Implementation Plan



M-0446 Ramp Metering Feasibility Study for Durham and Wake Counties

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Introduction

This report details the work involved in formulating strategies for the implementation of ramp metering within the study area.

The principles used in formulating strategy options rely on first calculating benefit-to-cost ratios (BCR) for each site, and then establishing those sites that are financially viable. These financially viable sites will be compared to a list of currently planned State Transportation Implementation Plan (STIP) and Mobility Fund projects, to ensure that a conflict does not limit the ability of a particular site to deliver a benefit.

The information for the potential costs of each site originates from Task 8 – Typical Cost Estimates. That task identified typical ramp metering cost estimates for various layouts, alternatives, and optional features, and documented the assumptions and unit costs used. The typical costs were then used to produce a cost estimate for each site. Program costs, including procurement and integration of the control software and the controller firmware, were also estimated.

The information for the potential benefits of each site originates from Task 9 – Performance Measures. That task established the expected benefits for each of the 21 sites recognized as being suitable for ramp metering, as shown in Figure 1 on the following page. Potential benefits are quantified as a value of time saved, through the reduction of vehicle hours delay (VHD) annually in each location because of the introduction of ramp metering.

This report contains the following sections:

- Recommended Improvements
- Estimated Costs
- Estimated Delay Benefits
- Cost-Benefit Analysis for Individual Sites
- STIP Projects and Freeway-to-Freeway (F2F) Sites
- Strategies for Implementation
- Summary and Recommendations



Figure 1: Sites Suitable for Ramp Metering

1. Recommended Improvements

Table 1 presents the recommended ramp meter improvements for each of the 21 sites, based on traffic congestion and the geometric conditions. The recommended improvement includes ramp meter equipment, signing, pavement markings, drainage improvements, guardrail, roadway resurfacing or widening, and related earthwork. Details of the assumptions for each site are included in Appendix A.

Log	Freeway	Cross Street	Exit	Direction	Ramp Meter
002	1-40	US-15 / US-501	270	WB	Single Lane
009	1-40	NC-55 / Apex Hwy	278	FB	Single Lane Loop
010	1-40	NC-55 / Apex Hwy	278	WB	Single Lane
0.0				EB-M2 (SB	
012*	I-40	NC-147 / Durham Fwy	279	to EB)	Single Lane F2F
				WB-M2 (SB	_
014*	I-40	NC-147 / Durham Fwy	279	to WB)	Single Lane F2F
015	I-40	Davis Dr	280	EB	Two Lane
017	I-40	S Miami Blvd	281	EB	Single Lane
019	I-40	Page Rd	282	EB	Two Lane Loop
025	I-40	SR 3015 - Airport Blvd	284	EB	Single Lane
027	1-40	SR 1002 - Aviation Pkwy	285	EB-M1 (SB	Single Lane Loop
				EB-M2 (NB	
028	I-40	SR 1002 - Aviation Pkwy	285	to EB)	Single Lane
030	I-40	SR 1652 - N Harrison Ave	287	EB	Single Lane
043	I-40	SR 1571 - Gorman St	295	WB	Single Lane
056	I-40	SR 5220 - Jones Sausage Rd	303	WB	Single Lane
089	I-440	SR 1319 - Jones Franklin Rd	1C	NB	Single Lane
090	I-440	SR 1319 - Jones Franklin Rd	1C	SB	Single Lane Loop
				SB-M2 (EB	
095	I-440	SR 1012 - Western Blvd	2	to SB)	Single Lane
102	I-440	Lake Boone Trail	5	NB	Single Lane
				WB-M2 (SB	
108	I-440	US-70 / NC-50 / Glenwood Ave	7	to WB)	Single Lane
133*	I-540	US-70	4	EB	Two Lane F2F
135	I-540	SR 1829 - Leesville Rd	7	EB	Single Lane

Table 1: Recommended Ramp Meter Configurations

* Freeway-to-Freeway site

For Sites 015 and 019 the ramp meter would be two lanes and would include some ramp widening.

2. Estimated Costs

Three types of costs can be associated with the implementation and operation of a ramp metering site:

- Implementation cost
- Annual maintenance and operations cost
- Program cost

More information on how the estimated costs were derived can be found in Task 8 – Typical Cost Estimates Report, which breaks each cost into its component parts and describes how they were calculated.

2.1. Estimated Implementation Cost

The implementation cost estimate is a dependent variable, based on the site requirements. This estimate includes the installed cost of equipment, its design, and construction administration. Construction includes ramp meter equipment, signing, pavement markings, drainage improvements, guardrail, roadway resurfacing or widening, and related earthwork. The prorated cost of the controller firmware is also included in the site-specific costs. The estimated implementation cost for each site is shown in Table 2, and details for each site can be found in Appendix A.

Log	Free- way	Cross Street	Exit	Direction	Implementa- tion Cost
002	I-40	US-15 / US-501	270	WB	\$105,000
009	I-40	NC-55 / Apex Hwy	278	EB	\$105,000
010	I-40	NC-55 / Apex Hwy	278	WB	\$107,000
012*	I-40	NC-147 / Durham Fwy	279	EB-M2 (SB to EB)	\$574,000
014*	I-40	NC-147 / Durham Fwy	279	WB-M2 (SB to WB)	\$331,000
015	I-40	Davis Dr	280	EB	\$284,000
017	I-40	S Miami Blvd	281	EB	\$107,000
019	I-40	Page Rd	282	EB	\$195,000
025	I-40	SR 3015 - Airport Blvd	284	EB	\$113,000
027	I-40	SR 1002 - Aviation Pkwy	285	EB-M1 (SB to EB)	\$103,000
028	I-40	SR 1002 - Aviation Pkwy	285	EB-M2 (NB to EB)	\$113,000
030	I-40	SR 1652 - N Harrison Ave	287	EB	\$106,000
043	I-40	SR 1571 - Gorman St	295	WB	\$113,000
056	I-40	SR 5220 - Jones Sausage Rd	303	WB	\$113,000

Table 2: Estimated Implementation Costs for Each Site

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Log	Free- way	Cross Street	Exit	Direction	Implementa- tion Cost
089	I-440	SR 1319 - Jones Franklin Rd	1C	NB	\$112,000
090	I-440	SR 1319 - Jones Franklin Rd	1C	SB	\$101,000
095	I-440	SR 1012 - Western Blvd	2	SB-M2 (EB to SB)	\$116,000
102	I-440	Lake Boone Trail	5	NB	\$107,000
108	I-440	US-70 / NC-50 / Glenwood Ave	7	WB-M2 (SB to WB)	\$101,000
133*	I-540	US-70	4	EB	\$405,000
135	I-540	SR 1829 - Leesville Rd	7	EB	\$109,000

* Freeway-to-Freeway site

2.2. Estimated Annual Cost

The estimated annual cost for each site includes maintenance, operations, and annual software support, and has been calculated as \$7,491 per site.

2.3. Estimated Equipment Replacement Cost

Typically, certain equipment would be replaced when its useful life has been reached. Types of equipment include controllers, servers, communications hardware, technology, and LED signal heads. Since the replacement period is typically 10 years, replacement costs do not need to be considered and have not been included in this analysis.

2.4. Estimated Program Cost

The estimated program cost is a fixed cost. It includes the procurement and integration of the control software, software drivers, training, servers, and miscellaneous central communications hardware. This is a one-time cost when implementing ramp metering for the first time. The cost remains the same and is not related to the number of sites being implemented. The program cost has been estimated at \$404,998 which will be divided proportionately among each group of sites considered in the Strategies for Implementation section.

2.5. Basis of Costs

During this task, costs have been expressed in 2012 prices. The estimated costs have not been discounted to a base year, nor subjected to anticipated inflation.

3. Estimated Delay Benefits

The benefits used are based on the value of time potentially saved through the introduction of a ramp metering site. These benefits are quantified in financial terms based on a 20 percent savings in delay time as presented in the Performance Measures Report. Annual benefits can be calculated as follows:

Annual benefits = Annual vehicle delay x Percentage reduction x Weighted cost per hour of delay

Weighted cost per hour of vehicle delay = % passenger vehicles x passenger cost per hour of vehicle delay + % trucks vehicles x truck cost per hour of delay

The expected annual benefit for each site is shown in Table 3.

Additional information on how benefits have been derived can be found in Task 9 – Performance Measures Report, which describes the process of how the benefits were calculated for each site.

Although the analysis uses only travel time benefits, other benefits will accrue (e.g., crash, emissions, and travel time reliability). These have not been quantified—the complexity and variability of such analysis and the contract time limitations did not permit us to expand on these benefits.

Log	Free- way	Cross Street	Exit	Direction	Annual Benefit
002	I-40	US-15 / US-501	270	WB	\$51,635
009	I-40	NC-55 / Apex Hwy	278	EB	\$115,973
010	I-40	NC-55 / Apex Hwy	278	WB	\$130,436
012*	I-40	NC-147 / Durham Fwy	279	EB-M2 (SB to EB)	\$100,713
014*	I-40	NC-147 / Durham Fwy	279	WB-M2 (SB to WB)	\$156,859
015	I-40	Davis Dr	280	EB	\$153,237
017	I-40	S Miami Blvd	281	EB	\$367,370
019	I-40	Page Rd	282	EB	\$405,096
025	I-40	SR 3015 - Airport Blvd	284	EB	\$22,653
027	I-40	SR 1002 - Aviation Pkwy	285	EB-M1 (SB to EB)	\$71,480
028	I-40	SR 1002 - Aviation Pkwy	285	EB-M2 (NB to EB)	\$70,095
030	I-40	SR 1652 - N Harrison Ave	287	EB	\$145,506
043	I-40	SR 1571 - Gorman St	295	WB	\$125,664
056	I-40	SR 5220 - Jones Sausage Rd	303	WB	\$141,856

Table 3: Annual Financial Benefit of Ramp Metering for Each Site

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Log	Free- way	Cross Street	Exit	Direction	Annual Benefit
089	I-440	SR 1319 - Jones Franklin Rd	1C	NB	\$22,170
090	I-440	SR 1319 - Jones Franklin Rd	1C	SB	\$27,183
095	I-440	SR 1012 - Western Blvd	2	SB-M2 (EB to SB)	\$227,845
102	I-440	Lake Boone Trail	5	NB	\$138,361
108	I-440	US-70 / NC-50 / Glenwood Ave	7	WB-M2 (SB to WB)	\$150,287
133*	I-540	US-70	4	EB	\$48,162
135	I-540	SR 1829 - Leesville Rd	7	EB	\$120,917

* Freeway-to-Freeway site

4. Cost-Benefit Analysis for Individual Sites

Cost-benefit ratios have been calculated for each of the potential ramp metering sites annually for periods of 5 and 10 years. This analysis uses the estimated costs described in Section 3, Estimated Costs, and the estimated delay benefits based on a 20 percent savings in delay outlined in Task 9 – Performance Measures.

The purpose of this analysis is to allow comparison of the relative economic conditions of each site. Therefore, only the costs directly associated with each individual site have been included (i.e., implementation cost and annual cost). The one-time program cost is a fixed cost for the first implementation in each area, so it will be added to the total costs for each scenario (see Section 7, Strategies for Implementation).

A benefit-cost ratio analysis is an established method to compare the cumulative benefits versus cumulative costs. If that ratio is greater than 1.0, then the project has positive net benefits over the analysis period. For purposes of this analysis, the program cost of \$404,998 includes all the central software, training, integration, and hardware.

Benefit Cost Ratio = Cumulative Benefits / (Capital Cost Cumulative + Annual Cost + Prorated Share of Program Costs

4.1. 5-Year and 10-Year Benefit-to-Cost Ratios

The period of time used for economic analysis normally should be the period of the useful lifetime of the assets included for the options under consideration. Therefore, the recommended period for the main benefit-cost analysis is 10 years. The 10-year analysis will determine if additional sites will be financially feasible in the second 5 years, if they were not in the first 5 years. This gives the opportunity to review the site after 10 years and decide if the investment is worthwhile to continue.

A second analysis period of 5 years has been used. This confirms to NCDOT normal practice for calculating benefit-cost of this type of project. If a site "pays back" within 5 years, then it should also be economically suitable for implementation.

The difference between the 5- and 10-year costs is the additional 5 years of annual maintenance costs and an extra 5 years of benefits.

4.1.1. 5-Year Benefit-Cost Results

Table 4 shows the expected cost and benefit of each site for 5 years. These are listed in descending order of the BCR.

The 5-year BCRs of the 21 sites considered suitable for ramp metering range from 12.72 to 0.54. The total 5-year BCR of all 21 sites is 3.24.

16 of the sites have a 5-year BCR of greater than a ratio of 1.0, i.e., offering payback within the first 5 years of implementation.

	Frooway	Cross Street	Evit	Direction	5 Year Total	5 Year Total	5 Year
LUG	Freeway	Closs Street		Direction	Cost	Benefit	BCR
017	I-40	S Miami Blvd	281	EB	\$144,455	\$1,836,848	12.72
019	I-40	Page Rd	282	EB	\$232,455	\$2,025,478	8.71
095	I-440	SR 1012 - Western Blvd	2	SB-M2 (EB to SB)	\$153,455	\$1,139,223	7.42
108	I-440	US-70 / NC-50 / Glenwood	7	WB-M2 (SB to WB)	\$138,455	\$751,436	5.43
030	I-40	SR 1652 - N Harrison Ave	287	EB	\$143,455	\$727,529	5.07
102	I-440	Lake Boone Trail	5	NB	\$144,455	\$691,807	4.79
056	I-40	SR 5220 - Jones Sausage Rd	303	WB	\$150,455	\$709,280	4.71
010	I-40	NC-55 / Apex Hwy	278	WB	\$144,455	\$652,178	4.51
043	I-40	SR 1571 - Gorman St	295	WB	\$150,455	\$628,322	4.18
135	I-540	SR 1829 - Leesville Rd	7	EB	\$146,455	\$604,585	4.13
009	I-40	NC-55 / Apex Hwy	278	EB	\$142,455	\$579,864	4.07
027	I-40	SR 1002 - Aviation Pkwy	285	EB-M1 (SB to EB)	\$140,455	\$357,399	2.54
015	I-40	Davis Dr	280	EB	\$321,455	\$766,186	2.38
028	I-40	SR 1002 - Aviation Pkwy	285	EB-M2 (NB to EB)	\$150,455	\$350,476	2.33
014*	I-40	NC-147 / Durham Fwy	279	WB-M2 (SB to WB)	\$368,455	\$784,294	2.13
002	I-40	US-15 / US-501	270	WB	\$142,455	\$258,176	1.81
090	I-440	SR 1319 - Jones Franklin Rd	1C	SB	\$138,455	\$135,915	0.98
012*	I-40	NC-147 / Durham Fwy	279	EB-M2 (SB to EB)	\$611,455	\$503,565	0.82
025	I-40	SR 3015 - Airport Blvd	284	EB	\$150,455	\$113,266	0.75
089	I-440	SR 1319 - Jones Franklin Rd	1C	NB	\$149,455	\$110,849	0.74
133*	I-540	US-70	4	EB	\$442,455	\$240,811	0.54

Table 4: Benefit-Cost Analysis over 5-Year Period for Each Site

* Freeway-to-Freeway site

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4.1.2. 10-Year Benefit-Cost Results

Table 5 shows the expected cost and benefit of each site for 10 years.

The 10-year BCRs of the 21 sites considered suitable for ramp metering range from 20.20 to 1.00. The total 10-year BCR of all 21 sites is 5.48.

Twenty-one sites have a 10-year BCR of greater than 1.00, i.e., offering payback within the first 10 years of implementation.

4.2. First-Year Rate of Return

The first-year rate of return (FYRR) is a measure to determine if a site pays for itself in the first year of operation. This analysis ascertains the highest performing sites from a financial perspective. The FYRR is calculated as follows:

FYRR = (Annual Benefits (1 year) – Capital Cost + Annual Cost (first year)) / (Capital Cost + Annual Cost (1 year))

4.2.1. First-Year Rate of Return Results

Eleven sites have a positive FYRR, i.e., they pay for themselves within the first year of operation. These sites, which exhibit strong financial feasibility, are shown in Table 6.

4.3. Summary

These overall positive results offer confidence that the installation of ramp metering at the 21 sites should provide positive benefits; however, selecting a subset of the sites would increase the overall benefit.

Log	Freework	Cross Street	Evit	Direction	10 Year Total	10 Year Total	10 Year
LOG	ггееwау	Cross Street		Direction	Cost	Benefit	BCR
017	I-40	S Miami Blvd	281	EB	\$181,910	\$3,673,695	20.20
019	I-40	Page Rd	282	EB	\$269,910	\$4,050,957	15.01
095	I-440	SR 1012 - Western Blvd	2	SB-M2 (EB to SB)	\$190,910	\$2,278,447	11.93
108	I-440	US-70 / NC-50 / Glenwood	7	WB-M2 (SB to WB)	\$175,910	\$1,502,872	8.54
030	I-40	SR 1652 - N Harrison Ave	287	EB	\$180,910	\$1,455,058	8.04
102	I-440	Lake Boone Trail	5	NB	\$181,910	\$1,383,614	7.61
056	I-40	SR 5220 - Jones Sausage Rd	303	WB	\$187,910	\$1,418,561	7.55
010	I-40	NC-55 / Apex Hwy	278	WB	\$181,910	\$1,304,356	7.17
043	I-40	SR 1571 - Gorman St	295	WB	\$187,910	\$1,256,645	6.69
135	I-540	SR 1829 - Leesville Rd	7	EB	\$183,910	\$1,209,170	6.57
009	I-40	NC-55 / Apex Hwy	278	EB	\$179,910	\$1,159,728	6.45
027	I-40	SR 1002 - Aviation Pkwy	285	EB-M1 (SB to EB)	\$177,910	\$714,798	4.02
015	I-40	Davis Dr	280	EB	\$358,910	\$1,532,373	4.27
028	I-40	SR 1002 - Aviation Pkwy	285	EB-M2 (NB to EB)	\$187,910	\$700,952	3.73
014*	I-40	NC-147 / Durham Fwy	279	WB-M2 (SB to WB)	\$405,910	\$1,568,587	3.86
002	I-40	US-15 / US-501	270	WB	\$179,910	\$516,352	2.87
090	I-440	SR 1319 - Jones Franklin Rd	1C	SB	\$175,910	\$271,829	1.55
012*	I-40	NC-147 / Durham Fwy	279	EB-M2 (SB to EB)	\$648,910	\$1,007,131	1.55
025	I-40	SR 3015 - Airport Blvd	284	EB	\$187,910	\$226,532	1.21
089	I-440	SR 1319 - Jones Franklin Rd	1C	NB	\$186,910	\$221,697	1.19
133*	I-540	US-70	4	EB	\$479,910	\$481,622	1.00

Table 5: Benefit-Cost Analysis over 10-Year Period for Each Site

* Freeway-to-Freeway site

4.4. Sensitivity Testing

Some basic sensitivity analysis has been performed to test the impact of any excessive optimism in the benefits calculations. This analysis assumes that the delays are reduced by only 10 percent instead of 20 percent to determine if fewer sites should be implemented because of the reduced financial benefit of 10 percent reduction in delay.

The site-by-site results of the sensitivity testing are shown in Tables 6 and 7 on pages 19 and 20.

In this scenario, only two of the sites (Site 017, I-40 eastbound at Miami Boulevard, and Site 019, I-40 eastbound at Page Road) have a positive FYRR. This indicates these two sites should have an excellent return on investment, and the benefits of 1 year exceed the capital and first-year operating costs in the first year of operation.

Fifteen sites have a 5-year BCR of greater than 1.00. The total 5-year BCR of all 21 sites is reduced from 6.36 to 0.27.

For the 10-year scenario, only two of the sites have a positive FYRR; however, 16 of the sites have a 5-year BCR of greater than 1.00. The total 10-year BCR of all 21 sites is reduced from 10.10 to 0.50.

4.5. Conclusions

From this financial analysis of benefit-cost ratios and the first-year rate of return, some logical groups have emerged. These groups are listed below in descending first-year rate of return order:

- Sites with positive first-year rate of return:
 - Site 017: I-40 eastbound at S. Miami Blvd.
 - Site 019: I-40 eastbound at Page Rd.
- Sites with benefit-cost ratio greater than 1.0 in the first 5 years:
 - o Site 002: I-40 westbound at US 15/501.
 - Site 009: I-40 eastbound at NC 55, Apex Highway.
 - Site 010: I-440 westbound at NC 55, Apex Highway.
 - Site 014: NC 147 westbound at NC 147 southbound.
 - Site 015: I-40 eastbound at Davis Dr.
 - Site 027: I-40 eastbound at SR 1002, Aviation Parkway southbound.
 - Site 028: I-40 eastbound at SR 1002, Aviation Parkway northbound.
 - Site 030: I-40 eastbound at SR 1652, N. Harrison Avenue.
 - Site 043: I-40 westbound at SR 1571, Gorman Street.
 - Site 056: I-40 westbound at SR 5220, Jones Sausage Rd.
 - Site 095: I-440 eastbound at SR 1002, Aviation Blvd. southbound.
 - Site 102: I-40 northbound at Lake Boone Trail.
 - o Site 108: I-440 westbound at US 70/NC 50, Glenwood Ave. southbound.
 - Site 135: I-540 westbound at SR 1829, Leesville Rd.
- Sites with benefit-cost ratio greater than 1.0 in the second 5 years:

- Site 012: I-40 eastbound at NC 147 southbound.
- Site 025: I-40 eastbound at SR 3015, Airport Blvd.
- Site 089: I-440 northbound at SR 1319, Jones Franklin Rd.
- Site 090: I-440 eastbound at SR 1319, Jones Franklin Rd.
- Site 133: I-540 eastbound at US 70.

