US 6/Wadsworth

Environmental Assessment

Alternatives Development and Screening Technical Memorandum

CDOT Project STU #0062-019 (15215)
CH2M HILL Project No. 358660

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TECHNICAL MEMORANDUM CH2MHILL

US 6 and Wadsworth Environmental Assessment Alternatives Development and Screening

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DATE: July 13, 2008

1. Introduction

Previous planning studies have indicated the need to improve the US 6 and Wadsworth interchange and Wadsworth Boulevard between 4th and 14th Avenues, but conceptual design alternatives were not developed through these studies.

As part of the US 6 and Wadsworth environmental assessment (EA), the project team developed and evaluated alternatives for improving the US 6 and Wadsworth Boulevard interchange and the Wadsworth Boulevard corridor between 4th and 14th Avenues. Interchange and roadway (Wadsworth Boulevard) alternatives were developed and evaluated separately and then combined into a single preferred alternative.

The potential alternatives included two general categories that considered the differing contexts of the interchange and Wadsworth Boulevard:

- Interchange alternatives that accommodate high traffic volumes and improve safety within a developed urban area with limited right-of-way.
- Wadsworth Boulevard alternatives that match or complement improved roadway sections north and south of the project area, improving safety, capacity, and multi-modal connections.

2. Overview of the Alternatives Development and Evaluation Process

The intent of the alternatives development and evaluation process was to conduct two levels of screening and evaluation for a range of design concepts for the interchange and Wadsworth Boulevard. General concepts for the interchange and Wadsworth Boulevard were developed and subjected to a Level 1 "fatal flaw" screening. Those concepts that were carried forward for further evaluation were refined and compared to each other in a Level 2 evaluation. The results of the Level 2 evaluation identified one combined alternative that will be evaluated in the EA.

Evaluation criteria were established for the Level 1 and Level 2 screening, prior to the development of any alternatives. These criteria were developed by the Colorado Department of Transportation (CDOT) and the Federal Highway Administration (FHWA) based on the project purpose and need. The City of Lakewood (City) and Regional Transportation District (RTD)

were consulted during the development of evaluation criteria and ultimately concurred with the evaluation criteria in accordance with the chartering agreement established at the beginning of the EA process. Charter team members also concurred with the purpose and need. Other stakeholders were provided opportunities to comment on, prioritize, and refine evaluation criteria as appropriate. Section 3 of this memorandum summarizes the input received on the evaluation criteria.

Level 1 screening identified a range of project improvements that could meet the project purpose and need, while eliminating concepts from detailed consideration that had "fatal flaws" (that is, were not reasonable or did not meet the purpose and need). Level 1 screening was supported by the baseline data collected during scoping. During the Level 1 screening, design concepts were evaluated qualitatively primarily using professional judgment of the project engineering and planning staff.

Level 2 evaluation was a more detailed evaluation of the concepts that passed the first level of screening. During Level 2 evaluation, design concepts were evaluated based on quantitative measures that were established in the development of the evaluation criteria. Attributes of each concept were rated as "good," "fair," or "poor." The results of the Level 2 evaluation led to the selection of a preferred alternative to be evaluated in the EA.

3. Evaluation Criteria

The US 6 and Wadsworth EA Project Leadership Team sought input from a variety of stakeholders in identifying the transportation, environmental, and community values that are important to successful project alternatives. During the scoping period (May through August 2007), the team collected baseline data and conducted numerous meetings with stakeholders. Input gathered during the scoping period was used to shape the evaluation criteria. Additional details on the evaluation criteria can be found in a separate technical memorandum located in the project files ("US 6 and Wadsworth Environmental Assessment Alternatives Evaluation Criteria," March 14, 2008).

3.1. Level 1 Screening Criteria

Level 1 screening was intended to define a range of design concepts that could meet the project purpose and need, could be implemented at a reasonable cost, and would not result in unacceptable environmental or community impacts. Design concepts identified for Level 1 screening included concepts that project staff, based on experience with similar projects, felt could meet transportation needs as well as concepts suggested by public or non-transportation agency stakeholders. Level 1 screening used available data and engineering judgment and was conducted by professionals with expertise in the applicable areas, such as roadway design, traffic, environmental resources, and cost estimating.

Level 1 screening criteria were developed to screen concepts in the following areas: safety and design; mobility and traffic operations; local impacts; environmental impacts; cost feasibility; and implementation. Consistent with the "fatal flaw" analysis, concepts were judged "yes" or "no" for meeting each criteria element.

Separate screening criteria were developed for the interchange and for Wadsworth Boulevard because the transportation goals and problems are distinctly different in these two areas. The

Level 1 screening criteria for the interchange and Wadsworth Boulevard are presented in Exhibits 1 and 2, respectively, on the following page.

EXHIBIT 1
Level 1 Screening Criteria – US 6 and Wadsworth Interchange (including Wadsworth Boulevard from 4th Avenue to Highland Drive)

Criteria	Description/Measure (yes/no)
Safety/Design	Is the alternative feasible from an engineering perspective?
	Can this alternative accommodate safer bicycle and pedestrian travel through the interchange?
	Does the alternative improve weaving/merge conditions?
Mobility/Traffic Operations	Can the alternative meet current and future traffic needs?
	Does the alternative address the interaction of the Wadsworth interchange and Carr/Garrison Street ramps?
Local Impacts	Does the alternative provide a means to access residences and businesses along the corridor?
Environmental impacts	Can environmental impacts be reasonably mitigated? Environmental impacts considered during Level 1 screening include right-of-way, noise, water quality, and Section 4(f).
Cost Feasibility	Can the alternative be constructed within 150 percent of estimated costs (i.e., less than $67.5 million [in 2010 dollars])? Costs include the capital construction and right-of-way.
Implementation	Is the alternative compatible with established local plans and visions?

EXHIBIT 2
Level 1 Screening Criteria – Wadsworth Boulevard (Highland Drive to 14th Avenue)

Criteria	Description/Measure (yes/no)
Safety/Design	Is the alternative feasible from an engineering perspective?
	Does the alternative decrease access conflicts?
	Can this alternative accommodate safer bicycle and pedestrian travel along and across Wadsworth?
Mobility/Traffic Operations	Can the alternative meet current and future traffic needs?
Local Impacts	Does the alternative provide a means to access residences and businesses along the corridor?
Environmental impacts	Can environmental impacts be reasonably mitigated? Primary environmental impacts considered during Level 1 screening include right-of-way, noise, water quality, and Section 4(f).
Cost Feasibility	Can the alternative be constructed within 150 percent of estimated costs (i.e., less than $30.0 million [in 2010 dollars])? Costs include the capital construction and right-of-way.
Implementation	Is the alternative compatible with established local plans and visions?
	Is the alternative compatible with RTD light rail transit plans?

3.2. Level 2 Evaluation Criteria

The purpose of the Level 2 evaluation was to establish a means for estimating and comparing how well design concepts performed in meeting transportation needs in a cost-effective and least environmentally harmful manner. The Level 2 evaluation expanded the measures for each of the criteria from Level 1 screening and provided a method for comparing concepts to support the selection of preferred alternative(s) to be evaluated in the EA. All stakeholders, including the charter members and the public, were asked to prioritize the measures. Although each of the criteria were measured and evaluated, the priorities helped the project team assess the performance of the design concepts for the measures determined to be most critical to the project's success.

Criteria were measured quantitatively where possible. A detailed analysis of impacts of the alternative passing Level 2 evaluation will be conducted in the EA. (That is, environmental resources not included in the Level 2 evaluation will be analyzed, and mitigation will be included as appropriate.) As with Level 1 screening, the Level 2 evaluation was divided between design concepts for the interchange and design concepts for Wadsworth Boulevard.

Exhibits 3 and 4 summarize the Level 2 evaluation criteria for the interchange and Wadsworth Boulevard, along with criteria descriptions, and assessment or performance measures for each criterion. Organization of the Level 2 criteria (in *italics*) was consistent with the categories (shown in bold) established in Level 1 Screening.

EXHIBIT 3
Level 2 Evaluation Criteria – US 6 and Wadsworth Boulevard Interchange Concepts (including Wadsworth Boulevard, 4th Avenue to Highland Drive)

		Assessment		
Criteria	**Description**	**Good**	**Fair**	**Poor**
Design/Safety				
Pedestrian and Bicycle Safety (controlled crossing)	A controlled crossing reduces motorized / non-motorized conflicts and provides a safer environment for pedestrians and bicyclists to cross interchange ramps and US 6.	Grade-separated crossing	Signalized crossing	Uncontrolled crossing
Ramp Entrance Design	CDOT prefers highway acceleration lanes that are parallel to through traffic, although tapered lanes are also acceptable.	Parallel acceleration lanes for all US 6 entrances	Mixed parallel and tapered acceleration lanes for US 6 entrances	Tapered acceleration lanes for all US 6 entrances
Design Exceptions	Design exceptions (as defined by FHWA's 13 controlling criteria) must be fully evaluated and require formal approval from FHWA to implement. (Note: approved design exceptions do meet standards but can cause delay in design.)	No new design exceptions required	N/A	Requires new design exceptions
Mobility/Traffic Operations				
Weave Sections	Weave sections adversely affect mainline operations and contribute to congestion and conflicts/crash potential.	Eliminates all weave sections	Improves weave sections (by elimination or increased distance)	Weave sections maintained
Ramp Operations	Level of service (LOS) of the directional ramp movements is a qualitative description of traffic-flow characteristics ranging from A (free flow) to F (stop-and-go) based on the volume of traffic in the ramp section.	LOS on US 6 ramps is improved over existing conditions	Existing LOS on US 6 ramps is maintained	LOS on US 6 ramps is lower than existing LOS
Wadsworth Boulevard Corridor Travel Time	Corridor travel time is influenced primarily by the number of signalized intersections that must be traversed through the corridor. Fewer intersections improve through-travel times.	No net increase in signalized intersections	Net increase of one signalized intersection	Net increase of more than one signalized intersection
Interchange Capacity	Any interchange design needs to accommodate current and projected future critical peak-hour interchange movements. Critical movements for the US 6 and Wadsworth interchange are defined as northbound (NB) to eastbound (EB) (a.m.) and westbound (WB) to southbound (SB) (p.m.) and measured by volume to capacity (V/C) ratios (year 2035).	Average V/C ratio of critical movements is less than 0.85	Average V/C ratio of critical movements is between 0.85 and 1.0	Average V/C ratio of critical movements is greater than 1.0

EXHIBIT 3
Level 2 Evaluation Criteria – US 6 and Wadsworth Boulevard Interchange Concepts (including Wadsworth Boulevard, 4th Avenue to Highland Drive)

		Assessment		
Criteria	**Description**	**Good**	**Fair**	**Poor**
Spacing Criteria for Frontage Roads	An increased distance between the frontage road intersection and the interchange ramp terminals is desirable.	Spacing is improved to CDOT Access Code standards of 0.5 mile	Spacing is improved (i.e., lengthened) over existing conditions	Existing spacing between frontage roads and ramps is maintained or decreased from existing conditions
Local Impacts				
Local Access to/from US 6	The distance of trips originating in nearby neighborhoods accessing US 6. Measured by average distance to/from US 6 from each quadrant of the interchange.	Distance to access US 6 for inbound and outbound trips is the same or less than existing	Distance to access US 6 for inbound and outbound trips is no more than 25 percent longer than existing	Distance to access US 6 for inbound and outbound trips is >25 percent longer than existing
Effects to Local Businesses	Business owners near the US 6 interchange could be adversely affected by changes to access, visibility, and/or parking associated with new interchange designs.	No businesses adversely affected	Up to two businesses adversely affected	More than two businesses adversely affected
Environmental Impacts				
Number of Relocations	The total number of residences and businesses that would require relocation. Relocations should be minimized if possible.	No relocations required	Up to two relocations required	More than two relocations required
Number of Properties Affected (partial and full acquisitions)	The total number of partial and full acquisitions but not easements. Fewer properties should be affected if possible.	Two or fewer private properties affected	Three to five private properties affected	More than five private properties affected
Number of Residences within 66-dBA noise contour	The number of residences within the 66-dBA noise contour under 2035 conditions as compared to existing conditions. Fewer residences within the 66-dBA contour represent fewer noise impacts.	Fewer number of residences within 66-dBA contour as compared to existing conditions	Same number of residences within 66-dBA contour as compared to existing conditions	Greater number of residences within 66-dBA contour as compared to existing conditions
Acres of Wetlands and Waters of the U.S. Affected	The total acres of fill/dredge of wetlands and waters of the U.S. Impacts to wetlands and waters of the U.S. should be minimized if practicable.	No wetlands/waters of the U.S. affected	Impacts to wetlands/waters of the U.S. can be mitigated and permitted under Nationwide Permits	Impacts to wetlands/waters of the U.S. require Individual 404 permit
Cost				
Project Cost	Estimated total cost of project alternative, including capital construction, right-of-way, and project development costs.	Within projected funding of approximately $45 million	Between 1 and 25 percent higher than projected funding	More than 25 percent higher than projected funding

EXHIBIT 3
Level 2 Evaluation Criteria – US 6 and Wadsworth Boulevard Interchange Concepts (including Wadsworth Boulevard, 4th Avenue to Highland Drive)

		Assessment		
Criteria	**Description**	**Good**	**Fair**	**Poor**
Right-of-Way Cost	Percentage of total project cost associated with estimated cost of right-of-way acquisition	20 percent	21 to 35 percent	More than 35 percent
Implementation				
Emergency Response	Emergency response goals are set to provide adequate emergency response to the public.	Emergency response goals are met	Emergency response goals are partially met	Emergency response goals cannot be met
Construction Staging	Alternatives that minimize travel lane and ramp closures are less disruptive to the traveling public. Performance is measured in anticipated duration of closures.	Closures conform with CDOT's lane closure policy	Some variance to CDOT's lane closure policy would be required	Closures would not conform to CDOT's lane closure policy
Expandability	Alternatives that can accommodate future widening of US 6 and/or Wadsworth Boulevard (for transit or added capacity) are preferable to those that would require reconstruction if the corridors were expanded (widened).	Limited or no reconstruction would be needed to expand the facility	Partial reconstruction (e.g., minor grading and/or modifying slope paving or ramp terminals) would be needed to expand the facility	Full reconstruction (e.g., reconstruct bridge structure) would be needed to expand the facility

EXHIBIT 4
Level 2 Evaluation Criteria – Wadsworth Boulevard Concepts (Highland Drive to 14th Avenue)

