



PHASE 2 ALTERNATIVES ANALYSIS

Appendix 4: Evaluation of Concepts



E02852
Work Order #1

July 2018
Final Report

SUMMARY OF COSTS AND BENEFITS
 Concept 1

Construction Cost	
VMS	\$4,520,000.00
Sign Structures	\$3,620,000.00
Power, Comm and Detection	\$280,000.00
System Integration	\$190,000.00
Bridge	\$0.00
Signals	\$0.00
Signage	\$0.00
Utilities	\$0.00
Additional Lump Sum	\$0.00
Design and PM	\$860,000.00
ROW	\$0.00
Total	\$9,470,000.00
Operating Cost	
Maintenance	\$150,000.00
Operations	\$100,000.00
Total	\$250,000.00
User Benefits	
Travel Time (Daily)	0 hr
Value of Travel Time (Annual)	\$0.00
Automobile Operating Costs (Annual)	\$0.00
Safety (Annual)	\$2,381,317.19
Total	\$2,381,317.19
Emissions (Annual)	
CO2	0 kg
NOx	0 kg
VOC	0 kg
Benefit:Cost Ratio	
NPV Benefits	\$35,774,059.86
NPV Operating Costs	\$3,755,700.84
NPV Capital Costs	\$9,274,801.54
Total Costs	\$13,030,502.37
Benefit:Cost Ratio	2.75

NET PRESENT VALUE CALCULATIONS

Concept 1

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$9,464,083.20
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$9,274,801.54
NPV Capital Costs			\$9,274,801.54

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224				
2021	0.9039	\$2,381,317	\$2,152,522	\$250,000	\$225,980
2022	0.8858	\$2,381,317	\$2,109,472	\$250,000	\$221,461
2023	0.8681	\$2,381,317	\$2,067,282	\$250,000	\$217,031
2024	0.8508	\$2,381,317	\$2,025,937	\$250,000	\$212,691
2025	0.8337	\$2,381,317	\$1,985,418	\$250,000	\$208,437
2026	0.8171	\$2,381,317	\$1,945,710	\$250,000	\$204,268
2027	0.8007	\$2,381,317	\$1,906,795	\$250,000	\$200,183
2028	0.7847	\$2,381,317	\$1,868,659	\$250,000	\$196,179
2029	0.7690	\$2,381,317	\$1,831,286	\$250,000	\$192,256
2030	0.7536	\$2,381,317	\$1,794,661	\$250,000	\$188,410
2031	0.7386	\$2,381,317	\$1,758,767	\$250,000	\$184,642
2032	0.7238	\$2,381,317	\$1,723,592	\$250,000	\$180,949
2033	0.7093	\$2,381,317	\$1,689,120	\$250,000	\$177,330
2034	0.6951	\$2,381,317	\$1,655,338	\$250,000	\$173,784
2035	0.6812	\$2,381,317	\$1,622,231	\$250,000	\$170,308
2036	0.6676	\$2,381,317	\$1,589,786	\$250,000	\$166,902
2037	0.6543	\$2,381,317	\$1,557,991	\$250,000	\$163,564
2038	0.6412	\$2,381,317	\$1,526,831	\$250,000	\$160,293
2039	0.6283	\$2,381,317	\$1,496,294	\$250,000	\$157,087
2040	0.6158	\$2,381,317	\$1,466,368	\$250,000	\$153,945
NPV		User Benefits	\$35,774,060	Op Costs	\$3,755,700.84

Safety
Concept 1

Safety

Crash Type	$N_{obs,2010-201}$	$N_{obs,frequenc}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	1075	358.33	0.89	318.92	39.42

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.11	0.84	4.11	13.13	21.23	\$ 2,381,317.19

CONSTRUCTION COST ESTIMATE
Concept 1

VMS

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
VMS - Type 1	18 ea	\$60,000.00	\$1,080,000.00	\$216,000.00	\$1,347,840.00
VMS - Type 2	18 ea	\$30,000.00	\$540,000.00	\$108,000.00	\$673,920.00
VMS - LUC	80 ea	\$25,000.00	\$2,000,000.00	\$400,000.00	\$2,496,000.00
Subtotal, VMS			\$3,620,000.00	\$724,000.00	\$4,517,760.00
					\$4,520,000.00

Sign Structures

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Full Span Bridge	11 ea	\$200,000.00	\$2,200,000.00	\$440,000.00	\$2,745,600.00
Half Span Bridge	7 ea	\$100,000.00	\$700,000.00	\$140,000.00	\$873,600.00
Cantilever Sign Structure	3				
Subtotal, Sign Structures			\$2,900,000.00	\$580,000.00	\$3,619,200.00
					\$3,620,000.00

Power, Comm and Detection

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Power & Comm	18 ea	\$6,000.00	\$108,000.00	\$21,600.00	\$134,784.00
Detection	29 ea	\$4,000.00	\$116,000.00	\$23,200.00	\$144,768.00
Subtotal, Power, Comm and Detection			\$224,000.00	\$44,800.00	\$279,552.00
					\$280,000.00

System Integration

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Software & Integration	1 ea	\$150,000.00	\$150,000.00	\$30,000.00	\$187,200.00
			\$150,000.00	\$30,000.00	\$187,200.00
					\$190,000.00

TOTAL CONSTRUCTION COSTS			\$6,894,000.00	\$1,378,800.00	\$8,603,712.00
					\$8,610,000.00
DESIGN AND CM COSTS			\$689,400.00	\$137,880.00	\$860,371.20
					\$860,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM			\$7,583,400.00		\$9,464,083.20
					\$9,470,000.00

SUMMARY OF COSTS AND BENEFITS
 Concept 1A

Construction Cost	
VMS	\$4,520,000.00
Sign Structures	\$3,620,000.00
Power, Comm and Detection	\$280,000.00
System Integration	\$190,000.00
Supplemental Roadway Construction	\$31,000.00
Earthwork	\$3,000.00
Pavement	\$119,000.00
Ramp Metering	\$3,280,000.00
Additional Lump Sum	\$12,000.00
Design and PM	\$876,000.00
ROW	\$0.00
Total	\$12,931,000.00
Operating Cost	
Maintenance	\$166,250.00
Operations	\$200,000.00
Total	\$366,250.00
User Benefits	
Travel Time (Daily)	0 hr
Value of Travel Time (Annual)	\$0.00
Automobile Operating Costs (Annual)	\$0.00
Safety (Annual)	\$2,381,317.19
Total	\$2,381,317.19
Emissions (Annual)	
CO2	0 kg
NOx	0 kg
VOC	0 kg
Benefit:Cost Ratio	
NPV Benefits	\$35,774,059.86
NPV Operating Costs	\$5,502,101.73
NPV Capital Costs	\$12,664,656.03
Total Costs	\$18,166,757.76
Benefit:Cost Ratio	1.97

NET PRESENT VALUE CALCULATIONS

Concept 1A

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$12,923,118.40
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$12,664,656.03
NPV Capital Costs			\$12,664,656.03

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224				
2021	0.9039	\$2,381,317	\$2,152,522	\$366,250	\$331,061
2022	0.8858	\$2,381,317	\$2,109,472	\$366,250	\$324,440
2023	0.8681	\$2,381,317	\$2,067,282	\$366,250	\$317,951
2024	0.8508	\$2,381,317	\$2,025,937	\$366,250	\$311,592
2025	0.8337	\$2,381,317	\$1,985,418	\$366,250	\$305,360
2026	0.8171	\$2,381,317	\$1,945,710	\$366,250	\$299,253
2027	0.8007	\$2,381,317	\$1,906,795	\$366,250	\$293,268
2028	0.7847	\$2,381,317	\$1,868,659	\$366,250	\$287,403
2029	0.7690	\$2,381,317	\$1,831,286	\$366,250	\$281,654
2030	0.7536	\$2,381,317	\$1,794,661	\$366,250	\$276,021
2031	0.7386	\$2,381,317	\$1,758,767	\$366,250	\$270,501
2032	0.7238	\$2,381,317	\$1,723,592	\$366,250	\$265,091
2033	0.7093	\$2,381,317	\$1,689,120	\$366,250	\$259,789
2034	0.6951	\$2,381,317	\$1,655,338	\$366,250	\$254,593
2035	0.6812	\$2,381,317	\$1,622,231	\$366,250	\$249,501
2036	0.6676	\$2,381,317	\$1,589,786	\$366,250	\$244,511
2037	0.6543	\$2,381,317	\$1,557,991	\$366,250	\$239,621
2038	0.6412	\$2,381,317	\$1,526,831	\$366,250	\$234,829
2039	0.6283	\$2,381,317	\$1,496,294	\$366,250	\$230,132
2040	0.6158	\$2,381,317	\$1,466,368	\$366,250	\$225,530
NPV		User Benefits	\$35,774,060	Op Costs	\$5,502,101.73

Safety
Concept 1A

Safety

Crash Type	$N_{obs,2010-201}$	$N_{obs,frequenc}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	1075	358.33	0.89	318.92	39.42

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.11	0.84	4.11	13.13	21.23	\$ 2,381,317.19

CONSTRUCTION COST ESTIMATE
 Concept 1A

Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
PBD & Geotextile	353 lf	\$11.00	\$3,883.00	\$776.60	\$4,845.98
Drainage	1 LS	\$20,859.12	\$20,859.12	\$4,171.82	\$26,032.18
Subtotal, Roadway Costs			\$24,742.12	\$4,948.42	\$30,878.17
					\$31,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	112 CY	\$20.00	\$2,240.00	\$448.00	\$2,795.52
Fill	CY	\$25.00	\$0.00	\$0.00	\$0.00
Subtotal, Earthwork Costs			\$2,240.00	\$448.00	\$2,795.52
					\$3,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	632 SY	\$110.00	\$69,520.00	\$13,904.00	\$86,760.96
Sidewalk	244 SY	\$105.00	\$25,620.00	\$5,124.00	\$31,973.76
Subtotal, Pavement Costs			\$95,140.00	\$19,028.00	\$118,734.72
					\$119,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00
					\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 1A

SUBTOTAL, CONSTRUCTION COSTS	\$122,122.12	\$24,424.42	\$152,408.41
			\$153,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	LS	\$0.00	\$0.00	\$0.00
Field Office	LS	\$0.00	\$0.00	\$0.00
Const. Scheduling	LS	\$0.00	\$0.00	\$0.00
Mobilization	LS	\$6,106.11	\$1,221.22	\$7,620.42
MPT	LS	\$3,663.66	\$732.73	\$4,572.25
		\$9,769.77	\$1,953.95	\$12,192.67
				\$12,000.00

TOTAL CONSTRUCTION COSTS	\$131,891.89	\$26,378.38	\$164,601.08
			\$165,000.00

DESIGN AND CM COSTS	\$12,212.21	\$2,637.84	\$16,460.11
			\$16,000.00

TOTAL, DESIGN, CONSTRUCTION AND C	\$134,334.33		\$181,061.19
			\$181,000.00

CONSTRUCTION COST ESTIMATE
 Concept 1A

VMS

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
VMS - Type 1	18 ea	\$60,000.00	\$1,080,000.00	\$216,000.00	\$1,347,840.00
VMS - Type 2	18 ea	\$30,000.00	\$540,000.00	\$108,000.00	\$673,920.00
VMS - LUC	80 ea	\$25,000.00	\$2,000,000.00	\$400,000.00	\$2,496,000.00
Subtotal, VMS			\$3,620,000.00	\$724,000.00	\$4,517,760.00
					\$4,520,000.00

Sign Structures

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Full Span Bridge	11 ea	\$200,000.00	\$2,200,000.00	\$440,000.00	\$2,745,600.00
Half Span Bridge	7 ea	\$100,000.00	\$700,000.00	\$140,000.00	\$873,600.00
Cantilever Sign Structure	3				
Subtotal, Sign Structures			\$2,900,000.00	\$580,000.00	\$3,619,200.00
					\$3,620,000.00

Power, Comm and Detection

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Power & Comm	18 ea	\$6,000.00	\$108,000.00	\$21,600.00	\$134,784.00
Detection	29 ea	\$4,000.00	\$116,000.00	\$23,200.00	\$144,768.00
Subtotal, Power, Comm and Detection			\$224,000.00	\$44,800.00	\$279,552.00
					\$280,000.00

System Integration

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Software & Integration	1 ea	\$150,000.00	\$150,000.00	\$30,000.00	\$187,200.00
			\$150,000.00	\$30,000.00	\$187,200.00
					\$190,000.00

TOTAL CONSTRUCTION COSTS			\$6,894,000.00	\$1,378,800.00	\$8,603,712.00
					\$8,610,000.00
DESIGN AND CM COSTS			\$689,400.00	\$137,880.00	\$860,371.20
					\$860,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM			\$7,583,400.00		\$9,464,083.20
					\$9,470,000.00

RAMP METERING COST ESTIMATE

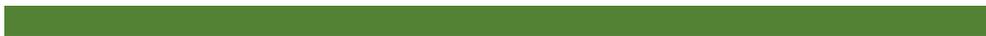
Concept 1A

Typical One-lane Ramp Metering

Item	Quantity	Units	Unit Cost	Cost
Flashing Warning Sign	1	ea	\$6,100.00 ea	\$6,100.00
Traffic Signal Support, 12' Pedestal	1	ea	\$2,600.00 ea	\$2,600.00
24" White Hot Thermoplastic Pavement Markings	15	lf	\$15.00 lf	\$225.00
Vehicular signal head, One 8" Section	3	ea	\$415.00 ea	\$1,245.00
Vehicular signal head, One 12" Section	2	ea	\$430.00 ea	\$860.00
3" Conduit	50	lf	\$6.25 lf	\$312.50
Trench and backfill	485	lf	\$57.67 lf	\$27,969.95
Signal cable	30	lf	\$1.58 lf	\$47.40
Controller assembly	1	ea	\$10,600.00 ea	\$10,600.00
Loop Sensors	180	lf	\$9.95 lf	\$1,791.00
Electrical service, Type A	1	ea	\$2,372.35 ea	\$2,372.35
Junction boxes	3	ea	\$1,428.00 ea	\$4,284.00
Signage	28	sf	\$17.50 sf	\$490.00
Detector Lead-In	340	lf	\$1.43 lf	\$486.20
1" Conduit	255	lf	\$5.25 lf	\$1,338.75
4" White Hot Thermoplastic Pavement Markings	100	lf	\$1.50 lf	\$150.00
Other: Power Conduit	400	lf	\$6.25 lf	\$2,500.00
Other: Power, Trench and Backfill	400	lf	\$36.25 lf	\$14,500.00
Other: Power Cable	400	lf	\$12.00 lf	\$4,800.00
Other: Wireless Comm	1	ea	\$5,000.00 ea	\$5,000.00
Subtotal Typical One-lane Ramp Metering				\$87,672.15

Incident Management Ramp Metering

Westbound Ramps	13
Eastbound Ramps	12
Total Ramps Metered	25
Total construction cost	\$2,191,803.75
Software & Integration (10% of Construction Cost)	\$219,180.38
Subtotal1	\$2,410,984.13
	\$2,410,000.00
MPT (3% of Subtotal1)	\$72,329.52
	\$72,300.00
Subtotal2	\$2,483,313.65
Contingency (20% of Subtotal2)	\$496,662.73
	\$497,000.00
Total	\$2,979,976.38
	\$2,980,000.00
Design & CM (10% of Total)	\$297,997.64
	\$298,000.00
Grand Total	\$3,277,974.02
	\$3,280,000.00



OPERATING COST ESTIMATE
Concept 1A

Maintenance	\$150,000.00
Operations	\$100,000.00
Maintenance, Power & Comm - Ramp Metering	\$16,250.00
Operations - Ramp Metering	\$100,000.00
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	\$366,250.00
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Total Annual Operating Costs	\$366,250.00

SUMMARY OF COSTS AND BENEFITS
 Concept 2

Construction Cost	
VMS	\$520,000.00
Sign Structures	\$750,000.00
Power, Comm and Detection	\$220,000.00
System Integration	\$270,000.00
Bridge	\$0.00
Signals	\$0.00
Signage	\$0.00
Utilities	\$0.00
Additional Lump Sum	\$0.00
Design and PM	\$180,000.00
ROW	\$0.00
Total	\$1,940,000.00
Operating Cost	
Maintenance	\$36,000.00
Operations	\$144,000.00
Total	\$180,000.00
User Benefits	
Travel Time (Daily)	0 hr
Value of Travel Time (Annual)	\$1,823,706.50
Automobile Operating Costs (Annual)	\$0.00
Safety (Annual)	\$1,731,867.05
Total	\$3,555,573.55
Emissions	
CO2	0 kg
NOx	0 kg
VOC	0 kg
Benefit:Cost Ratio	
NPV Benefits	\$53,414,682.20
NPV Operating Costs	\$2,704,104.60
NPV Capital Costs	\$1,909,850.34
Total Costs	\$4,613,954.95
Benefit:Cost Ratio	11.58

NET PRESENT VALUE CALCULATIONS

Concept 2

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$1,948,826.88
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$1,909,850.34
NPV Capital Costs			\$1,909,850.34

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224				
2021	0.9039	\$3,555,574	\$3,213,957	\$180,000	\$162,706
2022	0.8858	\$3,555,574	\$3,149,678	\$180,000	\$159,452
2023	0.8681	\$3,555,574	\$3,086,684	\$180,000	\$156,263
2024	0.8508	\$3,555,574	\$3,024,950	\$180,000	\$153,137
2025	0.8337	\$3,555,574	\$2,964,451	\$180,000	\$150,075
2026	0.8171	\$3,555,574	\$2,905,162	\$180,000	\$147,073
2027	0.8007	\$3,555,574	\$2,847,059	\$180,000	\$144,132
2028	0.7847	\$3,555,574	\$2,790,118	\$180,000	\$141,249
2029	0.7690	\$3,555,574	\$2,734,316	\$180,000	\$138,424
2030	0.7536	\$3,555,574	\$2,679,629	\$180,000	\$135,656
2031	0.7386	\$3,555,574	\$2,626,037	\$180,000	\$132,942
2032	0.7238	\$3,555,574	\$2,573,516	\$180,000	\$130,284
2033	0.7093	\$3,555,574	\$2,522,046	\$180,000	\$127,678
2034	0.6951	\$3,555,574	\$2,471,605	\$180,000	\$125,124
2035	0.6812	\$3,555,574	\$2,422,173	\$180,000	\$122,622
2036	0.6676	\$3,555,574	\$2,373,729	\$180,000	\$120,169
2037	0.6543	\$3,555,574	\$2,326,255	\$180,000	\$117,766
2038	0.6412	\$3,555,574	\$2,279,730	\$180,000	\$115,411
2039	0.6283	\$3,555,574	\$2,234,135	\$180,000	\$113,103
2040	0.6158	\$3,555,574	\$2,189,452	\$180,000	\$110,840
NPV		User Benefits	\$53,414,682	Op Costs	\$2,704,104.60

ITS Costs
Concept 2

VMS

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Full-size DMS	6 ea	\$70,000.00	\$420,000.00	\$84,000.00	\$524,160.00
Subtotal, VMS			\$420,000.00	\$84,000.00	\$524,160.00
					\$520,000.00

Sign Structures

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Full-span structures	6 ea	\$100,000.00	\$600,000.00	\$120,000.00	\$748,800.00
Subtotal, Sign Structures			\$600,000.00	\$120,000.00	\$748,800.00
					\$750,000.00

Power, Comm and Detection

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Power & communications	6 ea	\$30,000.00	\$180,000.00	\$36,000.00	\$224,640.00
Subtotal, Power, Comm and Detection			\$180,000.00	\$36,000.00	\$224,640.00
					\$220,000.00

System Integration

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Software & Integration	6 ea	\$30,000.00	\$180,000.00	\$36,000.00	\$224,640.00
MPT	1 LS	\$39,600.00	\$39,600.00	\$7,920.00	\$49,420.80
			\$219,600.00	\$43,920.00	\$274,060.80
					\$270,000.00

TOTAL CONSTRUCTION COSTS			\$1,419,600.00	\$283,920.00	\$1,771,660.80
					\$1,760,000.00
DESIGN AND CM COSTS			\$170,352.00	\$28,392.00	\$177,166.08
					\$180,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM			\$1,589,952.00		\$1,948,826.88
					\$1,940,000.00

Safety
Concept 2

Safety

Crash Type	$N_{obs,2010-2011}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	1075	358.33	0.92	329.67	28.67

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.08	0.61	2.99	9.55	15.44	\$ 1,731,867.05

FHWA Tool for Operations Benefit/Cost (TOPS-BC): Version 1.2

Estimate Benefits of TSM&O Strategies

Strategy: Dynamic Message Sign

Length of Analysis Period (Hours) 24
 Type of Traveler Information 2

Cost Information

Facility Performance	Volume Passing by the Sign Location(s) During the Period of Analysis	98000	
Impacts Due to Strategy	Percent time device is disseminating useful information	33%	25%
	Percent Drivers Acting on the Information	25%	10%
	Average Time Saved (Minutes) by Drivers Acting on the Information	4	3
	Average Time Saved (Minutes) by Drivers Not Acting on the Information	0	
ATIS Time Savings	Total hours saved due to ATIS deployments		539.00

User Entered Benefit (Annual \$'s)		
Number of Periods Per Year	250	250
TOTAL AVERAGE ANNUAL BENEFIT		\$ 1,823,706.50
Grand Total		\$ 1,823,706.50

OPERATING COST ESTIMATE
Concept 2

Maintenance	\$36,000.00
Operations	\$144,000.00
	\$180,000.00
Total Annual Operating Costs	\$180,000.00

SUMMARY OF COSTS AND BENEFITS
 Concept 3A

Construction Cost	
Supplemental Roadway Construction	\$31,000.00
Earthwork	\$3,000.00
Pavement	\$119,000.00
Walls	\$0.00
Bridges	\$0.00
Ramp Metering	\$1,668,786.77
Signage	\$0.00
Utilities	\$0.00
Additional Lump Sum	\$0.00
Design and PM	\$166,878.68
ROW	\$0.00
Total	\$1,988,665.45
Operating Cost	
Maintenance, Power & Comm	\$16,250.00
Operations	\$100,000.00
Total	\$116,250.00
User Benefits	
Travel Time (Day)	-58.90 hr
Value of Travel Time (Annual)	-\$257,641.04
Automobile Operating Costs (Annual)	\$79,806.09
Safety (Annual)	\$884,460.47
Total	\$706,625.53
Emissions (Annual)	
CO2	234107 kg
NOx	440 kg
VOC	648 kg
Benefit:Cost Ratio	
NPV Benefits	\$8,217,673.90
NPV Operating Costs	\$1,853,626.19
NPV Capital Costs	\$1,798,952.14
Total Costs	\$3,652,578.33
Benefit:Cost Ratio	2.25

NET PRESENT VALUE CALCULATIONS

Concept 3A

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$1,835,665.45
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$1,798,952.14
NPV Capital Costs			\$1,798,952.14

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224		\$0	\$116,250	\$107,225
2021	0.9039	\$547,013	\$494,457	\$116,250	\$105,081
2022	0.8858	\$547,013	\$484,568	\$116,250	\$102,979
2023	0.8681	\$547,013	\$474,876	\$116,250	\$100,920
2024	0.8508	\$547,013	\$465,379	\$116,250	\$98,901
2025	0.8337	\$547,013	\$456,071	\$116,250	\$96,923
2026	0.8171	\$547,013	\$446,950	\$116,250	\$94,985
2027	0.8007	\$547,013	\$438,011	\$116,250	\$93,085
2028	0.7847	\$547,013	\$429,251	\$116,250	\$91,223
2029	0.7690	\$547,013	\$420,666	\$116,250	\$89,399
2030	0.7536	\$547,013	\$412,252	\$116,250	\$87,611
2031	0.7386	\$547,013	\$404,007	\$116,250	\$85,859
2032	0.7238	\$547,013	\$395,927	\$116,250	\$84,141
2033	0.7093	\$547,013	\$388,008	\$116,250	\$82,459
2034	0.6951	\$547,013	\$380,248	\$116,250	\$80,809
2035	0.6812	\$547,013	\$372,643	\$116,250	\$79,193
2036	0.6676	\$547,013	\$365,190	\$116,250	\$77,609
2037	0.6543	\$547,013	\$357,887	\$116,250	\$76,057
2038	0.6412	\$547,013	\$350,729	\$116,250	\$74,536
2039	0.6283	\$547,013	\$343,714	\$116,250	\$73,045
2040	0.6158	\$547,013	\$336,840	\$116,250	\$71,584
NPV		User Benefits	\$8,217,674	Op Costs	\$1,853,626.19

CONSTRUCTION COST ESTIMATE
Concept 3A

Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
PBD & Geotextile	353 lf	\$11.00	\$3,883.00	\$776.60	\$4,845.98
Drainage	1 LS	\$20,859.12	\$20,859.12	\$4,171.82	\$26,032.18
Subtotal, Roadway Costs			\$24,742.12	\$4,948.42	\$30,878.17
					\$31,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	112 CY	\$20.00	\$2,240.00	\$448.00	\$2,795.52
Fill	0 CY	\$25.00	\$0.00	\$0.00	\$0.00
Subtotal, Earthwork Costs			\$2,240.00	\$448.00	\$2,795.52
					\$3,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	632 SY	\$110.00	\$69,520.00	\$13,904.00	\$86,760.96
Sidewalk	244 SY	\$105.00	\$25,620.00	\$5,124.00	\$31,973.76
Subtotal, Pavement Costs			\$95,140.00	\$19,028.00	\$118,734.72
					\$119,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00
					\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 3A

SUBTOTAL, CONSTRUCTION COSTS	\$122,122.12	\$24,424.42	\$152,408.41
			\$153,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	0 LS	\$0.00	\$0.00	\$0.00
Field Office	0 LS	\$0.00	\$0.00	\$0.00
Const. Scheduling	0 LS	\$0.00	\$0.00	\$0.00
Mobilization	0 LS	\$0.00	\$0.00	\$0.00
MPT	0 LS	\$0.00	\$0.00	\$0.00
		\$0.00	\$0.00	\$0.00
				\$0.00

TOTAL CONSTRUCTION COSTS	\$122,122.12	\$24,424.42	\$152,408.41
			\$153,000.00
DESIGN AND CM COSTS	\$24,424.42	\$4,884.88	\$30,481.68
			\$30,000.00
TOTAL, DESIGN, CONSTRUCTION AND C	\$146,546.54		\$182,890.09
			\$183,000.00

RAMP METERING COST ESTIMATE
 Concept 3A

Typical One-lane Ramp Metering

Item	Quantity	Units	Unit Cost	Cost
Flashing Warning Sign	1	ea	\$6,100.00 ea	\$6,100.00
Traffic Signal Support, 12' Pedestal	1	ea	\$2,600.00 ea	\$2,600.00
24" White Hot Thermoplastic Pavement Markings	15	lf	\$15.00 lf	\$225.00
Vehicular signal head, One 8" Section	3	ea	\$415.00 ea	\$1,245.00
Vehicular signal head, One 12" Section	2	ea	\$430.00 ea	\$860.00
3" Conduit	50	lf	\$6.25 lf	\$312.50
Trench and backfill	485	lf	\$57.67 lf	\$27,969.95
Signal cable	30	lf	\$1.58 lf	\$47.40
Controller assembly	1	ea	\$10,600.00 ea	\$10,600.00
Loop Sensors	180	lf	\$9.95 lf	\$1,791.00
Electrical service, Type A	1	ea	\$2,372.35 ea	\$2,372.35
Junction boxes	3	ea	\$1,428.00 ea	\$4,284.00
Signage	28	sf	\$17.50 sf	\$490.00
Detector Lead-In	340	lf	\$1.43 lf	\$486.20
1" Conduit	255	lf	\$5.25 lf	\$1,338.75
4" White Hot Thermoplastic Pavement Markings	100	lf	\$1.50 lf	\$150.00
Other: Power Conduit	400	lf	\$6.25 lf	\$2,500.00
Other: Power, Trench and Backfill	400	lf	\$36.25 lf	\$14,500.00
Other: Power Cable	400	lf	\$12.00 lf	\$4,800.00
Other: Wireless Comm	1	ea	\$5,000.00 ea	\$5,000.00
Subtotal Typical One-lane Ramp Metering				\$87,672.15

Phase 1 - Directional Ramp Metering to alleviate peak hour conditions

Westbound Ramps	7
Eastbound Ramps	7
Total Ramps Metered	14
Total construction cost	\$1,227,410.10
Software & Integration (10% of Construction Cost)	\$122,741.01
Subtotal1	\$1,350,151.11
MPT (3% of Subtotal1)	\$40,504.53
Subtotal2	\$1,390,655.64
Contingency (20% of Subtotal2)	\$278,131.13
Total	\$1,668,786.77
Design & CM (10% of Total)	\$166,878.68
Grand Total	\$1,835,665.45

Phase 2 - All Ramps Metered

Westbound Ramps	13
Eastbound Ramps	12
Total Ramps Metered	25
Total construction cost	\$2,191,803.75
Software & Integration (10% of Construction Cost)	\$219,180.38
Subtotal1	\$2,410,984.13
MPT (3% of Subtotal1)	\$72,329.52
Subtotal2	\$2,483,313.65
Contingency (20% of Subtotal2)	\$496,662.73
Total	\$2,979,976.38
Design & CM (10% of Total)	\$297,997.64
Grand Total	\$3,277,974.02

Safety
Concept 3A

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	122	40.67	0.64	26.03	14.64

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.04	0.31	1.53	4.88	7.89	\$ 884,460.47

USER BENEFITS
Concept 3A

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:PM Veh-Hrs	
No-build	244363	248483	6714	6200
Build	244510	248488	6664	6309
Change	147	5	-50	109
Subtotal, MOEs				

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	-47.509 hrs	-2.59 hrs
PM Peak Period	106.284 hrs	2.72 hrs
Total of Peaks	58.775 hrs	0.125 hrs
Daily Estimate	58.775 hrs	0.125 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	\$757.35	\$2.46

Total, all vehicles \$759.81 Value of travel time changes, per day
 \$257,641.04 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars		Trucks	
AM Peak Period				
Average Speed	20			
Change in Veh-Hrs		-47.509 hours		-2.591 hours
Fuel Consumption		0.022 gal/minute		0.102 gal/minute
		-62.7 gallons		-15.9 gallons

USER BENEFITS
Concept 3A

PM Peak Period

Average Speed	20		
Change in Veh-Hrs		106.3 hours	2.7 hours
Fuel Consumption		0.022 gal/minute	0.102 gal/minute
		140.3 gallons	16.6 gallons

Fuel Consumption

AM Peak Period		-62.7 gallons	-15.9 gallons
PM Peak Period		140.3 gallons	16.6 gallons
Total of Peaks		77.6 gallons	0.8 gallons
Daily Estimate		77.583 gallons	0.765 gallons
		\$3.004 per gallon	\$3.004 per gallon
		\$233.06 per day	\$2.30 per day

Total, all vehicles

78.3 fuel consumption change, gallons per day
26566.6 fuel consumption change, gallons per year

\$235.36 change in fuel cost, per day
\$79,806.09 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	\$257,641.04	Value of Travel Time change, Per year
Operating Costs	\$79,806.09	Value of Operating Costs change, per year
Total, User Benefits	\$337,447.13	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	77.583 gallons	0.765 gallons
Annual estimate	26307.238 gallons	259.371 gallons
CO2	19.4 lb/gal	22.2 lb/gal
	8799.6848 grams/gal	10069.7424 grams/gal
	231,495,400.98 g	2,611,797.85 g
Total	234,107.20 kg	

USER BENEFITS
Concept 3A

VOC

24.62 grams/gal	1.27 grams/gal
647,659.14 g	329.40 g
Total 647.99 kg	

NOx

16.5 grams/gal	24.52 grams/gal
434,069.42 g	6,359.77 g
Total 440.43 kg	

PM2.5

0.09761905 grams/gal	0.136 grams/gal
2,568.09 g	35.27 g
Total 2.60 kg	



SUMMARY OF COSTS AND BENEFITS
 Concept 3B

Construction Cost	
Supplemental Roadway Construction	\$31,000.00
Earthwork	\$3,000.00
Pavement	\$119,000.00
Walls	\$0.00
Bridges	\$0.00
Ramp Metering	\$2,979,976.38
Signage	\$0.00
Utilities	\$0.00
Additional Lump Sum	\$0.00
Design and PM	\$297,997.64
ROW	\$0.00
Total	\$3,430,974.02
Operating Cost	
Maintenance, Power & Comm	\$16,250.00
Operations	\$100,000.00
Total	\$116,250.00
User Benefits	
Travel Time (Day)	-58.90 hr
Value of Travel Time (Annual)	-\$257,641.04
Automobile Operating Costs (Annual)	\$79,806.09
Safety (Annual)	\$884,460.47
Total	\$706,625.53
Emissions (Annual)	
CO2	234107 kg
NOx	440 kg
VOC	648 kg
Benefit:Cost Ratio	
NPV Benefits	\$8,217,673.90
NPV Operating Costs	\$1,853,626.19
NPV Capital Costs	\$3,212,414.54
Total Costs	\$5,066,040.72
Benefit:Cost Ratio	1.62

NET PRESENT VALUE CALCULATIONS

Concept 3B

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$3,277,974.02
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$3,212,414.54
NPV Capital Costs			\$3,212,414.54

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224		\$0	\$116,250	\$107,225
2021	0.9039	\$547,013	\$494,457	\$116,250	\$105,081
2022	0.8858	\$547,013	\$484,568	\$116,250	\$102,979
2023	0.8681	\$547,013	\$474,876	\$116,250	\$100,920
2024	0.8508	\$547,013	\$465,379	\$116,250	\$98,901
2025	0.8337	\$547,013	\$456,071	\$116,250	\$96,923
2026	0.8171	\$547,013	\$446,950	\$116,250	\$94,985
2027	0.8007	\$547,013	\$438,011	\$116,250	\$93,085
2028	0.7847	\$547,013	\$429,251	\$116,250	\$91,223
2029	0.7690	\$547,013	\$420,666	\$116,250	\$89,399
2030	0.7536	\$547,013	\$412,252	\$116,250	\$87,611
2031	0.7386	\$547,013	\$404,007	\$116,250	\$85,859
2032	0.7238	\$547,013	\$395,927	\$116,250	\$84,141
2033	0.7093	\$547,013	\$388,008	\$116,250	\$82,459
2034	0.6951	\$547,013	\$380,248	\$116,250	\$80,809
2035	0.6812	\$547,013	\$372,643	\$116,250	\$79,193
2036	0.6676	\$547,013	\$365,190	\$116,250	\$77,609
2037	0.6543	\$547,013	\$357,887	\$116,250	\$76,057
2038	0.6412	\$547,013	\$350,729	\$116,250	\$74,536
2039	0.6283	\$547,013	\$343,714	\$116,250	\$73,045
2040	0.6158	\$547,013	\$336,840	\$116,250	\$71,584
NPV		User Benefits	\$8,217,674	Op Costs	\$1,853,626.19

CONSTRUCTION COST ESTIMATE
Concept 3B

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
PBD & Geotextile	353 lf	\$11.00	\$3,883.00	\$776.60	\$4,845.98
Drainage	1 LS	\$20,859.12	\$20,859.12	\$4,171.82	\$26,032.18
Subtotal, Supplemental Roadway Costs			\$24,742.12	\$4,948.42	\$30,878.17
					\$31,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	112 CY	\$20.00	\$2,240.00	\$448.00	\$2,795.52
Fill	0 CY	\$25.00	\$0.00	\$0.00	\$0.00
Subtotal, Earthwork Costs			\$2,240.00	\$448.00	\$2,795.52
					\$3,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	632 SY	\$110.00	\$69,520.00	\$13,904.00	\$86,760.96
Sidewalk	244 SY	\$105.00	\$25,620.00	\$5,124.00	\$31,973.76
Subtotal, Pavement Costs			\$95,140.00	\$19,028.00	\$118,734.72
					\$119,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00
					\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 3B

SUBTOTAL, CONSTRUCTION COSTS	\$122,122.12	\$24,424.42	\$152,408.41
			\$153,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	0 LS	\$0.00	\$0.00	\$0.00
Field Office	0 LS	\$0.00	\$0.00	\$0.00
Const. Scheduling	0 LS	\$0.00	\$0.00	\$0.00
Mobilization	0 LS	\$0.00	\$0.00	\$0.00
MPT	0 LS	\$0.00	\$0.00	\$0.00
		\$0.00	\$0.00	\$0.00
				\$0.00

TOTAL CONSTRUCTION COSTS	\$122,122.12	\$24,424.42	\$152,408.41
			\$153,000.00
DESIGN AND CM COSTS	\$24,424.42	\$4,884.88	\$30,481.68
			\$30,000.00
TOTAL, DESIGN, CONSTRUCTION AND C	\$146,546.54		\$182,890.09
			\$183,000.00

RAMP METERING COST ESTIMATE
 Concept 3B

Typical One-lane Ramp Metering

Item	Quantity	Units	Unit Cost	Cost
Flashing Warning Sign	1	ea	\$6,100.00 ea	\$6,100.00
Traffic Signal Support, 12' Pedestal	1	ea	\$2,600.00 ea	\$2,600.00
24" White Hot Thermoplastic Pavement Markings	15	lf	\$15.00 lf	\$225.00
Vehicular signal head, One 8" Section	3	ea	\$415.00 ea	\$1,245.00
Vehicular signal head, One 12" Section	2	ea	\$430.00 ea	\$860.00
3" Conduit	50	lf	\$6.25 lf	\$312.50
Trench and backfill	485	lf	\$57.67 lf	\$27,969.95
Signal cable	30	lf	\$1.58 lf	\$47.40
Controller assembly	1	ea	\$10,600.00 ea	\$10,600.00
Loop Sensors	180	lf	\$9.95 lf	\$1,791.00
Electrical service, Type A	1	ea	\$2,372.35 ea	\$2,372.35
Junction boxes	3	ea	\$1,428.00 ea	\$4,284.00
Signage	28	sf	\$17.50 sf	\$490.00
Detector Lead-In	340	lf	\$1.43 lf	\$486.20
1" Conduit	255	lf	\$5.25 lf	\$1,338.75
4" White Hot Thermoplastic Pavement Markings	100	lf	\$1.50 lf	\$150.00
Other: Power Conduit	400	lf	\$6.25 lf	\$2,500.00
Other: Power, Trench and Backfill	400	lf	\$36.25 lf	\$14,500.00
Other: Power Cable	400	lf	\$12.00 lf	\$4,800.00
Other: Wireless Comm	1	ea	\$5,000.00 ea	\$5,000.00
Subtotal Typical One-lane Ramp Metering				\$87,672.15

Phase 1 - Directional Ramp Metering to alleviate peak hour conditions

Westbound Ramps	13
Eastbound Ramps	12
Total Ramps Metered	25
Total construction cost	\$2,191,803.75
Software & Integration (10% of Construction Cost)	\$219,180.38
Subtotal1	\$2,410,984.13
MPT (3% of Subtotal1)	\$72,329.52
Subtotal2	\$2,483,313.65
Contingency (20% of Subtotal2)	\$496,662.73
Total	\$2,979,976.38
Design & CM (10% of Total)	\$297,997.64
Grand Total	\$3,277,974.02

Safety
 Concept 3B

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	122	40.67	0.64	26.03	14.64

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.04	0.31	1.53	4.88	7.89	\$ 884,460.47

USER BENEFITS
Concept 3B

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:PM Veh-Hrs	
No-build	244363	248483	6714	6200
Build	244510	248488	6664	6309
Change	147	5	-50	109
Subtotal, MOEs				

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	-47.509 hrs	-2.59 hrs
PM Peak Period	106.284 hrs	2.72 hrs
Total of Peaks	58.775 hrs	0.125 hrs
Daily Estimate	58.775 hrs	0.125 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	\$757.35	\$2.46

Total, all vehicles \$759.81 Value of travel time changes, per day
 \$257,641.04 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars		Trucks	
AM Peak Period				
Average Speed	20			
Change in Veh-Hrs		-47.509 hours		-2.591 hours
Fuel Consumption		0.022 gal/minute		0.102 gal/minute
		-62.7 gallons		-15.9 gallons

USER BENEFITS
Concept 3B

PM Peak Period

Average Speed	20		
Change in Veh-Hrs		106.3 hours	2.7 hours
Fuel Consumption		0.022 gal/minute	0.102 gal/minute
		<hr/> 140.3 gallons	<hr/> 16.6 gallons

Fuel Consumption

AM Peak Period		-62.7 gallons	-15.9 gallons
PM Peak Period		140.3 gallons	16.6 gallons
Total of Peaks		77.6 gallons	0.8 gallons
Daily Estimate		<hr/> 77.583 gallons	<hr/> 0.765 gallons
		\$3.004 per gallon	\$3.004 per gallon
		\$233.06 per day	\$2.30 per day

Total, all vehicles

78.3 fuel consumption change, gallons per day
26566.6 fuel consumption change, gallons per year

\$235.36 change in fuel cost, per day
\$79,806.09 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	\$257,641.04	Value of Travel Time change, Per year
Operating Costs	\$79,806.09	Value of Operating Costs change, per year
Total, User Benefits	\$337,447.13	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	77.583 gallons	0.765 gallons
Annual estimate	26307.238 gallons	259.371 gallons
CO2	19.4 lb/gal	22.2 lb/gal
	8799.6848 grams/gal	10069.7424 grams/gal
	231,495,400.98 g	2,611,797.85 g
Total	234,107.20 kg	

USER BENEFITS
Concept 3B

VOC

24.62 grams/gal

1.27 grams/gal

647,659.14 g

329.40 g

Total

647.99 kg

NOx

16.5 grams/gal

24.52 grams/gal

434,069.42 g

6,359.77 g

Total

440.43 kg

PM2.5

0.09761905 grams/gal

0.136 grams/gal

2,568.09 g

35.27 g

Total

2.60 kg



SUMMARY OF COSTS AND BENEFITS
 Concept 4

Construction Cost	
VSLs	\$580,000.00
Sign Structures	\$200,000.00
Power, Comm and Detection	\$1,050,000.00
System Integration	\$240,000.00
Bridge	\$0.00
Signals	\$0.00
Signage	\$0.00
Utilities	\$0.00
Additional Lump Sum	\$0.00
Design and PM	\$210,000.00
ROW	\$0.00
Total	\$2,280,000.00
Operating Cost	
Maintenance	\$70,000.00
Operations	\$140,000.00
Total	\$210,000.00
User Benefits	
Travel Time (Daily)	0 hr
Value of Travel Time (Annual)	\$0.00
Automobile Operating Costs (Annual)	\$0.00
Safety (Annual)	\$1,731,867.05
Total	\$1,731,867.05
Emissions (Annual)	
CO2	0 kg
NOx	0 kg
VOC	0 kg
Benefit:Cost Ratio	
NPV Benefits	\$26,017,498.08
NPV Operating Costs	\$3,154,788.70
NPV Capital Costs	\$2,028,033.70
Total Costs	\$5,182,822.40
Benefit:Cost Ratio	5.02

NET PRESENT VALUE CALCULATIONS

Concept 4

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$2,069,422.14
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$2,028,033.70
NPV Capital Costs			\$2,028,033.70

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224				
2021	0.9039	\$1,731,867	\$1,565,471	\$210,000	\$189,823
2022	0.8858	\$1,731,867	\$1,534,161	\$210,000	\$186,027
2023	0.8681	\$1,731,867	\$1,503,478	\$210,000	\$182,306
2024	0.8508	\$1,731,867	\$1,473,408	\$210,000	\$178,660
2025	0.8337	\$1,731,867	\$1,443,940	\$210,000	\$175,087
2026	0.8171	\$1,731,867	\$1,415,061	\$210,000	\$171,585
2027	0.8007	\$1,731,867	\$1,386,760	\$210,000	\$168,154
2028	0.7847	\$1,731,867	\$1,359,025	\$210,000	\$164,791
2029	0.7690	\$1,731,867	\$1,331,845	\$210,000	\$161,495
2030	0.7536	\$1,731,867	\$1,305,208	\$210,000	\$158,265
2031	0.7386	\$1,731,867	\$1,279,103	\$210,000	\$155,100
2032	0.7238	\$1,731,867	\$1,253,521	\$210,000	\$151,998
2033	0.7093	\$1,731,867	\$1,228,451	\$210,000	\$148,958
2034	0.6951	\$1,731,867	\$1,203,882	\$210,000	\$145,978
2035	0.6812	\$1,731,867	\$1,179,804	\$210,000	\$143,059
2036	0.6676	\$1,731,867	\$1,156,208	\$210,000	\$140,198
2037	0.6543	\$1,731,867	\$1,133,084	\$210,000	\$137,394
2038	0.6412	\$1,731,867	\$1,110,422	\$210,000	\$134,646
2039	0.6283	\$1,731,867	\$1,088,214	\$210,000	\$131,953
2040	0.6158	\$1,731,867	\$1,066,450	\$210,000	\$129,314
NPV		User Benefits	\$26,017,498	Op Costs	\$3,154,788.70

ITS Costs
Concept 4

VSLs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Variable speed limit sign	58 ea	\$8,000.00	\$464,000.00	\$92,800.00	\$579,072.00
Subtotal, VSLs			\$464,000.00	\$92,800.00	\$579,072.00
					\$580,000.00

Sign Structures

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Sign supports	54 ea	\$3,000.00	\$162,000.00	\$32,400.00	\$202,176.00
Subtotal, Sign Structures			\$162,000.00	\$32,400.00	\$202,176.00
					\$200,000.00

Power, Comm and Detection

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
3" Conduit	27000 lf	\$6.25	\$168,750.00	\$33,750.00	\$210,600.00
Trench and Backfill	27000 lf	\$14.77	\$398,790.00	\$79,758.00	\$497,689.92
Power & communications	54 ea	\$5,000.00	\$270,000.00	\$54,000.00	\$336,960.00
Subtotal, Power, Comm and Detection			\$837,540.00	\$167,508.00	\$1,045,249.92
					\$1,050,000.00

System Integration

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Software & Integration	1 ea	\$146,354.00	\$146,354.00	\$29,270.80	\$182,649.79
MPT	1 LS	\$48,296.82	\$48,296.82	\$9,659.36	\$60,274.43
			\$194,650.82	\$38,930.16	\$242,924.22
					\$240,000.00

TOTAL CONSTRUCTION COSTS			\$1,658,190.82	\$331,638.16	\$2,069,422.14
					\$2,070,000.00
DESIGN AND CM COSTS			\$198,982.90	\$33,163.82	\$206,942.21
					\$210,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM			\$1,857,173.72		\$2,276,364.36
					\$2,280,000.00

Safety
Concept 4

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	1075	358.33	0.92	329.67	28.67

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.08	0.61	2.99	9.55	15.44	\$ 1,731,867.05

SUMMARY OF COSTS AND BENEFITS
 Concept 6

Construction Cost	
Supplemental Roadway Construction	\$0.00
Earthwork	\$0.00
Pavement	\$0.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$0.00
Signage	\$1,260,000.00
Utilities	\$0.00
Additional Lump Sum	\$170,000.00
Design and PM	\$290,000.00
ROW	\$0.00
Total	\$1,720,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	466 hr
Value of Travel Time (Annual)	-\$387,546.82 hr
Automobile Operating Costs (Annual)	-\$4,509,675.11
Safety (Annual)	\$39,275.20
Total	-\$4,857,946.74
Emissions (Annual)	
CO2	15979179 kg
NOx	42255 kg
VOC	-13945 kg
Benefit:Cost Ratio	
NPV Benefits	-\$72,979,978.58
NPV Operating Costs	\$0.00
NPV Capital Costs	\$1,681,631.08
Total Costs	\$1,681,631.08
Benefit:Cost Ratio	-43.40

NET PRESENT VALUE CALCULATIONS

Concept 6

Capital Costs

2017 Total Capital Cost		\$1,715,950.08
Discount Rate	2% for 1 Year	
Discount Factor		0.980
NPV of capital costs		\$1,681,631.08
NPV Capital Costs		\$1,681,631.08

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224				
2021	0.9039	-\$4,857,947	-\$4,391,199	\$0	\$0
2022	0.8858	-\$4,857,947	-\$4,303,375	\$0	\$0
2023	0.8681	-\$4,857,947	-\$4,217,308	\$0	\$0
2024	0.8508	-\$4,857,947	-\$4,132,961	\$0	\$0
2025	0.8337	-\$4,857,947	-\$4,050,302	\$0	\$0
2026	0.8171	-\$4,857,947	-\$3,969,296	\$0	\$0
2027	0.8007	-\$4,857,947	-\$3,889,910	\$0	\$0
2028	0.7847	-\$4,857,947	-\$3,812,112	\$0	\$0
2029	0.7690	-\$4,857,947	-\$3,735,870	\$0	\$0
2030	0.7536	-\$4,857,947	-\$3,661,152	\$0	\$0
2031	0.7386	-\$4,857,947	-\$3,587,929	\$0	\$0
2032	0.7238	-\$4,857,947	-\$3,516,171	\$0	\$0
2033	0.7093	-\$4,857,947	-\$3,445,847	\$0	\$0
2034	0.6951	-\$4,857,947	-\$3,376,930	\$0	\$0
2035	0.6812	-\$4,857,947	-\$3,309,392	\$0	\$0
2036	0.6676	-\$4,857,947	-\$3,243,204	\$0	\$0
2037	0.6543	-\$4,857,947	-\$3,178,340	\$0	\$0
2038	0.6412	-\$4,857,947	-\$3,114,773	\$0	\$0
2039	0.6283	-\$4,857,947	-\$3,052,478	\$0	\$0
2040	0.6158	-\$4,857,947	-\$2,991,428	\$0	\$0
NPV		User Benefits	-\$72,979,979	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
Concept 6

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Supplemental Roadway Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Earthwork Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Pavement Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Major Entrance Signs; One-line dynamic message sign with extruded aluminum channel sign on Cantilever Sign Structure	5 ea	\$70,000.00	\$350,000.00	\$70,000.00	\$436,800.00
Regular Entrance Ramp Signs; One-line dynamic message sign with extruded aluminum channel sign on Type A Ground Mount Sign Structure	20 ea	\$30,000.00	\$600,000.00	\$120,000.00	\$748,800.00
Truck Detour Route Signs (Type B ground mounts)	120 ea	\$500.00	\$60,000.00	\$12,000.00	\$74,880.00
Subtotal, Signage Costs			\$1,010,000.00	\$202,000.00	\$1,260,480.00
					\$1,260,000.00

CONSTRUCTION COST ESTIMATE
 Concept 6

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00
					\$0.00

SUBTOTAL, CONSTRUCTION COSTS			\$1,010,000.00	\$202,000.00	\$1,260,480.00
					\$1,260,000.00

Additional Lump Sum

Item	Quantity		2016 Cost	Contingency	2017 Cost
Survey	1 LS		\$30,000.00	\$6,000.00	\$37,440.00
Field Office	1 LS		\$20,000.00	\$4,000.00	\$24,960.00
Const. Scheduling	1 LS		\$5,000.00	\$1,000.00	\$6,240.00
Mobilization	1 LS		\$50,500.00	\$10,100.00	\$63,024.00
MPT	1 LS		\$30,300.00	\$6,060.00	\$37,814.40
			\$135,800.00	\$27,160.00	\$169,478.40
					\$170,000.00

TOTAL CONSTRUCTION COSTS			\$1,145,800.00	\$229,160.00	\$1,429,958.40
					\$1,430,000.00

DESIGN AND CM COSTS			\$202,000.00	\$45,832.00	\$285,991.68
					\$290,000.00

TOTAL, DESIGN, CONSTRUCTION AND CM			\$1,212,000.00		\$1,715,950.08
					\$1,720,000.00

SIGNAGE UNIT COSTS

Concept 6

ITS Relocation

Item	Quantity	Units	Unit Cost	Cost
ITS Relocation	1	ls	\$200,000.00 sf	\$200,000.00
Subtotal ITS Relocation				\$200,000.00

At major entrances, assume one cantilever sign structure w/ an extruded aluminum channel sign & a small, one-line dynamic message sign

0948-0300 - STEEL SIGN STRUCTURE - CANTILEVER	1	EACH	\$ 40,000.00	\$ 40,000.00
Other items guiderail, seeding, excavation for drilled shafts, concrete and rebar.	1	LS	\$ 10,000.00	\$ 10,000.00
0936-0001 - STRUCTURE MOUNTED EXTRUDED ALUMINUM CHANNEL SIGNS	120	SF	\$ 25.00	\$ 3,000.00
Dynamic Message Sign Single-line, full-color high intensity LED	1	EACH	\$ 10,000.00	\$ 10,000.00
				\$ 63,000.00
		roundup		\$ 70,000.00
				5
				\$ 350,000.00

At other on-ramps, assume a ground-mount Type A post mount sign

0931-0003 - POST MOUNTED SIGNS, TYPE B, STEEL SQUARE POST				
0930-0004 - POST MOUNTED SIGNS, TYPE A	120	SF	\$ 30.00	\$ 3,600.00
0930-0101 - STEEL S OR W BEAM POSTS	800	LBS	\$ 5.00	\$ 4,000.00
Dynamic Message Sign Single-line, full-color high intensity LED	1	EACH	\$ 10,000.00	\$ 10,000.00
0930-0110 - BREAKAWAY SYSTEM	2	EA	\$ 2,000.00	\$ 4,000.00
				\$ 21,600.00
		roundup		\$ 30,000.00
				20
				\$ 600,000.00

Detour routes

0931-0003 - POST MOUNTED SIGNS, TYPE B, STEEL SQUARE POST	12	SF	\$ 40.00	480
		roundup		\$ 500.00

Assume two signs every half mile plus additional signs at turns/intersections

$$23.2 \text{ miles} \times 4 \text{ signs} \times \text{factor} = 120$$

\$ 500.00
\$ 60,000.00

Safety
Concept 6

Safety

Crash Type	$N_{obs,2010-2011}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Fatal & Injury	495	164.83	1.00	164.83	0.00
PDO	581	193.50	0.98	189.63	3.87

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.00	0.00	0.00	0.00	\$ -
0.00	0.00	0.00	0.00	3.87	\$ 39,275.20

Total: \$ 39,275.20

USER BENEFITS
Concept 6

Car MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:	PM Veh-Hrs
No-build	248236		265184	7994
Build	247396		266785	7259
Change	-840		1601	-735
Subtotal, Car MOEs				

Improvement only during peak period? Yes

Value of Time

	Cars	Trucks
Avg Hourly Wage	\$21.84	\$16.41
Benefits	18% \$3.93	20% \$3.28
Total Compensation	\$25.77	\$19.69
Value of Time	50% \$12.89	100% \$19.69
	of hourly wage	of total compensation

CHANGE IN TRAVEL TIME

*see Moe Truck for Direct Costs

AM Peak Period	-697.086 hrs	hrs
PM Peak Period	-1557.253 hrs	hrs
Total of Peaks	-2254.339 hrs	hrs
Daily Estimate	-2254.339 hrs	hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$29,048.51	

Total, all vehicles - \$29,048.51 Value of travel time changes, per day
-\$9,849,915.69 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars	Trucks
AM Peak Period		
Average Speed	21.339	
Change in Veh-Hrs	-697.086 hours	hours
Fuel Consumption	0.022 gal/minute	0.102 gal/minute
	-920.2 gallons	gallons
PM Peak Period		
Average Speed	22.518	
Change in Veh-Hrs	-1557.3 hours	hours
Fuel Consumption	0.022 gal/minute	0.102 gal/minute
	-2055.6 gallons	gallons
Fuel Consumption		
AM Peak Period	-920.2 gallons	gallons
PM Peak Period	-2055.6 gallons	gallons
Total of Peaks	-2975.7 gallons	gallons
Daily Estimate	-2975.728 gallons	gallons
	\$3.004 per gallon	\$3.004 per gallon
	-\$8,939.09 per day	per day
Total, all vehicles		
	-2975.7 fuel consumption change, gallons per day	
	(1,009,024.70) fuel consumption change, gallons per year	
	-\$8,939.09 change in fuel cost, per day	
	-\$3,031,110.21 change in fuel cost, per year	

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$9,849,915.69	Value of Travel Time change, Per year
Operating Costs	-\$3,031,110.21	Value of Operating Costs change, per year
Total, User Benefits	-\$12,881,025.89	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-2975.728 gallons	gallons
Annual estimate	-1009024.702 gallons	
CO2	19.4 lb/gal	22.2 lb/gal
	8799.6848 grams/gal	10069.7424 grams/gal
	(8,879,099,336.28) g	- g
Total	(8,879,099.34) kg	
VOC		
	24.62 grams/gal	1.27 grams/gal
	(24,841,227.20) g	-
Total	(24,841.23) kg	
NOx		
	16.5 grams/gal	24.52 grams/gal
	(16,648,907.59) g	-
Total	(16,648.91) kg	
PM2.5		
	0.09761905 grams/gal	0.136 grams/gal
	(98,500.03) g	-
Total	(98.50) kg	

USER BENEFITS
Concept 6

Truck MOEs

Item	AM VMT	PM VMT	AM Veh-Hr	PM Veh-Hrs	
No-build	333.0	1331.8	16.500	66.027	(per Hour)
Build	1497.7	1603.3	85.344	91.725	(per Hour)
Change	1164.7	272	68.844	25.698	(per Hour)
Subtotal, Truck MOEs	3494.16	814.5	206.532	77.094	3-hour period

Improvement only during peak period? Yes

Value of Time

	Cars		Trucks	
Avg Hourly Wage				\$16.41
Benefits	18%		20%	\$3.28
Total Compensation				\$19.69
Value of Time	50%	\$0.00	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

*see MOE sheet for Car Benefits

AM Peak Period	hrs	206.53 hrs
PM Peak Period	hrs	77.09 hrs
Total of Peaks	hrs	283.626 hrs
Daily Estimate	hrs	283.626 hrs
Hourly value of time	\$0.00	\$19.69
Value of Time		\$5,585.16

Total, all vehicles

\$5,585.16 Value of travel time changes, per day
\$1,893,845.06 Value of travel time changes, per year

Subtotal, Value of Time

USER BENEFITS
Concept 6

Automobile Operating Costs (Delay)

	Cars	Trucks
AM Peak Period		
Average Speed	20	
Change in Veh-Hrs	hours	206.532 hours
Fuel Consumption	0.022 gal/minute	0.102 gal/minute
	gallons	1264.0 gallons
PM Peak Period		
Average Speed	20	
Change in Veh-Hrs	hours	77.1 hours
Fuel Consumption	0.022 gal/minute	0.102 gal/minute
	gallons	471.8 gallons
Fuel Consumption		
AM Peak Period	gallons	1264.0 gallons
PM Peak Period	gallons	471.8 gallons
Total of Peaks	gallons	1735.8 gallons
Daily Estimate	gallons	1735.791 gallons
	\$3.004 per gallon	\$3.004 per gallon
	per day	\$5,214.32 per day
Total, all vehicles		
	1735.8 fuel consumption change, gallons per day	
	588,580.73 fuel consumption change, gallons per year	
	\$5,214.32 change in fuel cost, per day	
	\$1,768,096.52 change in fuel cost, per year	

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	\$1,893,845.06	Value of Travel Time change, Per year
Operating Costs	\$1,768,096.52	Value of Operating Costs change, per year
Total, User Benefits	\$3,661,941.58	

USER BENEFITS
 Concept 6

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	gallons	1735.791 gallons
Annual estimate	gallons	588580.732
CO2	19.4 lb/gal 8799.6848 grams/gal	22.2 lb/gal 10069.7424 grams/gal
	- g	5,926,856,352.09 g
Total	5,926,856.35 kg	
VOC	24.62 grams/gal	1.27 grams/gal
	- g	747,497.53
Total	747.50 kg	
NOx	16.5 grams/gal	24.52 grams/gal
	- g	14,431,999.55
Total	14,432.00 kg	
PM2.5	0.09761905 grams/gal	0.136 grams/gal
	- g	80,046.98
Total	80.05 kg	

USER BENEFITS
Concept 6

Network

Item	AM VMT	PM VMT	AM Veh-Hr	PM Veh-Hrs	
No-build	10840506.5	10840506.46	426395	426395	(per Hour)
Build	10848111.2	10848111.23	427815	427815	(per Hour)
Change	684.429	684.429	127.823	127.823	(per Hour)
Subtotal, Network	2053.2879	2053.2879	383.46809	383.468089	3-hour period

Improvement only during peak period? Yes

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	363.636 hrs	383.47 hrs
PM Peak Period	373.913 hrs	383.47 hrs
Total of Peaks	737.549 hrs	766.936 hrs
Daily Estimate	737.549 hrs	766.936 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time		\$15,102.51

Total, all vehicles \$15,102.51 Value of travel time changes, per day
\$5,121,033.66 Value of travel time changes, per year

Subtotal, Value of Time

USER BENEFITS
Concept 6

Automobile Operating Costs (Delay)

	Cars	Trucks
AM Peak Period		
Average Speed	20	
Change in Veh-Hrs	363.636 hours	383.468 hours
Fuel Consumption	0.022 gal/minute	0.102 gal/minute
	<u>480.0 gallons</u>	<u>2346.8 gallons</u>
PM Peak Period		
Average Speed	20	
Change in Veh-Hrs	373.9 hours	383.5 hours
Fuel Consumption	0.022 gal/minute	0.102 gal/minute
	<u>493.6 gallons</u>	<u>2346.8 gallons</u>
Fuel Consumption		
AM Peak Period	480.0 gallons	2346.8 gallons
PM Peak Period	493.6 gallons	2346.8 gallons
Total of Peaks	<u>973.6 gallons</u>	<u>4693.6 gallons</u>
Daily Estimate	973.565 gallons	4693.649 gallons
	<u>\$3.004 per gallon</u>	<u>\$3.004 per gallon</u>
	\$2,924.59 per day	\$14,099.72 per day
Total, all vehicles		
	5667.2 fuel consumption change, gallons per day	
	1,921,667.38 fuel consumption change, gallons per year	
	\$17,024.31 change in fuel cost, per day	
	\$5,772,688.80 change in fuel cost, per year	

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	\$5,121,033.66	Value of Travel Time change, Per year
Operating Costs	\$5,772,688.80	Value of Operating Costs change, per year
Total, User Benefits	\$10,893,722.46	

USER BENEFITS
Concept 6

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	973.565 gallons	4693.649 gallons
Annual estimate	330121.267 gallons	1591546.110
CO2		
	19.4 lb/gal	22.2 lb/gal
	8799.6848 grams/gal	10069.7424 grams/gal
	2,904,963,098.01 g	16,026,459,345.84 g
Total	18,931,422.44 kg	
VOC		
	24.62 grams/gal	1.27 grams/gal
	8,127,271.20 g	2,021,263.56
Total	10,148.53 kg	
NOx		
	16.5 grams/gal	24.52 grams/gal
	5,447,000.91 g	39,024,710.62
Total	44,471.71 kg	
PM2.5		
	0.09761905 grams/gal	0.136 grams/gal
	32,226.12 g	216,450.27
Total	248.68 kg	



USER BENEFITS

Concept 6

Combined MOEs

Value of Time

		Cars		Trucks
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	923.45	-333.450 hrs		590.00 hrs
PM Peak Period		-1183.340 hrs		460.562 hrs
Total of Peaks		-1516.790 hrs		1050.562 hrs
Daily Estimate		-1516.790 hrs		1050.562 hrs
Hourly value of time		\$12.89		\$19.69
Value of Time		-\$19,544.75		\$20,687.67

Total, all vehicles \$1,142.92 Value of travel time changes, per day
 \$387,546.82 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

		Cars		Trucks
AM Peak Period				
Average Speed	21.339			
Change in Veh-Hrs		-333.450 hours		590.000 hours
Fuel Consumption		0.022 gal/minute		0.102 gal/minute
		-440.2 gallons		3610.8 gallons
PM Peak Period				
Average Speed	22.518			
Change in Veh-Hrs		-1183.3 hours		460.6 hours
Fuel Consumption		0.022 gal/minute		0.102 gal/minute
		-1562.0 gallons		2818.6 gallons
Fuel Consumption				
AM Peak Period		-440.2 gallons		3610.8 gallons
PM Peak Period		-1562.0 gallons		2818.6 gallons

Total of Peaks	-2002.2 gallons	6429.4 gallons
Daily Estimate	-2002.163 gallons	6429.441 gallons
	\$3.004 per gallon	\$3.004 per gallon
	-\$6,014.50 per day	\$19,314.04 per day

Total, all vehicles
4427.3 fuel consumption change, gallons per day
1,501,223.41 fuel consumption change, gallons per year

\$13,299.54 change in fuel cost, per day
\$4,509,675.11 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	\$387,546.82 Value of Travel Time change, Per year
Operating Costs	\$4,509,675.11 Value of Operating Costs change, per year
Total, User Benefits	\$4,897,221.94

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-2002.163 gallons	6429.441 gallons
Annual estimate	-678903.435 gallons	2180126.842
CO2		
	19.4 lb/gal	22.2 lb/gal
	8799.6848 grams/gal	10069.7424 grams/gal
	(5,974,136,238.26) g	21,953,315,697.93 g
Total	15,979,179.46 kg	
VOC		
	24.62 grams/gal	1.27 grams/gal
	(16,713,956.00) g	2,768,761.09
Total	(13,945.19) kg	
NOx		
	16.5 grams/gal	24.52 grams/gal
	(11,201,906.68) g	53,456,710.17
Total	42,254.80 kg	
PM2.5		
	0.09761905 grams/gal	0.136 grams/gal
	(66,273.91) g	296,497.25
Total	230.22 kg	

SUMMARY OF COSTS AND BENEFITS
 Concept 7

Construction Cost	
Supplemental Roadway Construction	\$1,880,000.00
Earthwork	\$0.00
Pavement	\$0.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$0.00
Signage	\$0.00
Utilities	\$0.00
Additional Lump Sum	\$220,000.00
Design and PM	\$420,000.00
ROW	\$0.00
Total	\$2,520,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	32.93 hr
Value of Travel Time (Annual)	\$146,752.11
Automobile Operating Costs (Annual)	\$0.00
Safety (Annual)	\$0.00
Total	\$146,752.11
Emissions (Annual)	
CO2	0 kg
NOx	0 kg
VOC	0 kg
Benefit:Cost Ratio	
NPV Benefits	\$2,204,628.07
NPV Operating Costs	\$0.00
NPV Capital Costs	\$2,472,179.67
Total Costs	\$2,472,179.67
Benefit:Cost Ratio	0.89

NET PRESENT VALUE CALCULATIONS

Concept 7

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$2,522,632.32
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$2,472,179.67
NPV Capital Costs			\$2,472,179.67

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224		\$0	\$0	\$0
2021	0.9039	\$146,752	\$132,652	\$0	\$0
2022	0.8858	\$146,752	\$129,999	\$0	\$0
2023	0.8681	\$146,752	\$127,399	\$0	\$0
2024	0.8508	\$146,752	\$124,851	\$0	\$0
2025	0.8337	\$146,752	\$122,354	\$0	\$0
2026	0.8171	\$146,752	\$119,907	\$0	\$0
2027	0.8007	\$146,752	\$117,509	\$0	\$0
2028	0.7847	\$146,752	\$115,159	\$0	\$0
2029	0.7690	\$146,752	\$112,856	\$0	\$0
2030	0.7536	\$146,752	\$110,599	\$0	\$0
2031	0.7386	\$146,752	\$108,387	\$0	\$0
2032	0.7238	\$146,752	\$106,219	\$0	\$0
2033	0.7093	\$146,752	\$104,094	\$0	\$0
2034	0.6951	\$146,752	\$102,013	\$0	\$0
2035	0.6812	\$146,752	\$99,972	\$0	\$0
2036	0.6676	\$146,752	\$97,973	\$0	\$0
2037	0.6543	\$146,752	\$96,013	\$0	\$0
2038	0.6412	\$146,752	\$94,093	\$0	\$0
2039	0.6283	\$146,752	\$92,211	\$0	\$0
2040	0.6158	\$146,752	\$90,367	\$0	\$0
NPV		User Benefits	\$2,204,628	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 7

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Median Glare Screen	26050 lf	\$50.00	\$1,302,500.00	\$260,500.00	\$1,625,520.00
Median Glare Str. Mount	3750 lf	\$55.00	\$206,250.00	\$41,250.00	\$257,400.00
Subtotal, Supplemental Roadway Costs			\$1,508,750.00	\$301,750.00	\$1,882,920.00
					\$1,880,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Earthwork Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Pavement Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00
					\$0.00

SUBTOTAL, CONSTRUCTION COSTS			\$1,508,750.00	\$301,750.00	\$1,882,920.00
					\$1,880,000.00

CONSTRUCTION COST ESTIMATE
 Concept 7

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00
Mobilization	1 LS	\$75,437.50	\$15,087.50	\$94,146.00
MPT	1 LS	\$45,262.50	\$9,052.50	\$56,487.60
		\$175,700.00	\$35,140.00	\$219,273.60
				\$220,000.00
TOTAL CONSTRUCTION COSTS		\$1,684,450.00	\$336,890.00	\$2,102,193.60
				\$2,100,000.00
DESIGN AND CM COSTS		\$301,750.00	\$67,378.00	\$420,438.72
				\$420,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM		\$1,810,500.00		\$2,522,632.32
				\$2,520,000.00

Safety
Concept 7

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	1075	358.33	1.00	358.33	0.00

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.00	0.00	0.00	0.00	\$ -

USER BENEFITS
Concept 7

Value of Time

		Cars		Trucks
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

Incidents		112.0 /yr		
Delay Savings (annual)		-12018.2 hrs		
Delay Reduction (daily)		-31.7 hrs		-1.3 hrs
Hourly value of time		\$12.89		\$19.69
Value of Time		-\$408.17		-\$24.62
Total, all vehicles		-\$432.79	Value of travel time changes, per day	
		-\$146,752.11	Value of travel time changes, per year	
Subtotal, Value of Time				

User Benefits

Value of Time		-\$146,752.11	Value of Travel Time change, Per year
Operating Costs		\$0.00	Value of Operating Costs change, per year
Total, User Benefits		-\$146,752.11	

SUMMARY OF COSTS AND BENEFITS
 Concept 11

Construction Cost	
Supplemental Roadway Construction	\$145,000.00
Earthwork	\$14,000.00
Pavement	\$113,000.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$0.00
Signage	\$0.00
Utilities	\$0.00
Additional Lump Sum	\$90,000.00
Design and PM	\$72,000.00
ROW	\$0.00
Minimum Estimated Total	\$434,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	0 hr
Value of Travel Time (Annual)	\$19,689.89
Automobile Operating Costs (Annual)	\$0.00
Safety (Annual)	\$2,426.98
Total	\$22,116.86
Emissions (Annual)	
CO2	kg
NOx	kg
VOC	kg
Benefit:Cost Ratio	
NPV Benefits (Average)	\$332,257.25
NPV Operating Costs	\$0.00
NPV Capital Costs	\$425,713.67
Total Costs	\$425,713.67
Benefit:Cost Ratio	0.78

NET PRESENT VALUE CALCULATIONS

Concept 11

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$434,401.70
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$425,713.67
NPV Capital Costs			\$425,713.67

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224		\$0	\$0	\$0
2021	0.9039	\$22,117	\$19,992	\$0	\$0
2022	0.8858	\$22,117	\$19,592	\$0	\$0
2023	0.8681	\$22,117	\$19,200	\$0	\$0
2024	0.8508	\$22,117	\$18,816	\$0	\$0
2025	0.8337	\$22,117	\$18,440	\$0	\$0
2026	0.8171	\$22,117	\$18,071	\$0	\$0
2027	0.8007	\$22,117	\$17,710	\$0	\$0
2028	0.7847	\$22,117	\$17,355	\$0	\$0
2029	0.7690	\$22,117	\$17,008	\$0	\$0
2030	0.7536	\$22,117	\$16,668	\$0	\$0
2031	0.7386	\$22,117	\$16,335	\$0	\$0
2032	0.7238	\$22,117	\$16,008	\$0	\$0
2033	0.7093	\$22,117	\$15,688	\$0	\$0
2034	0.6951	\$22,117	\$15,374	\$0	\$0
2035	0.6812	\$22,117	\$15,067	\$0	\$0
2036	0.6676	\$22,117	\$14,765	\$0	\$0
2037	0.6543	\$22,117	\$14,470	\$0	\$0
2038	0.6412	\$22,117	\$14,181	\$0	\$0
2039	0.6283	\$22,117	\$13,897	\$0	\$0
2040	0.6158	\$22,117	\$13,619	\$0	\$0
NPV		User Benefits	\$332,257	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 11

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Single Faced Barrier	454 lf	\$60.00	\$27,240.00	\$5,448.00	\$33,995.52
PBD & Geotextile	454 lf	\$11.00	\$4,994.00	\$998.80	\$6,232.51
Drainage	1 ls	\$27,159.00	\$27,159.00	\$5,431.80	\$33,894.43
Lighting	454 lf	\$125.00	\$56,750.00	\$11,350.00	\$70,824.00
Subtotal, Supplemental Roadway Costs			\$116,143.00	\$23,228.60	\$144,946.46
					\$145,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	549 CY	\$20.00	\$10,980.00	\$2,196.00	\$13,703.04
Borrow	0 CY	\$25.00	\$0.00	\$0.00	\$0.00
Subtotal, Earthwork Costs			\$10,980.00	\$2,196.00	\$13,703.04
					\$14,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	823 SY	\$110.00	\$90,530.00	\$18,106.00	\$112,981.44
Subtotal, Pavement Costs			\$90,530.00	\$18,106.00	\$112,981.44
					\$113,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00
					\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 11

SUBTOTAL, CONSTRUCTION COSTS		\$217,653.00	\$43,530.60	\$271,630.94
				\$272,000.00
Additional Lump Sum				
Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00
Mobilization	1 LS	\$10,882.65	\$2,176.53	\$13,581.55
MPT	1 LS	\$6,529.59	\$1,305.92	\$8,148.93
		\$72,412.24	\$14,482.45	\$90,370.48
				\$90,000.00
EACH PULLOFF CONSTRUCTION COSTS		\$290,065.24	\$58,013.05	\$362,001.42
x9				\$362,000.00
DESIGN AND CM COSTS		\$43,530.60	\$11,602.61	\$72,400.28
				\$72,000.00
SUBTOTAL, DESIGN, CONSTRUCTION AND CM		\$261,183.60		\$434,401.70
				\$434,000.00
* Cost of Individual Pulloff zone (9 Total Identified)				x 9
GRAND TOTAL, DESIGN, CONSTRUCTION AND CM		\$2,350,652.40		\$3,909,615.33
				\$3,906,000.00

COMPARISON OF COSTS AND BENEFITS

Concept 11

Option	ROW	RW Cost	NPV Costs	Safety & Delay Benefits	B/C Ratio
EB-3	\$0.00	\$324,000.00	\$743,233.67	\$20,394.50	0.41
EB-5	\$0.00	\$324,000.00	\$743,233.67	\$20,394.50	0.01
EB-6	\$5,510.00	\$432,000.00	\$854,473.47	\$21,099.10	0.37
EB-7	\$1,000.00	\$26,400.00	\$452,565.67	\$22,508.31	0.75
EB-8	\$0.00	\$0.00	\$425,713.67	\$22,860.62	0.81
WB-1	\$65,300.00	\$0.00	\$489,707.67	\$21,451.40	0.66
WB-2	\$33,300.00	\$432,000.00	\$881,707.67	\$21,099.10	0.36
WB-3	\$1,807.00	\$360,000.00	\$780,284.53	\$26,383.64	0.51
WB-6	\$132,253.00	\$0.00	\$555,321.61	\$22,860.61	0.62

*Safety and NPV Calculations at End of PDF

Safety
Concept 11

Safety - EB3

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Rear Ends	2.00	0.67	0.98	0.65	0.01

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.00	0.00	0.00	0.01	\$ 704.61

Safety - EB5

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Rear Ends	2.00	0.67	0.98	0.65	0.01

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.00	0.00	0.00	0.01	\$ 704.61

Safety - EB6

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Rear Ends	4.00	1.33	0.98	1.31	0.03

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.00	0.00	0.01	0.01	\$ 1,409.21

Safety - EB7

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Rear Ends	8.00	2.67	0.98	2.61	0.05

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.00	0.00	0.02	0.03	\$ 2,818.42

Safety - EB8

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Rear Ends	9.00	3.00	0.98	2.94	0.06

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.00	0.01	0.02	0.03	\$ 3,170.73

Safety - WB-1

Crash Type	N _{obs,2010-2012}	N _{obs,frequency}	CMF	N _{pred,CMF}	N _{reduced}
Rear Ends	5.00	1.67	0.98	1.63	0.03

N _{reduced,K}	N _{reduced,A}	N _{reduced,B}	N _{reduced,C}	N _{reduced,O}	Dollars Saved, Annually
0.00	0.00	0.00	0.01	0.02	\$ 1,761.51

Safety - WB-2

Crash Type	N _{obs,2010-2012}	N _{obs,frequency}	CMF	N _{pred,CMF}	N _{reduced}
Rear Ends	4.00	1.33	0.98	1.31	0.03

N _{reduced,K}	N _{reduced,A}	N _{reduced,B}	N _{reduced,C}	N _{reduced,O}	Dollars Saved, Annually
0.00	0.00	0.00	0.01	0.01	\$ 1,409.21

Safety - WB-3

Crash Type	N _{obs,2010-2012}	N _{obs,frequency}	CMF	N _{pred,CMF}	N _{reduced}
Rear Ends	19.00	6.33	0.98	6.21	0.13

N _{reduced,K}	N _{reduced,A}	N _{reduced,B}	N _{reduced,C}	N _{reduced,O}	Dollars Saved, Annually
0.00	0.00	0.01	0.05	0.07	\$ 6,693.75

Safety - WB-6

Crash Type	N _{obs,2010-2012}	N _{obs,frequency}	CMF	N _{pred,CMF}	N _{reduced}
Rear Ends	8.00	2.67	0.98	2.61	0.05

N _{reduced,K}	N _{reduced,A}	N _{reduced,B}	N _{reduced,C}	N _{reduced,O}	Dollars Saved, Annually
0.00	0.00	0.00	0.02	0.03	\$ 3,170.73

Total \$ 21,842.78
 Average \$ 2,426.98

USER BENEFITS
Concept 11

Value of Time - Per Pulloff

		Cars		Trucks
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

Incidents		10.0 /yr		
Delay Savings (annual)		-1612.5 hrs		
Delay Reduction (daily)		-4.3 hrs		-0.2 hrs
Hourly value of time		\$12.89		\$19.69
Value of Time		-\$54.76		-\$3.30
Total, all vehicles		-\$58.07	Value of travel time changes, per day	
		-\$19,689.89	Value of travel time changes, per year	

Subtotal, Value of Time - Per Pulloff

User Benefits

Value of Time		-\$19,689.89	Value of Travel Time change, Per year
Operating Costs		\$0.00	Value of Operating Costs change, per year
Total, User Benefits		-\$19,689.89	

NET PRESENT VALUE CALCULATIONS

EB-3

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$758,401.70
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$743,233.67
NPV Capital Costs			\$743,233.67

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020					
2021	0.9039	\$20,394	\$18,435	\$0	\$0
2022	0.8858	\$20,394	\$18,066	\$0	\$0
2023	0.8681	\$20,394	\$17,705	\$0	\$0
2024	0.8508	\$20,394	\$17,351	\$0	\$0
2025	0.8337	\$20,394	\$17,004	\$0	\$0
2026	0.8171	\$20,394	\$16,664	\$0	\$0
2027	0.8007	\$20,394	\$16,331	\$0	\$0
2028	0.7847	\$20,394	\$16,004	\$0	\$0
2029	0.7690	\$20,394	\$15,684	\$0	\$0
2030	0.7536	\$20,394	\$15,370	\$0	\$0
2031	0.7386	\$20,394	\$15,063	\$0	\$0
2032	0.7238	\$20,394	\$14,761	\$0	\$0
2033	0.7093	\$20,394	\$14,466	\$0	\$0
2034	0.6951	\$20,394	\$14,177	\$0	\$0
2035	0.6812	\$20,394	\$13,893	\$0	\$0
2036	0.6676	\$20,394	\$13,616	\$0	\$0
2037	0.6543	\$20,394	\$13,343	\$0	\$0
2038	0.6412	\$20,394	\$13,076	\$0	\$0
2039	0.6283	\$20,394	\$12,815	\$0	\$0
2040	0.6158	\$20,394	\$12,559	\$0	\$0
NPV		User Benefits	\$306,383	Op Costs	\$0.00

NET PRESENT VALUE CALCULATIONS

EB-5

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$758,401.70
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$743,233.67
NPV Capital Costs			\$743,233.67

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020					
2021	0.9039	\$20,394	\$18,435	\$0	\$0
2022	0.8858	\$20,394	\$18,066	\$0	\$0
2023	0.8681	\$20,394	\$17,705	\$0	\$0
2024	0.8508	\$20,394	\$17,351	\$0	\$0
2025	0.8337	\$20,394	\$17,004	\$0	\$0
2026	0.8171	\$20,394	\$16,664	\$0	\$0
2027	0.8007	\$20,394	\$16,331	\$0	\$0
2028	0.7847	\$20,394	\$16,004	\$0	\$0
2029	0.7690	\$20,394	\$15,684	\$0	\$0
2030	0.7536	\$20,394	\$15,370	\$0	\$0
2031	0.7386	\$20,394	\$15,063	\$0	\$0
2032	0.7238	\$20,394	\$14,761	\$0	\$0
2033	0.7093	\$20,394	\$14,466	\$0	\$0
2034	0.6951	\$20,394	\$14,177	\$0	\$0
2035	0.6812	\$20,394	\$13,893	\$0	\$0
2036	0.6676	\$20,394	\$13,616	\$0	\$0
2037	0.6543	\$20,394	\$13,343	\$0	\$0
2038	0.6412	\$20,394	\$13,076	\$0	\$0
2039	0.6283	\$20,394	\$12,815	\$0	\$0
2040	0.6158	\$20,394	\$12,559	\$0	\$0
NPV		User Benefits	\$306,383	Op Costs	\$0.00

NET PRESENT VALUE CALCULATIONS

EB-6

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$871,911.70
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$854,473.47
NPV Capital Costs			\$854,473.47

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020					
2021	0.9039	\$21,099	\$19,072	\$0	\$0
2022	0.8858	\$21,099	\$18,690	\$0	\$0
2023	0.8681	\$21,099	\$18,317	\$0	\$0
2024	0.8508	\$21,099	\$17,950	\$0	\$0
2025	0.8337	\$21,099	\$17,591	\$0	\$0
2026	0.8171	\$21,099	\$17,239	\$0	\$0
2027	0.8007	\$21,099	\$16,895	\$0	\$0
2028	0.7847	\$21,099	\$16,557	\$0	\$0
2029	0.7690	\$21,099	\$16,226	\$0	\$0
2030	0.7536	\$21,099	\$15,901	\$0	\$0
2031	0.7386	\$21,099	\$15,583	\$0	\$0
2032	0.7238	\$21,099	\$15,271	\$0	\$0
2033	0.7093	\$21,099	\$14,966	\$0	\$0
2034	0.6951	\$21,099	\$14,667	\$0	\$0
2035	0.6812	\$21,099	\$14,373	\$0	\$0
2036	0.6676	\$21,099	\$14,086	\$0	\$0
2037	0.6543	\$21,099	\$13,804	\$0	\$0
2038	0.6412	\$21,099	\$13,528	\$0	\$0
2039	0.6283	\$21,099	\$13,258	\$0	\$0
2040	0.6158	\$21,099	\$12,992	\$0	\$0
NPV		User Benefits	\$316,968	Op Costs	\$0.00

