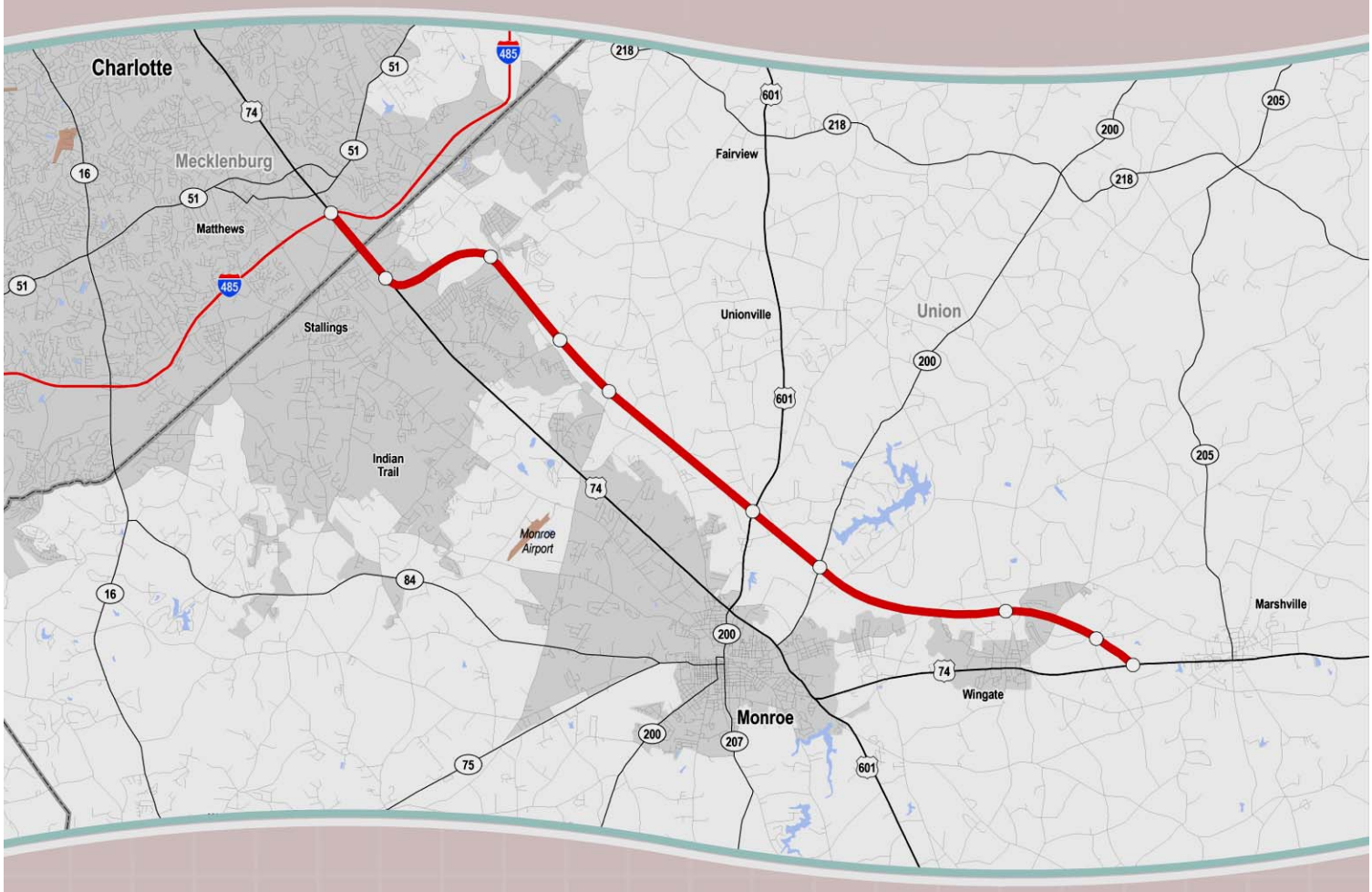
Final Report

Proposed Monroe Connector/Bypass Comprehensive Traffic and Revenue Study



NORTH CAROLINA
Turnpike Authority

Final Report

Proposed Monroe Connector/Bypass Comprehensive Traffic and Revenue Study

Prepared For

NORTH CAROLINA Turnpike Authority

Prepared By

ENGINEERS PLANNERS ECONOMISTS
WilburSmith ASSOCIATES

October 22, 2010

October 22, 2010

Mr. David Joyner
Executive Director
North Carolina Turnpike Authority
5400 Glenwood Avenue
Suite 400
Raleigh, NC 27612

Re: **Comprehensive Traffic and Revenue Study – Proposed Monroe Connector/Bypass**

Dear Mr. Joyner:

Wilbur Smith Associates (WSA) is most pleased to submit this report summarizing the results of our comprehensive traffic and revenue study for the proposed Monroe Connector/Bypass in Union and Mecklenburg Counties, North Carolina. This study was conducted at a level of detail that is considered sufficient for use in support of a project financing.

The proposed Monroe Connector/Bypass is approximately 20 miles in length and is generally parallel to US 74, a heavily congested facility that connects southeastern North Carolina including the Port of Wilmington to the Charlotte metropolitan area. The project is expected to open in January 2015 as a free flow, cashless system with electronic toll collection and video toll collection for customers without an electronic transponder.

We conducted additional economic and behavioral analyses for this study. An independent economist, the Kenan Institute of Private Enterprise of the Kenan-Flagler Business School at the University of North Carolina at Chapel Hill, reviewed and updated the latest regional socioeconomic forecasts that were used by the Mecklenburg-Union Metropolitan Planning Organization (MUMPO) in its regional transportation planning. Travel characteristics and traveler behavior were also identified through origin-destination travel surveys conducted by WSA and stated preference surveys by our specialty subcontractor, Resource Systems Group. Finally, traffic and revenue estimates in this report were updated in January, 2010 to reflect the impact of the current economic conditions.

Our project manager, David Danforth, and other key members of the project team including Ed Regan, Selvaraj Rayan, Will Letchworth, and Cissy Szeto, as well as our subconsultant team, gratefully acknowledge the assistance provided by NCTA, MUMPO, and others during the course of the study. We have appreciated this opportunity to be of service to the Authority.

Very truly yours,

WILBUR SMITH ASSOCIATES

Scott A. Allaire

Scott A. Allaire
Vice President

900 Chapel Street, Suite 1400 New Haven, Connecticut 06510
203.865.2191 *f* 203.624.0484 www.WilburSmith.com

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CHAPTER 1
INTRODUCTION

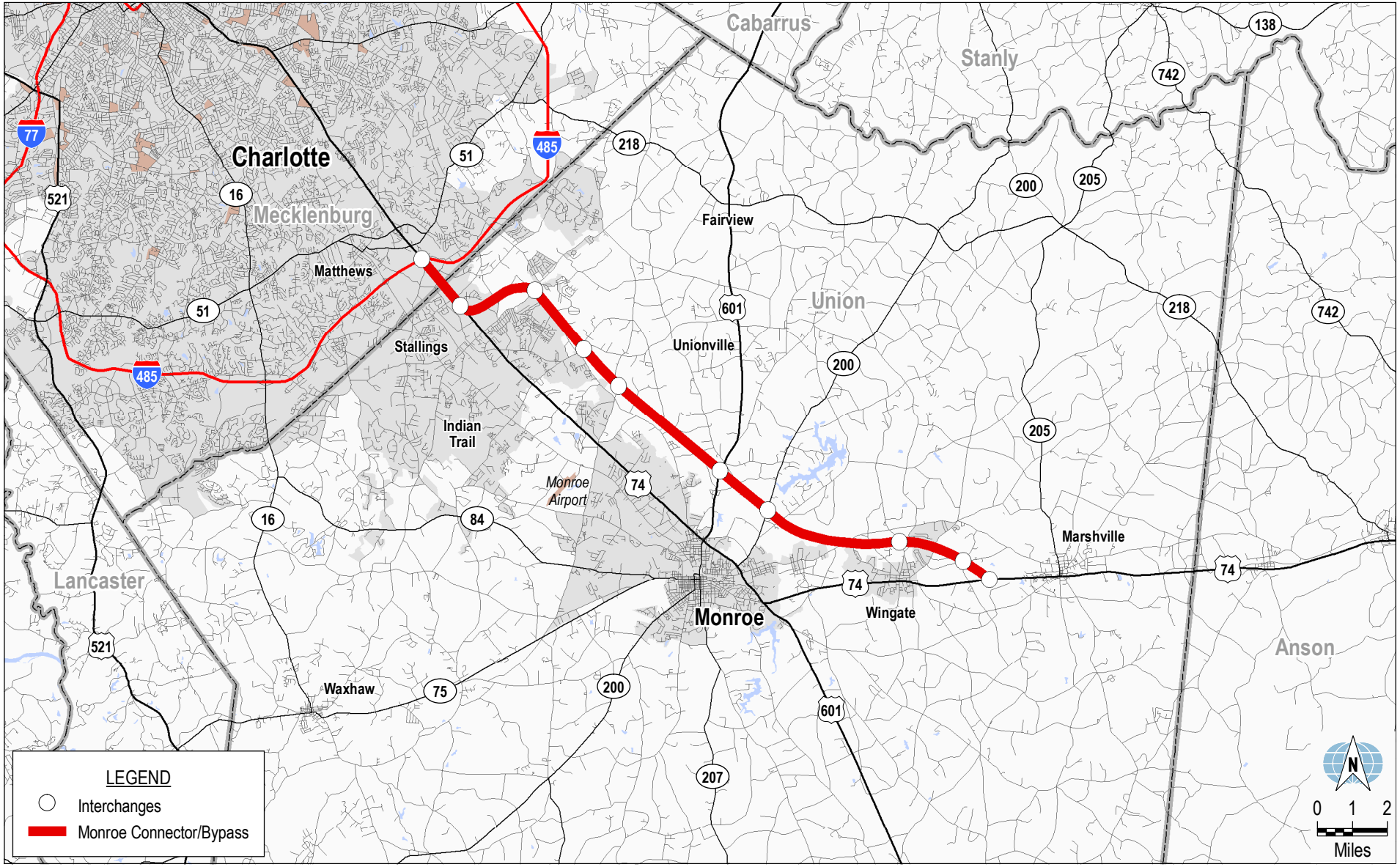
The proposed Monroe Connector/Bypass in the Charlotte metropolitan area is one of several candidate toll facility projects under consideration by the North Carolina Turnpike Authority (NCTA). Preliminary or "Level 2" traffic and revenue studies were conducted in 2006 for the project, and the NCTA decided to proceed with this comprehensive or "Level 3" study to support project financing of this approximately 19.8-mile facility.[(1)]

PROJECT DESCRIPTION

Figures 1-1 and 1-2 depict the project location and its relationship to the surrounding transportation system. The Monroe Connector/Bypass, planned to open in January 2015, would generally follow a northwest-southeast orientation, essentially paralleling US 74, which is a major facility that connects southeastern North Carolina to the Charlotte metropolitan area. It provides access between the Port of Wilmington and the southeastern North Carolina beaches and Charlotte and points west. With the Monroe Connector/Bypass, drivers would instead have a high-speed, access controlled facility between Monroe and Charlotte, which would reduce congestion on the heavily-utilized US 74. This existing major signalized arterial route currently carries high traffic volumes, particularly between I-485 and Monroe. Congestion levels are increasing during peak periods. The proposed Monroe Connector/Bypass would provide significant time savings for travelers moving between I-485 south of Charlotte and Monroe or points south and east. US 74 would remain the primary competing route to the Monroe Connector/Bypass.

The proposed Monroe Connector/Bypass, shown in Figure 1-2, would extend for approximately 19.8 miles from the interchange of US 74/I-485 near Matthews, at the northern end of the project to US 74 east of Wingate.

(1) Proposed Monroe Connector Preliminary Traffic and Revenue Study, Wilbur Smith Associates for the North Carolina Turnpike Authority, October 11, 2006.



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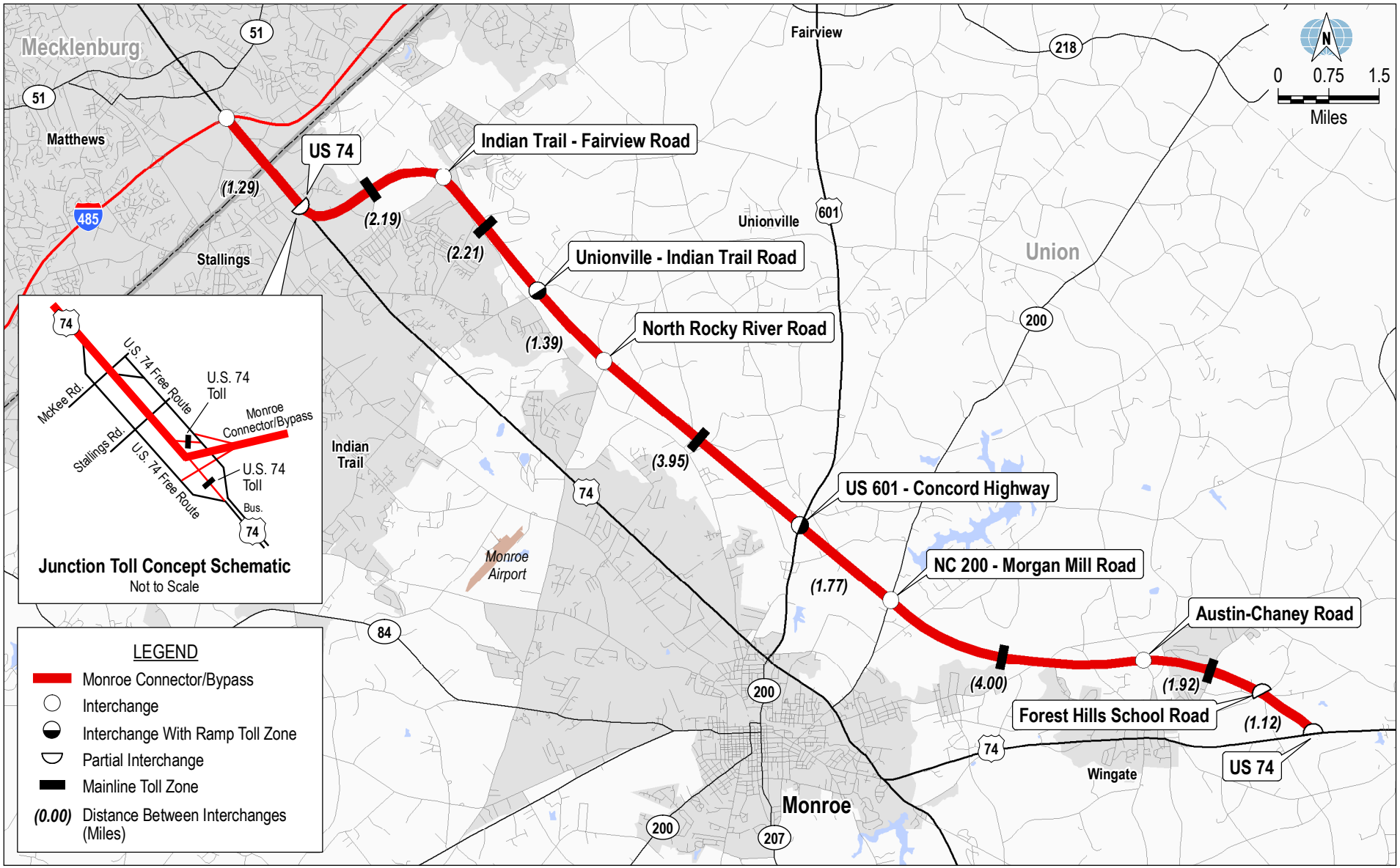
REGIONAL LOCATION MAP

FIGURE 1-1



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TOLL SYSTEM CONFIGURATION

FIGURE 1-2

PROJECT CONFIGURATION AND TOLL COLLECTION CONCEPT

The project would have eight intermediate interchanges, including an interchange with US 74 approximately 1.3 miles from I-485, commonly referred to as the Charlotte Outer Loop. Other interchanges are planned for Indian Trail-Fairview Road, Unionville-Indian Trail Road, North Rocky River Road, US 601, NC 200, Austin-Chaney Road, and Forest Hills School Road.

An all-electronic tolling (AET) system is planned for the Monroe Connector/Bypass. The system will have no free movements, and cash payments of tolls will not be available. Motorists not equipped for electronic toll collection (ETC) will be permitted to use the road under a video tolling collection (VTC) system. VTC rates will be higher than ETC rates because of the higher collection costs of video toll collection as compared to ETC. Rates would be based on the distances covered by each toll zone. For some shorter movements, a minimum toll would be established.

Since all toll collection will be by either ETC or VTC at highway speeds, the Monroe Connector/Bypass will not have conventional toll plazas. Instead it will have locations, called "tolling zones," with appropriate equipment to read transponders or to capture license plate information by digital video.

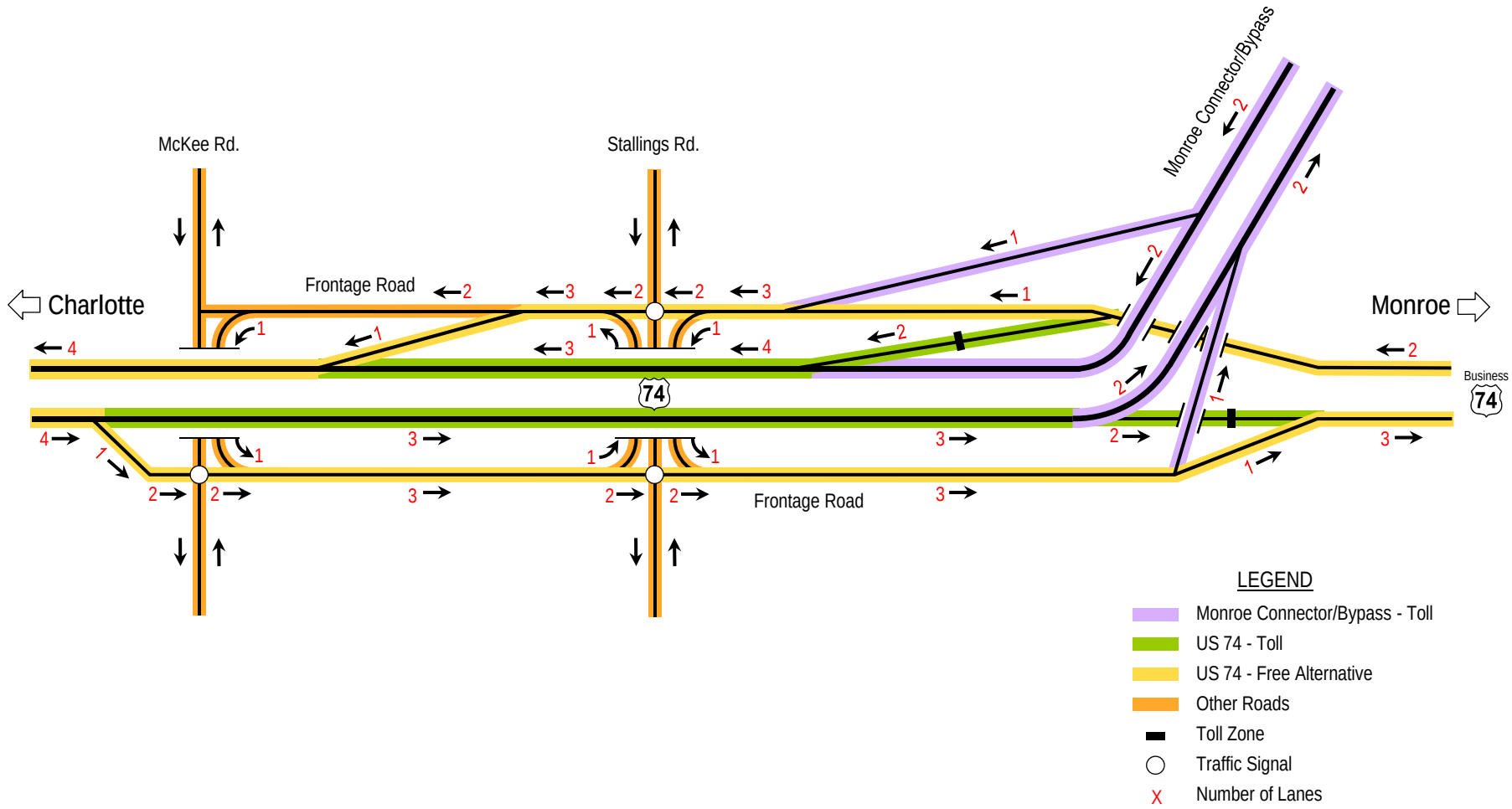
Five mainline tolling zones are planned as follows:

- Between US 74 and Austin-Chaney Road;
- Between Austin-Chaney Road and NC 200;
- Between US 601 and North Rocky River Road;
- Between Unionville-Indian Trail Road and Indian Trail-Fairview Road; and
- Between Indian Trail-Fairview Road and US 74.

Two sets of ramp tolling zones would be established on ramps to and from the east at US 601 and on ramps to and from the east at Unionville-Indian Trail Road. These locations were selected because of the short distances to other interchanges on the project in order to reduce the effects of minimum tolls for this mileage-based toll system.

In addition, a tolling zone would be established on US 74 at the western end of the project for traffic. The configuration of this interchange would allow drivers on US 74 to choose to pay a toll to use the improved section of US 74 or to choose not to pay a toll by using the adjacent service roads to be designated as US 74 Business. Figure 1-3 contains a schematic diagram of this interchange.

Schematic
Not To Scale



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MONROE CONNECTOR/BYPASS AND US 74 JUNCTION TOLL CONCEPT SCHEMATIC

FIGURE 1-3

SCOPE OF WORK

This study was a follow-up to the preliminary study described earlier, and previously collected data was reviewed and updated as necessary. Inventories of the corridor operating conditions including traffic counts and speed-delay studies on competing and complementary routes within the traffic impact study area plus other relevant routes outside the study area were conducted.