		Assessment		
Criteria	**Description**	**Good**	**Fair**	**Poor**
Design/Safety				
Through Lane Width	Design guidelines indicate that the recommended through-lane width be at least 11 feet, although 12 feet would be desirable.	12 feet	11 feet	Less than 11 feet (not acceptable)
Vehicular and Pedestrian Safety at Intersections (median)	A raised median would prohibit mid-block left turns, decreasing approach-turn accidents and reducing sideswipe accidents for opposite-traveling vehicles. A wide raised median also provides refuge for pedestrians when crossing the road. Narrow or striped medians do not provide refuge at intersections and do not provide space for safe u-turns.	Raised median of 18 feet wide or more (at intersection, 12-foot turn lane with minimum 6-foot raised median)	Raised median less than 18 feet wide (at intersection, 12-foot turn lane with less than 6-foot raised median)	Painted median (at intersection, 12-foot turn lane with painted median)
Pedestrian Safety (sidewalk and buffer)	A wider separation (either landscaped or hardscaped) between vehicles and sidewalks increases safety for pedestrians (sidewalk width is in addition to space required for signage or utilities).	Detached 5-foot sidewalk on both sides of Wadsworth	Attached 5-foot sidewalk on both sides of Wadsworth	Sidewalk less than 5 feet wide on both sides of Wadsworth or an unbalanced section
Bicycle Safety (path and buffer)	Safe bicycle travel requires a wider shared path or dedicated on-street travel area for bicycles.	Detached 8- to10-foot path on both sides of Wadsworth	Attached 8- to 10-foot path on both sides of Wadsworth	Attached path less than 8 feet on both sides of Wadsworth or an unbalanced section
Design Exceptions	Design exceptions (as defined by FHWA's 13 controlling criteria) must be fully evaluated and require formal approval from FHWA to implement. (Note: approved design exceptions do meet standards but can cause delay in design.)	No new design exceptions required	N/A	Requires new design exceptions
Mobility/Traffic Operations				
Controlled Access (median)	A raised median consolidates left-turn movements, reducing the potential for approach-turn accidents and allowing for managed full movements only at major intersections.	Raised median with left turns allowed at signalized intersections only	Raised median with left turns at some unsignalized intersections	Painted median

EXHIBIT 4
Level 2 Evaluation Criteria – Wadsworth Boulevard Concepts (Highland Drive to 14th Avenue)

		Assessment		
Criteria	**Description**	**Good**	**Fair**	**Poor**
Intersection Operations	Operations analyses measure the average amount of delay a vehicle experiences to pass through an intersection. This metric is an average of all signalized intersections.	Less than 55 seconds of delay	Between 55 and 80 seconds of delay	More than 80 seconds of delay
Local Impacts				
Neighborhood Traffic Impacts	Changes to intersection and frontage road accesses could change neighborhood traffic patterns and result in changes in volume or speed of traffic on local streets. Closing movements at unsignalized intersections would reduce neighborhood cut-through traffic.	Close more than 20 percent of movements at unsignalized intersections	Close up to 20 percent of movements at unsignalized intersections	Maintain current unrestricted unsignalized intersection access
Local Access to/from Wadsworth	The distance of trips originating in nearby neighborhoods accessing Wadsworth Boulevard.	Distance to access Wadsworth for inbound and outbound trips is the same or less than existing	Distance to access Wadsworth for inbound and outbound trips is no more than 25 percent longer than existing	Distance to access Wadsworth for inbound and outbound trips is >25 percent longer than existing
Effects to Local Businesses	Business owners along Wadsworth Boulevard could be adversely affected by changes to access, visibility, and/or parking associated with a widened cross section.	No businesses adversely affected	Up to two businesses adversely affected	More than two businesses adversely affected
Environmental Impacts				
Number of Relocations	The total number of residences and businesses that would require relocation.	No relocations required	Three or fewer relocations required	More than four relocations required
Number of Properties Affected (partial and full acquisitions)	The total number of partial and full acquisitions but not easements.	Minimal number of private properties affected (5 or less)	Moderate number of private properties affected (6 to 10)	High number of private properties affected (11 or more)
Number of Section 4(f) Uses	The number of Section 4(f) properties that would require transportation use. Section 4(f) properties include historic properties (to be identified) and the planned Two Creeks Park.	No or *de minimis* Section 4(f) impacts	Minor Section 4(f) use (qualifies for Programmatic Evaluation)	Section 4(f) use requiring individual 4(f) evaluation
Acres of Wetlands and Waters of the U.S. Affected	The total acres of fill/dredge of wetlands and waters of the U.S.	No wetlands/waters of the U.S. affected	Impacts to wetlands/ waters of the U.S. can be mitigated and permitted under Nationwide Permits	Impacts to wetlands/waters of the U.S. require Individual 404 permit

EXHIBIT 4
Level 2 Evaluation Criteria – Wadsworth Boulevard Concepts (Highland Drive to 14th Avenue)

		Assessment		
Criteria	**Description**	**Good**	**Fair**	**Poor**
Aesthetics – Median Landscaping and Design	An attractive, sustainable median design is important to the City of Lakewood's aesthetic vision for the Wadsworth Boulevard corridor.	Raised and irrigated planters landscaped with trees and xeric plants	Raised planters with landscaping to be provided in future	No landscaping
Aesthetics – Side-of-Road Landscaping	Attractive and sustainable side of the road landscaping is important to the City of Lakewood's aesthetic vision for the Wadsworth Boulevard corridor.	Minimum 7- to 10-foot landscaped buffer	Less than 7-foot landscaped roadway buffer	No landscaping
Cost				
Project Cost	Estimated total cost of project alternative, including capital construction, right-of-way, and project development costs.	Within projected funding of $20 million	Between 1 and 25 percent higher than projected funding	More than 25 percent higher than projected funding
Right-of-Way Cost	Percentage of total project cost associated with estimated cost of right-of-way acquisition.	40 percent	41 to 60 percent	More than 60 percent
Implementation				
Emergency Response	Emergency response goals are set to provide adequate emergency response to the public.	Emergency response goals are met	Emergency response goals are partially met	Emergency response goals cannot be met
Construction Duration	Longer duration construction projects have a greater effect on local businesses and residences.	8 months	Between 8 and 14 months	More than 14 months

4. Level 1 Screening Results

Once the Level 1 evaluation criteria were established, conceptual design feasibility evaluations were conducted to identify concepts for the US 6 and Wadsworth interchange and Wadsworth Boulevard. This effort resulted in a large number of potential improvement concepts being developed for consideration in Level 1 screening. A large number of improvement concepts were initially developed for the US 6 and Wadsworth Boulevard interchange and for Wadsworth Boulevard.

4.1. US 6 and Wadsworth Boulevard Interchange

The US 6 and Wadsworth Boulevard interchange is a service interchange – an interchange between a controlled access facility (US 6) and an arterial (Wadsworth Boulevard) – in an urban environment. The interchange type and setting shaped the range of initial design concepts considered. Typical configurations for service interchanges in urban areas include diamonds and partial cloverleafs. These configurations typically accommodate high volumes of traffic within areas of constrained right-of-way. The initial interchange designs also strove to address the highest volume movements from northbound Wadsworth Boulevard to eastbound US 6 in the morning peak hour, and from westbound US 6 to southbound Wadsworth Boulevard in the evening peak hour.

Given the interchange type and the location of the highest volume movements, the following general concepts, in addition to the No Build alternative, were considered for the US 6 and Wadsworth Boulevard interchange:

1. Traditional Diamond: The Traditional Diamond was considered because of its widespread application in freeway to arterial interchanges. It is the most common type for local access freeway interchanges with one entrance and one exit in each direction; on- and off-ramps meet at two signalized intersections. The interchange ramps form a diamond shape when viewed from the air.

2. Tight Diamond: The Tight Diamond operates the same as a traditional diamond except that ramp intersections are spaced more closely. It was considered because of its suitability to urban areas with constrained right-of-way.

3. Tight Diamond with Loop: The Tight Diamond with Loop is similar to the Tight Diamond except that a loop ramp would be maintained in the northwest quadrant of the interchange. There would be no traffic signal at the intersection of the loop ramp with Wadsworth Boulevard. The Tight Diamond with Loop was considered to accommodate the high volume left-turn movement from westbound US 6 to southbound Wadsworth Boulevard.

4. Single Point Urban Interchange (SPUI): The SPUI is similar to a Diamond interchange, with one entrance and one exit in each direction. However, all four ramps meet at one central signalized intersection, rather than at two signalized intersections. Like the Tight Diamond, the SPUI was considered because of its suitability to urban areas with constrained right-of-way.

5. Partial Cloverleaf: The Partial Cloverleaf would maintain loop ramps in the northwest and southeast quadrants of the interchange. The loops would be enlarged to meet current design standards, and the other ramps would be extended to improve acceleration and deceleration

lengths. The two loop ramps would provide greater capacity and would eliminate two left-turn signals and left-turn conflicts when compared with the Diamond or SPUI interchanges.

6. Partial Cloverleaf with Directional Ramp: The Partial Cloverleaf with Directional Ramp would maintain two loop ramps in the northeast and southwest quadrants and add an elevated ramp from westbound US 6 to northbound Wadsworth Boulevard. The ramp would fly over US 6 and touch down near 4th Avenue on Wadsworth Boulevard. Because this interchange would require only one signalized left turn, it would provide higher capacity than all of the other concepts considered except the Full Cloverleaf.

7. Full Cloverleaf with Collector-Distributor Roads: This interchange would enlarge the four loop ramps to meet current design standards and expand the frontage road system between ramps to eliminate weaving conflicts on mainline US 6. It is the highest capacity interchange and has the largest physical impact of the concepts considered.

8. Diverging Diamond: The Diverging Diamond is a rare interchange type that would remove left turns in the intersection by requiring Wadsworth drivers to briefly cross into the opposite lane of traffic at two crossover intersections. The Diverging Diamond was considered because it removes the need for left-turn signals at the interchange.

Each of these general concepts was measured by the Level 1 screening criteria to identify any fatal flaws. Concepts receiving a fatal flaw rating on any of the criteria elements (that is, one or more "No" responses) were eliminated from further consideration. All of the concepts met Mobility and Traffic Operations and Local Impacts criteria, but four of the concepts failed one or more of the Environmental Impacts, Cost Feasibility, or Implementation criteria.

The results of the Level 1 screening of the US 6 and Wadsworth Boulevard interchange concepts are presented in Exhibit 5. The No Action alternative does not meet evaluation criteria but was retained for baseline comparison; it is not included in Exhibit 5. In addition to the No Action alternative, the four concepts retained for Level 2 Evaluation included the Tight Diamond, Tight Diamond with Loop, SPUI, and Partial Cloverleaf.

EXHIBIT 5
Summary of Level 1 Screening Results – US 6 and Wadsworth Boulevard Interchange Concepts (including Wadsworth Boulevard from 4th Avenue to Highland Drive)

Concept	Screening Criteria Category					
	Safety/Design	**Mobility/Traffic Operations**	**Local Impacts**	**Environmental Impacts**	**Cost Feasibility**	**Implementation**
1: Traditional Diamond	Meets criteria	Meets criteria	Meets criteria	Does not meet criteria Larger right-of-way impacts in all quadrants of the interchange and three additional residential relocations compared with the tight diamond. The impacts could be minimized by shifting the ramp locations closer to US 6, resulting in the Tight Diamond configuration, which was carried forward for Level 2 analysis.	Meets criteria	Meets criteria.
2: Tight Diamond	Meets criteria	Meets criteria	Meets criteria	Meets criteria	Meets criteria	Meets criteria
4: Tight Diamond with Loop	Meets criteria	Meets criteria	Meets criteria	Meets criteria	Meets criteria	Meets criteria
4. Single Point Urban Interchange (SPUI)	Meets criteria	Meets criteria	Meets criteria	Meets criteria	Meets criteria	Meets criteria
5: Partial Cloverleaf	Meets criteria	Meets criteria	Meets criteria	Meets criteria	Meets criteria	Meets criteria
6: Partial Cloverleaf with Directional Ramp	Meets criteria	Meets criteria	Meets criteria	Does not meet criteria Flyover ramp elevates traffic and increases noise to surrounding residences that are already highly affected by traffic noise. Large right-of-way requirements in northeast and southwest quadrants to allow ramp to rise over US 6 and return down to Wadsworth Boulevard. Requires 25 relocations, which is 25 to 90 percent more than other concepts retained for evaluation.	Does not meet criteria Estimated cost is 20 percent more than other options retained for evaluation.* Increased cost primarily associated with structure costs for flyover ramp and right-of-way acquisition.	Meets criteria
7: Full Cloverleaf with Collector-Distributor Roads	Does not meet criteria Does not improve bicycle/pedestrian safety at crossing of loop ramps.	Meets criteria	Meets criteria	Does not meet criteria Significant right-of-way requirements in all quadrants of the interchange because of large footprint of enlarged loop ramps and additional width along US 6 to accommodate collector-distributor roads. Requires relocation of 27 residences and 5 businesses, which is 35 to 100 percent more than other concepts retained for evaluation.	Does not meet criteria Estimated cost is 30 percent more than other options retained for evaluation.* Increased cost primarily associated with right-of-way acquisition.	Does not meet criteria Does not meet local plans and visions for pedestrian and bicycle mobility along Wadsworth. Does not meet local and regional vision of adding rapid transit along Wadsworth; all the loop ramps would need to be reconstructed to accommodate further widening of Wadsworth.
8: Diverging Diamond	Meets criteria	Meets criteria	Meets criteria	Does not meet criteria Improving intersection geometry to better meet driver expectations (reduce confusion from driving on the opposing side of the road) requires substantial right-of-way.	Meets criteria	Does not meet criteria Design of the diverging diamond is not compatible with Wadsworth as a regional arterial. To improve interchange geometry and meet driver expectations (reduce confusion from driving on the opposing side of the road), speeds through the interchange would need to be reduced by 10 mph or more. The unusual design of the interchange (requiring drivers to drive on the opposite side of the road through the interchange) may be confusing to drivers and may not meet expectations.

*Note: Estimated costs for all concepts are located in the Appendix of this document, in Spreadsheet 1: Level 1 Conceptual Cost Estimate.

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4.2. Wadsworth Boulevard

The initial Wadsworth Boulevard design concepts were developed to balance the potential for right-of-way acquisition with the need to improve traffic capacity, traffic safety, and pedestrian and bicycle conditions. Concepts ranged from those that would require limited construction to those that would require increasing amounts of additional right-of-way adjacent to Wadsworth Boulevard. The concepts varied the number of lanes and the presence of medians and sidewalks to compare the "minimum" to "maximum" footprints. Travel lanes address capacity; medians address access control; and sidewalks address pedestrian and bicycle facilities.

The following general concepts, in addition to the No Build alternative, were considered for Wadsworth Boulevard:

1. Intelligent Transportation Systems (ITS)/Travel Demand Management (TDM)/Transportation Systems Management (TSM) Only (minimal physical improvements)
2. Intersection Improvements plus Median
3. 4-Lane plus Median plus Sidewalk
4. 5-Lane plus Median without Sidewalk
5. 5-Lane plus Median plus Sidewalk
6. 6-Lane plus Median without Sidewalk
7. 6-Lane without Median plus Sidewalk
8. 6-Lane plus Median plus Sidewalk
9. 6-Lane plus Two-Way Left-Turn plus Sidewalk
10. 6-Lane (4 Travel Lanes plus 2 Dedicated Transit Lanes)
11. 8 Lane (6 Travel Lanes plus 2 Dedicated Transit Lanes)

Each of these general concepts was measured by the Level 1 screening criteria to identify any fatal flaws. Concepts with any fatal flaws were eliminated from further consideration. Only one concept passed the Level 1 screening and was carried forward for further evaluation: 6-Lane plus Median plus Sidewalk (concept 8). Because additional lane capacity, access control, and improved pedestrian and bicycle facilities were critical elements of the purpose and need for this project, concept 8 was the only one that met the purpose and need for Wadsworth Boulevard improvements, and therefore, was the only concept carried forward to Level 2 evaluation.

The results of the Level 1 screening of the Wadsworth Boulevard design concepts are presented in Exhibit 6.

