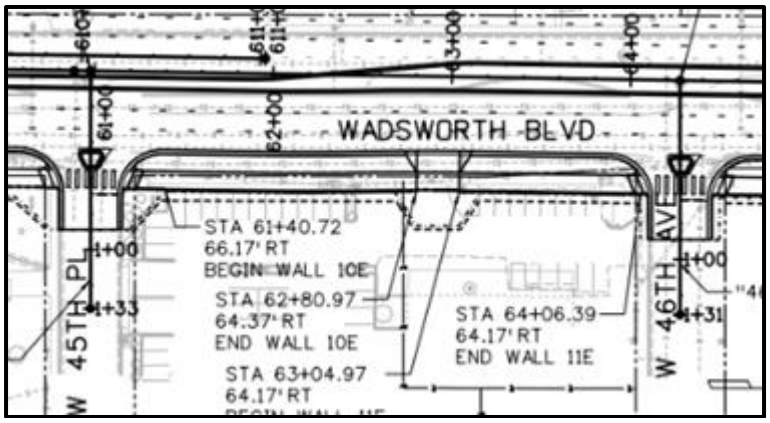
PROPOSED DESIGN:
Eliminate driveway on Wadsworth

ADVANTAGES:
- Eliminating the driveway removes a conflict point and improves safety; and,
- Provides additional parking for the parking lot.

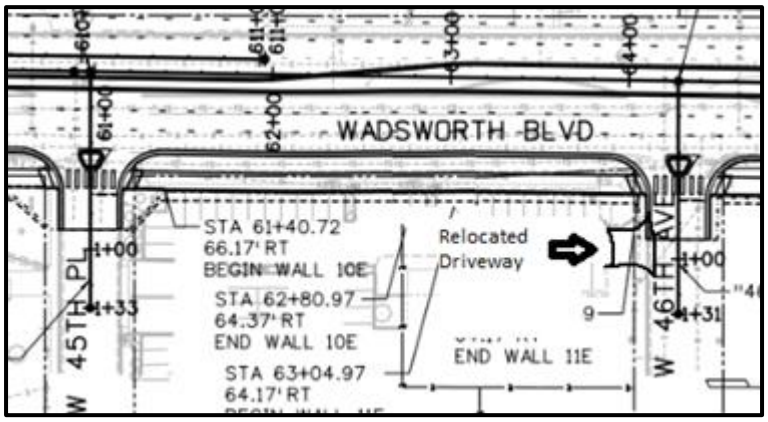
DISADVANTAGES:
- The property owners do not want to lose access to Wadsworth.

DISCUSSION/JUSTIFICATION:
Access to Discount Tire and the mini mall can be from 45th Place and 46th Ave

ORIGINAL DESIGN SKETCH:



PROPOSED CHANGE SKETCH:



DESIGN COMMENT DC-20	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-14** **Date: May 2, 2018**
DESCRIPTION OF DESIGN COMMENT: **Increase the length of the southbound and northbound left turns at 47th**	**Page No. 1 of 1** **Prepared By: Paul Scherner**

ORIGINAL DESIGN:
Left turn lanes do not meet deceleration and storage requirements

PROPOSED DESIGN:
Lengthen left turn lanes to meet design standards

ADVANTAGES:
- Improves safety by reducing the potential for rear-end accidents

DISADVANTAGES:
- None apparent

DISCUSSION/JUSTIFICATION:
Improves safety, meets standards

DESIGN COMMENT DC-21	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-15** **Date: May 2, 2018**
DESCRIPTION OF DESIGN COMMENT: **At 47th, reconfigure to ¾ movements in both directions**	**Page No. 1 of 1** **Prepared By: Paul Scherner**

ORIGINAL DESIGN:
Intersection is configured as a full movement intersection

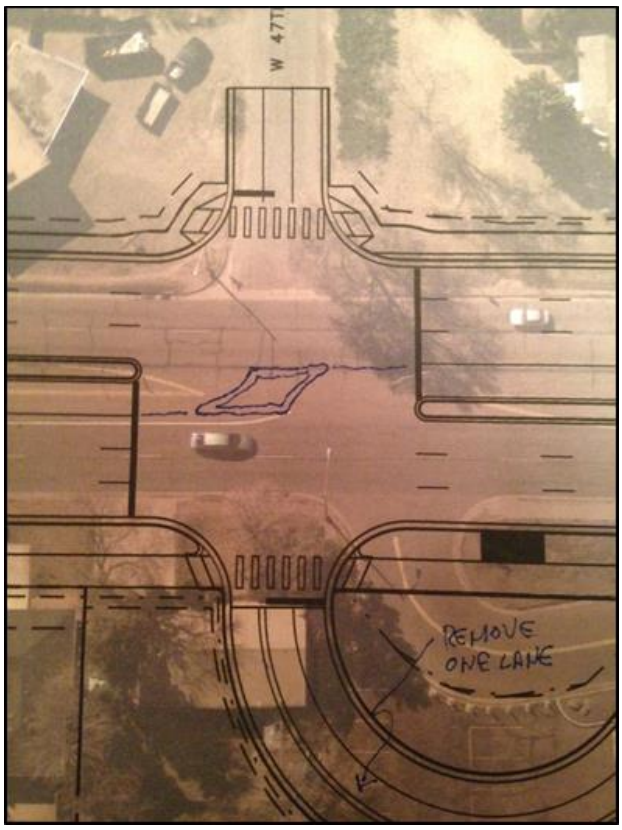
PROPOSED DESIGN:
Reconfigure to ¾ movements in both directions. This allows left turns off of Wadsworth, but prohibits left turns out, and also eliminates east and west through movements.

ADVANTAGES:
- Improves safety by removing high conflict movements; and,
- Removes one approach lane on the east and west legs of the intersection.

DISADVANTAGES:
- None apparent

DISCUSSION/JUSTIFICATION:
Improves safety, meets access control requirements for an NR-A facility.

PROPOSED CHANGE SKETCH:



DESIGN COMMENT DC-22	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-20** **Date: May 1, 2018**
DESCRIPTION OF DESIGN COMMENT: **Change sidewalk with backside footer to stand alone block wall**	**Page No. 1 of 2** **Prepared By: Darin Freeman**

ORIGINAL DESIGN:
The original design, as depicted in the document "Final Designs for Eligible Historic Properties" shows a retaining wall being needed to support the new sidewalk in front of Holy Cross Lutheran church. This retaining wall is currently shown as a "Backside Footer" wall that will be cast with the sidewalk concrete. This approach is somewhat difficult to construct and could result in a hard edge along the sidewalk that would cause cracking if differential settlement occurs.

PROPOSED DESIGN:
Since the wall is relatively short, construct the wall as a dry stack block wall that is independent of the sidewalk and railing. The sidewalk could be constructed as a typical sidewalk, and the railing would be founded on independent foundations.