Previous reports and study materials related to the proposed Monroe Connector/Bypass were also reviewed. This information included the long range transportation plan for the Mecklenburg-Union Metropolitan Planning Organization (MUMPO) and work associated with the preparation of the project environmental impact statement. Information on the planned transportation improvement program was reviewed to determine its prospective impact on the traffic and revenue potential of the Monroe Connector/Bypass.

ORIGIN-DESTINATION SURVEY

An origin-destination (OD) survey was conducted in the project area to identify current travel patterns and trip characteristics. A mail-back survey procedure was followed in which motorists were given survey cards while stopped at traffic signals and encouraged to return them by pre-paid mail. The information obtained in this survey was used to calibrate the travel demand model in the study corridor.

STATED PREFERENCE SURVEY

Surveys were also conducted to provide value-of-time data for use in the toll diversion models. Three methods of obtaining information were used. Interactive, notepad-based interviews were held at various employment centers, shopping areas, and government offices. Interactive, internet-based surveys were also conducted with OD survey participants who provided e-mail addresses on the OD survey card. Finally, individuals who provided e-mail addresses at public meetings for the environmental impact analysis were also asked if they wished to participate in the stated preference survey.

TRAFFIC MODEL REFINEMENT

The latest available version of the Metrolina Regional Travel Demand Model (MRTDM) was used in this study This traffic model covers all of Mecklenburg, Union, Gaston, and Cabarrus Counties as well as adjacent portions of Stanly County.

During the time of the study, MUMPO was preparing a new long range transportation plan with significant changes to the future roadway projects as compared to the model used for the preliminary study. MPO modeling work was not complete during this study, and a new long range transportation plan had not been adopted. However the future project list was nearly final, and such information was incorporated in the model used for this comprehensive toll traffic and revenue study.

The socioeconomic data used in the MRTDM trip generation process was adjusted by an independent economist.[(2)] Accordingly, new trip tables were developed by applying the new socioeconomic data to the trip generation, trip distribution, and mode choice modules of the MRTDM.

The revised base-year model was calibrated in the immediate project area to achieve the best traffic volume assignments compared to observed traffic counts and observed speeds during speed-delay studies.

The toll collection concept used in the preliminary studies was revised to reflect the NCTA's decision to use AET without toll plazas. As was the case for the earlier study, zone disaggregation was necessary along the Monroe Connector/Bypass. The trip tables were disaggregated on a proportionate basis using the updated trip generation and distribution process. Future-year trip tables were also disaggregated to reflect the new disaggregated zone system.

Information was also obtained regarding regional and corridor income characteristics to aid in the development of estimated values-of-time for potential users of the candidate toll facility. Additional information from the stated preference survey was used to establish values-of-time by trip purpose and income level. This is a critical model parameter used to assess motorists' willingness to pay tolls and to estimate motorists' sensitivity to toll rates for the facility. Vehicle operating cost parameters were also established specific to the study corridor.

Independent Corridor Growth Analysis

Economic growth is particularly important for a start-up toll facility such as the proposed Monroe Connector/Bypass. Since the completion of the preliminary study, MUMPO revised the region's socioeconomic forecasts. The new MUMPO forecasts as of December 2009, were used by the independent economist in its review of study area growth. The independent economist adjusted MUMPO's new forecasts as described in its report.

(2) Kenan Institute for Private Enterprise of the University of North Carolina at Chapel Hill.

These forecasts by the independent economist were then used in the transportation model to create new trip tables for the toll diversion analysis.

Traffic and Revenue Analysis

The refined models were used to run a series of traffic assignments, both with and without the proposed Monroe Connector/Bypass. In each case, traffic assignments were run at AM peak, PM peak and off-peak conditions. A review was made of the reasonableness of the travel demand estimates, particularly under a toll condition, using various evaluation techniques such as select link, corridor share, and capture rate.

Toll sensitivity curves were developed for 2015 traffic volumes and 2035 volumes to determine optimum toll rates. These optimum rates were then used to conduct traffic assignments for other years.

Based on the results of the traffic modeling analysis, annual estimates of traffic and revenue from the proposed Monroe Connector/Bypass were developed for the base-case condition from opening year 2015 through 2035. The forecasts beyond 2035 were based on an extrapolation of modeling results from 2035.

Revenue estimates in the early years of the projection period were adjusted to reflect ramp-up, a pattern of gradual build-up in demand for new toll facilities. This reflects the fact that the full demand along a facility is not typically realized when it opens, but gradually phases in over a period of two to four years.

Finally, estimates of revenue leakage were prepared to reflect potential losses of revenue due to system operational factors, unreadable license plates, unidentified vehicle owners, and account collection factors.

Sensitivity Tests

A series of sensitivity tests were also performed to provide additional information on the sensitivity of the forecasts to changes in key parameters such as higher and lower economic growth, different percentages of ETC usage, different values of time, and different vehicle operating costs.

REPORT STRUCTURE

The remainder of this report consists of six chapters.

- Chapter 2 presents the existing traffic conditions in the project study area.

- Chapter 3 summarizes the travel demand surveys.
- Chapter 4 contains a summary of the stated preference surveys.
- Chapter 5 describes the socioeconomic characteristics of the study area using the independent economist's socioeconomic forecast.
- Chapter 6 describes the development of the traffic forecast model, assumed roadway and transit improvements, toll configuration, toll sensitivity, recommended toll rates, traffic and gross revenue forecasts, and revenue leakage.
- Chapter 7 contains the results of a series of sensitivity tests on key model parameters.

CHAPTER 2

EXISTING TRAFFIC CONDITIONS

A major part of the effort involved in this phase of the study included the collection of existing data in order to:

- Understand existing travel behavior as a context for the evolution of future travel behavior after the proposed toll road and other area facilities planned for construction over the forecast period are built; and

- Calibrate the base year model to current/baseline observed traffic conditions to assure that the forecasting tools are adequately replicating current conditions in the study area prior to forecasting future traffic volumes.

To achieve these objectives, the latest travel data on traffic speeds, traffic volumes, and vehicle type in the study area were compiled. In addition, extensive route reconnaissance and reviews of available traffic statistics on highways within the study area were conducted.

This current empirical documentation of the traffic network in the study area was augmented by available traffic trend data from North Carolina Department of Transportation (NCDOT). Available information on programmed highway improvements scheduled in the study area was incorporated into the analysis also.

This chapter describes the collection of data used to characterize the operational performance of existing facilities in the Monroe Connector/Bypass study area.

EXISTING HIGHWAY SYSTEM

The proposed Monroe Connector/Bypass would primarily facilitate traffic movement in an east-west direction between the City of Monroe and I-485. It passes through or near major employment centers in Monroe and Charlotte, which is the dominant location for employment in the area.

The Monroe Connector/Bypass would provide a new limited access facility in an area currently served by the following major facilities as summarized in Table 2-1:

- US 74 extends east-west along the northeastern side of Monroe, connecting Monroe and points east with I-485 and Charlotte. US 74 is a four-lane median divided roadway with signalized and unsignalized intersections throughout its length. The speed limits along US 74 vary between 35 and 55 mph, but the road typically operates at lower average speeds due to high traffic volumes and over 20 signalized intersections between I-485 and US 601.

- Old Charlotte Highway provides east to west travel south of US 74 extending into the Town of Monroe. It has numerous signalized intersections and is an undivided two-lane roadway with 35 and 45 mph speed limits.

- Secrest Short Cut Road provides east to west travel north of US 74 until intersecting with US 74 near Monroe. It is primarily a two-lane roadway with 35 and 45 mph speed limits.

- Weddington Road runs east to west extending out from the Town of Monroe. It is a two-lane roadway with 25, 35, and 45 mph speed limits.

- NC 200 (Morgan Mill Road) runs north and south, south of I-85. NC 200 varies from two to four lanes with 35, 45, and 55 mph speed limits.

- US 601 (Concord Highway/Pageland Highway) runs north and south through the study area. US 601 is a two-lane roadway through the study area with the exception of the area south of US 74 and north of White Store Road with speed limits of 45 and 55 mph.

- Waxhaw-Indian Trail Road runs north to south, parallel to I-485 and intersects with US 74. Waxhaw-Indian Trail Road is a two-lane roadway with 55 mph speed limits. Waxhaw-Indian Trail Road becomes Indian Trail Road at Old Monroe Road and continues to Secrest Short Cut Road. At Secrest Short Cut Road it becomes Indian Trail-Fairview Road.

- North Rocky River Road is primarily a north to south route with an intersection at US 74 and is a two lane undivided roadway. The speed limit on North Rocky River Road is 45 mph.

Table 2-1
Key Attributes of Major Routes Within the Study Area

Route	Location in Study Area	Direction in Study Area	Lanes Per Direction	Controlled Access	Traffic Signals	Posted Speed Limit
NC 84 (Weddington Road)	NC 16 to NC 75	East - West	1	No	Yes	25-45
Old Charlotte Highway	I-485 to Downtown Monroe at NC 75 (Franklin Street)	East - West	1	No	Yes	35-45
US 74	I-485 to Old Pageland Monroe Road / Secrest Avenue	East - West	2	No	Yes	35-55
NC 200 (Morgan Mill Road)	New Salem Road to Downtown Monroe at Old Charlotte Avenue	North - South	1-2	No	Yes	45-55
US 601 (Concord Highway)	NC 218 (Fairview Road) to US 74	North - South	1	No	Yes	55
NC 218 (Fairview Road)	I-485 to NC 200 (Morgan Mill Road)	East - West	1	No	Yes	45-55
Secrest Short Cut Road	I-485 to US 74	East - West	1	No	Yes	35-45
Waxhaw-Indian Trail Road	NC 84 (Weddington Road) to Old Monroe Road	North - South	1	No	Yes	55
Indian Trail Road	Old Monroe Road to Secrest Short Cut Road/Idlewild Road	North - South	1	No	Yes	35
Indian Trail Fairview Road	Secrest Short Cut Road/Idlewild Road to NC 218 (Fairview Road)	North - South	1	No	Yes	35
Rocky River Road	Lawyers Road to NC 84 (Weddington Road)	North - South	1	No	Yes	45

TRAFFIC TRENDS AND VARIATIONS

The NCDOT Traffic Survey Group conducts traffic counts for selected roadways statewide. Mainline and ramp traffic volumes are collected annually for interstate and limited access highways and used to develop estimates of Average Annual Daily Traffic (AADT). Traffic counts on arterial roadways are usually collected biennially. Existing traffic data from NCDOT were reviewed to aid in the traffic model calibration process. Figure 2-1 provides a summary of selected 2007 and 2008 traffic counts conducted by NCDOT.

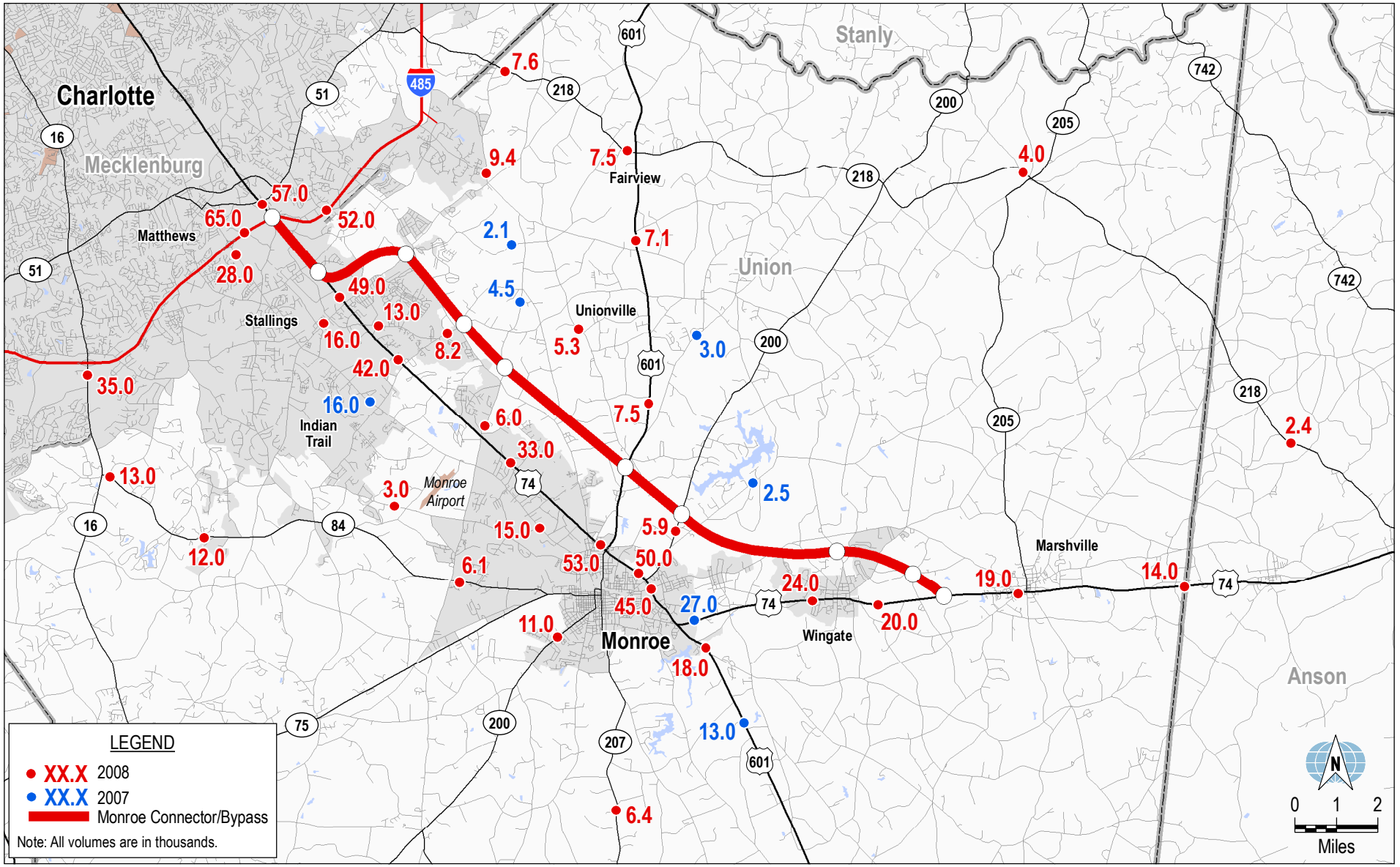
The dominant road within the study area is US 74 with AADTs up to 57,000 vehicles near the western end of the project. At the eastern end, average annual daily traffic is less than 25,000. Other roads in the area have AADTs less than 15,000 except on roads closer to I-485.

Traffic information supplied by NCDOT was supplemented by new traffic counts within the Monroe Connector/Bypass study area and other key locations during March 2009. The major purpose of this supplemental work was to obtain current traffic volumes as an aid in re-calibrating the regional transportation demand model in the area of the proposed Monroe Connector/Bypass. Seven-day counts by day, hour, and vehicle classification were performed at ten locations. The AADT volumes resulting from this data collection effort, which were calculated using North Carolina's published axle and seasonal correction factors, are summarized in Table 2-2.

Table 2-2
Average Weekday Traffic Volumes
at Supplemental Traffic Count Locations

Location	Average Weekday Traffic
NC 84 (Weddington Road) west of Rocky River Road	7,800
Old Charlotte Highway west of Dickerson Boulevard	16,000
US 74 east of Old Pageland Monroe Road / Secrest Avenue	27,600
NC 200 (Morgan Mill Road) north of Sutherland Avenue	10,300
US 74 west of Secrest Short Cut Road	52,500
US 601 (Concord Highway) north of Ridge Road / Baucom Deese Road	10,300
NC 218 (Fairview Road) east of US 601 (Concord Highway)	5,900
Secrest Short Cut Road south of Indian Trail Fairview Road	13,000
US 74 east of Indian Trail Road	49,800
Old Monroe Road east of Indian Trail Road	20,500

Source: 7-day Supplemental Counts in March 2009



Source: NCDOT Traffic Survey Group

NORTH CAROLINA Turnpike Authority

AVERAGE ANNUAL DAILY TRAFFIC AT SELECTED LOCATIONS

FIGURE 2-1

ANNUAL TRAFFIC TRENDS AND VARIATIONS

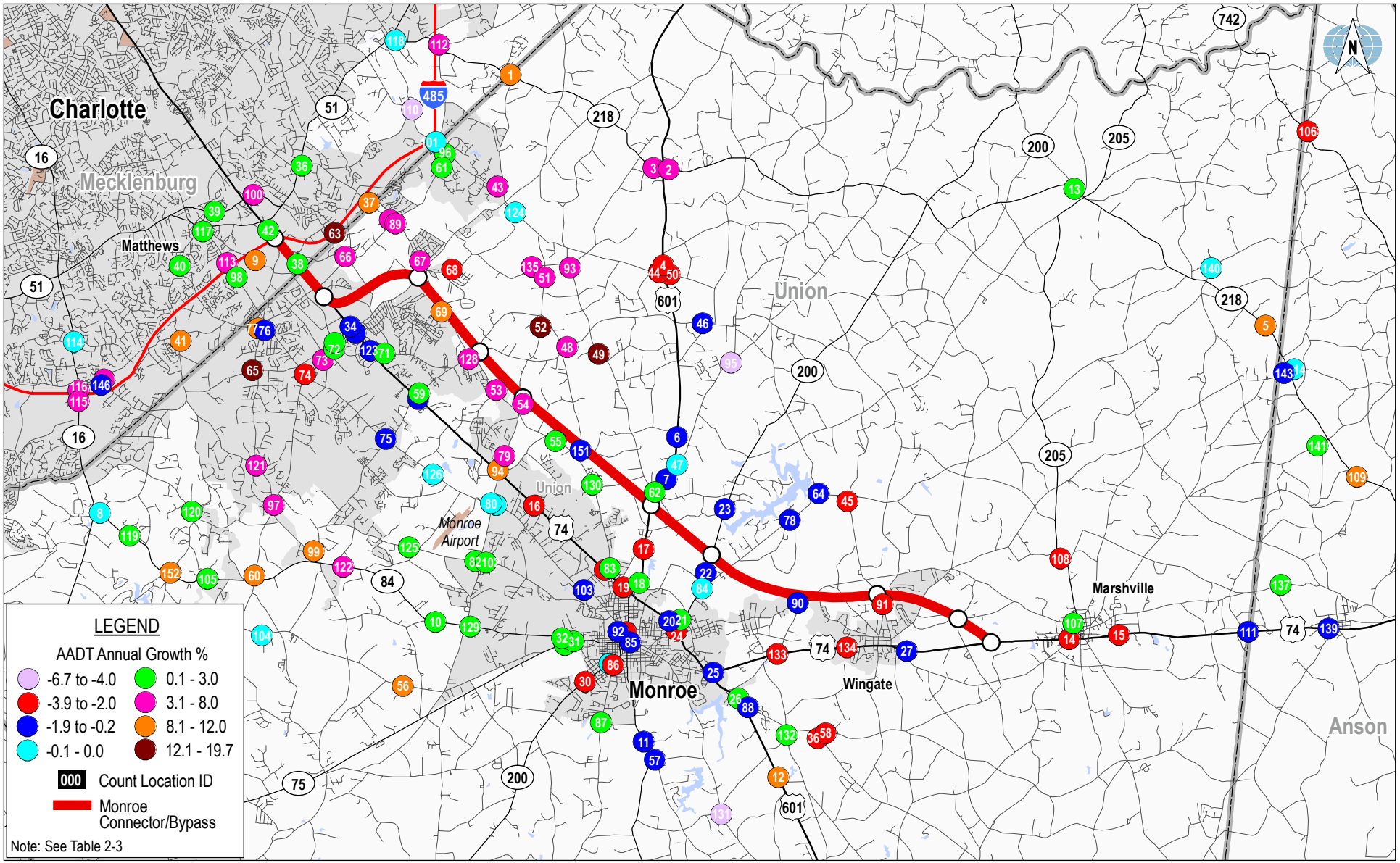
Figure 2-2 shows the location of traffic counts conducted by NCDOT on selected roadways between 2002 and 2008. Table 2-3 contains the traffic counts and the average annual growth rates for the locations indicated in the figure. The larger percentages of growth occurred on lower volume roads, which is likely due to the building of new housing developments in the area. US 74 on the other hand experienced decreases in volumes which is probably due to the amount of traffic delays and people finding alternate routes to work. The table also shows how traffic has changed for some roads in recent years. In many cases the average annual growth between 2006 and 2008 has been negative or flat which reflects the national downturn in traffic during the combination of the recession and the spike in fuel prices.

MONTHLY TRAFFIC VARIATIONS

Seasonal adjustment factors obtained from the NCDOT Traffic Survey Group are shown in Table 2-4. These seasonal adjustment factors reflect the monthly traffic variations that occur on roadways in the study area. As shown in the table for secondary roads, the average March traffic volumes are 1 percent below the monthly average traffic volumes. January runs an average of 8 percent below, and February an average of 3 percent below. Volumes typically pick back up in April, jumping to 4 percent above the average, and in May, June, July, and August traffic volumes are expected to be 8 percent above the normal. All routes in the proposed Monroe Connector/Bypass study area fall under the secondary road category, except US 74. However, research by the NCDOT Traffic Survey Group concludes that the same factor as used on the secondary roads during the month of March, when the Monroe Connector/Bypass supplemental data was collected, is appropriate for use on the March data collected for US 74. Urban interstates generally have higher deviations in volume from the monthly average, with the peak month being September with 10 percent above the monthly average. The seasonality on rural interstates is more pronounced, ranging from 12 percent below the monthly average in February to 9 percent above the monthly average in August.