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EXHIBIT 6
Summary of Level 1 Screening Results - Wadsworth Boulevard Concepts (Highland Drive to 14th Avenue)

Concept	Screening Criteria Category					
	Safety/Design	**Mobility/Traffic Operations**	**Local Impacts**	**Environmental Impacts**	**Cost Feasibility**	**Implementation**
1: ITS/TDM/TSM Only	Does not meet criteria Does not address access conflicts. Does not provide safer pedestrian and bicycle facilities.	Does not meet criteria Does not provide additional travel lanes to address low level of service.	Meets criteria	Meets criteria	Meets criteria	Does not meet criteria Does not accommodate six travel lanes identified in the regional Long-Range Transportation Plan. Does not provide additional travel lanes, medians, or sidewalks identified in Lakewood's Wadsworth Boulevard Strategic Plan.
2: Intersection Improvements plus Median	Does not meet criteria Does not provide safer pedestrian and bicycle facilities.	Does not meet criteria Does not provide additional travel lanes to address low level of service.	Meets criteria	Meets criteria	Meets criteria	Does not meet criteria Does not accommodate six travel lanes identified in the regional Long-Range Transportation Plan. Does not provide additional travel lanes, medians, or sidewalks identified in Lakewood's Wadsworth Boulevard Strategic Plan.
4: 4-Lane plus Median plus Sidewalk	Meets criteria	Does not meet criteria Does not provide additional travel lanes to address low level of service.	Meets criteria	Meets criteria	Meets criteria	Does not meet criteria Does not accommodate six travel lanes identified in the regional Long-Range Transportation Plan. Does not provide additional travel lanes identified in Lakewood's Wadsworth Boulevard Strategic Plan.
3: 5-Lane plus Median without Sidewalk	Does not meet criteria Does not provide safer pedestrian and bicycle facilities.	Does not meet criteria Does not provide enough additional travel lanes to address low level of service.	Meets criteria	Meets criteria	Meets criteria	Does not meet criteria Does not accommodate six travel lanes identified in the regional Long-Range Transportation Plan. Does not provide additional travel lanes or sidewalks identified in Lakewood's Wadsworth Boulevard Strategic Plan.
5: 5-Lane plus Median plus Sidewalk	Meets criteria	Does not meet criteria Does not provide enough additional travel lanes to address low level of service.	Meets criteria	Meets criteria	Meets criteria	Does not meet criteria Does not accommodate six travel lanes identified in the regional Long-Range Transportation Plan. Does not provide additional travel lanes identified in Lakewood's Wadsworth Boulevard Strategic Plan.
6: 6-Lane plus Median without Sidewalk	Does not meet criteria Does not provide safer pedestrian and bicycle facilities.	Meets criteria	Meets criteria	Meets criteria	Meets criteria	Does not meet criteria Does not provide sidewalks identified in Lakewood's Wadsworth Boulevard Strategic Plan.
7: 6-Lane without Median plus Sidewalk	Does not meet criteria Does not address access conflicts.	Does not meet criteria Does not address traffic turbulence in inside lanes, which would function as de facto left-turn lanes rather than travel lanes.	Meets criteria	Meets criteria	Meets criteria	Does not meet criteria Does not provide medians identified in Lakewood's Wadsworth Boulevard Strategic Plan.
8: 6-Lane plus Median plus Sidewalk	Meets criteria	Meets criteria	Meets criteria	Meets criteria	Meets criteria	Meets criteria

9: 6-Lane plus Two-Way Left-Turn plus Sidewalks	Does not meet criteria Does not address access conflicts.	Does not meet criteria Lack of access control does not address traffic turbulence from cars trying to maneuver through lanes and turn lanes in the center of the roadway. Traffic turbulence reduces capacity because the center lanes do not operate efficiently.	Meets criteria	Meets criteria	Meets criteria	Does not meet criteria Does not provide medians identified in Lakewood's Wadsworth Boulevard Strategic Plan.
10: 6-Lane Transit (4 Travel plus 2 Dedicated Transit)	Meets criteria	Does not meet criteria Does not provide additional travel lanes to address low level of service. Mode shift to transit would not reduce traffic volumes enough to improve level of service.	Meets criteria	Meets criteria	Meets criteria	Does not meet criteria Does not provide additional travel lanes identified in Lakewood's Wadsworth Boulevard Strategic Plan. Project limits do not provide logical termini for rapid transit identified in DRCOG and Lakewood vision.
11: 8-Lane Transit (6 Travel plus 2 Dedicated Transit)	Meets criteria	Meets criteria	Meets criteria	Does not meet criteria Significant impacts to right-of-way and land use.	Does not meet criteria $31 million cost, greater than 150% of estimated costs.*	Does not meet criteria Project limits do not provide logical termini for rapid transit identified in DRCOG and Lakewood vision.

*Note: Estimated costs for all concepts are located in the Appendix of this document, in Spreadsheet 1: Level 1 Conceptual Cost Estimate.

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5. Level 2 Evaluation

The Level 2 evaluation was conducted for the US 6 and Wadsworth Boulevard interchange concepts that passed the Level 1 screening. Because only one Wadsworth Boulevard concept passed the Level 1 screening, a Level 2 evaluation was conducted for that concept solely for the purpose of identifying mitigation opportunities relative to the evaluation criteria.

5.1. US 6 and Wadsworth Boulevard Interchange

Four interchange concepts were carried forward from the Level 1 screening for additional evaluation, in addition to the No Build alternative:

2. Tight Diamond
3. Tight Diamond with Loop
4. Single Point Urban Interchange
5. Partial Cloverleaf

The design of each of the four concepts was refined to better understand the benefits and impacts of the concepts and to provide information for a quantitative assessment in the Level 2 evaluation. The four concepts were then measured to determine how well each concept met the Level 2 evaluation criteria for the project. The results of the Level 2 evaluation of the US 6 and Wadsworth Boulevard interchange concepts are presented in Exhibit 7. The initial evaluation showed that none of the concepts clearly performed better than the others in all criteria categories; some performed better on some measures and worse on others. The decision process that led to selection of a preferred alternative is described in Section 6, Selection of the Preferred Alternative.

The features of each of the interchange concepts and their performance on several of the key evaluation criteria are described below.

5.1.1. Tight Diamond

The Tight Diamond interchange concept would provide four standard ramps between Wadsworth Boulevard and US 6. Two traffic signals would be added on Wadsworth Boulevard to allow left turns at the ramps. Right turns at the entrance ramps would be free-flow movements.

The Tight Diamond concept would address the highest volume left-turn movement from westbound US 6 to southbound Wadsworth Boulevard by providing three left-turn lanes on the westbound exit ramp. To address the limited vehicle storage area within the interchange, queuing of vehicles would be accommodated outside of the interchange. This would allow vehicles to wait for left turns outside of the ramp intersections on Wadsworth Boulevard.

The Tight Diamond would require more complex construction staging than the Tight Diamond with Loop and Partial Cloverleaf concepts, but would be easier to build than the SPUI concept. The Tight Diamond would cost less than the other interchange concepts. It would minimize right-of-way acquisition compared to the Tight Diamond with Loop and Partial Cloverleaf concepts.

Most of the pedestrian and bicycle crossings at the interchange would occur at signalized intersections, except at two free-flow right-turn movements. Additionally, pedestrians and bicyclists could cross Wadsworth Boulevard at either or both intersections in the interchange.

The Tight Diamond would allow easier future expansion of Wadsworth Boulevard and US 6 than the Tight Diamond with Loop and Partial Cloverleaf concepts, because the entrance and exit ramps would not require major reconstruction to accommodate additional lanes on Wadsworth Boulevard or US 6. Reconstruction would be limited to the ramp intersections with Wadsworth Boulevard and the entrance/exit tapers on US 6.

5.1.2. Tight Diamond with Loop

The Tight Diamond with Loop concept would provide a loop ramp for the highest volume left-turn movement from westbound US 6 to southbound Wadsworth Boulevard. Traffic making this movement would exit US 6 onto a loop ramp, as it does today. Placing the highest volume left-turn movement on a loop ramp would increase traffic capacity at other left-turn movements at the interchange, improving the operation of the entire interchange when compared to the Tight Diamond and SPUI concepts.

The eastbound ramps (on the south side of US 6) would be the same as those in the Tight Diamond, and would intersect Wadsworth at a traffic signal. The westbound ramp intersection (on the north side of US 6) would be shifted farther north than in the Tight Diamond, to allow for the placement of the loop ramp. The westbound ramp intersection would require a signal for southbound Wadsworth Boulevard traffic only; northbound traffic at this location would not require a signal.

The Tight Diamond with Loop would require fairly simple construction staging. It would cost more than the Tight Diamond concept due to the additional right-of-way acquisition required in the northwest quadrant of the interchange, but would cost less than the SPUI or Partial Cloverleaf.

Pedestrians and bicycles crossing through the interchange would cross the terminal of the loop ramp and two free-flow right-turn movements without the benefit of traffic signals. Loop ramp crossings present a greater safety concern than right-turn movements, because of the speed and sight lines of the vehicles on the loop ramp. Pedestrians and bicycles could cross Wadsworth Boulevard at the south ramp intersection, but not at the north ramp intersection.

The Tight Diamond with Loop would not easily accommodate expansion of Wadsworth Boulevard or US 6 in the future without reconstruction of the loop ramp and westbound entrance ramp. Constructing a loop ramp that would allow future expansion on Wadsworth Boulevard and US 6 would increase the already-large right-of-way impacts in the northwest quadrant of the interchange.

5.1.3. Single Point Urban Interchange (SPUI)

A SPUI would provide four standard ramps that converge to a single intersection. The left-turn movements at all four ramps would be controlled by a single traffic signal. SPUIs are often thought to operate more efficiently than tight diamond interchanges because there is only one traffic signal for vehicles to negotiate. However, the intersection is very large due to the geometry of the ramp movements.

The SPUI concept would address the highest volume left-turn movement from westbound US 6 to southbound Wadsworth Boulevard by providing three left-turn lanes on the westbound

exit ramp. Right turns at the ramps would be free-flow movements except in the southwest quadrant of the interchange. The right-turn movement in this quadrant would be signalized, allowing vehicles to travel across Wadsworth Boulevard to turn left onto 5th Avenue.

The SPUI concept would require the most difficult construction staging of the four interchange concepts, and would create significant disruption to traffic on US 6 and Wadsworth Boulevard for a longer period of time than the other concepts. The SPUI would cost more than the Tight Diamond and Tight Diamond with Loop, due to the type of bridge required on US 6.

Most of the pedestrian and bicycle crossings at the interchange would occur at signalized intersections, except at free-flow right-turn movements. Pedestrians and bicyclists could not cross Wadsworth Boulevard at the interchange; they would travel south to the 5th Avenue intersection or north to the 10th Avenue intersection.

The SPUI would allow easier future expansion of Wadsworth Boulevard and US 6 than the Tight Diamond with Loop and Partial Cloverleaf concepts, because the entrance and exit ramps would not require major reconstruction to accommodate additional lanes on Wadsworth Boulevard or US 6. Reconstruction would be limited to the ramp intersections with Wadsworth Boulevard and the entrance/exit tapers on US 6.

5.1.4. Partial Cloverleaf

The Partial Cloverleaf concept would provide loop ramps for two left-turn movements. The loop ramp in the northwest quadrant of the interchange would carry traffic at the highest volume left-turn movement from westbound US 6 to southbound Wadsworth Boulevard. The loop ramp in the southeast quadrant of the interchange would carry traffic from eastbound US 6 to northbound Wadsworth Boulevard. Traffic making these movements would exit US 6 onto loop ramps, as it does today. Placing two left-turn movements onto loop ramps would increase traffic capacity at other left-turn movements at the interchange, improving the operation of the entire interchange when compared to the Tight Diamond and SPUI concepts.

The remaining ramps would be shifted farther away from US 6, to allow for placement of the loop ramps, increasing impacts to properties around the interchange. Two traffic signals would be added on Wadsworth Boulevard, one at each ramp intersection.

The Partial Cloverleaf would require the simplest construction staging of the four interchange concepts, causing the least disruption to the traveling public. The Partial Cloverleaf would cost more than the other interchange concepts, because of the additional infrastructure and right-of-way acquisition required in the northwest and southeast quadrants of the interchange.

Pedestrians and bicycles crossing through the interchange would cross the terminals of the two loop ramps and two free-flow right-turn movements without the benefit of traffic signals. Loop ramp crossings present a greater safety concern than right-turn movements, because of the speed and sight lines of the vehicles on the loop ramp. Pedestrians and bicyclists could not cross Wadsworth Boulevard at the interchange; they would travel south to the 5th Avenue intersection or north to the 10th Avenue intersection.

The Partial Cloverleaf would not easily accommodate expansion of Wadsworth Boulevard or US 6 in the future without reconstruction of the loop ramps and entrance ramps. Constructing loop ramps that would allow future expansion on Wadsworth Boulevard and US 6 would increase the already-large right-of-way impacts in the northwest and southeast quadrants of the interchange.

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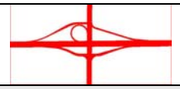
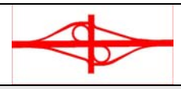
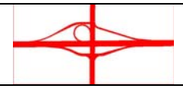
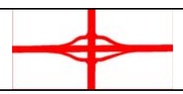
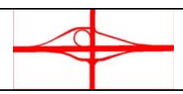
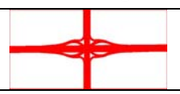
EXHIBIT 7
Level 2 Evaluation Results – US 6 and Wadsworth Boulevard Interchange (including Wadsworth Boulevard from 4th Avenue to Highland Drive)

Category	Criteria	US 6 and Wadsworth Interchange Concepts					
		NA	**2**	**3**	**4**	**5**	
		No Action **Full Cloverleaf**	**Tight Diamond**	**Tight Diamond w/Loop**	**Single Point Urban Interchange**	**Partial Cloverleaf**	**Comments**
							
Safety/Design	*Pedestrian and bicycle safety (controlled crossing)* Good = Separated crossing Fair = Signalized crossing Poor = Uncontrolled crossing	Poor 8 uncontrolled	Poor 2 uncontrolled / 6 controlled	Poor 3 uncontrolled / 5 controlled	Poor 3 uncontrolled / 5 controlled	Poor 4 uncontrolled / 4 controlled	Crossings of loop ramps in Concepts 3 and 5 have greater safety concerns than crossings of free-flow right-turn movements.
	Ramp entrance design Good = Parallel acceleration lanes for all US 6 entrances Fair = Mixed parallel and tapered acceleration lanes for US 6 entrances Poor = Tapered acceleration lanes for all US 6 entrances	Poor	Good	Good	Good	Good	No Action: One parallel acceleration lane, but with short acceleration length.
	Design exceptions Good = No new design exceptions required Poor = Requires new design exceptions	Not applicable (N/A)[i]	Good	Poor[ii]	Good	Poor[ii]	
Mobility/Traffic Operations	*Weave sections* Good = Eliminates all weave sections Fair = Improves weave sections Poor = Weave sections maintained	Poor	Good	Good	Good	Good	New weave sections between Wadsworth and Carr are considered an improvement over the existing entrance/exit tapers.
	Ramp operations Good = Level of Service (LOS)[iii] on US 6 ramps improved over existing conditions Fair = Existing LOS on US 6 ramps is maintained Poor = LOS on US 6 ramps lower than existing LOS	Fair	Good	Good	Good	Good	Action alternatives compared to 2035 No Action alternative. Majority of 2035 ramp LOS (peak hour) remain at E/F due to LOS E/F on US 6 mainline.
	Wadsworth Boulevard corridor travel time Good = No net increase in signalized intersections Fair = Net increase of one signalized intersection Poor = Net increase of more than one signalized intersection	N/A	Poor 2 new signals	Fair / Poor 1.5 new signals[iv]	Fair 1 new signal	Poor 2 new signals	Signals are added at intersection of ramps with Wadsworth.
	Interchange capacity Good = Average volume-to-capacity (V/C) ratio of critical movements is less than 0.85. Fair = Average V/C ratio of critical movements is between 0.85 and 1.0. Poor = Average V/C ratio of critical movements is greater than 1.0.	Good NB/EB = 0.8 WB/SB = 0.85	Fair NB/EB = 0.8 WB/SB = 1.0	Good NB/EB = 0.8 WB/SB = 0.85	Fair NB/EB = 0.8 WB/SB = 1.0	Good NB/EB = 0.8 WB/SB = 0.85	Critical movements are northbound Wadsworth to eastbound US 6 (NB/EB) (a.m.) and westbound US 6 to southbound Wadsworth (WB/SB) (p.m.).
	Spacing criteria for frontage roads Good = Spacing is improved to CDOT Access Code standards of 0.5 mile (2,640 ft) Fair = Spacing is improved over existing conditions Poor = Existing spacing between frontage roads and ramps is maintained or decreased from existing	Poor North – 175 ft South – 225 ft	Fair North – 375 ft South – 415 ft	Fair[v] North – 125 ft South – 415 ft	Fair North – 425 ft South – 425 ft	Poor[vi] North – 125 ft South – 175 ft	Distances are approximate. North frontage road intersects Wadsworth at Broadview, and South frontage road intersects Wadsworth at 5th Ave.