	Freewow	Cross Street	Evit	Direction	Cumulative	Cumulative	BCR in	EVDD
LOG	гтееway	Cross Street		Direction	Period	Period	Period	FIKK
017	I-40	S Miami Blvd	281	EB	\$144,455	\$918,424	6.36	60%
019	I-40	Page Rd	282	EB	\$232,455	\$1,012,739	4.36	0%
095	I-440	SR 1012 - Western Blvd	2	SB-M2 (EB to SB)	\$153,455	\$569,612	3.71	-8%
108	I-440	US-70 / NC-50 / Glenwood	7	WB-M2 (SB to WB)	\$138,455	\$375,718	2.71	-31%
030	I-40	SR 1652 - N Harrison Ave	287	EB	\$143,455	\$363,764	2.54	-36%
102	I-440	Lake Boone Trail	5	NB	\$144,455	\$345,903	2.39	-40%
056	I-40	SR 5220 - Jones Sausage Rd	303	WB	\$150,455	\$354,640	2.36	-41%
010	I-40	NC-55 / Apex Hwy	278	WB	\$358,455	\$326,089	0.91	-43%
043	I-40	SR 1571 - Gorman St	295	WB	\$150,455	\$314,161	2.09	-48%
135	I-540	SR 1829 - Leesville Rd	7	EB	\$146,455	\$303,292	2.07	-48%
009	I-40	NC-55 / Apex Hwy	278	EB	\$142,455	\$289,932	2.04	-48%
027	I-40	SR 1002 - Aviation Pkwy	285	EB-M1 (SB to EB)	\$150,455	\$178,700	1.19	-68%
015	I-40	Davis Dr	280	EB	\$321,455	\$383,093	1.19	-74%
028	I-40	SR 1002 - Aviation Pkwy	285	EB-M2 (NB to EB)	\$150,455	\$175,238	1.16	-71%
014*	I-40	NC-147 / Durham Fwy	279	WB-M2 (SB to WB)	\$366,455	\$392,147	1.07	-77%
002	I-40	US-15 / US-501	270	WB	\$142,455	\$129,080	0.91	-77%
090	I-440	SR 1319 - Jones Franklin Rd	1C	SB	\$138,455	\$67,957	0.49	-87%
012*	I-40	NC-147 / Durham Fwy	279	EB-M2 (SB to EB)	\$611,455	\$251,783	0.41	-91%
025	I-40	SR 3015 - Airport Blvd	284	EB	\$150,455	\$56,633	0.38	-91%
089	I-440	SR 1319 - Jones Franklin Rd	1C	NB	\$149,455	\$55,424	0.37	-91%
133*	I-540	US-70	4	EB	\$442,455	\$120,405	0.27	-94%

Table 6: Benefit Cost Appraisal over 5-Year Period for Each Site – 10% Delay Reduction

* Freeway-to-Freeway sites

Log	Freeway	Cross Street	Exit	Direction	Cumulative Cost in	Cumulative Benefit in	BCR in	FYRR
3					Period	Period	Period	
017	I-40	S Miami Blvd	281	EB	\$181,910	\$1,836,848	10.10	60%
019	I-40	Page Rd	282	EB	\$269,910	\$2,025,478	7.50	0%
095	I-440	SR 1012 - Western Blvd	2	SB-M2 (EB to SB)	\$190,910	\$1,139,223	5.97	-8%
108	I-440	US-70 / NC-50 / Glenwood	7	WB-M2 (SB to WB)	\$175,910	\$751,436	4.27	-31%
030	I-40	SR 1652 - N Harrison Ave	287	EB	\$180,910	\$727,529	4.02	-36%
102	I-440	Lake Boone Trail	5	NB	\$181,910	\$691,807	3.80	-40%
056	I-40	SR 5220 - Jones Sausage Rd	303	WB	\$187,910	\$709,280	3.77	-41%
010	I-40	NC-55 / Apex Hwy	278	WB	\$181,910	\$652,178	3.59	-43%
043	I-40	SR 1571 - Gorman St	295	WB	\$187,910	\$628,322	3.34	-48%
135	I-540	SR 1829 - Leesville Rd	7	EB	\$183,910	\$604,585	3.29	-48%
009	I-40	NC-55 / Apex Hwy	278	EB	\$179,910	\$579,864	3.22	-48%
027	I-40	SR 1002 - Aviation Pkwy	285	EB-M1 (SB to EB)	\$177,910	\$357,399	2.01	-68%
015	I-40	Davis Dr	280	EB	\$358,910	\$766,186	2.13	-74%
028	I-40	SR 1002 - Aviation Pkwy	285	EB-M2 (NB to EB)	\$187,910	\$350,476	1.87	-71%
014*	I-40	NC-147 / Durham Fwy	279	WB-M2 (SB to WB)	\$405,910	\$784,294	1.93	-77%
002	I-40	US-15 / US-501	270	WB	\$179,910	\$258,176	1.44	-77%
090	I-440	SR 1319 - Jones Franklin Rd	1C	SB	\$175,910	\$135,915	0.77	-87%
012*	I-40	NC-147 / Durham Fwy	279	EB-M2 (SB to EB)	\$648,910	\$503,565	0.78	-91%
025	I-40	SR 3015 - Airport Blvd	284	EB	\$187,910	\$113,266	0.60	-91%
089	I-440	SR 1319 - Jones Franklin Rd	1C	NB	\$186,910	\$110,849	0.59	-91%
133*	I-540	US-70	4	EB	\$479,910	\$240,811	0.50	-94%

Table 7: Benefit Cost Appraisal over 10-Year Period for Each Site – 10% Delay Reduction

* Freeway-to-Freeway sites

5. STIP Projects and F2F Sites

5.1. STIP Projects

The State Transportation Implementation Plan (STIP) can be found at: https://connect.ncdot.gov/projects/planning/Pages/Breakdown-Maps.aspx

The STIP has been reviewed to identify any planned projects in the vicinity of a potential ramp metering site. The information compiled in Table 8 includes an indication as to whether or not there is a short-term impact on ramp metering.

Log	STIP Project Number	Description	Anticipated Construction	Funding Status	Short-Term Impact on RM?	Agency
002	I-3306A	Widening I-40 for additional lanes from US 15/501 to I-85 in Division 7	2020	Funded	No	Div. 7
043	I-5338	I-40 pavement rehabilitation. Project includes auxiliary lanes between interchange ramp.	2013	Funded	Likely	Div. 5
056	I-5111A	Widening I-40 for additional lanes	2018	Funded	Yes	Div. 5
089, 090, 095	U-2719	Widening I-440 for additional lanes. There also is a pavement preservation project anticipated for 2016 or 2017 on this section.	2018	Funded	No	Div. 5

Table 8: List of STIP Projects

The two potential ramp metering installations that could be affected by STIP projects in the near term are shown in Table 9. Site 043 will be deleted from the analysis of the implementation strategies because its benefits cannot be assured. Site 056 will remain due to some uncertainty of its construction date and the potential for that site to make an interim improvement in the congestion.

Log	Free- way	Cross Street	Exit	Direction	5-Year BCR
043	I-40	SR 1571 - Gorman St	295	WB	4.18
056	I-40	SR 5220 - Jones Sausage Rd	303	WB	4.71

 Table 9: Sites Affected by STIP Projects in the List of Suitable Locations

5.2. Freeway-to-Freeway Sites

Early stages of the NCDOT Ramp Metering Feasibility Study included a number of freeway-to-freeway (F2F) sites for evaluation. This was to satisfy a desire to know how feasible F2F sites would be and the issues in implementing ramp metering at such sites, but there was no intention to install ramp metering at an F2F intersection in the first round of implementation.

Of five initially requested, three F2F sites were found to be potentially feasible for ramp metering based on the analysis of congestion, traffic, and geometric characteristics. They were therefore included in the list of 21 locations subject to financial analysis. Because there is no intention to install them at this stage, from this point forward these F2F sites will be removed from the analysis of the implementation strategies.

Table 10 identifies the three F2F sites and their relative 5-year BCRs. Only Site 014 has a benefit-cost ratio greater than 1.00.

Log	Free- way	Cross Street	reet Exit Direction			
012	I-40	NC-147 / Durham Fwy	279	EB-M2 (SB to EB)	0.82	
014	I-40	NC-147 / Durham Fwy	279	WB-M2 (SB to WB)	2.13	
133	I-540	US-70	4	EB	0.54	

Table 10: Freeway-to-Freeway Sites Applicable to the Suitable Locations

6. Strategies for Implementation

6.1. Introduction

This section presents two strategies for ramp meter implementation based on the congestion and benefit costs. The ultimate choice of strategy will be based on available funds, timescales, attitude toward risk, desire to learn from the first stage of implementation, and other factors.

The four sites identified in Section 5, those impacted by the STIP projects and freeway-tofreeway sites, will not be included in this analysis (Site 043: Westbound I-40 at SR 1571 – Gorman St., Site 012: Eastbound I-40 at Southbound NC-147/Durham Fwy, Site 014: Westbound I-40 at Southbound NC-147/Durham Fwy, and Site 133: Eastbound I-540 at US 70).

A number of factors must be considered for each site, beyond just the economics. These factors include such things as primary versus secondary causes of congestion, reduced effectiveness factors, and whether sites need to be included as part of a group to ensure the level of benefit predicted. For additional details, refer to the Screening and Detailed Analysis Task Report, Table 10: Groups of Congestion and Sites in Each Group.

6.1.1. Site 002 (Westbound I-40 at US 15/501)

Site 002 is not recommended for implementation in the 5-year program due to its low benefit-cost ratio.

6.1.2. Site 009 (Eastbound I-40 at NC 55/Apex Hwy)

Site 009 is in a group with Sites 012 and 011 (see Figure 2), which cover C082 and C060. Site 009 is the downstream site for congestion reference C060, so it is likely to be the primary cause of that congestion. This means that it can be implemented on its own without needing to revise the effectiveness factor.



Figure 2: Congestion Site C060 and C082

6.1.3. Site 010 (Westbound I-40 at NC 55/Apex Hwy)

Site 010 is the downstream site for congestion reference C051, so it is likely to be the primary cause of that congestion. Therefore, Site 010 should be implemented first in this group.



Figure 3: Congestion Site C051

6.1.4. Site 015 (Eastbound I-40 at Davis Dr)

Site 015 is a secondary site for congestion reference C006; the downstream sites are Sites 017 and 019. It is vital that the primary and downstream sites are included if Site 015 is implemented; otherwise, the effectiveness factor for Site 015 will need to be reduced.

This grouping of the sites represents an opportunity to investigate linked sites; the congestion might be completely resolved by implementing just the downstream site. Therefore, Site 015 should not be implemented initially.





6.1.5. Site 017 (Eastbound I-40 at S. Miami Blvd)

Site 017 is a secondary site in the middle of C006, as shown in Figure 4. It is vital that the primary Site 019 is included if Site 017 is implemented; otherwise, the effectiveness factor for Site 017 will need to be reduced. The success of Site 017 is dependent upon first implementing Site 019. Therefore, it is recommended to implement Site 017 after Site 019.

6.1.6. Site 019 (Eastbound I-40 at Page Rd)

Site 019 is the most downstream site of C006, as shown in Figure 4, and could be implemented on its own, if necessary. Therefore, Site 019 should be implemented first in this group.

6.1.7. Site 025 (Eastbound I-40 at SR 3015 – Airport Blvd)

Site 025 is not recommended for implementation in the 5-year program due to its low benefit-cost ratio.

6.1.8. Site 027 (Eastbound I-40 at Southbound SR 1002 – Aviation Pkwy)

Site 027 is a secondary site in C062—the primary site is Site 028. It is vital that the primary Site 028 is included if 027 is implemented; otherwise, the effectiveness factor for Site 027 will need to be reduced. The Site 027 ramp is short and curved, and storage is approximately 47 vehicles; therefore, benefits may be slightly reduced. Due to slight reduction in the site's ability to process entrance ramp traffic, the effectiveness factor is already reduced by 25 percent. This site should only be installed if the ramp metering system includes an effective queue management system (not just queue override).



Figure 5: Congestion Site C062

6.1.9. Site 028 (Eastbound I-40 at Northbound SR 1002 – Aviation Pkwy)

Site 028 is the primary site for congestion reference C062. Lower than threshold entranceramp volumes during part of the congested period may limit the amount of benefits achievable by ramp metering at this location. Ramp metering will only be effective during the worst part of the congestion, and not during the build-up or recovery; consequently, the effectiveness factor will be reduced by 50 percent.

6.1.10. Site 030 (Eastbound I-40 at SR 1652 – N Harrison Ave)

Site 030 is an individual site and the primary site for congestion reference C005. Therefore, it can be implemented without regard to other sites.



Figure 6: Congestion Site C030

6.1.11. Site 056 (Eastbound I-40 at SR 5220 – Jones Sausage Rd)

Site 056 is an individual site and the primary site for congestion reference C054. Therefore, it can be implemented without regard to other sites.

6.1.12. Site 089 (Northbound I-40 at SR 1319 – Jones Franklin Rd)

Site 089 is not recommended for implementation in the 5-year program due to its low benefit-cost ratio.

6.1.13. Site 090 (Southbound I-40 at SR 1319 – Jones Franklin Rd)

Site 090 is not recommended for implementation in the 5-year program due its low benefitcost ratio.

6.1.14. Site 095 (Southbound I-440 at Eastbound SR 1012 – Western Blvd)

Site 095 is in a group with Site 090. It is upstream, but is the primary site for congestion references C030 and C011. This means that it can be implemented on its own without needing to revise the effectiveness factor. Low entrance-ramp volumes, although within thresholds, may limit the amount of benefits achievable by ramp metering at this location; therefore, the effectiveness factor has been reduced by 25 percent.



Figure 7: Congestion Sites C030 & C011

6.1.15. Site 102 (Northbound I-440 at Lane Boone Trail)

Site 102 is a secondary site in C014, but the downstream site has been identified in the screening task as not suitable for ramp metering. In order to account for this, the effectiveness factor has been reduced to 50 percent in the Performance Measures task report, which means it can be implemented on its own without having to revise the level of benefits.



Figure 8: Congestion Site C014

6.1.16. Site 108 (Westbound I-440 at Southbound US-70/NC-50/Glenwood Ave)

Site 108 is an individual site, and is the primary site for congestion reference C016. Therefore, it can be implemented without regard to other sites.

6.1.17. Sites 133 (Eastbound I-540 at US 70 and 135 Eastbound I-540 SR 1829 – Leesville Rd)

Site 133 (a freeway-to-freeway site) is in a group with Site 135. Site 133 is the primary for congestion reference C032. This means that Site 133 can be implemented on its own without needing to revise the effectiveness factor. The effectiveness of Site 135 is dependent upon first implementing Site 133.

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Figure 9: Congestion Sites C101 and C032

6.2. Strategy 1: All Sites with Return on Investment in 5 Years

There was consensus within the Steering Committee that a site with a benefit-to-cost ratio greater than 1.0 within 5 years would be economically suitable for implementation. The first strategy presented, therefore, is to build all sites with a return on investment within 5 years in one program. In this strategy, 14 sites are included (in order by site number), and consist of non-freeway-to-freeway sites **not** in conflict with other STIP projects:

- o Site 002: Southbound I-40 at US 15/501
- Site 009: Eastbound I-40 at NC 55/Apex Hwy
- Site 010: Westbound I-40 at NC 55/Apex Hwy
- o Site 015: Eastbound I-40 at Davis Dr
- o Site 017: Eastbound I-40 at S. Miami Blvd
- Site 019: Eastbound I-40 at Page Rd
- Site 027: Eastbound I-40 at Southbound SR 1002 Aviation Pkwy
- Site 028: Eastbound I-40 at Northbound SR 1002 Aviation Pkwy
- Site 030: Eastbound I-40 at Harrison Avenue
- o Site 056: Westbound I-40 at Jones Sausage Road
- Site 095: Southbound I-40 at SR 1012 Western Blvd
- o Site 102: Northbound I-440 at Lane Boone Trail
- Site 108: Westbound I-440 at Southbound US-70/NC-50/Glenwood Ave
- o Site 135: Eastbound I-540 at SR 1829 Leesville Rd

These 14 sites are shown in Figure 10.

Seven of the 21 sites have a benefit-cost ratio less than 1.0, or are freeway-to-freeway sites, or are in conflict with an STIP project, and are not installed at this stage:

- Site 012: Eastbound I-40 at Southbound NC-147 / Durham Fwy
- Site 014: Westbound I-40 at Northbound NC-147 / Durham Fwy
- Site 025: Eastbound I-40 at SR 3015 Airport Blvd
- Site 043: Westbound I-40 at SR 1571 Gorman St
- o Site 089: Northbound I-40 at SR 1319 Jones Franklin Rd
- Site 090: Southbound I-40 at SR 1319 Jones Franklin Rd
- Site 133: Eastbound I-540 at Eastbound US 70

For the 14 sites, dividing the estimated total program cost of \$404,998 among the costs of these sites would add \$28,928 to the cost of each.

These results are shown in Table 11. Over a 10-year period the estimated total cost of implementing these sites would be \$3,210,274 and the estimated total benefits would be \$22,900,932 providing an overall BCR of 7.13. However, it can be seen that some sites would contribute far more (Sites 017, 019, and 095 have BCRs greater than 10), where others would contribute less (Sites 002, 015, 027, and 028 have BCRs less than 5).

It should be remembered that these figures relate to just delay time benefits, while other benefits, including accidents and emissions, will also be accrued.

This option includes some sites in groups, providing the opportunity to analyze the performance of the chosen system on grouped sites. It also includes some sites with low entrance-ramp volumes, allowing investigation of whether or not these succeed. Finally, this option includes some sites with short ramps, allowing analysis of whether the chosen system's queue management method is effective for such sites. The inclusion of these sites brings with it the risk that one or more sites might not perform as well as expected; if chosen, this strategy would allow lessons to be learned.



Figure 10: Strategy 1 Implementation Sites

Log	Freeway	Cross Street	Exit	Direction	10 Year Total Cost with Pro- rated Program	10 Year Total Benefit	10 Year BCR with Pro- rated Program
002	I-40	US-15 / US-501	270	WB	\$208,838	\$516,352	2.47
009	I-40	NC-55 / Apex Hwy	278	EB	\$208,838	\$1,159,728	5.55
010	I-40	NC-55 / Apex Hwy	278	WB	\$210,838	\$1,304,356	6.19
015	I-40	Davis Dr	280	EB	\$387,838	\$1,532,373	3.95
017	I-40	S Miami Blvd	281	EB	\$210,838	\$3,673,695	17.42
019	I-40	Page Rd	282	EB	\$298,838	\$4,050,957	13.56
027	I-40	SR 1002 - Aviation Pkwy	285	EB-M1 (SB to EB)	\$206,838	\$714,798	3.46
028	I-40	SR 1002 - Aviation Pkwy	285	EB-M2 (NB to EB)	\$216,838	\$700,952	3.23
030	I-40	SR 1652 - N Harrison Ave	287	EB	\$202,838	\$1,455,058	7.17
056	I-40	SR 5220 - Jones Sausage Rd	303	WB	\$219,838	\$1,418,561	6.45
095	I-440	SR 1012 - Western Blvd	2	SB-M2 (EB to SB)	\$210,838	\$2,278,447	10.81
102	I-440	Lake Boone Trail	5	NB	\$204,838	\$1,383,614	6.75
108	I-440	US-70 / NC-50 / Glenwood	7	WB-M2 (SB to WB)	\$212,838	\$1,502,872	7.06
135	I-540	SR 1829 - Leesville Rd	7	EB	\$215,064	\$1,209,170	5.62

Table 11: Costs, Benefits, and BCRs for Strategy 1 Sites

6.3. Strategy 2: 5-Year Payback and Reduced Risk

Some sites identified as suitable might achieve lower than average benefits (e.g., some secondary sites and some sites with less than ideal geometry). These have been given a reduced effectiveness factor as described in Task 9 – Performance Measures, and outlined previously in Section 6.1.

This option includes ten sites (shown in Figure 11) that have an effectiveness factor of 1, indicating they are primary sites with low risks:

- Site 002: Southbound I-40 at US 15/501
- Site 009: Eastbound I-40 at NC 55/Apex Hwy
- Site 010: Westbound I-40 at NC 55/Apex Hwy
- Site 015: Eastbound I-40 at Davis Dr
- Site 017: Eastbound I-40 at S. Miami Blvd
- Site 019: Eastbound I-40 at Page Rd
- Site 030: Eastbound I-40 at Harrison Avenue
- Site 056: Westbound I-40 at Jones Sausage Road
- Site 108: Westbound I-440 at Southbound US-70/NC-50/Glenwood Ave
- Site 135: Eastbound I-540 at SR 1829 Leesville Rd

If the estimated total program cost of \$404,998 is split among these sites, it adds \$40,500 to each. These results are shown in Table 12. Over a 10-year period the estimated total cost of implementing these sites would be \$2.465.848 and the estimated total benefits would be \$17,823,120, providing an overall BCR of 7.23.

Note that these figures relate only to travel time benefits, while other benefits, including accidents and emissions, will also be accrued.

This strategy also excludes four sites with effectiveness factors less than 1.0, indicating they are secondary sites and are at least partially dependent on a site downstream:

- 027: Eastbound I-40 at Southbound SR 1002 Aviation Pkwy
- 028: Eastbound I-40 at Northbound SR 1002 Aviation Pkwy
- 095: Southbound I-40 at SR 1012 Western Blvd
- 102: Northbound I-440 at Lane Boone Trail

While this strategy would increase the likelihood of all chosen sites achieving very high benefits, it would allow less opportunity to test the chosen system over the full range of scenarios. This would result in less potential to learn from performance of a broader range of sites, which could provide helpful information when contemplating ramp metering implementation for other urban areas in North Carolina.

Log	Freeway	Cross Street	Exit	Direction	10 Year Total Cost with Pro- rated Program	10 Year Total Benefit	10 Year BCR with Pro- rated
002	I-40	US-15 / US-501	270	WB	\$220,410	\$516,352	2.34
009	I-40	NC-55 / Apex Hwy	278	EB	\$220,410	\$1,159,728	5.26
010	I-40	NC-55 / Apex Hwy	278	WB	\$222,410	\$1,304,356	5.86
015	I-40	Davis Dr	280	EB	\$399,410	\$1,532,373	3.84
017	I-40	S Miami Blvd	281	EB	\$222,410	\$3,673,695	16.52
019	I-40	Page Rd	282	EB	\$310,410	\$4,050,957	13.05
030	I-40	SR 1652 - N Harrison Ave	287	EB	\$221,410	\$1,455,058	6.57
056	I-40	SR 5220 - Jones Sausage Rd	303	WB	\$208,410	\$1,418,561	6.81
108	I-440	US-70 / NC-50 / Glenwood	7	WB-M2 (SB to WB)	\$216,410	\$1,502,872	6.94
135	I-540	SR 1829 - Leesville Rd	7	EB	\$224,410	\$1,209,170	5.39

Table 12: Costs, Benefits, and BCRs for Strategy 2 Sites





7. Summary

Using the predicted costs and benefits of the sites taken from the list of the 21 sites, a benefit-cost analysis has been performed. This analysis takes into account implementation costs, maintenance costs, and program costs. The financial benefits are only for the reduction in travel time expected from the system.

