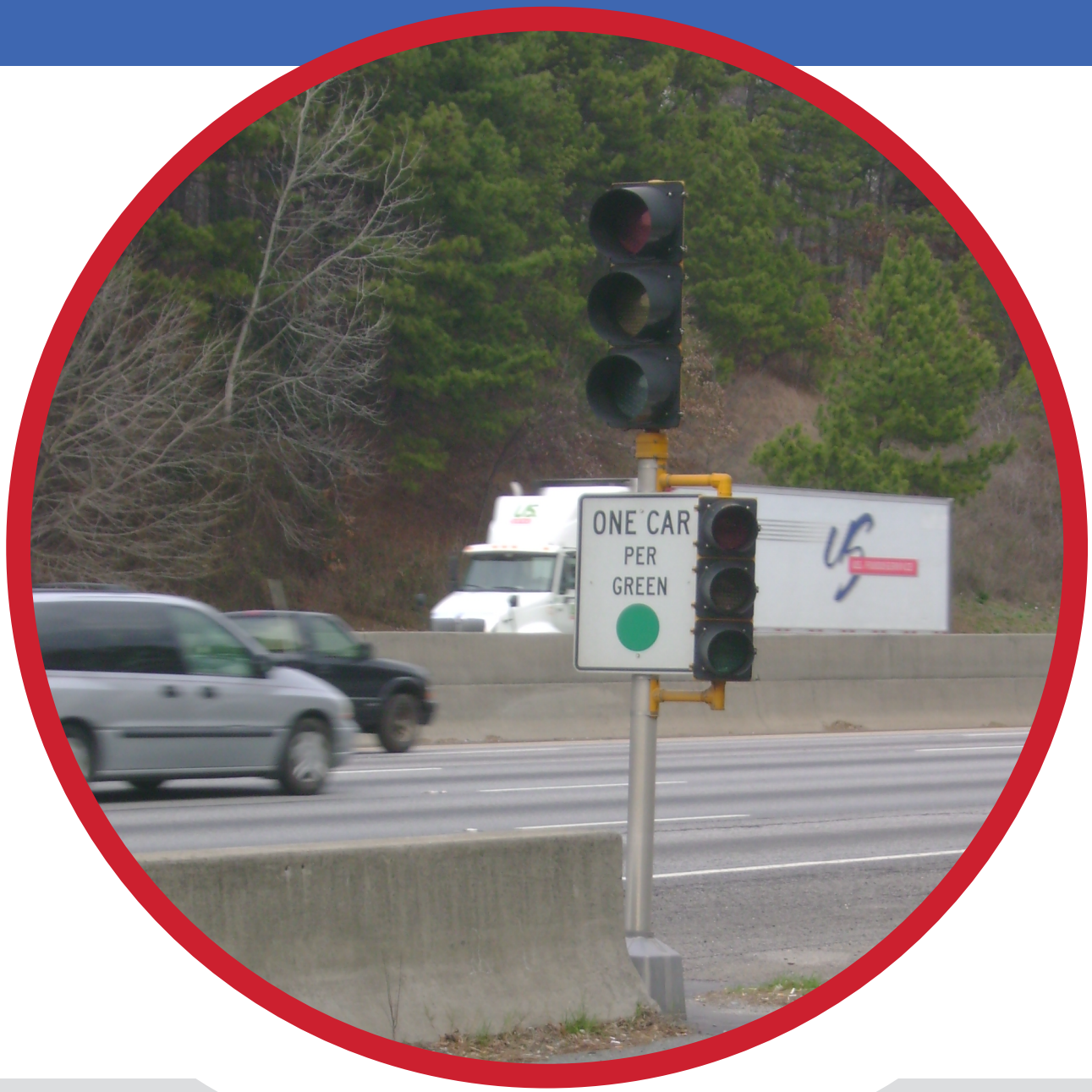
Implementation Plan



M-0468 Ramp Metering Feasibility Study for Cabarrus, Gaston, Iredell and Mecklenburg Counties

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1. Introduction

This report details the work involved in formulating options for the implementation of Ramp Metering within the study area.

The principles used in formulating the options rely on a combination of calculating Benefit to Cost Ratios (BCRs), a First-Year Rate of Return for each site and subsequently determining those sites that are viable based on these BCRs. These 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 used for the potential costs of each site originates from Task 8, *Typical Cost Estimates Report* of this project. That task identified typical ramp metering cost estimates for various layouts, alternative 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. The program costs including procurement and integration of the control software and the controller firmware were also estimated.

The information used for the potential benefits of each site originates from Task 9, *Performance Measures Report* of this project. That task established the expected benefits for each of the 38 sites identified as either ‘feasible for the introduction of ramp metering’ or ‘to be reviewed in future’ as shown in Table 1 below. The potential benefits are quantified as a value of time saved, through the reduction of Vehicle Hours Delay (VHD) annually at each location because of the introduction of ramp metering.

This report contains the following sections:

- Costs;
- Benefits;
- Cost Benefit Analysis for Individual Sites;
- STIP Projects and Freeway-to-Freeway Sites;
- Options for Implementation;
- Summary;
- Recommendations

Table 1. Sites Suitable for Ramp Metering

Log	FROM Cross Street	TO Freeway	Freeway Direction	Exit	County	Ramp Type	Recommendation
32	S Main St	I-85	NB	22	Gaston	Direct	Feasible
34	McAdenville Rd	I-85	NB	23	Gaston	Direct	Feasible
35	Belmont-Mt. Holly Rd	I-85	SB	26	Gaston	Direct	Feasible
93	Westinghouse Blvd	I-77	SB	1A	Mecklenburg	Direct	Feasible
101	Arrowood Rd	I-77	NB	3	Mecklenburg	Direct	Feasible
102	Nations Ford Rd	I-77	SB	4	Mecklenburg	Direct	Feasible
103	Nations Ford Rd	I-77	NB	4	Mecklenburg	Direct	Feasible
105	Tyvola Rd	I-77	NB	5	Mecklenburg	Direct	Feasible
111	Remount Rd	I-77	SB	8	Mecklenburg	Direct	Feasible
129*	I-85 SB	I-77	NB	13	Mecklenburg	F2F	Feasible
140	Gilead Rd	I-77	NB	23	Mecklenburg	Direct	Feasible
143	NC 73 (Sam Furr Rd)	I-77	NB	25	Mecklenburg	Direct	Feasible
145	US 21 (Catawba Ave)	I-77	NB	28	Mecklenburg	Direct	Feasible
146	Goodrum Rd / Griffith St	I-77	SB	30	Mecklenburg	Direct	Feasible
147	Goodrum Rd / Griffith St	I-77	NB	30	Mecklenburg	Direct	Feasible
64	Graham St	I-85	SB	40	Mecklenburg	Loop	Feasible
67	Sugar Creek Rd	I-85	NB	41	Mecklenburg	Direct	Feasible
72	Harris Blvd	I-85	SB	45	Mecklenburg	Direct	Feasible
75	Mallard Creek Rd	I-85	NB	46	Mecklenburg	Direct	Feasible

Log	FROM Cross Street	TO Freeway	Freeway Direction	Exit	County	Ramp Type	Recommendation
177	Steele Creek Rd	I-485	Inner	4	Mecklenburg	Loop	Feasible
179	Steele Creek Rd	I-485	Inner	4	Mecklenburg	Direct	Feasible
181	West Blvd	I-485	Inner	6	Mecklenburg	Direct	Feasible
230	NC 16 (Providence Rd)	I-485	Outer	57	Mecklenburg	Direct	Feasible
231	NC 16 (Providence Rd)	I-485	Inner	57	Mecklenburg	Loop	Feasible
232	NC 16 (Providence Rd)	I-485	Outer	57	Mecklenburg	Loop	Feasible
233	NC 16 (Providence Rd)	I-485	Inner	57	Mecklenburg	Direct	Feasible
234	Rea Rd	I-485	Outer	59	Mecklenburg	Direct	Feasible
236	Rea Rd	I-485	Inner	59	Mecklenburg	Loop	Feasible
237	Rea Rd	I-485	Inner	59	Mecklenburg	Direct	Feasible
239	US 521 (Johnston Rd)	I-485	Outer	61	Mecklenburg	Loop	Feasible
Review in Future							
30	Cox Rd	I-85	NB	21	Gaston	Direct	Review in Future
37	Beatty Dr / Park St	I-85	SB	27	Gaston	Direct	Review in Future
104	Tyvola Rd	I-77	SB	5	Mecklenburg	Direct	Review in Future
175	Arrowood Rd	I-485	Inner	3	Mecklenburg	Direct	Review in Future
182	US 74 / US 29 (Wilkinson Blvd)	I-485	Outer	9	Mecklenburg		Review in Future
229	E John St	I-485	Inner	52	Mecklenburg	Direct	Review in Future
Not Feasible							
97*	I-485	I-77	SB	1B	Mecklenburg	F2F	Not Feasible
250	Briar Creek Rd	US 74	WB	244	Mecklenburg	Direct	Not Feasible

* Freeway-to-Freeway site

2. Costs

There are four types of costs associated with the implementation and operation of a ramp metering site:

- Implementation or construction costs;
- Annual maintenance and operation costs;
- Equipment replacement costs; and
- Program costs.

More information on how the costs were derived can be found in Task 8, *Typical Cost Estimates Report* of this project, Task 8 breaks down each cost into its component parts and describes how they were calculated.

2.1. Implementation Cost

The implementation cost varies depending on the site requirements. The implementation cost includes the cost of design and construction cost. The construction costs would include ramp meter equipment, signing, pavement markings, temporary traffic control, 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 implementation cost for each site is shown in Table 2 below. Details for each site can be found in Appendix A.

Table 2 Implementation Costs for Each Site

Log	FROM Cross Street	TO Freeway	Freeway Direction	Exit	County	Implementation Costs	Recommendation
32	S Main St	I-85	NB	22	Gaston	$139,099	Feasible
34	McAdenville Rd	I-85	NB	23	Gaston	$162,687	Feasible
35	Belmont-Mt. Holly Rd	I-85	SB	26	Gaston	$179,458	Feasible
93	Westinghouse Blvd	I-77	SB	1A	Mecklenburg	$580,195	Feasible
101	Arrowood Rd	I-77	NB	3	Mecklenburg	$211,827	Feasible
102	Nations Ford Rd	I-77	SB	4	Mecklenburg	$154,201	Feasible
103	Nations Ford Rd	I-77	NB	4	Mecklenburg	$185,012	Feasible

Log	FROM Cross Street	TO Freeway	Freeway Direction	Exit	County	Implementation Costs	Recommendation
105	Tyvola Rd	I-77	NB	5	Mecklenburg	$177,930	Feasible
111	Remount Rd	I-77	SB	8	Mecklenburg	$158,370	Feasible
129*	I-85 SB	I-77	NB	13	Mecklenburg	$384,856	Feasible
140	Gilead Rd	I-77	NB	23	Mecklenburg	$227,022	Feasible
143	NC 73 (Sam Furr Rd)	I-77	NB	25	Mecklenburg	$208,050	Feasible
145	US 21 (Catawba Ave)	I-77	NB	28	Mecklenburg	$170,218	Feasible
146	Goodrum Rd / Griffith St	I-77	SB	30	Mecklenburg	$185,759	Feasible
147	Goodrum Rd / Griffith St	I-77	NB	30	Mecklenburg	$209,913	Feasible
64	Graham St	I-85	SB	40	Mecklenburg	$197,895	Feasible
67	Sugar Creek Rd	I-85	NB	41	Mecklenburg	$195,775	Feasible
72	Harris Blvd	I-85	SB	45	Mecklenburg	$190,057	Feasible
75	Mallard Creek Rd	I-85	NB	46	Mecklenburg	$222,762	Feasible
177	Steele Creek Rd	I-485	Inner	4	Mecklenburg	$232,328	Feasible
179	Steele Creek Rd	I-485	Inner	4	Mecklenburg	$211,368	Feasible
181	West Blvd	I-485	Inner	6	Mecklenburg	$210,146	Feasible
230	NC 16 (Providence Rd)	I-485	Outer	57	Mecklenburg	$266,183	Feasible
231	NC 16 (Providence Rd)	I-485	Inner	57	Mecklenburg	$226,669	Feasible
232	NC 16 (Providence Rd)	I-485	Outer	57	Mecklenburg	$161,539	Feasible
233	NC 16 (Providence Rd)	I-485	Inner	57	Mecklenburg	$239,220	Feasible

Log	FROM Cross Street	TO Freeway	Freeway Direction	Exit	County	Implementation Costs	Recommendation
234	Rea Rd	I-485	Outer	59	Mecklenburg	$197,314	Feasible
236	Rea Rd	I-485	Inner	59	Mecklenburg	$198,998	Feasible
237	Rea Rd	I-485	Inner	59	Mecklenburg	$197,779	Feasible
239	US 521 (Johnston Rd)	I-485	Outer	61	Mecklenburg	$196,970	Feasible
Review in Future							
30	Cox Rd	I-85	NB	21	Gaston	$193,847	Review in Future
37	Beatty Dr / Park St	I-85	SB	27	Gaston	$208,700	Review in Future
104	Tyvola Rd	I-77	SB	5	Mecklenburg	$259,180	Review in Future
175	Arrowood Rd	I-485	Inner	3	Mecklenburg	$602,263	Review in Future
182	US 74 / US 29 (Wilkinson Blvd)	I-485	Outer	9	Mecklenburg	$269,255	Review in Future
229	E John St	I-485	Inner	52	Mecklenburg	$203,919	Review in Future
Not Feasible							
97*	I-485	I-77	SB	1B	Mecklenburg	$493,144	Not Feasible
250	Briar Creek Rd	US 74	WB	244	Mecklenburg	$193,344	Not Feasible

* Freeway-to-Freeway site

2.2. Annual Cost

The annual cost for each site includes maintenance, operations, and annual software support and has been calculated as $8,300 per site.

2.3. Equipment Replacement Cost

Typically, certain equipment would be replaced when its useful life has been reached. This equipment would include controllers, servers, communications hardware, system software/firmware, and LED signal heads. Since the replacement period is typically ten years then replacement costs do not need to be considered in this analysis since the analysis covers a ten-year period.

2.4. Program Cost

The program cost is a fixed cost. It includes the procurement and integration of the central control software, software drivers, training, servers, and miscellaneous central communications hardware. This cost is a one-time cost when implementing ramp metering in a metropolitan area for the first time. The cost remains the same and is not related to the number of sites that are implemented. The program cost has been calculated at $622,720. This cost will be prorated to the total site costs for each group of sites considered in the Options for Implementation section.

2.5. Basis of Costs

During this task, costs were updated based on updated bid costs from the *Triangle Ramp Metering Study* however, most costs have been expressed in 2012 prices. Following discussion with the Steering Committee, costs have not been discounted to a base year, or adjusted in anticipation of inflation. The committee wanted to have a baseline costs that is consistent amongst all ramp metering projects statewide for a viable comparison.

3. Benefits

The benefits used in this study are based on the value of time potentially saved through the introduction of a ramp metering site. The benefits have been quantified in financial terms based on a 20% saving in delay time. The expected annual benefit for each site can be seen in Table 3 below.

More information on how the benefits have been derived can be found in Task 9, *Performance Measures Report* of this project. This report describes the process of how benefits were calculated for each site.

Although the benefit analysis uses only travel time benefits, other benefits will accrue, including crash, emissions and reliability benefits. These are not quantified due to the disproportionately large effort it would take, especially in light of their relatively small benefits within the scale of the project.

Table 3 Annual Financial Benefit for Ramp Metering for Each Site

Log	FROM Cross Street	TO Freeway	Freeway Direction	Exit	County	Annual Financial Benefit	Recommendation
32	S Main St	I-85	NB	22	Gaston	$166,653	Feasible
34	McAdenville Rd	I-85	NB	23	Gaston	$249,539	Feasible
35	Belmont-Mt. Holly Rd	I-85	SB	26	Gaston	$736,886	Feasible
93	Westinghouse Blvd	I-77	SB	1A	Mecklenburg	$4,240,251	Feasible
101	Arrowood Rd	I-77	NB	3	Mecklenburg	$302,400	Feasible
102	Nations Ford Rd	I-77	SB	4	Mecklenburg	$2,626,166	Feasible
103	Nations Ford Rd	I-77	NB	4	Mecklenburg	$524,893	Feasible
105	Tyvola Rd	I-77	NB	5	Mecklenburg	$2,364,260	Feasible
111	Remount Rd	I-77	SB	8	Mecklenburg	$1,850,566	Feasible
129*	I-85 SB	I-77	NB	13	Mecklenburg	$4,750,671	Feasible

Log	FROM Cross Street	TO Freeway	Freeway Direction	Exit	County	Annual Financial Benefit	Recommendation
140	Gilead Rd	I-77	NB	23	Mecklenburg	$243,918	Feasible
143	NC 73 (Sam Furr Rd)	I-77	NB	25	Mecklenburg	$1,038,634	Feasible
145	US 21 (Catawba Ave)	I-77	NB	28	Mecklenburg	$1,736,528	Feasible
146	Goodrum Rd / Griffith St	I-77	SB	30	Mecklenburg	$161,841	Feasible
147	Goodrum Rd / Griffith St	I-77	NB	30	Mecklenburg	$1,402,977	Feasible
64	Graham St	I-85	SB	40	Mecklenburg	$197,895	Feasible
67	Sugar Creek Rd	I-85	NB	41	Mecklenburg	$971,676	Feasible
72	Harris Blvd	I-85	SB	45	Mecklenburg	$16,792	Feasible
75	Mallard Creek Rd	I-85	NB	46	Mecklenburg	$57,005	Feasible
177	Steele Creek Rd	I-485	Inner	4	Mecklenburg	$238,572	Feasible
179	Steele Creek Rd	I-485	Inner	4	Mecklenburg	$446,865	Feasible
181	West Blvd	I-485	Inner	6	Mecklenburg	$65,612	Feasible
230	NC 16 (Providence Rd)	I-485	Outer	57	Mecklenburg	$866,973	Feasible
231	NC 16 (Providence Rd)	I-485	Inner	57	Mecklenburg	$644,724	Feasible
232	NC 16 (Providence Rd)	I-485	Outer	57	Mecklenburg	$545,454	Feasible
233	NC 16 (Providence Rd)	I-485	Inner	57	Mecklenburg	$931,982	Feasible
234	Rea Rd	I-485	Outer	59	Mecklenburg	$833,950	Feasible
236	Rea Rd	I-485	Inner	59	Mecklenburg	$332,898	Feasible
237	Rea Rd	I-485	Inner	59	Mecklenburg	$380,174	Feasible

Log	FROM Cross Street	TO Freeway	Freeway Direction	Exit	County	Annual Financial Benefit	Recommendation
239	US 521 (Johnston Rd)	I-485	Outer	61	Mecklenburg	$123,408	Feasible
Review in Future							
30	Cox Rd	I-85	NB	21	Gaston	$9,429	Review in Future
37	Beatty Dr / Park St	I-85	SB	27	Gaston	$283,050	Review in Future
104	Tyvola Rd	I-77	SB	5	Mecklenburg	$1,256,127	Review in Future
175	Arrowood Rd	I-485	Inner	3	Mecklenburg	$67,348	Review in Future
182	US 74 / US 29 (Wilkinson Blvd)	I-485	Outer	9	Mecklenburg	$89,555	Review in Future
229	E John St	I-485	Inner	52	Mecklenburg	$43,715	Review in Future
Not Feasible							
97*	I-485	I-77	SB	1B	Mecklenburg	$553,771	Not Feasible
250	Briar Creek Rd	US 74	WB	244	Mecklenburg	$0	Not Feasible

* Freeway-to-Freeway site

During this task, benefits have been expressed in 2012 prices. Following discussion with the Steering Committee, benefits have not been discounted to a base year or adjusted in anticipation of inflation. The committee wanted to have a baseline benefits that is consistent amongst all ramp metering projects state wide for a viable comparison.

4. Cost Benefit Analysis for Individual Sites

Using the costs and benefits outlined in the previous sections, cost benefit ratios have been calculated for each of the potential ramp metering sites annually for periods of five and ten years.

The purpose is to allow comparison of the relative economic analysis of each site. Therefore, only the costs directly associated with the implementation of each individual site have been included. The program cost is a fixed one-time cost for the first implementation in each area so it will be added to the total costs for each scenario in the options section. Note that costs included below in Tables 4-1 and 4-2 only includes implementation costs. It does not include any of the central costs.

4.1. Five and Ten Year Benefit to Cost Ratios

The period of time used for economic analysis should normally be the period of the useful lifetime of the assets included for the options under consideration. Therefore, the recommended period for the main cost benefit analysis is ten years. This is due to the need to replace and/or upgrade the technology equipment after this period. This gives the opportunity to review the site after ten years and decide if it is worthwhile making the investment to continue.

A second analysis period of five years has been used. This is because there was consensus within the Steering Committee that a site which 'pays back' within five years would also be economically suitable for implementation. The five-year payback period analysis helps to distinguish the higher benefits suggesting a higher priority of implementation. The Benefit/Cost Ratio (BCR) is calculated by dividing the Five Year Total Benefits by the Five Year Total Costs.

Benefit/Cost Ratio = 5 Year Total Benefits / 5 Year Total Costs

Benefits are also determined by calculating the First Year Rate of Return (FYRR). The FFYR is a measure to determine which sites can pay off the implementation and first year operating costs with their expected benefits in the first year. A positive number indicates a financially strong candidate site. The FFYR is calculated by:

$$\text{First Year Rate of Return} = \frac{\text{(Annual Benefits – (Implementation Costs +Annual Costs))}}{\text{(Implementation Costs +Annual Costs)}}$$

4.1.1. Five-Year Results

Table 4-1 shows the expected cost and benefit of each site for five years, the benefit to cost ratio (BCR) and the First Year Rate of Return (FYRR). These are listed in descending order of BCR.

The five-year BCRs of the 38 sites considered feasible for ramp metering range from 67.10 to 0.00. The total five-year BCR of all 38 sites is 14.96.

26 sites have a positive FYRR, i.e. they pay for themselves within the first year of operation. 33 of the sites have a five-year BCR of greater than 1. (i.e. offering payback within the first five years of implementation)

4.1.2. Ten-Year Results

Table 4-2 shows the expected cost and benefit of each site for ten years, the benefit to cost ratio (BCR) and the First Year Rate of Return (FYRR).

The ten-year BCRs of the 38 sites considered feasible for ramp metering range from 110.72 to 0.00. The total ten-year BCR of all 38 sites is 26.00.

34 sites have a ten-year BCR of greater than 1. (i.e. offering payback within the first ten years of implementation)

4.1.3. First Year Rate of Return

26 sites have a FFYR greater than zero indicating a strong expected performance. The highest score is 1516%.

4.1.4. Summary

These overall positive results give confidence that the installation of ramp metering at the 38 sites could provide benefits; however, selecting a suitable subset of the sites would increase the overall benefit.

4.2. Sensitivity Testing

Some basic sensitivity analysis has been performed to test the impact of any over optimism in the benefits calculations. This analysis assumes that the delays are reduced by only 10% instead of 20%.

The site-by-site results of the sensitivity testing are shown in Appendix B.

4.2.1. Five-Year Results

In this scenario, 18 of the sites have a FYRR of greater than 1, but 30 of the sites have a five-year BCR of greater than 1.0. The total five-year BCR of all 38 sites is reduced from 14.96 to 7.48 of the remaining twelve sites, seven sites have a benefit cost ratio greater than 1 for the five-year period and eight sites have a benefit cost ratio greater than one for the ten-year period.

4.2.2. Ten-Year Results

For the ten-year scenario, 18 of the sites have a FYRR of greater than one, but 32 of the sites have a ten-year BCR of greater than 1.0. The total ten-year BCR of all 38 sites is reduced from 26.00 to 13.00.