DAILY TRAFFIC VARIATIONS

In the absence of any continuous counting stations within the study area, the data collected during the seven-day supplemental counts conducted in March 2009 was used to analyze daily traffic variations. Table 2-5 summarizes the daily variations in traffic volumes at the ten count locations where a full week of data was available. The average weekday volume for all locations is 4 percent above the average daily traffic volume, while the average weekend traffic volume is 12 percent below the average. This suggests a typical commuter pattern present within the study area. For most locations, the peak day is Friday, as expected due to the common



NORTH CAROLINA Turnpike Authority

AVERAGE ANNUAL DAILY TRAFFIC ANNUAL GROWTH RATE 2002-2008

FIGURE 2-2

Table 2-3
Area Historic Roadway Traffic Counts
2002-2008

Map Location	Route Name	Traffic Count Location	Average Annual Daily Traffic (Thousands) 2002	2003	2004	2005	2006	2007	2008	Average Annual Growth	Period	Recent Average Annual Growth 2006 - 2008
9	I-485	From Exit 51 to Exit 52	39.0	45.0	63.0	68.0	68.0	68.0	65.0	8.9%	2002 - 2008	-2.2%
63	I-485	From Exit 49 to Exit 51	20.0	23.0	49.0	54.0	56.0	54.0	52.0	17.3%	2002 - 2008	-3.6%
114	NC 16	N of Country Lane	N/A	N/A	29.0	N/A	31.0	N/A	29.0	0.0%	2004 - 2008	-3.3%
115	NC 16	S of I-485	N/A	N/A	31.0	N/A	37.0	N/A	35.0	3.1%	2004 - 2008	-2.7%
116	NC 16	S of Forbes Drive	30.0	N/A	38.0	N/A	35.0	N/A	36.0	3.1%	2002 - 2008	1.4%
21	NC 200	N of US 74-601	9.7	9.3	9.8	11.0	9.7	11.0	11.0	2.1%	2002 - 2008	6.5%
22	NC 200	N of SR 1624	6.4	6.3	6.3	6.8	6.4	6.6	6.1	-0.8%	2002 - 2008	-2.4%
23	NC 200	N of SR 1621	6.1	6.0	5.6	6.5	6.1	6.2	5.9	-0.6%	2002 - 2008	-1.7%
28	NC 200	S of SR 1245	14.0	13.0	12.0	14.0	12.0	12.0	12.0	-2.5%	2002 - 2008	0.0%
29	NC 200	S of SR 2139	11.0	10.0	9.1	10.0	9.4	10.0	11.0	0.0%	2002 - 2008	8.2%
30	NC 200	N of SR 1216	13.0	11.0	9.8	10.0	10.0	11.0	11.0	-2.7%	2002 - 2008	4.9%
108	NC 205	N of SR 1736	2.1	2.1	1.8	2.2	1.8	1.7	1.7	-3.5%	2002 - 2008	-2.8%
11	NC 207	S of SR 2217	7.0	7.6	6.8	7.1	6.3	6.4	6.4	-1.5%	2002 - 2008	0.8%
1	NC 218	W of SR 1539	4.5	4.7	6.5	7.4	8.7	8.6	7.6	9.1%	2002 - 2008	-6.5%
2	NC 218	E of US 601	4.6	4.8	5.4	6.1	6.3	6.7	5.7	3.6%	2002 - 2008	-4.9%
3	NC 218	W of US 601	5.4	5.1	6.6	7.5	8.3	8.6	7.5	5.6%	2002 - 2008	-4.9%
5	NC 218	E of SR 1714	1.5	1.6	2.2	2.2	2.7	2.7	2.4	8.1%	2002 - 2008	-5.7%
13	NC 218	W of SR 1662	3.4	3.4	3.9	4.1	4.5	4.4	4.0	2.7%	2002 - 2008	-5.7%
109	NC 218	S of SR 1412	N/A	1.6	2.1	2.1	2.6	2.7	2.4	8.4%	2003 - 2008	-3.9%
112	NC 218	E of I-485	N/A	N/A	13.0	N/A	14.0	N/A	16.0	5.3%	2004 - 2008	6.9%
118	NC 218	E of SR 1004	11.0	N/A	11.0	N/A	12.0	N/A	11.0	0.0%	2002 - 2008	
		Philadelphia Church										-4.3%
39	NC 51 (Matthews Township)	E of SR 3474	26.0	N/A	30.0	N/A	30.0	N/A	30.0	2.4%	2002 - 2008	
												0.0%
100	NC 51 (Matthews Township Parkway)	W of SR 5215	N/A	N/A	23.0	N/A	23.0	N/A	26.0	3.1%	2004 - 2008	
												6.3%
106	NC 742	E of SR 1459	1.1	1.2	1.2	1.1	1.3	1.1	1.0	-2.4%	2002 - 2008	-14.5%
33	NC 75	S of NC 84	8.4	7.9	10.0	10.0	9.7	9.8	9.7	2.4%	2002 - 2008	0.0%
31	NC 75-84	E of NC 75	14.0	14.0	14.0	16.0	16.0	16.0	15.0	1.2%	2002 - 2008	-3.2%
8	NC 84	E of NC 16	13.0	12.0	11.0	15.0	15.0	N/A	13.0	0.0%	2002 - 2008	-6.9%
10	NC 84	E of SR 1334	5.8	5.5	5.4	6.6	6.4	7.0	6.3	1.4%	2002 - 2008	-0.8%
32	NC 84	N of NC 75	5.5	5.9	5.2	6.6	5.8	6.0	5.7	0.6%	2002 - 2008	-0.9%
105	NC 84	E of SR 1340	N/A	N/A	11.0	12.0	12.0	13.0	12.0	2.2%	2004 - 2008	0.0%
119	NC 84	W of SR 1482	11.0	9.3	11.0	12.0	12.0	13.0	12.0	1.5%	2002 - 2008	0.0%
122	NC 84	E of SR 1348	6.2	6.0	6.4	7.9	8.4	9.3	8.7	5.8%	2002 - 2008	1.8%
129	NC 84	E of SR 1007	N/A	N/A	5.8	6.9	6.1	7.0	6.1	1.3%	2004 - 2008	0.0%
47	SR 1001	E of US 601	N/A	3.2	N/A	3.5	N/A	3.2	N/A	0.0%	2003 - 2007	
95	SR 1001	S of SR 1615	N/A	3.7	N/A	3.9	N/A	3.0	N/A	-5.1%	2003 - 2007	
142	SR 1002	E of NC 218	N/A	0.6	N/A	0.7	N/A	0.6	N/A	0.0%	2003 - 2007	
143	SR 1002	W of NC 218	0.6	N/A	0.7	N/A	0.6	N/A	0.5	-1.8%	2002 - 2008	-8.6%
88	SR 1003	E of US 601	4.6	N/A	4.3	N/A	4.6	N/A	4.5	-0.4%	2002 - 2008	-1.1%
136	SR 1003	S of SR 1957	2.4	N/A	2.0	N/A	1.9	N/A	2.1	-2.2%	2002 - 2008	5.1%
144	SR 1003	W of SR 1252	N/A	0.5	N/A	0.5	N/A	0.5	N/A	2.2%	2003 - 2007	
43	SR 1004	W of SR 1539	7.8	N/A	8.0	N/A	8.8	N/A	9.4	3.2%	2002 - 2008	3.4%
44	SR 1004	W of US 601	3.8	N/A	3.0	N/A	2.9	N/A	3.2	-2.8%	2002 - 2008	5.0%
124	SR 1004	E of SR 1525	N/A	N/A	N/A	8.0	N/A	8.0	N/A	0.0%	2005 - 2007	
101	SR 1004 (Lawyer's Road)	E of I-485	N/A	N/A	16.0	N/A	17.0	N/A	16.0	0.0%	2004 - 2008	-3.0%
110	SR 1004 (Lawyer's Road)	S of Bain School Road	13.0	N/A	8.5	N/A	8.7	N/A	8.6	-6.7%	2002 - 2008	-0.6%
64	SR 1006	E of SR 1681	3.0	N/A	2.8	N/A	2.8	N/A	2.8	-1.1%	2002 - 2008	0.0%
78	SR 1006	S of SR 1765	N/A	2.7	N/A	2.7	N/A	2.5	N/A	-1.9%	2003 - 2007	
84	SR 1006	E of NC 200	3.3	N/A	3.2	N/A	3.5	N/A	3.3	0.0%	2002 - 2008	-2.9%
60	SR 1008	N of NC 84	3.8	N/A	4.8	N/A	6.5	N/A	7.1	11.0%	2002 - 2008	4.5%
72	SR 1008	S of SR 1367	15.0	N/A	15.0	N/A	17.0	N/A	16.0	1.1%	2002 - 2008	-3.0%

Table 2-3 (Cont'd)
Area Historic Roadway Traffic Counts
2002-2008

Map Location	Route Name	Traffic Count Location	Average Annual Daily Traffic (Thousands) 2002	2003	2004	2005	2006	2007	2008	Average Annual Growth	Period	Recent Average Annual Growth 2006 - 2008
73	SR 1008	S of SR 1371	N/A	13.0	N/A	15.0	N/A	15.0	N/A	3.6%	2003 - 2007	
97	SR 1008	N of SR 1357	4.1	N/A	4.4	N/A	5.3	N/A	5.3	4.4%	2002 - 2008	0.0%
74	SR 1009	N of SR 1008	N/A	22.0	N/A	16.0	N/A	19.0	N/A	-3.6%	2003 - 2007	
75	SR 1009	W of SR 1377	17.0	N/A	16.0	N/A	16.0	N/A	16.0	-1.0%	2002 - 2008	0.0%
80	SR 1009	W of SR 1007	N/A	17.0	N/A	18.0	N/A	17.0	N/A	0.0%	2003 - 2007	
81	SR 1009	E of SR 1007	16.0	N/A	16.0	N/A	16.0	N/A	16.0	0.0%	2002 - 2008	0.0%
92	SR 1009	N of NC 200	20.0	N/A	18.0	N/A	18.0	N/A	18.0	-1.7%	2002 - 2008	0.0%
103	SR 1009	E of SR 1223	N/A	N/A	16.0	N/A	16.0	N/A	15.0	-1.6%	2004 - 2008	-3.2%
126	SR 1009	E of SR 1380	13.0	N/A	13.0	N/A	13.0	N/A	13.0	0.0%	2002 - 2008	0.0%
113	SR 1010 (E John Street)	N of I-485	20.0	N/A	29.0	N/A	N/A	N/A	24.0	3.1%	2002 - 2008	
117	SR 1010 (E John Street)	S of SR 3448 S Trade Street	20.0	N/A	21.0	N/A	20.0	N/A	21.0	0.8%	2002 - 2008	2.5%
98	SR 1010 (John Street)	S of SR 5706	N/A	N/A	26.0	N/A	28.0	N/A	28.0	1.9%	2004 - 2008	0.0%
82	SR 1162	W of SR 1007	3.0	N/A	3.0	N/A	3.1	N/A	3.4	2.1%	2002 - 2008	4.7%
102	SR 1162	E of SR 1007	N/A	N/A	5.7	N/A	5.7	N/A	6.2	2.1%	2004 - 2008	4.3%
125	SR 1162	W of SR 1349	2.6	N/A	3.2	N/A	2.9	N/A	3.0	2.4%	2002 - 2008	1.7%
56	SR 1315	E of SR 1332	N/A	2.4	N/A	3.3	N/A	3.4	N/A	9.1%	2003 - 2007	
104	SR 1315	E of SR 3338	N/A	N/A	4.0	N/A	4.7	N/A	4.0	0.0%	2004 - 2008	-7.7%
152	SR 1341	N of NC 84	N/A	2.1	N/A	2.9	N/A	3.3	N/A	12.0%	2003 - 2007	
99	SR 1346	W of SR 1162	N/A	4.8	N/A	6.2	N/A	7.1	N/A	10.3%	2003 - 2007	
120	SR 1346	W of SR 1347	N/A	4.0	N/A	5.5	N/A	5.7	N/A	1.8%	2005 - 2007	
149	SR 1346	W of SR 1162	N/A	4.8	N/A	6.2	N/A	7.1	N/A	10.3%	2003 - 2007	
121	SR 1358	E of SR 1445	N/A	2.1	N/A	2.8	N/A	3.1	N/A	5.2%	2005 - 2007	
65	SR 1362	W of SR 1357	N/A	2.8	N/A	4.0	N/A	4.8	N/A	14.4%	2003 - 2007	
76	SR 1364	E of SR 1357	4.4	N/A	4.4	N/A	4.6	N/A	4.3	-0.4%	2002 - 2008	-3.3%
77	SR 1364	W of SR 1357	N/A	N/A	N/A	10.0	N/A	12.0	N/A	9.5%	2005 - 2007	
66	SR 1365	N of SR 1524	2.2	N/A	2.1	N/A	2.9	N/A	N/A	7.2%	2002 - 2006	
46	SR 1367	W of SR 1613	3.4	N/A	2.7	N/A	3.1	N/A	3.1	-1.5%	2002 - 2008	0.0%
48	SR 1367	E of SR 1508	3.7	N/A	3.5	N/A	3.9	N/A	5.1	5.5%	2002 - 2008	14.4%
71	SR 1367	E of SR 1519	12.0	N/A	11.0	N/A	13.0	N/A	13.0	1.3%	2002 - 2008	0.0%
128	SR 1367	W of SR 1501	6.3	N/A	6.0	N/A	7.7	N/A	8.2	4.5%	2002 - 2008	3.2%
147	SR 1367	N of SR 1008	3.2	N/A	3.8	N/A	3.9	N/A	3.7	2.4%	2002 - 2008	-2.6%
148	SR 1367	E of SR 1519	12.0	N/A	11.0	N/A	13.0	N/A	13.0	1.3%	2002 - 2008	0.0%
150	SR 1367	E of SR 1508	3.7	N/A	3.5	N/A	3.9	N/A	5.1	5.5%	2002 - 2008	14.4%
137	SR 1404	E of SR 1402	N/A	0.3	N/A	0.3	N/A	0.3	N/A	0.9%	2003 - 2007	
141	SR 1443	W of SR 1411	0.6	N/A	0.5	N/A	0.5	N/A	0.6	0.6%	2002 - 2008	10.5%
53	SR 1501	N of SR 1513	N/A	7.3	N/A	7.9	N/A	9.5	N/A	6.8%	2003 - 2007	
55	SR 1501	E of SR 1509	N/A	7.1	N/A	7.4	N/A	7.8	N/A	2.4%	2003 - 2007	
67	SR 1501	N of SR 1525	11.0	N/A	13.0	N/A	15.0	N/A	16.0	6.4%	2002 - 2008	3.3%
69	SR 1501	E of SR 1518	7.5	N/A	8.6	N/A	9.5	N/A	12.0	8.1%	2002 - 2008	12.4%
70	SR 1501	W of SR 1524	13.0	N/A	15.0	N/A	18.0	N/A	20.0	7.4%	2002 - 2008	5.4%
83	SR 1501	N of US 74	N/A	8.4	N/A	8.9	N/A	8.6	N/A	0.6%	2003 - 2007	
89	SR 1501	E of SR 1524	N/A	13.0	N/A	16.0	N/A	17.0	N/A	6.9%	2003 - 2007	
130	SR 1501	N of SR 1503	7.7	N/A	N/A	N/A	8.2	N/A	8.7	2.1%	2002 - 2008	3.0%
49	SR 1504	N of SR 1529	1.8	N/A	2.1	N/A	2.2	N/A	5.3	19.7%	2002 - 2008	55.2%
62	SR 1504	W of US 601	2.7	N/A	2.8	N/A	3.0	N/A	2.9	1.2%	2002 - 2008	-1.7%
93	SR 1504	S of SR 1520	1.3	N/A	2.0	N/A	1.9	N/A	1.9	6.5%	2002 - 2008	0.0%
151	SR 1508	E of SR 1501	1.1	N/A	1.4	N/A	1.1	N/A	1.0	-1.9%	2002 - 2008	-5.6%
51	SR 1514	S of SR 1520	3.0	N/A	2.9	N/A	4.3	N/A	4.3	6.2%	2002 - 2008	0.0%
52	SR 1514	S of SR 1508	N/A	2.4	N/A	2.8	N/A	4.5	N/A	17.0%	2003 - 2007	
54	SR 1514	N of SR 1501	N/A	3.2	N/A	3.6	N/A	3.9	N/A	5.1%	2003 - 2007	
79	SR 1514	N of US 74	5.0	N/A	4.7	N/A	5.8	N/A	6.0	3.1%	2002 - 2008	1.7%
94	SR 1514	N of US 74	N/A	6.4	N/A	8.3	N/A	8.8	N/A	8.3%	2003 - 2007	

Table 2-3 (Cont'd)
Area Historic Roadway Traffic Counts
2002-2008

Map Location	Route Name	Traffic Count Location	Average Annual Daily Traffic (Thousands)							Average Annual Growth	Period	Recent Average Annual Growth 2006 - 2008
			2002	2003	2004	2005	2006	2007	2008			
59	SR 1515	N of US 74	5.6	N/A	6.1	N/A	6.8	N/A	6.4	2.3%	2002 - 2008	-3.0%
68	SR 1520	E of SR 1518	4.0	N/A	3.0	N/A	3.8	N/A	3.5	-2.2%	2002 - 2008	-4.0%
135	SR 1520	W of SR 1514	N/A	1.7	N/A	1.9	N/A	2.1	N/A	5.4%	2003 - 2007	
61	SR 1524	N of SR 1591	4.5	N/A	4.8	N/A	5.1	N/A	5.3	2.8%	2002 - 2008	1.9%
96	SR 1524	S of SR 1004	N/A	5.0	N/A	5.3	N/A	5.2	N/A	1.0%	2003 - 2007	
50	SR 1612	E of US 601	1.1	N/A	1.0	N/A	0.8	N/A	0.9	-3.8%	2002 - 2008	2.4%
140	SR 1713	N of NC 218	0.2	N/A	0.3	N/A	0.1	N/A	0.2	0.0%	2002 - 2008	11.8%
90	SR 1751	E of SR 1763	4.5	N/A	5.1	N/A	4.5	N/A	4.2	-1.1%	2002 - 2008	-3.4%
107	SR 1751	W of NC 205	1.4	N/A	1.4	N/A	1.4	N/A	1.5	1.2%	2002 - 2008	3.5%
45	SR 1758	S of SR 1006	N/A	1.8	N/A	1.8	N/A	1.6	N/A	-2.9%	2003 - 2007	
91	SR 1758	N of SR 1631	1.4	N/A	1.2	N/A	1.3	N/A	1.1	-3.9%	2002 - 2008	-8.0%
132	SR 1941	S of SR 1003	1.8	N/A	2.2	N/A	2.1	N/A	2.0	1.8%	2002 - 2008	-2.4%
58	SR 1957	E of SR 1003	N/A	1.2	N/A	1.2	N/A	1.1	N/A	-2.2%	2003 - 2007	
85	SR 2100	E of NC 207	N/A	5.4	N/A	5.7	N/A	5.3	N/A	-0.5%	2003 - 2007	
131	SR 2102	S of SR 2106	N/A	1.0	N/A	1.0	N/A	0.9	N/A	-4.6%	2005 - 2007	
57	SR 2115	S of NC 207	3.7	N/A	3.6	N/A	3.4	N/A	3.5	-0.9%	2002 - 2008	1.5%
86	SR 2139	S of NC 200	4.6	N/A	4.1	N/A	3.8	N/A	4.0	-2.3%	2002 - 2008	2.6%
87	SR 2139	S of SR 2180	N/A	3.7	N/A	3.6	N/A	4.0	N/A	2.0%	2003 - 2007	
36	SR 3174 (Idlewild Road)	E of NC 51	14.0	N/A	14.0	N/A	15.0	N/A	16.0	2.3%	2002 - 2008	3.3%
37	SR 3174 (Idlewild Road)	E of I-485	13.0	N/A	16.0	N/A	20.0	N/A	22.0	9.2%	2002 - 2008	4.9%
145	SR 3440 (McKee Road)	S of Knox Avenue	10.0	N/A	12.0	N/A	14.0	N/A	13.0	4.5%	2002 - 2008	-3.6%
146	SR 3445	E of SR 3440	N/A	N/A	7.7	N/A	11.0	N/A	7.5	-0.7%	2004 - 2008	-17.4%
40	SR 3448 (S Trade Street)	N of Old Monroe Road	21.0	N/A	N/A	N/A	34.0	N/A	25.0	2.9%	2002 - 2008	-14.3%
41	SR 3468	S of SR 3440	7.7	N/A	11.0	N/A	12.0	N/A	13.0	9.1%	2002 - 2008	4.1%
4	US 601	N of SR 1004	8.5	8.1	6.9	7.4	7.4	7.3	7.1	-3.0%	2002 - 2008	-2.0%
6	US 601	S of SR 1505	7.8	8.0	7.3	8.0	7.8	8.1	7.5	-0.7%	2002 - 2008	-1.9%
7	US 601	N of SR 1504	12.0	11.0	9.9	11.0	11.0	11.0	11.0	-1.4%	2002 - 2008	0.0%
12	US 601	S of SR 2204	11.0	11.0	12.0	13.0	12.0	13.0	N/A	8.3%	2006 - 2007	
17	US 601	S of SR 1622	16.0	15.0	14.0	16.0	15.0	16.0	14.0	-2.2%	2002 - 2008	-3.4%
18	US 601	N of US 74	13.0	13.0	12.0	13.0	13.0	13.0	14.0	1.2%	2002 - 2008	3.8%
26	US 601	N of SR 1003	17.0	17.0	17.0	19.0	18.0	17.0	18.0	1.0%	2002 - 2008	0.0%
138	US 601	S of SR 1005	10.0	8.3	10.0	11.0	11.0	11.0	N/A	1.9%	2002 - 2007	
14	US 74	W of SR 1740	22.0	22.0	20.0	21.0	19.0	18.0	19.0	-2.4%	2002 - 2008	0.0%
15	US 74	E of SR 1738	16.0	17.0	15.0	16.0	15.0	15.0	14.0	-2.2%	2002 - 2008	-3.4%
16	US 74	E of SR 1007	38.0	36.0	35.0	36.0	36.0	N/A	33.0	-2.3%	2002 - 2008	-4.3%
19	US 74	W of US 601	60.0	56.0	57.0	56.0	57.0	53.0	53.0	-2.0%	2002 - 2008	-3.6%
25	US 74	E of US 601	29.0	30.0	26.0	29.0	27.0	27.0	N/A	-1.4%	2002 - 2007	
27	US 74	E of SR 1740	22.0	21.0	19.0	21.0	19.0	19.0	20.0	-1.6%	2002 - 2008	2.6%
34	US 74	W of SR 1008	53.0	52.0	54.0	52.0	53.0	53.0	49.0	-1.3%	2002 - 2008	-3.8%
35	US 74	E of SR 1520	50.0	48.0	46.0	49.0	51.0	50.0	47.0	-1.0%	2002 - 2008	-4.0%
38	US 74	E of I-485	52.0	N/A	54.0	N/A	58.0	N/A	N/A	2.8%	2002 - 2006	
42	US 74	W of I-485	55.0	N/A	60.0	N/A	59.0	N/A	57.0	0.6%	2002 - 2008	-1.7%
111	US 74	E of SR 1730	15.0	16.0	15.0	15.0	14.0	14.0	14.0	-1.1%	2002 - 2008	0.0%
123	US 74	W of SR 1367	49.0	48.0	49.0	49.0	50.0	54.0	47.0	-0.7%	2002 - 2008	-3.0%
127	US 74	S of SR 1515	44.0	41.0	44.0	41.0	42.0	43.0	42.0	-0.8%	2002 - 2008	0.0%
133	US 74	E of SR 1941	27.0	27.0	25.0	27.0	25.0	25.0	23.0	-2.6%	2002 - 2008	-4.1%
134	US 74	E of SR 1776	28.0	26.0	24.0	27.0	24.0	24.0	24.0	-2.5%	2002 - 2008	0.0%
139	US 74	W of SR 1240	N/A	15.0	14.0	15.0	13.0	13.0	14.0	-1.4%	2003 - 2008	3.8%
153	US 74	W of SR 1501	51.0	46.0	45.0	48.0	51.0	47.0	44.0	-2.4%	2002 - 2008	-7.1%
24	US 74-601	E of NC 200	51.0	46.0	47.0	51.0	48.0	47.0	45.0	-2.1%	2002 - 2008	-3.2%
20	US 74-601/NC 200	W of NC 200	55.0	51.0	52.0	54.0	55.0	52.0	50.0	-1.6%	2002 - 2008	-4.7%

Source: North Carolina Department of Transportation, Traffic Survey Unit

Table 2-4
Seasonal Adjustment for Selected
Automatic Traffic Recorder Groups[1]

Month	Monthly Index [2]		
	Urban Interstate	Rural Interstate	Secondary Roads
January	97	85	92
February	103	88	97
March	105	97	99
April	109	102	104
May	108	104	108
June	106	108	108
July	105	108	108
August	110	109	108
September	103	106	105
October	106	109	106
November	104	105	102
December	99	103	99

[1] An Automatic Traffic Recorder (ATR) Group is a set of roadways that have similar physical characterics and surrounding development patterns.