ADVANTAGES:
- Simplifies construction by separating the construction of the wall, railing, and sidewalk into three separate activities;
- Block walls are generally aesthetically pleasing and relatively cost effective due to simple installation methods;
- Sidewalk can settle and move independently of the wall and railing, and will not be required to be designed as a moment slab with reinforcing; and,
- Block wall and handrail layouts can easily be pivoted to avoid existing objects such as water wells.

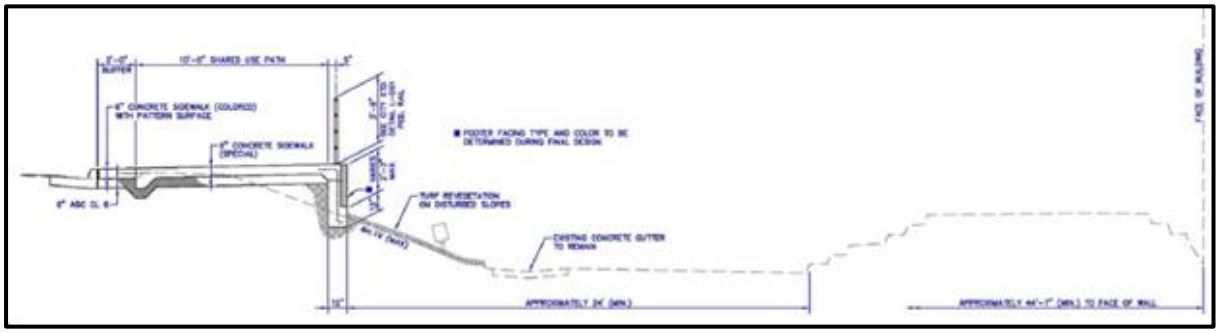
DISADVANTAGES:
- Block walls are susceptible to erosion if water is allowed to flow over the top of them; and,
- Possible reduction in design life, since block walls are dry stack.

DISCUSSION/JUSTIFICATION:
The current design indicates that the sidewalk, handrail, and toe wall will all act as one unit. Constructing this configuration will take careful coordination between each phase of construction to ensure that everything fits together. The proposed option gives the contractor the ability to build each step independently, and make field adjustments if necessary.

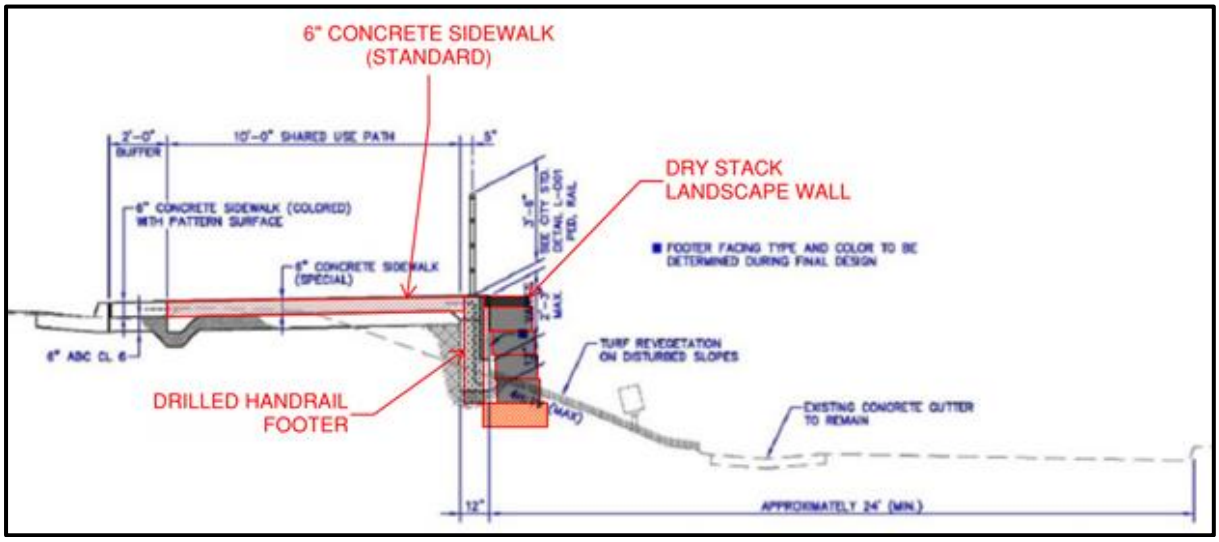
This approach is commonly used in locations where a wall less than 5' tall is needed adjacent to landscaping or path.

DESIGN COMMENT DC-22	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-20** **Date: May 1, 2018**
DESCRIPTION OF DESIGN COMMENT: **Change sidewalk with backside footer to stand alone block wall**	**Page No. 2 of 2** **Prepared By: Darin Freeman**

ORIGINAL DESIGN SKETCH:



PROPOSED CHANGE SKETCH:



DESIGN COMMENT DC-23	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I70-22** **Date: May 2, 2018**
DESCRIPTION OF DESIGN COMMENT: **Revise the driveway to Walgreens to a right-in only**	**Page No. 1o f 1** **Prepared By: Russ Higgins**

ORIGINAL DESIGN:
Right-in-right-out driveway to Walgreens Station 53+90

PROPOSED DESIGN:
Restrict the driveway to a right in only Station 53+90

ADVANTAGES:

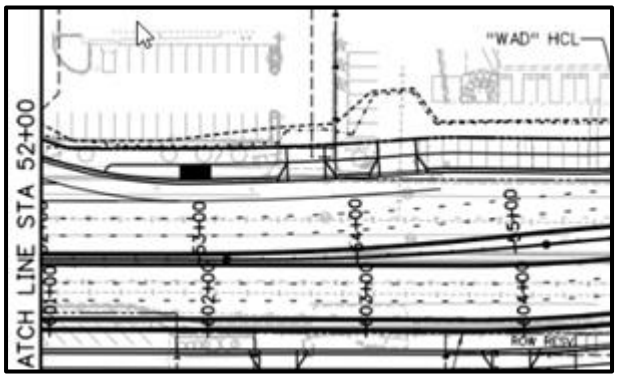
- The driveway would improve safety by limiting it to a right in only in the exclusive right turn lane.

DISADVANTAGES:

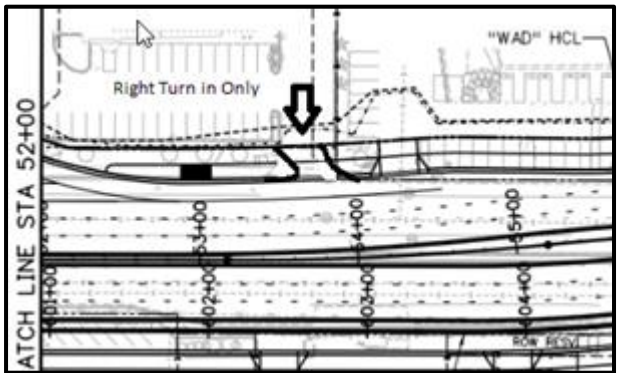
- The business owner will feel they are losing access.