Table 4-1 Benefit Cost Analysis over Five-Year Period for Each Site

Log	Freeway	Cross Street	Exit	Direction	County	Five Year Total Cost	Five Year Total Benefit	BCR in Period	FYRR
102	I-77	Nations Ford Rd	4	SB	Mecklenburg	$195,701	$13,130,831	67.1	1516%
129*	I-77	I-85 SB	13	NB	Mecklenburg	$426,356	$23,753,353	55.71	1108%
105	I-77	Tyvola Rd	5	NB	Mecklenburg	$219,430	$11,821,301	53.87	1170%
111	I-77	Remount Rd	8	SB	Mecklenburg	$199,870	$9,252,828	46.29	1010%
145	I-77	US 21 (Catawba Ave)	28	NB	Mecklenburg	$211,718	$8,682,642	41.01	873%
93	I-77	Westinghouse Blvd	1A	SB	Mecklenburg	$621,695	$21,201,256	34.1	621%
147	I-77	Goodrum Rd / Griffith St	30	NB	Mecklenburg	$251,413	$7,014,884	27.9	543%
143	I-77	NC 73 (Sam Furr Rd)	25	NB	Mecklenburg	$249,550	$5,193,170	20.81	380%
67	I-85	Sugar Creek Rd	41	NB	Mecklenburg	$237,275	$4,858,378	20.48	376%
104	I-77	Tyvola Rd	5	SB	Mecklenburg	$300,680	$6,280,635	20.89	370%
234	I-485	Rea Rd	59	Outer	Mecklenburg	$238,814	$4,169,750	17.46	306%
233	I-485	NC 16 (Providence Rd)	57	Inner	Mecklenburg	$280,720	$4,659,912	16.6	277%
35	I-85	Belmont-Mt. Holly Rd	26	SB	**Gaston**	$220,958	$3,684,428	16.67	292%
230	I-485	NC 16 (Providence Rd)	57	Outer	Mecklenburg	$307,683	$4,334,864	14.09	216%
232	I-485	NC 16 (Providence Rd)	57	Outer	Mecklenburg	$203,039	$2,727,270	13.43	221%
231	I-485	NC 16 (Providence Rd)	57	Inner	Mecklenburg	$268,169	$3,223,619	12.02	174%
103	I-77	Nations Ford Rd	4	NB	Mecklenburg	$226,512	$2,624,466	11.59	172%
179	I-485	Steele Creek Rd	4	Inner	Mecklenburg	$252,868	$2,234,327	8.84	103%
237	I-485	Rea Rd	59	Inner	Mecklenburg	$239,279	$1,900,870	7.94	84%
236	I-485	Rea Rd	59	Inner	Mecklenburg	$240,498	$1,664,490	6.92	61%
101	I-77	Arrowood Rd	3	NB	Mecklenburg	$253,327	$1,511,998	5.97	37%

Log	Freeway	Cross Street	Exit	Direction	County	Five Year Total Cost	Five Year Total Benefit	BCR in Period	FYRR
34	I-85	McAdenville Rd	23	NB	**Gaston**	$204,187	$1,247,694	6.11	46%
37	I-85	Beatty Dr / Park St	27	SB	**Gaston**	$250,200	$1,415,252	5.66	30%
097*	I-77	I-485	1B	SB	Mecklenburg	$534,644	$2,768,855	5.18	10%
140	I-77	Gilead Rd	23	NB	Mecklenburg	$268,522	$1,219,590	4.54	4%
32	I-85	S Main St	22	NB	**Gaston**	$180,599	$833,267	4.61	13%
177	I-485	Steele Creek Rd	4	Inner	Mecklenburg	$273,828	$1,192,859	4.36	-1%
64	I-85	Graham St	40	SB	Mecklenburg	$239,395	$993,608	4.15	-4%
146	I-77	Goodrum Rd / Griffith St	30	SB	Mecklenburg	$227,259	$809,207	3.56	-17%
239	I-485	US 521 (Johnston Rd)	61	Outer	Mecklenburg	$238,470	$617,042	2.59	-40%
182	I-485	US 74 / US 29 (Wilkinson Blvd)	9	Outer	Mecklenburg	$310,755	$447,774	1.44	-68%
181	I-485	West Blvd	6	Inner	Mecklenburg	$251,646	$328,058	1.3	-70%
75	I-85	Mallard Creek Rd	46	NB	Mecklenburg	$264,262	$285,024	1.08	-75%
229	I-485	E John St	52	Inner	Mecklenburg	$245,419	$218,577	0.89	-79%
175	I-485	Arrowood Rd	3	Inner	Mecklenburg	$643,763	$336,742	0.52	-89%
72	I-85	Harris Blvd	45	SB	Mecklenburg	$231,555	$83,960	0.36	-92%
30	I-85	Cox Rd	21	NB	**Gaston**	$235,347	$47,147	0.2	-95%
250	US-74	Briar Creek Road/Television Lane	244	WB	Mecklenburg	$234,844	$0	0	-100%

* Freeway-to-Freeway site

Table 4-2 Benefit Cost Analysis over Ten-Year Period for Each Site

Log	Freeway	Cross Street	Exit	Direction	County	Ten Year Total Costs	Ten Year Total Benefits	Ten Year BCR	FYRR
102	I-77	Nations Ford Rd	4	SB	Mecklenburg	$237,201	$26,261,662	110.72	1516%
129*	I-77	I-85 SB	13	NB	Mecklenburg	$467,856	$47,506,707	101.54	1108%
105	I-77	Tyvola Rd	5	NB	Mecklenburg	$260,930	$23,642,601	90.61	1170%
111	I-77	Remount Rd	8	SB	Mecklenburg	$241,370	$18,505,656	76.67	1010%
145	I-77	US 21 (Catawba Ave)	28	NB	Mecklenburg	$253,218	$17,365,283	68.58	873%
93	I-77	Westinghouse Blvd	1A	SB	Mecklenburg	$663,195	$42,402,512	63.94	621%
147	I-77	Goodrum Rd / Griffith St	30	NB	Mecklenburg	$292,913	$14,029,769	47.9	543%
143	I-77	NC 73 (Sam Furr Rd)	25	NB	Mecklenburg	$291,050	$10,386,340	35.69	380%
67	I-85	Sugar Creek Rd	41	NB	Mecklenburg	$278,775	$9,716,756	34.86	376%
104	I-77	Tyvola Rd	5	SB	Mecklenburg	$342,180	$12,561,271	36.71	370%
234	I-485	Rea Rd	59	Outer	Mecklenburg	$280,314	$8,339,499	29.75	306%
233	I-485	NC 16 (Providence Rd)	57	Inner	Mecklenburg	$322,220	$9,319,823	28.92	277%
35	I-85	Belmont-Mt. Holly Rd	26	SB	**Gaston**	$262,458	$7,368,856	28.08	292%
230	I-485	NC 16 (Providence Rd)	57	Outer	Mecklenburg	$349,183	$8,669,728	24.83	216%
232	I-485	NC 16 (Providence Rd)	57	Outer	Mecklenburg	$244,539	$5,454,540	22.31	221%
231	I-485	NC 16 (Providence Rd)	57	Inner	Mecklenburg	$309,669	$6,447,238	20.82	174%
103	I-77	Nations Ford Rd	4	NB	Mecklenburg	$268,012	$5,248,933	19.58	172%
179	I-485	Steele Creek Rd	4	Inner	Mecklenburg	$294,368	$4,468,653	15.18	103%
237	I-485	Rea Rd	59	Inner	Mecklenburg	$280,779	$3,801,741	13.54	84%
236	I-485	Rea Rd	59	Inner	Mecklenburg	$281,998	$3,328,980	11.8	61%
101	I-77	Arrowood Rd	3	NB	Mecklenburg	$294,827	$3,023,996	10.26	37%
34	I-85	McAdenville Rd	23	NB	**Gaston**	$245,687	$2,495,389	10.16	46%

Log	Freeway	Cross Street	Exit	Direction	County	Ten Year Total Costs	Ten Year Total Benefits	Ten Year BCR	FYRR
37	I-85	Beatty Dr / Park St	27	SB	**Gaston**	$291,700	$2,830,504	9.7	30%
097*	I-77	I-485	1B	SB	Mecklenburg	$576,144	$5,537,711	9.61	10%
140	I-77	Gilead Rd	23	NB	Mecklenburg	$310,022	$2,439,181	7.87	4%
32	I-85	S Main St	22	NB	**Gaston**	$222,099	$1,666,535	7.5	13%
177	I-485	Steele Creek Rd	4	Inner	Mecklenburg	$315,328	$2,385,718	7.57	-1%
64	I-85	Graham St	40	SB	Mecklenburg	$280,895	$1,987,216	7.07	-4%
146	I-77	Goodrum Rd / Griffith St	30	SB	Mecklenburg	$268,759	$1,618,415	6.02	-17%
239	I-485	US 521 (Johnston Rd)	61	Outer	Mecklenburg	$279,970	$1,234,084	4.41	-40%
182	I-485	US 74 / US 29 (Wilkinson Blvd)	9	Outer	Mecklenburg	$352,255	$895,548	2.54	-68%
181	I-485	West Blvd	6	Inner	Mecklenburg	$293,146	$656,116	2.24	-70%
75	I-85	Mallard Creek Rd	46	NB	Mecklenburg	$305,762	$570,048	1.86	-75%
229	I-485	E John St	52	Inner	Mecklenburg	$286,919	$437,154	1.52	-79%
175	I-485	Arrowood Rd	3	Inner	Mecklenburg	$685,263	$673,485	0.98	-89%
72	I-85	Harris Blvd	45	SB	Mecklenburg	$273,055	$167,920	0.61	-92%
30	I-85	Cox Rd	21	NB	**Gaston**	$276,847	$94,294	0.34	-95%
250	US-74	Briar Creek Road/Television Lane	244	WB	Mecklenburg	$276,344	$0	0	-100%

* Freeway-to-Freeway site

5. STIP Projects and Freeway-to-Freeway Sites

5.1. STIP Projects

The 2016-2025 State Transportation Implementation Plan (STIP) can be found in the following location: https://connect.ncdot.gov/projects/planning/STIPDocuments1/LIVE_STIP.pdf.

The STIP has been reviewed to identify any planned projects in the vicinity of a potential ramp metering site. The scope of the work, schedule and the funding of each STIP project were used to determine if there is a potential conflict with a ramp metering deployment. The list in Table 5-1 has been compiled, with a comment on whether that project is likely to affect the potential benefits from a ramp metering installation in that location.

Table 5-1 List of STIP Projects

Sites Affected (Log)	STIP Project Number	Description	Anticipated Construction	Short Term Impact on Ramp Metering	County	Agency
029, 030	I-5713	I-85 Cox Road interchange improvements (Exit 21)	2020	No	Gaston	Div. 12
030, 032, 033, 034, 035, 037	I-5719	I-85 widening to 8 lanes between US 321 (Exit 17) and NC 273 (Exit 27)	2024 onwards	No	Gaston	Div. 12
032, 033, 034, 035, 037	I-5869	I-85 ITS improvements between Main Street in Lowell (Exit 22) and Sam Wilson Road (Exit 29)	2024	No	Gaston / Mecklenburg	Div. 10, 12
145, 146, 147	I-4750AA	I-77 construct HOT lanes between West Catawba Ave (Exit 28) and NC 150 (Exit 36)	Current	No	Iredell / Mecklenburg	Div. 10, 12
145, 146, 147	I-4750AB	I-77 construct one additional lane in each direction between West Catawba Ave (Exit 28) and NC 150 (Exit 36)	Post 2025	No	Iredell / Mecklenburg	Div. 10, 12
129*, 140, 143, 145	I-5405	I-77 construct HOT lanes and convert HOV lanes to HOT lanes between I-277 (Exit 11) and West Catawba Ave (Exit 28)	Current	No	Mecklenburg	Div. 10
140, 143, 145	I-3311B	I-77 construct additional lanes between I-485 (Exit 19) and West Catawba Ave (Exit 28)	Post 2025	No	Mecklenburg	Div. 10

Sites Affected (Log)	STIP Project Number	Description	Anticipated Construction	Short Term Impact on Ramp Metering	County	Agency
129*	I-3311C	I-77 construct HOT lanes and convert HOV lanes to HOT lanes between I-277 (Exit 11) and I-85 (Exit 13)	Current	No	Mecklenburg	Div. 10
146, 147	I-4750AC	I-77/Exit 30 (Griffith St) Interchange; construct roundabouts at northbound and southbound ramp termini.	Current	No	Mecklenburg	Div. 10
140	I-5714	I-77 upgrade Gilead Road interchange (Exit 23)	2019	Yes	Mecklenburg	Div. 10
143	I-5715	I-77 upgrade NC 73 interchange (Exit 25)	2021	Yes	Mecklenburg	Div. 10
093, 097*, 099, 101, 102, 103, 104, 105	I-5718A	I-77 widens to 10 lanes between I-485 (Exit 1) to Woodlawn Road (Exit 6)	Post 2025	No	Mecklenburg	Div. 10
109, 111	I-5718B	I-77 widens to 10 lanes between Woodlawn Road (Exit 6) and I-277/US 74 (Exit 9)	Post 2025	No	Mecklenburg	Div. 10
None	I-5718C	I-77 widens to 10 lanes between I-277/US 74 (Exit 9) and I-277/NC 16 (Exit 11)	Post 2025	No	Mecklenburg	Div. 10
None	I-5718D	I-77 I-277/US 74/NC 27 interchange improvements (Exit 9)	Post 2025	No	Mecklenburg	Div. 10
None	I-5718E	I-77 I-277/NC 16/US 21 interchange improvements (Exit 11)	Post 2025	No	Mecklenburg	Div. 10
229, 230, 231, 232, 233, 234, 236, 237, 239	I-5507	I-485 construct one express lane in each direction between I-77 (Exit 51) and US 74 (Exit 67)	2016-2019	No	Mecklenburg	Div. 10
229	R-0211EC	I-485 construct Weddington Road interchange	2019-2022	No	Mecklenburg	Div. 10
229	R-2123CG	I-485 from US 74 (Independence Boulevard) to I-85 North; ITS Device installation	Current	No	Mecklenburg	Div. 10
N/A	R-2248EA	I-485 from East of NC 115 (Old Statesville Rd) to I-85 North; ITS Device installation	Current	No	Mecklenburg	Div. 10

Sites Affected (Log)	STIP Project Number	Description	Anticipated Construction	Short Term Impact on Ramp Metering	County	Agency
None	R-2248G	I-485 construct interchange with Oakdale Road	Current	No	Mecklenburg	Div. 10
230, 231, 232, 233	I-5507/ U-4714AB	I-485 from I-77 to US 74: Construct Hot Lanes; I-485 – Interchange at John St. (NC 16); construct two loops just south of Johns St/Providence Rd.	2017	Yes	Mecklenburg	Div. 10

* Freeway-to-Freeway site

It can be seen that six of the 38 potential ramp metering installations, 140, 143, 230, 231, 232, and 233 along I-485 could be affected by STIP projects.

These six sites will be removed from further analysis of the implementation options because their benefits cannot be assured.

Also, site 75, I-85 Northbound at Mallard Creek Church Road, could be impacted as well due to a NCDOT Congestion Management study that is currently being performed at this location. Recommendations from the study could impact site 75 from being proposed as a viable site for ramp metering implementation. That study has determined that implementation of ramp metering alone would not address the capacity problems being studied by the Congestion Management project. At this time, the committee will move forward with this site excluded.

5.2. Freeway-to-Freeway Sites

In the early stages of the NCDOT Ramp Metering Feasibility Study, the Steering Committee requested that a number of Freeway-to-Freeway (F2F) sites be considered. 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 the two F2F sites included at the Detailed Analysis stage, one (site 129, I-85 SBD ramp to I-77 NBD) was found to be potentially feasible for ramp metering based on the analysis of congestion, traffic and geometric characteristics. The second (site 097, I-485 ramp to I-77 SBD) was found to be not feasible, but it was retained for further analysis at the request of the Steering Committee. Because there is no intention to install them at this stage, from this point forward these F2F sites will be removed from the analysis.

Table 5-2 shows the two F2F sites and their relative five year BCRs. It can be seen that both of the sites have a BCR greater than one, i.e. a payback time of less than five years. In fact, site 129 has the second highest five-year BCR of all 38 sites, demonstrating the value of providing F2F metering, if a suitable system could be developed to operate in this scenario.

Table 5-2 Freeway-to-Freeway Sites Applicable to the Suitable Locations

Log	Freeway	Cross Street	Exit	Direction	County	5 Year BCR
097	I-77	I-485	1B	SB	Mecklenburg	5.18
129	I-77	I-85 SB	13	NB	Mecklenburg	55.71

6. Options for Implementation

6.1. Proposed Approach

This section presents the options for possible stages of implementation. The options have been developed by logically grouping the sites by location. This has the benefit of addressing congestion problems on a corridor by corridor basis, ensuring all sites associated with each congestion problem are implemented together to maximize the effectiveness and realized benefits. This grouping would potentially mitigate any route diversion impacts by drivers attempting to avoid a ramp meter. This corridor-based approach will also provide construction works efficiencies.

This approach differs from that adopted on the previous project in Raleigh where two options for implementation were proposed. In that study, the first option included all sites with a five-year BCR greater than 1. The second option was a subset of the first, removing sites with an effectiveness factor of less than 1 and thus only retaining sites where the expected benefits were more assured, offering a ‘reduced risk’ approach.

This approach is not deemed appropriate for the Charlotte ramp metering sites for the following key reasons:

1. A much greater proportion of the sites in this project have an effectiveness factor less than 1 due to the more complex nature of the sites and the congestion problems;
2. The significantly higher traffic volumes experienced at the sites in Charlotte increase the potential benefits that can be realized through the implementation of ramp metering, so despite lower effectiveness factors, the BCRs are higher relative to those calculated for the Raleigh sites.

The 38 potential ramp metering sites are located on three main highways: I-85, I-77 and I-485. For each highway, the sites are grouped into two distinct locations. This provides six groups as follows:

1. I-85 South (Gaston County)
2. I-85 North (Mecklenburg County)
3. I-77 South
4. I-77 North
5. I-485 Southwest
6. I-485 Southeast

6.2. Sites Removed from Further Analysis

As explained in Section 5, the following sites will not be included in the analysis but will be displayed in the tables:

- Sites affected by STIP projects (as described in Section 5.1): 140, 143, 230, 231, 232, and 233
- F2F sites (as described in Section 5.2): Sites 097 and 129
- Site 75, due to the current Congestion Management study

In addition, sites categorized as 'Review in Future' during the Detailed Analysis stage will be removed from further analysis. The effectiveness of these sites is less certain and will need to be reassessed following the implementation of other ramp metering sites within the same corridors. Sites which are not expected to pay for themselves within five years of construction (i.e. sites with a five-year BCR of less than 1) have also been removed from further analysis since they are not deemed economically suitable for implementation. These sites are as follows:

- 'Review in future' sites: Sites 030, 037, 104, 175, 182, 229 and 250; and
- Sites with a five-year BCR of less than 1: Sites 229, 175, 072, 030 and 250.

Note that some of these sites fall into both categories.

Therefore, moving forward, there are 21 potential ramp metering sites that are being recommended for implementation. They are as follows:

Log	FROM Cross Street	TO Freeway	Freeway Direction	Exit	County
32	S Main St	I-85	NB	22	Gaston
34	McAdenville Rd	I-85	NB	23	Gaston
35	Belmont-Mt. Holly Rd	I-85	SB	26	Gaston
93	Westinghouse Blvd	I-77	SB	1A	Mecklenburg
101	Arrowood Rd	I-77	NB	3	Mecklenburg
102	Nations Ford Rd	I-77	SB	4	Mecklenburg
103	Nations Ford Rd	I-77	NB	4	Mecklenburg
105	Tyvola Rd	I-77	NB	5	Mecklenburg
111	Remount Rd	I-77	SB	8	Mecklenburg
145	US 21 (Catawba Ave)	I-77	NB	28	Mecklenburg
146	Goodrum Rd / Griffith St	I-77	SB	30	Mecklenburg
147	Goodrum Rd / Griffith St	I-77	NB	30	Mecklenburg
64	Graham St	I-85	SB	40	Mecklenburg

Log	FROM Cross Street	TO Freeway	Freeway Direction	Exit	County
67	Sugar Creek Rd	I-85	NB	41	Mecklenburg
177	Steele Creek Rd	I-485	Inner	4	Mecklenburg
179	Steele Creek Rd	I-485	Inner	4	Mecklenburg
181	West Blvd	I-485	Inner	6	Mecklenburg
234	Rea Rd	I-485	Outer	59	Mecklenburg
236	Rea Rd	I-485	Inner	59	Mecklenburg
237	Rea Rd	I-485	Inner	59	Mecklenburg
239	US 521 (Johnston Rd)	I-485	Outer	61	Mecklenburg

6.3. Implementation Options

The following sections define each of the options for implementing ramp metering sites, grouped by location. The tables outlining the costs, benefits, and BCRs provide subtotals for the sites on each roadway, a total cost for both roadways not including the central cost, and a total cost including the central cost.

Note that costs included above in Tables 4-1 and 4-2 do not include the central costs. For each grouping below, the total costs for the central costs was included in each of the estimates. If NCDOT makes the decision to move forward with only one grouping, then this grouping will need to absorb the entire central costs. If more than one grouping is chosen to be implemented, NCDOT can either have one group absorb the entire central costs or the central costs can be distributed evenly amongst the number of groupings chosen for implementation.