[2] The ratio of Monthly Traffic Volumes to the Average Monthly Traffic Volumes.

Source: NCDOT Traffic Survey Unit - ATR Seasonal Groups

Table 2-5
Daily Traffic Variations at Selected Locations

Location	Daily Index [1]							Average Weekday	Average Weekend	Average Day
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday			
NC 84 (Weddington Road) west of Rocky River Road	72	109	111	105	104	111	88	108	80	100
Old Charlotte Highway west of Dickerson Boulevard	66	110	108	104	105	107		107	66	100
US 74 east of Old Pageland Monroe Road / Secrest Avenue	77	103	103	103	104	117	92	106	85	100
NC 200 (Morgan Mill Road) north of Sutherland Avenue	82	105	107	104	100	112	91	105	86	100
US 74 west of Secrest Short Cut Road	85	103	103	102	94	111	102	103	93	100
US 601 (Concord Highway) north of Ridge Road / Baucom Deese Road	74	106	108	104	106	115	87	108	81	100
NC 218 (Fairview Road) east of US 601 (Concord Highway)	82	98	100	95	99	129	98	104	90	100
Secrest Short Cut Road south of Indian Trail Fairview Road	81	99	99	102	99	119	101	104	91	100
US 74 east of Indian Trail Road	87	104	107	100	100	105	97	103	92	100
Old Monroe Road east of Indian Trail Road	72	103	106	102	104	114	100	106	86	100
Average	**81**	**104**	**105**	**102**	**100**	**111**	**90**	**104**	**88**	**100**

[1] Ratio of individual day's traffic to average daily traffic for the week.
Source: 7-Day Supplemental Counts in March 2009.

use of US 74 as a connector to the North Carolina coastal destinations. The average variation in daily traffic volumes is further illustrated in Figure 2-3.

Hourly Traffic Variations

Table 2-6 summarizes hourly traffic volumes at all ten supplemental count locations. The average hourly traffic volumes at three locations on US 74 are summarized in Figure 2-4. As the charts illustrate, the midday and PM peak hours carry the majority of traffic along US 74. The highest average hour occurs at 5:00 PM, followed by 4:00 PM, 3:00 PM, and 2:00 PM with the next highest percentages of traffic. This pattern may suggest a high volume of plant or shift workers in the area.

Table 2-7 examines the peak period share of average daily traffic at the ten supplemental count locations. The AM peak period is defined as 6:00-10:00 AM, and the PM peak period is defined as 3:00-7:00 PM. There is also a midday peak period from 10:00 AM to 3:00 PM and an off-peak period from 7:00 PM to 6:00 AM. From the table it is clear that the midday and PM peaks represent a similar and significant share of daily traffic. For the supplemental count locations, an average of 30.8 percent of daily traffic occurs during the Midday peak period and an average of 27.6 percent of the daily traffic occurs during the PM peak period. The AM peak period represents an average of 18.9 percent of daily traffic, and the off peak period represents an average of 22.8 percent of the daily traffic.

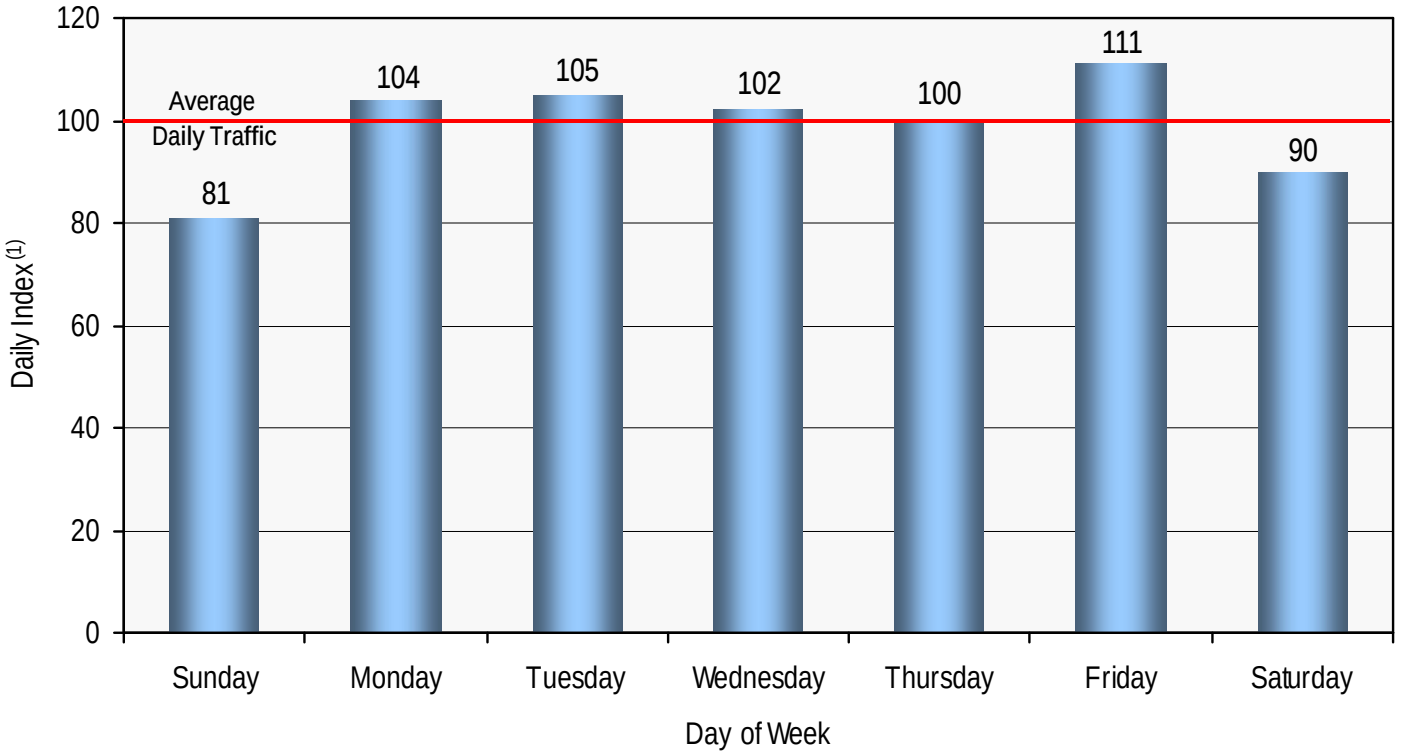
Vehicle Classification

Table 2-8 presents the vehicle classification data gathered from the ten supplemental traffic count locations. Passenger vehicles and light trucks account for the highest percentage of vehicles in this area, with an average of 91.6 percent for all locations. Multi-unit trucks constitute an average of 4.1 percent of all vehicles, while single-unit trucks make up 4.3 percent. The highest percentages of truck traffic were observed on US 74, US 601, and NC 218.

Travel Speeds and Delays

Weekday travel speeds within the project study area were measured during the first two weeks of May 2009 and supplemented in February 2010. Data collection was performed during the AM, PM, and off-peak periods on multiple roads in each direction. The results of this data collection are summarized in Table 2-9 for:

- US 74;
- Old Monroe Road;
- NC 84;
- NC 218;
- US 601 north of US 74;
- NC 200;
- NC 207; and
- US 601 south of US 74.



(1) Daily Index - Ratio of individual day's traffic to average daily traffic for week.

NORTH CAROLINA Turnpike Authority

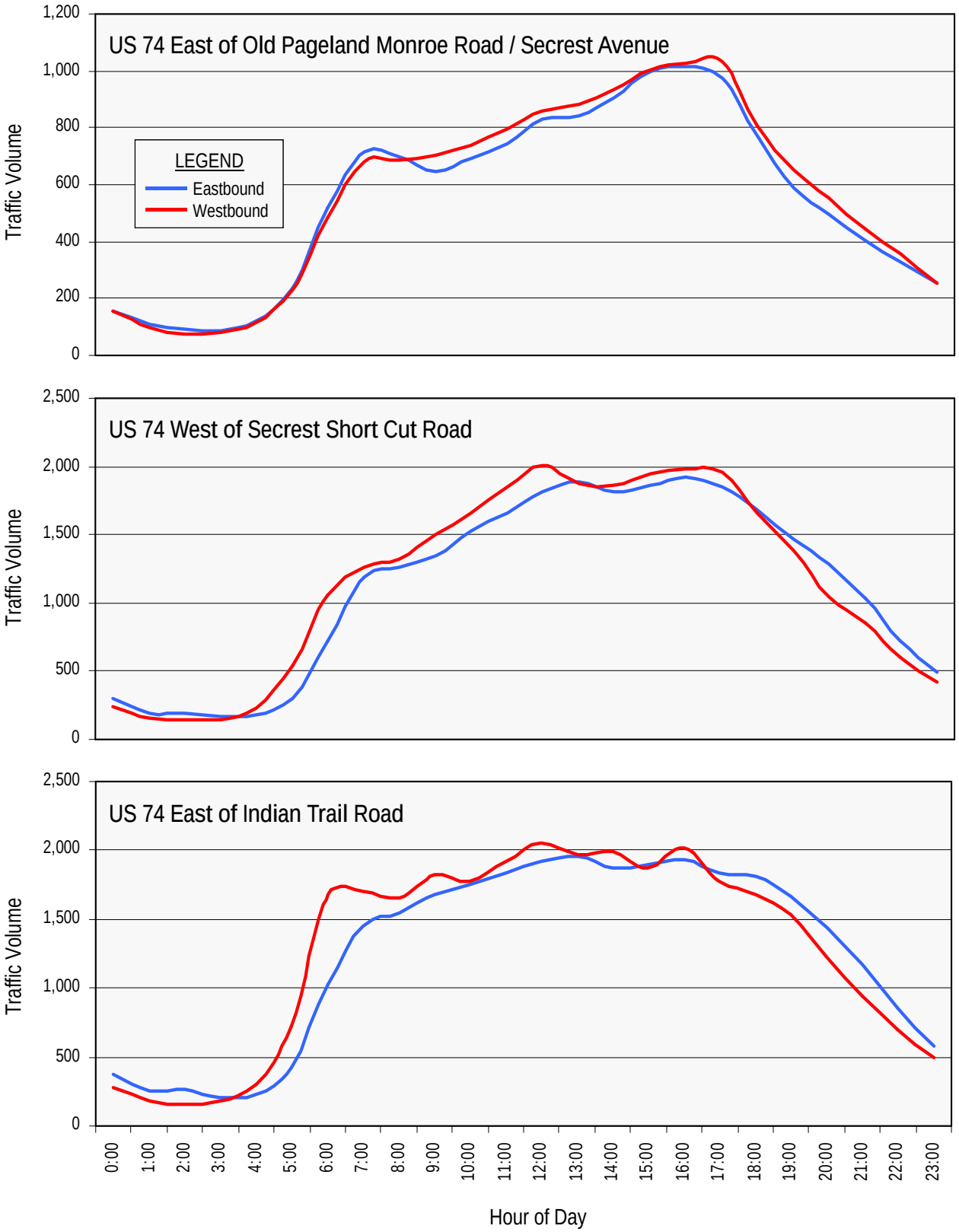
AVERAGE DAILY VARIATIONS
SUPPLEMENTAL TRAFFIC COUNT LOCATIONS

FIGURE 2-3

Table 2-6
Hourly Traffic Variations at Selected Locations

	Percent of Total Day (7-day Counts)										
Beginning Hour	**NC 84 (Weddington Road) west of Rocky River Road**	**Old Charlotte Highway west of Dickerson Boulevard**	**US 74 east of Old Pageland Monroe Road / Secrest Avenue**	**NC 200 (Morgan Mill Road) north of Sutherland Avenue**	**US 74 west of Secrest Short Cut Road**	**US 601 (Concord Highway) north of Ridge Road / Baucom Deese Road**	**NC 218 (Fairview Road) east of US 601 (Concord Highway)**	**Secrest Short Cut Road south of Indian Trail Fairview Road**	**US 74 east of Indian Trail Road**	**Old Monroe Road east of Indian Trail Road**	**Average**
0:00	0.5%	0.5%	2.8%	0.8%	1.0%	0.3%	0.5%	0.7%	1.1%	0.6%	1.1%
1:00	0.3%	0.3%	2.2%	0.5%	0.6%	0.3%	0.3%	0.4%	0.7%	0.3%	0.8%
2:00	0.2%	0.3%	1.5%	0.4%	0.6%	0.4%	0.3%	0.3%	0.7%	0.3%	0.6%
3:00	0.2%	0.3%	0.9%	0.3%	0.6%	0.6%	0.3%	0.2%	0.6%	0.3%	0.5%
4:00	0.4%	0.6%	0.7%	0.4%	0.8%	1.5%	0.7%	0.3%	0.9%	0.5%	0.7%
5:00	1.3%	1.7%	0.6%	1.5%	1.5%	4.4%	2.0%	1.2%	1.9%	1.4%	1.6%
6:00	4.3%	3.7%	0.7%	4.0%	3.3%	7.8%	5.2%	4.5%	4.5%	4.3%	3.8%
7:00	7.8%	6.0%	1.2%	6.2%	4.5%	6.3%	7.5%	6.4%	5.2%	5.4%	4.9%
8:00	6.5%	5.8%	2.6%	5.8%	4.7%	5.2%	5.4%	5.7%	5.3%	5.2%	4.9%
9:00	5.2%	5.4%	4.5%	5.4%	5.2%	5.0%	5.0%	4.7%	5.8%	5.3%	5.3%
10:00	4.9%	5.6%	5.6%	5.6%	5.8%	5.5%	4.9%	4.8%	5.8%	5.2%	5.6%
11:00	5.0%	6.2%	4.9%	5.9%	6.4%	5.8%	4.9%	5.0%	6.2%	5.6%	5.9%
12:00	5.9%	7.2%	5.2%	6.4%	7.0%	6.0%	5.3%	5.7%	6.6%	6.5%	6.4%
13:00	6.0%	6.8%	5.5%	6.2%	6.9%	6.2%	6.0%	5.7%	6.5%	6.4%	6.4%
14:00	6.5%	6.9%	6.1%	6.4%	6.7%	7.3%	6.2%	6.2%	6.4%	6.7%	6.5%
15:00	7.8%	7.8%	6.3%	6.8%	7.0%	7.8%	7.2%	7.2%	6.2%	7.3%	6.8%
16:00	8.1%	7.9%	6.6%	7.2%	7.2%	9.1%	8.1%	8.2%	6.5%	7.6%	7.2%
17:00	8.5%	8.0%	7.1%	8.1%	7.0%	6.7%	9.1%	9.3%	6.0%	7.6%	7.1%
18:00	6.9%	6.1%	7.6%	6.1%	6.1%	4.6%	7.2%	7.5%	5.8%	7.1%	6.4%
19:00	4.8%	4.6%	7.8%	5.1%	5.2%	3.7%	4.8%	5.4%	5.3%	5.6%	5.4%
20:00	3.9%	3.5%	6.5%	4.2%	4.3%	2.6%	3.9%	4.2%	4.4%	4.3%	4.4%
21:00	2.6%	2.4%	5.3%	3.1%	3.5%	1.6%	2.7%	3.2%	3.5%	3.2%	3.4%
22:00	1.6%	1.6%	4.2%	2.1%	2.4%	0.9%	1.7%	2.0%	2.6%	1.9%	2.4%
23:00	0.9%	0.8%	3.6%	1.4%	1.7%	0.4%	0.8%	1.2%	1.8%	1.2%	1.7%
Total Day	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Source: 7-Day Supplemental Counts in March 2009.



NORTH CAROLINA Turnpike Authority

AVERAGE WEEKDAY HOURLY VOLUME ON US 74

FIGURE 2-4

Table 2-7
Traffic Variations by Time Period at Selected Locations

Location	Percent of Average Daily Traffic				
	AM Peak 6 - 10 AM	Midday 10 AM- 3 PM	PM Peak 3 - 7 PM	Off-Peak 7 PM - 6 AM	Total Day
NC 84 (Weddington Road) west of Rocky River Road	23.7%	28.3%	31.3%	16.6%	100%
Old Charlotte Highway west of Dickerson Boulevard	20.9%	32.7%	29.8%	16.6%	100%
US 74 east of Old Pageland Monroe Road / Secrest Avenue	9.0%	27.3%	27.7%	36.1%	100%
NC 200 (Morgan Mill Road) north of Sutherland Avenue	21.4%	30.6%	28.2%	19.8%	100%
US 74 west of Secrest Short Cut Road	17.7%	32.9%	27.2%	22.2%	100%
US 601 (Concord Highway) north of Ridge Road / Baucom Deese Road	23.2%	32.5%	27.9%	16.4%	100%
NC 218 (Fairview Road) east of US 601 (Concord Highway)	23.0%	27.3%	31.6%	18.1%	100%
Secrest Short Cut Road south of Indian Trail Fairview Road	21.3%	27.4%	32.2%	19.1%	100%
US 74 east of Indian Trail Road	20.7%	31.4%	24.5%	23.4%	100%
Old Monroe Road east of Indian Trail Road	20.3%	30.5%	29.7%	19.6%	100%
Average	**18.9%**	**30.8%**	**27.6%**	**22.8%**	**100%**

Source: 7-Day Supplemental Counts in March 2009

Table 2-8
Vehicle Classifications at Selected Locations

Location	Passenger Vehicles & Light Trucks	Single-Unit Trucks	Multi-Unit Trucks	Total Trucks
NC 84 (Weddington Road) west of Rocky River Road	94.0%	4.0%	2.0%	6.0%
Old Charlotte Highway west of Dickerson Boulevard	93.0%	5.0%	2.0%	7.0%
US 74 east of Old Pageland Monroe Road / Secrest Avenue	89.4%	4.3%	6.3%	10.6%
NC 200 (Morgan Mill Road) north of Sutherland Avenue	95.0%	4.0%	1.0%	5.0%
US 74 west of Secrest Short Cut Road	92.2%	3.4%	4.4%	7.8%
US 601 (Concord Highway) north of Ridge Road / Baucom Deese Road	89.0%	6.0%	5.0%	11.0%
NC 218 (Fairview Road) east of US 601 (Concord Highway)	89.2%	6.1%	4.7%	10.8%
Secrest Short Cut Road south of Indian Trail Fairview Road	95.0%	4.0%	1.0%	5.0%
US 74 east of Indian Trail Road	89.8%	4.5%	5.7%	10.2%
Old Monroe Road east of Indian Trail Road	94.8%	4.0%	1.2%	5.2%
Average	**91.6%**	**4.3%**	**4.1%**	**8.4%**

Source: 7-Day Supplemental Counts in March 2009.