NET PRESENT VALUE CALCULATIONS

EB-7

Capital Costs

Construction Year	2017	
Current Year	2016	
2017 Total Capital Cost		\$461,801.70
Discount Rate	2% for 1 Year	
Discount Factor		0.980
NPV of capital costs		\$452,565.67
NPV Capital Costs		\$452,565.67

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020					
2021	0.9039	\$22,508	\$20,346	\$0	\$0
2022	0.8858	\$22,508	\$19,939	\$0	\$0
2023	0.8681	\$22,508	\$19,540	\$0	\$0
2024	0.8508	\$22,508	\$19,149	\$0	\$0
2025	0.8337	\$22,508	\$18,766	\$0	\$0
2026	0.8171	\$22,508	\$18,391	\$0	\$0
2027	0.8007	\$22,508	\$18,023	\$0	\$0
2028	0.7847	\$22,508	\$17,663	\$0	\$0
2029	0.7690	\$22,508	\$17,309	\$0	\$0
2030	0.7536	\$22,508	\$16,963	\$0	\$0
2031	0.7386	\$22,508	\$16,624	\$0	\$0
2032	0.7238	\$22,508	\$16,291	\$0	\$0
2033	0.7093	\$22,508	\$15,966	\$0	\$0
2034	0.6951	\$22,508	\$15,646	\$0	\$0
2035	0.6812	\$22,508	\$15,333	\$0	\$0
2036	0.6676	\$22,508	\$15,027	\$0	\$0
2037	0.6543	\$22,508	\$14,726	\$0	\$0
2038	0.6412	\$22,508	\$14,432	\$0	\$0
2039	0.6283	\$22,508	\$14,143	\$0	\$0
2040	0.6158	\$22,508	\$13,860	\$0	\$0
NPV		User Benefits	\$338,138	Op Costs	\$0.00

NET PRESENT VALUE CALCULATIONS

EB-8

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$434,401.70
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$425,713.67
NPV Capital Costs			\$425,713.67

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020					
2021	0.9039	\$22,861	\$20,664	\$0	\$0
2022	0.8858	\$22,861	\$20,251	\$0	\$0
2023	0.8681	\$22,861	\$19,846	\$0	\$0
2024	0.8508	\$22,861	\$19,449	\$0	\$0
2025	0.8337	\$22,861	\$19,060	\$0	\$0
2026	0.8171	\$22,861	\$18,679	\$0	\$0
2027	0.8007	\$22,861	\$18,305	\$0	\$0
2028	0.7847	\$22,861	\$17,939	\$0	\$0
2029	0.7690	\$22,861	\$17,580	\$0	\$0
2030	0.7536	\$22,861	\$17,229	\$0	\$0
2031	0.7386	\$22,861	\$16,884	\$0	\$0
2032	0.7238	\$22,861	\$16,546	\$0	\$0
2033	0.7093	\$22,861	\$16,216	\$0	\$0
2034	0.6951	\$22,861	\$15,891	\$0	\$0
2035	0.6812	\$22,861	\$15,573	\$0	\$0
2036	0.6676	\$22,861	\$15,262	\$0	\$0
2037	0.6543	\$22,861	\$14,957	\$0	\$0
2038	0.6412	\$22,861	\$14,658	\$0	\$0
2039	0.6283	\$22,861	\$14,364	\$0	\$0
2040	0.6158	\$22,861	\$14,077	\$0	\$0
NPV		User Benefits	\$343,431	Op Costs	\$0.00

NET PRESENT VALUE CALCULATIONS
WB-1

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$499,701.70
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$489,707.67
NPV Capital Costs			\$489,707.67

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020					
2021	0.9039	\$21,451	\$19,390	\$0	\$0
2022	0.8858	\$21,451	\$19,003	\$0	\$0
2023	0.8681	\$21,451	\$18,623	\$0	\$0
2024	0.8508	\$21,451	\$18,250	\$0	\$0
2025	0.8337	\$21,451	\$17,885	\$0	\$0
2026	0.8171	\$21,451	\$17,527	\$0	\$0
2027	0.8007	\$21,451	\$17,177	\$0	\$0
2028	0.7847	\$21,451	\$16,833	\$0	\$0
2029	0.7690	\$21,451	\$16,497	\$0	\$0
2030	0.7536	\$21,451	\$16,167	\$0	\$0
2031	0.7386	\$21,451	\$15,843	\$0	\$0
2032	0.7238	\$21,451	\$15,526	\$0	\$0
2033	0.7093	\$21,451	\$15,216	\$0	\$0
2034	0.6951	\$21,451	\$14,912	\$0	\$0
2035	0.6812	\$21,451	\$14,613	\$0	\$0
2036	0.6676	\$21,451	\$14,321	\$0	\$0
2037	0.6543	\$21,451	\$14,035	\$0	\$0
2038	0.6412	\$21,451	\$13,754	\$0	\$0
2039	0.6283	\$21,451	\$13,479	\$0	\$0
2040	0.6158	\$21,451	\$13,209	\$0	\$0
NPV		User Benefits	\$322,260	Op Costs	\$0.00

NET PRESENT VALUE CALCULATIONS
WB-2

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$899,701.70
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$881,707.67
NPV Capital Costs			\$881,707.67

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020					
2021	0.9039	\$21,099	\$19,072	\$0	\$0
2022	0.8858	\$21,099	\$18,690	\$0	\$0
2023	0.8681	\$21,099	\$18,317	\$0	\$0
2024	0.8508	\$21,099	\$17,950	\$0	\$0
2025	0.8337	\$21,099	\$17,591	\$0	\$0
2026	0.8171	\$21,099	\$17,239	\$0	\$0
2027	0.8007	\$21,099	\$16,895	\$0	\$0
2028	0.7847	\$21,099	\$16,557	\$0	\$0
2029	0.7690	\$21,099	\$16,226	\$0	\$0
2030	0.7536	\$21,099	\$15,901	\$0	\$0
2031	0.7386	\$21,099	\$15,583	\$0	\$0
2032	0.7238	\$21,099	\$15,271	\$0	\$0
2033	0.7093	\$21,099	\$14,966	\$0	\$0
2034	0.6951	\$21,099	\$14,667	\$0	\$0
2035	0.6812	\$21,099	\$14,373	\$0	\$0
2036	0.6676	\$21,099	\$14,086	\$0	\$0
2037	0.6543	\$21,099	\$13,804	\$0	\$0
2038	0.6412	\$21,099	\$13,528	\$0	\$0
2039	0.6283	\$21,099	\$13,258	\$0	\$0
2040	0.6158	\$21,099	\$12,992	\$0	\$0
NPV		User Benefits	\$316,968	Op Costs	\$0.00

NET PRESENT VALUE CALCULATIONS

WB-3

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$796,208.70
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$780,284.53
NPV Capital Costs			\$780,284.53

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020					
2021	0.9039	\$26,384	\$23,849	\$0	\$0
2022	0.8858	\$26,384	\$23,372	\$0	\$0
2023	0.8681	\$26,384	\$22,904	\$0	\$0
2024	0.8508	\$26,384	\$22,446	\$0	\$0
2025	0.8337	\$26,384	\$21,997	\$0	\$0
2026	0.8171	\$26,384	\$21,557	\$0	\$0
2027	0.8007	\$26,384	\$21,126	\$0	\$0
2028	0.7847	\$26,384	\$20,704	\$0	\$0
2029	0.7690	\$26,384	\$20,290	\$0	\$0
2030	0.7536	\$26,384	\$19,884	\$0	\$0
2031	0.7386	\$26,384	\$19,486	\$0	\$0
2032	0.7238	\$26,384	\$19,096	\$0	\$0
2033	0.7093	\$26,384	\$18,714	\$0	\$0
2034	0.6951	\$26,384	\$18,340	\$0	\$0
2035	0.6812	\$26,384	\$17,973	\$0	\$0
2036	0.6676	\$26,384	\$17,614	\$0	\$0
2037	0.6543	\$26,384	\$17,262	\$0	\$0
2038	0.6412	\$26,384	\$16,916	\$0	\$0
2039	0.6283	\$26,384	\$16,578	\$0	\$0
2040	0.6158	\$26,384	\$16,247	\$0	\$0
NPV		User Benefits	\$396,356	Op Costs	\$0.00

NET PRESENT VALUE CALCULATIONS

WB-6

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$566,654.70
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$555,321.61
NPV Capital Costs			\$555,321.61

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020					
2021	0.9039	\$22,861	\$20,664	\$0	\$0
2022	0.8858	\$22,861	\$20,251	\$0	\$0
2023	0.8681	\$22,861	\$19,846	\$0	\$0
2024	0.8508	\$22,861	\$19,449	\$0	\$0
2025	0.8337	\$22,861	\$19,060	\$0	\$0
2026	0.8171	\$22,861	\$18,679	\$0	\$0
2027	0.8007	\$22,861	\$18,305	\$0	\$0
2028	0.7847	\$22,861	\$17,939	\$0	\$0
2029	0.7690	\$22,861	\$17,580	\$0	\$0
2030	0.7536	\$22,861	\$17,229	\$0	\$0
2031	0.7386	\$22,861	\$16,884	\$0	\$0
2032	0.7238	\$22,861	\$16,546	\$0	\$0
2033	0.7093	\$22,861	\$16,216	\$0	\$0
2034	0.6951	\$22,861	\$15,891	\$0	\$0
2035	0.6812	\$22,861	\$15,573	\$0	\$0
2036	0.6676	\$22,861	\$15,262	\$0	\$0
2037	0.6543	\$22,861	\$14,957	\$0	\$0
2038	0.6412	\$22,861	\$14,658	\$0	\$0
2039	0.6283	\$22,861	\$14,364	\$0	\$0
2040	0.6158	\$22,861	\$14,077	\$0	\$0
NPV		User Benefits	\$343,430	Op Costs	\$0.00

SUMMARY OF COSTS AND BENEFITS
 Concept 14

Construction Cost	
Supplemental Roadway Construction	\$0.00
Earthwork	\$0.00
Pavement	\$0.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$0.00
Signage	\$1,250.00
Utilities	\$0.00
Additional Lump Sum	\$0.00
Design and PM	\$250.00
ROW	\$0.00
Total	\$1,500.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	0 hr
Value of Travel Time (Annual)	\$0.00
Automobile Operating Costs (Annual)	\$0.00
Safety (Annual)	\$5,343.07
Total	\$5,343.07
Emissions (Annual)	
CO2	0 kg
NOx	0 kg
VOC	0 kg
Benefit:Cost Ratio	
NPV Benefits	\$80,267.83
NPV Operating Costs	\$0.00
NPV Capital Costs	\$1,466.18
Total Costs	\$1,466.18
Benefit:Cost Ratio	54.75

NET PRESENT VALUE CALCULATIONS

Concept 14

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$1,496.10
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$1,466.18
NPV Capital Costs			\$1,466.18

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224		\$0	\$0	\$0
2021	0.9039	\$5,343	\$4,830	\$0	\$0
2022	0.8858	\$5,343	\$4,733	\$0	\$0
2023	0.8681	\$5,343	\$4,638	\$0	\$0
2024	0.8508	\$5,343	\$4,546	\$0	\$0
2025	0.8337	\$5,343	\$4,455	\$0	\$0
2026	0.8171	\$5,343	\$4,366	\$0	\$0
2027	0.8007	\$5,343	\$4,278	\$0	\$0
2028	0.7847	\$5,343	\$4,193	\$0	\$0
2029	0.7690	\$5,343	\$4,109	\$0	\$0
2030	0.7536	\$5,343	\$4,027	\$0	\$0
2031	0.7386	\$5,343	\$3,946	\$0	\$0
2032	0.7238	\$5,343	\$3,867	\$0	\$0
2033	0.7093	\$5,343	\$3,790	\$0	\$0
2034	0.6951	\$5,343	\$3,714	\$0	\$0
2035	0.6812	\$5,343	\$3,640	\$0	\$0
2036	0.6676	\$5,343	\$3,567	\$0	\$0
2037	0.6543	\$5,343	\$3,496	\$0	\$0
2038	0.6412	\$5,343	\$3,426	\$0	\$0
2039	0.6283	\$5,343	\$3,357	\$0	\$0
2040	0.6158	\$5,343	\$3,290	\$0	\$0
NPV		User Benefits	\$80,268	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE

Concept 14

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Supplemental Roadway Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Earthwork Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Pavement Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Merge Sign W4-1L	3 ea	\$333.00	\$999.00	\$199.80	\$1,246.75
Subtotal, Signage Costs			\$999.00	\$199.80	\$1,246.75
					\$1,250.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00
					\$0.00

SUBTOTAL, CONSTRUCTION COSTS			\$999.00	\$199.80	\$1,246.75
					\$1,250.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
		\$0.00	\$0.00	\$0.00
				\$0.00

TOTAL CONSTRUCTION COSTS		\$999.00	\$199.80	\$1,246.75
				\$1,250.00

DESIGN AND CM COSTS		\$199.80	\$39.96	\$249.35
				\$250.00

TOTAL, DESIGN, CONSTRUCTION AND CM		\$1,198.80		\$1,496.10
				\$1,500.00

Safety
 Concept 14

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Sideswipe	2	0.67	0.90	0.60	0.07

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually	
0.00	0.00	0.00	0.02	0.04	\$	5,343.07

SUMMARY OF COSTS AND BENEFITS
 Concept 18

Construction Cost	
Supplemental Roadway Construction	\$620,000.00
Earthwork	\$90,000.00
Pavement	\$1,130,000.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$0.00
Signage	\$0.00
Utilities	\$70,000.00
Additional Lump Sum	\$220,000.00
Design and PM	\$430,000.00
ROW	\$200,000.00
Total	\$2,760,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	-379.8695833 hr
Value of Travel Time (Annual)	-\$1,659,769.37
Automobile Operating Costs (Annual)	-\$603,625.57
Safety (Annual)	\$105,948.15
Total	-\$2,157,446.78
Emissions (Annual)	
CO2	1768214 kg
NOx	3316 kg
VOC	4947 kg
Benefit:Cost Ratio	
NPV Benefits	-\$32,410,898.76
NPV Operating Costs	\$0.00
NPV Capital Costs	\$2,706,432.63
Total Costs	\$2,706,432.63
Benefit:Cost Ratio	-11.98

NET PRESENT VALUE CALCULATIONS

Concept 18

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$2,761,665.95
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$2,706,432.63
NPV Capital Costs			\$2,706,432.63

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	-\$2,157,447	-\$1,950,161	\$0	\$0
2022	0.8858	-\$2,157,447	-\$1,911,158	\$0	\$0
2023	0.8681	-\$2,157,447	-\$1,872,935	\$0	\$0
2024	0.8508	-\$2,157,447	-\$1,835,476	\$0	\$0
2025	0.8337	-\$2,157,447	-\$1,798,766	\$0	\$0
2026	0.8171	-\$2,157,447	-\$1,762,791	\$0	\$0
2027	0.8007	-\$2,157,447	-\$1,727,535	\$0	\$0
2028	0.7847	-\$2,157,447	-\$1,692,985	\$0	\$0
2029	0.7690	-\$2,157,447	-\$1,659,125	\$0	\$0
2030	0.7536	-\$2,157,447	-\$1,625,942	\$0	\$0
2031	0.7386	-\$2,157,447	-\$1,593,424	\$0	\$0
2032	0.7238	-\$2,157,447	-\$1,561,555	\$0	\$0
2033	0.7093	-\$2,157,447	-\$1,530,324	\$0	\$0
2034	0.6951	-\$2,157,447	-\$1,499,717	\$0	\$0
2035	0.6812	-\$2,157,447	-\$1,469,723	\$0	\$0
2036	0.6676	-\$2,157,447	-\$1,440,329	\$0	\$0
2037	0.6543	-\$2,157,447	-\$1,411,522	\$0	\$0
2038	0.6412	-\$2,157,447	-\$1,383,292	\$0	\$0
2039	0.6283	-\$2,157,447	-\$1,355,626	\$0	\$0
2040	0.6158	-\$2,157,447	-\$1,328,513	\$0	\$0
NPV		User Benefits	-\$32,410,899	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 18

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
PBD & Geotextile	1861 lf	\$11.00	\$20,471.00	\$4,094.20	\$25,547.81
Drainage	1 ls	\$237,216.00	\$237,216.00	\$47,443.20	\$296,045.57
Lighting	1861 lf	\$125.00	\$232,625.00	\$46,525.00	\$290,316.00
ADA Ramps	16 ea	\$280.00	\$4,480.00	\$896.00	\$5,591.04
Subtotal, Supplemental Roadway Costs			\$494,792.00	\$98,958.40	\$617,500.42
					\$620,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	3672 CY	\$20.00	\$73,440.00	\$14,688.00	\$91,653.12
Borrow	87 CY	\$25.00	\$2,175.00	\$435.00	\$2,714.40
Subtotal, Earthwork Costs			\$75,615.00	\$15,123.00	\$94,367.52
					\$90,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	9981 SY	\$70.00	\$698,670.00	\$139,734.00	\$871,940.16
Sidewalk	618 SY	\$105.00	\$64,890.00	\$12,978.00	\$80,982.72
Island Concrete	1315 SY	\$110.00	\$144,650.00	\$28,930.00	\$180,523.20
Subtotal, Pavement Costs			\$908,210.00	\$181,642.00	\$1,133,446.08
					\$1,130,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Misc. Signage (each)	1 ea	\$2,250.00	\$2,250.00	\$450.00	\$2,808.00
Subtotal, Signage Costs			\$2,250.00	\$450.00	\$2,808.00
					\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 18

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Minor	1 LS	\$53,951.11	\$53,951.11	\$10,790.22	\$67,330.99
Subtotal, Utility Impact			\$53,951.11	\$10,790.22	\$67,330.99
					\$70,000.00

SUBTOTAL, CONSTRUCTION COSTS			\$1,534,818.11	\$306,963.62	\$1,915,453.00
					\$1,910,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost	
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00	
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00	
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00	
Mobilization	1 LS	\$76,740.91	\$15,348.18	\$95,772.65	
MPT	1 LS	\$46,044.54	\$9,208.91	\$57,463.59	
			\$177,785.45	\$35,557.09	\$221,876.24
					\$220,000.00

TOTAL CONSTRUCTION COSTS			\$1,712,603.56	\$342,520.71	\$2,137,329.24
					\$2,130,000.00
DESIGN AND CM COSTS			\$306,963.62	\$68,504.14	\$427,465.85
					\$430,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM			\$1,841,781.73		\$2,564,795.09
					\$2,560,000.00

Safety
 Concept 18

Safety

Crash Type	$N_{pred,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	11	3.65	0.52	1.90	1.75

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.04	0.18	0.58	0.94	\$ 105,948.15

USER BENEFITS
Concept 18

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:PM Veh-Hrs
No-build	0	0	18.049
Build	0	0	30.724
Change	0	0	12.675
Subtotal, MOEs			

Improvement only during peak period? Yes

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	12.675 hrs	0.00 hrs
PM Peak Period	113.948 hrs	0.00 hrs
Total of Peaks	126.623 hrs	0.000 hrs
Daily Estimate	379.870 hrs	0.000 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	\$4,894.85	\$0.00

Total, all vehicles \$4,894.85 Value of travel time changes, per day
\$1,659,769.37 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars	Trucks
AM Peak Period		
Average Speed	25	
Change in Veh-Hrs	12.675 hours	0.000 hours
Fuel Consumption	0.026 gal/minute	0.133 gal/minute
	19.8 gallons	0.0 gallons

USER BENEFITS
Concept 18

PM Peak Period

Average Speed	25		
Change in Veh-Hrs		113.9 hours	0.0 hours
Fuel Consumption		0.026 gal/minute	0.133 gal/minute
		<hr/> 177.8 gallons	<hr/> 0.0 gallons

Fuel Consumption

AM Peak Period		19.8 gallons	0.0 gallons
PM Peak Period		177.8 gallons	0.0 gallons
Total of Peaks		<hr/> 197.5 gallons	<hr/> 0.0 gallons
Daily Estimate		<hr/> 592.597 gallons	<hr/> 0.000 gallons
		\$3.004 per gallon	\$3.004 per gallon
		\$1,780.16 per day	\$0.00 per day

Total, all vehicles

592.6 fuel consumption change, gallons per day
 200,940.60 fuel consumption change, gallons per year

 \$1,780.16 change in fuel cost, per day
 \$603,625.57 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	\$1,659,769.37	Value of Travel Time change, Per year
Operating Costs	\$603,625.57	Value of Operating Costs change, per year
Total, User Benefits	\$2,263,394.93	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	592.597 gallons	0.000 gallons
Annual estimate	200940.601 gallons	0.000
CO	19.4 lb/gal 8799.6848 grams/gal	22.2 lb/gal 10069.7424 grams/gal
	1,768,213,953.70 g	- g
Total	1,768,213,953.70	6

USER BENEFITS
Concept 18

VOC	24.62 grams/gal	1.27 grams/gal	
	4,946,966.23 g		-
Total	4,946,966.23 g		
NOx	16.5 grams/gal	24.52 grams/gal	
	3,315,519.92 g		-
Total	3,315,519.92 g		
PM2.5	0.09761905 grams/gal	0.136 grams/gal	
	19,615.63 g		-
Total	19,615.63 g		



SUMMARY OF COSTS AND BENEFITS
 Concept 21

Construction Cost	
Supplemental Roadway Construction	\$500,000.00
Earthwork	\$300,000.00
Pavement	\$500,000.00
Walls	\$6,500,000.00
Bridges	\$0.00
Traffic Signals	\$0.00
Signage	\$200,000.00
Utilities	\$200,000.00
Additional Lump Sum	\$700,000.00
Design and PM	\$1,800,000.00
ROW	\$0.00
Total	\$10,700,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	1147 hr
Value of Travel Time (Annual)	\$5,062,699.98
Automobile Operating Costs (Annual)	\$1,646,700.54
Safety (Annual)	\$338,318.21
Total	\$7,047,718.73
Emissions (Annual)	
CO2	-4879694 kg
NOx	-9398 kg
VOC	-12466 kg
Benefit:Cost Ratio	
NPV Benefits	\$105,876,492.59
NPV Operating Costs	\$0.00
NPV Capital Costs	\$10,603,500.68
Total Costs	\$10,603,500.68
Benefit:Cost Ratio	9.99

NET PRESENT VALUE CALCULATIONS

Concept 21

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$10,819,898.65
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$10,603,500.68
NPV Capital Costs			\$10,603,500.68

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224		\$0	\$0	\$0
2021	0.9039	\$7,047,719	\$6,370,580	\$0	\$0
2022	0.8858	\$7,047,719	\$6,243,168	\$0	\$0
2023	0.8681	\$7,047,719	\$6,118,305	\$0	\$0
2024	0.8508	\$7,047,719	\$5,995,938	\$0	\$0
2025	0.8337	\$7,047,719	\$5,876,020	\$0	\$0
2026	0.8171	\$7,047,719	\$5,758,499	\$0	\$0
2027	0.8007	\$7,047,719	\$5,643,329	\$0	\$0
2028	0.7847	\$7,047,719	\$5,530,463	\$0	\$0
2029	0.7690	\$7,047,719	\$5,419,853	\$0	\$0
2030	0.7536	\$7,047,719	\$5,311,456	\$0	\$0
2031	0.7386	\$7,047,719	\$5,205,227	\$0	\$0
2032	0.7238	\$7,047,719	\$5,101,123	\$0	\$0
2033	0.7093	\$7,047,719	\$4,999,100	\$0	\$0
2034	0.6951	\$7,047,719	\$4,899,118	\$0	\$0
2035	0.6812	\$7,047,719	\$4,801,136	\$0	\$0
2036	0.6676	\$7,047,719	\$4,705,113	\$0	\$0
2037	0.6543	\$7,047,719	\$4,611,011	\$0	\$0
2038	0.6412	\$7,047,719	\$4,518,791	\$0	\$0
2039	0.6283	\$7,047,719	\$4,428,415	\$0	\$0
2040	0.6158	\$7,047,719	\$4,339,847	\$0	\$0
NPV		User Benefits	\$105,876,493	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
Concept 21

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Single Faced Barrier	1500 lf	\$60.00	\$90,000.00	\$18,000.00	\$112,320.00
PBD & Geotextile	1500 lf	\$11.00	\$16,500.00	\$3,300.00	\$20,592.00
Drainage	1500 lf	\$81.46	\$122,186.33	\$24,437.27	\$152,488.54
Lighting	1500 lf	\$125.00	\$187,500.00	\$37,500.00	\$234,000.00
Subtotal, Supplemental Roadway Costs			\$416,186.33	\$83,237.27	\$519,400.54
					\$500,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	1122 CY	\$20.00	\$22,440.00	\$4,488.00	\$28,005.12
Borrow	8670 CY	\$25.00	\$216,750.00	\$43,350.00	\$270,504.00
Subtotal, Earthwork Costs			\$239,190.00	\$47,838.00	\$298,509.12
					\$300,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	3703 SY	\$110.00	\$407,330.00	\$81,466.00	\$508,347.84
Subtotal, Pavement Costs			\$407,330.00	\$81,466.00	\$508,347.84
					\$500,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Retaining Wall	1600 lf	\$1,374.60	\$2,199,360.00	\$439,872.00	\$2,744,801.28
Sound Wall	2427 lf	\$1,250.00	\$3,033,750.00	\$606,750.00	\$3,786,120.00
Subtotal, Wall Costs			\$5,233,110.00	\$1,046,622.00	\$6,530,921.28
					\$6,500,000.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
ITS Relocation	1 ls	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00
Subtotal, Signage Costs			\$200,000.00	\$40,000.00	\$249,600.00
					\$200,000.00

CONSTRUCTION COST ESTIMATE
 Concept 21

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Minor	1 LS	\$129,916.33	\$129,916.33	\$25,983.27	\$162,135.58
Subtotal, Utility Impact			\$129,916.33	\$25,983.27	\$162,135.58
					\$200,000.00

SUBTOTAL, CONSTRUCTION COSTS			\$6,625,732.66	\$1,325,146.53	\$8,268,914.36
					\$8,200,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost	
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00	
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00	
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00	
Mobilization	1 LS	\$331,286.63	\$66,257.33	\$413,445.72	
MPT	1 LS	\$198,771.98	\$39,754.40	\$248,067.43	
			\$585,058.61	\$117,011.72	\$730,153.15
					\$700,000.00

TOTAL CONSTRUCTION COSTS			\$7,210,791.27	\$1,442,158.25	\$8,999,067.51
					\$8,900,000.00
DESIGN AND CM COSTS			\$1,325,146.53	\$288,431.65	\$1,799,813.50
					\$1,800,000.00
TOTAL, DESIGN, CONSTRUCTION AND C			\$7,950,879.19		\$10,798,881.01
					\$10,700,000.00

ROW COSTS
 Concept 21

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
0011-K-00340-0009-00	\$207,000.00	\$0.00	338,897	8,790	No	3%	\$5,368.69
0029-L-00013-0000-00	\$1,700.00	\$0.00	1,196	726	No	61%	\$1,032.59
0029-L-00052-0000-00	\$12,800.00	\$0.00	6,396	1,426	No	22%	\$2,854.52
0029-M-00160-0000-00	\$330,600.00	\$44,400.00	130,680	4,649	No	4%	\$11,761.84
Subtotal, ROW Costs							\$21,017.64
							\$0.00

USER BENEFITS
Concept 21

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:PM Veh-Hrs	
No-build	248236	265184	7994	8548
Build	248632	276286	8268	7126
Change	396	11103	274	-1422
Subtotal, MOEs				

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	260.209 hrs	14.19 hrs
PM Peak Period	-1386.446 hrs	-35.43 hrs
Total of Peaks	-1126.237 hrs	-21.239 hrs
Daily Estimate	-1126.237 hrs	-21.239 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$14,512.25	-\$418.23

Total, all vehicles
-\$14,930.47 Value of travel time changes, per day
-\$5,062,699.98 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars	Trucks
AM Peak Period		
Average Speed	20	
Change in Veh-Hrs	260.209 hours	14.191 hours
Fuel Consumption	0.022 gal/minute	0.102 gal/minute
	343.5 gallons	86.9 gallons

USER BENEFITS

Concept 21

PM Peak Period

Average Speed	20		
Change in Veh-Hrs		-1386.4 hours	-35.4 hours
Fuel Consumption		0.022 gal/minute	0.102 gal/minute
		-1830.1 gallons	-216.8 gallons

Fuel Consumption

AM Peak Period		343.5 gallons	86.9 gallons
PM Peak Period		-1830.1 gallons	-216.8 gallons
Total of Peaks		-1486.6 gallons	-130.0 gallons
Daily Estimate		-1486.633 gallons	-129.980 gallons
		\$3.004 per gallon	\$3.004 per gallon
		-\$4,465.85 per day	-\$390.46 per day

Total, all vehicles

	-1616.6 fuel consumption change, gallons per day
	-548169.3 fuel consumption change, gallons per year
	-\$4,856.31 change in fuel cost, per day
	-\$1,646,700.54 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$5,062,699.98	Value of Travel Time change, Per year
Operating Costs	-\$1,646,700.54	Value of Operating Costs change, per year
Total, User Benefits	-\$6,709,400.52	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-1486.633 gallons	-129.980 gallons
Annual estimate	-504095.113 gallons	-44074.176 gallons
CO2	19.4 lb/gal	22.2 lb/gal
	8799.6848 grams/gal	10069.7424 grams/gal
	(4,435,878,099.34) g	(443,815,596.51) g
Total	(4,879,693.70) kg	
VOC		
	24.62 grams/gal	1.27 grams/gal

USER BENEFITS

Concept 21

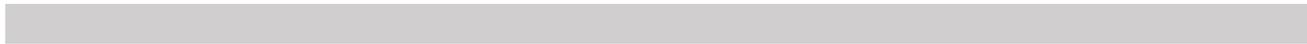
Total	(12,410,341.58) g (12,466.32) kg	(55,974.20) g
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NOx

	16.5 grams/gal (8,317,569.36) g	24.52 grams/gal (1,080,698.79) g
Total	(9,398.27) kg	

PM2.5

	0.09761905 grams/gal (49,209.28) g	0.136 grams/gal (5,994.09) g
Total	(55.20) kg	



Safety
 Concept 21

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	28	9.33	0.40	3.73	5.60

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually	
0.02	0.12	0.58	1.86	3.02	\$	338,318.21

SUMMARY OF COSTS AND BENEFITS
 Concept 23

Construction Cost	
Supplemental Roadway Construction	\$1,500,000.00
Earthwork	\$200,000.00
Pavement	\$900,000.00
Walls	\$27,600,000.00
Bridges	\$21,200,000.00
Traffic Signals	\$0.00
Signage	\$1,400,000.00
Utilities	\$1,600,000.00
Additional Lump Sum	\$4,400,000.00
Design and PM	\$11,800,000.00
ROW	\$0.00
Total	\$70,600,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	0 hr
Value of Travel Time (Annual)	\$33,562.31
Automobile Operating Costs (Annual)	\$0.00
Safety (Annual)	\$81,692.04
Total	\$115,254.35
Emissions (Annual)	
CO2	0 kg
NOx	0 kg
VOC	0 kg
Benefit:Cost Ratio	
NPV Benefits	\$1,731,443.46
NPV Operating Costs	\$0.00
NPV Capital Costs	\$69,188,000.00
Total Costs	\$69,188,000.00
Benefit:Cost Ratio	0.03

NET PRESENT VALUE CALCULATIONS

Concept 23

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$70,600,000.00
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$69,188,000.00
NPV Capital Costs			\$69,188,000.00

	0
Annual Costs and Benefits	0

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224		\$0	\$0	\$0
2021	0.9039	\$115,254	\$104,181	\$0	\$0
2022	0.8858	\$115,254	\$102,097	\$0	\$0
2023	0.8681	\$115,254	\$100,055	\$0	\$0
2024	0.8508	\$115,254	\$98,054	\$0	\$0
2025	0.8337	\$115,254	\$96,093	\$0	\$0
2026	0.8171	\$115,254	\$94,171	\$0	\$0
2027	0.8007	\$115,254	\$92,288	\$0	\$0
2028	0.7847	\$115,254	\$90,442	\$0	\$0
2029	0.7690	\$115,254	\$88,633	\$0	\$0
2030	0.7536	\$115,254	\$86,861	\$0	\$0
2031	0.7386	\$115,254	\$85,123	\$0	\$0
2032	0.7238	\$115,254	\$83,421	\$0	\$0
2033	0.7093	\$115,254	\$81,752	\$0	\$0
2034	0.6951	\$115,254	\$80,117	\$0	\$0
2035	0.6812	\$115,254	\$78,515	\$0	\$0
2036	0.6676	\$115,254	\$76,945	\$0	\$0
2037	0.6543	\$115,254	\$75,406	\$0	\$0
2038	0.6412	\$115,254	\$73,898	\$0	\$0
2039	0.6283	\$115,254	\$72,420	\$0	\$0
2040	0.6158	\$115,254	\$70,971	\$0	\$0
NPV		User Benefits	\$1,731,443	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
Concept 23

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Single Faced Barrier	5000 lf	\$60.00	\$300,000.00	\$60,000.00	\$374,400.00
PBD & Geotextile	5000 lf	\$11.00	\$55,000.00	\$11,000.00	\$68,640.00
Drainage	5000 lf	\$44.42	\$222,100.60	\$44,420.12	\$277,181.55
Lighting	5000 lf	\$125.00	\$625,000.00	\$125,000.00	\$780,000.00
Subtotal, Supplemental Roadway Costs			\$1,202,100.60	\$240,420.12	\$1,500,221.55
					\$1,500,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	0 CY	\$20.00	\$0.00	\$0.00	\$0.00
Borrow	6098 CY	\$25.00	\$152,450.00	\$30,490.00	\$190,257.60
Subtotal, Earthwork Costs			\$152,450.00	\$30,490.00	\$190,257.60
					\$200,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	6730 SY	\$110.00	\$740,300.00	\$148,060.00	\$923,894.40
Subtotal, Pavement Costs			\$740,300.00	\$148,060.00	\$923,894.40
					\$900,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Retaining Wall	3600 lf	\$4,746.24	\$17,086,464.00	\$3,417,292.80	\$21,323,907.07
Sound Wall	4027 lf	\$1,250.00	\$5,033,750.00	\$1,006,750.00	\$6,282,120.00
Subtotal, Wall Costs			\$22,120,214.00	\$4,424,042.80	\$27,606,027.07
					\$27,600,000.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Widening STA 730-735 (Over 2nd Ave)	1250 lf	\$11,250.00	\$14,062,500.00	\$2,812,500.00	\$17,550,000.00
Widening STA 770 (Over Bates St)	260 lf	\$11,250.00	\$2,925,000.00	\$585,000.00	\$3,650,400.00
Subtotal, Bridge Cost			\$16,987,500.00	\$3,397,500.00	\$21,200,400.00
					\$21,200,000.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
OH Truss 6 lanes	3 ea	\$200,000.00	\$600,000.00	\$120,000.00	\$748,800.00
ITS Relocation	1 ls	\$500,000.00	\$500,000.00	\$100,000.00	\$624,000.00
Subtotal, Signage Costs			\$1,100,000.00	\$220,000.00	\$1,372,800.00
					\$1,400,000.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
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CONSTRUCTION COST ESTIMATE
 Concept 23

Moderate	1 LS	\$1,269,076.94	\$1,269,076.94	\$253,815.39	\$1,583,808.02
Subtotal, Utility Impact			\$1,269,076.94	\$253,815.39	\$1,583,808.02
					\$1,600,000.00
SUBTOTAL, CONSTRUCTION COSTS			\$43,571,641.54	\$8,714,328.31	\$54,377,408.64
					\$54,400,000.00
Additional Lump Sum					
Item	Quantity		2016 Cost	Contingency	2017 Cost
Survey	1 LS		\$30,000.00	\$6,000.00	\$37,440.00
Field Office	1 LS		\$20,000.00	\$4,000.00	\$24,960.00
Const. Scheduling	1 LS		\$5,000.00	\$1,000.00	\$6,240.00
Mobilization	1 LS		\$2,178,582.08	\$435,716.42	\$2,718,870.43
MPT	1 LS		\$1,307,149.25	\$261,429.85	\$1,631,322.26
			\$3,540,731.32	\$708,146.26	\$4,418,832.69
					\$4,400,000.00
TOTAL CONSTRUCTION COSTS			\$47,112,372.86	\$9,422,474.57	\$58,796,241.33
					\$58,800,000.00
DESIGN AND CM COSTS			\$8,714,328.31	\$1,884,494.91	\$11,759,248.27
					\$11,800,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM			\$52,285,969.85		\$70,555,489.60
					\$70,600,000.00

SIGNAGE UNIT COSTS
 Concept 23

ITS Relocation

Item	Quantity	Units	Unit Cost	Cost
ITS Relocation	1	ls	\$200,000.00 sf	\$200,000.00
Type B Signage		sf	\$13,018.97 ea	\$0.00
Type B Signage		sf	\$13,018.97 ea	\$0.00
Type B Signage		sf	\$13,018.97 ea	\$0.00
Type B Signage		sf	\$13,018.97 lf	\$0.00
Type B Signage		sf	\$13,018.97 lf	\$0.00
Type B Signage		sf	\$13,018.97 lf	\$0.00
Type B Signage		sf	\$13,018.97 ea	\$0.00
Type B Signage		sf	\$13,018.97 ea	\$0.00
Type B Signage		sf	\$13,018.97 ea	\$0.00
Type B Signage		sf	\$13,018.97 ea	\$0.00
Type B Signage		sf	\$13,018.97 ea	\$0.00
Type B Signage		sf	\$13,018.97 ea	\$0.00
Type B Signage		sf	\$13,018.97 ea	\$0.00
Type B Signage		sf	\$13,018.97 ea	\$0.00
Type B Signage		sf	\$13,018.97 ea	\$0.00
Type B Signage		sf	\$13,018.97 ea	\$0.00
Type B Signage		sf	\$13,018.97 ea	\$0.00
Subtotal ITS Relocation				\$200,000.00

ROW COSTS
 Concept 23

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
0029-F-00007-0000-00	\$2,700.00	\$0.00	1,906	351	No	18%	\$500.00
0011-K-00340-0009-00	\$207,000.00	\$0.00	338,897	21,150	No	6%	\$12,918.50
0011-S-00056-0000-00	\$200.00	\$0.00	250	206	No	83%	\$500.00
0028-N-00303-0000-00	\$500.00	\$0.00	384	384	Yes	100%	\$500.00
0028-N-00290-0000-00	\$300.00	\$0.00	231	158	No	68%	\$500.00
0028-N-00286-0000-00	\$300.00	\$0.00	264	197	No	75%	\$500.00
0028-N-00285-0000-00	\$300.00	\$0.00	264	202	No	76%	\$500.00
0028-N-00284-0000-00	\$300.00	\$0.00	264	201	No	76%	\$500.00
0028-N-00282-0000-00	\$1,100.00	\$0.00	888	659	No	74%	\$816.82
0028-N-00278-0000-00	\$1,800.00	\$0.00	1,512	993	No	66%	\$1,181.96
Subtotal, ROW Costs							\$18,417.28
							\$0.00

Safety
 Concept 23

Safety

Crash Type	N _{obs,2010-2012}	N _{obs,frequency}	CMF	N _{pred,CMF}	N _{reduced}
Fatal & Injury	13	4.33	0.79	3.42	0.91
PDO	2	0.67	0.50	0.33	0.33

N _{reduced,K}	N _{reduced,A}	N _{reduced,B}	N _{reduced,C}	N _{reduced,O}	Dollars Saved, Annually
0.00	0.02	0.09	0.30	0.49	\$ 54,976.71
0.00	0.00	0.02	0.08	0.22	\$ 26,715.33

Total: \$ 81,692.04

USER BENEFITS
Concept 23

Value of Time

		Cars		Trucks
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

Incidents		17.0 /yr		
Delay Savings (annual)		-2748.6 hrs		
Delay Reduction (daily)		-7.2 hrs		-0.3 hrs
Hourly value of time		\$12.89		\$19.69
Value of Time		-\$93.35		-\$5.63
Total, all vehicles		-\$98.98	Value of travel time changes, per day	
		-\$33,562.31	Value of travel time changes, per year	

Subtotal, Value of Time

User Benefits

Value of Time	-\$33,562.31	Value of Travel Time change, Per year
Operating Costs	\$0.00	Value of Operating Costs change, per year
Total, User Benefits	-\$33,562.31	

SUMMARY OF COSTS AND BENEFITS
 Concept 26

Construction Cost	
Supplemental Roadway Construction	\$340,000.00
Earthwork	\$220,000.00
Pavement	\$990,000.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$0.00
Signage	\$0.00
Utilities	\$80,000.00
Additional Lump Sum	\$200,000.00
Design and PM	\$370,000.00
ROW	\$1,610,000.00
Total	\$3,810,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	550 hr
Value of Travel Time (Annual)	\$2,485,545.74
Automobile Operating Costs (Annual)	\$865,399.19
Safety (Annual)	\$2,140.63
Total	\$3,353,085.56
Emissions (Annual)	
CO2	-2608877 kg
NOx	-5220 kg
VOC	-5735 kg
Benefit:Cost Ratio	
NPV Benefits	\$50,372,744.97
NPV Operating Costs	\$0.00
NPV Capital Costs	\$3,737,359.13
Total Costs	\$3,737,359.13
Benefit:Cost Ratio	13.48

NET PRESENT VALUE CALCULATIONS

Concept 26

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$3,813,631.76
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$3,737,359.13
NPV Capital Costs			\$3,737,359.13

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$3,353,086	\$3,030,924	\$0	\$0
2022	0.8858	\$3,353,086	\$2,970,305	\$0	\$0
2023	0.8681	\$3,353,086	\$2,910,899	\$0	\$0
2024	0.8508	\$3,353,086	\$2,852,681	\$0	\$0
2025	0.8337	\$3,353,086	\$2,795,628	\$0	\$0
2026	0.8171	\$3,353,086	\$2,739,715	\$0	\$0
2027	0.8007	\$3,353,086	\$2,684,921	\$0	\$0
2028	0.7847	\$3,353,086	\$2,631,222	\$0	\$0
2029	0.7690	\$3,353,086	\$2,578,598	\$0	\$0
2030	0.7536	\$3,353,086	\$2,527,026	\$0	\$0
2031	0.7386	\$3,353,086	\$2,476,485	\$0	\$0
2032	0.7238	\$3,353,086	\$2,426,956	\$0	\$0
2033	0.7093	\$3,353,086	\$2,378,417	\$0	\$0
2034	0.6951	\$3,353,086	\$2,330,848	\$0	\$0
2035	0.6812	\$3,353,086	\$2,284,231	\$0	\$0
2036	0.6676	\$3,353,086	\$2,238,547	\$0	\$0
2037	0.6543	\$3,353,086	\$2,193,776	\$0	\$0
2038	0.6412	\$3,353,086	\$2,149,900	\$0	\$0
2039	0.6283	\$3,353,086	\$2,106,902	\$0	\$0
2040	0.6158	\$3,353,086	\$2,064,764	\$0	\$0
NPV		User Benefits	\$50,372,745	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 26

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
PBD & Geotextile	888 lf	\$11.00	\$9,768.00	\$1,953.60	\$12,190.46
Drainage	1 ls	\$151,140.00	\$151,140.00	\$30,228.00	\$188,622.72
Lighting	888 lf	\$125.00	\$111,000.00	\$22,200.00	\$138,528.00
ADA Ramps	12 ea	\$280.00	\$3,360.00	\$672.00	\$4,193.28
Subtotal, Supplemental Roadway Costs			\$275,268.00	\$55,053.60	\$343,534.46
					\$340,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	8764 CY	\$20.00	\$175,280.00	\$35,056.00	\$218,749.44
Borrow	0 CY	\$25.00	\$0.00	\$0.00	\$0.00
Subtotal, Earthwork Costs			\$175,280.00	\$35,056.00	\$218,749.44
					\$220,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	5905 SY	\$110.00	\$649,550.00	\$129,910.00	\$810,638.40
Sidewalk	458 SY	\$105.00	\$48,090.00	\$9,618.00	\$60,016.32
Island Concrete	866 SY	\$110.00	\$95,260.00	\$19,052.00	\$118,884.48
Subtotal, Pavement Costs			\$792,900.00	\$158,580.00	\$989,539.20
					\$990,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Retaining Wall	lf	\$0.00	\$0.00	\$0.00	\$0.00
Sound Wall	lf	\$0.00	\$0.00	\$0.00	\$0.00
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 26

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Misc. Signage (each)	1 ea	\$2,250.00	\$2,250.00	\$450.00	\$2,808.00
Subtotal, Signage Costs			\$2,250.00	\$450.00	\$2,808.00
					\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Moderate	1 LS	\$66,935.40	\$66,935.40	\$13,387.08	\$83,535.38
Subtotal, Utility Impact			\$66,935.40	\$13,387.08	\$83,535.38
					\$80,000.00

SUBTOTAL, CONSTRUCTION COSTS			\$1,312,633.40	\$262,526.68	\$1,638,166.48
					\$1,630,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost	
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00	
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00	
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00	
Mobilization	1 LS	\$65,631.67	\$13,126.33	\$81,908.32	
MPT	1 LS	\$39,379.00	\$7,875.80	\$49,144.99	
			\$160,010.67	\$32,002.13	\$199,693.32
					\$200,000.00

TOTAL CONSTRUCTION COSTS			\$1,472,644.07	\$294,528.81	\$1,837,859.80
					\$1,830,000.00

DESIGN AND CM COSTS			\$262,526.68	\$58,905.76	\$367,571.96
					\$370,000.00

TOTAL, DESIGN, CONSTRUCTION AND CM			\$1,575,160.08		\$2,205,431.76
					\$2,200,000.00

SIGNAGE UNIT COSTS
 Concept 26

Misc. Signage (each)

Item	Quantity	Units	Unit Cost	Cost/lf
Type B Signage	9	sf	\$250.00 sf	\$2,250.00
Subtotal Misc. Signage (each)				\$2,250.00

ITS Relocation

Item	Quantity	Units	Unit Cost	Cost
ITS Relocation	1	ls	\$200,000.00 ls	\$200,000.00
Subtotal ITS Relocation				\$200,000.00

ROW COSTS
 Concept 26

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
87-P-101		\$169,200.00	4,900		Y	100%	\$169,200.00
87-P-100		\$125,500.00	3,675		Y	100%	\$125,500.00
87-P-99		\$133,900.00	3,677		Y	100%	\$133,900.00
87-P-98		\$149,600.00	3,675		Y	100%	\$149,600.00
87-P-97		\$149,300.00	3675		Y	100%	\$149,300.00
87-P-96		\$176,700.00	4900		Y	100%	\$176,700.00
87-9-94		\$88,400.00	4890		Y	100%	\$88,400.00
87-P-92		\$117,600.00	3294		Y	100%	\$117,600.00
87-P-91		\$76,700.00	3294		Y	100%	\$76,700.00
87-P-90		\$121,400.00	3066		Y	100%	\$121,400.00
87-P-89		\$143,300.00	4880		Y	100%	\$143,300.00
87-P-87		\$156,600.00	4850		Y	100%	\$156,600.00
Subtotal, ROW Costs							\$1,608,200.00
							\$1,610,000.00

Safety
 Concept 26

Safety

Crash Type	$N_{pred,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	1	0.30	0.88	0.26	0.04

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.00	0.00	0.01	0.02	\$ 2,140.63

USER BENEFITS
Concept 26

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:PM Veh-Hrs
No-build	0	0	38.125 178
Build	0	0	11.630 24
Change	0	0	-26.495 -154
Subtotal, MOEs			

Improvement only during peak period? Yes

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	-25.125 hrs	-1.37 hrs
PM Peak Period	-146.118 hrs	-7.97 hrs
Total of Peaks	-171.242 hrs	-9.339 hrs
Daily Estimate	-513.727 hrs	-36.079 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$6,619.68	-\$710.47

Total, all vehicles
-\$7,330.16 Value of travel time changes, per day
-\$2,485,545.74 Value of travel time changes, per year

Subtotal, Value of Time

USER BENEFITS
Concept 26

Automobile Operating Costs (Delay)

	Cars	Trucks
AM Peak Period		
Average Speed	20	
Change in Veh-Hrs	-25.125 hours	-1.370 hours
Fuel Consumption	0.022 gal/minute	0.102 gal/minute
	-33.2 gallons	-8.4 gallons
PM Peak Period		
Average Speed	20	
Change in Veh-Hrs	-146.1 hours	-8.0 hours
Fuel Consumption	0.022 gal/minute	0.102 gal/minute
	-192.9 gallons	-48.8 gallons
Fuel Consumption		
AM Peak Period	-33.2 gallons	-8.4 gallons
PM Peak Period	-192.9 gallons	-48.8 gallons
Total of Peaks	-226.0 gallons	-57.2 gallons
Daily Estimate	-678.120 gallons	-171.467 gallons
	\$3.004 per gallon	\$3.004 per gallon
	-\$2,037.07 per day	-\$515.09 per day
Total, all vehicles		
	-849.6 fuel consumption change, gallons per day	
	(288,082.29) fuel consumption change, gallons per year	
	-\$2,552.16 change in fuel cost, per day	
	-\$865,399.19 change in fuel cost, per year	

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	- \$2,485,545.74	Value of Travel Time change, Per year
Operating Costs	- \$865,399.19	Value of Operating Costs change, per year
Total, User Benefits	- \$3,350,944.93	

USER BENEFITS
 Concept 26

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-678.120 gallons	-171.467 gallons
Annual estimate	-229940.343 gallons	-58141.944
CO	19.4 lb/gal 8799.6848 grams/gal (2,023,402,537.64) g	22.2 lb/gal 10069.7424 grams/gal (585,474,394.12) g
Total	(2,608,876,931.75)	6
VOC	24.62 grams/gal (5,660,912.24) g	1.27 grams/gal (73,840.27)
Total	(5,734,752.51) g	
NOx	16.5 grams/gal (3,794,015.65) g	24.52 grams/gal (1,425,640.46)
Total	(5,219,656.11) g	
PM2.5	0.09761905 grams/gal (22,446.56) g	0.136 grams/gal (7,907.30)
Total	(30,353.86) g	

SUMMARY OF COSTS AND BENEFITS
 Concept 27

Construction Cost	
Supplemental Roadway Construction	\$370,000.00
Earthwork	\$70,000.00
Pavement	\$700,000.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$0.00
Signage	\$0.00
Utilities	\$90,000.00
Additional Lump Sum	\$170,000.00
Design and PM	\$280,000.00
ROW	\$560,000.00
Total	\$2,240,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	7 hr
Value of Travel Time (Annual)	\$32,737.18
Automobile Operating Costs (Annual)	\$13,751.48
Safety (Annual)	\$57,250.29
Total	\$103,738.95
Emissions (Annual)	
CO2	-41551 kg
NOx	-84 kg
VOC	-89 kg
Benefit:Cost Ratio	
NPV Benefits	\$1,558,449.82
NPV Operating Costs	\$0.00
NPV Capital Costs	\$2,186,529.71
Total Costs	\$2,186,529.71
Benefit:Cost Ratio	0.71

NET PRESENT VALUE CALCULATIONS

Concept 27

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$2,231,152.77
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$2,186,529.71
NPV Capital Costs			\$2,186,529.71

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$103,739	\$93,772	\$0	\$0
2022	0.8858	\$103,739	\$91,896	\$0	\$0
2023	0.8681	\$103,739	\$90,058	\$0	\$0
2024	0.8508	\$103,739	\$88,257	\$0	\$0
2025	0.8337	\$103,739	\$86,492	\$0	\$0
2026	0.8171	\$103,739	\$84,762	\$0	\$0
2027	0.8007	\$103,739	\$83,067	\$0	\$0
2028	0.7847	\$103,739	\$81,406	\$0	\$0
2029	0.7690	\$103,739	\$79,778	\$0	\$0
2030	0.7536	\$103,739	\$78,182	\$0	\$0
2031	0.7386	\$103,739	\$76,618	\$0	\$0
2032	0.7238	\$103,739	\$75,086	\$0	\$0
2033	0.7093	\$103,739	\$73,584	\$0	\$0
2034	0.6951	\$103,739	\$72,113	\$0	\$0
2035	0.6812	\$103,739	\$70,670	\$0	\$0
2036	0.6676	\$103,739	\$69,257	\$0	\$0
2037	0.6543	\$103,739	\$67,872	\$0	\$0
2038	0.6412	\$103,739	\$66,514	\$0	\$0
2039	0.6283	\$103,739	\$65,184	\$0	\$0
2040	0.6158	\$103,739	\$63,880	\$0	\$0
NPV		User Benefits	\$1,558,450	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 27

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
PBD & Geotextile	1035 lf	\$11.00	\$11,385.00	\$2,277.00	\$14,208.48
Drainage	1 ls	\$151,140.00	\$151,140.00	\$30,228.00	\$188,622.72
Lighting	1035 lf	\$125.00	\$129,375.00	\$25,875.00	\$161,460.00
ADA Ramps	18 ea	\$280.00	\$5,040.00	\$1,008.00	\$6,289.92
Subtotal, Supplemental Roadway Costs			\$296,940.00	\$59,388.00	\$370,581.12
					\$370,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	2446 CY	\$20.00	\$48,920.00	\$9,784.00	\$61,052.16
Borrow	292 CY	\$25.00	\$7,300.00	\$1,460.00	\$9,110.40
Subtotal, Earthwork Costs			\$56,220.00	\$11,244.00	\$70,162.56
					\$70,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	4207 SY	\$110.00	\$462,770.00	\$92,554.00	\$577,536.96
Sidewalk	507 SY	\$105.00	\$53,235.00	\$10,647.00	\$66,437.28
Island Concrete	373 SY	\$110.00	\$41,030.00	\$8,206.00	\$51,205.44
Subtotal, Pavement Costs			\$557,035.00	\$111,407.00	\$695,179.68
					\$700,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 27

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Misc. Signage (each)	1 ea	\$2,250.00	\$2,250.00	\$450.00	\$2,808.00
Subtotal, Signage Costs			\$2,250.00	\$450.00	\$2,808.00
					\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Major	1 LS	\$71,341.88	\$71,341.88	\$14,268.38	\$89,034.67
Subtotal, Utility Impact			\$71,341.88	\$14,268.38	\$89,034.67
					\$90,000.00

SUBTOTAL, CONSTRUCTION COSTS			\$983,786.88	\$196,757.38	\$1,227,766.03
					\$1,230,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost	
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00	
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00	
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00	
Mobilization	1 LS	\$49,189.34	\$9,837.87	\$61,388.30	
MPT	1 LS	\$29,513.61	\$5,902.72	\$36,832.98	
			\$133,702.95	\$26,740.59	\$166,861.28
					\$170,000.00

TOTAL CONSTRUCTION COSTS			\$1,117,489.83	\$223,497.97	\$1,394,627.31
					\$1,400,000.00

DESIGN AND CM COSTS			\$196,757.38	\$44,699.59	\$278,925.46
					\$280,000.00

TOTAL, DESIGN, CONSTRUCTION AND CM			\$1,180,544.26		\$1,673,552.77
					\$1,680,000.00

SIGNAGE UNIT COSTS
 Concept 27

Misc. Signage (each)

Item	Quantity	Units	Unit Cost	Cost/lf
Type B Signage	9	sf	\$250.00 sf	\$2,250.00
Subtotal Misc. Signage (each)				\$2,250.00

ITS Relocation

Item	Quantity	Units	Unit Cost	Cost
ITS Relocation	1	ls	\$200,000.00 sf	\$200,000.00
Subtotal ITS Relocation				\$200,000.00

Safety
 Concept 27

Safety

Crash Type	$N_{pred,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	6	1.97	0.52	1.03	0.95

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.02	0.10	0.32	0.51	\$ 57,250.29

USER BENEFITS
Concept 27

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:PM Veh-Hrs	
No-build	0	0	7.093	9.168
Build	0	0	4.714	5.324
Change	0	0	-2.378	-3.845
Subtotal, MOEs				

Improvement only during peak period? Yes

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	-2.255 hrs	-0.12 hrs
PM Peak Period	0.000 hrs	0.00 hrs
Total of Peaks	-2.255 hrs	-0.123 hrs
Daily Estimate	-6.766 hrs	-0.475 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$87.19	-\$9.36

Total, all vehicles - \$96.55 Value of travel time changes, per day
-\$32,737.18 Value of travel time changes, per year

Subtotal, Value of Time

USER BENEFITS
Concept 27

Automobile Operating Costs (Delay)

	Cars	Trucks
AM Peak Period		
Average Speed	25	
Change in Veh-Hrs	-2.255 hours	-0.123 hours
Fuel Consumption	0.026 gal/minute	0.133 gal/minute
	<u>-3.5 gallons</u>	<u>-1.0 gallons</u>
PM Peak Period		
Average Speed	25	
Change in Veh-Hrs	0.0 hours	0.0 hours
Fuel Consumption	0.026 gal/minute	0.133 gal/minute
	<u>0.0 gallons</u>	<u>0.0 gallons</u>
Fuel Consumption		
AM Peak Period	<u>-3.5 gallons</u>	<u>-1.0 gallons</u>
PM Peak Period	<u>0.0 gallons</u>	<u>0.0 gallons</u>
Total of Peaks	<u>-3.5 gallons</u>	<u>-1.0 gallons</u>
Daily Estimate	<u>-10.555 gallons</u>	<u>-2.945 gallons</u>
	\$3.004 per gallon	\$3.004 per gallon
	<u>-\$31.71 per day</u>	<u>-\$8.85 per day</u>
Total, all vehicles		
	-13.5 fuel consumption change, gallons per day	
	(4,577.72) fuel consumption change, gallons per year	
	-\$40.55 change in fuel cost, per day	
	-\$13,751.48 change in fuel cost, per year	

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-32,737.18	Value of Travel Time change, Per year
Operating Costs	-13,751.48	Value of Operating Costs change, per year
Total, User Benefits	<u>-46,488.66</u>	

USER BENEFITS
 Concept 27

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-10.555 gallons	-2.945 gallons
Annual estimate	-3579.195 gallons	-998.529
CO	19.4 lb/gal 8799.6848 grams/gal (31,495,785.62) g	22.2 lb/gal 10069.7424 grams/gal (10,054,925.64) g
Total	(41,550,711.26)	6
VOC	24.62 grams/gal (88,116.37) g	1.27 grams/gal (1,268.13)
Total	(89,384.50) g	
NOx	16.5 grams/gal (59,056.71) g	24.52 grams/gal (24,483.92)
Total	(83,540.63) g	
PM2.5	0.09761905 grams/gal (349.40) g	0.136 grams/gal (135.80)
Total	(485.20) g	

SUMMARY OF COSTS AND BENEFITS
 Concept 28

Construction Cost	
Supplemental Roadway Construction	\$127,000.00
Earthwork	\$0.00
Pavement	\$203,000.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$94,000.00
Signage	\$0.00
Utilities	\$0.00
Additional Lump Sum	\$103,000.00
Design and PM	\$105,000.00
ROW	\$0.00
Total	\$632,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	0 hr
Value of Travel Time (Annual)	\$0.00
Automobile Operating Costs (Annual)	\$0.00
Safety (Annual)	\$26,722.09
Total	\$26,722.09
Emissions (Annual)	
CO2	0 kg
NOx	0 kg
VOC	0 kg
Benefit:Cost Ratio	
NPV Benefits	\$401,440.67
NPV Operating Costs	\$0.00
NPV Capital Costs	\$618,498.16
Total Costs	\$618,498.16
Benefit:Cost Ratio	0.65

NET PRESENT VALUE CALCULATIONS

Concept 28

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$631,120.57
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$618,498.16
NPV Capital Costs			\$618,498.16

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$26,722	\$24,155	\$0	\$0
2022	0.8858	\$26,722	\$23,672	\$0	\$0
2023	0.8681	\$26,722	\$23,198	\$0	\$0
2024	0.8508	\$26,722	\$22,734	\$0	\$0
2025	0.8337	\$26,722	\$22,279	\$0	\$0
2026	0.8171	\$26,722	\$21,834	\$0	\$0
2027	0.8007	\$26,722	\$21,397	\$0	\$0
2028	0.7847	\$26,722	\$20,969	\$0	\$0
2029	0.7690	\$26,722	\$20,550	\$0	\$0
2030	0.7536	\$26,722	\$20,139	\$0	\$0
2031	0.7386	\$26,722	\$19,736	\$0	\$0
2032	0.7238	\$26,722	\$19,341	\$0	\$0
2033	0.7093	\$26,722	\$18,955	\$0	\$0
2034	0.6951	\$26,722	\$18,575	\$0	\$0
2035	0.6812	\$26,722	\$18,204	\$0	\$0
2036	0.6676	\$26,722	\$17,840	\$0	\$0
2037	0.6543	\$26,722	\$17,483	\$0	\$0
2038	0.6412	\$26,722	\$17,133	\$0	\$0
2039	0.6283	\$26,722	\$16,791	\$0	\$0
2040	0.6158	\$26,722	\$16,455	\$0	\$0
NPV		User Benefits	\$401,441	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 28

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Curb	1683 lf	\$60.00	\$100,980.00	\$20,196.00	\$126,023.04
Line Striping 24"	96 lf	\$9.00	\$864.00	\$172.80	\$1,078.27
Subtotal, Supplemental Roadway Costs			\$101,844.00	\$20,368.80	\$127,101.31
					\$127,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Earthwork Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Sidewalk	1547 SY	\$105.00	\$162,435.00	\$32,487.00	\$202,718.88
Subtotal, Pavement Costs			\$162,435.00	\$32,487.00	\$202,718.88
					\$203,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Traffic Signal	1 ea	\$75,000.00	\$75,000.00	\$15,000.00	\$93,600.00
Subtotal, Signal Costs			\$75,000.00	\$15,000.00	\$93,600.00
					\$94,000.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00
					\$0.00

SUBTOTAL, CONSTRUCTION COSTS			\$339,279.00	\$67,855.80	\$423,420.19
					\$424,000.00

CONSTRUCTION COST ESTIMATE
 Concept 28

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00
Mobilization	1 LS	\$16,963.95	\$3,392.79	\$21,171.01
MPT	1 LS	\$10,178.37	\$2,035.67	\$12,702.61
		\$82,142.32	\$16,428.46	\$102,513.62
				\$103,000.00
TOTAL CONSTRUCTION COSTS		\$421,421.32	\$84,284.26	\$525,933.81
				\$527,000.00
DESIGN AND CM COSTS		\$67,855.80	\$16,856.85	\$105,186.76
				\$105,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM		\$407,134.80		\$631,120.57
				\$632,000.00

SIGNAGE UNIT COSTS
Concept 28

ITS Relocation

Item	Quantity	Units	Unit Cost	Cost
ITS Relocation	1	ls	\$200,000.00 sf	\$200,000.00
Subtotal ITS Relocation				\$200,000.00

Safety
 Concept 28

Safety

Crash Type	$N_{pred,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	5	1.53	0.71	1.08	0.44

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.01	0.05	0.15	0.24	\$ 26,722.09

SUMMARY OF COSTS AND BENEFITS
 Concept 29

Construction Cost	
Supplemental Roadway Construction	\$4,200,000.00
Earthwork	\$500,000.00
Pavement	\$4,500,000.00
Walls	\$21,100,000.00
Bridges	\$36,700,000.00
General ITS	\$400,000.00
Signage	\$1,200,000.00
Utilities	\$4,100,000.00
Additional Lump Sum	\$5,900,000.00
Design and PM	\$15,700,000.00
ROW	\$200,000.00
Total	\$94,500,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	-271 hr
Value of Travel Time (Annual)	-\$1,196,766.17
Automobile Operating Costs (Annual)	\$4,199,394.34
Safety (Annual)	\$22,554.55
Total	\$3,025,182.71
Emissions (Annual)	
CO2	-47552348 kg
NOx	-79058 kg
VOC	-94172 kg
Benefit:Cost Ratio	
NPV Benefits	\$45,446,724.99
NPV Operating Costs	\$0.00
NPV Capital Costs	\$92,514,743.91
Total Costs	\$92,514,743.91
Benefit:Cost Ratio	0.49

NET PRESENT VALUE CALCULATIONS

Concept 29

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$94,402,799.91
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$92,514,743.91
NPV Capital Costs			\$92,514,743.91

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$3,025,183	\$2,734,526	\$0	\$0
2022	0.8858	\$3,025,183	\$2,679,835	\$0	\$0
2023	0.8681	\$3,025,183	\$2,626,238	\$0	\$0
2024	0.8508	\$3,025,183	\$2,573,714	\$0	\$0
2025	0.8337	\$3,025,183	\$2,522,239	\$0	\$0
2026	0.8171	\$3,025,183	\$2,471,795	\$0	\$0
2027	0.8007	\$3,025,183	\$2,422,359	\$0	\$0
2028	0.7847	\$3,025,183	\$2,373,911	\$0	\$0
2029	0.7690	\$3,025,183	\$2,326,433	\$0	\$0
2030	0.7536	\$3,025,183	\$2,279,905	\$0	\$0
2031	0.7386	\$3,025,183	\$2,234,306	\$0	\$0
2032	0.7238	\$3,025,183	\$2,189,620	\$0	\$0
2033	0.7093	\$3,025,183	\$2,145,828	\$0	\$0
2034	0.6951	\$3,025,183	\$2,102,911	\$0	\$0
2035	0.6812	\$3,025,183	\$2,060,853	\$0	\$0
2036	0.6676	\$3,025,183	\$2,019,636	\$0	\$0
2037	0.6543	\$3,025,183	\$1,979,243	\$0	\$0
2038	0.6412	\$3,025,183	\$1,939,659	\$0	\$0
2039	0.6283	\$3,025,183	\$1,900,865	\$0	\$0
2040	0.6158	\$3,025,183	\$1,862,848	\$0	\$0
NPV		User Benefits	\$45,446,725	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
Concept 29

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Single Faced Barrier	9050 lf	\$60.00	\$543,000.00	\$108,600.00	\$677,664.00
PBD & Geotextile	16100 lf	\$11.00	\$177,100.00	\$35,420.00	\$221,020.80
Drainage	16100 lf	\$66.58	\$1,071,883.27	\$214,376.65	\$1,337,710.32
Lighting	9050 lf	\$125.00	\$1,131,250.00	\$226,250.00	\$1,411,800.00
Center Median Barrier	8050 lf	\$50.00	\$402,500.00	\$80,500.00	\$502,320.00
Subtotal, Supplemental Roadway Costs			\$3,325,733.27	\$665,146.65	\$4,150,515.12
					\$4,200,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	13690 CY	\$20.00	\$273,800.00	\$54,760.00	\$341,702.40
Borrow	3734 CY	\$25.00	\$93,350.00	\$18,670.00	\$116,500.80
Subtotal, Earthwork Costs			\$367,150.00	\$73,430.00	\$458,203.20
					\$500,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	32481 SY	\$110.00	\$3,572,910.00	\$714,582.00	\$4,458,991.68
Subtotal, Pavement Costs			\$3,572,910.00	\$714,582.00	\$4,458,991.68
					\$4,500,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Retaining Wall	6320 lf	\$942.68	\$5,957,719.08	\$1,191,543.82	\$7,435,233.41
Sound Wall	8747 lf	\$1,250.00	\$10,933,750.00	\$2,186,750.00	\$13,645,320.00
Subtotal, Wall Costs			\$16,891,469.08	\$3,378,293.82	\$21,080,553.41
					\$21,100,000.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Widening over Forward Ave	280 lf	\$11,250.00	\$3,150,000.00	\$630,000.00	\$3,931,200.00
Replace Bridge for Ramps of PWKY	180 lf	\$27,000.00	\$4,860,000.00	\$972,000.00	\$6,065,280.00
Widening Saline Bridge STA 821 to 826	510 lf	\$11,250.00	\$5,737,500.00	\$1,147,500.00	\$7,160,400.00
Widening over Frazier STA 798 to 810	1140 lf	\$13,750.00	\$15,675,000.00	\$3,135,000.00	\$19,562,400.00
Subtotal, Bridge Cost			\$29,422,500.00	\$5,884,500.00	\$36,719,280.00
					\$36,700,000.00

ITS Truck Sensors

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Relocate Overhead Detection	1 ls	\$300,000.00	\$300,000.00	\$60,000.00	\$374,400.00
Subtotal, ITS Truck Sensors			\$300,000.00	\$60,000.00	\$374,400.00
					\$400,000.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Overhead Pedestal	2 ea	\$50,000.00	\$100,000.00	\$20,000.00	\$124,800.00

CONSTRUCTION COST ESTIMATE
 Concept 29

OH Truss 5 Lanes	1 ea	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00
OH Truss 6 lanes	1 ea	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00
ITS Relocation	1 ls	\$500,000.00	\$500,000.00	\$100,000.00	\$624,000.00
Subtotal, Signage Costs			\$1,000,000.00	\$200,000.00	\$1,248,000.00
					\$1,200,000.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Moderate	1 LS	\$3,312,573.68	\$3,312,573.68	\$662,514.74	\$4,134,091.95
Subtotal, Utility Impact			\$3,312,573.68	\$662,514.74	\$4,134,091.95
					\$4,100,000.00

SUBTOTAL, CONSTRUCTION COSTS			\$58,192,336.03	\$11,638,467.21	\$72,624,035.36
					\$72,700,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost	
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00	
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00	
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00	
Mobilization	1 LS	\$2,909,616.80	\$581,923.36	\$3,631,201.77	
MPT	1 LS	\$1,745,770.08	\$349,154.02	\$2,178,721.06	
			\$4,710,386.88	\$942,077.38	\$5,878,562.83
					\$5,900,000.00

TOTAL CONSTRUCTION COSTS			\$62,902,722.91	\$12,580,544.58	\$78,502,598.19
					\$78,600,000.00
DESIGN AND CM COSTS			\$11,638,467.21	\$2,516,108.92	\$15,700,519.64
					\$15,700,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM			\$69,830,803.23		\$94,203,117.83
					\$94,300,000.00

Wall Breakdown								
Concept 29								
Retaining Wall	Proposed Length (ft)	Min Ht. (Ft)	Max. Ht. (Ft)	Wall Exposed Area (SF)	Cut/ Fill	Wall Type	Unit Cost (\$/SF)	Total cost
RW-Eastbound- STA. 857 - STA 867	625	0	9	2932.8	Fill	MSE wall or T-Wall	120	\$351,936.00
RW-Eastbound- STA. 851 - STA 857	690	0	13	2786	Cut	Soldier Piles with concrete lagging	150	\$417,900.00
RW-Eastbound- STA. 841 - STA 850	440	0	14	6205.6	Cut	Soldier Piles with concrete lagging	150	\$930,840.00
	480	0	3	924.4	Cut	Soldier Piles with concrete	150	\$138,660.00
RW-Eastbound- STA. 811- STA 821.7	325	0	27	2638.4	Fill	MSE wall or T-Wall	120	\$316,608.00
	305	0	8	1223.2	Cut	Soldier Piles with concrete lagging	150	\$183,480.00
	440	0	25	4276.8	Fill	MSE wall or T-Wall	120	\$513,216.00
RW-Eastbound- STA. 779- 799.5	918	0	23	10630.2	Fill	MSE wall or T-Wall	120	\$1,275,624.00
	632	0	6	2178.8	Cut	Soldier Piles with concrete lagging	150	\$326,820.00
	400	0	16	4849	Fill	MSE wall or T-Wall	120	\$581,880.00
Retaining Wall Cost Breakdown								\$5,036,964.00
								\$5,000,000.00

SIGNAGE UNIT COSTS
Concept 29

ITS Relocation

Item	Quantity	Units	Unit Cost	Cost
ITS Relocation	1	ls	\$300,000.00 sf	\$300,000.00
Subtotal ITS Relocation				\$300,000.00

ROW COSTS
 Concept 29

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
0011-K-00340-0009-00	\$207,000.00	\$0.00	338,897	1,668	No	0%	\$1,018.98
0029-L-00013-0000-00	\$1,700.00	\$0.00	1,196	245	No	20%	\$500.00
0029-L-00052-0000-00	\$ 12,800.00	\$0.00	6,396	878	No	14%	\$1,756.69
0029-M-00160-0000-00	\$ 330,600.00	\$ 44,400.00	130,680	7,203	No	6%	\$18,223.65
0029-M-00184-0000-00	\$3,500.00	\$0.00	18,731	1,964	No	10%	\$500.00
0029-M-00150-0000-00	\$ 267,700.00	\$ 132,300.00	63,158	1,677	No	3%	\$7,109.02
0029-S-00250-000C-02	\$3,000.00	\$0.00	65,340	0	No	0%	\$500.00
0029-M-00310-0000-01	\$15,800.00	\$0.00	44,025	2,873	No	7%	\$1,031.22
0029-M-00047-000A-00	\$28,000.00	\$0.00	12,415	3	No	0%	\$500.00
0029-M-00074-0000-00	\$17,300.00	\$0.00	422	422	Yes	100%	\$17,300.00
0029-M-00069-0000-00	\$7,500.00	\$4,700.00	6,000	792	No	13%	\$989.95
0054-J-00145-0000-00	\$3,000.00	\$0.00	2,400	456	No	19%	\$570.01
0054-J-00144-0000-00	\$3,000.00	\$23,600.00	2,400	437	Yes	100%	\$26,600.00
0054-J-00143-0000-00	\$3,000.00	\$49,200.00	2,400	323	Yes	100%	\$52,200.00
0054-J-00142-0000-00	\$600.00	\$0.00	2,400	301	No	13%	\$500.00
0054-J-00127-0000-00	\$2,400.00	\$0.00	5,280	100	No	2%	\$500.00
0054-J-00124-0000-00	\$1,700.00	\$0.00	3,740	338	No	9%	\$500.00
0054-J-00121-0000-00	\$1,700.00	\$0.00	3,740	606	No	16%	\$500.00
0054-J-00120-0000-00	\$1,700.00	\$0.00	3,740	630	No	17%	\$500.00
0054-J-00117-0000-00	\$1,700.00	\$0.00	3,740	647	No	17%	\$500.00
0054-J-00116-0000-00	\$1,000.00	\$0.00	3,360	769	No	23%	\$500.00
0054-J-00113-0000-00	\$1,100.00	\$0.00	2,216	658	No	30%	\$500.00
0054-J-00112-0000-00	\$10,000.00	\$4,900.00	1,955	557	Yes	100%	\$14,900.00
0054-J-00109-0000-00	\$4,700.00	\$18,000.00	2,184	586	Yes	100%	\$22,700.00
0054-J-00105-0000-00	\$700.00	\$0.00	1,276	558	No	44%	\$500.00
0054-J-00108-0000-00	\$1,300.00	\$0.00	2,703	650	No	24%	\$500.00
0054-J-00104-0000-00	\$70,500.00	\$60,100.00	7,920	399	No	5%	\$3,554.48
0054-J-00044-0000-00	\$6,600.00	\$0.00	14,752	2,685	No	18%	\$1,201.44
0054-J-00039-0000-00	\$7,100.00	\$0.00	15,930	2,715	No	17%	\$1,210.26
0054-J-00038-0000-00	\$2,100.00	\$0.00	4,650	689	No	15%	\$500.00
0054-J-00037-0000-00	\$2,200.00	\$0.00	4,750	697	No	15%	\$500.00
0054-J-00035-0000-00	\$2,900.00	\$0.00	9,500	1,334	No	14%	\$500.00
0054-F-00086-0000-00	\$700.00	\$0.00	1,360	836	No	61%	\$500.00
0054-F-00083-0000-00	\$300.00	\$0.00	525	14	No	3%	\$500.00
0054-F-00006-0000-01	\$65,300.00	\$20,000.00	368,082	3,984	No	1%	\$706.74
0054-L-00236-0000-00	\$52,700.00	\$0.00	79,715	55	No	0%	\$500.00
0054-H-00030-0000-00	\$13,700.00	\$0.00	505,732	3,552	No	1%	\$500.00
0054-M-00331-0000-00	\$45,200.00	\$95,700.00	6,547	81	No	1%	\$559.12
0087-E-00236-0000-00	\$44,000.00	\$127,600.00	5,208	258	No	5%	\$2,182.25
0087-E-00238-0000-00	\$45,000.00	\$170,500.00	5,376	29	No	1%	\$500.00

Subtotal, ROW Costs \$199,682.08

\$200,000.00

Safety
Concept 29

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	112	37.33	0.99	36.96	0.37

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.01	0.04	0.12	0.20	\$ 22,554.55

USER BENEFITS
Concept 29

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:PM Veh-Hrs	
No-build	12836	13492	7994	8548
Build	12857	14027	7942	8871
Change	21	535	-52	323
Subtotal, MOEs				

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	-49.117 hrs	-2.68 hrs
PM Peak Period	314.818 hrs	8.04 hrs
Total of Peaks	265.702 hrs	5.366 hrs
Daily Estimate	265.702 hrs	5.366 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	\$3,423.73	\$105.67

Total, all vehicles \$3,529.40 Value of travel time changes, per day
\$1,196,766.17 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars	Trucks
AM Peak Period	3006.1 gallons	163.9 gallons
PM Peak Period	-7111.0 gallons	-181.7 gallons
Total of Peaks	-4104.9 gallons	-17.8 gallons
Daily Estimate	-4104.894 gallons	-17.772 gallons
	\$3.004 per gallon	\$3.004 per gallon

USER BENEFITS
Concept 29

-\$12,331.10 per day -\$53.39 per day

Total, all vehicles -4122.7 fuel consumption change, gallons per day
-1397934.2 fuel consumption change, gallons per year

-\$12,384.49 change in fuel cost, per day
-\$4,199,394.34 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	\$1,196,766.17 Value of Travel Time change, Per year
Operating Costs	-\$4,199,394.34 Value of Operating Costs change, per year
Total, User Benefits	-\$3,002,628.16

Emissions

	Cars	Trucks
Fuel Consumption		
AM Peak Period	3006.1 gallons	163.9 gallons
PM Peak Period	-7111.0 gallons	-181.7 gallons
Total of Peaks	-4104.9 gallons	-17.8 gallons
Daily Estimate	-15858.1 gallons	-68.7 gallons
Annual estimate	-5377229.26 gallons	-23280.174
CO2	19.4 lb/gal 8799.6848 grams/gal (47,317,922.60) kg	22.2 lb/gal 10069.7424 grams/gal (234,425.36) kg
Total	(47,552,347.95) kg	
Nox	(76,056.23) kg	(3,001.44) kg
Total	(79,057.68) kg	
VOC	(90,596.59) kg	(3,575.26) kg
Total	(94,171.85) kg	
PM2.5	0.09761905 grams/gal (524.92) kg	0.136 grams/gal (3.17) kg
Total	(528.09) kg	

SUMMARY OF COSTS AND BENEFITS
 Concept 29

Construction Cost	
Supplemental Roadway Construction	\$1,100,000.00
Earthwork	\$100,000.00
Pavement	\$1,200,000.00
Walls	\$10,500,000.00
Bridges	\$10,000,000.00
General ITS	\$400,000.00
Signage	\$900,000.00
Utilities	\$4,100,000.00
Additional Lump Sum	\$2,300,000.00
Design and PM	\$6,100,000.00
ROW	\$0.00
Total	\$36,700,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	382 hr
Value of Travel Time (Annual)	\$1,699,299.32
Automobile Operating Costs (Annual)	-\$361,601.12
Safety (Annual)	\$6,645.54
Total	\$1,344,343.74
Emissions (Annual)	
CO2	4111116 kg
NOx	20630 kg
VOC	24574 kg
Benefit:Cost Ratio	
NPV Benefits	\$20,195,811.69
NPV Operating Costs	\$0.00
NPV Capital Costs	\$36,039,955.60
Total Costs	\$36,039,955.60
Benefit:Cost Ratio	0.56

NET PRESENT VALUE CALCULATIONS

Concept 29

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$36,775,464.89
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$36,039,955.60
NPV Capital Costs			\$36,039,955.60

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$1,344,344	\$1,215,180	\$0	\$0
2022	0.8858	\$1,344,344	\$1,190,877	\$0	\$0
2023	0.8681	\$1,344,344	\$1,167,059	\$0	\$0
2024	0.8508	\$1,344,344	\$1,143,718	\$0	\$0
2025	0.8337	\$1,344,344	\$1,120,844	\$0	\$0
2026	0.8171	\$1,344,344	\$1,098,427	\$0	\$0
2027	0.8007	\$1,344,344	\$1,076,458	\$0	\$0
2028	0.7847	\$1,344,344	\$1,054,929	\$0	\$0
2029	0.7690	\$1,344,344	\$1,033,830	\$0	\$0
2030	0.7536	\$1,344,344	\$1,013,154	\$0	\$0
2031	0.7386	\$1,344,344	\$992,891	\$0	\$0
2032	0.7238	\$1,344,344	\$973,033	\$0	\$0
2033	0.7093	\$1,344,344	\$953,572	\$0	\$0
2034	0.6951	\$1,344,344	\$934,501	\$0	\$0
2035	0.6812	\$1,344,344	\$915,811	\$0	\$0
2036	0.6676	\$1,344,344	\$897,495	\$0	\$0
2037	0.6543	\$1,344,344	\$879,545	\$0	\$0
2038	0.6412	\$1,344,344	\$861,954	\$0	\$0
2039	0.6283	\$1,344,344	\$844,715	\$0	\$0
2040	0.6158	\$1,344,344	\$827,820	\$0	\$0
NPV		User Benefits	\$20,195,812	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
Concept 29

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Single Faced Barrier	1950 lf	\$60.00	\$117,000.00	\$23,400.00	\$146,016.00
PBD & Geotextile	3200 lf	\$11.00	\$35,200.00	\$7,040.00	\$43,929.60
Drainage	3200 lf	\$66.58	\$213,045.12	\$42,609.02	\$265,880.31
Lighting	3200 lf	\$125.00	\$400,000.00	\$80,000.00	\$499,200.00
Center Median Barrier	2300 lf	\$50.00	\$115,000.00	\$23,000.00	\$143,520.00
Subtotal, Supplemental Roadway Costs			\$880,245.12	\$176,049.02	\$1,098,545.91
					\$1,100,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	2750 CY	\$20.00	\$55,000.00	\$11,000.00	\$68,640.00
Borrow	0 CY	\$25.00	\$0.00	\$0.00	\$0.00
Subtotal, Earthwork Costs			\$55,000.00	\$11,000.00	\$68,640.00
					\$100,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	9010 SY	\$110.00	\$991,100.00	\$198,220.00	\$1,236,892.80
Subtotal, Pavement Costs			\$991,100.00	\$198,220.00	\$1,236,892.80
					\$1,200,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Retaining Wall	1940 lf	\$919.55	\$1,783,926.00	\$356,785.20	\$2,226,339.65
Sound Wall	5320 lf	\$1,250.00	\$6,650,000.00	\$1,330,000.00	\$8,299,200.00
Subtotal, Wall Costs			\$8,433,926.00	\$1,686,785.20	\$10,525,539.65
					\$10,500,000.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Widening over Forward Ave	280 lf	\$11,250.00	\$3,150,000.00	\$630,000.00	\$3,931,200.00
Replace Bridge for Ramps of PWKY	180 lf	\$27,000.00	\$4,860,000.00	\$972,000.00	\$6,065,280.00
Subtotal, Bridge Cost			\$8,010,000.00	\$1,602,000.00	\$9,996,480.00
					\$10,000,000.00

ITS Truck Sensors

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Relocate Overhead Detection	1 ls	\$300,000.00	\$300,000.00	\$60,000.00	\$374,400.00
Subtotal, ITS Truck Sensors			\$300,000.00	\$60,000.00	\$374,400.00
					\$400,000.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Overhead Pedestal	0 ea	\$50,000.00	\$0.00	\$0.00	\$0.00
OH Truss 5 Lanes	0 ea	\$200,000.00	\$0.00	\$0.00	\$0.00
OH Truss 6 lanes	1 ea	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00
ITS Relocation	1 ls	\$500,000.00	\$500,000.00	\$100,000.00	\$624,000.00