From this analysis, two strategies have been identified:

- Strategy 1: Includes all sites suitable for ramp metering that pay back within 5 years (i.e., have a 5-year benefit-to-cost ratio greater than 1.00), does not include one site that overlaps an STIP project, and does not include three sites that are freeway-to-freeway sites.
- Strategy 2: This lower-risk strategy includes only sites with a 5-year payback that have an effectiveness factor of 1.00, does not include one site that overlaps an STIP project, and does not include three sites that are freeway-to-freeway sites.

Strategy 1 would offer more potential to learn about the performance of the system in different scenarios—knowledge that could then be used to decide where to apply ramp metering elsewhere in North Carolina.

Strategy 2 removes some sites that have a slightly higher chance of not performing as expected. The key results of these two strategies are shown in Table 13.

Strategy	Number of Sites	10-Year Total Cost	10-Year Total Benefit	10-Year BCR		
1	14	\$3,210,274	\$22,900,932	7.13		
2	10	\$2,465,848	\$17,823,120	7.23		

 Table 13: Strategy Results

It is important to consider the following:

- Care must be taken with the choice of system, particularly with Strategy 2, due to the greater need for effective queue management (although good queue management is essential at all sites in order to obtain optimum benefits).
- The analysis is based on travel time benefits only, whereas other benefits actually will accrue including safety, emissions, and reliability improvements. Some of the sites screened out during the previous phase of analysis might well provide benefits in the future.
- Following a pilot ramp-metering program using either Strategy 1 or 2 above, it might be useful to review some of those sites based on the results of the pilot to determine whether to install at those sites.

8. Recommendations

8.1. Recommended Strategy

Two implementation strategies have been presented in this report. Strategy 1 is a slightly higher-risk option that deploys more sites, with more variety, which would allow NCDOT to gain more operational experience and a broader understanding for a wider selection of sites. Strategy 2 is the lower-risk option and includes a smaller group of projects with less variability in site conditions. Low risk can be defined as those sites with an effectiveness factor of 1.0, indicating they are the primary sites of congestion not dependent on sites downstream.

The benefits were conservatively estimated based upon other states' implementations and without the benefit of estimating emissions, safety, etc. Since this a pilot study, a logical goal of the project would be to gain as much knowledge about a variety of sites. Therefore, it is recommended the Strategy 1 implementation sites be installed.

8.2. Sequence of Implementation of Strategy 1

Upon determining an overall strategy to select a group of sites, a scheme must be developed that addresses the priorities within the select group of sites. This will allow the Department to implement the sites in a variety of ways. Site prioritization must consider that this is a pilot project, which will afford the Department the opportunity to develop a knowledge base of design, operations, and maintenance issues with implementation.

All of the sites in the Strategy 1 group have good benefit-cost ratios; therefore, it can be assumed they will all offer good performance. To ensure the initial deployment provides solid results without the effects of other sites that are not suitable, it is logical to rank the highest the primary sites at the sources of the congestion. It is also beneficial to first deploy sites that will have less complicated design issues. This helps the Department learn from the experience of progressively more complicated designs. Table 14 shows the proposed order of implementation for Strategy 1.

Each site has been ranked based upon four criteria—benefit-cost ratio, congestion importance, and relative difficulty of design. Each site was graded as follows:

- For benefit-cost ranking, B/C ratio > 5 is a 1, B/C ratio > 4 is a 2, B/C ratio > 2 is a 3, and B/C ratio > 1 is a 4.
- For congestion importance ranking, each site was graded with a score—primary congestion site = 1, median site = 2, and every secondary site = 3.
- For relative difficulty of design, each site was scored—low design difficulty site = 1, medium-low difficulty design = 2, medium difficulty design = 3, and high difficulty design = 4. The lowest overall score is the highest ranking.
- Each site was given a score of 1 if there is no conflict with a STIP project, a score of 2 if there was a potential conflict, and a score of 3 if there is a definite conflict with a STIP project.

	Freeway	Cross Street	Evit	Direction		TIP	Congesti	Design	Ramp Meter		TIP	B/C	Congestion	Design	Total	
LUg	Treeway	01033 011661		Direction	F2F?	Conflict	Location	Difficulty	Configuration	Location Notes	Conflict	Ranking	ranking	Difficulty	Score	Ranking
017	I-40	S Miami Blvd	281	EB	No	No	primary	Low	Single Lane	downstream	1	1	1	1	4	1
				SB-M2 (EB												
095	I-440	SR 1012 - Western Blvd	2	to SB)	No	No	primary	Low	Single Lane	downstream	1	1	1	1	4	1
102	I-440	Lake Boone Trail	5	NB	No	No	primary	Low	Single Lane	downstream	1	2	1	1	5	2
135	I-540	SR 1829 - Leesville Rd	7	EB	No	No	solo site	Low	Single Lane	downstream	1	2	1	1	5	2
				EB-M2 (NB												
028	I-40	SR 1002 - Aviation Pkwy	285	to EB)	No	No	primary	Low	Single Lane	downstream	1	3	1	1	6	3
030	I-40	SR 1652 - N Harrison Ave	287	EB	No	No	secondary	Low	Single Lane	upstream of 019	1	1	3	1	6	3
		US-70 / NC-50 /		WB-M2 (SB						upstream of 019						
108	I-440	Glenwood Ave	7	to WB)	No	No	secondary	Low	Single Lane	amd 017	1	1	3	1	6	3
										(F2F) and 011						
009	I-40	NC-55 / Apex Hwy	278	EB	No	No	secondary	Low	Single Lane Loop	(unsuitable)	1	2	3	1	7	4
010	I-40	NC-55 / Apex Hwy	278	WB	No	No	secondary	Low	Single Lane	upstream of 028	1	2	3	1	7	4
										upstream of F2F						
										one and non-						
019	I-40	Page Rd	282	EB	No	No	secondary	Medium	Two Lane Loop	suitable one	1	1	3	3	8	5
				EB-M1 (SB												
027	I-40	SR 1002 - Aviation Pkwy	285	to EB)	No	No	secondary	Low	Single Lane Loop	upstream of 028	1	3	3	1	8	5
		SR 5220 - Jones														
056	I-40	Sausage Rd	303	WB	No	Potential	secondary	Low	Single Lane	TIP Conflict	2	2	3	1	8	5
										upstream of non-						
002	I-40	US-15 / US-501	270	WB	No	No	secondary	Low	Single Lane	suitable site 104	1	4	3	1	9	6
								Medium-		upstream of 019						
015	I-40	Davis Dr	280	EB	No	No	secondary	Low	Two Lane	and 017	1	3	3	2	9	6

Table 14: Recommended Order of Implementation in Strategy Group 1

NCDOT might not deploy ramp metering projects in the order that they are ranked, due to other considerations and constraints.

Appendices

Appendix A. Site-Specific Cost Estimates

Site-specific cost estimates were developed for the 21 sites passing the detailed analysis. These estimates are presented in this Appendix.
Log No.: Location:	002 I-40 Eastbound Exit 270B	Ramp:	US 15/501
Two Lane Ra Length of Two Distance from	mp Widening (Y/N): o Lane Ramp Widening (ft.): n Stopbar to W3-8 sign (ft.):	N 0 800	
Pipe Crossing Retaining Wa Fill (Y/N): Guardrail Oth Equipment (Y	gs (Y/N): Ills (Y/N): er than for Ramp Meter ⁄/N):	N N N	
Nearest Powe	er Source (ft.):	850	

Notes
Nearest power source is traffic signal.
Install equipment on right side only, protect with guardrail

Log No.: 002 Location: I-40 Eastbound Exit 2	Ramp 270B	:	U	S 15/501			
Categories Description	Unit	Quantity	U	nit Cost	٦	otal Cost	Assumptions
Earthwork and Structures							T
Retaining Wall 5' High	LF	0	\$	250.00	\$	-	
Retaining Wall 10' High	LF	0	\$	475.00	\$	÷	
Excavation	CY	0	\$	4.00	\$	-	
Fill	CY	0	\$	5.00	\$	-	
Seeding	SY	1499	S	2.50	S	3 747 50	Seeding around trench, conduit runs,
Subtotal		1100	<u> </u>	2.00	\$	3,747.50	
				L.			4
Guardrail							T
Guardrail Rail	LF	250	\$	15.00	\$	3,750.00	
Guardrail Approach End Treatme	ent EA	1	\$	1,500.00	\$	1,500.00	
Subtotal					\$	5,250.00	ļ
Drainage							
Pipe	LF	0	\$	44.00	\$		
Subtotal					\$	-	
				I			1
Signalization							
olghallzaton	T		1				One queue, three passage and one
6'x6' loops	EA	5	s	394 50	s	1 972 50	clearance
Detector Lead-in Cable	FA	390	s	1 50	S	585.00	Assumed setback distance 350'
MVDS detector	FA	1	\$	1 800 00	\$	1 800 00	Mainline detection
Detector pole	EA	1	\$	6 000 00	S	6 000 00	
Pullbox (Std.)	EA	6	S	300.00	ŝ	1,800,00	
Conduit (Trenched)	LF	2200	S	6.00	S	13,200,00	All purposes
Conduit (Directional Drilled)	LF	50	\$	14.00	\$	700.00	One ramp crossing, multiple conduits
Electrical Service	EA	1	\$	1,500.00	\$	1,500.00	
Electrical Conductors	LF	850	\$	5.00	\$	4,250.00	
2070 Controller and Cabinet	EA	1	\$	14.000.00	\$	14,000,00	
Firmware/Calibration	EA	1	\$	5,300.00	\$	5,300.00	
Cabinet Foundation	EA	1	\$	450.00	\$	450.00	
45' Mast Arm Poles and Founda	tion EA	0	\$	15,000.00	\$	12	
Pedestal Pole	EA	1	\$	1,000.00	\$	1,000.00	
Three Section Signal Head	EA	2	\$	1,000.00	\$	2,000.00	
One Section Signal Head	EA	2	\$	500.00	\$	1,000.00	Ramp meter advance signal
Signal Cable	LF	400	\$	2.75	\$	1,100.00	
Subtotal					\$	56,657.50	
							-
Communications	1						
Serial Communications	EA	350	\$	2.00	\$	700.00	Link to MVDS
Splice Enclosure	EA	1	\$	1,000.00	\$	1,000.00	
Pullbox (Special Size)	EA	1	\$	1,750.00	\$	1,750.00	For splice enclosure
Interconnect Center	EA LE	1	\$	1,500.00	\$	1,500.00	In capinet
Ethernet Switch		000	5	1.50	9 6	1 700.00	Drop cable to controller cabinet
	EA	1	Þ	1,700.00	\$	7,700.00	
Subtotal				l	⊅	7,400.00	1
Pavement Marking							
		3303 M/M		2004-04-020	5.945		40 mph design speed. 110' transitions,
Pavement Marking Removal	LF	640	\$	0.62	\$	396.80	100' narrowed lane

Log No.: Location:	002 I-40 Eastbound Exit 270B	Ramp	:	US	S 15/501			
Categories	Description	Unit	Quantity	U	nit Cost	1	otal Cost	Assumptions
Raised Pa	vement Markers	EA	0	\$	4.50	\$	-	
White Edge	e Line	LF	320	\$	0.95	\$	304.00	110' transitions, 100' narrowed lane
Yellow Edg	ge Line	LF	320	\$	0.95	\$	304.00	110' transitions, 100' narrowed lane
24" Stop B	Bar	LF	12	\$	7.00	\$	84.00	
Subtotal						\$	1,088.80	
Signing								
W3-8, Ran	np Metered When Flashing	EA	2	\$	650.00	\$	1,300.00	Sign and post only
W3-4, Be F	Prepared to Stop	EA	1	\$	650.00	\$	650.00	Sign and post
R10-6, Sto	p Here on Red	EA	1	\$	175.00	\$	175.00	Pedestal mounted
R10-28, X	X Vehicles Per Green	EA	1	\$	175.00	\$	175.00	Pedestal mounted
Subtotal Subtotal Con	nstruction					\$	2,300.00 77,000.00	
Traffic Cor	ntrol				3%	\$	3,000.00	
Contingencies			10%	\$	8,000.00	1		
Total Construction				\$	88,000.00	1		
Design				T	8%	\$	8,000.00	1
Construction	Administration				10%	\$	9,000.00	1
Total Design	and Construction					\$	105,000.00	

Log No.: Location:	009 I-40 Eastbound Exit 278	Ramp:	NC 55
Two Lane Ra Length of Two Distance from	mp Widening (Y/N): o Lane Ramp Widening (ft.): n Stopbar to W3-8 sign (ft.):	N 0 610	
Pipe Crossing Retaining Wa Fill (Y/N): Guardrail Oth Equipment (Y	gs (Y/N): Ills (Y/N): uer than for Ramp Meter ′/N):	N N N	
Nearest Powe	er Source (ft.):	850	
	Notes		
Nearest Powe	er source is signal cabinet.		

Ramp has curb and gutter on both sides.

Install equipment on right side only, protect with guardrail

A stance inc.	Description	Unit	1 Augustitu	$\overline{\mathbf{T}}$	t Coat		t-l Oast	Accomptions
Categories	Description	Unit	Quantity	U	nit Cost		otal Cost	Assumptions
Earthwork and Str	uctures .		0	0	250.00	¢		
Retaining wai	5' High		0	\$	250.00	5	<u> </u>	
Retaining wai	10' High		0	5	4/5.00	5	-	
Excavation		Cr	0	3	4.00	5		
Fill		Cr	0	\$	0.00	\$	5	Coording around tropph, conduit rupe
Seeding		SY	1499	\$	2.50	\$	3,747.50	pull box, and foundation areas
Subtotal						\$	3,747.50	
					92			
Guardrail Bail			250	10	15.00	10	2 750 00	т
Guardrail Appr			200	D C	15.00	Ð	1 500.00	<u></u>
Guardran Appro	Jach End Treatment		1	φ	1,500.00	3	F 250 00	<u> </u>
Subtotal					ļ	Ŷ	5,250.00	1
Drainage								
Pipe		LF	0	\$	44.00	\$		
Subtotal						\$		<u> </u>
					-			4
Signalization								
		Τ_,		Γ.		Γ.		One queue, three passage and one
6'x6' loops		EA	5	\$	394.50	\$	1,972.50	clearance
Detector Lead-	in Cable	EA	390	\$	1.50	\$	585.00	Assumed setback distance 350'
MVDS detector		EA	1	\$	1,800.00	\$	1,800.00	Mainline detection
Detector pole		EA	1	\$	6,000.00	\$	6,000.00	
Pullbox (Std.)		EA	6	\$	300.00	\$	1,800.00	
Conduit (Trencl	ned)	LF	2200	\$	6.00	\$	13,200.00	All purposes
Conduit (Direct	ional Drilled)	LF	50	\$	14.00	\$	700.00	One ramp crossing, mult. conduits
Electrical Service	ce	EA	1	\$	1,500.00	\$	1,500.00	
Electrical Cond	uctors	LF	850	\$	5.00	\$	4,250.00	
2070 Controller	and Cabinet	EA	1	\$	14,000.00	\$	14,000.00	
Firmware/Calib	ration	EA	1	\$	5,300.00	\$	5,300.00	
Cabinet Founda	ation	EA	1	\$	450.00	\$	450.00	
45' Mast Arm P	oles and Foundation	EA	0	\$	15,000.00	\$	8	
Pedestal Pole		EA	1	\$	1,000.00	\$	1,000.00	
Three Section S	Signal Head	EA	2	\$	1,000.00	\$	2,000.00	
One Section Si	gnal Head	EA	2	\$	500.00	\$	1,000.00	Ramp meter advance signal
Signal Cable		LF	400	\$	2.75	\$	1,100.00	
Subtotal						\$	56,657.50	<u></u>
					2.000			-
Communications	14 M M 14 M M M M M M M M M M M M M M M		1 050	1.0	2.00		700.00	
Serial Commun	lications	EA	350	5	2.00	5	700.00	Link to MVDS
Splice Enclosur	e	EA		3	1,000.00	5	1,000.00	Link to SMFO
D. III. The second second	Il Size)	EA	1	5	1,750.00	5	1,750.00	For splice enclosure
Pullbox (Specia	antar	EA	1	\$	1,500.00	\$	1,500.00	In cabinet
Interconnect Ce	enter	+		-	1 50	-	750.00	The second se
Fiber-optic Dro	o Cable (six strands)	LF	500	\$	1.50	\$	750.00	Drop cable to controller cabinet

Log No.:	009	Ramp:			NC 55		
Location:	I-40 Eastbound Exit 278						
Categories	Description	Unit	Quantity	U	nit Cost	Total Cost	Assumptions
							30 mph design speed, 60' transitions,
Pavement	Marking Removal	LF	440	\$	0.62	\$ 272.80	100' narrowed lane
Raised Pa	vement Markers	EA	0	\$	4.50	\$ 14	
White Edg	je Line	LF	220	\$	0.95	\$ 209.00	60' transitions, 100' narrowed lane
Yellow Ed	ge Line	LF	220	\$	0.95	\$ 209.00	60' transitions, 100' narrowed lane
24" Stop E	Bar	LF	12	\$	7.00	\$ 84.00	
Subtotal						\$ 774.80	
							4
Signing							
W3-8, Rar	mp Metered When Flashing	EA	2	\$	650.00	\$ 1,300.00	Sign and post only
W3-4, Be	Prepared to Stop	EA	1	\$	650.00	\$ 650.00	Sign and post
R10-6, Sto	op Here on Red	EA	1	\$	175.00	\$ 175.00	Pedestal mounted
R10-28, X	X Vehicles Per Green	EA	1	\$	175.00	\$ 175.00	Pedestal mounted
Subtotal						\$ 2,300.00	
Subtotal Con	struction					\$ 77,000.00	1
Traffic Co	ntrol				3%	\$ 3,000.00	
Contingen	cies				10%	\$ 8,000.00	
Total Const	ruction			Ī		\$ 88,000.00	
Design					8%	\$ 8,000.00]
Construction	Administration				10%	\$ 9,000.00	1
Total Design	and Construction			1		\$ 105,000.00	

Log No.: Location:	010 I-40 Westbound Exit 278	Ramp:	NC 55
Two Lane Ra Length of Tw Distance fron	mp Widening (Y/N): o Lane Ramp Widening (ft.): n Stopbar to W3-8 sign (ft.):	N 0 760	
Pipe Crossing Retaining Wa Fill (Y/N): Guardrail Oth Equipment (Y	gs (Y/N): alls (Y/N): ner than for Ramp Meter ⁄/N):	Y N N N	
Nearest Pow	er Source (ft.):	1000 (to CCT\	Ŋ

Notes Nearest Power source is signal cabinet. Guardrail full length of right side of ramp. Steep slopes Pipe crossing not an issue. Install equipment on left side only, protect with guardrail

Log No.: 01 Location: I-4	0 0 Westbound Exit 278	Ramp: NC 55						
Categories	Description	Unit	Quantity	U	Init Cost	T	otal Cost	Assumptions
Earthwork and S	tructures	11						r
Retaining Wal	I 5' High	LF	0	\$	250.00	\$	-	
Retaining Wal	l 10' High	LF	0	\$	475.00	\$	-	
Excavation		CY	0	\$	4.00	\$	-	
Fill		CY	0	\$	5.00	\$	÷	
Seeding		sy	1599	\$	2 50	ç	3 997 50	Seeding around trench, conduit runs,
Subtotal		01	1000	1.0	2.00	IS S	3.997.50	
oubtotal						Ľ	-,	J
Guardrail								
Guardrail Rail		LF	250	\$	15.00	\$	3,750.00	
Guardrail App	roach End Treatment	EA	1	\$	1,500.00	\$	1,500.00	
Subtotal						\$	5,250.00	
					,			4
Drainage								
Pipe		LF	0	\$	44.00	\$	-	
Subtotal						\$		
								-
Signalization								
								One queue, three passage and one
6'x6' loops		EA	5	\$	394.50	\$	1,972.50	clearance
Detector Lead	l-in Cable	EA	390	\$	1.50	\$	585.00	Assumed setback distance 350'
MVDS detecto	or	EA	1	\$	1,800.00	\$	1,800.00	Mainline detection
Detector pole		EA	1	\$	6,000.00	\$	6,000.00	
Pullbox (Std.)		EA	6	\$	300.00	\$	1,800.00	
Conduit (Tren	ched)	LF	2350	\$	6.00	\$	14,100.00	All purposes
Conduit (Dired	ctional Drilled)	LF	50	\$	14.00	\$	700.00	One ramp crossing, multiple conduits
Electrical Serv	vice	EA	1	\$	1,500.00	\$	1,500.00	
Electrical Con	ductors	LF	1000	\$	5.00	\$	5,000.00	
2070 Controlle	er and Cabinet	EA	1	\$	14,000.00	\$	14,000.00	
Firmware/Cali	bration	EA	1	\$	5,300.00	\$	5,300.00	
Cabinet Found	dation	EA	1	\$	450.00	\$	450.00	
45' Mast Arm	Poles and Foundation	EA	0	\$	15,000.00	\$	-	
Pedestal Pole	4 -	EA	1	\$	1,000.00	\$	1,000.00	
Three Section	Signal Head	EA	2	\$	1,000.00	\$	2,000.00	
One Section S	Signal Head	EA	2	\$	500.00	\$	1,000.00	Ramp meter advance signal
Signal Cable		LF	400	\$	2.75	\$	1,100.00	
Subtotal						\$	58,307.50	
Communications								
Serial Comm	inications	FA	350	\$	2.00	8	700.00	Link to MVDS
Splice Enclose	Ire	FA	1	ŝ	1 000 00	ŝ	1 000 00	Link to SMEO
Pullbox (Spec	ial Size)	FA	1	S	1 750 00	S	1 750 00	For splice enclosure
Interconnect C	Center	EA	1	S	1,500,00	S	1,500.00	In cabinet
Fiber-optic Dr	op Cable (six strands)	LF	500	S	1.50	\$	750.00	Drop cable to controller cabinet
Ethernet Swite	sh	EA	1	\$	1,700.00	\$	1,700.00	
Subtotal				1		\$	7,400.00	
								4
Pavement Markin	ng							
10.20	10749 - 252 B	262.00	12524645	0.83	101010100		1000000 2002	40 mph design speed. 110' transitions,
Pavement Ma	rking Removal	LF	640	\$	0.62	\$	396.80	100' narrowed lane