Table 6-1 Group 1 - I-85 South (Gaston County)

Log	Freeway	Cross Street	Exit	Direction	Include in Group?	Ten Year Total Cost	Ten Year Total Benefits	Ten Year BCR
030	I-85	Cox Rd	21	NB	No - review in future			
032	I-85	S Main St	22	NB	Yes	$222,099	$1,666,535	7.50
034	I-85	McAdenville Rd	23	NB	Yes	$245,687	$2,495,389	10.16
Subtotal (Northbound)						**$467,786**	**$4,161,923**	**8.90**
033	I-85	McAdenville Rd	23	SB	No - ramp flows too low			
035	I-85	Belmont-Mt. Holly Rd	26	SB	Yes	$262,458	$7,368,856	28.08
037	I-85	Beatty Dr / Park St	27	SB	No - review in future			
Subtotal (Southbound)						**$262,458**	**$7,368,856**	**28.08**
Total without Central Cost (I-85 South – Gaston County)						$730,245	$11,530,779	15.79
Central Cost						$622,720		
Total including Central Cost (I-85 South – Gaston County)						**$1,352,965**	**$11,530,779**	**8.52**

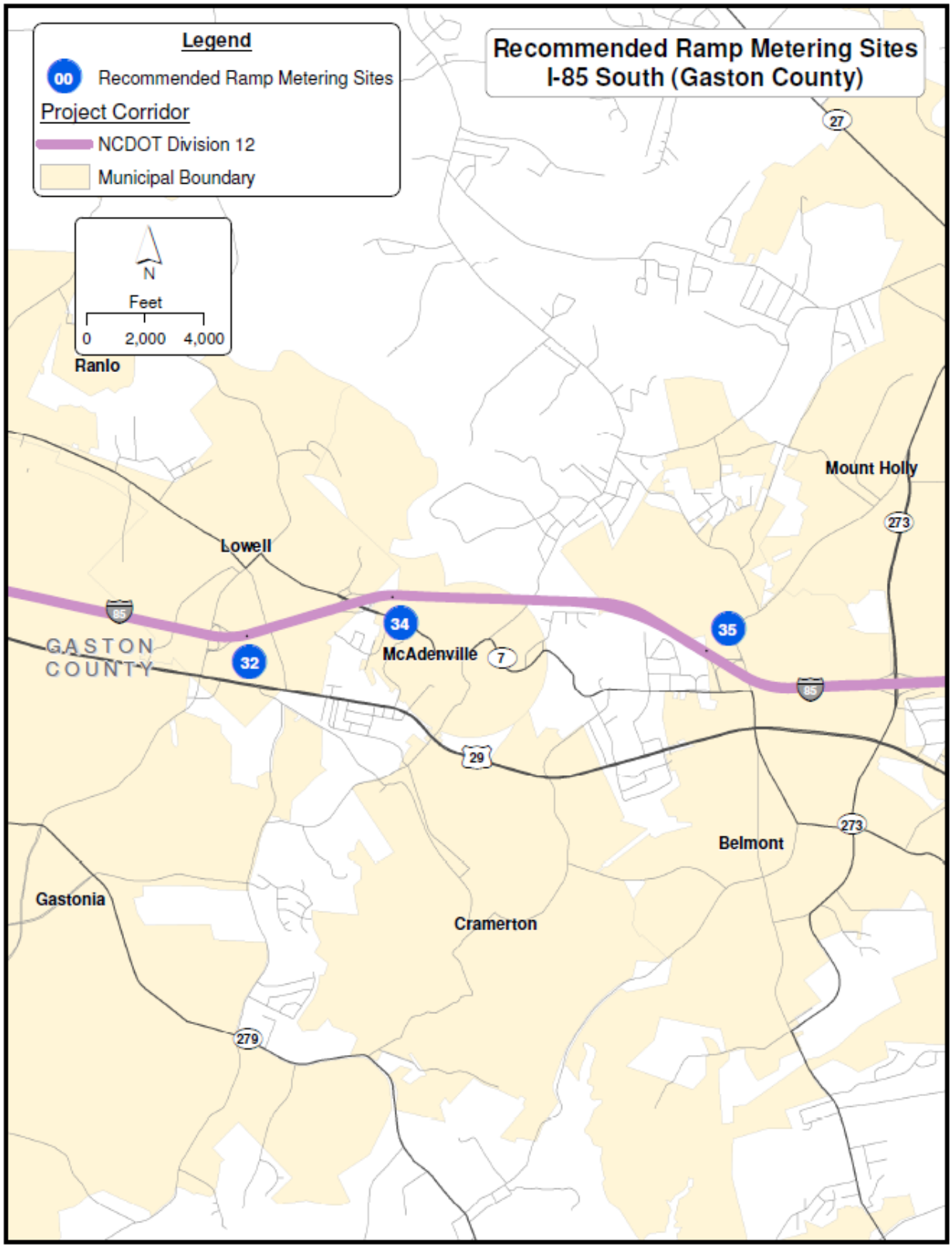

Figure 1. Group 1 – I-85 South (Gaston County) Map

Table 6-2 Group 2 - I-85 North (Mecklenburg County)

Log	Freeway	Cross Street	Exit	Direction	Status	Ten Year Total Cost	Ten Year Total Benefits	Ten Year BCR
129	I-77	I-85 SB	13	NB	No - F2F site			
062	I-85	I-77 NB	38	NB	No - cannot extend acceleration lane			
063	I-85	Statesville Ave	39	NB	No - cannot extend acceleration lane			
065	I-85	Graham St	40	NB	No - cannot extend acceleration lane			
067	I-85	Sugar Creek Rd	41	NB	Yes	$278,775	$9,716,756	34.86
075	I-85	Mallard Creek Rd	46	NB	No			
Subtotal (Northbound)						**$278,775**	**$9,716,756**	**34.86**
061	I-85	Statesville Ave	39	SB	No - cannot extend acceleration lane			
064	I-85	Graham St	40	SB	Yes	$280,895	$1,987,216	7.07
066	I-85	Sugar Creek Rd	40	SB	No - cannot extend acceleration lane			
068	I-85	US 29 Connector (US 29/49)	42	SB	No - cannot extend acceleration lane			
069	I-85	University City Blvd	43	SB	No - ramp flows too low			
070	I-85	University City Blvd	43	SB	No - cannot extend acceleration lane			
072	I-85	Harris Blvd	45	SB	No - low BCR			
Subtotal (Southbound)						**$280,895**	**$1,987,216**	**7.07**
Total without Central Cost (I-85 North – Mecklenburg County)						$559,670	$11,703,971	20.91
Central Cost						$622,720		
Total including Central Cost (I-85 North – Mecklenburg County)						**$1,182,390**	**$11,703,971**	**9.90**

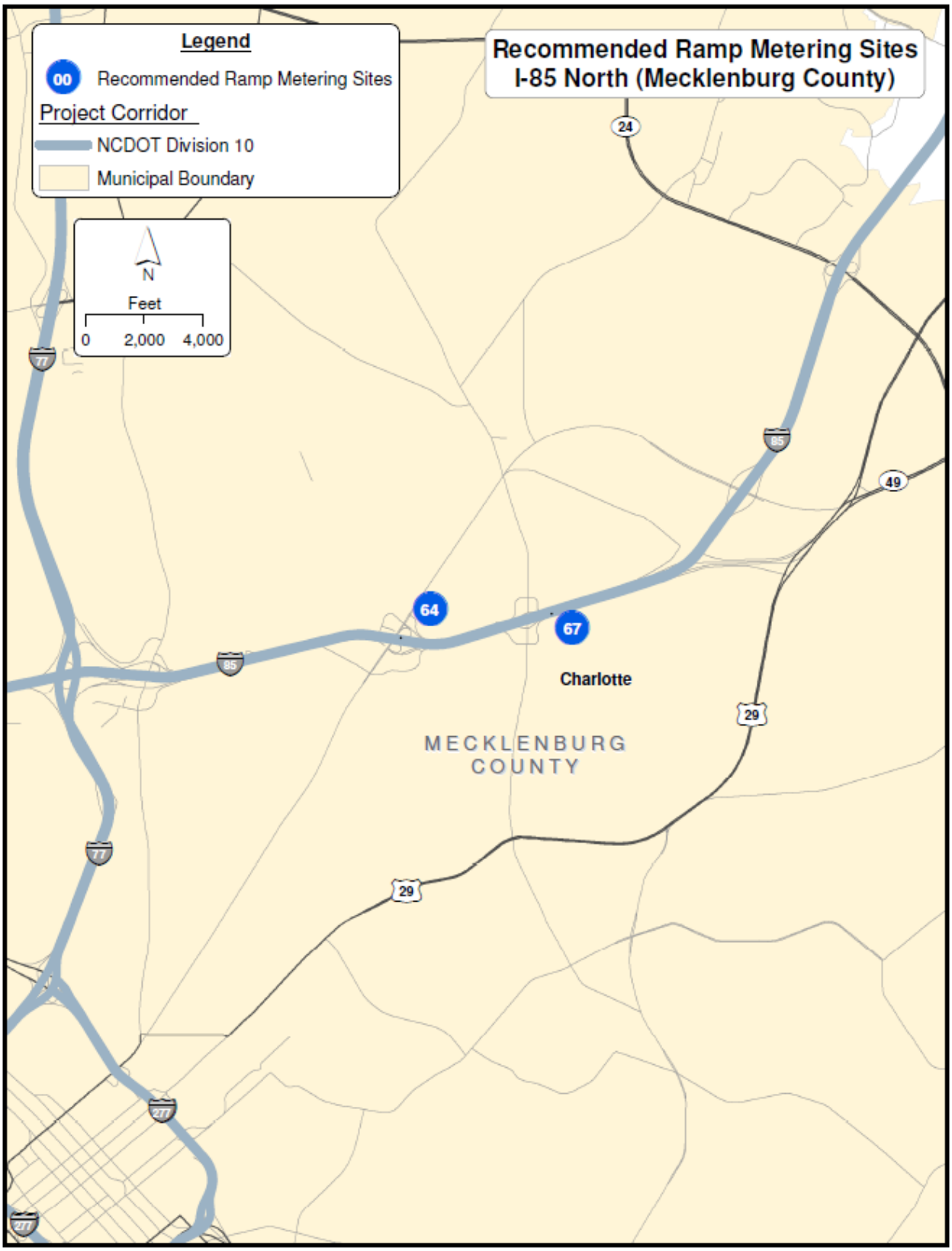

Figure 2. Group 2 – I-85 North (Mecklenburg County) Map

Table 6-3 Group 3 - I-77 South

Log	Freeway	Cross Street	Exit	Direction	Status	Ten Year Total Cost	Ten Year Total Benefits	Ten Year BCR
100	I-77	I-485	1B	NB	No - F2F site			
101	I-77	Arrowood Rd	3	NB	Yes	$294,827	$3,023,996	10.26
103	I-77	Nations Ford Rd	4	NB	Yes	$268,012	$5,248,933	19.58
105	I-77	Tyvola Rd	5	NB	Yes	$260,930	$23,642,601	90.61
107	I-77	S Tryon St	6B	NB	No - primary site is F2F site			
110	I-77	Clanton Rd	7	NB	No - primary site is F2F site			
113	I-77	West Blvd	9A	NB	No - primary site is F2F site			
Subtotal (Northbound)						**$823,769**	**$31,915,530**	**38.74**
093	I-77	Westinghouse Blvd	1A	SB	Yes	$663,195	$42,402,512	63.94
097	I-77	I-485	1B	SB	No - F2F site			
099	I-77	Arrowood Rd	3	SB	No - ramp flow too high, complex CDR			
102	I-77	Nations Ford Rd	4	SB	Yes	$237,201	$26,261,662	110.72
104	I-77	Tyvola Rd	5	SB	No - review in future			
106	I-77	Woodlawn Rd	6A	SB	No - cannot extend acceleration lane			
108	I-77	S Tryon St	6B	SB	No - cannot extend acceleration lane			
109	I-77	Clanton Rd	7	SB	No - low ramp flow, little congestion			
111	I-77	Remount Rd	8	SB	Yes	$241,370	$18,505,656	76.67
112	I-77	I-77 CD (US 74 (Wilkinson Blvd)/ Freedom Dr / I-277 (John Belk Frwy)	9	SB	No - F2F site			
Subtotal (Southbound)						**$1,141,765**	**$87,169,830**	**76.35**
Total without Central Cost (I-77 South)						$1,965,534	$119,085,360	60.59
Central Cost						$622,720		
Total including Central Cost (I-77 South)						**$2,588,254**	**$119,085,360**	**46.01**

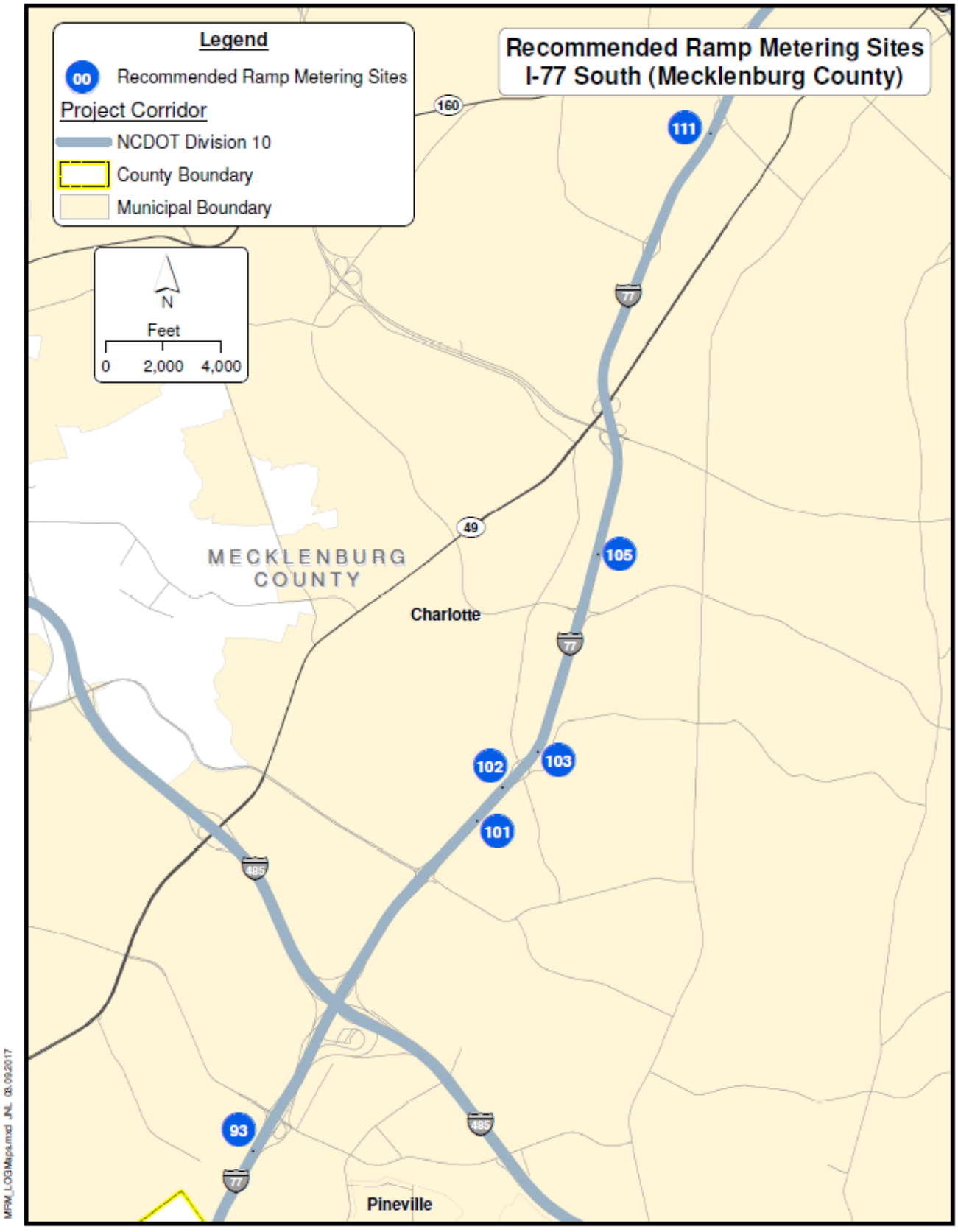

Figure 3. Group 3 – I-77 South Map

Table 6-4 Group 4 - I-77 North

Log	Freeway	Cross Street	Exit	Direction	Status	Ten Year Total Cost	Ten Year Total Benefits	Ten Year BCR
140	I-77	Gilead Rd	23	NB	No			
143	I-77	NC 73 (Sam Furr Rd)	25	NB	No			
145	I-77	US 21 (Catawba Ave)	28	NB	Yes	$253,218	$17,365,283	68.58
147	I-77	Goodrum Rd / Griffith St	30	NB	Yes	$292,913	$14,029,769	47.90
Subtotal (Northbound)						**$546,131**	**$31,395,052**	**57.49**
146	I-77	Goodrum Rd / Griffith St	30	SB	Yes	$268,759	$1,618,415	6.02
Subtotal (Southbound)						**$268,759**	**$1,618,415**	**6.02**
Total without Central Cost (I-77 North)						$814,890	$33,013,467	40.51
Central Cost						$622,720		
Total including Central Cost (I-77 North)						**$1,437,610**	**$33,013,467**	**22.96**

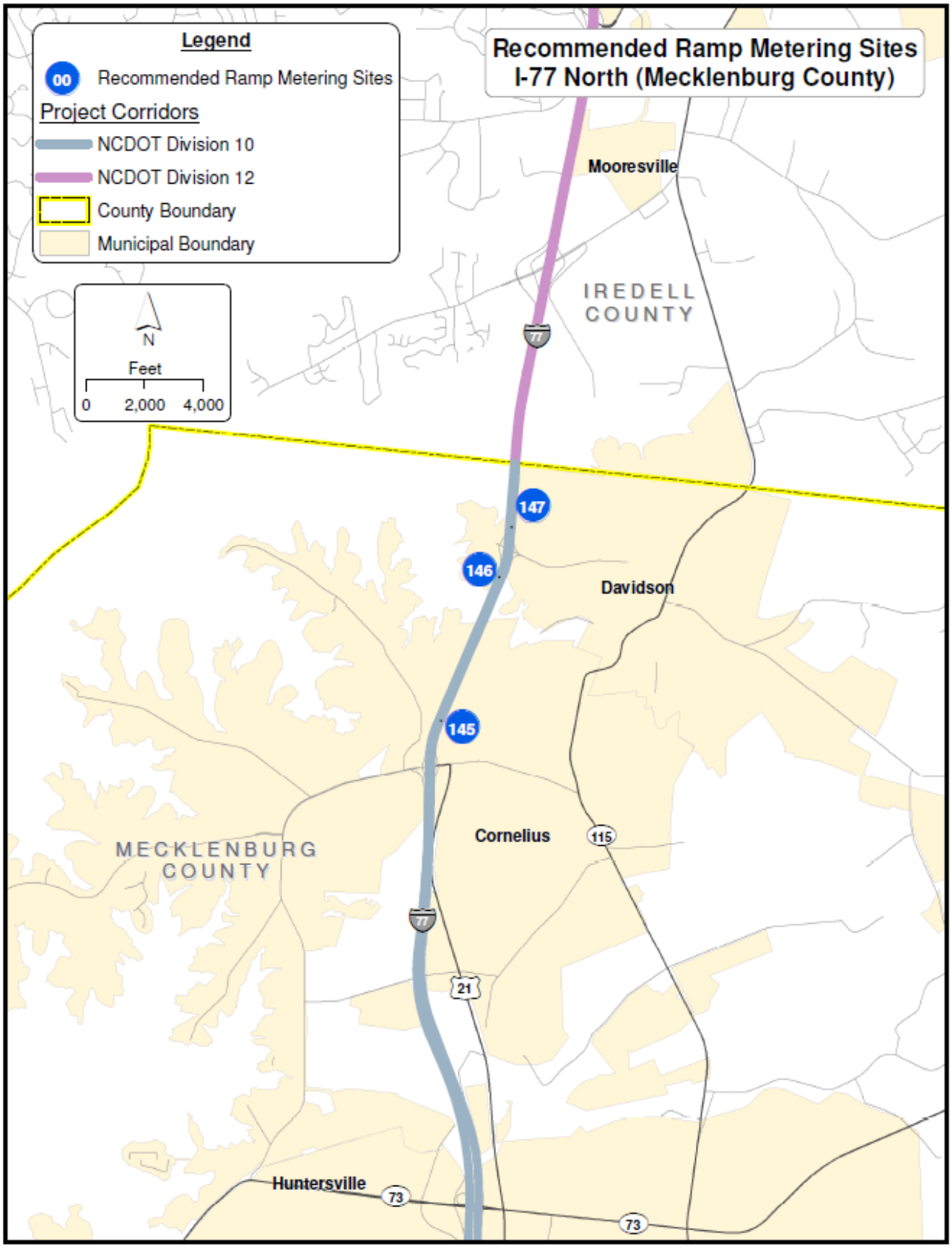

Figure 4. Group 4 – I-77 North Map

Table 6-5 Group 5 - I-485 Southwest

Log	Freeway	Cross Street	Exit	Direction	Status	Ten Year Total Cost	Ten Year Total Benefits	Ten Year BCR
175	I-485	Arrowood Rd	3	Inner	No - review in future			
177	I-485	Steele Creek Rd	4	Inner	Yes	$315,328	$2,385,718	7.57
179	I-485	Steele Creek Rd	4	Inner	Yes	$294,368	$4,468,653	15.18
181	I-485	West Blvd	6	Inner	Yes	$293,146	$656,116	2.24
Subtotal (Inner)						**$902,843**	**$7,510,487**	**8.32**
182	I-485	US 74 / US 29 (Wilkinson Blvd)	9		No - review in future			
180	I-485	West Blvd	6		No - Ramp flows too low			
Subtotal (Outer)						**$0**	**$0**	**N/A**
Total without Central Cost (I-485 Southwest)						$902,843	$7,510,487	8.32
Central Cost						$622,720		
Total including Central Cost (I-485 Southwest)						**$1,525,563**	**$7,510,487**	**4.92**

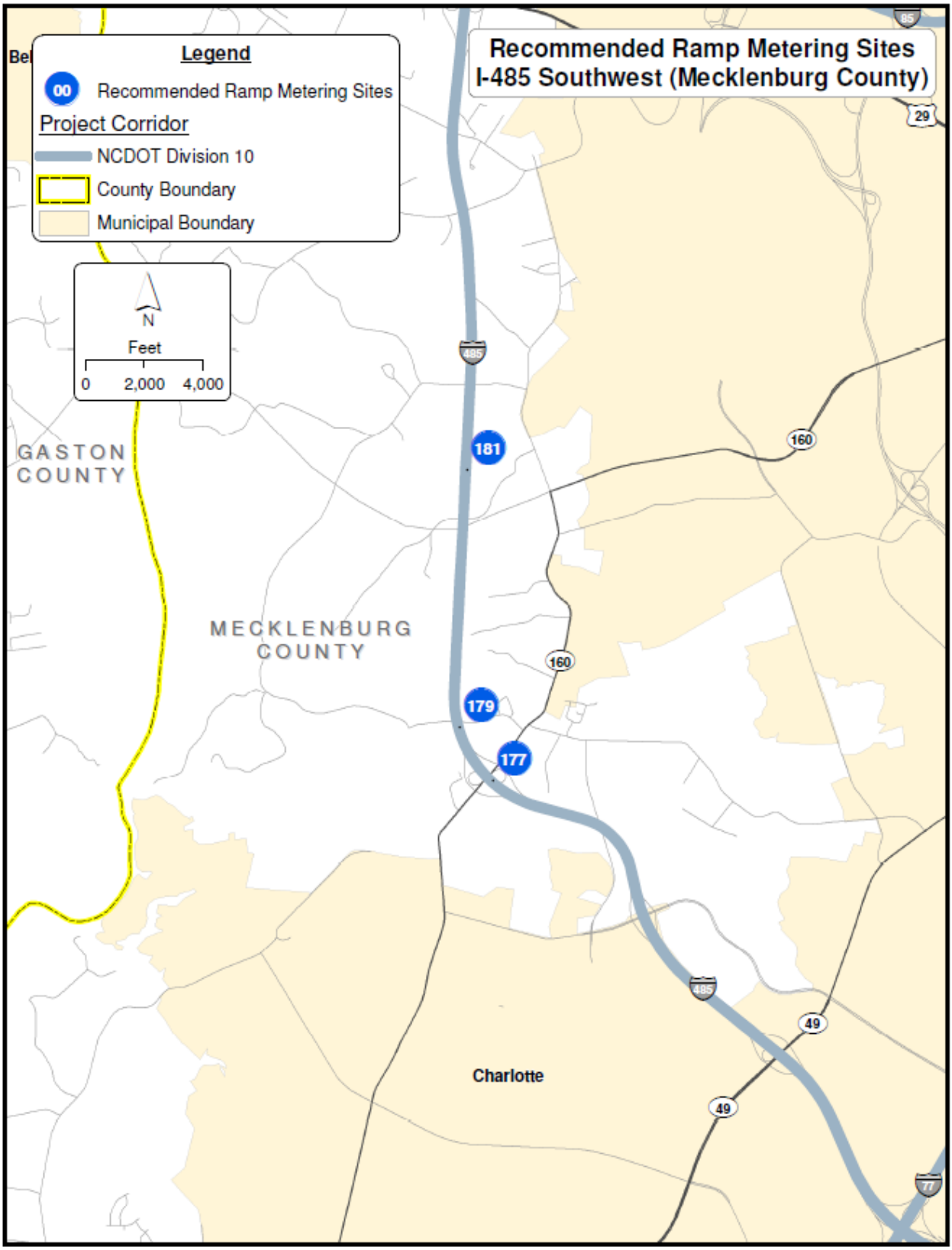

Figure 5. Group 5 – I-485 Southwest Map

Table 6-6 Group 6 - I-485 Southeast

Log	Freeway	Cross Street	Exit	Direction	Status	Ten Year Total Cost	Ten Year Total Benefits	Ten Year BCR
229	I-485	E John St	52	Inner	No - review in future			
231	I-485	NC 16 (Providence Rd)	57	Inner	No			
233	I-485	NC 16 (Providence Rd)	57	Inner	no			
236	I-485	Rea Rd	59	Inner	Yes	$281,998	$3,328,980	11.80
237	I-485	Rea Rd	59	Inner	Yes	$280,779	$3,801,741	13.54
Subtotal (Inner)						$562,777	$7,130,721	12.67
230	I-485	NC 16 (Providence Rd)	57	Outer	No			
232	I-485	NC 16 (Providence Rd)	57	Outer	No			
234	I-485	Rea Rd	59	Outer	Yes	$280,314	$8,339,499	29.75
235	I-485	Rea Rd	59	Outer	No - ramp flow low, poor visibility			
238	I-485	US 521 (Johnston Rd)	61	Outer	No - ramp flow too low			
239	I-485	US 521 (Johnston Rd)	61	Outer	Yes	$279,970	$1,234,084	4.41
Subtotal (Outer)						$560,283	$9,573,583	17.09
Total without Central Cost (I-485 Southeast)						$1,123,060	$16,704,304	14.87
Central Cost						$622,720		
Total including Central Cost (I-485 Southeast)						**$1,745,780**	**$16,704,304**	**9.57**

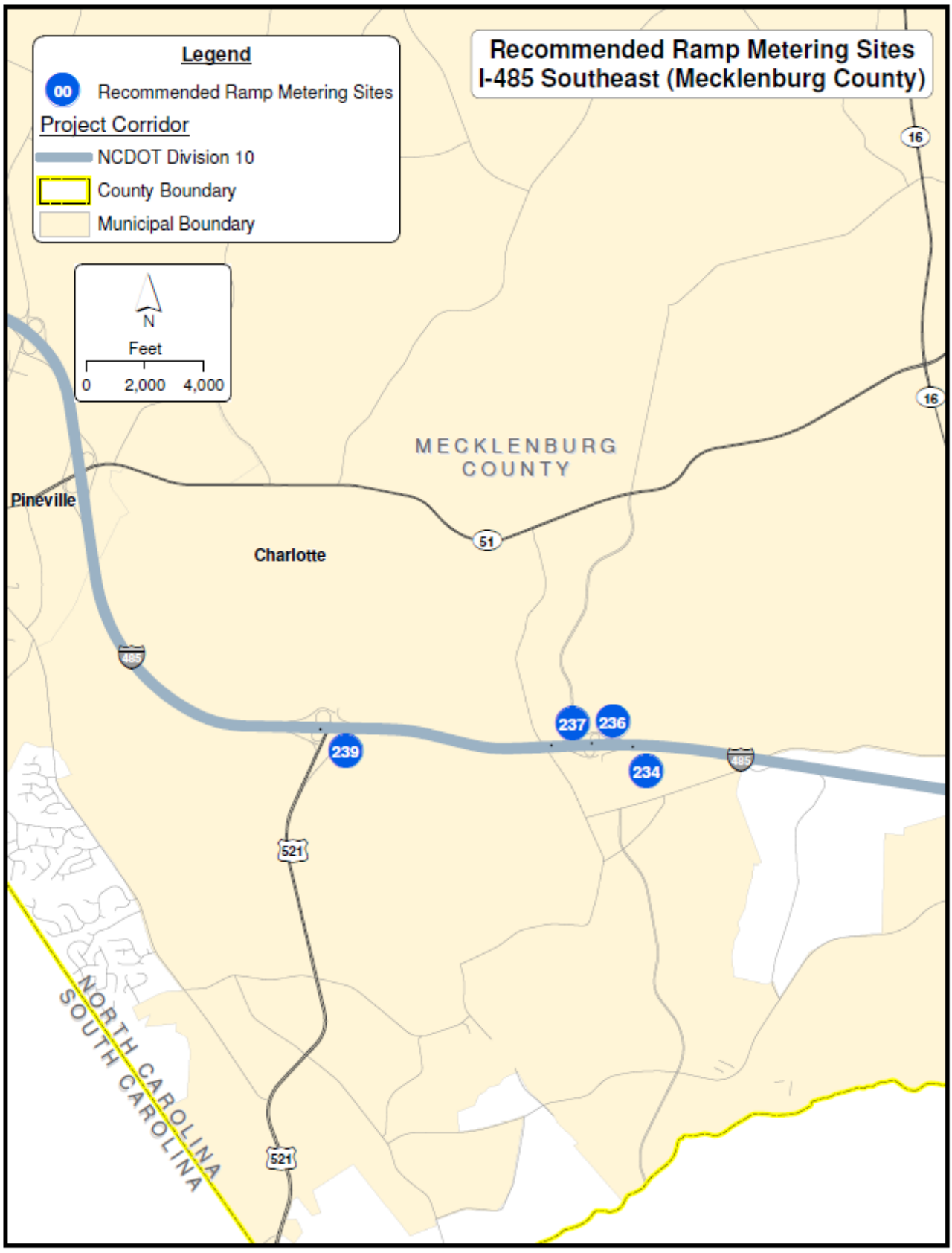

Figure 6. Group 6 – I-485 Southeast Map

7. Summary

Using the calculated costs and benefits of the ramp metering sites taken from the list of the 38 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 implementation of a ramp metering system.

