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MEMORANDUM

February 5, 2021

To: Mason Giem, Public Works Programs Coordinator
Organization: City of SeaTac
From: Eric Widstrand, PE, PTOE, Rachel Finfer, Michael Hintze, Brian Almdale, Katie Knapp
Project: City of SeaTac LRSP and IB Pedestrian Crossing Safety Improvements

Re: Phase I Task 4 Pedestrian Countermeasure Prioritization Overview

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This memo is intended to detail how potential countermeasures and projects have been identified and prioritized to improve pedestrian safety along International Blvd in the most cost-effective and impactful manner. The result of this prioritization process is a list of projects, scores for each prioritization variable, and an overall prioritization score. The separate prioritization sub-scores for each variable allows for scenario-building possibilities, offers increased process transparency, and helps communicate project benefits during project development and implementation phases.

Process for Countermeasure Selection

The overall process for identifying potential countermeasures first involved the development of a countermeasure toolbox. This toolbox draws from multiple sources, including National Cooperative Highway Research *Program Report 926 - Guidance to Improve Pedestrian and Bicyclist Safety at Intersections*, *Target Zero* - Washington State's Strategic Highway Safety Plan, and California's *Local Roadway Safety Manual* (which specifies countermeasures that have been thoroughly researched and verified as to their quantifiable safety benefits). In addition, Toole Design identified countermeasures and programs not included in these sources that are applicable to International Blvd corridor. See Table 7 for the countermeasure toolbox in its entirety, which contains information for each countermeasure considered in this analysis, details on crash modification factors (CMF), countermeasure cost estimates, implementation applicability along International Blvd, and each crash type addressed.

Countermeasures from this toolbox have been identified that address the top twelve high-priority locations along the corridor identified from the crash analysis, in alignment with Washington State Department of Transportation (WSDOT) process for project identification in Local Roadway Safety Plans. In addition to the top twelve high-priority locations, the entire corridor was reviewed to ensure that systemic safety opportunities were maximized.

Factors and Variables

Prioritization consisted of two elements: the first being *location priority* and the second being a *Benefit-Cost comparison* (see Table 1). Each of these elements include one or more factors. Further, some of these factors have several variables based on how the factor is best measured.

The location priority variables aim to prioritize locations that have a history of pedestrian crashes in terms of frequency and severity, and proximity to nearby common pedestrian activity generators. These activity generating variables serve as proxies for pedestrian exposure as pedestrian volume data is not available at the time of this analysis.

The Benefit-Cost comparison aims to assess individual countermeasures as well as selected countermeasure(s) at intersections along the corridors on how effective the countermeasures are expected to reduce pedestrian crashes (and

the associated societal costs of these crashes) compared to estimated countermeasure costs. Additional background information is provided below for the Benefit-Cost comparison metrics.

Table 1. Proposed Prioritization Factors

Factor	Details	Weighting
Location Priority		
Locations with high crash injury weighting	Aggregate weighted crash scores within 150 feet of intersections	5 points if in top third 3 points if in middle third 0 points if in bottom third
High Pedestrian Activity Location: Transit	Light rail or Rapid Ride	2 points for light rail stations (note – 176th St and 200th St have both a light rail station and a Rapid Ride stop, these locations would score 3 points). 1 point for Rapid Ride stop
High Pedestrian Activity Location: Destinations	Location is adjacent to restaurant, bar, grocery store, retail, school, park, or other similar pedestrian destination.	1 point if pedestrian destination is present within 500' of the roadway per intersection leg (4 points possible)
Benefit-Cost Comparison		
Benefit-Cost Ratio	When CMFs are available: apply expected crash modification factor to the value of observed crash history, calculated using EPDO criteria. Divide by the estimated cost to obtain the Benefit-Cost Ratio.	10 points if BCR is in top third 5 points if BCR is in middle third 0 points if BCR is in bottom third
[or]		
Generalized benefit vs. cost	When CMFs are not available, either because the recommendation is programmatic or because a CMF has not yet been evaluated, develop a generalized high-medium-low benefit/cost ratio based on estimated costs as well as expected safety benefit informed by research and engineering judgment.	10 points if generalized benefit vs. cost is high 5 points if generalized benefit vs. cost is medium 0 points if generalized benefit vs. cost is low
		Total Points Possible: 22

Benefit-Cost Ratio Development

Development of a Benefit-Cost Ratio (BCR) is based on the estimated cost of each countermeasure compared to the expected safety benefit. The BCR is developed by multiplying the countermeasures' CMF by the cost valuation of the location's applicable crash history. The cost valuation is assigned using the Equivalent Property Damage Only (EPDO) method. This method weighs crashes according to the highest severity injury sustained in the crash by converting each crash to an equivalent number of Property Damage Only (PDO) crashes. For example, a crash that results in a possible injury is equivalent to approximately 10 PDO crashes, whereas a fatal crash is equivalent to approximately 231 PDO crashes. These EPDO factors are informed by the comprehensive societal costs of crashes and are scaled relative to PDO comprehensive crash cost estimates. The EPDO technique is utilized because normalizing crashes to a base unit in this way allows crashes to be easily compared, which is helpful during prioritization efforts. Additionally, subcategories of crashes can be compared based on the average EPDO score per crash type to identify which types resulted in higher severity injuries. Total EPDO scores are a measure of overall crash intensity and the average EPDO score per crash is a measurement of average crash intensity/severity. See Table 2 for the comprehensive crash costs for each crash severity provided by WSDOT.

For this prioritization analysis, the expected benefit for each project was developed by multiplying the crash reduction factor by the EPDO score of the applicable crash history. This value was then divided by the countermeasure's estimated cost, resulting in the BCR. A higher BCR reflects higher cost effectiveness for safety impacts. Planning level cost estimates were developed for the purposes of calculating the BCR, and the cost estimated details can be found in the Appendix.

$$\text{Benefit-Cost Ratio} = \frac{EPDO * (100 * (1 - CMF))}{Estimated\ Countermeasure\ Cost}$$

Table 2. WSDOT Crash Costs Estimates (2020 Values)[1]

Crash Severity	EPDO Score	Comprehensive Crash Cost
Fatal (K)[2], Suspected Serious Injury (A)	231.31	$3,423,400
Suspected Minor Injury (B)	16.04	$237,400
Possible Injury (C)	9.61	$142,300
Property Damage Only (PDO)	1.0	$14,800

Generalized Benefit vs. Cost Comparison

Not all pedestrian safety countermeasures have been rigorously studied and many have yet to be assigned a CMF. In addition, CMFs are not assigned to programmatic countermeasures, such as education and outreach programs. As a result of several known safety countermeasures lacking estimated CMFs, an additional method is needed to review and prioritize benefits and costs qualitatively. To do this, the countermeasures' cost will be compared with the overall safety expectation of the countermeasure based on research and engineering judgement. This will enable a relative comparison of costs and benefits.

Prioritization Results

The following tables summarize the results of the prioritization analysis. Not every variable used in the prioritization are included in these tables (Table 3 through Table 5), those details can be viewed in the appendix of this memo.

Table 3 summarizes the results of the intersection prioritization analysis (Table 6 includes additional details for each prioritization element). Note, the weighted pedestrian injury total column in this table is an input variable used in the prioritization analysis, the raw value displayed here is to provide additional insight into how many crashes (and severity) occurred at each location relative to the overall prioritization score. The top five *high priority intersections* are indicated with bold text.[3] These locations have a relatively high pedestrian crash intensity, are located near pedestrian activity generators, and have feasible countermeasures that are expected to reduce pedestrian crashes while having relatively low associated costs.

[1] Values provided by WSDOT staff

[2] Letters within the parenthesis refer to injury severity levels used by WSDOT (KABCO scale)

[3] The top five intersection roadway configurations can be viewed in the International Boulevard Crash Analysis memo, which include crash diagrams for the top intersections based on aggregate EPDO scores.