DISCUSSION/JUSTIFICATION:
Restricting the driveway to a right in only improves safety since the driver would have to cross an exclusive right turn lane to exit the driveway and go south bound on Wadsworth. Access to 44th Ave. is available for the driver both east and west from the driveways accessing 44th Ave.

ORIGINAL DESIGN SKETCH:



PROPOSED CHANGE SKETCH:



5.6 Dropped During Development

The following idea is one that the VE Team carried forward to the Development Phase of the VE Study. However, during development it was determined that this idea was not feasible, and therefore it was dropped from further consideration. The work completed during the development of this VE idea is provided in order to document why it was determined not to carry this idea forward.

DROPPED DURING DEVELOPMENT	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-18** **Date: May 2, 2018**
DESCRIPTION OF VE PROPOSAL: **Evaluate the feasibility of laying back the slope in lieu of a caisson wall for wall 2W**	**Page No. 1 of 4** **Prepared By: Darin Freeman**

ORIGINAL DESIGN:
Currently wall 2W is designated as a tangent caisson wall with a maximum height of 23'.

PROPOSED DESIGN:
Purchase the property on the west side on hill and lay the slope back instead of retaining wall and build house further back on the property. Slope could be stabilized using a soil nail system, or laid back at a 2:1 without soil stabilization

ADVANTAGES:
- Eliminates costly tangent caisson wall; and,
- Creates a more open look to the area.

DISADVANTAGES:
- Results in additional ROW acquisition; and,
- Creates some long term risk of future conflict if soil nails are used within a permanent easement.

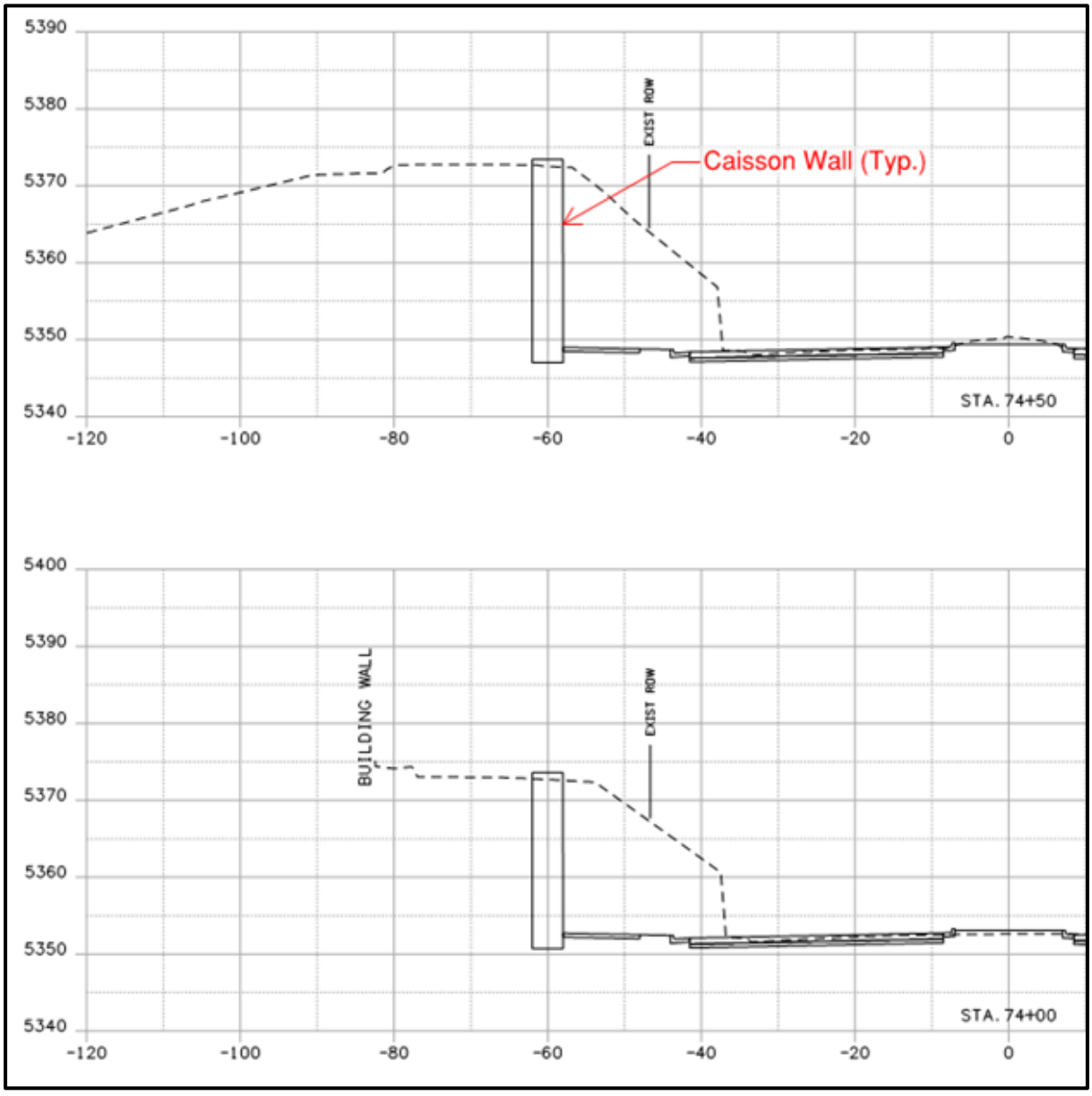
DISCUSSION/JUSTIFICATION:
There are multiple variations to this option that warrant some discussion:
- Lay back slope and stabilize without moving house;
- Lay back slope without stabilization and move house; and,
- Replace tangent caisson wall with soil nail wall and obtain permanent easement within affected property.

This option will look at the cost of laying back the slope with stabilization, and leaving the house in place.