CONSTRUCTION COST ESTIMATE
 Concept 29

Subtotal, Signage Costs	\$700,000.00	\$140,000.00	\$873,600.00
			\$900,000.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Moderate	1 LS	\$3,312,573.68	\$3,312,573.68	\$662,514.74	\$4,134,091.95
Subtotal, Utility Impact			\$3,312,573.68	\$662,514.74	\$4,134,091.95
					\$4,100,000.00

SUBTOTAL, CONSTRUCTION COSTS	\$22,682,844.80	\$4,536,568.96	\$28,308,190.31
			\$28,300,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00
Mobilization	1 LS	\$1,134,142.24	\$226,828.45	\$1,415,409.52
MPT	1 LS	\$680,485.34	\$136,097.07	\$849,245.71
		\$1,869,627.58	\$373,925.52	\$2,333,295.23
				\$2,300,000.00

TOTAL CONSTRUCTION COSTS	\$24,552,472.39	\$4,910,494.48	\$30,641,485.54
			\$30,600,000.00

DESIGN AND CM COSTS	\$4,536,568.96	\$982,098.90	\$6,128,297.11
			\$6,100,000.00

TOTAL, DESIGN, CONSTRUCTION AND CM	\$27,219,413.76		\$36,769,782.65
			\$36,700,000.00

Wall Breakdown								
Concept 29								
Retaining Wall	Proposed Length (ft)	Min Ht. (Ft)	Max. Ht. (Ft)	Wall Exposed Area (SF)	Cut/ Fill	Wall Type	Unit Cost (\$/SF)	Total cost
RW-Eastbound- STA. 857 - STA 867	625	0	9	2932.8	Fill	MSE wall or T-Wall	120	\$351,936.00
RW-Eastbound- STA. 851 - STA 857	690	0	13	2786	Cut	Soldier Piles with concrete lagging	150	\$417,900.00
RW-Eastbound- STA. 841 - STA 850	440	0	14	6205.6	Cut	Soldier Piles with concrete lagging	150	\$930,840.00
	185	0	3	555	Cut	Soldier Piles with concrete lagging	150	\$83,250.00
Retaining Wall Cost Breakdown								\$1,783,926.00
								\$1,800,000.00

SIGNAGE UNIT COSTS
Concept 29

ITS Relocation

Item	Quantity	Units	Unit Cost	Cost
ITS Relocation	1	ls	\$300,000.00 sf	\$300,000.00
Subtotal ITS Relocation				\$300,000.00

ROW COSTS
 Concept 29

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
0087-E-00236-0000-00	\$44,000.00	\$127,600.00	5,208	258	No	5%	\$2,182.25
0087-E-00238-0000-00	\$45,000.00	\$170,500.00	5,376	29	No	1%	\$500.00
0087-E-00240-0000-00	\$ 36,500.00	\$73,500.00	5,897	50	No	1%	\$500.00
0087-E-00242-0000-00	\$ 44,400.00	\$ 70,600.00	4,867	50	No	1%	\$500.00
0087-E-00244-0000-00	\$22,600.00	\$85,100.00	3,408	50	No	1%	\$500.00
0087-E-00245-0000-00	\$ 22,600.00	\$ 85,100.00	3,398	50	No	1%	\$500.00
0087-E-00247-0000-00	\$22,600.00	\$74,600.00	3,383	50	No	1%	\$500.00
0087-E-00248-0000-00	\$22,600.00	\$69,900.00	3,383	50	No	1%	\$500.00
Subtotal, ROW Costs							\$5,682.25
							\$0.00

Safety
Concept 29

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	33	11.00	0.99	10.89	0.11

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.00	0.01	0.04	0.06	\$ 6,645.54

USER BENEFITS
Concept 29

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:PM Veh-Hrs	
No-build	12836	13492	7994	8548
Build	12849	13535	7864	8296
Change	13	43	-130	-252
Subtotal, MOEs				

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	-123.277 hrs	-6.72 hrs
PM Peak Period	-245.768 hrs	-6.28 hrs
Total of Peaks	-369.044 hrs	-13.004 hrs
Daily Estimate	-369.044 hrs	-13.004 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$4,755.36	-\$256.07

Total, all vehicles
-\$5,011.43 Value of travel time changes, per day
-\$1,699,299.32 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars	Trucks
AM Peak Period	91.7 gallons	5.0 gallons
PM Peak Period	251.8 gallons	6.4 gallons
Total of Peaks	343.6 gallons	11.4 gallons
Daily Estimate	343.557 gallons	11.437 gallons
	\$3.004 per gallon	\$3.004 per gallon

USER BENEFITS
Concept 29

\$1,032.04 per day

\$34.36 per day

Total, all vehicles

355.0 fuel consumption change, gallons per day

120373.2 fuel consumption change, gallons per year

\$1,066.40 change in fuel cost, per day

\$361,601.12 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$1,699,299.32	Value of Travel Time change, Per year
Operating Costs	\$361,601.12	Value of Operating Costs change, per year
Total, User Benefits	-\$1,337,698.20	

Emissions

	Cars	Trucks
Fuel Consumption		
AM Peak Period	91.7 gallons	5.0 gallons
PM Peak Period	251.8 gallons	6.4 gallons
Total of Peaks	343.6 gallons	11.4 gallons
Daily Estimate	1327.2 gallons	44.2 gallons
Annual estimate	450044.21 gallons	14982.436
CO2	19.4 lb/gal 8799.6848 grams/gal	22.2 lb/gal 10069.7424 grams/gal
	3,960,247.16 kg	150,869.27 kg
Total	4,111,116.43 kg	
Nox	19,846.50 kg	783.21 kg
Total	20,629.71 kg	
VOC	23,640.61 kg	932.94 kg
Total	24,573.55 kg	
PM2.5	0.09761905 grams/gal	0.136 grams/gal
	43.93 kg	2.04 kg
Total	45.97 kg	

SUMMARY OF COSTS AND BENEFITS
 Concept 30A

Construction Cost	
Supplemental Roadway Construction	\$1,600,000.00
Earthwork	\$1,800,000.00
Pavement	\$1,200,000.00
Walls	\$9,600,000.00
Bridges	\$3,400,000.00
Traffic Signals	\$200,000.00
Signage	\$100,000.00
Utilities	\$400,000.00
Additional Lump Sum	\$1,500,000.00
Design and PM	\$4,000,000.00
ROW	\$200,000.00
Total	\$24,000,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	78 hr
Value of Travel Time (Annual)	\$339,861.84
Automobile Operating Costs (Annual)	\$99,613.62
Safety (Annual)	\$257,504.19
Total	\$696,979.65
Emissions (Annual)	
CO2	-288665 kg
Nox	-527 kg
VOC	-874 kg
Benefit:Cost Ratio	
NPV Benefits	\$10,470,588.19
NPV Operating Costs	\$0.00
NPV Capital Costs	\$23,452,974.39
Total Costs	\$23,452,974.39
Benefit:Cost Ratio	0.45

NET PRESENT VALUE CALCULATIONS

Concept 30A

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$23,931,606.52
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$23,452,974.39
NPV Capital Costs			\$23,452,974.39

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$696,980	\$630,014	\$0	\$0
2022	0.8858	\$696,980	\$617,414	\$0	\$0
2023	0.8681	\$696,980	\$605,066	\$0	\$0
2024	0.8508	\$696,980	\$592,965	\$0	\$0
2025	0.8337	\$696,980	\$581,105	\$0	\$0
2026	0.8171	\$696,980	\$569,483	\$0	\$0
2027	0.8007	\$696,980	\$558,093	\$0	\$0
2028	0.7847	\$696,980	\$546,932	\$0	\$0
2029	0.7690	\$696,980	\$535,993	\$0	\$0
2030	0.7536	\$696,980	\$525,273	\$0	\$0
2031	0.7386	\$696,980	\$514,768	\$0	\$0
2032	0.7238	\$696,980	\$504,472	\$0	\$0
2033	0.7093	\$696,980	\$494,383	\$0	\$0
2034	0.6951	\$696,980	\$484,495	\$0	\$0
2035	0.6812	\$696,980	\$474,805	\$0	\$0
2036	0.6676	\$696,980	\$465,309	\$0	\$0
2037	0.6543	\$696,980	\$456,003	\$0	\$0
2038	0.6412	\$696,980	\$446,883	\$0	\$0
2039	0.6283	\$696,980	\$437,945	\$0	\$0
2040	0.6158	\$696,980	\$429,186	\$0	\$0
NPV		User Benefits	\$10,470,588	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
Concept 30A

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Single Faced Barrier	3100 lf	\$60.00	\$186,000.00	\$37,200.00	\$223,200.00
PBD & Geotextile	5750 lf	\$11.00	\$63,250.00	\$12,650.00	\$75,900.00
Drainage	5750 lf	\$51.39	\$295,482.00	\$59,096.40	\$354,578.40
Lighting	5750 lf	\$125.00	\$718,750.00	\$143,750.00	\$862,500.00
Guiderail	500 lf	\$16.50	\$8,250.00	\$1,650.00	\$9,900.00
Subtotal, Supplemental Roadway Costs			\$1,271,732.00	\$254,346.40	\$1,526,078.40
					\$1,600,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	844 CY	\$20.00	\$16,880.00	\$3,376.00	\$20,256.00
Borrow	55454 CY	\$25.00	\$1,386,350.00	\$277,270.00	\$1,663,620.00
Subtotal, Earthwork Costs			\$1,403,230.00	\$280,646.00	\$1,683,876.00
					\$1,800,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	8954 SY	\$110.00	\$984,940.00	\$196,988.00	\$1,181,928.00
Subtotal, Pavement Costs			\$984,940.00	\$196,988.00	\$1,181,928.00
					\$1,200,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Retaining Wall	1050 lf	\$3,092.30	\$3,246,910.80	\$649,382.16	\$3,896,292.96
Sound Wall	3545 lf	\$1,250.00	\$4,431,250.00	\$886,250.00	\$5,317,500.00
Subtotal, Wall Costs			\$7,678,160.80	\$1,535,632.16	\$9,213,792.96
					\$9,600,000.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
New EB Ramp Hammer Head (Ramp X)	200 lf	\$13,500.00	\$2,700,000.00	\$540,000.00	\$3,240,000.00
Subtotal, Bridge Cost			\$2,700,000.00	\$540,000.00	\$3,240,000.00
					\$3,400,000.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Overhead Detection	1 ls	\$50,000.00	\$50,000.00	\$10,000.00	\$60,000.00
Traffic Signal at Beechwood (T int.)	1 ea	\$150,000.00	\$150,000.00	\$30,000.00	\$180,000.00
Subtotal, Signal Costs			\$200,000.00	\$40,000.00	\$240,000.00
					\$200,000.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Overhead Pedestal	1 ea	\$50,000.00	\$50,000.00	\$10,000.00	\$60,000.00
Subtotal, Signage Costs			\$50,000.00	\$10,000.00	\$60,000.00
					\$100,000.00

Utility Impact

CONSTRUCTION COST ESTIMATE
 Concept 30A

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Moderate	1 LS	\$357,201.57	\$357,201.57	\$71,440.31	\$445,787.56
Subtotal, Utility Impact			\$357,201.57	\$71,440.31	\$445,787.56
					\$400,000.00

SUBTOTAL, CONSTRUCTION COSTS			\$14,645,264.37	\$2,929,052.87	\$18,277,289.93
					\$18,300,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost	
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00	
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00	
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00	
Mobilization	1 LS	\$732,263.22	\$146,452.64	\$913,864.50	
MPT	1 LS	\$439,357.93	\$87,871.59	\$548,318.70	
			\$1,226,621.15	\$245,324.23	\$1,530,823.19
					\$1,500,000.00

TOTAL CONSTRUCTION COSTS			\$15,871,885.52	\$3,174,377.10	\$19,808,113.13
					\$19,800,000.00

DESIGN AND CM COSTS			\$2,929,052.87	\$634,875.42	\$3,961,622.63
					\$4,000,000.00

TOTAL, DESIGN, CONSTRUCTION AND CM			\$17,574,317.24		\$23,769,735.75
					\$23,800,000.00

ROW COSTS
 Concept 30A

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
0054-F-00006-0000-01	\$65,300.00	\$20,000.00	868,082	5,607	No	1%	\$500.00
0054-L-00236-0000-00	\$52,700.00	\$0.00	79,715	179	No	0%	\$500.00
0054-H-00030-0000-00	\$13,700.00	\$0.00	505,732	22,385	No	4%	\$606.39
0054-M-00314-0000-00	\$45,400.00	\$59,300.00	8,891	0	No	0%	\$500.00
0054-M-00322-0000-00	\$42,800.00	\$57,800.00	4,521	173	No	4%	\$1,637.37
0054-M-00324-0000-00	\$35,100.00	\$64,900.00	5,864	632	No	11%	\$3,781.59
0054-M-00326-0000-00	\$33,200.00	\$51,800.00	6,101	869	No	14%	\$4,726.92
0054-M-00328-0000-00	\$33,000.00	\$73,000.00	6,338	1,674	No	26%	\$8,718.50
0054-M-00331-0000-00	\$45,200.00	\$95,700.00	6,547	4,749	Yes	100%	\$140,900.00
Subtotal, ROW Costs							\$161,870.76
							\$200,000.00

Safety
 Concept 30A

Safety

Crash Type	N _{obs,2010-2012}	N _{obs,frequency}	CMF	N _{pred,CMF}	N _{reduced}
Fatal & Injury	15	5.00	0.60	3.00	2.00
PDO	18	6.00	0.67	4.02	1.98

N _{reduced,K}	N _{reduced,A}	N _{reduced,B}	N _{reduced,C}	N _{reduced,O}	Dollars Saved, Annually
0.01	0.09	0.45	1.44	0.00	\$ 237,409.90
0.00	0.00	0.00	0.00	1.98	\$ 20,094.29

Total: \$ 257,504.19

USER BENEFITS
Concept 30A

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr	PM Veh-Hrs
No-build	248236	265184	7994	8548
Build	247677	266670	8111	8352
Change	-559	1487	117	-196
Subtotal, MOEs				

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	111.232 hrs	6.07 hrs
PM Peak Period	-190.834 hrs	-4.88 hrs
Total of Peaks	-79.602 hrs	1.190 hrs
Daily Estimate	-79.602 hrs	1.190 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$1,025.72	\$23.43

Total, all vehicles
-\$1,002.29 Value of travel time changes, per day
-\$339,861.84 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars		Trucks	
AM Peak Period				
Average Speed	20			
Change in Veh-Hrs		111.232 hours		6.066 hours
Fuel Consumption		0.022 gal/minute		0.102 gal/minute
		146.8 gallons		37.1 gallons

USER BENEFITS

Concept 30A

PM Peak Period

Average Speed	20		
Change in Veh-Hrs		-190.8 hours	-4.9 hours
Fuel Consumption		0.022 gal/minute	0.102 gal/minute
		-251.9 gallons	-29.8 gallons

Fuel Consumption

AM Peak Period		146.8 gallons	37.1 gallons
PM Peak Period		-251.9 gallons	-29.8 gallons
Total of Peaks		-105.1 gallons	7.3 gallons
Daily Estimate		-105.075 gallons	7.281 gallons
		\$3.004 per gallon	\$3.004 per gallon
		-\$315.64 per day	\$21.87 per day

Total, all vehicles

-97.8 fuel consumption change, gallons per day
-33160.3 fuel consumption change, gallons per year
-\$293.77 change in fuel cost, per day
-\$99,613.62 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$339,861.84	Value of Travel Time change, Per year
Operating Costs	-\$99,613.62	Value of Operating Costs change, per year
Total, User Benefits	-\$439,475.46	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-105.075 gallons	7.281 gallons
Annual estimate	-35629.204 gallons	2468.878 gallons
CO2	19.4 lb/gal	22.2 lb/gal
	8799.6848 grams/gal	10069.7424 grams/gal
	(313,525,768.43) g	24,860,962 g
Total	(288,664.81) kg	
VOC		
	24.62 grams/gal	1.27 grams/gal

USER BENEFITS

Concept 30A

Total	(877,157.08) g (874.02) kg	3,135.47 g
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NOx

16.5 grams/gal

24.52 grams/gal

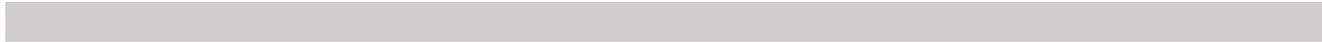
Total	(587,881.87) g (527.34) kg	60,536.88 g
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PM2.5

0.09761905 grams/gal

0.136 grams/gal

Total	(3,478.09) g (3.14) kg	335.77 g
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SUMMARY OF COSTS AND BENEFITS
 Concept 30B

Construction Cost	
Supplemental Roadway Construction	\$1,600,000.00
Earthwork	\$700,000.00
Pavement	\$1,400,000.00
Walls	\$11,000,000.00
Bridges	\$8,200,000.00
Traffic Signals	\$200,000.00
Signage	\$300,000.00
Utilities	\$900,000.00
Additional Lump Sum	\$2,000,000.00
Design and PM	\$5,300,000.00
ROW	\$1,800,000.00
Total	\$33,400,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	318.00 hr
Value of Travel Time (Annual)	\$1,418,306.15
Automobile Operating Costs (Annual)	\$488,720.86
Safety (Annual)	\$396,383.26
Total	\$2,303,410.27
Emissions (Annual)	
CO2	-1464583 kg
NOx	-2893 kg
VOC	-3399 kg
Benefit:Cost Ratio	
NPV Benefits	\$34,603,679.50
NPV Operating Costs	\$0.00
NPV Capital Costs	\$32,717,941.69
Total Costs	\$32,717,941.69
Benefit:Cost Ratio	1.06

NET PRESENT VALUE CALCULATIONS

Concept 30B

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$33,385,654.78
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$32,717,941.69
NPV Capital Costs			\$32,717,941.69

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$2,303,410	\$2,082,100	\$0	\$0
2022	0.8858	\$2,303,410	\$2,040,458	\$0	\$0
2023	0.8681	\$2,303,410	\$1,999,649	\$0	\$0
2024	0.8508	\$2,303,410	\$1,959,656	\$0	\$0
2025	0.8337	\$2,303,410	\$1,920,463	\$0	\$0
2026	0.8171	\$2,303,410	\$1,882,054	\$0	\$0
2027	0.8007	\$2,303,410	\$1,844,413	\$0	\$0
2028	0.7847	\$2,303,410	\$1,807,525	\$0	\$0
2029	0.7690	\$2,303,410	\$1,771,374	\$0	\$0
2030	0.7536	\$2,303,410	\$1,735,947	\$0	\$0
2031	0.7386	\$2,303,410	\$1,701,228	\$0	\$0
2032	0.7238	\$2,303,410	\$1,667,203	\$0	\$0
2033	0.7093	\$2,303,410	\$1,633,859	\$0	\$0
2034	0.6951	\$2,303,410	\$1,601,182	\$0	\$0
2035	0.6812	\$2,303,410	\$1,569,158	\$0	\$0
2036	0.6676	\$2,303,410	\$1,537,775	\$0	\$0
2037	0.6543	\$2,303,410	\$1,507,020	\$0	\$0
2038	0.6412	\$2,303,410	\$1,476,879	\$0	\$0
2039	0.6283	\$2,303,410	\$1,447,342	\$0	\$0
2040	0.6158	\$2,303,410	\$1,418,395	\$0	\$0
NPV		User Benefits	\$34,603,679	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
Concept 30B

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Single Faced Barrier	4742 lf	\$60.00	\$284,520.00	\$56,904.00	\$355,080.96
PBD & Geotextile	4571 lf	\$11.00	\$50,281.00	\$10,056.20	\$62,750.69
Drainage	4742 lf	\$70.27	\$333,237.67	\$66,647.53	\$415,880.61
Lighting	4571 lf	\$125.00	\$571,375.00	\$114,275.00	\$713,076.00
Guiderail	500 lf	\$16.50	\$8,250.00	\$1,650.00	\$10,296.00
Subtotal, Supplemental Roadway Costs			\$1,247,663.67	\$249,532.73	\$1,557,084.26
					\$1,600,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	28027 CY	\$20.00	\$560,540.00	\$112,108.00	\$699,553.92
Subtotal, Earthwork Costs			\$560,540.00	\$112,108.00	\$699,553.92
					\$700,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	10098 SY	\$110.00	\$1,110,780.00	\$222,156.00	\$1,386,253.44
Subtotal, Pavement Costs			\$1,110,780.00	\$222,156.00	\$1,386,253.44
					\$1,400,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Retaining Wall	1930 lf	\$2,092.66	\$4,038,829.31	\$807,765.86	\$5,040,458.97
Sound Wall	3811 lf	\$1,250.00	\$4,763,750.00	\$952,750.00	\$5,945,160.00
Subtotal, Wall Costs			\$8,802,579.31	\$1,760,515.86	\$10,985,618.97
					\$11,000,000.00

Bridge Cost

Item	Quantity	Cost/sf	2016 Cost	Contingency	2017 Cost
Ramp B Structure	5985 sf	\$450.00	\$2,693,250.00	\$538,650.00	\$3,361,176.00
Ramp Structure over Ramp E	8672 sf	\$450.00	\$3,902,400.00	\$780,480.00	\$4,870,195.20
Subtotal, Bridge Cost			\$6,595,650.00	\$1,319,130.00	\$8,231,371.20
					\$8,200,000.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Overhead Detection	1 ls	\$50,000.00	\$50,000.00	\$10,000.00	\$62,400.00
Traffic Signal at Beechwood	1 ea	\$150,000.00	\$150,000.00	\$30,000.00	\$187,200.00
Subtotal, Signal Costs			\$200,000.00	\$40,000.00	\$249,600.00
					\$200,000.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Overhead Pedestal	1 ea	\$50,000.00	\$50,000.00	\$10,000.00	\$62,400.00
OH Truss 5 Lanes	1 ea	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00
Subtotal, Signage Costs			\$250,000.00	\$50,000.00	\$312,000.00
					\$300,000.00

CONSTRUCTION COST ESTIMATE
 Concept 30B

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Major	1 LS	\$740,101.68	\$740,101.68	\$148,020.34	\$923,646.90
Subtotal, Utility Impact			\$740,101.68	\$148,020.34	\$923,646.90
					\$900,000.00

SUBTOTAL, CONSTRUCTION COSTS			\$19,507,314.66	\$3,901,462.93	\$24,345,128.69
					\$24,300,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost	
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00	
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00	
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00	
Mobilization	1 LS	\$975,365.73	\$195,073.15	\$1,217,256.43	
MPT	1 LS	\$585,219.44	\$117,043.89	\$730,353.86	
			\$1,615,585.17	\$323,117.03	\$2,016,250.30
					\$2,000,000.00

TOTAL CONSTRUCTION COSTS			\$21,122,899.83	\$4,224,579.97	\$26,361,378.99
					\$26,300,000.00

DESIGN AND CM COSTS			\$3,901,462.93	\$844,915.99	\$5,272,275.80
					\$5,300,000.00

TOTAL, DESIGN, CONSTRUCTION AND CM			\$23,408,777.59		\$31,633,654.78
					\$31,600,000.00

ROW COSTS
 Concept 30B

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
0054-H-00030-0000-00	\$13,700.00	\$0.00	505,732	1,171	Yes	100%	\$500.00
0054-M-00331-0000-00	\$45,200.00	\$95,700.00	6,547	297	Yes	100%	\$140,900.00
0054-H-00011-0000-00	\$39,200.00	\$64,800.00	3,715	256	Yes	100%	\$104,000.00
0054-H-00014-0000-00	\$30,000.00	\$80,000.00	4,417	1,008	Yes	100%	\$110,000.00
0054-H-00017-0000-00	\$44,300.00	\$72,700.00	4,835	1,527	Yes	100%	\$117,000.00
0054-H-00020-0000-00	\$41,300.00	\$89,800.00	4,173	1,719	Yes	100%	\$131,100.00
0054-H-00022-0000-00	\$43,900.00	\$87,400.00	4,757	2,218	Yes	100%	\$131,300.00
0087-E-00236-0000-00	\$44,000.00	\$127,600.00	5,208	3,057	Yes	100%	\$171,600.00
0087-E-00238-0000-00	\$45,000.00	\$170,500.00	5,376	2,253	Yes	100%	\$215,500.00
0087-E-00240-0000-00	\$36,500.00	\$73,500.00	4,897	2,136	Yes	100%	\$110,000.00
0087-E-00242-0000-00	\$44,400.00	\$70,600.00	4,867	1,853	Yes	100%	\$115,000.00
0087-E-00244-0000-00	\$22,600.00	\$85,100.00	3,408	1,097	Yes	100%	\$107,700.00
0087-E-00245-0000-00	\$22,600.00	\$85,100.00	3,398	1,027	Yes	100%	\$107,700.00
0087-E-00247-0000-00	\$22,600.00	\$74,600.00	3,383	1,050	Yes	100%	\$97,200.00
0087-E-00248-0000-00	\$22,600.00	\$69,900.00	3,383	1,377	Yes	100%	\$92,500.00
Subtotal, ROW Costs							\$1,752,000.00
							\$1,800,000.00

Safety
 Concept 30B

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Fatal & Injury	12	4.00	0.24	0.96	3.04
PDO	15	5.00	0.38	1.90	3.10

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.02	0.14	0.69	2.19	0.00	\$ 360,863.05
0.00	0.00	0.00	0.00	3.50	\$ 35,520.21

Total: \$ 396,383.26

USER BENEFITS
Concept 30B

MOEs

Item	AM VMT	PM VMT	AM Veh-Hrs	PM Veh-Hrs
No-build	248236	265184	7994.00	8548.00
Build	248513	266935	7823.00	8401.00
Change	277	1751	-171	-147
Subtotal, MOEs				

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	-162.156 hrs	-8.84 hrs
PM Peak Period	-143.337 hrs	-3.66 hrs
Total of Peaks	-305.493 hrs	-12.507 hrs
Daily Estimate	-305.493 hrs	-12.507 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$3,936.47	-\$246.28

Total, all vehicles
-\$4,182.75 Value of travel time changes, per day
-\$1,418,306.15 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars		Trucks	
AM Peak Period				
Average Speed	20			
Change in Veh-Hrs		-162.156 hours		-8.844 hours
Fuel Consumption		0.022 gal/minute		0.102 gal/minute
		-214.0 gallons		-54.1 gallons
PM Peak Period				
Average Speed	20			
Change in Veh-Hrs		-143.3 hours		-3.7 hours
Fuel Consumption		0.022 gal/minute		0.102 gal/minute
		-189.2 gallons		-22.4 gallons
Fuel Consumption				
AM Peak Period		-214.0 gallons		-54.1 gallons
PM Peak Period		-189.2 gallons		-22.4 gallons
Total of Peaks		-403.3 gallons		-76.5 gallons
Daily Estimate		-403.251 gallons		-76.540 gallons
		\$3.004 per gallon		\$3.004 per gallon
		-\$1,211.37 per day		-\$229.93 per day

Total, all vehicles
-479.8 fuel consumption change, gallons per day

USER BENEFITS
 Concept 30B

-162690.0 fuel consumption change, gallons per year

-\$1,441.29 change in fuel cost, per day

-\$488,720.86 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$1,418,306.15	Value of Travel Time change, Per year
Operating Costs	-\$488,720.86	Value of Operating Costs change, per year
Total, User Benefits	-\$1,907,027.01	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-403.251 gallons	-76.540 gallons
Annual estimate	-136736.498 gallons	-25953.534 gallons
CO2	19.4 lb/gal 8799.6848 grams/gal	22.2 lb/gal 10069.7424 grams/gal
Total	(1,203,238,087.45) g (1,464,583.49) kg	(261,345,404) g
VOC	24.62 grams/gal	1.27 grams/gal
Total	(3,366,322.37) g (3,399.28) kg	(32,960.99) g
NOx	16.5 grams/gal	24.52 grams/gal
Total	(2,256,152.23) g (2,892.53) kg	(636,380.66) g
PM2.5	0.097619048 grams/gal	0.136 grams/gal
Total	(13,348.09) g (16.88) kg	(3,529.68) g

SUMMARY OF COSTS AND BENEFITS
 Concept 30B Revised

Construction Cost	
Supplemental Roadway Construction	\$1,600,000.00
Earthwork	\$700,000.00
Pavement	\$1,500,000.00
Walls	\$11,000,000.00
Bridges	\$11,700,000.00
Traffic Signals	\$200,000.00
Signage	\$300,000.00
Utilities	\$900,000.00
Additional Lump Sum	\$2,300,000.00
Design and PM	\$6,000,000.00
ROW	\$1,800,000.00
Total	\$38,000,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	318.00 hr
Value of Travel Time (Annual)	\$1,418,306.15
Automobile Operating Costs (Annual)	\$488,720.86
Safety (Annual)	\$407,822.14
Total	\$2,314,849.15
Emissions (Annual)	
CO2	-1464583 kg
NOx	-2893 kg
VOC	-3399 kg
Benefit:Cost Ratio	
NPV Benefits	\$34,775,523.54
NPV Operating Costs	\$0.00
NPV Capital Costs	\$37,267,250.47
Total Costs	\$37,267,250.47
Benefit:Cost Ratio	0.93

NET PRESENT VALUE CALCULATIONS

Concept 30B Revised

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$38,027,806.60
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$37,267,250.47
NPV Capital Costs			\$37,267,250.47

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$2,314,849	\$2,092,440	\$0	\$0
2022	0.8858	\$2,314,849	\$2,050,591	\$0	\$0
2023	0.8681	\$2,314,849	\$2,009,580	\$0	\$0
2024	0.8508	\$2,314,849	\$1,969,388	\$0	\$0
2025	0.8337	\$2,314,849	\$1,930,000	\$0	\$0
2026	0.8171	\$2,314,849	\$1,891,400	\$0	\$0
2027	0.8007	\$2,314,849	\$1,853,572	\$0	\$0
2028	0.7847	\$2,314,849	\$1,816,501	\$0	\$0
2029	0.7690	\$2,314,849	\$1,780,171	\$0	\$0
2030	0.7536	\$2,314,849	\$1,744,567	\$0	\$0
2031	0.7386	\$2,314,849	\$1,709,676	\$0	\$0
2032	0.7238	\$2,314,849	\$1,675,483	\$0	\$0
2033	0.7093	\$2,314,849	\$1,641,973	\$0	\$0
2034	0.6951	\$2,314,849	\$1,609,133	\$0	\$0
2035	0.6812	\$2,314,849	\$1,576,951	\$0	\$0
2036	0.6676	\$2,314,849	\$1,545,412	\$0	\$0
2037	0.6543	\$2,314,849	\$1,514,504	\$0	\$0
2038	0.6412	\$2,314,849	\$1,484,213	\$0	\$0
2039	0.6283	\$2,314,849	\$1,454,529	\$0	\$0
2040	0.6158	\$2,314,849	\$1,425,439	\$0	\$0
NPV		User Benefits	\$34,775,524	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 30B Revised

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Single Faced Barrier	4742 lf	\$60.00	\$284,520.00	\$56,904.00	\$355,080.96
PBD & Geotextile	4571 lf	\$11.00	\$50,281.00	\$10,056.20	\$62,750.69
Drainage	4742 lf	\$70.27	\$333,237.67	\$66,647.53	\$415,880.61
Lighting	4571 lf	\$125.00	\$571,375.00	\$114,275.00	\$713,076.00
Guiderail	500 lf	\$16.50	\$8,250.00	\$1,650.00	\$10,296.00
Subtotal, Supplemental Roadway Costs			\$1,247,663.67	\$249,532.73	\$1,557,084.26
					\$1,600,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	28027 CY	\$20.00	\$560,540.00	\$112,108.00	\$699,553.92
Subtotal, Earthwork Costs			\$560,540.00	\$112,108.00	\$699,553.92
					\$700,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	10098 SY	\$110.00	\$1,110,780.00	\$222,156.00	\$1,386,253.44
Mountable Concrete Curb Island	1002 lf	\$54.00	\$54,108.00	\$10,821.60	\$67,526.78
Plain Cement Concrete 4"	1128 SY	\$45.00	\$50,760.00	\$10,152.00	\$63,348.48
Subtotal, Pavement Costs			\$1,215,648.00	\$243,129.60	\$1,517,128.70
					\$1,500,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Retaining Wall	1930 lf	\$2,092.66	\$4,038,829.31	\$807,765.86	\$5,040,458.97
Sound Wall	3811 lf	\$1,250.00	\$4,763,750.00	\$952,750.00	\$5,945,160.00
Subtotal, Wall Costs			\$8,802,579.31	\$1,760,515.86	\$10,985,618.97
					\$11,000,000.00

Bridge Cost

Item	Quantity	Cost/sf	2016 Cost	Contingency	2017 Cost
Ramp B Structure	5985 sf	\$450.00	\$2,693,250.00	\$538,650.00	\$3,361,176.00
Ramp A/D Structure	14817 sf	\$450.00	\$6,667,650.00	\$1,333,530.00	\$8,321,227.20
Subtotal, Bridge Cost			\$9,360,900.00	\$1,872,180.00	\$11,682,403.20
					\$11,700,000.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Overhead Detection	1 ls	\$50,000.00	\$50,000.00	\$10,000.00	\$62,400.00
Traffic Signal at Beechwood	1 ea	\$150,000.00	\$150,000.00	\$30,000.00	\$187,200.00
Subtotal, Signal Costs			\$200,000.00	\$40,000.00	\$249,600.00
					\$200,000.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Overhead Pedestal	1 ea	\$50,000.00	\$50,000.00	\$10,000.00	\$62,400.00
OH Truss 5 Lanes	1 ea	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00

CONSTRUCTION COST ESTIMATE
 Concept 30B Revised

Subtotal, Signage Costs	\$250,000.00	\$50,000.00	\$312,000.00
			\$300,000.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Major	1 LS	\$740,101.68	\$740,101.68	\$148,020.34	\$923,646.90
Subtotal, Utility Impact			\$740,101.68	\$148,020.34	\$923,646.90
					\$900,000.00

SUBTOTAL, CONSTRUCTION COSTS	\$22,377,432.66	\$4,475,486.53	\$27,927,035.96
			\$27,900,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00
Mobilization	1 LS	\$1,118,871.63	\$223,774.33	\$1,396,351.80
MPT	1 LS	\$671,322.98	\$134,264.60	\$837,811.08
		\$1,845,194.61	\$369,038.92	\$2,302,802.88
				\$2,300,000.00

TOTAL CONSTRUCTION COSTS	\$24,222,627.27	\$4,844,525.45	\$30,229,838.83
			\$30,200,000.00

DESIGN AND CM COSTS	\$4,475,486.53	\$968,905.09	\$6,045,967.77
			\$6,000,000.00

TOTAL, DESIGN, CONSTRUCTION AND CM	\$26,852,919.19		\$36,275,806.60
			\$36,200,000.00

ROW COSTS
 Concept 30B Revised

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
0054-H-00030-0000-00	\$13,700.00	\$0.00	505,732	1,171	Yes	100%	\$500.00
0054-M-00331-0000-00	\$45,200.00	\$95,700.00	6,547	297	Yes	100%	\$140,900.00
0054-H-00011-0000-00	\$39,200.00	\$64,800.00	3,715	256	Yes	100%	\$104,000.00
0054-H-00014-0000-00	\$30,000.00	\$80,000.00	4,417	1,008	Yes	100%	\$110,000.00
0054-H-00017-0000-00	\$44,300.00	\$72,700.00	4,835	1,527	Yes	100%	\$117,000.00
0054-H-00020-0000-00	\$41,300.00	\$89,800.00	4,173	1,719	Yes	100%	\$131,100.00
0054-H-00022-0000-00	\$43,900.00	\$87,400.00	4,757	2,218	Yes	100%	\$131,300.00
0087-E-00236-0000-00	\$44,000.00	\$127,600.00	5,208	3,057	Yes	100%	\$171,600.00
0087-E-00238-0000-00	\$45,000.00	\$170,500.00	5,376	2,253	Yes	100%	\$215,500.00
0087-E-00240-0000-00	\$36,500.00	\$73,500.00	4,897	2,136	Yes	100%	\$110,000.00
0087-E-00242-0000-00	\$44,400.00	\$70,600.00	4,867	1,853	Yes	100%	\$115,000.00
0087-E-00244-0000-00	\$22,600.00	\$85,100.00	3,408	1,097	Yes	100%	\$107,700.00
0087-E-00245-0000-00	\$22,600.00	\$85,100.00	3,398	1,027	Yes	100%	\$107,700.00
0087-E-00247-0000-00	\$22,600.00	\$74,600.00	3,383	1,050	Yes	100%	\$97,200.00
0087-E-00248-0000-00	\$22,600.00	\$69,900.00	3,383	1,377	Yes	100%	\$92,500.00
Subtotal, ROW Costs							\$1,752,000.00
							\$1,800,000.00

Safety
 Concept 30B Revised

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Fatal & Injury	12	4.00	0.24	0.96	3.04
PDO	15	5.00	0.38	1.90	3.10

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually	
0.02	0.14	0.69	2.19	0.00	\$	360,863.05
0.00	0.00	0.00	0.00	3.50	\$	35,520.21
Benefits from widened Ramp A/D structure					\$	11,438.88

Total: \$ 407,822.14

USER BENEFITS
Concept 30B Revised

MOEs

Item	AM VMT	PM VMT	AM Veh-Hrs	PM Veh-Hrs
No-build	248236	265184	7994.00	8548.00
Build	248513	266935	7823.00	8401.00
Change	277	1751	-171	-147
Subtotal, MOEs				

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	-162.156 hrs	-8.84 hrs
PM Peak Period	-143.337 hrs	-3.66 hrs
Total of Peaks	-305.493 hrs	-12.507 hrs
Daily Estimate	-305.493 hrs	-12.507 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$3,936.47	-\$246.28

Total, all vehicles
-\$4,182.75 Value of travel time changes, per day
-\$1,418,306.15 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars		Trucks	
AM Peak Period				
Average Speed	20			
Change in Veh-Hrs		-162.156 hours		-8.844 hours
Fuel Consumption		0.022 gal/minute		0.102 gal/minute
		-214.0 gallons		-54.1 gallons
PM Peak Period				
Average Speed	20			
Change in Veh-Hrs		-143.3 hours		-3.7 hours
Fuel Consumption		0.022 gal/minute		0.102 gal/minute
		-189.2 gallons		-22.4 gallons
Fuel Consumption				
AM Peak Period		-214.0 gallons		-54.1 gallons
PM Peak Period		-189.2 gallons		-22.4 gallons
Total of Peaks		-403.3 gallons		-76.5 gallons
Daily Estimate		-403.251 gallons		-76.540 gallons
		\$3.004 per gallon		\$3.004 per gallon
		-\$1,211.37 per day		-\$229.93 per day

Total, all vehicles
-479.8 fuel consumption change, gallons per day

USER BENEFITS
 Concept 30B Revised

-162690.0 fuel consumption change, gallons per year

-\$1,441.29 change in fuel cost, per day

-\$488,720.86 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$1,418,306.15	Value of Travel Time change, Per year
Operating Costs	-\$488,720.86	Value of Operating Costs change, per year
Total, User Benefits	-\$1,907,027.01	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-403.251 gallons	-76.540 gallons
Annual estimate	-136736.498 gallons	-25953.534 gallons
CO2	19.4 lb/gal 8799.6848 grams/gal	22.2 lb/gal 10069.7424 grams/gal
Total	(1,203,238,087.45) g (1,464,583.49) kg	(261,345,404) g
VOC	24.62 grams/gal	1.27 grams/gal
Total	(3,366,322.37) g (3,399.28) kg	(32,960.99) g
NOx	16.5 grams/gal	24.52 grams/gal
Total	(2,256,152.23) g (2,892.53) kg	(636,380.66) g
PM2.5	0.097619048 grams/gal	0.136 grams/gal
Total	(13,348.09) g (16.88) kg	(3,529.68) g

SUMMARY OF COSTS AND BENEFITS
 Concept 30C

Construction Cost	
Supplemental Roadway Construction	\$2,900,000.00
Earthwork	\$2,700,000.00
Pavement	\$3,100,000.00
Walls	\$10,100,000.00
Bridges	\$11,700,000.00
Traffic Signals	\$100,000.00
Signage	\$300,000.00
Utilities	\$900,000.00
Additional Lump Sum	\$2,600,000.00
Design and PM	\$6,900,000.00
ROW	\$600,000.00
Total	\$41,900,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	405 hr
Value of Travel Time (Annual)	\$1,801,484.50
Automobile Operating Costs (Annual)	\$614,323.25
Safety (Annual)	\$396,383.26
Total	\$2,812,191.01
Emissions (Annual)	
CO2	-1837361 kg
Nox	-3613 kg
VOC	-4340 kg
Benefit:Cost Ratio	
NPV Benefits	\$42,246,992.57
NPV Operating Costs	\$0.00
NPV Capital Costs	\$41,097,307.15
Total Costs	\$41,097,307.15
Benefit:Cost Ratio	1.03

NET PRESENT VALUE CALCULATIONS

Concept 30C

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$41,936,027.70
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$41,097,307.15
NPV Capital Costs			\$41,097,307.15

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$2,812,191	\$2,541,998	\$0	\$0
2022	0.8858	\$2,812,191	\$2,491,158	\$0	\$0
2023	0.8681	\$2,812,191	\$2,441,335	\$0	\$0
2024	0.8508	\$2,812,191	\$2,392,508	\$0	\$0
2025	0.8337	\$2,812,191	\$2,344,658	\$0	\$0
2026	0.8171	\$2,812,191	\$2,297,765	\$0	\$0
2027	0.8007	\$2,812,191	\$2,251,810	\$0	\$0
2028	0.7847	\$2,812,191	\$2,206,773	\$0	\$0
2029	0.7690	\$2,812,191	\$2,162,638	\$0	\$0
2030	0.7536	\$2,812,191	\$2,119,385	\$0	\$0
2031	0.7386	\$2,812,191	\$2,076,997	\$0	\$0
2032	0.7238	\$2,812,191	\$2,035,457	\$0	\$0
2033	0.7093	\$2,812,191	\$1,994,748	\$0	\$0
2034	0.6951	\$2,812,191	\$1,954,853	\$0	\$0
2035	0.6812	\$2,812,191	\$1,915,756	\$0	\$0
2036	0.6676	\$2,812,191	\$1,877,441	\$0	\$0
2037	0.6543	\$2,812,191	\$1,839,892	\$0	\$0
2038	0.6412	\$2,812,191	\$1,803,094	\$0	\$0
2039	0.6283	\$2,812,191	\$1,767,033	\$0	\$0
2040	0.6158	\$2,812,191	\$1,731,692	\$0	\$0
NPV		User Benefits	\$42,246,993	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
Concept 30C

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Single Faced Barrier	8294 lf	\$60.00	\$497,640.00	\$99,528.00	\$621,054.72
PBD & Geotextile	9725 lf	\$11.00	\$106,975.00	\$21,395.00	\$133,504.80
Drainage	9725 lf	\$51.39	\$499,749.99	\$99,950.00	\$623,687.99
Lighting	9725 lf	\$125.00	\$1,215,625.00	\$243,125.00	\$1,517,100.00
Guiderail	1100 lf	\$16.50	\$18,150.00	\$3,630.00	\$22,651.20
Subtotal, Supplemental Roadway Costs			\$2,338,139.99	\$467,628.00	\$2,917,998.71
					\$2,900,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	28343 CY	\$20.00	\$566,860.00	\$113,372.00	\$707,441.28
Borrow	62686 CY	\$25.00	\$1,567,150.00	\$313,430.00	\$1,955,803.20
Subtotal, Earthwork Costs			\$2,134,010.00	\$426,802.00	\$2,663,244.48
					\$2,700,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	22557 SY	\$110.00	\$2,481,270.00	\$496,254.00	\$3,096,624.96
Subtotal, Pavement Costs			\$2,481,270.00	\$496,254.00	\$3,096,624.96
					\$3,100,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Retaining Wall	2800 lf	\$1,200.00	\$3,360,000.00	\$672,000.00	\$4,193,280.00
Sound Wall	3811 lf	\$1,250.00	\$4,763,750.00	\$952,750.00	\$5,945,160.00
Subtotal, Wall Costs			\$8,123,750.00	\$1,624,750.00	\$10,138,440.00
					\$10,100,000.00

Bridge Cost

Item	Quantity	Cost/sf	2016 Cost	Contingency	2017 Cost
Ramp Structure for ML Ramp D	8000 sf	\$450.00	\$3,600,000.00	\$720,000.00	\$4,492,800.00
Tunnel Under Ramp	4800 sf	\$1,200.00	\$5,760,000.00	\$1,152,000.00	\$7,188,480.00
Subtotal, Bridge Cost			\$9,360,000.00	\$1,872,000.00	\$11,681,280.00
					\$11,700,000.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Overhead Detection	1 ls	\$50,000.00	\$50,000.00	\$10,000.00	\$62,400.00
Subtotal, Signal Costs			\$50,000.00	\$10,000.00	\$62,400.00
					\$100,000.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Overhead Pedestal	1 ea	\$50,000.00	\$50,000.00	\$10,000.00	\$62,400.00
OH Truss 5 Lanes	1 ea	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00
Subtotal, Signage Costs			\$250,000.00	\$50,000.00	\$312,000.00
					\$300,000.00

CONSTRUCTION COST ESTIMATE
 Concept 30C

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Major	1 LS	\$740,101.68	\$740,101.68	\$148,020.34	\$923,646.90
Subtotal, Utility Impact			\$740,101.68	\$148,020.34	\$923,646.90
					\$900,000.00

SUBTOTAL, CONSTRUCTION COSTS			\$25,477,271.67	\$5,095,454.33	\$31,795,635.05
					\$31,800,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost	
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00	
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00	
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00	
Mobilization	1 LS	\$1,273,863.58	\$254,772.72	\$1,589,781.75	
MPT	1 LS	\$764,318.15	\$152,863.63	\$953,869.05	
			\$2,093,181.73	\$418,636.35	\$2,612,290.80
					\$2,600,000.00

TOTAL CONSTRUCTION COSTS			\$27,570,453.41	\$5,514,090.68	\$34,407,925.85
					\$34,400,000.00

DESIGN AND CM COSTS			\$5,095,454.33	\$1,102,818.14	\$6,881,585.17
					\$6,900,000.00

TOTAL, DESIGN, CONSTRUCTION AND CM			\$30,572,726.01		\$41,289,511.02
					\$41,300,000.00

ROW COSTS
 Concept 30C

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
0054-L-00266-0000-00	\$45,600.00	\$97,300.00	10,941	10,941	Yes	100%	\$142,900.00
0054-L-00269-0000-00	\$22,800.00	\$81,800.00	5,490	5,490	Yes	100%	\$104,600.00
0054-L-00270-0000-00	\$22,800.00	\$81,800.00	5,226	5,226	Yes	100%	\$104,600.00
0054-L-00302-0000-00	\$22,800.00	\$70,600.00	4,998	1,445	No	29%	\$27,003.40
0054-M-00303-0000-00	\$22,700.00	\$74,400.00	4,694	983	No	21%	\$20,334.32
0054-M-00304-0000-00	\$22,700.00	\$66,100.00	4,687	377	No	8%	\$7,142.65
0054-M-00322-0000-00	\$42,800.00	\$57,800.00	4,521	80	No	2%	\$1,780.14
0054-M-00324-0000-00	\$35,100.00	\$64,900.00	5,864	571	No	10%	\$9,737.38
0054-M-00326-0000-00	\$33,200.00	\$51,800.00	6,101	1,160	No	19%	\$16,161.29
0054-M-00328-0000-00	\$33,000.00	\$73,000.00	6,338	1,605	No	25%	\$26,842.85
0054-M-00331-0000-00	\$45,200.00	\$95,700.00	6,547	1,813	No	28%	\$39,018.13
0054-H-00030-0000-00	\$13,700.00	\$0.00	505,732	505,732	Yes	100%	\$13,700.00
0054-H-00020-0000-00	\$41,300.00	\$89,800.00	4,173	248	No	6%	\$7,791.23
0054-H-00022-0000-00	\$43,900.00	\$87,400.00	4,757	445	No	9%	\$12,282.64
0054-E-00236-0000-00	\$44,000.00	\$127,600.00	6,350	690	No	11%	\$18,646.30
0054-E-00238-0000-00	\$45,000.00	\$170,500.00	5,376	852	No	16%	\$34,152.90
0054-E-00240-0000-00	\$36,500.00	\$73,500.00	4,897	338	No	7%	\$7,592.40
0054-E-00242-0000-00	\$44,400.00	\$70,600.00	4,867	410	No	8%	\$9,687.69
0054-E-00244-0000-00	\$22,600.00	\$85,100.00	3,408	613	No	18%	\$19,372.10
0054-E-00245-0000-00	\$22,600.00	\$85,100.00	3,398	598	No	18%	\$18,953.68
0054-E-00247-0000-00	\$22,600.00	\$74,600.00	3,383	123	No	4%	\$3,534.02
0054-E-00248-0000-00	\$22,600.00	\$69,900.00	3,383	25	No	1%	\$683.56
Subtotal, ROW Costs							\$646,516.68
							\$600,000.00

Safety
 Concept 30C

Safety

Crash Type	N _{obs,2010-2012}	N _{obs,frequency}	CMF	N _{pred,CMF}	N _{reduced}
Fatal & Injury	12	4.00	0.24	0.96	3.04
PDO	15	5.00	0.38	1.90	3.10

N _{reduced,K}	N _{reduced,A}	N _{reduced,B}	N _{reduced,C}	N _{reduced,O}	Dollars Saved, Annually
0.02	0.14	0.69	2.19	0.00	\$ 360,863.05
0.00	0.00	0.00	0.00	3.50	\$ 35,520.21

Total: \$ 396,383.26

USER BENEFITS
Concept 30C

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:PM Veh-Hrs	
No-build	248236	265184	7994	8548
Build	248862	267580	7835	8302
Change	626	2396	-159	-246
Subtotal, MOEs				

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	-150.777 hrs	-8.22 hrs
PM Peak Period	-239.603 hrs	-6.12 hrs
Total of Peaks	-390.380 hrs	-14.346 hrs
Daily Estimate	-390.380 hrs	-14.346 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$5,030.28	-\$282.50

Total, all vehicles
-\$5,312.78 Value of travel time changes, per day
-\$1,801,484.50 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars	Trucks
AM Peak Period		
Average Speed	20	
Change in Veh-Hrs	-150.777 hours	-8.223 hours
Fuel Consumption	0.022 gal/minute	0.102 gal/minute
	-199.0 gallons	-50.3 gallons

USER BENEFITS

Concept 30C

PM Peak Period

Average Speed	20		
Change in Veh-Hrs		-239.6 hours	-6.1 hours
Fuel Consumption		0.022 gal/minute	0.102 gal/minute
		-316.3 gallons	-37.5 gallons

Fuel Consumption

AM Peak Period		-199.0 gallons	-50.3 gallons
PM Peak Period		-316.3 gallons	-37.5 gallons
Total of Peaks		-515.3 gallons	-87.8 gallons
Daily Estimate		-515.302 gallons	-87.797 gallons
		\$3.004 per gallon	\$3.004 per gallon
		-\$1,547.97 per day	-\$263.74 per day

Total, all vehicles

-603.1 fuel consumption change, gallons per day
-204501.7 fuel consumption change, gallons per year
-\$1,811.71 change in fuel cost, per day
-\$614,323.25 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$1,801,484.50	Value of Travel Time change, Per year
Operating Costs	-\$614,323.25	Value of Operating Costs change, per year
Total, User Benefits	-\$2,415,807.75	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-515.302 gallons	-87.797 gallons
Annual estimate	-174731.075 gallons	-29770.672 gallons
CO2	19.4 lb/gal	22.2 lb/gal
	8799.6848 grams/gal	10069.7424 grams/gal
	(1,537,578,388.48) g	(299,782,997) g
Total	(1,837,361.39) kg	
VOC		
	24.62 grams/gal	1.27 grams/gal

USER BENEFITS

Concept 30C

Total	(4,301,712.67) g (4,339.52) kg	(37,808.75) g
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NOx

	16.5 grams/gal (2,883,062.74) g	24.52 grams/gal (729,976.88) g
Total	(3,613.04) kg	

PM2.5

	0.09761905 grams/gal (17,057.08) g	0.136 grams/gal (4,048.81) g
Total	(21.11) kg	



SUMMARY OF COSTS AND BENEFITS
 Concept 30C Revised

Construction Cost	
Supplemental Roadway Construction	\$2,900,000.00
Earthwork	\$2,700,000.00
Pavement	\$3,200,000.00
Walls	\$10,100,000.00
Bridges	\$15,500,000.00
Traffic Signals	\$100,000.00
Signage	\$300,000.00
Utilities	\$900,000.00
Additional Lump Sum	\$2,900,000.00
Design and PM	\$7,700,000.00
ROW	\$600,000.00
Total	\$46,900,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	405 hr
Value of Travel Time (Annual)	\$1,801,484.50
Automobile Operating Costs (Annual)	\$614,323.25
Safety (Annual)	\$407,822.14
Total	\$2,823,629.89
Emissions (Annual)	
CO2	-1837361 kg
Nox	-3613 kg
VOC	-4340 kg
Benefit:Cost Ratio	
NPV Benefits	\$42,418,836.62
NPV Operating Costs	\$0.00
NPV Capital Costs	\$46,125,938.02
Total Costs	\$46,125,938.02
Benefit:Cost Ratio	0.92

NET PRESENT VALUE CALCULATIONS
 Concept 30C Revised

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$47,067,283.69
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$46,125,938.02
NPV Capital Costs			\$46,125,938.02

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$2,823,630	\$2,552,338	\$0	\$0
2022	0.8858	\$2,823,630	\$2,501,291	\$0	\$0
2023	0.8681	\$2,823,630	\$2,451,265	\$0	\$0
2024	0.8508	\$2,823,630	\$2,402,240	\$0	\$0
2025	0.8337	\$2,823,630	\$2,354,195	\$0	\$0
2026	0.8171	\$2,823,630	\$2,307,111	\$0	\$0
2027	0.8007	\$2,823,630	\$2,260,969	\$0	\$0
2028	0.7847	\$2,823,630	\$2,215,750	\$0	\$0
2029	0.7690	\$2,823,630	\$2,171,435	\$0	\$0
2030	0.7536	\$2,823,630	\$2,128,006	\$0	\$0
2031	0.7386	\$2,823,630	\$2,085,446	\$0	\$0
2032	0.7238	\$2,823,630	\$2,043,737	\$0	\$0
2033	0.7093	\$2,823,630	\$2,002,862	\$0	\$0
2034	0.6951	\$2,823,630	\$1,962,805	\$0	\$0
2035	0.6812	\$2,823,630	\$1,923,549	\$0	\$0
2036	0.6676	\$2,823,630	\$1,885,078	\$0	\$0
2037	0.6543	\$2,823,630	\$1,847,376	\$0	\$0
2038	0.6412	\$2,823,630	\$1,810,429	\$0	\$0
2039	0.6283	\$2,823,630	\$1,774,220	\$0	\$0
2040	0.6158	\$2,823,630	\$1,738,736	\$0	\$0
NPV		User Benefits	\$42,418,837	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 30C Revised

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Single Faced Barrier	8294 lf	\$60.00	\$497,640.00	\$99,528.00	\$621,054.72
PBD & Geotextile	9725 lf	\$11.00	\$106,975.00	\$21,395.00	\$133,504.80
Drainage	9725 lf	\$51.39	\$499,749.99	\$99,950.00	\$623,687.99
Lighting	9725 lf	\$125.00	\$1,215,625.00	\$243,125.00	\$1,517,100.00
Guiderail	1100 lf	\$16.50	\$18,150.00	\$3,630.00	\$22,651.20
Subtotal, Supplemental Roadway Costs			\$2,338,139.99	\$467,628.00	\$2,917,998.71
					\$2,900,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	28343 CY	\$20.00	\$566,860.00	\$113,372.00	\$707,441.28
Borrow	62686 CY	\$25.00	\$1,567,150.00	\$313,430.00	\$1,955,803.20
Subtotal, Earthwork Costs			\$2,134,010.00	\$426,802.00	\$2,663,244.48
					\$2,700,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	22557 SY	\$110.00	\$2,481,270.00	\$496,254.00	\$3,096,624.96
Mountable Concrete Curb Island	1002 lf	\$54.00	\$54,108.00	\$10,821.60	\$67,526.78
Plain Cement Concrete 4"	1128 SY	\$45.00	\$50,760.00	\$10,152.00	\$63,348.48
Subtotal, Pavement Costs			\$2,586,138.00	\$517,227.60	\$3,227,500.22
					\$3,200,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Retaining Wall	2800 lf	\$1,200.00	\$3,360,000.00	\$672,000.00	\$4,193,280.00
Sound Wall	3811 lf	\$1,250.00	\$4,763,750.00	\$952,750.00	\$5,945,160.00
Subtotal, Wall Costs			\$8,123,750.00	\$1,624,750.00	\$10,138,440.00
					\$10,100,000.00

Bridge Cost

Item	Quantity	Cost/sf	2016 Cost	Contingency	2017 Cost
Ramp Structure for ML Ramp A/D	14817 sf	\$450.00	\$6,667,650.00	\$1,333,530.00	\$8,321,227.20
Tunnel Under Ramp	4800 sf	\$1,200.00	\$5,760,000.00	\$1,152,000.00	\$7,188,480.00
Subtotal, Bridge Cost			\$12,427,650.00	\$2,485,530.00	\$15,509,707.20
					\$15,500,000.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Overhead Detection	1 ls	\$50,000.00	\$50,000.00	\$10,000.00	\$62,400.00
Subtotal, Signal Costs			\$50,000.00	\$10,000.00	\$62,400.00
					\$100,000.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Overhead Pedestal	1 ea	\$50,000.00	\$50,000.00	\$10,000.00	\$62,400.00
OH Truss 5 Lanes	1 ea	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00

CONSTRUCTION COST ESTIMATE
 Concept 30C Revised

Subtotal, Signage Costs	\$250,000.00	\$50,000.00	\$312,000.00
			\$300,000.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Major	1 LS	\$740,101.68	\$740,101.68	\$148,020.34	\$923,646.90
Subtotal, Utility Impact			\$740,101.68	\$148,020.34	\$923,646.90
					\$900,000.00

SUBTOTAL, CONSTRUCTION COSTS	\$28,649,789.67	\$5,729,957.93	\$35,754,937.51
			\$35,700,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00
Mobilization	1 LS	\$1,432,489.48	\$286,497.90	\$1,787,746.88
MPT	1 LS	\$859,493.69	\$171,898.74	\$1,072,648.13
		\$2,346,983.17	\$469,396.63	\$2,929,035.00
				\$2,900,000.00

TOTAL CONSTRUCTION COSTS	\$30,996,772.85	\$6,199,354.57	\$38,683,972.51
			\$38,600,000.00

DESIGN AND CM COSTS	\$5,729,957.93	\$1,239,870.91	\$7,736,794.50
			\$7,700,000.00

TOTAL, DESIGN, CONSTRUCTION AND CM	\$34,379,747.61		\$46,420,767.01
			\$46,300,000.00

ROW COSTS
 Concept 30C Revised

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
0054-L-00266-0000-00	\$45,600.00	\$97,300.00	10,941	10,941	Yes	100%	\$142,900.00
0054-L-00269-0000-00	\$22,800.00	\$81,800.00	5,490	5,490	Yes	100%	\$104,600.00
0054-L-00270-0000-00	\$22,800.00	\$81,800.00	5,226	5,226	Yes	100%	\$104,600.00
0054-L-00302-0000-00	\$22,800.00	\$70,600.00	4,998	1,445	No	29%	\$27,003.40
0054-M-00303-0000-00	\$22,700.00	\$74,400.00	4,694	983	No	21%	\$20,334.32
0054-M-00304-0000-00	\$22,700.00	\$66,100.00	4,687	377	No	8%	\$7,142.65
0054-M-00322-0000-00	\$42,800.00	\$57,800.00	4,521	80	No	2%	\$1,780.14
0054-M-00324-0000-00	\$35,100.00	\$64,900.00	5,864	571	No	10%	\$9,737.38
0054-M-00326-0000-00	\$33,200.00	\$51,800.00	6,101	1,160	No	19%	\$16,161.29
0054-M-00328-0000-00	\$33,000.00	\$73,000.00	6,338	1,605	No	25%	\$26,842.85
0054-M-00331-0000-00	\$45,200.00	\$95,700.00	6,547	1,813	No	28%	\$39,018.13
0054-H-00030-0000-00	\$13,700.00	\$0.00	505,732	505,732	Yes	100%	\$13,700.00
0054-H-00020-0000-00	\$41,300.00	\$89,800.00	4,173	248	No	6%	\$7,791.23
0054-H-00022-0000-00	\$43,900.00	\$87,400.00	4,757	445	No	9%	\$12,282.64
0054-E-00236-0000-00	\$44,000.00	\$127,600.00	6,350	690	No	11%	\$18,646.30
0054-E-00238-0000-00	\$45,000.00	\$170,500.00	5,376	852	No	16%	\$34,152.90
0054-E-00240-0000-00	\$36,500.00	\$73,500.00	4,897	338	No	7%	\$7,592.40
0054-E-00242-0000-00	\$44,400.00	\$70,600.00	4,867	410	No	8%	\$9,687.69
0054-E-00244-0000-00	\$22,600.00	\$85,100.00	3,408	613	No	18%	\$19,372.10
0054-E-00245-0000-00	\$22,600.00	\$85,100.00	3,398	598	No	18%	\$18,953.68
0054-E-00247-0000-00	\$22,600.00	\$74,600.00	3,383	123	No	4%	\$3,534.02
0054-E-00248-0000-00	\$22,600.00	\$69,900.00	3,383	25	No	1%	\$683.56
Subtotal, ROW Costs							\$646,516.68
							\$600,000.00

Safety
 Concept 30C Revised

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Fatal & Injury	12	4.00	0.24	0.96	3.04
PDO	15	5.00	0.38	1.90	3.10

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.02	0.14	0.69	2.19	0.00	\$ 360,863.05
0.00	0.00	0.00	0.00	3.50	\$ 35,520.21
Benefits from Ramp A/D structure					\$ 11,438.88

Total: \$ 407,822.14

USER BENEFITS
 Concept 30C Revised

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:PM Veh-Hrs	
No-build	248236	265184	7994	8548
Build	248862	267580	7835	8302
Change	626	2396	-159	-246
Subtotal, MOEs				

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	-150.777 hrs	-8.22 hrs
PM Peak Period	-239.603 hrs	-6.12 hrs
Total of Peaks	-390.380 hrs	-14.346 hrs
Daily Estimate	-390.380 hrs	-14.346 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$5,030.28	-\$282.50

Total, all vehicles
 -\$5,312.78 Value of travel time changes, per day
 -\$1,801,484.50 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars		Trucks	
AM Peak Period				
Average Speed	20			
Change in Veh-Hrs		-150.777 hours		-8.223 hours
Fuel Consumption		0.022 gal/minute		0.102 gal/minute
		-199.0 gallons		-50.3 gallons

USER BENEFITS
 Concept 30C Revised
 PM Peak Period

Average Speed	20		
Change in Veh-Hrs		-239.6 hours	-6.1 hours
Fuel Consumption		0.022 gal/minute	0.102 gal/minute
		-316.3 gallons	-37.5 gallons

Fuel Consumption			
AM Peak Period		-199.0 gallons	-50.3 gallons
PM Peak Period		-316.3 gallons	-37.5 gallons
Total of Peaks		-515.3 gallons	-87.8 gallons
Daily Estimate		-515.302 gallons	-87.797 gallons
		\$3.004 per gallon	\$3.004 per gallon
		-\$1,547.97 per day	-\$263.74 per day

Total, all vehicles		-603.1 fuel consumption change, gallons per day	
		-204501.7 fuel consumption change, gallons per year	
		-\$1,811.71 change in fuel cost, per day	
		-\$614,323.25 change in fuel cost, per year	

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-1,801,484.50	Value of Travel Time change, Per year
Operating Costs	-\$614,323.25	Value of Operating Costs change, per year
Total, User Benefits	-\$2,415,807.75	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-515.302 gallons	-87.797 gallons
Annual estimate	-174731.075 gallons	-29770.672 gallons
CO2	19.4 lb/gal	22.2 lb/gal
	8799.6848 grams/gal	10069.7424 grams/gal
	(1,537,578,388.48) g	(299,782,997) g
Total	(1,837,361.39) kg	
VOC		
	24.62 grams/gal	1.27 grams/gal

USER BENEFITS

Concept 30C Revised

Total	(4,301,712.67) g (4,339.52) kg	(37,808.75) g
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NOx

16.5 grams/gal

24.52 grams/gal

Total	(2,883,062.74) g (3,613.04) kg	(729,976.88) g
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PM2.5

0.09761905 grams/gal

0.136 grams/gal

Total	(17,057.08) g (21.11) kg	(4,048.81) g
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SUMMARY OF COSTS AND BENEFITS
 Concept 31A

Construction Cost	
Supplemental Roadway Construction	\$1,500,000.00
Earthwork	\$1,800,000.00
Pavement	\$1,600,000.00
Walls	\$17,700,000.00
Bridges	\$3,400,000.00
Traffic Signals	\$100,000.00
Signage	\$300,000.00
Utilities	\$700,000.00
Additional Lump Sum	\$2,200,000.00
Design and PM	\$5,800,000.00
ROW	\$1,100,000.00
Total	\$36,200,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	-267 hr
Value of Travel Time (Annual)	-\$1,192,987.53
Automobile Operating Costs (Annual)	-\$415,735.03
Safety (Annual)	\$0.00
Total	-\$1,608,722.56
Emissions (Annual)	
CO2	1248483 kg
NOx	2477 kg
VOC	2843 kg
Benefit:Cost Ratio	
NPV Benefits	-\$24,167,522.65
NPV Operating Costs	\$0.00
NPV Capital Costs	\$34,317,091.42
Total Costs	\$34,317,091.42
Benefit:Cost Ratio	-0.70

NET PRESENT VALUE CALCULATIONS

Concept 31A

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$35,017,440.23
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$34,317,091.42
NPV Capital Costs			\$34,317,091.42

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	-\$1,608,723	-\$1,454,158	\$0	\$0
2022	0.8858	-\$1,608,723	-\$1,425,075	\$0	\$0
2023	0.8681	-\$1,608,723	-\$1,396,573	\$0	\$0
2024	0.8508	-\$1,608,723	-\$1,368,642	\$0	\$0
2025	0.8337	-\$1,608,723	-\$1,341,269	\$0	\$0
2026	0.8171	-\$1,608,723	-\$1,314,443	\$0	\$0
2027	0.8007	-\$1,608,723	-\$1,288,155	\$0	\$0
2028	0.7847	-\$1,608,723	-\$1,262,391	\$0	\$0
2029	0.7690	-\$1,608,723	-\$1,237,144	\$0	\$0
2030	0.7536	-\$1,608,723	-\$1,212,401	\$0	\$0
2031	0.7386	-\$1,608,723	-\$1,188,153	\$0	\$0
2032	0.7238	-\$1,608,723	-\$1,164,390	\$0	\$0
2033	0.7093	-\$1,608,723	-\$1,141,102	\$0	\$0
2034	0.6951	-\$1,608,723	-\$1,118,280	\$0	\$0
2035	0.6812	-\$1,608,723	-\$1,095,914	\$0	\$0
2036	0.6676	-\$1,608,723	-\$1,073,996	\$0	\$0
2037	0.6543	-\$1,608,723	-\$1,052,516	\$0	\$0
2038	0.6412	-\$1,608,723	-\$1,031,466	\$0	\$0
2039	0.6283	-\$1,608,723	-\$1,010,836	\$0	\$0
2040	0.6158	-\$1,608,723	-\$990,620	\$0	\$0
NPV		User Benefits	-\$24,167,523	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 31A

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Single Faced Barrier	4600 lf	\$60.00	\$276,000.00	\$55,200.00	\$344,448.00
PBD & Geotextile	3800 lf	\$11.00	\$41,800.00	\$8,360.00	\$52,166.40
Drainage	4600 lf	\$85.09	\$391,425.39	\$78,285.08	\$488,498.89
Lighting	3800 lf	\$125.00	\$475,000.00	\$95,000.00	\$592,800.00
Subtotal, Supplemental Roadway Costs			\$1,184,225.39	\$236,845.08	\$1,477,913.29
					\$1,500,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	71212 CY	\$20.00	\$1,424,240.00	\$284,848.00	\$1,777,451.52
Borrow	0 CY	\$25.00	\$0.00	\$0.00	\$0.00
Subtotal, Earthwork Costs			\$1,424,240.00	\$284,848.00	\$1,777,451.52
					\$1,800,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	11861 SY	\$110.00	\$1,304,710.00	\$260,942.00	\$1,628,278.08
Subtotal, Pavement Costs			\$1,304,710.00	\$260,942.00	\$1,628,278.08
					\$1,600,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Retaining Wall	1430 lf	\$6,076.52	\$8,689,428.00	\$1,737,885.60	\$10,844,406.14
Sound Wall	4376 lf	\$1,250.00	\$5,470,000.00	\$1,094,000.00	\$6,826,560.00
Subtotal, Wall Costs			\$14,159,428.00	\$2,831,885.60	\$17,670,966.14
					\$17,700,000.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Ramp over Parkway	150 lf	\$18,000.00	\$2,700,000.00	\$540,000.00	\$3,369,600.00
Subtotal, Bridge Cost			\$2,700,000.00	\$540,000.00	\$3,369,600.00
					\$3,400,000.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Overhead Detection	1 ls	\$50,000.00	\$50,000.00	\$10,000.00	\$62,400.00
Subtotal, Signal Costs			\$50,000.00	\$10,000.00	\$62,400.00
					\$100,000.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Overhead Pedestal	1 ea	\$50,000.00	\$50,000.00	\$10,000.00	\$62,400.00
OH Truss 5 Lanes	1 ea	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00
Subtotal, Signage Costs			\$250,000.00	\$50,000.00	\$312,000.00
					\$300,000.00

CONSTRUCTION COST ESTIMATE
 Concept 31A

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Moderate	1 LS	\$526,815.08	\$526,815.08	\$105,363.02	\$657,465.22
Subtotal, Utility Impact			\$526,815.08	\$105,363.02	\$657,465.22
					\$700,000.00

SUBTOTAL, CONSTRUCTION COSTS			\$21,599,418.47	\$4,319,883.69	\$26,956,074.25
					\$27,100,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost	
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00	
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00	
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00	
Mobilization	1 LS	\$1,079,970.92	\$215,994.18	\$1,347,803.71	
MPT	1 LS	\$647,982.55	\$129,596.51	\$808,682.23	
			\$1,782,953.48	\$356,590.70	\$2,225,125.94
					\$2,200,000.00

TOTAL CONSTRUCTION COSTS			\$23,382,371.95	\$4,676,474.39	\$29,181,200.19
					\$29,300,000.00

DESIGN AND CM COSTS			\$4,319,883.69	\$935,294.88	\$5,836,240.04
					\$5,800,000.00

TOTAL, DESIGN, CONSTRUCTION AND CM			\$25,919,302.16		\$35,017,440.23
					\$35,100,000.00

ROW COSTS
 Concept 31A

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
0027-S-00150-0000-01	\$531,391,000.00	\$8,278,000.00	18,164,520	24,319	No	0%	\$711,447.20
0054-H-00030-0000-00	\$13,700.00	\$0.00	505,732	76,537	No	15%	\$2,073.34
0054-L-00236-0000-00	\$52,700.00	\$0.00	79,715	9,001	No	11%	\$5,950.83
0054-L-00247-0000-00	\$352,800.00	\$1,047,200.00	33,302	38	No	0%	\$500.00
0054-L-00266-0000-00	\$45,600.00	\$97,300.00	10,941	341	No	3%	\$1,421.60
0054-L-00269-0000-00	\$22,800.00	\$81,800.00	5,490	1,337	No	24%	\$5,551.00
0054-L-00270-0000-00	\$22,800.00	\$81,800.00	5,226	1,659	No	32%	\$7,235.88
0054-M-00302-0000-00	\$22,800.00	\$70,600.00	4,998	2,187	No	44%	\$9,977.04
0054-M-00303-0000-00	\$22,700.00	\$74,400.00	4,694	2,179	No	46%	\$10,538.04
0054-M-00304-0000-00	\$22,700.00	\$66,100.00	4,687	2,378	No	51%	\$11,517.14
0054-M-00306-0000-00	\$22,700.00	\$87,700.00	4,741	2,579	No	54%	\$12,350.19
0054-M-00307-0000-00	\$44,700.00	\$55,000.00	4,926	2,751	No	56%	\$24,963.67
0054-M-00308-0000-00	\$44,500.00	\$57,000.00	4,878	2,473	No	51%	\$22,557.72
0054-M-00310-0000-00	\$45,000.00	\$74,300.00	5,147	2,691	No	52%	\$23,531.51
0054-M-00312-0000-00	\$44,000.00	\$56,600.00	4,769	2,303	No	48%	\$21,250.82
0054-M-00313-0000-00	\$42,700.00	\$132,300.00	4,495	1,751	Yes	100%	\$175,000.00
0054-M-00316-0000-00	\$42,500.00	\$62,700.00	4,448	1,754	No	39%	\$16,762.07
0054-M-00314-0000-00	\$45,400.00	\$59,300.00	8,891	2,567	No	29%	\$13,108.07
0054-M-00322-0000-00	\$42,800.00	\$57,800.00	4,521	873	No	19%	\$8,265.84
0054-M-00324-0000-00	\$35,100.00	\$64,900.00	5,864	821	No	14%	\$4,914.59
0054-M-00326-0000-00	\$33,200.00	\$51,800.00	6,101	589	No	10%	\$3,202.49
0054-M-00328-0000-00	\$33,000.00	\$73,000.00	6,338	593	No	9%	\$3,089.56
0054-M-00331-0000-00	\$45,200.00	\$95,700.00	6,547	541	No	8%	\$3,733.51
Subtotal, ROW Costs							\$1,098,942.12

\$1,100,000.00

Safety
 Concept 31A

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Fatal & Injury	28	9.33	1.00	9.33	0.00

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.00	0.00	0.00	0.00	\$ -

USER BENEFITS
Concept 31A

PM Peak Period

Average Speed	20		
Change in Veh-Hrs		78.9 hours	2.0 hours
Fuel Consumption		0.022 gal/minute	0.102 gal/minute
		104.2 gallons	12.3 gallons

Fuel Consumption

AM Peak Period		232.7 gallons	58.9 gallons
PM Peak Period		104.2 gallons	12.3 gallons
Total of Peaks		336.9 gallons	71.2 gallons
Daily Estimate		336.942 gallons	71.197 gallons
		\$3.004 per gallon	\$3.004 per gallon
		\$1,012.17 per day	\$213.88 per day

Total, all vehicles

408.1 fuel consumption change, gallons per day
 138393.8 fuel consumption change, gallons per year

 \$1,226.05 change in fuel cost, per day
 \$415,735.03 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	\$1,192,987.53	Value of Travel Time change, Per year
Operating Costs	\$415,735.03	Value of Operating Costs change, per year
Total, User Benefits	\$1,608,722.56	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	336.942 gallons	71.197 gallons
Annual estimate	114252.065 gallons	24141.753 gallons
CO2	19.4 lb/gal	22.2 lb/gal
	8799.6848 grams/gal	10069.7424 grams/gal
	1,005,382,162.83 g	243,101,233.10 g
Total	1,248,483.40 kg	

USER BENEFITS
Concept 31A

VOC

24.62 grams/gal	1.27 grams/gal
2,812,777.04 g	30,660.03 g
Total 2,843.44 kg	

NOx

16.5 grams/gal	24.52 grams/gal
1,885,159.08 g	591,955.78 g
Total 2,477.11 kg	

PM2.5

0.09761905 grams/gal	0.136 grams/gal
11,153.18 g	3,283.28 g
Total 14.44 kg	



SUMMARY OF COSTS AND BENEFITS
 Concept 31B

Construction Cost	
Supplemental Roadway Construction	\$900,000.00
Earthwork	\$1,200,000.00
Pavement	\$1,000,000.00
Walls	\$8,500,000.00
Bridges	\$0.00
Traffic Signals	\$300,000.00
Signage	\$300,000.00
Utilities	\$600,000.00
Additional Lump Sum	\$1,100,000.00
Design and PM	\$2,800,000.00
ROW	\$2,300,000.00
Total	\$19,000,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	171 hr
Value of Travel Time (Annual)	\$744,961.96
Automobile Operating Costs (Annual)	\$229,227.67
Safety (Annual)	\$0.00
Total	\$974,189.63
Emissions (Annual)	
CO2	-671470 kg
NOx	-1259 kg
VOC	-1879 kg
Benefit:Cost Ratio	
NPV Benefits	\$14,635,059.26
NPV Operating Costs	\$0.00
NPV Capital Costs	\$18,643,897.29
Total Costs	\$18,643,897.29
Benefit:Cost Ratio	0.78

NET PRESENT VALUE CALCULATIONS
 Concept 31B

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$19,024,384.99
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$18,643,897.29
NPV Capital Costs			\$18,643,897.29

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$974,190	\$880,590	\$0	\$0
2022	0.8858	\$974,190	\$862,978	\$0	\$0
2023	0.8681	\$974,190	\$845,719	\$0	\$0
2024	0.8508	\$974,190	\$828,805	\$0	\$0
2025	0.8337	\$974,190	\$812,228	\$0	\$0
2026	0.8171	\$974,190	\$795,984	\$0	\$0
2027	0.8007	\$974,190	\$780,064	\$0	\$0
2028	0.7847	\$974,190	\$764,463	\$0	\$0
2029	0.7690	\$974,190	\$749,174	\$0	\$0
2030	0.7536	\$974,190	\$734,190	\$0	\$0
2031	0.7386	\$974,190	\$719,506	\$0	\$0
2032	0.7238	\$974,190	\$705,116	\$0	\$0
2033	0.7093	\$974,190	\$691,014	\$0	\$0
2034	0.6951	\$974,190	\$677,194	\$0	\$0
2035	0.6812	\$974,190	\$663,650	\$0	\$0
2036	0.6676	\$974,190	\$650,377	\$0	\$0
2037	0.6543	\$974,190	\$637,369	\$0	\$0
2038	0.6412	\$974,190	\$624,622	\$0	\$0
2039	0.6283	\$974,190	\$612,129	\$0	\$0
2040	0.6158	\$974,190	\$599,887	\$0	\$0
NPV		User Benefits	\$14,635,059	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
Concept 31B

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Single Faced Barrier	3000 lf	\$60.00	\$180,000.00	\$36,000.00	\$224,640.00
PBD & Geotextile	2240 lf	\$11.00	\$24,640.00	\$4,928.00	\$30,750.72
Drainage	2240 lf	\$110.45	\$247,418.75	\$49,483.75	\$308,778.60
Lighting	2240 lf	\$125.00	\$280,000.00	\$56,000.00	\$349,440.00
Subtotal, Supplemental Roadway Costs			\$732,058.75	\$146,411.75	\$913,609.32
					\$900,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	6403 CY	\$20.00	\$128,060.00	\$25,612.00	\$159,818.88
Borrow	32923 CY	\$25.00	\$823,075.00	\$164,615.00	\$1,027,197.60
Subtotal, Earthwork Costs			\$951,135.00	\$190,227.00	\$1,187,016.48
					\$1,200,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	7498 SY	\$110.00	\$824,780.00	\$164,956.00	\$1,029,325.44
Subtotal, Pavement Costs			\$824,780.00	\$164,956.00	\$1,029,325.44
					\$1,000,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Retaining Wall	1290 lf	\$1,500.26	\$1,935,330.00	\$387,066.00	\$2,415,291.84
Sound Wall	3883 lf	\$1,250.00	\$4,853,750.00	\$970,750.00	\$6,057,480.00
Subtotal, Wall Costs			\$6,789,080.00	\$1,357,816.00	\$8,472,771.84
					\$8,500,000.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Overhead Detection	1 ls	\$50,000.00	\$50,000.00	\$10,000.00	\$62,400.00
Traffic Signal at Beechwood/Greenfield	1 ea	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00
Subtotal, Signal Costs			\$250,000.00	\$50,000.00	\$312,000.00
					\$300,000.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Overhead Pedestal	1 ea	\$50,000.00	\$50,000.00	\$10,000.00	\$62,400.00
OH Truss 5 Lanes	1 ea	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00
Subtotal, Signage Costs			\$250,000.00	\$50,000.00	\$312,000.00
					\$300,000.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Major	1 LS	\$489,852.69	\$489,852.69	\$97,970.54	\$611,336.16

CONSTRUCTION COST ESTIMATE
 Concept 31B

Subtotal, Utility Impact	\$489,852.69	\$97,970.54	\$611,336.16
			\$600,000.00

SUBTOTAL, CONSTRUCTION COSTS	\$10,286,906.44	\$2,057,381.29	\$12,838,059.24
			\$12,800,000.00

Administrative Costs

Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00
Mobilization	1 LS	\$514,345.32	\$102,869.06	\$641,902.96
MPT	1 LS	\$308,607.19	\$61,721.44	\$385,141.78
		\$877,952.52	\$175,590.50	\$1,095,684.74
				\$1,100,000.00

TOTAL CONSTRUCTION COSTS	\$11,164,858.96	\$2,232,971.79	\$13,933,743.98
			\$13,900,000.00

DESIGN AND CM COSTS	\$2,057,381.29	\$446,594.36	\$2,786,748.80
			\$2,800,000.00

TOTAL, DESIGN, CONSTRUCTION AND CM	\$12,344,287.73		\$16,720,492.77
			\$16,700,000.00

ROW COSTS
 Concept 31B

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
0054-H-00030-0000-00	\$13,700.00	\$0.00	505,732	53,981	No	11%	\$1,462.32
0054-L-00247-0000-00	\$352,800.00	\$1,047,200.00	33,302	24,098	Yes	100%	\$1,400,000.00
0054-L-00252-0000-00	\$91,400.00	\$695,600.00	12,000	7,950	Yes	100%	\$787,000.00
0054-L-00260-0000-00	\$22,700.00	\$72,300.00	4,043	940	No	23%	\$5,280.05
0054-L-00262-0000-00	\$22,700.00	\$72,300.00	4,374	1,527	No	35%	\$7,927.10
0054-L-00263-0000-00	\$22,700.00	\$67,200.00	4,726	2,113	No	45%	\$10,147.75
0054-L-00264-0000-00	\$22,800.00	\$71,700.00	5,079	2,250	No	44%	\$10,101.68
0054-L-00266-0000-00	\$45,600.00	\$97,300.00	10,941	5,206	No	48%	\$21,696.70
0054-L-00269-0000-00	\$22,800.00	\$81,800.00	5,490	2,856	No	52%	\$11,860.84
0054-L-00270-0000-00	\$22,800.00	\$81,800.00	5,226	2,123	No	41%	\$9,261.25
0054-M-00302-0000-00	\$22,800.00	\$70,600.00	4,998	1,969	No	39%	\$8,982.46
0054-M-00303-0000-00	\$22,700.00	\$74,400.00	4,694	1,352	No	29%	\$6,537.23
0054-M-00304-0000-00	\$22,700.00	\$66,100.00	4,687	1,152	No	25%	\$5,580.72
0054-M-00306-0000-00	\$22,700.00	\$87,700.00	4,741	1,128	No	24%	\$5,399.24
0054-M-00307-0000-00	\$44,700.00	\$55,000.00	4,926	686	No	14%	\$6,229.33
0054-M-00308-0000-00	\$44,500.00	\$57,000.00	4,878	67	No	1%	\$606.75
0054-M-00326-0000-00	\$33,200.00	\$51,800.00	6,101	7	No	0%	\$500.00
0054-M-00328-0000-00	\$33,000.00	\$73,000.00	6,338	270	No	4%	\$1,403.94
0054-M-00331-0000-00	\$45,200.00	\$95,700.00	6,547	567	No	9%	\$3,914.85
Subtotal, ROW Costs							\$2,303,892.22
							\$2,300,000.00