Table 3. Intersection Prioritization Results (bold = high priority)

Rank	Location	Countermeasures	Weighted Pedestrian Injury Total	Location Priority Score	Potential per Project Score	Overall Score
1	**International Blvd and S 188th St**	**> Fill in Bus Pull Out > Move bus stop closer to intersection > Pedestrian signal recall* (assumed absent) > Add signage R9-3bP Use Crosswalk > Install median fencing at southern leg**	**28**	**11**	**8.75**	**19.75**
2	**International Blvd and S 176th St**	**> Upgrade curb ramp > Pedestrian Signal Recall* (assumed absent) > Improve signal hardware: retroreflective backplate > Install pedestrian scramble**	**21**	**11**	**8.3**	**19.3**
3	**International Blvd and S 154th St**	**> Curb radius reduction on SE/NW corner**	**9**	**9**	**10**	**19**
4	**International Blvd and S 208th St**	**> Install median fencing at southern leg**	**10**	**8**	**10**	**18**
5	**International Blvd and S 200th St**	**> Fill in Bus Pull Out > Move bus stop closer to intersection > Pedestrian signal recall* (assumed absent) > Add signage R9-3bP Use Crosswalk > Median fencing at northern leg**	**11**	**10**	**7.5**	**17.5**
6	International Blvd and S 216th St	> Install median fencing at northern leg	3	11	5	16
7	International Blvd and S 182nd St	> Curb radius reduction on SW corner > Remove left turn lane > Install median refuge island > Install median fencing at southern leg	5	10	3.3	13.3
8	International Blvd and S 160th St	> Curb radius reduction at NE corner > Remove left turn lane > Install median refuge island > Install median fencing at southern leg	3	8	1.7	9.7
9	International Blvd and 518	> Install marked pedestrian crossing at slip lane > Add signage "yield here to pedestrians"	0	3	5	8

Rank	Location	Countermeasures	Weighted Pedestrian Injury Total	Location Priority Score	Potential per Project Score	Overall Score
	off-ramp (northernmost)					
10	International Blvd and S 195th St	> Install marked pedestrian crossing at northern leg	0	7	0	7
11	International Blvd and S 180th St	> Install marked pedestrian crossing at southern leg	2	6	0	6
12	International Blvd and 518 onramp (southernmost)	> Install marked pedestrian crossing at slip lane > Add signage "yield here to pedestrians"	0	3	0	3

Table 4 summarizes the prioritization results of several corridor wide countermeasures, based on a generalized Benefit-Cost analysis. In total, 10 corridor wide countermeasures were included in this analysis. Of those countermeasures, only five were included due to the availability of CMF estimates. Please note that projects ranked 6-10 should still be considered as viable projects. They have not been ruled out as infeasible—rather, because CMFs are not available for these treatments, a Benefit-Cost Ratio was not developed to support prioritization. Projects such as re-evaluating signal timing to support a reduced posted speed limit and evaluating the corridor for lane removal potential would support safety benefits along the corridor systemically by supporting slower motor vehicle speeds and minimizing pedestrian crossing distances—two key factors related to pedestrian crash risk. This table includes a cost estimate, number of location where the countermeasure might be installed, CMF, and an assessment of how effective the corridor wide project might be at reducing pedestrian crashes relative to cost.

Table 4: Corridor Wide Countermeasures Prioritization Results

Rank	Countermeasure	Cost	Multiplier (# of Locations)	Total Cost	CMF	Safety Potential compared to Costs
1	Install Leading Pedestrian Interval at each signalized intersection	$1,521.63	18	$27,389.34	0.4	Very High
2	Reduce posted speed limit to 30 MPH along corridor	$18,259.56	1	$18,259.56	0.96	Medium
3	Install pedestrian countdown signals at locations where not already present	$273,893.40	1	$273,893.40	0.75	Medium-Low
4	Stripe lane lines along International Blvd	$827,523.26	1	$827,523.26	0.82	Low
5	Install new pedestrian crossings at locations where crossings are more than ¼ mile apart	$250,000.00	5	$1,250,000.00	0.453	Low

6	*Re-evaluate signal timing (in conjunction with reduced posted speed limit)*	*Not Assessed (CMF not available)*
7	*Install "No turn on red" signs at each signalized intersection*	*Not Assessed (CMF not available*
8	*Evaluate corridor for lane removal potential based on traffic analysis to reduce pedestrian crossing distances.*	*Not Assessed (CMF not available*
9	*Convert HOV lane to bus only lane along corridor*	*Not Assessed (CMF not available*
10	*Install pedestrian signal recall at all intersections with bus or light rail stop, if not already present*	*Not Assessed (CMF not available*

Table 5 includes three programmatic recommendations that are applicable to the City of SeaTac and along International Blvd. These programmatic recommendations were selected from the countermeasure toolbox as being feasible to implement with reasonable expected crash reduction qualities. CMFs or cost estimates are not available for these programmatic countermeasures, so only the top 3 that were determined appropriate for SeaTac have been selected and included as priority countermeasures.

Table 5: Priority Programmatic Countermeasures

	Countermeasure
1	Further engineering analysis to evaluate the effectiveness of street lighting along the corridor
2	Active speed feedback signs
3	Pedestrian decoy enforcement operations[4]

Alignment with other SeaTac Planning Efforts

The projects identified through this planning effort represent significant investments within SeaTac and are largely in alignment with several of the City's adopted planning documents and guidelines. Two key transportation planning documents, the City's Transportation Master Plan (2015) and the ADA Self-Assessment and Transition Plan (2018), recognize the significant role that International Blvd plays within SeaTac's transportation network and the need for safety improvements for people traveling along and across the corridor. Furthermore, the Transportation Master Plan identified significant growth opportunities along International Blvd as part of the City's Urban Center District. These growth opportunities were identified in parallel with existing safety and accessibility concerns in the form of high crash intersections and roadway sections, and the need for ADA-compliant sidewalk and crossing investments. Addressing these safety and accessibility concerns will ensure that future growth is best supported by the corridor.

Although the countermeasures recommended in this memo are in alignment with broader planning efforts, one of the projects identified though in the Transportation Master Plan to accommodate growth within the Urban Center District is not in alignment with this project's focus on pedestrian safety. The Transportation Master Plan recommends the widening of International Blvd between S 170th St and S 188th St, which is in conflict with the eighth corridor-wide countermeasure in

[4] Enforcement efforts should actively consider equity-related issues and concerns. Public engagement should be conducted to help inform the program design and application prior to implementation to prevent equity-related issue from arising.

Table 4. This countermeasure recommends that the corridor be evaluated for lane removal feasibility in order to reduce pedestrian crossing distances and support speed management. This conflict highlights the need for the City to balance competing modal priorities along International Blvd, and to identify solutions that support safety and mobility for all users along and across the corridor. The prioritized projects from this planning process present an opportunity for the City to work towards both of its safety and mobility goals, and to address previously identified investment needs that will continue to support growth within the Urban Center District and along the City's transportation network.

In addition to City-led planning efforts, several of the City's partner agencies have also identified planning goals and project needs along and in connection to International Blvd. These goals and project needs have been considered in the identification and prioritization process as the projects' approval, design, and implementation will require close coordination between the City and its partner agencies. Because this roadway is state-owned, WSDOT will be a key partner. Other partner agencies include, but are not limited to the Port of Seattle, King County Metro, Sound Transit, and adjacent property owners along International Blvd. For example, the Port's desires to promote pedestrian and bicycle access to and from the airport via the light rail stations and to continue to support more intuitive connections between the Sound Transit Airport Light Rail Station highlights the need for continued coordination between the Port, the City, and Sound Transit for planning for and creating multi-modal connections along and across International Blvd. In particular, a countermeasure to relocate bus stops is included in the recommended countermeasure for the intersections at International Blvd and 188th St as well as International Blvd and 200th St (see Table 3). This change would need to be implemented in partnership with King County Metro. King County Metro and WSDOT are working on a project to improve speed and reliability for the Metro Rapid Ride line A along International Blvd. so any geometric changes related to bus stops should be coordinated with this project.

Appendix

The following map and tables are included as appendix items to improve document legibility. The primary attributes for each table are included in the body of this document, but additional details are included in the following tables.