SUMMARY OF COST ANALYSIS	
	Construction Cost
ORIGINAL DESIGN	$342,000
PROPOSED DESIGN	$510,000
ESTIMATED ADDITIONAL COST	**Additional cost of $168,000 (See conclusion below)**

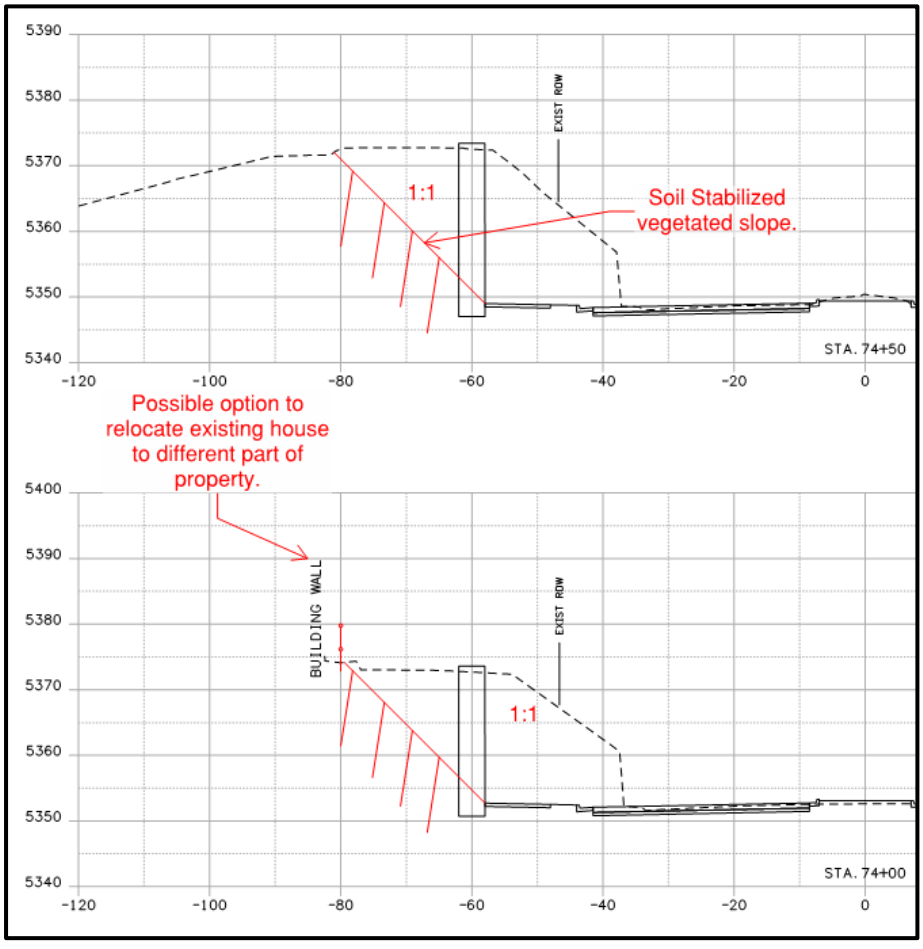
DROPPED DURING DEVELOPMENT	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-18** **Date: May 2, 2018**
DESCRIPTION OF VE PROPOSAL: **Evaluate the feasibility of laying back the slope in lieu of a caisson wall for wall 2W**	**Page No. 2 of 4** **Prepared By: Darin Freeman**

ORIGINAL DESIGN SKETCH:



DROPPED DURING DEVELOPMENT	
PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-18** **Date: May 2, 2018**
DESCRIPTION OF VE PROPOSAL: **Evaluate the feasibility of laying back the slope in lieu of a caisson wall for wall 2W**	**Page No. 3 of 4** **Prepared By: Darin Freeman**

PROPOSED CHANGE SKETCH:



DROPPED DURING DEVELOPMENT

PROJECT: Wadsworth Widening Environmental Assessment and Design	**Idea No.: 44/I-70-18** **Date: May 2, 2018**
DESCRIPTION OF VE PROPOSAL: **Evaluate the feasibility of laying back the slope in lieu of a caisson wall for wall 2W**	**Page No. 4 of 4** **Prepared By: Darin Freeman**

Construction Item		Current Design			Proposed Design		
Item	**Units**	**No. of Units**	**Cost / Unit**	**Total**	**No. of Units**	**Cost / Unit**	**Total**
Caisson wall (Average ht of 14.4', length of 280')	SF	4,020	$85	$342,000			
Soil Nail Wall (Project area onto 1:1)	SF				5,685	$65	$370,000
Additional ROW acquisition	SF				5,600	$25	$140,000
Total				$342,000			$510,000
						Net Cost Increase	**$168,000**

Conclusion - It appears that this option will be more costly, and thus not competitive with the original design. The other option of laying the slope back without soil reinforcements would require relocating the existing house, which would likely be much more expensive than just constructing the tangent caisson wall. It is recommended that this idea be withdrawn from consideration.

Appendix A Pareto Cost Model

A.1 Pareto Cost Model

Pareto Cost Models are used to understand where the majority of the project resources are being allocated. Pareto's Law of Distribution states that 80% of the project costs are found in 20% of the project items. A Pareto Cost Model is developed to:

- Organize the costs in order for them to be understood effectively;
- Identify where the major costs are to be found; and
- Help focus the Value Engineering Team efforts on project elements with the most potential for value improvement.

Table 6 and **Figure 11** provide the Pareto Cost Model developed based on cost estimate provided in *Appendix D. Detailed Statement of Work, Project Cost and, Schedule of the 2017 TIGER Grant Application, Wadsworth Boulevard Widening Project.* The elements in yellow represent 80% of the project cost. Note that the cost of the right-of-way, which is estimated to be $17,659,722, was not included in the Pareto Cost Model in order to determine where the high costs are in the project in addition to the right-of-way.

Table 6: Pareto Cost Model Table

Items	Cost	% of Project	Total %
412-01000 Concrete Pavement (10 Inch)	$4,689,178	16.2%	16.2%
Mobilization	$1,928,037	6.7%	22.9%
Construction Engineering	$1,928,037	6.7%	29.5%
Environmental Mitigation	$1,542,429	5.3%	34.9%
603-01605 60 Inch Reinforced Concrete Pipe (Complete In Place)	$1,082,627	3.7%	38.6%
608-00006 Concrete Sidewalk (6 Inch)	$966,745	3.3%	41.9%
Traffic Control	$964,018	3.3%	45.3%
Landscape and Irrigation	$964,018	3.3%	48.6%
614 4 Legged Signalization of Intersection	$795,675	2.7%	51.3%
700-70010 F/A Minor Contract Revisions	$750,000	2.6%	53.9%
614 Crossover Signalization	$742,630	2.6%	56.5%
203-00010 Unclassified Excavation (Complete In Place)	$678,976	2.3%	58.9%
601-07000 Concrete Retaining Wall	$636,540	2.2%	61.1%
601-07000S Concrete Retaining Wall (Special)	$636,540	2.2%	63.3%
613-30005 Light Standard and Luminaire (Pedestrian)	$591,982	2.0%	65.3%
Relocation of Dry Utilities	$578,411	2.0%	67.3%
304-06007 Aggregate Base Course (Class 6)	$477,405	1.6%	68.9%
610-00024 Median Cover Material (4 Inch Patterned Concrete)	$448,162	1.5%	70.5%
Sewer and Service	$385,607	1.3%	71.8%