Log No.: Location:	010 I-40 Westbound Exit 278	Ramp			NC 55			
Categories	Description	Unit	Quantity	U	nit Cost		Total Cost	Assumptions
Raised Pa	vement Markers	EA	0	\$	4.50	\$	-	
White Edg	le Line	LF	320	\$	0.95	\$	304.00	110' transitions, 100' narrowed lane
Yellow Ed	ge Line	LF	320	\$	0.95	\$	304.00	110' transitions, 100' narrowed lane
24" Stop E	Bar	LF	12	\$	7.00	\$	84.00	
Subtotal						\$	1,088.80	
Signing								
W3-8, Rar	mp Metered When Flashing	EA	2	\$	650.00	\$	1,300.00	Sign and post only
W3-4, Be	Prepared to Stop	EA	1	\$	650.00	\$	650.00	Sign and post
R10-6, Sto	op Here on Red	EA	1	\$	175.00	\$	175.00	Pedestal mounted
R10-28, X	X Vehicles Per Green	EA	1	\$	175.00	\$	175.00	Pedestal mounted
Subtotal						\$	2,300.00	
Subtotal Cor	nstruction					\$	79,000.00	
Traffic Cor	ntrol				3%	\$	3,000.00	
Contingen	cies				10%	\$	8,000.00	
Total Constr	ruction					\$	90,000.00	
Design				1	8%	S	8 000 00	1
Construction	Administration			1	10%	\$	9,000.00	
Total Design	and Construction					\$	107,000.00	

Log No.: Location:	012 I-40 Eastbound Exit 279	Ramp:	NC 147 Southbound to Fastbound
Two Lane Ra Length of Tw Distance fror	amp Widening (Y/N): ro Lane Ramp Widening (ft.): n Stopbar to W3-8 sign (ft.):	Y 2000 1000	Luciocaria
Pipe Crossin Retaining Wa Fill (Y/N): Guardrail Oth Equipment (N	gs (Y/N): alls (Y/N): ner than for Ramp Meter (/N):	N N N	
Nearest Pow	er Source (ft.):	3200	

Notes
No nearby power source. This estimate assumes pulling power from
CCTV at Davis Dr. Possible closer power source could be from the nearby office park.
Install equipment on left side only, protect with guardrail

Typical Design and Construction Costs Two Lane Freeway to Freeway Ramp Meter

Log No.: 01 Location: I-4	2 I0 Eastbound Exit 279	Ramp:		NC	147 South	nbou	und to Eastbo	bund
Categories	Description	Unit	Quantity	U	nit Cost	[·	Total Cost	Assumptions
Earthwork and S	itructures							
Retaining Wa	ll 5' High	LF	0	\$	250.00	\$		
Retaining Wa	ll 10' High	LF	0	\$	475.00	\$	2 4 2	
Excavation		CY	0	\$	4.00	\$	8.51	
Fill		CY	0	\$	5.00	\$	3 4 5	
Seeding		SY	4922	\$	2.50	\$	12,305.00	Seeding along pavement widening and around trench, conduit, pull box, and foundation areas
Subtotal						\$	12,305.00]
Guardrail					1011-011-01-01-01-01-01-01-01-01-01-01-0			
Guardrail Rail		LF	1250	\$	15.00	\$	18,750.00	
Guardrail App	proach End Treatment	EA	5	\$	1,500.00	\$	7,500.00	
Subtotal Paving						\$	26,250.00]
Traffic Separa	ator, 4' Wide	LF	0	\$	32.00	\$	2 4 0	
Ramp Wideni	na	SY	3556	\$	32.00	\$	113,792,00	· · · · · · · · · · · · · · · · · · ·
Pavement Re	surfacing	SY	3556	\$	12.00	\$	42,672.00	
<u>Drainage</u> Pipe		T LF T	0	\$	44.00	\$	-	
Subtotal						\$		Í
Signalization						1		One queue, three passage and one
6'x6' loops		EA	10	\$	394.50	\$	3,945.00	clearance
Detector Lead	l-in Cable	EA	390	\$	1.50	\$	585.00	Assumed setback distance 350'
MVDS detected	or	EA	1	\$	1,800.00	\$	1,800.00	Mainline detection
Detector pole		EA	1	\$	6.000.00	\$	6.000.00	
Pullbox (Std.)		EA	10	\$	300.00	\$	3 000 00	
Conduit (Tren	ched)	LF	5310	\$	6.00	\$	31,860,00	All purposes
Conduit (Dired	ctional Drilled)	LF	125	\$	14.00	\$	1,750.00	One ramp crossing, mult. Conduits, electrical conduit across interstate
Electrical Ser	vice	EA	1	\$	1,500.00	\$	1,500,00	
Electrical Con	ductors	LF	3200	\$	5.00	\$	16,000,00	
2070 Controlle	er and Cabinet	EA	1	\$	14,000,00	S	14,000,00	
Firmware/Cali	ibration	EA	1	\$	5,300,00	\$	5,300,00	
Cabinet Foun	dation	EA	1	\$	450.00	\$	450.00	
45' Mast Arm	Poles and Foundation	EA	1	\$	15.000.00	\$	15,000,00	
Pedestal Pole	,	EA	0	\$	1.000.00	\$	-	
Three Section	Signal Head	EA	2	\$	1.000.00	\$	2,000,00	
One Section S	Signal Head	EA	6	\$	500.00	\$	3,000.00	Ramp meter advance signal
Signal Cable	•	LF	1386	\$	2.75	\$	3,811.50	
Subtotal Communications	5					\$	110,001.50	j
Serial Commu	unications	EA	350	\$	2.00	\$	700.00	Link to MVDS
Splice Enclos	ure	EA	1	\$	1,000.00	\$	1,000.00	Link to SMFO
Pullbox (Spec	ial Size)	EA	1	\$	1,750.00	\$	1,750.00	For splice enclosure
Interconnect (Center	EA	1	\$	1,500.00	\$	1,500.00	In cabinet
Fiber-optic Dr	op Cable (six strands)	LF	500	\$	1.50	\$	750.00	Drop cable to controller cabinet

Typical Design and Construction Costs Two Lane Freeway to Freeway Ramp Meter

Log No.: 012 Ramp: NC				NC 147 Southbound to Eastbound						
Location:	1-40 Eastbound Exit 279									
Categories	Description	Unit	Quantity	L	Unit Cost	0	Total Cost	Assumptions		
Ethernet S	Switch	EA	1	\$	1,700.00	\$	1,700.00			
Subtotal					3	\$	7,400.00			
Dovement M	orling									
Pavement w	arking		0	1	-	1		To person lense 50 MDU design		
		1 1						no narrow lanes, 50 MPH design		
Payaman	t Marking Romoval	1.5		C	0.62	¢		speed, maintain one edge line, pave		
Paveillelli Paicod Pa	woment Markers		25	0	4.60	0	112.50			
Raiseura	avement markers	EA	25	\$	4.50	φ	112.30	200' transitions 100' parrowed lane 50		
Maito Ede	no Lino	I I E	2400	¢	0.05	¢	2 280 00	ADU		
VVIILE EUÇ	Je Lille		2400	- D	0.95	Φ	2,200.00	200' transitions 100' parrowed land 50		
Vollow Ed	lao Lino	1 1 5	600	¢	0.05	¢	570.00	MDL		
24" Stop			24	0	7.00	¢ ¢	168.00			
White Ski	n line		2000	\$	0.24	\$	475.00			
Subtotal	p Line		2000	Ψ	0.24	1¢	3 605 50	1		
Jubiolai						Ľ	5,000,000	4		
Signing										
W3-8 Rai	mp Metered When Elashing	FA	2	\$	650.00	2	1 300 00	Sign and post only		
W3-4 Re	Prenared to Ston	FA	1	¢	650.00	\$	650.00	Sign and post		
R10-6 St	on Here on Red	FA	1	¢	175.00	\$	175.00	Pedestal mounted		
R10-28 X	X Vehicles Per Green	FA	1	S	175.00	\$	175.00	Pedestal mounted		
W4-11 M	erge Left	FA	2	\$	650.00	\$	1 300 00			
Sign Strue	cture (Cantilever)	FA	2	S	50 000 00	\$	100 000 00			
Ramp Me	ter On Sign (Message A)	EA	1	\$	5 000 00	\$	5 000 00			
Prepare to	Stop Sign (Message B)	EA	1	\$	5,000.00	\$	5,000,00			
Subtotal						\$	113,600.00			
Subtotal Co	nstruction					Š	430,000.00			
Traffic Co	introl			T	3%	\$	13,000,00			
Continger	ncies			+	10%	\$	43 000 00			
Total Const	ruction			t		\$	486,000.00			
	anda kekangan di Kal			_			-	4		
Desian				T	8%	\$	39.000.00	1		
Construction	Administration				10%	\$	49,000.00	1		
Total Design	n and Construction					\$	574,000.00	1		
				1	1		.,	1		

Log No.: Location:	014 I-40 Westbound Exit 279	Ramp:	NC 147 Southbound to Westbound
Two Lane Ra Length of Tw Distance fron	mp Widening (Y/N): o Lane Ramp Widening (ft.): n Stopbar to W3-8 sign (ft.):	N N 1000	
Pipe Crossing Retaining Wa Fill (Y/N): Guardrail Oth Equipment (N	gs (Y/N): Ills (Y/N): ner than for Ramp Meter ⁄/N):	N N N	
Nearest Pow	er Source (ft.):	1800	

Notes Nearest Power source is CCTV at 147 interchange. Install equipment on right side only, protect with guardrail

Typical Design and Construction Costs Single Lane Freeway to Freeway Ramp Meter

ocation: 1-40 Westbound Exit 279							
Categories Description	Unit	Quantity	Unit	t Cost	1	Fotal Cost	Assumptions
arthwork and Structures							
Retaining Wall 5' High	LF	0	\$	250.00	\$	-	
Retaining Wall 10' High	LF	0	\$	475.00	\$		
Excavation	CY	0	\$	4.00	\$		
Fill	CY	0	\$	5.00	\$	577	
	01	0055		0.50		0 007 50	Seeding around trench, pull box,
Seeding	SY	2600	Э	2.50	\$	6,637.50	conduit, and foundation areas
Subtotal				2	ð	0,037.50	
Guardrail							
Guardrail Rail	LF	1250	\$	15.00	\$	18,750.00	
Guardrail Approach End Treatment	EA	5	\$ 1	,500.00	\$	7,500.00	
Subtotal					\$	26,250.00	
				3			u da
)rainage		0	¢	14.00	¢		
Pipe	LF	0	φ	44.00	φ Φ	1973 - 1923 -	
Subtotal				3	\$		
Signalization							No. 1852
		200					One queue, three passage and one
6'x6' loops	EA	5	\$	394.50	\$	1,972.50	clearance
Detector Lead-in Cable	EA	390	\$	1.50	\$	585.00	Assumed setback distance 350'
MVDS detector	EA	1	\$ 1	,800.00	\$	1,800.00	Mainline detection
Detector pole	EA	1	\$ 6	,000.00	\$	6,000.00	
Pullbox (Std.)	EA	10	\$	300.00	\$	3,000.00	
Conduit (Trenched)	LF	3910	\$	6.00	\$	23,460.00	All purposes
							One ramp crossing, mult. Conduits,
Conduit (Directional Drilled)	LF	100	\$	14.00	\$	1,400.00	ramp crossing for electrical.
Electrical Service	EA	1	\$ 1	,500.00	\$	1,500.00	
Electrical Conductors	LF	1800	\$	5.00	\$	9,000.00	
2070 Controller and Cabinet	EA	1	\$14	,000.00	\$	14,000.00	
Firmware/Calibration	EA	1	\$ 5	,300.00	\$	5,300.00	
Cabinet Foundation	EA	1	\$	450.00	\$	450.00	
45' Mast Arm Poles and Foundation	EA	1	\$ 15,	,000.00	\$	15,000.00	
Pedestal Pole	EA	0	\$ 1	,000.00	\$	1981	
Three Section Signal Head	EA	2	\$ 1	,000.00	\$	2,000.00	
One Section Signal Head	EA	6	\$	500.00	\$	3,000.00	Ramp meter advance signal
Signal Cable	LF	1386	\$	2.75	\$	3,811.50	
subtotal				1	\$	92,279.00	
				8			u
Communications							
Serial Communications	FA	350	S	2 00	\$	700.00	Link to MVDS
Splice Enclosure	FA	1	\$ 1	000 000	S	1 000 00	Link to SMEQ
Pullbox (Special Size)	FA	1	\$ 1	750.00	S	1 750 00	For splice enclosure
Interconnect Center	FA	1	\$ 1	500.00	S	1,500,00	In cabinet
Fiber-ontic Dron Cable (six strands)	15	500	¢ I	1 50	¢	750.00	Drop cable to controller cabinet
i inci-optio Drop Gable (aix attailus)		000		1.00	Ψ	100.00	brop dable to controller dabinet
Ethernet Switch		1	1 8 1	700 00	S	1 700 00	

Typical Design and Construction Costs Single Lane Freeway to Freeway Ramp Meter

Log No.: Location:	014 I-40 Westbound Exit 279	Ramp: NC 147 Sol				NC 147 Southbound to Westbound							ithbound to Westbound					
Categories	Description	Unit	Quantity	U	Init Cost		Total Cost	Assumptions										
	•							50 MPH design speed, 200' transitions,										
Pavement	Marking Removal	LF	1000	\$	0.62	\$	620.00	100' narrowed lane										
Raised Pa	vement Markers	EA	0	\$	4.50	\$	1 4 0											
White Edg	je Line	LF	500	\$	0.95	\$	475.00	200' transitions, 100' narrowed lane, 50 MPH										
Yellow Ed	ge Line	LF	500	\$	0.95	\$	475.00	200' transitions, 100' narrowed lane, 50 MPH										
24" Stop E	Bar	LF	12	\$	7.00	\$	84.00	Maintain existing skip										
Subtotal						\$	1,654.00											
<u>Signing</u> W3-8, Rar	mp Metered When Flashing	EA	2	\$	650.00	\$	1,300.00	Sign and post only										
W3-4. Be	Prepared to Stop	EA	1	\$	650.00	\$	650.00	Sign and post										
R10-6, Sto	pp Here on Red	EA	1	\$	175.00	\$	175.00	Pedestal mounted										
R10-28, X	X Vehicles Per Green	EA	1	\$	175.00	\$	175.00	Pedestal mounted										
Sign Struc	ture (Cantilever)	EA	2	\$	50,000.00	\$	100,000.00											
Ramp Met	ter On Sign (Message A)	EA	1	\$	5,000.00	\$	5,000.00											
Prepare to	Stop Sign (Message B)	EA	1	\$	5,000.00	\$	5,000.00											
Subtotal Subtotal Cor	nstruction					\$ \$	112,300.00 247,000.00											
Traffic Co	ntrol			Т	3%	\$	8,000.00											
Contingen	cies				10%	\$	25,000.00	1										
Total Const	ruction					\$	280,000.00											
Design					8%	\$	23,000.00											
Construction	Administration				10%	\$	28,000.00]										
Total Design	and Construction			1		\$	331,000.00											

Log No.: Location:	015 I-40 Eastbound Exit 280	Ramp:	Davis Drive
Two Lane R Length of Tv Distance fro	amp Widening (Y/N): vo Lane Ramp Widening (ft.): m Stopbar to W3-8 sign (ft.):	Y 1500 950	
Pipe Crossir Retaining W Fill (Y/N): Guardrail Ot Equipment (ngs (Y/N): alls (Y/N): her than for Ramp Meter Y/N):	N N N N	
Nearest Pov	ver Source (ft.):	1200	

Notes Nearest Power source is CCTV at 147 interchange. Protect with guardrail on both sides.

Log No.: 015 Location: I-40	5) Eastbound Exit 280	Ramp:		Da	vis Drive			
Categories	Description	Unit	Quantity	Ui	nit Cost	1	Total Cost	Assumptions
Earthwork and Str	ructures							•
Retaining Wall	5' High	LF	0	\$	250.00	\$		
Retaining Wall	10' High	LF	0	\$	475.00	\$	2	
Excavation		CY	0	\$	4.00	\$	<u>~</u>	
Fill		CY	0	\$	5.00	\$	-	
Seeding		SY	1760	\$	2.50	\$	4,400.00	Seeding along pavement widening and around trench, conduit, pull box, and foundation areas
Subtotal						\$	4,400.00	
Guardrail								
Guardrail Rail		LF	500	\$	15.00	\$	7,500.00	
Guardrail Appre	oach End Treatment	EA	2	\$	1,500.00	\$	3,000.00	
Subtotal]	\$	10,500.00	
Paving								T
Ramp Widenin	g	SY	2667	\$	32.00	\$	85,344.00	
Pavement Res	urfacing	SY	2667	\$	12.00	\$	32,004.00	
Drainage			0		44.00			1
Pipe			0	\$	44.00	5		
Signalization			10		204.50		0.045.00	One queue, three passage and one
6'x6' loops	in Only	EA	10	5	394.50	\$	3,945.00	clearance
Detector Lead-		EA	390	3	1.00	3	585.00	Assumed setback distance 350
MVDS detector		EA	1	3	1,800.00	3	1,800.00	
Delector pole			6	0	300.00	0	1,000.00	
Conduit (Tropo	bod)		2585	0	6.00	9	15 510 00	All purposes
Conduit (Direct	tional Drilled)		250	ŝ	14.00	\$	3,500,00	One ramp crossing mult conduits
Electrical Servi		EA	1	\$	1 500 00	\$	1 500 00	one ramp crocoing, mail contacto
Electrical Cond	luctors		1200	S	5.00	S	6,000,00	
2070 Controlle	r and Cabinet	EA	1	\$ 1	4 000 00	S	14 000 00	·
Firmware/Calib	pration	EA	1	\$	5,300.00	\$	5,300.00	
Cabinet Found	ation	EA	1	\$	450.00	\$	450.00	
45' Mast Arm F	Poles and Foundation	EA	0	\$1	5,000.00	\$	-	
Pedestal Pole		EA	2	\$	1,000.00	\$	2,000.00	dual pedestals
Three Section	Signal Head	EA	2	\$	1,000.00	\$	2,000.00	
One Section Si	ignal Head	EA	2	\$	500.00	\$	1,000.00	Ramp meter advance signal
Signal Cable		LF	505	\$	2.75	\$	1,388.75	
Subtotal						\$	66,778.75	
Communications	aiaatiana		250		0.00	6	700.00	Lipkta MVDS
Selia Commun	re	EA	350	9	2.00	9	1 000 00	Link to MVDS
Dullbox (Specie		EA	1	0	1,000.00	9	1,000.00	
	an Size)	EA	1	0	1,750.00	9	1,750.00	In cabinet
Fiber-optic Dro	n Cable (six strands)		500	9	1,500.00	9 6	750.00	Drop cable to controller cabinet
Ethernet Switch	h	EA	1	S	1,700.00	\$	1,700.00	

Log No.:	015	Ramp:		Da	avis Drive			
Location:	I-40 Eastbound Exit 280							
Categories	Description	Unit	Quantity	U	nit Cost		Total Cost	Assumptions
Subtotal						\$	7,400.00	
Pavement M	arking					_		
			012010-22	1220			12.212.12.2	40 mph design speed. 110' transitions,
Pavement	Marking Removal	LF	640	\$	0.62	\$	396.80	100' narrowed lane
Raised Pa	avement Markers	EA	19	\$	4.50	\$	85.50	Along skip line only
White Edg	je Line	LF	320	\$	0.95	\$	304.00	110' transitions, 100' narrowed lane
Yellow Ed	ge Line	LF	320	\$	0.95	\$	304.00	110' transitions, 100' narrowed lane
White Skip	p Line	LF	1500	\$	0.24	\$	356.25	
24" Stop E	Bar	LF	12	\$	7.00	\$	84.00	
Subtotal					i i i	\$	1,530.55	
								-
Signing								
W3-8, Rar	mp Metered When Flashing	EA	2	\$	650.00	\$	1,300.00	Sign and post only
W3-4, Be	Prepared to Stop	EA	1	\$	650.00	\$	650.00	Sign and post
R10-6, Sto	op Here on Red	EA	1	\$	175.00	\$	175.00	Pedestal mounted
R10-28, X	X Vehicles Per Green	EA	1	\$	175.00	\$	175.00	Pedestal mounted
W4-1L, M	erge Left	EA	1	\$	650.00	\$	650.00	
Subtotal						\$	2,950.00	
Subtotal Con	nstruction					\$	211,000.00	1
Traffic Col	ntrol				3%	\$	7,000.00	
Contingen	ncies				10%	\$	22,000.00	1
Total Const	ruction					\$	240,000.00	1
								.
Design					8%	\$	20,000.00	1
Construction	Administration				10%	\$	24,000.00	1
Total Desigr	n and Construction			T		\$	284,000.00	1

Log No.: Location:	017 I-40 Eastbound Exit 281	Ramp:	S. Miami Blvd.
Two Lane Ra Length of Two Distance from	mp Widening (Y/N): b Lane Ramp Widening (ft.): i Stopbar to W3-8 sign (ft.):	N N 600	
Pipe Crossing Retaining Wa Fill (Y/N): Guardrail Oth Equipment (Y	ıs (Y/N): IIs (Y/N): er than for Ramp Meter /N):	N N N	
Nearest Powe	er Source (ft.):	925	

Notes Nearest Power source is signal cabinet. Narrow shoulder on right. Guardrail needed. Ramp already widened for the first 325 ft. Ramp taper is 700 ft. Install equipment on right side only, protect with guardrail