Map 1: Intersection Prioritization Results

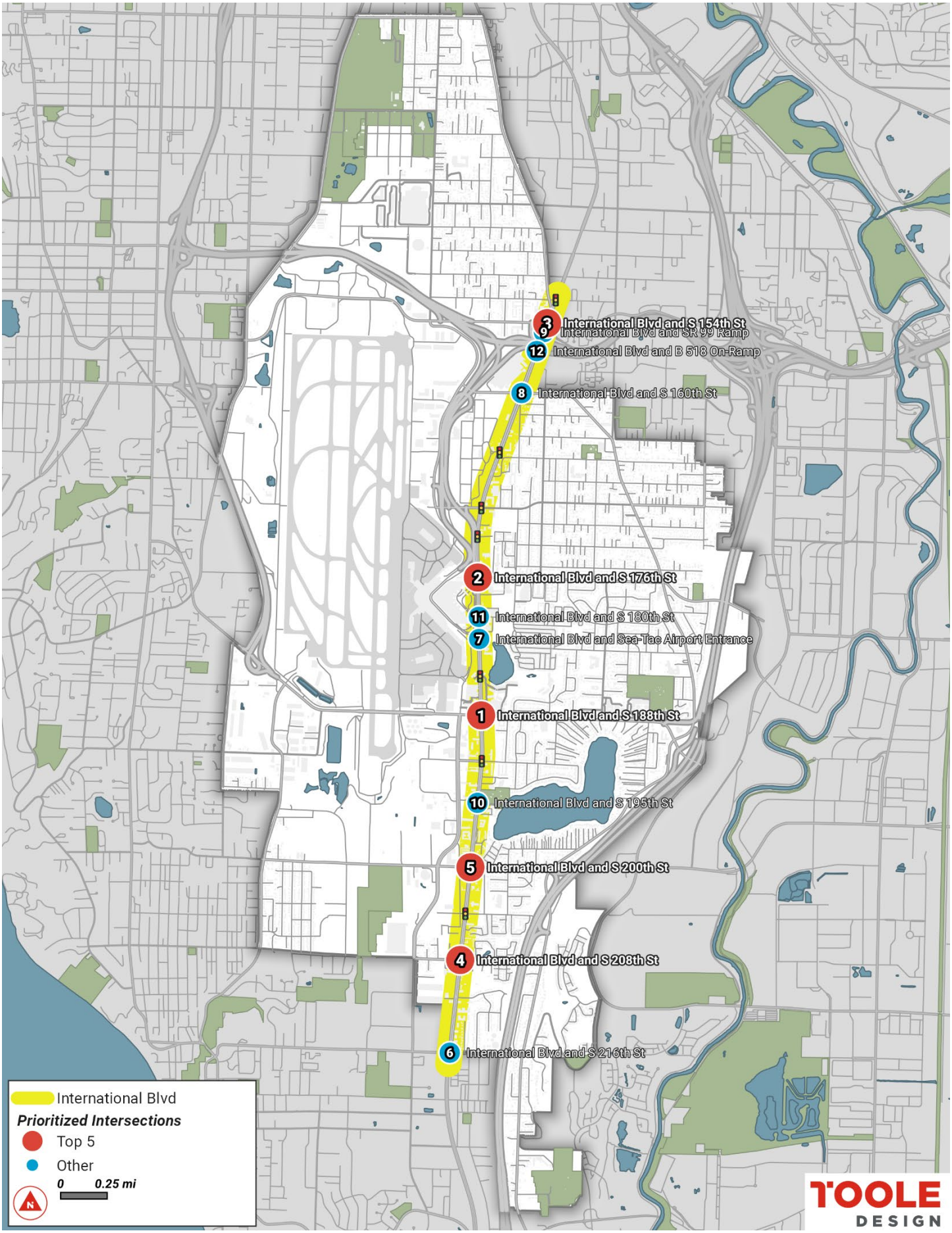

Table 6: Intersection Prioritization Analysis Details

Rank	Location	CM	Treatment Cost	CMF	K	A	B	C	O	Crash score	Transit Score	Destination Score	Total Location Priority	Safety Potential per CM	Qualitative Safety Potential Justification	Safety Potential per Project	Overall Score
1	International Blvd and S 188th St	Fill in Bus Pull Out	$ 163,941.54	None	0	6	5	5	0	5	2	4 (hotels or fast food on all legs)	**11**	High cost high benefit (5)	Very expensive, but would likely have a significant impact at high crash location	**8.75**	**19.75**
		Move bus stop closer to intersection	$ 14,314.59	None										Low cost medium benefit (10)	Will help with compliance		
		Pedestrian signal recall	$ 1,268.03	None										Low cost medium benefit (10)	Will help with compliance		
		Add signage R9-3bP Use Crosswalk	$ 760.82	None										10	N/A (see Q7)		
		Median fencing at southern leg (near term solution)	$ 22,190.44	0.65													
2	International Blvd and S 176th St	Upgrade curb ramp	$ 65,895.03	None	1	3	2	5	2	5	3	3 (SeaTac, Hilton, Park n Fly)	**11**	High cost low benefit (5)	Fairly expensive, primarily related to accessibility but would also have safety impacts	**8.3**	**19.3**
		Pedestrian Signal Recall	$ 1,268.03	None										Low cost high benefit (10)	Will help with compliance		
		Improve signal hardware: retroreflective backplate	$ 16,484.33	0.85										10	N/A (SEE q11)		
		Install pedestrian scramble	$ 14,455.49	0.6													
5	International Blvd and S 200th St	Fill in Bus Pull Out	$ 173,339.02	None	0	2	2	3	0	5	3	2 (grocery, pizza)	**10**	High cost medium benefit (0)	Very expensive, less benefit compared to 188th due to historical crash data. Valuable from a systemic standpoint (the risk is still there, even if crash history is not as high).	**7.5**	**17.5**
		Move bus stop closer to intersection	$ 14,314.59	None													
		Pedestrian signal recall	$ 1,268.03	None										Low cost medium benefit (10)	Will help with compliance		
		Add signage R9-3bP Use Crosswalk	$ 760.82	None										Low cost medium benefit (10)	Will help with compliance		
		Median fencing at northern leg (near term solution)	$ 28,530.56	0.65										10	N/A		
4	International Blvd and S 208th St	Install median fencing at southern leg (near term solution)	$ 19,020.38	0.65	1	1	2	2	0	5	2	1 (hotel)	**8**	10	N/A	**10**	**18**
3	International Blvd and S 154th St	Curb radius reduction on SE/NW corner	$ 5,817.06	None	0	1	4	2	0	5	2	2 (retail and restaurant)	**9**	Low cost high benefit (10)	Will slow turning speeds	**10**	**19**
7	International Blvd and S 182nd St/Sea-Tac Airport Entrance	Curb radius reduction on SW corner	$ 59,371.75	None	0	0	3	2	0	5	2	3 (restaurant, hotel, and SeaTac)	**10**	High cost low benefit (0)	Less benefit than at 154th - speeds are probably somewhat low coming out of SeaTac	**3.3**	**13.3**
		Remove left turn lane	$ 17,131.02	None										Medium cost medium benefit (5)	Will shorten crossing distances/allows for refuge island		
		Install median refuge island	$ 19,350.06	0.44										5	N/A		
		Install median fencing at southern leg	$ 25,360.50	0.65													
6	International Blvd and S 216th St	Install median fencing at northern leg	$ 19,020.38	0.65	0	1	0	0	0	5	2	4 (restaurant, hotel, hotel, retail)	**11**	5	N/A	**5**	**16**
8	International Blvd and S 160th St	Curb radius reduction at NE corner	$ 52,242.63	None	0	0	1	2	0	3	2	3 (restaurant, subway, barber shop)	**8**	High cost low benefit (0)	Not a significant crash history to justify	**1.7**	**9.7**
		Remove left turn lane	$ 19,793.87	None										Medium cost medium benefit (5)	Will shorten crossing distances/allows for refuge island		
		Install median refuge island	$ 30,622.80	0.44										0	N/A		
		Install median fencing at southern leg	$ 19,020.38	0.65													
9	International Blvd and 518 (northern off-ramp)	Install marked pedestrian crossing at slip lane	$ 1,902.04	0.75	0	0	0	2	0	3	0	0	**3**	5	N/A	**5**	**8**
		Add signage "Yield here to pedestrians"	$ 10,905.02	None										Low cost low benefit (5)	Not very expensive, but not a significant crash history to address		
12	International Blvd and 518 (southern onramp)	Install marked pedestrian crossing at slip lane	$ 1,902.04	0.75	0	0	0	0	0	3	0	0	**3**	0	N/A	**0**	**3**
		Add signage "Yield here to pedestrians"	$ 10,905.02	None										Medium cost low benefit (0)	Not very expensive, but not a significant crash history to address		
11	International Blvd and S 180th St	Install marked pedestrian crossing at southern leg	$ 12,933.86	0.6	0	0	2	0	0	3	2	1 (SeaTac)	**6**	0	N/A	**0**	**6**
10	International Blvd and S 195th St	Install marked pedestrian crossing at northern leg	$ 12,426.65	0.6	0	0	1	1	0	3	2	2 (hotel, park)	**7**	0	N/A	**0**	**7**