Table 2-9
Speed and Delay Studies on Selected Roads

			Observed Travel Speeds (MPH)			
		Distance	Inbound		Outbound	
Segment Start	Sengment End	(miles)	AM	PM	AM	PM
US 74						
NC 27	I 485	7.7	19.8	19.2	32.5	21.3
I 485	Sardis Church Road	4.5	23.8	31.6	31.2	33.9
Sardis Church Road	Rocky River Road	2.5	35.3	48.0	51.5	35.8
Rocky River Road	US 601	4.2	48.3	39.9	42.3	34.7
US 601/Concord Hwy	US 601/Pageland Hwy	2.6	38.3	43.6	32.5	28.0
US 601	Presson Road	3.0	44.6	49.8	49.7	53.9
Presson Road	Phil Austin Road	2.1	35.4	36.3	44.4	36.3
Phil Austin Road	Stegall Road	4.8	36.6	42.1	41.9	46.6
Stegall Road	NC 218	8.2	52.7	59.3	57.6	57.8
	Total Distance/ Average Speed	**39.4**	**32.5**	**35.0**	**40.9**	**35.1**
Old Monroe Road						
I-485	Waxhaw Indian Trail Road	3.0	21.7	35.6	28.6	17.7
Waxhaw Indian Trail Road	Rogers Road	4.1	26.5	32.7	28.1	30.6
Rogers Road	NC 75/NC 74	5.5	36.4	25.2	32.0	27.3
	Total Distance/ Average Speed	**12.6**	**28.4**	**29.3**	**29.8**	**25.0**
NC 84						
NC 16	Silverleaf Lane	4.6	39.0	41.6	33.9	36.4
Silverleaf Lane	Rocky River Road	4.9	41.0	44.6	40.1	42.9
Rocky River Road	Waxhaw Hwy	2.4	41.6	42.6	26.1	37.0
Waxhaw Hwy	NC207	1.1	31.2	33.7	19.4	28.7
	Total Distance/ Average Speed	**13.1**	**39.4**	**42.3**	**32.2**	**39.8**
NC 218						
I 485	US 601	6.3	45.2	46.6	44.9	44.8
US 601	NC 200	6.5	47.1	49.3	47.0	46.7
NC 200	US 74	17.8	44.1	47.5	47.1	47.8
	Total Distance/ Average Speed	**30.6**	**45.2**	**48.0**	**46.8**	**47.2**
US 601						
NC 218	US 74	10.0	49.6	48.4	49.6	48.9
NC 200						
NC 218	US 74	11.2	46.5	45.1	43.9	48.2
NC 207						
US 74	Maurice Street	2.7	27.5	29.4	28.3	24.2
Maurice Street	Stack Road	1.2	47.9	45.8	47.8	42.3
	Total Distance/ Average Speed	**3.9**	**30.8**	**33.0**	**32.2**	**28.1**
US 601						
US 74	Eudy Road	2.7	41.7	42.8	51.3	NA
Eudy Road	Mt. Springs Church Road	2.8	42.4	47.2	54.1	46.8
	Total Distance/ Average Speed	**5.6**	**41.8**	**45.7**	**52.6**	**NA**

Observed travel speeds collected during typical AM peak period speed and delay studies in the inbound direction toward Charlotte are shown in Figure 2-5. Data for the outbound direction from Charlotte are shown in Figure 2-6. The figures show reduced speeds on US 74 within the town of Indian Trail, and along Old Monroe Road in the same area. Figures 2-5 and 2-6 also show that NC 218, US 601 and NC 200 appear to be generally at free-flow speeds. These observations are borne out by the average observed travel speeds presented in Table 2-9.

Travel speed data was also collected on the same roadways during the PM peak period. Figure 2-7 presents the observed travel speeds collected during the PM peak period in the outbound direction from Charlotte; Figure 2-8 presents the inbound data. Congestion is clearly visible on US 74 eastbound near I-485 and just outside of Monroe, while US 74 westbound appears to be free-flow speeds except for local congestion inside of Indian Trail. Additionally, there is some congestion in both directions on Old Monroe Road and on the southern half of US 601 northbound. Figures 2-7 and 2-8 also show that NC 218, NC 200 and the northern half of US 601 appear to be generally at free-flow speeds. These observations are borne out by the average travel speeds presented in Table 2-9.

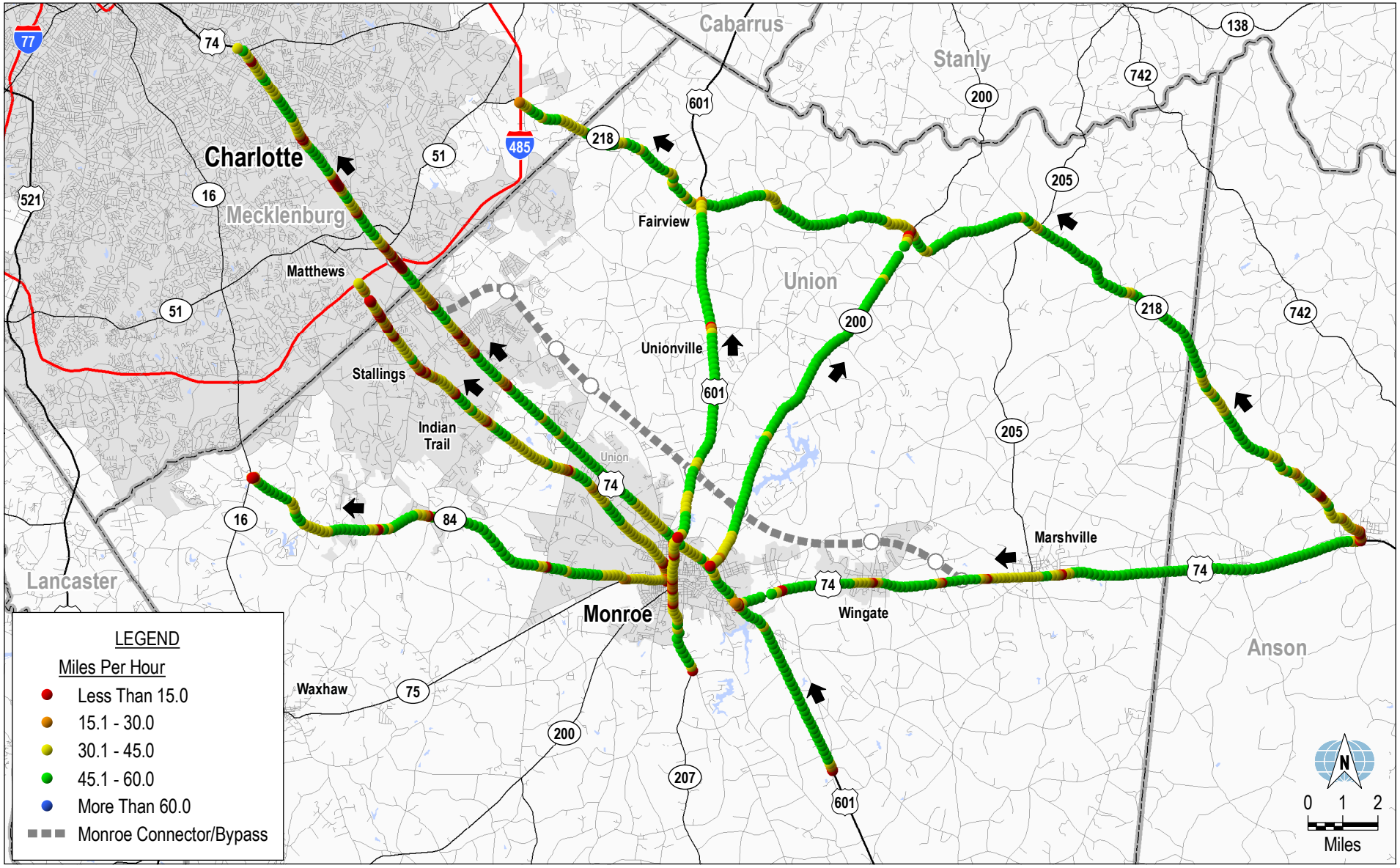
EXISTING TRANSIT SERVICES IN THE STUDY AREA

TRANSIT AGENCIES

Three major transit agencies operate within the Mecklenburg and Union County area. All three of these agencies are owned by local government. The Charlotte Area Transit System (CATS) is operated by the City of Charlotte. Mecklenburg Transportation System is run by the Department of Social Services for Mecklenburg County. Union County Transit is operated by Union County.

Both Mecklenburg Transportation System and Union County Transit are county-wide agencies that provide demand-response services. These services are mainly reserved for senior citizens and people with disabilities.

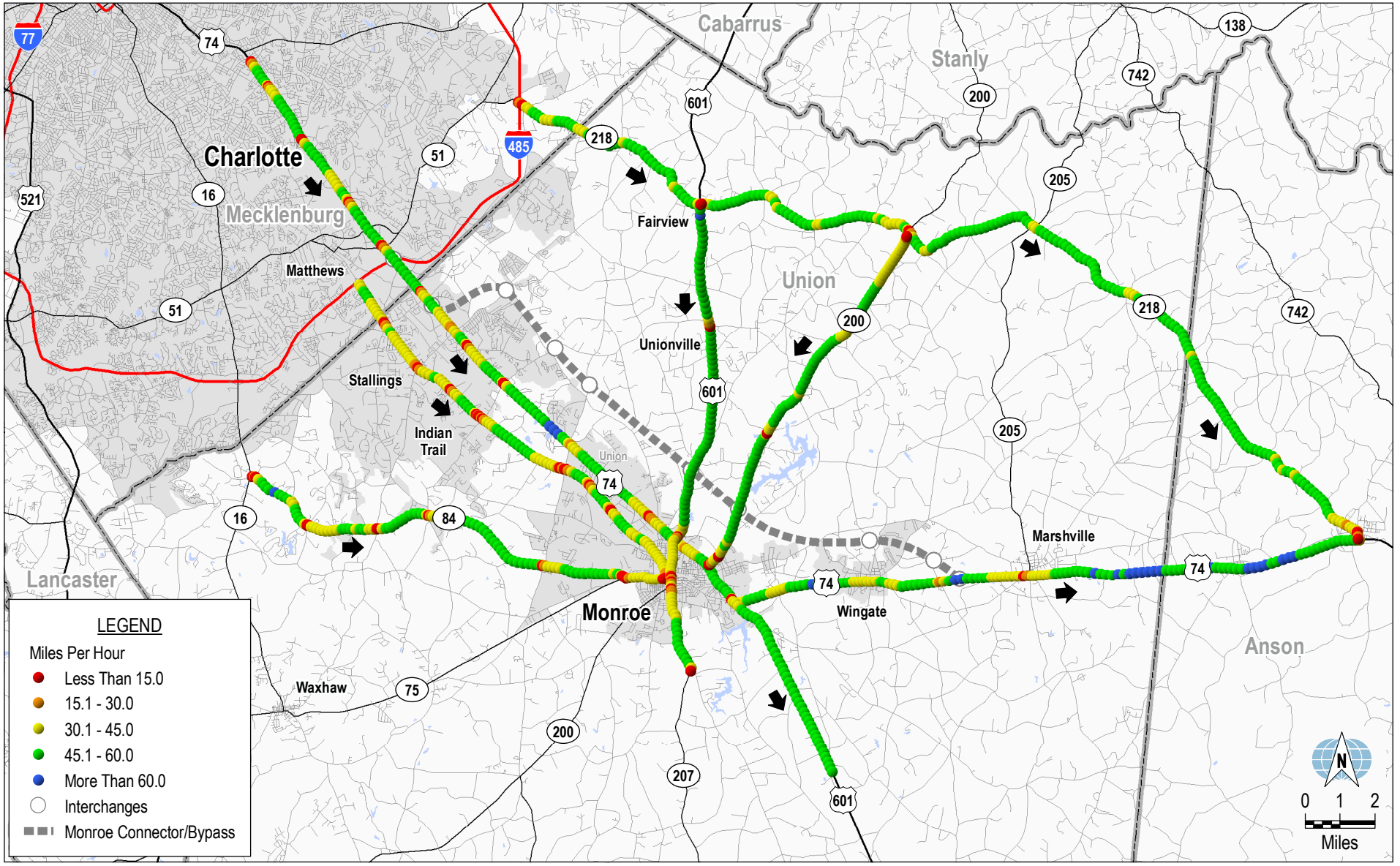
CATS provides four different types of transit services. The first of which is bus service for the entire Charlotte metropolitan area including some service into Union County. The second type of service is a light rail system called Lynx that runs along I-77 from Uptown Charlotte to I-485. CATS also has special transportation which caters to the disabled and elderly. Finally CATS has vanpools and carpools for commuters. With the vanpools and CATS Express service a guaranteed ride home is available in case of emergencies. Table 2-10 contains system data for CATS. It is a



NORTH CAROLINA Turnpike Authority

OBSERVED AM PEAK PERIOD TRAVEL SPEEDS INBOUND TOWARD CHARLOTTE

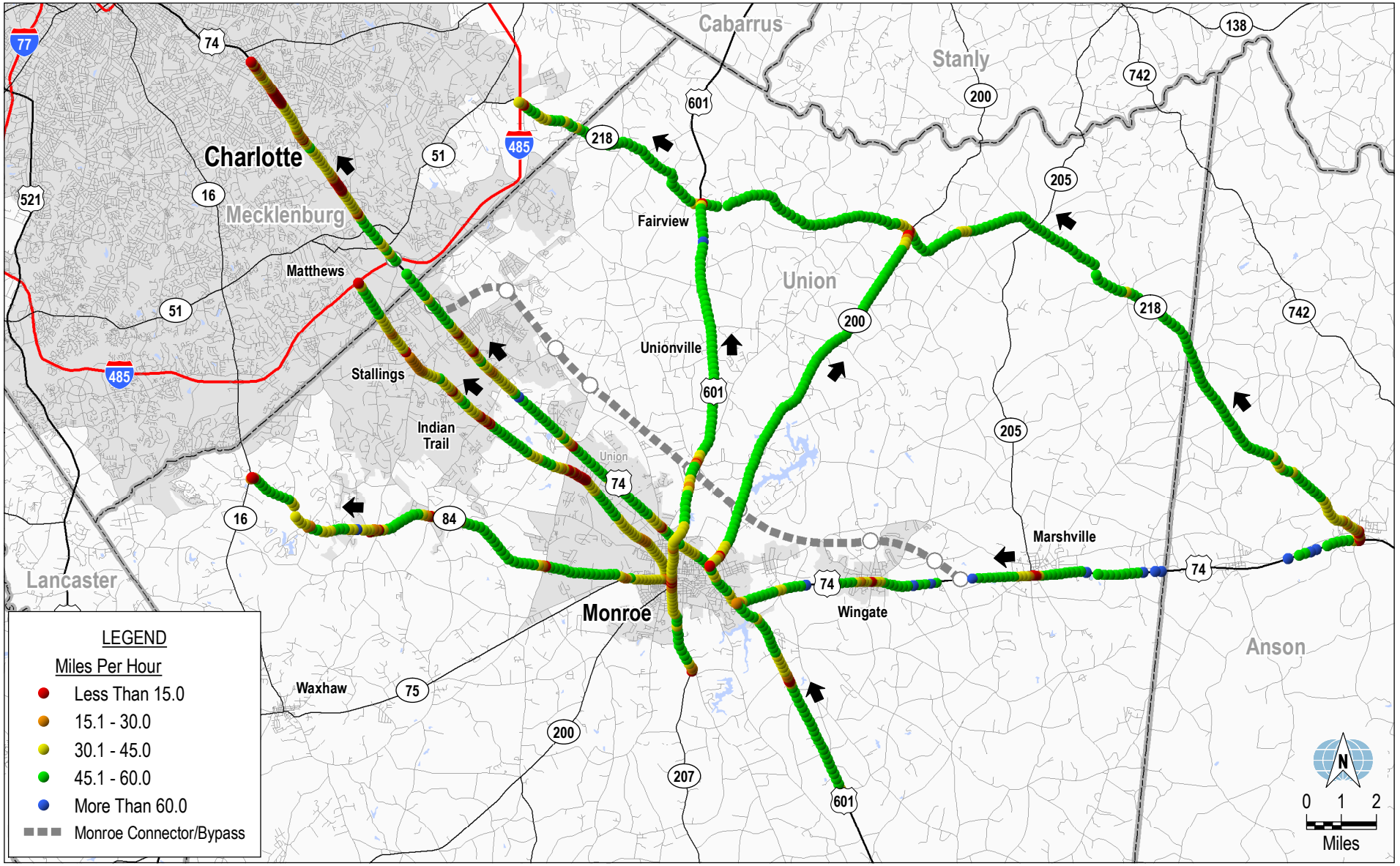
FIGURE 2-5



NORTH CAROLINA Turnpike Authority

OBSERVED AM PEAK PERIOD TRAVEL SPEEDS OUTBOUND FROM CHARLOTTE

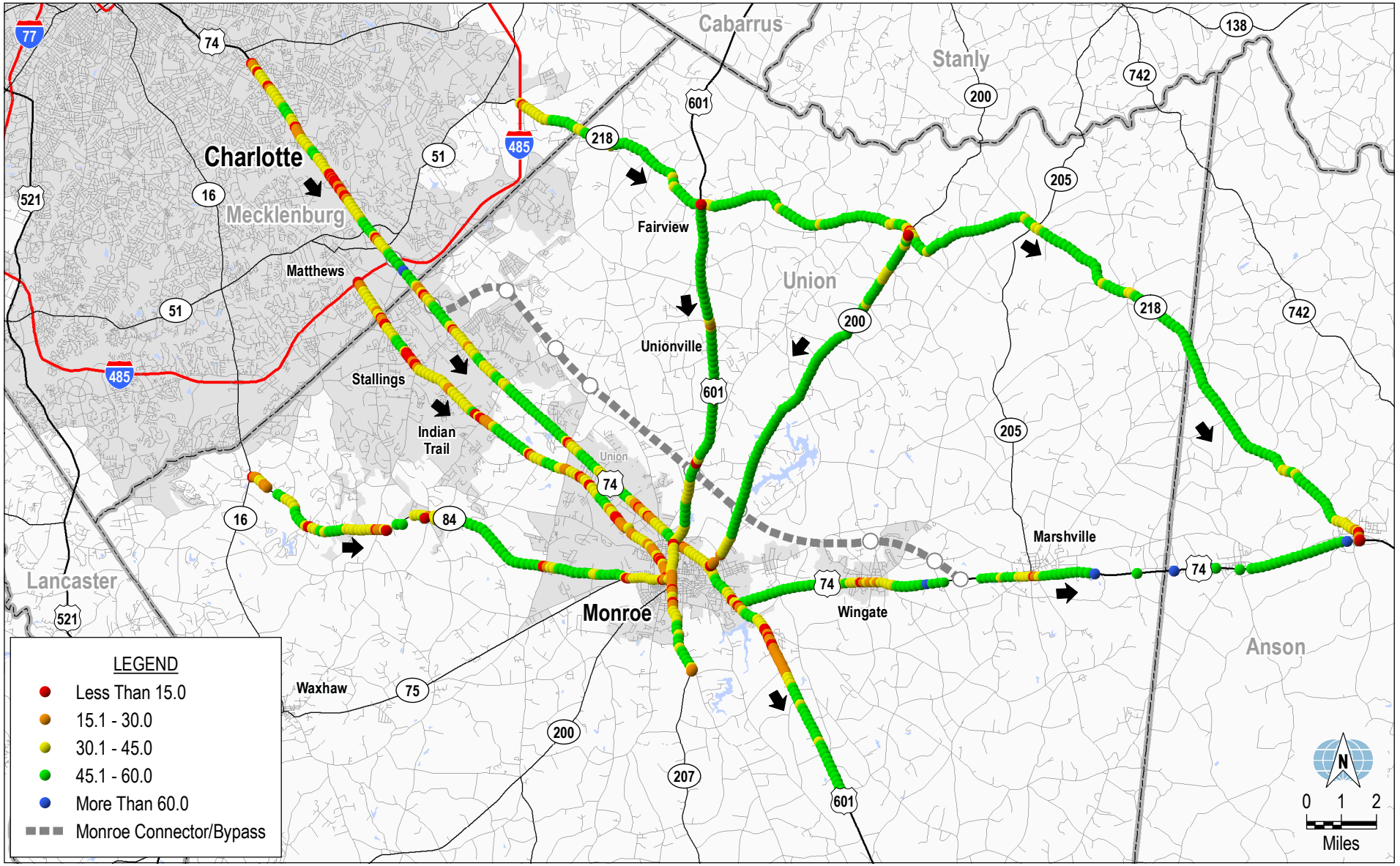
FIGURE 2-6



NORTH CAROLINA Turnpike Authority

OBSERVED PM PEAK PERIOD TRAVEL SPEEDS INBOUND TOWARD CHARLOTTE

FIGURE 2-7



NORTH CAROLINA Turnpike Authority

OBSERVED PM PEAK PERIOD TRAVEL SPEEDS OUTBOUND FROM CHARLOTTE

FIGURE 2-8

mid-sized system which concentrates in the more urbanized areas of the metropolitan area.

Table 2-10
CATS Vanpool Routes

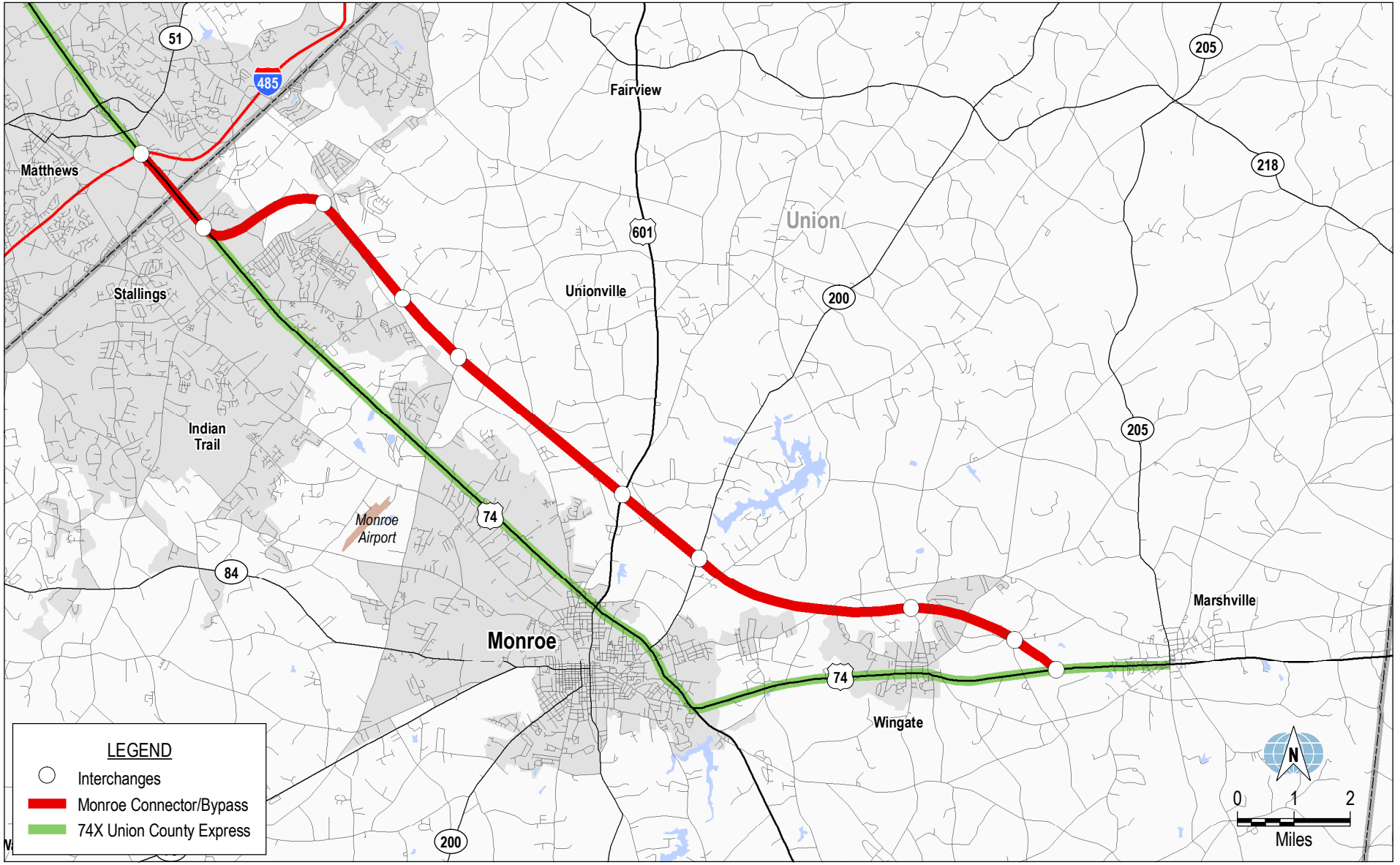
Route	From	To	Shift
210	Waxhaw	Airport	3rd
230	Indian Trail	Uptown	1st

Fixed Route Services in the Study Area

Figure 2-9 displays the only bus route in the study area. CATS operates Route 74X, the Union County Express between the Charlotte Transportation Center and a park and ride facility in Marshville. Four weekday morning runs are provided on approximately 30 minute headways to Charlotte and in the opposite direction in the afternoon. No service is available on weekends and holidays. The one-way fare is $3.00 or $80 for a monthly pass.