Safety
 Concept 31B

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Fatal & Injury	28	9.33	1.00	9.33	0.00

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.00	0.00	0.00	0.00	\$ -

USER BENEFITS
Concept 31B

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:PM Veh-Hrs	
No-build	248236	265184	7994	8548
Build	248089	268189	8153	8219
Change	-147	3005	159	-329
Subtotal, MOEs				

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	150.491 hrs	8.21 hrs
PM Peak Period	-320.997 hrs	-8.20 hrs
Total of Peaks	-170.506 hrs	0.005 hrs
Daily Estimate	-170.506 hrs	0.005 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$2,197.07	\$0.09

Total, all vehicles
-\$2,196.98 Value of travel time changes, per day
-\$744,961.96 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars		Trucks	
AM Peak Period				
Average Speed	20			
Change in Veh-Hrs		150.491 hours		8.207 hours
Fuel Consumption		0.022 gal/minute		0.102 gal/minute
		198.6 gallons		50.2 gallons

USER BENEFITS
Concept 31B

PM Peak Period

Average Speed	20		
Change in Veh-Hrs		-321.0 hours	-8.2 hours
Fuel Consumption		0.022 gal/minute	0.102 gal/minute
		<hr/> -423.7 gallons	<hr/> -50.2 gallons

Fuel Consumption

AM Peak Period		198.6 gallons	50.2 gallons
PM Peak Period		-423.7 gallons	-50.2 gallons
Total of Peaks		-225.1 gallons	0.0 gallons
Daily Estimate		<hr/> -225.067 gallons	<hr/> 0.028 gallons
		\$3.004 per gallon	\$3.004 per gallon
		<hr/> -\$676.10 per day	<hr/> \$0.08 per day

Total, all vehicles

-225.0 fuel consumption change, gallons per day
 -76307.5 fuel consumption change, gallons per year

 -\$676.02 change in fuel cost, per day
 -\$229,227.67 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	- \$744,961.96	Value of Travel Time change, Per year
Operating Costs	- \$229,227.67	Value of Operating Costs change, per year
Total, User Benefits	- \$974,189.63	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-225.067 gallons	0.028 gallons
Annual estimate	-76316.987 gallons	9.506 gallons
CO2	19.4 lb/gal 8799.6848 grams/gal	22.2 lb/gal 10069.7424 grams/gal
	(671,565,428.34) g	95,727.64 g
Total	(671,469.70) kg	

USER BENEFITS
Concept 31B

VOC

24.62 grams/gal	1.27 grams/gal
(1,878,851.53) g	12.07 g
(1,878.84) kg	

Total

NOx

16.5 grams/gal	24.52 grams/gal
(1,259,230.28) g	233.10 g
(1,259.00) kg	

Total

PM2.5

0.09761905 grams/gal	0.136 grams/gal
(7,449.99) g	1.29 g
(7.45) kg	

Total



SUMMARY OF COSTS AND BENEFITS
 Concept 31D

Construction Cost	
Supplemental Roadway Construction	\$1,000,000.00
Earthwork	\$2,500,000.00
Pavement	\$900,000.00
Walls	\$8,100,000.00
Bridges	\$0.00
Traffic Signals	\$100,000.00
Signage	\$300,000.00
Utilities	\$600,000.00
Additional Lump Sum	\$1,200,000.00
Design and PM	\$2,900,000.00
ROW	\$1,200,000.00
Total	\$18,800,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	215 hr
Value of Travel Time (Annual)	\$943,581.97
Automobile Operating Costs (Annual)	\$297,105.75
Safety (Annual)	\$0.00
Total	\$1,240,687.72
Emissions (Annual)	
CO2	-874568 kg
NOx	-1659 kg
VOC	-2357 kg
Benefit:Cost Ratio	
NPV Benefits	\$18,638,607.63
NPV Operating Costs	\$0.00
NPV Capital Costs	\$18,516,898.22
Total Costs	\$18,516,898.22
Benefit:Cost Ratio	1.01

NET PRESENT VALUE CALCULATIONS

Concept 31D

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$18,894,794.10
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$18,516,898.22
NPV Capital Costs			\$18,516,898.22

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$1,240,688	\$1,121,483	\$0	\$0
2022	0.8858	\$1,240,688	\$1,099,054	\$0	\$0
2023	0.8681	\$1,240,688	\$1,077,073	\$0	\$0
2024	0.8508	\$1,240,688	\$1,055,531	\$0	\$0
2025	0.8337	\$1,240,688	\$1,034,421	\$0	\$0
2026	0.8171	\$1,240,688	\$1,013,732	\$0	\$0
2027	0.8007	\$1,240,688	\$993,458	\$0	\$0
2028	0.7847	\$1,240,688	\$973,588	\$0	\$0
2029	0.7690	\$1,240,688	\$954,117	\$0	\$0
2030	0.7536	\$1,240,688	\$935,034	\$0	\$0
2031	0.7386	\$1,240,688	\$916,334	\$0	\$0
2032	0.7238	\$1,240,688	\$898,007	\$0	\$0
2033	0.7093	\$1,240,688	\$880,047	\$0	\$0
2034	0.6951	\$1,240,688	\$862,446	\$0	\$0
2035	0.6812	\$1,240,688	\$845,197	\$0	\$0
2036	0.6676	\$1,240,688	\$828,293	\$0	\$0
2037	0.6543	\$1,240,688	\$811,727	\$0	\$0
2038	0.6412	\$1,240,688	\$795,493	\$0	\$0
2039	0.6283	\$1,240,688	\$779,583	\$0	\$0
2040	0.6158	\$1,240,688	\$763,991	\$0	\$0
NPV		User Benefits	\$18,638,608	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
Concept 31D

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Single Faced Barrier	4300 lf	\$60.00	\$258,000.00	\$51,600.00	\$321,984.00
PBD & Geotextile	2080 lf	\$11.00	\$22,880.00	\$4,576.00	\$28,554.24
Drainage	2080 lf	\$110.45	\$229,745.98	\$45,949.20	\$286,722.99
Lighting	2080 lf	\$125.00	\$260,000.00	\$52,000.00	\$324,480.00
Subtotal, Supplemental Roadway Costs			\$770,625.98	\$154,125.20	\$961,741.23
					\$1,000,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	6428 CY	\$20.00	\$128,560.00	\$25,712.00	\$160,442.88
Borrow	76307 CY	\$25.00	\$1,907,675.00	\$381,535.00	\$2,380,778.40
Subtotal, Earthwork Costs			\$2,036,235.00	\$407,247.00	\$2,541,221.28
					\$2,500,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	6532 SY	\$110.00	\$718,520.00	\$143,704.00	\$896,712.96
Subtotal, Pavement Costs			\$718,520.00	\$143,704.00	\$896,712.96
					\$900,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Retaining Wall	1300 lf	\$2,320.39	\$3,016,512.00	\$603,302.40	\$3,764,606.98
Sound Wall	2807 lf	\$1,250.00	\$3,508,750.00	\$701,750.00	\$4,378,920.00
Subtotal, Wall Costs			\$6,525,262.00	\$1,305,052.40	\$8,143,526.98
					\$8,100,000.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Overhead Detection	1 ls	\$50,000.00	\$50,000.00	\$10,000.00	\$62,400.00
Subtotal, Signal Costs			\$50,000.00	\$10,000.00	\$62,400.00
					\$100,000.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Overhead Pedestal	1 ea	\$50,000.00	\$50,000.00	\$10,000.00	\$62,400.00
OH Truss 5 Lanes	1 ea	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00
Subtotal, Signage Costs			\$250,000.00	\$50,000.00	\$312,000.00
					\$300,000.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Major	1 LS	\$517,532.15	\$517,532.15	\$103,506.43	\$645,880.12
Subtotal, Utility Impact			\$517,532.15	\$103,506.43	\$645,880.12

CONSTRUCTION COST ESTIMATE
 Concept 31D

\$600,000.00

SUBTOTAL, CONSTRUCTION COSTS	\$10,868,175.13	\$2,173,635.03	\$13,563,482.56
			\$13,500,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00
Mobilization	1 LS	\$543,408.76	\$108,681.75	\$678,174.13
MPT	1 LS	\$326,045.25	\$65,209.05	\$406,904.48
		\$924,454.01	\$184,890.80	\$1,153,718.61
				\$1,200,000.00

TOTAL CONSTRUCTION COSTS	\$11,792,629.14	\$2,358,525.83	\$14,717,201.17
			\$14,700,000.00

DESIGN AND CM COSTS	\$2,173,635.03	\$471,705.17	\$2,943,440.23
			\$2,900,000.00

TOTAL, DESIGN, CONSTRUCTION AND CM	\$13,041,810.16		\$17,660,641.40
			\$17,600,000.00

ROW COSTS
 Concept 31D

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
0054-H-00030-0000-00	\$13,700.00	\$0.00	505,732	50,890	No	10%	\$1,378.59
0054-L-00236-0000-00	\$52,700.00	\$0.00	79,715	17,582	No	22%	\$11,623.61
0054-L-00247-0000-00	\$352,800.00	\$1,047,200.00	33,302	13,061	No	39%	\$138,368.84
0054-L-00252-0000-00	\$91,400.00	\$695,600.00	12,000	1,843	Yes	100%	\$787,000.00
0054-L-00260-0000-00	\$22,700.00	\$72,300.00	4,043	3,750	Yes	100%	\$95,000.00
0054-L-00262-0000-00	\$22,700.00	\$72,300.00	4,374	4,153	Yes	100%	\$95,000.00
0054-L-00263-0000-00	\$22,700.00	\$67,200.00	4,726	3,957	Yes	100%	\$89,900.00
0054-L-00264-0000-00	\$22,800.00	\$71,700.00	5,079	1,016	No	20%	\$4,563.09
0054-L-00266-0000-00	\$45,600.00	\$97,300.00	10,941	1,472	No	13%	\$6,133.38
0054-L-00269-0000-00	\$22,800.00	\$81,800.00	5,490	240	No	4%	\$996.68
0054-M-00328-0000-00	\$33,000.00	\$73,000.00	6,338	146	No	2%	\$762.56
0054-M-00331-0000-00	\$45,200.00	\$95,700.00	6,547	496	No	8%	\$3,425.95
Subtotal, ROW Costs							\$1,234,152.69
							\$1,200,000.00

Safety
Concept 31D

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Fatal & Injury	28	9.33	1.00	9.33	0.00

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.00	0.00	0.00	0.00	\$ -

USER BENEFITS
Concept 31D

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:PM Veh-Hrs	
No-build	248236	265184	7994	8548
Build	250031	268072	8134	8193
Change	1795	2889	140	-355
Subtotal, MOEs				

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	132.608 hrs	7.23 hrs
PM Peak Period	-346.101 hrs	-8.84 hrs
Total of Peaks	-213.493 hrs	-1.612 hrs
Daily Estimate	-213.493 hrs	-1.612 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$2,750.98	-\$31.75

Total, all vehicles
-\$2,782.73 Value of travel time changes, per day
-\$943,581.97 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars	Trucks
AM Peak Period		
Average Speed	20	
Change in Veh-Hrs	132.608 hours	7.232 hours
Fuel Consumption	0.022 gal/minute	0.102 gal/minute
	175.0 gallons	44.3 gallons

USER BENEFITS
Concept 31D

PM Peak Period

Average Speed	20		
Change in Veh-Hrs		-346.1 hours	-8.8 hours
Fuel Consumption		0.022 gal/minute	0.102 gal/minute
		-456.9 gallons	-54.1 gallons

Fuel Consumption

AM Peak Period		175.0 gallons	44.3 gallons
PM Peak Period		-456.9 gallons	-54.1 gallons
Total of Peaks		-281.8 gallons	-9.9 gallons
Daily Estimate		-281.810 gallons	-9.867 gallons
		\$3.004 per gallon	\$3.004 per gallon
		-\$846.56 per day	-\$29.64 per day

Total, all vehicles

-291.7 fuel consumption change, gallons per day
-98903.4 fuel consumption change, gallons per year
-
-\$876.20 change in fuel cost, per day
-\$297,105.75 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$943,581.97	Value of Travel Time change, Per year
Operating Costs	-\$297,105.75	Value of Operating Costs change, per year
Total, User Benefits	-\$1,240,687.72	

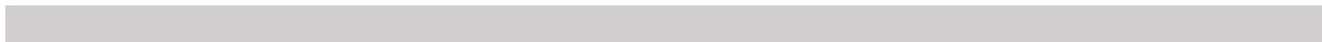
Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-281.810 gallons	-9.867 gallons
Annual estimate	-95557.680 gallons	-3345.697 gallons
CO2	19.4 lb/gal	22.2 lb/gal
	8799.6848 grams/gal	10069.7424 grams/gal
	(840,877,468.46) g	(33,690,305.20) g
Total	(874,567.77) kg	

VOC

USER BENEFITS
Concept 31D

	24.62 grams/gal	1.27 grams/gal
	(2,352,539.09) g	(4,249.03) g
Total	(2,356.79) kg	
NOx		
	16.5 grams/gal	24.52 grams/gal
	(1,576,701.73) g	(82,036.49) g
Total	(1,658.74) kg	
PM2.5		
	0.09761905 grams/gal	0.136 grams/gal
	(9,328.25) g	(455.01) g
Total	(9.78) kg	



SUMMARY OF COSTS AND BENEFITS
 Concept 31D Revised

Construction Cost	
Supplemental Roadway Construction	\$1,000,000.00
Earthwork	\$2,500,000.00
Pavement	\$1,000,000.00
Walls	\$8,100,000.00
Bridges	\$8,300,000.00
Traffic Signals	\$100,000.00
Signage	\$300,000.00
Utilities	\$600,000.00
Additional Lump Sum	\$1,800,000.00
Design and PM	\$4,800,000.00
ROW	\$1,200,000.00
Total	\$29,700,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	215 hr
Value of Travel Time (Annual)	\$943,581.97
Automobile Operating Costs (Annual)	\$297,105.75
Safety (Annual)	\$11,438.88
Total	\$1,252,126.60
Emissions (Annual)	
CO2	-874568 kg
NOx	-1659 kg
VOC	-2357 kg
Benefit:Cost Ratio	
NPV Benefits	\$18,810,451.68
NPV Operating Costs	\$0.00
NPV Capital Costs	\$29,251,744.51
Total Costs	\$29,251,744.51
Benefit:Cost Ratio	0.64

NET PRESENT VALUE CALCULATIONS
 Concept 31D Revised

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$29,848,718.89
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$29,251,744.51
NPV Capital Costs			\$29,251,744.51

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$1,252,127	\$1,131,823	\$0	\$0
2022	0.8858	\$1,252,127	\$1,109,187	\$0	\$0
2023	0.8681	\$1,252,127	\$1,087,003	\$0	\$0
2024	0.8508	\$1,252,127	\$1,065,263	\$0	\$0
2025	0.8337	\$1,252,127	\$1,043,958	\$0	\$0
2026	0.8171	\$1,252,127	\$1,023,079	\$0	\$0
2027	0.8007	\$1,252,127	\$1,002,617	\$0	\$0
2028	0.7847	\$1,252,127	\$982,565	\$0	\$0
2029	0.7690	\$1,252,127	\$962,913	\$0	\$0
2030	0.7536	\$1,252,127	\$943,655	\$0	\$0
2031	0.7386	\$1,252,127	\$924,782	\$0	\$0
2032	0.7238	\$1,252,127	\$906,286	\$0	\$0
2033	0.7093	\$1,252,127	\$888,161	\$0	\$0
2034	0.6951	\$1,252,127	\$870,397	\$0	\$0
2035	0.6812	\$1,252,127	\$852,989	\$0	\$0
2036	0.6676	\$1,252,127	\$835,930	\$0	\$0
2037	0.6543	\$1,252,127	\$819,211	\$0	\$0
2038	0.6412	\$1,252,127	\$802,827	\$0	\$0
2039	0.6283	\$1,252,127	\$786,770	\$0	\$0
2040	0.6158	\$1,252,127	\$771,035	\$0	\$0
NPV		User Benefits	\$18,810,452	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 31D Revised

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Single Faced Barrier	4300 lf	\$60.00	\$258,000.00	\$51,600.00	\$321,984.00
PBD & Geotextile	2080 lf	\$11.00	\$22,880.00	\$4,576.00	\$28,554.24
Drainage	2080 lf	\$110.45	\$229,745.98	\$45,949.20	\$286,722.99
Lighting	2080 lf	\$125.00	\$260,000.00	\$52,000.00	\$324,480.00
Subtotal, Supplemental Roadway Costs			\$770,625.98	\$154,125.20	\$961,741.23
					\$1,000,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	6428 CY	\$20.00	\$128,560.00	\$25,712.00	\$160,442.88
Borrow	76307 CY	\$25.00	\$1,907,675.00	\$381,535.00	\$2,380,778.40
Subtotal, Earthwork Costs			\$2,036,235.00	\$407,247.00	\$2,541,221.28
					\$2,500,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	6532 SY	\$110.00	\$718,520.00	\$143,704.00	\$896,712.96
Mountable Concrete Curb Island	1002 lf	\$54.00	\$54,108.00	\$10,821.60	\$67,526.78
Plain Cement Concrete 4"	1128 SY	\$45.00	\$50,760.00	\$10,152.00	\$63,348.48
Subtotal, Pavement Costs			\$823,388.00	\$164,677.60	\$1,027,588.22
					\$1,000,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Retaining Wall	1300 lf	\$2,320.39	\$3,016,512.00	\$603,302.40	\$3,764,606.98
Sound Wall	2807 lf	\$1,250.00	\$3,508,750.00	\$701,750.00	\$4,378,920.00
Subtotal, Wall Costs			\$6,525,262.00	\$1,305,052.40	\$8,143,526.98
					\$8,100,000.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Ramp A/D Structure	14817 sf	\$450.00	\$6,667,650.00	\$1,333,530.00	\$8,321,227.20
Subtotal, Bridge Cost			\$6,667,650.00	\$1,333,530.00	\$8,321,227.20
					\$8,300,000.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Overhead Detection	1 ls	\$50,000.00	\$50,000.00	\$10,000.00	\$62,400.00
Subtotal, Signal Costs			\$50,000.00	\$10,000.00	\$62,400.00
					\$100,000.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Overhead Pedestal	1 ea	\$50,000.00	\$50,000.00	\$10,000.00	\$62,400.00
OH Truss 5 Lanes	1 ea	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00
Subtotal, Signage Costs			\$250,000.00	\$50,000.00	\$312,000.00
					\$300,000.00

CONSTRUCTION COST ESTIMATE
 Concept 31D Revised

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Major	1 LS	\$517,532.15	\$517,532.15	\$103,506.43	\$645,880.12
Subtotal, Utility Impact			\$517,532.15	\$103,506.43	\$645,880.12
					\$600,000.00

SUBTOTAL, CONSTRUCTION COSTS			\$17,640,693.13	\$3,528,138.63	\$22,015,585.03
					\$21,900,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost	
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00	
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00	
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00	
Mobilization	1 LS	\$882,034.66	\$176,406.93	\$1,100,779.25	
MPT	1 LS	\$529,220.79	\$105,844.16	\$660,467.55	
			\$1,466,255.45	\$293,251.09	\$1,829,886.80
					\$1,800,000.00

TOTAL CONSTRUCTION COSTS			\$19,106,948.58	\$3,821,389.72	\$23,845,471.83
					\$23,700,000.00

DESIGN AND CM COSTS			\$3,528,138.63	\$764,277.94	\$4,769,094.37
					\$4,800,000.00

TOTAL, DESIGN, CONSTRUCTION AND CM			\$21,168,831.76		\$28,614,566.20
					\$28,500,000.00

ROW COSTS
 Concept 31D Revised

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
0054-H-00030-0000-00	\$13,700.00	\$0.00	505,732	50,890	No	10%	\$1,378.59
0054-L-00236-0000-00	\$52,700.00	\$0.00	79,715	17,582	No	22%	\$11,623.61
0054-L-00247-0000-00	\$352,800.00	\$1,047,200.00	33,302	13,061	No	39%	\$138,368.84
0054-L-00252-0000-00	\$91,400.00	\$695,600.00	12,000	1,843	Yes	100%	\$787,000.00
0054-L-00260-0000-00	\$22,700.00	\$72,300.00	4,043	3,750	Yes	100%	\$95,000.00
0054-L-00262-0000-00	\$22,700.00	\$72,300.00	4,374	4,153	Yes	100%	\$95,000.00
0054-L-00263-0000-00	\$22,700.00	\$67,200.00	4,726	3,957	Yes	100%	\$89,900.00
0054-L-00264-0000-00	\$22,800.00	\$71,700.00	5,079	1,016	No	20%	\$4,563.09
0054-L-00266-0000-00	\$45,600.00	\$97,300.00	10,941	1,472	No	13%	\$6,133.38
0054-L-00269-0000-00	\$22,800.00	\$81,800.00	5,490	240	No	4%	\$996.68
0054-M-00328-0000-00	\$33,000.00	\$73,000.00	6,338	146	No	2%	\$762.56
0054-M-00331-0000-00	\$45,200.00	\$95,700.00	6,547	496	No	8%	\$3,425.95
Subtotal, ROW Costs							\$1,234,152.69
							\$1,200,000.00

Safety
 Concept 31D Revised

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Fatal & Injury	28	9.33	1.00	9.33	0.00

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually	
0.00	0.00	0.00	0.00	0.00	\$	11,438.88
Benefits from Ramp A/D structure					\$	11,438.88

USER BENEFITS
Concept 31D Revised

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:PM Veh-Hrs	
No-build	248236	265184	7994	8548
Build	250031	268072	8134	8193
Change	1795	2889	140	-355
Subtotal, MOEs				

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	132.608 hrs	7.23 hrs
PM Peak Period	-346.101 hrs	-8.84 hrs
Total of Peaks	-213.493 hrs	-1.612 hrs
Daily Estimate	-213.493 hrs	-1.612 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$2,750.98	-\$31.75

Total, all vehicles
-\$2,782.73 Value of travel time changes, per day
-\$943,581.97 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars		Trucks	
AM Peak Period				
Average Speed	20			
Change in Veh-Hrs		132.608 hours		7.232 hours
Fuel Consumption		0.022 gal/minute		0.102 gal/minute
		175.0 gallons		44.3 gallons

USER BENEFITS
 Concept 31D Revised

PM Peak Period

Average Speed	20		
Change in Veh-Hrs		-346.1 hours	-8.8 hours
Fuel Consumption		0.022 gal/minute	0.102 gal/minute
		-456.9 gallons	-54.1 gallons

Fuel Consumption

AM Peak Period		175.0 gallons	44.3 gallons
PM Peak Period		-456.9 gallons	-54.1 gallons
Total of Peaks		-281.8 gallons	-9.9 gallons
Daily Estimate		-281.810 gallons	-9.867 gallons
		\$3.004 per gallon	\$3.004 per gallon
		-\$846.56 per day	-\$29.64 per day

Total, all vehicles

-291.7 fuel consumption change, gallons per day
-98903.4 fuel consumption change, gallons per year
- \$876.20 change in fuel cost, per day
-\$297,105.75 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$943,581.97	Value of Travel Time change, Per year
Operating Costs	-\$297,105.75	Value of Operating Costs change, per year
Total, User Benefits	-\$1,240,687.72	

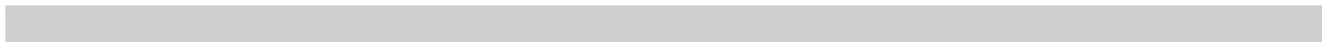
Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-281.810 gallons	-9.867 gallons
Annual estimate	-95557.680 gallons	-3345.697 gallons
CO2	19.4 lb/gal	22.2 lb/gal
	8799.6848 grams/gal	10069.7424 grams/gal
	(840,877,468.46) g	(33,690,305.20) g
Total	(874,567.77) kg	

VOC

USER BENEFITS
Concept 31D Revised

	24.62 grams/gal	1.27 grams/gal
	(2,352,539.09) g	(4,249.03) g
Total	(2,356.79) kg	
NOx		
	16.5 grams/gal	24.52 grams/gal
	(1,576,701.73) g	(82,036.49) g
Total	(1,658.74) kg	
PM2.5		
	0.09761905 grams/gal	0.136 grams/gal
	(9,328.25) g	(455.01) g
Total	(9.78) kg	



SUMMARY OF COSTS AND BENEFITS
 Concept 32

Construction Cost	
Supplemental Roadway Construction	\$1,850,000.00
Earthwork	\$20,000.00
Pavement	\$160,000.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$250,000.00
Signage	\$60,000.00
Utilities	\$60,000.00
Additional Lump Sum	\$260,000.00
Design and PM	\$530,000.00
ROW	\$0.00
Total	\$3,190,000.00
Operating Cost	
Negligible	\$0.00
	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	-48 hr
Value of Travel Time (Annual)	-\$229,859.83
Automobile Operating Costs (Annual)	-\$103,778.56
Safety (Annual)	\$40,073.00
Total	-\$293,565.40
Emissions (Annual)	
CO2	324841 kg
NOx	702 kg
VOC	467 kg
Benefit:Cost Ratio	
NPV Benefits	-\$4,410,175.21
NPV Operating Costs	\$0.00
NPV Capital Costs	\$3,121,445.05
Total Costs	\$3,121,445.05
Benefit:Cost Ratio	-1.41

NET PRESENT VALUE CALCULATIONS

Concept 32

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$3,185,148.01
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$3,121,445.05
NPV Capital Costs			\$3,121,445.05

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224		\$0	\$0	\$0
2021	0.9039	-\$293,565	-\$265,360	\$0	\$0
2022	0.8858	-\$293,565	-\$260,053	\$0	\$0
2023	0.8681	-\$293,565	-\$254,852	\$0	\$0
2024	0.8508	-\$293,565	-\$249,755	\$0	\$0
2025	0.8337	-\$293,565	-\$244,759	\$0	\$0
2026	0.8171	-\$293,565	-\$239,864	\$0	\$0
2027	0.8007	-\$293,565	-\$235,067	\$0	\$0
2028	0.7847	-\$293,565	-\$230,366	\$0	\$0
2029	0.7690	-\$293,565	-\$225,758	\$0	\$0
2030	0.7536	-\$293,565	-\$221,243	\$0	\$0
2031	0.7386	-\$293,565	-\$216,818	\$0	\$0
2032	0.7238	-\$293,565	-\$212,482	\$0	\$0
2033	0.7093	-\$293,565	-\$208,232	\$0	\$0
2034	0.6951	-\$293,565	-\$204,068	\$0	\$0
2035	0.6812	-\$293,565	-\$199,986	\$0	\$0
2036	0.6676	-\$293,565	-\$195,987	\$0	\$0
2037	0.6543	-\$293,565	-\$192,067	\$0	\$0
2038	0.6412	-\$293,565	-\$188,226	\$0	\$0
2039	0.6283	-\$293,565	-\$184,461	\$0	\$0
2040	0.6158	-\$293,565	-\$180,772	\$0	\$0
NPV		User Benefits	-\$4,410,175	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 32

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
PBD & Geotextile	2080 lf	\$11.00	\$22,880.00	\$4,576.00	\$28,554.24
Drainage	2080 lf	\$575.39	\$1,196,816.28	\$239,363.26	\$1,493,626.72
Lighting	2080 lf	\$125.00	\$260,000.00	\$52,000.00	\$324,480.00
Subtotal, Supplemental Roadway Costs			\$1,479,696.28	\$295,939.26	\$1,846,660.96
					\$1,850,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	604 CY	\$20.00	\$12,080.00	\$2,416.00	\$15,075.84
Borrow	0 CY	\$25.00	\$0.00	\$0.00	\$0.00
Subtotal, Earthwork Costs			\$12,080.00	\$2,416.00	\$15,075.84
					\$20,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	1180 SY	\$110.00	\$129,800.00	\$25,960.00	\$161,990.40
Subtotal, Pavement Costs			\$129,800.00	\$25,960.00	\$161,990.40
					\$160,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Traffic Signal at Braddock/Monongahela	1 ls	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00
Subtotal, Signal Costs			\$200,000.00	\$40,000.00	\$249,600.00
					\$250,000.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
ITS Relocation	1 ls	\$50,000.00	\$50,000.00	\$10,000.00	\$62,400.00
Subtotal, Signage Costs			\$50,000.00	\$10,000.00	\$62,400.00
					\$60,000.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Minor	1 LS	\$46,789.41	\$46,789.41	\$9,357.88	\$58,393.18
Subtotal, Utility Impact			\$46,789.41	\$9,357.88	\$58,393.18
					\$60,000.00

SUBTOTAL, CONSTRUCTION COSTS			\$1,918,365.69	\$383,673.14	\$2,394,120.38
					\$2,400,000.00

CONSTRUCTION COST ESTIMATE
 Concept 32

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00
Mobilization	1 LS	\$95,918.28	\$19,183.66	\$119,706.02
MPT	1 LS	\$57,550.97	\$11,510.19	\$71,823.61
		\$208,469.26	\$41,693.85	\$260,169.63
				\$260,000.00
TOTAL CONSTRUCTION COSTS		\$2,126,834.94	\$425,366.99	\$2,654,290.01
				\$2,660,000.00
DESIGN AND CM COSTS		\$383,673.14	\$85,073.40	\$530,858.00
				\$530,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM		\$2,302,038.83		\$3,185,148.01
				\$3,190,000.00

Safety
 Concept 32

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Sideswipes	3	1.00	0.50	0.50	0.50

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.00	0.03	0.13	0.33	\$ 40,073.00

USER BENEFITS
Concept 32

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:PM Veh-Hrs	
No-build	248236	265184	7994	8548
Build	249584	269554	8244	8346
Change	1348	4370	250	-202
Subtotal, MOEs				

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	237.079 hrs	12.93 hrs
PM Peak Period	-196.555 hrs	-5.02 hrs
Total of Peaks	40.524 hrs	7.907 hrs
Daily Estimate	40.524 hrs	7.907 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	\$522.18	\$155.70

Total, all vehicles \$677.88 Value of travel time changes, per day
 \$229,859.83 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars		Trucks	
AM Peak Period				
Average Speed	20			
Change in Veh-Hrs		237.079 hours		12.930 hours
Fuel Consumption		0.022 gal/minute		0.102 gal/minute
		312.9 gallons		79.1 gallons

USER BENEFITS
Concept 32

PM Peak Period

Average Speed	20.1		
Change in Veh-Hrs		-196.6 hours	-5.0 hours
Fuel Consumption		0.022 gal/minute	0.102 gal/minute
		-259.5 gallons	-30.7 gallons

Fuel Consumption

AM Peak Period		312.9 gallons	79.1 gallons
PM Peak Period		-259.5 gallons	-30.7 gallons
Total of Peaks		53.5 gallons	48.4 gallons
Daily Estimate		53.492 gallons	48.390 gallons
		\$3.004 per gallon	\$3.004 per gallon
		\$160.69 per day	\$145.36 per day

Total, all vehicles

101.9 fuel consumption change, gallons per day
34,546.79 fuel consumption change, gallons per year

\$306.05 change in fuel cost, per day
\$103,778.56 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	\$229,859.83	Value of Travel Time change, Per year
Operating Costs	\$103,778.56	Value of Operating Costs change, per year
Total, User Benefits	\$333,638.39	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	53.492 gallons	48.390 gallons
Annual estimate	18138.346 gallons	16408.446
CO	19.4 lb/gal	22.2 lb/gal
	8799.6848 grams/gal	10069.7424 grams/gal
	159,611,729.45 g	165,228,827.13 g
Total	324,840.56 kg	

USER BENEFITS
Concept 32

VOC

24.62 grams/gal

1.27 grams/gal

446,548.81 g

20,838.73

Total

467.39 kg

NOx

16.5 grams/gal

24.52 grams/gal

299,282.71 g

402,335.10

Total

701.62 kg

PM2.5

0.09761905 grams/gal

0.136 grams/gal

1,770.65 g

2,231.55

Total

4.00 kg



SUMMARY OF COSTS AND BENEFITS
 Concept 37

Construction Cost	
Supplemental Roadway Construction	\$0.00
Earthwork	\$0.00
Pavement	\$0.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$0.00
Signage	\$1,250.00
Utilities	\$0.00
Additional Lump Sum	\$100.00
Design and PM	\$270.00
ROW	\$0.00
Total	\$1,620.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	3 hr
Value of Travel Time (Annual)	\$14,042.82
Automobile Operating Costs (Annual)	\$4,997.56
Safety (Annual)	\$0.00
Total	\$19,040.38
Emissions (Annual)	
CO2	-15066 kg
NOx	-30 kg
VOC	-33 kg
Benefit:Cost Ratio	
NPV Benefits	\$286,039.82
NPV Operating Costs	\$0.00
NPV Capital Costs	\$1,585.06
Total Costs	\$1,585.06
Benefit:Cost Ratio	180.46

NET PRESENT VALUE CALCULATIONS

Concept 37

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$1,617.41
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$1,585.06
NPV Capital Costs			\$1,585.06

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$19,040	\$17,211	\$0	\$0
2022	0.8858	\$19,040	\$16,867	\$0	\$0
2023	0.8681	\$19,040	\$16,529	\$0	\$0
2024	0.8508	\$19,040	\$16,199	\$0	\$0
2025	0.8337	\$19,040	\$15,875	\$0	\$0
2026	0.8171	\$19,040	\$15,557	\$0	\$0
2027	0.8007	\$19,040	\$15,246	\$0	\$0
2028	0.7847	\$19,040	\$14,941	\$0	\$0
2029	0.7690	\$19,040	\$14,642	\$0	\$0
2030	0.7536	\$19,040	\$14,350	\$0	\$0
2031	0.7386	\$19,040	\$14,063	\$0	\$0
2032	0.7238	\$19,040	\$13,781	\$0	\$0
2033	0.7093	\$19,040	\$13,506	\$0	\$0
2034	0.6951	\$19,040	\$13,236	\$0	\$0
2035	0.6812	\$19,040	\$12,971	\$0	\$0
2036	0.6676	\$19,040	\$12,712	\$0	\$0
2037	0.6543	\$19,040	\$12,457	\$0	\$0
2038	0.6412	\$19,040	\$12,208	\$0	\$0
2039	0.6283	\$19,040	\$11,964	\$0	\$0
2040	0.6158	\$19,040	\$11,725	\$0	\$0
NPV		User Benefits	\$286,040	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 37

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Supplemental Roadway Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Earthwork Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Pavement Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Misc. Signage (each)	1 ea	\$1,000.00	\$1,000.00	\$200.00	\$1,248.00
Subtotal, Signage Costs			\$1,000.00	\$200.00	\$1,248.00
					\$1,250.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00
					\$0.00

SUBTOTAL, CONSTRUCTION COSTS			\$1,000.00	\$200.00	\$1,248.00
					\$1,250.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
		\$80.00	\$16.00	\$99.84
				\$100.00

CONSTRUCTION COST ESTIMATE
Concept 37

TOTAL CONSTRUCTION COSTS	\$1,080.00	\$216.00	\$1,347.84
			\$1,350.00
DESIGN AND CM COSTS	\$200.00	\$43.20	\$269.57
			\$270.00
TOTAL, DESIGN, CONSTRUCTION AND CM	\$1,200.00		\$1,617.41
			\$1,620.00

USER BENEFITS
Concept 37

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:PM Veh-Hrs
No-build	0	0	1.806
Build	0	0	0.763
Change	0	0	-1.043
Subtotal, MOEs			

Improvement only during peak period? Yes

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	-0.989 hrs	-0.05 hrs
PM Peak Period	0.000 hrs	0.00 hrs
Total of Peaks	-0.989 hrs	-0.054 hrs
Daily Estimate	-2.967 hrs	-0.162 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$38.23	-\$3.19

Total, all vehicles - \$41.41 Value of travel time changes, per day
-\$14,042.82 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars		Trucks	
AM Peak Period				
Average Speed	20			
Change in Veh-Hrs		-0.989 hours		-0.054 hours
Fuel Consumption		0.022 gal/minute		0.102 gal/minute
		-1.3 gallons		-0.3 gallons

USER BENEFITS
Concept 37

PM Peak Period

Average Speed	20		
Change in Veh-Hrs		0.0 hours	0.0 hours
Fuel Consumption		0.022 gal/minute	0.102 gal/minute
		0.0 gallons	0.0 gallons

Fuel Consumption

AM Peak Period		-1.3 gallons	-0.3 gallons
PM Peak Period		0.0 gallons	0.0 gallons
Total of Peaks		-1.3 gallons	-0.3 gallons
Daily Estimate		-3.916 gallons	-0.990 gallons
		\$3.004 per gallon	\$3.004 per gallon
		-\$11.76 per day	-\$2.97 per day

Total, all vehicles

-4.9 fuel consumption change, gallons per day
 (1,663.63) fuel consumption change, gallons per year

 -\$14.74 change in fuel cost, per day
 -\$4,997.56 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-	\$14,042.82	Value of Travel Time change, Per year
Operating Costs	-	\$4,997.56	Value of Operating Costs change, per year
Total, User Benefits	-	\$19,040.38	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-3.916 gallons	-0.990 gallons
Annual estimate	-1327.873 gallons	-335.762
CO	19.4 lb/gal 8799.6848 grams/gal	22.2 lb/gal 10069.7424 grams/gal
	(11,684,864.26) g	(3,381,032.05) g
Total	(15,065,896.30)	

USER BENEFITS
Concept 37

VOC

24.62 grams/gal

1.27 grams/gal

(32,690.97) g

(426.42)

Total

(33,117.39) g

NOx

16.5 grams/gal

24.52 grams/gal

(21,909.91) g

(8,232.87)

Total

(30,142.78) g

PM2.5

0.09761905 grams/gal

0.136 grams/gal

(129.63) g

(45.66)

Total

(175.29) g



SUMMARY OF COSTS AND BENEFITS
 Concept 38

Construction Cost	
Supplemental Roadway Construction	\$0.00
Earthwork	\$6,000.00
Pavement	\$51,000.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$0.00
Signage	\$1,000.00
Utilities	\$0.00
Additional Lump Sum	\$73,000.00
Design and PM	\$26,000.00
ROW	\$0.00
Total	\$157,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	6 hr
Value of Travel Time (Annual)	\$27,168.86
Automobile Operating Costs (Annual)	\$10,637.45
Safety (Annual)	\$0.00
Total	\$37,806.31
Emissions (Annual)	
CO2	-31680 kg
NOx	-62 kg
VOC	-78 kg
Benefit:Cost Ratio	
NPV Benefits	\$567,956.79
NPV Operating Costs	\$0.00
NPV Capital Costs	\$154,506.29
Total Costs	\$154,506.29
Benefit:Cost Ratio	3.68

NET PRESENT VALUE CALCULATIONS

Concept 38

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$157,659.47
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$154,506.29
NPV Capital Costs			\$154,506.29

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$37,806	\$34,174	\$0	\$0
2022	0.8858	\$37,806	\$33,490	\$0	\$0
2023	0.8681	\$37,806	\$32,821	\$0	\$0
2024	0.8508	\$37,806	\$32,164	\$0	\$0
2025	0.8337	\$37,806	\$31,521	\$0	\$0
2026	0.8171	\$37,806	\$30,891	\$0	\$0
2027	0.8007	\$37,806	\$30,273	\$0	\$0
2028	0.7847	\$37,806	\$29,667	\$0	\$0
2029	0.7690	\$37,806	\$29,074	\$0	\$0
2030	0.7536	\$37,806	\$28,492	\$0	\$0
2031	0.7386	\$37,806	\$27,923	\$0	\$0
2032	0.7238	\$37,806	\$27,364	\$0	\$0
2033	0.7093	\$37,806	\$26,817	\$0	\$0
2034	0.6951	\$37,806	\$26,281	\$0	\$0
2035	0.6812	\$37,806	\$25,755	\$0	\$0
2036	0.6676	\$37,806	\$25,240	\$0	\$0
2037	0.6543	\$37,806	\$24,735	\$0	\$0
2038	0.6412	\$37,806	\$24,240	\$0	\$0
2039	0.6283	\$37,806	\$23,755	\$0	\$0
2040	0.6158	\$37,806	\$23,280	\$0	\$0
NPV		User Benefits	\$567,957	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 38

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Supplemental Roadway Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Earthwork Costs			\$4,920.00	\$984.00	\$6,140.16
					\$6,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	369.37 SY	\$110.00	\$40,630.70	\$8,126.14	\$50,707.11
Subtotal, Pavement Costs			\$40,630.70	\$8,126.14	\$50,707.11
					\$51,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Misc. Signage (each)	1 ea	\$1,000.00	\$1,000.00	\$200.00	\$1,248.00
Subtotal, Signage Costs			\$1,000.00	\$200.00	\$1,248.00
					\$1,000.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00
					\$0.00

SUBTOTAL, CONSTRUCTION COSTS			\$46,550.70	\$9,310.14	\$58,095.27
					\$58,000.00

CONSTRUCTION COST ESTIMATE
 Concept 38

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00
Mobilization	1 LS	\$2,327.54	\$465.51	\$2,904.76
MPT	1 LS	\$1,396.52	\$279.30	\$1,742.86
		\$58,724.06	\$11,744.81	\$73,287.62
				\$73,000.00
TOTAL CONSTRUCTION COSTS		\$105,274.76	\$21,054.95	\$131,382.90
				\$131,000.00
DESIGN AND CM COSTS		\$9,310.14	\$4,210.99	\$26,276.58
				\$26,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM		\$55,860.84		\$157,659.47
				\$157,000.00

USER BENEFITS
Concept 38

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:PM Veh-Hrs
No-build	0	0	0.000 3
Build	0	0	0.000 1
Change	0	0	0.000 -2
Subtotal, MOEs			

Improvement only during peak period? Yes

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	0.000 hrs	0.00 hrs
PM Peak Period	-1.973 hrs	-0.05 hrs
Total of Peaks	-1.973 hrs	-0.050 hrs
Daily Estimate	-5.920 hrs	-0.195 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$76.29	-\$3.84

Total, all vehicles - \$80.12 Value of travel time changes, per day
-\$27,168.86 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars	Trucks
AM Peak Period		
Average Speed	25	
Change in Veh-Hrs	0.000 hours	0.000 hours
Fuel Consumption	0.026 gal/minute	0.133 gal/minute
	0.0 gallons	0.0 gallons

USER BENEFITS
Concept 38

PM Peak Period

Average Speed	25		
Change in Veh-Hrs		-2.0 hours	-0.1 hours
Fuel Consumption		0.026 gal/minute	0.133 gal/minute
		-3.1 gallons	-0.4 gallons

Fuel Consumption

AM Peak Period		0.0 gallons	0.0 gallons
PM Peak Period		-3.1 gallons	-0.4 gallons
Total of Peaks		-3.1 gallons	-0.4 gallons
Daily Estimate		-9.236 gallons	-1.207 gallons
		\$3.004 per gallon	\$3.004 per gallon
		-\$27.74 per day	-\$3.63 per day

Total, all vehicles

-10.4 fuel consumption change, gallons per day
 (3,541.10) fuel consumption change, gallons per year

 -\$31.37 change in fuel cost, per day
 -\$10,637.45 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	- \$27,168.86	Value of Travel Time change, Per year
Operating Costs	- \$10,637.45	Value of Operating Costs change, per year
Total, User Benefits	- \$37,806.31	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-9.236 gallons	-1.207 gallons
Annual estimate	-3131.716 gallons	-409.379
CO	19.4 lb/gal 8799.6848 grams/gal	22.2 lb/gal 10069.7424 grams/gal
Total	(27,558,117.04) g (31,680.46) kg	(4,122,338.19) g

USER BENEFITS
Concept 38

VOC

24.62 grams/gal

1.27 grams/gal

(77,099.87) g

(519.91)

Total

(77.62) kg

NOx

16.5 grams/gal

24.52 grams/gal

(51,673.32) g

(10,037.97)

Total

(61.71) g

PM2.5

0.09761905 grams/gal

0.136 grams/gal

(305.72) g

(55.68)

Total

(0.36) g



SUMMARY OF COSTS AND BENEFITS
 Concept 42A

Construction Cost	
Supplemental Roadway Construction	\$700,000.00
Earthwork	\$300,000.00
Pavement	\$1,000,000.00
Walls	\$11,700,000.00
Bridges	\$13,200,000.00
Traffic Signals	\$0.00
Signage	\$600,000.00
Utilities	\$1,200,000.00
Additional Lump Sum	\$2,400,000.00
Design and PM	\$6,200,000.00
ROW	\$200,000.00
Total	\$37,500,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	487.00 hr
Value of Travel Time (Annual)	\$2,172,748.01
Automobile Operating Costs (Annual)	\$1,296,878.57
Safety (Annual)	\$54,976.71
Total	\$3,524,603.28
Emissions (Annual)	
CO2	-3919451 kg
NOx	-7884 kg
VOC	-8414 kg
Benefit:Cost Ratio	
NPV Benefits	\$52,949,422.04
NPV Operating Costs	\$0.00
NPV Capital Costs	\$36,727,563.28
Total Costs	\$36,727,563.28
Benefit:Cost Ratio	1.44

NET PRESENT VALUE CALCULATIONS

Concept 42A

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$37,477,105.39
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$36,727,563.28
NPV Capital Costs			\$36,727,563.28

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$3,524,603	\$3,185,962	\$0	\$0
2022	0.8858	\$3,524,603	\$3,122,243	\$0	\$0
2023	0.8681	\$3,524,603	\$3,059,798	\$0	\$0
2024	0.8508	\$3,524,603	\$2,998,602	\$0	\$0
2025	0.8337	\$3,524,603	\$2,938,630	\$0	\$0
2026	0.8171	\$3,524,603	\$2,879,857	\$0	\$0
2027	0.8007	\$3,524,603	\$2,822,260	\$0	\$0
2028	0.7847	\$3,524,603	\$2,765,815	\$0	\$0
2029	0.7690	\$3,524,603	\$2,710,499	\$0	\$0
2030	0.7536	\$3,524,603	\$2,656,289	\$0	\$0
2031	0.7386	\$3,524,603	\$2,603,163	\$0	\$0
2032	0.7238	\$3,524,603	\$2,551,100	\$0	\$0
2033	0.7093	\$3,524,603	\$2,500,078	\$0	\$0
2034	0.6951	\$3,524,603	\$2,450,076	\$0	\$0
2035	0.6812	\$3,524,603	\$2,401,075	\$0	\$0
2036	0.6676	\$3,524,603	\$2,353,053	\$0	\$0
2037	0.6543	\$3,524,603	\$2,305,992	\$0	\$0
2038	0.6412	\$3,524,603	\$2,259,872	\$0	\$0
2039	0.6283	\$3,524,603	\$2,214,675	\$0	\$0
2040	0.6158	\$3,524,603	\$2,170,381	\$0	\$0
NPV		User Benefits	\$52,949,422	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
Concept 42A

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Single Faced Barrier	2011 lf	\$60.00	\$120,660.00	\$24,132.00	\$150,583.68
PBD & Geotextile	2080 lf	\$11.00	\$22,880.00	\$4,576.00	\$28,554.24
Drainage	1 ls	\$181,416.57	\$181,416.57	\$36,283.31	\$226,407.88
Lighting	2080 lf	\$125.00	\$260,000.00	\$52,000.00	\$324,480.00
Guiderail	850 lf	\$16.50	\$14,025.00	\$2,805.00	\$17,503.20
Subtotal, Supplemental Roadway Costs			\$598,981.57	\$119,796.31	\$747,529.00
					\$700,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	10781 CY	\$20.00	\$215,620.00	\$43,124.00	\$269,093.76
Borrow	0 CY	\$25.00	\$0.00	\$0.00	\$0.00
Subtotal, Earthwork Costs			\$215,620.00	\$43,124.00	\$269,093.76
					\$300,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	7562 SY	\$110.00	\$831,820.00	\$166,364.00	\$1,038,111.36
Subtotal, Pavement Costs			\$831,820.00	\$166,364.00	\$1,038,111.36
					\$1,000,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Retaining Wall	1815 lf	\$1,046.91	\$1,900,140.00	\$380,028.00	\$2,371,374.72
Sound Wall	5981 lf	\$1,250.00	\$7,476,250.00	\$1,495,250.00	\$9,330,360.00
Subtotal, Wall Costs			\$9,376,390.00	\$1,875,278.00	\$11,701,734.72
					\$11,700,000.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Edgewood/ Norfolk Bridge Repl	100 lf	\$72,000.00	\$7,200,000.00	\$1,440,000.00	\$8,985,600.00
Chestnut St. Bridge Repl.	150 lf	\$22,500.00	\$3,375,000.00	\$675,000.00	\$4,212,000.00
Subtotal, Bridge Cost			\$10,575,000.00	\$2,115,000.00	\$13,197,600.00
					\$13,200,000.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
OH Truss 4 Lanes	1 ea	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00
ITS Relocation	1 ls	\$300,000.00	\$300,000.00	\$60,000.00	\$374,400.00
Subtotal, Signage Costs			\$500,000.00	\$100,000.00	\$624,000.00
					\$600,000.00

Utility Impact

CONSTRUCTION COST ESTIMATE
 Concept 42A

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Moderate	1 LS	\$927,182.77	\$927,182.77	\$185,436.55	\$1,157,124.10
Subtotal, Utility Impact			\$927,182.77	\$185,436.55	\$1,157,124.10
					\$1,200,000.00

SUBTOTAL, CONSTRUCTION COSTS			\$23,024,994.34	\$4,604,998.87	\$28,735,192.94
					\$28,700,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost	
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00	
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00	
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00	
Mobilization	1 LS	\$1,151,249.72	\$230,249.94	\$1,436,759.65	
MPT	1 LS	\$690,749.83	\$138,149.97	\$862,055.79	
			\$1,896,999.55	\$379,399.91	\$2,367,455.43
					\$2,400,000.00

TOTAL CONSTRUCTION COSTS			\$24,921,993.89	\$4,984,398.78	\$31,102,648.37
					\$31,100,000.00

DESIGN AND CM COSTS			\$4,604,998.87	\$996,879.76	\$6,220,529.67
					\$6,200,000.00

TOTAL, DESIGN, CONSTRUCTION AND CM			\$27,629,993.21		\$37,323,178.05
					\$37,300,000.00

ROW COSTS
 Concept 42A

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
0177-L-00080-0000-00	\$87,200.00	\$0.00	320,471	1,570	No	0%	\$500.00
0177-L-00086-0000-00	\$7,500,000.00	\$17,150,000.00	1,306,800	5,703	No	0%	\$32,733.31
0176-S-00157-0009-00	\$12,100.00	\$0.00	263,974	508	No	0%	\$500.00
0235-N-00001-0000-00	\$445,600.00	\$0.00	445,641	266	No	0%	\$500.00
0177-H-00205-0000-00	\$21,600.00	\$0.00	22,673	11,257	No	50%	\$10,724.50
0177-H-00187-0000-00	\$83,700.00	\$0.00	9,700	2,147	No	22%	\$18,523.27
0177-H-00184-0000-00	\$40,000.00	\$73,900.00	5,391	2,207	No	41%	\$16,377.78
0177-H-00182-0000-00	\$40,000.00	\$89,400.00	5,442	1,626	No	30%	\$11,949.97
0234-E-00278-0000-00	\$41,600.00	\$0.00	22,783	15,909	No	70%	\$29,048.28
0234-E-00263-0000-00	\$36,800.00	\$119,500.00	4,187	23	No	1%	\$500.00
0234-E-00262-0000-00	\$500.00	\$0.00	1,187	87	No	7%	\$500.00
0234-E-00265-0000-00	\$40,200.00	\$107,900.00	6,616	1,063	No	16%	\$6,456.79
0234-E-00267-0000-00	\$40,000.00	\$42,500.00	5,386	1,189	No	22%	\$8,829.32
0234-E-00266-0000-00	\$30,000.00	\$73,700.00	5,421	1,297	No	24%	\$7,175.29
0234-E-00272-0000-00	\$40,200.00	\$83,100.00	7,460	1,474	No	20%	\$7,943.91
0234-E-00274-0000-00	\$40,200.00	\$93,300.00	7,463	216	No	3%	\$1,164.92
0234-F-00150-0000-00	\$14,300.00	\$0.00	261,360	1,100	No	0%	\$500.00

Subtotal, ROW Costs \$153,927.35
 \$200,000.00

Safety
 Concept 42A

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Fatal & Injury	13	4.33	0.79	3.42	0.91

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually	
0.00	0.02	0.09	0.30	0.49	\$	54,976.71

USER BENEFITS

Concept 42A

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:	PM Veh-Hrs
No-build	248236	256184	7994.00	8548.00
Build	249414	270472	7721.00	8334.00
Change	1178	14288	-273.00	-214.00
Subtotal, MOEs				

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	-258.881 hrs	-14.12 hrs
PM Peak Period	-208.668 hrs	-5.33 hrs
Total of Peaks	-467.549 hrs	-19.451 hrs
Daily Estimate	-467.549 hrs	-19.451 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$6,024.65	-\$383.03

Total, all vehicles
 -\$6,407.68 Value of travel time changes, per day
 -\$2,172,748.01 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars		Trucks	
AM Peak Period				
Average Speed	49.75			
Change in Veh-Hrs		-258.881 hours		-14.119 hours
Fuel Consumption		0.043 gal/minute		0.280 gal/minute
		-667.9 gallons		-237.2 gallons

USER BENEFITS

Concept 42A

PM Peak Period

Average Speed	29.77		
Change in Veh-Hrs		-208.7 hours	-5.3 hours
Fuel Consumption		0.026 gal/minute	0.133 gal/minute
		-325.5 gallons	-42.6 gallons

Fuel Consumption

AM Peak Period		-667.9 gallons	-237.2 gallons
PM Peak Period		-325.5 gallons	-42.6 gallons
Total of Peaks		-993.4 gallons	-279.7 gallons
Daily Estimate		-993.435 gallons	-279.748 gallons
		\$3.004 per gallon	\$3.004 per gallon
		-\$2,984.28 per day	-\$840.36 per day

Total, all vehicles

	-1273.2 fuel consumption change, gallons per day
	-431717.2 fuel consumption change, gallons per year
	-\$3,824.64 change in fuel cost, per day
	-\$1,296,878.57 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$2,172,748.01	Value of Travel Time change, Per year
Operating Costs	-\$1,296,878.57	Value of Operating Costs change, per year
Total, User Benefits	-\$3,469,626.58	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-993.435 gallons	-279.748 gallons
Annual estimate	-336858.92 gallons	-94858.31 gallons
CO2	19.4 lb/gal	22.2 lb/gal
	8799.6848 grams/gal	10069.7424 grams/gal
	(2,964,252,330) g	(955,198,768) g
Total	(3,919,451.10) kg	

USER BENEFITS

Concept 42A

VOC

	24.62 grams/gal	1.27 grams/gal
	(8,293,145.82) g	(120,470.06) g
Total	(8,413.62) kg	

NOx

	16.5 grams/gal	24.52 grams/gal
	(5,558,172.20) g	(2,325,925.81) g
Total	(7,884.10) kg	

PM2.5

	0.0976 grams/gal	0.136 grams/gal
	(32,883.85) g	(12,900.73) g
Total	(45.78) kg	



SUMMARY OF COSTS AND BENEFITS
 Concept 42B

Construction Cost	
Supplemental Roadway Construction	\$1,200,000.00
Earthwork	\$300,000.00
Pavement	\$2,200,000.00
Walls	\$17,100,000.00
Bridges	\$19,200,000.00
Traffic Signals	\$0.00
Signage	\$600,000.00
Utilities	\$1,100,000.00
Additional Lump Sum	\$3,400,000.00
Design and PM	\$9,000,000.00
ROW	\$600,000.00
Total	\$54,700,000.00
Operating Cost	
Negligible	\$0.00
	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	358 hr
Value of Travel Time (Annual)	\$1,596,093.37
Automobile Operating Costs (Annual)	\$546,317.49
Safety (Annual)	\$54,976.71
Total	\$2,197,387.58
Emissions (Annual)	
CO2	-1635123 kg
NOx	-3220 kg
VOC	-3838 kg
Benefit:Cost Ratio	
NPV Benefits	\$33,010,921.44
NPV Operating Costs	\$0.00
NPV Capital Costs	\$53,739,362.95
Total Costs	\$53,739,362.95
Benefit:Cost Ratio	0.61

NET PRESENT VALUE CALCULATIONS

Concept 42B

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$54,836,084.64
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$53,739,362.95
NPV Capital Costs			\$53,739,362.95

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$2,197,388	\$1,986,264	\$0	\$0
2022	0.8858	\$2,197,388	\$1,946,539	\$0	\$0
2023	0.8681	\$2,197,388	\$1,907,608	\$0	\$0
2024	0.8508	\$2,197,388	\$1,869,456	\$0	\$0
2025	0.8337	\$2,197,388	\$1,832,067	\$0	\$0
2026	0.8171	\$2,197,388	\$1,795,426	\$0	\$0
2027	0.8007	\$2,197,388	\$1,759,517	\$0	\$0
2028	0.7847	\$2,197,388	\$1,724,327	\$0	\$0
2029	0.7690	\$2,197,388	\$1,689,840	\$0	\$0
2030	0.7536	\$2,197,388	\$1,656,043	\$0	\$0
2031	0.7386	\$2,197,388	\$1,622,923	\$0	\$0
2032	0.7238	\$2,197,388	\$1,590,464	\$0	\$0
2033	0.7093	\$2,197,388	\$1,558,655	\$0	\$0
2034	0.6951	\$2,197,388	\$1,527,482	\$0	\$0
2035	0.6812	\$2,197,388	\$1,496,932	\$0	\$0
2036	0.6676	\$2,197,388	\$1,466,993	\$0	\$0
2037	0.6543	\$2,197,388	\$1,437,654	\$0	\$0
2038	0.6412	\$2,197,388	\$1,408,901	\$0	\$0
2039	0.6283	\$2,197,388	\$1,380,723	\$0	\$0
2040	0.6158	\$2,197,388	\$1,353,108	\$0	\$0
NPV		User Benefits	\$33,010,921	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
Concept 42B

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Single Faced Barrier	8930 lf	\$60.00	\$535,800.00	\$107,160.00	\$668,678.40
PBD & Geotextile	2080 lf	\$11.00	\$22,880.00	\$4,576.00	\$28,554.24
Drainage	1 ls	\$174,081.98	\$174,081.98	\$34,816.40	\$217,254.31
Lighting	2080 lf	\$125.00	\$260,000.00	\$52,000.00	\$324,480.00
Subtotal, Supplemental Roadway Costs			\$992,761.98	\$198,552.40	\$1,238,966.95
					\$1,200,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	10781 CY	\$20.00	\$215,620.00	\$43,124.00	\$269,093.76
Borrow	0 CY	\$25.00	\$0.00	\$0.00	\$0.00
Subtotal, Earthwork Costs			\$215,620.00	\$43,124.00	\$269,093.76
					\$300,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	16054 SY	\$110.00	\$1,765,940.00	\$353,188.00	\$2,203,893.12
Subtotal, Pavement Costs			\$1,765,940.00	\$353,188.00	\$2,203,893.12
					\$2,200,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Retaining Wall	2330 lf	\$3,313.00	\$7,719,294.60	\$1,543,858.92	\$9,633,679.66
Sound Wall	4805 lf	\$1,250.00	\$6,006,250.00	\$1,201,250.00	\$7,495,800.00
Subtotal, Wall Costs			\$13,725,544.60	\$2,745,108.92	\$17,129,479.66
					\$17,100,000.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Proposed Tunnel at Edgewood	250 lf	\$48,000.00	\$12,000,000.00	\$2,400,000.00	\$14,976,000.00
Chestnut St. Bridge Repl.	150 lf	\$22,500.00	\$3,375,000.00	\$675,000.00	\$4,212,000.00
Subtotal, Bridge Cost			\$15,375,000.00	\$3,075,000.00	\$19,188,000.00
					\$19,200,000.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
OH Truss 4 Lanes	1 ea	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00
ITS Relocation	1 ls	\$300,000.00	\$300,000.00	\$60,000.00	\$374,400.00
Subtotal, Signage Costs			\$500,000.00	\$100,000.00	\$624,000.00
					\$600,000.00

CONSTRUCTION COST ESTIMATE
 Concept 42B

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Moderate	1 LS	\$919,971.40	\$919,971.40	\$183,994.28	\$1,148,124.31
Subtotal, Utility Impact			\$919,971.40	\$183,994.28	\$1,148,124.31
					\$1,100,000.00

SUBTOTAL, CONSTRUCTION COSTS			\$33,494,837.98	\$6,698,967.60	\$41,801,557.80
					\$41,700,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost	
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00	
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00	
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00	
Mobilization	1 LS	\$1,674,741.90	\$334,948.38	\$2,090,077.89	
MPT	1 LS	\$1,004,845.14	\$200,969.03	\$1,254,046.73	
			\$2,734,587.04	\$546,917.41	\$3,412,764.62
					\$3,400,000.00

TOTAL CONSTRUCTION COSTS			\$36,229,425.02	\$7,245,885.00	\$45,214,322.42
					\$45,100,000.00

DESIGN AND CM COSTS			\$6,698,967.60	\$1,449,177.00	\$9,042,864.48
					\$9,000,000.00

TOTAL, DESIGN, CONSTRUCTION AND CM			\$40,193,805.58		\$54,257,186.91
					\$54,100,000.00

ROW COSTS
 Concept 42B

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
0177-L-00080-0000-00	\$87,200.00	\$0.00	320,471	30,201	No	9%	\$8,217.78
0177-L-00082-0000-00	\$600.00	\$0.00	958	760	No	79%	\$500.00
0177-L-00084-0000-00	\$19,100.00	\$0.00	33,541	812	No	2%	\$500.00
0177-L-00086-0000-00	\$7,500,000.00	\$17,150,000.00	1,306,800	31,277	No	2%	\$179,506.83
0176-S-00157-0009-00	\$12,100.00	\$0.00	263,974	3,159	No	1%	\$500.00
0235-N-00001-0000-00	\$445,600.00	\$0.00	445,641	1,677	No	0%	\$1,677.26
0177-H-00202-0000-00	\$84,000.00	\$194,900.00	7,280	605	Yes	100%	\$278,900.00
0177-H-00205-0000-00	\$21,600.00	\$0.00	22,673	16,618	No	73%	\$15,831.91
0177-H-00187-0000-00	\$83,700.00	\$0.00	9,700	2,374	No	24%	\$20,481.18
0177-H-00184-0000-00	\$40,000.00	\$73,900.00	5,391	2,212	No	41%	\$16,411.66
0177-H-00182-0000-00	\$40,000.00	\$89,400.00	5,442	1,622	No	30%	\$11,918.96
0234-E-00278-0000-00	\$41,600.00	\$0.00	22,783	14,067	No	62%	\$25,685.98
0234-E-00267-0000-00	\$40,000.00	\$42,500.00	5,385	716	No	13%	\$5,316.66
0234-E-00266-0000-00	\$30,000.00	\$73,700.00	5,421	868	No	16%	\$4,804.00
0234-E-00272-0000-00	\$40,200.00	\$83,100.00	7,460	1,156	No	15%	\$6,230.50
0234-E-00274-0000-00	\$40,200.00	\$93,300.00	7,463	141	No	2%	\$759.80
0234-E-00265-0000-00	\$40,200.00	\$107,900.00	6,616	272	No	4%	\$1,655.22

Subtotal, ROW Costs \$578,897.73
\$600,000.00

Safety
 Concept 42B

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Fatal & Injury	13	4.33	0.79	3.42	0.91

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually	
0.00	0.02	0.09	0.30	0.49	\$	54,976.71

USER BENEFITS
Concept 42B

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:PM Veh-Hrs	
No-build	248236	265184	7994	8548
Build	248798	267230	7835	8349
Change	562	2046	-159	-199
Subtotal, MOEs				

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	-151.040 hrs	-8.24 hrs
PM Peak Period	-194.088 hrs	-4.96 hrs
Total of Peaks	-345.128 hrs	-13.197 hrs
Daily Estimate	-345.128 hrs	-13.197 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$4,447.18	-\$259.88

Total, all vehicles
-\$4,707.06 Value of travel time changes, per day
-\$1,596,093.37 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars		Trucks	
AM Peak Period				
Average Speed	20			
Change in Veh-Hrs		-151.040 hours		-8.237 hours
Fuel Consumption		0.022 gal/minute		0.102 gal/minute
		-199.4 gallons		-50.4 gallons

USER BENEFITS
Concept 42B

PM Peak Period

Average Speed	20		
Change in Veh-Hrs		-194.1 hours	-5.0 hours
Fuel Consumption		0.022 gal/minute	0.102 gal/minute
		-256.2 gallons	-30.4 gallons

Fuel Consumption

AM Peak Period		-199.4 gallons	-50.4 gallons
PM Peak Period		-256.2 gallons	-30.4 gallons
Total of Peaks		-455.6 gallons	-80.8 gallons
Daily Estimate		-455.569 gallons	-80.767 gallons
		\$3.004 per gallon	\$3.004 per gallon
		-\$1,368.53 per day	-\$242.62 per day

Total, all vehicles

	-536.3 fuel consumption change, gallons per day
	-181863.3 fuel consumption change, gallons per year
	-\$1,611.15 change in fuel cost, per day
	-\$546,317.49 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$1,596,093.37	Value of Travel Time change, Per year
Operating Costs	-\$546,317.49	Value of Operating Costs change, per year
Total, User Benefits	-\$2,142,410.87	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-455.569 gallons	-80.767 gallons
Annual estimate	-154476.601 gallons	-27386.746 gallons
CO2	19.4 lb/gal 8799.6848 grams/gal (1,359,345,394.36) g	22.2 lb/gal 10069.7424 grams/gal (275,777,481) g
Total	(1,635,122.87) kg	

USER BENEFITS
Concept 42B

VOC

24.62 grams/gal	1.27 grams/gal
(3,803,066.79) g	(34,781.17) g
Total (3,837.85) kg	

NOx

16.5 grams/gal	24.52 grams/gal
(2,548,863.91) g	(671,523.02) g
Total (3,220.39) kg	

PM2.5

0.09761905 grams/gal	0.136 grams/gal
(15,079.86) g	(3,724.60) g
Total (18.80) kg	



SUMMARY OF COSTS AND BENEFITS
 Concept 42-43A

Construction Cost	
Supplemental Roadway Construction	\$1,200,000.00
Earthwork	\$300,000.00
Pavement	\$2,200,000.00
Walls	\$16,500,000.00
Bridges	\$33,000,000.00
Traffic Signals	\$0.00
Signage	\$600,000.00
Utilities	\$1,100,000.00
Additional Lump Sum	\$4,500,000.00
Design and PM	\$11,900,000.00
ROW	\$600,000.00
Total	\$71,900,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	16.00 hr
Value of Travel Time (Annual)	\$73,117.68
Automobile Operating Costs (Annual)	\$28,310.55
Safety (Annual)	\$81,692.04
Total	\$183,120.27
Emissions (Annual)	
CO2	-86595 kg
NOx	-179 kg
VOC	-165 kg
Benefit:Cost Ratio	
NPV Benefits	\$2,750,979.79
NPV Operating Costs	\$0.00
NPV Capital Costs	\$70,416,173.79
Total Costs	\$70,416,173.79
Benefit:Cost Ratio	0.04

NET PRESENT VALUE CALCULATIONS
 Concept 42-43A

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$71,853,238.56
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$70,416,173.79
NPV Capital Costs			\$70,416,173.79

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$183,120	\$165,526	\$0	\$0
2022	0.8858	\$183,120	\$162,216	\$0	\$0
2023	0.8681	\$183,120	\$158,971	\$0	\$0
2024	0.8508	\$183,120	\$155,792	\$0	\$0
2025	0.8337	\$183,120	\$152,676	\$0	\$0
2026	0.8171	\$183,120	\$149,623	\$0	\$0
2027	0.8007	\$183,120	\$146,630	\$0	\$0
2028	0.7847	\$183,120	\$143,698	\$0	\$0
2029	0.7690	\$183,120	\$140,824	\$0	\$0
2030	0.7536	\$183,120	\$138,007	\$0	\$0
2031	0.7386	\$183,120	\$135,247	\$0	\$0
2032	0.7238	\$183,120	\$132,542	\$0	\$0
2033	0.7093	\$183,120	\$129,891	\$0	\$0
2034	0.6951	\$183,120	\$127,293	\$0	\$0
2035	0.6812	\$183,120	\$124,748	\$0	\$0
2036	0.6676	\$183,120	\$122,253	\$0	\$0
2037	0.6543	\$183,120	\$119,808	\$0	\$0
2038	0.6412	\$183,120	\$117,411	\$0	\$0
2039	0.6283	\$183,120	\$115,063	\$0	\$0
2040	0.6158	\$183,120	\$112,762	\$0	\$0
NPV		User Benefits	\$2,750,980	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 42-43A

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Single Faced Barrier	8930 lf	\$60.00	\$535,800.00	\$107,160.00	\$668,678.40
PBD & Geotextile	2080 lf	\$11.00	\$22,880.00	\$4,576.00	\$28,554.24
Drainage	1 ls	\$174,081.98	\$174,081.98	\$34,816.40	\$217,254.31
Lighting	2080 lf	\$125.00	\$260,000.00	\$52,000.00	\$324,480.00
Subtotal, Supplemental Roadway Costs			\$992,761.98	\$198,552.40	\$1,238,966.95
					\$1,200,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	10781 CY	\$20.00	\$215,620.00	\$43,124.00	\$269,093.76
Borrow	0 CY	\$25.00	\$0.00	\$0.00	\$0.00
Subtotal, Earthwork Costs			\$215,620.00	\$43,124.00	\$269,093.76
					\$300,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	16054 SY	\$110.00	\$1,765,940.00	\$353,188.00	\$2,203,893.12
Subtotal, Pavement Costs			\$1,765,940.00	\$353,188.00	\$2,203,893.12
					\$2,200,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Retaining Wall	2330 lf	\$3,313.00	\$7,719,294.60	\$1,543,858.92	\$9,633,679.66
Sound Wall	4370 lf	\$1,250.00	\$5,462,500.00	\$1,092,500.00	\$6,817,200.00
Subtotal, Wall Costs			\$13,181,794.60	\$2,636,358.92	\$16,450,879.66
					\$16,500,000.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Proposed Tunnel at Edgewood	250 lf	\$78,400.00	\$19,600,000.00	\$3,920,000.00	\$24,460,800.00
New Ramp (EB over Braddock Ave)	220 lf	\$15,750.00	\$3,465,000.00	\$693,000.00	\$4,324,320.00
Chestnut St. Bridge Repl.	150 lf	\$22,500.00	\$3,375,000.00	\$675,000.00	\$4,212,000.00
Subtotal, Bridge Cost			\$26,440,000.00	\$5,288,000.00	\$32,997,120.00
					\$33,000,000.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
OH Truss 4 Lanes	1 ea	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00
ITS Relocation	1 ls	\$300,000.00	\$300,000.00	\$60,000.00	\$374,400.00
Subtotal, Signage Costs			\$500,000.00	\$100,000.00	\$624,000.00
					\$600,000.00

CONSTRUCTION COST ESTIMATE
 Concept 42-43A

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Moderate	1 LS	\$919,971.40	\$919,971.40	\$183,994.28	\$1,148,124.31
Subtotal, Utility Impact			\$919,971.40	\$183,994.28	\$1,148,124.31
					\$1,100,000.00

SUBTOTAL, CONSTRUCTION COSTS			\$44,016,087.98	\$8,803,217.60	\$54,932,077.80
					\$54,900,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost	
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00	
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00	
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00	
Mobilization	1 LS	\$2,200,804.40	\$440,160.88	\$2,746,603.89	
MPT	1 LS	\$1,320,482.64	\$264,096.53	\$1,647,962.33	
			\$3,576,287.04	\$715,257.41	\$4,463,206.22
					\$4,500,000.00

TOTAL CONSTRUCTION COSTS			\$47,592,375.02	\$9,518,475.00	\$59,395,284.02
					\$59,400,000.00

DESIGN AND CM COSTS			\$8,803,217.60	\$1,903,695.00	\$11,879,056.80
					\$11,900,000.00

TOTAL, DESIGN, CONSTRUCTION AND CM			\$52,819,305.58		\$71,274,340.83
					\$71,300,000.00

ROW COSTS
 Concept 42-43A

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
0177-L-00080-0000-00	\$87,200.00	\$0.00	320,471	30,201	No	9%	\$8,217.78
0177-L-00082-0000-00	\$600.00	\$0.00	958	760	No	79%	\$500.00
0177-L-00084-0000-00	\$19,100.00	\$0.00	33,541	812	No	2%	\$500.00
0177-L-00086-0000-00	\$7,500,000.00	\$17,150,000.00	1,306,800	31,277	No	2%	\$179,506.83
0176-S-00157-0009-00	\$12,100.00	\$0.00	263,974	3,159	No	1%	\$500.00
0235-N-00001-0000-00	\$445,600.00	\$0.00	445,641	1,677	No	0%	\$1,677.26
0177-H-00202-0000-00	\$84,000.00	\$194,900.00	7,280	605	Yes	####	\$278,900.00
0177-H-00205-0000-00	\$21,600.00	\$0.00	22,673	16,618	No	73%	\$15,831.91
0177-H-00187-0000-00	\$83,700.00	\$0.00	9,700	2,374	No	24%	\$20,481.18
0177-H-00184-0000-00	\$40,000.00	\$73,900.00	5,391	2,212	No	41%	\$16,411.66
0177-H-00182-0000-00	\$40,000.00	\$89,400.00	5,442	1,622	No	30%	\$11,918.96
0234-E-00278-0000-00	\$41,600.00	\$0.00	22,783	14,067	No	62%	\$25,685.98
0234-E-00267-0000-00	\$40,000.00	\$42,500.00	5,385	716	No	13%	\$5,316.66
0234-E-00266-0000-00	\$30,000.00	\$73,700.00	5,421	868	No	16%	\$4,804.00
0234-E-00272-0000-00	\$40,200.00	\$83,100.00	7,460	1,156	No	15%	\$6,230.50
0234-E-00274-0000-00	\$40,200.00	\$93,300.00	7,463	141	No	2%	\$759.80
0234-E-00265-0000-00	\$40,200.00	\$107,900.00	6,616	272	No	4%	\$1,655.22

Subtotal, ROW Costs \$578,897.73
\$600,000.00

Safety
 Concept 42-43A

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Fatal & Injury	13	4.33	0.79	3.42	0.91
PDO	2	0.67	0.50	0.33	0.33

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually	
0.00	0.02	0.09	0.30	0.49	\$	54,976.71
0.00	0.00	0.02	0.08	0.22	\$	26,715.33

Total: \$ 81,692.04

USER BENEFITS
Concept 42-43A

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr: PM Veh-Hrs	
No-build	248236	265184	7994	8548
Build	248806	265289	7957	8569
Change	570	105	-37	21
Subtotal, MOEs				

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	-35.086 hrs	-1.91 hrs
PM Peak Period	20.477 hrs	0.52 hrs
Total of Peaks	-14.610 hrs	-1.390 hrs
Daily Estimate	-14.610 hrs	-1.390 hrs
Hourly value of time	\$12.89	\$19.69
Safety (Annual)	-\$188.26	-\$27.38

Total, all vehicles
-\$215.63 Value of travel time changes, per day
-\$73,117.68 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars		Trucks	
AM Peak Period				
Average Speed	20			
Change in Veh-Hrs		-35.086 hours		-1.914 hours
Fuel Consumption		0.022 gal/minute		0.102 gal/minute
		-46.3 gallons		-11.7 gallons

USER BENEFITS
 Concept 42-43A
 PM Peak Period

Average Speed	20		
Change in Veh-Hrs		20.5 hours	0.5 hours
Fuel Consumption		0.022 gal/minute	0.102 gal/minute
		27.0 gallons	3.2 gallons

Fuel Consumption			
AM Peak Period		-46.3 gallons	-11.7 gallons
PM Peak Period		27.0 gallons	3.2 gallons
Total of Peaks		-19.3 gallons	-8.5 gallons
Daily Estimate		-19.285 gallons	-8.508 gallons
		\$3.004 per gallon	\$3.004 per gallon
		-\$57.93 per day	-\$25.56 per day

Total, all vehicles		-27.8 fuel consumption change, gallons per day	
		-9424.3 fuel consumption change, gallons per year	
		-\$83.49 change in fuel cost, per day	
		-\$28,310.55 change in fuel cost, per year	

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	- \$73,117.68	Value of Travel Time change, Per year
Operating Costs	- \$28,310.55	Value of Operating Costs change, per year
Total, User Benefits	- \$101,428.23	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-19.285 gallons	-8.508 gallons
Annual estimate	-6539.20 gallons	-2885.08 gallons
CO2	19.4 lb/gal	22.2 lb/gal
	8799.6848 grams/gal	10069.7424 grams/gal
	(57,542,924) g	(29,052,019) g
Total	(86,594.94) kg	

USER BENEFITS
Concept 42-43A
VOC

	24.62 grams/gal	1.27 grams/gal
	(160,988.95) g	(3,664.05) g
Total	(164.65) kg	

NOx	16.5 grams/gal	24.52 grams/gal
	(107,896.85) g	(70,742.18) g
Total	(178.64) kg	

PM2.5	0.09761905 grams/gal	0.136 grams/gal
	(638.35) g	(392.37) g
Total	(1.03) kg	



SUMMARY OF COSTS AND BENEFITS
 Concept 42-43B

Construction Cost	
Supplemental Roadway Construction	\$2,700,000.00
Earthwork	\$700,000.00
Pavement	\$5,000,000.00
Walls	\$9,000,000.00
Bridges	\$4,300,000.00
Traffic Signals	\$0.00
Signage	\$600,000.00
Utilities	\$1,100,000.00
Additional Lump Sum	\$2,000,000.00
Design and PM	\$5,100,000.00
ROW	\$200,000.00
Total	\$30,700,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	-37.95 hr
Value of Travel Time (Annual)	-\$165,718.23
Automobile Operating Costs (Annual)	-\$50,804.52
Safety (Annual)	\$81,692.04
Total	-\$134,830.71
Emissions (Annual)	
CO2	148702 kg
NOx	278 kg
VOC	419 kg
Benefit:Cost Ratio	
NPV Benefits	-\$2,025,535.25
NPV Operating Costs	\$0.00
NPV Capital Costs	\$30,246,624.59
Total Costs	\$30,246,624.59
Benefit:Cost Ratio	-0.07

NET PRESENT VALUE CALCULATIONS

Concept 42-43B

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$30,863,902.64
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$30,246,624.59
NPV Capital Costs			\$30,246,624.59

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	-\$134,831	-\$121,876	\$0	\$0
2022	0.8858	-\$134,831	-\$119,439	\$0	\$0
2023	0.8681	-\$134,831	-\$117,050	\$0	\$0
2024	0.8508	-\$134,831	-\$114,709	\$0	\$0
2025	0.8337	-\$134,831	-\$112,415	\$0	\$0
2026	0.8171	-\$134,831	-\$110,167	\$0	\$0
2027	0.8007	-\$134,831	-\$107,963	\$0	\$0
2028	0.7847	-\$134,831	-\$105,804	\$0	\$0
2029	0.7690	-\$134,831	-\$103,688	\$0	\$0
2030	0.7536	-\$134,831	-\$101,614	\$0	\$0
2031	0.7386	-\$134,831	-\$99,582	\$0	\$0
2032	0.7238	-\$134,831	-\$97,590	\$0	\$0
2033	0.7093	-\$134,831	-\$95,638	\$0	\$0
2034	0.6951	-\$134,831	-\$93,726	\$0	\$0
2035	0.6812	-\$134,831	-\$91,851	\$0	\$0
2036	0.6676	-\$134,831	-\$90,014	\$0	\$0
2037	0.6543	-\$134,831	-\$88,214	\$0	\$0
2038	0.6412	-\$134,831	-\$86,450	\$0	\$0
2039	0.6283	-\$134,831	-\$84,721	\$0	\$0
2040	0.6158	-\$134,831	-\$83,026	\$0	\$0
NPV		User Benefits	-\$2,025,535	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 42-43B

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Single Faced Barrier	5000 lf	\$60.00	\$300,000.00	\$60,000.00	\$374,400.00
PBD & Geotextile	12800 lf	\$11.00	\$140,800.00	\$28,160.00	\$175,718.40
Drainage	1 ls	\$1,205,886.00	\$1,205,886.00	\$241,177.20	\$1,504,945.73
Lighting	2080 lf	\$125.00	\$260,000.00	\$52,000.00	\$324,480.00
Median Barrier	4800 lf	\$50.00	\$240,000.00	\$48,000.00	\$299,520.00
Guiderail	850 lf	\$16.50	\$14,025.00	\$2,805.00	\$17,503.20
Subtotal, Supplemental Roadway Costs			\$2,160,711.00	\$432,142.20	\$2,696,567.33
					\$2,700,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	29661 CY	\$20.00	\$593,220.00	\$118,644.00	\$740,338.56
Borrow	0 CY	\$25.00	\$0.00	\$0.00	\$0.00
Subtotal, Earthwork Costs			\$593,220.00	\$118,644.00	\$740,338.56
					\$700,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	36542 SY	\$110.00	\$4,019,620.00	\$803,924.00	\$5,016,485.76
Subtotal, Pavement Costs			\$4,019,620.00	\$803,924.00	\$5,016,485.76
					\$5,000,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Retaining Wall	3200 lf	\$553.09	\$1,769,880.00	\$353,976.00	\$2,208,810.24
Sound Wall	4370 lf	\$1,250.00	\$5,462,500.00	\$1,092,500.00	\$6,817,200.00
Subtotal, Wall Costs			\$7,232,380.00	\$1,446,476.00	\$9,026,010.24
					\$9,000,000.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
New Ramp (EB over Braddock Ave)	220 lf	\$15,750.00	\$3,465,000.00	\$693,000.00	\$4,324,320.00
Subtotal, Bridge Cost			\$3,465,000.00	\$693,000.00	\$4,324,320.00
					\$4,300,000.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
OH Truss 4 Lanes	1 ea	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00
ITS Relocation	1 ls	\$300,000.00	\$300,000.00	\$60,000.00	\$374,400.00
Subtotal, Signage Costs			\$500,000.00	\$100,000.00	\$624,000.00
					\$600,000.00

CONSTRUCTION COST ESTIMATE
 Concept 42-43B

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Moderate	1 LS	\$919,971.40	\$919,971.40	\$183,994.28	\$1,148,124.31
Subtotal, Utility Impact			\$919,971.40	\$183,994.28	\$1,148,124.31
					\$1,100,000.00

SUBTOTAL, CONSTRUCTION COSTS			\$18,890,902.40	\$3,778,180.48	\$23,575,846.20
					\$23,400,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost	
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00	
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00	
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00	
Mobilization	1 LS	\$944,545.12	\$188,909.02	\$1,178,792.31	
MPT	1 LS	\$566,727.07	\$113,345.41	\$707,275.39	
			\$1,566,272.19	\$313,254.44	\$1,954,707.70
					\$2,000,000.00