Table 7: Countermeasure Toolbox

Countermeasure Name	Relevance to corridor	Relevance Details	Crash Types Addressed	Applicable context and tradeoffs	Source	CMF	CMF crash types or other safety details
Grade separated crossing (e.g. sky bridge)	Low	Only appropriate if other fixes are not feasible	Motorist Failed to Yield to Pedestrian, Pedestrian Failed to Yield, Motorist Left Turn into Pedestrian—Parallel Paths, Motorist Right Turn into Pedestrian—Parallel Paths	Measure of last resort. Locations where at-grade crossing treatments are not possible or potentially unsafe, such as crossings of free-flow, high-speed highway ramps or railroads; locations with high vehicle volumes, high-speed highways, railroad tracks or natural barriers where it is preferable to prioritize bicycle and pedestrian travel through the intersection to reduce overall delay. May reduce delay for motorists compared to at grade crossing; will increase travel time for pedestrians (climbing stairs or elevator)	NCHRP 926 (Tier 3 CM)	0.87	
Curb extensions	Low	No locations with on-street parking at intersections	Motorist Right Turn into Pedestrian—Parallel Paths	Applicable in areas with permanent on-street parking	2019 Target Zero, NCHRP 926 (Tier 3 CM)	N/A	
Pedestrian Hybrid Beacons	Low	No unsignalized marked crossings across International Blvd	Motorist Failed to Yield to Pedestrian, Pedestrian Failed to Yield		2019 Target Zero, NCHRP 926 (Tier 3 CM)	0.7	All
Road Reconfiguration/diet	Medium	Long-term solution	Motorist Failed to Yield to Pedestrian, Pedestrian Failed to Yield, Motorist Left Turn into Pedestrian—Parallel Paths, Motorist Right Turn into Pedestrian—Parallel Paths	Priority bicycle and pedestrian routes; May reduce motor vehicle capacity	2019 Target Zero, NCHRP 926 (Tier 3 CM)	0.71	All
RRFB	Low	No unsignalized marked crossings across International Blvd; International Blvd speed limit above recommended context	Motorist Failed to Yield to Pedestrian, Pedestrian Failed to Yield		2019 Target Zero, NCHRP 926 (Tier 3 CM)	0.53	Vehicle-pedestrian crashes
Curb Radius Reduction	High	Appropriate with truck aprons	Motorist Right Turn into Pedestrian—Parallel Paths	Areas with low truck volumes; May make turning more difficult for large trucks; may result in shorter cycle lengths due to reduced crossing distances	2019 Target Zero, NCHRP 926 (Tier 3 CM)	N/A	Thomas et al 2016 suggests that the treatment may effectively slow motorist turning speeds, which can increase opportunities for motorists to yield to pedestrians and reduce the severity of crashes.
In-street pedestrian crossing signs	Low	No uncontrolled marked crossings		Uncontrolled crossings	2019 Target Zero	N/A	
Pedestrian-scale lighting	Low	Much of the corridor already has pedestrian-scale lighting; would need further study to confirm need			2019 Target Zero	0.73	Injury crashes
Accessible pedestrian signals	Medium				2019 Target Zero	N/A	
Curb ramps	Medium				2019 Target Zero	N/A	
Leading Pedestrian Interval	High		Motorist Right Turn into Pedestrian—Parallel Paths	Signalized intersections; medium to high turning-vehicle volumes and pedestrian volumes. May increase delay for motorists	2019 Target Zero, NCHRP 926 (Tier 3 CM)	0.41	Vehicle-pedestrian crashes
Exclusive pedestrian phasing/ Protected phases	High		Motorist Left Turn into Pedestrian—Parallel Paths, Motorist Right Turn into Pedestrian—Parallel Paths	Intersections with high volumes of pedestrians and low to medium vehicle volumes. May increase delay for all users	2019 Target Zero, NCHRP 926 (Tier 3 CM)	0.64	Vehicle-pedestrian crashes
Updated signal timing	Medium		Motorist Failed to Yield to Pedestrian, Pedestrian Failed to Yield	Signalized intersections where pedestrian and/or bicyclist traffic is expected, particularly medium or high volumes. May impact delay for all users	2019 Target Zero, NCHRP 926 (Tier 3 CM)	0.5	Vehicle-pedestrian crashes; varies based on specific signal phasing
Improve signal hardware: lenses, back-plates, mounting, size, and number	Medium		Applicable with high frequency of right-angle or read-end crashes that can be attributed to signal visibility.		CA LRSM	0.85	All

Countermeasure Name	Relevance to corridor	Relevance Details	Crash Types Addressed	Applicable context and tradeoffs	Source	CMF	CMF crash types or other safety details
Install left-turn lane and add turn phase (signal has no left-turn phase before)	Low		Look for rear-end crashes and/or crashes involving non-motorized users (driver may be looking for gaps and not paying attention to pedestrian).		CA LRSM	0.45	All
Provide protected left turn phase (left turn lane already exists)	Medium		Applicable to crashes involving left-turning vehicles -- may be angle, head-on, sideswipe or rear end. Also may include pedestrian crashes.		CA LRSM	0.7	All
Improve pavement friction (High Friction Surface Treatments)	Low		Wet-pavement condition crashes or "failure to stop" crashes	Applicable to crashes involving left-turning vehicles -- may be angle, head-on, sideswipe or rear end. Also may include pedestrian crashes.	CA LRSM	0.45	All
Install raised median on approaches (at signalized intersections)	Medium		Intersections noted as having turning movement crashes near the intersection as a result of insufficient access control.	High volume intersections, driveways located too close to the functional area of the intersection	CA LRSM	0.55	All
Install pedestrian median fencing (roadway or signalized intersection)	Medium		Pedestrian/Bicycle crashes occurring on the approaches/influence area of the new pedestrian median fencing	Signalized intersections with high pedestrian generators nearby may experience high volumes of pedestrians J-walking across the travel lanes at midblock locations instead of walking to the intersection and waiting to cross during the walk phase. When the safety issue cannot be mitigated with signal timing and shoulder/sidewalk treatments, then installing a continuous pedestrian barrier in the median may be a viable solution. Will increase out of direction travel for pedestrians, likely increasing delay and decreasing convenience	CA LRSM, NCHRP 926 (Tier 3 CM)	0.65	Ped/Bike
Pedestrian Countdown Signals	High	Appropriate if not already installed	Pedestrian Failed to Yield	Signalized intersections spanning wide streets; crossings with medium to high volumes of pedestrians	CA LRSM, NCHRP 926 (Tier 3 CM)	-0.3, 0.75	Vehicle-pedestrian crashes have shown non-negative
All-Walk Phase	Low		Motorist Left Turn into Pedestrian—Parallel Paths, Motorist Right Turn into Pedestrian—Parallel Paths	Signalized intersections with high instances of turning-vehicle--pedestrian conflicts. Will increase delay for all motorists and bicyclists.	CA LRSM, NCHRP 926 (Tier 3 CM)	0.66	Vehicle-pedestrian crashes
Install pedestrian crossing (signalized intersections)	Medium		signalized intersections with no marked crossing and pedestrian signal heads, where pedestrians are known to be crossing intersections that involve significant turning movements. They are especially important at intersections with multiphase traffic signals such as left turn arrows and split phases, school crossings, double right or double left turns.		CA LRSM	0.75	Ped/Bike
Lighting	Medium		Motorist Failed to Yield, Pedestrian Failed to Yield, Motorist Left Turn into Pedestrians - Parallel Paths, Motorist Right Turn into Pedestrian—Parallel Paths	Controlled and uncontrolled intersections; at and near intersections in commercial or retail areas; near schools, parks, and recreation centers	Scope, NCHRP 926 (Tier 3 CM), CA LRSM	0.73	Injury crashes
Install dynamic/variable speed warning signs	Medium				CA LRSM	0.7	All
Install sidewalk/pathway (to avoid walking along roadway)	High			Areas noted as not having adequate or no sidewalks and a history of walking along roadway pedestrian crashes.	CA LRSM	0.2	Ped/Bike
Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safety features)	High			Non-signalized intersections where pedestrians are known to be crossing intersections that involve significant vehicular traffic. They are especially important at intersections with turn pockets. Detectable Warning Surfaces at curb ramps should be considered as an enhanced safety feature.	CA LRSM, 2019 Target Zero	0.65	Ped/Bike
Install raised pedestrian crossing	Low	Speeds should be below 35 mph	Motorist Left Turn into Pedestrian—Parallel Paths, Motorist Right Turn into Pedestrian—Parallel Paths	Locations where motorists are failing to yield at pedestrian crossings, slip lanes. May slightly increase motorist delay, may be difficult for large trucks to cross	Target Zero, CA LRSM, NCHRP 926 (Tier 3 CM)	0.54 - 0.49	.54 - fatal/injury; .49 - fatal/injury on entrances or exits to streets and driveways
Advance stop/yield lines	Low	No uncontrolled marked crossings	Motorist Failed to Yield to Pedestrian	Uncontrolled multilane crossings (at least two lanes in one direction)	NCHRP 926 (Tier 3 CM)	0.75	
Active Warning Beacons	Low	No unsignalized marked crossings across	Pedestrian Failed to Yield	Unsignalized crossings, high pedestrian volumes, crossings where driver yielding is low. Occasional slight delay for motorists	NCHRP 926 (Tier 3 CM)	N/A	