Gray shading represents criteria that have measurable differences among the concepts.

Category	Criteria	US 6 and Wadsworth Interchange Concepts					
		NA	**2**	**3**	**4**	**5**	
		No Action **Full Cloverleaf**	**Tight Diamond**	**Tight Diamond w/Loop**	**Single Point Urban Interchange**	**Partial Cloverleaf**	**Comments**
							
Local Impacts	*Local access to / from US 6* Good = Distance to access US 6 for inbound and outbound trips is the same or less than existing Fair = Distance to access US 6 for inbound and outbound trips is no more than 25% longer than existing Poor = Distance to access US 6 for inbound and outbound trips is more than 25% longer than existing	N/A	Poor	Poor	Poor	Poor	Distance, which is measured from Broadview to northwest ramp of US 6, is impacted by eliminating northbound Wadsworth left-turn access to frontage road northwest of interchange.
	Effects to local businesses Good = No businesses adversely affected (access, parking, visibility) Fair = Up to two businesses adversely affected (access, parking, visibility) Poor = More than two businesses adversely affected (access, parking, visibility)	N/A[vii]	Poor[viii]	Poor[viii]	Poor[viii]	Poor[viii]	Businesses northwest of interchange are impacted due to elimination of northbound Wadsworth left-turn access to one-way frontage road northwest of interchange.
Environmental Impacts	*# of Relocations (residences and businesses)* Good = No relocations required Fair = Up to two relocations required Poor = More than two relocations required	N/A	Poor 9 businesses 17 residences	Poor 20 businesses 13 residences 50+ storage units	Poor 9 businesses 17 residences	Poor 21 businesses 31 residences 50+ storage units	Relocation estimates do not include consideration of potential mitigation such as noise or retaining walls. Relocations include active businesses only (i.e., vacant office space not counted as a relocation).
	# of Properties affected (partial and full acquisitions) Good = Two or fewer private properties affected (partial and full acquisitions) Fair = Three to five private properties affected (partial and full acquisitions) Poor = More than five private properties affected (partial and full acquisitions)	N/A	Poor 76 properties affected	Poor 78 properties affected	Poor 76 properties affected	Poor 78 properties affected	Numbers increased from conceptual design after refined modeling.
	# of Residences within 66 dBA noise contour compared to existing conditions[ix] Good = Fewer # of residences within 66 dBA contour Fair = Same # of residences within 66 dBA contour Poor = Greater # of residences within 66 dBA contour	N/A 137 residences	Fair 137 residences	Poor 138 residences	Good 133 residences	Poor 141 residences	Properties identified as relocations were not considered in numbers within the contours.
	Acres of wetlands and waters of the U.S. affected Good = No wetlands/waters of the U.S. affected Fair = Impacts to wetlands/waters of the U.S. can be mitigated and permitted under Nationwide Permits Poor = Impacts to wetlands/waters of the U.S. require Individual 404 permit	N/A	Fair	Fair	Fair	Fair	Impacts to wetlands and waters of the U.S. for all alternatives may qualify for new "single and complete project" guidance that only requires post-construction notification (less than Nationwide Permit requirements). MacIntyre Gulch requires more new culvert in Concepts 3 & 5.
	# of Section 4(f) uses[x] Good = No or *de minimis* Section 4(f) impacts Fair = Minor Section 4(f) use (qualifies for Programmatic Evaluation) Poor = Section 4(f) use requiring individual 4(f) evaluation	N/A	Poor Section 4(f) use of 4 historic properties (4 relocations)	Poor Section 4(f) use of 4 historic properties (3 relocations)	Poor Section 4(f) use of 4 historic properties (4 relocations)	Poor Section 4(f) use of 4 historic properties (3 relocations)	
Cost	*Project cost (includes capital construction, right-of-way, and project development)*[xi] Good = Within projected funding of approximately $45 million Fair = Between 1 and 25% higher than projected funding ($45 million - $56.25 million) Poor = More than 25% higher than projected funding (more than $56.25 million)	N/A	Poor $61.5M[xii]	Poor $74.4M[xiii]	Poor $76.4M[xiv]	Poor $80.7M[xv]	

Gray shading represents criteria that have measurable differences among the concepts.

Category	Criteria	US 6 and Wadsworth Interchange Concepts					
		NA	2	3	4	5	
		No Action Full Cloverleaf	Tight Diamond	Tight Diamond w/Loop	Single Point Urban Interchange	Partial Cloverleaf	Comments
							
	Right-of-way cost (percentage of total cost)[xi] Good = 20 percent Fair = 21 to 35 percent Poor = More than 35 percent	N/A	Good 20%	Fair 23%	Good 15%	Fair 26%	
Implementation	*Emergency response* Good = Emergency response goals are met Fair = Partially met Poor = Emergency response goals cannot be met	Fair	Good	Good	Good	Good	
	Construction staging Good = Closures conform with CDOT's lane closure policy Fair = Some variance to CDOT's lane closure policy would be required Poor = Closures would not conform to CDOT's lane closure policy	N/A	Fair	Fair	Poor[xvi]	Fair	
	Expandability Good = Limited or no reconstruction would be needed to expand the facility Fair = Partial reconstruction would be needed to expand the facility Poor = Full reconstruction would be needed to expand the facility	Poor	Fair[xvii]	Poor[xviii]	Fair[xix]	Poor[xx]	Expandability refers to the ability to accommodate additional lanes on US 6 or Wadsworth in the future. All concepts assume bridge will accommodate future widening of US 6.

Gray shading represents criteria that have measurable differences among the concepts.

[i] Design exceptions are not required for existing facilities.
[ii] Design exception required for northwest ramp profile grade. (Could be designed without exceptions but would require additional right-of-way.)
[iii] Level of Service is a term used by transportation engineers to indicate that traffic is moving at ideal, average, or poor efficiency and measured on a grade scale of "A" through "F".
[iv] Signalized control for southbound traffic only (thus counted as a half intersection).
[v] Only south spacing improved.
[vi] South spacing is decreased.
[vii] Poor existing access conditions not evaluated.
[viii] Businesses in northwest quadrant of the interchange (Public Storage, office park) adversely affected by changes to frontage road access. Parking for several businesses is also affected, but these businesses were counted as relocations so not counted in this category.
[ix] Number of affected residences does not consider mitigation. All alternatives will likely include noise mitigation, and, with this mitigation, the number of affected residences will be reduced.
[x] Section 4(f) of the Department of Transportation Act of 1966 requires FHWA and CDOT to analyze the effects of their projects on historical sites and public parks and carefully consider options to avoid or mitigate those effects
[xi] Estimated costs for each concept are located in the Appendix of this document, in Spreadsheet 2: Level 2 Conceptual Cost Estimate.
[xii] Increase from Level 1 cost estimate due to retaining walls (length) and right-of-way costs. A more detailed explanation of the cost increase is provided in the Appendix, in Spreadsheet 3: Comparison of Level 1 and Level 2 Cost Estimates.
[xiii] Increase from Level 1 cost estimate due to culvert (size) and right-of-way costs. A more detailed explanation of the cost increase is provided in the Appendix, in Spreadsheet 3: Comparison of Level 1 and Level 2 Cost Estimates.
[xiv] Increase from Level 1 cost estimate due to increased bridge (materials), retaining walls (length), and right-of-way costs. A more detailed explanation of the cost increase is provided in the Appendix, in Spreadsheet 3: Comparison of Level 1 and Level 2 Cost Estimates.
[xv] Increase from Level 1 cost estimate due to increased bridge (materials), culvert (size), and right-of-way costs. A more detailed explanation of the cost increase is provided in the Appendix, in Spreadsheet 3: Comparison of Level 1 and Level 2 Cost Estimates.
[xvi] Poor rating is for complex structural and intersection phasing requirements.
[xvii] Entrance/exit tapers would require reconstruction if US 6 were expanded, and two intersections would need to be reconstructed if Wadsworth were expanded.
[xviii] Poor rating is based on ability to expand loop ramp(s). Loops were designed at minimum radii to reduce right-of-way requirements.
[xix] Entrance/exit tapers would require reconstruction if US 6 were expanded, and one intersection would need to be reconstructed if Wadsworth were expanded.
[xx] Poor rating is based on ability to expand loop ramp(s). Loops were designed at minimum radii to reduce right-of-way requirements.

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5.2. Wadsworth Boulevard

A single Wadsworth Boulevard concept was carried forward from the Level 1 screening for additional evaluation, in addition to the No Build alternative: six travel lanes with a median and sidewalks. This concept was recommended as the preferred alternative for Wadsworth Boulevard.

Three design options were studied that varied the widths of the elements comprising the preferred alternative. The design options created minimum, medium, and maximum width cross sections on Wadsworth Boulevard. The elements of the design options are shown below in Exhibit 8, along with the design standard that corresponds to each element. The intent of the minimum width cross section was to minimize physical impacts adjacent to Wadsworth Boulevard. The intent of the maximum width cross section was to provide the greatest opportunity for landscaping along Wadsworth Boulevard.

EXHIBIT 8
Wadsworth Boulevard Preferred Alternative Design Options

Element	Minimum width design option	Medium width design option	Maximum width design option
Raised median	6 feet – CDOT standard minimum width	18 feet – CDOT standard landscaped width	23 feet – Lakewood standard landscaped width
Multi-use sidewalk	Attached, 10 feet – 8-foot walk plus 2-foot signage area	Detached, 8 feet – AASHTO* standard for multi-use walk	Detached, 8 feet – AASHTO* standard for multi-use walk
Landscaped buffer	None	7 feet – CDOT standard landscaped width	10 feet – Lakewood standard landscaped width

*Note: AASHTO is the American Association of State Highway and Transportation Officials.

The project team found that median turn lanes would be required throughout a majority of the corridor. Accommodating the required median left turn lanes resulted in use of overlapping approach tapers which left only two areas in the corridor to either minimize the median width to 6 feet or maximize it to 23 feet. Auxiliary lanes and double left-turn lanes would be required in several locations, varying the cross section further. To accommodate the variety of left-turn lane and auxiliary lane configurations required, the three design options were combined, with elements of each applied to different locations in the corridor.

Since a preferred alternative was identified for Wadsworth Boulevard after Level 1 screening, a separate Level 2 evaluation was not needed. Instead, a Level 2 evaluation was conducted for the alternative to identify mitigation opportunities relative to the evaluation criteria. The results of this evaluation are presented in Exhibit 9.

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EXHIBIT 9
Level 2 Evaluation Results - Wadsworth Boulevard Preferred Alternative (Highland Drive to 14th Avenue)

Category	Criteria	Mitigation Opportunities/Comments
Safety/Design	*Through lane width*	Design includes 12-foot lanes, but 11-foot lanes could be considered. Eleven-foot lanes are allowed by the current standards and would match existing improved sections north and south of the project area (that is, north to Colfax Avenue, and south to Alameda Avenue).
	Vehicular and pedestrian safety at intersections (median)	Design includes raised medians with an area for pedestrian refuge at intersection crossings.
	Pedestrian safety (sidewalk and buffer)	Detached sidewalks are preferred, but attached sidewalks or reduced buffer areas could be considered in areas where right-of-way is constrained. The sidewalk section would likely vary throughout the corridor, achieving a detached sidewalk where possible and reducing to an attached sidewalk where necessary.
	Bicycle safety (path and buffer)	An 8-foot shared path is included in the design. An additional buffer, such as a tree lawn, would be provided where possible (see *Pedestrian Safety* above).
	Design exceptions	Design exceptions are not anticipated for any elements.
Mobility/ Traffic Operations	*Controlled access (median)*	Median access would include left turns at some unsignalized intersections. All mid-block access would be controlled with raised medians.
	Intersection operations (average)	Design reduces delay at signalized intersections, and all intersections would operate with less than 55 seconds of delay.
Local Impacts	*Neighborhood traffic impacts*	Design closes 26 movements (from 74 existing movements to 48 proposed movements) at unsignalized intersections. A movement is considered to be a right turn, left turn, or cross-street movement at an intersection.
	Local access to / from Wadsworth (distance)	Closing direct access from Wadsworth Boulevard to the frontage road northwest of the interchange would increase the distance of travel for residents and businesses located off of the frontage road. Access would be provided by u-turn movements on Wadsworth Boulevard north of the interchange.
	Effects to local businesses	Parking for more than two businesses (that are not relocated) would be affected.
Environmental Impacts	*# of Relocations (residences and businesses)*	Between 11 and 15 relocations have been identified. Variation is due to application of different side-of-road treatments (attached sidewalks, reduced buffer areas, reduced lane widths, or realignment could be considered to avoid some relocations).
	# of Properties affected	Regardless of the side-of-road landscaping option selected, 41 properties would be affected.

EXHIBIT 9
Level 2 Evaluation Results - Wadsworth Boulevard Preferred Alternative (Highland Drive to 14th Avenue)

Category	Criteria	Mitigation Opportunities/Comments
	# of Section 4(f) uses	Regardless of the side-of-road landscaping option selected, three historic properties and one park property would be affected. The impacts will likely qualify as *de minimis*, and an individual Section 4(f) evaluation would not be required for any of these properties.
	Acres of wetlands and waters of the U.S. affected	Regardless of the side-of-road landscaping option selected, impacts to wetlands and waters of the U.S. would be minimal and may qualify for new "single and complete project" guidance that only requires post-construction notification (less than Nationwide Permit requirements).
	Aesthetics – Median landscaping and design	The total area available for landscaping is limited because of the need to provide for alternating left-turn lanes. If desired and feasible, landscaping would be included.
	Aesthetics – Side-of-road landscaping	Side-of-road landscaping would be provided where desired and feasible. Sight distance issues may limit locations where trees are possible.
Cost Feasibility	*Project cost (including capital construction, right-of-way, and project development)**	Project costs are estimated between $26 million and $31 million, with the higher costs attributed primarily to additional right-of-way costs for side-of-road landscaping. Attaching sidewalks and reducing the buffer areas in select (constrained) areas may reduce project costs.
	*Right-of-way cost**	Right-of-way is anticipated to be approximately 40 percent of project costs.
Implementation	*Emergency response*	Emergency response goals would be partially met. Improved capacity of Wadsworth would meet goals, but medians restrict movements, particularly near interchange, and would not meet goals.
	Construction duration	Construction is anticipated to take between 8 and 14 months.