TOTAL CONSTRUCTION COSTS			\$20,457,174.59	\$4,091,434.92	\$25,530,553.89
					\$25,400,000.00

DESIGN AND CM COSTS			\$3,778,180.48	\$818,286.98	\$5,106,110.78
					\$5,100,000.00

TOTAL, DESIGN, CONSTRUCTION AND CM			\$22,669,082.88		\$30,636,664.67
					\$30,500,000.00

ROW COSTS
 Concept 42-43B

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
0177-L-00080-0000-00	\$87,200.00	\$0.00	320,471	65,354	No	20%	\$17,782.80
0177-L-00082-0000-00	\$600.00	\$0.00	958	958	Yes	100%	\$600.00
0177-L-00084-0000-00	\$19,100.00	\$0.00	33,541	812	No	2%	\$500.00
0177-L-00086-0000-00	\$7,500,000.00	\$17,150,000.00	1,306,800	18,030	No	1%	\$103,477.96
0177-H-00205-0000-00	\$21,600.00	\$0.00	22,673	7,107	No	31%	\$6,770.66
0177-H-00187-0000-00	\$83,700.00	\$0.00	9,700	3,925	No	40%	\$33,868.30
0177-H-00184-0000-00	\$40,000.00	\$73,900.00	7,449	2,029	No	27%	\$10,895.42
0177-H-00182-0000-00	\$40,000.00	\$89,400.00	5,442	1,191	No	22%	\$8,754.13
0234-E-00278-0000-00	\$41,600.00	\$0.00	22,783	14,918	No	65%	\$27,239.12
0234-E-00265-0000-00	\$40,200.00	\$107,900.00	6,616	767	No	12%	\$4,660.43
0234-E-00267-0000-00	\$40,000.00	\$42,500.00	5,385	911	No	17%	\$6,766.95
0234-E-00266-0000-00	\$30,000.00	\$73,700.00	5,421	890	No	16%	\$4,925.29
0234-E-00272-0000-00	\$40,200.00	\$83,100.00	7,460	185	No	2%	\$996.92
Subtotal, ROW Costs							\$227,237.97
				117,077			\$200,000.00

Safety
 Concept 42-43B

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Fatal & Injury	13	4.33	0.79	3.42	0.91
PDO	2	0.67	0.50	0.33	0.33

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually	
0.00	0.02	0.09	0.30	0.49	\$	54,976.71
0.00	0.00	0.02	0.08	0.22	\$	26,715.33

Total: \$ 81,692.04

USER BENEFITS
Concept 42-43B

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr: PM Veh-Hrs	
No-build	248236	265184	7994.00	8548.05
Build	248806	265259	7957.00	8623.00
Change	570	75	-37.00	74.95
Subtotal, MOEs				

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	-35.086 hrs	-1.91 hrs
PM Peak Period	73.084 hrs	1.87 hrs
Total of Peaks	37.998 hrs	-0.046 hrs
Daily Estimate	37.998 hrs	-0.046 hrs
Hourly value of time	\$12.89	\$19.69
Safety (Annual)	\$489.63	-\$0.90

Total, all vehicles \$488.72 Value of travel time changes, per day
 \$165,718.23 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars		Trucks	
AM Peak Period				
Average Speed	20			
Change in Veh-Hrs		-35.086 hours		-1.914 hours
Fuel Consumption		0.022 gal/minute		0.102 gal/minute
		-46.3 gallons		-11.7 gallons

USER BENEFITS
 Concept 42-43B
 PM Peak Period

Average Speed	20		
Change in Veh-Hrs		73.1 hours	1.9 hours
Fuel Consumption		0.022 gal/minute	0.102 gal/minute
		96.5 gallons	11.4 gallons

Fuel Consumption			
AM Peak Period		-46.3 gallons	-11.7 gallons
PM Peak Period		96.5 gallons	11.4 gallons
Total of Peaks		50.2 gallons	-0.3 gallons
Daily Estimate		50.157 gallons	-0.281 gallons
		\$3.004 per gallon	\$3.004 per gallon
		\$150.67 per day	-\$0.84 per day

Total, all vehicles		49.9 fuel consumption change, gallons per day	
		16912.3 fuel consumption change, gallons per year	
		\$149.83 change in fuel cost, per day	
		\$50,804.52 change in fuel cost, per year	

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	\$165,718.23	Value of Travel Time change, Per year
Operating Costs	\$50,804.52	Value of Operating Costs change, per year
Total, User Benefits	\$216,522.75	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	50.157 gallons	-0.281 gallons
Annual estimate	17007.57 gallons	-95.28 gallons
CO2	19.4 lb/gal	22.2 lb/gal
	8799.6848 grams/gal	10069.7424 grams/gal
	149,661,250 g	(959,429) g
Total	148,701.82 kg	

USER BENEFITS
Concept 42-43B
VOC

	24.62 grams/gal	1.27 grams/gal
	418,710.16 g	(121.00) g
Total	418.59 kg	

NOx

	16.5 grams/gal	24.52 grams/gal
	280,624.90 g	(2,336.23) g
Total	278.29 kg	

PM2.5

	0.09761905 grams/gal	0.136 grams/gal
	1,660.26 g	(12.96) g
Total	1.65 kg	



SUMMARY OF COSTS AND BENEFITS
 Concept 42-43C

Construction Cost	
Supplemental Roadway Construction	\$1,900,000.00
Earthwork	\$1,100,000.00
Pavement	\$2,000,000.00
Walls	\$10,700,000.00
Bridges	\$29,500,000.00
Traffic Signals	\$0.00
Signage	\$700,000.00
Utilities	\$1,100,000.00
Additional Lump Sum	\$3,800,000.00
Design and PM	\$10,200,000.00
ROW	\$200,000.00
Total	\$61,200,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	1150 hr
Value of Travel Time (Annual)	\$5,331,431.92
Automobile Operating Costs (Annual)	\$1,831,714.73
Safety (Annual)	\$26,715.33
Total	\$7,189,861.97
Emissions (Annual)	
CO2	-5486188 kg
NOx	-10822 kg
VOC	-12796 kg
Benefit:Cost Ratio	
NPV Benefits	\$108,011,882.56
NPV Operating Costs	\$0.00
NPV Capital Costs	\$60,128,583.50
Total Costs	\$60,128,583.50
Benefit:Cost Ratio	1.80

NET PRESENT VALUE CALCULATIONS

Concept 42-43C

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$61,355,697.45
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$60,128,583.50
NPV Capital Costs			\$60,128,583.50

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$7,189,862	\$6,499,066	\$0	\$0
2022	0.8858	\$7,189,862	\$6,369,084	\$0	\$0
2023	0.8681	\$7,189,862	\$6,241,703	\$0	\$0
2024	0.8508	\$7,189,862	\$6,116,869	\$0	\$0
2025	0.8337	\$7,189,862	\$5,994,531	\$0	\$0
2026	0.8171	\$7,189,862	\$5,874,641	\$0	\$0
2027	0.8007	\$7,189,862	\$5,757,148	\$0	\$0
2028	0.7847	\$7,189,862	\$5,642,005	\$0	\$0
2029	0.7690	\$7,189,862	\$5,529,165	\$0	\$0
2030	0.7536	\$7,189,862	\$5,418,582	\$0	\$0
2031	0.7386	\$7,189,862	\$5,310,210	\$0	\$0
2032	0.7238	\$7,189,862	\$5,204,006	\$0	\$0
2033	0.7093	\$7,189,862	\$5,099,926	\$0	\$0
2034	0.6951	\$7,189,862	\$4,997,927	\$0	\$0
2035	0.6812	\$7,189,862	\$4,897,969	\$0	\$0
2036	0.6676	\$7,189,862	\$4,800,009	\$0	\$0
2037	0.6543	\$7,189,862	\$4,704,009	\$0	\$0
2038	0.6412	\$7,189,862	\$4,609,929	\$0	\$0
2039	0.6283	\$7,189,862	\$4,517,730	\$0	\$0
2040	0.6158	\$7,189,862	\$4,427,376	\$0	\$0
NPV		User Benefits	\$108,011,883	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 42-43C

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Single Faced Barrier	4125 lf	\$60.00	\$247,500.00	\$49,500.00	\$308,880.00
PBD & Geotextile	5575 lf	\$11.00	\$61,325.00	\$12,265.00	\$76,533.60
Drainage	1 ls	\$487,806.00	\$487,806.00	\$97,561.20	\$608,781.89
Lighting	5575 lf	\$125.00	\$696,875.00	\$139,375.00	\$869,700.00
Guiderail	900 lf	\$16.50	\$14,850.00	\$2,970.00	\$18,532.80
Center Median Barrier	300 lf	\$50.00	\$15,000.00	\$3,000.00	\$18,720.00
Subtotal, Supplemental Roadway Costs			\$1,523,356.00	\$304,671.20	\$1,901,148.29
					\$1,900,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	45755 CY	\$20.00	\$915,100.00	\$183,020.00	\$1,142,044.80
Borrow	0 CY	\$25.00	\$0.00	\$0.00	\$0.00
Subtotal, Earthwork Costs			\$915,100.00	\$183,020.00	\$1,142,044.80
					\$1,100,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	14782 SY	\$110.00	\$1,626,020.00	\$325,204.00	\$2,029,272.96
Subtotal, Pavement Costs			\$1,626,020.00	\$325,204.00	\$2,029,272.96
					\$2,000,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Retaining Wall	1860 lf	\$1,182.72	\$2,199,852.00	\$439,970.40	\$2,745,415.30
Sound Wall	5088 lf	\$1,250.00	\$6,360,000.00	\$1,272,000.00	\$7,937,280.00
Subtotal, Wall Costs			\$8,559,852.00	\$1,711,970.40	\$10,682,695.30
					\$10,700,000.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
New Ramp (EB over Braddock Ave)	220 lf	\$15,750.00	\$3,465,000.00	\$693,000.00	\$4,324,320.00
Edgewood Ave/ Est Busway Bridge Repl	200 lf	\$84,000.00	\$16,800,000.00	\$3,360,000.00	\$20,966,400.00
Chestnut St. Bridge Repl.	150 lf	\$22,500.00	\$3,375,000.00	\$675,000.00	\$4,212,000.00
Subtotal, Bridge Cost			\$23,640,000.00	\$4,728,000.00	\$29,502,720.00
					\$29,500,000.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 42-43C

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
OH Truss 4 Lanes	1 ea	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00
Remove Overhead Pedestal	1 ea	\$50,000.00	\$50,000.00	\$10,000.00	\$62,400.00
ITS Relocation	1 ls	\$350,000.00	\$350,000.00	\$70,000.00	\$436,800.00
Subtotal, Signage Costs			\$600,000.00	\$120,000.00	\$748,800.00
					\$700,000.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Moderate	1 LS	\$919,971.40	\$919,971.40	\$183,994.28	\$1,148,124.31
Subtotal, Utility Impact			\$919,971.40	\$183,994.28	\$1,148,124.31
					\$1,100,000.00

SUBTOTAL, CONSTRUCTION COSTS			\$37,784,299.40	\$7,556,859.88	\$47,154,805.65
					\$47,000,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00
Mobilization	1 LS	\$1,889,214.97	\$377,842.99	\$2,357,740.28
MPT	1 LS	\$1,133,528.98	\$226,705.80	\$1,414,644.17
		\$3,077,743.95	\$615,548.79	\$3,841,024.45
				\$3,800,000.00

TOTAL CONSTRUCTION COSTS		\$40,862,043.35	\$8,172,408.67	\$50,995,830.10
				\$50,800,000.00

DESIGN AND CM COSTS		\$7,556,859.88	\$1,634,481.73	\$10,199,166.02
				\$10,200,000.00

TOTAL, DESIGN, CONSTRUCTION AND CM		\$45,341,159.28		\$61,194,996.12
				\$61,000,000.00

ROW COSTS
 Concept 42-43C

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
0177-L-00080-0000-00	\$87,200.00	\$0.00	320,471	86,813	No	27%	\$23,621.78
0177-L-00086-0000-00	\$7,500,000.00	\$17,150,000.00	1,306,800	3,486	No	0%	\$20,007.07
0176-S-00157-0009-00	\$12,100.00	\$0.00	263,974	158	No	0%	\$500.00
0235-N-00001-0000-00	\$445,600.00	\$0.00	445,641	80	No	0%	\$500.00
0177-H-00205-0000-00	\$21,600.00	\$0.00	22,673	10,825	No	48%	\$10,312.50
0177-H-00187-0000-00	\$83,700.00	\$0.00	9,700	2,176	No	22%	\$18,774.54
0177-H-00184-0000-00	\$40,000.00	\$73,900.00	5,391	2,219	No	41%	\$16,462.59
0177-H-00182-0000-00	\$40,000.00	\$89,400.00	5,442	1,601	No	29%	\$11,767.68
0234-E-00278-0000-00	\$41,600.00	\$0.00	22,783	12,154	No	53%	\$22,192.74
0234-E-00263-0000-00	\$36,800.00	\$119,500.00	4,187	23	No	1%	\$500.00
0234-E-00262-0000-00	\$500.00	\$0.00	1,187	87	No	7%	\$500.00
0234-E-00265-0000-00	\$40,200.00	\$107,900.00	6,616	1,063	No	16%	\$6,456.79
0234-E-00267-0000-00	\$40,000.00	\$42,500.00	5,386	1,189	No	22%	\$8,829.32
0234-E-00266-0000-00	\$30,000.00	\$73,700.00	5,421	1,297	No	24%	\$7,175.29
0234-E-00272-0000-00	\$40,200.00	\$83,100.00	7,460	1,474	No	20%	\$7,943.91
0234-E-00274-0000-00	\$40,200.00	\$93,300.00	7,463	216	No	3%	\$1,164.92
0234-F-00150-0000-00	\$14,300.00	\$0.00	261,360	1,100	No	0%	\$500.00
0127-H-00100-0000-01	\$4,483,000.00	\$1,290,600.00	19,692,605	2,720	No	0%	\$619.27
0177-L-00084-0000-00	\$19,100.00	\$0.00	33,541	3,991	No	12%	\$2,272.93
0177-L-00082-0000-00	\$600.00	\$0.00	958	961	Yes	####	\$600.00
Subtotal, ROW Costs							\$160,701.33
							\$200,000.00

Safety
 Concept 42-43C

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Sideswipes	2	0.67	0.50	0.33	0.33

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.00	0.02	0.08	0.22	\$ 26,715.33

USER BENEFITS
Concept 42-43C

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:	PM Veh-Hrs
No - build	18908	22271	7994	8548
Build	18903	22243	7400	7946
Change	-5	-28	-594	-602
Subtotal, MOEs				

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	-563.280 hrs	-30.72 hrs
PM Peak Period	-587.046 hrs	-15.00 hrs
Total of Peaks	-1150.326 hrs	-45.722 hrs
Daily Estimate	-1150.326 hrs	-45.722 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$14,822.65	-\$900.35

Total, all vehicles
-\$15,723.00 Value of travel time changes, per day
-\$5,331,431.92 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars		Trucks	
AM Peak Period				
Average Speed	20			
Change in Veh-Hrs		-563.280 hours		-30.720 hours
Fuel Consumption		0.022 gal/minute		0.102 gal/minute
		-743.5 gallons		-188.0 gallons

USER BENEFITS

Concept 42-43C

PM Peak Period

Average Speed	20.1		
Change in Veh-Hrs		-587.0 hours	-15.0 hours
Fuel Consumption		0.022 gal/minute	0.102 gal/minute
		-774.9 gallons	-91.8 gallons

Fuel Consumption

AM Peak Period		-743.5 gallons	-188.0 gallons
PM Peak Period		-774.9 gallons	-91.8 gallons
Total of Peaks		-1518.4 gallons	-279.8 gallons
Daily Estimate		-1518.431 gallons	-279.816 gallons
		\$3.004 per gallon	\$3.004 per gallon
		-\$4,561.37 per day	-\$840.57 per day

Total, all vehicles

-1798.2 fuel consumption change, gallons per day
 (609,758.56) fuel consumption change, gallons per year

-\$5,401.93 change in fuel cost, per day
 -\$1,831,714.73 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-5,331,431.92	Value of Travel Time change, Per year
Operating Costs	-1,831,714.73	Value of Operating Costs change, per year
Total, User Benefits	-7,163,146.64	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-1518.431 gallons	-279.816 gallons
Annual estimate	-514877.133 gallons	-94881.431
CO	19.4 lb/gal	22.2 lb/gal
	8799.6848 grams/gal	10069.7424 grams/gal
	(4,530,756,483.93) g	(955,431,565.66) g
Total	(5,486,188.05) kg	

USER BENEFITS
Concept 42-43C
VOC

	24.62 grams/gal	1.27 grams/gal
	(12,675,784.66) g	(120,499.42)
Total	(12,796.28) kg	

NOx

	16.5 grams/gal	24.52 grams/gal
	(8,495,472.70) g	(2,326,492.68)
Total	(10,821.97) kg	

PM2.5

	0.09761905 grams/gal	0.136 grams/gal
	(50,261.82) g	(12,903.87)
Total	(63.17) kg	



SUMMARY OF COSTS AND BENEFITS
 Concept 43

Construction Cost	
Supplemental Roadway Construction	\$1,500,000.00
Earthwork	\$900,000.00
Pavement	\$1,600,000.00
Walls	\$8,400,000.00
Bridges	\$25,300,000.00
Traffic Signals	\$0.00
Signage	\$400,000.00
Utilities	\$600,000.00
Additional Lump Sum	\$3,200,000.00
Design and PM	\$8,400,000.00
ROW	\$100,000.00
Total	\$50,400,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	844 hr
Value of Travel Time (Annual)	\$3,915,970.96
Automobile Operating Costs (Annual)	\$1,349,021.35
Safety (Annual)	\$26,715.33
Total	\$5,291,707.64
Emissions (Annual)	
CO2	-4042510 kg
NOx	-7983 kg
VOC	-9387 kg
Benefit:Cost Ratio	
NPV Benefits	\$79,496,283.28
NPV Operating Costs	\$0.00
NPV Capital Costs	\$49,243,826.88
Total Costs	\$49,243,826.88
Benefit:Cost Ratio	1.61

NET PRESENT VALUE CALCULATIONS

Concept 43

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$50,248,802.94
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$49,243,826.88
NPV Capital Costs			\$49,243,826.88

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$5,291,708	\$4,783,285	\$0	\$0
2022	0.8858	\$5,291,708	\$4,687,619	\$0	\$0
2023	0.8681	\$5,291,708	\$4,593,867	\$0	\$0
2024	0.8508	\$5,291,708	\$4,501,989	\$0	\$0
2025	0.8337	\$5,291,708	\$4,411,949	\$0	\$0
2026	0.8171	\$5,291,708	\$4,323,710	\$0	\$0
2027	0.8007	\$5,291,708	\$4,237,236	\$0	\$0
2028	0.7847	\$5,291,708	\$4,152,491	\$0	\$0
2029	0.7690	\$5,291,708	\$4,069,442	\$0	\$0
2030	0.7536	\$5,291,708	\$3,988,053	\$0	\$0
2031	0.7386	\$5,291,708	\$3,908,292	\$0	\$0
2032	0.7238	\$5,291,708	\$3,830,126	\$0	\$0
2033	0.7093	\$5,291,708	\$3,753,523	\$0	\$0
2034	0.6951	\$5,291,708	\$3,678,453	\$0	\$0
2035	0.6812	\$5,291,708	\$3,604,884	\$0	\$0
2036	0.6676	\$5,291,708	\$3,532,786	\$0	\$0
2037	0.6543	\$5,291,708	\$3,462,130	\$0	\$0
2038	0.6412	\$5,291,708	\$3,392,888	\$0	\$0
2039	0.6283	\$5,291,708	\$3,325,030	\$0	\$0
2040	0.6158	\$5,291,708	\$3,258,530	\$0	\$0
NPV		User Benefits	\$79,496,283	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
Concept 43

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Single Faced Barrier	3060 lf	\$60.00	\$183,600.00	\$36,720.00	\$229,132.80
PBD & Geotextile	4760 lf	\$11.00	\$52,360.00	\$10,472.00	\$65,345.28
Drainage	1 ls	\$380,680.67	\$380,680.67	\$76,136.13	\$475,089.48
Lighting	4460 lf	\$125.00	\$557,500.00	\$111,500.00	\$695,760.00
Guiderail	900 lf	\$16.50	\$14,850.00	\$2,970.00	\$18,532.80
Center Median Barrier	300 lf	\$50.00	\$15,000.00	\$3,000.00	\$18,720.00
Subtotal, Supplemental Roadway Costs			\$1,203,990.67	\$240,798.13	\$1,502,580.36
					\$1,500,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	34974 CY	\$20.00	\$699,480.00	\$139,896.00	\$872,951.04
Borrow	0 CY	\$25.00	\$0.00	\$0.00	\$0.00
Subtotal, Earthwork Costs			\$699,480.00	\$139,896.00	\$872,951.04
					\$900,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	11536 SY	\$110.00	\$1,268,960.00	\$253,792.00	\$1,583,662.08
Subtotal, Pavement Costs			\$1,268,960.00	\$253,792.00	\$1,583,662.08
					\$1,600,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Retaining Wall	1280 lf	\$1,718.63	\$2,199,852.00	\$439,970.40	\$2,745,415.30
Sound Wall	3594 lf	\$1,250.00	\$4,492,500.00	\$898,500.00	\$5,606,640.00
Subtotal, Wall Costs			\$6,692,352.00	\$1,338,470.40	\$8,352,055.30
					\$8,400,000.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
New Ramp (EB over Braddock Ave)	220 lf	\$15,750.00	\$3,465,000.00	\$693,000.00	\$4,324,320.00
Edgewood Ave/ Est Busway Bridge Repl	200 lf	\$84,000.00	\$16,800,000.00	\$3,360,000.00	\$20,966,400.00
Subtotal, Bridge Cost			\$20,265,000.00	\$4,053,000.00	\$25,290,720.00
					\$25,300,000.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
ITS Relocation	1 ls	\$350,000.00	\$350,000.00	\$70,000.00	\$436,800.00
Subtotal, Signage Costs			\$350,000.00	\$70,000.00	\$436,800.00
					\$400,000.00

CONSTRUCTION COST ESTIMATE
 Concept 43

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Minor	1 LS	\$457,196.74	\$457,196.74	\$91,439.35	\$570,581.53
Subtotal, Utility Impact			\$457,196.74	\$91,439.35	\$570,581.53
					\$600,000.00

SUBTOTAL, CONSTRUCTION COSTS			\$30,936,979.41	\$6,187,395.88	\$38,609,350.30
					\$38,700,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost	
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00	
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00	
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00	
Mobilization	1 LS	\$1,546,848.97	\$309,369.79	\$1,930,467.52	
MPT	1 LS	\$928,109.38	\$185,621.88	\$1,158,280.51	
			\$2,529,958.35	\$505,991.67	\$3,157,388.02
					\$3,200,000.00

TOTAL CONSTRUCTION COSTS			\$33,466,937.76	\$6,693,387.55	\$41,766,738.33
					\$41,900,000.00

DESIGN AND CM COSTS			\$6,187,395.88	\$1,338,677.51	\$8,353,347.67
					\$8,400,000.00

TOTAL, DESIGN, CONSTRUCTION AND CM			\$37,124,375.29		\$50,120,085.99
					\$50,300,000.00

ROW COSTS
 Concept 43

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
0127-H-00100-0000-01	\$4,483,000.00	\$1,290,600.00	19,692,605	2,720	No	0%	\$619.27
0177-L-00084-0000-00	\$19,100.00	\$0.00	33,541	3,991	No	12%	\$2,272.93
0177-L-00082-0000-00	\$600.00	\$0.00	958	961	Yes	####	\$600.00
0177-L-00080-0000-00	\$87,200.00	\$0.00	320,471	86,813	No	27%	\$23,621.78
0177-L-00086-0000-00	\$7,500,000.00	\$17,150,000.00	1,306,800	3,486	No	0%	\$20,007.07
0176-S-00157-0009-00	\$12,100.00	\$0.00	263,974	158	No	0%	\$500.00
0235-N-00001-0000-00	\$445,600.00	\$0.00	445,641	80	No	0%	\$500.00
0177-H-00205-0000-00	\$21,600.00	\$0.00	22,673	10,825	No	48%	\$10,312.50
0177-H-00187-0000-00	\$83,700.00	\$0.00	9,700	2,176	No	22%	\$18,774.54
0177-H-00184-0000-00	\$40,000.00	\$73,900.00	5,391	2,219	No	41%	\$16,462.59
0177-H-00182-0000-00	\$40,000.00	\$89,400.00	5,442	1,601	No	29%	\$11,767.68
0234-E-00278-0000-00	\$41,600.00	\$0.00	22,783	12,154	No	53%	\$22,192.74
0234-E-00265-0000-00	\$40,200.00	\$107,900.00	6,616	96	No	1%	\$585.85
0234-E-00262-0000-00	\$500.00	\$0.00	1,187	20	No	2%	\$500.00
Subtotal, ROW Costs							\$128,716.95
							\$100,000.00

Safety
 Concept 43

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Sideswipes	2	0.67	0.50	0.33	0.33

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.00	0.02	0.08	0.22	\$ 26,715.33

USER BENEFITS

Concept 43

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:	PM Veh-Hrs
No - build	18908	22271	7994	8548
Build	18903	22243	7525	8139
Change	-5	-28	-469	-409
Subtotal, MOEs				

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	-444.745 hrs	-24.26 hrs
PM Peak Period	-398.856 hrs	-10.19 hrs
Total of Peaks	-843.600 hrs	-34.448 hrs
Daily Estimate	-843.600 hrs	-34.448 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$10,870.29	-\$678.35

Total, all vehicles
 -\$11,548.64 Value of travel time changes, per day
 -\$3,915,970.96 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars		Trucks	
AM Peak Period				
Average Speed	20			
Change in Veh-Hrs		-444.745 hours		-24.255 hours
Fuel Consumption		0.022 gal/minute		0.102 gal/minute
		-587.1 gallons		-148.4 gallons

USER BENEFITS

Concept 43

PM Peak Period

Average Speed	20.1		
Change in Veh-Hrs		-398.9 hours	-10.2 hours
Fuel Consumption		0.022 gal/minute	0.102 gal/minute
		-526.5 gallons	-62.4 gallons

Fuel Consumption

AM Peak Period		-587.1 gallons	-148.4 gallons
PM Peak Period		-526.5 gallons	-62.4 gallons
Total of Peaks		-1113.6 gallons	-210.8 gallons
Daily Estimate		-1113.552 gallons	-210.821 gallons
		\$3.004 per gallon	\$3.004 per gallon
		-\$3,345.11 per day	-\$633.31 per day

Total, all vehicles

-1324.4 fuel consumption change, gallons per day
 (449,075.02) fuel consumption change, gallons per year

-\$3,978.42 change in fuel cost, per day
 -\$1,349,021.35 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-3,915,970.96	Value of Travel Time change, Per year
Operating Costs	-1,349,021.35	Value of Operating Costs change, per year
Total, User Benefits	-5,264,992.31	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-1113.552 gallons	-210.821 gallons
Annual estimate	-377588.852 gallons	-71486.164
CO	19.4 lb/gal	22.2 lb/gal
	8799.6848 grams/gal	10069.7424 grams/gal
	(3,322,662,877.79) g	(719,847,259.72) g
Total	(4,042,510.14) kg	

USER BENEFITS

Concept 43

VOC

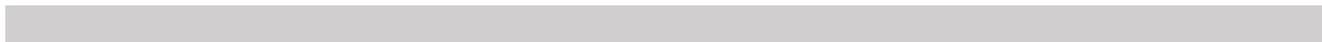
	24.62 grams/gal	1.27 grams/gal
	(9,295,877.92) g	(90,787.43)
Total	(9,386.67) kg	

NOx

	16.5 grams/gal	24.52 grams/gal
	(6,230,216.05) g	(1,752,840.75)
Total	(7,983.06) kg	

PM2.5

	0.09761905 grams/gal	0.136 grams/gal
	(36,859.86) g	(9,722.12)
Total	(46.58) kg	



SUMMARY OF COSTS AND BENEFITS
 Concept 46

Construction Cost	
Supplemental Roadway Construction	\$500,000.00
Earthwork	\$20,000.00
Pavement	\$520,000.00
Walls	\$3,300,000.00
Bridges	\$0.00
Traffic Signals	\$0.00
Signage	\$0.00
Utilities	\$220,000.00
Additional Lump Sum	\$430,000.00
Design and PM	\$1,000,000.00
ROW	\$0.00
Total	\$5,990,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	-52 hr
Value of Travel Time (Annual)	-\$239,470.42
Automobile Operating Costs (Annual)	-\$93,499.25
Safety (Annual)	\$197,352.29
Total	-\$135,617.38
Emissions (Annual)	
CO2	286381 kg
NOx	592 kg
VOC	537 kg
Benefit:Cost Ratio	
NPV Benefits	-\$2,037,353.29
NPV Operating Costs	\$0.00
NPV Capital Costs	\$5,887,451.19
Total Costs	\$5,887,451.19
Benefit:Cost Ratio	-0.35

NET PRESENT VALUE CALCULATIONS

Concept 46

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$6,007,603.26
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$5,887,451.19
NPV Capital Costs			\$5,887,451.19

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	-\$135,617	-\$122,587	\$0	\$0
2022	0.8858	-\$135,617	-\$120,136	\$0	\$0
2023	0.8681	-\$135,617	-\$117,733	\$0	\$0
2024	0.8508	-\$135,617	-\$115,378	\$0	\$0
2025	0.8337	-\$135,617	-\$113,071	\$0	\$0
2026	0.8171	-\$135,617	-\$110,809	\$0	\$0
2027	0.8007	-\$135,617	-\$108,593	\$0	\$0
2028	0.7847	-\$135,617	-\$106,421	\$0	\$0
2029	0.7690	-\$135,617	-\$104,293	\$0	\$0
2030	0.7536	-\$135,617	-\$102,207	\$0	\$0
2031	0.7386	-\$135,617	-\$100,163	\$0	\$0
2032	0.7238	-\$135,617	-\$98,160	\$0	\$0
2033	0.7093	-\$135,617	-\$96,196	\$0	\$0
2034	0.6951	-\$135,617	-\$94,272	\$0	\$0
2035	0.6812	-\$135,617	-\$92,387	\$0	\$0
2036	0.6676	-\$135,617	-\$90,539	\$0	\$0
2037	0.6543	-\$135,617	-\$88,728	\$0	\$0
2038	0.6412	-\$135,617	-\$86,954	\$0	\$0
2039	0.6283	-\$135,617	-\$85,215	\$0	\$0
2040	0.6158	-\$135,617	-\$83,511	\$0	\$0
NPV		User Benefits	-\$2,037,353	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
Concept 46

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Single Faced Barrier	900 lf	\$60.00	\$54,000.00	\$10,800.00	\$67,392.00
PBD & Geotextile	1600 lf	\$11.00	\$17,600.00	\$3,520.00	\$21,964.80
Drainage	1 ls	\$125,970.17	\$125,970.17	\$25,194.03	\$157,210.77
Lighting	1600 lf	\$125.00	\$200,000.00	\$40,000.00	\$249,600.00
Guiderail	400 lf	\$16.50	\$6,600.00	\$1,320.00	\$8,236.80
Subtotal, Supplemental Roadway Costs			\$404,170.17	\$80,834.03	\$504,404.37
					\$500,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	902 CY	\$20.00	\$18,040.00	\$3,608.00	\$22,513.92
Borrow	0 CY	\$25.00	\$0.00	\$0.00	\$0.00
Subtotal, Earthwork Costs			\$18,040.00	\$3,608.00	\$22,513.92
					\$20,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	3817 SY	\$110.00	\$419,870.00	\$83,974.00	\$523,997.76
Subtotal, Pavement Costs			\$419,870.00	\$83,974.00	\$523,997.76
					\$520,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Retaining Wall	405 lf	\$1,311.85	\$531,300.00	\$106,260.00	\$663,062.40
Sound Wall	1691 lf	\$1,250.00	\$2,113,750.00	\$422,750.00	\$2,637,960.00
Subtotal, Wall Costs			\$2,645,050.00	\$529,010.00	\$3,301,022.40
					\$3,300,000.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Moderate	1 LS	\$175,356.51	\$175,356.51	\$35,071.30	\$218,844.92
Subtotal, Utility Impact			\$175,356.51	\$35,071.30	\$218,844.92
					\$220,000.00

CONSTRUCTION COST ESTIMATE
 Concept 46

SUBTOTAL, CONSTRUCTION COSTS		\$3,662,486.68	\$732,497.34	\$4,570,783.38
				\$4,560,000.00
Additional Lump Sum				
Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00
Mobilization	1 LS	\$183,124.33	\$36,624.87	\$228,539.17
MPT	1 LS	\$109,874.60	\$21,974.92	\$137,123.50
		\$347,998.93	\$69,599.79	\$434,302.67
				\$430,000.00
TOTAL CONSTRUCTION COSTS		\$4,010,485.61	\$802,097.12	\$5,005,086.05
				\$4,990,000.00
DESIGN AND CM COSTS		\$732,497.34	\$160,419.42	\$1,001,017.21
				\$1,000,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM		\$4,394,984.02		\$6,006,103.26
				\$5,990,000.00

ROW COSTS
 Concept 46

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
0234-F-00088-0000-00	\$65,500.00	\$164,600.00	14,716	56	No	0%	\$500.00
0234-F-00092-0000-00	\$65,300.00	\$210,100.00	13,780	68	No	0%	\$500.00
0234-F-00110-0000-00	\$67,700.00	\$240,900.00	29,676	79	No	0%	\$500.00
Subtotal, ROW Costs							\$1,500.00
							\$0.00

Safety
Concept 46

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	28	9.33	0.65	6.07	3.27

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.01	0.07	0.34	1.09	1.76	\$ 197,352.29

USER BENEFITS

Concept 46

PM Peak Period

Average Speed	20.1		
Change in Veh-Hrs		-74.0 hours	-1.9 hours
Fuel Consumption		0.022 gal/minute	0.102 gal/minute
		-97.7 gallons	-11.6 gallons

Fuel Consumption

AM Peak Period		160.5 gallons	40.6 gallons
PM Peak Period		-97.7 gallons	-11.6 gallons
Total of Peaks		62.8 gallons	29.0 gallons
Daily Estimate		62.785 gallons	29.006 gallons
		\$3.004 per gallon	\$3.004 per gallon
		\$188.61 per day	\$87.13 per day

Total, all vehicles

91.8 fuel consumption change, gallons per day
 31,124.92 fuel consumption change, gallons per year

 \$275.74 change in fuel cost, per day
 \$93,499.25 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	\$239,470.42	Value of Travel Time change, Per year
Operating Costs	\$93,499.25	Value of Operating Costs change, per year
Total, User Benefits	\$332,969.68	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	62.785 gallons	29.006 gallons
Annual estimate	21289.392 gallons	9835.525
CO	19.4 lb/gal	22.2 lb/gal
	8799.6848 grams/gal	10069.7424 grams/gal
	187,339,939.60 g	99,041,206.61 g
Total	286,381.15 kg	

USER BENEFITS

Concept 46

VOC

	24.62 grams/gal	1.27 grams/gal
	524,124.56 g	12,491.12
Total	536.62 kg	

NOx

	16.5 grams/gal	24.52 grams/gal
	351,274.97 g	241,167.08
Total	592.44 kg	

PM2.5

	0.09761905 grams/gal	0.136 grams/gal
	2,078.25 g	1,337.63
Total	3.42 kg	



SUMMARY OF COSTS AND BENEFITS
 Concept 47A

Construction Cost	
Supplemental Roadway Construction	\$2,600,000.00
Earthwork	\$500,000.00
Pavement	\$2,900,000.00
Walls	\$9,000,000.00
Bridges	\$18,500,000.00
Traffic Signals	\$0.00
Signage	\$0.00
Utilities	\$700,000.00
Additional Lump Sum	\$2,800,000.00
Design and PM	\$7,400,000.00
ROW	\$0.00
Total	\$44,400,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	377 hr
Value of Travel Time (Annual)	\$1,689,010.95
Automobile Operating Costs (Annual)	\$595,507.46
Safety (Annual)	\$13,357.67
Total	\$2,297,876.07
Emissions (Annual)	
CO2	-1792206 kg
NOx	-3573 kg
VOC	-4002 kg
Benefit:Cost Ratio	
NPV Benefits	\$34,520,540.38
NPV Operating Costs	\$0.00
NPV Capital Costs	\$43,550,390.50
Total Costs	\$43,550,390.50
Benefit:Cost Ratio	0.79

NET PRESENT VALUE CALCULATIONS

Concept 47A

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$44,439,173.98
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$43,550,390.50
NPV Capital Costs			\$43,550,390.50

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$2,297,876	\$2,077,098	\$0	\$0
2022	0.8858	\$2,297,876	\$2,035,556	\$0	\$0
2023	0.8681	\$2,297,876	\$1,994,845	\$0	\$0
2024	0.8508	\$2,297,876	\$1,954,948	\$0	\$0
2025	0.8337	\$2,297,876	\$1,915,849	\$0	\$0
2026	0.8171	\$2,297,876	\$1,877,532	\$0	\$0
2027	0.8007	\$2,297,876	\$1,839,981	\$0	\$0
2028	0.7847	\$2,297,876	\$1,803,182	\$0	\$0
2029	0.7690	\$2,297,876	\$1,767,118	\$0	\$0
2030	0.7536	\$2,297,876	\$1,731,776	\$0	\$0
2031	0.7386	\$2,297,876	\$1,697,140	\$0	\$0
2032	0.7238	\$2,297,876	\$1,663,197	\$0	\$0
2033	0.7093	\$2,297,876	\$1,629,934	\$0	\$0
2034	0.6951	\$2,297,876	\$1,597,335	\$0	\$0
2035	0.6812	\$2,297,876	\$1,565,388	\$0	\$0
2036	0.6676	\$2,297,876	\$1,534,080	\$0	\$0
2037	0.6543	\$2,297,876	\$1,503,399	\$0	\$0
2038	0.6412	\$2,297,876	\$1,473,331	\$0	\$0
2039	0.6283	\$2,297,876	\$1,443,864	\$0	\$0
2040	0.6158	\$2,297,876	\$1,414,987	\$0	\$0
NPV		User Benefits	\$34,520,540	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
Concept 47A

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Single Faced Barrier	6400 lf	\$60.00	\$384,000.00	\$76,800.00	\$479,232.00
PBD & Geotextile	7300 lf	\$11.00	\$80,300.00	\$16,060.00	\$100,214.40
Drainage	1 ls	\$692,109.00	\$692,109.00	\$138,421.80	\$863,752.03
Lighting	7300 lf	\$125.00	\$912,500.00	\$182,500.00	\$1,138,800.00
Guiderail	750 lf	\$16.50	\$12,375.00	\$2,475.00	\$15,444.00
Center Median Barrier	550 lf	\$50.00	\$27,500.00	\$5,500.00	\$34,320.00
Subtotal, Supplemental Roadway Costs			\$2,108,784.00	\$421,756.80	\$2,631,762.43
					\$2,600,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	20710 CY	\$20.00	\$414,200.00	\$82,840.00	\$516,921.60
Borrow	0 CY	\$25.00	\$0.00	\$0.00	\$0.00
Subtotal, Earthwork Costs			\$414,200.00	\$82,840.00	\$516,921.60
					\$500,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	20973 SY	\$110.00	\$2,307,030.00	\$461,406.00	\$2,879,173.44
Subtotal, Pavement Costs			\$2,307,030.00	\$461,406.00	\$2,879,173.44
					\$2,900,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Retaining Wall	1035 lf	\$1,241.19	\$1,284,630.00	\$256,926.00	\$1,603,218.24
Sound Wall	4749 lf	\$1,250.00	\$5,936,250.00	\$1,187,250.00	\$7,408,440.00
Subtotal, Wall Costs			\$7,220,880.00	\$1,444,176.00	\$9,011,658.24
					\$9,000,000.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Replace Bridge D over PWKY	280 lf	\$18,000.00	\$5,040,000.00	\$1,008,000.00	\$6,289,920.00
Replace Tied Arch Bridge carrying Ramp A over SR0008 Ardmore Blvd	280 lf	\$18,000.00	\$5,040,000.00	\$1,008,000.00	\$6,289,920.00
Ramp A over Ramp G	240 lf	\$19,800.00	\$4,752,000.00	\$950,400.00	\$5,930,496.00
Subtotal, Bridge Cost			\$14,832,000.00	\$2,966,400.00	\$18,510,336.00
					\$18,500,000.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00
					\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 47A

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Moderate	1 LS	\$539,118.88	\$539,118.88	\$107,823.78	\$672,820.36
Subtotal, Utility Impact			\$539,118.88	\$107,823.78	\$672,820.36
					\$700,000.00

SUBTOTAL, CONSTRUCTION COSTS			\$27,422,012.88	\$5,484,402.58	\$34,222,672.07
					\$34,200,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost	
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00	
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00	
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00	
Mobilization	1 LS	\$1,371,100.64	\$274,220.13	\$1,711,133.60	
MPT	1 LS	\$822,660.39	\$164,532.08	\$1,026,680.16	
			\$2,248,761.03	\$449,752.21	\$2,806,453.77
					\$2,800,000.00

TOTAL CONSTRUCTION COSTS			\$29,670,773.91	\$5,934,154.78	\$37,029,125.84
					\$37,000,000.00

DESIGN AND CM COSTS			\$5,484,402.58	\$1,186,830.96	\$7,405,825.17
					\$7,400,000.00

TOTAL, DESIGN, CONSTRUCTION AND CM			\$32,906,415.46		\$44,434,951.01
					\$44,400,000.00

ROW COSTS
 Concept 47A

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
0233-S-00100-0000-00	\$38,000.00	\$0.00	802,549	89,188	No	11%	\$4,222.97
Subtotal, ROW Costs							\$4,222.97
							\$0.00

Safety
 Concept 47A

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Sideswipes	1	0.33	0.50	0.17	0.17

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.00	0.01	0.04	0.11	\$ 13,357.67

USER BENEFITS

Concept 47A

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:	PM Veh-Hrs
No-build	248236	265184	7994	8548
Build	251950	274393	7668	8497
Change	3714	9209	-326	-51
Subtotal, MOEs				

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	-308.974 hrs	-16.85 hrs
PM Peak Period	-49.888 hrs	-1.27 hrs
Total of Peaks	-358.862 hrs	-18.126 hrs
Daily Estimate	-358.862 hrs	-18.126 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$4,624.16	-\$356.93

Total, all vehicles
 -\$4,981.08 Value of travel time changes, per day
 -\$1,689,010.95 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars		Trucks	
AM Peak Period				
Average Speed	20			
Change in Veh-Hrs		-308.974 hours		-16.851 hours
Fuel Consumption		0.022 gal/minute		0.102 gal/minute
		-407.8 gallons		-103.1 gallons

USER BENEFITS

Concept 47A

PM Peak Period

Average Speed	20.1		
Change in Veh-Hrs		-49.9 hours	-1.3 hours
Fuel Consumption		0.022 gal/minute	0.102 gal/minute
		-65.9 gallons	-7.8 gallons

Fuel Consumption

AM Peak Period		-407.8 gallons	-103.1 gallons
PM Peak Period		-65.9 gallons	-7.8 gallons
Total of Peaks		-473.7 gallons	-110.9 gallons
Daily Estimate		-473.698 gallons	-110.929 gallons
		\$3.004 per gallon	\$3.004 per gallon
		-\$1,422.99 per day	-\$333.23 per day

Total, all vehicles

-584.6 fuel consumption change, gallons per day
 (198,238.17) fuel consumption change, gallons per year

 -\$1,756.22 change in fuel cost, per day
 -\$595,507.46 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-1,689,010.95	Value of Travel Time change, Per year
Operating Costs	-\$595,507.46	Value of Operating Costs change, per year
Total, User Benefits	-\$2,284,518.41	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-473.698 gallons	-110.929 gallons
Annual estimate	-160623.930 gallons	-37614.239
CO	19.4 lb/gal	22.2 lb/gal
	8799.6848 grams/gal	10069.7424 grams/gal
	(1,413,439,958.14) g	(378,765,696.08) g
Total	(1,792,205.65) kg	

USER BENEFITS

Concept 47A

VOC

24.62 grams/gal	1.27 grams/gal
(3,954,408.19) g	(47,770.08)
Total (4,002.18) kg	

NOx

16.5 grams/gal	24.52 grams/gal
(2,650,294.85) g	(922,301.14)
Total (3,572.60) kg	

PM2.5

0.09761905 grams/gal	0.136 grams/gal
(15,679.96) g	(5,115.54)
Total (20.80) kg	



SUMMARY OF COSTS AND BENEFITS
 Concept 47B

Construction Cost	
Supplemental Roadway Construction	\$5,400,000.00
Earthwork	\$22,800,000.00
Pavement	\$7,100,000.00
Walls	\$30,200,000.00
Bridges	\$2,100,000.00
Traffic Signals	\$200,000.00
Signage	\$1,400,000.00
Utilities	\$1,700,000.00
Additional Lump Sum	\$5,700,000.00
Design and PM	\$15,300,000.00
ROW	\$500,000.00
Total	\$92,400,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	1710 hr
Value of Travel Time (Annual)	\$7,618,437.37
Automobile Operating Costs (Annual)	\$2,608,111.33
Safety (Annual)	-\$301,135.54
Total	\$9,925,413.15
Emissions (Annual)	
CO2	-7806301 kg
NOx	-15376 kg
VOC	-18317 kg
Benefit:Cost Ratio	
NPV Benefits	\$149,107,529.92
NPV Operating Costs	\$0.00
NPV Capital Costs	\$90,551,377.33
Total Costs	\$90,551,377.33
Benefit:Cost Ratio	1.65

NET PRESENT VALUE CALCULATIONS

Concept 47B

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$92,399,364.62
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$90,551,377.33
NPV Capital Costs			\$90,551,377.33

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$9,925,413	\$8,971,787	\$0	\$0
2022	0.8858	\$9,925,413	\$8,792,352	\$0	\$0
2023	0.8681	\$9,925,413	\$8,616,505	\$0	\$0
2024	0.8508	\$9,925,413	\$8,444,174	\$0	\$0
2025	0.8337	\$9,925,413	\$8,275,291	\$0	\$0
2026	0.8171	\$9,925,413	\$8,109,785	\$0	\$0
2027	0.8007	\$9,925,413	\$7,947,589	\$0	\$0
2028	0.7847	\$9,925,413	\$7,788,638	\$0	\$0
2029	0.7690	\$9,925,413	\$7,632,865	\$0	\$0
2030	0.7536	\$9,925,413	\$7,480,208	\$0	\$0
2031	0.7386	\$9,925,413	\$7,330,603	\$0	\$0
2032	0.7238	\$9,925,413	\$7,183,991	\$0	\$0
2033	0.7093	\$9,925,413	\$7,040,312	\$0	\$0
2034	0.6951	\$9,925,413	\$6,899,505	\$0	\$0
2035	0.6812	\$9,925,413	\$6,761,515	\$0	\$0
2036	0.6676	\$9,925,413	\$6,626,285	\$0	\$0
2037	0.6543	\$9,925,413	\$6,493,759	\$0	\$0
2038	0.6412	\$9,925,413	\$6,363,884	\$0	\$0
2039	0.6283	\$9,925,413	\$6,236,606	\$0	\$0
2040	0.6158	\$9,925,413	\$6,111,874	\$0	\$0
NPV		User Benefits	\$149,107,530	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 47B

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Single Faced Barrier	5115 lf	\$60.00	\$306,900.00	\$61,380.00	\$383,011.20
PBD & Geotextile	16750 lf	\$11.00	\$184,250.00	\$36,850.00	\$229,944.00
Drainage	1 ls	\$1,710,730.63	\$1,710,730.63	\$342,146.13	\$2,134,991.83
Lighting	16750 lf	\$125.00	\$2,093,750.00	\$418,750.00	\$2,613,000.00
Subtotal, Supplemental Roadway Costs			\$4,295,630.63	\$859,126.13	\$5,360,947.03

\$5,400,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	912443 CY	\$20.00	\$18,248,860.00	\$3,649,772.00	\$22,774,577.28
Borrow	0 CY	\$25.00	\$0.00	\$0.00	\$0.00
Subtotal, Earthwork Costs			\$18,248,860.00	\$3,649,772.00	\$22,774,577.28

\$22,800,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	51840 SY	\$110.00	\$5,702,400.00	\$1,140,480.00	\$7,116,595.20
Subtotal, Pavement Costs			\$5,702,400.00	\$1,140,480.00	\$7,116,595.20

\$7,100,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Retaining Wall	2887 lf	\$4,191.72	\$12,101,502.00	\$2,420,300.40	\$15,102,674.50
Sound Wall	9660 lf	\$1,250.00	\$12,075,000.00	\$2,415,000.00	\$15,069,600.00
Subtotal, Wall Costs			\$24,176,502.00	\$4,835,300.40	\$30,172,274.50

\$30,200,000.00

Bridge Cost

Item	Quantity	Cost/sf	2016 Cost	Contingency	2017 Cost
Remove Current Bridges	33504 sf	\$50.00	\$1,675,200.00	\$335,040.00	\$2,090,649.60
Subtotal, Bridge Cost			\$1,675,200.00	\$335,040.00	\$2,090,649.60

\$2,100,000.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
SR0008 Traffic Signal	1 ea	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00
Subtotal, Signal Costs			\$200,000.00	\$40,000.00	\$249,600.00

\$200,000.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
OH Truss 6 lanes	2 ea	\$200,000.00	\$400,000.00	\$80,000.00	\$499,200.00
ITS Relocation	1 ls	\$700,000.00	\$700,000.00	\$140,000.00	\$873,600.00
Subtotal, Signage Costs			\$1,100,000.00	\$220,000.00	\$1,372,800.00

\$1,400,000.00

CONSTRUCTION COST ESTIMATE
 Concept 47B

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Moderate	1 LS	\$1,379,964.82	\$1,379,964.82	\$275,992.96	\$1,722,196.10
Subtotal, Utility Impact			\$1,379,964.82	\$275,992.96	\$1,722,196.10
					\$1,700,000.00

SUBTOTAL, CONSTRUCTION COSTS			\$56,778,557.45	\$11,355,711.49	\$70,859,639.70
					\$70,900,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost	
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00	
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00	
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00	
Mobilization	1 LS	\$2,838,927.87	\$567,785.57	\$3,542,981.98	
MPT	1 LS	\$1,703,356.72	\$340,671.34	\$2,125,789.19	
			\$4,597,284.60	\$919,456.92	\$5,737,411.18
					\$5,700,000.00

TOTAL CONSTRUCTION COSTS			\$61,375,842.05	\$12,275,168.41	\$76,597,050.87
					\$76,600,000.00

DESIGN AND CM COSTS			\$11,355,711.49	\$2,455,033.68	\$15,319,410.17
					\$15,300,000.00

TOTAL, DESIGN, CONSTRUCTION AND CM			\$68,134,268.94		\$91,916,461.05
					\$91,900,000.00

ROW COSTS
 Concept 47B

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
0234-G-00200-0000-00	\$1,305,100.00	\$7,294,900.00	869,153	49,677	No	6%	\$74,593.37
0234-C-00200-0000-00	\$100,500.00	\$0.00	591,545	32,818	No	6%	\$5,575.57
0234-D-00075-0000-00	\$217,400.00	\$1,109,000.00	172,454	13,425	No	8%	\$16,923.38
0233-S-00100-0000-00	\$38,000.00	\$0.00	1,348,662	881,661	No	65%	\$24,841.75
0233-L-00098-0000-00	\$93,200.00	\$129,400.00	24,496	39	No	0%	\$500.00
0233-S-00001-0000-00	\$23,100.00	\$0.00	64,425	494	No	1%	\$500.00
0233-S-00250-0000-00	\$898,000.00	\$2,570,000.00	500,069	128,086	No	26%	\$230,011.19
0298-E-00001-0000-01	\$13,900.00	\$2,500.00	1,619,561	5,145	No	0%	\$500.00
0298-J-00100-0000-00	\$2,293,700.00	\$455,500.00	570,941	30,005	No	5%	\$120,542.75
0298-E-00004-0000-00	\$7,000.00	\$0.00	10,210	2,802	No	27%	\$1,920.75
0298-E-00003-0000-00	\$800.00	\$0.00	7,569	817	No	11%	\$500.00
0298-F-00172-0000-00	\$34,700.00	\$159,200.00	7,751	708	No	9%	\$3,167.84
0298-F-00174-0000-00	\$35,400.00	\$157,800.00	8,282	468	No	6%	\$2,001.09
0298-F-00176-0000-00	\$36,500.00	\$145,400.00	9,163	207	No	2%	\$825.90
0298-F-00178-0000-00	\$39,300.00	\$150,000.00	11,399	21	No	0%	\$500.00
Subtotal, ROW Costs							\$482,903.57
							\$500,000.00

Safety
 Concept 47B

Ramp Safety

Crash Type	N _{obs,2010-2012}	N _{obs,frequency}	CMF	N _{pred,CMF}	N _{reduced}
Sideswipes	3	1.00	0.50	0.50	0.50

N _{reduced,K}	N _{reduced,A}	N _{reduced,B}	N _{reduced,C}	N _{reduced,O}	Dollars Saved, Annually
0.00	0.00	0.03	0.13	0.33	\$ 40,073.00

Intersection Creation Safety

Crash Type	N _{est, before}	N _{pred, frequency}	N _{pred, after}	N _{reduced}
All	2	0.51	6.16	-5.65

N _{reduced,K}	N _{reduced,A}	N _{reduced,B}	N _{reduced,C}	N _{reduced,O}	Dollars Saved, Annually
-0.02	-0.12	-0.59	-1.88	-3.04	\$ (341,208.54)

Total \$ (301,135.54)

USER BENEFITS

Concept 47B

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:	PM Veh-Hrs
No-build	248236	265184	7994	8548
Build	252453	265810	7230	7602
Change	4217	627	-764	-946
Subtotal, MOEs				

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	-724.721 hrs	-39.52 hrs
PM Peak Period	-922.475 hrs	-23.57 hrs
Total of Peaks	-1647.196 hrs	-63.098 hrs
Daily Estimate	-1647.196 hrs	-63.098 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$21,225.11	-\$1,242.52

Total, all vehicles
 -\$22,467.63 Value of travel time changes, per day
 -\$7,618,437.37 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars		Trucks	
AM Peak Period				
Average Speed	20			
Change in Veh-Hrs		-724.721 hours		-39.525 hours
Fuel Consumption		0.022 gal/minute		0.102 gal/minute
		-956.6 gallons		-241.9 gallons

USER BENEFITS

Concept 47B

PM Peak Period

Average Speed	20.1		
Change in Veh-Hrs		-922.5 hours	-23.6 hours
Fuel Consumption		0.022 gal/minute	0.102 gal/minute
		<hr/> -1217.7 gallons	<hr/> -144.3 gallons

Fuel Consumption

AM Peak Period		-956.6 gallons	-241.9 gallons
PM Peak Period		-1217.7 gallons	-144.3 gallons
Total of Peaks		<hr/> -2174.3 gallons	<hr/> -386.2 gallons
Daily Estimate		<hr/> -2174.299 gallons	<hr/> -386.159 gallons
		\$3.004 per gallon	\$3.004 per gallon
		-\$6,531.59 per day	-\$1,160.02 per day

Total, all vehicles

-2560.5 fuel consumption change, gallons per day
 (868,212.83) fuel consumption change, gallons per year

-\$7,691.62 change in fuel cost, per day
 -\$2,608,111.33 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	- \$7,618,437.37	Value of Travel Time change, Per year
Operating Costs	- \$2,608,111.33	Value of Operating Costs change, per year
Total, User Benefits	- \$10,226,548.69	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-2174.299 gallons	-386.159 gallons
Annual estimate	-737272.121 gallons	-130940.705
CO	19.4 lb/gal	22.2 lb/gal
	8799.6848 grams/gal	10069.7424 grams/gal
	(6,487,762,273.37) g	##### g
Total	(7,806,301.44) kg	

USER BENEFITS

Concept 47B

VOC

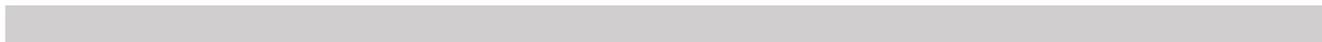
24.62 grams/gal	1.27 grams/gal
(18,150,937.45) g	(166,294.69)
Total (18,317.23) kg	

NOx

16.5 grams/gal	24.52 grams/gal
(12,164,989.99) g	(3,210,666.08)
Total (15,375.66) kg	

PM2.5

0.09761905 grams/gal	0.136 grams/gal
(71,971.80) g	(17,807.94)
Total (89.78) kg	



SUMMARY OF COSTS AND BENEFITS
 Concept 49

Construction Cost	
Supplemental Roadway Construction	\$8,090.00
Earthwork	\$0.00
Pavement	\$0.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$0.00
Signage	\$0.00
Utilities	\$0.00
Additional Lump Sum	\$0.00
Design and PM	\$1,620.00
ROW	\$0.00
Total	\$9,710.00
Operating Cost	
Negligible	\$0.00
	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	28 hr
Value of Travel Time (Annual)	\$128,180.05
Automobile Operating Costs (Annual)	\$48,563.09
Safety (Annual)	\$13,357.67
Total	\$190,100.80
Emissions (Annual)	
CO2	-148008 kg
Nox	-303 kg
VOC	-292 kg
Benefit:Cost Ratio	
NPV Benefits	\$2,855,846.96
NPV Operating Costs	\$0.00
NPV Capital Costs	\$9,510.36
Total Costs	\$9,510.36
Benefit:Cost Ratio	300.29

NET PRESENT VALUE CALCULATIONS

Concept 49

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$9,704.45
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$9,510.36
NPV Capital Costs			\$9,510.36

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224		\$0	\$0	\$0
2021	0.9039	\$190,101	\$171,836	\$0	\$0
2022	0.8858	\$190,101	\$168,399	\$0	\$0
2023	0.8681	\$190,101	\$165,031	\$0	\$0
2024	0.8508	\$190,101	\$161,731	\$0	\$0
2025	0.8337	\$190,101	\$158,496	\$0	\$0
2026	0.8171	\$190,101	\$155,326	\$0	\$0
2027	0.8007	\$190,101	\$152,220	\$0	\$0
2028	0.7847	\$190,101	\$149,175	\$0	\$0
2029	0.7690	\$190,101	\$146,192	\$0	\$0
2030	0.7536	\$190,101	\$143,268	\$0	\$0
2031	0.7386	\$190,101	\$140,403	\$0	\$0
2032	0.7238	\$190,101	\$137,595	\$0	\$0
2033	0.7093	\$190,101	\$134,843	\$0	\$0
2034	0.6951	\$190,101	\$132,146	\$0	\$0
2035	0.6812	\$190,101	\$129,503	\$0	\$0
2036	0.6676	\$190,101	\$126,913	\$0	\$0
2037	0.6543	\$190,101	\$124,375	\$0	\$0
2038	0.6412	\$190,101	\$121,887	\$0	\$0
2039	0.6283	\$190,101	\$119,449	\$0	\$0
2040	0.6158	\$190,101	\$117,060	\$0	\$0
NPV		User Benefits	\$2,855,847	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 49

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Line Striping 8"	8100 lf	\$0.80	\$6,480.00	\$1,296.00	\$8,087.04
Subtotal, Supplemental Roadway Costs			\$6,480.00	\$1,296.00	\$8,087.04
					\$8,090.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Earthwork Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Pavement Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00
					\$0.00

SUBTOTAL, CONSTRUCTION COSTS			\$6,480.00	\$1,296.00	\$8,087.04
					\$8,090.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost	
Survey	0 LS	\$0.00	\$0.00	\$0.00	
Field Office	0 LS	\$0.00	\$0.00	\$0.00	
Const. Scheduling	0 LS	\$0.00	\$0.00	\$0.00	
Mobilization	0 LS	\$0.00	\$0.00	\$0.00	
MPT	0 LS	\$0.00	\$0.00	\$0.00	
			\$0.00	\$0.00	
					\$0.00

CONSTRUCTION COST ESTIMATE
Concept 49

TOTAL CONSTRUCTION COSTS	\$6,480.00	\$1,296.00	\$8,087.04
			\$8,090.00
DESIGN AND CM COSTS	\$1,296.00	\$259.20	\$1,617.41
			\$1,620.00
TOTAL, DESIGN, CONSTRUCTION AND CM	\$7,776.00		\$9,704.45
			\$9,710.00

Safety
 Concept 49

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Sideswipes	1	0.33	0.50	0.17	0.17

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.00	0.01	0.04	0.11	\$ 13,357.67

USER BENEFITS
Concept 49

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:	PM Veh-Hrs
No-build	249871	265093	8049	8521
Build	248236	265184	7994	8548
Change	-1635	90	-55	27
Subtotal, MOEs				

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	-52.354 hrs	-2.86 hrs
PM Peak Period	26.352 hrs	0.67 hrs
Total of Peaks	-26.002 hrs	-2.182 hrs
Daily Estimate	-26.002 hrs	-2.182 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$335.05	-\$42.97

Total, all vehicles
-\$378.02 Value of travel time changes, per day
-\$128,180.05 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars		Trucks	
AM Peak Period				
Average Speed	20			
Change in Veh-Hrs		-52.354 hours		-2.855 hours
Fuel Consumption		0.022 gal/minute		0.102 gal/minute
		-69.1 gallons		-17.5 gallons

USER BENEFITS
Concept 49

PM Peak Period

Average Speed	20		
Change in Veh-Hrs		26.4 hours	0.7 hours
Fuel Consumption		0.022 gal/minute	0.102 gal/minute
		34.8 gallons	4.1 gallons

Fuel Consumption

AM Peak Period		-69.1 gallons	-17.5 gallons
PM Peak Period		34.8 gallons	4.1 gallons
Total of Peaks		-34.3 gallons	-13.4 gallons
Daily Estimate		-34.323 gallons	-13.353 gallons
		\$3.004 per gallon	\$3.004 per gallon
		-\$103.11 per day	-\$40.11 per day

Total, all vehicles

-47.7 fuel consumption change, gallons per day
 -16166.1 fuel consumption change, gallons per year

 -\$143.22 change in fuel cost, per day
 -\$48,563.09 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$128,180.05	Value of Travel Time change, Per year
Operating Costs	-\$48,563.09	Value of Operating Costs change, per year
Total, User Benefits	-\$176,743.14	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-34.323 gallons	-13.353 gallons
Annual estimate	-11638.313 gallons	-4527.827 gallons
CO2	19.4 lb/gal	22.2 lb/gal
	8799.6848 grams/gal	10069.7424 grams/gal
	(102,413,489.10) g	(45,594,055.85) g
Total	(148,007.54) kg	

USER BENEFITS
Concept 49

VOC	24.62 grams/gal	1.27 grams/gal
Total	(286,524.19) g (292.27) kg	(5,750.34) g
NOx	16.5 grams/gal	24.52 grams/gal
Total	(192,032.17) g (303.05) kg	(111,022.33) g
PM2.5	0.09761905 grams/gal	0.136 grams/gal
Total	(1,136.12) g (1.75) kg	(615.78) g



SUMMARY OF COSTS AND BENEFITS
 Concept 50A

Construction Cost	
Supplemental Roadway Construction	\$1,100,000.00
Earthwork	\$600,000.00
Pavement	\$1,100,000.00
Walls	\$6,000,000.00
Bridges	\$8,800,000.00
Traffic Signals	\$0.00
Signage	\$500,000.00
Utilities	\$200,000.00
Additional Lump Sum	\$1,500,000.00
Design and PM	\$4,000,000.00
ROW	\$0.00
Total	\$23,800,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	-1513 hr
Value of Travel Time (Annual)	-\$6,709,816.15
Automobile Operating Costs (Annual)	-\$2,244,533.18
Safety (Annual)	\$76,121.60
Total	-\$8,878,227.73
Emissions (Annual)	
CO2	6688308 kg
NOx	13044 kg
VOC	16311 kg
Benefit:Cost Ratio	
NPV Benefits	-\$133,375,869.24
NPV Operating Costs	\$0.00
NPV Capital Costs	\$23,453,226.84
Total Costs	\$23,453,226.84
Benefit:Cost Ratio	-5.69

NET PRESENT VALUE CALCULATIONS
 Concept 50A

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$23,931,864.12
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$23,453,226.84
NPV Capital Costs			\$23,453,226.84

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	-\$8,878,228	-\$8,025,215	\$0	\$0
2022	0.8858	-\$8,878,228	-\$7,864,710	\$0	\$0
2023	0.8681	-\$8,878,228	-\$7,707,416	\$0	\$0
2024	0.8508	-\$8,878,228	-\$7,553,268	\$0	\$0
2025	0.8337	-\$8,878,228	-\$7,402,202	\$0	\$0
2026	0.8171	-\$8,878,228	-\$7,254,158	\$0	\$0
2027	0.8007	-\$8,878,228	-\$7,109,075	\$0	\$0
2028	0.7847	-\$8,878,228	-\$6,966,894	\$0	\$0
2029	0.7690	-\$8,878,228	-\$6,827,556	\$0	\$0
2030	0.7536	-\$8,878,228	-\$6,691,005	\$0	\$0
2031	0.7386	-\$8,878,228	-\$6,557,185	\$0	\$0
2032	0.7238	-\$8,878,228	-\$6,426,041	\$0	\$0
2033	0.7093	-\$8,878,228	-\$6,297,520	\$0	\$0
2034	0.6951	-\$8,878,228	-\$6,171,570	\$0	\$0
2035	0.6812	-\$8,878,228	-\$6,048,138	\$0	\$0
2036	0.6676	-\$8,878,228	-\$5,927,176	\$0	\$0
2037	0.6543	-\$8,878,228	-\$5,808,632	\$0	\$0
2038	0.6412	-\$8,878,228	-\$5,692,459	\$0	\$0
2039	0.6283	-\$8,878,228	-\$5,578,610	\$0	\$0
2040	0.6158	-\$8,878,228	-\$5,467,038	\$0	\$0
NPV		User Benefits	-\$133,375,869	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 50A

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Single Faced Barrier	2800 lf	\$60.00	\$168,000.00	\$33,600.00	\$209,664.00
PBD & Geotextile	3400 lf	\$11.00	\$37,400.00	\$7,480.00	\$46,675.20
Drainage	1 ls	\$271,472.67	\$271,472.67	\$54,294.53	\$338,797.89
Lighting	3400 lf	\$125.00	\$425,000.00	\$85,000.00	\$530,400.00
Subtotal, Supplemental Roadway Costs			\$901,872.67	\$180,374.53	\$1,125,537.09

\$1,100,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	124 CY	\$20.00	\$2,480.00	\$496.00	\$3,095.04
Borrow	18236 CY	\$25.00	\$455,900.00	\$91,180.00	\$568,963.20
Subtotal, Earthwork Costs			\$458,380.00	\$91,676.00	\$572,058.24

\$600,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	8226 SY	\$110.00	\$904,860.00	\$180,972.00	\$1,129,265.28
Subtotal, Pavement Costs			\$904,860.00	\$180,972.00	\$1,129,265.28

\$1,100,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Retaining Wall	1050 lf	\$1,826.74	\$1,918,080.00	\$383,616.00	\$2,393,763.84
Sound Wall	2341 lf	\$1,250.00	\$2,926,250.00	\$585,250.00	\$3,651,960.00
Subtotal, Wall Costs			\$4,844,330.00	\$968,866.00	\$6,045,723.84

\$6,000,000.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
William Penn Highway Ramp Overpass	350 lf	\$20,250.00	\$7,087,500.00	\$1,417,500.00	\$8,845,200.00
Subtotal, Bridge Cost			\$7,087,500.00	\$1,417,500.00	\$8,845,200.00

\$8,800,000.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00

\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
OH Truss 6 lanes	1 ea	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00
ITS Relocation	1 ls	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00
Subtotal, Signage Costs			\$400,000.00	\$80,000.00	\$499,200.00

\$500,000.00

CONSTRUCTION COST ESTIMATE
 Concept 50A

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Minor	1 LS	\$148,561.32	\$148,561.32	\$29,712.26	\$185,404.53
Subtotal, Utility Impact			\$148,561.32	\$29,712.26	\$185,404.53
					\$200,000.00

SUBTOTAL, CONSTRUCTION COSTS			\$14,745,503.99	\$2,949,100.80	\$18,402,388.98
					\$18,300,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost	
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00	
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00	
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00	
Mobilization	1 LS	\$737,275.20	\$147,455.04	\$920,119.45	
MPT	1 LS	\$442,365.12	\$88,473.02	\$552,071.67	
			\$1,234,640.32	\$246,928.06	\$1,540,831.12
					\$1,500,000.00

TOTAL CONSTRUCTION COSTS			\$15,980,144.31	\$3,196,028.86	\$19,943,220.10
					\$19,800,000.00

DESIGN AND CM COSTS			\$2,949,100.80	\$639,205.77	\$3,988,644.02
					\$4,000,000.00

TOTAL, DESIGN, CONSTRUCTION AND CM			\$17,694,604.79		\$23,931,864.12
					\$23,800,000.00

Safety
 Concept 50A

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Fatal & Injury	18	6.00	0.79	4.74	1.26

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.03	0.13	0.42	0.68	\$ 76,121.60

USER BENEFITS
Concept 50A

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:PM Veh-Hrs	
No-build	248236	265184	7994	8548
Build	249278	264112	8192	9863
Change	1042	-1072	198	1315
Subtotal, MOEs				

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	187.760 hrs	10.24 hrs
PM Peak Period	1282.187 hrs	32.77 hrs
Total of Peaks	1469.947 hrs	43.005 hrs
Daily Estimate	1469.947 hrs	43.005 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	\$18,941.14	\$846.86

Total, all vehicles \$19,788.01 Value of travel time changes, per day
 \$6,709,816.15 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars		Trucks	
AM Peak Period				
Average Speed	20			
Change in Veh-Hrs		187.760 hours		10.240 hours
Fuel Consumption		0.022 gal/minute		0.102 gal/minute
		247.8 gallons		62.7 gallons

USER BENEFITS
Concept 50A

PM Peak Period

Average Speed	20		
Change in Veh-Hrs		1282.2 hours	32.8 hours
Fuel Consumption		0.022 gal/minute	0.102 gal/minute
		<hr/> 1692.5 gallons	<hr/> 200.5 gallons

Fuel Consumption

AM Peak Period		247.8 gallons	62.7 gallons
PM Peak Period		1692.5 gallons	200.5 gallons
Total of Peaks		1940.3 gallons	263.2 gallons
Daily Estimate		<hr/> 1940.329 gallons	<hr/> 263.193 gallons
		\$3.004 per gallon	\$3.004 per gallon
		\$5,828.75 per day	\$790.63 per day

Total, all vehicles

2203.5 fuel consumption change, gallons per day
 747181.5 fuel consumption change, gallons per year

 \$6,619.38 change in fuel cost, per day
 \$2,244,533.18 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	\$6,709,816.15	Value of Travel Time change, Per year
Operating Costs	\$2,244,533.18	Value of Operating Costs change, per year
Total, User Benefits	\$8,954,349.32	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	1940.329 gallons	263.193 gallons
Annual estimate	657936.623 gallons	89244.860 gallons
CO2	19.4 lb/gal	22.2 lb/gal
	8799.6848 grams/gal	10069.7424 grams/gal
	5,789,634,898.14 g	898,672,755.47 g
Total	6,688,307.65 kg	

USER BENEFITS
Concept 50A

VOC

	24.62 grams/gal	1.27 grams/gal
	16,197,773.04 g	113,340.97 g
Total	16,311.11 kg	

NOx

	16.5 grams/gal	24.52 grams/gal
	10,855,954.27 g	2,188,283.98 g
Total	13,044.24 kg	

PM2.5

	0.09761905 grams/gal	0.136 grams/gal
	64,227.15 g	12,137.30 g
Total	76.36 kg	



SUMMARY OF COSTS AND BENEFITS
 Concept 50B

Construction Cost	
Supplemental Roadway Construction	\$8,000.00
Earthwork	\$0.00
Pavement	\$0.00
Walls	\$0.00
Bridges	\$0.00
Signals	\$6,000.00
Signage	\$499,000.00
Utilities	\$0.00
Additional Lump Sum	\$110,000.00
Design and PM	\$125,000.00
ROW	\$0.00
Total	\$748,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	-5360 hr
Value of Travel Time (Annual)	-\$23,735,668.13
Automobile Operating Costs (Annual)	-\$45,813.90
Safety (Annual)	\$76,121.60
Total	-\$23,705,360.43
Emissions (Annual)	
CO2	46211140 kg
NOx	89778 kg
VOC	114359 kg
Benefit:Cost Ratio	
NPV Benefits	-\$356,120,968.16
NPV Operating Costs	\$0.00
NPV Capital Costs	\$732,307.04
Total Costs	\$732,307.04
Benefit:Cost Ratio	-486.30

NET PRESENT VALUE CALCULATIONS

Concept 50B

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$747,252.08
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$732,307.04
NPV Capital Costs			\$732,307.04

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	-\$23,705,360	-\$21,427,768	\$0	\$0
2022	0.8858	-\$23,705,360	-\$20,999,213	\$0	\$0
2023	0.8681	-\$23,705,360	-\$20,579,229	\$0	\$0
2024	0.8508	-\$23,705,360	-\$20,167,644	\$0	\$0
2025	0.8337	-\$23,705,360	-\$19,764,291	\$0	\$0
2026	0.8171	-\$23,705,360	-\$19,369,005	\$0	\$0
2027	0.8007	-\$23,705,360	-\$18,981,625	\$0	\$0
2028	0.7847	-\$23,705,360	-\$18,601,993	\$0	\$0
2029	0.7690	-\$23,705,360	-\$18,229,953	\$0	\$0
2030	0.7536	-\$23,705,360	-\$17,865,354	\$0	\$0
2031	0.7386	-\$23,705,360	-\$17,508,047	\$0	\$0
2032	0.7238	-\$23,705,360	-\$17,157,886	\$0	\$0
2033	0.7093	-\$23,705,360	-\$16,814,728	\$0	\$0
2034	0.6951	-\$23,705,360	-\$16,478,434	\$0	\$0
2035	0.6812	-\$23,705,360	-\$16,148,865	\$0	\$0
2036	0.6676	-\$23,705,360	-\$15,825,888	\$0	\$0
2037	0.6543	-\$23,705,360	-\$15,509,370	\$0	\$0
2038	0.6412	-\$23,705,360	-\$15,199,182	\$0	\$0
2039	0.6283	-\$23,705,360	-\$14,895,199	\$0	\$0
2040	0.6158	-\$23,705,360	-\$14,597,295	\$0	\$0
NPV		User Benefits	-\$356,120,968	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 50B

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Line Stripping 8"	7600 lf	\$0.80	\$6,080.00	\$1,216.00	\$7,587.84
Subtotal, Supplemental Roadway Costs			\$6,080.00	\$1,216.00	\$7,587.84
					\$8,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Earthwork Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Pavement Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Retiming Traffic Signal	2 ea	\$2,500.00	\$5,000.00	\$1,000.00	\$6,240.00
Subtotal, Signal Costs			\$5,000.00	\$1,000.00	\$6,240.00
					\$6,000.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
OH Truss 6 lanes	1 ea	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00
ITS Relocation	1 ls	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00
Subtotal, Signage Costs			\$400,000.00	\$80,000.00	\$499,200.00
					\$499,000.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00
					\$0.00

SUBTOTAL, CONSTRUCTION COSTS			\$411,080.00	\$82,216.00	\$513,027.84
					\$513,000.00

CONSTRUCTION COST ESTIMATE
 Concept 50B

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00
Mobilization	1 LS	\$20,554.00	\$4,110.80	\$25,651.39
MPT	1 LS	\$12,332.40	\$2,466.48	\$15,390.84
		\$87,886.40	\$17,577.28	\$109,682.23
				\$110,000.00
TOTAL CONSTRUCTION COSTS		\$498,966.40	\$99,793.28	\$622,710.07
				\$623,000.00
DESIGN AND CM COSTS		\$82,216.00	\$19,958.66	\$124,542.01
				\$125,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM		\$493,296.00		\$747,252.08
				\$748,000.00

Safety
 Concept 50B

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Fatal & Injury	18	6.00	0.79	4.74	1.26

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.03	0.13	0.42	0.68	\$ 76,121.60

USER BENEFITS

Concept 50B

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr: PM Veh-Hrs	
Supplemental Roadway	248236	265184	7994	8548
Build	250962	242669.6225	8132.199	13769.703
Change	2726	-22514	138.199	5222
Subtotal, MOEs				

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	131.052 hrs	7.15 hrs
PM Peak Period	5091.544 hrs	130.11 hrs
Total of Peaks	5222.596 hrs	137.258 hrs
Daily Estimate	5222.596 hrs	137.258 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	\$67,296.28	\$2,702.89

Total, all vehicles \$69,999.17 Value of travel time changes, per day
 \$23,735,668.13 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars		Trucks	
AM Peak Period				
Average Speed	20			
Change in Veh-Hrs		5091.544 hours		130.111 hours
Fuel Consumption		0.022 gal/minute		0.102 gal/minute
		6720.8 gallons		796.3 gallons

USER BENEFITS

Concept 50B

PM Peak Period

Average Speed	20		
Change in Veh-Hrs		5222.6 hours	137.3 hours
Fuel Consumption		0.022 gal/minute	0.102 gal/minute
		6893.8 gallons	840.0 gallons

Fuel Consumption

AM Peak Period		6720.8 gallons	796.3 gallons
PM Peak Period		6893.8 gallons	840.0 gallons
Total of Peaks		13614.7 gallons	1636.3 gallons
Daily Estimate		13614.665 gallons	1636.300 gallons
		\$3.004 per gallon	\$3.004 per gallon
		\$40,898.45 per day	\$4,915.45 per day

Total, all vehicles

15251.0 fuel consumption change, gallons per day
 5171373.3 fuel consumption change, gallons per year

 \$45,813.90 change in fuel cost, per day
 \$15,534,805.41 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	\$23,735,668.13	Value of Travel Time change, Per year
Operating Costs	\$45,813.90	Value of Operating Costs change, per year
Total, User Benefits	\$23,781,482.03	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	13614.665 gallons	1636.300 gallons
Annual estimate	4616528.533 gallons	554844.772 gallons
CO2	19.4 lb/gal	22.2 lb/gal
	8799.6848 grams/gal	10069.7424 grams/gal
	40,623,995,964.93 g	5,587,143,922.89 g
Total	46,211,139.89 kg	

USER BENEFITS

Concept 50B

VOC

	24.62 grams/gal	1.27 grams/gal
	113,654,535.80 g	704,652.86 g
Total	114,359.19 kg	

NOx

	16.5 grams/gal	24.52 grams/gal
	76,172,720.80 g	13,604,793.80 g
Total	89,777.51 kg	

PM2.5

	0.09761905 grams/gal	0.136 grams/gal
	450,661.12 g	75,458.89 g
Total	526.12 kg	



SUMMARY OF COSTS AND BENEFITS
 Concept 51

Construction Cost	
Supplemental Roadway Construction	\$171,000.00
Earthwork	\$0.00
Pavement	\$165,000.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$0.00
Signage	\$0.00
Utilities	\$0.00
Additional Lump Sum	\$96,000.00
Design and PM	\$86,000.00
ROW	\$0.00
Total	\$518,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	28 hr
Value of Travel Time (Annual)	\$128,180.05
Automobile Operating Costs (Annual)	\$8,932.42
Safety (Annual)	-\$112,303.39
Total	\$24,809.09
Emissions	
CO2	-30142 kg
Nox	-74 kg
VOC	0 kg
Benefit:Cost Ratio	
NPV Benefits	\$372,702.03
NPV Operating Costs	\$0.00
NPV Capital Costs	\$507,355.35
Total Costs	\$507,355.35
Benefit:Cost Ratio	0.73

NET PRESENT VALUE CALCULATIONS

Concept 51

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$517,709.54
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$507,355.35
NPV Capital Costs			\$507,355.35

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224		\$0	\$0	\$0
2021	0.9039	\$24,809	\$22,425	\$0	\$0
2022	0.8858	\$24,809	\$21,977	\$0	\$0
2023	0.8681	\$24,809	\$21,537	\$0	\$0
2024	0.8508	\$24,809	\$21,107	\$0	\$0
2025	0.8337	\$24,809	\$20,685	\$0	\$0
2026	0.8171	\$24,809	\$20,271	\$0	\$0
2027	0.8007	\$24,809	\$19,865	\$0	\$0
2028	0.7847	\$24,809	\$19,468	\$0	\$0
2029	0.7690	\$24,809	\$19,079	\$0	\$0
2030	0.7536	\$24,809	\$18,697	\$0	\$0
2031	0.7386	\$24,809	\$18,323	\$0	\$0
2032	0.7238	\$24,809	\$17,957	\$0	\$0
2033	0.7093	\$24,809	\$17,598	\$0	\$0
2034	0.6951	\$24,809	\$17,246	\$0	\$0
2035	0.6812	\$24,809	\$16,901	\$0	\$0
2036	0.6676	\$24,809	\$16,563	\$0	\$0
2037	0.6543	\$24,809	\$16,231	\$0	\$0
2038	0.6412	\$24,809	\$15,907	\$0	\$0
2039	0.6283	\$24,809	\$15,589	\$0	\$0
2040	0.6158	\$24,809	\$15,277	\$0	\$0
NPV		User Benefits	\$372,702	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 51

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Center Median Barrier	2700 lf	\$50.00	\$135,000.00	\$27,000.00	\$168,480.00
Line Striping 8"	2700 lf	\$0.80	\$2,160.00	\$432.00	\$2,695.68
Subtotal, Supplemental Roadway Costs			\$137,160.00	\$27,432.00	\$171,175.68
					\$171,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Earthwork Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	1200 SY	\$110.00	\$132,000.00	\$26,400.00	\$164,736.00
Subtotal, Pavement Costs			\$132,000.00	\$26,400.00	\$164,736.00
					\$165,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00
					\$0.00

SUBTOTAL, CONSTRUCTION COSTS			\$269,160.00	\$53,832.00	\$335,911.68
					\$336,000.00

CONSTRUCTION COST ESTIMATE
 Concept 51

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00
Mobilization	1 LS	\$13,458.00	\$2,691.60	\$16,795.58
MPT	1 LS	\$8,074.80	\$1,614.96	\$10,077.35
		\$76,532.80	\$15,306.56	\$95,512.93
				\$96,000.00
TOTAL CONSTRUCTION COSTS		\$345,692.80	\$69,138.56	\$431,424.61
				\$432,000.00
DESIGN AND CM COSTS		\$53,832.00	\$13,827.71	\$86,284.92
				\$86,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM		\$322,992.00		\$517,709.54
				\$518,000.00

Safety
 Concept 51

Safety

All Crashes	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Weave - Sideswipes	1	0.33	0.50	0.17	0.17
Barrier - All	26	8.67	1.24	10.75	-2.08

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually	
0.00	0.00	0.01	0.04	0.11	\$	13,357.67
-0.01	-0.04	-0.22	-0.69	-1.12	\$	(125,661.05)
					Total: \$	(112,303.39)

USER BENEFITS

Concept 51

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:	PM Veh-Hrs
No-build	249871	265093	8049	8521
Build	248236	265184	7994	8548
Change	-1635	90	-55	27
Subtotal, MOEs				

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	-52.354 hrs	-2.86 hrs
PM Peak Period	26.352 hrs	0.67 hrs
Total of Peaks	-26.002 hrs	-2.182 hrs
Daily Estimate	-26.002 hrs	-2.182 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$335.05	-\$42.97

Total, all vehicles
 -\$378.02 Value of travel time changes, per day
 -\$128,180.05 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars	Trucks
AM Peak Period		
Average Speed	20	
Change in Veh-Hrs	26.352 hours	0.673 hours
Fuel Consumption	0.022 gal/minute	0.102 gal/minute
	34.8 gallons	4.1 gallons

USER BENEFITS

Concept 51

PM Peak Period

Average Speed	20		
Change in Veh-Hrs		-26.0 hours	-2.2 hours
Fuel Consumption		0.022 gal/minute	0.102 gal/minute
		-34.3 gallons	-13.4 gallons