As we move forward with the implementation of ramp metering sites in the Metrolina area, a site will be considered suitable for implementation when that ramp metering site will provide the “pay back” of the construction and operations costs within five years, (i.e. have a five-year benefit to cost ratio greater than 1.0). If the site does provide a “pay back” within the next five years, it must not have a conflicting current STIP project scheduled to be advertised in the next five years. If there is a STIP project that is planned to be advertised in the next five years, the proposed ramp meter site has been removed and will not be considered a viable site for ramp metering at this time. Lastly, freeway-to-freeway sites will not be considered for implementation of ramp metering at this time.

Table 7-1 Cumulative Site Implementation Costs and Benefits

Number of Sites	Ten Year Total Cost	Ten Year Total Benefit	Ten Year BCR
21	$6,718,962	$199,548,370	29.70

After the criteria above was applied to each site, the final number of sites being recommended for implementation are 21. These 21 ramp meter sites were then placed into groups. These groups will be the format for funding/projects as NCDOT moves forward.

It is important to consider the following as decisions are made about implementation:

- The analysis is based on travel time benefits only, whereas actually other benefits 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 an initial installation of ramp metering in the Metrolina area, it might be useful to review the effectiveness of some of those implemented ramp metering sites to determine whether to install at some of the sites screened out previously.

8. Recommendations

As mentioned previously, the sites for ramp metering were selected based on the criteria listed below.

- Does ramp metering site provide the “pay back” of the system costs within five years? (i.e. have a five-year benefit to cost ratio greater than 1.0)
- Is there a STIP project in the next five years that could impact ramp meter implementation?
- Is the site a freeway-to-freeway site?

Once the sites were filtered using the above criteria and grouped, ranking for implementation was then analyzed based on the best ‘bang for the buck’. The analysis looked at how many sites were going to be implemented within each group, the sites individual rankings within the group, and what the total and average costs per site/group were. An analysis was also performed to determine how sites should be implemented based on a location as well as the direction. Table 8-1 below shows the priority for implementation based on group implementation while Table 8-2 shows the priority for implementation based on their site location and for a particular direction.

For implementation based on an entire group as shown in Table 8-1, Group 3 is recommended to be the first ramp meter implementation in the Metrolina area. While this group has the highest costs for implementation, it also includes the most sites with the highest site rankings, and has the lowest average costs/site for each of the groups.

After implementing Group 3, the recommended order for implementation would be Group 4, Group 6, Group 1, Group 5, and Group 2, refer to Table 8-1. Note that although Group 2 has a higher BCR than Groups 6, 1, and 5, the average cost/site for implementation is $100,000 to $150,000 higher.

If the Department decides to implement ramp meters based on location and direction as shown in Table 8-2, then the recommendation for implementation would be:

1. Southbound direction of I-77
2. Northbound direction of I-77 North
3. South Northbound direction of I-77 South
4. Both directions of I-85 North in Mecklenburg County
5. Southbound direction of I-85 South in Gaston County
6. Outer Loop of I-485 Southeast
7. Inner Loop of I-485 Southeast
8. Inner Loop of I-485 Southwest
9. Northbound direction of I-85 South in Gaston County
10. Southbound direction of I-77 North

As stated previously in Section 6.3, central costs have been included in each groups total 10 year costs. Therefore, if only one group is chosen for implementation, it would incur all of the central costs and the other groups 10 year total costs would each be reduced by $622,720.

Table 8-1 Recommended Order for Ramp Meter Implementation – Per Group

Priority	Group	Direction	Sites	Site Rankings	Ten Year Individual Costs	Ten Year Total Costs	Ten Year Individual Benefits	Ten Year Total Benefits	Average Costs/Site for Group	Ten Year BCR	Combined BCR
1	3 (I-77 South)	NB	101	21	$294,827	$2,588,254	$3,023,996	$119,085,360	$431,376	10.26	46.01
		NB	103	17	$268,012		$5,248,933			19.58	
		NB	105	3	$260,930		$23,642,601			90.61	
		SB	93	6	$663,195		$42,402,512			63.94	
		SB	102	1	$237,201		$26,261,662			110.72	
		SB	111	4	$241,370		$18,505,656			76.67	
		-	Central	-	$622,720		-			-	
2	4 (I-77 North)	NB	145	5	$253,218	$1,438.610	$17,365,283	$33,013,467	$479,537	68.58	22.96
		NB	147	7	$292,913		$14,029,769			47.9	
		SB	146	29	$268,759		$1,618,415			6.02	
		-	Central	-	$622,720		-			-	
3	6 (I-485 Southeast)	Inner	236	20	$281,998	$1,745,780	$3,323,980	$16,704,304	$436,445	11.80	9.57
		Inner	237	19	$280,779		$3,801,741			13.54	
		Outer	234	11	$280,314		$8,339,499			29.75	
		Outer	239	30	$279,970		$1,234,084			4.41	
		-	Central	-	$622,720		-			-	
4	1 (I-85 South Gaston County)	NB	32	26	$222,099	$1,352,955	$1,666,535	$11,530,779	$450,985	7.50	8.52
		NB	34	22	$245,687		$2.495.389			10.16	
		SB	35	13	$262,458		$7,368,856			28.08	
		-	Central	-	$622,720		-			-	
5	5 (I-485 Southwest)	Inner	177	27	$315,328	$1,525,563	$2.385,718	$7,510,487	$508,521	7.57	4.92
		Inner	179	18	$294,368		$4,468,653			15.18	
		Inner	181	32	$293,146		$656,116			2.24	
		-	Central	-	$622,720		-			-	
6	2 (I-85 North Mecklenburg County)	NB	67	9	$278,775	$1,182,390	$9,716,756	$11,703,971	$591,195	34.86	9.90
		SB	64	28	$280,895		$1,987,216			7.07	
		-	Central	-	$622,720		-			-	

Table 8-2 Recommended Order for Ramp Meter Implementation – Location / Direction

Group	Direction	Sites	Site Rankings	Ten Year Individual Costs	Ten Year Total Costs	Ten Year Individual Benefits	Ten Year Total Benefits	Average Costs/Site for Group	Ten Year BCR	Combined BCR	Priority
3 (I-77 South)	NB	101	21	$294,827	$1,446,489	$3,023,996	$31,915,530	$482,163	10.26	22.06	3
	NB	103	17	$268,012		$5,248,933			19.58		
	NB	105	3	$260,930		$23,642,601			90.61		
	-	Central	-	$622,720		-			-		
	SB	93	6	$663,195	$1,764,486	$42,402,512	$87,169,830	$588,162	63.94	49.40	1
	SB	102	1	$237,201		$26,261,662			110.71		
	SB	111	4	$241,370		$18,505,656			76.67		
	-	Central	-	$622,720		-			-		
4 (I-77 North)	NB	145	5	$253,218	$1,168,851	$17,365,283	$31,395,052	$584,426	68.58	26.86	2
	NB	147	7	$292,913		$14,029,769			47.90		
	-	Central		$622,720		-			-		
	SB	146	29	$268,759	$891,479	$1,618,415	$1,618,415	$891,479	6.02	1.82	10
	-	Central	-	$622,720		-			-		
6 (I-485 Southeast)	Inner	236	20	$281,998	$1,185,497	$3,323,980	$7,125,721	$592,749	11.79	6.01	7
	Inner	237	19	$280,779		$3,801,741			13.54		
	-	Central	-	$622,720		-					
	Outer	234	11	$280,314	$1,183,004	$8,339,499	$9,573,583	$591,502	29.75	8.09	6
	Outer	239	30	$279,970		$1,234,084			4.41		
	-	Central	-	$622,720		-			-		
1 (I-85 South Gaston County)	NB	32	26	$222,099	$1,090,506	$1,666,535	$4,161,924	$545,253	7.50	3.82	9
	NB	34	22	$245,687		$2,495,389			10.16		
	-	Central	-	$622,720		-					
	SB	35	13	$262,458	$885,178	$7,368,856	$7,368,856	$885,178	28.08	8.32	5
	-	Central	-	$622,720		-			-		
5 (I-485 Southwest)	Inner	177	27	$315,328	$1,525,562	$2,385,718	$7,510,487	$508,521	7.57	4.92	8
	Inner	179	18	$294,368		$4,468,653			15.18		
	Inner	181	32	$293,146		$656,116			2.24		
	-	Central	-	$622,720		-			-		
2 (I-85 North Mecklenburg County)	NB	67	9	$278,775	$1,182,390	$9,716,756	$11,703,972	$591,195	34.86	9.90	4
	SB	64	28	$280,895		$1,987,216			7.07		
	-	Central	-	$622,720		-			-		

Appendix A. Detailed Implementation Site Costs

A.1. Site Cost Estimates

Each of the sites were evaluated and cost estimates were prepared looking at the following categories. As stated previously, site costs are impacted by the type of ramp, the mainline geometric conditions, and the existing ITS infrastructure, as well as the availability of power at each of the site locations.

Categories
Earthwork and Structure
Guardrail
Paving
Drainage
Signalization
Communications
Pavement Marking
Signing
SUBTOTAL CONSTRUCTION
Traffic Control
Contingencies
TOTAL CONSTRUCTION
Design
Construction Administration
TOTAL DESIGN AND CONSTRUCTION

A.1.1. Proposed One Lane Ramp Locations

A.1.1.1. Gaston County

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

030

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 30 **Ramp**: Cox Rd
Location: I-85 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	2027	$2.88	$5,837.76	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$5,837.76**	
Guardrail					
- Guardrail Rail	LF	0	$20.00	$0.00	
- Guardrail Approach End Treatment	EA	0	$1,725.00	$0.00	
SUBTOTAL				**$0.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	6	$453.68	$2,722.05	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 30 **Ramp**: Cox Rd
Location: I-85 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	12	$345.00	$4,140.00	
- Conduit (Trenched)	LF	2950	$6.90	$20,355.00	All purposes
- Conduit (Directional Drilled)	LF	1620	$16.10	$26,082.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	1500	$5.75	$8,625.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$103,431.80**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	1	$1,080.00	$1,080.00	
- Ethernet Switch	EA	1	$1,955.00	$1,955.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 30 **Ramp**: Cox Rd
Location: I-85 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$17,547.50**	
Pavement Marking					
- Pavement Marking Removal	LF	600	$0.71	$427.80	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	300	$1.09	$327.75	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	300	$1.09	$327.75	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,212.10**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$131,421.66**	
Traffic Control	15%			$19,713.25	
Contingencies	10%			$13,142.17	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 30 **Ramp**: Cox Rd
Location: I-85 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
TOTAL CONSTRUCTION				**$164,277.08**	
Design	8%			$13,142.17	
Construction Administration	10%			$16,427.71	
TOTAL DESIGN AND CONSTRUCTION				**$193,846.95**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

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Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 032 **Ramp**: S Main St. (Gaston Co.)
Location: I-85 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	1210	$2.88	$3,484.80	Seeding around trench, conduit runs, pull box, and foundation areas.
SUBTOTAL				**$3,484.80**	
Guardrail					
- Guardrail Rail	LF	0	$20.00	$0.00	
- Guardrail Approach End Treatment	EA	0	$1,725.00	$0.00	
SUBTOTAL				**$0.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	6	$453.68	$2,722.05	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	850	$1.73	$1,466.25	Assumed setback distance 350'
- Pullbox (Std.)	EA	12	$345.00	$4,140.00	
- Conduit (Trenched)	LF	1725	$6.90	$11,902.50	All purposes
- Conduit (Directional Drilled)	LF	340	$16.10	$5,474.00	Five ramp crossings,

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 032 **Ramp**: S Main St. (Gaston Co.)
Location: I-85 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
					multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	1000	$5.75	$5,750.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	540	$3.16	$1,707.75	
SUBTOTAL				**$70,607.93**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	0	$2,012.50	$0.00	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	1	$1,080.00	$1,080.00	
- Ethernet Switch	EA	1	$1,955.00	$1,955.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$15,535.00**	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 032 **Ramp**: S Main St. (Gaston Co.)
Location: I-85 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Pavement Marking					
- Pavement Marking Removal	LF	640	$0.71	$456.32	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	320	$1.09	$349.60	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	320	$1.09	$349.60	110' transitions, 100' narrowed lane
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,284.32**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$94,304.55**	
Traffic Control	15%			$14,145.68	
Contingencies	10%			$9,430.45	
TOTAL CONSTRUCTION				**$117,880.68**	
Design	8%			$9,430.45	
Construction Administration	10%			$11,788.07	
TOTAL DESIGN AND CONSTRUCTION				**$139,099.20**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

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Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 033 **Ramp**: McAdenville Rd
Location: I-85 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	1694	$2.88	$4,878.72	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$4,878.72**	
Guardrail					
- Guardrail Rail	LF	300	$20.00	$6,000.00	
- Guardrail Approach End Treatment	EA	1	$1,725.00	$1,725.00	
SUBTOTAL				**$7,725.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	6	$453.68	$2,722.05	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	12	$345.00	$4,140.00	
- Conduit (Trenched)	LF	2450	$6.90	$16,905.00	All purposes

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 033 **Ramp**: McAdenville Rd
Location: I-85 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Conduit (Directional Drilled)	LF	1120	$16.10	$18,032.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	1000	$5.75	$5,750.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$89,056.80**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	1	$1,080.00	$1,080.00	
- Ethernet Switch	EA	1	$1,955.00	$1,955.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 033 **Ramp**: McAdenville Rd
Location: I-85 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
SUBTOTAL				**$17,547.50**	
Pavement Marking					
- Pavement Marking Removal	LF	500	$0.71	$356.50	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	250	$1.09	$273.13	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	250	$1.09	$273.13	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,031.55**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$123,632.07**	
Traffic Control	15%			$18,544.81	
Contingencies	10%			$12,363.21	
TOTAL CONSTRUCTION				**$154,540.09**	
Design	8%			$12,363.21	
Construction Administration	10%			$15,454.01	
TOTAL DESIGN AND CONSTRUCTION				**$182,357.30**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

034

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 034 **Ramp**: McAdenville Rd
Location: I-85 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	1294	$2.88	$3,726.72	Seeding around trench, conduit runs, pull box, and foundation areas.
SUBTOTAL				**$3,726.72**	
Guardrail					
- Guardrail Rail	LF	500	$20.00	$10,000.00	
- Guardrail Approach End Treatment	EA	2	$1,725.00	$3,450.00	
SUBTOTAL				**$13,450.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	6	$453.68	$2,722.05	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	850	$1.73	$1,466.25	Assumed setback distance 350'
Pullbox (Std.)	EA	12	$345.00	$4,140.00	
- Conduit (Trenched)	LF	1850	$6.90	$12,765.00	All purposes
- Conduit (Directional Drilled)	LF	340	$16.10	$5,474.00	Five ramp crossings,

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 034 **Ramp**: McAdenville Rd
Location: I-85 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
					multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	1250	$5.75	$7,187.50	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	540	$3.16	$1,707.75	
SUBTOTAL				**$72,907.93**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	0	$2,012.50	$0.00	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	1	$1,080.00	$1,080.00	
- Ethernet Switch	EA	1	$1,955.00	$1,955.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$15,535.00**	
Pavement Marking					

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 034 **Ramp**: McAdenville Rd
Location: I-85 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Pavement Marking Removal	LF	640	$0.71	$456.32	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	320	$1.09	$349.60	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	320	$1.09	$349.60	110' transitions, 100' narrowed lane
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,284.32**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$110,296.47**	
Traffic Control	15%			$16,544.47	
Contingencies	10%			$11,029.65	
TOTAL CONSTRUCTION				**$137,870.58**	
Design	8%			$11,029.65	
Construction Administration	10%			$13,787.06	
TOTAL DESIGN AND CONSTRUCTION				**$162,687.29**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

035

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 035 **Ramp**: Belmont-Mt. Holly Rd (Gaston Co.)
Location: I-85 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	1	$300.00	$ 300.00	
- Seeding	SY	6294	$2.88	$18,126.72	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$18,426.72**	
Guardrail					
- Guardrail Rail	LF	0	$20.00	$0.00	
- Guardrail Approach End Treatment	EA	0	$1,725.00	$0.00	
SUBTOTAL				**$0.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	6	$453.68	$2,722.05	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	850	$1.73	$1,466.25	Assumed setback distance 350'
- Pullbox (Std.)	EA	12	$345.00	$4,140.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 035 **Ramp**: Belmont-Mt. Holly Rd (Gaston Co.)
Location: I-85 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Conduit (Trenched)	LF	2090	$6.90	$14,421.00	All purposes
- Conduit (Directional Drilled)	LF	730	$16.10	$11,753.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	1630	$5.75	$9,372.50	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	540	$3.16	$1,707.75	
SUBTOTAL				**$83,027.93**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	0	$2,012.50	$0.00	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	1	$1,080.00	$1,080.00	
- Ethernet Switch	EA	1	$1,955.00	$1,955.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 035 **Ramp**: Belmont-Mt. Holly Rd (Gaston Co.)
Location: I-85 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$15,535.00**	
Pavement Marking					
- Pavement Marking Removal	LF	640	$0.71	$456.32	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	320	$1.09	$349.60	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	320	$1.09	$349.60	110' transitions, 100' narrowed lane
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,284.32**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$121,666.47**	
Traffic Control	15%			$18,249.97	
Contingencies	10%			$12,166.65	
TOTAL CONSTRUCTION				**$152,083.08**	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 035 **Ramp**: Belmont-Mt. Holly Rd (Gaston Co.)
Location: I-85 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Design	8%			$12,166.65	
Construction Administration	10%			$15,208.31	
TOTAL DESIGN AND CONSTRUCTION				**$179,458.04**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

037

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 37 **Ramp**: Beatty Dr / Park St
Location: I-85 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	2402	$2.88	$6,917.76	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$6,917.76**	
Guardrail					
- Guardrail Rail	LF	0	$20.00	$0.00	
- Guardrail Approach End Treatment	EA	0	$1,725.00	$0.00	
SUBTOTAL				**$0.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	8	$453.68	$3,629.40	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	14	$345.00	$4,830.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 37 **Ramp**: Beatty Dr / Park St
Location: I-85 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Conduit (Trenched)	LF	3500	$6.90	$24,150.00	All purposes
- Conduit (Directional Drilled)	LF	1620	$16.10	$26,082.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	2000	$5.75	$11,500.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$111,699.15**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	1	$1,080.00	$1,080.00	
- Ethernet Switch	EA	1	$1,955.00	$1,955.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 37 **Ramp**: Beatty Dr / Park St
Location: I-85 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$17,547.50**	
Pavement Marking					
- Pavement Marking Removal	LF	1000	$0.71	$713.00	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	500	$1.09	$546.25	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	500	$1.09	$546.25	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,934.30**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$141,491.21**	
Traffic Control	15%			$21,223.68	
Contingencies	10%			$14,149.12	
TOTAL CONSTRUCTION				**$176,864.01**	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 37 **Ramp**: Beatty Dr / Park St
Location: I-85 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Design	8%			$14,149.12	
Construction Administration	10%			$17,686.40	
TOTAL DESIGN AND CONSTRUCTION				**$208,699.53**	

A.1.1.2. Iredell County

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

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Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 148 **Ramp:** Langtree Rd
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	2019	$2.88	$5,814.72	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$5,814.72**	
Guardrail					
- Guardrail Rail	LF	0	$20.00	$0.00	
- Guardrail Approach End Treatment	EA	0	$1,725.00	$0.00	
SUBTOTAL				**$0.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	4	$453.68	$1,814.70	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	10	$345.00	$3,450.00	
- Conduit (Trenched)	LF	2950	$6.90	$20,355.00	All purposes

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 148 **Ramp:** Langtree Rd
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Conduit (Directional Drilled)	LF	1620	$16.10	$26,082.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	2000	$5.75	$11,500.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$104,709.45**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	1	$1,080.00	$1,080.00	
- Ethernet Switch	EA	1	$1,955.00	$1,955.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$17,547.50**	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 148 **Ramp:** Langtree Rd
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Pavement Marking					
- Pavement Marking Removal	LF	1000	$0.71	$713.00	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	500	$1.09	$546.25	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	500	$1.09	$546.25	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,934.30**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$133,398.47**	
Traffic Control	15%			$20,009.77	
Contingencies	10%			$13,339.85	
TOTAL CONSTRUCTION				**$166,748.09**	
Design	8%			$13,339.85	
Construction Administration	10%			$16,674.81	
TOTAL DESIGN AND CONSTRUCTION				**$196,762.74**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