Countermeasure Name	Relevance to corridor	Relevance Details	Crash Types Addressed	Applicable context and tradeoffs	Source	CMF	CMF crash types or other safety details
Parking Restrictions/Daylighting	Low	No existing parking	Motorist Failed to Yield to Pedestrian, Pedestrian Failed to Yield, Motorist Right Turn into Pedestrian--Parallel Paths		NCHRP 926 (Tier 3 CM)	0.7	Vehicle-pedestrian crashes
Hardened Centerline or Continuous Raised Median	Medium		Motorist Left Turn into Pedestrian—Parallel Paths	intersection/midblock crossing locations or locations where it is desired to restrict left-turning movements, such as those where left turning motorists don't sufficiently yield, turn too fast, or cut across centerlines. Access restrictions may divert traffic to inappropriate routes or increase U-turns. Required turning radius of large trucks may impact ability of island to protect crossings.	NCHRP 926 (Tier 3 CM)	0.54 - 0.69	.54 all crashes; .69 Vehicle-pedestrian crashes
No turn on red signs	High		Motorist Right Turn into Pedestrian—Parallel Paths	Signalized intersections; high volumes of right-turning vehicles and high volumes of pedestrians. May increase delay for motorists	NCHRP 926 (Tier 3 CM)	0.97	All crashes, but not well studied, possibly would result in safety improvements for pedestrians and bicyclists
Protected Intersections	Low	No bike facilities on corridor	Motorist Right Turn into Pedestrian—Parallel Paths		NCHRP 926 (Tier 3 CM)	N/A	
Crossing Islands/pedestrian refuge island	High		Motorist Failed to Yield to Pedestrian, Pedestrian Failed to Yield	Preferable on all roads with two or more lanes of through traffic in each direction and operating speeds over 30 mph; midblock or intersection crossings; should be considered on all roadways where space is available to provide refuge and particularly on roads with medium-to-high speeds and medium-to-high vehicle volumes. Motorists: access restrictions may divert traffic to inappropriate routes or increase U-turns; Required turning radius of large trucks may impact ability of island to protect crossings	NCHRP 926 (Tier 3 CM), Caltrans, Target Zero. Recognized as FHWA Proven Safety Countermeasure.	0.54 -0.69	0.54 - all crashes; 0.69 -Vehicle-pedestrian crashes.
Pedestrian Decoy Operations	High		Motorist Failed to Yield to Pedestrian	Equity concerns with enforcement		N/A	
Pedestrian Conspicuity Enhancements & Education	Low	Most appropriate at citywide scale	Nighttime			N/A	
Pedestrian Gap Acceptance Training	Low	Most appropriate at citywide scale	Pedestrian Failed to Yield			N/A	
Install left turn lane (where no left-turn lane exists)	Low				CA LRSM	0.65	All
Lower speed limit by 10 mph	High				CMF Clearinghouse	0.96	All
Install automated speed camera at signalized intersection	High				CMF Clearinghouse	0.76	Injury
HOV to bus lane conversion	Medium or High					N/A	
Lighting study	Medium or High				Non-engineering strategy	N/A	
Detached sidewalk (as redevelopment occurs)	Low					N/A	
Install new traffic signal in non-signalized location	Medium or High		Right-angle, left-turn	Consideration should only be given after less restrictive forms of traffic control have been utilized	CA LRSM	0.7	All

Cost Estimates

Assumptions

- The contingencies in cost estimates were taken from a similar project in Seattle due to the comparable level of improvements between the two projects.
- Seattle Department of Transportation bid item unit costs from 2017-2019 were used to assume the cost of the items for this project, as City of SeaTac bid cost items were not readily available.
- An assumption was made on the capability of the existing signal equipment to be able to reprogram for signal recall. The lump sum for implementing the signal recall only includes labor cost.
- Data was not available to clarify which intersections currently have pedestrian countdown signals. Our assumption is that every intersection requires new signals.
- The LPI cost lump sum was taken from the $200 to $1200 cost range estimated in FHWA's *Safe Transportation for Every Pedestrian Countermeasures Tech* Sheets from October 2019.
- For the median fencing countermeasures, chain linked fence is to be installed 20' from the end of the median at the intersection and 20' past the bus stop.
- The signal improvement at 176th St only includes the retro-reflective signal backplate.

S 118th St

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Fill in Bus Pull Out	SIDEWALK, CEM CONC W/ 25% POZZOLANS	SY	100	244	$ 24,444
	REMOVE CURB & GUTTER	LF	20	230	$ 4,600
	CURB AND GUTTER, CEM CONC W/ 25% POZZOLANS	LF	80	250	$ 20,000
	REMOVE INLET	EA	500	3	$ 1,500
	INLET, TYPE 250A	EA	2500	3	$ 7,500
	ADJUST EXISTING MH, CB, OR VC	EA	600	3	$ 1,800
	CURB RAMP 422A W/ 25% POZZOLANS	EA	2400	2	$ 4,800
Project EE Subtotal					**$ 64,644.44**
Escalation			6%		$ 3,878.67
EE Subtotal (after escalation)					**$ 68,523.11**
EE Contingency			25%		$ 17,130.78
PM Contingency			20%		$ 13,704.62
EE Grand Total (Construction & Closeout)					**$ 99,358.51**
Mobilization			10%		$ 9,935.85
Traffic Control			15%		$ 14,903.78
Design & Environmental			30%		$ 29,807.55
Construction & Closeout					$ 99,358.51
Project Subtotal					**$ 154,005.69**
Management Const Contingency (10% CC)			10%		$ 9,935.85
Project Total					**$ 163,941.54**

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Move Bus Stop	REMOVE BUS SHELTER FOOTING	EA	900	1	$ 900
	BUS SHELTER FOOTING W/ 25% POZZOLANS	SY	800	6	$ 4,444
	RELOCATE SIGN, BUS ZONE	EA	300	1	$ 300
Project EE Subtotal					**$ 5,644.44**
Escalation			6%		$ 338.67
EE Subtotal (after escalation)					**$ 5,983.11**
EE Contingency			25%		$ 1,495.78
PM Contingency			20%		$ 1,196.62
EE Grand Total (Construction & Closeout)					**$ 8,675.51**
Mobilization			10%		$ 867.55
Traffic Control			15%		$ 1,301.33
Design & Environmental			30%		$ 2,602.65
Construction & Closeout					$ 8,675.51
Project Subtotal					**$ 13,447.04**
Management Const Contingency (10% CC)			10%		$ 867.55
Project Total					**$ 14,314.59**

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Pedestrian Signal Recall	PEDESTRIAN SIGNAL RECALL	LS	500	1	$ 500
Project EE Subtotal					**$ 500.00**
Escalation			6%		$ 30.00
EE Subtotal (after escalation)					**$ 530.00**
EE Contingency			25%		$ 132.50
PM Contingency			20%		$ 106.00
EE Grand Total (Construction & Closeout)					**$ 768.50**
Mobilization			10%		$ 76.85
Traffic Control			15%		$ 115.28
Design & Environmental			30%		$ 230.55
Construction & Closeout					$ 768.50
Project Subtotal					**$ 1,191.18**
Management Const Contingency (10% CC)			10%		$ 76.85
Project Total					**$ 1,268.03**

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Signage	SIGN, TRAFFIC	SF	200	1.5	$ 300
Project EE Subtotal					**$ 300.00**
Escalation			6%		$ 18.00
EE Subtotal (after escalation)					**$ 318.00**
EE Contingency			25%		$ 79.50
PM Contingency			20%		$ 63.60
EE Grand Total (Construction & Closeout)					**$ 461.10**
Mobilization			10%		$ 46.11

Traffic Control	15%	$	69.17
Design & Environmental	30%	$	138.33
Construction & Closeout		$	461.10
Project Subtotal		**$**	**714.71**
Management Const Contingency (10% CC)	10%	$	46.11
Project Total		**$**	**760.82**

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY		UNIT PRICE EXTENSION
Median Fencing	CHAIN LINK FENCE, TYPE 6	LF	50	175	$	8,750
Project EE Subtotal					**$**	**8,750.00**
Escalation			6%		$	525.00
EE Subtotal (after escalation)					**$**	**9,275.00**
EE Contingency			25%		$	2,318.75
PM Contingency			20%		$	1,855.00
EE Grand Total (Construction & Closeout)					**$**	**13,448.75**
Mobilization			10%		$	1,344.88
Traffic Control			15%		$	2,017.31
Design & Environmental			30%		$	4,034.63
Construction & Closeout					$	13,448.75
Project Subtotal					**$**	**20,845.56**
Management Const Contingency (10% CC)			10%		$	1,344.88
Project Total					**$**	**22,190.44**

S 176th St

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Upgrade Curb Ramps	REMOVE CEM CONC SIDEWALK	SY	50	56	$ 2,778
	SIDEWALK, CEM CONC W/ 25% POZZOLANS	SY	100	56	$ 5,556
	REMOVE CURB & GUTTER	LF	20	100	$ 2,000
	CURB AND GUTTER, CEM CONC W/ 25% POZZOLANS	LF	80	100	$ 8,000
	CURB RAMP 422A W/ 25% POZZOLANS	EA	2400	3	$ 7,200
	SAWCUT CEMENT CONCRETE SIDEWALK, FULL DEPTH	LF	5	90	$ 450
Project EE Subtotal					**$ 25,983.33**
Escalation			6%		$ 1,559.00
EE Subtotal (after escalation)					**$ 27,542.33**
EE Contingency			25%		$ 6,885.58
PM Contingency			20%		$ 5,508.47
EE Grand Total (Construction & Closeout)					**$ 39,936.38**
Mobilization			10%		$ 3,993.64
Traffic Control			15%		$ 5,990.46
Design & Environmental			30%		$ 11,980.92
Construction & Closeout					$ 39,936.38
Project Subtotal					**$ 61,901.39**
Management Const Contingency (10% CC)			10%		$ 3,993.64
Project Total					**$ 65,895.03**

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Pedestrian Signal Recall	PEDESTRIAN SIGNAL RECALL	LS	500	1	$ 500
Project EE Subtotal					**$ 500.00**
Escalation			6%		$ 30.00
EE Subtotal (after escalation)					**$ 530.00**
EE Contingency			25%		$ 132.50
PM Contingency			20%		$ 106.00
EE Grand Total (Construction & Closeout)					**$ 768.50**
Mobilization			10%		$ 76.85
Traffic Control			15%		$ 115.28
Design & Environmental			30%		$ 230.55
Construction & Closeout					$ 768.50
Project Subtotal					**$ 1,191.18**
Management Const Contingency (10% CC)			10%		$ 76.85
Project Total					**$ 1,268.03**