Items	Cost	% of Project	Total %
514-00200 Pedestrian Railing (Steel)	$330,152	1.1%	73.0%
604-31010 Manhole Box Base (10 Foot)	$329,303	1.1%	74.1%
609-21020 Curb and Gutter Type 2 (Section II-B)	$324,635	1.1%	75.2%
201-00000 Clearing and Grubbing	$318,270	1.1%	76.3%
403-34721 Hot Mix Asphalt (Grading SX) (75) (PG 58-28)	$305,539	1.1%	77.4%
700-70019 F/A Asphalt Cement Cost Adjustment	$300,000	1.0%	78.4%
621-00450 Detour Pavement	$288,565	1.0%	79.4%
609-21010 Curb and Gutter Type 2 (Section I-B)	$286,443	1.0%	80.4%
619 Waterline Service	$271,548	0.9%	81.3%
603-01365 36 Inch Reinforced Concrete Pipe (Complete In Place)	$264,397	0.9%	82.3%
603-01545 54 Inch Reinforced Concrete Pipe (Complete In Place)	$264,031	0.9%	83.2%
603-01185 18 Inch Reinforced Concrete Pipe (Complete In Place)	$263,315	0.9%	84.1%
306-01000 Reconditioning	$262,573	0.9%	85.0%
202-00220 Removal of Asphalt Mat	$259,921	0.9%	85.9%
601-40010 Masonry Wall	$254,616	0.9%	86.8%
604-19205 Inlet Type R L 10 (5 Foot)	$223,426	0.8%	87.5%
604-19105 Inlet Type R L 5 (5 Foot)	$201,571	0.7%	88.2%
210 Unaccounted Resets and Adjustments	$200,000	0.7%	88.9%
700-70195 F/A Utilities and Maintenance of Field Facilities	$180,000	0.6%	89.5%
202 Unaccounted (Not Fully Quantified) Removal and Resets	$165,353	0.6%	90.1%
202-00035 Removal of Pipe	$164,440	0.6%	90.7%
614/627 Unaccounted (Not Fully Quantified) Signing, Signals and Striping	$161,931	0.6%	91.2%
202-00203 Removal of Curb and Gutter	$145,343	0.5%	91.7%
604-19410 Inlet Type R Special (40 Foot)	$127,308	0.4%	92.2%
603-01425 42 Inch Reinforced Concrete Pipe (Complete In Place)	$125,398	0.4%	92.6%
304-412 Unaccounted (Not Fully Quantified) Roadway Surfacing	$115,422	0.4%	93.0%
202-00000 Removal of Structures and Obstructions	$106,090	0.4%	93.4%
604 Water Quality Pond	$106,090	0.4%	93.8%
625-00000 Construction Surveying	$106,090	0.4%	94.1%
603-01485 48 Inch Reinforced Concrete Pipe (Complete In Place)	$104,138	0.4%	94.5%
604-30010 Manhole Slab Base (10 Foot)	$81,159	0.3%	94.8%
601 Unaccounted (Not Fully Quantified) Walls	$76,385	0.3%	95.0%
202-00200 Removal of Sidewalk	$68,959	0.2%	95.3%

Items	Cost	% of Project	Total %
603-604 Unaccounted (Not Fully Quantified) Drainage	$68,674	0.2%	95.5%
626-01000 Public Information Services	$63,654	0.2%	95.7%
202-00010 Removal of Tree	$61,002	0.2%	95.9%
202-00210 Removal of Concrete Pavement	$59,410	0.2%	96.1%
208-00207 Erosion Control Management	$53,045	0.2%	96.3%
614-85001 Impact Attenuator	$53,045	0.2%	96.5%
620-00002 Field Office (Class 2)	$53,045	0.2%	96.7%
202-00019 Removal of Inlet	$51,984	0.2%	96.9%
700-70016 F/A Fuel Cost Adjustment	$50,000	0.2%	97.0%
700-70380 F/A Erosion Control	$50,000	0.2%	97.2%
202-00155 Removal of Wall	$47,741	0.2%	97.4%
603-01305 30 Inch Reinforced Concrete Pipe (Complete In Place)	$44,133	0.2%	97.5%
208-00002 Erosion Log (12 Inch)	$42,966	0.1%	97.7%
202-00240 Removal of Asphalt Mat (Planning)	$42,436	0.1%	97.8%
608-609 Unaccounted (Not Fully Quantified) Sidewalk Surfacing	$40,676	0.1%	98.0%
604-31015 Manhole Box Base (15 Foot)	$38,192	0.1%	98.1%
603-01245 24 Inch Reinforced Concrete Pipe (Complete in Place)	$35,540	0.1%	98.2%
202-00700 Removal of Light Standard	$35,328	0.1%	98.3%
403-00720 Hot Mix Asphalt (Patching) (Asphalt)	$34,373	0.1%	98.5%
208 Unaccounted (Not Fully Quantified) Erosion Control	$31,254	0.1%	98.6%
604-19305 Inlet Type R L 15 (5 Foot)	$29,069	0.1%	98.7%
614-72863 Pedestrian Push Button Post Assembly	$25,462	0.1%	98.8%
203-01597 Potholing	$23,870	0.1%	98.8%
614-00011 Sign Panel (Class I)	$23,153	0.1%	98.9%
606-00710 Guardrail Type 7 (Style CA)	$22,279	0.1%	99.0%
604-31025 Manhole Box Vase (25 Foot)	$21,218	0.1%	99.1%
604-19110 Inlet Type R L 5 (10 Foot)	$21,006	0.1%	99.1%
700-70011 F/A Partnering	$20,000	0.1%	99.2%
700-70589 F/A Environmental Health and Safety Management	$20,000	0.1%	99.3%
202-00705 Removal of Light Standard Foundation	$19,627	0.1%	99.3%
604-19210 Inlet Type R L 10 (10 Foot)	$18,672	0.1%	99.4%
614-01502 Steel Sign Support (2-Inch Round)(Post and Socket)	$17,891	0.1%	99.5%
603-77011 Culvert Wingwall (3-Sided Culvert) (Type 1)	$15,914	0.1%	99.5%
604-31020 Manhole Box Base (20 Foot)	$15,914	0.1%	99.6%
620-00012 Field Office Laboratory (Class 2)	$15,914	0.1%	99.6%