Vanpool Services

The CATS offers both a vanpool service and minivan service. The services coverage area depends on current ridership and where the vans are coming from and where they are going. A vanpool consists of nine to fifteen passengers with one rider agreeing to be the driver and at least one other rider agreeing to be the backup driver. For fewer passengers the minivan service is for four to seven passengers. Both services include gas, maintenance, insurance, and the Guaranteed Ride Home program. The CATS website provides all current service listing as well as directions on how to get a new vanpool or minivan service started. Table 2-10 lists the current CATS vanpool routes in the study area and Table 2-11 shows a monthly fare based on average daily round-trip mileage, number of riders, and number of days the route is taken per month.



NORTH CAROLINA Turnpike Authority

STUDY AREA TRANSIT SERVICE 2010

FIGURE 2-9

Table 2-11
CATS Vanpool Fares
2009

Daily Round Trip (Miles)	Monthly Lease	Rider Fare 15 Riders	Rider Fare 12 Riders	Rider Fare 10 Riders	Rider Fare 8 Riders	Rider Fare 6 Riders	Rider Fare 4 Riders
20	$351.64	$23.44	$29.30	$35.16	$43.96	$58.61	$87.91
25	368.80	24.59	30.73	36.88	46.10	61.47	92.20
30	385.96	25.73	32.16	38.60	48.25	64.33	96.49
35	403.12	26.87	33.59	40.31	50.39	67.19	100.78
40	420.28	28.02	35.02	42.03	52.54	70.05	105.07
45	437.44	29.16	36.45	43.74	54.68	72.91	109.36
50	454.60	30.31	37.88	45.46	56.83	75.77	113.65
65	506.08	33.74	42.17	50.61	63.26	84.35	126.52
70	523.24	34.88	43.60	52.32	65.41	87.21	130.81
75	540.40	36.03	45.03	54.04	67.55	90.07	135.10
80	557.56	37.17	46.46	55.76	69.70	92.93	139.39
85	574.72	38.31	47.89	57.47	71.84	95.79	143.68
90	591.88	39.46	49.32	59.19	73.99	98.65	147.97
95	609.04	40.60	50.75	60.90	76.13	101.51	152.26
100	626.20	41.75	52.18	62.62	78.28	104.37	156.55
110	660.52	44.03	55.04	66.05	82.57	110.09	165.13
120	694.84	46.32	57.90	69.48	86.86	115.81	173.71
130	729.16	48.61	60.76	72.92	91.15	121.53	182.29
140	763.48	50.90	63.62	76.35	95.44	127.25	190.87
150	797.80	53.19	66.48	79.78	99.73	132.97	199.45

JOURNEY TO WORK

The study area for the Monroe Connector/Bypass incorporates portions of both Mecklenburg and Union County. The majority of commuters living in those counties chose to drive alone to work. Mecklenburg County has the largest percentage of workers using public transportation to commute to work (2.6 percent), as well as the largest percentage of people walking (1.4 percent) to work. Union County has the largest percentage of people choosing to carpool to work (13 percent). Mecklenburg County, as the more populous of the two counties, has the most commuters using public transportation (9,331) and carpooling (45,473). The means of travel to work in Mecklenburg and Union Counties, as reported by the 2000 Census, is provided in Table 2-12. For the two county area, approximately 86 percent of workers either drove alone or carpooled to work. Less than 2.5 percent used public transportation.

Commuter travel time is influenced by several factors, such as the location of major employment centers, county size, and population. Table 2-13 provides 2000 travel time data for Mecklenburg and Union Counties. The average commute time for the two counties was 28 minutes. Union County commutes were 31 minutes.

Table 2-12
Transportation to Work Mode
2000

Mode	Mecklenburg County Workers Age 16+	Mecklenburg County % of Total Workers	Union County Workers Age 16+	Union County % of Total Workers	Two County Area Workers Age 16+	Two County Area % of Total Workers
Drove Alone	287,663	79.2%	49,851	81.4%	337,514	79.6%
Carpooled	45,473	12.5%	7,943	13.0%	53,416	12.6%
Public Transportation	9,331	2.6%	230	0.4%	9,561	2.3%
Motorcycle	202	0.1%	74	0.1%	276	0.1%
Bicycle	489	0.1%	61	0.1%	550	0.1%
Walked	5,097	1.4%	580	0.9%	5,677	1.3%
Other Means	2,424	0.7%	346	0.6%	2,770	0.7%
Worked at Home	12,312	3.4%	2,132	3.5%	14,444	3.4%
Total	362,991	100.0%	61,217	100.0%	424,208	100.0%

Table 2-13
Travel Time to Work
2000

Trip Length	Mecklenburg County Commuters	Mecklenburg County % of Total Commuters	Union County Commuters	Union County % of Total Commuters	Two County Area Commuters	Two County Area % of Total Commuters
Less than 5 minutes	6,170	1.8%	1,433	2.4%	7,603	1.9%
5 to 9 minutes	25,156	7.2%	4,759	8.1%	29,915	7.3%
10 to 14 minutes	43,828	12.5%	6,580	11.1%	50,408	12.3%
15 to 19 minutes	55,760	15.9%	8,422	14.3%	64,182	15.7%
20 to 24 minutes	60,977	17.4%	8,130	13.8%	69,107	16.9%
25 to 29 minutes	26,042	7.4%	3,680	6.2%	29,722	7.3%
30 to 34 minutes	61,914	17.7%	8,835	15.0%	70,749	17.3%
35 to 39 minutes	11,163	3.2%	2,023	3.4%	13,186	3.2%
40 to 44 minutes	14,030	4.0%	2,734	4.6%	16,764	4.1%
45 to 59 minutes	26,871	7.7%	6,985	11.8%	33,856	8.3%
60 to 89 minutes	11,900	3.4%	4,049	6.9%	15,949	3.9%
90 or more minutes	6,868	2.0%	1,455	2.5%	8,323	2.0%
Total	350,679	100.0%	59,085	100.0%	409,764	100.0%
Average Travel time	27		31		28	

Table 2-14 shows vehicle occupancy data for Mecklenburg and Union counties collected during the 2000 Census. The two counties had nearly the same average vehicle occupancy (1.21 persons). The two counties also had approximately the same percentage of single-occupant vehicles.

Table 2-14
Commuter Vehicle Occupancy
2000

	Mecklenburg County		Union County		Two County Area	
Trip Length	**Motorists**	**% of Total Motorists**	**Motorists**	**% of Total Motorists**	**Motorists**	**% of Total Motorists**
Drove alone	287,663	86.4%	49,851	86.3%	337,514	86.3%
2-person carpool	32,567	9.8%	5,664	9.8%	38,231	9.8%
3-person carpool	6,755	2.0%	1,457	2.5%	8,212	2.1%
4-person carpool	3,136	0.9%	434	0.8%	3,570	0.9%
5- or 6-person carpool	2,054	0.6%	321	0.6%	2,375	0.6%
7-or-more-person carpool	961	0.3%	67	0.1%	1,028	0.3%
Total	333,136	100.0%	57,794	100.0%	390,930	100.0%
Average Occupancy	1.21		1.20		1.21	

CHAPTER 3

TRAVEL PATTERN SURVEYS

Travel pattern surveys were conducted in March and April 2009 at ten locations in the vicinity of the proposed Monroe Connector/Bypass. The travel patterns observed from the survey served as integral inputs into the travel demand model for the project traffic and toll revenue forecast. The key findings of the travel pattern surveys are summarized below.

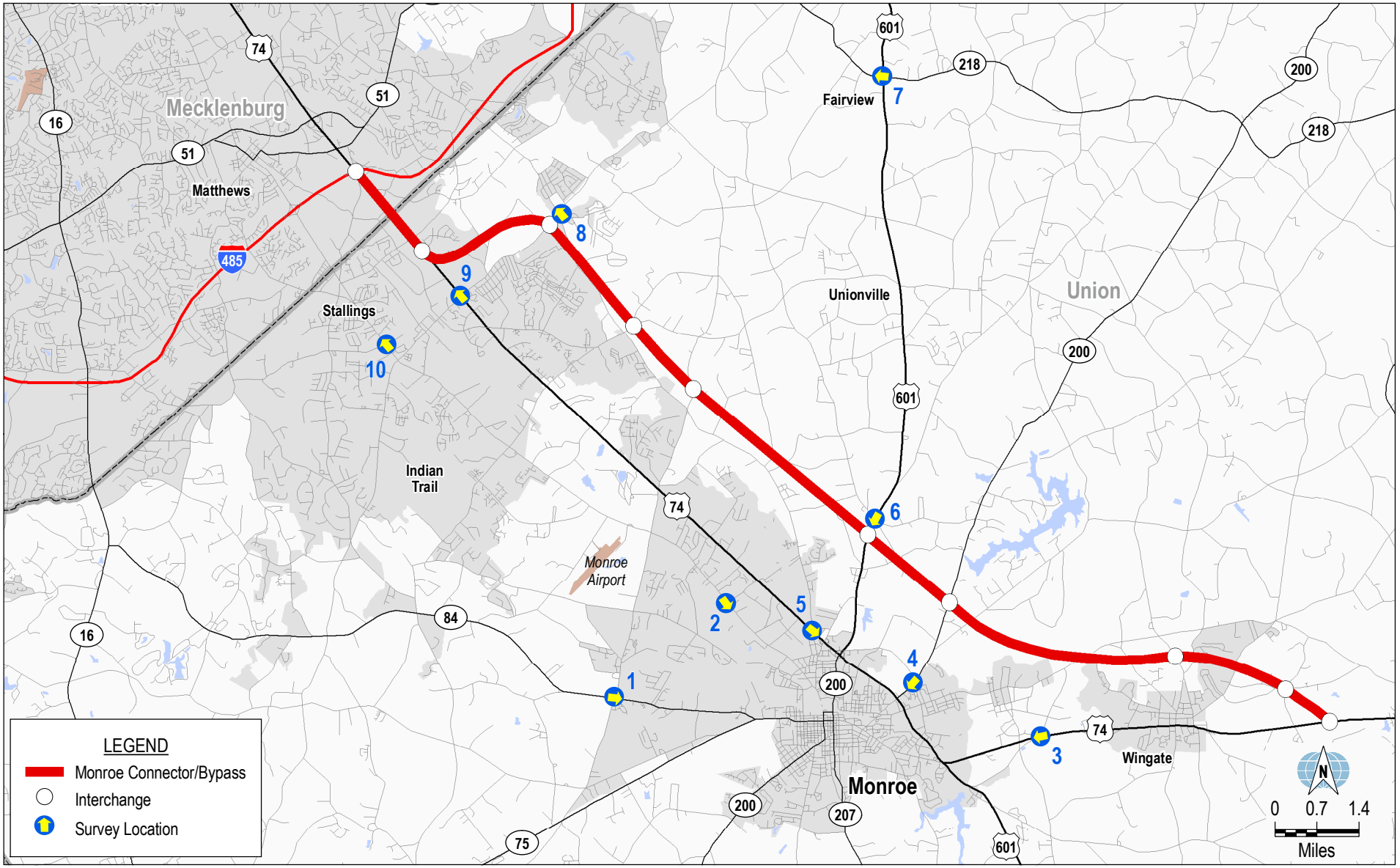
METHODOLOGY AND PROCEDURES

Ten survey locations were selected for the travel pattern survey in order to provide an adequate representation of study area traffic. The survey team coordinated with county and local jurisdictions to ensure that safety concerns were taken into consideration. Figure 3-1 depicts the locations of the ten survey stations. As shown in the figure, all surveys were conducted in a single direction of travel at signalized intersections in accordance with an operation and safety plan developed for each location.[(1)] The survey was conducted in such a manner as to minimize impact on traffic flow and maximize safety to motorists and survey personnel.

The survey questionnaire was distributed in the form of a postage-paid business-reply card. Figure 3-2 shows the mail-back, handout survey questionnaire**.** The survey contained eight questions that queried motorists about their trip origin and destination, residence status, trip purpose, trip frequency, and vehicle occupancy. An optional question was included asking if motorists wished to participate in an internet-based survey of transportation options as described in more detail in Chapter 4.

Of the 23,807 surveys distributed, a total of 3,611 valid surveys were returned or 15.2 percent of the total. Table 3-1 indicates the dates on which the surveys were conducted, the number of surveys distributed and the return rate for each location. Upon receipt, the completed questionnaires

(1) During later survey processing, observed one-way trips were "reversed" in order to provide estimates of daily travel patterns in each direction.



NORTH CAROLINA Turnpike Authority

TRAVEL PATTERN SURVEY LOCATIONS

FIGURE 3-1

7

Dear Motorist:
The North Carolina Turnpike Authority (NCTA) is undertaking an important transportation initiative to improve mobility in the Mecklenburg/Union County Region. NCTA is requesting your assistance and is asking for information about the one-way trip that you made today when you received this card. Please complete the card and drop it into the mail at your earliest convenience. Postage is pre-paid. All information is confidential and will not be used for any purpose other than for this study. Thank you for your participation. This information is critical as NCTA plans future highway improvements in the area.

8

A. Where did you start your trip today? (In this direction) Please be as specific as possible. If you do not know the street address, please identify the nearest intersection, shopping area, subdivision, etc.

9

Street Address, nearest intersection or location

City or town State Zip Code (if known)

10

B. Where did you end this trip today? (In this direction) Please be as specific as possible. If you do not know the street address, please identify the nearest intersection, shopping area, subdivision, etc.
The answer should not be the same as your answer for Question A. Please do not describe a round trip such as home to work and then home. Please describe the trip only in the direction you were going when you received this card.

11

Street Address, nearest intersection or location

12

City or town State Zip Code (if known)

13

C. Did you or will you use any of the following roads during this specific one-way trip? (Circle all that apply)

1. US 74 2. Old Charlotte Hwy 3. US 601 4. NC 200 5. NC 218
6. Lawyers Rd 7. I-485 8. NC 84 9. Did not use any of these roads

14

D. Please indicate the main purpose of your one-way trip. (Circle one)

1. To or from work 3. School 5. Recreation 7. Other personal business
2. Company business 4. Shopping 6. Social event and/or visit

15

E. How many times per week do you make this one-way trip? (Circle one)

Less than 1 1 2 3 4 5 6 or more

16

F. How many people, including yourself and any children, were in your vehicle? (Circle one)

1 2 3 4 5 6 or more

17

G. Please identify the type of vehicle you were driving. (Circle one)

1. Two-axle, Four-tire Passenger Car, SUV or Pickup Truck
2. 2-axle, 6 tire Truck
3. 3-axle Truck
4. Four-axle Truck
5. Truck with Five or More Axles
6. Motorcycle

H. What is the zip code of your primary residence? _____

I. OPTIONAL - If you would like to participate in an internet-based survey of transportation options, please provide your e-mail address. (This information will be used only for the internet survey and will not be used for any other purpose.)

E-mail address _____

18

1	3	2														
	DAY	DIR	HR	C							D	E	F	G	H	I

Table 3-1
Motorist Survey Sample Size

Survey Station	Location	Date	Direction	Number of Surveys Distributed	Number of Valid Surveys Returned	Passing Traffic	Percent of Passing Traffic Surveyed	Percent of Valid Surveys Returned
1	NC 84 West of Rocky River Road	3/24/2009	Eastbound	1,478	299	3,160	46.8%	20.2%
2	Old Monroe Road West of Dickerson Boulevard	3/24/2009	Eastbound	1,844	152	6,099	30.2%	8.2%
3	US 74 West of North Bivens Road	3/25/2009 - 3/300/2009	Westbound	2,190	283	9,448	23.2%	12.9%
4	NC 200 North of North Sutherland Avenue	3/25/2009 - 3/300/2009	Southbound	944	223	4,107	23.0%	23.6%
5	US 74 West of Secrest Short Cut Road	4/2/2009	Eastbound	4,235	390	17,580	24.1%	9.2%
6	US 601 North of Ridge Road	4/2/2009	Southbound	836	140	3,342	25.0%	16.7%
7	NC 218 East of US 601	4/1/2009	Westbound	1,029	280	2,139	48.1%	27.2%
8	Secrest Short Cut Road, Southeast of Indian Trail-Fairview Road	4/1/2009	Northbound/ Westbound	1,578	285	4,821	32.7%	18.1%
9	US 74 Southeast of Indian Trail-Fairview Road	4/2/2009	Northbound/ Westbound	6,010	923	21,390	28.1%	15.4%
10	Old Monroe Road, Southeast of Waxhaw Indian Trail Road	4/2/2009	Northbound/ Westbound	3,663	636	6,919	52.9%	17.4%
			Total	23,807	3,611	79,005	30.1%	15.2%

were filtered for validity and entered into a geographic information systems (GIS) database. This GIS database was a valuable tool in evaluating the validity of each travel survey and ensuring that model trip tables reflected current usage patterns of the highway system in the study area.

SURVEY TRIP CHARACTERISTICS

The travel pattern survey results illustrated several trends in trip characteristics in the Monroe Connector/Bypass area as illustrated in Figure 3-3.

TRIP PURPOSE

The primary trip purpose for those respondents traveling during the AM and PM peak periods was travel "to and from work." This response accounted for approximately 60 percent of peak period traffic. During the non-peak period, "to and from work" was still the largest category with 27 percent, closely followed by "other personnel business" which accounted for 25 percent of all non-peak responses. During the non-peak period, "shopping" accounted for a significantly greater portion of all traffic than during the peak period.

TRIP FREQUENCY

Approximately 63 percent of peak period survey respondents indicated that they make the trip described in the survey a minimum of five times per week. During off-peak periods the number of people making the trip five times or more a week declined to less than 40 percent.

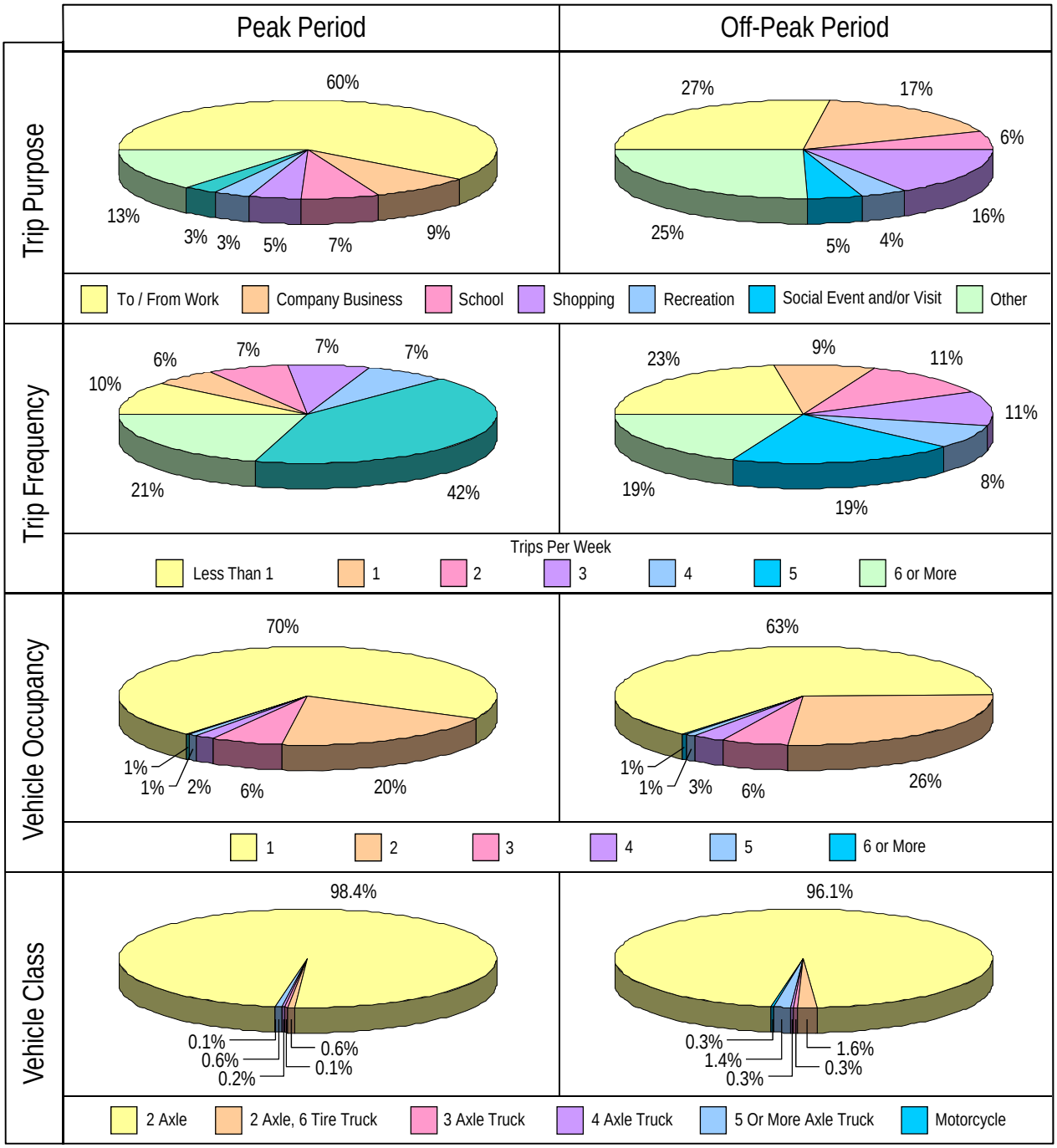
VEHICLE OCCUPANCY AND VEHICLE CLASS

Vehicle occupancy rates were found to be similar during the peak and off-peak periods. As shown in figure, single occupant vehicles accounted for 70 and 63 percent of all valid survey responses during the peak and off-peak periods, respectively. Approximately 20 percent of the additional vehicles carried just a single passenger, meaning vehicles with three or more passengers account for less than ten percent of all survey responses. The average vehicle occupancy totaled 1.42 passengers per vehicle in the peak period and 1.52 passengers per vehicle during the off-peak period.