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Improve Signal Hardware	RETROREFLECTIVE BACKPLATE	EA	500	13	$ 6,500
Project EE Subtotal					**$ 6,500.00**
Escalation			6%		$ 390.00
EE Subtotal (after escalation)					**$ 6,890.00**
EE Contingency			25%		$ 1,722.50
PM Contingency			20%		$ 1,378.00
EE Grand Total (Construction & Closeout)					**$ 9,990.50**
Mobilization			10%		$ 999.05
Traffic Control			15%		$ 1,498.58
Design & Environmental			30%		$ 2,997.15
Construction & Closeout					$ 9,990.50
Project Subtotal					**$ 15,485.28**
Management Const Contingency (10% CC)			10%		$ 999.05
Project Total					**$ 16,484.33**

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Pedestrian Scramble Phase	SIGNAL HEAD, PEDESTRIAN COUNTDOWN, LED	EA	1500	2	$ 3,000
	INSTALL SIGN, TRAFFIC, OWNER FURNISHED	EA	300	4	$ 1,200
	PAVEMENT MARKING, THERMOPLASTIC, 8 IN STRIPE	LF	5	60	$ 300
	REMOVE PAINT STRIPING	LF	5	60	$ 300

	REMOVE CURB	LF	30	30	$	900
Project EE Subtotal					**$**	**5,700.00**
Escalation			6%		$	342.00
EE Subtotal (after escalation)					**$**	**6,042.00**
EE Contingency			25%		$	1,510.50
PM Contingency			20%		$	1,208.40
EE Grand Total (Construction & Closeout)					**$**	**8,760.90**
Mobilization			10%		$	876.09
Traffic Control			15%		$	1,314.14
Design & Environmental			30%		$	2,628.27
Construction & Closeout					$	8,760.90
Project Subtotal					**$**	**13,579.40**
Management Const Contingency (10% CC)			10%		$	876.09
Project Total					**$**	**14,455.49**

S 200th St

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Fill in Bus Pull Out	SIDEWALK, CEM CONC W/ 25% POZZOLANS	SY	100	200	$ 20,000
	REMOVE CURB & GUTTER	LF	20	275	$ 5,500
	CURB AND GUTTER, CEM CONC W/ 25% POZZOLANS	LF	80	275	$ 22,000
	REMOVE INLET	EA	500	2	$ 1,000
	INLET, TYPE 250A	EA	2500	2	$ 5,000
	ADJUST EXISTING MH, CB, OR VC	EA	600	2	$ 1,200
	CURB RAMP 422A W/ 25% POZZOLANS	EA	2400	1	$ 2,400
	DRIVEWAY, CEM CONC, HES (24 HRS), 8 IN	SY	200	100	$ 20,000
Project EE Subtotal					**$ 68,350.00**
Escalation			6%		$ 4,101.00
EE Subtotal (after escalation)					**$ 72,451.00**
EE Contingency			25%		$ 18,112.75
PM Contingency			20%		$ 14,490.20
EE Grand Total (Construction & Closeout)					**$ 105,053.95**
Mobilization			10%		$ 10,505.40
Traffic Control			15%		$ 15,758.09
Design & Environmental			30%		$ 31,516.19
Construction & Closeout					$ 105,053.95
Project Subtotal					**$ 162,833.62**
Management Const Contingency (10% CC)			10%		$ 10,505.40
Project Total					**$ 173,339.02**

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Move Bus Stop	REMOVE BUS SHELTER FOOTING	EA	900	1	$ 900
	BUS SHELTER FOOTING W/ 25% POZZOLANS	SY	800	6	$ 4,444
	RELOCATE SIGN, BUS ZONE	EA	300	1	$ 300
Project EE Subtotal					**$ 5,644.44**
Escalation			6%		$ 338.67
EE Subtotal (after escalation)					**$ 5,983.11**
EE Contingency			25%		$ 1,495.78
PM Contingency			20%		$ 1,196.62
EE Grand Total (Construction & Closeout)					**$ 8,675.51**
Mobilization			10%		$ 867.55
Traffic Control			15%		$ 1,301.33
Design & Environmental			30%		$ 2,602.65
Construction & Closeout					$ 8,675.51
Project Subtotal					**$ 13,447.04**
Management Const Contingency (10% CC)			10%		$ 867.55
Project Total					**$ 14,314.59**

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Pedestrian Signal Recall	PEDETRIAN SIGNAL RECALL	LS	500	1	$ 500
Project EE Subtotal					**$ 500.00**
Escalation			6%		$ 30.00
EE Subtotal (after escalation)					**$ 530.00**
EE Contingency			25%		$ 132.50
PM Contingency			20%		$ 106.00
EE Grand Total (Construction & Closeout)					**$ 768.50**
Mobilization			10%		$ 76.85
Traffic Control			15%		$ 115.28
Design & Environmental			30%		$ 230.55
Construction & Closeout					$ 768.50
Project Subtotal					**$ 1,191.18**
Management Const Contingency (10% CC)			10%		$ 76.85
Project Total					**$ 1,268.03**

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Signage	SIGN, TRAFFIC	SF	200	1.5	$ 300
Project EE Subtotal					**$ 300.00**
Escalation			6%		$ 18.00
EE Subtotal (after escalation)					**$ 318.00**
EE Contingency			25%		$ 79.50
PM Contingency			20%		$ 63.60
EE Grand Total (Construction & Closeout)					**$ 461.10**
Mobilization			10%		$ 46.11
Traffic Control			15%		$ 69.17
Design & Environmental			30%		$ 138.33
Construction & Closeout					$ 461.10
Project Subtotal					**$ 714.71**
Management Const Contingency (10% CC)			10%		$ 46.11
Project Total					**$ 760.82**

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Median Fencing	CHAIN LINK FENCE, TYPE 6	LF	50	225	$ 11,250
Project EE Subtotal					**$ 11,250.00**
Escalation			6%		$ 675.00
EE Subtotal (after escalation)					**$ 11,925.00**
EE Contingency			25%		$ 2,981.25
PM Contingency			20%		$ 2,385.00
EE Grand Total (Construction & Closeout)					**$ 17,291.25**
Mobilization			10%		$ 1,729.13
Traffic Control			15%		$ 2,593.69
Design & Environmental			30%		$ 5,187.38
Construction & Closeout					$ 17,291.25
Project Subtotal					**$ 26,801.44**
Management Const Contingency (10% CC)			10%		$ 1,729.13
Project Total					**$ 28,530.56**

S 208th St

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Median Fencing	CHAIN LINK FENCE, TYPE 6	LF	50	150	$ 7,500
Project EE Subtotal					**$ 7,500.00**
Escalation			6%		$ 450.00
EE Subtotal (after escalation)					**$ 7,950.00**
EE Contingency			25%		$ 1,987.50
PM Contingency			20%		$ 1,590.00
EE Grand Total (Construction & Closeout)					**$ 11,527.50**
Mobilization			10%		$ 1,152.75
Traffic Control			15%		$ 1,729.13
Design & Environmental			30%		$ 3,458.25
Construction & Closeout					$ 11,527.50
Project Subtotal					**$ 17,867.63**
Management Const Contingency (10% CC)			10%		$ 1,152.75
Project Total					**$ 19,020.38**

S 154th St

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Curb Radius Reduction	REMOVE PAINT STRIPING	LF	5	20	$ 100
	PAVEMENT MARKING, PAINT, 4 IN STRIPE	LF	5	50	$ 250
	PAVEMENT MARKING, PAINT, 8 IN STRIPE	LF	5	50	$ 250
	FLEXIBLE DELINEATOR POST	EA	200	3	$ 600
Pillow Apron	SAWCUT ASPHALT CONCRETE, FULL DEPTH	LF	5	50	$ 250
	REMOVE ASPHALT PAVEMENT	SY	50	8	$ 417
	PAVEMENT, HMA (CL 1/2 IN)	TN	300	1	$ 427
Project EE Subtotal					**$ 2,293.75**
Escalation			6%		$ 137.63
EE Subtotal (after escalation)					**$ 2,431.38**
EE Contingency			25%		$ 607.84
PM Contingency			20%		$ 486.28
EE Grand Total (Construction & Closeout)					**$ 3,525.49**
Mobilization			10%		$ 352.55
Traffic Control			15%		$ 528.82
Design & Environmental			30%		$ 1,057.65
Construction & Closeout					$ 3,525.49
Project Subtotal					**$ 5,464.52**
Management Const Contingency (10% CC)			10%		$ 352.55
Project Total					**$ 5,817.06**