Items	Cost	% of Project	Total %
202-00810 Removal of Ground Sign	$12,413	0.0%	99.7%
202-Removal of Traffic Signal Pole	$10,821	0.0%	99.7%
627-30410 Preformed Thermoplastic Pavement Marking (StopLine)	$9,166	0.0%	99.7%
603-77001 Culvert Headwall (3-Sided Culvert) (Type 1)	$7,957	0.0%	99.8%
608-00010 Concrete Curb Ramp	$7,808	0.0%	99.8%
506-00218 Riprap (18 Inch)	$7,426	0.0%	99.8%
604-30005 Manhole Slab Base (5 Foot)	$7,108	0.0%	99.9%
604-31005 Manhole Box Base (5 Foot)	$6,206	0.0%	99.9%
208-00051 Storm Drain Inlet Protection (Type 1)	$5,623	0.0%	99.9%
202-05030 Sawing Asphalt Material (10 Inch)	$5,013	0.0%	99.9%
202-00848 Removal of Traffic Signal Controller and Cabinet	$4,456	0.0%	99.9%
203-00100 Muck Excavation	$3,734	0.0%	99.9%
627-00005 Epoxy Pavement Marking	$3,209	0.0%	100.0%
202-00805 Removal of Overhead Sign Structure	$3,183	0.0%	100.0%
202-00842 Removal of Mast Arm	$2,546	0.0%	100.0%
208-00045 Concrete Washout Structure	$2,546	0.0%	100.0%
614-72860 Pedestrian Push Button	$2,122	0.0%	100.0%
411-10255 Emulsified Asphalt (Slow-Setting)	$2,027	0.0%	100.0%
202-01000 Removal of Fence	$1,644	0.0%	100.0%
Total	**$28,940,923**	**100.0%**	

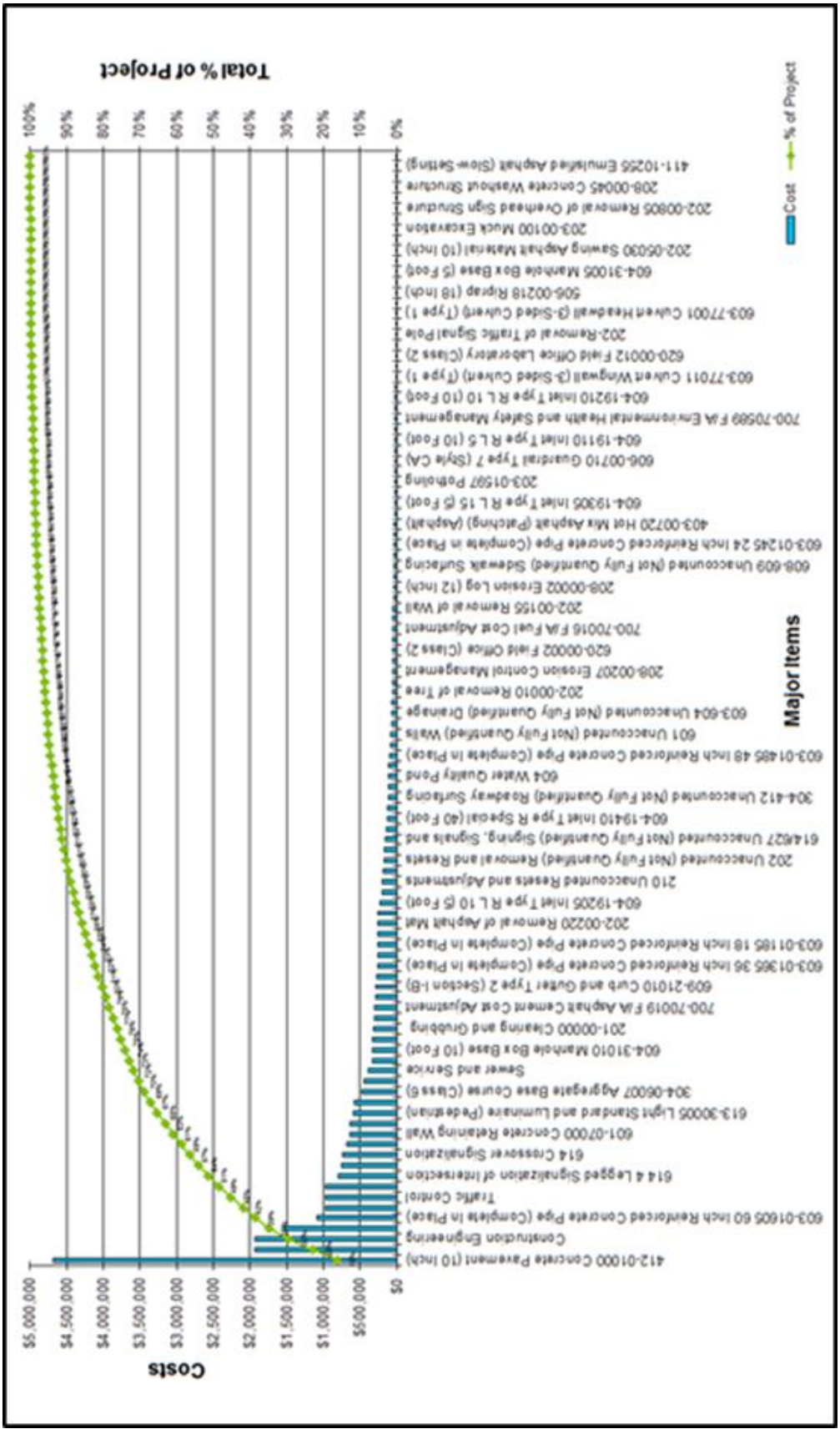


Figure 11: Pareto Cost Model Figure

Appendix B Function Analysis

B.1 Function Analysis

Function Analysis was undertaken by the VE Team to develop an understanding of the functions that the project must achieve to satisfy the City and CDOT. A function is an expression of what something needs to do without defining how it should be done. Functions are defined in active verb / measureable noun statements to reduce the needs of the project to their most elemental level. Identifying the functions of the major project elements allows alternative solutions to be generated to accomplish those functions. **Table 7** provides the functions of the project identified by the VE Team.

Table 7: Functions

Function	Function
Increase Capacity	Reduce Conflict Points
Increase Safety	Accommodate Pedestrian Movements
Reduce Delay	Accommodate Bike Movements
Improve Multi-Model Environment	Improve Drainage
Improve Access	Convey Runoff
Consolidate Access	Improve Maintainability
Control Access	Enhance Regional Mobility
Enhance Aesthetics	Illuminate Area

B.2 Function Analysis System Technique (FAST) Diagram

The Function Analysis System Technique (FAST) Diagram shown in **Figure 12** graphically illustrates the functions in logical order. A function diagram organizes the identified functions into the "How-Why" logic model. Proper arrangement and relationship of the functions in the function diagram can be confirmed with the How-Why logic test as follows:

- Ask the question of any function, "**How** do I verb-noun?" The answer should be the function to the immediate **right**.
- Ask the question "**Why** do I verb-noun?" The answer should be the function to the immediate **left** (i.e., "so that I can verb-noun?").
- A function that does not pass the How-Why test is either described improperly or is in the wrong place. The answer must make sense.