149

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 149 **Ramp:** Langtree Rd
Location: I-77 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	2952	$2.88	$8,501.76	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$8,501.76**	
Guardrail					
- Guardrail Rail	LF	0	$20.00	$0.00	
- Guardrail Approach End Treatment	EA	0	$1,725.00	$0.00	
SUBTOTAL				**$0.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	4	$453.68	$1,814.70	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	10	$345.00	$3,450.00	
- Conduit (Trenched)	LF	4350	$6.90	$30,015.00	All purposes
- Conduit (Directional Drilled)	LF	1120	$16.10	$18,032.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 149 **Ramp:** Langtree Rd
Location: I-77 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Electrical Conductors	LF	4800	$5.75	$27,600.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$122,419.45**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	1	$1,080.00	$1,080.00	
- Ethernet Switch	EA	1	$1,955.00	$1,955.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$17,547.50**	
Pavement Marking					
- Pavement Marking Removal	LF	2000	$0.71	$1,426.00	40 MPH design speed. 110' transitions, 100' narrowed lane

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 149 **Ramp:** Langtree Rd
Location: I-77 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	1000	$1.09	$1,092.50	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	1000	$1.09	$1,092.50	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$3,739.80**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$155,601.01**	
Traffic Control	15%			$23,340.15	
Contingencies	10%			$15,560.10	
TOTAL CONSTRUCTION				**$194,501.26**	
Design	8%			$15,560.10	
Construction Administration	10%			$19,450.13	
TOTAL DESIGN AND CONSTRUCTION				**$229,511.49**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

150

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 150 **Ramp:** Williamson Rd / US 21 / Charlotte Hwy

Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	1860	$2.88	$5,356.80	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$5,356.80**	
Guardrail					
- Guardrail Rail	LF	0	$20.00	$0.00	
- Guardrail Approach End Treatment	EA	0	$1,725.00	$0.00	
SUBTOTAL				**$0.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	6	$453.68	$2,722.05	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	12	$345.00	$4,140.00	
- Conduit (Trenched)	LF	2700	$6.90	$18,630.00	All purposes
- Conduit (Directional Drilled)	LF	1370	$16.10	$22,057.00	Five ramp crossings, multiple conduits

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 150 **Ramp:** Williamson Rd / US 21 / Charlotte Hwy

Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	1500	$5.75	$8,625.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$97,681.80**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	1	$1,080.00	$1,080.00	
- Ethernet Switch	EA	1	$1,955.00	$1,955.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$17,547.50**	
Pavement Marking					

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 150 **Ramp:** Williamson Rd / US 21 / Charlotte Hwy

Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Pavement Marking Removal	LF	750	$0.71	$534.75	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	375	$1.09	$409.69	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	375	$1.09	$409.69	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,482.93**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$125,461.53**	
Traffic Control	15%			$18,819.23	
Contingencies	10%			$12,546.15	
TOTAL CONSTRUCTION				**$156,826.91**	
Design	8%			$12,546.15	
Construction Administration	10%			$15,682.69	
TOTAL DESIGN AND CONSTRUCTION				**$185,055.75**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

153

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 153 **Ramp:** SR 1100 - Brawley School Road
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	1886	$2.88	$5,431.68	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$5,431.68**	
Guardrail					
- Guardrail Rail	LF	0	$20.00	$0.00	
- Guardrail Approach End Treatment	EA	0	$1,725.00	$0.00	
SUBTOTAL				**$0.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	4	$453.68	$1,814.70	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	10	$345.00	$3,450.00	
- Conduit (Trenched)	LF	2750	$6.90	$18,975.00	All purposes
- Conduit (Directional Drilled)	LF	1420	$16.10	$22,862.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 153 **Ramp:** SR 1100 - Brawley School Road
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Electrical Conductors	LF	1600	$5.75	$9,200.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$97,809.45**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	1	$1,080.00	$1,080.00	
- Ethernet Switch	EA	1	$1,955.00	$1,955.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$17,547.50**	
Pavement Marking					
- Pavement Marking Removal	LF	800	$0.71	$570.40	40 MPH design speed. 110'

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 153 **Ramp:** SR 1100 - Brawley School Road
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
					transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	400	$1.09	$437.00	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	400	$1.09	$437.00	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,573.20**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$125,754.33**	
Traffic Control	15%			$18,863.15	
Contingencies	10%			$12,575.43	
TOTAL CONSTRUCTION				**$157,192.91**	
Design	8%			$12,575.43	
Construction Administration	10%			$15,719.29	
TOTAL DESIGN AND CONSTRUCTION				**$185,487.64**	

A.1.1.3. Mecklenburg County

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

075

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 075 **Ramp:** Mallard Creek Church Rd (Mecklenburg Co.)
Location: I-85 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	1750	$2.88	$5,040.00	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$5,040.00**	
Guardrail					
- Guardrail Rail	LF	350	$20.00	$7,000.00	
- Guardrail Approach End Treatment	EA	1	$1,725.00	$1,725.00	
SUBTOTAL				**$8,725.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	8	$453.68	$3,629.40	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	900	$1.73	$1,552.50	Assumed setback distance 350'
- Pullbox (Std.)	EA	14	$345.00	$4,830.00	
- Conduit (Trenched)	LF	2850	$6.90	$19,665.00	All purposes

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 075 **Ramp:** Mallard Creek Church Rd (Mecklenburg Co.)
Location: I-85 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Conduit (Directional Drilled)	LF	1810	$16.10	$29,141.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	1500	$5.75	$8,625.00	
- Ground Rods	EA	8	$82.00	$656.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	590	$3.16	$1,865.88	
SUBTOTAL				**$106,918.15**	
Communications					
- Splice Enclosure	EA	1	$1,150.00	$1,150.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	1	$1,725.00	$1,725.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	500	$1.73	$862.50	Drop cable to controller cabinet
- Tracer Wire	LF	500	$14.00	$7,000.00	
- Broadband Internet Service	LS	0	$1,080.00	$0.00	
- Ethernet Switch	EA	0	$1,955.00	$0.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 075 **Ramp:** Mallard Creek Church Rd (Mecklenburg Co.)
Location: I-85 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$25,250.00**	
Pavement Marking					
- Pavement Marking Removal	LF	900	$0.71	$641.70	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	425	$1.09	$464.31	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	425	$1.09	$464.31	110' transitions, 100' narrowed lane
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,699.13**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$151,024.78**	
Traffic Control			15%	$22,653.72	
Contingencies			10%	$15,102.48	
TOTAL CONSTRUCTION				**$188,780.97**	
Design			8%	$15,102.48	
Construction Administration			10%	$18,878.10	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 075 **Ramp:** Mallard Creek Church Rd (Mecklenburg Co.)
Location: I-85 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
TOTAL DESIGN AND CONSTRUCTION				**$222,761.54**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

099

Typical Design and Construction Costs

Single Lane Ramp Meter

Log No.: 99 **Ramp**: Arrowood Rd
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	2019	$2.88	$5,814.72	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$5,814.72**	
Guardrail					
- Guardrail Rail	LF	300	$20.00	$6,000.00	
- Guardrail Approach End Treatment	EA	1	$1,725.00	$1,725.00	
SUBTOTAL				**$7,725.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	4	$453.68	$1,814.70	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	10	$345.00	$3,450.00	
- Conduit (Trenched)	LF	2950	$6.90	$20,355.00	All purposes

Typical Design and Construction Costs

Single Lane Ramp Meter

Log No.: 99 **Ramp**: Arrowood Rd
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Conduit (Directional Drilled)	LF	2120	$16.10	$34,132.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	2000	$5.75	$11,500.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$112,759.45**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	0	$2,012.50	$0.00	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	0	$1,080.00	$0.00	
- Ethernet Switch	EA	0	$1,955.00	$0.00	
- CCTV Pole (55' Wood)	EA	0	$4,600.00	$0.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	0	$3,300.00	$0.00	
- CCTV Assembly	EA	0	$4,600.00	$0.00	

Typical Design and Construction Costs

Single Lane Ramp Meter

Log No.: 99 **Ramp**: Arrowood Rd
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
SUBTOTAL				**$0.00**	
Pavement Marking					
- Pavement Marking Removal	LF	750	$0.71	$534.75	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	375	$1.09	$409.69	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	375	$1.09	$409.69	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,482.93**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$131,174.60**	
Traffic Control	15%			$19,676.19	
Contingencies	10%			$13,117.46	
TOTAL CONSTRUCTION				**$163,968.24**	
Design	8%			$13,117.46	
Construction Administration	10%			$16,396.82	
TOTAL DESIGN AND CONSTRUCTION				**$193,482.53**	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 101 **Ramp**: Arrowood Rd (Mecklenburg Co.)
Location: I-77 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	2077	$2.88	$5,981.76	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$5,981.76**	
Guardrail					
- Guardrail Rail	LF	350	$20.00	$7,000.00	
- Guardrail Approach End Treatment	EA	1	$1,725.00	$1,725.00	
SUBTOTAL				**$8,725.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	6	$453.68	$2,722.05	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	850	$1.73	$1,466.25	Assumed setback distance 350'
- Pullbox (Std.)	EA	12	$345.00	$4,140.00	
- Conduit (Trenched)	LF	3025	$6.90	$20,872.50	All purposes
- Conduit (Directional Drilled)	LF	1320	$16.10	$21,252.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	3000	$5.75	$17,250.00	
- Ground Rods	EA	6	$82.00	$492.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 101 **Ramp**: Arrowood Rd (Mecklenburg Co.)
Location: I-77 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$107,140.55**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	0	$2,012.50	$0.00	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	1	$1,080.00	$1,080.00	
- Ethernet Switch	EA	1	$1,955.00	$1,955.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$15,535.00**	
Pavement Marking					
- Pavement Marking Removal	LF	1500	$0.71	$1,069.50	40 MPH design speed. 110' transitions, 100' narrowed lane

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 101 **Ramp**: Arrowood Rd (Mecklenburg Co.)
Location: I-77 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	750	$1.09	$819.38	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	750	$1.09	$819.38	110' transitions, 100' narrowed lane
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$2,837.05**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$143,611.86**	
Traffic Control	15%			$21,541.78	
Contingencies	10%			$14,361.19	
TOTAL CONSTRUCTION				**$179,514.83**	
Design	8%			$14,361.19	
Construction Administration	10%			$17,951.48	
TOTAL DESIGN AND CONSTRUCTION				**$211,827.49**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 102 **Ramp**: Nations Ford Rd (Mecklenburg Co.)
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	2077	$2.88	$5,981.76	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$5,981.76**	
Guardrail					
- Guardrail Rail	LF	0	$20.00	$0.00	
- Guardrail Approach End Treatment	EA	0	$1,725.00	$0.00	
SUBTOTAL				**$0.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	6	$453.68	$2,722.05	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	850	$1.73	$1,466.25	Assumed setback distance 350'
- Pullbox (Std.)	EA	12	$345.00	$4,140.00	
- Conduit (Trenched)	LF	3025	$6.90	$20,872.50	All purposes
- Conduit (Directional Drilled)	LF	1020	$16.10	$16,422.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	1500	$5.75	$8,625.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 102 **Ramp**: Nations Ford Rd (Mecklenburg Co.)
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$93,685.55**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	0	$2,012.50	$0.00	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	0	$1,080.00	$0.00	
- Ethernet Switch	EA	0	$1,955.00	$0.00	
- CCTV Pole (55' Wood)	EA	0	$4,600.00	$0.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	0	$3,300.00	$0.00	
- CCTV Assembly	EA	0	$4,600.00	$0.00	
SUBTOTAL				**$0.00**	
Pavement Marking					
- Pavement Marking Removal	LF	750	$0.71	$534.75	40 MPH design speed. 110'

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 102 **Ramp**: Nations Ford Rd (Mecklenburg Co.)
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
					transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	375	$1.09	$409.69	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	375	$1.09	$409.69	110' transitions, 100' narrowed lane
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,482.93**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$104,542.74**	
Traffic Control	15%			$15,681.41	
Contingencies	10%			$10,454.27	
TOTAL CONSTRUCTION				**$130,678.42**	
Design	8%			$10,454.27	
Construction Administration	10%			$13,067.84	
TOTAL DESIGN AND CONSTRUCTION				**$154,200.53**	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 103 **Ramp:** Nations Ford Rd (Mecklenburg Co.)
Location: I-77Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	1250	$2.88	$3,600.00	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$3,600.00**	
Guardrail					
- Guardrail Rail	LF	500	$20.00	$10,000.00	
- Guardrail Approach End Treatment	EA	2	$1,725.00	$3,450.00	
SUBTOTAL				**$13,450.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	6	$453.68	$2,722.05	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	850	$1.73	$1,466.25	Assumed setback distance 350'
- Pullbox (Std.)	EA	12	$345.00	$4,140.00	
- Conduit (Trenched)	LF	2225	$6.90	$15,352.50	All purposes
- Conduit (Directional Drilled)	LF	1020	$16.10	$16,422.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 103 **Ramp:** Nations Ford Rd (Mecklenburg Co.)
Location: I-77Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Electrical Conductors	LF	1200	$5.75	$6,900.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$517.50	$517.50	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$1,400.00	$2,800.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$80,918.05**	
Communications					
- Splice Enclosure	EA	1	$1,150.00	$1,150.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	1	$1,725.00	$1,725.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	350	$1.73	$603.75	Drop cable to controller cabinet
- Tracer Wire	LF	350	$14.00	$4,900.00	
- Broadband Internet Service	LS	0	$1,080.00	$0.00	
- Ethernet Switch	EA	0	$1,955.00	$0.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$22,891.25**	
Pavement Marking					

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 103 **Ramp:** Nations Ford Rd (Mecklenburg Co.)
Location: I-77Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Pavement Marking Removal	LF	600	$0.71	$427.80	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	300	$1.09	$327.75	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	300	$1.09	$327.75	110' transitions, 100' narrowed lane
- 24" Stop Bar	LF	12	$8.05	$96.60	
SUBTOTAL				**$1,179.90**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$125,431.70**	
Traffic Control			15%	$18,814.76	
Contingencies			10%	$12,543.17	
TOTAL CONSTRUCTION				**$156,789.63**	
Design			8%	$12,543.17	
Construction Administration			10%	$15,678.96	
TOTAL DESIGN AND CONSTRUCTION				**$185,011.76**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

104

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 104 **Ramp:** Tyvola Road
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	2510	$2.88	$7,228.80	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$7,228.80**	
Guardrail					
- Guardrail Rail	LF	0	$20.00	$0.00	
- Guardrail Approach End Treatment	EA	0	$1,725.00	$0.00	
SUBTOTAL				**$0.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	6	$453.68	$2,722.05	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	850	$1.73	$1,466.25	Assumed setback distance 350'
- Pullbox (Std.)	EA	12	$345.00	$4,140.00	
- Conduit (Trenched)	LF	3675	$6.90	$25,357.50	All purposes

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 104 **Ramp:** Tyvola Road
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Conduit (Directional Drilled)	LF	2670	$16.10	$42,987.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	3000	$5.75	$17,250.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	540	$3.16	$1,707.75	
SUBTOTAL				**$133,075.93**	
Communications					
- Splice Enclosure	EA	1	$1,150.00	$1,150.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	1	$1,725.00	$1,725.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	750	$1.73	$1,293.75	Drop cable to controller cabinet
- Tracer Wire	LF	750	$14.00	$10,500.00	
- Broadband Internet Service	LS	0	$1,080.00	$0.00	
- Ethernet Switch	EA	0	$1,955.00	$0.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 104 **Ramp:** Tyvola Road
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
SUBTOTAL				**$29,181.25**	
Pavement Marking					
- Pavement Marking Removal	LF	1500	$0.71	$1,069.50	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	750	$1.09	$819.38	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	750	$1.09	$819.38	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$2,837.05**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$175,715.53**	
Traffic Control			15%	$26,357.33	
Contingencies			10%	$17,571.55	
TOTAL CONSTRUCTION				**$219,644.41**	
Design			8%	$17,571.55	
Construction Administration			10%	$21,964.44	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 104 **Ramp:** Tyvola Road
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
TOTAL DESIGN AND CONSTRUCTION				**$259,180.40**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 105 **Ramp**: Tyvola Rd (Mecklenburg Co.)
Location: I-77Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	1877	$2.88	$5,405.76	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$5,405.76**	
Guardrail					
- Guardrail Rail	LF	350	$20.00	$7,000.00	
- Guardrail Approach End Treatment	EA	1	$1,725.00	$1,725.00	
SUBTOTAL				**$8,725.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	6	$453.68	$2,722.05	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	850	$1.73	$1,466.25	Assumed setback distance 350'
- Pullbox (Std.)	EA	12	$345.00	$4,140.00	
- Conduit (Trenched)	LF	2725	$6.90	$18,802.50	All purposes
- Conduit (Directional Drilled)	LF	1020	$16.10	$16,422.00	Five ramp crossings,

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 105 **Ramp**: Tyvola Rd (Mecklenburg Co.)
Location: I-77Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
					multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	2400	$5.75	$13,800.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$96,790.55**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	0	$2,012.50	$0.00	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	0	$1,080.00	$0.00	
- Ethernet Switch	EA	0	$1,955.00	$0.00	
- CCTV Pole (55' Wood)	EA	0	$4,600.00	$0.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	0	$3,300.00	$0.00	
- CCTV Assembly	EA	0	$4,600.00	$0.00	
SUBTOTAL				**$0.00**	
Pavement Marking					

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 105 **Ramp**: Tyvola Rd (Mecklenburg Co.)
Location: I-77Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Pavement Marking Removal	LF	750	$0.71	$534.75	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	15	$5.18	$77.63	
- White Edge Line	LF	2400	$1.09	$2,622.00	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	2400	$1.09	$2,622.00	110' transitions, 100' narrowed lane
- White Skip Line	LF	1200	$0.28	$331.20	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$6,316.38**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$120,630.19**	
Traffic Control	15%			$18,094.53	
Contingencies	10%			$12,063.02	
TOTAL CONSTRUCTION				**$150,787.73**	
Design	8%			$12,063.02	
Construction Administration	10%			$15,078.77	
TOTAL DESIGN AND CONSTRUCTION				**$177,929.52**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 109 **Ramp**: Clanton Rd
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	2027	$2.88	$5,837.76	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$5,837.76**	
Guardrail					
- Guardrail Rail	LF	300	$20.00	$6,000.00	
- Guardrail Approach End Treatment	EA	1	$1,725.00	$1,725.00	
SUBTOTAL				**$7,725.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	6	$453.68	$2,722.05	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	12	$345.00	$4,140.00	
- Conduit (Trenched)	LF	2950	$6.90	$20,355.00	All purposes
- Conduit (Directional Drilled)	LF	1620	$16.10	$26,082.00	Five ramp crossings,

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 109 **Ramp**: Clanton Rd
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
					multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	1200	$5.75	$6,900.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$101,706.80**	
Communications					
- Splice Enclosure	EA	1	$1,150.00	$1,150.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	1	$1,725.00	$1,725.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	250	$1.73	$431.25	Drop cable to controller cabinet
- Tracer Wire	LF	250	$14.00	$3,500.00	
- Broadband Internet Service	LS	0	$1,080.00	$0.00	
- Ethernet Switch	EA	0	$1,955.00	$0.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$21,318.75**	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 109 **Ramp**: Clanton Rd
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Pavement Marking					
- Pavement Marking Removal	LF	600	$0.71	$427.80	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	300	$1.09	$327.75	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	300	$1.09	$327.75	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,212.10**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$141,192.91**	
Traffic Control	15%			$21,178.94	
Contingencies	10%			$14,119.29	
TOTAL CONSTRUCTION				**$176,491.14**	
Design	8%			$14,119.29	
Construction Administration	10%			$17,649.11	
TOTAL DESIGN AND CONSTRUCTION				**$208,259.54**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

111

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 111 **Ramp**: Remount Rd (Mecklenburg Co.)
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	2177	$2.88	$6,269.76	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$6,269.76**	
Guardrail					
- Guardrail Rail	LF	0	$20.00	$0.00	
- Guardrail Approach End Treatment	EA	0	$1,725.00	$0.00	
SUBTOTAL				**$0.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	6	$453.68	$2,722.05	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	850	$1.73	$1,466.25	Assumed setback distance 350'
- Pullbox (Std.)	EA	12	$345.00	$4,140.00	
- Conduit (Trenched)	LF	3175	$6.90	$21,907.50	All purposes
- Conduit (Directional Drilled)	LF	820	$16.10	$13,202.00	Five ramp crossings,

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 111 **Ramp**: Remount Rd (Mecklenburg Co.)
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
					multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	2400	$5.75	$13,800.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$96,675.55**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	0	$2,012.50	$0.00	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	0	$1,080.00	$0.00	
- Ethernet Switch	EA	0	$1,955.00	$0.00	
- CCTV Pole (55' Wood)	EA	0	$4,600.00	$0.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	0	$3,300.00	$0.00	
- CCTV Assembly	EA	0	$4,600.00	$0.00	
SUBTOTAL				**$0.00**	
Pavement Marking					

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 111 **Ramp**: Remount Rd (Mecklenburg Co.)
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Pavement Marking Removal	LF	500	$0.71	$356.50	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	250	$1.09	$273.13	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	250	$1.09	$273.13	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,031.55**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$107,369.36**	
Traffic Control	15%			$16,105.40	
Contingencies	10%			$10,736.94	
TOTAL CONSTRUCTION				**$134,211.70**	
Design	8%			$10,736.94	
Construction Administration	10%			$13,421.17	
TOTAL DESIGN AND CONSTRUCTION				**$158,369.81**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

117

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 117 **Ramp**: West Trade St (Loop)
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	2502	$2.88	$7,205.76	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$7,205.76**	
Guardrail					
- Guardrail Rail	LF	0	$20.00	$0.00	
- Guardrail Approach End Treatment	EA	0	$1,725.00	$0.00	
SUBTOTAL				**$0.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	8	$453.68	$3,629.40	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	14	$345.00	$4,830.00	
- Conduit (Trenched)	LF	3650	$6.90	$25,185.00	All purposes
- Conduit (Directional Drilled)	LF	2320	$16.10	$37,352.00	Five ramp crossings,

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 117 **Ramp**: West Trade St (Loop)
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
					multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	2400	$5.75	$13,800.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$126,304.15**	
Communications					
- Splice Enclosure	EA	1	$1,150.00	$1,150.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	1	$1,725.00	$1,725.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	500	$1.73	$862.50	Drop cable to controller cabinet
- Tracer Wire	LF	500	$14.00	$7,000.00	
- Broadband Internet Service	LS	0	$1,080.00	$0.00	
- Ethernet Switch	EA	0	$1,955.00	$0.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$25,250.00**	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 117 **Ramp**: West Trade St (Loop)
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Pavement Marking					
- Pavement Marking Removal	LF	600	$0.71	$427.80	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	300	$1.09	$327.75	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	300	$1.09	$327.75	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,212.10**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$163,364.51**	
Traffic Control	15%			$24,504.68	
Contingencies	10%			$16,336.45	
TOTAL CONSTRUCTION				**$204,205.64**	
Design	8%			$16,336.45	
Construction Administration	10%			$20,420.56	
TOTAL DESIGN AND CONSTRUCTION				**$240,962.65**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

140

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 140 **Ramp**: Gilead Street
Location: I-77 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	2769	$2.88	$7,974.72	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$7,974.72**	
Guardrail					
- Guardrail Rail	LF	250	$20.00	$5,000.00	
- Guardrail Approach End Treatment	EA	1	$1,725.00	$1,725.00	
SUBTOTAL				**$6,725.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	4	$453.68	$1,814.70	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	10	$345.00	$3,450.00	
- Conduit (Trenched)	LF	4075	$6.90	$28,117.50	All purposes
- Conduit (Directional Drilled)	LF	1420	$16.10	$22,862.00	Five ramp crossings, multiple conduits

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 140 **Ramp**: Gilead Street
Location: I-77 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	2400	$5.75	$13,800.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$111,551.95**	
Communications					
- Splice Enclosure	EA	1	$1,150.00	$1,150.00	Link to SMFO
- Pullbox (Special Size)	EA	0	$2,012.50	$0.00	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	1	$1,725.00	$1,725.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	500	$1.73	$862.50	Drop cable to controller cabinet
- Tracer Wire	LF	500	$14.00	$7,000.00	
- Broadband Internet Service	LS	0	$1,080.00	$0.00	
- Ethernet Switch	EA	0	$1,955.00	$0.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$23,237.50**	
Pavement Marking					
- Pavement Marking Removal	LF	500	$0.71	$356.50	40 MPH design speed. 110'