*Note: Estimated costs for the design options for the Wadsworth Boulevard preferred alternative are located in the Appendix of this document, in Spreadsheet 2: Level 2 Conceptual Cost Estimate.

6. Selection of the Preferred Alternative

The preferred alternative for the project was identified separately for the US 6 and Wadsworth Boulevard interchange and for Wadsworth Boulevard north of Highland Drive. The first round of analysis for the Level 2 evaluation did not clearly identify a preferred alternative for the US 6 and Wadsworth Boulevard interchange, and an additional decision process was conducted. The preferred alternative for Wadsworth Boulevard was identified as a result of the Level 1 screening.

6.1. US 6 and Wadsworth Boulevard Interchange

The Level 2 evaluation revealed that for many of the criteria, all four interchange concepts performed similarly. An additional decision process was conducted within the Level 2 evaluation to identify a preferred alternative for the interchange. The decision process led to the recommendation of the Tight Diamond with Loop concept as the preferred alternative for the interchange.

6.1.1. Distinguishing Criteria

The project team, in consultation with the City and RTD, narrowed the consideration of Level 2 evaluation criteria to those for which there was a measurable difference among the concepts. For instance, parallel ramp entrance design was incorporated into each concept, and, therefore, all concepts scored "good" for this measure, and there was no difference among the concepts in meeting the criteria. The identification of the distinguishing criteria was not necessarily tied to the rankings of "good," "fair," and "poor" in every case, however. For example, all concepts rated "poor" in number of relocations, but there were measurable differences in number of relocations among the concepts. The distinguishing criteria, highlighted in gray in Exhibit 7 above, are listed below. Criteria are described in additional detail when their "good/fair/poor" rankings did not capture the differences among concepts.

- Pedestrian and bicycle safety. All concepts rated "poor" in pedestrian and bicycle safety because they would have at least two uncontrolled pedestrian crossings. Some concepts would have more uncontrolled crossings than others, and an uncontrolled crossing at a right-turn movement was determined to be safer than an uncontrolled crossing at a loop ramp, because visibility is better at a right-turn movement.
- Wadsworth Boulevard corridor travel time. This criterion rated concepts on the number of additional signals added on Wadsworth Boulevard.
- Interchange capacity. This criterion rated concepts on their volume-to-capacity ratios at critical movements in the interchange.
- Spacing criteria for frontage roads. The distance between the interchange ramp terminals and 5th Avenue, to the south, was deemed the critical factor for this criterion.
- Number of relocations (residences and businesses). All concepts scored "poor" on number of relocations because all would have more than five relocations. However, the concepts with loop ramps would have significantly more relocations than the Tight Diamond and SPUI concepts.
- Project cost (includes capital construction, right-of-way, and project development). All concepts scored "poor" on project cost because they would each cost more than 25 percent more than the

projected funding of $56.25 million. The cost differences among the concepts would be significant, despite the "poor" rating for each.

- Construction staging. This criterion rated concepts on their ability to conform to CDOT's lane closure policy during construction.
- Expandability. This criterion rated concepts on the amount of reconstruction that would be needed to accommodate future physical expansion of US 6 or Wadsworth Boulevard.

Because the differences among the interchange concepts were not captured by the rankings of "good," "fair," and "poor" in all cases, the project team compared the concepts to one another, with a rank of 1st through 4th place assigned to each concept for each of the distinguishing criteria (see Exhibit 10). The Partial Cloverleaf ranked 4th place in five of the eight criteria, and was determined to be an unlikely preferred alternative. The Tight Diamond, Tight Diamond with Loop, and SPUI concepts remained under discussion.

6.1.2 Priority Criteria

The eight distinguishing criteria were ranked in order of priority by CDOT, FHWA, and the City. Public input on priorities, collected at Open House #2, was also considered. The combined opinions resulted in the following priority order (highest to lowest):

1. Interchange Capacity
2. Pedestrian and Bicycle Crossings
3. Project Cost
4. Corridor Travel Time
5. Relocations
6. Expandability
7. Spacing Criteria for Frontage Roads
8. Construction Staging

Although there were some differences in the rankings of concepts among CDOT, FHWA, and the City, the top four and bottom four criteria were relatively consistent. The one exception was that the City did not include cost as one of the top four criteria. The prioritized distinguishing criteria, and the comparative performance of the concepts for each of the criteria, are shown in Exhibit 10.

EXHIBIT 10
Level 2 Evaluation of Interchange Concepts by Comparative Performance on Prioritized Distinguishing Criteria

Priority	Distinguishing Criteria	Comparative Ranking			
		Tight Diamond	Tight Diamond w/ Loop	Single Point Urban Interchange	Partial Cloverleaf
1	Interchange Capacity	4th	2nd	3rd	1st
2	Pedestrian and Bicycle Crossings	1st	3rd	2nd	4th
3	Project Cost	1st	2nd	3rd	4th
4	Corridor Travel Time	4th	2nd	1st	3rd
5	Relocations	1st	3rd	1st	4th

Priority	Distinguishing Criteria	Comparative Ranking			
		Tight Diamond	Tight Diamond w/ Loop	Single Point Urban Interchange	Partial Cloverleaf
6	Expandability	1st	3rd	1st	4th
7	Spacing Criteria for Frontage Roads	2nd	3rd	1st	4th
8	Construction Staging	3rd	2nd	4th	1st

6.1.3 Preferred Alternative Selection

The Partial Cloverleaf concept ranked poorly on a majority of the distinguishing criteria and was removed from consideration. Of the remaining three concepts, the Tight Diamond with Loop performed best on the highest priority criterion, interchange capacity. The Tight Diamond with Loop would provide measurably better capacity than the Tight Diamond and SPUI concepts because it would allow the highest volume movement (from westbound US 6 to southbound Wadsworth Boulevard) to bypass traffic signals. Additionally, this concept performed better in off-peak conditions (which was not measured by the criteria rating). The loop option also had a greater level of support from the City because of the measurably better interchange capacity.

For the remaining three top priority criteria – pedestrian and bicycle crossings, project cost, and corridor travel time - the Tight Diamond with Loop ranked 2nd on cost and corridor travel time. It ranked 3rd on safety of pedestrian and bicycle crossings; however, the project team felt comfortable that pedestrian and bicycle accommodations could be readily mitigated during design refinement. After detailed evaluation of the criteria, the Tight Diamond with Loop was determined to best balance transportation needs with environmental and community impacts, and was recommended as the preferred alternative.

Charter team members agreed to the recommendation of the Tight Diamond with Loop as the preferred alternative. Two open houses held with the public presented the Level 2 evaluation results and the recommended Preferred Alternative. Comments from the public indicated concurrence with the recommendation as well.

6.2 Wadsworth Boulevard

The preferred alternative for Wadsworth Boulevard was selected after the Level 1 screening, as it was the only concept that met the project purpose and need. The preferred alternative would have six travel lanes, a median, and sidewalks. After the Level 1 screening, options were developed that varied design features such as median width and sidewalk locations.

A Level 2 evaluation of the preferred alternative was conducted to identify mitigation opportunities relative to the evaluation criteria, and to assist with decisions on design features. Some of the mitigation opportunities were incorporated into the design of the preferred alternative. The resulting features of the preferred alternative are described below.

The Wadsworth Boulevard preferred alternative would feature 11- and 12-foot travel lanes, a raised median of varying width, and a detached multi-use sidewalk in most locations north of US 6. The outside travel lane in each direction would be 12 feet wide. The two inside travel lanes in each

direction would be 11 feet wide. The 11-foot width was determined to be an acceptable mitigation measure to reduce property impacts, as travel lanes north and south of the project limits are 11 feet wide as well.

A raised median would provide access control and landscaping opportunities. The median width would vary throughout the corridor because of left-turn lane and landscaping requirements. Adjacent to left-turn lanes, there would be no landscaping opportunities in the median; therefore, the median width would be reduced to six feet, in accordance with accepted design standards. In locations without left-turn lanes, the median width would be 23 feet to provide landscaping opportunities in accordance with the City's preferred design for a landscaped median.

The median would prevent left turns at mid-block locations and would channel left turns to intersections with cross streets. At most intersections, u-turns would be allowed. No additional traffic signals would be added on Wadsworth Boulevard, except those required at the interchange. Traffic signals would remain at 5th, 10th, and 14th Avenues. Other intersections with cross streets would remain unsignalized. Cross street access to Wadsworth Boulevard at Highland Drive, 8th Place, 9th Avenue, and 13th Avenue would be limited to further improve safety and traffic capacity in the corridor.

An eight-foot multi-use sidewalk would be provided on both sides of Wadsworth Boulevard to accommodate pedestrians and bicyclists. The multi-use sidewalk between US 6 and 14th Avenue would be detached in most locations. The detached walk would provide a higher level of safety to pedestrians and bicyclists, moving them farther away from vehicular traffic, and would provide landscaping opportunities in the buffer between the road and sidewalk. The walk would be attached immediately north and south of 10th Avenue, where right-turn lanes would be required. In these locations, the walk would be 10 feet wide. South of US 6, the multi-use sidewalk would be attached in most locations to avoid business relocations and to tie in to the existing attached sidewalk south of 4th Avenue.

Charter team members agreed to the recommendation of a six-lane section with raised median and detached sidewalks as the preferred alternative. Two open houses held with the public presented the Level 2 evaluation results and the recommended preferred alternative. Comments from the public indicated concurrence with the recommendation as well.

6.3 Preferred Alternative Design Refinement

The preferred alternative for the interchange and Wadsworth Boulevard was presented to the public at two open houses in April and May 2008 and on the project website. The initial design of the preferred alternative proposed the following features for the frontage roads north of US 6:

- Frontage road northwest of interchange
    - Maintain one-way frontage road
    - Remove left-turn access to frontage road from northbound Wadsworth Boulevard because of the frontage road intersection's proximity to the interchange
    - Vehicles on northbound Wadsworth Boulevard would make a u-turn at 9th Avenue to access the frontage road from Wadsworth Boulevard

- Frontage road northeast of interchange
    - Frontage road would change to two-way west of Crescent Lane and remain two-way east of Crescent Lane
    - Frontage road access to Wadsworth Boulevard would be moved north to the location of the old intersection between Broadview Drive and Wadsworth Boulevard
    - Broadview Drive would continue to be a dead end, and would not be accessible from the frontage road

After this design was presented to the public, property owners north of US 6 submitted numerous comments suggesting changes to the frontage road design. Northwest of the interchange, businesses were interested in maintaining access to the frontage road from northbound Wadsworth Boulevard and changing the frontage road to a two-way road, allowing business customers to easily return to Wadsworth Boulevard. Northeast of the interchange, property owners noted that, currently, traffic traveling from southbound Wadsworth Boulevard to the eastbound frontage road must cut through the neighborhood on residential streets, to access the frontage road, as it does today. The proposed design would not have changed this condition.

In response to the comments made by property owners in the area, several changes were proposed to the frontage road designs north of US 6. The revised design would provide the following features:

- Frontage road northwest of interchange
    - Access to the frontage road would be shifted north. Shifting the access north would move the access farther from the interchange and allow left-turn access to the frontage road from northbound Wadsworth Boulevard.
    - The frontage road would be changed to two-way operation between Wadsworth Boulevard and the 6th Avenue Business Center, allowing business customers easier access to and from Wadsworth Boulevard.
- Frontage road northeast of interchange
    - Access to the frontage road would be shifted north to the location of the existing Highland Drive intersection. Shifting the access north would move the access farther from the interchange, creating better traffic operations at the interchange and on Wadsworth Boulevard.
    - With the new location of the frontage road intersection, southbound Wadsworth Boulevard traffic would be allowed to turn onto the frontage road, removing the need for traffic to cut through the neighborhood on residential streets to access the frontage road.
    - The reconfigured frontage road takes advantage of excess right-of-way created by properties that were affected by the widening of Wadsworth Boulevard; that is, no additional property acquisition would be necessary to accommodate this new configuration.
    - Highland Drive and Broadview Drive would both access the frontage road, allowing residents easier access to and from Wadsworth Boulevard and improve emergency access to the neighborhood.

Residents and property owners were given the opportunity to view and comment on the frontage road design revisions at a public open house, on the project website, via a project atlas sent to potentially impacted property owners, and at three small group meetings in or near the project area. The revised design was met with support from all interested parties who chose to comment on the design, and it has been incorporated into the preferred alternative.

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Appendix

Spreadsheet 1: Level 1 Conceptual Cost Estimate
Spreadsheet 2: Level 2 Conceptual Cost Estimate
Spreadsheet 3: Comparison of Level 1 and Level 2 Cost Estimates