Log No.: 017 Location: I-40 Eastbound Exit 28	Ramp 1		S. Miami Blvo	1.	
Categories Description	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structures					r
Retaining Wall 5' High	LF	0	\$ 250.00	\$-	
Retaining Wall 10' High	LF	0	\$ 475.00	\$ -	
Excavation	CY	0	\$ 4.00	\$ -	
Fill	CY	0	\$ 5.00	\$-	
Oradian	ev l	1540	0.50	C 2 970 E0	Seeding around trench, conduit runs,
Seeding	ST	1549	\$ 2.50	5 3,072.00	puil box, and foundation areas
Subtotal				\$ 3,872.50	1
Guardrail					
Guardrail Rail	LE	250	\$ 15.00	\$ 3,750.00	
Guardrail Approach End Treatmer	t EA	1	\$ 1,500.00	\$ 1,500.00	
Subtotal	°			\$ 5,250.00	
Cuptotal					4
Drainage					
Pipe	LF	0	\$ 44.00	\$-	
Subtotal				\$-	
Signalization					
					One queue, three passage and one
6'x6' loops	EA	5	\$ 394.50	\$ 1,972.50	clearance
Detector Lead-in Cable	EA	390	\$ 1.50	\$ 585.00	Assumed setback distance 350'
MVDS detector	EA	1	\$ 1,800.00	\$ 1,800.00	Mainline detection
Detector pole	EA	1	\$ 6,000.00	\$ 6,000.00	
Pullbox (Std.)	EA	6	\$ 300.00	\$ 1,800.00	
Conduit (Trenched)	LF	2275	\$ 6.00	\$ 13,650.00	All purposes
Conduit (Directional Drilled)	LF	175	\$ 14.00	\$ 2,450.00	One ramp crossing, multiple conduits
Electrical Service	EA	1	\$ 1,500.00	\$ 1,500.00	
Electrical Conductors	LF	925	\$ 5.00	\$ 4,625.00	
2070 Controller and Cabinet	EA	1	\$ 14,000.00	\$ 14,000.00	
Firmware/Calibration	EA	1	\$ 5,300.00	\$ 5,300.00	
Cabinet Foundation	EA	1	\$ 450.00	\$ 450.00	
45' Mast Arm Poles and Foundation	on EA	0	\$ 15,000.00	\$ -	
Pedestal Pole	EA	1	\$ 1,000.00	\$ 1,000.00	
Three Section Signal Head	EA	2	\$ 1,000.00	\$ 2,000.00	8
One Section Signal Head	EA	2	\$ 500.00	\$ 1,000.00	Ramp meter advance signal
Signal Cable		400	\$ 2.75	\$ 1,100.00	1
Subtotal				\$ 59,232.50	_
Communications					
Serial Communications		350	\$ 200	\$ 700.00	Link to MVDS
Splice Enclosure		1	\$ 1,000,00	\$ 1,000,00	Link to SMEO
Pullbox (Special Size)		1	\$ 1,000.00	\$ 1,000.00	For splice enclosure
Interconnect Center	FA	1	\$ 1,700.00	\$ 1,700.00	In cabinet
Fiber-optic Drop Cable (six strand	s) LF	500	\$ 1.50	\$ 750.00	Drop cable to controller cabinet
Ethernet Switch	EA	1	\$ 1,700.00	\$ 1,700.00	
Subtotal				\$ 7,400.00	1
				<u> </u>	4
Pavement Marking					
			1	1	40 mph design speed. 110' transitions.
Pavement Marking Removal	LF	440	\$ 0.62	\$ 272.80	100' narrowed lane

Log No.: Location:	017 I-40 Eastbound Exit 281	Ramp	:	S. N	/liami Blvd		
Categories	Description	Unit	Quantity	U	nit Cost	Total Cost	Assumptions
Raised Pa	vement Markers	EA	0	\$	4.50	\$ -	
White Edg	e Line	LF	220	\$	0.95	\$ 209.00	110' transitions, 100' narrowed lane
Yellow Edg	ge Line	LF	220	\$	0.95	\$ 209.00	110' transitions, 100' narrowed lane
24" Stop B	Bar	LF	12	\$	7.00	\$ 84.00	
Subtotal						\$ 774.80	
Signing							
W3-8, Ran	np Metered When Flashing	EA	2	\$	650.00	\$ 1,300.00	Sign and post only
W3-4, Be I	Prepared to Stop	EA	1	\$	650.00	\$ 650.00	Sign and post
R10-6, Sto	p Here on Red	EA	1	\$	175.00	\$ 175.00	Pedestal mounted
R10-28, X	X Vehicles Per Green	EA	1	\$	175.00	\$ 175.00	Pedestal mounted
Subtotal						\$ 2,300.00	
Subtotal Con	nstruction					\$ 79,000.00	
Traffic Cor	ntrol				3%	\$ 3,000.00	
Contingen	cies				10%	\$ 8,000.00	
Total Construction						\$ 90,000.00]
Design				1	8%	\$ 8,000.00	1
Construction	Administration				10%	\$ 9,000.00	1
Total Design	and Construction					\$ 107,000.00	1

Log No.: Location:	019 I-40 Eastbound Exit 282	Ramp:	Page Road
Two Lane R Length of Tv Distance fro	amp Widening (Y/N): vo Lane Ramp Widening (ft.): m Stopbar to W3-8 sign (ft.):	Y 750 500	
Pipe Crossir Retaining W Fill (Y/N): Guardrail Ot Equipment (ngs (Y/N): alls (Y/N): her than for Ramp Meter Y/N):	N N N N	
Nearest Pov	/er Source (ft.):	650	

Notes Nearest Power source is signal cabinet. Ramp has already been widened for the first 600 ft. Protect with guardrail on both sides.

Log No.: 019 Location: I-40 Eastbound Exit 282	Ramp:		Pag	e Road			
Categories Description	Unit	Quantity	U	nit Cost	1	Fotal Cost	Assumptions
Earthwork and Structures							
Retaining Wall 5' High	LF	0	\$	250.00	\$	-	
Retaining Wall 10' High	LF	0	\$	475.00	\$	12	
Excavation	CY	0	\$	4.00	\$	-	
Fill	CY	0	\$	5.00	\$	×	
							Seeding along pavement widening and around trench, conduit, pull box, and
Seeding	SY	1393	\$	2.50	\$	3,482.50	foundation areas
Subtotal			- 271	3	\$	3,482.50	
Guardrail		500	1.0	15.00		7 500 00	
Guardrail Rail	LF	500	\$	15.00	\$	7,500.00	
Guardrail Approach End Treatment	EA	2	\$	1,500.00	\$	3,000.00	
Subtotal]	\$	10,500.00	
Paving					_		
Ramp Widening	SY	1334	\$	32.00	\$	42,688.00	
Pavement Resurfacing	SY	1334	\$	12.00	\$	16,008.00	
Subtotal]	\$	58,696.00	
Drainage							
Pipe	LF	0	\$	44.00	\$	12	
Signalization			1				One queue, three passage and one
6'x6' loops	EA	10	\$	394.50	\$	3,945.00	clearance
Detector Lead-in Cable	EA	390	\$	1.50	\$	585.00	Assumed setback distance 350'
MVDS detector	EA	1	\$	1,800.00	\$	1,800.00	Mainline detection
Detector pole	EA	1	\$	6,000.00	\$	6,000.00	
Pullbox (Std.)	EA	6	\$	300.00	\$	1,800.00	
Conduit (Trenched)	LF	2035	\$	6.00	\$	12,210.00	All purposes
Conduit (Directional Drilled)	LF	150	\$	14.00	\$	2,100.00	One ramp crossing, mult. conduits
Electrical Service	EA	1	\$	1,500.00	\$	1,500.00	
Electrical Conductors	LF	650	\$	5.00	\$	3,250.00	
2070 Controller and Cabinet	EA	1	\$1	4,000.00	\$	14,000.00	
Firmware/Calibration	EA	1	\$	5,300.00	\$	5,300.00	
Cabinet Foundation	EA	1	\$	450.00	\$	450.00	
45' Mast Arm Poles and Foundation	EA	0	\$1	5,000.00	\$	-	
Pedestal Pole	EA	2	\$	1,000.00	\$	2,000.00	dual pedestals
Three Section Signal Head	EA	2	\$	1,000.00	\$	2,000.00	
One Section Signal Head	EA	2	\$	500.00	\$	1,000.00	Ramp meter advance signal
Signal Cable	LF	505	\$	2.75	\$	1,388.75	
Subtotal					\$	59,328.75	
Serial Communications	EA	350	\$	2.00	\$	700.00	Link to MVDS
Splice Enclosure	EA EA	1	\$	1 000 00	9	1 000 00	Link to SMEO
Dullboy (Special Size)		1	\$	1 750 00	\$	1,000.00	
Interconnect Center		1	0	1,700.00	9	1,750.00	In cabinet
Fiber ontio Drop Cable (six strands)		500	0	1,500.00	9	750.00	Drop cable to controller cabinet
Ethernet Switch	EA	1	S	1,700.00	\$	1,700.00	

Log No.:	019	Ramp:		Pag	e Road			
Location:	I-40 Eastbound Exit 282	10048525.02 8 904						
Categories	Description	Unit	Quantity	U	nit Cost		Total Cost	Assumptions
Subtotal						\$	7,400.00	
Pavement Ma	arking							
				1		1		40 mph design speed. 110' transitions,
Pavement	Marking Removal	LF	640	\$	0.62	\$	396.80	100' narrowed lane
Raised Pa	vement Markers	EA	10	\$	4.50	\$	45.00	Along skip line only
White Edg	je Line	LF	320	\$	0.95	\$	304.00	110' transitions, 100' narrowed lane
Yellow Ed	ge Line	LF	320	\$	0.95	\$	304.00	110' transitions, 100' narrowed lane
White Skip	Line	LF	750	\$	0.24	\$	178.13	
24" Stop E	Bar	LF	12	\$	7.00	\$	84.00	
Subtotal					j.	\$	1,311.93	
Signing	nn Matarad M/han Flashing				650.00	6	1 200 00	
W0-0, Rai	Properted to Stop	EA		0	650.00	0	1,300.00	Sign and post only
D106 Sto	Prepared to Stop		1	0 C	175.00	0	175.00	Dedectal mounted
R10-0, 30	X Vehicles Per Green	EA	1	¢	175.00	\$	175.00	Pedestal mounted
W4-1L Me	erge Left	EA	1	S	650.00	S	650.00	recestarmounted
Subtotal			•			Ŝ.	2,950.00	
Subtotal Cor	nstruction					\$	144,000.00	
Traffic Cor	ntrol				3%	\$	5,000.00	
Contingen	cies				10%	\$	15,000.00	1
Total Constr	ruction			Τ		\$	164,000.00]
Docign				-	00/	¢	14,000,00	1
Construction	Administration			+	10%	9	17,000.00	
Total Design	and Construction			+	1070	ŝ	195 000 00	4
i otal Desigi	and construction					Ψ	100,000.00	J

Log No.: Location:	025 I-40 Eastbound Exit 284	Ramp:	Airport Blvd
Two Lane Ra Length of Tw Distance fror	amp Widening (Y/N): /o Lane Ramp Widening (ft.): n Stopbar to W3-8 sign (ft.):	N 750 1000	
Pipe Crossin Retaining W Fill (Y/N): Guardrail Ot Equipment (gs (Y/N): alls (Y/N): her than for Ramp Meter Y/N):	N N N	
Nearest Pow	ver Source (ft.):	1250	

Notes Nearest Power source is signal cabinet. Install equipment on right side only, protect with guardrail.

Log No.: 025 Location: I-40 Eastbound Exit 284	Ramp	:	Air	port Blvd			
Categories Description	Unit	Quantity	ι	Init Cost	1	otal Cost	Assumptions
Earthwork and Structures							
Retaining Wall 5' High	LF	0	\$	250.00	\$		
Retaining Wall 10' High	LF	0	\$	475.00	\$	-	
Excavation	CY	0	\$	4.00	\$	-	
Fill	CY	0	\$	5.00	\$	7	
Seeding	SY	1766	S	2 50	s	4 415 00	Seeding around trench, conduit runs, pull box, and foundation areas
Subtotal	101	1100	1.	2.00	\$	4,415.00	
Quardrail					2		-
		250	T ¢	15.00	¢	3 750 00	
Guardrail Rall		200	0	1 500 00	0 Q	1,500,00	
Guardraii Approach End Treatment	LA	1	Ψ	1,000.00	φ Γ¢	1,000.00	
Subtotal					⊅	5,250.00	
Drainage Pine	IIFI	0	15	44 00	s		
Subtotal		0	ŢΨ	.00	S		
Subtotal					Ľ		
Signalization			-		_		
6'x6' loops	EA	5	s	394.50	s	1.972.50	Che queue, three passage and one clearance
Detector Lead-in Cable	EA	390	\$	1.50	S	585.00	Assumed setback distance 350'
MVDS detector	EA	1	\$	1.800.00	\$	1,800.00	Mainline detection
Detector pole	EA	1	\$	6,000,00	\$	6.000.00	
Pullbox (Std.)	EA	6	\$	300.00	\$	1.800.00	
Conduit (Trenched)	LF	2600	\$	6.00	\$	15,600.00	All purposes
Conduit (Directional Drilled)	LF	150	\$	14.00	\$	2,100.00	One ramp crossing, multiple conduits
Electrical Service	EA	1	\$	1,500.00	\$	1,500.00	
Electrical Conductors	LF	1250	\$	5.00	\$	6,250.00	
2070 Controller and Cabinet	EA	1	\$	14,000.00	\$	14,000.00	
Firmware/Calibration	EA	1	\$	5,300.00	\$	5,300.00	
Cabinet Foundation	EA	1	\$	450.00	\$	450.00	
45' Mast Arm Poles and Foundation	EA	0	\$	15,000.00	\$	12	
Pedestal Pole	EA	1	\$	1,000.00	\$	1,000.00	
Three Section Signal Head	EA	2	\$	1,000.00	\$	2,000.00	
One Section Signal Head	EA	2	\$	500.00	\$	1,000.00	Ramp meter advance signal
Signal Cable	LF	400	\$	2.75	\$	1,100.00	
Subtotal					\$	62,457.50	
Communications							
Serial Communications	EA	350	\$	2.00	\$	700.00	Link to MVDS
Splice Enclosure	EA	1	\$	1,000.00	\$	1,000.00	Link to SMFO
Pullbox (Special Size)	EA	1	\$	1,750.00	\$	1,750.00	For splice enclosure
Interconnect Center	EA	1	\$	1,500.00	\$	1,500.00	In cabinet
Fiber-optic Drop Cable (six strands)	LF	500	\$	1.50	\$	750.00	Drop cable to controller cabinet
Ethernet Switch	EA	1	\$	1,700.00	\$	1,700.00	
Subtotal					\$	7,400.00	
Pavement Marking							40 mph design speed. 110' transitions,
Pavement Marking Removal	LF	640	\$	0.62	\$	396.80	100' narrowed lane

Log No.: Location:	025 I-40 Eastbound Exit 284	Ramp	:	Airp	ort Blvd			
Categories	Description	Unit	Quantity	U	nit Cost	•	Total Cost	Assumptions
Raised Pa	vement Markers	EA	0	\$	4.50	\$	-	
White Edg	e Line	LF	320	\$	0.95	\$	304.00	110' transitions, 100' narrowed lane
Yellow Edg	ge Line	LF	320	\$	0.95	\$	304.00	110' transitions, 100' narrowed lane
24" Stop E	Bar	LF	12	\$	7.00	\$	84.00	
Subtotal						\$	1,088.80	
Signing								
W3-8, Rar	mp Metered When Flashing	EA	2	\$	650.00	\$	1,300.00	Sign and post only
W3-4, Be	Prepared to Stop	EA	1	\$	650.00	\$	650.00	Sign and post
R10-6, Sto	p Here on Red	EA	1	\$	175.00	\$	175.00	Pedestal mounted
R10-28, X	X Vehicles Per Green	EA	1	\$	175.00	\$	175.00	Pedestal mounted
Subtotal						\$	2,300.00	
Subtotal Cor	nstruction					\$	83,000.00	
Traffic Cor	ntrol				3%	\$	3,000.00	
Contingen	cies				10%	\$	9,000.00	
Total Constr	ruction					\$	95,000.00	
Design				1	8%	\$	8 000 00	1
Construction	Administration			+	10%	\$	10.000.00	
Total Design	and Construction					\$	113,000.00	

Log No.: Location:	027 I-40 Eastbound Exit 285	Ramp:	Aviation Parkway Southbound to Eastbound
Two Lane Ra Length of Tw Distance fror	amp Widening (Y/N): /o Lane Ramp Widening (ft.): n Stopbar to W3-8 sign (ft.):	N 0 750	
Pipe Crossin Retaining Wa Fill (Y/N): Guardrail Ot Equipment (gs (Y/N): alls (Y/N): her than for Ramp Meter Y/N):	N N N	
Nearest Pow	ver Source (ft.):	775	

Notes Nearest Power source is signal cabinet. Curb and gutter on right side. Install equipment on right side only, protect with guardrail

Categories	Description	Unit	Quantity	ΓU	nit Cost	7	fotal Cost	Assumptions
Earthwork and St	ructures				int occit			,
Retaining Wall	5' High	LF	0	\$	250.00	\$	-	T
Retaining Wall	10' High	LF	0	\$	475.00	\$	<u>.</u>	
Excavation		CY	0	\$	4.00	\$		1
Fill		CY	0	\$	5.00	\$		
		1 7						Seeding around trench, conduit runs
Seeding		SY	1449	\$	2.50	\$	3,622.50	pull box, and foundation areas
Subtotal					y	\$	3,622.50	Ĵ
					817°			
Guardrail			050	0	15.00	L C	2 750 00	
Guardrail Appr	Treatmont		200	Ð	10.00	D C	3,750.00	<u> </u>
Guardrail Appro	Jach End Treatment		1	Φ	1,500.00	9	T,500.00	<u></u>
Subtotal					ľ	>	5,250.00	4
Drainage								
Pipe		LF	0	\$	44.00	\$		<u>+</u>
Subtotal		_		-		\$		i
					e	<u> </u>		1
Signalization								
		T						One queue, three passage and one
6'x6' loops		EA	5	\$	394.50	\$	1,972.50	clearance
Detector Lead-	in Cable	EA	390	\$	1.50	\$	585.00	Assumed setback distance 350'
MVDS detector	(EA	1	\$	1,800.00	\$	1,800.00	Mainline detection
Detector pole		EA	1	\$	6,000.00	\$	6,000.00	
Pullbox (Std.)		EA	6	\$	300.00	\$	1,800.00	
Conduit (Trenc	hed)	LF /	2125	\$	6.00	\$	12,750.00	All purposes
Conduit (Direct	ional Drilled)	LF /	100	\$	14.00	\$	1,400.00	Two ramp crossing, mult. conduits
Electrical Servin	ce	EA	1	\$	1,500.00	\$	1,500.00	1
Electrical Cond	luctors	LF	775	\$	5.00	\$	3,875.00	
2070 Controller	r and Cabinet	EA	1	\$	14,000.00	\$	14,000.00	
Firmware/Calib	ration	EA	1	\$	5,300.00	\$	5,300.00	
Cabinet Found	ation	EA	1	\$	450.00	\$	450.00	
45' Mast Arm P	oles and Foundation	EA	0	\$	15,000.00	\$		
Pedestal Pole		EA	1	\$	1,000.00	\$	1,000.00	
Three Section S	Signal Head	EA	2	\$	1,000.00	\$	2,000.00	
One Section Si	gnal Head	EA	2	\$	500.00	\$	1,000.00	Ramp meter advance signal
Signal Cable			400	\$	2.75	\$	1,100.00	
Subtotal				-	- I	\$	56,532.50	
Communications	·		1 250	T _C	2.00		700.00	
Serial Commun	lications		350	3	1 000 00	3	1 000 00	
Splice Enclosur	/e			0	1,000.00	3	1,000.00	
Pullbox (opecie	al Sizej			0 Ø	1,750.00	D C	1,700.00	For splice enclosure
Fiber optic Dro	anter		500	0 0	1,500.00	D C	750.00	In capinet
Ethernet Swite	D Cable (Six Strands)	FA	1	\$	1 700 00	9	1 700.00	
	-1		1 1	· ·	1,100.00,	14	1,100.00	

Log No.:	027	Ramp:	1	Avia	ation Park	way	Southbound	d to Eastbound
Location:	I-40 Eastbound Exit 285					1		
Categories	Description	Unit	Quantity	U	nit Cost	1	Total Cost	Assumptions
	-							30 mph design speed, 60' transitions,
Pavement	Marking Removal	LF	440	\$	0.62	\$	272.80	100' narrowed lane
Raised Pa	avement Markers	EA	0	\$	4.50	\$	14	2. 7.
White Edg	je Line	LF	220	\$	0.95	\$	209.00	60' transitions, 100' narrowed lane
Yellow Ed	ge Line	LF	220	\$	0.95	\$	209.00	60' transitions, 100' narrowed lane
24" Stop E	Bar	LF	12	\$	7.00	\$	84.00	
Subtotal						\$	774.80	
Signing						_		÷
W3-8, Rai	mp Metered When Flashing	EA	2	\$	650.00	\$	1,300.00	Sign and post only
W3-4, Be	Prepared to Stop	EA	1	\$	650.00	\$	650.00	Sign and post
R10-6, Sto	op Here on Red	EA	1	\$	175.00	\$	175.00	Pedestal mounted
R10-28, X	X Vehicles Per Green	EA	1	\$	175.00	\$	175.00	Pedestal mounted
Subtotal	10. 9.c					\$	2,300.00	
Subtotal Cor	struction					\$	76,000.00]
Traffic Co	ntrol				3%	\$	3,000.00	1
Continger	icies				10%	\$	8,000.00	1
Total Const	ruction					\$	87,000.00	
								-1
Design					8%	\$	7,000.00]
Construction	Administration				10%	\$	9,000.00	1
Total Design	n and Construction					\$	103,000.00]

Log No.: Location:	028 I-40 Eastbound Exit 285	Ramp:	Northbound to Eastbound
Two Lane Ra Length of Tw Distance fror	amp Widening (Y/N): to Lane Ramp Widening (ft.): n Stopbar to W3-8 sign (ft.):	N 0 1000	
Pipe Crossin Retaining Wa Fill (Y/N): Guardrail Oth Equipment (`	gs (Y/N): alls (Y/N): ner than for Ramp Meter Y/N):	N N N	
Nearest Pow	er Source (ft.):	1200	