S 182nd St

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Reduce Curb Radius	SIDEWALK, CEM CONC W/ 25% POZZOLANS	SY	100	61	$ 6,111
	REMOVE CURB & GUTTER	LF	20	75	$ 1,500
	CURB AND GUTTER, CEM CONC W/ 25% POZZOLANS	LF	80	100	$ 8,000
	REMOVE INLET	EA	500	1	$ 500
	INLET, TYPE 250A	EA	2500	1	$ 2,500
	CURB RAMP 422A W/ 25% POZZOLANS	EA	2400	2	$ 4,800
Project EE Subtotal					**$ 23,411.11**
Escalation			6%		$ 1,404.67
EE Subtotal (after escalation)					**$ 24,815.78**
EE Contingency			25%		$ 6,203.94
PM Contingency			20%		$ 4,963.16
EE Grand Total (Construction & Closeout)					**$ 35,982.88**
Mobilization			10%		$ 3,598.29
Traffic Control			15%		$ 5,397.43
Design & Environmental			30%		$ 10,794.86
Construction & Closeout					$ 35,982.88
Project Subtotal					**$ 55,773.46**
Management Const Contingency (10% CC)			10%		$ 3,598.29
Project Total					**$ 59,371.75**

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Remove Left Turn Lane	PAVEMENT MARKING, PAINT, 4 IN STRIPE	LF	5	500	$ 2,500
	PAVEMENT MARKING, PAINT, 8 IN STRIPE	LF	5	800	$ 4,000
	REMOVE THERMO LEGEND/SYMBOL	EA	200	1	$ 200
	REMOVE THERMO STRIPING	LF	5	11	$ 55
Project EE Subtotal					**$ 6,755.00**
Escalation			6%		$ 405.30
EE Subtotal (after escalation)					**$ 7,160.30**
EE Contingency			25%		$ 1,790.08
PM Contingency			20%		$ 1,432.06
EE Grand Total (Construction & Closeout)					**$ 10,382.44**
Mobilization			10%		$ 1,038.24
Traffic Control			15%		$ 1,557.37
Design & Environmental			30%		$ 3,114.73
Construction & Closeout					$ 10,382.44
Project Subtotal					**$ 16,092.77**
Management Const Contingency (10% CC)			10%		$ 1,038.24
Project Total					**$ 17,131.02**

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Median Refuge Island	REMOVE CURB	LF	30	6	$ 180
	SAWCUT ASPHALT CONCRETE, FULL DEPTH	LF	5	50	$ 250
	REMOVE PAVEMENT	SY	70	11	$ 778
	CURB, CEM CONC W/ 25% POZZOLANS	LF	60	50	$ 3,000
	SIDEWALK, CEM CONC W/ 25% POZZOLANS	SY	200	11	$ 2,222
	DETECTABLE WARNING PLATE	SF	50	24	$ 1,200
Project EE Subtotal					**$ 7,630.00**
Escalation			6%		$ 457.80
EE Subtotal (after escalation)					**$ 8,087.80**
EE Contingency			25%		$ 2,021.95
PM Contingency			20%		$ 1,617.56
EE Grand Total (Construction & Closeout)					**$ 11,727.31**
Mobilization			10%		$ 1,172.73
Traffic Control			15%		$ 1,759.10
Design & Environmental			30%		$ 3,518.19
Construction & Closeout					$ 11,727.31
Project Subtotal					**$ 18,177.33**
Management Const Contingency (10% CC)			10%		$ 1,172.73
Project Total					**$ 19,350.06**

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Median Fencing	CHAIN LINK FENCE, TYPE 6	LF	50	200	$ 10,000
Project EE Subtotal					**$ 10,000.00**
Escalation			6%		$ 600.00
EE Subtotal (after escalation)					**$ 10,600.00**

EE Contingency	25%	$	2,650.00
PM Contingency	20%	$	2,120.00
EE Grand Total (Construction & Closeout)		**$**	**15,370.00**
Mobilization	10%	$	1,537.00
Traffic Control	15%	$	2,305.50
Design & Environmental	30%	$	4,611.00
Construction & Closeout		$	15,370.00
Project Subtotal		**$**	**23,823.50**
Management Const Contingency (10% CC)	10%	$	1,537.00
Project Total		**$**	**25,360.50**

S 216th St

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Median Fencing	CHAIN LINK FENCE, TYPE 6	LF	50	150	$ 7,500
Project EE Subtotal					**$ 7,500.00**
Escalation			6%		$ 450.00
EE Subtotal (after escalation)					**$ 7,950.00**
EE Contingency			25%		$ 1,987.50
PM Contingency			20%		$ 1,590.00
EE Grand Total (Construction & Closeout)					**$ 11,527.50**
Mobilization			10%		$ 1,152.75
Traffic Control			15%		$ 1,729.13
Design & Environmental			30%		$ 3,458.25
Construction & Closeout					$ 11,527.50
Project Subtotal					**$ 17,867.63**
Management Const Contingency (10% CC)			10%		$ 1,152.75
Project Total					**$ 19,020.38**

S 160th St

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Reduce Curb Radius	SIDEWALK, CEM CONC W/ 25% POZZOLANS	SY	100	50	$ 5,000
	REMOVE CURB & GUTTER	LF	20	70	$ 1,400
	CURB AND GUTTER, CEM CONC W/ 25% POZZOLANS	LF	80	80	$ 6,400
	REMOVE INLET	EA	500	1	$ 500
	INLET, TYPE 250A	EA	2500	1	$ 2,500
	CURB RAMP 422A W/ 25% POZZOLANS	EA	2400	2	$ 4,800
Project EE Subtotal					**$ 20,600.00**
Escalation			6%		$ 1,236.00
EE Subtotal (after escalation)					**$ 21,836.00**
EE Contingency			25%		$ 5,459.00
PM Contingency			20%		$ 4,367.20
EE Grand Total (Construction & Closeout)					**$ 31,662.20**
Mobilization			10%		$ 3,166.22
Traffic Control			15%		$ 4,749.33
Design & Environmental			30%		$ 9,498.66
Construction & Closeout					$ 31,662.20
Project Subtotal					**$ 49,076.41**
Management Const Contingency (10% CC)			10%		$ 3,166.22
Project Total					**$ 52,242.63**

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Remove Left Turn Lane	PAVEMENT MARKING, PAINT, 4 IN STRIPE	LF	5	550	$ 2,750
	PAVEMENT MARKING, PAINT, 8 IN STRIPE	LF	5	935	$ 4,675
	REMOVE THERMO LEGEND/SYMBOL	EA	200	1	$ 200
	REMOVE THERMO STRIPING	LF	5	36	$ 180
Project EE Subtotal					**$ 7,805.00**
Escalation			6%		$ 468.30
EE Subtotal (after escalation)					**$ 8,273.30**
EE Contingency			25%		$ 2,068.33
PM Contingency			20%		$ 1,654.66
EE Grand Total (Construction & Closeout)					**$ 11,996.29**
Mobilization			10%		$ 1,199.63
Traffic Control			15%		$ 1,799.44
Design & Environmental			30%		$ 3,598.89
Construction & Closeout					$ 11,996.29
Project Subtotal					**$ 18,594.24**
Management Const Contingency (10% CC)			10%		$ 1,199.63
Project Total					**$ 19,793.87**

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Median Refuge Island	SAWCUT ASPHALT CONCRETE, FULL DEPTH	LF	5	75	$ 375
	REMOVE PAVEMENT	SY	70	22	$ 1,556
	CURB, CEM CONC W/ 25% POZZOLANS	LF	60	75	$ 4,500
	SIDEWALK, CEM CONC W/ 25% POZZOLANS	SY	200	22	$ 4,444
	DETECTABLE WARNING PLATE	SF	50	24	$ 1,200
Project EE Subtotal					**$ 12,075.00**
Escalation			6%		$ 724.50
EE Subtotal (after escalation)					**$ 12,799.50**
EE Contingency			25%		$ 3,199.88
PM Contingency			20%		$ 2,559.90
EE Grand Total (Construction & Closeout)					**$ 18,559.28**
Mobilization			10%		$ 1,855.93
Traffic Control			15%		$ 2,783.89
Design & Environmental			30%		$ 5,567.78
Construction & Closeout					$ 18,559.28
Project Subtotal					**$ 28,766.88**
Management Const Contingency (10% CC)			10%		$ 1,855.93
Project Total					**$ 30,622.80**

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Median Fencing	CHAIN LINK FENCE, TYPE 6	LF	50	150	$ 7,500
Project EE Subtotal					**$ 7,500.00**
Escalation			6%		$ 450.00
EE Subtotal (after escalation)					**$ 7,950.00**
EE Contingency			25%		$ 1,987.50

PM Contingency	20%	$	1,590.00
EE Grand Total (Construction & Closeout)		**$**	**11,527.50**
Mobilization	10%	$	1,152.75
Traffic Control	15%	$	1,729.13
Design & Environmental	30%	$	3,458.25
Construction & Closeout		$	11,527.50
Project Subtotal		**$**	**17,867.63**
Management Const Contingency (10% CC)	10%	$	1,152.75
Project Total		**$**	**19,020.38**