Spreadsheet 1: Level 1 Conceptual Cost Estimate

US 6/Wadsworth Boulevard Interchange Conceptual Design Alternatives

Item No.	Item	Unit	2007 Unit Cost	1 Diamond		2 Tight Diamond		3 Tight Diamond w/Loop B		4 Single Point Urban Interchange		5 Partial Cloverleaf B		6 Partial Cloverleaf A w/Directional Ramp		7 Full Cloverleaf with Collector/Distributer Roads		8 Diverging Diamond		Remarks
				Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	
1.0	Removals																			
	Paved Surfaces	SY	$5	109,865	$549,327	108,383	$541,914	121,792	$608,961	108,450	$542,252	108,201	$541,004	109,619	$548,095	117,457	$587,284	105,406	$527,029	
	Bridge	SF	$16	20,889	$334,226	20,889	$334,226	20,889	$334,226	20,889	$334,226	20,889	$334,226	20,889	$334,226	20,889	$334,226	20,889	$334,226	
2.0	Reconstruction/Construction																			
	Earthwork	CY	$15	106,516	$1,597,744	104,866	$1,572,997	102,580	$1,538,697	104,694	$1,570,410	99,848	$1,497,719	138,087	$2,071,298	136,108	$2,041,619	121,953	$1,829,301	
	Pavement (Asphalt) - Assume 10 in	SY	$36	106,516	$3,834,586	104,866	$3,775,192	102,580	$3,692,872	104,694	$3,768,985	99,848	$3,594,526	105,679	$3,804,458	136,108	$4,899,885	121,953	$4,390,322	
	Sidewalk/Median	SY	$40	2,721	$108,859	3,395	$135,806	2,819	$112,777	5,415	$216,584	0	$0	0	$0	0	$0	0	$0	
3.0	Bridges/Structures																			
	US 6																			
	US 6 Bridge over Wadsworth Boulevard	SF	$105	23,745	$2,493,179	28,090	$2,949,498	25,993	$2,729,223	32,649	$3,428,127	24,170	$2,537,881	24,170	$2,537,881	37,337	$3,920,414	26,502	$2,782,688	
	WB US 6 to SB Wadsworth Blvd Flyover	SF	$125	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	24,647	$3,080,883	N/A	N/A	N/A	N/A	
	3 - 10' x 10' Concrete Box Culvert	SF	$100	3,423	$342,267	3,673	$367,338	16,592	$1,659,201	1,164	$116,388	16,580	$1,657,954	4,275	$427,471	17,543	$1,754,320	2,735	$273,475	
	1 - 8' x 8' Concrete Box Culvert	SF	$100	208	$20,756	118	$11,789	108	$10,769	62	$6,247	119	$11,870	6,048	$604,768	674	$67,374	75	$7,517	
4.0	Retaining Walls																			
	Fill Configuration; 0' to 10' High	LF	$710	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	Fill Configuration; 10' to 20' High	LF	$1,185	N/A	N/A	N/A	N/A	N/A	N/A	860	$1,019,100	N/A	N/A	18	$21,330	N/A	N/A	N/A	N/A	
	Fill Configuration; > 20' High	LF	$1,900	N/A	N/A	N/A	N/A	N/A	N/A	860	$1,634,000	N/A	N/A	25	$47,500	N/A	N/A	N/A	N/A	
	Cut Configuration; 0' to 10' High	LF	$415	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	Cut Configuration; 10' to 20' High	LF	$1,250	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	Cut Configuration; > 20' High	LF	$2,459	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	Sound Walls; 10' to 16' High	LF	$480	11,250	$5,399,776	10,920	$5,241,808	11,014	$5,286,592	10,849	$5,207,584	11,211	$5,381,248	11,493	$5,516,560	13,175	$6,323,824	8,945	$4,293,616	
5.0	Lighting																			
	Highway	MI	$72,500	1	$72,500	1	$72,500	1	$72,500	1	$72,500	1	$72,500	1	$72,500	1	$72,500	1	$72,500	
6.0	Traffic Signal	EA	$300,000	3	$900,000	3	$900,000	3	$900,000	2	$600,000	3	$900,000	2	$600,000	1	$300,000	3	$900,000	
(A)	**Subtotal of Construction Items**		**(A)**		**$15,653,219**		**$15,903,067**		**$16,945,817**		**$18,516,402**		**$16,528,927**		**$19,666,970**		**$20,301,446**		**$15,410,674**	
(B)	Contingencies	15%-30% of (A)	(B)	20%	$3,130,644	20%	$3,180,613	20%	$3,389,163	20%	$3,703,280	20%	$3,305,785	20%	$3,933,394	20%	$4,060,289	20%	$3,082,135	
(C)	Intelligent Transportation Systems (ITS) Strategies (VMS, Ramp Metering)	$280,000 per Navjoy	(C)	N/A	$280,000	N/A	$280,000	N/A	$280,000	N/A	$280,000	N/A	$280,000	N/A	$280,000	N/A	$280,000	N/A	$280,000	
(D)	Drainage	3%-10% of (A+B) Default =6%	(D)	6%	$1,127,032	6%	$1,145,021	6%	$1,220,099	6%	$1,333,181	6%	$1,190,083	6%	$1,416,022	6%	$1,461,704	6%	$1,109,569	
(E)	Urban Design/Landscaping	1%-4% of (A+B) Default =2%	(E)	2%	$375,677	2%	$381,674	2%	$406,700	2%	$444,394	2%	$396,694	2%	$472,007	2%	$487,235	2%	$369,856	
(F)	Signing and Striping Interstate	5% of (A+B+C+D+E)	(F)	5%	$1,028,329	5%	$1,044,519	5%	$1,112,089	5%	$1,213,863	5%	$1,085,074	5%	$1,288,420	5%	$1,329,534	5%	$1,012,612	
(G)	Construction Signing and Traffic Control Interstate	5%-25% of (A+B+C+D+E+F) Default =20%	(G)	20%	$4,318,980.21	20%	$4,386,978.73	20%	$4,670,773.46	20%	$5,098,224.03	20%	$4,557,312.75	20%	$5,411,362.42	20%	$5,584,041.43	20%	$4,252,969.00	
(H)	Mobilization	4%-10% of (A+B+C+D+E+F+G) Default =7%	(H)	7%	$1,813,971.69	7%	$1,842,531.07	7%	$1,961,724.85	7%	$2,141,254.09	7%	$1,914,071.35	7%	$2,272,772.22	7%	$2,345,297.40	7%	$1,786,246.98	
(I)	**Total of Construction Items**	(A+B+C+D+E+F+G+H)	**(I)**		**$27,727,853**		**$28,164,403**		**$29,986,366**		**$32,730,598**		**$29,257,948**		**$34,740,947**		**$35,849,546**		**$27,304,061**	
(J)	Force Account - Utilities	(1%-2%) of (I) Default =2%	(J)	2%	$554,557	2%	$563,288	2%	$599,727	2%	$654,612	2%	$585,159	2%	$694,819	2%	$716,991	2%	$546,081	
(K)	Force Account - Miscellaneous	(10%-15%) of (I)	(K)	12%	$3,327,342	12%	$3,379,728	12%	$3,598,364	12%	$3,927,672	12%	$3,510,954	12%	$4,168,914	12%	$4,301,946	12%	$3,276,487	
(L)	**Subtotal of Construction Cost (2007)**	(I+J+K)	**(L)**		**$31,609,752**		**$32,107,420**		**$34,184,457**		**$37,312,882**		**$33,354,061**		**$39,604,679**		**$40,868,482**		**$31,126,630**	
(M)	**Subtotal of Construction Cost (2010, Escalated 5% Per Year)**		**(M)**		**$36,592,240**		**$37,168,352**		**$39,572,782**		**$43,194,325**		**$38,611,494**		**$45,847,367**		**$47,310,377**		**$36,032,965**	
	Other Costs																			
	Preliminary Engineering	10% of (M)		10%	$3,659,224	10%	$3,716,835	10%	$3,957,278	10%	$4,319,433	10%	$3,861,149	10%	$4,584,737	10%	$4,731,038	10%	$3,603,296	
	Construction Engineering	17% of (M)		17%	$6,220,681	17%	$6,318,620	17%	$6,727,373	17%	$7,343,035	17%	$6,563,954	17%	$7,794,052	17%	$8,042,764	17%	$6,125,604	
	Construction Services	1% of (M)		1%	$365,922	1%	$371,684	1%	$395,728	1%	$431,943	1%	$386,115	1%	$458,474	1%	$473,104	1%	$360,330	
(N)	**Total of Construction Cost (2010)**		**(N)**		**$46,838,067**		**$47,575,491**		**$50,653,161**		**$55,288,736**		**$49,422,713**		**$58,684,630**		**$60,557,282**		**$46,122,195**	
	Right-Of-Way																			
	Residential and Commercial - Land Only	SF	$30	179,194	$5,375,814	149,572	$4,487,150	163,579	$4,907,372	137,526	$4,125,782	121,908	$3,657,248	110,328	$3,309,827	86,892	$2,606,774	153,786	$4,613,590	
	Residential - Full Acquisition	EACH	$250,000	17	$4,250,000	14	$3,500,000	14	$3,500,000	11	$2,750,000	16	$4,000,000	21	$5,250,000	27	$6,750,000	11	$2,750,000	
	Residential - Relocation	EACH	$50,000	17	$850,000	14	$700,000	14	$700,000	11	$550,000	16	$800,000	21	$1,050,000	27	$1,350,000	11	$550,000	
	Commercial - Full Acquisition	Assessor's Value x 1.4	N/A	4	$1,362,620	4	$1,362,620	4	$1,362,620	2	$1,067,500	4	$1,362,620	4	$1,067,360	5	$2,183,860	9	$3,763,060	
	Commercial - Relocation	$50,000 - $100,000	N/A	4	$200,000	4	$200,000	4	$200,000	2	$150,000	4	$200,000	4	$125,000	5	$365,000	9	$570,000	
(O)	**Total of Right-of-Way Costs**		**(O)**		**$12,038,434**		**$10,249,770**		**$10,669,992**		**$8,643,282**		**$10,019,868**		**$10,802,187**		**$13,255,634**		**$12,246,650**	
(P)	**Total US6/Wadsworth Interchange (2010)**		**(P)**		**$58,876,501**		**$57,825,261**		**$61,323,153**		**$63,932,019**		**$59,442,581**		**$69,486,817**		**$73,812,917**		**$58,368,845**	

Wadsworth Boulevard Conceptual Design Alternatives

Item No.	Item	Unit	2007 Unit Cost	1		2		3		4		5		6		7		8		9		10		11		Remarks
				Intelligent Transportation Systems/Travel Demand Management/Transportation Systems Management		Intersection Improvements + Median		4 Lane + Median + Sidewalks		5 Lane + Median + Without Sidewalks		5 Lane + Median + Sidewalks		6 Lane + Median + Without Sidewalks		6 Lane + No Median + Sidewalks		6 Lane + Median + Sidewalks		6 Lane + Two Way Left Turn + Sidewalks		6 Lane (4 Travel Lanes + Two Dedicated Transit)		8 Lane (6 Travel Lanes + Two Dedicated Transit)		
				Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	
1.0	Removals																									
	Paved Surfaces	SY	$5	0	$0	13,789	$68,945	39,139	$195,697	38,346	$191,731	46,293	$231,466	38,875	$194,375	41,732	$208,660	46,822	$234,110	45,188	$225,940	46,822	$234,110	52,847	$264,235	
	Concrete Box Culvert	SF	$7	0	$0	0	$0	2,557	$17,899	2,557	$17,899	2,557	$17,899	2,557	$17,899	2,557	$17,899	2,557	$17,899	2,557	$17,899	2,557	$17,899	2,557	$17,899	
2.0	Reconstruction/Construction																									
	Earthwork	CY	$15	0	$0	779	$11,685	2,404	$36,060	2,107	$31,605	2,433	$36,495	2,136	$32,040	2,116	$31,740	2,463	$36,945	2,328	$34,920	2,463	$36,945	2,939	$44,085	
	Pavement (Asphalt) - Assume 10 in	SY	$36	0	$0	13,825	$497,700	30,122	$1,084,400	30,651	$1,103,440	30,651	$1,103,440	31,180	$1,122,480	32,295	$1,162,620	31,180	$1,122,480	35,904	$1,292,544	31,180	$1,122,480	39,735	$1,430,460	
	Sidewalk/Median	SY	$40	0	$0	200	$8,000	13,151	$526,040	7,275	$291,000	13,151	$526,040	7,275	$291,000	5,784	$231,360	13,151	$526,040	5,999	$239,960	13,151	$526,040	13,169	$526,760	
3.0	Bridges/Structures																									
	Wadsworth Boulevard																									
	3 - 12' x 10' Concrete Box Culvert	SF	$100	0	$0	0	$0	9,262	$926,180	7,861	$786,140	8,951	$895,140	8,795	$879,500	9,885	$988,500	9,885	$988,500	9,418	$941,800	9,885	$988,500	11,753	$1,175,300	
	1 - 7' x 5' Elleptical Concrete Pipe	LF	$210	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	23	$4,830	
5.0	Lighting																									
	Arterial	MI	$138,700	0	$0	0.7	$97,090	0.7	$97,090	0.7	$97,090	0.7	$97,090	0.7	$97,090	0.7	$97,090	0.7	$97,090	0.7	$97,090	0.7	$97,090	0.7	$97,090	
6.0	Traffic Signal	EA	$300,000	0	$0	1	$300,000	1.5	$450,000	1.5	$450,000	1.5	$450,000	1.5	$450,000	1.5	$450,000	1.5	$450,000	1.5	$450,000	1.5	$450,000	1.5	$450,000	
(A)	**Subtotal of Construction Items**		**(A)**		**$0**		**$983,420**		**$3,333,366**		**$2,968,905**		**$3,357,570**		**$3,084,384**		**$3,187,869**		**$3,473,064**		**$3,300,153**		**$3,473,064**		**$4,010,659**	
(B)	Contingencies	15%-30% of (A)	(B)	20%	$0	20%	$196,684	20%	$666,673	20%	$593,781	20%	$671,514	20%	$616,877	20%	$637,574	20%	$694,613	20%	$660,031	20%	$694,613	20%	$802,132	
(C)	Intelligent Transportation Systems (ITS) Strategies	$240,000 per Navjoy	(C)	N/A	$240,000	N/A	$240,000	N/A	$240,000	N/A	$240,000	N/A	$240,000	N/A	$240,000	N/A	$240,000	N/A	$240,000	N/A	$240,000	N/A	$240,000	N/A	$240,000	
(D)	Drainage	3%-10% of (A+B) Default =6%	(D)	6%	$0	6%	$70,806	6%	$240,002	6%	$213,761	6%	$241,745	6%	$222,076	6%	$229,527	6%	$250,061	6%	$237,611	6%	$250,061	6%	$288,767	
(E)	Urban Design/Landscaping	$300,000/Acre per CDOT	(E)	N/A	$0	N/A	$350,000	N/A	$350,000	N/A	$350,000	N/A	$350,000	N/A	$350,000	N/A	$350,000	N/A	$350,000	N/A	$350,000	N/A	$350,000	N/A	$350,000	
(F)	Signing and Striping Arterial	5% of (A+B+C+D+E)	(F)	5%	$12,000	5%	$92,046	5%	$241,502	5%	$218,322	5%	$243,041	5%	$225,667	5%	$232,248	5%	$250,387	5%	$239,390	5%	$250,387	5%	$284,578	
(G)	Construction Signing and Traffic Control	5%-25% of (A+B+C+D+E+F) Default =20%	(G)	10%	$25,200.00	20%	$386,591.15	20%	$1,014,308.79	20%	$916,953.78	20%	$1,020,773.98	20%	$947,800.65	20%	$975,443.57	20%	$1,051,624.86	20%	$1,005,436.87	20%	$1,051,624.86	20%	$1,195,227.23	
(H)	Mobilization	4%-10% of (A+B+C+D+E+F+G) Default =7%	(H)	5%	$13,860.00	7%	$162,368.28	7%	$426,009.69	7%	$385,120.59	7%	$428,725.07	7%	$398,076.27	7%	$409,686.30	7%	$441,682.44	7%	$422,283.49	7%	$441,682.44	7%	$501,995.44	
(I)	**Total of Construction Items**	(A+B+C+D+E+F+G+H)	**(I)**		**$291,060**		**$2,481,915**		**$6,511,862**		**$5,886,843**		**$6,553,369**		**$6,084,880**		**$6,262,348**		**$6,751,432**		**$6,454,905**		**$6,751,432**		**$7,673,359**	
(J)	Force Account - Utilities	(1%-2%) of (I) Default =2%	(J)	2%	$5,821	2%	$49,638	2%	$130,237	2%	$117,737	2%	$131,067	2%	$121,698	2%	$125,247	2%	$135,029	2%	$129,098	2%	$135,029	2%	$153,467	
(K)	Force Account - Miscellaneous	(10%-15%) of (I)	(K)	12%	$34,927	12%	$297,830	12%	$781,423	12%	$706,421	12%	$786,404	12%	$730,186	12%	$751,482	12%	$810,172	12%	$774,589	12%	$810,172	12%	$920,803	
(L)	**Subtotal of Construction Cost (2007)**	(I+J+K)	**(L)**		**$331,808**		**$2,829,383**		**$7,423,523**		**$6,711,001**		**$7,470,841**		**$6,936,763**		**$7,139,076**		**$7,696,632**		**$7,358,591**		**$7,696,632**		**$8,747,629**	
(M)	**Subtotal of Construction Cost (2010, Escalated 5% Per Year)**		**(M)**		**$384,110**		**$3,275,365**		**$8,593,656**		**$7,768,823**		**$8,648,432**		**$8,030,171**		**$8,264,373**		**$8,909,814**		**$8,518,489**		**$8,909,814**		**$10,126,474**	
	Other Costs																									
	Preliminary Engineering	10% of (M)		10%	$38,411	10%	$327,536	10%	$859,366	10%	$776,882	10%	$864,843	10%	$803,017	10%	$826,437	10%	$890,981	10%	$851,849	10%	$890,981	10%	$1,012,647	
	Construction Engineering	17% of (M)		17%	$65,299	17%	$556,812	17%	$1,460,922	17%	$1,320,700	17%	$1,470,233	17%	$1,365,129	17%	$1,404,943	17%	$1,514,668	17%	$1,448,143	17%	$1,514,668	17%	$1,721,501	
	Construction Services	1% of (M)		1%	$3,841	1%	$32,754	1%	$85,937	1%	$77,688	1%	$86,484	1%	$80,302	1%	$82,644	1%	$89,098	1%	$85,185	1%	$89,098	1%	$101,265	
(N)	**Total of Construction Cost (2010)**		**(N)**		**$491,660**		**$4,192,467**		**$10,999,880**		**$9,944,093**		**$11,069,993**		**$10,278,619**		**$10,578,398**		**$11,404,561**		**$10,903,666**		**$11,404,561**		**$12,961,887**	
	Right-Of-Way																									
	Residential and Commercial - Land Only	SF	$30	0	$0	20,980	$629,408	56,937	$1,708,109	49,858	$1,495,750	83,741	$2,512,239	81,812	$2,454,374	99,085	$2,972,540	110,655	$3,319,664	103,041	$3,091,240	110,655	$3,319,664	138,358	$4,150,750	
	Residential - Full Acquisition	EACH	$250,000	0	$0	0	$0	1	$250,000	1	$250,000	1	$250,000	1	$250,000	1	$250,000	1	$250,000	1	$250,000	1	$250,000	1	$250,000	
	Residential - Relocation	EACH	$50,000	0	$0	0	$0	1	$50,000	1	$50,000	1	$50,000	1	$50,000	1	$50,000	1	$50,000	1	$50,000	1	$50,000	1	$50,000	
	Commercial - Full Acquisition	Assessor's Value x 1.4	N/A	0	$0	2	$1,796,480	3	$958,720	0	$0	6	$2,209,760	0	$0	7	$2,436,000	7	$2,436,000	3	$1,284,920	7	$2,436,000	11	$11,594,940	
	Commercial - Relocation	$50,000 - $100,000	N/A	0	$0	2	$320,000	3	$150,000	0	$0	6	$300,000	0	$0	7	$350,000	7	$350,000	3	$150,000	7	$350,000	11	$1,620,000	
(O)	**Total of Right-of-Way Costs**		**(O)**		**$0**		**$2,745,888**		**$3,116,829**		**$1,795,750**		**$5,321,999**		**$2,754,374**		**$6,058,540**		**$6,405,664**		**$4,826,160**		**$6,405,664**		**$17,665,690**	
(P)	**Total Wadsworth Boulevard (2010)**	(N+O)	**(P)**		**$491,660**		**$6,938,355**		**$14,116,709**		**$11,739,843**		**$16,391,992**		**$13,032,992**		**$16,636,938**		**$17,810,226**		**$15,729,826**		**$17,810,226**		**$30,627,577**	