The farther you proceed from left to right in the diagram, the more precise you become. Conversely, the farther you proceed from right to left, the more general you become. It is important to understand that the position of functions in a functional diagram in no way represents the chronological order of events. The intent of the FAST Diagram is to help the VE Team consider the logic of how and why something is done, as well as the importance and relevance of each function.

Some of the functions listed in **Table 7** may not in the FAST Diagram because they were not considered critical functions when the diagram was created. In addition, some of the critical functions in the FAST Diagram are not listed above because they were not identified until the diagram was created.

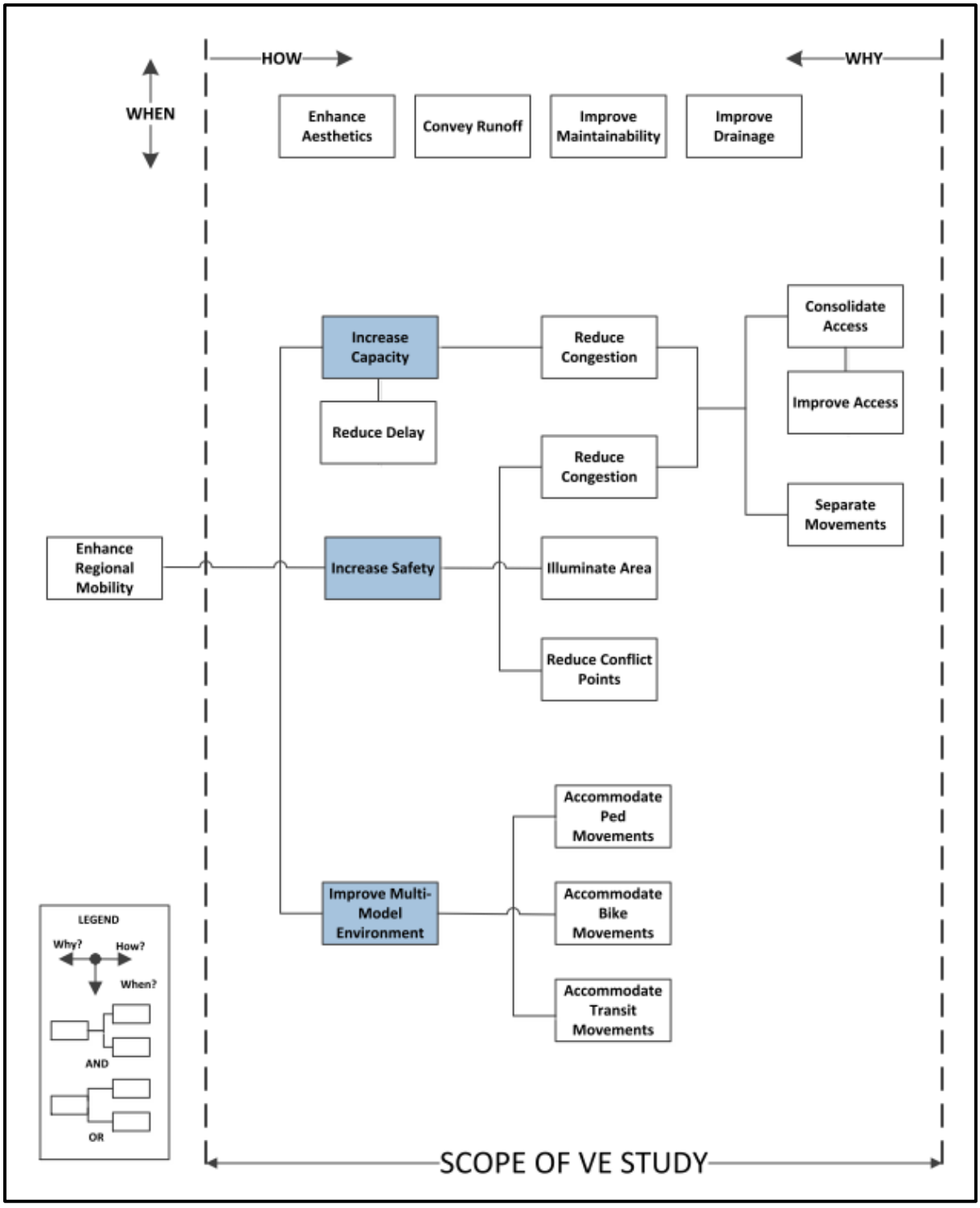


Figure 12: FAST Diagram

Appendix C Creative Phase and Evaluation Table

C.1 Creative Phase and Evaluation Table

During the Creative Phase of the VE Study, the VE Team was encouraged to offer any and all ideas, including “wild ideas” or “out of the box” ideas, to perform the intended functions of the project. A positive environment for brainstorming was maintained at all times, reserving all judgment of the ideas until the Evaluation Phase so that all VE Team members would be comfortable offering thoughts and ideas. The VE Team was looking for quantity and association of ideas. The more ideas generated, the more likely a “breakthrough” idea would be identified with significant value implications.

During the Evaluation Phase, the VE Team critically viewed each of the ideas generated during the Creative Phase of the workshop to determine whether the ideas were likely to improve the value of the project. The following legend was used by the VE Team in the evaluation of the ideas generated during the Creative Phase:

- CF: Carried Forward = Idea to be developed into a VE Proposal
- DC: Design Comment = Idea to be developed into a Design Comment
- NCF: Not Carried Forward = Idea rejected by the VE Team
- W: With = Idea is being developed with another idea
- ABD: Already Being Done = Already Being Done in the base case
- DDD: Dropped During Development = Idea was determined to not be feasible

Only ideas scoring a “CF” were developed into VE Proposals. Ideas scoring a “DC” were developed into Design Comments. Design Comments are ideas that in the opinion of the VE Team were good ideas but for any number of reasons were not selected for development as VE Proposals. Design comments can be notes, documentation of various thoughts that came up during the course of the VE Study, a reference to possible problems, items that might need further study, or questions that the City, CDOT and the design team might want to explore.

Table 8 provides the results of the Creative Phase and Evaluation Phase.