Two-axle vehicles accounted for over 98 percent of survey responses, as indicated in the figure. While commercial vehicles account for a slightly greater percentage of traffic during the off peak period, two-axle vehicles still made up over 96 percent of total survey responses.

ROAD CHOICE

Motorists were asked to identify the roadways used on the trip being described on the survey questionnaire. Combined with the origin-destination



Note: Charts represent sum of all survey locations.

information, the road choice answers provided insight into the most likely route between two points. As it would not be practical to list all area roads, only select major roads and logical route choices were offered.

The road choice information was broken down by peak and off-peak periods. Over 62 percent of all respondents reported that they used US 74 during these peak periods and 70 percent in the off-peak periods. Other roads with reported usage included Old Charlotte Highway (approximately 30 percent) and I-485 (approximately 25 percent). Roads such as US 601, NC 200, NC 218, Lawyer's Road, and NC 84 had less than 17 percent each. For the most part the percentage of usage for these roads remained relatively consistent during the peak and non peak periods.

TRIP ORIGINS AND DESTINATIONS

The primary objective of a travel pattern survey, commonly referred to as an "origin-destination survey," is to better understand the primary travel movements within a designated project corridor. The first set of questions in the survey questionnaire was designed to obtain this information. The origin-destination information presented below is based on the survey data factored to the traffic count volumes.

A majority of survey respondents indicated that their trip began in the communities of Monroe, Indian Trail, Marshville, Wingate, and Charlotte. These five communities were indicated as the trip origin for approximately 78 percent of the responses received. The most prevalent destination cities included Monroe, Charlotte, and Matthews which accounted for almost 75 percent of trip destinations. Table 3-2 shows the percent distribution of trips by origin and destination city. For both origins and destination, more than 80 percent of all trips started and ended in the cities and towns listed.

Table 3-3 shows the number of "factored" trips in the peak and off-peak periods for some of the common traffic movements identified from the surveys. The top five origin cities were included in the table. The most popular trips represented by the survey data were from Monroe to Monroe, Monroe to Charlotte, and Indian Trail to Charlotte. These three movements accounted for more than 53 percent of all the trips shown in Table 3-3. Trips within the city of Monroe accounted for nearly 28 percent by themselves.

Table 3-2
Trips by Origin and Destination City

Origin City	Total Trips	Percent
Monroe	31,402	42.9%
Indian Trail	12,661	17.3%
Marshville	4,660	6.4%
Wingate	4,133	5.7%
Charlotte	4,112	5.6%
Wadesboro	2,307	3.2%
Matthews	2,234	3.1%
Other	11,605	15.8%
Total	73,114	100.0%

Destination City	Total Trips	Percent
Monroe	25,734	35.4%
Charlotte	19,446	26.8%
Matthews	9,222	12.7%
Indian Trail	3,025	4.2%
Wingate	2,413	3.3%
Other	12,785	17.6%
Total	72,625	100.0%

Table 3-3
Trips for Common Origin-Destination Pairs

Origin City or Town	Destination City or Town	Trips			Percent Share of Trips		
		Peak	Off-Peak	Total	Peak	Off-Peak	Total
Monroe	Charlotte	4,238	2,726	6,964	30.8%	21.1%	26.1%
	Indian Trail	438	830	1,268	3.2%	6.4%	4.8%
	Matthews	2,725	1,889	4,614	19.8%	14.7%	17.3%
	Monroe	5,663	7,047	12,709	41.2%	54.7%	47.7%
	Wingate	683	398	1,082	5.0%	3.1%	4.1%
	Total	13,747	12,890	26,637	100.0%	100.0%	100.0%
Indian Trail	Charlotte	2,532	2,342	4,875	53.5%	48.5%	51.0%
	Matthews	1,138	1,442	2,580	24.1%	29.9%	27.0%
	Monroe	1,060	1,042	2,103	22.4%	21.6%	22.0%
	Total	4,730	4,826	9,558	100.0%	100.0%	100.0%
Marshville	Charlotte	292	1,140	1,433	16.4%	67.5%	41.3%
	Monroe	1,003	549	1,552	56.3%	32.5%	44.7%
	Richbury	487	0	487	27.3%	0.0%	14.0%
	Total	1,782	1,689	3,472	100.0%	100.0%	100.0%
Wingate	Charlotte	668	295	964	33.9%	19.0%	27.3%
	Matthews	276	266	542	14.0%	17.1%	15.4%
	Monroe	1,028	991	2,020	52.1%	63.9%	57.3%
	Total	1,972	1,552	3,526	100.0%	100.0%	100.0%
Charlotte	Cheraw	0	362	362	0.0%	18.4%	12.5%
	Hamlet	0	605	605	0.0%	30.8%	20.8%
	Monroe	937	998	1,935	100.0%	50.8%	66.7%
	Total	937	1,965	2,902	100.0%	100.0%	100.0%

CHAPTER 4

STATED PREFERENCE SURVEYS

The Monroe Connector/Bypass Stated Preference Survey was conducted by Resource Systems Group (RSG) for Wilbur Smith Associates and the North Carolina Turnpike Authority (NCTA). The objective of the stated preference survey was to estimate levels of the toll sensitivity, or "values of time," of travelers in the proposed Monroe Connector/Bypass study area. The survey was designed to provide sufficient detail to allow analyses of traveler responses to different toll structures and toll collection options; and to allow analysis of toll sensitivity to support route diversion modeling. The inputs and results of the stated preference survey are documented in a technical memorandum provided to the NCTA.

APPROACH

The stated preference survey instrument was programmed using special software developed by RSG for field intercepts using laptops and for online administration through RSG's website, SurveyCafe.com.

Respondents for this survey were recruited from several sources. Email invitations were sent to those travel pattern survey respondents expressing interest in participating in follow-up surveys. Other surveys were conducted at locations with high pedestrian traffic such as city offices, libraries, shopping centers, motor vehicle departments and community colleges. Online surveys were conducted using mailing lists provided by the NCTA and by the local Chamber of Commerce.

Commercial vehicle surveys were also conducted with commercial vehicle operators in the area and a special survey at the Port of Wilmington since some heavy truck traffic to and from the port uses the Monroe corridor along US 74.

The customized computer-based survey software adapts to the trip characteristics of each respondent, making the survey realistic for them. By performing calculations behind the scenes, it allowed for the presentation of complex ideas in a simple manner. Electronic validation of each question eliminated item non-response and prevented the entry of invalid inputs. Responses were stored directly into a database after every question, reducing data entry costs and eliminating transcription error.

AUTOMOBILE SURVEY QUESTIONNAIRE

The automobile survey questionnaire briefly introduced the purpose of the survey and then asked questions grouped into four sections: trip description, stated preference with questions about travel time and toll cost, stated preference follow-up questions, and demographic questions.

TRIP DESCRIPTION

Respondents were screened to ensure that they had made trips recently within the Monroe Connector/Bypass study area. Each was asked to provide details of their trip, including day of the week, the purpose of their trip, the time period in which their trip began, the roads they used during their trip, and where their trip began and ended. These data were used to validate the Monroe Connector/Bypass as a possible alternative for the respondent's reported trip and as inputs to build the alternatives described in the stated preference scenarios.

After entering origin and destination information, respondents were asked for additional details about their trips including trip duration, amount of travel delay experienced, vehicle occupancy and how many times a week they make the particular trip.

STATED PREFERENCE SECTION

Before beginning the stated preference exercises, respondents were presented with more specific information about the proposed Monroe Connector/Bypass. Respondents were also given a description of the toll collection methods that likely would be used on the new facility.

Definition of Alternatives **-** The stated preference section consisted of nine hypothetical scenarios, with each scenario presenting three alternatives for traveling between the respondent's trip origin and destination. The first alternative presented the respondent's reported travel time using a toll-free route. The second and third alternatives presented the estimated travel time and two levels of toll costs based on the calculated use of the

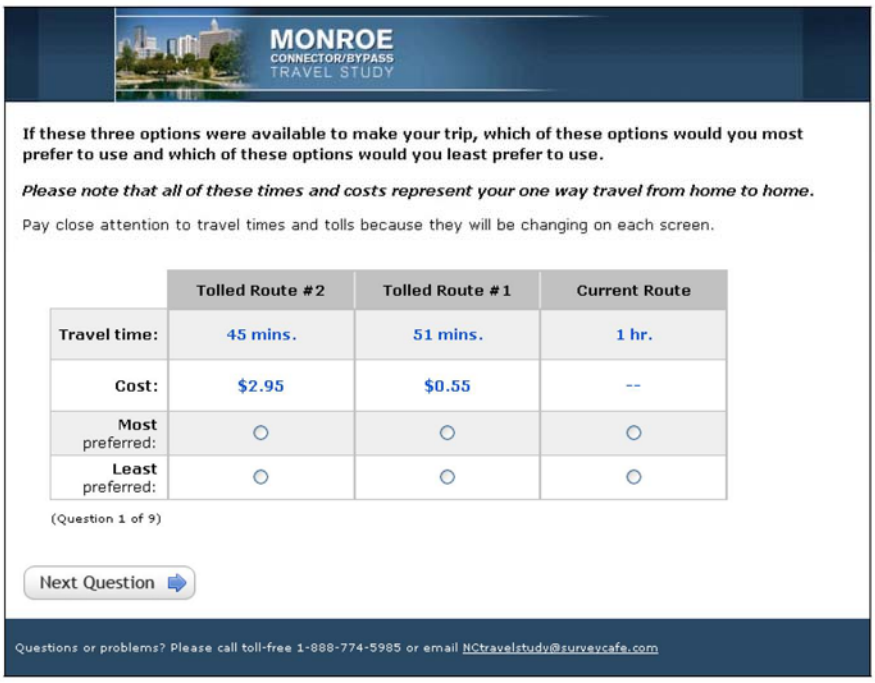
Monroe Connector/Bypass for the identical trip. Figure 4-1 shows an example automobile stated preference experiment.

Definition of Attributes and Levels **-** Travel times for the respondent's current route, as well as travel times and toll costs for the Monroe Connector/Bypass alternative, were presented at different values or "levels" in nine scenarios for each respondent. The combination of times and costs presented in each scenario were selected using a fractional factorial orthogonal experimental design, a commonly used experimental design method. The experimental design consisted of 72 scenarios, and each respondent saw 9 of the 72 scenarios in a randomized order. The two alternative toll costs in each scenario were designed to identify the perceived value of alternative toll costs such as for electronic and video tolling differential toll levels.

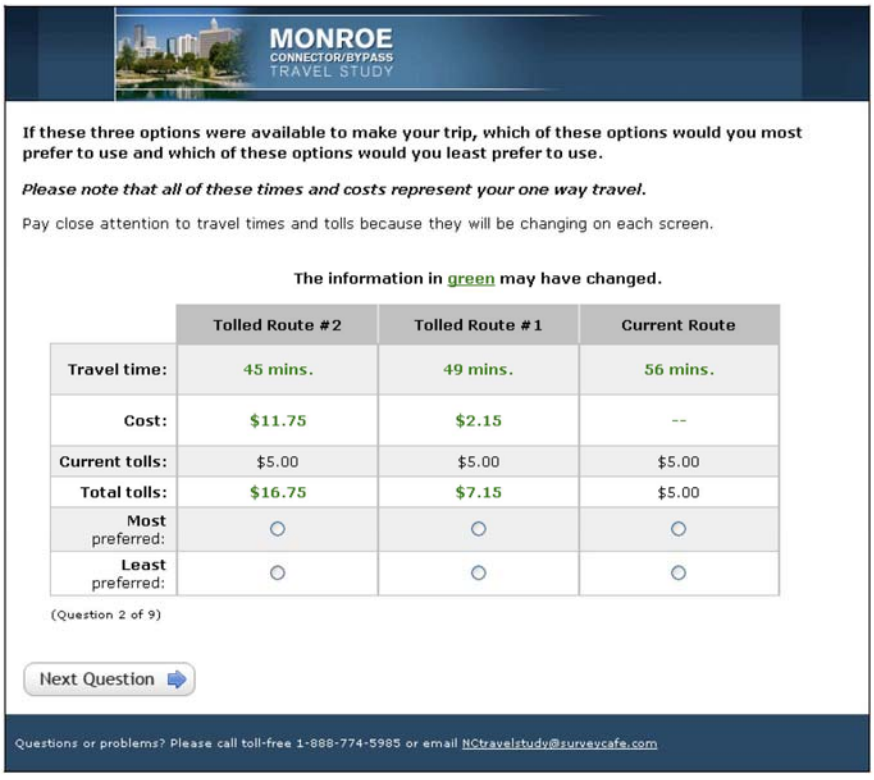
To ensure that the Monroe Connector/Bypass scenarios were believable to the respondent, the values for travel times and toll costs were based on characteristics of the respondent's own trip: the respondent's likely route for their trip using the Monroe Connector/Bypass was estimated based on the stated origin and destination for their trip. Calculations of the most likely entrance and exit ramps determined the respondent's hypothetical access times to, egress times from, and total distance along the project. Times spent on the project road and toll costs were varied by travel speed and toll cost per mile, respectively, to provide values meeting the experimental design criteria. By varying the travel times and tolls shown in each scenario, the respondent was presented with different time costs and saving amounts for each scenario, allowing the demonstration of travel preferences across a range of values of time.

STATED PREFERENCE FOLLOW-UP

Directly following the stated preference section, respondents who did not select the Monroe Connector/Bypass alternative in any of the nine stated preference scenarios were asked to indicate their primary reason for not choosing the toll road. Respondents who chose the Monroe Connector/Bypass option at least once were asked their likelihood of acquiring an electronic toll collection (ETC) device as well as their familiarity with these devices. Those respondents who were not "very likely" to acquire an ETC device were asked if a reduced toll would increase their likelihood of ETC use. Respondents who still were not interested in ETC devices were asked why they were unlikely to open an ETC account.



Example Automobile Stated Preference Experiment



Example Commercial Vehicle Stated Preference Experiment

NORTH CAROLINA Turnpike Authority

EXAMPLE STATED PREFERENCE SURVEY QUESTIONS

FIGURE 4-1

The final follow-up section of the survey asked about their opinions of the project and their primary reason for support or opposition. Finally, respondents were asked a few attitudinal questions regarding tolling in general.

DEMOGRAPHICS

The final section of the survey contained a series of questions to collect data such as zip code of residence, household size, number of household vehicles, gender, age, employment status, and income. This information was used to determine differences in responses among traveler market segments.

COMMERCIAL VEHICLE SURVEY QUESTIONNAIRE

The commercial vehicle survey questionnaire was similar to the automobile questionnaire. It briefly introduced the purpose of the survey and then asked questions grouped into four sections: trip description and type of commercial vehicle and operation, stated preference with questions about travel time and toll cost, stated preference follow-up questions, and company background questions.

TRIP DESCRIPTION

Respondents were screened by type of company, respondent's role in the company, and the route decision-making authority of the respondent. Then questions were asked to ensure that they had made trips recently within the Monroe Connector/Bypass study area. Each was asked to provide details of their trip, including day of the week, vehicle type, number of axles, the time period in which their trip began, the roads they used during their trip, and where their trip began and ended. These data were used to validate the Monroe Connector/Bypass as a possible alternative for the respondent's reported trip and as inputs to build the alternatives described in the stated preference scenarios.

After entering origin and destination information, respondents were asked for additional details about their trips including trip duration, amount of travel delay experienced, how many times a week they make the particular trip, and whether or not a ETC transponder was in the vehicle.

STATED PREFERENCE SECTION

Before beginning the stated preference exercises, respondents were presented with more specific information about the proposed Monroe Connector/Bypass. Respondents were also given a description of the toll collection methods that likely would be used on the new facility.

Definition of Alternatives **-** The stated preference section consisted of nine hypothetical scenarios, with each scenario presenting three alternatives for traveling between the respondent's trip origin and destination. The first alternative presented the respondent's reported travel time using a toll-free route. The second and third alternatives presented the estimated travel time and two levels of toll costs based on the calculated use of the Monroe Connector/Bypass for the identical trip. Figure 4-1 also shows an example a commercial vehicle stated preference experiment.

Definition of Attributes and Levels – As with the automobile stated preference survey, commercial vehicle travel times for the respondent's current route, as well as travel times and toll costs for the Monroe Connector/Bypass alternative, were presented at different values or "levels" in nine scenarios for each respondent. The commercial vehicle survey also had 72 scenarios of which each respondent received one of eight randomly selected combinations of nine questions. Each scenario consisted of a free alternative and two tolled alternatives at different toll rates. The toll rates represented ranges of tolls that might be charged for commercial vehicles through either electronic toll collection or video toll collection.

STATED PREFERENCE FOLLOW-UP

Directly following the stated preference section, respondents who did not select the Monroe Connector/Bypass alternative in any of the nine stated preference scenarios were asked to indicate their primary reason for not choosing the toll road. Commercial respondents who chose the Monroe Connector/Bypass option at least once but who did not currently have an ETC transponder were asked were asked if they were more likely to pay the toll using a transponder or to pay a higher charge using video collection. Those respondents who were not "very likely" to acquire an ETC device were asked if a reduced toll would increase their likelihood of ETC use. Respondents who still were not interested in ETC devices were asked why they were unlikely to open an ETC account.

The final follow-up section of the survey asked about their opinions of the project and their primary reason for support or opposition. Finally, respondents were asked a few attitudinal questions regarding tolling in general.

COMPANY CHARACTERISTICS

The final section of the survey contained a series of questions to collect data such as location of company headquarters, average trip length, type of goods carried, delivery schedules, and fleet size.

SURVEY RESULTS

AUTOMOBILE SAMPLE OVERVIEW

Stated preference data from 1,343 respondents were used to estimate the automobile choice models. Approximately 60 percent of these responses were conducted online via respondents to the origin-destination survey, mailing lists furnished by the NCTA, recruitment via the Chamber of Commerce, and an online sample provider.

The automobile intercept surveys were conducted at the following locations:

- North Carolina Department of Motor Vehicles – Monroe;
- Monroe Mall;
- Monroe Public Library;
- Wingate University (Wingate);
- Town of Matthews/Library Building (Matthews);
- Extreme Ice/Fitness Center (Indian Trail);
- Marshville Public Library (Marshville); and
- Monroe City Clerk's office.

AUTOMOBILE RESPONDENT CHARACTERISTICS

The automobile sample revealed several characteristics of the respondents. It was comprised of 53 percent women and 47 percent men. The median age was between 45 and 54 years of age. The greatest proportion of respondents (38 percent) reported a household size of two people. The greatest number (44 percent) of respondents had two vehicles in their household and another 25 percent had three vehicles.

Only 54 percent of respondents indicated that they were employed full time; 9 percent were self employed, and another 7 percent were employed part time. Approximately 6 percent were unemployed. The remaining respondents were retired, homemakers, and students. Annual household income of less than $50,000 before taxes was reported for 35 percent of the respondents. More than 10 percent reported household incomes over $125,000.

AUTOMOBILE RESPONDENT TRIP CHARACTERISTICS

The survey also provided information on travel characteristics. Most (87 percent) of respondents indicated that their trip began at home, and nearly half (44 percent) reported the purpose of the trip was either to or from work or for company business. The majority of trips (79 percent) took less than one hour. Work trips were generally shorter in duration than

non-work trips with 17 percent of non-work trips taking more than 81 minutes as indicated in Figure 4-2. Around half of the trips took place during the peak periods. Most of the delay experienced by respondents was less than 20 minutes. Figure 4-2 also shows the reported delay by time of day.