Fuel Consumption

AM Peak Period		34.8 gallons	4.1 gallons
PM Peak Period		-34.3 gallons	-13.4 gallons
Total of Peaks		0.5 gallons	-9.2 gallons
Daily Estimate		0.463 gallons	-9.232 gallons
		\$3.004 per gallon	\$3.004 per gallon
		\$1.39 per day	-\$27.73 per day

Total, all vehicles

-8.8 fuel consumption change, gallons per day
-2973.5 fuel consumption change, gallons per year
-\$26.34 change in fuel cost, per day
-\$8,932.42 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$128,180.05	Value of Travel Time change, Per year
Operating Costs	-\$8,932.42	Value of Operating Costs change, per year
Total, User Benefits	-\$137,112.47	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	0.463 gallons	-9.232 gallons
Annual estimate	156.838 gallons	-3130.348 gallons
CO2	19.4 lb/gal	22.2 lb/gal
	8799.6848 grams/gal	10069.7424 grams/gal
Total	1,380,125.04 g (30,141.67) kg	(31,521,793.92) g

USER BENEFITS

Concept 51

VOC

24.62 grams/gal

1.27 grams/gal

3,861.20 g

(3,975.54) g

Total

(0.11) kg

NOx

16.5 grams/gal

24.52 grams/gal

2,587.83 g

(76,756.12) g

Total

(74.17) kg

PM2.5

0.09761905 grams/gal

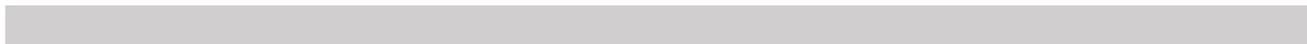
0.136 grams/gal

15.31 g

(425.73) g

Total

(0.41) kg



SUMMARY OF COSTS AND BENEFITS
 Concept 53A

Construction Cost	
Supplemental Roadway Construction	\$18,000.00
Earthwork	\$21,000.00
Pavement	\$78,000.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$0.00
Signage	\$0.00
Utilities	\$5,000.00
Additional Lump Sum	\$35,000.00
Design and PM	\$31,000.00
ROW	\$99,000.00
Total	\$287,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	0 hr
Value of Travel Time (Annual)	\$0.00
Automobile Operating Costs (Annual)	\$0.00
Safety (Annual)	\$0.00
Total	\$0.00
Emissions (Annual)	
CO2	0 kg
Nox	0 kg
VOC	0 kg
Benefit:Cost Ratio	
NPV Benefits	\$0.00
NPV Operating Costs	\$0.00
NPV Capital Costs	\$281,495.06
Total Costs	\$281,495.06
Benefit:Cost Ratio	Not Calculated

NET PRESENT VALUE CALCULATIONS
 Concept 53A

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$287,239.86
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$281,495.06
NPV Capital Costs			\$281,495.06

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
NPV		User Benefits	\$0	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 53A

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Drainage	1 ls	\$14,058.00	\$14,058.00	\$2,811.60	\$17,544.38
ADA Ramps	1 ea	\$280.00	\$280.00	\$56.00	\$349.44
Subtotal, Supplemental Roadway Costs			\$14,338.00	\$2,867.60	\$17,893.82
					\$18,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	852 CY	\$20.00	\$17,040.00	\$3,408.00	\$21,265.92
Borrow	0 CY	\$25.00	\$0.00	\$0.00	\$0.00
Subtotal, Earthwork Costs			\$17,040.00	\$3,408.00	\$21,265.92
					\$21,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	426 SY	\$110.00	\$46,860.00	\$9,372.00	\$58,481.28
Curb	259 LF	\$60.00	\$15,540.00	\$3,108.00	\$19,393.92
Subtotal, Pavement Costs			\$62,400.00	\$12,480.00	\$77,875.20
					\$78,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Moderate	1 LS	\$3,932.82	\$3,932.82	\$786.56	\$4,908.16
Subtotal, Utility Impact			\$3,932.82	\$786.56	\$4,908.16
					\$5,000.00

CONSTRUCTION COST ESTIMATE
 Concept 53A

SUBTOTAL, CONSTRUCTION COSTS	\$97,710.82	\$19,542.16	\$121,943.10
			\$122,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	1 LS	\$10,000.00	\$1,000.00	\$11,440.00
Field Office	1 LS	\$10,000.00	\$1,000.00	\$11,440.00
Const. Scheduling	1 LS	\$2,000.00	\$200.00	\$2,288.00
Mobilization	1 LS	\$4,885.54	\$977.11	\$6,097.16
MPT	1 LS	\$2,931.32	\$586.26	\$3,658.29
		\$29,816.87	\$3,763.37	\$34,923.45
				\$35,000.00

TOTAL CONSTRUCTION COSTS	\$127,527.69	\$23,305.54	\$156,866.55
			\$157,000.00
DESIGN AND CM COSTS	\$19,542.16	\$4,661.11	\$31,373.31
			\$31,000.00
TOTAL, DESIGN, CONSTRUCTION AND C	\$117,252.98		\$188,239.86
			\$188,000.00

ROW COSTS
 Concept 53A

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
0297R00030000000		\$98,800.00			Y	100.0%	\$98,800.00
Subtotal, ROW Costs							\$98,800.00
							\$99,000.00

SUMMARY OF COSTS AND BENEFITS
 Concept 53B

Construction Cost	
Supplemental Roadway Construction	\$48,000.00
Earthwork	\$58,000.00
Pavement	\$171,000.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$0.00
Signage	\$0.00
Utilities	\$5,000.00
Additional Lump Sum	\$48,000.00
Design and PM	\$66,000.00
ROW	\$0.00
Total	\$396,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	0 hr
Value of Travel Time (Annual)	\$0.00
Automobile Operating Costs (Annual)	\$0.00
Safety (Annual)	\$0.00
Total	\$0.00
Emissions (Annual)	
CO2	0 kg
Nox	0 kg
VOC	0 kg
Benefit:Cost Ratio	
NPV Benefits	\$0.00
NPV Operating Costs	\$0.00
NPV Capital Costs	\$387,785.14
Total Costs	\$387,785.14
Benefit:Cost Ratio	Not Calculated

NET PRESENT VALUE CALCULATIONS
 Concept 53B

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$395,699.13
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$387,785.14
NPV Capital Costs			\$387,785.14

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
NPV		User Benefits	\$0	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 53B

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Drainage	1 ls	\$38,133.48	\$38,133.48	\$7,626.70	\$47,590.58
ADA Ramps	1 ea	\$280.00	\$280.00	\$56.00	\$349.44
Subtotal, Supplemental Roadway Costs			\$38,413.48	\$7,682.70	\$47,940.02
					\$48,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	2312 CY	\$20.00	\$46,240.00	\$9,248.00	\$57,707.52
Borrow	0 CY	\$25.00	\$0.00	\$0.00	\$0.00
Subtotal, Earthwork Costs			\$46,240.00	\$9,248.00	\$57,707.52
					\$58,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	1156 SY	\$110.00	\$127,160.00	\$25,432.00	\$158,695.68
Curb	163 LF	\$60.00	\$9,780.00	\$1,956.00	\$12,205.44
Subtotal, Pavement Costs			\$136,940.00	\$27,388.00	\$170,901.12
					\$171,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Moderate	1 LS	\$4,383.84	\$4,383.84	\$876.77	\$5,471.03
Subtotal, Utility Impact			\$4,383.84	\$876.77	\$5,471.03
					\$5,000.00

CONSTRUCTION COST ESTIMATE
 Concept 53B

SUBTOTAL, CONSTRUCTION COSTS	\$225,977.32	\$45,195.46	\$282,019.70
			\$282,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	1 LS	\$10,000.00	\$1,000.00	\$11,440.00
Field Office	1 LS	\$10,000.00	\$1,000.00	\$11,440.00
Const. Scheduling	1 LS	\$2,000.00	\$200.00	\$2,288.00
Mobilization	1 LS	\$11,298.87	\$2,259.77	\$14,100.98
MPT	1 LS	\$6,779.32	\$1,355.86	\$8,460.59
		\$40,078.19	\$5,815.64	\$47,729.58
				\$48,000.00

TOTAL CONSTRUCTION COSTS	\$266,055.51	\$51,011.10	\$329,749.27
			\$330,000.00

DESIGN AND CM COSTS	\$45,195.46	\$10,202.22	\$65,949.85
			\$66,000.00

TOTAL, DESIGN, CONSTRUCTION AND C	\$271,172.78		\$395,699.13
			\$396,000.00

SUMMARY OF COSTS AND BENEFITS
 Concept 54

Construction Cost	
Supplemental Roadway Construction	\$1,100,000.00
Earthwork	\$1,000,000.00
Pavement	\$1,400,000.00
Walls	\$5,400,000.00
Bridges	\$3,300,000.00
Traffic Signals	\$0.00
Signage	\$400,000.00
Utilities	\$100,000.00
Additional Lump Sum	\$1,100,000.00
Design and PM	\$2,700,000.00
ROW	\$0.00
Total	\$16,500,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	47 hr
Value of Travel Time (Annual)	\$210,745.45
Automobile Operating Costs (Annual)	\$77,393.31
Safety (Annual)	\$93,037.51
Total	\$381,176.27
Emissions	
CO2	-234619 kg
NOx	-475 kg
VOC	-489 kg
Benefit:Cost Ratio	
NPV Benefits	\$5,726,336.16
NPV Operating Costs	\$0.00
NPV Capital Costs	\$16,139,321.22
Total Costs	\$16,139,321.22
Benefit:Cost Ratio	0.35

NET PRESENT VALUE CALCULATIONS

Concept 54

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$16,468,695.13
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$16,139,321.22
NPV Capital Costs			\$16,139,321.22

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$381,176	\$344,553	\$0	\$0
2022	0.8858	\$381,176	\$337,662	\$0	\$0
2023	0.8681	\$381,176	\$330,909	\$0	\$0
2024	0.8508	\$381,176	\$324,291	\$0	\$0
2025	0.8337	\$381,176	\$317,805	\$0	\$0
2026	0.8171	\$381,176	\$311,449	\$0	\$0
2027	0.8007	\$381,176	\$305,220	\$0	\$0
2028	0.7847	\$381,176	\$299,115	\$0	\$0
2029	0.7690	\$381,176	\$293,133	\$0	\$0
2030	0.7536	\$381,176	\$287,270	\$0	\$0
2031	0.7386	\$381,176	\$281,525	\$0	\$0
2032	0.7238	\$381,176	\$275,895	\$0	\$0
2033	0.7093	\$381,176	\$270,377	\$0	\$0
2034	0.6951	\$381,176	\$264,969	\$0	\$0
2035	0.6812	\$381,176	\$259,670	\$0	\$0
2036	0.6676	\$381,176	\$254,476	\$0	\$0
2037	0.6543	\$381,176	\$249,387	\$0	\$0
2038	0.6412	\$381,176	\$244,399	\$0	\$0
2039	0.6283	\$381,176	\$239,511	\$0	\$0
2040	0.6158	\$381,176	\$234,721	\$0	\$0
NPV		User Benefits	\$5,726,336	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
Concept 54

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
PBD & Geotextile	3450 lf	\$11.00	\$37,950.00	\$7,590.00	\$47,361.60
Drainage	1 ls	\$352,359.44	\$352,359.44	\$70,471.89	\$439,744.58
Lighting	3450 lf	\$125.00	\$431,250.00	\$86,250.00	\$538,200.00
Guiderail	1850 lf	\$16.50	\$30,525.00	\$6,105.00	\$38,095.20
Subtotal, Supplemental Roadway Costs			\$852,084.44	\$170,416.89	\$1,063,401.38
					\$1,100,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	3708 CY	\$20.00	\$74,160.00	\$14,832.00	\$92,551.68
Fill	28465 CY	\$25.00	\$711,625.00	\$142,325.00	\$888,108.00
Subtotal, Earthwork Costs			\$785,785.00	\$157,157.00	\$980,659.68
					\$1,000,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	10431 SY	\$110.00	\$1,147,410.00	\$229,482.00	\$1,431,967.68
Subtotal, Pavement Costs			\$1,147,410.00	\$229,482.00	\$1,431,967.68
					\$1,400,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Sound Wall	3448 lf	\$1,250.00	\$4,310,000.00	\$862,000.00	\$5,378,880.00
Subtotal, Wall Costs			\$4,310,000.00	\$862,000.00	\$5,378,880.00
					\$5,400,000.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Bridge Widening for PWKY over Beulah	195 lf	\$13,500.00	\$2,632,500.00	\$526,500.00	\$3,285,360.00
Subtotal, Bridge Cost			\$2,632,500.00	\$526,500.00	\$3,285,360.00
					\$3,300,000.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
OH Truss 6 lanes	1 ea	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00
ITS Relocation	1 ls	\$100,000.00	\$100,000.00	\$20,000.00	\$124,800.00
Subtotal, Signage Costs			\$300,000.00	\$60,000.00	\$374,400.00
					\$400,000.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Minor	1 LS	\$100,277.79	\$100,277.79	\$20,055.56	\$125,146.68
Subtotal, Utility Impact			\$100,277.79	\$20,055.56	\$125,146.68
					\$100,000.00

CONSTRUCTION COST ESTIMATE
 Concept 54

SUBTOTAL, CONSTRUCTION COSTS		\$10,128,057.23	\$2,025,611.45	\$12,639,815.42
				\$12,700,000.00
Additional Lump Sum				
Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00
Mobilization	1 LS	\$506,402.86	\$101,280.57	\$631,990.77
MPT	1 LS	\$303,841.72	\$60,768.34	\$379,194.46
		\$865,244.58	\$173,048.92	\$1,079,825.23
				\$1,100,000.00
TOTAL CONSTRUCTION COSTS		\$10,993,301.81	\$2,198,660.36	\$13,719,640.66
				\$13,800,000.00
DESIGN AND CM COSTS		\$2,025,611.45	\$439,732.07	\$2,743,928.13
				\$2,700,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM		\$12,153,668.68		\$16,463,568.79
				\$16,500,000.00

ROW COSTS
 Concept 54

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
0370-N-00350-0000-00	\$300,000.00	\$613,500.00	5,817,534	99,409	No	2%	\$5,126.34
Subtotal, ROW Costs							\$5,126.34
							\$0.00

Safety
 Concept 54

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Fatal & Injury	22	7.33	0.79	5.79	1.54

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.03	0.16	0.51	0.83	\$ 93,037.51

USER BENEFITS
Concept 54

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:PM Veh-Hrs	
No-build	247493	265184	8063	8548
Build	247492	265091	7994	8570
Change	-1	-93	-69	22
Subtotal, MOEs				

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	-65.052 hrs	-3.55 hrs
PM Peak Period	21.405 hrs	0.55 hrs
Total of Peaks	-43.647 hrs	-3.001 hrs
Daily Estimate	-43.647 hrs	-3.001 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$562.42	-\$59.09

Total, all vehicles
-\$621.51 Value of travel time changes, per day
-\$210,745.45 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars		Trucks	
AM Peak Period				
Average Speed	20			
Change in Veh-Hrs		-65.052 hours		-3.548 hours
Fuel Consumption		0.022 gal/minute		0.102 gal/minute
		-85.9 gallons		-21.7 gallons

USER BENEFITS
Concept 54

PM Peak Period

Average Speed	20		
Change in Veh-Hrs		21.4 hours	0.5 hours
Fuel Consumption		0.022 gal/minute	0.102 gal/minute
		<hr/> 28.3 gallons	<hr/> 3.3 gallons

Fuel Consumption

AM Peak Period		-85.9 gallons	-21.7 gallons
PM Peak Period		28.3 gallons	3.3 gallons
Total of Peaks		-57.6 gallons	-18.4 gallons
Daily Estimate		<hr/> -57.614 gallons	<hr/> -18.365 gallons
		\$3.004 per gallon	\$3.004 per gallon
		-\$173.07 per day	-\$55.17 per day

Total, all vehicles

-76.0 fuel consumption change, gallons per day
 -25763.4 fuel consumption change, gallons per year

 -\$228.24 change in fuel cost, per day
 -\$77,393.31 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$210,745.45	Value of Travel Time change, Per year
Operating Costs	-\$77,393.31	Value of Operating Costs change, per year
Total, User Benefits	-\$288,138.76	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-57.614 gallons	-18.365 gallons
Annual estimate	-19536.143 gallons	-6227.276 gallons
CO2	19.4 lb/gal 8799.6848 grams/gal	22.2 lb/gal 10069.7424 grams/gal
	(171,911,900.82) g	(62,707,063.36) g
Total	(234,618.96) kg	

USER BENEFITS
Concept 54

VOC

24.62 grams/gal	1.27 grams/gal
(480,961.24) g	(7,908.64) g
Total	(488.87) kg

NOx

16.5 grams/gal	24.52 grams/gal
(322,346.36) g	(152,692.80) g
Total	(475.04) kg

PM2.5

0.09761905 grams/gal	0.136 grams/gal
(1,907.10) g	(846.91) g
Total	(2.75) kg



SUMMARY OF COSTS AND BENEFITS
 Concept 56

Construction Cost	
Supplemental Roadway Construction	\$690,000.00
Earthwork	\$110,000.00
Pavement	\$710,000.00
Walls	\$4,000,000.00
Bridges	\$0.00
Traffic Signals	\$0.00
Signage	\$560,000.00
Utilities	\$0.00
Additional Lump Sum	\$550,000.00
Design and PM	\$1,330,000.00
ROW	\$0.00
Total	\$7,950,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	-160 hr
Value of Travel Time (Annual)	-\$724,222.45
Automobile Operating Costs (Annual)	-\$268,752.58
Safety (Annual)	\$261,793.86
Total	-\$731,181.18
Emissions (Annual)	
CO2	816203 kg
NOx	1659 kg
VOC	1671 kg
Benefit:Cost Ratio	
NPV Benefits	-\$10,984,391.02
NPV Operating Costs	\$0.00
NPV Capital Costs	\$7,795,977.74
Total Costs	\$7,795,977.74
Benefit:Cost Ratio	-1.41

NET PRESENT VALUE CALCULATIONS

Concept 56

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$7,955,079.33
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$7,795,977.74
NPV Capital Costs			\$7,795,977.74

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	-\$731,181	-\$660,930	\$0	\$0
2022	0.8858	-\$731,181	-\$647,711	\$0	\$0
2023	0.8681	-\$731,181	-\$634,757	\$0	\$0
2024	0.8508	-\$731,181	-\$622,062	\$0	\$0
2025	0.8337	-\$731,181	-\$609,621	\$0	\$0
2026	0.8171	-\$731,181	-\$597,428	\$0	\$0
2027	0.8007	-\$731,181	-\$585,480	\$0	\$0
2028	0.7847	-\$731,181	-\$573,770	\$0	\$0
2029	0.7690	-\$731,181	-\$562,295	\$0	\$0
2030	0.7536	-\$731,181	-\$551,049	\$0	\$0
2031	0.7386	-\$731,181	-\$540,028	\$0	\$0
2032	0.7238	-\$731,181	-\$529,227	\$0	\$0
2033	0.7093	-\$731,181	-\$518,643	\$0	\$0
2034	0.6951	-\$731,181	-\$508,270	\$0	\$0
2035	0.6812	-\$731,181	-\$498,104	\$0	\$0
2036	0.6676	-\$731,181	-\$488,142	\$0	\$0
2037	0.6543	-\$731,181	-\$478,380	\$0	\$0
2038	0.6412	-\$731,181	-\$468,812	\$0	\$0
2039	0.6283	-\$731,181	-\$459,436	\$0	\$0
2040	0.6158	-\$731,181	-\$450,247	\$0	\$0
NPV		User Benefits	-\$10,984,391	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
Concept 56

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Single Faced Barrier	1950 lf	\$60.00	\$117,000.00	\$23,400.00	\$146,016.00
PBD & Geotextile	1950 lf	\$11.00	\$21,450.00	\$4,290.00	\$26,769.60
Drainage	1 ls	\$170,331.33	\$170,331.33	\$34,066.27	\$212,573.50
Lighting	1950 lf	\$125.00	\$243,750.00	\$48,750.00	\$304,200.00
Subtotal, Supplemental Roadway Costs			\$552,531.33	\$110,506.27	\$689,559.10
					\$690,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	188 CY	\$20.00	\$3,760.00	\$752.00	\$4,692.48
Borrow	3385 CY	\$25.00	\$84,625.00	\$16,925.00	\$105,612.00
Subtotal, Earthwork Costs			\$88,385.00	\$17,677.00	\$110,304.48
					\$110,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	5162 SY	\$110.00	\$567,820.00	\$113,564.00	\$708,639.36
Subtotal, Pavement Costs			\$567,820.00	\$113,564.00	\$708,639.36
					\$710,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Sound Wall	2567 lf	\$1,250.00	\$3,208,750.00	\$641,750.00	\$4,004,520.00
Subtotal, Wall Costs			\$3,208,750.00	\$641,750.00	\$4,004,520.00
					\$4,000,000.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
OH Truss 6 lanes	2 ea	\$200,000.00	\$400,000.00	\$80,000.00	\$499,200.00
ITS Relocation	1 ls	\$50,000.00	\$50,000.00	\$10,000.00	\$62,400.00
Subtotal, Signage Costs			\$450,000.00	\$90,000.00	\$561,600.00
					\$560,000.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00
					\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 56

SUBTOTAL, CONSTRUCTION COSTS		\$4,867,486.33	\$973,497.27	\$6,074,622.94
				\$6,070,000.00
Additional Lump Sum				
Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00
Mobilization	1 LS	\$243,374.32	\$48,674.86	\$303,731.15
MPT	1 LS	\$146,024.59	\$29,204.92	\$182,238.69
		\$444,398.91	\$88,879.78	\$554,609.84
				\$550,000.00
TOTAL CONSTRUCTION COSTS		\$5,311,885.24	\$1,062,377.05	\$6,629,232.78
				\$6,620,000.00
DESIGN AND CM COSTS		\$973,497.27	\$212,475.41	\$1,325,846.56
				\$1,330,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM		\$5,840,983.60		\$7,955,079.33
				\$7,950,000.00

Safety
 Concept 56

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	25	8.33	0.48	4.00	4.33

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.01	0.09	0.45	1.44	2.33	\$ 261,793.86

USER BENEFITS
Concept 56

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:PM Veh-Hrs	
No-build	248236	265184	7994	8548
Build	247310	265211	8255	8447
Change	-926	27	261	-101
Subtotal, MOEs				

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	247.502 hrs	13.50 hrs
PM Peak Period	-98.530 hrs	-2.52 hrs
Total of Peaks	148.972 hrs	10.980 hrs
Daily Estimate	148.972 hrs	10.980 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	\$1,919.59	\$216.22

Total, all vehicles \$2,135.81 Value of travel time changes, per day
 \$724,222.45 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars		Trucks	
AM Peak Period				
Average Speed	20			
Change in Veh-Hrs		247.502 hours		13.498 hours
Fuel Consumption		0.022 gal/minute		0.102 gal/minute
		326.7 gallons		82.6 gallons

USER BENEFITS
Concept 56

PM Peak Period

Average Speed	20		
Change in Veh-Hrs		-98.5 hours	-2.5 hours
Fuel Consumption		0.022 gal/minute	0.102 gal/minute
		-130.1 gallons	-15.4 gallons

Fuel Consumption

AM Peak Period		326.7 gallons	82.6 gallons
PM Peak Period		-130.1 gallons	-15.4 gallons
Total of Peaks		196.6 gallons	67.2 gallons
Daily Estimate		196.643 gallons	67.199 gallons
		\$3.004 per gallon	\$3.004 per gallon
		\$590.71 per day	\$201.87 per day

Total, all vehicles

263.8 fuel consumption change, gallons per day
89464.9 fuel consumption change, gallons per year

\$792.58 change in fuel cost, per day
\$268,752.58 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	\$724,222.45	Value of Travel Time change, Per year
Operating Costs	\$268,752.58	Value of Operating Costs change, per year
Total, User Benefits	\$992,975.03	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	196.643 gallons	67.199 gallons
Annual estimate	66678.566 gallons	22786.342 gallons
CO2	19.4 lb/gal	22.2 lb/gal
	8799.6848 grams/gal	10069.7424 grams/gal
	586,750,367.16 g	229,452,592.63 g
Total	816,202.96 kg	

USER BENEFITS
Concept 56

VOC

	24.62 grams/gal	1.27 grams/gal
	1,641,562.80 g	28,938.65 g
Total	1,670.50 kg	

NOx

	16.5 grams/gal	24.52 grams/gal
	1,100,196.35 g	558,721.10 g
Total	1,658.92 kg	

PM2.5

	0.09761905 grams/gal	0.136 grams/gal
	6,509.10 g	3,098.94 g
Total	9.61 kg	



SUMMARY OF COSTS AND BENEFITS
 Concept 59

Construction Cost	
Supplemental Roadway Construction	\$3,000.00
Earthwork	\$1,000.00
Pavement	\$31,000.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$250,000.00
Signage	\$3,000.00
Utilities	\$4,000.00
Additional Lump Sum	\$48,000.00
Design and PM	\$68,000.00
ROW	\$0.00
Total	\$408,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	106 hr
Value of Travel Time (Annual)	\$472,199.72
Automobile Operating Costs (Annual)	\$186,736.58
Safety (Annual)	\$29,922.76
Total	\$688,859.06
Emissions (Annual)	
CO2	-557323 kg
NOx	-1091 kg
VOC	-1341 kg
Benefit:Cost Ratio	
NPV Benefits	\$10,348,594.19
NPV Operating Costs	\$0.00
NPV Capital Costs	\$399,825.94
Total Costs	\$399,825.94
Benefit:Cost Ratio	25.88

NET PRESENT VALUE CALCULATIONS

Concept 59

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$407,985.65
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$399,825.94
NPV Capital Costs			\$399,825.94

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$688,859	\$622,674	\$0	\$0
2022	0.8858	\$688,859	\$610,221	\$0	\$0
2023	0.8681	\$688,859	\$598,016	\$0	\$0
2024	0.8508	\$688,859	\$586,056	\$0	\$0
2025	0.8337	\$688,859	\$574,335	\$0	\$0
2026	0.8171	\$688,859	\$562,848	\$0	\$0
2027	0.8007	\$688,859	\$551,591	\$0	\$0
2028	0.7847	\$688,859	\$540,559	\$0	\$0
2029	0.7690	\$688,859	\$529,748	\$0	\$0
2030	0.7536	\$688,859	\$519,153	\$0	\$0
2031	0.7386	\$688,859	\$508,770	\$0	\$0
2032	0.7238	\$688,859	\$498,595	\$0	\$0
2033	0.7093	\$688,859	\$488,623	\$0	\$0
2034	0.6951	\$688,859	\$478,850	\$0	\$0
2035	0.6812	\$688,859	\$469,273	\$0	\$0
2036	0.6676	\$688,859	\$459,888	\$0	\$0
2037	0.6543	\$688,859	\$450,690	\$0	\$0
2038	0.6412	\$688,859	\$441,676	\$0	\$0
2039	0.6283	\$688,859	\$432,843	\$0	\$0
2040	0.6158	\$688,859	\$424,186	\$0	\$0
NPV		User Benefits	\$10,348,594	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
Concept 59

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Drainage	1 ls	\$2,013.18	\$2,013.18	\$402.64	\$2,512.45
ADA Ramps	2 ea	\$280.00	\$560.00	\$112.00	\$698.88
Subtotal, Supplemental Roadway Costs			\$2,573.18	\$514.64	\$3,211.33
					\$3,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	41 CY	\$20.00	\$820.00	\$164.00	\$1,023.36
Borrow	0 CY	\$25.00	\$0.00	\$0.00	\$0.00
Subtotal, Earthwork Costs			\$820.00	\$164.00	\$1,023.36
					\$1,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	61 SY	\$110.00	\$6,710.00	\$1,342.00	\$8,374.08
Curb	306 LF	\$60.00	\$18,360.00	\$3,672.00	\$22,913.28
Subtotal, Pavement Costs			\$25,070.00	\$5,014.00	\$31,287.36
					\$31,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Braddock/Forbes Traffic Signal	1 ea	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00
Subtotal, Signal Costs			\$200,000.00	\$40,000.00	\$249,600.00
					\$250,000.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Misc. Signage (each)	1 ea	\$2,250.00	\$2,250.00	\$450.00	\$2,808.00
Subtotal, Signage Costs			\$2,250.00	\$450.00	\$2,808.00
					\$3,000.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Moderate	1 LS	\$2,860.57	\$2,860.57	\$572.11	\$3,569.99
SUBTOTAL, CONSTRUCTION COSTS			\$233,573.75	\$46,714.75	\$291,500.04
					\$292,000.00

CONSTRUCTION COST ESTIMATE
 Concept 59

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	1 LS	\$10,000.00	\$1,000.00	\$11,440.00
Field Office	1 LS	\$10,000.00	\$1,000.00	\$11,440.00
Const. Scheduling	1 LS	\$2,000.00	\$200.00	\$2,288.00
Mobilization	1 LS	\$11,678.69	\$2,335.74	\$14,575.00
MPT	1 LS	\$7,007.21	\$1,401.44	\$8,745.00
		\$40,685.90	\$5,937.18	\$48,488.00
				\$48,000.00
TOTAL CONSTRUCTION COSTS		\$274,259.65	\$52,651.93	\$339,988.04
				\$340,000.00
DESIGN AND CM COSTS		\$46,714.75	\$10,530.39	\$67,997.61
				\$68,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM		\$280,288.50		\$407,985.65
				\$408,000.00

Safety
 Concept 59

Safety

Crash Type	$N_{pred,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	11	3.54	0.86	3.04	0.50

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.01	0.05	0.16	0.27	\$ 29,922.76

USER BENEFITS

Concept 59

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:	PM Veh-Hrs
No-build	0	0	24.729	59
Build	0	0	20.002	28
Change	0	0	-4.727	-30
Subtotal, MOEs				

Improvement only during peak period? Yes

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	-4.482 hrs	-0.24 hrs
PM Peak Period	-29.574 hrs	-0.76 hrs
Total of Peaks	-34.056 hrs	-1.000 hrs
Daily Estimate	-102.167 hrs	-3.864 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$1,316.48	-\$76.09

Total, all vehicles
 -\$1,392.57 Value of travel time changes, per day
 -\$472,199.72 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars	Trucks
AM Peak Period		
Average Speed	25	
Change in Veh-Hrs	-4.482 hours	-0.244 hours
Fuel Consumption	0.026 gal/minute	0.133 gal/minute
	-7.0 gallons	-2.0 gallons

USER BENEFITS

Concept 59

PM Peak Period

Average Speed	25		
Change in Veh-Hrs		-29.6 hours	-0.8 hours
Fuel Consumption		0.026 gal/minute	0.133 gal/minute
		-46.1 gallons	-6.0 gallons

Fuel Consumption

AM Peak Period		-7.0 gallons	-2.0 gallons
PM Peak Period		-46.1 gallons	-6.0 gallons
Total of Peaks		-53.1 gallons	-8.0 gallons
Daily Estimate		-159.380 gallons	-23.944 gallons
		\$3.004 per gallon	\$3.004 per gallon
		-\$478.78 per day	-\$71.93 per day

Total, all vehicles

-183.3 fuel consumption change, gallons per day
 (62,162.64) fuel consumption change, gallons per year

 -\$550.71 change in fuel cost, per day
 -\$186,736.58 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$472,199.72	Value of Travel Time change, Per year
Operating Costs	-\$186,736.58	Value of Operating Costs change, per year
Total, User Benefits	-\$658,936.30	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-159.380 gallons	-23.944 gallons
Annual estimate	-54043.531 gallons	-8119.114
CO	19.4 lb/gal	22.2 lb/gal
	8799.6848 grams/gal	10069.7424 grams/gal
	(475,566,035.63) g	(81,757,386.14) g
Total	(557,323.42) kg	

USER BENEFITS

Concept 59

VOC

24.62 grams/gal	1.27 grams/gal
(1,330,500.26) g	(10,311.27)
Total (1,340.81) kg	

NOx

16.5 grams/gal	24.52 grams/gal
(891,718.26) g	(199,080.67)
Total (1,090.80) kg	

PM2.5

0.09761905 grams/gal	0.136 grams/gal
(5,275.68) g	(1,104.20)
Total (6.38) kg	

Total



SUMMARY OF COSTS AND BENEFITS
 Concept 61

Construction Cost	
Supplemental Roadway Construction	\$14,000.00
Earthwork	\$15,000.00
Pavement	\$174,000.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$250,000.00
Signage	\$3,000.00
Utilities	\$9,000.00
Additional Lump Sum	\$62,000.00
Design and PM	\$106,000.00
ROW	\$46,000.00
Total	\$679,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	35 hr
Value of Travel Time (Annual)	\$158,686.27
Automobile Operating Costs (Annual)	\$65,542.27
Safety (Annual)	\$113,473.71
Total	\$337,702.26
Emissions (Annual)	
CO2	-197376 kg
NOx	-394 kg
VOC	-438 kg
Benefit:Cost Ratio	
NPV Benefits	\$5,073,234.63
NPV Operating Costs	\$0.00
NPV Capital Costs	\$665,958.64
Total Costs	\$665,958.64
Benefit:Cost Ratio	7.62

NET PRESENT VALUE CALCULATIONS

Concept 61

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$679,549.63
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$665,958.64
NPV Capital Costs			\$665,958.64

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$337,702	\$305,256	\$0	\$0
2022	0.8858	\$337,702	\$299,151	\$0	\$0
2023	0.8681	\$337,702	\$293,168	\$0	\$0
2024	0.8508	\$337,702	\$287,305	\$0	\$0
2025	0.8337	\$337,702	\$281,559	\$0	\$0
2026	0.8171	\$337,702	\$275,927	\$0	\$0
2027	0.8007	\$337,702	\$270,409	\$0	\$0
2028	0.7847	\$337,702	\$265,001	\$0	\$0
2029	0.7690	\$337,702	\$259,701	\$0	\$0
2030	0.7536	\$337,702	\$254,507	\$0	\$0
2031	0.7386	\$337,702	\$249,416	\$0	\$0
2032	0.7238	\$337,702	\$244,428	\$0	\$0
2033	0.7093	\$337,702	\$239,540	\$0	\$0
2034	0.6951	\$337,702	\$234,749	\$0	\$0
2035	0.6812	\$337,702	\$230,054	\$0	\$0
2036	0.6676	\$337,702	\$225,453	\$0	\$0
2037	0.6543	\$337,702	\$220,944	\$0	\$0
2038	0.6412	\$337,702	\$216,525	\$0	\$0
2039	0.6283	\$337,702	\$212,194	\$0	\$0
2040	0.6158	\$337,702	\$207,950	\$0	\$0
NPV		User Benefits	\$5,073,235	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 61

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Drainage	1 ls	\$9,304.84	\$9,304.84	\$1,860.97	\$11,612.44
ADA Ramps	8 ea	\$280.00	\$2,240.00	\$448.00	\$2,795.52
Subtotal, Supplemental Roadway Costs			\$11,544.84	\$2,308.97	\$14,407.96
					\$14,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	606 CY	\$20.00	\$12,120.00	\$2,424.00	\$15,125.76
Borrow	0 CY	\$25.00	\$0.00	\$0.00	\$0.00
Subtotal, Earthwork Costs			\$12,120.00	\$2,424.00	\$15,125.76
					\$15,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	282 SY	\$110.00	\$31,020.00	\$6,204.00	\$38,712.96
Curb	655 LF	\$60.00	\$39,300.00	\$7,860.00	\$49,046.40
Sidewalk	627 SY	\$110.00	\$68,970.00	\$13,794.00	\$86,074.56
Subtotal, Pavement Costs			\$139,290.00	\$27,858.00	\$173,833.92
					\$174,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Penn/Braddock Traffic Signal	1 ea	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00
Subtotal, Signal Costs			\$200,000.00	\$40,000.00	\$249,600.00
					\$250,000.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Misc. Signage (each)	1 ea	\$2,250.00	\$2,250.00	\$450.00	\$2,808.00
Subtotal, Signage Costs			\$2,250.00	\$450.00	\$2,808.00
					\$3,000.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Moderate	1 LS	\$7,541.74	\$7,541.74	\$1,508.35	\$9,412.09
Subtotal, Utility Impact			\$7,541.74	\$1,508.35	\$9,412.09
					\$9,000.00

CONSTRUCTION COST ESTIMATE
 Concept 61

SUBTOTAL, CONSTRUCTION COSTS		\$372,746.58	\$74,549.32	\$465,187.73
				\$465,000.00
Additional Lump Sum				
Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	1 LS	\$10,000.00	\$1,000.00	\$11,440.00
Field Office	1 LS	\$10,000.00	\$1,000.00	\$11,440.00
Const. Scheduling	1 LS	\$2,000.00	\$200.00	\$2,288.00
Mobilization	1 LS	\$18,637.33	\$3,727.47	\$23,259.39
MPT	1 LS	\$11,182.40	\$2,236.48	\$13,955.63
		\$51,819.73	\$8,163.95	\$62,383.02
				\$62,000.00
TOTAL CONSTRUCTION COSTS		\$424,566.31	\$82,713.26	\$527,570.75
				\$527,000.00
DESIGN AND CM COSTS		\$74,549.32	\$16,542.65	\$105,514.15
				\$106,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM		\$447,295.90		\$633,084.90
				\$633,000.00

ROW COSTS
 Concept 61

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
175-J-253	\$99,600.00		21,600	350	No	2%	\$1,613.89
175-J-259	\$99,000.00		12,780	550	No	4%	\$4,260.56
175-K-26	\$ 558,100.00		46,509	2000	No	4%	\$23,999.66
175-J-262	\$ 330,900.00		15,956	800	No	5%	\$16,590.62
Subtotal, ROW Costs							\$46,464.73
							\$46,000.00

Safety
 Concept 61

Safety

Crash Type	$N_{pred,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	13	4.47	0.58	2.59	1.88

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.01	0.04	0.20	0.63	1.01	\$ 113,473.71

USER BENEFITS
Concept 61

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:PM Veh-Hrs
No-build	0	0	36.781 34
Build	0	0	28.092 31
Change	0	0	-8.689 -3
Subtotal, MOEs			

Improvement only during peak period? Yes

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	-8.240 hrs	-0.45 hrs
PM Peak Period	-2.839 hrs	-0.07 hrs
Total of Peaks	-11.079 hrs	-0.522 hrs
Daily Estimate	-33.237 hrs	-2.016 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$428.28	-\$39.71

Total, all vehicles
-\$467.98 Value of travel time changes, per day
-\$158,686.27 Value of travel time changes, per year

Subtotal, Value of Time

USER BENEFITS
Concept 61

Automobile Operating Costs (Delay)

	Cars	Trucks
AM Peak Period		
Average Speed	25	
Change in Veh-Hrs	-8.240 hours	-0.449 hours
Fuel Consumption	0.026 gal/minute	0.133 gal/minute
	-12.9 gallons	-3.6 gallons
PM Peak Period		
Average Speed	25	
Change in Veh-Hrs	-2.8 hours	-0.1 hours
Fuel Consumption	0.026 gal/minute	0.133 gal/minute
	-4.4 gallons	-0.6 gallons
Fuel Consumption		
AM Peak Period	-12.9 gallons	-3.6 gallons
PM Peak Period	-4.4 gallons	-0.6 gallons
Total of Peaks	-17.3 gallons	-4.2 gallons
Daily Estimate	-51.850 gallons	-12.495 gallons
	\$3.004 per gallon	\$3.004 per gallon
	-\$155.76 per day	-\$37.54 per day
Total, all vehicles		
	-64.3 fuel consumption change, gallons per day	
	(21,818.33) fuel consumption change, gallons per year	
	-\$193.29 change in fuel cost, per day	
	-\$65,542.27 change in fuel cost, per year	

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$158,686.27	Value of Travel Time change, Per year
Operating Costs	-\$65,542.27	Value of Operating Costs change, per year
Total, User Benefits	-\$224,228.54	

USER BENEFITS
 Concept 61

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-51.850 gallons	-12.495 gallons
Annual estimate	-17581.435 gallons	-4236.898
CO	19.4 lb/gal 8799.6848 grams/gal (154,711,089.69) g	22.2 lb/gal 10069.7424 grams/gal (42,664,471.38) g
Total	(197,375.56) kg	
VOC	24.62 grams/gal (432,838.19) g	1.27 grams/gal (5,380.86)
Total	(438.22) kg	
NOx	16.5 grams/gal (290,093.68) g	24.52 grams/gal (103,888.74)
Total	(393.98) kg	
PM2.5	0.09761905 grams/gal (1,716.28) g	0.136 grams/gal (576.22)
Total	(2.29) kg	

SUMMARY OF COSTS AND BENEFITS
 Concept 62

Construction Cost	
Pedestrian Improvements	\$479,500.00
Earthwork	\$0.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$0.00
Signage	\$0.00
Utilities	\$0.00
Additional Lump Sum	\$0.00
Design and PM	\$65,000.00
ROW	\$0.00
Total	\$544,500.00
Operating Cost	
Negligible	\$0.00
	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	0 hr
Value of Travel Time (Annual)	\$0.00
Automobile Operating Costs (Annual)	\$0.00
Safety (Annual)	\$0.00
Total	\$0.00
Emissions	
CO2	0 kg
NOx	0 kg
VOC	0 kg
Benefit:Cost Ratio	
NPV Benefits	\$0.00
NPV Operating Costs	\$0.00
NPV Capital Costs	\$533,610.00
Total Costs	\$533,610.00
Benefit:Cost Ratio	Not Calculated

NET PRESENT VALUE CALCULATIONS
 Concept 62

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$544,500.00
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$533,610.00
NPV Capital Costs			\$533,610.00

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
NPV		User Benefits	\$0	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 62

Pedestrian Improvement Costs

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
TAP Improvement	1 ls	\$479,500.00	\$0.00	\$0.00	\$479,500.00
TAP Approval Amt	1 ls	-\$479,500.00	\$0.00	\$0.00	\$0.00
ADA Ramps	131 ea	included	\$0.00	\$0.00	\$0.00
Subtotal, Pedestrian Improvement Costs			\$0.00	\$0.00	\$479,500.00
					\$480,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Earthwork Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Sidewalk	626.75 SY	included	\$0.00	\$0.00	\$0.00
Subtotal, Pavement Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00
					\$0.00

SUBTOTAL, CONSTRUCTION COSTS			\$0.00	\$0.00	\$479,500.00
					\$480,000.00

CONSTRUCTION COST ESTIMATE
 Concept 62

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
		\$0.00	\$0.00	\$0.00
				\$0.00
TOTAL CONSTRUCTION COSTS		\$0.00	\$0.00	\$479,500.00
				\$480,000.00
DESIGN AND PM COSTS		\$0.00	\$0.00	\$65,000.00
				\$65,000.00
TOTAL, DESIGN, CONSTRUCTION AND C		\$0.00		\$544,500.00
				\$545,000.00

SUMMARY OF COSTS AND BENEFITS
 Concept 63

Construction Cost	
ADA Ramps	\$90,000.00
Earthwork	\$0.00
Sidewalk	\$6,700,000.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$0.00
Signage	\$0.00
Utilities	\$0.00
Additional Lump Sum	\$610,000.00
Design and PM	\$1,480,000.00
ROW	\$0.00
Total	\$8,880,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	0 hr
Value of Travel Time (Annual)	\$0.00
Automobile Operating Costs (Annual)	\$0.00
Safety (Annual)	\$0.00
Total	\$0.00
Emissions (Annual)	
CO2	0 kg
NOx	0 kg
VOC	0 kg
Benefit:Cost Ratio	
NPV Benefits	\$0.00
NPV Operating Costs	\$0.00
NPV Capital Costs	\$8,701,861.66
Total Costs	\$8,701,861.66
Benefit:Cost Ratio	Not Calculated

NET PRESENT VALUE CALCULATIONS

Concept 63

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$8,879,450.68
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$8,701,861.66
NPV Capital Costs			\$8,701,861.66

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
NPV		User Benefits	\$0	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 63

Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
ADA Ramps	251 ea	\$280.00	\$70,280.00	\$14,056.00	\$87,709.44
Subtotal, Roadway Costs			\$70,280.00	\$14,056.00	\$87,709.44
					\$90,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Earthwork Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Sidewalk	51,130.67 SY	\$105.00	\$5,368,720.35	\$1,073,744.07	\$6,700,163.00
Subtotal, Pavement Costs			\$5,368,720.35	\$1,073,744.07	\$6,700,163.00
					\$6,700,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00
					\$0.00

SUBTOTAL, CONSTRUCTION COSTS			\$5,439,000.35	\$1,087,800.07	\$6,787,872.44
					\$6,790,000.00

CONSTRUCTION COST ESTIMATE
 Concept 63

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00
Mobilization	1 LS	\$271,950.02	\$54,390.00	\$339,393.62
MPT	1 LS	\$163,170.01	\$32,634.00	\$203,636.17
		\$490,120.03	\$98,024.01	\$611,669.79
				\$610,000.00
TOTAL CONSTRUCTION COSTS		\$5,929,120.38	\$1,185,824.08	\$7,399,542.23
				\$7,400,000.00
DESIGN AND CM COSTS		\$1,087,800.07	\$237,164.82	\$1,479,908.45
				\$1,480,000.00
TOTAL, DESIGN, CONSTRUCTION AND C		\$6,526,800.42		\$8,879,450.68
				\$8,880,000.00

SUMMARY OF COSTS AND BENEFITS
 Concept 64

Construction Cost	
Supplemental Roadway Construction	\$700,000.00
Earthwork	\$1,400,000.00
Pavement	\$1,400,000.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$0.00
Signage	\$250,000.00
Utilities	\$1,310,000.00
Additional Lump Sum	\$470,000.00
Design and PM	\$1,110,000.00
ROW	\$3,790,000.00
Total	\$10,430,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	-531 hr
Value of Travel Time (Annual)	-\$2,321,141.82
Automobile Operating Costs (Annual)	-\$844,153.76
Safety (Annual)	\$161,247.21
Total	-\$3,004,048.37
Emissions (Annual)	
CO2	2472799 kg
NOx	4637 kg
VOC	6918 kg
Benefit:Cost Ratio	
NPV Benefits	-\$45,129,227.88
NPV Operating Costs	\$0.00
NPV Capital Costs	\$10,226,337.96
Total Costs	\$10,226,337.96
Benefit:Cost Ratio	-4.41

NET PRESENT VALUE CALCULATIONS

Concept 64

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$10,435,038.73
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$10,226,337.96
NPV Capital Costs			\$10,226,337.96

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	-\$3,004,048	-\$2,715,422	\$0	\$0
2022	0.8858	-\$3,004,048	-\$2,661,113	\$0	\$0
2023	0.8681	-\$3,004,048	-\$2,607,891	\$0	\$0
2024	0.8508	-\$3,004,048	-\$2,555,733	\$0	\$0
2025	0.8337	-\$3,004,048	-\$2,504,619	\$0	\$0
2026	0.8171	-\$3,004,048	-\$2,454,526	\$0	\$0
2027	0.8007	-\$3,004,048	-\$2,405,436	\$0	\$0
2028	0.7847	-\$3,004,048	-\$2,357,327	\$0	\$0
2029	0.7690	-\$3,004,048	-\$2,310,180	\$0	\$0
2030	0.7536	-\$3,004,048	-\$2,263,977	\$0	\$0
2031	0.7386	-\$3,004,048	-\$2,218,697	\$0	\$0
2032	0.7238	-\$3,004,048	-\$2,174,323	\$0	\$0
2033	0.7093	-\$3,004,048	-\$2,130,837	\$0	\$0
2034	0.6951	-\$3,004,048	-\$2,088,220	\$0	\$0
2035	0.6812	-\$3,004,048	-\$2,046,456	\$0	\$0
2036	0.6676	-\$3,004,048	-\$2,005,527	\$0	\$0
2037	0.6543	-\$3,004,048	-\$1,965,416	\$0	\$0
2038	0.6412	-\$3,004,048	-\$1,926,108	\$0	\$0
2039	0.6283	-\$3,004,048	-\$1,887,586	\$0	\$0
2040	0.6158	-\$3,004,048	-\$1,849,834	\$0	\$0
NPV		User Benefits	-\$45,129,228	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 64

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
PBD & Geotextile	1607 lf	\$11.00	\$17,677.00	\$3,535.40	\$22,060.90
Drainage	1 ls	\$338,217.00	\$338,217.00	\$67,643.40	\$422,094.82
Lighting	1607 lf	\$125.00	\$200,875.00	\$40,175.00	\$250,692.00
ADA Ramps	16 ea	\$280.00	\$4,480.00	\$896.00	\$5,591.04
Subtotal, Supplemental Roadway Costs			\$561,249.00	\$112,249.80	\$700,438.75
					\$700,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	56249 CY	\$20.00	\$1,124,980.00	\$224,996.00	\$1,403,975.04
Borrow	0 CY	\$25.00	\$0.00	\$0.00	\$0.00
Subtotal, Earthwork Costs			\$1,124,980.00	\$224,996.00	\$1,403,975.04
					\$1,400,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	7877 SY	\$110.00	\$866,470.00	\$173,294.00	\$1,081,354.56
Sidewalk	655 SY	\$105.00	\$68,775.00	\$13,755.00	\$85,831.20
Island Concrete	1710 SY	\$110.00	\$188,100.00	\$37,620.00	\$234,748.80
Subtotal, Pavement Costs			\$1,123,345.00	\$224,669.00	\$1,401,934.56
					\$1,400,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
ITS Relocation	1 ls	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00
Subtotal, Signage Costs			\$200,000.00	\$40,000.00	\$249,600.00
					\$250,000.00

CONSTRUCTION COST ESTIMATE
 Concept 64

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Major	1 LS	\$1,049,185.90	\$1,049,185.90	\$209,837.18	\$1,309,384.00
Subtotal, Utility Impact			\$1,049,185.90	\$209,837.18	\$1,309,384.00
					\$1,310,000.00

SUBTOTAL, CONSTRUCTION COSTS			\$4,058,759.90	\$811,751.98	\$5,065,332.36
					\$5,060,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost	
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00	
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00	
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00	
Mobilization	1 LS	\$202,938.00	\$40,587.60	\$253,266.62	
MPT	1 LS	\$121,762.80	\$24,352.56	\$151,959.97	
				\$473,866.59	
					\$470,000.00

TOTAL CONSTRUCTION COSTS			\$4,438,460.69	\$887,692.14	\$5,539,198.94
					\$5,530,000.00
DESIGN AND CM COSTS			\$811,751.98	\$177,538.43	\$1,107,839.79
					\$1,110,000.00
TOTAL, DESIGN, CONSTRUCTION AND C			\$4,870,511.88		\$6,647,038.73
					\$6,640,000.00

ROW COSTS
 Concept 64

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
28-R-342		\$1,025,600.00	39,767	39,767	Y	100%	\$1,025,600.00
28-318		\$139,500.00	94,403	94,403	Y	100%	\$139,500.00
28-R-259		\$93,300.00	3,854	3,854	Y	100%	\$93,300.00
28-R-260		\$101,100.00	3,661	3,661	Y	100%	\$101,100.00
28-R-261		63800	4158	4158	Y	100%	\$63,800.00
28-R-290		31000	22144	22144	Y	100%	\$31,000.00
28-R-257		10900	2429	2429	Y	100%	\$10,900.00
28-R-256		6900	1538	1538	Y	100%	\$6,900.00
28-R-255		95200	1459	1459	Y	100%	\$95,200.00
28-R-254		6600	1458	1458	Y	100%	\$6,600.00
28-R-253		6600	1466	1466	Y	100%	\$6,600.00
28-R-252		84400	1456	1456	Y	100%	\$84,400.00
28-R-251		89600	1463	1463	Y	100%	\$89,600.00
28-R-250		96100	1457	1457	Y	100%	\$96,100.00
28-R-249		6600	1468	1468	Y	100%	\$6,600.00
28-R-248		96600	1515	1515	Y	100%	\$96,600.00
28-R-247		55600	2092	2092	Y	100%	\$55,600.00
28-R-246		40000	1820	1820	Y	100%	\$40,000.00
28-L-7		113500	1273	1273	Y	100%	\$113,500.00
28-L-5		399500	1444	1444	Y	100%	\$399,500.00
28-R-362		125000	1550	1550	Y	100%	\$125,000.00
28-R-361		125000	1500	1500	Y	100%	\$125,000.00
28-R-360		55700	1500	1500	Y	100%	\$55,700.00
28-R-359		179800	1500	1500	Y	100%	\$179,800.00
28-R-358		125000	1500	1500	Y	100%	\$125,000.00
28-R-357		125000	1500	1500	Y	100%	\$125,000.00
28-R-356		125000	1500	1500	Y	100%	\$125,000.00
28-R-355		179800	1500	1500	Y	100%	\$179,800.00
28-R-354		59300	1500	1500	Y	100%	\$59,300.00
28-R-353		69500	2250	2250	Y	100%	\$69,500.00
28-R-262	43500	98400	4650	2325	N	50%	\$21,750.00
28-R-263	33500	92000	5150	2575	N	50%	\$16,750.00
28-R-264	36000	90000	3000	750	N	25%	\$9,000.00
28-R-265	36000	115500	3000	750	N	25%	\$9,000.00
Subtotal, ROW Costs							\$3,788,000.00
							\$3,790,000.00

Safety
 Concept 64

Safety

Crash Type	$N_{pred,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	17	5.56	0.52	2.89	2.67

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.01	0.06	0.28	0.89	1.44	\$ 161,247.21

USER BENEFITS
Concept 64

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:PM Veh-Hrs
No-build	0	0	161.066 45
Build	0	0	176.364 207
Change	0	0	15.298 162
Subtotal, MOEs			

Improvement only during peak period? Yes

Value of Time

	Cars	Trucks
Avg Hourly Wage	\$21.84	\$16.41
Benefits	18% \$3.93	20% \$3.28
Total Compensation	\$25.77	\$19.69
Value of Time	50% \$12.89 of hourly wage	100% \$19.69 of total compensation

CHANGE IN TRAVEL TIME

AM Peak Period	15.298 hrs	0.00 hrs
PM Peak Period	161.781 hrs	0.00 hrs
Total of Peaks	177.079 hrs	0.000 hrs
Daily Estimate	531.237 hrs	0.000 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	\$6,845.31	\$0.00

Total, all vehicles \$6,845.31 Value of travel time changes, per day
\$2,321,141.82 Value of travel time changes, per year

Subtotal, Value of Time

USER BENEFITS
Concept 64

Automobile Operating Costs (Delay)

	Cars	Trucks
AM Peak Period		
Average Speed	25	
Change in Veh-Hrs	15.298 hours	0.000 hours
Fuel Consumption	0.026 gal/minute	0.133 gal/minute
	23.9 gallons	0.0 gallons
PM Peak Period		
Average Speed	25	
Change in Veh-Hrs	161.8 hours	0.0 hours
Fuel Consumption	0.026 gal/minute	0.133 gal/minute
	252.4 gallons	0.0 gallons
Fuel Consumption		
AM Peak Period	23.9 gallons	0.0 gallons
PM Peak Period	252.4 gallons	0.0 gallons
Total of Peaks	276.2 gallons	0.0 gallons
Daily Estimate	828.730 gallons	0.000 gallons
	\$3.004 per gallon	\$3.004 per gallon
	\$2,489.50 per day	\$0.00 per day
Total, all vehicles		
	828.7 fuel consumption change, gallons per day	
	281,009.91 fuel consumption change, gallons per year	
	\$2,489.50 change in fuel cost, per day	
	\$844,153.76 change in fuel cost, per year	

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	\$2,321,141.82	Value of Travel Time change, Per year
Operating Costs	\$844,153.76	Value of Operating Costs change, per year
Total, User Benefits	\$3,165,295.57	

USER BENEFITS
 Concept 64

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	828.730 gallons	0.000 gallons
Annual estimate	281009.905 gallons	0.000
CO		
	19.4 lb/gal	22.2 lb/gal
	8799.6848 grams/gal	10069.7424 grams/gal
	2,472,798,592.04 g	- g
Total	2,472,798.59 kg	
VOC		
	24.62 grams/gal	1.27 grams/gal
	6,918,196.24 g	-
Total	6,918.20 kg	
NOx		
	16.5 grams/gal	24.52 grams/gal
	4,636,663.44 g	-
Total	4,636.66 kg	
PM2.5		
	0.09761905 grams/gal	0.136 grams/gal
	27,431.92 g	-
Total	27.43 kg	

SUMMARY OF COSTS AND BENEFITS
 Concept 65

Construction Cost	
Supplemental Roadway Construction	\$0.00
Earthwork	\$0.00
Pavement	\$0.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$12,467.52
Signage	\$2,808.00
Utilities	\$0.00
Additional Lump Sum	\$1,222.04
Design and PM	\$3,299.51
ROW	\$0.00
Total	\$19,797.07
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	-23 hr
Value of Travel Time (Annual)	-\$100,604.76
Automobile Operating Costs (Annual)	-\$36,587.98
Safety (Annual)	\$1,374,417.74
Total	\$1,237,225.00
Emissions (Annual)	
CO2	107178 kg
NOx	201 kg
VOC	300 kg
Benefit:Cost Ratio	
NPV Benefits	\$5,372,525.24
NPV Operating Costs	\$0.00
NPV Capital Costs	\$3,234.00
Total Costs	\$3,234.00
Benefit:Cost Ratio	1661.26

NET PRESENT VALUE CALCULATIONS

Concept 65

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$3,300.00
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$3,234.00
NPV Capital Costs			\$3,234.00

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$1,237,225	\$1,118,353	\$0	\$0
2022	0.8858	\$1,237,225	\$1,095,986	\$0	\$0
2023	0.8681	\$1,237,225	\$1,074,067	\$0	\$0
2024	0.8508	\$1,237,225	\$1,052,585	\$0	\$0
2025	0.8337	\$1,237,225	\$1,031,534	\$0	\$0
NPV		User Benefits	\$5,372,525	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 65

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Supplemental Roadway Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Earthwork Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Pavement Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Typical Signal 1: Signage (2), Retiming	1 ls	\$4,060.00	\$4,060.00	\$812.00	\$5,066.88
Typical Signal 2: Signage (2), Signal Head, Retiming	1 ls	\$2,020.00	\$2,020.00	\$404.00	\$2,520.96
Typical Signal 3: Signage, Retiming	1 ls	\$540.00	\$540.00	\$108.00	\$673.92
Typical Signal 4: Signage (2), Striping (1), Retiming	1 ls	\$880.00	\$880.00	\$176.00	\$1,098.24
Typical Signal 5: Signage (2), Striping (2), Retiming	1 ls	\$1,180.00	\$1,180.00	\$236.00	\$1,472.64
Typical Signal 6: Signage (2), Signal Head, Striping (1), Retiming	1 ls	\$1,310.00	\$1,310.00	\$262.00	\$1,634.88
Typical Signal 7	1 ls	\$0.00	\$0.00	\$0.00	\$0.00
Subtotal, Signal Costs			\$9,990.00	\$1,998.00	\$12,467.52
					\$12,500.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Misc. Signage (each)	1 ea	\$2,250.00	\$2,250.00	\$450.00	\$2,808.00
Subtotal, Signage Costs			\$2,250.00	\$450.00	\$2,808.00
					\$2,800.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00
					\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 65

SUBTOTAL, CONSTRUCTION COSTS		\$12,240.00	\$2,448.00	\$15,275.52
				\$15,300.00
Administrative Costs				
Item	Quantity	2016 Cost	Contingency	2017 Cost
		\$979.20	\$195.84	\$1,222.04
				\$1,200.00
TOTAL CONSTRUCTION COSTS		\$13,219.20	\$2,643.84	\$16,497.56
				\$16,500.00
DESIGN AND CM COSTS		\$2,448.00	\$528.77	\$3,299.51
				\$3,300.00
TOTAL, DESIGN, CONSTRUCTION AND CM		\$14,688.00		\$19,797.07
				\$19,800.00

USER BENEFITS
Concept 65

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:PM Veh-Hrs
No-build	0	0	20.029 25
Build	0	0	25.907 27
Change	0	0	5.878 2
Subtotal, MOEs			

Improvement only during peak period? Yes

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	5.878 hrs	0.00 hrs
PM Peak Period	1.797 hrs	0.00 hrs
Total of Peaks	7.675 hrs	0.000 hrs
Daily Estimate	23.025 hrs	0.000 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	\$296.69	\$0.00

Total, all vehicles \$296.69 Value of travel time changes, per day
\$100,604.76 Value of travel time changes, per year

Subtotal, Value of Time

USER BENEFITS
Concept 65

Automobile Operating Costs (Delay)

	Cars	Trucks
AM Peak Period		
Average Speed	25	
Change in Veh-Hrs	5.878 hours	0.000 hours
Fuel Consumption	0.026 gal/minute	0.133 gal/minute
	9.2 gallons	0.0 gallons
PM Peak Period		
Average Speed	25	
Change in Veh-Hrs	1.8 hours	0.0 hours
Fuel Consumption	0.026 gal/minute	0.133 gal/minute
	2.8 gallons	0.0 gallons
Fuel Consumption		
AM Peak Period	9.2 gallons	0.0 gallons
PM Peak Period	2.8 gallons	0.0 gallons
Total of Peaks	12.0 gallons	0.0 gallons
Daily Estimate	35.919 gallons	0.000 gallons
	\$3.004 per gallon	\$3.004 per gallon
	\$107.90 per day	\$0.00 per day
Total, all vehicles		
	35.9 fuel consumption change, gallons per day	
	12,179.75 fuel consumption change, gallons per year	
	\$107.90 change in fuel cost, per day	
	\$36,587.98 change in fuel cost, per year	

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	\$100,604.76	Value of Travel Time change, Per year
Operating Costs	\$36,587.98	Value of Operating Costs change, per year
Total, User Benefits	\$137,192.74	

USER BENEFITS
 Concept 65

Emissions

	Cars		Trucks	
Fuel Consumption				
Daily Estimate		35.919 gallons		0.000 gallons
Annual estimate		12179.753 gallons		0.000
CO	19.4 lb/gal 8799.6848 grams/gal		22.2 lb/gal 10069.7424 grams/gal	
Total		107,177,985.64 g	6	- g
VOC	24.62 grams/gal		1.27 grams/gal	
Total		299,853.91 g		-
NOx	16.5 grams/gal		24.52 grams/gal	
Total		200,965.92 g		-
PM2.5	0.09761905 grams/gal		0.136 grams/gal	
Total		1,188.98 g		-

Safety
 Concept 65

Safety

Crash Type	$N_{pred,2010-2012}$	$N_{pred,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	137	45.50	0.50	22.75	22.75

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.06	0.49	2.37	7.58	12.25	\$ 1,374,417.74

SUMMARY OF COSTS AND BENEFITS
 Concept 69

Construction Cost	
Supplemental Roadway Construction	\$0.00
Earthwork	\$0.00
Pavement	\$0.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$1,330,000.00
Signage	\$0.00
Utilities	\$0.00
Additional Lump Sum	\$0.00
Design and PM	\$270,000.00
ROW	\$0.00
Total	\$1,600,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Daily)	435 hr
Value of Travel Time (Annual)	\$1,369,607.03
Automobile Operating Costs (Annual)	\$983,409.25
Safety (Annual)	\$792,359.38
Total	\$3,145,375.66
Emissions (Annual)	
CO2	-16414 kg
NOx	-31 kg
VOC	-46 kg
Benefit:Cost Ratio	
NPV Benefits	\$13,658,477.67
NPV Operating Costs	\$0.00
NPV Capital Costs	\$1,569,350.14
Total Costs	\$1,569,350.14
Benefit:Cost Ratio	8.70

NET PRESENT VALUE CALCULATIONS

Concept 69

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$1,601,377.69
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$1,569,350.14
NPV Capital Costs			\$1,569,350.14

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224		\$0	\$0	\$0
2021	0.9039	\$3,145,376	\$2,843,170	\$0	\$0
2022	0.8858	\$3,145,376	\$2,786,307	\$0	\$0
2023	0.8681	\$3,145,376	\$2,730,581	\$0	\$0
2024	0.8508	\$3,145,376	\$2,675,969	\$0	\$0
2025	0.8337	\$3,145,376	\$2,622,450	\$0	\$0
NPV		User Benefits	\$13,658,478	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
Concept 69

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Supplemental Roadway Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Earthwork Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Pavement Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Retiming Signals from Roup Ave to Angela Ave	24 ea	\$4,554.00	\$109,296.00	\$21,859.20	\$136,401.41
Adaptive Signal Retiming	24 ea	\$15,000.00	\$360,000.00	\$72,000.00	\$449,280.00
Typical Signal 3	3 ls	\$200,000.00	\$600,000.00	\$120,000.00	\$748,800.00
Subtotal, Signal Costs			\$1,069,296.00	\$213,859.20	\$1,334,481.41
					\$1,330,000.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00
					\$0.00

SUBTOTAL, CONSTRUCTION COSTS			\$1,069,296.00	\$213,859.20	\$1,334,481.41
					\$1,330,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
		\$0.00	\$0.00	\$0.00
				\$0.00

TOTAL CONSTRUCTION COSTS			\$1,069,296.00	\$213,859.20	\$1,334,481.41
					\$1,330,000.00

CONSTRUCTION COST ESTIMATE
Concept 69

DESIGN AND CM COSTS	\$213,859.20	\$42,771.84	\$266,896.28
			\$270,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM	\$1,283,155.20		\$1,601,377.69
			\$1,600,000.00

Safety
 Concept 69

Safety

Crash Type	$N_{pred,2010-2012}$	$N_{pred,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	231	77.15	0.83	64.03	13.12

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.04	0.28	1.37	4.37	7.06	\$ 792,359.38

USER BENEFITS
Concept 69

MOEs

Item	Per Year	
Delay	-113217	hr
Fuel	-352386	gal
Emissions	-16910	kg
Subtotal, MOEs		

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

Daily Estimate	-426.741 hrs	-8.709 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$5,498.81	-\$171.50

Total, all vehicles
-\$5,670.31 Value of travel time changes, per day
-\$1,369,607.03 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars	Trucks
Daily Estimate	-1328.224 gallons	-27.107 gallons
	\$3.004 per gallon	\$3.004 per gallon
	-\$3,989.99 per day	-\$81.43 per day

Total, all vehicles
-1355.3 fuel consumption change, gallons per day
(327,366.59) fuel consumption change, gallons per year

USER BENEFITS
Concept 69

-\$4,071.41 change in fuel cost, per day
-\$983,409.25 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$1,369,607.03	Value of Travel Time change, Per year
Operating Costs	-\$983,409.25	Value of Operating Costs change, per year
Total, User Benefits	-\$2,353,016.28	

Emissions

		Cars	Trucks
Daily emissions		-63.738 KG	-1.301 KG
Annual emissions		-16571.800 KG	-338.200 KG
CO2	368.4 0.971	-16086 KG	-328 KG
Annual total		(16,413.86)	
VOC	1.034 0.003	-45 KG	-1 KG
Total		(46.07)	
NOx	0.693 0.002	-30 KG	-1 KG
Total		(30.88)	
PM2.5	0.0041 0.000	0 KG	0 KG
Total		(0.18)	
Other	9.4044	0.025	

SUMMARY OF COSTS AND BENEFITS
 Concept 70

Construction Cost	
Supplemental Roadway Construction	\$0.00
Earthwork	\$0.00
Pavement	\$0.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$1,070,000.00
Signage	\$0.00
Utilities	\$0.00
Additional Lump Sum	\$0.00
Design and PM	\$210,000.00
ROW	\$0.00
Total	\$1,280,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Daily)	78 hr
Value of Travel Time (Annual)	\$243,856.18
Automobile Operating Costs (Annual)	\$451,349.78
Safety (Annual)	\$437,826.06
Total	\$1,133,032.02
Emissions (Annual)	
CO2	-2484 kg
NOx	-5 kg
VOC	-7 kg
Benefit:Cost Ratio	
NPV Benefits	\$4,920,077.68
NPV Operating Costs	\$0.00
NPV Capital Costs	\$1,260,213.57
Total Costs	\$1,260,213.57
Benefit:Cost Ratio	3.90

NET PRESENT VALUE CALCULATIONS

Concept 70

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$1,285,932.21
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$1,260,213.57
NPV Capital Costs			\$1,260,213.57

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224		\$0	\$0	\$0
2021	0.9039	\$1,133,032	\$1,024,171	\$0	\$0
2022	0.8858	\$1,133,032	\$1,003,688	\$0	\$0
2023	0.8681	\$1,133,032	\$983,614	\$0	\$0
2024	0.8508	\$1,133,032	\$963,942	\$0	\$0
2025	0.8337	\$1,133,032	\$944,663	\$0	\$0
NPV		User Benefits	\$4,920,078	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE

Concept 70

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Supplemental Roadway Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Earthwork Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Pavement Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Signal Retiming on Braddock Ave	3 ea	\$4,554.00	\$13,662.00	\$2,732.40	\$17,050.18
Adaptive Signals	3 ea	\$15,000.00	\$45,000.00	\$9,000.00	\$56,160.00
Traffic Signals	4 ls	\$200,000.00	\$800,000.00	\$160,000.00	\$998,400.00
Subtotal, Signal Costs			\$858,662.00	\$171,732.40	\$1,071,610.18
					\$1,070,000.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00
					\$0.00

SUBTOTAL, CONSTRUCTION COSTS			\$858,662.00	\$171,732.40	\$1,071,610.18
					\$1,070,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
		\$0.00	\$0.00	\$0.00
				\$0.00

TOTAL CONSTRUCTION COSTS			\$858,662.00	\$171,732.40	\$1,071,610.18
					\$1,070,000.00

DESIGN AND CM COSTS			\$171,732.40	\$34,346.48	\$214,322.04
					\$210,000.00

CONSTRUCTION COST ESTIMATE

Concept 70

TOTAL, DESIGN, CONSTRUCTION AND CM	\$1,030,394.40	\$1,285,932.21
		\$1,280,000.00

Safety
Concept 70

Safety

Crash Type	$N_{pred,2010-2012}$	$N_{pred,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	128	42.63	0.83	35.38	7.25

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.02	0.16	0.76	2.41	3.90	\$ 437,826.06

USER BENEFITS
Concept 70

MOEs

Item	Per Year	
Delay	-20158	hr
Fuel	-161733	gal
Emissions	-2559	kg
Subtotal, MOEs		

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

Daily Estimate	-75.981 hrs	-1.551 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$979.05	-\$30.53

Total, all vehicles
 -\$1,009.59 Value of travel time changes, per day
 -\$243,856.18 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars	Trucks
Daily Estimate	-609.608 gallons	-12.441 gallons
	\$3.004 per gallon	\$3.004 per gallon
	-\$1,831.26 per day	-\$37.37 per day

Total, all vehicles
 -622.0 fuel consumption change, gallons per day
 (150,249.59) fuel consumption change, gallons per year

USER BENEFITS
Concept 70

-\$1,868.63 change in fuel cost, per day
-\$451,349.78 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$243,856.18	Value of Travel Time change, Per year
Operating Costs	-\$451,349.78	Value of Operating Costs change, per year
Total, User Benefits	-\$695,205.96	

Emissions

		Cars	Trucks
Daily emissions		-9.644 KG	-0.197 KG
Annual emissions		-2507.550 KG	-51.174 KG
CO2	368.4 0.971	-2434 KG	-50 KG
Annual total		(2,483.65)	
VOC	1.034 0.003	-7 KG	0 KG
Total		(6.97)	
NOx	0.693 0.002	-5 KG	0 KG
Total		(4.67)	
PM2.5	0.0041 0.000	0 KG	0 KG
Total		(0.03)	
Other	9.4044	0.025	

SUMMARY OF COSTS AND BENEFITS
 Concept 71

Construction Cost	
Supplemental Roadway Construction	\$0.00
Earthwork	\$0.00
Pavement	\$0.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$634,000.00
Signage	\$0.00
Utilities	\$0.00
Additional Lump Sum	\$0.00
Design and PM	\$127,000.00
ROW	\$0.00
Total	\$761,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Daily)	636 hr
Value of Travel Time (Annual)	\$2,000,569.50
Automobile Operating Costs (Annual)	\$1,220,795.18
Safety (Annual)	\$1,040,183.51
Total	\$4,261,548.20
Emissions (Annual)	
CO2	-20376 kg
NOx	-38 kg
VOC	-57 kg
Benefit:Cost Ratio	
NPV Benefits	\$18,505,344.75
NPV Operating Costs	\$0.00
NPV Capital Costs	\$746,158.11
Total Costs	\$746,158.11
Benefit:Cost Ratio	24.80

NET PRESENT VALUE CALCULATIONS

Concept 71

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$761,385.83
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$746,158.11
NPV Capital Costs			\$746,158.11

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$4,261,548	\$3,852,102	\$0	\$0
2022	0.8858	\$4,261,548	\$3,775,060	\$0	\$0
2023	0.8681	\$4,261,548	\$3,699,559	\$0	\$0
2024	0.8508	\$4,261,548	\$3,625,568	\$0	\$0
2025	0.8337	\$4,261,548	\$3,553,056	\$0	\$0
NPV		User Benefits	\$18,505,345	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE

Concept 71

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Supplemental Roadway Costs			\$0.00	\$0.00	\$0.00

\$0.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Earthwork Costs			\$0.00	\$0.00	\$0.00

\$0.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Pavement Costs			\$0.00	\$0.00	\$0.00

\$0.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00

\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00

\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Fifth Avenue Retiming	26 ea	\$4,554.00	\$118,404.00	\$23,680.80	\$147,768.19
Adaptive Signals	26 ea	\$15,000.00	\$390,000.00	\$78,000.00	\$486,720.00
Subtotal, Signal Costs			\$508,404.00	\$101,680.80	\$634,488.19

\$634,000.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00

\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00

\$0.00

SUBTOTAL, CONSTRUCTION COSTS			\$508,404.00	\$101,680.80	\$634,488.19
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\$634,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
		\$0.00	\$0.00	\$0.00

\$0.00

CONSTRUCTION COST ESTIMATE

Concept 71

TOTAL CONSTRUCTION COSTS	\$508,404.00	\$101,680.80	\$634,488.19
			\$634,000.00
DESIGN AND CM COSTS	\$101,680.80	\$20,336.16	\$126,897.64
			\$127,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM	\$610,084.80		\$761,385.83
			\$761,000.00

Safety
 Concept 71

Safety

Crash Type	$N_{pred,2010-2012}$	$N_{pred,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	304	101.28	0.83	84.06	17.22

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.05	0.37	1.79	5.73	9.27	\$ 1,040,183.51

USER BENEFITS
Concept 71

MOEs

Item	Per Year	
Delay	-165375	hr
Fuel	-437449	gal
Emissions	-20991	kg
Subtotal, MOEs		

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

Daily Estimate	-623.336 hrs	-12.721 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$8,032.06	-\$250.50

Total, all vehicles
 -\$8,282.56 Value of travel time changes, per day
 -\$2,000,569.50 Value of travel time changes, per year

Subtotal, Value of Time

USER BENEFITS
Concept 71

Automobile Operating Costs (Delay)

	Cars	Trucks
AM Peak Period		
Average Speed	20	
Change in Veh-Hrs	0.000 hours	0.000 hours
Fuel Consumption	0.022 gal/minute	0.102 gal/minute
	0.0 gallons	0.0 gallons
PM Peak Period		
Average Speed	20	
Change in Veh-Hrs	0.0 hours	0.0 hours
Fuel Consumption	0.022 gal/minute	0.102 gal/minute
	0.0 gallons	0.0 gallons
Fuel Consumption		
AM Peak Period	0.0 gallons	0.0 gallons
PM Peak Period	0.0 gallons	0.0 gallons
Total of Peaks	0.0 gallons	0.0 gallons
Daily Estimate	-1648.845 gallons	-33.650 gallons
	\$3.004 per gallon	\$3.004 per gallon
	-\$4,953.13 per day	-\$101.08 per day
Total, all vehicles		
	-1682.5 fuel consumption change, gallons per day	
	(406,389.87) fuel consumption change, gallons per year	
	-\$5,054.22 change in fuel cost, per day	
	-\$1,220,795.18 change in fuel cost, per year	

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$2,000,569.50	Value of Travel Time change, Per year
Operating Costs	-\$1,220,795.18	Value of Operating Costs change, per year
Total, User Benefits	-\$3,221,364.69	

USER BENEFITS
Concept 71

Emissions

		Cars	Trucks
Daily emissions		-79.122 KG	-1.615 KG
Annual emissions		-20571.668 KG	-419.830 KG
CO2	368.4	-19968 KG	-408 KG
	0.971		
Annual total		(20,375.61)	
VOC	1.034	-56 KG	-1 KG
	0.003		
Total		(57.19)	
NOx	0.693	-38 KG	-1 KG
	0.002		
Total		(38.33)	
PM2.5	0.0041	0 KG	0 KG
	0.000		
Total		(0.23)	
Other	9.4044	0.025	

SUMMARY OF COSTS AND BENEFITS
 Concept 72

Construction Cost	
Supplemental Roadway Construction	\$0.00
Earthwork	\$0.00
Pavement	\$0.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$719,000.00
Signage	\$0.00
Utilities	\$0.00
Additional Lump Sum	\$0.00
Design and PM	\$144,000.00
ROW	\$0.00
Total	\$863,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Daily)	136 hr
Value of Travel Time (Annual)	\$426,239.01
Automobile Operating Costs (Annual)	\$260,101.20
Safety (Annual)	\$200,991.23
Total	\$887,331.43
Emissions (Annual)	
CO2	-4341 kg
NOx	-8 kg
VOC	-12 kg
Benefit:Cost Ratio	
NPV Benefits	\$3,853,147.57
NPV Operating Costs	\$0.00
NPV Capital Costs	\$845,344.70
Total Costs	\$845,344.70
Benefit:Cost Ratio	4.56

NET PRESENT VALUE CALCULATIONS

Concept 72

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$862,596.63
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$845,344.70
NPV Capital Costs			\$845,344.70

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$887,331	\$802,077	\$0	\$0
2022	0.8858	\$887,331	\$786,036	\$0	\$0
2023	0.8681	\$887,331	\$770,315	\$0	\$0
2024	0.8508	\$887,331	\$754,909	\$0	\$0
2025	0.8337	\$887,331	\$739,811	\$0	\$0
NPV		User Benefits	\$3,853,148	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE

Concept 72

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Supplemental Roadway Costs			\$0.00	\$0.00	\$0.00

\$0.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Earthwork Costs			\$0.00	\$0.00	\$0.00

\$0.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Pavement Costs			\$0.00	\$0.00	\$0.00

\$0.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00

\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00

\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Murray Avenue Retiming	9 ea	\$4,554.00	\$40,986.00	\$8,197.20	\$51,150.53
Adaptive Signal	9 ea	\$15,000.00	\$135,000.00	\$27,000.00	\$168,480.00
Traffic Signal	2 ea	\$200,000.00	\$400,000.00	\$80,000.00	\$499,200.00
Subtotal, Signal Costs			\$575,986.00	\$115,197.20	\$718,830.53

\$719,000.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00

\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00

\$0.00

SUBTOTAL, CONSTRUCTION COSTS			\$575,986.00	\$115,197.20	\$718,830.53
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\$719,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
		\$0.00	\$0.00	\$0.00

\$0.00

CONSTRUCTION COST ESTIMATE

Concept 72

TOTAL CONSTRUCTION COSTS	\$575,986.00	\$115,197.20	\$718,830.53
			\$719,000.00
DESIGN AND CM COSTS	\$115,197.20	\$23,039.44	\$143,766.11
			\$144,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM	\$691,183.20		\$862,596.63
			\$863,000.00

Safety
 Concept 72

Safety

Crash Type	$N_{pred,2010-2012}$	$N_{pred,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	59	19.57	0.83	16.24	3.33

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.01	0.07	0.35	1.11	1.79	\$ 200,991.23

USER BENEFITS
Concept 72

MOEs

Item	Per Year	
Delay	-35235	hr
Fuel	-93202	gal
Emissions	-4472	kg
Subtotal, MOEs		

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

Daily Estimate	-132.807 hrs	-2.710 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$1,711.30	-\$53.37

Total, all vehicles -\$1,764.67 Value of travel time changes, per day
 -\$426,239.01 Value of travel time changes, per year

Subtotal, Value of Time

USER BENEFITS
 Concept 72

Automobile Operating Costs (Delay)

	Cars	Trucks
Daily Estimate	-351.301 gallons \$3.004 per gallon -\$1,055.31 per day	-7.169 gallons \$3.004 per gallon -\$21.54 per day
Total, all vehicles	-358.5 fuel consumption change, gallons per day (86,584.95) fuel consumption change, gallons per year -\$1,076.85 change in fuel cost, per day -\$260,101.20 change in fuel cost, per year	

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$426,239.01 Value of Travel Time change, Per year
Operating Costs	-\$260,101.20 Value of Operating Costs change, per year
Total, User Benefits	-\$686,340.21

USER BENEFITS
 Concept 72

Emissions

		Cars	Trucks
Daily emissions		-16.858 KG	-0.344 KG
Annual emissions		-4382.976 KG	-89.448 KG
CO2	368.4	-4254 KG	-87 KG
	0.971		
Annual total		(4,341.20)	
VOC	1.034	-12 KG	0 KG
	0.003		
Total		(12.18)	
NOx	0.693	-8 KG	0 KG
	0.002		
Total		(8.17)	
PM2.5	0.0041	0 KG	0 KG
	0.000		
Total		(0.05)	
Other	9.4044	0.025	

SUMMARY OF COSTS AND BENEFITS
 Concept 73

Construction Cost	
Supplemental Roadway Construction	\$0.00
Earthwork	\$0.00
Pavement	\$0.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$561,000.00
Signage	\$0.00
Utilities	\$0.00
Additional Lump Sum	\$0.00
Design and PM	\$112,000.00
ROW	\$0.00
Total	\$673,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Daily)	565 hr
Value of Travel Time (Annual)	\$1,776,397.14
Automobile Operating Costs (Annual)	\$1,083,999.87
Safety (Annual)	\$694,585.42
Total	\$3,554,982.42
Emissions (Annual)	
CO2	-18092 kg
NOx	-34 kg
VOC	-51 kg
Benefit:Cost Ratio	
NPV Benefits	\$15,437,153.89
NPV Operating Costs	\$0.00
NPV Capital Costs	\$660,062.95
Total Costs	\$660,062.95
Benefit:Cost Ratio	23.39

NET PRESENT VALUE CALCULATIONS

Concept 73

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$673,533.62
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$660,062.95
NPV Capital Costs			\$660,062.95

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224		\$0	\$0	\$0
2021	0.9039	\$3,554,982	\$3,213,423	\$0	\$0
2022	0.8858	\$3,554,982	\$3,149,154	\$0	\$0
2023	0.8681	\$3,554,982	\$3,086,171	\$0	\$0
2024	0.8508	\$3,554,982	\$3,024,448	\$0	\$0
2025	0.8337	\$3,554,982	\$2,963,959	\$0	\$0
NPV		User Benefits	\$15,437,154	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE

Concept 73

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Supplemental Roadway Costs			\$0.00	\$0.00	\$0.00

\$0.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Earthwork Costs			\$0.00	\$0.00	\$0.00

\$0.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Pavement Costs			\$0.00	\$0.00	\$0.00

\$0.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00

\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00

\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Forbes Avenue Retiming	23 ea	\$4,554.00	\$104,742.00	\$20,948.40	\$130,718.02
Adaptive Signals	23 ea	\$15,000.00	\$345,000.00	\$69,000.00	\$430,560.00
Subtotal, Signal Costs			\$449,742.00	\$89,948.40	\$561,278.02

\$561,000.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00

\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00

\$0.00

SUBTOTAL, CONSTRUCTION COSTS			\$449,742.00	\$89,948.40	\$561,278.02
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\$561,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
		\$0.00	\$0.00	\$0.00

\$0.00

TOTAL CONSTRUCTION COSTS		\$449,742.00	\$89,948.40	\$561,278.02
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\$561,000.00