Notes Nearest Power source is signal cabinet. Install equipment on right side only, protect with guardrail

Unit LF CY CY SY	Quantity 0 0 0 0 0 0 0	9 9 9	250.00	T ¢	otal Cost	Assumptions
LF LF CY CY SY	0 0 0 0	\$ \$ \$	250.00	¢		
LF LF CY CY SY	0 0 0 0	\$	250.00	2		
LF CY CY SY	0 0 0	\$	175 00	Ψ	-	
CY CY SY	0 0	\$	475.00	\$	- :	
CY SY	0	_	4.00	\$	1 	
SY		\$	5.00	\$	7.0	
	1732	\$	2.50	\$	4,330.00	Seeding around trench, conduit runs, pull box, and foundation areas
				\$	4,330.00	
LE	250	1.8	15 00	S	3 750 00	Γ
FA	1	ŝ	1 500.00	ŝ	1 500.00	
	1	-	1,000.00	ŝ	5 250 00	i
			I	Ψ	5,250.00	J
						10
LF	0	\$	44.00	\$	-	
				\$	-	
		1				
EA	5	\$	394.50	s	1.972.50	One queue, three passage and one clearance
EA	390	\$	1.50	ŝ	585.00	Assumed setback distance 350'
FA	1	\$	1 800.00	ŝ	1 800.00	Mainline detection
EA	1	\$	6 000.00	ŝ	6 000.00	
EA	6	s	300.00	ŝ	1.800.00	
LF	2550	\$	6.00	\$	15,300.00	All purposes
LF	150	\$	14.00	\$	2,100.00	One ramp crossing, multiple conduits
EA	1	\$	1.500.00	\$	1,500.00	
LF	1200	\$	5.00	\$	6.000.00	
EA	1	\$	14,000.00	\$	14,000.00	
EA	1	\$	5,300.00	\$	5,300.00	
EA	1	\$	450.00	\$	450.00	
EA	0	\$	15,000.00	\$	12	
EA	1	\$	1,000.00	\$	1,000.00	
EA	2	\$	1,000.00	\$	2,000.00	
EA	2	\$	500.00	\$	1,000.00	Ramp meter advance signal
LF	400	\$	2.75	\$	1,100.00	
				\$	61,907.50	[
EA	350	\$	2.00	\$	700.00	Link to MVDS
EA	1	\$	1,000.00	\$	1,000.00	Link to SMFO
EA	1	\$	1,750.00	\$	1,750.00	For splice enclosure
EA	1	\$	1,500.00	\$	1,500.00	In cabinet
LF	500	\$	1.50	\$	750.00	Drop cable to controller cabinet
EA	1	\$	1,700.00	\$	1,700.00	
				\$	7,400.00	
LF	640	\$	0.62	\$	396.80	40 mph design speed. 110' transitions, 100' narrowed lane
	LF LF EA EA	SY 1732 LF 250 EA 1 LF 0 EA 1 EA 5 EA 390 EA 1 EA	SY 1732 \$ LF 250 \$ EA 1 \$ LF 0 \$ EA 5 \$ EA 1 \$ EA 5 \$ EA 5 \$ EA 1 \$ EA 2 \$ EA 1 \$ EA 1 \$ EA 1 \$ EA 1 \$ EA	SY 1732 \$ 2.50 LF 250 \$ 15.00 EA 1 \$ 1,500.00 LF 0 \$ 44.00 EA 5 \$ 394.50 EA 5 \$ 394.50 EA 1 \$ 1,800.00 EA 1 \$ 1,800.00 EA 1 \$ 6,000.00 EA 1 \$ 6,000.00 EA 1 \$ 1,800.00 EA 1 \$ 1,800.00 EA 1 \$ 1,000.00 EA 1 \$ 1,500.00 LF 1200 \$ 5.00 EA 1 \$ 1,500.00 EA 1 \$ 1,000.00 EA 1 \$ 1,000.00 EA 1 \$ 1,000.00 EA 1 \$ 1,000.00	SY 1732 \$ 2.50 \$ LF 250 \$ 15.00 \$ EA 1 \$ 1,500.00 \$ LF 0 \$ 44.00 \$ LF 0 \$ 44.00 \$ EA 5 \$ 394.50 \$ EA 5 \$ 394.50 \$ EA 1 \$ 1,800.00 \$ EA 1 \$ 1,000.00 \$	SY 1732 \$ 2.50 \$ 4,330.00 \$ 4,330.00 \$ 4,330.00 LF 250 \$ 15.00 \$ 3,750.00 EA 1 \$ 1,500.00 \$ 3,750.00 EA 1 \$ 1,500.00 \$ 1,500.00 LF 0 \$ 44.00 \$ - EA 5 \$ 394.50 \$ 1,972.50 EA 390 \$ 1.50 \$ 585.00 EA 1 \$ 6,000.00 \$ 6,000.00 EA 1 \$ 6,000.00 \$ 6,000.00 EA 1 \$ 1,800.00 \$ 1,800.00 LF

Log No.: Location:	028 I-40 Eastbound Exit 285	Ramp		Avia	ation Park	way	Northboun	d to Eastbound
Categories	Description	Unit	Quantity	U	nit Cost	Т	otal Cost	Assumptions
Raised Pa	vement Markers	EA	0	\$	4.50	\$		
White Edg	je Line	LF	320	\$	0.95	\$	304.00	110' transitions, 100' narrowed lane
Yellow Ed	ge Line	LF	320	\$	0.95	\$	304.00	110' transitions, 100' narrowed lane
24" Stop E	Bar	LF	12	\$	7.00	\$	84.00	
Subtotal						\$	1,088.80	
Signing								
W3-8, Rai	mp Metered When Flashing	EA	2	\$	650.00	\$	1,300.00	Sign and post only
W3-4, Be	Prepared to Stop	EA	1	\$	650.00	\$	650.00	Sign and post
R10-6, Sto	op Here on Red	EA	1	\$	175.00	\$	175.00	Pedestal mounted
R10-28, X	X Vehicles Per Green	EA	1	\$	175.00	\$	175.00	Pedestal mounted
Subtotal						\$	2,300.00	
Subtotal Con	nstruction					\$	83,000.00	
Traffic Co	ntrol				3%	\$	3,000.00	1
Continger	icies				10%	\$	9,000.00	1
Total Const	ruction					\$	95,000.00]
Desian				1	8%	s	8 000 00	1
Construction	Administration			1	10%	\$	10,000.00	1
Total Design	n and Construction					\$	113,000.00	1

Log No.: 030 Location: I-40 Eastbound Exit 287 Ramp: Harrison Avenue

Two Lane Ramp Widening (Y/N): Length of Two Lane Ramp Widening (ft.): Distance from Stopbar to W3-8 sign (ft.):

Pipe Crossings (Y/N): Retaining Walls (Y/N): Fill (Y/N): Guardrail Other than for Ramp Meter Equipment (Y/N):

850	
N	
N	
N	

Ν

950

Ν

0

Nearest Power Source (ft.):

Notes

Nearest Power source is signal cabinet.

Extensive guardrail on right side for ramp meter. Install equipment on left side only, protect with guardrail.

Log No.: 030	F	Ramp:	Ha	rrison Aver	nue		
.ocation: I-40 Eastbound Exit 287							
Categories Descri	ntion Unit	Quantity	Τu	Init Cost	-	fotal Cost	Assumptions
Earthwork and Structures		quantity	1 -			otal oost	Assumptions
Retaining Wall 5' High	LF	0	\$	250.00	\$	2	
Retaining Wall 10' High	LF	0	\$	475.00	S	-	
Excavation	CY	0	\$	4.00	S	-	
Fill	CY	0	\$	5.00	\$	-	
			Ť			5401	Seeding around trench, conduit runs,
Seeding	SY	1566	\$	2.50	\$	3,915.00	pull box, and foundation areas
Subtotal					\$	3,915.00	
Guardrail							
Guardrail Rail	LIET	250	1.5	15.00	\$	3 750 00	1
Guardrail Approach End Tr	eatment FA	1	S	1 500 00	S	1,500,00	
Subtotal	eatment		U.	1,000.00	ŝ	5 250 00	
Subtotal				,	Ψ	5,250.00	
Drainage	1		1.0	44.00	0		1
Pipe		0	\$	44.00	\$	-	
Subtotal					\$	-	
<u>Signalization</u>							
							One queue, three passage and one
6'x6' loops	EA	5	\$	394.50	\$	1,972.50	clearance
Detector Lead-in Cable	EA	390	\$	1.50	\$	585.00	Assumed setback distance 350'
MVDS detector	EA	1	\$	1,800.00	\$	1,800.00	Mainline detection
Detector pole	EA	1	\$	6,000.00	\$	6,000.00	
Pullbox (Std.)	EA	6	\$	300.00	\$	1,800.00	
Conduit (Trenched)	LF	2300	\$	6.00	\$	13,800.00	All purposes
Conduit (Directional Drilled) LF	50	\$	14.00	\$	700.00	One ramp crossing, multiple conduits
Electrical Service	EA	1	\$	1,500.00	\$	1,500.00	
Electrical Conductors	LF	950	\$	5.00	\$	4,750.00	
2070 Controller and Cabine	et EA	1	\$	14,000.00	\$	14,000.00	
Firmware/Calibration	EA	1	\$	5,300.00	\$	5,300.00	
Cabinet Foundation	EA	1	\$	450.00	\$	450.00	
45' Mast Arm Poles and Fo	undation EA	0	\$	15,000.00	\$	12	
Pedestal Pole	EA	1	\$	1,000.00	\$	1,000.00	
Three Section Signal Head	EA	2	\$	1,000.00	\$	2,000.00	
One Section Signal Head	EA	2	\$	500.00	\$	1,000.00	Ramp meter advance signal
Signal Cable	LF	400	\$	2.75	\$	1,100.00	
Subtotal					\$	57,757.50	1
							2
Communications							
Serial Communications	EA	350	\$	2.00	\$	700.00	Link to MVDS
Splice Enclosure	EA	1	\$	1.000.00	\$	1.000.00	Link to SMFO
Pullbox (Special Size)	EA	1	\$	1,750.00	\$	1,750.00	For splice enclosure
Interconnect Center	EA	1	S	1,500.00	\$	1,500.00	In cabinet
Fiber-optic Drop Cable (six	strands) LF	500	S	1.50	\$	750.00	Drop cable to controller cabinet
Ethernet Switch	EA	1	\$	1,700.00	\$	1,700.00	
Subtotal	1 1		+		IS	7,400.00	
					Ľ	.,	1
Development							
			<u> </u>		_		40 mmh design an e-d 4401 hans 10
Devenue at Marking D		0.40		0.00		000.00	40 mph design speed. 110' transitions,
Pavement Marking Remova	ai LF	640	\$	0.62	\$	396.80	100 narrowed lane

Log No.: 030		Ramp:		Harrison Avenue					
Location:	I-40 Eastbound Exit 287								
Categories	Description	Unit	Quantity	U	nit Cost	1	Total Cost	Assumptions	
Raised Pavement Markers		EA	0	\$	4.50	\$	-		
White Edge Line		LF	320	\$	0.95	\$	304.00	110' transitions, 100' narrowed lane	
Yellow Edge Line		LF	320	\$	0.95	\$	304.00	110' transitions, 100' narrowed lane	
24" Stop Bar		LF	12	\$	7.00	\$	84.00		
Subtotal						\$	1,088.80		
Signing									
W3-8, Ramp Metered When Flashing		EA	2	\$	650.00	\$	1,300.00	Sign and post only	
W3-4, Be Prepared to Stop		EA	1	\$	650.00	\$	650.00	Sign and post	
R10-6, Stop Here on Red		EA	1	\$	175.00	\$	175.00	Pedestal mounted	
R10-28, XX Vehicles Per Green		EA	1	\$	175.00	\$	175.00	Pedestal mounted	
Subtotal						\$	2,300.00		
Subtotal Construction						\$	78,000.00		
Traffic Control				3%	\$	3,000.00			
Contingencies				10%	\$	8,000.00	1		
Total Construction			Î		\$	89,000.00			
Design				8%	\$	8,000.00			
Construction Administration				10%	\$	9,000.00			
Total Design and Construction					\$	106,000.00			
Log No.: Location:	043 I-40 Westbound Exit 295	Ramp:	Gorman Street						
--	--	----------------	---------------						
Two Lane R Length of Ty Distance fro	amp Widening (Y/N): wo Lane Ramp Widening (ft.): m Stopbar to W3-8 sign (ft.):	N 0 1150							
Pipe Crossi	ngs (Y/N):	N							

Retaining Walls (Y/N): Fill (Y/N): Guardrail Other than for Ramp Meter Equipment (Y/N):

1150	
N	
N	
N	
N	

Nearest Power Source (ft.):

1300

Notes Nearest power source is signal cabinet. Guardrail full length of ramp side of ramp. Concrete pavement may need rrehab for detectors. Install equipment on right side only, protect with guardrail

Log No.: 04 Location: 1-4	13 10 Westbound Exit 295	Ramp	:	Go	rman Stree	et		
Categories	Description	Unit	Quantity	U	Init Cost	Т	otal Cost	Assumptions
Earthwork and S	Structures							r
Retaining Wa	ll 5' High	LF	0	\$	250.00	\$	9	
Retaining Wa	ll 10' High	LF	0	\$	475.00	\$	-	
Excavation		CY	0	\$	4.00	\$	1 0	
Fill		CY	0	\$	5.00	\$	5	
Seeding		SY	1799	S	2 50	s	4 497 50	Seeding around trench, conduit runs,
Subtotal			1100	<u> </u>	2.00	\$	4,497.50	
								4
Guardrail			and Grand					
Guardrail Rail		LF	250	\$	15.00	\$	3,750.00	
Guardrail App	proach End Treatment	EA	1	\$	1,500.00	\$	1,500.00	
Subtotal						\$	5,250.00	
Drainage								
Pine		TIFT	0	1 \$	44.00	8		
Subtotal			0	Ψ	44.00	¢		
Subtotal						Ľ		
Signalization								r
6'v6' loops			5	c	304 50	¢	1 072 50	One queue, three passage and one
Detector Loop	t in Cable		300	0	394.00	0	1,972.00	Accumed actional distance 250'
MVDS dotoot			390	0	1 900 00	0	1 800.00	Assumed serback distance 550
Detector pala	51		1	9	6,000,00	9	6,000,00	
Detector pole			6	0	300.00	ф Ф	1,800,00	
Conduit (Tren	iched)		2650	9	6.00	9	15,800.00	All purposes
Conduit (Dire	ctional Drilled)		2000	\$	14.00	\$	700.00	One ramp crossing multiple conduits
Electrical Son	vice		1	¢	1 500.00	¢	1 500.00	Che ramp crossing, manple conduits
Electrical Con	iductore		1300	e e	5.00	¢ ¢	6,500,00	
2070 Controll	er and Cabinet	EA	1300	¢	14 000 00	¢ ¢	14,000,00	
Eirmware/Cali	ibration	EA	1	¢ ¢	5 300 00	\$	5 300 00	
Cabinet Found	dation	EA	1	ŝ	450.00	\$	450.00	
45' Mast Arm	Poles and Foundation	FA	0	ŝ	15 000 00	\$	400.00	
Pedestal Pole	a of the stand standard of the	FA	1	15	1 000 00	ŝ	1 000 00	
Three Section	, Signal Head	FA	2	S	1,000,00	S	2 000 00	
One Section S	Signal Head	FA	2	S	500.00	ŝ	1 000 00	Ramp meter advance signal
Signal Cable	Signarrieda	LF	400	\$	2.75	\$	1,100.00	
Subtotal				1 +		\$	61,607.50	1
Communications								9
Sorial Commi	inications		250	0	2.00	¢	700.00	Link to MVDS
Serial Commu			300	0	1 000 00	Ф Ф	1 000.00	Link to MVDS
Dullboy (Spoo	vial Sizo)			0	1,000.00	9	1,000.00	
	Center		1	9	1,750.00	\$	1,700.00	
Fiber ontic Dr	on Cable (six strands)		500	Q Q	1,500.00	9	750.00	Drop cable to controller cabinet
Ethernet Swite	ch	EA	1	S	1,700,00	\$	1,700.00	
Subtotal		1 - 1		<u>ι</u> Ψ		\$	7,400.00	
Pavement Marki	na							
Pavement Ma	rking Removal	LE	640	¢	0.62	¢	396.80	40 mph design speed. 110' transitions, 100' parrowed lane
	in ing normoval		540	1.Ψ	0.02	Ψ	000.00	

Log No.: Location:	043 I-40 Westbound Exit 295	Ramp	•	Gor	man Stree	et		
Categories	Description	Unit	Quantity	U	nit Cost	1	Total Cost	Assumptions
Raised Pa	vement Markers	EA	0	\$	4.50	\$	-	-
White Edg	le Line	LF	320	\$	0.95	\$	304.00	110' transitions, 100' narrowed lane
Yellow Ed	ge Line	LF	320	\$	0.95	\$	304.00	110' transitions, 100' narrowed lane
24" Stop E	Bar	LF	12	\$	7.00	\$	84.00	
Subtotal						\$	1,088.80	
Signing								
W3-8, Rar	np Metered When Flashing	EA	2	\$	650.00	\$	1,300.00	Sign and post only
W3-4, Be	Prepared to Stop	EA	1	\$	650.00	\$	650.00	Sign and post
R10-6, Sto	op Here on Red	EA	1	\$	175.00	\$	175.00	Pedestal mounted
R10-28, X	X Vehicles Per Green	EA	1	\$	175.00	\$	175.00	Pedestal mounted
Subtotal						\$	2,300.00	
Subtotal Cor	nstruction					\$	83,000.00	
Traffic Cor	ntrol				3%	\$	3,000.00	
Contingen	cies				10%	\$	9,000.00	
Total Const	ruction					\$	95,000.00	
Desian				1	8%	\$	8.000.00	1
Construction	Administration				10%	\$	10,000.00	
Total Desigr	and Construction					\$	113,000.00	

Log No.:	056	Ramp:	Jones Sausage
Location:	I-40 Westbound Exit 303		Rd.
Two Lane Ra	mp Widening (Y/N):	N	
Length of Tw	o Lane Ramp Widening (ft.):	0	
Distance fron	n Stopbar to W3-8 sign (ft.):	800	
Pipe Crossing Retaining Wa Fill (Y/N): Guardrail Oth Equipment (Y	gs (Y/N): Ills (Y/N): her than for Ramp Meter //N):	N N N	
Nearest Pow	er Source (ft.):	1300	

Notes	
Nearest power source is from DMS in median.	
Install equipment on right side only, protect with guardrail	

Log No.: 056 Location: I-40 Westbound Exit 303	Ramp	:	Jones Sausage Rd.				
Categories Description	Unit	Quantity	Unit Cost	Total Cost	Assumptions		
Earthwork and Structures							
Retaining Wall 5' High	LF	0	\$ 250.00	\$-			
Retaining Wall 10' High	LF	0	\$ 475.00	\$-			
Excavation	CY	0	\$ 4.00	\$-			
Fill	CY	0	\$ 5.00	\$-			
					Seeding around trench, conduit runs,		
Seeding	SY	1799	\$ 2.50	\$ 4,497.50	pull box, and foundation areas		
Subtotal				\$ 4,497.50			
Quere des il							
	TIET	250	10 15 00	1 9 3 750 00			
Guardrail Approach End Treatment		200	\$ 1500.00	\$ 1,700.00			
		1	↓ 1,000.00	\$ 1,000.00			
Subtotal				\$ 5,250.00			
Design							
Pipe	TIFT	0	T\$ 44.00	1\$.			
Pipe	Lſ	0	44.00				
Subtotal				-			
Signalization			1	1			
		-	0.00450	0 1070 50	One queue, three passage and one		
6'x6' loops	EA	5	\$ 394.50	\$ 1,972.50	clearance		
Detector Lead-In Cable	EA	390	\$ 1.50	\$ 585.00	Assumed setback distance 350		
MVDS detector	EA	1	\$ 1,800.00	\$ 1,800.00	Mainline detection		
Detector pole	EA	1	\$ 6,000.00	\$ 6,000.00			
Pullbox (Std.)	EA	6	\$ 300.00	\$ 1,800.00			
Conduit (Trenched)		2650	\$ 6.00	\$ 15,900.00	All purposes		
					interstate median for power multiple		
Conduit (Directional Drilled)	LF	100	\$ 14.00	\$ 1,400.00	conduits		
Electrical Service	EA	1	\$ 1,500,00	\$ 1,500,00			
Electrical Conductors	LF	1300	\$ 5.00	\$ 6,500,00			
2070 Controller and Cabinet	EA	1	\$ 14,000,00	\$ 14,000,00			
Firmware/Calibration	EA	1	\$ 5,300,00	\$ 5,300.00			
Cabinet Foundation	EA	1	\$ 450.00	\$ 450.00			
45' Mast Arm Poles and Foundation	EA	0	\$ 15,000.00	\$ -			
Pedestal Pole	EA	1	\$ 1,000.00	\$ 1,000.00			
Three Section Signal Head	EA	2	\$ 1,000.00	\$ 2,000.00			
One Section Signal Head	EA	2	\$ 500.00	\$ 1,000.00	Ramp meter advance signal		
Signal Cable	LF	400	\$ 2.75	\$ 1,100.00			
Subtotal				\$ 62,307.50			
Communications							
Serial Communications	EA	350	\$ 2.00	\$ 700.00	Link to MVDS		
Splice Enclosure	EA	1	\$ 1,000.00	\$ 1,000.00	Link to SMFO		
Pullbox (Special Size)	EA	1	\$ 1,750.00	\$ 1,750.00	For splice enclosure		
Interconnect Center	EA	1	\$ 1,500.00	\$ 1,500.00	In cabinet		
Fiber-optic Drop Cable (six strands)	LF	500	\$ 1.50	\$ 750.00	Drop cable to controller cabinet		
Ethernet Switch	EA	1	\$ 1,700.00	\$ 1,700.00			
Subtotal				\$ 7,400.00			
					3		
Pavement Marking							

Log No.:	056	Ramp):	Jor	nes Sausag	ge l	Rd.	
Location:	I-40 Westbound Exit 303							
Categories	Description	Unit	Quantity	U	nit Cost	.	Total Cost	Assumptions
								40 mph design speed. 110' transitions,
Pavement	Marking Removal	LF	640	\$	0.62	\$	396.80	100' narrowed lane
Raised Pa	avement Markers	EA	0	\$	4.50	\$		- -
White Edg	je Line	LF	320	\$	0.95	\$	304.00	110' transitions, 100' narrowed lane
Yellow Ed	ge Line	LF	320	\$	0.95	\$	304.00	110' transitions, 100' narrowed lane
24" Stop E	Bar	LF	12	\$	7.00	\$	84.00	
Subtotal						\$	1,088.80	
<u>Signing</u> W3-8, Rai	mp Metered When Flashing	EA	2	\$	650.00	\$	1,300.00	Sign and post only
W3-0, Rai	Propared to Stop	EA	1	0	650.00	D D	1,300.00	Sign and post only
R10-6 St	an Here on Red	EA	1	5	175.00	ŝ	175.00	Pedestal mounted
R10-28 X	X Vehicles Per Green	EA	1	S	175.00	ŝ	175.00	Pedestal mounted
Subtotal			100			5	2.300.00	
Subtotal Co	nstruction					\$	83,000.00	1
Traffic Co	ntrol				3%	\$	3,000.00	
Continger	icies			i di	10%	\$	9,000.00	1
Total Const	ruction					\$	95,000.00	
						_		-
Design					8%	\$	8,000.00	4
Construction	Administration				10%	\$	10,000.00	
Total Desig	n and Construction					\$	113,000.00]

Log No.: Location:	089 I-440 Northbound Exit 1C	Ramp:	Jones Franklin Road
Two Lane Ra Length of Tw Distance fron	amp Widening (Y/N): o Lane Ramp Widening (ft.): n Stopbar to W3-8 sign (ft.):	N 0 800	
Pipe Crossin Retaining Wa Fill (Y/N): Guardrail Oth Equipment (Y	gs (Y/N): alls (Y/N): ner than for Ramp Meter (/N):	N N N	
Nearest Pow	er Source (ft.):	1150	

Notes	
Nearest power source is from DMS in median.	
Guardrail full length of right side or ramp.	
Install equipment on left side only, protect with guardrail.	