Table 8: Summary of Creative Ideas and Evaluation Table

Idea No.	Description	Evaluation Action
	Corridor	
C-1	Add advance signage to the intersections throughout the corridor	DC
C-2	Use a multi-use trail on the east side of the corridor in lieu of separate bike and ped facilities	CF
C-3	Permanent easement in lieu of purchasing right-of-way throughout the project	CF
C-4	Overlay existing pavement throughout the project	NCF
C-5	Use asphalt in lieu of concrete throughout the project	CF
C-6	Reduce median width throughout the corridor	CF

Idea No.	Description	Evaluation Action
C-7	Reduce width of amenity area throughout the corridor	CF
C-8	Widen the lane for the displaced left turn lane throughout the corridor	DC
C-9	Reduce the width of space between the CFI cross over throughout the corridor	NCF
C-10	Taper the median nose throughout the corridor	DC
C-11	Eliminate the amenity zone throughout the corridor	NCF
C-12	Use HMA instead of PCC for sidewalks	CF
C-13	Add transit signal priority throughout the corridor	DC
C-14	Reduce project limits	CF
C-15	Reduce temporary pavement width	ABD
C-16	Replace trees with bushes	CF
C-17	Investigate a business district to maintain the amenity zones	DC
C-18	Reduce the depth of the concrete pavement	NCF
C-19	Eliminate ABC from under cycle track and sidewalks	CF
35th to 38th		
35/38-1	Do not construct noise walls for the proposed building on the west side of the corridor	ABD
35/38-2	Do not construct noise walls for the seniors housing on the east side of the corridor	ABD
35/38-3	Eliminate the right-in-right-out for the new development on the west side of the corridor	DC
35/38-4	Run a right-turn overlap with left turn at CFI crossover separation at all CFI crossover locations	DC
35/38-5	Eliminate the CFI and use double left turns	NCF
35/38-6	Use roundabout at 38th and Wadsworth	NCF
35/38-7	Eliminate the ped crossing at the CFI cross over	w 35/38-4
35/38-8	Increase the radius of the secondary compound curve and extend the median nose downstream on the southeast and northwest corners of the 38th and 44th and Wadsworth	DC
35/38-9	On south 38th, extend the median to cover the right-in right-out	DC
35/38-10	Move the stop bars further south at the cross over	DC
35/38-11	Eliminate traffic islands and right turn lanes at 38th and 44th	CF
38th to 39th		
38/39-1	Eliminate the left-out on the east side of the corridor	NCF
38/39-2	Right-in only at the dental office	DC
38/39-3	Eliminate right-turn channelized lanes at the 38th and Wadsworth intersection	w 35/38-11
38/39-4	Consolidate the two adjacent driveways on the west side of the corridor	DC
38/39-5	Run a right-turn overlap with left turn at CFI separation	w 35/38-4

Idea No.	Description	Evaluation Action
38/39-6	Eliminate the signal if the CFI is eliminated	NCF
38/39-7	Use roundabout at 39th and Wadsworth	NCF
38/39-8	Move the stop bars further south at the cross over	w 35/38-10
39th to 44th		
39/44-1	Increase the length of the southbound and northbound left turns at 41st	DC
39/44-2	Provide a left-thru-right at westbound 41st	NCF
39/44-3	Provide the same left lane storage on both sides of the CFI	w 39/44-1
39/44-4	Extend CFI median south and modify the driveway	DC
39/44-5	Increase the radius of the secondary compound curve and extend the median nose downstream on the southeast and northwest corners of 44th and Wadsworth	w 35/38-8
39/44-6	Angle the stop bars at the 38th and 44th intersections	NCF
39/44-7	Eliminate the ped islands at the 44th and Wadsworth intersection	w 35/38-11
39/44-8	Eliminate right-turn channelized lanes at the 44th and Wadsworth intersection	w 35/38-11
39/44-9	Add raised median eastbound at 44th	DC
39/44-10	Eliminate the exclusive right turn lanes on the east and west legs of 44th Avenue and the east leg of 38th Avenue	CF
44th to I-70		
44/I-70-1	Investigate the reverse curves northbound between 44th and 45th	DC
44/I-70-2	Consolidate the two adjacent driveways on the east side of the corridor between 44th and 45th and put on the property line	DC
44/I-70-3	Use the existing north access for Red Lobster	DC
44/I-70-4	Eliminate Discount Tires access on Wadsworth	DC
44/I-70-5	Relocate the road to behind Wadsworth Plaza	NCF
44/I-70-6	Reconfigure 48th Avenue into a cul-de-sac with limited access	CF
44/I-70-7	Tier the retaining wall on the west and east side (Walls 2W and 12E)	CF
44/I-70-8	Shift Wadsworth to the east in order to keep existing wall on West side (Wall 2W)	CF
44/I-70-9	Leave the west wall in place and reduce the median width	w 44/I-70-8
44/I-70-10	Reduce the sidewalk width to 5 feet in front of the Johnson Park	CF
44/I-70-11	Use existing outlet in Johnson Park with water quality vault	CF
44/I-70-12	Install a deeper water quality swale in Johnson Park	NCF
44/I-70-13	Consider soil nail walls instead of caisson wall on the east side north of 48th	CF
44/I-70-14	Increase the length of the southbound and northbound left turns at 47th	DC
44/I-70-15	At 47th, reconfigure to 3/4 in both directions	DC

Idea No.	Description	Evaluation Action
44/I-70-16	Use off-ramp from Wadsworth onto 48th and eliminate the frontage road	CF
44/I-70-17	Close driveway to Johnson Park	NCF
44/I-70-18	Purchase the property on the west side on hill and lay the slope back instead of retaining wall and build house further back on the property	DDD
44/I-70-19	Do not construct the noise walls on 44th Street	ABD
44/I-70-20	Change sidewalk with backside footer to stand alone block wall	DC
44/I-70-21	Split the drainage system at Johnson Park	CF
44/I-70-22	Revise the driveway to Walgreens to a right-in only	DC

Appendix D Report-Out Presentation Attendees

D.1 Attendees

AECOM Imagine it. Delivered.

JOB TITLE Wadsworth Widening Project

PROJECT/JOB NO. _____ CALCULATION NO. _____

COMPUTED BY _____ DATE May 3/18

VERIFIED BY _____ DATE _____

SCALE _____ SHEET NO. _____ OF _____

VE Report Out Presentation

Name	Organization/Role	Contact
① Tammy Dau	AECOM - VE Team Leader	Tammy.dau@aecom.com
② PAUL SCHERNER	CDOT - TRAFFIC	PAUL.SCHERNER@STATE.CO.US
③ Jeff Hampton	CDOT	jeffery.hampton@hotmail.com
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Joy French	CDOT LA	joy.french@state.co.us
Patricia McKinney-Clark	CDOT R1 Utilities	patricia.mckinney@state.co.us

5x5 = 1 in

AECOM Imagine it. Delivered.

JOB TITLE _____

PROJECT/JOB NO. _____ CALCULATION NO. _____

COMPUTED BY _____ DATE _____

VERIFIED BY _____ DATE _____

SCALE _____ SHEET NO. _____ OF _____

Patrick Goff WR City Manager pgoff@ci.wheatridge.co.us


INVESTING
4 THE FUTURE
ANDERSON PARK
CLEAR CREEK CROSSING
WADSWORTH BOULEVARD
WR•WARD STATION