DESIGN AND CM COSTS		\$89,948.40	\$17,989.68	\$112,255.60
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\$112,000.00

TOTAL, DESIGN, CONSTRUCTION AND CM		\$539,690.40		\$673,533.62
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\$673,000.00

Safety
Concept 73

Safety

Crash Type	$N_{pred,2010-2012}$	$N_{pred,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	203	67.63	0.83	56.13	11.50

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.03	0.25	1.20	3.83	6.19	\$ 694,585.42

USER BENEFITS
Concept 73

MOEs

Item	Per Year	
Delay	-146844	hr
Fuel	-388431	gal
Emissions	-18639	kg
Subtotal, MOEs		

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

Daily Estimate	-553.488 hrs	-11.296 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$7,132.03	-\$222.43

Total, all vehicles
 -\$7,354.46 Value of travel time changes, per day
 -\$1,776,397.14 Value of travel time changes, per year

Subtotal, Value of Time

USER BENEFITS
 Concept 73

Automobile Operating Costs (Delay)

	Cars	Trucks
Daily Estimate	-1464.085 gallons	-29.879 gallons
	\$3.004 per gallon	\$3.004 per gallon
	-\$4,398.11 per day	-\$89.76 per day
Total, all vehicles	-1494.0 fuel consumption change, gallons per day (360,852.15) fuel consumption change, gallons per year	
	-\$4,487.87 change in fuel cost, per day -\$1,083,999.87 change in fuel cost, per year	

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$1,776,397.14 Value of Travel Time change, Per year
Operating Costs	-\$1,083,999.87 Value of Operating Costs change, per year
Total, User Benefits	-\$2,860,397.01

USER BENEFITS
 Concept 73

Emissions

		Cars	Trucks
Daily emissions		-70.256 KG	-1.434 KG
Annual emissions		-18266.525 KG	-372.786 KG
CO2	368.4	-17731 KG	-362 KG
	0.971		
Annual total		(18,092.44)	
VOC	1.034	-50 KG	-1 KG
	0.003		
Total		(50.78)	
NOx	0.693	-33 KG	-1 KG
	0.002		
Total		(34.03)	
PM2.5	0.0041	0 KG	0 KG
	0.000		
Total		(0.20)	
Other	9.4044	0.025	

SUMMARY OF COSTS AND BENEFITS
 Concept 74

Construction Cost	
Supplemental Roadway Construction	\$0.00
Earthwork	\$0.00
Pavement	\$0.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$397,000.00
Signage	\$0.00
Utilities	\$0.00
Additional Lump Sum	\$0.00
Design and PM	\$79,000.00
ROW	\$0.00
Total	\$476,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	0 hr
Value of Travel Time (Annual)	\$0.00
Automobile Operating Costs (Annual)	\$0.00
Safety (Annual)	\$256,961.82
Total	\$256,961.82
Emissions (Annual)	
CO2	0 kg
NOx	0 kg
VOC	0 kg
Benefit:Cost Ratio	
NPV Benefits	\$1,352,844.28
NPV Operating Costs	\$0.00
NPV Capital Costs	\$466,712.06
Total Costs	\$466,712.06
Benefit:Cost Ratio	2.90

NET PRESENT VALUE CALCULATIONS

Concept 74

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$476,236.80
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$466,712.06
NPV Capital Costs			\$466,712.06

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$256,962	\$237,013	\$0	\$0
2021	0.9039	\$256,962	\$232,273	\$0	\$0
2022	0.8858	\$256,962	\$227,628	\$0	\$0
2023	0.8681	\$256,962	\$223,075	\$0	\$0
2024	0.8508	\$256,962	\$218,614	\$0	\$0
2025	0.8337	\$256,962	\$214,241	\$0	\$0
NPV		User Benefits	\$1,352,844	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 74

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Supplemental Roadway Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Earthwork Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Pavement Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Rodi Road	1 ls	\$22,700.00	\$22,700.00	\$4,540.00	\$28,329.60
Beulah Road	1 ls	\$51,400.00	\$51,400.00	\$10,280.00	\$64,147.20
Frankstown Road	1 ls	\$119,100.00	\$119,100.00	\$23,820.00	\$148,636.80
Penn Avenue	1 ls	\$37,600.00	\$37,600.00	\$7,520.00	\$46,924.80
Braddock Avenue	1 ls	\$24,800.00	\$24,800.00	\$4,960.00	\$30,950.40
Ardmore Boulevard	1 ls	\$46,100.00	\$46,100.00	\$9,220.00	\$57,532.80
Greensburg Pike	1 ls	\$16,300.00	\$16,300.00	\$3,260.00	\$20,342.40
Subtotal, Signal Costs			\$318,000.00	\$63,600.00	\$396,864.00
					\$397,000.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00
					\$0.00

SUBTOTAL, CONSTRUCTION COSTS			\$318,000.00	\$63,600.00	\$396,864.00
					\$397,000.00

CONSTRUCTION COST ESTIMATE
 Concept 74

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
		\$0.00	\$0.00	\$0.00
				\$0.00
TOTAL CONSTRUCTION COSTS		\$318,000.00	\$63,600.00	\$396,864.00
				\$397,000.00
DESIGN AND CM COSTS		\$63,600.00	\$12,720.00	\$79,372.80
				\$79,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM		\$381,600.00		\$476,236.80
				\$476,000.00

Safety
 Concept 74

Safety

Crash Type	$N_{pred,2010-2012}$	$N_{pred,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Pedestrian Strikes	9	3.13	0.63	1.97	1.16

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.02	0.25	0.34	0.47	0.08	\$ 256,961.82

SUMMARY OF COSTS AND BENEFITS
 Concept 75

Construction Cost	
Supplemental Roadway Construction	\$0.00
Earthwork	\$0.00
Pavement	\$0.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$757,000.00
Signage	\$0.00
Utilities	\$0.00
Additional Lump Sum	\$0.00
Design and PM	\$151,000.00
ROW	\$0.00
Total	\$908,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Daily)	1375 hr
Value of Travel Time (Annual)	\$4,325,625.24
Automobile Operating Costs (Annual)	\$2,639,599.60
Safety (Annual)	\$967,263.86
Total	\$7,932,488.70
Emissions (Annual)	
CO2	-44056 kg
NOx	-83 kg
VOC	-124 kg
Benefit:Cost Ratio	
NPV Benefits	\$34,446,034.94
NPV Operating Costs	\$0.00
NPV Capital Costs	\$889,650.06
Total Costs	\$889,650.06
Benefit:Cost Ratio	38.72

NET PRESENT VALUE CALCULATIONS

Concept 75

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$907,806.18
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$889,650.06
NPV Capital Costs			\$889,650.06

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$7,932,489	\$7,170,342	\$0	\$0
2022	0.8858	\$7,932,489	\$7,026,935	\$0	\$0
2023	0.8681	\$7,932,489	\$6,886,396	\$0	\$0
2024	0.8508	\$7,932,489	\$6,748,668	\$0	\$0
2025	0.8337	\$7,932,489	\$6,613,695	\$0	\$0
NPV		User Benefits	\$34,446,035	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 75

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Supplemental Roadway Costs			\$0.00	\$0.00	\$0.00

\$0.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Earthwork Costs			\$0.00	\$0.00	\$0.00

\$0.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Pavement Costs			\$0.00	\$0.00	\$0.00

\$0.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00

\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00

\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Signal Retiming Rt 22 Nottingham Dr to Ext to Tpk	23 ea	\$4,554.00	\$104,742.00	\$20,948.40	\$130,718.02
Signal Retiming Rt 30 Brinton Rd to Ramps to Tri-Boro Exp.	8 ea	\$4,554.00	\$36,432.00	\$7,286.40	\$45,467.14
Adaptive Signals Rt 22	23 ea	\$15,000.00	\$345,000.00	\$69,000.00	\$430,560.00
Adaptive Signals Rt 30	8 ls	\$15,000.00	\$120,000.00	\$24,000.00	\$149,760.00
Subtotal, Signal Costs			\$606,174.00	\$121,234.80	\$756,505.15

\$757,000.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00

\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00

\$0.00

SUBTOTAL, CONSTRUCTION COSTS			\$606,174.00	\$121,234.80	\$756,505.15
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\$757,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
		\$0.00	\$0.00	\$0.00

\$0.00

CONSTRUCTION COST ESTIMATE
Concept 75

TOTAL CONSTRUCTION COSTS	\$606,174.00	\$121,234.80	\$756,505.15
			\$757,000.00
DESIGN AND CM COSTS	\$121,234.80	\$24,246.96	\$151,301.03
			\$151,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM	\$727,408.80		\$907,806.18
			\$908,000.00

Safety
 Concept 75

Safety

Crash Type	$N_{pred,2010-2012}$	$N_{pred,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	283	94.18	0.83	78.17	16.01

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.04	0.34	1.67	5.33	8.62	\$ 967,263.86

USER BENEFITS
Concept 75

MOEs

Item	Per Year	
Delay	-268064	hr
Fuel	-709082	gal
Emissions	-34026	kg
Subtotal, MOEs		

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

Daily Estimate	-1010.395 hrs	-20.620 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$13,019.55	-\$406.06

Total, all vehicles
 -\$13,425.60 Value of travel time changes, per day
 -\$3,242,820.41 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars	Trucks
Daily Estimate	-2672.693 gallons	-54.545 gallons
	\$3.004 per gallon	\$3.004 per gallon
	-\$8,028.77 per day	-\$163.85 per day

Total, all vehicles
 -2727.2 fuel consumption change, gallons per day
 (658,737.11) fuel consumption change, gallons per year

USER BENEFITS
Concept 75

-\$8,192.62 change in fuel cost, per day
-\$1,978,846.29 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$3,242,820.41	Value of Travel Time change, Per year
Operating Costs	-\$1,978,846.29	Value of Operating Costs change, per year
Total, User Benefits	-\$5,221,666.70	

Emissions

		Cars	Trucks
Daily emissions		-128.252 KG	-2.617 KG
Annual emissions		-33345.618 KG	-680.523 KG
CO2	368.4 0.971	-32367 KG	-661 KG
Annual total		(33,027.82)	
VOC	1.034 0.003	-91 KG	-2 KG
Total		(92.70)	
NOx	0.693 0.002	-61 KG	-1 KG
Total		(62.13)	
PM2.5	0.0041 0.000	0 KG	0 KG
Total		(0.37)	
Other	9.4044	0.025	

USER BENEFITS
Concept 75

MOEs

Item	Per Year	
Delay	-89509	hr
Fuel	-236768	gal
Emissions	-11362	kg
Subtotal, MOEs		

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

Daily Estimate	-337.379 hrs	-6.885 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$4,347.34	-\$135.59

Total, all vehicles
-\$4,482.92 Value of travel time changes, per day
-\$1,082,804.84 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars	Trucks
Daily Estimate	-892.435 gallons	-18.213 gallons
	\$3.004 per gallon	\$3.004 per gallon
	-\$2,680.87 per day	-\$54.71 per day

Total, all vehicles
-910.6 fuel consumption change, gallons per day
(219,957.83) fuel consumption change, gallons per year

-\$2,735.59 change in fuel cost, per day
 -\$660,753.31 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$1,082,804.84	Value of Travel Time change, Per year
Operating Costs	-\$660,753.31	Value of Operating Costs change, per year
Total, User Benefits	-\$1,743,558.15	

Emissions

		Cars	Trucks
Daily emissions		-42.825 KG	-0.874 KG
Annual emissions		-11134.381 KG	-227.232 KG
CO2	368.4 0.971	-10808 KG	-221 KG
Annual total		(11,028.27)	
VOC	1.034 0.003	-30 KG	-1 KG
Total		(30.95)	
NOx	0.693 0.002	-20 KG	0 KG
Total		(20.75)	
PM2.5	0.0041 0.000	0 KG	0 KG
Total		(0.12)	
Other	9.4044	0.025	

USER BENEFITS
Concept 75

MOEs

Item	Per Year	
Delay	-357573	hr
Fuel	-945850	gal
Emissions	-45388	kg
Subtotal, MOEs		

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

Daily Estimate	-1347.775 hrs	-27.506 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$17,366.89	-\$541.64

Total, all vehicles
 -\$17,908.53 Value of travel time changes, per day
 -\$4,325,625.24 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars	Trucks
Daily Estimate	-3565.128 gallons	-72.758 gallons
	\$3.004 per gallon	\$3.004 per gallon
	-\$10,709.64 per day	-\$218.56 per day

Total, all vehicles
 -3637.9 fuel consumption change, gallons per day
 (878,694.94) fuel consumption change, gallons per year

-\$10,928.21 change in fuel cost, per day
 -\$2,639,599.60 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$4,325,625.24	Value of Travel Time change, Per year
Operating Costs	-\$2,639,599.60	Value of Operating Costs change, per year
Total, User Benefits	-\$6,965,224.85	

Emissions

		Cars	Trucks
Daily emissions		-171.077 KG	-3.491 KG
Annual emissions		-44479.999 KG	-907.755 KG
CO2	368.4 0.971	-43175 KG	-881 KG
Annual total		(44,056.09)	
VOC	1.034 0.003	-121 KG	-2 KG
Total		(123.65)	
NOx	0.693 0.002	-81 KG	-2 KG
Total		(82.87)	
PM2.5	0.0041 0.000	0 KG	0 KG
Total		(0.49)	
Other	9.4044	0.025	

SUMMARY OF COSTS AND BENEFITS
 Concept 76

Construction Cost	
Supplemental Roadway Construction	\$0.00
Earthwork	\$0.00
Pavement	\$0.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$146,000.00
Signage	\$0.00
Utilities	\$0.00
Additional Lump Sum	\$0.00
Design and PM	\$29,000.00
ROW	\$0.00
Total	\$175,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	131 hr
Value of Travel Time (Annual)	\$413,374.48
Automobile Operating Costs (Annual)	\$252,250.96
Safety (Annual)	\$210,131.86
Total	\$875,757.30
Emissions (Annual)	
CO2	-4210 kg
NOx	-8 kg
VOC	-12 kg
Benefit:Cost Ratio	
NPV Benefits	\$3,802,888.04
NPV Operating Costs	\$0.00
NPV Capital Costs	\$172,190.33
Total Costs	\$172,190.33
Benefit:Cost Ratio	22.09

NET PRESENT VALUE CALCULATIONS

Concept 76

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$175,704.42
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$172,190.33
NPV Capital Costs			\$172,190.33

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$875,757	\$791,615	\$0	\$0
2022	0.8858	\$875,757	\$775,783	\$0	\$0
2023	0.8681	\$875,757	\$760,267	\$0	\$0
2024	0.8508	\$875,757	\$745,062	\$0	\$0
2025	0.8337	\$875,757	\$730,161	\$0	\$0
NPV		User Benefits	\$3,802,888	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE

Concept 76

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Supplemental Roadway Costs			\$0.00	\$0.00	\$0.00

\$0.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Earthwork Costs			\$0.00	\$0.00	\$0.00

\$0.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Pavement Costs			\$0.00	\$0.00	\$0.00

\$0.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00

\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00

\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Hazelwood 885 Retiming	6 ea	\$4,554.00	\$27,324.00	\$5,464.80	\$34,100.35
Adaptive Signals	6 ea	\$15,000.00	\$90,000.00	\$18,000.00	\$112,320.00
Subtotal, Signal Costs			\$117,324.00	\$23,464.80	\$146,420.35

\$146,000.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00

\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00

\$0.00

SUBTOTAL, CONSTRUCTION COSTS			\$117,324.00	\$23,464.80	\$146,420.35
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\$146,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
		\$0.00	\$0.00	\$0.00

\$0.00

CONSTRUCTION COST ESTIMATE

Concept 76

TOTAL CONSTRUCTION COSTS	\$117,324.00	\$23,464.80	\$146,420.35
			\$146,000.00
DESIGN AND CM COSTS	\$23,464.80	\$4,692.96	\$29,284.07
			\$29,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM	\$140,788.80		\$175,704.42
			\$175,000.00

Safety
 Concept 76

Safety

Crash Type	$N_{pred,2010-2012}$	$N_{pred,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	61	20.46	0.83	16.98	3.48

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.01	0.07	0.36	1.16	1.87	\$ 210,131.86

USER BENEFITS
Concept 76

MOEs

Item	Per Year	
Delay	-34171	hr
Fuel	-90389	gal
Emissions	-4337	kg
Subtotal, MOEs		

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

Daily Estimate	-128.799 hrs	-2.629 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$1,659.65	-\$51.76

Total, all vehicles
 -\$1,711.41 Value of travel time changes, per day
 -\$413,374.48 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars	Trucks
Daily Estimate	-340.698 gallons	-6.953 gallons
	\$3.004 per gallon	\$3.004 per gallon
	-\$1,023.46 per day	-\$20.89 per day

Total, all vehicles
 -347.7 fuel consumption change, gallons per day
 (83,971.69) fuel consumption change, gallons per year

USER BENEFITS
Concept 76

-\$1,044.34 change in fuel cost, per day
-\$252,250.96 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$413,374.48	Value of Travel Time change, Per year
Operating Costs	-\$252,250.96	Value of Operating Costs change, per year
Total, User Benefits	-\$665,625.44	

Emissions

		Cars	Trucks
Daily emissions		-16.349 KG	-0.334 KG
Annual emissions		-4250.691 KG	-86.749 KG
CO2	368.4 0.971	-4126 KG	-84 KG
Annual total		(4,210.18)	
VOC	1.034 0.003	-12 KG	0 KG
Total		(11.82)	
NOx	0.693 0.002	-8 KG	0 KG
Total		(7.92)	
PM2.5	0.0041 0.000	0 KG	0 KG
Total		(0.05)	
Other	9.4044	0.025	

SUMMARY OF COSTS AND BENEFITS
 Concept 77

Construction Cost	
Supplemental Roadway Construction	\$0.00
Earthwork	\$0.00
Pavement	\$0.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$48,800.00
Signage	\$0.00
Utilities	\$0.00
Additional Lump Sum	\$0.00
Design and PM	\$9,800.00
ROW	\$0.00
Total	\$58,600.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	97 hr
Value of Travel Time (Annual)	\$306,269.80
Automobile Operating Costs (Annual)	\$186,893.13
Safety (Annual)	\$74,768.33
Total	\$567,931.26
Emissions (Annual)	
CO2	-3119 kg
NOx	-6 kg
VOC	-9 kg
Benefit:Cost Ratio	
NPV Benefits	\$2,466,184.41
NPV Operating Costs	\$0.00
NPV Capital Costs	\$57,396.78
Total Costs	\$57,396.78
Benefit:Cost Ratio	42.97

NET PRESENT VALUE CALCULATIONS

Concept 77

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$58,568.14
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$57,396.78
NPV Capital Costs			\$57,396.78

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$567,931	\$513,365	\$0	\$0
2022	0.8858	\$567,931	\$503,098	\$0	\$0
2023	0.8681	\$567,931	\$493,036	\$0	\$0
2024	0.8508	\$567,931	\$483,175	\$0	\$0
2025	0.8337	\$567,931	\$473,511	\$0	\$0
NPV		User Benefits	\$2,466,184	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE

Concept 77

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Supplemental Roadway Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Earthwork Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Pavement Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
William Penn Retiming	2 ea	\$4,554.00	\$9,108.00	\$1,821.60	\$11,366.78
Adaptive Signals	2 ea	\$15,000.00	\$30,000.00	\$6,000.00	\$37,440.00
Subtotal, Signal Costs			\$39,108.00	\$7,821.60	\$48,806.78
					\$48,800.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00
					\$0.00

SUBTOTAL, CONSTRUCTION COSTS			\$39,108.00	\$7,821.60	\$48,806.78
					\$48,800.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
		\$0.00	\$0.00	\$0.00
				\$0.00

TOTAL CONSTRUCTION COSTS			\$39,108.00	\$7,821.60	\$48,806.78
					\$48,800.00

DESIGN AND CM COSTS			\$7,821.60	\$1,564.32	\$9,761.36
					\$9,800.00

TOTAL, DESIGN, CONSTRUCTION AND CM			\$46,929.60		\$58,568.14
					\$58,600.00

Safety
 Concept 77

Safety

Crash Type	$N_{pred,2010-2012}$	$N_{pred,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	22	7.28	0.83	6.04	1.24

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.03	0.13	0.41	0.67	\$ 74,768.33

USER BENEFITS
Concept 77

MOEs

Item	Per Year	
Delay	-25317	hr
Fuel	-66970	gal
Emissions	-3214	kg
Subtotal, MOEs		

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

Daily Estimate	-95.427 hrs	-1.947 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$1,229.64	-\$38.35

Total, all vehicles
 -\$1,267.99 Value of travel time changes, per day
 -\$306,269.80 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars	Trucks
Daily Estimate	-252.424 gallons	-5.152 gallons
	\$3.004 per gallon	\$3.004 per gallon
	-\$758.28 per day	-\$15.48 per day

Total, all vehicles
 -257.6 fuel consumption change, gallons per day
 (62,214.76) fuel consumption change, gallons per year

USER BENEFITS
Concept 77

-\$773.76 change in fuel cost, per day
-\$186,893.13 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$306,269.80	Value of Travel Time change, Per year
Operating Costs	-\$186,893.13	Value of Operating Costs change, per year
Total, User Benefits	-\$493,162.93	

Emissions

		Cars	Trucks
Daily emissions		-12.113 KG	-0.247 KG
Annual emissions		-3149.344 KG	-64.272 KG
CO2	368.4 0.971	-3057 KG	-62 KG
Annual total		(3,119.33)	
VOC	1.034 0.003	-9 KG	0 KG
Total		(8.76)	
NOx	0.693 0.002	-6 KG	0 KG
Total		(5.87)	
PM2.5	0.0041 0.000	0 KG	0 KG
Total		(0.03)	
Other	9.4044	0.025	

SUMMARY OF COSTS AND BENEFITS
 Concept 78

Construction Cost	
Supplemental Roadway Construction	\$0.00
Earthwork	\$0.00
Pavement	\$0.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$24,403.72
Signage	\$0.00
Utilities	\$0.00
Additional Lump Sum	\$0.00
Design and PM	\$4,900.00
ROW	\$0.00
Total	\$29,303.72
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	43 hr
Value of Travel Time (Annual)	\$135,379.60
Automobile Operating Costs (Annual)	\$82,753.10
Safety (Annual)	\$54,124.87
Total	\$272,257.58
Emissions (Annual)	
CO2	-1380 kg
NOx	-3 kg
VOC	-4 kg
Benefit:Cost Ratio	
NPV Benefits	\$1,182,251.16
NPV Operating Costs	\$0.00
NPV Capital Costs	\$28,698.77
Total Costs	\$28,698.77
Benefit:Cost Ratio	41.20

NET PRESENT VALUE CALCULATIONS
 Concept E03665 WO2 - Draft Final Design Price Proposal

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$29,284.46
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$28,698.77
NPV Capital Costs			\$28,698.77

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$272,258	\$246,099	\$0	\$0
2022	0.8858	\$272,258	\$241,177	\$0	\$0
2023	0.8681	\$272,258	\$236,354	\$0	\$0
2024	0.8508	\$272,258	\$231,627	\$0	\$0
2025	0.8337	\$272,258	\$226,994	\$0	\$0
NPV		User Benefits	\$1,182,251	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept E03665 WO2 - Draft Final Design Price Proposal

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Supplemental Roadway Costs			\$0.00	\$0.00	\$0.00

\$0.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Earthwork Costs			\$0.00	\$0.00	\$0.00

\$0.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Pavement Costs			\$0.00	\$0.00	\$0.00

\$0.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00

\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00

\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Ardmore Blvd/Brinton Rd Traffic Signal	1 ls	\$4,554.26	\$4,554.26	\$910.85	\$5,683.72
Adaptive Signal Timing	1 ea	\$15,000.00	\$15,000.00	\$3,000.00	\$18,720.00
Subtotal, Signal Costs			\$19,554.26	\$3,910.85	\$24,403.72

\$24,400.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00

\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00

\$0.00

SUBTOTAL, CONSTRUCTION COSTS			\$19,554.26	\$3,910.85	\$24,403.72
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\$24,400.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
		\$0.00	\$0.00	\$0.00

\$0.00

CONSTRUCTION COST ESTIMATE
Concept E03665 WO2 - Draft Final Design Price Proposal

TOTAL CONSTRUCTION COSTS	\$19,554.26	\$3,910.85	\$24,403.72
			\$24,400.00
DESIGN AND CM COSTS	\$3,910.85	\$782.17	\$4,880.74
			\$4,900.00
TOTAL, DESIGN, CONSTRUCTION AND CM	\$23,465.11		\$29,284.46
			\$29,300.00

Safety
 Concept E03665 WO2 - Draft Final Design Price Proposal

Safety

Crash Type	$N_{pred,2010-2012}$	$N_{pred,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	16	5.27	0.83	4.37	0.90

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.02	0.09	0.30	0.48	\$ 54,124.87

USER BENEFITS
 Concept E03665 WO2 - Draft Final Design Price Proposal

MOEs

Item	Per Year	
Delay	-11191	hr
Fuel	-29653	gal
Emissions	-1422	kg
Subtotal, MOEs		

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

Daily Estimate	-42.181 hrs	-0.861 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$543.53	-\$16.95

Total, all vehicles
 -\$560.49 Value of travel time changes, per day
 -\$135,379.60 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars	Trucks
Daily Estimate	-111.769 gallons	-2.281 gallons
	\$3.004 per gallon	\$3.004 per gallon
	-\$335.75 per day	-\$6.85 per day

Total, all vehicles
 -114.1 fuel consumption change, gallons per day
 (27,547.64) fuel consumption change, gallons per year

USER BENEFITS
 Concept E03665 WO2 - Draft Final Design Price Proposal

-\$342.61 change in fuel cost, per day
 -\$82,753.10 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$135,379.60	Value of Travel Time change, Per year
Operating Costs	-\$82,753.10	Value of Operating Costs change, per year
Total, User Benefits	-\$218,132.70	

Emissions

		Cars	Trucks
Daily emissions		-5.360 KG	-0.109 KG
Annual emissions		-1393.560 KG	-28.440 KG
CO2	368.4 0.971	-1353 KG	-28 KG
Annual total		(1,380.28)	
VOC	1.034 0.003	-4 KG	0 KG
Total		(3.87)	
NOx	0.693 0.002	-3 KG	0 KG
Total		(2.60)	
PM2.5	0.0041 0.000	0 KG	0 KG
Total		(0.02)	
Other	9.4044	0.025	

SUMMARY OF COSTS AND BENEFITS
 Concept 79

Construction Cost	
Supplemental Roadway Construction	\$0.00
Earthwork	\$0.00
Pavement	\$0.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$970,000.00
Signage	\$0.00
Utilities	\$0.00
Additional Lump Sum	\$0.00
Design and PM	\$190,000.00
ROW	\$0.00
Total	\$1,160,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Daily)	235 hr
Value of Travel Time (Annual)	\$739,646.27
Automobile Operating Costs (Annual)	\$451,349.78
Safety (Annual)	\$265,078.36
Total	\$1,456,074.41
Emissions (Annual)	
CO2	-7533 kg
NOx	-14 kg
VOC	-21 kg
Benefit:Cost Ratio	
NPV Benefits	\$6,322,856.80
NPV Operating Costs	\$0.00
NPV Capital Costs	\$1,138,874.30
Total Costs	\$1,138,874.30
Benefit:Cost Ratio	5.55

NET PRESENT VALUE CALCULATIONS
 Concept 79

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$1,162,116.63
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$1,138,874.30
NPV Capital Costs			\$1,138,874.30

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$1,456,074	\$1,316,176	\$0	\$0
2022	0.8858	\$1,456,074	\$1,289,852	\$0	\$0
2023	0.8681	\$1,456,074	\$1,264,055	\$0	\$0
2024	0.8508	\$1,456,074	\$1,238,774	\$0	\$0
2025	0.8337	\$1,456,074	\$1,213,999	\$0	\$0
NPV		User Benefits	\$6,322,857	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE

Concept 79

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Supplemental Roadway Costs			\$0.00	\$0.00	\$0.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Earthwork Costs			\$0.00	\$0.00	\$0.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Pavement Costs			\$0.00	\$0.00	\$0.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Boulevard of Allies Signal Retiming	9 ea	\$4,554.00	\$40,986.00	\$8,197.20	\$51,150.53
Adaptive Signals	9 ea	\$15,000.00	\$135,000.00	\$27,000.00	\$168,480.00
Traffic Signal	3 ea	\$200,000.00	\$600,000.00	\$120,000.00	\$748,800.00
Subtotal, Signal Costs			\$775,986.00	\$155,197.20	\$968,430.53

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00

SUBTOTAL, CONSTRUCTION COSTS			\$775,986.00	\$155,197.20	\$968,430.53
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Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
		\$0.00	\$0.00	\$0.00

TOTAL CONSTRUCTION COSTS		\$775,986.00	\$155,197.20	\$968,430.53
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DESIGN AND CM COSTS		\$155,197.20	\$31,039.44	\$193,686.11
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TOTAL, DESIGN, CONSTRUCTION AND CM		\$931,183.20		\$1,162,116.63
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Safety
 Concept 79

Safety

Crash Type	$N_{pred,2010-2012}$	$N_{pred,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	77	25.81	0.83	21.42	4.39

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.01	0.09	0.46	1.46	2.36	\$ 265,078.36

USER BENEFITS
Concept 79

MOEs

Item	Per Year	
Delay	-61142	hr
Fuel	-161733	gal
Emissions	-7761	kg
Subtotal, MOEs		

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

Daily Estimate	-230.458 hrs	-4.703 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$2,969.59	-\$92.62

Total, all vehicles
-\$3,062.21 Value of travel time changes, per day
-\$739,646.27 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars	Trucks
Daily Estimate	-609.608 gallons	-12.441 gallons
	\$3.004 per gallon	\$3.004 per gallon
	-\$1,831.26 per day	-\$37.37 per day

Total, all vehicles
-622.0 fuel consumption change, gallons per day
(150,249.59) fuel consumption change, gallons per year

USER BENEFITS
Concept 79

-\$1,868.63 change in fuel cost, per day
-\$451,349.78 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$739,646.27	Value of Travel Time change, Per year
Operating Costs	-\$451,349.78	Value of Operating Costs change, per year
Total, User Benefits	-\$1,190,996.05	

Emissions

		Cars	Trucks
Daily emissions		-29.253 KG	-0.597 KG
Annual emissions		-7605.713 KG	-155.219 KG
CO2	368.4 0.971	-7383 KG	-151 KG
Annual total		(7,533.23)	
VOC	1.034 0.003	-21 KG	0 KG
Total		(21.14)	
NOx	0.693 0.002	-14 KG	0 KG
Total		(14.17)	
PM2.5	0.0041 0.000	0 KG	0 KG
Total		(0.08)	
Other	9.4044	0.025	

SUMMARY OF COSTS AND BENEFITS
 Concept 80

Construction Cost	
Supplemental Roadway Construction	\$0.00
Earthwork	\$0.00
Pavement	\$0.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$24,403.39
Signage	\$0.00
Utilities	\$0.00
Additional Lump Sum	\$0.00
Design and PM	\$4,900.00
ROW	\$0.00
Total	\$29,303.39
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	7 hr
Value of Travel Time (Annual)	\$31,452.25
Automobile Operating Costs (Annual)	\$17,516.87
Safety (Annual)	\$56,384.36
Total	\$105,353.48
Emissions (Annual)	
CO2	-52926 kg
NOx	-106 kg
VOC	-114 kg
Benefit:Cost Ratio	
NPV Benefits	\$457,486.90
NPV Operating Costs	\$0.00
NPV Capital Costs	\$28,698.39
Total Costs	\$28,698.39
Benefit:Cost Ratio	15.94

NET PRESENT VALUE CALCULATIONS

Concept 80

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$29,284.07
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$28,698.39
NPV Capital Costs			\$28,698.39

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$105,353	\$95,231	\$0	\$0
2022	0.8858	\$105,353	\$93,327	\$0	\$0
2023	0.8681	\$105,353	\$91,460	\$0	\$0
2024	0.8508	\$105,353	\$89,631	\$0	\$0
2025	0.8337	\$105,353	\$87,838	\$0	\$0
NPV		User Benefits	\$457,487	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE

Concept 80

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Supplemental Roadway Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Earthwork Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Pavement Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Ardmore Blvd / Ross Avenue Retiming	1 ls	\$4,554.00	\$4,554.00	\$910.80	\$5,683.39
Adaptive Signal Timing	1 ea	\$15,000.00	\$15,000.00	\$3,000.00	\$18,720.00
Subtotal, Signal Costs			\$19,554.00	\$3,910.80	\$24,403.39
					\$24,400.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00
					\$0.00

SUBTOTAL, CONSTRUCTION COSTS			\$19,554.00	\$3,910.80	\$24,403.39
					\$24,400.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
		\$0.00	\$0.00	\$0.00
				\$0.00

TOTAL CONSTRUCTION COSTS		\$19,554.00	\$3,910.80	\$24,403.39
				\$24,400.00

DESIGN AND CM COSTS		\$3,910.80	\$782.16	\$4,880.68
				\$4,900.00

TOTAL, DESIGN, CONSTRUCTION AND CM		\$23,464.80		\$29,284.07
				\$29,300.00

Safety
 Concept 80

Safety

Crash Type	$N_{pred,2010-2012}$	$N_{pred,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	16	5.49	0.83	4.56	0.93

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.02	0.10	0.31	0.50	\$ 56,384.36

USER BENEFITS
Concept 80

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:PM Veh-Hrs
No-build	0	0	18.962
Build	0	0	17.274
Change	0	0	-1.688
Subtotal, MOEs			

Improvement only during peak period? Yes

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	-1.600 hrs	-0.09 hrs
PM Peak Period	-0.597 hrs	-0.02 hrs
Total of Peaks	-2.198 hrs	-0.103 hrs
Daily Estimate	-6.593 hrs	-0.396 hrs
Value of Time	-\$84.96	-\$7.80

Total, all vehicles
-\$92.76 Value of travel time changes, per day
-\$31,452.25 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars	Trucks
AM Peak Period		
Average Speed	35	
Change in Veh-Hrs	-1.600 hours	-0.087 hours
Fuel Consumption	0.034 gal/minute	0.203 gal/minute
	-3.3 gallons	-1.1 gallons

USER BENEFITS
Concept 80

PM Peak Period

Average Speed	35		
Change in Veh-Hrs		-0.6 hours	0.0 hours
Fuel Consumption		0.034 gal/minute	0.203 gal/minute
		-1.2 gallons	-0.2 gallons

Fuel Consumption

AM Peak Period		-3.3 gallons	-1.1 gallons
PM Peak Period		-1.2 gallons	-0.2 gallons
Total of Peaks		-4.5 gallons	-1.2 gallons
Daily Estimate		-13.450 gallons	-3.747 gallons
		\$3.004 per gallon	\$3.004 per gallon
		-\$40.40 per day	-\$11.26 per day

Total, all vehicles

-17.2 fuel consumption change, gallons per day
 (5,831.18) fuel consumption change, gallons per year

 -\$51.66 change in fuel cost, per day
 -\$17,516.87 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-	\$31,452.25	Value of Travel Time change, Per year
Operating Costs	-	\$17,516.87	Value of Operating Costs change, per year
Total, User Benefits	-	\$48,969.13	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-13.450 gallons	-3.747 gallons
Annual estimate	-4560.618 gallons	-1270.565
CO	19.4 lb/gal 8799.6848 grams/gal	22.2 lb/gal 10069.7424 grams/gal
	(40,131,997.74) g	(12,794,261.25) g
Total	(52,926,258.99) g	

USER BENEFITS
Concept 80

VOC

24.62 grams/gal

1.27 grams/gal

(112,278.06) g

(1,613.62)

Total

(113,891.68) g

NOx

16.5 grams/gal

24.52 grams/gal

(75,250.19) g

(31,154.25)

Total

(106,404.44) g

PM2.5

0.09761905 grams/gal

0.136 grams/gal

(445.20) g

(172.80)

Total

(618.00) g



SUMMARY OF COSTS AND BENEFITS
 Concept 82

Construction Cost	
Supplemental Roadway Construction	\$11,000,000.00
Earthwork	\$10,000,000.00
Pavement	\$15,000,000.00
Walls	\$122,000,000.00
Bridges	\$84,000,000.00
Traffic Signals	\$0.00
Signage	\$0.00
Utilities	\$12,000,000.00
Additional Lump Sum	\$20,000,000.00
Design and PM	\$55,000,000.00
ROW	\$353,381.88
Total	\$329,353,381.88
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	1041 hr
Value of Travel Time (Annual)	\$4,607,461.66
Automobile Operating Costs (Annual)	\$1,060,176.47
Safety (Annual)	\$145,463.70
Total	\$5,813,101.83
Emissions (Annual)	
CO2	-16480196 kg
NOx	-105538 kg
VOC	-125714 kg
Benefit:Cost Ratio	
NPV Benefits	\$87,329,085.61
NPV Operating Costs	\$0.00
NPV Capital Costs	\$322,231,453.09
Total Costs	\$322,231,453.09
Benefit:Cost Ratio	0.27

NET PRESENT VALUE CALCULATIONS

Concept 82

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$328,807,605.19
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$322,231,453.09
NPV Capital Costs			\$322,231,453.09

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$0	\$0
2021	0.9039	\$5,813,102	\$5,254,584	\$0	\$0
2022	0.8858	\$5,813,102	\$5,149,492	\$0	\$0
2023	0.8681	\$5,813,102	\$5,046,502	\$0	\$0
2024	0.8508	\$5,813,102	\$4,945,572	\$0	\$0
2025	0.8337	\$5,813,102	\$4,846,661	\$0	\$0
2026	0.8171	\$5,813,102	\$4,749,727	\$0	\$0
2027	0.8007	\$5,813,102	\$4,654,733	\$0	\$0
2028	0.7847	\$5,813,102	\$4,561,638	\$0	\$0
2029	0.7690	\$5,813,102	\$4,470,405	\$0	\$0
2030	0.7536	\$5,813,102	\$4,380,997	\$0	\$0
2031	0.7386	\$5,813,102	\$4,293,377	\$0	\$0
2032	0.7238	\$5,813,102	\$4,207,510	\$0	\$0
2033	0.7093	\$5,813,102	\$4,123,360	\$0	\$0
2034	0.6951	\$5,813,102	\$4,040,892	\$0	\$0
2035	0.6812	\$5,813,102	\$3,960,075	\$0	\$0
2036	0.6676	\$5,813,102	\$3,880,873	\$0	\$0
2037	0.6543	\$5,813,102	\$3,803,256	\$0	\$0
2038	0.6412	\$5,813,102	\$3,727,191	\$0	\$0
2039	0.6283	\$5,813,102	\$3,652,647	\$0	\$0
2040	0.6158	\$5,813,102	\$3,579,594	\$0	\$0
NPV		User Benefits	\$87,329,086	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 82

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Single Faced Barrier	44340 lf	\$60.00	\$2,660,400.00	\$532,080.00	\$3,320,179.20
PBD & Geotextile	22170 lf	\$11.00	\$243,870.00	\$48,774.00	\$304,349.76
Drainage	22170 lf	\$133.35	\$2,956,432.37	\$591,286.47	\$3,689,627.60
Lighting	22170 lf	\$125.00	\$2,771,250.00	\$554,250.00	\$3,458,520.00
Subtotal, Supplemental Roadway Costs			\$8,631,952.37	\$1,726,390.47	\$10,772,676.56
					\$11,000,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	327259 CY	\$20.00	\$6,545,180.00	\$1,309,036.00	\$8,168,384.64
Borrow	51341 CY	\$25.00	\$1,283,525.00	\$256,705.00	\$1,601,839.20
Subtotal, Earthwork Costs			\$7,828,705.00	\$1,565,741.00	\$9,770,223.84
					\$10,000,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder - Mainline	99489 SY	\$110.00	\$10,943,790.00	\$2,188,758.00	\$13,657,849.92
Roadway & Shoulder - Spur	8898 SY	\$110.00	\$978,780.00	\$195,756.00	\$1,221,517.44
Subtotal, Pavement Costs			\$11,922,570.00	\$2,384,514.00	\$14,879,367.36
					\$15,000,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Retaining Wall - Mainline	15450 lf	\$4,677.67	\$72,270,000.00	\$14,454,000.00	\$90,192,960.00
Sound Wall	14626 lf	\$1,250.00	\$18,282,500.00	\$3,656,500.00	\$22,816,560.00
Retaining Wall - Spur	1600 lf	\$4,687.50	\$7,500,000.00	\$1,500,000.00	\$9,360,000.00
Subtotal, Wall Costs			\$98,052,500.00	\$19,610,500.00	\$122,369,520.00
					\$122,000,000.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Viaduct over Railroad - Mainline	4500 lf	\$14,000.00	\$63,000,000.00	\$12,600,000.00	\$78,624,000.00
Viaduct Connection - Spur	280 lf	\$14,000.00	\$3,920,000.00	\$784,000.00	\$4,892,160.00
Subtotal, Bridge Cost			\$66,920,000.00	\$13,384,000.00	\$83,516,160.00
					\$84,000,000.00

CONSTRUCTION COST ESTIMATE
 Concept 82

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Moderate	1 LS	\$9,667,786.37	\$9,667,786.37	\$1,933,557.27	\$12,065,397.39
Subtotal, Utility Impact			\$9,667,786.37	\$1,933,557.27	\$12,065,397.39

SUBTOTAL, CONSTRUCTION COSTS			\$203,023,513.74	\$40,604,702.75	\$253,373,345.15
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Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00
Mobilization	1 LS	\$10,151,175.69	\$2,030,235.14	\$12,668,667.26
MPT	1 LS	\$6,090,705.41	\$1,218,141.08	\$7,601,200.35
		\$16,296,881.10	\$3,259,376.22	\$20,338,507.61

TOTAL CONSTRUCTION COSTS		\$219,320,394.84	\$43,864,078.97	\$273,711,852.76
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DESIGN AND CM COSTS		\$40,604,702.75	\$8,772,815.79	\$54,742,370.55
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TOTAL, DESIGN, CONSTRUCTION AND C		\$243,628,216.49		\$328,454,223.31
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ROW COSTS
Concept 82

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
0057-H-00100-0000-00	\$1,328,900.00	\$773,600.00	4,847,313	73,759	No	2%	\$20,221.12
0030-M-00100-0000-00	\$121,700.00	\$0.00	2,650,626	607,147	No	23%	\$27,876.37
0088-S-00100-000A-02	\$2,800.00	\$0.00	190,862	8,602	No	5%	\$500.00
Not Assessed	-	-	72,494	19,688	No	27%	-
0129-N-00040-0000-00	\$118,800.00	\$0.00	62,291	36,168	No	58%	\$68,979.05
0129-N-00019-0000-00	\$800.00	\$0.00	15,856	982	No	6%	\$500.00
0129-J-00057-0000-00	\$2,200.00	\$0.00	4,704	68	No	1%	\$500.00
0129-J-00150-0000-00	\$265,700.00	\$0.00	2,877,108	50,619	No	2%	\$4,674.67
0129-J-00125-0000-00	\$135,300.00	\$0.00	4,662	1,973	No	42%	\$57,251.51
0129-J-00100-0000-00	\$22,400.00	\$0.00	973,566	13,884	No	1%	\$500.00
0129-J-00175-0000-00	\$26,800.00	\$8,800.00	60,775	16,764	No	28%	\$7,392.56
0088-H-00161-0000-00	\$300,000.00	\$0.00	626,776	45,559	No	7%	\$21,806.12
0088-S-00040-0000-01	\$9,500.00	\$200.00	12,632	4,071	No	32%	\$3,061.31
0129-K-00100-0000-01	\$48,100.00	\$0.00	1,046,834	192,195	No	18%	\$8,830.98
0129-L-00250-0000-00	\$15,000.00	\$0.00	316,202	95,019	No	30%	\$4,507.51
0129-M-00300-0000-00	\$7,500.00	\$0.00	181,827	22,667	No	12%	\$934.96
0129-K-00100-0005-00	\$900.00	\$0.00	101,059	22,569	No	22%	\$500.00
0178-J-00120-0000-00	\$30,400.00	\$0.00	663,462	4,779	No	1%	\$500.00
0178-R-00050-0000-00	\$9,600.00	\$0.00	208,626	123,026	No	59%	\$5,661.08
0178-K-00200-0000-00	\$148,900.00	\$0.00	289,761	116,501	No	40%	\$59,866.66
0178-L-00250-0000-00	\$9,800.00	\$3,200.00	25,025	17	No	0%	\$500.00
0178-R-00025-0000-00	\$3,100.00	\$0.00	68,298	8,701	No	13%	\$500.00
0178-R-00080-0000-00	\$3,700.00	\$0.00	60,881	28,176	No	46%	\$1,712.39
0178-R-00052-0000-00	\$400.00	\$0.00	1,439	1,027	No	71%	\$500.00
0178-R-00053-0000-00	\$1,600.00	\$0.00	1,560	945	No	61%	\$969.37
0178-R-00054-0000-00	\$800.00	\$0.00	1,620	1,054	No	65%	\$520.35
0178-R-00055-0000-00	\$600.00	\$0.00	1,814	993	No	55%	\$500.00
0178-R-00057-0000-00	\$2,000.00	\$0.00	2,000	1,005	No	50%	\$1,005.45
0178-R-00059-0000-00	\$1,000.00	\$0.00	2,140	1,008	No	47%	\$500.00
0178-R-00062-0000-00	\$1,100.00	\$0.00	2,300	1,025	No	45%	\$500.00
0178-R-00064-0000-00	\$600.00	\$0.00	2,460	963	No	39%	\$500.00
0178-R-00067-0000-00	\$2,700.00	\$0.00	2,700	898	No	33%	\$898.21
0178-R-00069-0000-00	\$700.00	\$0.00	2,760	967	No	35%	\$500.00
0178-R-00072-0000-00	\$700.00	\$0.00	2,820	873	No	31%	\$500.00
0178-R-00074-0000-00	\$700.00	\$0.00	2,880	855	No	30%	\$500.00
0178-R-00076-0000-00	\$300.00	\$0.00	2,946	835	No	28%	\$500.00
0178-R-00225-0000-00	\$6,500.00	\$0.00	33,149	28,376	No	86%	\$5,564.04
0178-R-00151-0000-00	\$500.00	\$0.00	2,000	282	No	14%	\$500.00
0178-R-00148-0000-00	\$500.00	\$0.00	2,204	1,726	Yes	100%	\$500.00
0178-R-00150-0000-00	\$500.00	\$0.00	1,908	1,439	Yes	100%	\$500.00
0178-R-00173-0000-00	\$700.00	\$0.00	3,032	2,114	Yes	100%	\$700.00

ROW COSTS

Concept 82

0178-R-00275-0009-00	\$13,500.00	\$0.00	294,901	1,566	No	1%	\$500.00
0178-R-00350-0000-01	\$28,000.00	\$0.00	265,895	63,659	No	24%	\$6,703.65
0178-R-00193-0000-00	\$2,000.00	\$0.00	5,780	5,772	Yes	100%	\$2,000.00
0178-R-00196-0000-00	\$4,300.00	\$0.00	8,000	6,671	No	83%	\$3,585.65
0178-S-00322-0000-00	\$800.00	\$0.00	2,000	1,221	No	61%	\$500.00
0178-S-00323-0000-00	\$500.00	\$0.00	2,000	1,187	No	59%	\$500.00
0178-S-00324-0000-00	\$500.00	\$0.00	2,000	1,111	No	56%	\$500.00
0178-S-00325-0000-00	\$500.00	\$0.00	2,000	955	No	48%	\$500.00
0178-S-00326-0000-00	\$800.00	\$0.00	2,000	893	No	45%	\$500.00
0178-S-00327-0000-00	\$500.00	\$0.00	2,000	719	No	36%	\$500.00
0178-S-00328-0000-00	\$800.00	\$0.00	2,000	604	No	30%	\$500.00
0178-S-00329-0000-00	\$800.00	\$0.00	2,000	499	No	25%	\$500.00
0178-S-00330-0000-00	\$2,000.00	\$0.00	5,000	926	No	19%	\$500.00
0178-S-00333-0000-00	\$800.00	\$0.00	1,980	5	No	0%	\$500.00
Not Assessed	-	-	9,128	7,138	No	78%	-
0178-S-00376-0000-00	\$6,100.00	\$0.00	28,009	1,769	No	6%	\$500.00
0178-S-00389-0000-00	\$600.00	\$0.00	2,385	311	No	13%	\$500.00
0179-D-00042-0000-00	\$700.00	\$0.00	3,240	346	No	11%	\$500.00
0179-D-00044-0000-00	\$500.00	\$0.00	2,140	303	No	14%	\$500.00
0179-D-00045-0000-00	\$500.00	\$0.00	2,120	383	No	18%	\$500.00
0179-D-00046-0000-00	\$700.00	\$0.00	3,150	652	No	21%	\$500.00
0179-D-00048-0000-00	\$1,800.00	\$0.00	9,000	2,654	No	29%	\$530.73
0179-D-00053-0000-00	\$500.00	\$0.00	2,000	752	No	38%	\$500.00
0179-D-00054-0000-00	\$900.00	\$0.00	4,000	1,713	No	43%	\$500.00
0179-D-00056-0000-00	\$3,900.00	\$0.00	19,810	8,900	No	45%	\$1,752.21
0179-D-00064-0000-00	\$700.00	\$0.00	3,255	1,544	No	47%	\$500.00
0179-D-00066-0000-00	\$500.00	\$0.00	2,046	827	No	40%	\$500.00
0179-D-00067-0000-00	\$500.00	\$0.00	2,046	607	No	30%	\$500.00
0179-D-00068-0000-00	\$500.00	\$0.00	2,046	489	No	24%	\$500.00
0179-D-00069-0000-00	\$500.00	\$0.00	2,046	317	No	15%	\$500.00
0179-D-00070-0000-00	\$500.00	\$0.00	2,046	208	No	10%	\$500.00
0179-D-00071-0000-00	\$500.00	\$0.00	2,046	41	No	2%	\$500.00
0236-A-00374-0000-00	\$9,700.00	\$0.00	66,647	35,252	No	53%	\$5,130.67
0236-E-00138-0000-00	\$10,400.00	\$0.00	112,995	16,668	No	15%	\$1,534.10
0236-E-00098-0000-00	\$5,900.00	\$0.00	30,493	19,810	No	65%	\$3,832.89
0236-F-00108-0000-00	\$3,800.00	\$0.00	19,629	14,868	No	76%	\$2,878.25
Subtotal, ROW Costs				1,740,657			\$353,381.88
							\$0.00

Safety
 Concept 82

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
Fatal & Injury	1075	358.33	1.00	358.33	0.00
PDO	1075	358.33	0.96	344.00	14.33

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.00	0.00	0.00	0.00	\$ -
0.00	0.00	0.00	0.00	14.33	\$ 145,463.70

Total: \$ 145,463.70

USER BENEFITS

Concept 82

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:	PM Veh-Hrs
No-build	0	265184	0	8548
Build	0	261475	0	7133
Change	0	-3708	0	-1415
Subtotal, MOEs				

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	0.000 hrs	0.00 hrs
PM Peak Period	-1380.023 hrs	-35.27 hrs
Total of Peaks	-1380.023 hrs	-35.266 hrs
Daily Estimate	-1380.023 hrs	-35.266 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$17,782.42	-\$694.45

Total, all vehicles
 -\$18,476.87 Value of travel time changes, per day
 -\$6,265,230.30 Value of travel time changes, per year

Subtotal, Value of Time

USER BENEFITS

Concept 82

Automobile Operating Costs (Delay)

	Cars	Trucks
Fuel Consumption		
AM Peak Period	0.0 gallons	0.0 gallons
PM Peak Period	-5366.2 gallons	-137.1 gallons
Total of Peaks	-5366.2 gallons	-137.1 gallons
Daily Estimate	-5366.226 gallons	-137.130 gallons
	\$3.004 per gallon	\$3.004 per gallon
	-\$16,120.14 per day	-\$411.94 per day
Total, all vehicles	-5503.4 fuel consumption change, gallons per day	
	(1,866,105.47) fuel consumption change, gallons per year	
	-\$16,532.08 change in fuel cost, per day	
	-\$5,605,780.83 change in fuel cost, per year	

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$6,265,230.30	Value of Travel Time change, Per year
Operating Costs	-\$5,605,780.83	Value of Operating Costs change, per year
Total, User Benefits	-\$11,871,011.13	

USER BENEFITS

Concept 82

Emissions

	Cars	Trucks
Fuel Consumption		
AM Peak Period	0.0 gallons	0.0 gallons
PM Peak Period	-5366.2 gallons	-137.1 gallons
Total of Peaks	-5366.2 gallons	-137.1 gallons
Daily Estimate	-5366.2 gallons	-137.1 gallons
Annual estimate	-1819606.64 gallons	-46498.833
CO2	19.4 lb/gal 8799.6848 grams/gal (16,011,964.86) kg	22.2 lb/gal 10069.7424 grams/gal (468,231.27) kg
Total	(16,480,196.13) kg	
Nox	(101,531.30) kg	(4,006.78) kg
Total	(105,538.08) kg	
VOC	(120,941.66) kg	(4,772.78) kg
Total	(125,714.44) kg	
PM2.5	0.09761905 grams/gal (177.63) kg	0.136 grams/gal (6.32) kg
Total	(183.95) kg	

USER BENEFITS
Concept 82

	Peak Veh/Hr from PWKY	246		
MOEs	Average Speed mph	20.595		
Item	AM VMT	PM VMT	AM Veh-Hr:	PM Veh-Hrs
No-build	0	0	0	0
Build	0	3856	0	374
Change	0	3856	0	374
Subtotal, MOEs				

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	0.000 hrs	0.00 hrs
PM Peak Period	365.152 hrs	9.33 hrs
Total of Peaks	365.152 hrs	9.331 hrs
Daily Estimate	365.152 hrs	9.331 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	\$4,705.20	\$183.75

Total, all vehicles
 \$4,888.95 Value of travel time changes, per day
 \$1,657,768.64 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars	Trucks
PM Peak Period		
Average Speed	20.1	
Change in Veh-Hrs	365.2 hours	9.3 hours
Fuel Consumption	0.022 gal/minute	0.102 gal/minute
	<u>482.0 gallons</u>	<u>57.1 gallons</u>
Fuel Consumption		
AM Peak Period	0.0 gallons	0.0 gallons
PM Peak Period	482.0 gallons	57.1 gallons
Total of Peaks	482.0 gallons	57.1 gallons
Daily Estimate	<u>482.000 gallons</u>	<u>57.107 gallons</u>
	\$3.004 per gallon	\$3.004 per gallon
	\$1,447.93 per day	\$171.55 per day
Total, all vehicles	539.1 fuel consumption change, gallons per day	
	182,803.11 fuel consumption change, gallons per year	
	\$1,619.48 change in fuel cost, per day	
	\$549,140.55 change in fuel cost, per year	

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	\$1,657,768.64	Value of Travel Time change, Per year
Operating Costs	\$549,140.55	Value of Operating Costs change, per year
Total, User Benefits	\$2,206,909.19	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	482.000 gallons	57.107 gallons
Annual estimate	163438.994 gallons	19364.118
CO2		
	19.4000 lb/gal	0.2 lb/gal
	8799.6848 grams/gal	90.7184 grams/gal
	1,438,211,633.11 g	1,756,681.77 g
Total	1,439,968.31 kg	
VOC		
	24.62 grams/gal	1.27 grams/gal
	4,023,868.04 g	24,592.43
Total	4,048.46 kg	
NOx		
	16.5 grams/gal	24.52 grams/gal
	2,696,743.40 g	474,808.16
Total	3,171.55 kg	
PM2.5		
	0.097619 grams/gal	0.136 grams/gal
	15,954.75 g	2,633.52
Total	18.59 kg	

USER BENEFITS
Concept 82

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	0.000 hrs	0.00 hrs
PM Peak Period	-1014.871 hrs	-25.93 hrs
Total of Peaks	-1014.871 hrs	-25.934 hrs
Daily Estimate	-1014.871 hrs	-25.934 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$13,077.23	-\$510.70

Total, all vehicles
-\$13,587.93 Value of travel time changes, per day
-\$4,607,461.66 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars	Trucks
Fuel Consumption		
AM Peak Period	0.0 gallons	0.0 gallons
PM Peak Period	-1014.9 gallons	-25.9 gallons
Total of Peaks	-1014.9 gallons	-25.9 gallons
Daily Estimate	-1014.871 gallons	-25.934 gallons
	\$3.004 per gallon	\$3.004 per gallon
	-\$3,048.67 per day	-\$77.91 per day

Total, all vehicles
-1040.8 fuel consumption change, gallons per day
(352,921.59) fuel consumption change, gallons per year

-\$3,126.58 change in fuel cost, per day
 -\$1,060,176.47 change in fuel cost, per year

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$4,607,461.66	Value of Travel Time change, Per year
Operating Costs	-\$1,060,176.47	Value of Operating Costs change, per year
Total, User Benefits	-\$5,667,638.13	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-5366 gallons	-137 gallons
Annual estimate	-1819607 gallons	-46499 gallons
CO2		
Total	(15,040,227.81) kg	
Nox		
Total	(102,366.53) kg	
VOC		
Total	(121,665.98) kg	
PM2.5		
Total	(165.36) kg	

SUMMARY OF COSTS AND BENEFITS
 Concept 85

Construction Cost	
Supplemental Roadway Construction	\$70,000.00
Earthwork	\$180,000.00
Pavement	\$190,000.00
Walls	\$1,370,000.00
Bridges	\$1,570,000.00
Traffic Signals	\$0.00
Signage	\$0.00
Utilities	\$70,000.00
Additional Lump Sum	\$350,000.00
Design and PM	\$760,000.00
ROW	\$120,000.00
Total	\$4,680,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Mobility Benefits	\$26,743.24
Health Benefits	\$88,521.73
Decreased Auto Use	\$8,913.45
Total	\$124,178.43
Emissions (Annual)	
CO2	-2523 kg
NOx	-5 kg
VOC	-7 kg
Benefit:Cost Ratio	
NPV Benefits	\$1,865,508.06
NPV Operating Costs	\$0.00
NPV Capital Costs	\$4,590,152.35
Total Costs	\$4,590,152.35
Benefit:Cost Ratio	0.41

NET PRESENT VALUE CALCULATIONS

Concept 85

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$4,683,828.93
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$4,590,152.35
NPV Capital Costs			\$4,590,152.35

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224		\$0	\$0	\$0
2021	0.9039	\$124,178	\$112,247	\$0	\$0
2022	0.8858	\$124,178	\$110,003	\$0	\$0
2023	0.8681	\$124,178	\$107,802	\$0	\$0
2024	0.8508	\$124,178	\$105,646	\$0	\$0
2025	0.8337	\$124,178	\$103,533	\$0	\$0
2026	0.8171	\$124,178	\$101,463	\$0	\$0
2027	0.8007	\$124,178	\$99,434	\$0	\$0
2028	0.7847	\$124,178	\$97,445	\$0	\$0
2029	0.7690	\$124,178	\$95,496	\$0	\$0
2030	0.7536	\$124,178	\$93,586	\$0	\$0
2031	0.7386	\$124,178	\$91,714	\$0	\$0
2032	0.7238	\$124,178	\$89,880	\$0	\$0
2033	0.7093	\$124,178	\$88,082	\$0	\$0
2034	0.6951	\$124,178	\$86,321	\$0	\$0
2035	0.6812	\$124,178	\$84,594	\$0	\$0
2036	0.6676	\$124,178	\$82,903	\$0	\$0
2037	0.6543	\$124,178	\$81,244	\$0	\$0
2038	0.6412	\$124,178	\$79,620	\$0	\$0
2039	0.6283	\$124,178	\$78,027	\$0	\$0
2040	0.6158	\$124,178	\$76,467	\$0	\$0
NPV		User Benefits	\$1,865,508	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 85

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
ROW Type 1	3970 lf	\$12.50	\$49,625.00	\$9,925.00	\$61,932.00
Drainage	3970 lf	\$1.96	\$7,788.00	\$1,557.60	\$9,719.42
Subtotal, Supplemental Roadway Costs			\$57,413.00	\$11,482.60	\$71,651.42
					\$70,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	7228 CY	\$20.00	\$144,560.00	\$28,912.00	\$180,410.88
Borrow	0 CY	\$25.00	\$0.00	\$0.00	\$0.00
Subtotal, Earthwork Costs			\$144,560.00	\$28,912.00	\$180,410.88
					\$180,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Trail Pavement	4720 SY	\$33.00	\$155,760.00	\$31,152.00	\$194,388.48
Subtotal, Pavement Costs			\$155,760.00	\$31,152.00	\$194,388.48
					\$190,000.00

Wall Costs

Item	Quantity	Cost/sf	2016 Cost	Contingency	2017 Cost
Retaining Wall	7340 sf	\$150.00	\$1,101,000.00	\$220,200.00	\$1,374,048.00
Subtotal, Wall Costs			\$1,101,000.00	\$220,200.00	\$1,374,048.00
					\$1,370,000.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Bike Bridge	200 lf	\$6,300.00	\$1,260,000.00	\$252,000.00	\$1,572,480.00
Subtotal, Bridge Cost			\$1,260,000.00	\$252,000.00	\$1,572,480.00
					\$1,570,000.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00
					\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 85

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Minor	1 LS	\$54,468.33	\$54,468.33	\$10,893.67	\$67,976.48
Subtotal, Utility Impact			\$54,468.33	\$10,893.67	\$67,976.48
					\$70,000.00

SUBTOTAL, CONSTRUCTION COSTS			\$2,773,201.33	\$554,640.27	\$3,460,955.26
					\$3,450,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost	
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00	
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00	
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00	
Mobilization	1 LS	\$138,660.07	\$27,732.01	\$173,047.76	
MPT	1 LS	\$83,196.04	\$16,639.21	\$103,828.66	
			\$276,856.11	\$55,371.22	\$345,516.42
					\$350,000.00

TOTAL CONSTRUCTION COSTS			\$3,050,057.44	\$610,011.49	\$3,806,471.68
					\$3,800,000.00
DESIGN AND CM COSTS			\$554,640.27	\$122,002.30	\$761,294.34
					\$760,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM			\$3,327,841.60		\$4,567,766.02
					\$4,560,000.00

ROW COSTS
 Concept 85

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
29-M-151-0-2	\$2,700.00	\$105,700.00	57,935	2,371	No	88%	\$2,371.00
29-M-151	\$72,300.00	\$27,700.00	80,586	1,190	No	1%	\$1,067.64
29-M-150	\$267,700.00	\$132,300.00	63,162	20,487	No	32%	\$86,830.21
29-M-310-0-1	\$15,800.00	\$0.00	13,199	9,312	No	71%	\$11,147.03
29-H-300	\$50,300.00	\$0.00	57,499	1,034	No	2%	\$904.54
29-H-320	\$198,900.00	\$0.00	188,179	6,832	No	4%	\$7,221.23
29-H-238	\$422,100.00	\$0.00	232,175	3,587	No	2%	\$6,521.26
Subtotal, ROW Costs							\$116,062.91

\$120,000.00

USER BENEFITS
Concept 85

Value of Time

Cars		
Avg Hourly Wage		\$21.84
Benefits	18%	\$3.93
Total Compensation		\$25.77
Value of Time of hourly wage	50%	\$12.89

Length of Bicycle Facility (Miles)

New Portion	0.50
Full Portion (with Three Rivers Trail)	6.80

Estimated Bicycle Ridership (Daily)

New Ridership	5.58
Existing Ridership using new facility	686.00

User Benefits

0.5 miles		EXISTING USERS	
	Per Trip/ Mile	Daily	Annually (based on 180 days of bicycling)
Mobility Benefits	\$4.08	\$2,798.88	\$26,527.62
Health Benefits	\$128		\$87,808.00
Decreased Auto Use	\$0.13	\$44.59	\$8,026.20
			\$122,361.82
		NEW USERS	
	Per Trip/ Mile	Daily	Annually (based on 180 days of bicycling)
Mobility Benefits	\$4.08	\$22.75	\$215.62
Health Benefits	\$128		\$713.73
Decreased Auto Use	\$0.13	\$4.93	\$887.25
			\$1,816.61
TOTAL BENEFITS			
Mobility Benefits			\$26,743.24
Health Benefits			\$88,521.73
Decreased Auto Use			\$8,913.45
Total User Benefits			\$124,178.43

Emissions

Cars

Fuel Consumption

Daily Estimate -1.593 gallons

Annual estimate -286.700 gallons

CO2 19.4 lb/gal
8799.6848 grams/gal
(2,522,869.63) g
Total (2,522.87) kg

VOC 24.62 grams/gal
(7,058.28) g
Total (7.06) kg

NOx 16.5 grams/gal
(4,730.55) g
Total (4.73) kg

PM2.5 0.097619 grams/gal
(27.99) g
Total (0.03) kg

SUMMARY OF COSTS AND BENEFITS
 Concept 86A

Construction Cost	
Supplemental Roadway Construction	\$300,000.00
Earthwork	\$1,200,000.00
Pavement	\$700,000.00
Walls	\$18,700,000.00
Bridges	\$500,000.00
Traffic Signals	\$0.00
Signage	\$0.00
Utilities	\$400,000.00
Additional Lump Sum	\$1,800,000.00
Design and PM	\$4,700,000.00
ROW	\$1,100,000.00
Total	\$29,400,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Mobility Benefits	\$27,469.39
Health Benefits	\$90,925.31
Decreased Auto Use	\$29,803.10
Total	\$148,197.80
Emissions (Annual)	
CO2	-14906 kg
NOx	-28 kg
VOC	-42 kg
Benefit:Cost Ratio	
NPV Benefits	\$2,226,346.41
NPV Operating Costs	\$0.00
NPV Capital Costs	\$28,741,889.66
Total Costs	\$28,741,889.66
Benefit:Cost Ratio	0.08

NET PRESENT VALUE CALCULATIONS
 Concept 86A

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$29,328,458.84
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$28,741,889.66
NPV Capital Costs			\$28,741,889.66

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224		\$0	\$0	\$0
2021	0.9039	\$148,198	\$133,959	\$0	\$0
2022	0.8858	\$148,198	\$131,280	\$0	\$0
2023	0.8681	\$148,198	\$128,654	\$0	\$0
2024	0.8508	\$148,198	\$126,081	\$0	\$0
2025	0.8337	\$148,198	\$123,560	\$0	\$0
2026	0.8171	\$148,198	\$121,088	\$0	\$0
2027	0.8007	\$148,198	\$118,667	\$0	\$0
2028	0.7847	\$148,198	\$116,293	\$0	\$0
2029	0.7690	\$148,198	\$113,967	\$0	\$0
2030	0.7536	\$148,198	\$111,688	\$0	\$0
2031	0.7386	\$148,198	\$109,454	\$0	\$0
2032	0.7238	\$148,198	\$107,265	\$0	\$0
2033	0.7093	\$148,198	\$105,120	\$0	\$0
2034	0.6951	\$148,198	\$103,018	\$0	\$0
2035	0.6812	\$148,198	\$100,957	\$0	\$0
2036	0.6676	\$148,198	\$98,938	\$0	\$0
2037	0.6543	\$148,198	\$96,959	\$0	\$0
2038	0.6412	\$148,198	\$95,020	\$0	\$0
2039	0.6283	\$148,198	\$93,120	\$0	\$0
2040	0.6158	\$148,198	\$91,257	\$0	\$0
NPV		User Benefits	\$2,226,346	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 86A

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Single Faced Barrier	0 lf	\$60.00	\$0.00	\$0.00	\$0.00
ROW Type 1	1 ls	\$179,318.70	\$179,318.70	\$35,863.74	\$223,789.74
Drainage	6560 lf	\$4.56	\$29,886.45	\$5,977.29	\$37,298.29
Subtotal, Supplemental Roadway Costs			\$209,205.15	\$41,841.03	\$261,088.03
					\$300,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	12535 CY	\$20.00	\$250,700.00	\$50,140.00	\$312,873.60
Borrow	27466 CY	\$25.00	\$686,650.00	\$137,330.00	\$856,939.20
Subtotal, Earthwork Costs			\$937,350.00	\$187,470.00	\$1,169,812.80
					\$1,200,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Trail Pavement	18113 SY	\$33.00	\$597,729.00	\$119,545.80	\$745,965.79
Subtotal, Pavement Costs			\$597,729.00	\$119,545.80	\$745,965.79
					\$700,000.00

Wall Costs

Item	Quantity	Cost/sf	2016 Cost	Contingency	2017 Cost
Retaining Wall	99641 sf	\$150.00	\$14,946,150.00	\$2,989,230.00	\$18,652,795.20
Subtotal, Wall Costs			\$14,946,150.00	\$2,989,230.00	\$18,652,795.20
					\$18,700,000.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Bike Bridge	60 lf	\$7,000.00	\$420,000.00	\$84,000.00	\$524,160.00
Subtotal, Bridge Cost			\$420,000.00	\$84,000.00	\$524,160.00
					\$500,000.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00
					\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 86A

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Minor	1 LS	\$292,130.48	\$292,130.48	\$58,426.10	\$364,578.84
Subtotal, Utility Impact			\$292,130.48	\$58,426.10	\$364,578.84
					\$400,000.00

SUBTOTAL, CONSTRUCTION COSTS			\$17,402,564.63	\$3,480,512.93	\$21,718,400.66
					\$21,800,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost	
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00	
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00	
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00	
Mobilization	1 LS	\$870,128.23	\$174,025.65	\$1,085,920.03	
MPT	1 LS	\$522,076.94	\$104,415.39	\$651,552.02	
			\$1,447,205.17	\$289,441.03	\$1,806,112.05
					\$1,800,000.00

TOTAL CONSTRUCTION COSTS			\$18,849,769.80	\$3,769,953.96	\$23,524,512.71
					\$23,600,000.00
DESIGN AND CM COSTS			\$3,480,512.93	\$753,990.79	\$4,704,902.54
					\$4,700,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM			\$20,883,077.56		\$28,229,415.25
					\$28,300,000.00

ROW COSTS
 Concept 86A

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
29-M-151-0-2	\$2,700.00	\$105,700.00	57,935	440	No	16%	\$440.00
29-M-151	\$72,300.00	\$27,700.00	80,586	4,873	No	6%	\$4,371.95
29-S-250-C-2	\$3,000.00	\$0.00	65,340	16,071	No	25%	\$737.88
29-M-310-0-1	\$15,800.00	\$0.00	13,199	1,388	No	11%	\$1,661.52
29-M-41	\$200.00	\$0.00	600	600	Yes	100%	\$200.00
29-M-151-0-1	\$300.00	\$0.00	5,576	5,576	Yes	100%	\$300.00
29-M-47-A	\$28,000.00	\$0.00	12,415	12,415	Yes	100%	\$28,000.00
29-M-51	\$300.00	\$0.00	1,200	1,200	Yes	100%	\$300.00
54-F-6-0-2	\$14,100.00	\$0.00	39,992	2,255	No	8%	\$1,126.90
54-G-48	\$57,500.00	\$226,200.00	28,215	2,297	No	8%	\$4,681.11
27-S-150-0-1	\$531,391,000.00	\$10,339,100.00	18,164,520	33,973	No	0%	\$993,857.61
87-E-150	\$77,900.00	\$0.00	64,904	1,458	No	2%	\$1,749.93
87-E-116	\$240,000.00	\$1,191,400.00	56,780	5,708	No	10%	\$24,126.61
87-E-180	\$48,900.00	\$17,200.00	23,606	929	No	4%	\$1,924.43
87-E-170	\$125,300.00	\$0.00	104,378	5,863	No	6%	\$7,038.17
87-E-171	\$48,100.00	\$0.00	19,521	2,901	No	15%	\$7,148.10
87-E-188	\$21,500.00	\$0.00	17,920	2,785	No	16%	\$3,341.38
87-F-260	\$4,500.00	\$0.00	10,388	10,388	Yes	100%	\$4,500.00
87-F-246	\$80,600.00	\$109,400.00	7,680	387	No	5%	\$4,061.48
87-F-218	\$200,000.00	\$0.00	60,592	2,871	No	5%	\$9,476.50
Subtotal, ROW Costs							\$1,099,043.58
							\$1,100,000.00

USER BENEFITS
Concept 86A

Value of Time

Cars		
Avg Hourly Wage		\$21.84
Benefits	18%	\$3.93
Total Compensation		\$25.77
Value of Time of hourly wage	50%	\$12.89

Length of Bicycle Facility (Miles)

New Portion	1.53
Full Portion (with Three Rivers Trail)	9.20

Estimated Bicycle Ridership (Daily)

New Ridership	24.35
Existing Ridership using new facility	686.00

User Benefits

1.53 miles				
		EXISTING USERS		
	Per Trip/ Mile	Daily	Annually (based on 180 days of bicycling)	
Mobility Benefits	\$4.08	\$2,798.88	\$26,527.62	
Health Benefits	\$128		\$87,808.00	
Decreased Auto Use	\$0.13	\$136.45	\$24,560.17	
			\$138,895.79	
		NEW USERS		
	Per Trip/ Mile	Daily	Annually (based on 180 days of bicycling)	
Mobility Benefits	\$4.08	\$99.36	\$941.77	
Health Benefits	\$128		\$3,117.31	
Decreased Auto Use	\$0.13	\$4.93	\$5,242.93	
			\$9,302.01	
		TOTAL BENEFITS		
Mobility Benefits			\$27,469.39	
Health Benefits			\$90,925.31	
Decreased Auto Use			\$29,803.10	
Total User Benefits			\$148,197.80	

Emissions

Cars

Fuel Consumption

Daily Estimate -9.411 gallons

Annual estimate -1693.900 gallons

CO2 19.4 lb/gal
8799.6848 grams/gal
(14,905,786.08) g
Total (14,905.79) kg

VOC 24.62 grams/gal
(41,702.20) g
Total (41.70) kg

NOx 16.5 grams/gal
(27,949.35) g
Total (27.95) kg

PM2.5 0.097619 grams/gal
(165.36) g
Total (0.17) kg

SUMMARY OF COSTS AND BENEFITS
 Concept 86B

Construction Cost	
Supplemental Roadway Construction	\$100,000.00
Earthwork	\$800,000.00
Pavement	\$1,000,000.00
Walls	\$10,400,000.00
Bridges	\$500,000.00
Traffic Signals	\$0.00
Signage	\$0.00
Utilities	\$400,000.00
Additional Lump Sum	\$1,100,000.00
Design and PM	\$2,900,000.00
ROW	\$200,000.00
Total	\$17,400,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Mobility Benefits	\$27,272.79
Health Benefits	\$90,274.56
Decreased Auto Use	\$19,279.18
Total	\$136,826.53
Emissions (Annual)	
CO2	-10999 kg
NOx	-21 kg
VOC	-31 kg
Benefit:Cost Ratio	
NPV Benefits	\$2,055,518.05
NPV Operating Costs	\$0.00
NPV Capital Costs	\$17,044,805.61
Total Costs	\$17,044,805.61
Benefit:Cost Ratio	0.12

NET PRESENT VALUE CALCULATIONS
 Concept 86B

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$17,392,658.78
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$17,044,805.61
NPV Capital Costs			\$17,044,805.61

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224		\$0	\$0	\$0
2021	0.9039	\$136,827	\$123,680	\$0	\$0
2022	0.8858	\$136,827	\$121,207	\$0	\$0
2023	0.8681	\$136,827	\$118,783	\$0	\$0
2024	0.8508	\$136,827	\$116,407	\$0	\$0
2025	0.8337	\$136,827	\$114,079	\$0	\$0
2026	0.8171	\$136,827	\$111,797	\$0	\$0
2027	0.8007	\$136,827	\$109,561	\$0	\$0
2028	0.7847	\$136,827	\$107,370	\$0	\$0
2029	0.7690	\$136,827	\$105,223	\$0	\$0
2030	0.7536	\$136,827	\$103,118	\$0	\$0
2031	0.7386	\$136,827	\$101,056	\$0	\$0
2032	0.7238	\$136,827	\$99,035	\$0	\$0
2033	0.7093	\$136,827	\$97,054	\$0	\$0
2034	0.6951	\$136,827	\$95,113	\$0	\$0
2035	0.6812	\$136,827	\$93,211	\$0	\$0
2036	0.6676	\$136,827	\$91,346	\$0	\$0
2037	0.6543	\$136,827	\$89,520	\$0	\$0
2038	0.6412	\$136,827	\$87,729	\$0	\$0
2039	0.6283	\$136,827	\$85,975	\$0	\$0
2040	0.6158	\$136,827	\$84,255	\$0	\$0
NPV		User Benefits	\$2,055,518	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 86B

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
ROW Type 1	1 ls	\$76,500.00	\$76,500.00	\$15,300.00	\$95,472.00
Drainage	2550 lf	\$4.56	\$11,617.45	\$2,323.49	\$14,498.57
Subtotal, Supplemental Roadway Costs			\$88,117.45	\$17,623.49	\$109,970.57
					\$100,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	31516 CY	\$20.00	\$630,320.00	\$126,064.00	\$786,639.36
Borrow	0 CY	\$25.00	\$0.00	\$0.00	\$0.00
Subtotal, Earthwork Costs			\$630,320.00	\$126,064.00	\$786,639.36
					\$800,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Trail Pavement	7681 SY	\$33.00	\$253,473.00	\$50,694.60	\$316,334.30
Stairs w/ Runnels	1 LS	\$547,000.00	\$547,000.00	\$109,400.00	\$682,656.00
Subtotal, Pavement Costs			\$800,473.00	\$160,094.60	\$998,990.30
					\$1,000,000.00

Wall Costs

Item	Quantity	Cost/sf	2016 Cost	Contingency	2017 Cost
Retaining Wall	55641 sf	\$150.00	\$8,346,112.50	\$1,669,222.50	\$10,415,948.40
Subtotal, Wall Costs			\$8,346,112.50	\$1,669,222.50	\$10,415,948.40
					\$10,400,000.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Bike Bridge	60 lf	\$7,000.00	\$420,000.00	\$84,000.00	\$524,160.00
Subtotal, Bridge Cost			\$420,000.00	\$84,000.00	\$524,160.00
					\$500,000.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00
					\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 86B

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Minor	1 LS	\$292,130.48	\$292,130.48	\$58,426.10	\$364,578.84
Subtotal, Utility Impact			\$292,130.48	\$58,426.10	\$364,578.84
					\$400,000.00

SUBTOTAL, CONSTRUCTION COSTS			\$10,577,153.43	\$2,115,430.69	\$13,200,287.48
					\$13,200,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost	
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00	
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00	
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00	
Mobilization	1 LS	\$528,857.67	\$105,771.53	\$660,014.37	
MPT	1 LS	\$317,314.60	\$63,462.92	\$396,008.62	
			\$901,172.27	\$180,234.45	\$1,124,663.00
					\$1,100,000.00

TOTAL CONSTRUCTION COSTS			\$11,478,325.70	\$2,295,665.14	\$14,324,950.47
					\$14,300,000.00
DESIGN AND CM COSTS			\$2,115,430.69	\$459,133.03	\$2,864,990.09
					\$2,900,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM			\$12,692,584.11		\$17,189,940.57
					\$17,200,000.00

ROW COSTS
 Concept 86B

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
29-M-151-0-2	\$2,700.00	\$105,700.00	57,935	440	No	16%	\$440.00
29-M-151	\$72,300.00	\$27,700.00	80,586	4,873	No	6%	\$4,371.95
29-S-250-C-2	\$3,000.00	\$0.00	65,340	16,071	No	25%	\$737.88
29-M-310-0-1	\$15,800.00	\$0.00	13,199	1,388	No	11%	\$1,661.52
29-M-41	\$200.00	\$0.00	600	600	Yes	100%	\$200.00
29-M-151-0-1	\$300.00	\$0.00	5,576	5,576	Yes	100%	\$300.00
29-M-47-A	\$28,000.00	\$0.00	12,415	12,415	Yes	100%	\$28,000.00
29-M-51	\$300.00	\$0.00	1,200	1,200	Yes	100%	\$300.00
54-F-6-0-2	\$14,100.00	\$0.00	39,992	2,255	No	8%	\$1,126.90
54-G-48	\$57,500.00	\$226,200.00	28,215	2,297	No	8%	\$4,681.11
27-S-150-0-1	\$531,391,000.00	\$10,339,100.00	18,164,520	5,500	No	0%	\$160,898.86
Subtotal, ROW Costs				52,615			\$202,718.21
							\$200,000.00

USER BENEFITS
Concept 86B

Value of Time

Cars		
Avg Hourly Wage		\$21.84
Benefits	18%	\$3.93
Total Compensation		\$25.77
Value of Time of hourly wage	50%	\$12.89

Length of Bicycle Facility (Miles)

New Portion	0.96
Full Portion (with Three Rivers Trail)	4.29

Estimated Bicycle Ridership (Daily)

New Ridership	19.27
Existing Ridership using new facility	686.00

User Benefits

0.96 miles				
EXISTING USERS				
	Per Trip/ Mile	Daily	Annually (based on 180 days of bicycling)	
Mobility Benefits	\$4.08	\$2,798.88	\$26,527.62	
Health Benefits	\$128		\$87,808.00	
Decreased Auto Use	\$0.13	\$136.45	\$24,560.17	
			\$138,895.79	
NEW USERS				
	Per Trip/ Mile	Daily	Annually (based on 180 days of bicycling)	
Mobility Benefits	\$4.08	\$78.62	\$745.17	
Health Benefits	\$128		\$2,466.56	
Decreased Auto Use	\$0.13	\$21.49	\$3,868.88	
			\$7,080.61	
TOTAL BENEFITS				
Mobility Benefits			\$27,272.79	
Health Benefits			\$90,274.56	
Decreased Auto Use			\$19,279.18	
Total User Benefits			\$136,826.53	

Emissions

Cars

Fuel Consumption

Daily Estimate -6.944 gallons

Annual estimate -1249.940 gallons

CO2 19.4 lb/gal
8799.6848 grams/gal
(10,999,078.02) g
Total (10,999.08) kg

VOC 24.62 grams/gal
(30,772.33) g
Total (30.77) kg

NOx 16.5 grams/gal
(20,624.01) g
Total (20.62) kg

PM2.5 0.097619 grams/gal
(122.02) g
Total (0.12) kg

SUMMARY OF COSTS AND BENEFITS
 Concept 89

Construction Cost	
Supplemental Roadway Construction	\$170,000.00
Earthwork	\$1,770,000.00
Pavement	\$1,620,000.00
Walls	\$1,080,000.00
Bridges	\$870,000.00
Traffic Signals	\$0.00
Signage	\$0.00
Utilities	\$120,000.00
Additional Lump Sum	\$520,000.00
Design and PM	\$1,230,000.00
ROW	\$80,000.00
Total	\$7,460,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Mobility Benefits	\$27,095.22
Health Benefits	\$89,686.78
Decreased Auto Use	\$65,395.47
Total	\$182,177.47
Emissions (Annual)	
CO2	-124994 kg
NOx	-234 kg
VOC	-350 kg
Benefit:Cost Ratio	
NPV Benefits	\$2,736,816.31
NPV Operating Costs	\$0.00
NPV Capital Costs	\$7,308,872.55
Total Costs	\$7,308,872.55
Benefit:Cost Ratio	0.37

NET PRESENT VALUE CALCULATIONS

Concept 89

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$7,458,033.21
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$7,308,872.55
NPV Capital Costs			\$7,308,872.55