SR99 On Ramp N

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Yield Here to Ped Sign	SIGN, TRAFFIC	SF	200	9	$ 1,800
	PAVEMENT MARKING, THERMOPLASTIC, LEGEND/SYMBOL	EA	300	7	$ 2,100
	POST, TRAFFIC SIGN, TS-10	EA	400	1	$ 400
Project EE Subtotal					**$ 4,300.00**
Escalation			6%		$ 258.00
EE Subtotal (after escalation)					**$ 4,558.00**
EE Contingency			25%		$ 1,139.50
PM Contingency			20%		$ 911.60
EE Grand Total (Construction & Closeout)					**$ 6,609.10**
Mobilization			10%		$ 660.91
Traffic Control			15%		$ 991.37
Design & Environmental			30%		$ 1,982.73
Construction & Closeout					$ 6,609.10
Project Subtotal					**$ 10,244.11**
Management Const Contingency (10% CC)			10%		$ 660.91
Project Total					**$ 10,905.02**

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Marked Crosswalk	PAVEMENT MARKING, PAINT, 8 IN STRIPE	LF	5	150	$ 750
Project EE Subtotal					**$ 750.00**
Escalation			6%		$ 45.00
EE Subtotal (after escalation)					**$ 795.00**
EE Contingency			25%		$ 198.75
PM Contingency			20%		$ 159.00
EE Grand Total (Construction & Closeout)					**$ 1,152.75**
Mobilization			10%		$ 115.28
Traffic Control			15%		$ 172.91
Design & Environmental			30%		$ 345.83
Construction & Closeout					$ 1,152.75
Project Subtotal					**$ 1,786.76**
Management Const Contingency (10% CC)			10%		$ 115.28
Project Total					**$ 1,902.04**

SR99 On Ramp S

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Yield Here to Ped Sign	SIGN, TRAFFIC	SF	200	9	$ 1,800
	PAVEMENT MARKING, THERMOPLASTIC, LEGEND/SYMBOL	EA	300	7	$ 2,100
	POST, TRAFFIC SIGN, TS-10	EA	400	1	$ 400
Project EE Subtotal					**$ 4,300.00**
Escalation			6%		$ 258.00
EE Subtotal (after escalation)					**$ 4,558.00**
EE Contingency			25%		$ 1,139.50
PM Contingency			20%		$ 911.60
EE Grand Total (Construction & Closeout)					**$ 6,609.10**
Mobilization			10%		$ 660.91
Traffic Control			15%		$ 991.37
Design & Environmental			30%		$ 1,982.73
Construction & Closeout					$ 6,609.10
Project Subtotal					**$ 10,244.11**
Management Const Contingency (10% CC)			10%		$ 660.91
Project Total					**$ 10,905.02**

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Marked Crosswalk	PAVEMENT MARKING, PAINT, 8 IN STRIPE	LF	5	150	$ 750
Project EE Subtotal					**$ 750.00**
Escalation			6%		$ 45.00
EE Subtotal (after escalation)					**$ 795.00**
EE Contingency			25%		$ 198.75
PM Contingency			20%		$ 159.00
EE Grand Total (Construction & Closeout)					**$ 1,152.75**
Mobilization			10%		$ 115.28
Traffic Control			15%		$ 172.91
Design & Environmental			30%		$ 345.83
Construction & Closeout					$ 1,152.75
Project Subtotal					**$ 1,786.76**
Management Const Contingency (10% CC)			10%		$ 115.28
Project Total					**$ 1,902.04**

S 180th St

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Marked Crosswalk	REMOVE CURB & GUTTER	LF	20	10	$ 200
	CURB AND GUTTER, CEM CONC W/ 25% POZZOLANS	LF	80	10	$ 800
	PAVEMENT MARKING, PAINT, 8 IN STRIPE	LF	5	340	$ 1,700
	CURB RAMP 422A W/ 25% POZZOLANS	EA	2400	1	$ 2,400
Project EE Subtotal					**$ 5,100.00**
Escalation			6%		$ 306.00
EE Subtotal (after escalation)					**$ 5,406.00**
EE Contingency			25%		$ 1,351.50
PM Contingency			20%		$ 1,081.20
EE Grand Total (Construction & Closeout)					**$ 7,838.70**
Mobilization			10%		$ 783.87
Traffic Control			15%		$ 1,175.81
Design & Environmental			30%		$ 2,351.61
Construction & Closeout					$ 7,838.70
Project Subtotal					**$ 12,149.99**
Management Const Contingency (10% CC)			10%		$ 783.87
Project Total					**$ 12,933.86**

S 195th St

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Marked Crosswalk	REMOVE CURB	LF	30	50	$ 1,500
	REMOVE THERMO STRIPING	LF	5	180	$ 900
	RELOCATE SIGN, TRAFFIC	EA	300	1	$ 300
	CURB, CEM CONC W/ 25% POZZOLANS	LF	50	10	$ 500
	PAVEMENT MARKING, PAINT, 8 IN STRIPE	LF	5	340	$ 1,700
Project EE Subtotal					**$ 4,900.00**
Escalation			6%		$ 294.00
EE Subtotal (after escalation)					**$ 5,194.00**
EE Contingency			25%		$ 1,298.50
PM Contingency			20%		$ 1,038.80
EE Grand Total (Construction & Closeout)					**$ 7,531.30**
Mobilization			10%		$ 753.13
Traffic Control			15%		$ 1,129.70
Design & Environmental			30%		$ 2,259.39
Construction & Closeout					$ 7,531.30
Project Subtotal					**$ 11,673.52**
Management Const Contingency (10% CC)			10%		$ 753.13
Project Total					**$ 12,426.65**

Corridor Wide

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Reduce Posted Speed Limit	REMOVE SIGN, TRAFFIC	EA	300	12	$ 3,600
	INSTALL SIGN, TRAFFIC, OWNER FURNISHED	EA	300	12	$ 3,600
Project EE Subtotal					**$ 7,200.00**
Escalation			6%		$ 432.00
EE Subtotal (after escalation)					**$ 7,632.00**
EE Contingency			25%		$ 1,908.00
PM Contingency			20%		$ 1,526.40
EE Grand Total (Construction & Closeout)					**$ 11,066.40**
Mobilization			10%		$ 1,106.64
Traffic Control			15%		$ 1,659.96
Design & Environmental			30%		$ 3,319.92
Construction & Closeout					$ 11,066.40
Project Subtotal					**$ 17,152.92**
Management Const Contingency (10% CC)			10%		$ 1,106.64
Project Total					**$ 18,259.56**

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Leading Pedestrian Interval	REPROGRAMMING TRAFFIC SIGNAL	LS	600	1	$ 600
Project EE Subtotal					**$ 600.00**
Escalation			6%		$ 36.00
EE Subtotal (after escalation)					**$ 636.00**
EE Contingency			25%		$ 159.00
PM Contingency			20%		$ 127.20
EE Grand Total (Construction & Closeout)					**$ 922.20**
Mobilization			10%		$ 92.22
Traffic Control			15%		$ 138.33
Design & Environmental			30%		$ 276.66
Construction & Closeout					$ 922.20
Project Subtotal					**$ 1,429.41**
Management Const Contingency (10% CC)			10%		$ 92.22
Project Total					**$ 1,521.63**

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Pedestrian Countdown Signal	SIGNAL HEAD, PEDESTRIAN COUNTDOWN, LED	EA	1500	72	$ 108,000
Project EE Subtotal					**$ 108,000.00**
Escalation			6%		$ 6,480.00
EE Subtotal (after escalation)					**$ 114,480.00**
EE Contingency			25%		$ 28,620.00
PM Contingency			20%		$ 22,896.00
EE Grand Total (Construction & Closeout)					**$ 165,996.00**
Mobilization			10%		$ 16,599.60
Traffic Control			15%		$ 24,899.40
Design & Environmental			30%		$ 49,798.80
Construction & Closeout					$ 165,996.00
Project Subtotal					**$ 257,293.80**
Management Const Contingency (10% CC)			10%		$ 16,599.60
Project Total					**$ 273,893.40**

COUNTERMEASURES	DESCRIPTION	UNITS	UNIT PRICE	QUANTITY	UNIT PRICE EXTENSION
Striped Lane Lines	PAVEMENT MARKING, PAINT, 4 IN STRIPE	LF	5	65261	$ 326,304
Project EE Subtotal					**$ 326,304.00**
Escalation			6%		$ 19,578.24
EE Subtotal (after escalation)					**$ 345,882.24**
EE Contingency			25%		$ 86,470.56

PM Contingency	20%	$	69,176.45
EE Grand Total (Construction & Closeout)		**$**	**501,529.25**
Mobilization	10%	$	50,152.92
Traffic Control	15%	$	75,229.39
Design & Environmental	30%	$	150,458.77
Construction & Closeout		$	501,529.25
Project Subtotal		**$**	**777,370.33**
Management Const Contingency (10% CC)	10%	$	50,152.92
Project Total		**$**	**827,523.26**