Log No.: 089 Location: I-440 Northbound Exit 1C	Ramp	:	Jon	es Frankli	n R	oad	
Categories Description	Unit	Quantity	U	nit Cost	Т	otal Cost	Assumptions
Earthwork and Structures							r
Retaining Wall 5' High	LF	0	\$	250.00	\$		
Retaining Wall 10' High	LF	0	\$	475.00	\$		
Excavation	CY	0	\$	4.00	\$		
Fill	CY	0	\$	5.00	\$		
Seeding	SY	1699	s	2.50	s	4.247.50	Seeding around trench, conduit runs, pull box, and foundation areas
Subtotal					\$	4,247.50	
Querdreil				-	2		-
Guardrail Pail	LET	250	10	15.00	¢	3 750 00	
Guardrail Approach End Treatment		200	¢ ¢	1 500 00	0 Q	1,500,00	
Guardrali Approach End Treatment	LA	1	Ψ	1,000.00	Ŷ	T,000.00	
Subtotal					Þ	5,250.00	1
<u>Prainage</u> Pipe	LF	0	\$	44.00	\$	-	
Subtotal			130		\$	-	
						5.60	1
Signalization							
Signalization							One queue three passage and one
6'x6' loops	FA	5	S	394 50	s	1 972 50	clearance
Detector Lead-in Cable	FA	390	S	1.50	S	585.00	Assumed setback distance 350'
MVDS detector	FA	1	ŝ	1 800 00	S	1 800 00	Mainline detection
Detector pole	FA	1	S	6 000 00	S	6,000,00	
Pullbox (Std.)	FA	6	S	300.00	S	1 800 00	
Conduit (Trenched)	LE	2500	S	6.00	S	15,000,00	All purposes
Condair (Honoriod)		2000		0.00	Ţ.	10,000.00	One ramp crossing, power from
	1.2	150		44.00		0 400 00	cabinet across intersection, multiple
Conduit (Directional Drilled)		150	\$	14.00	\$	2,100.00	conduits
Electrical Service	EA	1	\$	1,500.00	\$	1,500.00	
Electrical Conductors	LF	1150	\$	5.00	\$	5,750.00	
2070 Controller and Cabinet	EA	1	\$1	4,000.00	\$	14,000.00	
Firmware/Calibration	EA	1	\$	5,300.00	\$	5,300.00	
Cabinet Foundation	EA	1	\$	450.00	\$	450.00	
45' Mast Arm Poles and Foundation	EA	0	\$1	5,000.00	\$	-	
Pedestal Pole	EA	1	\$	1,000.00	\$	1,000.00	
Three Section Signal Head	EA	2	\$	1,000.00	\$	2,000.00	D
One Section Signal Head	EA	2	\$	500.00	\$	1,000.00	Ramp meter advance signal
Signal Cable		400	\$	2.75	\$	1,100.00	
Subtotal					\$	61,357.50	
Communications							
Serial Communications	EA	350	\$	2.00	\$	700.00	Link to MVDS
Splice Enclosure	EA	1	\$	1,000.00	\$	1,000.00	Link to SMFO
Pullbox (Special Size)	EA	1	\$	1,750.00	\$	1,750.00	For splice enclosure
Interconnect Center	EA	1	\$	1,500.00	\$	1,500.00	In cabinet
Fiber-optic Drop Cable (six strands)	LF	500	\$	1.50	\$	750.00	Drop cable to controller cabinet
Ethernet Switch	EA	1	\$	1,700.00	\$	1,700.00	
Subtotal					\$	7,400.00	
				,	_		4
Pavement Marking							

Log No.:	089	Ramp):	Jor	nes Frankli	n R	Road	
Location:	I-440 Northbound Exit 1C							
Categories	Description	Unit	Quantity	U	nit Cost	· ·	Total Cost	Assumptions
								40 mph design speed. 110' transitions,
Pavement	t Marking Removal	LF	640	\$	0.62	\$	396.80	100' narrowed lane
Raised Pa	avement Markers	EA	0	\$	4.50	\$	÷	
White Edg	ge Line	LF	320	\$	0.95	\$	304.00	110' transitions, 100' narrowed lane
Yellow Ed	ge Line	LF	320	\$	0.95	\$	304.00	110' transitions, 100' narrowed lane
24" Stop E	Bar	LF	12	\$	7.00	\$	84.00	
Subtotal						\$	1,088.80	
<u>Signing</u> W3-8, Rai	mp Metered When Flashing	EA	2	\$	650.00	\$	1,300.00	Sign and post only
W3-4 Be	Prepared to Stop	EA	1	ŝ	650.00	ŝ	650.00	Sign and post
R10-6, Sto	op Here on Red	EA	1	\$	175.00	\$	175.00	Pedestal mounted
R10-28, X	X Vehicles Per Green	EA	1	\$	175.00	\$	175.00	Pedestal mounted
Subtotal						\$	2,300.00	
Subtotal Co	nstruction					\$	82,000.00	1
Traffic Co	ntrol				3%	\$	3,000.00	
Continger	ncies				10%	\$	9,000.00]
Total Const	ruction					\$	94,000.00]
Design					8%	\$	8,000.00]
Construction Administration				10%	\$	10,000.00		
Total Design	n and Construction					\$	112,000.00]

Log No.:	090	Ramp:	Jones Frankliln
Location:	I-40 Southbound Exit 1C		Road
Two Lane Ra	mp Widening (Y/N):	N	
Length of Tw	o Lane Ramp Widening (ft.):	0	
Distance fron	n Stopbar to W3-8 sign (ft.):	250	
Pipe Crossing Retaining Wa Fill (Y/N): Guardrail Oth Equipment (Y	gs (Y/N): Ills (Y/N): ner than for Ramp Meter ′/N):	N N N	
Nearest Powe	er Source (ft.):	550	

Notes	
Nearest power source is from signal cabinet	
Curb and gutter on right side of ramp.	
Install equipment on right side only, protect with guardrail	

Log No.: 09	30 40 Southbourd Exit 1C	Ramp:	:	Jones Frankliln Road				
								
Categories	Description	Unit	Quantity	U	nit Cost		otal Cost	Assumptions
Earthwork and E	Structures		1 0	¢	250.00	¢		1
Retaining wa	II 5' High			3	475.00	3		
Retaining wa	III 10' High		0	5	4/5.00	5		
Excavation		CY	0	5	4.00	5	-	
Fill		CY	0	\$	5.00	\$	5	
Sooding		SY	1299	S	2 50	S	3 247 50	Seeding around trench, conduit runs,
Security			1200	÷	2.00	IS	3 247.50	
Subtotal					P	Ľ	V j 4	1
Guardrail								
Guardrail Rai	if	T I F	250	15	15 00	S	3 750 00	1
Guardrail Apr	proach End Treatment	EA	1	S	1,500.00	ŝ	1 500.00	<u>+</u>
Subtotal			<u>ــــنــــل</u>		1,000.00	is	5 250.00	<u> </u>
Subtotal					J	Ľ	0,200.00	1
Draipaga								1
Dine		LE	0	S	44 00	\$		+
Pipe				Ψ	47.00	is		.
Subiotai					ľ	Ľ	802	1
Ointerligetion								
Signalization			1	T		<u>г</u>		Loss supus three passage and one
elvel loone			5	G	204 50	le.	1 072 50	One queue, three passage and one
Detector Lea	d in Ophia		200	9	1 50	0	595.00	Clearance
Detector Leave	d-In Cable		390	¢ ¢	1.00	9	4 900 00	Assumed setback distance 550
Detector pole	or			Q Q	1,800.00	B	1,600.00	Mainline detection
Detector pole	<u>2</u>		6	0	200.00	0	4 900 00	<u> </u>
Conduit (Tree	/		1000	9	6.00	0	1,000.00	
Conduit (Dire	Ichea)		100	8	14.00	0	1 400.00	All purposes
			100	4 C	4 500.00	e e	1,400.00	Two ramp crossing, muit, conduite
Electrical Co	VICe		550	¢	1,500.00	0	0.750.00	
Electrical Control	Iductors		550	0	0.00	9	44,000,00	
20/0 Control	er and Cabinet			D D	5 200 00	D	5 200 00	
Firmware/Car	Ibration			0 C	5,300.00	3	5,300.00	
Cabinet Four	idation			¢	450.00	3	400.00	<u>_</u>
45' Mast Am	Poles and Foundation	EA		9	15,000.00	3	4 000 00	
Pedestal Pole	3			Ð	1,000.00	0	1,000.00	
Three Section	n Signal Head	EA	2	\$	1,000.00	\$	2,000.00	
One Section :	Signal Head		2	D C	0.00	0	1,000.00	Ramp meter advance signal
Signal Cable			400	\$	2.75	5	1,100.00	<u> </u>
Subtotal					ŗ	\$	54,057.50	
						_		-
Communications	<u>s</u>							
Serial Comm	unications	EA	350	\$	2.00	\$	700.00	Link to MVDS
Splice Enclos	sure	EA	1	\$	1,000.00	\$	1,000.00	Link to SMFO
Pullbox (Spec	cial Size)	EA	1	\$	1,750.00	\$	1,750.00	For splice enclosure
Interconnect	Center	EA	1	\$	1,500.00	\$	1,500.00	In cabinet
Fiber-optic Dr	rop Cable (six strands)	LF	500	\$	1.50	\$	750.00	Drop cable to controller cabinet
Ethernet Swit	<i>i</i> ch	EA	1	\$	1,700.00	\$	1,700.00	
Subtotal					y	\$	7,400.00	
					1.7			3
Pavement Mark	ing							

Log No.: Location:	090 I-40 Southbound Exit 1C	Ramp:		Jon	es Frankli	In R	load	
Categories	Description	Unit	Quantity	U	nit Cost		Total Cost	Assumptions
	•							30 mph design speed, 60' transitions.
Pavement	Marking Removal	LF	440	\$	0.62	\$	272.80	100' narrowed lane
White Edg	ie Line	LF	220	\$	0.95	\$	209.00	60' transitions, 100' narrowed lane
Yellow Ed	ge Line	LF	220	\$	0.95	\$	209.00	60' transitions, 100' narrowed lane
24" Stop E	Bar	LF	12	\$	7.00	\$	84.00	
Subtotal						\$	774.80	
Signing		1						I
W3-8, Rar	mp Metered When Flashing	EA	2	\$	650.00	\$	1,300.00	Sign and post only
W3-4, Be	Prepared to Stop	EA	1	\$	650.00	\$	650.00	Sign and post
R10-6, Sto	op Here on Red	EA	1	\$	175.00	\$	175.00	Pedestal mounted
R10-28, X	X Vehicles Per Green	EA	1	\$	175.00	\$	175.00	Pedestal mounted
Subtotal						\$	2,300.00	
Subtotal Con	struction					\$	74,000.00	
Traffic Co	ntrol				3%	\$	3,000.00	
Contingen	cies				10%	\$	8,000.00	
Total Const	ruction					\$	85,000.00]
Design					8%	\$	7 000 00	1
Construction	Administration				10%	\$	9,000.00	1
Total Desigr	and Construction					\$	101,000.00	1

 Log No.:
 095
 Ramp:
 US 1 Eastbound to Southbound

 Location:
 I-440 Southbound Exit 2
 N
 to Southbound

 Two Lane Ramp Widening (Y/N):
 N
 0
 0

Pipe Crossings (Y/N): Retaining Walls (Y/N): Fill (Y/N): Guardrail Other than for Ramp Meter Equipment (Y/N):

Distance from Stopbar to W3-8 sign (ft.):

Γ	800	
Γ	Ν	
Γ	Ν	
Г	N	

Ν

Nearest Power Source (ft.):

1350

Notes	
Nearest power source is from signal cabinet at Blue Rid Western Blvd.	ge Rd &
Lengthy section of guardrail along right side of ramp in v meter. steep slopes behind guardrail.	icinity of ramp
Install equipment on left side only, protect with guardrail	Č

Cotomorios Description	Hait	Quantity	1 11	nit Cost		atal Coat	Accumutions
Categories Description	Tour	Quantity	10	nit Cost		otal Cost	Assumptions
Retaining Wall 5' High	LE	0	2	250.00	¢	0	Î.
Retaining Wall 10' High	LF	0	\$	475.00	÷ S		
Excavation	CY	0	S	4.00	ŝ	-	
Fill	CY	0	ŝ	5.00	9		
1.00		0	+	0.00	Ψ	17.0	Seeding around trench, conduit runs
Seeding	SY	1832	S	2.50	S	4,580.00	pull box, and foundation areas
Subtotal			1 +		\$	4,580.00	
				ļ	- T	.,	J
Quardrail							
Guardrail Rail	LE	250	8	15.00	\$	3 750 00	1
Guardrail Approach End Treatment	FA	1	ŝ	1 500 00	S	1,500,00	
			Ŷ	1,000.00	¢.	5 250 00	
ubtotal				ļ	Ψ	5,250.00	
See 1							
Drainage	TIET		10	44.00	¢		1
Pipe	LF	0	Þ	44.00	Ð	-	
Jubtotal					2		
lignalization							
							One queue, three passage and one
6'x6' loops	EA	5	\$	394.50	\$	1,972.50	clearance
Detector Lead-in Cable	EA	390	\$	1.50	\$	585.00	Assumed setback distance 350'
MVDS detector	EA	1	\$	1,800.00	\$	1,800.00	Mainline detection
Detector pole	EA	1	\$	6,000.00	\$	6,000.00	
Pullbox (Std.)	EA	6	\$	300.00	\$	1,800.00	
Conduit (Trenched)	LF	2700	\$	6.00	\$	16,200.00	All purposes
							One ramp crossing, power from
		050		44.00	•	0 500 00	cabinet across intersection, multiple
Conduit (Directional Drilled)		250	\$	14.00	\$	3,500.00	conduits
Electrical Service	EA	1	\$	1,500.00	\$	1,500.00	
Electrical Conductors	LF	1350	\$	5.00	\$	6,750.00	
2070 Controller and Cabinet	EA	1	\$1	14,000.00	\$	14,000.00	
Firmware/Calibration	EA	1	\$	5,300.00	\$	5,300.00	
Cabinet Foundation	EA	1	\$	450.00	\$	450.00	
45' Mast Arm Poles and Foundation	EA	0	\$	15,000.00	\$	-	
Pedestal Pole	EA	1	\$	1,000.00	9	1,000.00	
I hree Section Signal Head	EA	2	3	1,000.00	9 €	2,000.00	Denne meter educates signal
Che Section Signal Head		2	\$	2.75	Ф Ф	1,000.00	Ramp meter advance signal
Signal Cable	LF	400	Þ	2.75	Ð	1,100.00	
Subtotal					\$	64,957.50	
1 1911 2225							
Communications		10101101					E. MARTINE MARTINE
Serial Communications	EA	350	\$	2.00	\$	700.00	Link to MVDS
Splice Enclosure	EA	1	\$	1,000.00	\$	1,000.00	LINK TO SMFO
Pullbox (Special Size)	EA	1	\$	1,750.00	\$	1,750.00	For splice enclosure
Interconnect Center	EA	1	\$	1,500.00	\$	1,500.00	In cabinet
Fiber-optic Drop Cable (six strands)	LF	500	\$	1.50	\$	750.00	Drop cable to controller cabinet
Ethernet Switch	EA	1	\$	1,700.00	\$	1,700.00	
ubtoto						7 400 00	

Log No.:	095	Ramp	:	US	1 Eastbou	Ind	to Southbou	und
Location:	I-440 Southbound Exit 2							
Categories	Description	Unit	Quantity	U	nit Cost	-	Total Cost	Assumptions
								40 mph design speed. 110' transitions,
Pavement	Marking Removal	LF	640	\$	0.62	\$	396.80	100' narrowed lane
Raised Pa	evement Markers	EA	0	\$	4.50	\$	¥ :	2
White Edg	je Line	LF	320	\$	0.95	\$	304.00	110' transitions, 100' narrowed lane
Yellow Ed	ge Line	LF	320	\$	0.95	\$	304.00	110' transitions, 100' narrowed lane
24" Stop E	Bar	LF	12	\$	7.00	\$	84.00	
Subtotal						\$	1,088.80	1
0								
Signing		Let			050.00	-		
W3-8, Rai	mp Metered When Flashing	EA	2	\$	650.00	\$	1,300.00	Sign and post only
W3-4, Be	Prepared to Stop	EA	1	\$	650.00	\$	650.00	Sign and post
R10-6, Sto	op Here on Red	EA	1	\$	175.00	\$	175.00	Pedestal mounted
R10-28, X	X Vehicles Per Green	EA	1	\$	175.00	\$	175.00	Pedestal mounted
Subtotal						\$	2,300.00	
Subtotal Co	nstruction					\$	86,000.00]
Traffic Co	ntrol				3%	\$	3,000.00	1
Continger	icies				10%	\$	9,000.00	1
Total Const	ruction			T		\$	98,000.00	
						_		-
Design					8%	\$	8,000.00	1
Construction	Administration				10%	\$	10,000.00	
Total Design	n and Construction					\$	116,000.00]

102 Log No.: Lake Boone Trail Ramp: Location: I-440 Northbound Exit 5 Two Lane Ramp Widening (Y/N): Ν Length of Two Lane Ramp Widening (ft.): 0 Distance from Stopbar to W3-8 sign (ft.): 650 Pipe Crossings (Y/N): N Retaining Walls (Y/N): N Ν Fill (Y/N): Guardrail Other than for Ramp Meter Ν Equipment (Y/N): Nearest Power Source (ft.): 950

Notes Guardrail full length of right side of ramp. Install equipment on left side only, protect with guardrail.