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 140 **Ramp**: Gilead Street
Location: I-77 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
					transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	250	$1.09	$273.13	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	250	$1.09	$273.13	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,031.55**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$153,913.22**	
Traffic Control	15%			$23,086.98	
Contingencies	10%			$15,391.32	
TOTAL CONSTRUCTION				**$192,391.53**	
Design	8%			$15,391.32	
Construction Administration	10%			$19,239.15	
TOTAL DESIGN AND CONSTRUCTION				**$227,022.00**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 143 **Ramp:** NC 73 (Sam Furr Road)
Location: I-77 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	2236	$2.88	$6,439.68	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$6,439.68**	
Guardrail					
- Guardrail Rail	LF	500	$20.00	$10,000.00	
- Guardrail Approach End Treatment	EA	1	$1,725.00	$1,725.00	
SUBTOTAL				**$11,725.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	4	$453.68	$1,814.70	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	10	$345.00	$3,450.00	
- Conduit (Trenched)	LF	3275	$6.90	$22,597.50	All purposes
- Conduit (Directional Drilled)	LF	1370	$16.10	$22,057.00	Five ramp crossings, multiple conduits

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 143 **Ramp:** NC 73 (Sam Furr Road)
Location: I-77 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	2000	$5.75	$11,500.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$102,926.95**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	0	$2,012.50	$0.00	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	1	$1,080.00	$1,080.00	
- Ethernet Switch	EA	1	$1,955.00	$1,955.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$15,535.00**	
Pavement Marking					
- Pavement Marking Removal	LF	500	$0.71	$356.50	40 MPH design speed. 110'

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 143 **Ramp:** NC 73 (Sam Furr Road)
Location: I-77 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
					transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	250	$1.09	$273.13	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	250	$1.09	$273.13	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,031.55**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$141,050.68**	
Traffic Control	15%			$21,157.60	
Contingencies	10%			$14,105.07	
TOTAL CONSTRUCTION				**$176,313.35**	
Design	8%			$14,105.07	
Construction Administration	10%			$17,631.34	
TOTAL DESIGN AND CONSTRUCTION				**$208,049.75**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

145

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 145 **Ramp:** US 21 (Catawba Avenue)
Location: I-77 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	1500	$2.88	$4,320.00	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$4,320.00**	
Guardrail					
- Guardrail Rail	LF	500	$20.00	$10,000.00	
- Guardrail Approach End Treatment	EA	2	$1,725.00	$3,450.00	
SUBTOTAL				**$13,450.00**	
Drainage					
- Pipe	LF	50	$60.00	$3,000.00	Extend existing
SUBTOTAL				**$3,000.00**	
Signalization					
- 6x6' loops - Mainline	EA	4	$453.68	$1,814.70	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	10	$345.00	$3,450.00	
- Conduit (Trenched)	LF	3900	$6.90	$26,910.00	All purposes

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 145 **Ramp:** US 21 (Catawba Avenue)
Location: I-77 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Conduit (Directional Drilled)	LF	340	$16.10	$5,474.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	2000	$5.75	$11,500.00	
- Ground Rods	EA	4	$82.00	$328.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	540	$3.16	$1,707.75	
SUBTOTAL				**$90,207.83**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	0	$2,012.50	$0.00	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	0	$1,080.00	$0.00	
- Ethernet Switch	EA	0	$1,955.00	$0.00	
- CCTV Pole (55' Wood)	EA	0	$4,600.00	$0.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	0	$3,300.00	$0.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 145 **Ramp:** US 21 (Catawba Avenue)
Location: I-77 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- CCTV Assembly	EA	0	$4,600.00	$0.00	
SUBTOTAL				**$0.00**	
Pavement Marking					
- Pavement Marking Removal	LF	500	$0.71	$356.50	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	250	$1.09	$273.13	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	250	$1.09	$273.13	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,031.55**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$115,401.88**	
Traffic Control			15%	$17,310.28	
Contingencies			10%	$11,540.19	
TOTAL CONSTRUCTION				**$144,252.34**	
Design			8%	$11,540.19	
Construction Administration			10%	$14,425.23	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 145 **Ramp:** US 21 (Catawba Avenue)
Location: I-77 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
TOTAL DESIGN AND CONSTRUCTION				**$170,217.77**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

146

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 146 **Ramp:** Goodrum Rd / Griffith St
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	2586	$2.88	$7,447.68	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$7,447.68**	
Guardrail					
- Guardrail Rail	LF	500	$20.00	$10,000.00	
- Guardrail Approach End Treatment	EA	2	$1,725.00	$3,450.00	
SUBTOTAL				**$13,450.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	4	$453.68	$1,814.70	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	10	$345.00	$3,450.00	
- Conduit (Trenched)	LF	3800	$6.90	$26,220.00	All purposes

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 146 **Ramp:** Goodrum Rd / Griffith St
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Conduit (Directional Drilled)	LF	340	$16.10	$5,474.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	1200	$5.75	$6,900.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	540	$3.16	$1,707.75	
SUBTOTAL				**$85,081.83**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	0	$2,012.50	$0.00	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	1	$1,080.00	$1,080.00	
- Ethernet Switch	EA	1	$1,955.00	$1,955.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 146 **Ramp:** Goodrum Rd / Griffith St
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
SUBTOTAL				**$15,535.00**	
Pavement Marking					
- Pavement Marking Removal	LF	500	$0.71	$356.50	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	250	$1.09	$273.13	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	250	$1.09	$273.13	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,031.55**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$125,938.56**	
Traffic Control			15%	$18,890.78	
Contingencies			10%	$12,593.86	
TOTAL CONSTRUCTION				**$157,423.19**	
Design			8%	$12,593.86	
Construction Administration			10%	$15,742.32	
TOTAL DESIGN AND CONSTRUCTION				**$185,759.37**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

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Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 147 **Ramp:** Goodrum Rd/Griffith St
Location: I-77 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	1	$300.00	$ 300.00	
- Seeding	SY	6942	$2.88	$19,992.96	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$20,292.96**	
Guardrail					
- Guardrail Rail	LF	250	$20.00	$5,000.00	
- Guardrail Approach End Treatment	EA	0	$1,725.00	$0.00	
SUBTOTAL				**$5,000.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	4	$453.68	$1,814.70	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	10	$345.00	$3,450.00	
- Conduit (Trenched)	LF	3075	$6.90	$21,217.50	All purposes

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 147 **Ramp:** Goodrum Rd/Griffith St
Location: I-77 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Conduit (Directional Drilled)	LF	1270	$16.10	$20,447.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	1500	$5.75	$8,625.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$97,061.95**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	0	$2,012.50	$0.00	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	1	$1,080.00	$1,080.00	
- Ethernet Switch	EA	1	$1,955.00	$1,955.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$15,535.00**	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 147 **Ramp:** Goodrum Rd/Griffith St
Location: I-77 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Pavement Marking					
- Pavement Marking Removal	LF	500	$0.71	$356.50	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	250	$1.09	$273.13	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	250	$1.09	$273.13	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,031.55**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$142,313.96**	
Traffic Control	15%			$21,347.09	
Contingencies	10%			$14,231.40	
TOTAL CONSTRUCTION				**$177,892.45**	
Design	8%			$14,231.40	
Construction Administration	10%			$17,789.25	
TOTAL DESIGN AND CONSTRUCTION				**$209,913.09**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

045

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 45 **Ramp**: Little Rock Rd (Mecklenburg Co.)
Location: I-85 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	1868	$2.88	$5,379.84	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$5,379.84**	
Guardrail					
- Guardrail Rail	LF	0	$20.00	$0.00	
- Guardrail Approach End Treatment	EA	0	$1,725.00	$0.00	
SUBTOTAL				**$0.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	8	$453.68	$3,629.40	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	14	$345.00	$4,830.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 45 **Ramp**: Little Rock Rd (Mecklenburg Co.)
Location: I-85 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Conduit (Trenched)	LF	2700	$6.90	$18,630.00	All purposes
- Conduit (Directional Drilled)	LF	1370	$16.10	$22,057.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	1500	$5.75	$8,625.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$99,279.15**	
Communications					
- Splice Enclosure	EA	1	$1,150.00	$1,150.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	1	$1,725.00	$1,725.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	500	$1.73	$862.50	Drop cable to controller cabinet
- Tracer Wire	LF	500	$14.00	$7,000.00	
- Broadband Internet Service	LS	0	$1,080.00	$0.00	
- Ethernet Switch	EA	0	$1,955.00	$0.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 45 **Ramp**: Little Rock Rd (Mecklenburg Co.)
Location: I-85 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$25,250.00**	
Pavement Marking					
- Pavement Marking Removal	LF	750	$0.71	$534.75	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	375	$1.09	$409.69	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	375	$1.09	$409.69	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,482.93**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$134,784.42**	
Traffic Control	15%			$20,217.66	
Contingencies	10%			$13,478.44	
TOTAL CONSTRUCTION				**$168,480.52**	
Design	8%			$13,478.44	
Construction Administration	10%			$16,848.05	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 45 **Ramp**: Little Rock Rd (Mecklenburg Co.)
Location: I-85 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
TOTAL DESIGN AND CONSTRUCTION				**$198,807.01**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

064

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 064 **Ramp**: Graham St (Mecklenburg Co.)
Location: I-85 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0.5	$300.00	$ 150.00	
- Seeding	SY	3838	$2.88	$11,053.44	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$11,203.44**	
Guardrail					
- Guardrail Rail	LF	350	$20.00	$7,000.00	
- Guardrail Approach End Treatment	EA	1	$1,725.00	$1,725.00	
SUBTOTAL				**$8,725.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	8	$453.68	$3,629.40	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	850	$1.73	$1,466.25	Assumed setback distance 350'
- Pullbox (Std.)	EA	14	$345.00	$4,830.00	
- Conduit (Trenched)	LF	2025	$6.90	$13,972.50	All purposes

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 064 **Ramp**: Graham St (Mecklenburg Co.)
Location: I-85 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Conduit (Directional Drilled)	LF	1070	$16.10	$17,227.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	1630	$5.75	$9,372.50	
- Ground Rods	EA	8	$82.00	$656.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	540	$3.16	$1,707.75	
SUBTOTAL				**$89,814.78**	
Communications					
- Splice Enclosure	EA	1	$1,150.00	$1,150.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	1	$1,725.00	$1,725.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	150	$1.73	$258.75	Drop cable to controller cabinet
- Tracer Wire	LF	150	$14.00	$2,100.00	
- Broadband Internet Service	LS	0	$1,080.00	$0.00	
- Ethernet Switch	EA	0	$1,955.00	$0.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$19,746.25**	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 064 **Ramp**: Graham St (Mecklenburg Co.)
Location: I-85 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Pavement Marking					
- Pavement Marking Removal	LF	640	$0.71	$456.32	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	320	$1.09	$349.60	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	320	$1.09	$349.60	110' transitions, 100' narrowed lane
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,284.32**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$134,166.29**	
Traffic Control	15%			$20,124.94	
Contingencies	10%			$13,416.63	
TOTAL CONSTRUCTION				**$167,707.86**	
Design	8%			$13,416.63	
Construction Administration	10%			$16,770.79	
TOTAL DESIGN AND CONSTRUCTION				**$197,895.27**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

067

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 067 **Ramp**: Sugarcreek Rd (Mecklenburg Co.)
Location: I-85 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	1585	$2.88	$4,564.80	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$4,564.80**	
Guardrail					
- Guardrail Rail	LF	350	$20.00	$7,000.00	
- Guardrail Approach End Treatment	EA	1	$1,725.00	$1,725.00	
SUBTOTAL				**$8,725.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	8	$453.68	$3,629.40	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	900	$1.73	$1,552.50	Assumed setback distance 350'
- Pullbox (Std.)	EA	14	$345.00	$4,830.00	
- Conduit (Trenched)	LF	2275	$6.90	$15,697.50	All purposes
- Conduit (Directional Drilled)	LF	1460	$16.10	$23,506.00	Five ramp crossings,

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 067 **Ramp**: Sugarcreek Rd (Mecklenburg Co.)
Location: I-85 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
					multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	1100	$5.75	$6,325.00	
- Ground Rods	EA	8	$82.00	$656.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	590	$3.16	$1,865.88	
SUBTOTAL				**$95,015.65**	
Communications					
- Splice Enclosure	EA	1	$1,150.00	$1,150.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	1	$1,725.00	$1,725.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	150	$1.73	$258.75	Drop cable to controller cabinet
- Tracer Wire	LF	150	$14.00	$2,100.00	
- Broadband Internet Service	LS	0	$1,080.00	$0.00	
- Ethernet Switch	EA	0	$1,955.00	$0.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$19,746.25**	
Pavement Marking					

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 067 **Ramp**: Sugarcreek Rd (Mecklenburg Co.)
Location: I-85 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Pavement Marking Removal	LF	640	$0.71	$456.32	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	320	$1.09	$349.60	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	320	$1.09	$349.60	110' transitions, 100' narrowed lane
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,284.32**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$132,728.52**	
Traffic Control	15%			$19,909.28	
Contingencies	10%			$13,272.85	
TOTAL CONSTRUCTION				**$165,910.65**	
Design	8%			$13,272.85	
Construction Administration	10%			$16,591.07	
TOTAL DESIGN AND CONSTRUCTION				**$195,774.57**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

069

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 69 **Ramp**: University City Blvd
Location: I-85 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	2710	$2.88	$7,804.80	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$7,804.80**	
Guardrail					
- Guardrail Rail	LF	0	$20.00	$0.00	
- Guardrail Approach End Treatment	EA	0	$1,725.00	$0.00	
SUBTOTAL				**$0.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	10	$453.68	$4,536.75	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	16	$345.00	$5,520.00	
- Conduit (Trenched)	LF	3950	$6.90	$27,255.00	All purposes

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 69 **Ramp**: University City Blvd
Location: I-85 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Conduit (Directional Drilled)	LF	2620	$16.10	$42,182.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	3000	$5.75	$17,250.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$138,251.50**	
Communications					
- Splice Enclosure	EA	1	$1,150.00	$1,150.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	1	$1,725.00	$1,725.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	500	$1.73	$862.50	Drop cable to controller cabinet
- Tracer Wire	LF	500	$14.00	$7,000.00	
- Broadband Internet Service	LS	0	$1,080.00	$0.00	
- Ethernet Switch	EA	0	$1,955.00	$0.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 69 **Ramp**: University City Blvd
Location: I-85 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
SUBTOTAL				**$25,250.00**	
Pavement Marking					
- Pavement Marking Removal	LF	750	$0.71	$534.75	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	375	$1.09	$409.69	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	375	$1.09	$409.69	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,482.93**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$176,181.73**	
Traffic Control	15%			$26,427.26	
Contingencies	10%			$17,618.17	
TOTAL CONSTRUCTION				**$220,227.16**	
Design	8%			$17,618.17	
Construction Administration	10%			$22,022.72	
TOTAL DESIGN AND CONSTRUCTION				**$259,868.04**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

072

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 072 **Ramp:** Harris Blvd (Mecklenburg Co.)
Location: I-85 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	1450	$2.88	$4,176.00	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$4,176.00**	
Guardrail					
- Guardrail Rail	LF	350	$20.00	$7,000.00	
- Guardrail Approach End Treatment	EA	1	$1,725.00	$1,725.00	
SUBTOTAL				**$8,725.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	8	$453.68	$3,629.40	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	900	$1.73	$1,552.50	Assumed setback distance 350'
- Pullbox (Std.)	EA	14	$345.00	$4,830.00	
- Conduit (Trenched)	LF	2550	$6.90	$17,595.00	All purposes
- Conduit (Directional Drilled)	LF	1560	$16.10	$25,116.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 072 **Ramp:** Harris Blvd (Mecklenburg Co.)
Location: I-85 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Electrical Conductors	LF	1100	$5.75	$6,325.00	
- Ground Rods	EA	8	$82.00	$656.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$517.50	$517.50	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$1,400.00	$2,800.00	Breakaway pole
- Two Section Signal Head	EA	4	$500.00	$2,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	540	$3.16	$1,707.75	
SUBTOTAL				**$93,842.53**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	1	$1,080.00	$1,080.00	
- Ethernet Switch	EA	1	$1,955.00	$1,955.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$17,547.50**	
Pavement Marking					
- Pavement Marking Removal	LF	600	$0.71	$427.80	40 MPH design speed. 110' transitions, 100' narrowed lane

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 072 **Ramp:** Harris Blvd (Mecklenburg Co.)
Location: I-85 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Raised Pavement Markers	EA	4	$5.18	$20.70	
- White Edge Line	LF	300	$1.09	$327.75	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	300	$1.09	$327.75	110' transitions, 100' narrowed lane
- 24" Stop Bar	LF	8	$8.05	$64.40	
SUBTOTAL				**$1,168.40**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$128,851.93**	
Traffic Control			15%	$19,327.79	
Contingencies			10%	$12,885.19	
TOTAL CONSTRUCTION				**$161,064.91**	
Design			8%	$12,885.19	
Construction Administration			10%	$16,106.49	
TOTAL DESIGN AND CONSTRUCTION				**$190,056.59**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

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Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 177 **Ramp:** Steele Creek Rd (LOOP)
Location: I-485 Inner

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	100	$25.00	$2,500.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	1	$300.00	$ 300.00	
- Seeding	SY	7034	$2.88	$20,257.92	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$23,057.92**	
Guardrail					
- Guardrail Rail	LF	350	$20.00	$7,000.00	
- Guardrail Approach End Treatment	EA	1	$1,725.00	$1,725.00	
SUBTOTAL				**$8,725.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	6	$453.68	$2,722.05	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1450	$1.73	$2,501.25	Assumed setback distance 350'
- Pullbox (Std.)	EA	12	$345.00	$4,140.00	
- Conduit (Trenched)	LF	3200	$6.90	$22,080.00	All purposes
- Conduit (Directional Drilled)	LF	1620	$16.10	$26,082.00	Five ramp crossings, multiple conduits

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 177 **Ramp:** Steele Creek Rd (LOOP)
Location: I-485 Inner

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	1500	$5.75	$8,625.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$105,588.05**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	0	$2,012.50	$0.00	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	1	$1,080.00	$1,080.00	
- Ethernet Switch	EA	1	$1,955.00	$1,955.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$15,535.00**	
Pavement Marking					

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 177 **Ramp:** Steele Creek Rd (LOOP)
Location: I-485 Inner

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Pavement Marking Removal	LF	600	$0.71	$427.80	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	300	$1.09	$327.75	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	300	$1.09	$327.75	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,212.10**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$157,510.57**	
Traffic Control	15%			$23,626.59	
Contingencies	10%			$15,751.06	
TOTAL CONSTRUCTION				**$196,888.21**	
Design	8%			$15,751.06	
Construction Administration	10%			$19,688.82	
TOTAL DESIGN AND CONSTRUCTION				**$232,328.09**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

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Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 179 **Ramp**: Steele Creek Rd (RAMP)
Location: I-485 Inner

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	2327	$2.88	$6,701.76	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$6,701.76**	
Guardrail					
- Guardrail Rail	LF	0	$20.00	$0.00	
- Guardrail Approach End Treatment	EA	0	$1,725.00	$0.00	
SUBTOTAL				**$0.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	6	$453.68	$2,722.05	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	12	$345.00	$4,140.00	
- Conduit (Trenched)	LF	3400	$6.90	$23,460.00	All purposes
- Conduit (Directional Drilled)	LF	1870	$16.10	$30,107.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 179 **Ramp**: Steele Creek Rd (RAMP)
Location: I-485 Inner

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Electrical Conductors	LF	2400	$5.75	$13,800.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$115,736.80**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	0	$2,012.50	$0.00	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	1	$1,080.00	$1,080.00	
- Ethernet Switch	EA	1	$1,955.00	$1,955.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$15,535.00**	
Pavement Marking					
- Pavement Marking Removal	LF	1000	$0.71	$713.00	40 MPH design speed. 110'

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 179 **Ramp**: Steele Creek Rd (RAMP)
Location: I-485 Inner

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
					transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	500	$1.09	$546.25	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	500	$1.09	$546.25	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,934.30**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$143,300.36**	
Traffic Control	15%			$21,495.05	
Contingencies	10%			$14,330.04	
TOTAL CONSTRUCTION				**$179,125.45**	
Design	8%			$14,330.04	
Construction Administration	10%			$17,912.55	
TOTAL DESIGN AND CONSTRUCTION				**$211,368.03**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

180

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 180 **Ramp:** West Blvd.
Location: I-485 Outer

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	2194	$2.88	$6,318.72	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$6,318.72**	
Guardrail					
- Guardrail Rail	LF	300	$20.00	$6,000.00	
- Guardrail Approach End Treatment	EA	1	$1,725.00	$1,725.00	
SUBTOTAL				**$7,725.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	6	$453.68	$2,722.05	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	12	$345.00	$4,140.00	
- Conduit (Trenched)	LF	3200	$6.90	$22,080.00	All purposes
- Conduit (Directional Drilled)	LF	1870	$16.10	$30,107.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 180 **Ramp:** West Blvd.
Location: I-485 Outer

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Electrical Conductors	LF	2500	$5.75	$14,375.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$114,931.80**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	0	$2,012.50	$0.00	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	0	$1,080.00	$0.00	
- Ethernet Switch	EA	0	$1,955.00	$0.00	
- CCTV Pole (55' Wood)	EA	0	$4,600.00	$0.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	0	$3,300.00	$0.00	
- CCTV Assembly	EA	0	$4,600.00	$0.00	
SUBTOTAL				**$0.00**	
Pavement Marking					

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 180 **Ramp:** West Blvd.
Location: I-485 Outer

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Pavement Marking Removal	LF	1000	$0.71	$713.00	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	500	$1.09	$546.25	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	500	$1.09	$546.25	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,934.30**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$134,302.32**	
Traffic Control	15%			$20,145.35	
Contingencies	10%			$13,430.23	
TOTAL CONSTRUCTION				**$167,877.90**	
Design	8%			$13,430.23	
Construction Administration	10%			$16,787.79	
TOTAL DESIGN AND CONSTRUCTION				**$198,095.92**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

181

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 181 **Ramp:** West Blvd
Location: I-485 Inner

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0.25	$300.00	$ 75.00	
- Seeding	SY	3404	$2.88	$9,803.52	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$9,878.52**	
Guardrail					
- Guardrail Rail	LF	300	$20.00	$6,000.00	
- Guardrail Approach End Treatment	EA	1	$1,725.00	$1,725.00	
SUBTOTAL				**$7,725.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	6	$453.68	$2,722.05	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	12	$345.00	$4,140.00	
- Conduit (Trenched)	LF	3200	$6.90	$22,080.00	All purposes
- Conduit (Directional Drilled)	LF	1370	$16.10	$22,057.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 181 **Ramp:** West Blvd
Location: I-485 Inner

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Electrical Conductors	LF	2000	$5.75	$11,500.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$104,006.80**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	0	$2,012.50	$0.00	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	1	$1,080.00	$1,080.00	
- Ethernet Switch	EA	1	$1,955.00	$1,955.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$15,535.00**	
Pavement Marking					

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 181 **Ramp:** West Blvd
Location: I-485 Inner

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Pavement Marking Removal	LF	1000	$0.71	$713.00	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	500	$1.09	$546.25	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	500	$1.09	$546.25	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,934.30**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$142,472.12**	
Traffic Control	15%			$21,370.82	
Contingencies	10%			$14,247.21	
TOTAL CONSTRUCTION				**$178,090.15**	
Design	8%			$14,247.21	
Construction Administration	10%			$17,809.02	
TOTAL DESIGN AND CONSTRUCTION				**$210,146.38**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

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Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 182 **Ramp:** US 74/&S 29/Wilkinson Blvd
Location: I-485 Outer

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	3394	$2.88	$9,774.72	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$9,774.72**	
Guardrail					
- Guardrail Rail	LF	0	$20.00	$0.00	
- Guardrail Approach End Treatment	EA	0	$1,725.00	$0.00	
SUBTOTAL				**$0.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	6	$453.68	$2,722.05	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	12	$345.00	$4,140.00	
- Conduit (Trenched)	LF	5000	$6.90	$34,500.00	All purposes
- Conduit (Directional Drilled)	LF	3120	$16.10	$50,232.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 182 **Ramp:** US 74/&S 29/Wilkinson Blvd
Location: I-485 Outer