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224		\$0	\$0	\$0
2021	0.9039	\$182,177	\$164,674	\$0	\$0
2022	0.8858	\$182,177	\$161,381	\$0	\$0
2023	0.8681	\$182,177	\$158,153	\$0	\$0
2024	0.8508	\$182,177	\$154,990	\$0	\$0
2025	0.8337	\$182,177	\$151,890	\$0	\$0
2026	0.8171	\$182,177	\$148,852	\$0	\$0
2027	0.8007	\$182,177	\$145,875	\$0	\$0
2028	0.7847	\$182,177	\$142,958	\$0	\$0
2029	0.7690	\$182,177	\$140,099	\$0	\$0
2030	0.7536	\$182,177	\$137,297	\$0	\$0
2031	0.7386	\$182,177	\$134,551	\$0	\$0
2032	0.7238	\$182,177	\$131,860	\$0	\$0
2033	0.7093	\$182,177	\$129,222	\$0	\$0
2034	0.6951	\$182,177	\$126,638	\$0	\$0
2035	0.6812	\$182,177	\$124,105	\$0	\$0
2036	0.6676	\$182,177	\$121,623	\$0	\$0
2037	0.6543	\$182,177	\$119,191	\$0	\$0
2038	0.6412	\$182,177	\$116,807	\$0	\$0
2039	0.6283	\$182,177	\$114,471	\$0	\$0
2040	0.6158	\$182,177	\$112,181	\$0	\$0
NPV		User Benefits	\$2,736,816	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 89

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
ROW Type 1	5990 lf	\$12.50	\$74,875.00	\$14,975.00	\$93,444.00
Drainage	1 ls	\$64,919.79	\$64,919.79	\$12,983.96	\$81,019.90
Subtotal, Supplemental Roadway Costs			\$139,794.79	\$27,958.96	\$174,463.90
					\$170,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	9846 CY	\$20.00	\$196,920.00	\$39,384.00	\$245,756.16
Borrow	48910 CY	\$25.00	\$1,222,750.00	\$244,550.00	\$1,525,992.00
Subtotal, Earthwork Costs			\$1,419,670.00	\$283,934.00	\$1,771,748.16
					\$1,770,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Trail Pavement	39345 SY	\$33.00	\$1,298,385.00	\$259,677.00	\$1,620,384.48
Subtotal, Pavement Costs			\$1,298,385.00	\$259,677.00	\$1,620,384.48
					\$1,620,000.00

Wall Costs

Item	Quantity	Cost/sf	2016 Cost	Contingency	2017 Cost
Retaining Wall	5750 sf	\$150.00	\$862,500.00	\$172,500.00	\$1,076,400.00
Subtotal, Wall Costs			\$862,500.00	\$172,500.00	\$1,076,400.00
					\$1,080,000.00

Bridge Cost

Item	Quantity	Cost/sf	2016 Cost	Contingency	2017 Cost
Railway Mainline	2000 sf	\$350.00	\$700,000.00	\$140,000.00	\$873,600.00
Subtotal, Bridge Cost			\$700,000.00	\$140,000.00	\$873,600.00
					\$870,000.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00
					\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 89

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Minor	1 LS	\$93,008.75	\$93,008.75	\$18,601.75	\$116,074.92
Subtotal, Utility Impact			\$93,008.75	\$18,601.75	\$116,074.92
					\$120,000.00

SUBTOTAL, CONSTRUCTION COSTS			\$4,513,358.54	\$902,671.71	\$5,632,671.46
					\$5,630,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost	
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00	
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00	
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00	
Mobilization	1 LS	\$225,667.93	\$45,133.59	\$281,633.57	
MPT	1 LS	\$135,400.76	\$27,080.15	\$168,980.14	
			\$416,068.68	\$83,213.74	\$519,253.72
					\$520,000.00

TOTAL CONSTRUCTION COSTS			\$4,929,427.22	\$985,885.44	\$6,151,925.17
					\$6,150,000.00

DESIGN AND CM COSTS			\$902,671.71	\$197,177.09	\$1,230,385.03
					\$1,230,000.00

TOTAL, DESIGN, CONSTRUCTION AND CI			\$5,416,030.25		\$7,382,310.21
					\$7,380,000.00

ROW COSTS
 Concept 89

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
57-H-150-A-1	\$5,300.00		105,197	32,500	N	31%	\$1,643.00
57-H-100	\$1,328,900.00		4,847,313	15,000	N	0.3%	\$3,990.00
90-E-50-A	\$20,800.00		414,953	340,000	N	82%	\$17,060.00
129-N-40	\$118,800.00		62,290	22,500	N	36%	\$42,770.00
129-K-100-0-1	\$48,100.00		1,046,834	105,000	N	10%	\$4,810.00
129-L-250	\$15,000.00		316,202	47,500	N	15%	\$2,250.00
129-M-300	\$900.00		25,700	10,000	N	39%	\$500.00
129-K-100-5	\$7,500.00		101,059	36,250	N	36%	\$2,700.00
Subtotal, ROW Costs							\$75,723.00
							\$80,000.00

USER BENEFITS
Concept 89

Value of Time

Cars		
Avg Hourly Wage		\$21.84
Benefits	18%	\$3.93
Total Compensation		\$25.77
Value of Time of hourly wage	50%	\$12.89

Length of Bicycle Facility (Miles)

New Portion	3.80
Full Portion (with Three Rivers Trail)	9.20

Estimated Bicycle Ridership (Daily)

New Ridership	14.68
Existing Ridership using new facility	686.00

User Benefits

3.8 miles				
		EXISTING USERS		
	Per Trip/ Mile	Daily	Annually (based on 180 days of bicycling)	
Mobility Benefits	\$4.08	\$2,798.88	\$26,527.62	
Health Benefits	\$128		\$87,808.00	
Decreased Auto Use	\$0.13	\$338.88	\$60,999.12	
			\$175,334.74	
		NEW USERS		
	Per Trip/ Mile	Daily	Annually (based on 180 days of bicycling)	
Mobility Benefits	\$4.08	\$59.89	\$567.60	
Health Benefits	\$128		\$1,878.78	
Decreased Auto Use	\$0.13	\$4.93	\$4,396.35	
			\$6,842.73	
		TOTAL BENEFITS		
Mobility Benefits			\$27,095.22	
Health Benefits			\$89,686.78	
Decreased Auto Use			\$65,395.47	
Total User Benefits			\$182,177.47	

Emissions

Cars

Fuel Consumption

Daily Estimate -78.913 gallons

Annual estimate -14204.400 gallons

CO2 19.4 lb/gal
8799.6848 grams/gal
(124,994,242.77) g
Total (124,994.24) kg

VOC
24.62 grams/gal
(349,698.80) g
Total (349.70) kg

NOx
16.5 grams/gal
(234,372.60) g
Total (234.37) kg

PM2.5
0.097619 grams/gal
(1,386.62) g
Total (1.39) kg

SUMMARY OF COSTS AND BENEFITS
 Concept 90

Construction Cost	
Supplemental Roadway Construction	\$7,000.00
Earthwork	\$0.00
Pavement	\$468,000.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$0.00
Signage	\$0.00
Utilities	\$12,000.00
Additional Lump Sum	\$108,000.00
Design and PM	\$119,000.00
ROW	\$0.00
Total	\$714,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Mobility Benefits	\$26,683.00
Health Benefits	\$89,686.78
Decreased Auto Use	\$26,757.06
Total	\$143,126.84
Emissions (Annual)	
CO2	-2138 kg
NOx	-4 kg
VOC	-6 kg
Benefit:Cost Ratio	
NPV Benefits	\$2,150,166.37
NPV Operating Costs	\$0.00
NPV Capital Costs	\$699,056.76
Total Costs	\$699,056.76
Benefit:Cost Ratio	3.08

NET PRESENT VALUE CALCULATIONS

Concept 90

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$713,323.23
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$699,056.76
NPV Capital Costs			\$699,056.76

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224		\$0	\$0	\$0
2021	0.9039	\$143,127	\$129,375	\$0	\$0
2022	0.8858	\$143,127	\$126,788	\$0	\$0
2023	0.8681	\$143,127	\$124,252	\$0	\$0
2024	0.8508	\$143,127	\$121,767	\$0	\$0
2025	0.8337	\$143,127	\$119,332	\$0	\$0
2026	0.8171	\$143,127	\$116,945	\$0	\$0
2027	0.8007	\$143,127	\$114,606	\$0	\$0
2028	0.7847	\$143,127	\$112,314	\$0	\$0
2029	0.7690	\$143,127	\$110,068	\$0	\$0
2030	0.7536	\$143,127	\$107,866	\$0	\$0
2031	0.7386	\$143,127	\$105,709	\$0	\$0
2032	0.7238	\$143,127	\$103,595	\$0	\$0
2033	0.7093	\$143,127	\$101,523	\$0	\$0
2034	0.6951	\$143,127	\$99,493	\$0	\$0
2035	0.6812	\$143,127	\$97,503	\$0	\$0
2036	0.6676	\$143,127	\$95,553	\$0	\$0
2037	0.6543	\$143,127	\$93,642	\$0	\$0
2038	0.6412	\$143,127	\$91,769	\$0	\$0
2039	0.6283	\$143,127	\$89,933	\$0	\$0
2040	0.6158	\$143,127	\$88,135	\$0	\$0
NPV		User Benefits	\$2,150,166	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 90

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Delineators	7300 lf	\$0.80	\$5,840.00	\$1,168.00	\$7,288.32
Subtotal, Supplemental Roadway Costs			\$5,840.00	\$1,168.00	\$7,288.32
					\$7,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Earthwork Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Trail Pavement	11356 SY	\$33.00	\$374,748.00	\$74,949.60	\$467,685.50
Subtotal, Pavement Costs			\$374,748.00	\$74,949.60	\$467,685.50
					\$468,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Minor	1 LS	\$9,514.70	\$9,514.70	\$1,902.94	\$11,874.35
Subtotal, Utility Impact			\$9,514.70	\$1,902.94	\$11,874.35
					\$12,000.00

SUBTOTAL, CONSTRUCTION COSTS			\$390,102.70	\$78,020.54	\$486,848.17
					\$487,000.00

CONSTRUCTION COST ESTIMATE
 Concept 90

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00
Mobilization	1 LS	\$19,505.14	\$3,901.03	\$24,342.41
MPT	1 LS	\$11,703.08	\$2,340.62	\$14,605.45
		\$86,208.22	\$17,241.64	\$107,587.85
				\$108,000.00
TOTAL CONSTRUCTION COSTS		\$476,310.92	\$95,262.18	\$594,436.02
DESIGN AND CM COSTS		\$78,020.54	\$19,052.44	\$118,887.20
TOTAL, DESIGN, CONSTRUCTION AND CM		\$468,123.24		\$713,323.23
				\$714,000.00

USER BENEFITS
Concept 90

Value of Time

Cars		
Avg Hourly Wage		\$21.84
Benefits	18%	\$3.93
Total Compensation		\$25.77
Value of Time of hourly wage	50%	\$12.89

Length of Bicycle Facility (Miles)

New Portion	1.62
Full Portion (with Three Rivers Trail)	8.00

Estimated Bicycle Ridership (Daily)

New Ridership	4.02
Existing Ridership using new facility	686.00

User Benefits

1.62 miles				
EXISTING USERS				
	Per Trip/ Mile	Daily	Annually (based on 180 days of bicycling)	
Mobility Benefits	\$4.08	\$2,798.88	\$26,527.62	
Health Benefits	\$128		\$87,808.00	
Decreased Auto Use	\$0.13	\$144.47	\$26,004.89	
			\$140,340.51	
NEW USERS				
	Per Trip/ Mile	Daily	Annually (based on 180 days of bicycling)	
Mobility Benefits	\$4.08	\$16.39	\$155.38	
Health Benefits	\$128		\$1,878.78	
Decreased Auto Use	\$0.13	\$4.18	\$752.17	
			\$2,786.33	
TOTAL BENEFITS				
Mobility Benefits			\$26,683.00	
Health Benefits			\$89,686.78	
Decreased Auto Use			\$26,757.06	
Total User Benefits			\$143,126.84	

Emissions

Cars

Fuel Consumption

Daily Estimate -1.350 gallons

Annual estimate -243.000 gallons

CO2 19.4 lb/gal
8799.6848 grams/gal
(2,138,323.41) g
Total (2,138.32) kg

VOC 24.62 grams/gal
(5,982.43) g
Total (5.98) kg

NOx 16.5 grams/gal
(4,009.50) g
Total (4.01) kg

PM2.5 0.097619 grams/gal
(23.72) g
Total (0.02) kg

SUMMARY OF COSTS AND BENEFITS
 Concept 91

Construction Cost	
Supplemental Roadway Construction	\$0.00
Earthwork	\$0.00
Pavement	\$200,000.00
Walls	\$8,300,000.00
Bridges	\$0.00
Traffic Signals	\$0.00
Signage	\$0.00
Utilities	\$100,000.00
Additional Lump Sum	\$800,000.00
Design and PM	\$1,900,000.00
ROW	\$100,000.00
Total	\$11,400,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Mobility Benefits	\$26,889.11
Health Benefits	\$89,004.54
Decreased Auto Use	\$7,383.43
Total	\$123,277.08
Emissions (Annual)	
CO2	-2737 kg
NOx	-5 kg
VOC	-8 kg
Benefit:Cost Ratio	
NPV Benefits	\$1,851,967.33
NPV Operating Costs	\$0.00
NPV Capital Costs	\$11,079,606.61
Total Costs	\$11,079,606.61
Benefit:Cost Ratio	0.17

NET PRESENT VALUE CALCULATIONS

Concept 91

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$11,305,721.03
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$11,079,606.61
NPV Capital Costs			\$11,079,606.61

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224		\$0	\$0	\$0
2021	0.9039	\$123,277	\$111,433	\$0	\$0
2022	0.8858	\$123,277	\$109,204	\$0	\$0
2023	0.8681	\$123,277	\$107,020	\$0	\$0
2024	0.8508	\$123,277	\$104,880	\$0	\$0
2025	0.8337	\$123,277	\$102,782	\$0	\$0
2026	0.8171	\$123,277	\$100,726	\$0	\$0
2027	0.8007	\$123,277	\$98,712	\$0	\$0
2028	0.7847	\$123,277	\$96,738	\$0	\$0
2029	0.7690	\$123,277	\$94,803	\$0	\$0
2030	0.7536	\$123,277	\$92,907	\$0	\$0
2031	0.7386	\$123,277	\$91,049	\$0	\$0
2032	0.7238	\$123,277	\$89,228	\$0	\$0
2033	0.7093	\$123,277	\$87,443	\$0	\$0
2034	0.6951	\$123,277	\$85,694	\$0	\$0
2035	0.6812	\$123,277	\$83,980	\$0	\$0
2036	0.6676	\$123,277	\$82,301	\$0	\$0
2037	0.6543	\$123,277	\$80,655	\$0	\$0
2038	0.6412	\$123,277	\$79,042	\$0	\$0
2039	0.6283	\$123,277	\$77,461	\$0	\$0
2040	0.6158	\$123,277	\$75,912	\$0	\$0
NPV		User Benefits	\$1,851,967	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
Concept 91

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
ROW Type 1	2200 lf	\$12.50	\$27,500.00	\$5,500.00	\$34,320.00
Drainage	1 ls	\$7,270.92	\$7,270.92	\$1,454.18	\$9,074.11
Subtotal, Supplemental Roadway Costs			\$34,770.92	\$6,954.18	\$43,394.11
					\$0.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	138 CY	\$20.00	\$2,760.00	\$552.00	\$3,444.48
Borrow	0 CY	\$25.00	\$0.00	\$0.00	\$0.00
Subtotal, Earthwork Costs			\$2,760.00	\$552.00	\$3,444.48
					\$0.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Trail Pavement	4407 SY	\$33.00	\$145,431.00	\$29,086.20	\$181,497.89
Subtotal, Pavement Costs			\$145,431.00	\$29,086.20	\$181,497.89
					\$200,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Retaining Wall	2204 lf	\$3,000.00	\$6,612,000.00	\$1,322,400.00	\$8,251,776.00
Subtotal, Wall Costs			\$6,612,000.00	\$1,322,400.00	\$8,251,776.00
					\$8,300,000.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Minor	1 LS	\$67,949.62	\$67,949.62	\$13,589.92	\$84,801.13
Subtotal, Utility Impact			\$67,949.62	\$13,589.92	\$84,801.13
					\$100,000.00

CONSTRUCTION COST ESTIMATE
 Concept 91

SUBTOTAL, CONSTRUCTION COSTS	\$6,862,911.54	\$1,372,582.31	\$8,564,913.60
			\$8,600,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00
Mobilization	1 LS	\$343,145.58	\$68,629.12	\$428,245.68
MPT	1 LS	\$205,887.35	\$41,177.47	\$256,947.41
		\$604,032.92	\$120,806.58	\$753,833.09
				\$800,000.00

TOTAL CONSTRUCTION COSTS	\$7,466,944.46	\$1,493,388.89	\$9,318,746.69
			\$9,400,000.00
DESIGN AND CM COSTS	\$1,372,582.31	\$298,677.78	\$1,863,749.34
			\$1,900,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM	\$8,235,493.85		\$11,182,496.03
			\$11,300,000.00

ROW COSTS
 Concept 91

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
28-N-189	\$17,400.00		14,520	3,630	N	25%	\$4,350.00
28-N-200	\$33,000.00		27,492	13,746	N	50%	\$16,500.00
28-N-233	\$15,900.00		13,266	3,317	N	25%	\$3,975.00
11-S-69	\$1,000.00		4,818	1,205	N	25%	\$500.00
28-N-268	\$2,100.00		1,763	1,763	Y	100%	\$2,100.00
28-N-263	\$20,400.00		16,975	16,975	Y	100%	\$20,400.00
28-N-201	\$2,000.00		1,683	1,683	Y	100%	\$2,000.00
28-N-203	\$5,500.00		4,563	4,563	Y	100%	\$5,500.00
28-N-204	\$3,300.00		2,784	2,784	Y	100%	\$3,300.00
28-N-205	\$3,300.00		2,760	2,760	Y	100%	\$3,300.00
28-N-206	\$3,300.00		2,712	2,712	Y	100%	\$3,300.00
28-N-207	\$3,300.00		2,712	2,712	Y	100%	\$3,300.00
28-N-208	\$3,300.00		2,705	2,705	Y	100%	\$3,300.00
28-N-209	\$3,200.00		2,688	2,688	Y	100%	\$3,200.00
28-N-210	\$3,200.00		2,688	2,688	Y	100%	\$3,200.00
28-N-211	\$3,200.00		2,640	2,640	Y	100%	\$3,200.00
28-N-212	\$3,200.00		2,664	2,664	Y	100%	\$3,200.00
28-N-213	\$2,900.00		2,400	2,400	Y	100%	\$2,900.00
28-N-214	\$3,100.00		2,616	2,616	Y	100%	\$3,100.00
28-N-215	\$3,100.00		2,592	2,592	Y	100%	\$3,100.00
28-N-216	\$300.00		234	234	Y	100%	\$500.00
28-N-217	\$3,100.00		2,568	2,568	Y	100%	\$3,100.00
28-N-218	\$3,200.00		2,625	2,625	Y	100%	\$3,200.00
28-N-223	\$10,700.00		8,919	8,919	Y	100%	\$10,700.00
28-N-241	\$3,400.00		2,856	2,856	Y	100%	\$3,400.00
28-N-239	\$2,500.00		2,100	2,100	Y	100%	\$2,500.00
28-N-234	\$1,300.00		1,100	1,100	Y	100%	\$1,300.00
28-N-235	\$2,400.00		2,000	2,000	Y	100%	\$2,400.00
28-N-236	\$2,400.00		2,000	2,000	Y	100%	\$2,400.00
Subtotal, ROW Costs							\$123,225.00
							\$100,000.00

USER BENEFITS
Concept 91

Value of Time

Cars		
Avg Hourly Wage		\$21.84
Benefits	18%	\$3.93
Total Compensation		\$25.77
Value of Time of hourly wage	50%	\$12.89

Length of Bicycle Facility (Miles)

New Portion	0.40
Full Portion (with Three Rivers Trail)	4.40

Estimated Bicycle Ridership (Daily)

New Ridership	9.35
Existing Ridership using new facility	686.00

User Benefits

0.4 miles		EXISTING USERS	
	Per Trip/ Mile	Daily	Annually (based on 180 days of bicycling)
Mobility Benefits	\$4.08	\$2,798.88	\$26,527.62
Health Benefits	\$128		\$87,808.00
Decreased Auto Use	\$0.13	\$35.67	\$6,420.96
			\$120,756.58
		NEW USERS	
	Per Trip/ Mile	Daily	Annually (based on 180 days of bicycling)
Mobility Benefits	\$4.08	\$38.14	\$361.49
Health Benefits	\$128		\$1,196.54
Decreased Auto Use	\$0.13	\$4.93	\$962.47
			\$2,520.50
TOTAL BENEFITS			
Mobility Benefits			\$26,889.11
Health Benefits			\$89,004.54
Decreased Auto Use			\$7,383.43
Total User Benefits			\$123,277.08

Emissions

Cars

Fuel Consumption

Daily Estimate -1.728 gallons

Annual estimate -311.000 gallons

CO2 19.4 lb/gal
8799.6848 grams/gal
(2,736,701.97) g
Total (2,736.70) kg

VOC 24.62 grams/gal
(7,656.52) g
Total (7.66) kg

NOx 16.5 grams/gal
(5,131.50) g
Total (5.13) kg

PM2.5 0.097619 grams/gal
(30.36) g
Total (0.03) kg

SUMMARY OF COSTS AND BENEFITS
 Concept 95

Construction Cost	
Supplemental Roadway Construction	\$0.00
Earthwork	\$0.00
Pavement	\$0.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$0.00
Signage	\$0.00
Utilities	\$0.00
Additional Lump Sum	\$0.00
Design and PM	\$0.00
ROW	\$2,200,000.00
Total	\$2,200,000.00
Operating Cost	
Additional service on Route P12	\$297,856.00
Lot annual O&M	\$50,000.00
Total	\$347,856.00
User Benefits	
Travel Time (Day)	112 hr
Value of Travel Time (Annual)	\$373,888.57
Automobile Operating Costs (Annual)	\$107,275.84
Parking Savings (Annual)	\$108,810.00
Safety (Annual)	\$12,479.20
Total	\$493,643.62
Emissions (Annual)	
CO2	-314246 kg
NOx	-589 kg
VOC	-879 kg
Benefit:Cost Ratio	
NPV Benefits	\$9,606,226.22
NPV Operating Costs	\$5,546,623.58
NPV Capital Costs	\$2,156,000.00
Total Costs	\$7,702,623.58
Benefit:Cost Ratio	1.25

NET PRESENT VALUE CALCULATIONS

Concept 95

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$2,200,000.00
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$2,156,000.00
NPV Capital Costs			\$2,156,000.00

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$602,454	\$555,684	\$347,856	\$320,851
2021	0.9039	\$602,454	\$544,570	\$347,856	\$314,434
2022	0.8858	\$602,454	\$533,679	\$347,856	\$308,146
2023	0.8681	\$602,454	\$523,005	\$347,856	\$301,983
2024	0.8508	\$602,454	\$512,545	\$347,856	\$295,943
2025	0.8337	\$602,454	\$502,294	\$347,856	\$290,024
2026	0.8171	\$602,454	\$492,248	\$347,856	\$284,224
2027	0.8007	\$602,454	\$482,403	\$347,856	\$278,539
2028	0.7847	\$602,454	\$472,755	\$347,856	\$272,968
2029	0.7690	\$602,454	\$463,300	\$347,856	\$267,509
2030	0.7536	\$602,454	\$454,034	\$347,856	\$262,159
2031	0.7386	\$602,454	\$444,954	\$347,856	\$256,916
2032	0.7238	\$602,454	\$436,055	\$347,856	\$251,777
2033	0.7093	\$602,454	\$427,333	\$347,856	\$246,742
2034	0.6951	\$602,454	\$418,787	\$347,856	\$241,807
2035	0.6812	\$602,454	\$410,411	\$347,856	\$236,971
2036	0.6676	\$602,454	\$402,203	\$347,856	\$232,231
2037	0.6543	\$602,454	\$394,159	\$347,856	\$227,587
2038	0.6412	\$602,454	\$386,276	\$347,856	\$223,035
2039	0.6283	\$602,454	\$378,550	\$347,856	\$218,574
2040	0.6158	\$602,454	\$370,979	\$347,856	\$214,203
NPV		User Benefits	\$9,606,226	Op Costs	\$5,546,623.58

ROW COSTS
Concept 95

Parcel	Market Price	Area (sf)	Taking (sf)	Full	%	ROW Cost
Purchase property	\$2,200,000.00			Yes	100%	\$2,200,000.00
Subtotal, ROW Costs						\$2,200,000.00
						\$2,200,000.00

Safety
Concept 95

Safety

Crash Type	$N_{pred,2010-2012}$	$N_{pred,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	207	68.85	1.00	68.65	0.21

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.00	0.02	0.07	0.11	\$ 12,479.20

OPERATING COST ESTIMATE
Concept 95

	Trips/Day	Cost/Mi	Weekdays/Year	Mi/Trip	
Additional service on Route P12	2	\$14.32	260	40	\$297,856.00
Lot annual O&M					\$50,000.00
Total Annual Operating Costs					\$347,856.00

USER BENEFITS
 Concept 95

-\$412.60 change in fuel cost, per day
 -\$107,275.84 change in fuel cost, per year

Subtotal, Total, all vehicles

Parking Savings

Cars

Downtown Parking - P&R Bus Costs = Savings

Downtown Parking	
Number of Riders	93
Parking Garage Cost / Day	\$12.00 per rider
	<u>\$1,116.00 per day</u>

Bus Fare	
Number of Riders	93
Parking Garage Cost / Day	\$7.50 Round Trip
	<u>\$697.50 per day</u>

Total, all riders
 -\$418.50 Difference in parking per day
 -\$108,810.00 Difference in parking per year, 260 working days

Subtotal, Parking Savings

User Benefits

Value of Time	-\$373,888.57	Value of Travel Time change, Per year
Operating Costs	-\$107,275.84	Value of Operating Costs change, per year
Parking Costs	-\$108,810.00	Value of Parking Costs change, per year
Total, Parking Costs	-\$589,974.41	

USER BENEFITS
Concept 95
Emissions

Cars

Fuel Consumption

Daily Estimate -137.4 gallons
Annual estimate -35711.0 gallons

CO2 19.4 lb/gal
8799.68 grams/gal
(314,245.54) kg
Total (314,245.54) kg

Nox 16.5 (589.23) kg
Total (589.23) kg

VOC 24.62 (879.17) kg
Total (879.17) kg

PM2.5 0.098 grams/gal
(3.49) kg
Total (3.49) kg

SUMMARY OF COSTS AND BENEFITS
 Concept 96

Construction Cost	
Supplemental Roadway Construction	\$0.00
Earthwork	\$0.00
Pavement	\$749,000.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$0.00
Signage	\$0.00
Utilities	\$0.00
Additional Lump Sum	\$0.00
Design and PM	\$150,000.00
ROW	\$685,000.00
Total	\$1,584,000.00
Operating Cost	
Additional service on Route P16	\$684,840.00
Lot annual O&M	\$75,000.00
Total	\$759,840.00
User Benefits	
Travel Time (Day)	165 hr
Value of Travel Time (Annual)	\$552,792.24
Automobile Operating Costs (Annual)	\$123,284.04
Parking Savings (Annual)	\$175,500.00
Safety (Annual)	\$20,798.67
Total	\$696,874.95
Emissions (Annual)	
CO2	-361139 kg
NOx	-677 kg
VOC	-1010 kg
Benefit:Cost Ratio	
NPV Benefits	\$13,105,517.31
NPV Operating Costs	\$12,115,779.12
NPV Capital Costs	\$1,551,888.80
Total Costs	\$13,667,667.92
Benefit:Cost Ratio	0.96

NET PRESENT VALUE CALCULATIONS

Concept 96

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$1,583,560.00
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$1,551,888.80
NPV Capital Costs			\$1,551,888.80

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224		\$0	\$759,840	\$700,852
2021	0.9039	\$872,375	\$788,558	\$759,840	\$686,835
2022	0.8858	\$872,375	\$772,787	\$759,840	\$673,098
2023	0.8681	\$872,375	\$757,331	\$759,840	\$659,637
2024	0.8508	\$872,375	\$742,184	\$759,840	\$646,444
2025	0.8337	\$872,375	\$727,341	\$759,840	\$633,515
2026	0.8171	\$872,375	\$712,794	\$759,840	\$620,845
2027	0.8007	\$872,375	\$698,538	\$759,840	\$608,428
2028	0.7847	\$872,375	\$684,567	\$759,840	\$596,259
2029	0.7690	\$872,375	\$670,876	\$759,840	\$584,334
2030	0.7536	\$872,375	\$657,458	\$759,840	\$572,647
2031	0.7386	\$872,375	\$644,309	\$759,840	\$561,194
2032	0.7238	\$872,375	\$631,423	\$759,840	\$549,970
2033	0.7093	\$872,375	\$618,795	\$759,840	\$538,971
2034	0.6951	\$872,375	\$606,419	\$759,840	\$528,192
2035	0.6812	\$872,375	\$594,290	\$759,840	\$517,628
2036	0.6676	\$872,375	\$582,404	\$759,840	\$507,275
2037	0.6543	\$872,375	\$570,756	\$759,840	\$497,130
2038	0.6412	\$872,375	\$559,341	\$759,840	\$487,187
2039	0.6283	\$872,375	\$548,154	\$759,840	\$477,443
2040	0.6158	\$872,375	\$537,191	\$759,840	\$467,895
NPV		User Benefits	\$13,105,517	Op Costs	\$12,115,779.12

CONSTRUCTION COST ESTIMATE
 Concept 96

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Supplemental Roadway Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Earthwork Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Construct lot	1 LS	\$600,000.00	\$600,000.00	\$120,000.00	\$748,800.00
Subtotal, Pavement Costs			\$600,000.00	\$120,000.00	\$748,800.00
					\$749,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00
					\$0.00

SUBTOTAL, CONSTRUCTION COSTS			\$600,000.00	\$120,000.00	\$748,800.00
					\$749,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
		\$0.00	\$0.00	\$0.00
				\$0.00

CONSTRUCTION COST ESTIMATE
Concept 96

TOTAL CONSTRUCTION COSTS	\$600,000.00	\$120,000.00	\$748,800.00
			\$749,000.00
DESIGN AND CM COSTS	\$120,000.00	\$24,000.00	\$149,760.00
			\$150,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM	\$720,000.00		\$898,560.00
			\$899,000.00

ROW COSTS
 Concept 96

Parcel	Market Price	Area (sf)	Taking (sf)	Full	%	ROW Cost
Purchase property	\$685,000.00			Yes	100%	\$685,000.00
Subtotal, ROW Costs						\$685,000.00
						\$685,000.00

Safety
Concept 96

Safety

Crash Type	$N_{pred,2010-2012}$	$N_{pred,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	207	68.85	1.00	68.51	0.34

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.01	0.04	0.11	0.19	\$ 20,798.67

OPERATING COST ESTIMATE
Concept 96

	Trips/Day	Cost/Mi	Weekdays/Year	Mi/Trip	
Additional service on Route P16	4	\$14.32	260	46	\$684,840.00
Lot annual O&M					\$75,000.00
Total Annual Operating Costs					\$759,840.00

USER BENEFITS

Concept 96

Value of Time

Riders		
Avg Hourly Wage		\$21.84
Benefits	18%	\$3.93
Total Compensation		\$25.77
Value of Time	50%	\$12.89
	of hourly wage	

CHANGE IN TRAVEL TIME

Number of Riders		150
Daily Estimate (Individual)		-1.1 hrs
Daily Estimate (Total)		-165.0 hrs
Hourly value of time		\$12.89
Value of Time		-\$2,126.12

Total, all vehicles - \$2,126.12 Value of travel time changes, per day
-\$552,792.24 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs

Cars		
Daily		
Average Speed	25	
Change in VMT/Day		-3156.9 miles
Fuel Consumption		0.050 gal/mile
		-157.8 gallons
Fuel Consumption		
Daily Estimate		-157.8 gallons
		\$3.004 per gallon
		-\$474.17

Total, all vehicles -157.8 fuel consumption change, gallons per day
-41040.0 fuel consumption change, gallons per year

USER BENEFITS
Concept 96

-\$474.17 change in fuel cost, per day
-\$123,284.04 change in fuel cost, per year

Subtotal, Total, all vehicles

Parking Savings

Cars

Downtown Parking - P&R Bus Costs = Savings

Downtown Parking

Number of Riders	150
Parking Garage Cost / Day	\$12.00 per rider
	<hr/>
	\$1,800.00 per day

Bus Fare

Number of Riders	150
Parking Garage Cost / Day	\$7.50 Round Trip
	<hr/>
	\$1,125.00 per day

Total, all riders
-\$675.00 Difference in parking per day
-\$175,500.00 Difference in parking per year, 260 working days

Subtotal, Parking Savings

User Benefits

Value of Time	-\$552,792.24	Value of Travel Time change, Per year
Operating Costs	-\$123,284.04	Value of Operating Costs change, per year
Parking Costs	-\$175,500.00	Value of Parking Costs change, per year
Total, Parking Costs	-\$851,576.28	

Emissions

Cars

USER BENEFITS
Concept 96

Fuel Consumption

Daily Estimate -157.8 gallons
Annual estimate -41040.0 gallons

CO2 19.4 lb/gal
8799.68 grams/gal
(361,138.71) kg
Total (361,138.71) kg

Nox 16.5 (677.16) kg
Total (677.16) kg

VOC 24.62 (1,010.36) kg
Total (1,010.36) kg

PM2.5 0.098 grams/gal
(4.01) kg
Total (4.01) kg



SUMMARY OF COSTS AND BENEFITS
 Concept 98

Construction Cost	
Supplemental Roadway Construction	\$0.00
Earthwork	\$0.00
Pavement	\$2,500,000.00
Walls	\$0.00
Bridges	\$0.00
Traffic Signals	\$0.00
Signage	\$0.00
Utilities	\$0.00
Additional Lump Sum	\$0.00
Design and PM	\$500,000.00
ROW	\$0.00
Total	\$3,000,000.00
Operating Cost	
Deck annual O&M	\$272,000.00
LEASE TBD	\$0.00
Total	\$272,000.00
User Benefits	
Travel Time (Day)	64 hr
Value of Travel Time (Annual)	\$214,416.38
Automobile Operating Costs (Annual)	\$37,399.71
Parking Savings (Annual)	\$93,600.00
Safety (Annual)	\$2,640.78
Total	\$254,456.88
Emissions (Annual)	
CO2	-109556 kg
NOx	-205 kg
VOC	-307 kg
Benefit:Cost Ratio	
NPV Benefits	\$5,228,790.04
NPV Operating Costs	\$4,337,086.65
NPV Capital Costs	\$2,935,296.00
Total Costs	\$7,272,382.65
Benefit:Cost Ratio	0.72

NET PRESENT VALUE CALCULATIONS

Concept 98

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$2,995,200.00
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$2,935,296.00
NPV Capital Costs			\$2,935,296.00

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224		\$0	\$272,000	\$250,884
2021	0.9039	\$348,057	\$314,616	\$272,000	\$245,866
2022	0.8858	\$348,057	\$308,324	\$272,000	\$240,949
2023	0.8681	\$348,057	\$302,157	\$272,000	\$236,130
2024	0.8508	\$348,057	\$296,114	\$272,000	\$231,408
2025	0.8337	\$348,057	\$290,192	\$272,000	\$226,779
2026	0.8171	\$348,057	\$284,388	\$272,000	\$222,244
2027	0.8007	\$348,057	\$278,700	\$272,000	\$217,799
2028	0.7847	\$348,057	\$273,126	\$272,000	\$213,443
2029	0.7690	\$348,057	\$267,664	\$272,000	\$209,174
2030	0.7536	\$348,057	\$262,310	\$272,000	\$204,991
2031	0.7386	\$348,057	\$257,064	\$272,000	\$200,891
2032	0.7238	\$348,057	\$251,923	\$272,000	\$196,873
2033	0.7093	\$348,057	\$246,884	\$272,000	\$192,936
2034	0.6951	\$348,057	\$241,947	\$272,000	\$189,077
2035	0.6812	\$348,057	\$237,108	\$272,000	\$185,295
2036	0.6676	\$348,057	\$232,366	\$272,000	\$181,589
2037	0.6543	\$348,057	\$227,718	\$272,000	\$177,958
2038	0.6412	\$348,057	\$223,164	\$272,000	\$174,398
2039	0.6283	\$348,057	\$218,701	\$272,000	\$170,910
2040	0.6158	\$348,057	\$214,327	\$272,000	\$167,492
NPV		User Benefits	\$5,228,790	Op Costs	\$4,337,086.65

CONSTRUCTION COST ESTIMATE
 Concept 98

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Supplemental Roadway Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Earthwork Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Construct deck	1 EA	\$2,000,000.00	\$2,000,000.00	\$400,000.00	\$2,496,000.00
Subtotal, Pavement Costs			\$2,000,000.00	\$400,000.00	\$2,496,000.00
					\$2,500,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00
					\$0.00

SUBTOTAL, CONSTRUCTION COSTS			\$2,000,000.00	\$400,000.00	\$2,496,000.00
					\$2,500,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
		\$0.00	\$0.00	\$0.00
				\$0.00

CONSTRUCTION COST ESTIMATE
Concept 98

TOTAL CONSTRUCTION COSTS	\$2,000,000.00	\$400,000.00	\$2,496,000.00
			\$2,500,000.00
DESIGN AND CM COSTS	\$400,000.00	\$80,000.00	\$499,200.00
			\$500,000.00
TOTAL, DESIGN, CONSTRUCTION AND CM	\$2,400,000.00		\$2,995,200.00
			\$3,000,000.00

Safety
 Concept 98

Safety

Crash Type	$N_{pred,2010-2012}$	$N_{pred,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	55	18.20	1.00	18.15	0.04

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.00	0.00	0.00	0.01	0.02	\$ 2,640.78

OPERATING COST ESTIMATE
Concept 98

	Trips/Day	Cost/Mi	Weekdays/Year	Mi/Trip	
Deck annual O&M					\$272,000.00
LEASE TBD					
Total Annual Operating Costs					\$272,000.00

USER BENEFITS
Concept 98

Fuel Consumption

Daily Estimate	-47.9 gallons
	<u>\$3.004 per gallon</u>
	-\$143.85

Total, all vehicles

	-47.9 fuel consumption change, gallons per day
	-12450.0 fuel consumption change, gallons per year
	-\$143.85 change in fuel cost, per day
	-\$37,399.71 change in fuel cost, per year

Subtotal, Total, all vehicles

Parking Savings

Cars

Downtown Parking - P&R Bus Costs = Savings

Downtown Parking

Number of Riders	80
Parking Garage Cost / Day	<u>\$12.00 per rider</u>
	\$960.00 per day

Bus Fare

Number of Riders	80
Parking Garage Cost / Day	<u>\$7.50 Round Trip</u>
	\$600.00 per day

Total, all riders

	-\$360.00 Difference in parking per day
	-\$93,600.00 Difference in parking per year, 260 working days

Subtotal, Parking Savings

USER BENEFITS
Concept 98

User Benefits

Value of Time	-\$214,416.38	Value of Travel Time change, Per year
Operating Costs	-\$37,399.71	Value of Operating Costs change, per year
Parking Costs	-\$93,600.00	Value of Parking Costs change, per year
Total, User Benefits	-\$345,416.09	

Emissions

Cars

Fuel Consumption

Daily Estimate	-47.9 gallons
Annual estimate	<u>-12450.0 gallons</u>

CO2	19.4 lb/gal	
	8799.68 grams/gal	
		(109,555.81) kg
Total		(109,555.81) kg

Nox	16.5	(205.42) kg
Total		(205.42) kg

VOC	24.62	(306.51) kg
Total		(306.51) kg

PM2.5	0.098 grams/gal	
		(1.22) kg
Total		(1.22) kg



SUMMARY OF COSTS AND BENEFITS
 Concept 99

Construction Cost	
Roadway Construction	\$0.00
Earthwork	\$0.00
Pavement	\$0.00
Walls	\$0.00
Bridges	\$0.00
Ramp Metering	\$1,685,547.72
Signage	\$0.00
Utilities	\$0.00
Additional Lump Sum	\$0.00
Design and PM	\$168,554.77
ROW	\$0.00
Total	\$1,854,102.49
Operating Cost	
Maintenance, Power & Comm	\$16,250.00
Operations	\$100,000.00
Total	\$116,250.00
User Benefits	
Travel Time (Day)	10 hr
Value of Travel Time (Annual)	-\$2,426,815.88
Automobile Operating Costs (Annual)	\$1,191,698.35
Safety (Annual)	\$848,212.09
Total	-\$386,905.43
Emissions (Annual)	
CO2	-3255303 kg
NOx	-423 kg
VOC	-504 kg
Benefit:Cost Ratio	
NPV Benefits	-\$5,812,404.22
NPV Operating Costs	\$1,853,626.19
NPV Capital Costs	\$1,817,020.44
Total Costs	\$3,670,646.63
Benefit:Cost Ratio	-1.58

NET PRESENT VALUE CALCULATIONS

Concept 99

Capital Costs

Construction Year	2017	
Current Year	2016	
2017 Total Capital Cost		\$1,854,102.49
Discount Rate	2% for 1 Year	
Discount Factor		0.980
NPV of capital costs		\$1,817,020.44
NPV Capital Costs		\$1,817,020.44

Annual Costs and Benefits

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224	\$0	\$0	\$116,250	\$107,225
2021	0.9039	-\$386,905	-\$349,732	\$116,250	\$105,081
2022	0.8858	-\$386,905	-\$342,737	\$116,250	\$102,979
2023	0.8681	-\$386,905	-\$335,882	\$116,250	\$100,920
2024	0.8508	-\$386,905	-\$329,165	\$116,250	\$98,901
2025	0.8337	-\$386,905	-\$322,582	\$116,250	\$96,923
2026	0.8171	-\$386,905	-\$316,130	\$116,250	\$94,985
2027	0.8007	-\$386,905	-\$309,807	\$116,250	\$93,085
2028	0.7847	-\$386,905	-\$303,611	\$116,250	\$91,223
2029	0.7690	-\$386,905	-\$297,539	\$116,250	\$89,399
2030	0.7536	-\$386,905	-\$291,588	\$116,250	\$87,611
2031	0.7386	-\$386,905	-\$285,756	\$116,250	\$85,859
2032	0.7238	-\$386,905	-\$280,041	\$116,250	\$84,141
2033	0.7093	-\$386,905	-\$274,440	\$116,250	\$82,459
2034	0.6951	-\$386,905	-\$268,952	\$116,250	\$80,809
2035	0.6812	-\$386,905	-\$263,573	\$116,250	\$79,193
2036	0.6676	-\$386,905	-\$258,301	\$116,250	\$77,609
2037	0.6543	-\$386,905	-\$253,135	\$116,250	\$76,057
2038	0.6412	-\$386,905	-\$248,072	\$116,250	\$74,536
2039	0.6283	-\$386,905	-\$243,111	\$116,250	\$73,045
2040	0.6158	-\$386,905	-\$238,249	\$116,250	\$71,584
NPV		User Benefits	-\$5,812,404	Op Costs	\$1,853,626.19

CONSTRUCTION COST ESTIMATE
 Concept 99

Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Roadway Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Earthwork Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Pavement Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Wall Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Bridge Cost

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Subtotal, Bridge Cost			\$0.00	\$0.00	\$0.00
					\$0.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
Subtotal, Signal Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
Subtotal, Signage Costs			\$0.00	\$0.00	\$0.00
					\$0.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Subtotal, Utility Impact			\$0.00	\$0.00	\$0.00
					\$0.00

SUBTOTAL, CONSTRUCTION COSTS			\$0.00	\$0.00	\$0.00
					\$0.00

CONSTRUCTION COST ESTIMATE
 Concept 99

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00
Mobilization	1 LS	\$0.00	\$0.00	\$0.00
MPT	1 LS	\$0.00	\$0.00	\$0.00
		\$55,000.00	\$11,000.00	\$68,640.00
				\$68,600.00
TOTAL CONSTRUCTION COSTS		\$55,000.00	\$11,000.00	\$68,640.00
				\$68,600.00
DESIGN AND CM COSTS		\$0.00	\$2,200.00	\$13,728.00
				\$13,700.00
TOTAL, DESIGN, CONSTRUCTION AND C		\$0.00		\$82,368.00
				\$82,300.00

RAMP METERING COST ESTIMATE
 Concept 99

Typical One-lane Ramp Metering

Item	Quantity	Units	Unit Cost	Cost
Flashing Warning Sign	1	ea	\$6,100.00 ea	\$6,100.00
Traffic Signal Support, 12' Pedestal	1	ea	\$2,600.00 ea	\$2,600.00
24" White Hot Thermoplastic Pavement Markings	15	lf	\$15.00 lf	\$225.00
Vehicular signal head, One 8" Section	3	ea	\$415.00 ea	\$1,245.00
Vehicular signal head, One 12" Section	2	ea	\$430.00 ea	\$860.00
3" Conduit	50	lf	\$6.25 lf	\$312.50
Trench and backfill	485	lf	\$57.67 lf	\$27,969.95
Signal cable	30	lf	\$1.58 lf	\$47.40
Controller assembly	1	ea	\$10,600.00 ea	\$10,600.00
Loop Sensors	180	lf	\$9.95 lf	\$1,791.00
Electrical service, Type A	1	ea	\$2,372.35 ea	\$2,372.35
Junction boxes	3	ea	\$1,428.00 ea	\$4,284.00
Signage	28	sf	\$17.50 sf	\$490.00
Detector Lead-In	340	lf	\$1.43 lf	\$486.20
1" Conduit	255	lf	\$5.25 lf	\$1,338.75
4" White Hot Thermoplastic Pavement Markings	100	lf	\$1.50 lf	\$150.00
Other: Power Conduit	400	lf	\$6.25 lf	\$2,500.00
Other: Power, Trench and Backfill	400	lf	\$36.25 lf	\$14,500.00
Other: Power Cable	400	lf	\$12.00 lf	\$4,800.00
Other: Wireless Comm	1	ea	\$5,000.00 ea	\$5,000.00
Subtotal Typical One-lane Ramp Metering				\$87,672.15

Ramp Closure

Other: Ramp Closure - Automated Gate	1	ea	\$ 5,000.00 ea	\$5,000.00
Other: Ramp Closure - Signage with VMS	3	ea	\$ 25,000.00 ea	\$75,000.00
Other: Ramp Closure - CCTV	1	ea	\$ 20,000.00 ea	\$20,000.00
Subtotal Ramp Closure				\$100,000.00

Phase 1 - Directional Ramp Metering to alleviate peak hour conditions

Westbound Ramps	7
Eastbound Ramps	6
Total Ramps Metered	13
Ramp Closure Installation	\$100,000.00
Ramp Metering Construction	\$1,139,737.95
Total Ramp Construction Cost	\$1,239,737.95
Software & Integration (10% of Construction Cost)	\$123,973.80
Subtotal1	\$1,363,711.75
MPT (3% of Subtotal1)	\$40,911.35
Subtotal2	\$1,404,623.10
Contingency (20% of Subtotal2)	\$280,924.62
Total	\$1,685,547.72
Design & CM (10% of Total)	\$168,554.77
Grand Total	\$1,854,102.49

Phase 2 - All Ramps Metered

Westbound Ramps	11
Eastbound Ramps	14
Total Ramps Metered	25
Ramp Closure Installation	\$100,000.00
Ramp Metering Construction	\$2,191,803.75
Total construction cost	\$2,291,803.75
Software & Integration (10% of Construction Cost)	\$229,180.38
Subtotal1	\$2,520,984.13
MPT (3% of Subtotal1)	\$75,629.52
Subtotal2	\$2,596,613.65
Contingency (20% of Subtotal2)	\$519,322.73
Total	\$3,115,936.38
Design & CM (10% of Total)	\$311,593.64
Grand Total	\$3,427,530.02

Safety
 Concept 99

Safety

Crash Type	$N_{obs,2010-2012}$	$N_{obs,frequency}$	CMF	$N_{pred,CMF}$	$N_{reduced}$
All	117	39.00	0.64	24.96	14.04

$N_{reduced,K}$	$N_{reduced,A}$	$N_{reduced,B}$	$N_{reduced,C}$	$N_{reduced,O}$	Dollars Saved, Annually
0.04	0	1.46	4.68	7.56	\$ 848,212.09

USER BENEFITS
Concept 99

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr:PM Veh-Hrs
No-build	0	248483	0 6200
Build		249533	6039
Change	0	1050	0 -161
Subtotal, MOEs			

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	0.000 hrs	0.00 hrs
PM Peak Period	-157.471 hrs	-4.02 hrs
Total of Peaks	-157.471 hrs	-4.024 hrs
Daily Estimate	-608.344 hrs	-15.546 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	-\$7,838.88	-\$306.13

Total, all vehicles -\$8,145.01 Value of travel time changes, per day
 -\$2,761,849.35 Value of travel time changes, per year

Subtotal, Value of Time

USER BENEFITS
Concept 99

Automobile Operating Costs (Delay)

	Cars	Trucks
AM Peak Period		
Average Speed	0	
Change in Veh-Hrs	0.000 hours	0.000 hours
Fuel Consumption	#N/A gal/minute	#N/A gal/minute
	#N/A gallons	#N/A gallons
PM Peak Period		
Average Speed	27.125	
Change in Veh-Hrs	-157.5 hours	-4.0 hours
Fuel Consumption	0.026 gal/minute	0.133 gal/minute
	-245.7 gallons	-32.1 gallons
Fuel Consumption		
AM Peak Period	0.0 gallons	0.0 gallons
PM Peak Period	-245.7 gallons	-32.1 gallons
Total of Peaks	-245.7 gallons	-32.1 gallons
Daily Estimate	-949.017 gallons	-124.056 gallons
	\$3.004 per gallon	\$3.004 per gallon
	-\$2,850.85 per day	-\$372.66 per day
Total, all vehicles	-1073.1 fuel consumption change, gallons per day	
	(363,862.73) fuel consumption change, gallons per year	
	-\$3,223.51 change in fuel cost, per day	
	-\$1,093,043.65 change in fuel cost, per year	

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	-\$2,761,849.35	Value of Travel Time change, Per year
Operating Costs	-\$1,093,043.65	Value of Operating Costs change, per year
Total, User Benefits	-\$3,854,893.00	

USER BENEFITS
 Concept 99

Emissions

	Cars	Trucks
Fuel Consumption		
AM Peak Period	0 gallons	0 gallons
PM Peak Period	-246 gallons	-32 gallons
Total of Peaks	-246 gallons	-32 gallons
Daily Estimate	-949 gallons	-124 gallons
Annual estimate	-321797 gallons	-42065
CO2	19.4 lb/gal 8799.6848 grams/gal (2,831,714.92) kg	22.2 lb/gal 10069.7424 grams/gal (423,587.96) kg
Total	(3,255,302.88) kg	
Nox	(407.42) kg	(16.08) kg
Total	(423.50) kg	
VOC	(485.31) kg	(19.15) kg
Total	(504.46) kg	
PM2.5	0.09761905 grams/gal (31.41) kg	0.136 grams/gal (5.72) kg
Total	(37.13) kg	

USER BENEFITS
Concept 99

Peak Veh/Hr from PWKY 530

MOEs

Item	AM VMT	PM VMT	AM Veh-Hr	PM Veh-Hrs
No-build	0	0	0	0
Build	0	-99	0	152
Change	0	-99	0	152
Subtotal, MOEs				

Improvement only during peak period?

Value of Time

	Cars		Trucks	
Avg Hourly Wage		\$21.84		\$16.41
Benefits	18%	\$3.93	20%	\$3.28
Total Compensation		\$25.77		\$19.69
Value of Time	50%	\$12.89	100%	\$19.69
	of hourly wage		of total compensation	

CHANGE IN TRAVEL TIME

AM Peak Period	0.000 hrs	0.00 hrs
PM Peak Period	147.920 hrs	3.78 hrs
Total of Peaks	147.920 hrs	3.780 hrs
Daily Estimate	1142.891 hrs	29.206 hrs
Hourly value of time	\$12.89	\$19.69
Value of Time	\$14,726.84	\$575.12

Total, all vehicles \$15,301.96 Value of travel time changes, per day
\$5,188,665.23 Value of travel time changes, per year

Subtotal, Value of Time

Automobile Operating Costs (Delay)

	Cars	Trucks
AM Peak Period		
Average Speed		
Change in Veh-Hrs	0.000 hours	0.000 hours
Fuel Consumption	#N/A gal/minute	#N/A gal/minute
	#N/A gallons	#N/A gallons
PM Peak Period		
Detour Distance mi	4.20	
Average Speed mph	7.41	
Change in Veh-Hrs	-96.5 miles	-2.5 miles
Fuel Consumption	0.117 gal/mile	0.503 gal/mile
	-11.3 gallons	-1.2 gallons
Fuel Consumption		
AM Peak Period	0.0 gallons	0.0 gallons
PM Peak Period	-11.3 gallons	-1.2 gallons
Total of Peaks	-11.3 gallons	-1.2 gallons
Daily Estimate	-87.265 gallons	-9.587 gallons
	\$3.004 per gallon	\$3.004 per gallon
	-\$262.14 per day	-\$28.80 per day
Total, all vehicles		
	(97) fuel consumption change, gallons per day	
	(32,841) fuel consumption change, gallons per year	
	-\$290.94 change in fuel cost, per day	
	-\$98,654.70 change in fuel cost, per year	

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	\$5,188,665.23	Value of Travel Time change, Per year
Operating Costs	-\$98,654.70	Value of Operating Costs change, per year
Total, User Benefits	\$5,090,010.52	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-11.3 gallons	-1.2 gallons
Annual estimate	-3829.8 gallons	-420.7 gallons
CO2		
	19.4 lb/gal	19.4 lb/gal
	8799.7 grams/gal	8799.7 grams/gal
	(33,700.63) kg	(3,702.41) kg
Total	(37,403.05) kg	
VOC		
	24.62 grams/gal	1.27 grams/gal
	(94.28) kg	(0.53) kg
Total	(94.82) kg	
NOx		
	16.5 grams/gal	24.52 grams/gal
	(63.19) kg	(10.32) kg
Total	(73.51) kg	
PM2.5		
	0.098 grams/gal	0.136 grams/gal
	(0.37) kg	(0.06) kg
Total	(0.43) kg	

Ramp Metering Detour Routes							
Concept 99							
Tributary Road Impacts							
Detour Impact Summary	Signal Delay (hr)	Route Delay (hr)	No. Vehicles per Hour	Peak Hours	Vehicle Miles Traveled		
Intersection Delay	56.0						
Route Delay							
Oakland to Parkway via Bates		8.1	343	2	-1098		
Oakland to Parkway via Penn/Forest Hills		44.1	32	2	224		
Oakland to Parkway via Commercial/Swissvale		18.2	78	2	465		
Oakland to Parkway via Forbes/Edgewood		25.3	78	2	310		
	56.0 hr	95.7 hr			-99 mi		
Detour Routes	Dist. (mi)	Increase (mi)	#Veh/Hr	Peak Hr	VMT		
Base: Oakland to Parkway via SQ Hill Interchange	3.0						
Detour: Oakland to Parkway via Bates	1.4	-1.6	343	2	-1098		
Detour: Oakland to Parkway via Penn/Forest Hills	6.5	3.5	32	2	224		
Detour: Oakland to Parkway via Commerical/Swissvale	6.0	3.0	78	2	465		
Detour: Oakland to Parkway via Forbes/Edgewood	5.0	2.0	78	2	310		
Total Detour VMT					-99 mi		
Route Delay	AADT	K	D	Peak Hr	Signals	Delay/Int. (s)	Delay (hr)
Base: Oakland to Parkway via SQ Hill Interchange							
Detour: Oakland to Parkway via Bates							
Fifth Avenue	13792	0.1	1.0	2.0	3	2.0	4.6
Craft	7777	0.1	0.6	2.0	2	2.0	1.0
Boulevard of the Allies	11646	0.1	1.0	2.0	2	2.0	2.6
							8.1 hr
Detour: Oakland to Parkway via Penn/Forest Hills							
Fifth Avenue	13792	0.1	1.0	2.0	1	2.0	1.5
Forbes to Bellefield	16080	0.1	1.0	2.0	8	2.0	14.3
Fifth Avenue	21486	0.1	0.55	2	9	2.0	11.8
Penn Avenue (to Braddock)	11764	0.1	0.55	2	6	2.0	4.3
Penn Avenue (to Penn)	19802	0.1	0.55	2	10	2.0	12.1
							44.1 hr
Detour: Oakland to Parkway via Commercial/Swissvale							
Fifth Avenue	13792	0.1	1.0	2.0	1	2.0	1.5
Forbes to Bellefield	16080	0.1	1.0	2.0	6	2.0	10.7
Panther Hollow	5910	0.1	0.6	2.0	3	2.0	1.1
Pocussset	5704	0.1	0.6	2.0	6	2.0	2.1
Braddock	22446	0.1	0.6	2.0	2	2.0	2.7
							18.2 hr

Detour: Oakland to Parkway via Forbes/Edgewood							
Fifth Avenue	13792	0.1	1.0	2.0	1	2.0	1.5
Forbes to Bellefield	16080	0.1	1.0	2.0	8	2.0	14.3
Forbes to Braddock	6635	0.1	1.0	2.0	11	2.0	8.1
Braddock	11527	0.1	0.6	2.0	2	2.0	1.4
							25.3 hr
Route Delay Subtotal							95.7 hr
Intersection Delays							
	Detour Incr	Detour	Peak Hr	Inter. Incr.	No Build	Delay hr	
Forward/Murray/Poccussett	60.5 s/veh	78 veh/hr	2.0	24.0 s/veh	1725 veh/hr	25.6	
Bates/Boulevard of the Allies	1.2 s/veh	343 veh/hr	2.0	1.2 s/veh	3672 veh/hr	2.7	
Penn/Braddock	1.8 s/veh	32 veh/hr	2.0	0.9 s/veh	3092 veh/hr	1.6	
Forbes/Braddock	34.2 s/veh	76 veh/hr	2.0	17.2 s/veh	2583 veh/hr	26.1	
Intersection Delay Subtotal							56.0 hr
Traffic Volumes (ADT)							
	ADT						
Forbes Avenue							
Craft to Bellefield	16080						
to Beeler	8990						
to Murray	7515						
to Beechwood	9800						
to Braddock	14590						
Fifth Avenue							
Craft to Bellefield	13792						
to Shady	17646						
to Murray	25325						
Penn Avenue							
Fifth Avenue to Wilkins	10912						
to Braddock	12615						
to Swissvale Avenue	19078						
to I-376	20526						
Schenly Drive	3624						
Panther Hollow	5910						
Poccussett/Commercial	5704						
Braddock Avenue (South of I-376)	22446						
Craft Avenue	7777						
Boulevard of the Allies (EB only)	11646						
Braddock Avenue (North of I-376)	11527						

Automobile Operating Costs (Delay)

	Cars	Trucks
AM Peak Period		
Average Speed		
Change in Veh-Hrs	0.000 hours	0.000 hours
Fuel Consumption	#N/A gal/minute	#N/A gal/minute
	#N/A gallons	#N/A gallons
PM Peak Period		
Average Speed		
Change in Veh-Hrs		
Fuel Consumption		
	-256.9 gallons	-33.4 gallons
Fuel Consumption		
AM Peak Period	0.0 gallons	0.0 gallons
PM Peak Period	-256.9 gallons	-33.4 gallons
Total of Peaks	-256.9 gallons	-33.4 gallons
Daily Estimate	-1036.282 gallons	-133.643 gallons
	\$3.004 per gallon	\$3.004 per gallon
	-\$3,112.99 per day	-\$401.46 per day
Total, all vehicles		
	-1169.9 fuel consumption change, gallons per day	
	(396,703.85) fuel consumption change, gallons per year	
	-\$3,514.45 change in fuel cost, per day	
	-\$1,191,698.35 change in fuel cost, per year	

Subtotal, Automobile Operating Costs (Delay)

User Benefits

Value of Time	\$2,426,815.88	Value of Travel Time change, Per year
Operating Costs	-\$1,191,698.35	Value of Operating Costs change, per year
Total, User Benefits	\$1,235,117.52	

Emissions

	Cars	Trucks
Fuel Consumption		
Daily Estimate	-949 gallons	-124 gallons
Annual estimate	-321797 gallons	-42065 gallons
CO2		
Total	(3,292,705.93) kg	
Nox		
Total	(423.50) kg	
VOC		
Total	(504.46) kg	
PM2.5		
Total	(37.13) kg	

SUMMARY OF COSTS AND BENEFITS
 Concept 100A

Construction Cost	
Supplemental Roadway Construction	\$1,400,000.00
Earthwork	\$300,000.00
Pavement	\$2,100,000.00
Walls	\$4,500,000.00
Bridges	\$16,700,000.00
Traffic Signals	\$200,000.00
Signage	\$1,700,000.00
Utilities	\$700,000.00
Additional Lump Sum	\$2,300,000.00
Design and PM	\$6,000,000.00
ROW	\$2,300,000.00
Total	\$38,200,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	0.1 hr
Value of Travel Time (Annual)	\$155,279.34
Automobile Operating Costs (Annual)	\$0.00
Safety (Annual)	\$124,186.26
Total	\$279,465.60
Emissions (Annual)	
CO2	0 kg
NOx	0 kg
VOC	0 kg
Benefit:Cost Ratio	
NPV Benefits	\$1,865,625.78
NPV Operating Costs	\$0.00
NPV Capital Costs	\$37,436,000.00
Total Costs	\$37,436,000.00
Benefit:Cost Ratio	0.05

NET PRESENT VALUE CALCULATIONS

Concept 100A

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$38,200,000.00
Discount Rate	2%	for	1 Year
Discount Factor			0.980
NPV of capital costs			\$37,436,000.00
NPV Capital Costs			\$37,436,000.00

	0
Annual Costs and Benefits	0

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224		\$0	\$0	\$0
2021	0.9039	\$124,186	\$112,255	\$0	\$0
2022	0.8858	\$124,186	\$110,009	\$0	\$0
2023	0.8681	\$124,186	\$107,809	\$0	\$0
2024	0.8508	\$124,186	\$105,653	\$0	\$0
2025	0.8337	\$124,186	\$103,540	\$0	\$0
2026	0.8171	\$124,186	\$101,469	\$0	\$0
2027	0.8007	\$124,186	\$99,440	\$0	\$0
2028	0.7847	\$124,186	\$97,451	\$0	\$0
2029	0.7690	\$124,186	\$95,502	\$0	\$0
2030	0.7536	\$124,186	\$93,592	\$0	\$0
2031	0.7386	\$124,186	\$91,720	\$0	\$0
2032	0.7238	\$124,186	\$89,886	\$0	\$0
2033	0.7093	\$124,186	\$88,088	\$0	\$0
2034	0.6951	\$124,186	\$86,326	\$0	\$0
2035	0.6812	\$124,186	\$84,600	\$0	\$0
2036	0.6676	\$124,186	\$82,908	\$0	\$0
2037	0.6543	\$124,186	\$81,250	\$0	\$0
2038	0.6412	\$124,186	\$79,625	\$0	\$0
2039	0.6283	\$124,186	\$78,032	\$0	\$0
2040	0.6158	\$124,186	\$76,471	\$0	\$0
NPV		User Benefits	\$1,865,626	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
Concept 100A

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Guiderail	9000 lf	\$16.50	\$148,500.00	\$29,700.00	\$185,328.00
Concrete Barrier	685 lf	\$60.00	\$41,100.00	\$8,220.00	\$51,292.80
PBD & Geotextile	670 lf	\$11.00	\$7,370.00	\$1,474.00	\$9,197.76
Drainage - inlets	12 ea	\$4,000.00	\$48,000.00	\$9,600.00	\$59,904.00
Drainage - pavement base drain	10075 lf	\$0.75	\$7,556.25	\$1,511.25	\$9,430.20
Lighting	7000 lf	\$125.00	\$875,000.00	\$175,000.00	\$1,092,000.00
Subtotal, Supplemental Roadway Costs			\$1,127,526.25	\$225,505.25	\$1,407,152.76
					\$1,400,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	11750 CY	\$20.00	\$235,000.00	\$47,000.00	\$293,280.00
Borrow	225 CY	\$25.00	\$5,625.00	\$1,125.00	\$7,020.00
Subtotal, Earthwork Costs			\$240,625.00	\$48,125.00	\$300,300.00
					\$300,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	15000 SY	\$110.00	\$1,650,000.00	\$330,000.00	\$2,059,200.00
Subtotal, Pavement Costs			\$1,650,000.00	\$330,000.00	\$2,059,200.00
					\$2,100,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Retaining Wall	1350 lf	\$2,650.00	\$3,577,500.00	\$715,500.00	\$4,464,720.00
Sound Wall	0 lf	\$1,250.00	\$0.00	\$0.00	\$0.00
Subtotal, Wall Costs			\$3,577,500.00	\$715,500.00	\$4,464,720.00
					\$4,500,000.00

Bridge Cost

Item	Quantity	Cost/unit	2016 Cost	Contingency	2017 Cost
Widening STA 157-161 (Over SR 8)	5100 sf	\$700.00	\$3,570,000.00	\$714,000.00	\$4,455,360.00
Widening STA 162 (Over SR 8012/A)	2180 sf	\$600.00	\$1,308,000.00	\$261,600.00	\$1,632,384.00
Widening STA 170 (Over SR 8012/G)	2000 sf	\$600.00	\$1,200,000.00	\$240,000.00	\$1,497,600.00
Widening STA 230 (Over Beulah Rd)	1750 sf	\$600.00	\$1,050,000.00	\$210,000.00	\$1,310,400.00
Widening STA 235 (Over Wm Penn)	6384 sf	\$450.00	\$2,872,800.00	\$574,560.00	\$3,585,254.40
Chestnut St. Bridge Replacement	150 lf	\$22,500.00	\$3,375,000.00	\$675,000.00	\$4,212,000.00
Subtotal, Bridge Cost			\$13,375,800.00	\$2,675,160.00	\$16,692,998.40
					\$16,700,000.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
New Ramp and Edgewood Ave	1 ea	\$175,000.00	\$175,000.00	\$35,000.00	\$218,400.00
Subtotal, Signal Costs			\$175,000.00	\$35,000.00	\$218,400.00
					\$200,000.00

CONSTRUCTION COST ESTIMATE
 Concept 100A

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
OH Truss 6 lanes	2 ea	\$250,000.00	\$500,000.00	\$100,000.00	\$624,000.00
OH Truss 4 lanes	1 lf	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00
Hard Shoulder Running Signs	700 lf	\$30.00	\$21,000.00	\$4,200.00	\$26,208.00
Cantilever Sign	1 ea	\$50,000.00	\$50,000.00	\$10,000.00	\$62,400.00
Type A Signs	4 ea	\$2,500.00	\$10,000.00	\$2,000.00	\$12,480.00
ITS Relocation	1 ls	\$600,000.00	\$600,000.00	\$120,000.00	\$748,800.00
Subtotal, Signage Costs			\$1,381,000.00	\$276,200.00	\$1,723,488.00
					\$1,700,000.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Low	1 LS	\$538,186.00	\$538,186.00	\$107,637.20	\$671,656.13
Subtotal, Utility Impact			\$538,186.00	\$107,637.20	\$671,656.13
					\$700,000.00

SUBTOTAL, CONSTRUCTION COSTS			\$22,065,637.25	\$4,413,127.45	\$27,537,915.29
					\$27,600,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00
Mobilization	1 LS	\$1,103,281.86	\$220,656.37	\$1,376,895.76
MPT	1 LS	\$661,969.12	\$132,393.82	\$826,137.46
		\$1,820,250.98	\$364,050.20	\$2,271,673.22
				\$2,300,000.00

TOTAL CONSTRUCTION COSTS		\$23,885,888.23	\$4,777,177.65	\$29,809,588.51
				\$29,900,000.00

DESIGN AND CM COSTS		\$4,413,127.45	\$955,435.53	\$5,961,917.70
				\$6,000,000.00

TOTAL, DESIGN, CONSTRUCTION AND CM		\$26,478,764.70		\$35,771,506.21
				\$35,900,000.00

ROW COSTS
 Concept 100A

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
0177-H-00220-0000-00	\$315,000.00	\$1,683,800.00	85,378	85,378	Yes	100%	\$1,998,800.00
0011-K-00340-0009-00	\$93,200.00	\$160,200.00	32,544	32,544	Yes	100%	\$253,400.00
0234-E-00287-0000-00	\$36,400.00	\$88,000.00	4,101	105.92	No	3%	\$940.13
0234-E-00289-0000-00	\$32,000.00	\$106,000.00	3,000	244.86	No	8%	\$2,611.84
0234-E-00291-0000-00	\$21,000.00	\$58,000.00	3,000	95.83	No	3%	\$670.81
Subtotal, ROW Costs							\$2,256,422.78
							\$2,300,000.00

Safety
 Concept 100A

Safety

Crash Type	N _{obs,2010-2012}	N _{obs,frequency}	CMF	N _{pred,CMF}	N _{reduced}
Fatal & Injury	42	14.00	0.87	12.14	1.86
PDO	55	18.33	0.94	17.21	1.13

N _{reduced,K}	N _{reduced,A}	N _{reduced,B}	N _{reduced,C}	N _{reduced,O}	Dollars Saved, Annually
0.00	0.04	0.18	0.62	1.01	\$ 77,819.75
0.00	0.02	0.11	0.38	0.62	\$ 46,366.51

Total: \$ 124,186.26

USER BENEFITS
 Concept 100A

\$0.00 change in fuel cost, per day
 \$0.00 change in fuel cost, per year

Subtotal, Total, all vehicles

Parking Savings

Cars

Downtown Parking - P&R Bus Costs = Savings

Downtown Parking

Number of Riders	0
Parking Garage Cost / Day	\$12.00 per rider
	<hr/>
	\$0.00 per day

Bus Fare

Number of Riders	0
Parking Garage Cost / Day	\$7.50 Round Trip
	<hr/>
	\$0.00 per day

Total, all riders	\$0.00 Difference in parking per day
	\$0.00 Difference in parking per year, 260 working days

Subtotal, Parking Savings

User Benefits

Value of Time	-\$155,279.34	Value of Travel Time change, Per year
Operating Costs	\$0.00	Value of Operating Costs change, per year
Parking Costs	\$0.00	Value of Parking Costs change, per year
Total, Parking Costs	-\$155,279.34	

USER BENEFITS
Concept 100A
Emissions

Cars

Fuel Consumption

Daily Estimate 0.0 gallons
Annual estimate 0.0 gallons

CO2 19.4 lb/gal
8799.68 grams/gal
- kg
Total - kg

Nox 16.5 - kg
Total - kg

VOC 24.62 - kg
Total - kg

PM2.5 0.098 grams/gal
- kg
Total - kg

SUMMARY OF COSTS AND BENEFITS
 Concept 100B

Construction Cost	
Supplemental Roadway Construction	\$1,400,000.00
Earthwork	\$300,000.00
Pavement	\$2,100,000.00
Walls	\$4,500,000.00
Bridges	\$16,700,000.00
Traffic Signals	\$200,000.00
Signage	\$1,700,000.00
Utilities	\$700,000.00
Additional Lump Sum	\$2,300,000.00
Design and PM	\$6,000,000.00
ROW	\$2,300,000.00
Total	\$38,200,000.00
Operating Cost	
Negligible	\$0.00
Total	\$0.00
User Benefits	
Travel Time (Day)	0.1 hr
Value of Travel Time (Annual)	\$155,279.34
Automobile Operating Costs (Annual)	\$0.00
Safety (Annual)	\$124,186.26
Total	\$279,465.60
Emissions (Annual)	
CO2	0 kg
NOx	0 kg
VOC	0 kg
Benefit:Cost Ratio	
NPV Benefits	\$1,865,625.78
NPV Operating Costs	\$0.00
NPV Capital Costs	\$37,436,000.00
Total Costs	\$37,436,000.00
Benefit:Cost Ratio	0.05

NET PRESENT VALUE CALCULATIONS

Concept 100B

Capital Costs

Construction Year	2017		
Current Year	2016		
2017 Total Capital Cost			\$38,200,000.00
Discount Rate	2% for	1 Year	
Discount Factor			0.980
NPV of capital costs			\$37,436,000.00
NPV Capital Costs			\$37,436,000.00

	0
Annual Costs and Benefits	0

Year	Discount Factor	Benefits 2016\$	Discounted	Op. Costs 2016\$	Discounted
2020	0.9224		\$0	\$0	\$0
2021	0.9039	\$124,186	\$112,255	\$0	\$0
2022	0.8858	\$124,186	\$110,009	\$0	\$0
2023	0.8681	\$124,186	\$107,809	\$0	\$0
2024	0.8508	\$124,186	\$105,653	\$0	\$0
2025	0.8337	\$124,186	\$103,540	\$0	\$0
2026	0.8171	\$124,186	\$101,469	\$0	\$0
2027	0.8007	\$124,186	\$99,440	\$0	\$0
2028	0.7847	\$124,186	\$97,451	\$0	\$0
2029	0.7690	\$124,186	\$95,502	\$0	\$0
2030	0.7536	\$124,186	\$93,592	\$0	\$0
2031	0.7386	\$124,186	\$91,720	\$0	\$0
2032	0.7238	\$124,186	\$89,886	\$0	\$0
2033	0.7093	\$124,186	\$88,088	\$0	\$0
2034	0.6951	\$124,186	\$86,326	\$0	\$0
2035	0.6812	\$124,186	\$84,600	\$0	\$0
2036	0.6676	\$124,186	\$82,908	\$0	\$0
2037	0.6543	\$124,186	\$81,250	\$0	\$0
2038	0.6412	\$124,186	\$79,625	\$0	\$0
2039	0.6283	\$124,186	\$78,032	\$0	\$0
2040	0.6158	\$124,186	\$76,471	\$0	\$0
NPV		User Benefits	\$1,865,626	Op Costs	\$0.00

CONSTRUCTION COST ESTIMATE
Concept 100B

Supplemental Roadway Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Guiderail	9000 lf	\$16.50	\$148,500.00	\$29,700.00	\$185,328.00
Concrete Barrier	685 lf	\$60.00	\$41,100.00	\$8,220.00	\$51,292.80
PBD & Geotextile	670 lf	\$11.00	\$7,370.00	\$1,474.00	\$9,197.76
Drainage - inlets	12 ea	\$4,000.00	\$48,000.00	\$9,600.00	\$59,904.00
Drainage - pavement base drain	10075 lf	\$0.75	\$7,556.25	\$1,511.25	\$9,430.20
Lighting	7000 lf	\$125.00	\$875,000.00	\$175,000.00	\$1,092,000.00
Subtotal, Supplemental Roadway Costs			\$1,127,526.25	\$225,505.25	\$1,407,152.76
					\$1,400,000.00

Earthwork Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Cut	11750 CY	\$20.00	\$235,000.00	\$47,000.00	\$293,280.00
Borrow	225 CY	\$25.00	\$5,625.00	\$1,125.00	\$7,020.00
Subtotal, Earthwork Costs			\$240,625.00	\$48,125.00	\$300,300.00
					\$300,000.00

Pavement Costs

Item	Quantity	Unit Cost	2016 Cost	Contingency	2017 Cost
Roadway & Shoulder	15000 SY	\$110.00	\$1,650,000.00	\$330,000.00	\$2,059,200.00
Subtotal, Pavement Costs			\$1,650,000.00	\$330,000.00	\$2,059,200.00
					\$2,100,000.00

Wall Costs

Item	Quantity	Cost/lf	2016 Cost	Contingency	2017 Cost
Retaining Wall	1350 lf	\$2,650.00	\$3,577,500.00	\$715,500.00	\$4,464,720.00
Sound Wall	0 lf	\$1,250.00	\$0.00	\$0.00	\$0.00
Subtotal, Wall Costs			\$3,577,500.00	\$715,500.00	\$4,464,720.00
					\$4,500,000.00

Bridge Cost

Item	Quantity	Cost/unit	2016 Cost	Contingency	2017 Cost
Widening STA 157-161 (Over SR 8)	5100 sf	\$700.00	\$3,570,000.00	\$714,000.00	\$4,455,360.00
Widening STA 162 (Over SR 8012/A)	2180 sf	\$600.00	\$1,308,000.00	\$261,600.00	\$1,632,384.00
Widening STA 170 (Over SR 8012/G)	2000 sf	\$600.00	\$1,200,000.00	\$240,000.00	\$1,497,600.00
Widening STA 230 (Over Beulah Rd)	1750 sf	\$600.00	\$1,050,000.00	\$210,000.00	\$1,310,400.00
Widening STA 235 (Over Wm Penn)	6384 sf	\$450.00	\$2,872,800.00	\$574,560.00	\$3,585,254.40
Chestnut St. Bridge Replacement	150 lf	\$22,500.00	\$3,375,000.00	\$675,000.00	\$4,212,000.00
Subtotal, Bridge Cost			\$13,375,800.00	\$2,675,160.00	\$16,692,998.40
					\$16,700,000.00

Signal Costs

Item	Quantity	Cost/ea	2016 Cost	Contingency	2017 Cost
New Ramp and Edgewood Ave	1 ea	\$175,000.00	\$175,000.00	\$35,000.00	\$218,400.00
Subtotal, Signal Costs			\$175,000.00	\$35,000.00	\$218,400.00
					\$200,000.00

CONSTRUCTION COST ESTIMATE
 Concept 100B

Signage Costs

Item	Quantity	Cost/Unit	2016 Cost	Contingency	2017 Cost
OH Truss 6 lanes	2 ea	\$250,000.00	\$500,000.00	\$100,000.00	\$624,000.00
OH Truss 4 lanes	1 lf	\$200,000.00	\$200,000.00	\$40,000.00	\$249,600.00
Hard Shoulder Running Signs	700 lf	\$30.00	\$21,000.00	\$4,200.00	\$26,208.00
Cantilever Sign	1 ea	\$50,000.00	\$50,000.00	\$10,000.00	\$62,400.00
Type A Signs	4 ea	\$2,500.00	\$10,000.00	\$2,000.00	\$12,480.00
ITS Relocation	1 ls	\$600,000.00	\$600,000.00	\$120,000.00	\$748,800.00
Subtotal, Signage Costs			\$1,381,000.00	\$276,200.00	\$1,723,488.00

\$1,700,000.00

Utility Impact

Item	Quantity	Cost	2016 Cost	Contingency	2017 Cost
Low	1 LS	\$538,186.00	\$538,186.00	\$107,637.20	\$671,656.13
Subtotal, Utility Impact			\$538,186.00	\$107,637.20	\$671,656.13

\$700,000.00

SUBTOTAL, CONSTRUCTION COSTS			\$22,065,637.25	\$4,413,127.45	\$27,537,915.29
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\$27,600,000.00

Additional Lump Sum

Item	Quantity	2016 Cost	Contingency	2017 Cost
Survey	1 LS	\$30,000.00	\$6,000.00	\$37,440.00
Field Office	1 LS	\$20,000.00	\$4,000.00	\$24,960.00
Const. Scheduling	1 LS	\$5,000.00	\$1,000.00	\$6,240.00
Mobilization	1 LS	\$1,103,281.86	\$220,656.37	\$1,376,895.76
MPT	1 LS	\$661,969.12	\$132,393.82	\$826,137.46
		\$1,820,250.98	\$364,050.20	\$2,271,673.22

\$2,300,000.00

TOTAL CONSTRUCTION COSTS			\$23,885,888.23	\$4,777,177.65	\$29,809,588.51
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\$29,900,000.00

DESIGN AND CM COSTS			\$4,413,127.45	\$955,435.53	\$5,961,917.70
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\$6,000,000.00

TOTAL, DESIGN, CONSTRUCTION AND CM			\$26,478,764.70		\$35,771,506.21
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\$35,900,000.00

ROW COSTS
 Concept 100B

Parcel	Land Value	Bldg Value	Area (sf)	Taking (sf)	Full	%	ROW Cost
0177-H-00220-0000-00	\$315,000.00	\$1,683,800.00	85,378	85,378	Yes	100%	\$1,998,800.00
0177-H-00210-0000-00	\$93,200.00	\$160,200.00	32,544	32,544	Yes	100%	\$253,400.00
0234-E-00285-0000-00	\$36,500.00	\$65,400.00	4,132	51.66	No	1%	\$456.34
0234-E-00287-0000-00	\$36,400.00	\$88,000.00	4,101	483.88	No	12%	\$4,294.86
0234-E-00289-0000-00	\$32,000.00	\$106,000.00	3,000	644.45	No	21%	\$6,874.13
0234-E-00291-0000-00	\$21,000.00	\$58,000.00	3,000	536.11	No	18%	\$3,752.77
0234-E-00293-0000-00	\$32,000.00	\$94,100.00	3,000	461.30	No	15%	\$4,920.53
0234-E-00295-0000-00	\$32,000.00	\$70,800.00	3,000	361.45	No	12%	\$3,855.47
0234-E-00297-0000-00	\$32,000.00	\$97,700.00	3,000	306.19	No	10%	\$3,266.03
0234-E-00299-0000-00	\$32,000.00	\$80,000.00	3,000	233.91	No	8%	\$2,495.04
0234-E-00301-0000-00	\$32,000.00	\$101,900.00	3,000	153.16	No	5%	\$1,633.71
0234-E-00303-0000-00	\$32,000.00	\$118,600.00	3,000	90.37	No	3%	\$963.95
0234-E-00305-0000-00	\$32,000.00	\$110,200.00	3,000	46.21	No	2%	\$492.91
0234-E-00307-0000-00	\$32,000.00	\$93,100.00	3,000	32.36	No	1%	\$345.17
0234-E-00308-0000-00	\$32,000.00	\$66,000.00	3,000	17.21	No	1%	\$183.57
0234-E-00311-0000-00	\$32,000.00	\$7,100.00	3,000	4.96	No	0%	\$52.91
Subtotal, ROW Costs							\$2,285,787.38
							\$2,300,000.00

The land value of 0234-E-00311-0000-00 was estimated at \$32,000 based on comparable area.

Safety
 Concept 100B

Safety

Crash Type	N _{obs,2010-2012}	N _{obs,frequency}	CMF	N _{pred,CMF}	N _{reduced}
Fatal & Injury	42	14.00	0.87	12.14	1.86
PDO	55	18.33	0.94	17.21	1.13

N _{reduced,K}	N _{reduced,A}	N _{reduced,B}	N _{reduced,C}	N _{reduced,O}	Dollars Saved, Annually
0.00	0.04	0.18	0.62	1.01	\$ 77,819.75
0.00	0.02	0.11	0.38	0.62	\$ 46,366.51

Total: \$ 124,186.26

USER BENEFITS
 Concept 100B

\$0.00 change in fuel cost, per day
 \$0.00 change in fuel cost, per year

Subtotal, Total, all vehicles

Parking Savings

Cars

Downtown Parking - P&R Bus Costs = Savings

Downtown Parking

Number of Riders	0
Parking Garage Cost / Day	\$12.00 per rider
	<u> </u>
	\$0.00 per day

Bus Fare

Number of Riders	0
Parking Garage Cost / Day	\$7.50 Round Trip
	<u> </u>
	\$0.00 per day

Total, all riders	\$0.00 Difference in parking per day
	\$0.00 Difference in parking per year, 260 working days

Subtotal, Parking Savings

User Benefits

Value of Time	-\$155,279.34	Value of Travel Time change, Per year
Operating Costs	\$0.00	Value of Operating Costs change, per year
Parking Costs	\$0.00	Value of Parking Costs change, per year
Total, Parking Costs	-\$155,279.34	

USER BENEFITS
Concept 100B
Emissions

Cars

Fuel Consumption

Daily Estimate 0.0 gallons
Annual estimate 0.0 gallons

CO2 19.4 lb/gal
8799.68 grams/gal
- kg
Total - kg

Nox 16.5 - kg
Total - kg

VOC 24.62 - kg
Total - kg

PM2.5 0.098 grams/gal
- kg
Total - kg