Nearest power source is from CCTV

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Unit	a					
	Quantity	U	nit Cost	Т	otal Cost	Assumptions
				_		
LF	0	\$	250.00	\$		
LF	0	\$	475.00	\$	34 C	
CY	0	\$	4.00	\$		
CY	0	\$	5.00	\$	50	
SY	1566	S	2 50	S	3 915 00	Seeding around trench, conduit runs,
	1000	<u> </u>	2.00	IS	3,915.00	
			Ľ	Ľ.	0,010.00	1
LF	250	\$	15.00	\$	3,750.00	1
EA	1	\$	1,500.00	\$	1,500.00	
				\$	5.250.00	1
			U	<u> </u>	-,	4
			11.00			
LF	0	\$	44.00	\$	-	
				\$	•	
		Т				One queue, three passage and one
EA	5	\$	394.50	\$	1,972.50	clearance
EA	390	\$	1.50	\$	585.00	Assumed setback distance 350'
EA	1	\$	1.800.00	\$	1.800.00	Mainline detection
EA	1	\$	6.000.00	\$	6.000.00	
EA	6	\$	300.00	\$	1.800.00	1
LF	2300	\$	6.00	\$	13,800.00	All purposes
						One ramp crossing, power from
	100		1100		100.00	cabinet across intersection, multiple
	100	\$	14.00	\$	1,400.00	conduits
EA	1	\$	1,500.00	\$	1,500.00	
LF	950	\$	5.00	\$	4,750.00	
EA	1	\$1	14,000.00	\$	14,000.00	
EA	1	\$	5,300.00	\$	5,300.00	
EA	1	\$	450.00	\$	450.00	
EA	0	\$1	15,000.00	\$	-	
EA	1	\$	1,000.00	\$	1,000.00	
EA	2	\$	1,000.00	\$	2,000.00	
EA	2	\$	500.00	\$	1,000.00	Ramp meter advance signal
LF	400	\$	2.75	\$	1,100.00	
				\$	58,457.50	
			-			-
EA	350	\$	2.00	\$	700.00	Link to MVDS
EA	1	\$	1,000.00	\$	1,000.00	Link to SMFO
EA	1	\$	1,750.00	\$	1,750.00	For splice enclosure
EA	1	\$	1,500.00	\$	1,500.00	In cabinet
LF	500	\$	1.50	\$	750.00	Drop cable to controller cabinet
EA	1	\$	1,700.00	\$	1,700.00	
	/		· · · · · · · · · · · · · · · · · · ·	C.A.		û
				1 3	7,400.00	
	LF LF CY SY SY LF EA EA	LF 0 LF 0 CY 0 CY 0 SY 1566 LF 250 EA 1 LF 0 LF 250 EA 1 LF 0 LF 2300 EA 1 EA	LF 0 \$ LF 0 \$ CY 0 \$ CY 0 \$ SY 1566 \$ LF 250 \$ EA 1 \$ LF 0 \$ EA 1 \$ EA 1 \$ EA 1 \$ EA 1 \$ EA 5 \$ EA 1 \$ EA	LF 0 \$ 250.00 LF 0 \$ 475.00 CY 0 \$ 4.00 CY 0 \$ 5.00 SY 1566 \$ 2.50 SY 1566 \$ 2.50 LF 250 \$ 15.00 EA 1 \$ 1,500.00 EA 1 \$ 1,800.00 EA 1 \$ 1,000.00 EA 1 \$ 1,000.00 <	LF 0 \$ 250.00 \$ LF 0 \$ 475.00 \$ CY 0 \$ 4.00 \$ CY 0 \$ 5.00 \$ SY 1566 \$ 2.50 \$ EA 1 \$ 1,500.00 \$ EA 1 \$ 1,800.00 \$ EA 1 \$ 1,800.00 \$ EA 1 \$ 6,000.00 \$ EA 1 \$ 1,800.00 \$ EA 1 \$	Lr 0 \$ 250.00 \$ - LF 0 \$ 475.00 \$ - CY 0 \$ 5.00 \$ - CY 0 \$ 5.00 \$ - SY 1566 \$ 2.50 \$ 3,915.00 \$ SY 1566 \$ 2.50 \$ 3,915.00 \$ LF 250 \$ 15.00 \$ 3,750.00 \$ EA 1 \$ 1,500.00 \$ 1,500.00 EA 1 \$ 1,500.00 \$ 1,500.00 EA 1 \$ 1,500.00 \$ 1,500.00 EA 1 \$ 1,500.00 \$ 1,800.00 EA 1 \$ 1,800.00 \$ 1,800.00 EA 1 \$ 1,800.00 \$ 1,800.00 EA 1 \$ 1,800.00 \$ 1,800.00 EA 1 \$ 1,800.00 \$ 1,800.00 EA 1 \$ 1,800.00 \$ 1,800.00 EA 1 \$ 1,800.00

Log No.:	102	Ramp):	Lak	ke Boone T	Trai	1	
Location:	I-440 Northbound Exit 5							
Categories	Description	Unit	Quantity	U	nit Cost	· ·	Total Cost	Assumptions
			G. 167					40 mph design speed. 110' transitions,
Pavement	Marking Removal	LF	640	\$	0.62	\$	396.80	100' narrowed lane
Raised Pa	vement Markers	EA	0	\$	4.50	\$	¥.:	
White Edg	je Line	LF	320	\$	0.95	\$	304.00	110' transitions, 100' narrowed lane
Yellow Ed	ge Line	LF	320	\$	0.95	\$	304.00	110' transitions, 100' narrowed lane
24" Stop E	Bar	LF	12	\$	7.00	\$	84.00	
Subtotal						\$	1,088.80	
42785 51.0 52								-
Signing						_		T
W3-8, Rar	mp Metered When Flashing	EA	2	\$	650.00	\$	1,300.00	Sign and post only
W3-4, Be	Prepared to Stop	EA	1	\$	650.00	\$	650.00	Sign and post
R10-6, Sto	op Here on Red	EA	1	\$	175.00	\$	175.00	Pedestal mounted
R10-28, X	X Vehicles Per Green	EA	1	\$	175.00	\$	175.00	Pedestal mounted
Subtotal	224 - 34630					\$	2,300.00	
Subtotal Cor	nstruction					\$	79,000.00	
Traffic Co	ntrol				3%	\$	3,000.00	
Contingencies			10%	\$	8,000.00			
Total Const	ruction					\$	90,000.00]
5- 						_		
Design					8%	\$	8,000.00	
Construction	Administration				10%	\$	9,000.00	1
Total Design	n and Construction					\$	107,000.00	1

Log No.: Location:	108 I-440 Westbound Exit 7	Ramp:	US 70 Southbound to Westbound
Two Lane Ra Length of Two Distance from	mp Widening (Y/N): b Lane Ramp Widening (ft.): n Stopbar to W3-8 sign (ft.):	N 0 550	
Pipe Crossing Retaining Wa Fill (Y/N): Guardrail Oth Equipment (Y	gs (Y/N): Ils (Y/N): er than for Ramp Meter //N):	N N N	
Nearest Powe	er Source (ft.):	650	

Notes
Nearest power source is from CCTV.
Install equipment on left side only, protect with guardrail

<u> </u>	B	11.4	0	1		-		A
Categories	Description	Unit	Quantity		nit Cost	Т	otal Cost	Assumptions
Earthwork and Str	S' Llich		0	C	250.00	¢	ii.	
Retaining Wall			0	9	475.00	Ф Ф	-	
Excavation			0	\$ \$	4/ 5.00	Q Q	-	
EXCAVALION				0	5.00	9	-	
E III			0		0.00	φ		Seeding around trench, conduit runs
Seeding		SY	1366	S	2 50	s	3 415 00	pull box and foundation areas
Subtotal				1.		\$	3,415.00	
					ļ			
Guardrail								
Guardrail Rail		LF	250	\$	15.00	\$	3,750.00	
Guardrail Appro	pach End Treatment	EA	1	\$	1,500.00	\$	1,500.00	
Subtotal						S	5.250.00	
Jubtotal					I	<u> </u>	-,	
Drainage								
Pipe		LF	0	\$	44.00	\$	-	
Subtotal			270		100710 5080	\$	-	
					I		5.40	1
Signalization								
Signalization				T				One queue three passage and one
6'x6' loops		FA	5	S	394 50	s	1 972 50	clearance
Detector Lead-	in Cable	FA	390	S	1.50	S	585.00	Assumed setback distance 350'
MVDS detector		FA	1	S	1 800 00	\$	1 800 00	Mainline detection
Detector pole		FA	1	S	6 000 00	S	6,000,00	
Pullbox (Std.)		FA	6	S	300.00	S	1 800 00	
Conduit (Trenc	hed)	LF	2000	\$	6.00	S	12,000,00	All purposes
		1-1				-		One ramp crossing, power from
		1 1						cabinet across intersection, multiple
Conduit (Direct	ional Drilled)	LF	50	\$	14.00	\$	700.00	conduits
Electrical Servi	ce	EA	1	\$	1,500,00	\$	1,500.00	
Electrical Cond	uctors	LF	650	\$	5.00	\$	3,250.00	
2070 Controller	r and Cabinet	EA	1	\$	14,000.00	\$	14,000.00	
Firmware/Calib	ration	EA	1	\$	5,300.00	\$	5,300.00	
Cabinet Founda	ation	EA	1	\$	450.00	\$	450.00	
45' Mast Arm P	oles and Foundation	EA	0	\$	15,000.00	\$		
Pedestal Pole		EA	1	\$	1,000.00	\$	1,000.00	
Three Section 8	Signal Head	EA	2	\$	1,000.00	\$	2,000.00	
One Section Si	gnal Head	EA	2	\$	500.00	\$	1,000.00	Ramp meter advance signal
Signal Cable		LF	400	\$	2.75	\$	1,100.00	
Subtotal						\$	54,457.50	
Communications								
Serial Commur	nications	EA	350	\$	2.00	\$	700.00	Link to MVDS
Splice Enclosu	re	EA	1	\$	1,000.00	\$	1,000.00	Link to SMFO
Pullbox (Specia	al Size)	EA	1	\$	1,750.00	\$	1,750.00	For splice enclosure
Interconnect Ce	enter	EA	1	\$	1,500.00	\$	1,500.00	In cabinet
Fiber-optic Dro	p Cable (six strands)	LF	500	\$	1.50	\$	750.00	Drop cable to controller cabinet
Ethernet Switch	n	EA	1	\$	1,700.00	\$	1,700.00	
						6		1

Log No.: Location:	108 I-440 Westbound Exit 7	Ramp	mp: US 70 Southbound to Westbound						
Categories	Description	Unit	Quantity	U	nit Cost	Γ.	Total Cost	Assumptions	
	The constant of the second second		G.162					40 mph design speed. 110' transitions,	
Pavement	Marking Removal	LF	640	\$	0.62	\$	396.80	100' narrowed lane	
Raised Pa	vement Markers	EA	0	\$	4.50	\$	-		
White Edg	je Line	LF	320	\$	0.95	\$	304.00	110' transitions, 100' narrowed lane	
Yellow Ed	ge Line	LF	320	\$	0.95	\$	304.00	110' transitions, 100' narrowed lane	
24" Stop E	Bar	LF	12	\$	7.00	\$	84.00		
Subtotal						\$	1,088.80		
<u>Signing</u> W3-8. Rar	mp Metered When Flashing	EAT	2	I S	650.00	\$	1.300.00	Sign and post only	
W3-4 Be	Prepared to Stop	EA	1	s	650.00	\$	650.00	Sign and post	
R10-6, Sto	p Here on Red	EA	1	\$	175.00	\$	175.00	Pedestal mounted	
R10-28, X	X Vehicles Per Green	EA	1	\$	175.00	\$	175.00	Pedestal mounted	
Subtotal						\$	2,300.00		
Subtotal Cor	nstruction					\$	74,000.00]	
Traffic Co	ntrol				3%	\$	3,000.00		
Contingen	cies				10%	\$	8,000.00		
Total Const	ruction					\$	85,000.00		
Design					8%	\$	7,000.00]	
Construction	Administration				10%	\$	9,000.00]	
Total Design and Construction						\$	101,000.00]	

Log No.: Location:	133 I-540 Eastbound Exit 4	Ramp:	US 70
Two Lane Ra Length of Two Distance from	mp Widening (Y/N): o Lane Ramp Widening (ft.): n Stopbar to W3-8 sign (ft.):	Y 0 1000	
Pipe Crossing Retaining Wa Fill (Y/N): Guardrail Oth Equipment (Y	gs (Y/N): Ills (Y/N): ner than for Ramp Meter //N):	N N N	
Nearest Pow	er Source (ft.):	1000	

Notes
Nearest power source is from transformer on Mt Herman Rd.
Dual F2F ramps merge to 1. Extra Sign A needed.
400' additional cable/conduit to reach extra sign upstream.
Guardrail along right side of ramp.
Stream crossing, no extension needed
Install ramp meter equipment on right side only, protect with guardrail.

Typical Design and Construction Costs Two Lane Freeway to Freeway Ramp Meter

Log No.: Location:	133 I-540 Eastbound Exit 4	Ramp:		US	70			
Categories	Description	Unit	Quantity	ι	Jnit Cost	['	Total Cost	Assumptions
Earthwork and	Structures				0.000			
Retaining W	Vall 5' High	LF	0	\$	250.00	\$	2	
Retaining W	Vall 10' High	LF	0	\$	475.00	\$		
Excavation		CY	0	\$	4.00	\$		
Fill		CY	0	\$	5.00	\$		
Seeding		SY	2388	\$	2.50	\$	5,970.00	Seeding along pavement widening and around trench, conduit, pull box, and foundation areas
Subtotal						\$	5,970.00	
<u>Guardrail</u>			National States					
Guardrail R	ail	LF	1250	\$	15.00	\$	18,750.00	
Guardrail A	pproach End Treatment	EA	5	\$	1,500.00	\$	7,500.00	
Subtotal						\$	26,250.00	
Paving					22.00			
Ramp vvide	ning Desurfectors	ST OV	0	2	32.00	3	-	
Pavement P	Resurracing	01	0	Φ	12.00	D T		
Subtotal					1	\$	-	
Drainage								
Pipe		LF	0	\$	44.00	\$	-	
Signalization		11	121	Τ.				One queue, three passage and one
6'x6' loops		EA	10	\$	394.50	\$	3,945.00	clearance
Detector Le	ad-in Cable	EA	390	\$	1.50	\$	585.00	Assumed setback distance 350'
MVDS deter	ctor	EA	1	\$	1,800.00	\$	1,800.00	Mainline detection
Detector po	le	EA	1	\$	6,000.00	\$	6,000.00	
Pullbox (Sto	d.)	EA	10	\$	300.00	\$	3,000.00	
Conduit (Tre	enched)		3510	\$	6.00	\$	21,060.00	All purposes
Conduit (Dir	rectional Drilled)		100	\$	14.00	\$	1,400.00	electrical conduit on Mt. Herman Rd
Electrical Se	ervice	EA	1	\$	1,500.00	\$	1,500.00	
Electrical Co	onductors		1400	\$	5.00	\$	7,000.00	
2070 Contro	oller and Cabinet	EA	1	5	14,000.00	\$	14,000.00	
Firmware/C	allbration	EA	1	2	5,300.00	3	5,300.00	
Cabinet Fol	Pales and Faundation	EA	1	3	400.00	\$	450.00	
40 Mast All				0	1000.00	Ф Ф	15,000.00	
Three Section	on Signal Load			0	1,000.00	0	2 000 00	
One Section			6	0	500.00	9	3,000,00	Ramp meter advance signal
Signal Cabl			1786	6	2 75	÷ ¢	4 911 50	Ramp meter advance signal
Signal Cabl	e	LI	1700	Ψ	2.15	U C	90 951 50	1
Communicatio	ns					Ŷ	30,331.30	1
Serial Com	munications	EA	350	\$	2.00	\$	700.00	Link to MVDS
Splice Enclo	osure	EA	1	\$	1,000.00	\$	1,000.00	Link to SMFO
Pullbox (Sp	ecial Size)	EA	1	\$	1,750.00	\$	1,750.00	For splice enclosure
Interconnec	t Center	EA	1	\$	1,500.00	\$	1,500.00	In cabinet
Fiber-optic [Drop Cable (six strands)	LF	500	\$	1.50	\$	750.00	Drop cable to controller cabinet
Ethernet Sw	vitch	EA	1	\$	1,700.00	\$	1,700.00	
Subtotal	an a					\$	7,400.00	

Typical Design and Construction Costs Two Lane Freeway to Freeway Ramp Meter

Log No.: 133 Location: 1-54	3 40 Eastbound Exit 4	Ramp:		US	70			
Categories	Description	Unit	Quantity	Unit Cost			Total Cost	Assumptions
Pavement Markir	na							
Raised Pavem	ent Markers	EA	0	\$	4.50	\$	12	Along skip line only
White Edge Li	ne	LF	400	\$	0.95	\$	380.00	200' transitions, 100' narrowed lane, 50 MPH
Yellow Edge L	ine	LF	600	\$	0.95	\$	570.00	300' transitions, 100' narrowed lane, 50 MPH
24" Stop Bar		LF	24	\$	7.00	\$	168.00	
White Skip Lin	e	LF	0	\$	0.24	\$		
Subtotal						\$	1,118.00	
Signing					050.00		1.000.00	
VV3-8, Ramp N	letered vvnen Flasning	EA	2	\$	650.00	\$	1,300.00	Sign and post only
VV3-4, Be Prep	bared to Stop	EA	1	5	650.00	\$	650.00	Sign and post
R10-6, Stop H	ere on Rea	EA	1	3	175.00	3	175.00	Pedestal mounted
10-20, AA VE		EA		0	650.00	D D	1 200.00	Pedestal mounted
Sign Structure	(Cantilever)		2	Ф Ф	50,000,00	ф Ф	150,000,00	
Ramn Meter C)n Sign (Message A)	FA	2	\$	5,000,00	\$	10,000.00	
Prepare to Sto	on Sign (Message B)	EA	1	- S	5 000 00	\$	5 000 00	
Subtotal	p olgit (meddago b)	1 - 1				\$	168,600.00	
Subtotal Constru	uction					\$	301,000.00	1
Traffic Control				1	3%	\$	10 000 00	1
Contingencies				+	10%	\$	31,000.00	1
Total Construction				t		\$	342,000.00	1
Desian				Т	8%	\$	28.000.00	1
Construction Adm	ninistration			+	10%	\$	35,000.00	1
Total Design and	d Construction			+		\$	405,000.00	1

Log No.: 135 Location: I-540 Eastbound Exit 7

Ramp:

Ν

0

Leesville Road

Two Lane Ramp Widening (Y/N): Length of Two Lane Ramp Widening (ft.): Distance from Stopbar to W3-8 sign (ft.):

Pipe Crossings (Y/N): Retaining Walls (Y/N): Fill (Y/N): Guardrail Other than for Ramp Meter Equipment (Y/N):

L	950	
Γ	Y	
Γ	N	
Γ	Ν	
Γ	N	

1050

Nearest Power Source (ft.):

Notes Nearest power source is from signal cabinet. Existing guardrail on right side of ramp. Pipe crossing but not in the way. Two lane ramp for then first 450 ft. with 375 ft taper. Install equipment on one side only, protect with guardrail.

Location: 1-5	40 Eastbound Exit 7	Ramp		Lee	Sville Road	a		
Categories	Description	Unit	Quantity	U	Init Cost	[Total Cost	Assumptions
Earthwork and St	ructures					_		
Retaining Wall	i 5' High	LF	0	\$	250.00	\$		
Retaining Wall	i 10' High	LF	0	\$	475.00	\$	¥ :	
Excavation		CY	0	\$	4.00	\$		
Fill		CY	0	\$	5.00	\$		
_			1000		2.50		1000.00	Seeding around trench, conduit runs,
Seeding		ST	1632	2	2.50	15	4,080.00	pull box, and foundation areas
Subtotal					J.	Ľ	4,000.00	1
Quardrail								
Guardrail Rail		LET	250	18	15.00	\$	3 750 00	T
Guardrail App	reach End Treatment	FA	1	S	1 500 00	\$	1 500.00	+
Guaruran Appr	Oach Eng Treatment			U.	1,000.00	Te	E 250.00	1
Subtotal					J,	تل	5,250.00	
Destas as								
Drainage		TIFT	0	1.5	44 00	S		T
Subtotal			0	Ψ	44.00	15		<u> </u>
Subiotai					J	Ľ	C225	1
Oinnelization								
Signalization				T		Γ		Tops quote three passage and one
elvel loope			Б	6	204 50	c	1 072 50	One queue, three passage and one
Detector Lead			200	¢ ¢	1 50	9	595.00	Clearance
			1	9	4 900 00	9	1 200.00	Assumed setDack distance 555
Detector pole	<u>r</u>		1	8	0,000,00	e e	6 000 00	Mainline detection
Detector pore			6	8	300.00	9	1 200 00	<u>_</u>
Conduit (Tren	-bod	+==+	2400		6.00	9	1,000.00	
Conduit (Trend	ineuj	+-+	2400	+	0.00	÷	14,400.00	All purposes
Conduit (Direc	tional Drilled)	IF	100	s	14 00	s	1 400.00	Two ramp crossings multiple conduits
Electrical Serv	tion of the state	FA	1	- s	1 500 00	\$	1 500 00	Two ramp orosonigo, manpie terra
Electrical Con	ductore		1050	15	5.00	1°S	5 250 00	+
2070 Controlle	and Cabinet		1	- s	14,000,00	1 S	14 000 00	+
Sirmware/Cali	hand Capinet	FA	1	- S	5 300 00	\$	5 300 00	1
Cabinet Found	dation	EA	1	5	450.00	4 C	450.00	+
45' Mast Arm	Pales and Foundation	EA	0	ŝ	15 000 00	4 C	400.00	+
Pedestal Pole	"Oles and Foundation	FA	1	\$	1 000 00	÷ S	1 000 00	+
Three Section	Signal Head		2	15	1,000.00	ŝ	2 000 00	+
One Section S	Nanal Head	FA	2	- s	500.00	ŝ	1 000.00	Pamp meter advance signal
Signal Cable			400	1 s	2 75	S	1 100 00	
Subtotal			100	<u> </u>		is	59 557 50	<u>l</u>
Subiotai					ŗ	Ľ	00,001.00	1
Communications								
Sorial Commu	inicatione		350	2	2.00	¢	700.00	Link to MVDS
Selice Enclosi	nications		1	4	1 000 00	4	1 000.00	
Dullbox (Spec	ine Size)		1	- S	1,000.00	8	1 750 00	
Pullbox (Specie	al Sizej		1	8	1,750.00	9 6	1,700.00	For splice enclosure
Fiber optic Dr	enter		500	10	1,500.00	9 6	750.00	In cabinet
Ethorpot Swite	p Cable (six stranus)		1	9	1 700 00	0 S	1 700.00	Drop cable to controller cabinet
Ethernet Owno	<u>n</u>		10	Ψ	1,700.00	I CC	7 400 00	
Subtotal					ļ,	٤	7,400.00	1
Pavement Markir	na							

Log No.: Location:	135 I-540 Eastbound Exit 7	Ramp):	Lee	esville Roa	d		
Categories	Description	Unit	Quantity	U	nit Cost	L .	Total Cost	Assumptions
			- 1 C					40 mph design speed. 110' transitions,
Pavement	Marking Removal	LF	640	\$	0.62	\$	396.80	100' narrowed lane
Raised Pa	vement Markers	EA	0	\$	4.50	\$	-	
White Edg	je Line	LF	320	\$	0.95	\$	304.00	110' transitions, 100' narrowed lane
Yellow Ed	ge Line	LF	320	\$	0.95	\$	304.00	110' transitions, 100' narrowed lane
24" Stop E	Bar	LF	12	\$	7.00	\$	84.00	
Subtotal						\$	1,088.80	
<u>Signing</u> W3-8, Rar	mp Metered When Flashing	EA	2	\$	650.00	\$	1,300.00	Sign and post only
W3-4, Be	Prepared to Stop	EA	1	\$	650.00	\$	650.00	Sign and post
R10-6, Sto	op Here on Red	EA	1	\$	175.00	\$	175.00	Pedestal mounted
R10-28, X	X Vehicles Per Green	EA	1	\$	175.00	\$	175.00	Pedestal mounted
Subtotal						\$	2,300.00	
Subtotal Cor	nstruction					\$	80,000.00]
Traffic Co	ntrol				3%	\$	3,000.00	
Contingen	cies				10%	\$	8,000.00	
Total Const	ruction					\$	91,000.00	
Design					8%	\$	8,000.00	
Construction Administration					10%	\$	10,000.00]
Total Design and Construction						\$	109,000.00	1

Alf Badgett, PE

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