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Electrical Conductors	LF	3500	$5.75	$20,125.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$153,226.80**	
Communications					
- Splice Enclosure	EA	1	$1,150.00	$1,150.00	Link to SMFO
- Pullbox (Special Size)	EA	0	$2,012.50	$0.00	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	1	$1,725.00	$1,725.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	750	$1.73	$1,293.75	Drop cable to controller cabinet
- Tracer Wire	LF	750	$14.00	$10,500.00	
- Broadband Internet Service	LS	0	$1,080.00	$0.00	
- Ethernet Switch	EA	0	$1,955.00	$0.00	
- CCTV Pole (55' Wood)	EA	0	$4,600.00	$0.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	0	$3,300.00	$0.00	
- CCTV Assembly	EA	0	$4,600.00	$0.00	
SUBTOTAL				**$14,668.75**	
Pavement Marking					

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 182 **Ramp:** US 74/&S 29/Wilkinson Blvd
Location: I-485 Outer

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Pavement Marking Removal	LF	750	$0.71	$534.75	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	375	$1.09	$409.69	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	375	$1.09	$409.69	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,482.93**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$182,545.70**	
Traffic Control	15%			$27,381.85	
Contingencies	10%			$18,254.57	
TOTAL CONSTRUCTION				**$228,182.12**	
Design	8%			$18,254.57	
Construction Administration	10%			$22,818.21	
TOTAL DESIGN AND CONSTRUCTION				**$269,254.90**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

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Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 229 **Ramp:** E John St
Location: I-485 Inner

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	2386	$2.88	$6,871.68	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$6,871.68**	
Guardrail					
- Guardrail Rail	LF	0	$20.00	$0.00	
- Guardrail Approach End Treatment	EA	0	$1,725.00	$0.00	
SUBTOTAL				**$0.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	4	$453.68	$1,814.70	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	10	$345.00	$3,450.00	
- Conduit (Trenched)	LF	3500	$6.90	$24,150.00	All purposes
- Conduit (Directional Drilled)	LF	1620	$16.10	$26,082.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 229 **Ramp:** E John St
Location: I-485 Inner

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Electrical Conductors	LF	2000	$5.75	$11,500.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$108,504.45**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	1	$1,080.00	$1,080.00	
- Ethernet Switch	EA	1	$1,955.00	$1,955.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$17,547.50**	
Pavement Marking					
- Pavement Marking Removal	LF	1000	$0.71	$713.00	40 MPH design speed. 110'

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 229 **Ramp:** E John St
Location: I-485 Inner

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
					transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	500	$1.09	$546.25	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	500	$1.09	$546.25	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,934.30**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$138,250.43**	
Traffic Control	15%			$20,737.56	
Contingencies	10%			$13,825.04	
TOTAL CONSTRUCTION				**$172,813.04**	
Design	8%			$13,825.04	
Construction Administration	10%			$17,281.30	
TOTAL DESIGN AND CONSTRUCTION				**$203,919.38**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

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Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 230 **Ramp:** NC 16 (Providence Rd)
Location: I-485 Outer

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	3686	$2.88	$10,615.68	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$10,615.68**	
Guardrail					
- Guardrail Rail	LF	300	$20.00	$6,000.00	
- Guardrail Approach End Treatment	EA	1	$1,725.00	$1,725.00	
SUBTOTAL				**$7,725.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	4	$453.68	$1,814.70	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	10	$345.00	$3,450.00	
- Conduit (Trenched)	LF	5450	$6.90	$37,605.00	All purposes
- Conduit (Directional Drilled)	LF	1370	$16.10	$22,057.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 230 **Ramp:** NC 16 (Providence Rd)
Location: I-485 Outer

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Electrical Conductors	LF	1500	$5.75	$8,625.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$115,059.45**	
Communications					
- Splice Enclosure	EA	1	$1,150.00	$1,150.00	Link to SMFO
- Pullbox (Special Size)	EA	0	$2,012.50	$0.00	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	1	$1,725.00	$1,725.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	2500	$1.73	$4,312.50	Drop cable to controller cabinet
- Tracer Wire	LF	2500	$14.00	$35,000.00	
- Broadband Internet Service	LS	0	$1,080.00	$0.00	
- Ethernet Switch	EA	0	$1,955.00	$0.00	
- CCTV Pole (55' Wood)	EA	0	$4,600.00	$0.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	0	$3,300.00	$0.00	
- CCTV Assembly	EA	0	$4,600.00	$0.00	
SUBTOTAL				**$42,187.50**	
Pavement Marking					
- Pavement Marking Removal	LF	750	$0.71	$534.75	40 MPH design speed. 110'

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 230 **Ramp:** NC 16 (Providence Rd)
Location: I-485 Outer

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
					transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	375	$1.09	$409.69	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	375	$1.09	$409.69	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,482.93**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$180,463.06**	
Traffic Control	15%			$27,069.46	
Contingencies	10%			$18,046.31	
TOTAL CONSTRUCTION				**$225,578.82**	
Design	8%			$18,046.31	
Construction Administration	10%			$22,557.88	
TOTAL DESIGN AND CONSTRUCTION				**$266,183.01**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

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Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 231 **Ramp:** NC 16 (Providence Rd) (LOOP)
Location: I-485 Inner

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	2786	$2.88	$8,023.68	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$8,023.68**	
Guardrail					
- Guardrail Rail	LF	0	$20.00	$0.00	
- Guardrail Approach End Treatment	EA	0	$1,725.00	$0.00	
SUBTOTAL				**$0.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	4	$453.68	$1,814.70	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	10	$345.00	$3,450.00	
- Conduit (Trenched)	LF	4100	$6.90	$28,290.00	All purposes
- Conduit (Directional Drilled)	LF	2120	$16.10	$34,132.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 231 **Ramp:** NC 16 (Providence Rd) (LOOP)
Location: I-485 Inner

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Electrical Conductors	LF	1000	$5.75	$5,750.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$114,944.45**	
Communications					
- Splice Enclosure	EA	1	$1,150.00	$1,150.00	Link to SMFO
- Pullbox (Special Size)	EA	0	$2,012.50	$0.00	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	1	$1,725.00	$1,725.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	1500	$1.73	$2,587.50	Drop cable to controller cabinet
- Tracer Wire	LF	1500	$14.00	$21,000.00	
- Broadband Internet Service	LS	0	$1,080.00	$0.00	
- Ethernet Switch	EA	0	$1,955.00	$0.00	
- CCTV Pole (55' Wood)	EA	0	$4,600.00	$0.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	0	$3,300.00	$0.00	
- CCTV Assembly	EA	0	$4,600.00	$0.00	
SUBTOTAL				**$26,462.50**	
Pavement Marking					
- Pavement Marking Removal	LF	400	$0.71	$285.20	40 MPH design speed. 110'

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 231 **Ramp:** NC 16 (Providence Rd) (LOOP)
Location: I-485 Inner

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
					transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	200	$1.09	$218.50	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	200	$1.09	$218.50	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$851.00**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$153,674.13**	
Traffic Control	15%			$23,051.12	
Contingencies	10%			$15,367.41	
TOTAL CONSTRUCTION				**$192,092.66**	
Design	8%			$15,367.41	
Construction Administration	10%			$19,209.27	
TOTAL DESIGN AND CONSTRUCTION				**$226,669.34**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

232

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 232 **Ramp:** NC 16 (Providence Rd) (LOOP)
Location: I-485 Outer

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	1786	$2.88	$5,143.68	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$5,143.68**	
Guardrail					
- Guardrail Rail	LF	0	$20.00	$0.00	
- Guardrail Approach End Treatment	EA	0	$1,725.00	$0.00	
SUBTOTAL				**$0.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	4	$453.68	$1,814.70	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	10	$345.00	$3,450.00	
- Conduit (Trenched)	LF	2600	$6.90	$17,940.00	All purposes
- Conduit (Directional Drilled)	LF	1420	$16.10	$22,862.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 232 **Ramp:** NC 16 (Providence Rd) (LOOP)
Location: I-485 Outer

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Electrical Conductors	LF	1000	$5.75	$5,750.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$93,324.45**	
Communications					
- Splice Enclosure	EA	1	$1,150.00	$1,150.00	Link to SMFO
- Pullbox (Special Size)	EA	0	$2,012.50	$0.00	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	1	$1,725.00	$1,725.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	250	$1.73	$431.25	Drop cable to controller cabinet
- Tracer Wire	LF	250	$14.00	$3,500.00	
- Broadband Internet Service	LS	0	$1,080.00	$0.00	
- Ethernet Switch	EA	0	$1,955.00	$0.00	
- CCTV Pole (55' Wood)	EA	0	$4,600.00	$0.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	0	$3,300.00	$0.00	
- CCTV Assembly	EA	0	$4,600.00	$0.00	
SUBTOTAL				**$6,806.25**	
Pavement Marking					
- Pavement Marking Removal	LF	400	$0.71	$285.20	40 MPH design speed. 110'

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 232 **Ramp:** NC 16 (Providence Rd) (LOOP)
Location: I-485 Outer

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
					transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	200	$1.09	$218.50	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	200	$1.09	$218.50	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$851.00**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$109,517.88**	
Traffic Control	15%			$16,427.68	
Contingencies	10%			$10,951.79	
TOTAL CONSTRUCTION				**$136,897.35**	
Design	8%			$10,951.79	
Construction Administration	10%			$13,689.74	
TOTAL DESIGN AND CONSTRUCTION				**$161,538.87**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

233

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 233 **Ramp:** NC 16 (Providence Rd)
Location: I-485 Inner

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	2686	$2.88	$7,735.68	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$7,735.68**	
Guardrail					
- Guardrail Rail	LF	300	$20.00	$6,000.00	
- Guardrail Approach End Treatment	EA	1	$1,725.00	$1,725.00	
SUBTOTAL				**$7,725.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	4	$453.68	$1,814.70	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	10	$345.00	$3,450.00	
- Conduit (Trenched)	LF	3950	$6.90	$27,255.00	All purposes
- Conduit (Directional Drilled)	LF	1620	$16.10	$26,082.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 233 **Ramp:** NC 16 (Providence Rd)
Location: I-485 Inner

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Electrical Conductors	LF	1500	$5.75	$8,625.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$108,734.45**	
Communications					
- Splice Enclosure	EA	1	$1,150.00	$1,150.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	1	$1,725.00	$1,725.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	1000	$1.73	$1,725.00	Drop cable to controller cabinet
- Tracer Wire	LF	1000	$14.00	$14,000.00	
- Broadband Internet Service	LS	0	$1,080.00	$0.00	
- Ethernet Switch	EA	0	$1,955.00	$0.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$33,112.50**	
Pavement Marking					
- Pavement Marking Removal	LF	750	$0.71	$534.75	40 MPH design speed. 110'

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 233 **Ramp:** NC 16 (Providence Rd)
Location: I-485 Inner

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
					transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	375	$1.09	$409.69	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	375	$1.09	$409.69	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,482.93**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$162,183.06**	
Traffic Control	15%			$24,327.46	
Contingencies	10%			$16,218.31	
TOTAL CONSTRUCTION				**$202,728.82**	
Design	8%			$16,218.31	
Construction Administration	10%			$20,272.88	
TOTAL DESIGN AND CONSTRUCTION				**$239,220.01**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

234

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 234 **Ramp:** Rea Rd
Location: I-485 Outer

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	2019	$2.88	$5,814.72	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$5,814.72**	
Guardrail					
- Guardrail Rail	LF	300	$20.00	$6,000.00	
- Guardrail Approach End Treatment	EA	1	$1,725.00	$1,725.00	
SUBTOTAL				**$7,725.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	4	$453.68	$1,814.70	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	10	$345.00	$3,450.00	
- Conduit (Trenched)	LF	2950	$6.90	$20,355.00	All purposes
- Conduit (Directional Drilled)	LF	1370	$16.10	$22,057.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 234 **Ramp:** Rea Rd
Location: I-485 Outer

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Electrical Conductors	LF	1500	$5.75	$8,625.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$97,809.45**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	1	$1,080.00	$1,080.00	
- Ethernet Switch	EA	1	$1,955.00	$1,955.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$17,547.50**	
Pavement Marking					
- Pavement Marking Removal	LF	750	$0.71	$534.75	40 MPH design speed. 110'

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 234 **Ramp:** Rea Rd
Location: I-485 Outer

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
					transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	375	$1.09	$409.69	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	375	$1.09	$409.69	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,482.93**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION			**$133,772.10**		
Traffic Control	15%		$20,065.81		
Contingencies	10%		$13,377.21		
TOTAL CONSTRUCTION			**$167,215.12**		
Design	8%		$13,377.21		
Construction Administration	10%		$16,721.51		
TOTAL DESIGN AND CONSTRUCTION			**$197,313.84**		

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

235

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 235 **Ramp:** Rea Rd. (Loop)
Location: I-485 Outer

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	1852	$2.88	$5,333.76	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$5,333.76**	
Guardrail					
- Guardrail Rail	LF	300	$20.00	$6,000.00	
- Guardrail Approach End Treatment	EA	1	$1,725.00	$1,725.00	
SUBTOTAL				**$7,725.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	4	$453.68	$1,814.70	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	10	$345.00	$3,450.00	
- Conduit (Trenched)	LF	2700	$6.90	$18,630.00	All purposes
- Conduit (Directional Drilled)	LF	1370	$16.10	$22,057.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	1500	$5.75	$8,625.00	
- Ground Rods	EA	6	$82.00	$492.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 235 **Ramp:** Rea Rd. (Loop)
Location: I-485 Outer

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$96,084.45**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	1	$1,080.00	$1,080.00	
- Ethernet Switch	EA	1	$1,955.00	$1,955.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$17,547.50**	
Pavement Marking					
- Pavement Marking Removal	LF	750	$0.71	$534.75	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 235 **Ramp:** Rea Rd. (Loop)
Location: I-485 Outer

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- White Edge Line	LF	375	$1.09	$409.69	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	375	$1.09	$409.69	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,482.93**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$131,566.14**	
Traffic Control	15%			$19,734.92	
Contingencies	10%			$13,156.61	
TOTAL CONSTRUCTION				**$164,457.67**	
Design	8%			$13,156.61	
Construction Administration	10%			$16,445.77	
TOTAL DESIGN AND CONSTRUCTION				**$194,060.05**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

236

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 236 **Ramp:** Rea Rd (LOOP)
Location: I-485 Inner

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	1500	$2.88	$4,320.00	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$4,320.00**	
Guardrail					
- Guardrail Rail	LF	250	$20.00	$5,000.00	
- Guardrail Approach End Treatment	EA	1	$1,725.00	$1,725.00	
SUBTOTAL				**$6,725.00**	
Drainage					
- Pipe	LF	50	$60.00	$3,000.00	Extend existing
SUBTOTAL				**$3,000.00**	
Signalization					
- 6x6' loops - Mainline	EA	6	$453.68	$2,722.05	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	10	$345.00	$3,450.00	
- Conduit (Trenched)	LF	2950	$6.90	$20,355.00	All purposes
- Conduit (Directional Drilled)	LF	1370	$16.10	$22,057.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	1500	$5.75	$8,625.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 236 **Ramp:** Rea Rd (LOOP)
Location: I-485 Inner

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$98,716.80**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	1	$1,080.00	$1,080.00	
- Ethernet Switch	EA	1	$1,955.00	$1,955.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$17,547.50**	
Pavement Marking					
- Pavement Marking Removal	LF	600	$0.71	$427.80	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	300	$1.09	$327.75	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	300	$1.09	$327.75	110' transitions, 100' narrowed lane

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 236 **Ramp:** Rea Rd (LOOP)
Location: I-485 Inner

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,212.10**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$134,913.90**	
Traffic Control			15%	$20,237.09	
Contingencies			10%	$13,491.39	
TOTAL CONSTRUCTION				**$168,642.38**	
Design			8%	$13,491.39	
Construction Administration			10%	$16,864.24	
TOTAL DESIGN AND CONSTRUCTION				**$198,998.00**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

237

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 237 **Ramp:** Rea Rd
Location: I-485 Inner

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	2052	$2.88	$5,909.76	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$5,909.76**	
Guardrail					
- Guardrail Rail	LF	150	$20.00	$3,000.00	
- Guardrail Approach End Treatment	EA	0	$1,725.00	$0.00	
SUBTOTAL				**$3,000.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	4	$453.68	$1,814.70	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	10	$345.00	$3,450.00	
- Conduit (Trenched)	LF	3000	$6.90	$20,700.00	All purposes
- Conduit (Directional Drilled)	LF	1620	$16.10	$26,082.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	1600	$5.75	$9,200.00	
- Ground Rods	EA	6	$82.00	$492.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 237 **Ramp:** Rea Rd
Location: I-485 Inner

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$102,754.45**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	1	$1,080.00	$1,080.00	
- Ethernet Switch	EA	1	$1,955.00	$1,955.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$17,547.50**	
Pavement Marking					
- Pavement Marking Removal	LF	750	$0.71	$534.75	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 237 **Ramp:** Rea Rd
Location: I-485 Inner

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- White Edge Line	LF	375	$1.09	$409.69	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	375	$1.09	$409.69	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,482.93**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$134,087.14**	
Traffic Control	15%			$20,113.07	
Contingencies	10%			$13,408.71	
TOTAL CONSTRUCTION				**$167,608.92**	
Design	8%			$13,408.71	
Construction Administration	10%			$16,760.89	
TOTAL DESIGN AND CONSTRUCTION				**$197,778.52**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

238

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 238 **Ramp:** US 521 (Johnston Rd)
Location: I-485 Outer

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	3027	$2.88	$8,717.76	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$8,717.76**	
Guardrail					
- Guardrail Rail	LF	300	$20.00	$6,000.00	
- Guardrail Approach End Treatment	EA	1	$1,725.00	$1,725.00	
SUBTOTAL				**$7,725.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	6	$453.68	$2,722.05	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	12	$345.00	$4,140.00	
- Conduit (Trenched)	LF	4450	$6.90	$30,705.00	All purposes
- Conduit (Directional Drilled)	LF	3120	$16.10	$50,232.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	5000	$5.75	$28,750.00	
- Ground Rods	EA	6	$82.00	$492.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 238 **Ramp:** US 521 (Johnston Rd)
Location: I-485 Outer

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$158,056.80**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	1	$1,080.00	$1,080.00	
- Ethernet Switch	EA	1	$1,955.00	$1,955.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$17,547.50**	
Pavement Marking					
- Pavement Marking Removal	LF	1000	$0.71	$713.00	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	500	$1.09	$546.25	110' transitions, 100' narrowed lane

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 238 **Ramp:** US 521 (Johnston Rd)
Location: I-485 Outer

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Yellow Edge Line	LF	500	$1.09	$546.25	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,934.30**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$197,373.86**	
Traffic Control	15%			$29,606.08	
Contingencies	10%			$19,737.39	
TOTAL CONSTRUCTION				**$246,717.33**	
Design	8%			$19,737.39	
Construction Administration	10%			$24,671.73	
TOTAL DESIGN AND CONSTRUCTION				**$291,126.44**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

239

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 239 **Ramp:** US 521/Johnston Rd.
Location: I-485 Outer

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	1960	$2.88	$5,644.80	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$5,644.80**	
Guardrail					
- Guardrail Rail	LF	150	$20.00	$3,000.00	
- Guardrail Approach End Treatment	EA	0	$1,725.00	$0.00	
SUBTOTAL				**$3,000.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	6	$453.68	$2,722.05	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	12	$345.00	$4,140.00	
- Conduit (Trenched)	LF	2850	$6.90	$19,665.00	All purposes
- Conduit (Directional Drilled)	LF	1620	$16.10	$26,082.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	1500	$5.75	$8,625.00	
- Ground Rods	EA	6	$82.00	$492.00	

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 239 **Ramp:** US 521/Johnston Rd.
Location: I-485 Outer

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$102,741.80**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	1	$1,080.00	$1,080.00	
- Ethernet Switch	EA	1	$1,955.00	$1,955.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$17,547.50**	
Pavement Marking					
- Pavement Marking Removal	LF	600	$0.71	$427.80	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	300	$1.09	$327.75	110' transitions, 100' narrowed lane

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 239 **Ramp:** US 521/Johnston Rd.
Location: I-485 Outer

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Yellow Edge Line	LF	300	$1.09	$327.75	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,212.10**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$133,538.70**	
Traffic Control	15%			$20,030.81	
Contingencies	10%			$13,353.87	
TOTAL CONSTRUCTION				**$166,923.38**	
Design	8%			$13,353.87	
Construction Administration	10%			$16,692.34	
TOTAL DESIGN AND CONSTRUCTION				**$196,969.58**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

250

Typical Design and Construction Costs
Single Lane Ramp Meter

Log No.: 250 **Ramp:** Briar Creek Rd
Location: US 74 - Independence Blvd WB

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	1960	$2.88	$5,644.80	Seeding around trench, conduit runs, pull box, clear/grub area, and foundation areas.
SUBTOTAL				**$5,644.80**	
Guardrail					
- Guardrail Rail	LF	0	$20.00	$0.00	
- Guardrail Approach End Treatment	EA	0	$1,725.00	$0.00	
SUBTOTAL				**$0.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	6	$453.68	$2,722.05	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	5	$453.68	$2,268.38	One queue, three passage and one clearance
- Detector Lead-in Cable	EA	1200	$1.73	$2,070.00	Assumed setback distance 350'
- Pullbox (Std.)	EA	12	$345.00	$4,140.00	
- Conduit (Trenched)	LF	2850	$6.90	$19,665.00	All purposes
- Conduit (Directional Drilled)	LF	1620	$16.10	$26,082.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	1500	$5.75	$8,625.00	
- Ground Rods	EA	6	$82.00	$492.00	

Typical Design and Construction Costs

Single Lane Ramp Meter

Log No.: 250 **Ramp:** Briar Creek Rd
Location: US 74 - Independence Blvd WB

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	2	$500.00	$1,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	630	$3.16	$1,992.38	
SUBTOTAL				**$102,741.80**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For Direction Drill on Mainline/Splice Enclosures
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	1	$1,080.00	$1,080.00	
- Ethernet Switch	EA	1	$1,955.00	$1,955.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	45' Mounting height
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$17,547.50**	
Pavement Marking					
- Pavement Marking Removal	LF	900	$0.71	$641.70	40 MPH design speed. 110' transitions, 100' narrowed lane
- Raised Pavement Markers	EA	0	$5.18	$0.00	
- White Edge Line	LF	450	$1.09	$491.63	110' transitions, 100' narrowed lane

Typical Design and Construction Costs

Single Lane Ramp Meter

Log No.: 250 **Ramp:** Briar Creek Rd
Location: US 74 - Independence Blvd WB

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Yellow Edge Line	LF	450	$1.09	$491.63	110' transitions, 100' narrowed lane
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	16	$8.05	$128.80	
SUBTOTAL				**$1,753.75**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	1	$201.25	$201.25	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	1	$201.25	$201.25	Pedestal mounted
SUBTOTAL				**$3,392.50**	
SUBTOTAL CONSTRUCTION				**$131,080.35**	
Traffic Control	15%			$19,662.05	
Contingencies	10%			$13,108.04	
TOTAL CONSTRUCTION				**$163,850.44**	
Design	8%			$13,108.04	
Construction Administration	10%			$16,385.04	
TOTAL DESIGN AND CONSTRUCTION				**$193,343.52**	

A.1.2. Proposed Two Lane Ramp Locations

A.1.2.1. Mecklenburg County

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

093

Typical Design and Construction Costs
Two Lane Ramp Meter

Log No.: 093 **Ramp:** Westinghouse Blvd (Mecklenburg Co.)
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	Assumed 6'x1300
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	Assumed 12'x1000'x6'
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	Assumed 25'x1000'
- Seeding	SY	1755	$2.88	$5,054.40	Seeding around trench, conduit runs, pull box, and foundation areas.
SUBTOTAL				**$5,054.40**	
Guardrail					
- Guardrail Rail	LF	350	$20.00	$7,000.00	
- Guardrail Approach End Treatment	EA	1	$1,725.00	$1,725.00	
SUBTOTAL				**$8,725.00**	
Paving					
- Ramp Widening	SY	3140	$62.50	$196,250.00	includes both asphalt and binder
- Pavement Resurfacing	SY	4225	$13.50	$57,037.50	
SUBTOTAL				**$253,287.50**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	8	$453.68	$3,629.40	Mainline detection two loops per lane