Spreadsheet 2: Level 2 Conceptual Cost Estimate

US 6/Wadsworth Environmental Assessment

US 6/Wadsworth Boulevard Interchange Screened Design Alternatives

Item No.	Item	Unit	2007 Unit Cost	2 Tight Diamond		3 Tight Diamond w/Loop B		4 Single Point Diamond Interchange		5 Partial Cloverleaf B	
				Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount
1.0	Removals										
	Paved Surfaces	SY	$5	124,987	$624,937	126,039	$630,194	124,748	$623,738	131,756	$658,779
	Bridge	SF	$16	20,889	$334,226	20,889	$334,226	20,889	$334,226	20,889	$334,226
2.0	Reconstruction/Construction										
	Earthwork	CY	$15	100,036	$1,500,540	88,918	$1,333,770	113,962	$1,709,430	99,669	$1,495,035
	Pavement (Asphalt) - Assume 10 in	SY	$36	110,840	$3,990,231	107,622	$3,874,382	111,520	$4,014,713	107,974	$3,887,080
	Sidewalk/Median	SY	$40	8,567	$342,694	7,776	$311,021	10,545	$421,807	7,023	$280,902
3.0	Bridges/Structures										
	US 6										
	US 6 Bridge over Wadsworth Boulevard	SF	$100	25,650	$2,565,000	N/A	N/A	N/A	N/A	N/A	N/A
	US 6 Bridge over Wadsworth Boulevard	SF	$95	N/A	N/A	27,305	$2,593,975	N/A	N/A	30,970	$2,942,150
	US 6 Bridge over Wadsworth Boulevard	SF	$120	N/A	N/A	N/A	N/A	40,705	$4,884,600	N/A	N/A
	3 - 11' x 10' Concrete Box Culvert	SF	$120	2,584	$310,080	N/A	N/A	2,788	$334,560	N/A	N/A
	1 - 8' x 8' Concrete Box Culvert	SF	$100	250	$25,000	112	$11,200	263	$26,300	179	$17,900
	3 - 12' x 10' Concrete Box Culvert (Replacement)	SF	$120	N/A	N/A	31,466	$3,775,920	N/A	N/A	31,466	$3,775,920
4.0	Retaining Walls										
	Fill Configuration; 0' to 10' High	LF	$710	875	621,250	255	181,050	N/A	N/A	320	227,200
	Fill Configuration; 10' to 20' High	LF	$1,185	N/A	N/A	N/A	N/A	1,145	$1,356,825	N/A	N/A
	Fill Configuration; > 20' High	LF	$1,900	N/A	N/A	N/A	N/A	1,085	$2,061,500	N/A	N/A
	Cut Configuration; 0' to 10' High	LF	$415	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cut Configuration; 10' to 20' High	LF	$1,250	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cut Configuration; > 20' High	LF	$2,459	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Sound Walls; 10' to 16' High	LF	$480	10,920	$5,241,808	11,014	$5,286,592	10,849	$5,207,584	11,211	$5,381,248
5.0	Lighting										
	Highway	MI	$72,500	0.9	$65,250	0.9	$65,250	0.9	$65,250	0.9	$65,250
	Arterial	MI	$138,700	0.4	$55,480	0.4	$55,480	0.4	$55,480	0.4	$55,480
6.0	Traffic Signal	EA	$300,000	3	$900,000	2.5	$750,000	2	$600,000	3	$900,000
(A)	**Subtotal of Construction Items**		**(A)**		**$16,576,496**		**$19,203,059**		**$21,696,012**		**$20,021,170**
(B)	Contingencies	15%-30% of (A)	(B)	20%	$3,315,299	20%	$3,840,612	20%	$4,339,202	20%	$4,004,234
(C)	Intelligent Transportation Systems (ITS) Strategies (VMS, Ramp Metering)	$280,000 per Navjoy	(C)	N/A	$280,000	N/A	$280,000	N/A	$280,000	N/A	$280,000
(D)	Drainage	3%-10% of (A+B) Default =6%	(D)	6%	$1,193,508	6%	$1,382,620	6%	$1,562,113	6%	$1,441,524
(E)	Urban Design/Landscaping	1%-4% of (A+B) Default =2%	(E)	2%	$397,836	2%	$460,873	2%	$520,704	2%	$480,508
(F)	Signing and Striping Interstate	5% of (A+B+C+D+E)	(F)	5%	$1,088,157	5%	$1,258,358	5%	$1,419,902	5%	$1,311,372
(G)	Construction Signing and Traffic Control Interstate	5%-25% of (A+B+C+D+E+F) Default =20%	(G)	20%	$4,570,259.07	20%	$5,285,104.64	20%	$5,963,586.66	20%	$5,507,761.66
(H)	Mobilization	4%-10% of (A+B+C+D+E+F+G) Default =7%	(H)	7%	$1,919,508.81	7%	$2,219,743.95	7%	$2,504,706.40	7%	$2,313,259.90
(I)	**Total of Construction Items**	(A+B+C+D+E+F+G+H)	**(I)**		**$29,341,063**		**$33,930,372**		**$38,286,226**		**$35,359,830**

US 6/Wadsworth Boulevard Interchange Screened Design Alternatives

Item No.	Item	Unit	2007 Unit Cost	2 Tight Diamond		3 Tight Diamond w/Loop B		4 Single Point Diamond Interchange		5 Partial Cloverleaf B	
(J)	Force Account - Utilities	(1%-2%) of (I) Default =2%	(J)	2%	$586,821	2%	$678,607	2%	$765,725	2%	$707,197
(K)	Force Account - Miscellaneous	(10%-15%) of (I)	(K)	12%	$3,520,928	12%	$4,071,645	12%	$4,594,347	12%	$4,243,180
(L)	**Subotal of Construction Cost (2007)**	(I+J+K)	**(L)**		**$33,448,812**		**$38,680,624**		**$43,646,298**		**$40,310,206**
(M)	**Subtotal of Construction Cost (2010, Escalated 5% Per Year)**		**(M)**		**$38,721,181**		**$44,777,657**		**$50,526,046**		**$46,664,102**
	Other Costs										
	Preliminary Engineering	10% of (M)		10%	$3,872,118	10%	$4,477,766	10%	$5,052,605	10%	$4,666,410
	Construction Engineering	17% of (M)		17%	$6,582,601	17%	$7,612,202	17%	$8,589,428	17%	$7,932,897
	Construction Services	1% of (M)		1%	$387,212	1%	$447,777	1%	$505,260	1%	$466,641
(N)	**Total of Construction Cost (2010)**		**(N)**		**$49,563,112**		**$57,315,401**		**$64,673,339**		**$59,730,051**
	Right-Of-Way										
	Residential and Commercial - Land Only	SF	$30	23,109	$693,275	56,592	$1,697,758	21,431	$642,941	63,693	$1,910,783
	Residential and Commercial - Permanent Easement	SF	$27	17,175	$463,723	16,864	$455,325	17,209	$464,635	15,979	$431,423
	Residential and Commercial - Temporary Easement	SF	$15	107,852	$1,617,773	124,194	$1,862,912	98,253	$1,473,797	128,408	$1,926,127
	Residential - Full Acquisition	EACH	$250,000	17	$4,250,000	13	$3,250,000	17	$4,250,000	13	$3,250,000
	Residential - Relocation	EACH	$50,000	17	$850,000	13	$650,000	17	$850,000	13	$650,000
	Commercial - Full Acquisition	Assessor's Value x 1.4	N/A	9	$3,497,900	11	$7,280,280	9	$3,497,900	12	$10,306,100
	Commercial - Relocation	$50,000 - $100,000	N/A	9	$550,000	12	$1,850,000	9	$550,000	14	$2,450,000
	Vacant Land	Assessor's Value x 1.4	N/A	5	$56,378	5	$56,378	5	$56,378	5	$56,378
(O)	**Total of Right-of-Way Costs**		**(O)**		**$11,979,048**		**$17,102,654**		**$11,785,651**		**$20,980,810**
(P)	**Total US6/Wadsworth Interchange (2010)**		**(P)**		**$61,542,160**		**$74,418,055**		**$76,458,990**		**$80,710,861**

Wadsworth Boulevard Screened Design Alternatives

Item No.	Item	Unit	2007 Unit Cost	8b 6 Lane + 18' Median + 8' Detached Sidewalk		8c 6 Lane + 23' Median + 10' Detached Sidewalk	
				Quantity	Amount	Quantity	Amount
1.0	Removals						
	Paved Surfaces	SY	$5	59,192	$293,490	62,616	$313,080
	Concrete Box Culvert	SF	$7	2,557	$17,899	2,557	$17,899
2.0	Reconstruction/Construction						
	Earthwork	CY	$15	19,421	$285,555	20,302	$304,530
	Pavement (Asphalt) - Assume 10 in	SY	$36	38,197	$1,371,816	39,303	$1,414,908
	Sidewalk/Median	SY	$40	9,111	$490,600	11,319	$452,769
3.0	Bridges/Structures						
	Wadsworth Boulevard						
	4 - 16' x 9' Concrete Box Culvert	SF	$120	8,589	$1,030,680	9,680	$1,161,600
	2 - 14' x 6' Concrete Box Culvert	SF	$110	12,109	$1,331,990	12,261	$1,348,710
5.0	Lighting						
	Arterial	MI	$138,700	0.7	$97,090	0.7	$97,090
6.0	Traffic Signal	EA	$300,000	1.5	$450,000	1.5	$450,000
(A)	**Subtotal of Construction Items**		**(A)**		**$5,369,120**		**$5,560,586**
(B)	Contingencies	15%-30% of (A)	(B)	20%	$1,073,824	20%	$1,112,117
(C)	Intelligent Transportation Systems (ITS) Strategies	$240,000 per Navjoy	(C)	N/A	$240,000	N/A	$240,000
(D)	Drainage	3%-10% of (A+B) Default =6%	(D)	6%	$386,577	6%	$400,362
(E)	Urban Design/Landscaping	$300,000/Acre per CDOT	(E)	N/A	$350,000	N/A	$350,000
(F)	Signing and Striping Arterial	5% of (A+B+C+D+E)	(F)	5%	$370,976	5%	$383,153
(G)	Construction Signing and Traffic Control	5%-25% of (A+B+C+D+E+F) Default =20%	(G)	20%	$1,558,099.33	20%	$1,609,243.70
(H)	Mobilization	4%-10% of (A+B+C+D+E+F+G) Default =7%	(H)	7%	$654,401.72	7%	$675,882.35
(I)	**Total of Construction Items**	(A+B+C+D+E+F+G+H)	**(I)**		**$10,002,998**		**$10,331,345**
(J)	Force Account - Utilities	(1%-2%) of (I) Default =2%	(J)	2%	$200,060	2%	$206,627
(K)	Force Account - Miscellaneous	(10%-15%) of (I)	(K)	12%	$1,200,360	12%	$1,239,761
(L)	**Subtotal of Construction Cost (2007)**	(I+J+K)	**(L)**		**$11,403,417**		**$11,777,733**
(M)	**Subtotal of Construction Cost (2010, Escalated 5% Per Year)**		**(M)**		**$13,200,881**		**$13,634,198**
	Other Costs						
	Preliminary Engineering	10% of (M)		10%	$1,320,088	10%	$1,363,420
	Construction Engineering	17% of (M)		17%	$2,244,150	17%	$2,317,814
	Construction Services	1% of (M)		1%	$132,009	1%	$136,342
(N)	**Total of Construction Cost (2010)**		**(N)**		**$16,897,128**		**$17,451,773**
	Right-Of-Way						
	Residential and Commercial - ROW	SF	$30	31,495	$944,841	33,572	$1,007,169
	Residential and Commercial - Permanent Easem	SF	$27	71,515	$1,930,903	84,317	$2,276,570
	Residential and Commercial - Temporary Easem	SF	$15	91,036	$1,365,546	83,688	$1,255,321
	Residential - Full Acquisition	EACH	$250,000	2	$500,000	2	$500,000
	Residential - Relocation	EACH	$50,000	2	$100,000	2	$100,000
	Commercial - Full Acquisition	Assessor's Value x 1.4	N/A	10	$5,242,020	13	$7,386,680
	Commercial - Relocation	$50,000 - $100,000	N/A	10	$550,000	13	$920,000
(O)	**Total of Right-of-Way Costs**		**(O)**		**$10,633,310**		**$13,445,741**
(P)	**Total Wadsworth Boulevard (2010)**	(N+O)	**(P)**		**$27,530,438**		**$30,897,514**