Typical Design and Construction Costs
Two Lane Ramp Meter

Log No.: 093 **Ramp:** Westinghouse Blvd (Mecklenburg Co.)
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- 6x6' loops - Ramp	EA	10	$453.68	$4,536.75	Two queue, six passage and two clearance
- Detector Lead-in Cable	EA	900	$1.73	$1,552.50	Assumed setback distance 350'
- Pullbox (Std.)	EA	19	$345.00	$6,555.00	
- Conduit (Trenched)	LF	2500	$6.90	$17,250.00	All purposes
- Conduit (Directional Drilled)	LF	1360	$16.10	$21,896.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	1500	$5.75	$8,625.00	
- Ground Rods	EA	8	$82.00	$656.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	4	$500.00	$2,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	540	$3.16	$1,707.75	
SUBTOTAL				**$102,093.40**	
Communications					
- Splice Enclosure	EA	0	$1,150.00	$0.00	Link to SMFO
- Pullbox (Special Size)	EA	0	$2,012.50	$0.00	For splice enclosure
- Interconnect Center	EA	0	$1,725.00	$0.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	0	$1.73	$0.00	Drop cable to controller cabinet
- Tracer Wire	LF	0	$14.00	$0.00	
- Broadband Internet Service	LS	1	$1,080.00	$1,080.00	
- Ethernet Switch	EA	1	$1,955.00	$1,955.00	45' Mounting height
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	

Typical Design and Construction Costs
Two Lane Ramp Meter

Log No.: 093 **Ramp:** Westinghouse Blvd (Mecklenburg Co.)
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$15,535.00**	
Pavement Marking					40 MPH design speed. 110' transitions, 100' narrowed lane
- Pavement Marking Removal	LF	2000	$0.71	$1,426.00	Along skip line only
- Raised Pavement Markers	EA	12	$5.18	$62.10	110' transitions, 100' narrowed lane
- White Edge Line	LF	1000	$1.09	$1,092.50	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	1000	$1.09	$1,092.50	
- White Skip Line	LF	900	$0.28	$248.40	
- 24" Stop Bar	LF	24	$8.05	$193.20	
SUBTOTAL				**$4,114.70**	
Signing					Sign and post only
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Pedestal mounted
- R10-6R and R10-6L, Stop Here on Red	EA	2	$201.25	$402.50	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	2	$201.25	$402.50	
- W4-1L, Merge Left	EA	1	$747.50	$747.50	
SUBTOTAL				**$4,542.50**	
SUBTOTAL CONSTRUCTION				**$393,352.50**	
Traffic Control	15%			$59,002.88	
Contingencies	10%			$39,335.25	
TOTAL CONSTRUCTION				**$491,690.63**	
Design	8%			$39,335.25	
Construction Administration	10%			$49,169.06	
TOTAL DESIGN AND CONSTRUCTION				**$580,194.94**	

Typical Design and Construction Costs
Two Lane Ramp Meter

Log No.: 175 **Ramp:** Arrowood Rd
Location: I-485 Inner

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	2314	$2.88	$6,664.32	Seeding around trench, conduit runs, pull box, and foundation areas.
SUBTOTAL				**$6,664.32**	
Guardrail					
- Guardrail Rail	LF	0	$20.00	$0.00	
- Guardrail Approach End Treatment	EA	0	$1,725.00	$0.00	
SUBTOTAL				**$0.00**	
Paving					
- Ramp Widening	SY	3140	$62.50	$196,250.00	includes both asphalt and binder
- Pavement Resurfacing	SY	4225	$13.50	$57,037.50	
SUBTOTAL				**$253,287.50**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	6	$453.68	$2,722.05	Mainline detection two loops per lane
- 6x6' loops - Ramp	EA	10	$453.68	$4,536.75	Two queue, six passage and two clearance
- Detector Lead-in Cable	EA	850	$1.73	$1,466.25	Assumed setback distance 350'
- Pullbox (Std.)	EA	17	$345.00	$5,865.00	
- Conduit (Trenched)	LF	3350	$6.90	$23,115.00	All purposes
- Conduit (Directional Drilled)	LF	2370	$16.10	$38,157.00	Five ramp crossings, multiple conduits

Typical Design and Construction Costs
Two Lane Ramp Meter

Log No.: 175 **Ramp:** Arrowood Rd
Location: I-485 Inner

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	0	$5.75	$0.00	
- Ground Rods	EA	6	$82.00	$492.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	2	$3,650.00	$7,300.00	Breakaway pole
- Two Section Signal Head	EA	4	$500.00	$2,000.00	Two each pedestal pole
- One Section Signal Head	EA	2	$575.00	$1,150.00	Ramp meter advance signal
- Signal Cable	LF	190	$3.16	$600.88	
SUBTOTAL				**$112,639.93**	
Communications					
- Splice Enclosure	EA	1	$1,150.00	$1,150.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For splice enclosure
- Interconnect Center	EA	1	$1,725.00	$1,725.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	750	$1.73	$1,293.75	Drop cable to controller cabinet
- Tracer Wire	LF	750	$14.00	$10,500.00	
- Broadband Internet Service	LS	0	$1,080.00	$0.00	
- Ethernet Switch	EA	0	$1,955.00	$0.00	45' Mounting height
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$29,181.25**	
Pavement Marking					40 MPH design speed. 110' transitions, 100' narrowed lane
- Pavement Marking Removal	LF	1000	$0.71	$713.00	Along skip line only

Typical Design and Construction Costs
Two Lane Ramp Meter

Log No.: 175 **Ramp:** Arrowood Rd
Location: I-485 Inner

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Raised Pavement Markers	EA	0	$5.18	$0.00	110' transitions, 100' narrowed lane
- White Edge Line	LF	500	$1.09	$546.25	110' transitions, 100' narrowed lane
- Yellow Edge Line	LF	500	$1.09	$546.25	
- White Skip Line	LF	0	$0.28	$0.00	
- 24" Stop Bar	LF	24	$8.05	$193.20	
SUBTOTAL				**$1,998.70**	
Signing					Sign and post only
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Pedestal mounted
- R10-6R and R10-6L, Stop Here on Red	EA	2	$201.25	$402.50	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	2	$201.25	$402.50	
- W4-1L, Merge Left	EA	1	$747.50	$747.50	
SUBTOTAL				**$4,542.50**	
SUBTOTAL CONSTRUCTION				**$408,314.20**	
Traffic Control	15%			$61,247.13	
Contingencies	10%			$40,831.42	
TOTAL CONSTRUCTION				**$510,392.74**	
Design	8%			$40,831.42	
Construction Administration	10%			$51,039.27	
TOTAL DESIGN AND CONSTRUCTION				**$602,263.44**	

A.1.3. Proposed Two Lane Freeway to Freeway Ramp Locations

A.1.3.1. Mecklenburg County

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

097

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

Log No.: 97 **Ramp:** I-485 (F2F)
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	3160	$2.88	$9,100.80	Seeding around trench, conduit runs, pull box, and foundation areas.
SUBTOTAL				**$9,100.80**	
Guardrail					
- Guardrail Rail	LF	300	$20.00	$6,000.00	
- Guardrail Approach End Treatment	EA	1	$1,725.00	$1,725.00	
SUBTOTAL				**$7,725.00**	
Paving					
- Ramp Widening	SY	0	$62.50	$0.00	includes both asphalt and binder
- Pavement Resurfacing	SY	0	$13.50	$0.00	
SUBTOTAL				**$0.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	6	$453.68	$2,722.05	Mainline detection

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

Log No.: 97 **Ramp:** I-485 (F2F)
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- 6x6' loops - Ramp	EA	10	$453.68	$4,536.75	two queue, six passage and two clearance
- Detector Lead-in Cable	EA	390	$1.73	$672.75	Assumed setback distance 350'
- Pullbox (Std.)	EA	17	$345.00	$5,865.00	
- Conduit (Trenched)	LF	4625	$6.90	$31,912.50	All purposes
- Conduit (Directional Drilled)	LF	3620	$16.10	$58,282.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	1000	$5.75	$5,750.00	
- Ground Rods	EA	5	$82.00	$410.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	1	$17,250.00	$17,250.00	
- Pedestal Pole (Type III with Foundation)	EA	0	$3,650.00	$0.00	
- Two Section Signal Head	EA	2	$500.00	$1,000.00	
- One Section Signal Head	EA	6	$575.00	$3,450.00	Ramp meter advance signal
- Signal Cable	LF	190	$3.16	$600.88	
SUBTOTAL				**$157,686.93**	
Communications					
- Splice Enclosure	EA	1	$1,150.00	$1,150.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For splice enclosure
- Interconnect Center	EA	1	$1,725.00	$1,725.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	500	$1.73	$862.50	Drop cable to controller cabinet
- Tracer Wire	LF	500	$14.00	$7,000.00	
- Broadband Internet Service	LS	0	$500.00	$0.00	
- Ethernet Switch	EA	0	$1,955.00	$0.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	

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

Log No.: 97 **Ramp:** I-485 (F2F)
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$25,250.00**	
Pavement Marking					
- Pavement Marking Removal	LF	2000	$0.71	$1,426.00	To narrow lanes, 50 PMH design speed, maintain one edgeline, pave over other edgeline
- Raised Pavement Markers	EA	3	$5.18	$15.53	Along skip line only
- White Edge Line	LF	400	$1.09	$437.00	200' transitions, 100' narrowed lane, 50 MPH
- Yellow Edge Line	LF	600	$1.09	$655.50	200' transitions, 100' narrowed lane, 50 MPH
- White Skip Line	LF	200	$0.28	$55.20	
- 24" Stop Bar	LF	24	$8.05	$193.20	
SUBTOTAL				**$2,782.43**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	2	$201.25	$402.50	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	2	$201.25	$402.50	Pedestal mounted
- W4-1L, Merge Left	EA	2	$747.50	$1,495.00	
- Sign Structure (Cantilever)	EA	2	$57,500.00	$115,000.00	
- Ramp Meter On Sign (Message A)	EA	1	$5,750.00	$5,750.00	
- Ramp Meter On Sign (Message B)	EA	1	$5,750.00	$5,750.00	
SUBTOTAL				**$131,790.00**	
SUBTOTAL CONSTRUCTION				**$334,335.15**	
Traffic Control	15%			$50,150.27	

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

Log No.: 97 **Ramp:** I-485 (F2F)
Location: I-77 Southbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Contingencies	10%			$33,433.52	
TOTAL CONSTRUCTION				**$417,918.94**	
Design	8%			$33,433.52	
Construction Administration	10%			$41,791.89	
TOTAL DESIGN AND CONSTRUCTION				**$493,144.35**	

NCDOT Ramp Metering Feasibility Study

Individual Site Cost Estimate

129

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

Log No.: 129 **Ramp:** I-85 Southbound
Location: I-77 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Earthwork and Structure					
- Retaining Wall	SF	0	$85.00	$0.00	
- Excavation	CY	0	$25.00	$0.00	
- Fill	CY	0	$22.00	$0.00	
- Suppl. Clearing and Grub	AC	0	$300.00	$ 0.00	
- Seeding	SY	2409	$2.88	$6,937.92	Seeding around trench, conduit runs, pull box, and foundation areas.
SUBTOTAL				**$6,937.92**	
Guardrail					
- Guardrail Rail	LF	500	$20.00	$10,000.00	
- Guardrail Approach End Treatment	EA	2	$1,725.00	$3,450.00	
SUBTOTAL				**$13,450.00**	
Paving					
- Ramp Widening	SY	0	$62.50	$0.00	includes both asphalt and binder
- Pavement Resurfacing	SY	0	$13.50	$0.00	
SUBTOTAL				**$0.00**	
Drainage					
- Pipe	LF	0	$60.00	$0.00	Extend existing
SUBTOTAL				**$0.00**	
Signalization					
- 6x6' loops - Mainline	EA	10	$453.68	$4,536.75	Mainline detection
- 6x6' loops - Ramp	EA	10	$453.68	$4,536.75	two queue, six passage and two clearance
- Detector Lead-in Cable	EA	390	$1.73	$672.75	Assumed setback distance 350'
- Pullbox (Std.)	EA	12	$345.00	$4,140.00	

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

Log No.: 129 **Ramp:** I-85 Southbound
Location: I-77 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Conduit (Trenched)	LF	3535	$6.90	$24,391.50	All purposes
- Conduit (Directional Drilled)	LF	340	$16.10	$5,474.00	Five ramp crossings, multiple conduits
- Electrical Service	EA	1	$1,500.00	$1,500.00	
- Electrical Conductors	LF	1000	$5.75	$5,750.00	
- Ground Rods	EA	4	$82.00	$328.00	
- ATC/2070E Controller and Cabinet	EA	1	$16,100.00	$16,100.00	
- Firmware/Calibration	EA	1	$6,095.00	$6,095.00	
- Cabinet Foundation	EA	1	$1,540.00	$1,540.00	
- 45' Mast Arm Poles and Foundation	EA	0	$17,250.00	$0.00	
- Pedestal Pole (Type III with Foundation)	EA	0	$3,650.00	$0.00	
- Two Section Signal Head	EA	2	$500.00	$1,000.00	
- One Section Signal Head	EA	6	$575.00	$3,450.00	Ramp meter advance signal
- Signal Cable	LF	190	$3.16	$600.88	
SUBTOTAL				**$80,115.63**	
Communications					
- Splice Enclosure	EA	1	$1,150.00	$1,150.00	Link to SMFO
- Pullbox (Special Size)	EA	1	$2,012.50	$2,012.50	For splice enclosure
- Interconnect Center	EA	1	$1,725.00	$1,725.00	In cabinet
- Fiber-optic Drop Cable (six strands)	LF	500	$1.73	$862.50	Drop cable to controller cabinet
- Tracer Wire	LF	500	$14.00	$7,000.00	
- Broadband Internet Service	LS	0	$500.00	$0.00	
- Ethernet Switch	EA	1	$1,955.00	$1,955.00	
- CCTV Pole (55' Wood)	EA	1	$4,600.00	$4,600.00	
- CCTV Cabinet (Pole Mount, Type 336)	EA	1	$3,300.00	$3,300.00	
- CCTV Assembly	EA	1	$4,600.00	$4,600.00	
SUBTOTAL				**$27,205.00**	
Pavement Marking					

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

Log No.: 129 **Ramp:** I-85 Southbound
Location: I-77 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
- Pavement Marking Removal	LF	0	$0.71	$0.00	To narrow lanes, 50 PMH design speed, maintain one edgeline, pave over other edgeline
- Raised Pavement Markers	EA	3	$5.18	$15.53	Along skip line only
- White Edge Line	LF	400	$1.09	$437.00	200' transitions, 100' narrowed lane, 50 MPH
- Yellow Edge Line	LF	600	$1.09	$655.50	200' transitions, 100' narrowed lane, 50 MPH
- White Skip Line	LF	200	$0.28	$55.20	
- 24" Stop Bar	LF	32	$8.05	$257.60	
SUBTOTAL				**$1,420.83**	
Signing					
- W3-7, Ramp Meter Ahead	EA	2	$747.50	$1,495.00	Sign and post only
- W3-8, Ramp Metered When Flashing	EA	2	$747.50	$1,495.00	Sign and post only
- R10-6R and R10-6L, Stop Here on Red	EA	2	$201.25	$402.50	Pedestal mounted
- R10-28, One Vehicle Per Green	EA	2	$201.25	$402.50	Pedestal mounted
- W4-1L, Merge Left	EA	2	$747.50	$1,495.00	
- Sign Structure (Cantilever)	EA	2	$57,500.00	$115,000.00	
- Ramp Meter On Sign (Message A)	EA	1	$5,750.00	$5,750.00	
- Ramp Meter On Sign (Message B)	EA	1	$5,750.00	$5,750.00	
SUBTOTAL				**$131,790.00**	
SUBTOTAL CONSTRUCTION				**$260,919.37**	
Traffic Control	15%			$39,137.91	
Contingencies	10%			$26,091.94	
TOTAL CONSTRUCTION				**$326,149.21**	

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

Log No.: 129 **Ramp:** I-85 Southbound
Location: I-77 Northbound

Categories Descriptions	Unit	Quantity	Unit Cost	Total Cost	Assumptions
Design	8%			$26,091.94	
Construction Administration	10%			$32,614.92	
TOTAL DESIGN AND CONSTRUCTION				**$384,856.07**	

Appendix B. Sensitivity Calculations

B.1. Benefit Cost Appraisal over 5-Year Period for Each Site – 10% Delay Reduction

Log	Freeway	Cross Street	Exit	Direction	County	Cumulative Cost in Period	Cumulative Benefit in Period	BCR in Period	FYRR
102	I-77	Nations Ford Rd	4	SB	Mecklenburg	$195,701	$6,565,415	33.55	708%
129	I-77	I-85 SB	13	NB	Mecklenburg	$426,356	$11,876,677	27.86	504%
105	I-77	Tyvola Rd	5	NB	Mecklenburg	$219,430	$5,910,650	26.94	535%
111	I-77	Remount Rd	8	SB	Mecklenburg	$199,870	$4,626,414	23.15	455%
145	I-77	US 21 (Catawba Ave)	28	NB		$211,718	$4,341,321	20.51	386%
093	I-77	Westinghouse Blvd	1A	SB	Mecklenburg	$621,695	$10,600,628	17.05	260%
147	I-77	Goodrum Rd / Griffith St	30	NB		$251,413	$3,507,442	13.95	221%
143	I-77	NC 73 (Sam Furr Rd)	25	NB		$249,550	$2,596,585	10.41	140%
067	I-85	Sugar Creek Rd	41	NB		$237,275	$2,429,189	10.24	138%
104	I-77	Tyvola Rd	5	SB		$300,680	$3,140,318	10.44	135%
234	I-485	Rea Rd	59	Outer		$238,814	$2,084,875	8.73	103%
233	I-485	NC 16 (Providence Rd)	57	Inner		$280,720	$2,329,956	8.30	88%
035	I-85	Belmont-Mt. Holly Rd	26	SB		$220,958	$1,842,214	8.34	96%
230	I-485	NC 16 (Providence Rd)	57	Outer		$307,683	$2,167,432	7.04	58%
232	I-485	NC 16 (Providence Rd)	57	Outer		$203,039	$1,363,635	6.72	61%
231	I-485	NC 16 (Providence Rd)	57	Inner		$268,169	$1,611,809	6.01	37%
103	I-77	Nations Ford Rd	4	NB		$226,512	$1,312,233	5.79	36%
179	I-485	Steele Creek Rd	4	Inner		$252,868	$1,117,163	4.42	2%
237	I-485	Rea Rd	59	Inner		$239,279	$950,435	3.97	-8%
236	I-485	Rea Rd	59	Inner		$240,498	$832,245	3.46	-20%
101	I-77	Arrowood Rd	3	NB		$253,327	$755,999	2.98	-31%
034	I-85	McAdenville Rd	23	NB		$204,187	$623,847	3.06	-27%
037	I-85	Beatty Dr / Park St	27	SB		$250,200	$707,626	2.83	-35%
097	I-77	I-485	1B	SB		$534,644	$1,384,428	2.59	-45%
140	I-77	Gilead Rd	23	NB		$268,522	$609,795	2.27	-48%
032	I-85	S Main St	22	NB		$180,599	$416,634	2.31	-43%
177	I-485	Steele Creek Rd	4	Inner		$273,828	$596,430	2.18	-50%
064	I-85	Graham St	40	SB		$239,395	$496,804	2.08	-52%
146	I-77	Goodrum Rd / Griffith St	30	SB		$227,259	$404,604	1.78	-58%
239	I-485	US 521 (Johnston Rd)	61	Outer		$238,470	$308,521	1.29	-70%
182	I-485	US 74 / US 29 (Wilkinson Blvd)	9	Outer		$310,755	$223,887	0.72	-84%
181	I-485	West Blvd	6	Inner		$251,646	$164,029	0.65	-85%

Log	Freeway	Cross Street	Exit	Direction	County	Cumulative Cost in Period	Cumulative Benefit in Period	BCR in Period	FYRR
075	I-85	Mallard Creek Rd	46	NB		$264,262	$142,512	0.54	-88%
229	I-485	E John St	52	Inner		$245,419	$109,289	0.45	-90%
175	I-485	Arrowood Rd	3	Inner		$643,763	$168,371	0.26	-94%
072	I-85	Harris Blvd	45	SB		$231,555	$41,980	0.18	-96%
030	I-85	Cox Rd	21	NB		$235,347	$23,574	0.10	-98%
250	US-74	Briar Creek Road/Television Lane	244	WB		$234,844	$0	0.00	-100%

B.2. Benefit Cost Appraisal over 10-Year Period for Each Site – 10% Delay Reduction

Log	Freeway	Cross Street	Exit	Direction	Cumulative Cost in Period	County	Cumulative Benefit in Period	BCR in Period	FYRR
102	I-77	Nations Ford Rd	4	SB	$237,201	Mecklenburg	$13,130,831	55.36	708%
129	I-77	I-85 SB	13	NB	$467,856		$23,753,353	50.77	504%
105	I-77	Tyvola Rd	5	NB	$260,930		$11,821,301	45.30	535%
111	I-77	Remount Rd	8	SB	$241,370		$9,252,828	38.33	455%
145	I-77	US 21 (Catawba Ave)	28	NB	$253,218		$8,682,642	34.29	386%
093	I-77	Westinghouse Blvd	1A	SB	$663,195		$21,201,256	31.97	260%
147	I-77	Goodrum Rd / Griffith St	30	NB	$292,913		$7,014,884	23.95	221%
143	I-77	NC 73 (Sam Furr Rd)	25	NB	$291,050		$5,193,170	17.84	140%
067	I-85	Sugar Creek Rd	41	NB	$278,775		$4,858,378	17.43	138%
104	I-77	Tyvola Rd	5	SB	$342,180		$6,280,635	18.35	135%
234	I-485	Rea Rd	59	Outer	$280,314		$4,169,750	14.88	103%
233	I-485	NC 16 (Providence Rd)	57	Inner	$322,220		$4,659,912	14.46	88%
035	I-85	Belmont-Mt. Holly Rd	26	SB	$262,458		$3,684,428	14.04	96%
230	I-485	NC 16 (Providence Rd)	57	Outer	$349,183		$4,334,864	12.41	58%
232	I-485	NC 16 (Providence Rd)	57	Outer	$244,539		$2,727,270	11.15	61%
231	I-485	NC 16 (Providence Rd)	57	Inner	$309,669		$3,223,619	10.41	37%
103	I-77	Nations Ford Rd	4	NB	$268,012		$2,624,466	9.79	36%
179	I-485	Steele Creek Rd	4	Inner	$294,368		$2,234,327	7.59	2%
237	I-485	Rea Rd	59	Inner	$280,779		$1,900,870	6.77	-8%
236	I-485	Rea Rd	59	Inner	$281,998		$1,664,490	5.90	-20%
101	I-77	Arrowood Rd	3	NB	$294,827		$1,511,998	5.13	-31%
034	I-85	McAdenville Rd	23	NB	$245,687		$1,247,694	5.08	-27%
037	I-85	Beatty Dr / Park St	27	SB	$291,700		$1,415,252	4.85	-35%
097	I-77	I-485	1B	SB	$576,144		$2,768,855	4.81	-45%
140	I-77	Gilead Rd	23	NB	$310,022		$1,219,590	3.93	-48%
032	I-85	S Main St	22	NB	$222,099		$833,267	3.75	-43%
177	I-485	Steele Creek Rd	4	Inner	$315,328		$1,192,859	3.78	-50%
064	I-85	Graham St	40	SB	$280,895		$993,608	3.54	-52%
146	I-77	Goodrum Rd / Griffith St	30	SB	$268,759		$809,207	3.01	-58%
239	I-485	US 521 (Johnston Rd)	61	Outer	$279,970		$617,042	2.20	-70%
182	I-485	US 74 / US 29 (Wilkinson Blvd)	9	Outer	$352,255		$447,774	1.27	-84%
181	I-485	West Blvd	6	Inner	$293,146		$328,058	1.12	-85%
075	I-85	Mallard Creek Rd	46	NB	$305,762		$285,024	0.93	-88%
229	I-485	E John St	52	Inner	$286,919		$218,577	0.76	-90%

Log	Freeway	Cross Street	Exit	Direction	Cumulative Cost in Period	County	Cumulative Benefit in Period	BCR in Period	FYRR
175	I-485	Arrowood Rd	3	Inner	$685,263		$336,742	0.49	-94%
072	I-85	Harris Blvd	45	SB	$273,055		$83,960	0.31	-96%
030	I-85	Cox Rd	21	NB	$276,847		$47,147	0.17	-98%
250	US-74	Briar Creek Road/Television Lane	244	WB	$276,344		$0	0.00	-100%

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