Spreadsheet 3: Comparison of Level 1 and Level 2 Cost Estimates

US 6/Wadsworth Boulevard Interchange Screened Design Alternatives

Item No.	Item	Unit	2007 Unit Cost	2 Tight Diamond						3 Tight Diamond w/Loop B						4 Single Point Diamond Interchange						5 Partial Cloverleaf B					
				SA (Level 2)		CA (Level 1)*		Difference		SA (Level 2)		CA (Level 1)*		Difference		SA (Level 2)		CA (Level 1)*		Difference		SA (Level 2)		CA (Level 1)*		Difference	
				Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount
1.0	Removals																										
	Paved Surfaces	SY	$5	124,987	$624,937	108,383	$541,914	16,605	$83,023	126,039	$630,194	121,792	$608,961	4,247	$21,233	124,748	$623,738	108,450	$542,252	16,297	$81,486	131,756	$658,779	108,201	$541,004	23,555	$117,775
	Bridge	SF	$16	20,889	$334,226	20,889	$334,226	-	$0	20,889	$334,226	20,889	$334,226	-	$0	20,889	$334,226	20,889	$334,226	-	$0	20,889	$334,226	20,889	$334,226	-	$0
2.0	Reconstruction/Construction																										
	Earthwork	CY	$15	100,036	$1,500,540	104,866	$1,572,997	(4,830)	($72,457)	88,918	$1,333,770	102,580	$1,538,697	(13,662)	($204,927)	113,962	$1,709,430	104,694	$1,570,410	9,268	$139,020	99,669	$1,495,035	99,848	$1,497,719	(179)	($2,684)
	Pavement (Asphalt) - Assume 10 in	SY	$36	110,840	$3,990,231	104,866	$3,775,192	5,973	$215,039	107,622	$3,874,382	102,580	$3,692,872	5,042	$181,511	111,520	$4,014,713	104,694	$3,768,985	6,826	$245,728	107,974	$3,887,080	99,848	$3,594,526	8,127	$292,555
	Sidewalk/Median	SY	$40	8,567	$342,694	3,395	$135,806	5,172	$206,888	7,776	$311,021	2,819	$112,777	4,956	$198,244	10,545	$421,807	5,415	$216,584	5,131	$205,223	7,023	$280,902	-	$0	7,023	$280,902
3.0	Bridges/Structures			28,484																							
	US 6																										
	US 6 Bridge over Wadsworth Boulevard	SF	$100	25,650	$2,565,000	28,090	$2,949,498	(2,440)	($384,498)	N/A	N/A					N/A	N/A					N/A	N/A				
	US 6 Bridge over Wadsworth Boulevard	SF	$95	N/A	N/A					27,305	$2,593,975	25,993	$2,729,223	$1,312	($135,248)	N/A	N/A					30,970	$2,942,150	24,170	$2,537,881	$6,800	$404,269
	US 6 Bridge over Wadsworth Boulevard	SF	$120	N/A	N/A					N/A	N/A					40,705	$4,884,600	32,649	$3,428,127	$8,056	$1,456,473	N/A	N/A				
	3 - 11' x 10' Concrete Box Culvert	SF	$120	2,584	$310,080	3,673	$367,338	(1,089)	($57,258)	N/A	N/A					2,788	$334,560	1,164	$116,388	1,624	$218,172	N/A	N/A				
	1 - 8' x 8' Concrete Box Culvert	SF	$100	250	$25,000	118	$11,789	132	$13,211	112	$11,200	108	$10,769	4	$431	263	$26,300	62	$6,247	201	$20,053	179	$17,900	119	$11,870	60	$6,030
	3 - 12' x 10' Concrete Box Culvert (Replacement)	SF	$120	N/A	N/A					31,466	$3,775,920	16,592	$1,659,201	$14,874	$2,116,719	N/A	N/A					31,466	$3,775,920	16,580	$1,657,954	$14,886	$2,117,966
4.0	Retaining Walls																										
	Fill Configuration; 0' to 10' High	LF	$710	875	$621,250			875	$621,250	255	181,050			255	$181,050	N/A	N/A					320	$227,200			320	$227,200
	Fill Configuration; 10' to 20' High	LF	$1,185	N/A	N/A					N/A	N/A					1,145	$1,356,825	860	$1,019,100	285	$337,725	N/A	N/A				
	Fill Configuration; > 20' High	LF	$1,900	N/A	N/A					N/A	N/A					1,085	$2,061,500	860	$1,634,000	225	$427,500	N/A	N/A				
	Cut Configuration; 0' to 10' High	LF	$415	N/A	N/A					N/A	N/A					N/A	N/A					N/A	N/A				
	Cut Configuration; 10' to 20' High	LF	$1,250	N/A	N/A					N/A	N/A					N/A	N/A					N/A	N/A				
	Cut Configuration; > 20' High	LF	$2,459	N/A	N/A					N/A	N/A					N/A	N/A					N/A	N/A				
	Sound Walls; 10' to 16' High	LF	$480	10,920	$5,241,808	10,920	$5,241,808	-	$0	11,014	$5,286,592	11,014	$5,286,592	-	$0	10,849	$5,207,584	10,849	$5,207,584	-	$0	11,211	$5,381,248	11,211	$5,381,248	-	$0
5.0	Lighting																										
	Highway	MI	$72,500	0.9	$65,250	1	$72,500	(0.1)	($7,250)	0.9	$65,250	1	$72,500	(0.1)	($7,250)	0.9	$65,250	1	$72,500	(0.1)	($7,250)	0.9	$65,250	1	$72,500	(0.1)	($7,250)
	Arterial	MI	$138,700	0.4	$55,480			0.4	$55,480	0.4	$55,480			0.4	$55,480	0.4	$55,480			0.4	$55,480	0.4	$55,480			0.4	$55,480
6.0	Traffic Signal	EA	$300,000	3	$900,000	3	$900,000	-	$0	2.5	$750,000	3	$900,000	(0.5)	($150,000)	2	$600,000	2	$600,000	-	$0	3	$900,000	3	$900,000	-	$0
(A)	**Subtotal of Construction Items**		**(A)**		**$16,576,496**		**$15,903,067**		**$673,429**		**$19,203,059**		**$16,945,817**		**$2,257,243**		**$21,696,012**		**$18,516,402**		**$3,179,610**		**$20,021,170**		**$16,528,927**		**$3,492,243**
(B)	Contingencies	15%-30% of (A)	(B)	20%	$3,315,299	0	$3,180,613	-	$134,686	20%	$3,840,612	0	$3,389,163	-	$451,449	20%	$4,339,202	0	$3,703,280	-	$635,922	20%	$4,004,234	0	$3,305,785	-	$698,449
(C)	Intelligent Transportation Systems (ITS) Strategies (VMS, Ramp Metering)	$280,000 per Navjoy	(C)	N/A	$280,000	N/A	$280,000		$0	N/A	$280,000	N/A	$280,000		$0	N/A	$280,000	N/A	$280,000		$0	N/A	$280,000	N/A	$280,000		$0
(D)	Drainage	3%-10% of (A+B) Default =6%	(D)	6%	$1,193,508	0	$1,145,021	-	$48,487	6%	$1,382,620	0	$1,220,099	-	$162,521	6%	$1,562,113	0	$1,333,181	-	$228,932	6%	$1,441,524	0	$1,190,083	-	$251,442
(E)	Urban Design/Landscaping	1%-4% of (A+B) Default =2%	(E)	2%	$397,836	0	$381,674	-	$16,162	2%	$460,873	0	$406,700	-	$54,174	2%	$520,704	0	$444,394	-	$76,311	2%	$480,508	0	$396,694	-	$83,814
(F)	Signing and Striping Interstate	5% of (A+B+C+D+E)	(F)	5%	$1,088,157	0	$1,044,519	-	$43,638	5%	$1,258,358	0	$1,112,089	-	$146,269	5%	$1,419,902	0	$1,213,863	-	$206,039	5%	$1,311,372	0	$1,085,074	-	$226,297
(G)	Construction Signing and Traffic Control Interstate	5%-25% of (A+B+C+D+E+F) Default =20%	(G)	20%	$4,570,259	0	$4,386,979	-	$183,280	20%	$5,285,105	0	$4,670,773	-	$614,331	20%	$5,963,587	0	$5,098,224	-	$865,363	20%	$5,507,762	0	$4,557,313	-	$950,449
(H)	Mobilization	4%-10% of (A+B+C+D+E+F+G) Default =7%	(H)	7%	$1,919,509	0	$1,842,531	-	$76,978	7%	$2,219,744	0	$1,961,725	-	$258,019	7%	$2,504,706	0	$2,141,254	-	$363,452	7%	$2,313,260	0	$1,914,071	-	$399,189
					$12,764,568		$12,261,336		$503,231				$13,040,549		$1,686,763				$14,214,196		$2,376,018				$12,729,021		$2,609,639
(I)	**Total of Construction Items**	(A+B+C+D+E+F+G+H)	**(I)**		**$29,341,063**		**$28,164,403**		**$1,176,660**		**$33,930,372**		**$29,986,366**		**$3,944,006**		**$38,286,226**		**$32,730,598**		**$5,555,628**		**$35,359,830**		**$29,257,948**		**$6,101,882**
(J)	Force Account - Utilities	(1%-2%) of (I) Default =2%	(J)	2%	$586,821	0	$563,288	-	$23,533	2%	$678,607	0	$599,727	-	$78,880	2%	$765,725	0	$654,612	-	$111,113	2%	$707,197	0	$585,159	-	$122,038
(K)	Force Account - Miscellaneous	(10%-15%) of (I)	(K)	12%	$3,520,928	0	$3,379,728	-	$141,199	12%	$4,071,645	0	$3,598,364	-	$473,281	12%	$4,594,347	0	$3,927,672	-	$666,675	12%	$4,243,180	0	$3,510,954	-	$732,226
					$4,107,749		$3,943,016		$164,732				$4,198,091		$552,161				$4,582,284		$777,788				$4,096,113		$854,263
(L)	**Subtotal of Construction Cost (2007)**	(I+J+K)	**(L)**		**$33,448,812**		**$32,107,420**		**$1,341,392**		**$38,680,624**		**$34,184,457**		**$4,496,167**		**$43,646,298**		**$37,312,882**		**$6,333,416**		**$40,310,206**		**$33,354,061**		**$6,956,145**
(M)	**Subtotal of Construction Cost (2010, Escalated 5% Per Year)**		**(M)**		**$38,721,181**		**$37,168,352**		**$1,552,829**		**$44,777,657**		**$39,572,782**		**$5,204,875**		**$50,526,046**		**$43,194,325**		**$7,331,721**		**$46,664,102**		**$38,611,494**		**$8,052,608**
	Other Costs																										
	Preliminary Engineering	10% of (M)		10%	$3,872,118	0	$3,716,835	-	$155,283	10%	$4,477,766	0	$3,957,278	-	$520,488	10%	$5,052,605	0	$4,319,433	-	$733,172	10%	$4,666,410	0	$3,861,149	-	$805,261
	Construction Engineering	17% of (M)		17%	$6,582,601	0	$6,318,620	-	$263,981	17%	$7,612,202	0	$6,727,373	-	$884,829	17%	$8,589,428	0	$7,343,035	-	$1,246,393	17%	$7,932,897	0	$6,563,954	-	$1,368,943
	Construction Services	1% of (M)		1%	$387,212	0	$371,684	-	$15,528	1%	$447,777	0	$395,728	-	$52,049	1%	$505,260	0	$431,943	-	$73,317	1%	$466,641	0	$386,115	-	$80,526
					$10,841,931		$10,407,139		$434,792				$11,080,379		$1,457,365				$12,094,411		$2,052,882				$10,811,218		$2,254,730
(N)	**Total of Construction Cost (2010)**		**(N)**		**$49,563,112**		**$47,575,491**		**$1,987,621**		**$57,315,401**		**$50,653,161**		**$6,662,240**		**$64,673,339**		**$55,288,736**		**$9,384,603**		**$59,730,051**		**$49,422,713**		**$10,307,338**
	Right-Of-Way																										
	Residential and Commercial - Land Only	SF	$30	23,109	$693,275	149,572	$4,487,150	(1,436)	($1,712,380)	56,592	$1,697,758	163,579	$4,907,372	34,071	($891,377)	21,431	$642,941	137,526	$4,125,782	(633)	($1,544,409)	63,693	$1,910,790	121,908	$3,657,248	86,171	$611,085
	Residential and Commercial - Permanent Easement	SF	$27	17,175	$463,723					16,864	$455,325					17,209	$464,635					15,979	$431,423				
	Residential and Commercial - Temporary Easement	SF	$15	107,852	$1,617,773					124,194	$1,862,912					98,253	$1,473,797					128,408	$1,926,120				
	Residential - Full Acquisition	EACH	$250,000	17	$4,250,000	14	$3,500,000	3	$750,000	13	$3,250,000	14	$3,500,000	(1)	($250,000)	17	$4,250,000	11	$2,750,000	6	$1,500,000	13	$3,250,000	16	$4,000,000	(3)	($750,000)
	Residential - Relocation	EACH	$50,000	17	$850,000	14	$700,000	3	$150,000	13	$650,000	14	$700,000	(1)	($50,000)	17	$850,000	11	$550,000	6	$300,000	13	$650,000	16	$800,000	(3)	($150,000)
	Commercial - Full Acquisition	Assessor's Value x 1.4	N/A	9	$3,497,900	4	$1,362,620	5	$2,135,280	11	$7,280,280	4	$1,362,620	7	$5,917,660	9	$3,497,900	2	$1,067,500	7	$2,430,400	12	$10,306,100	4	$1,362,620	8	$8,943,480
	Commercial - Relocation	$50,000 - $100,000	N/A	9	$550,000	4	$200,000	5	$350,000	12	$1,850,000	4	$200,000	8	$1,650,000	9	$550,000	2	$150,000	7	$400,000	14	$2,450,000	4	$200,000	10	$2,250,000
	Vacant Land	Assessor's Value x 1.4	N/A	5	$56,378			5	$56,378	5	$56,378			5	$56,378	5	$56,378			5	$56,378	5	$56,378			5	$56,378
(O)	**Total of Right-of-Way Costs**		**(O)**		**$11,979,048**		**$10,249,770**		**$1,729,278**		**$17,102,654**		**$10,669,992**		**$6,432,661**		**$11,785,651**		**$8,643,282**		**$3,142,369**		**$20,980,811**		**$10,019,868**		**$10,960,943**
					19.5%		**17.7%**		**46.5%**		**23.0%**		**17.4%**		**49.1%**		**15.4%**		**13.5%**		**25.1%**		**26.0%**		**16.9%**		**51.5%**
(P)	**Total US6/Wadsworth Interchange (2010)**		**(P)**		**$61,542,160**		**$57,825,261**		**$3,716,899**		**$74,418,055**		**$61,323,153**		**$13,094,902**		**$76,458,990**		**$63,932,019**		**$12,526,971**		**$80,710,862**		**$59,442,581**		**$21,268,281**

* Cost data pulled from Conceptual Alternative (CA) cost estimate. Unit prices may not match unit prices used in the Screened Alternative (SA) cost estimate.