Commercial Vehicle Sample Overview

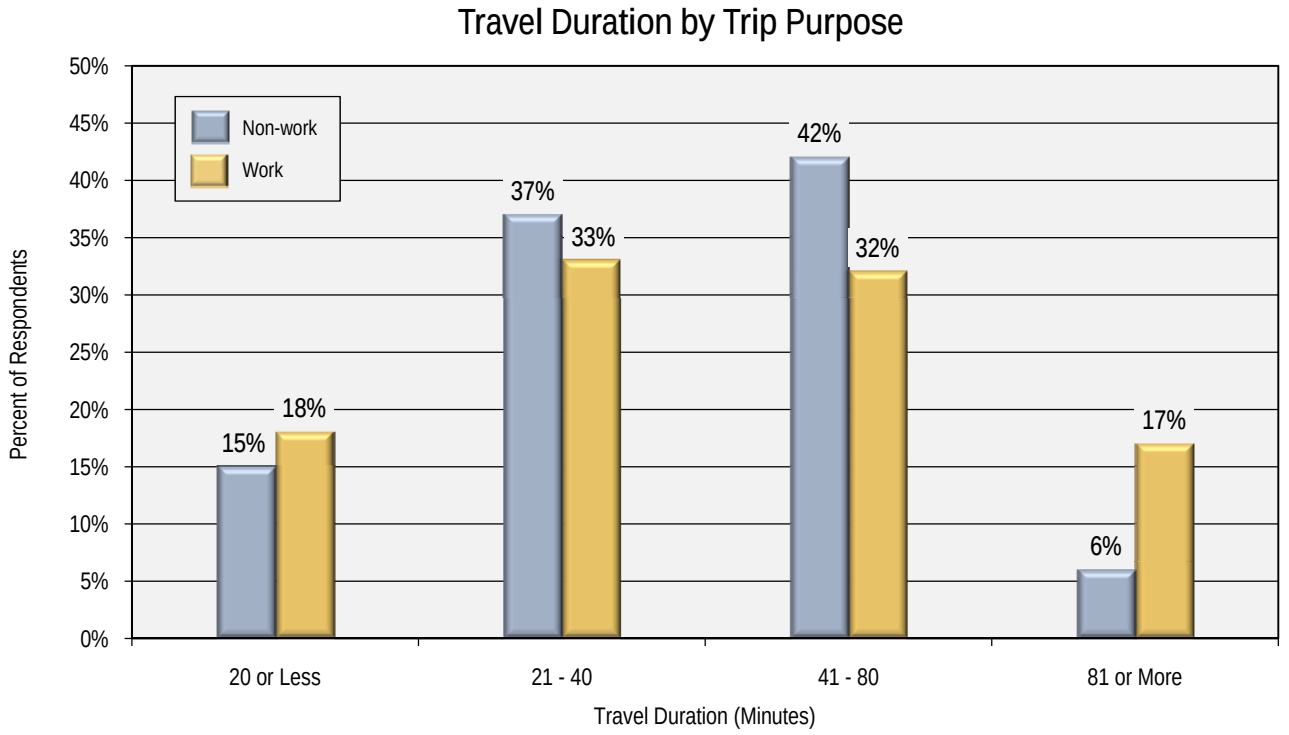
Commercial vehicle drivers and decision makers who made or directed trips in the study area were recruited from two sources: a survey of respondents intercepted at the Port of Wilmington and an online survey via an invitation to employees of commercial vehicle operators in the region. A total of 251 commercial vehicle surveys were conducted.

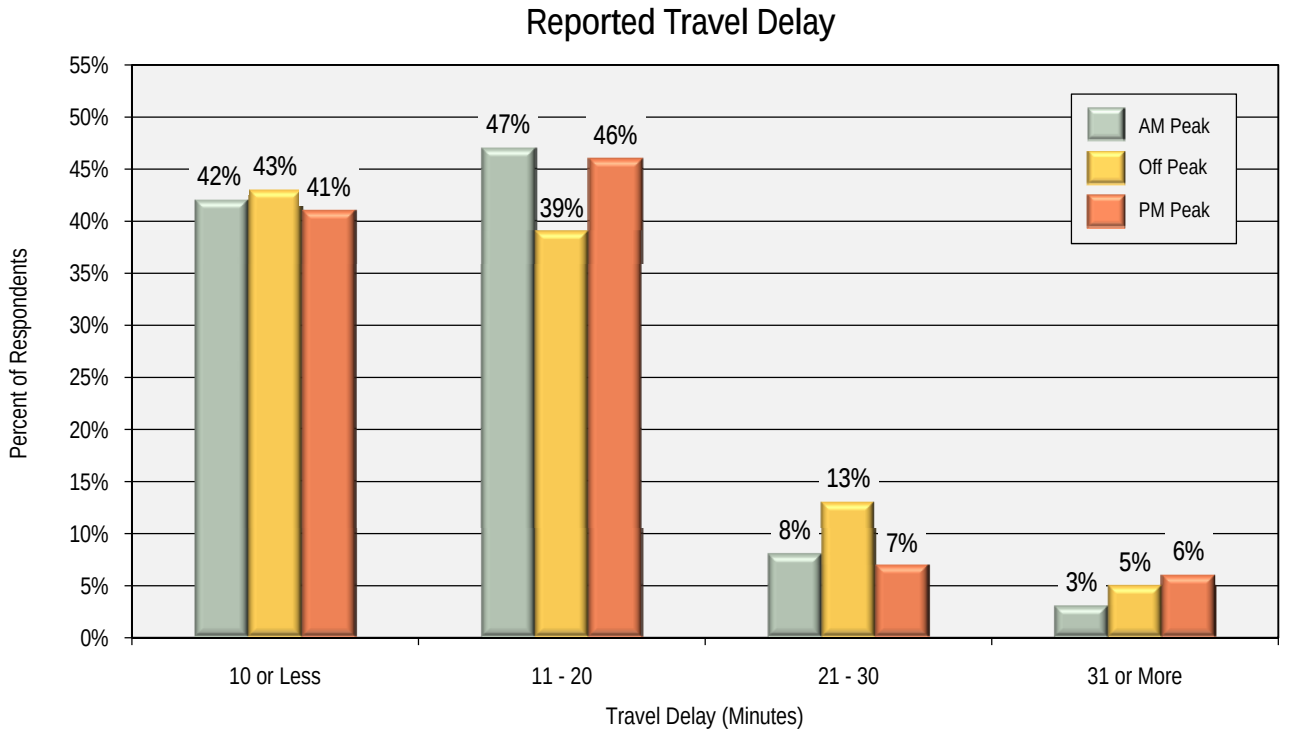
Commercial Vehicle Respondent Characteristics

The commercial vehicle sample revealed several characteristics that were differentiated by the location of the company headquarters. Nearly 90 percent of respondents reported their headquarters was in North Carolina, and 23 percent were within the Charlotte area. Those in the Charlotte area reported shorter trip lengths compared to those with a headquarters elsewhere. Approximately 42 percent had fleet sizes of less than 20 vehicles. Over 60 percent had flexible delivery schedules. Over half of respondents reported that they were self-employed. Nearly 60 percent of respondents were owner-operators, and nearly 80 percent reported that they work for only one private carrier.

Commercial Vehicle Respondent Trip Characteristics

The survey also provided information on travel characteristics of the respondents. Approximately 86 percent of the commercial vehicle survey respondents drove a tractor trailer combination of five or more axles. Most trips were made during weekdays with the peak travel day on Wednesdays and the lowest travel day on Fridays. A quarter of the trips began before 7:00 AM, and approximately 43 percent reported trips beginning in the midday period. Approximately 75 percent of the respondents reported that they did not stop in the Monroe corridor except for traffic delays. Approximately 54 percent of the commercial vehicle respondents reported traffic delays of less than 30 minutes, and the remainder reported travel delays in the corridor of more than 30 minutes. Approximately 25 percent of the respondents travel the corridor five or more times a week and a third travel between two or three times a week.





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TRAVEL CHARACTERISTICS OF AUTOMOBILE STATED PREFERENCE SURVEY RESPONDENTS

FIGURE 4-2

MODEL ESTIMATION

Data from the stated preference alternatives were expanded into a dataset that contained nine observations for each usable survey. The statistical estimation and specification testing was completed using a conventional maximum likelihood procedure that estimated a single set of coefficients for a multinomial logit model. These coefficients were used to estimate the value of travel time savings for travelers in the proposed Monroe Connector/Bypass study area. The value of time estimates were input into the travel demand model to estimate traffic and revenue for the proposed Monroe Connector/Bypass.

This stated preference survey was conducted in the spring of 2009 at a time when the Charlotte region was experiencing a significant economic downturn particularly in the financial industry but extending to most other sectors. Upon review of the values of time derived from this study, RSG in early 2010 drew upon other studies in which they had measured values of time for the same location at different time periods during different economic conditions including downturns. Their studies indicated that respondents' values of time are impacted by the state of the economy and that the values estimated during the downturns are lower than the values measured in better economic times. They concluded that the values of time estimated for the Monroe Connector/Bypass survey would likely be at least 10 percent higher in a post recessionary period. Therefore the values shown in this section have been increased by 10 percent based on this empirical evidence from elsewhere.

MODEL COEFFICIENTS BY MARKET SEGMENT

Model coefficients were estimated for the four automobile and one commercial vehicle market segment listed below:

- Peak Work Trips;
- Peak Non-work Trips;
- Off-peak Work Trips;
- Off-peak Non-work Trips; and
- Commercial Vehicles.

The final model structures were provided to the NCTA in a technical memorandum. For the automobile market segments, value of time was determined to be sensitive to income. That is, people with higher incomes tended to have higher values of time. For commercial vehicles, value of time was sensitive to the size of the vehicle.

While Table 4-1 summarizes average value of time for the automobile and commercial vehicle segments at the regional median income levels, the values of time for the automobile drivers were determined to vary by income and trip purpose. The value of time for the commercial vehicle segment is sensitive to the number of axles. It should be noted that these values in Table 4-1 were chosen to be a representative sample but the actual values used in the traffic and revenue analysis were localized for the average income for each traffic analysis zone in the model.

Table 4-1
Estimated Values of Time
Monroe Connector/Bypass Stated Preference Survey
2010 Dollars

Automobile

Market Segment	Average Household Income	Value of Time Per Hour
Peak Work	$83,000	$7.71
Off-peak Work	$82,000	$8.13
Peak Non-work	$70,000	$8.21
Off-peak Non-work	$76,000	$8.21

Commercial Vehicles

Number of Axles	Value of Time Per Hour
2	$7.41
3	$12.55
4	$15.55
5	$17.69
6	$19.34
7	$20.69
8	$21.84

Average axles in sample: 4.7

APPLICATION TO MODEL FOR TRAFFIC AND REVENUE FORECAST

A weighted average value of time was calculated for each traffic analysis zone within the travel demand model used for the traffic and revenue analysis for this project. The estimated value of time for each zone was weighted based on the trip purpose distribution for trips originating within the zone, the household income for the zone, and the average length of trips from the zone that would potentially use the Monroe Connector/Bypass. This value of time matrix was used as input to the traffic assignments for the project under a variety of tolling conditions.

CHAPTER 5

STUDY AREA GROWTH REVIEW

When conducting a study to determine the viability of a start-up toll facility such as the Monroe Connector/Bypass, forecasted economic growth is a significant factor which must be reviewed thoroughly. As this study is to be used in support of project financing; it was deemed necessary to have an independent analysis of the expected economic growth of the region and study corridor. The independent economist was tasked with creating an alternate forecast of socioeconomic growth for all parameters that were used in the regional travel demand model. The forecast values prepared through this process were used in the study rather than relying on the growth estimates developed by the Mecklenburg Union Metropolitan Planning Organization (MUMPO).

The independent economist selected to update socioeconomic growth estimates was the Kenan Institute of Private Enterprise of the Kenan-Flagler Business School at the University of North Carolina at Chapel Hill. The team of economists had no affiliation with the original forecasts developed by the MPO or with local governments or developers in the area. As such, the review of regional economic growth and creation of Transportation Analysis Zone (TAZ) level data sets were unbiased and independently-derived.

METHODOLOGY

A brief overview of the methodology employed by the independent economist is presented below. A detailed description of the work performed by Kenan is in the Kenan report provided in a technical memorandum to the NCTA.

Kenan employed two methods in preparing the regional socioeconomic forecast that was used for this traffic and revenue study. The results of these two approaches were used to guide and adjust the MPO TAZ-level forecast data.

The first method was a top-down approach which began with national and regional forecasts of population and employment. Model-driven methods were then employed to allocate population and employment throughout the region. The reasonableness of the resulting forecasts were checked based on a thorough review of recent population and employment growth trends. Additionally, the competitiveness of the region's key industries and the input from several local economic experts were used to check the reasonableness of the forecasts.

The second method was a bottom-up review of the TAZ-level forecast developed by MUMPO, rather than the national and regional forecasts. The basic assumptions upon which the MPO's jurisdictions forecast socioeconomic growth were reviewed by Kenan. Interview with local planners, developers, and others were used to verify the reasonableness of the forecasts as well as to better understand contingencies upon which the projections might vary significantly.

This analysis was completed in 2009 at a time when the economy in the Charlotte metropolitan area was still experiencing the effects of the recession. In 2010, the independent economist reviewed the analysis completed earlier and adjusted the 2010 base year estimates to reflect more current conditions.

COMPARISON WITH PREVIOUS FORECASTS

While the preliminary Monroe Connector/Bypass studies completed by WSA used the MPO forecasts of socioeconomic data, for this comprehensive-level study the socioeconomic forecasts produced by Kenan form the basis of the traffic and revenue forecasts presented later in this report. Three unique sets of socioeconomic data are of interest to this study. The first of these forecasts is the 2005 MPO dataset which was used in the preliminary studies completed by WSA. The second relative dataset is a new set of forecasts prepared by MUMPO, which was completed in 2008 and was provided to Kenan as a starting point for their economic review. Finally, the TAZ level forecasts prepared by Kenan are vital to the study. Each of these three forecasts differs; and as such it was important to compare them, identify any major changes, and recognize the potential effect on traffic and revenue the changes in socioeconomic forecasts could cause.

Tables 5-1 and 5-2 contain comparisons of the population and employment forecasts, respectively, for the Monroe Connector/Bypass study area.

Table 5-1
Comparison of Population Projections
Monroe Connector/Bypass Study Area

Year	2005 MPO Population Forecast[1]	Current MPO [2] Population Forecast	Current MPO [2] Change from 2005 MPO Forecast	Independent Economist [3] Population Forecast	Independent Economist [3] Change from 2005 MPO Forecast
2010	129,467	140,267	8.3%	131,307	1.4%
2020	169,321	178,152	5.2%	165,207	-2.4%
2030	210,860	211,973	0.5%	198,613	-5.8%

(1) Forecasts were contained in the Regional Transportation Demand Model adopted at the time the 2006 Preliminary study.

(2) Forecasts were prepared by the Mecklenburg Union MPO in 2008 and are included in the Regional Transportation Demand Model current at the time of this study.

(3) Forecasts prepared by Kenan Insitute of Private Enterprise based on review of 2008 MPO forecasts.

Table 5-2
Comparison of Employment Projections
Monroe Connector/Bypass Study Area

Year	2005 MPO Employment Forecast [1]	Current MPO [2] Employment Forecast	Current MPO [2] Change from 2005 MPO Forecast	Independent Economist [3] Employment Forecast	Independent Economist [3] Change from 2005 MPO Forecast
2010	63,120	62,270	-1.3%	57,046	-9.6%
2020	88,451	87,951	-0.6%	80,881	-8.6%
2030	115,327	115,538	0.2%	106,690	-7.5%

(1) Forecasts were contained in the Regional Transportation Demand Model adopted at the time the 2006 Preliminary study.

(2) Forecasts were prepared by the Mecklenburg Union MPO in 2008 and are included in the Regional Transportation Demand Model current at the time of this study.

(3) Forecasts prepared by Kenan Insitute of Private Enterprise based on review of 2008 MPO forecasts.

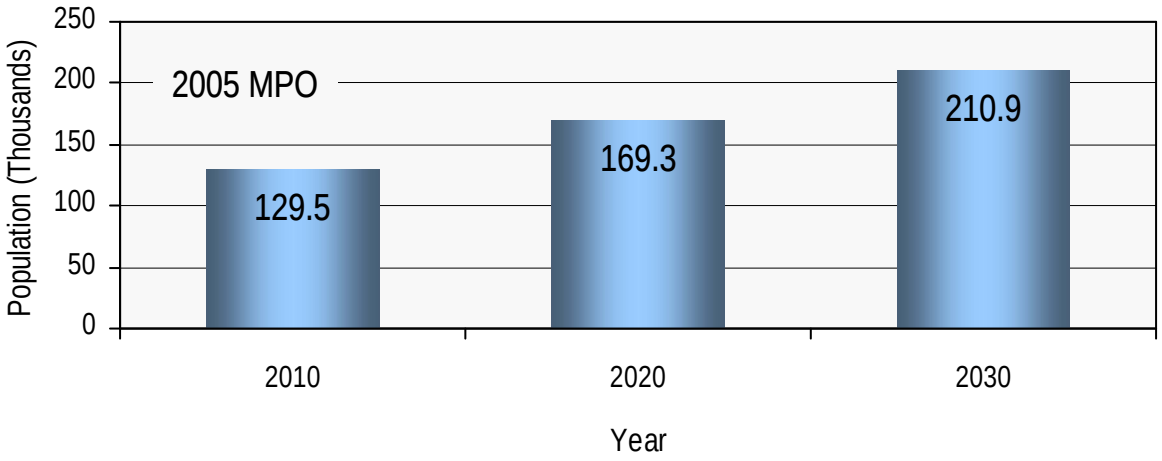
The study area values for each of the three forecasts have been included: the 2005 MPO forecasts used in the preliminary studies, the 2008 forecasts prepared by the MPO, and the forecasts prepared by Kenan, the independent economist. The same information is presented graphically in Figures 5-1 and 5-2.

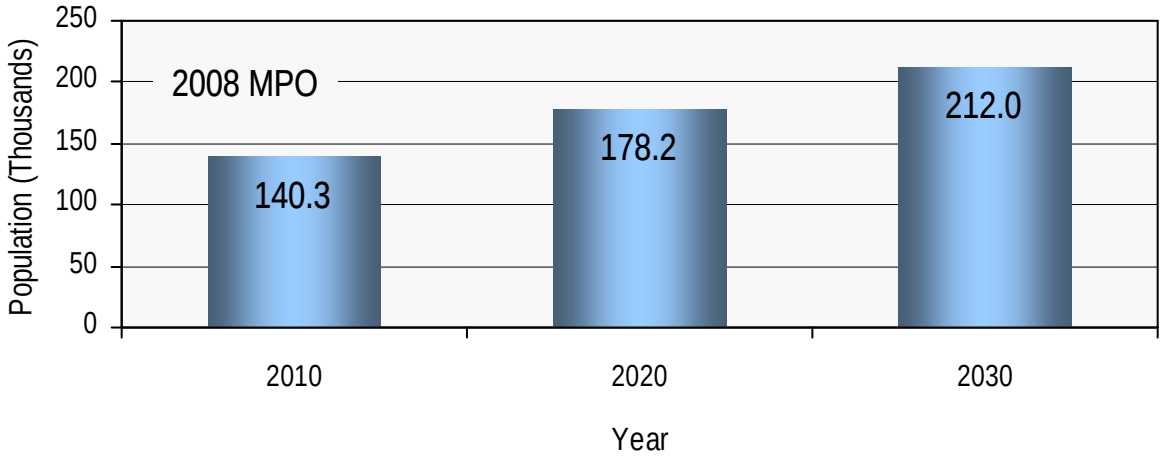
Population in the Monroe Connector/Bypass Study Area

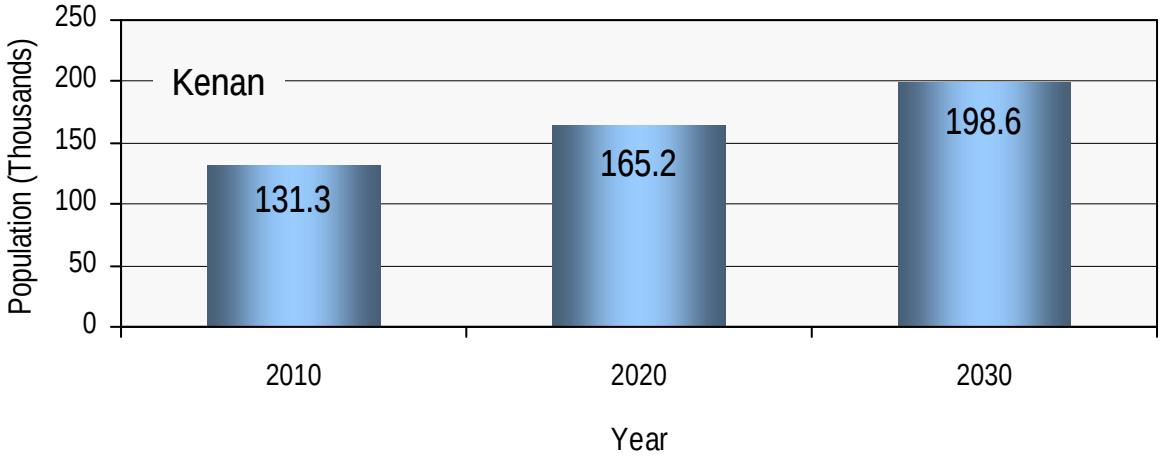
The MPO and Kenan population forecasts in the study area are significantly different as summarized in Table 5-1. The current MPO 2010 base year forecasts are 8.3 percent higher than study area population used in the preliminary study. The current MPO forecasts for 2020 are over 5 percent higher. By 2030, the two MPO forecasts are similar. Following the review by the independent economist, the adjusted population estimates for 2010 used in the current study are only slightly higher than the earlier MPO forecasts which in turn means that the 2010 study area population estimates used in this traffic and revenue study are lower than the current MPO population estimates. The variance between the independent economist 2020 and 2030 forecasts and the current MPO forecasts is more significant. In both cases the population forecasts used for this study are lower than both the older and the current MPO forecasts. For example, the independent economist study area forecast for 2020 is approximately 165,000 which is 2.4 percent lower than the study area population used in the preliminary study. With the current 2020 MPO study area population forecast of 178,000, the population forecast used in this traffic and revenue study is significantly lower than the current MPO forecast. A similar pattern is also shown for 2030.

Employment in the Monroe Connector/Bypass Study Area

Table 5-2 presents a similar comparison of the three employment forecasts for the study area. The current MPO employment forecasts are slightly lower in the early years and nearly the same by 2030 in comparison to the study area employment forecasts used in the preliminary study. However, these MPO forecasts were prepared before the recession began. The independent economist reviewed these forecasts and adjusted them downward based on the current recession. In the base year, the study area employment is estimated to be nearly 10 percent lower than the employment used in the preliminary study. For 2020 and 2030, the independent economist forecasts are 8.6 percent and 7.5 percent lower than the forecasts used in the preliminary study.







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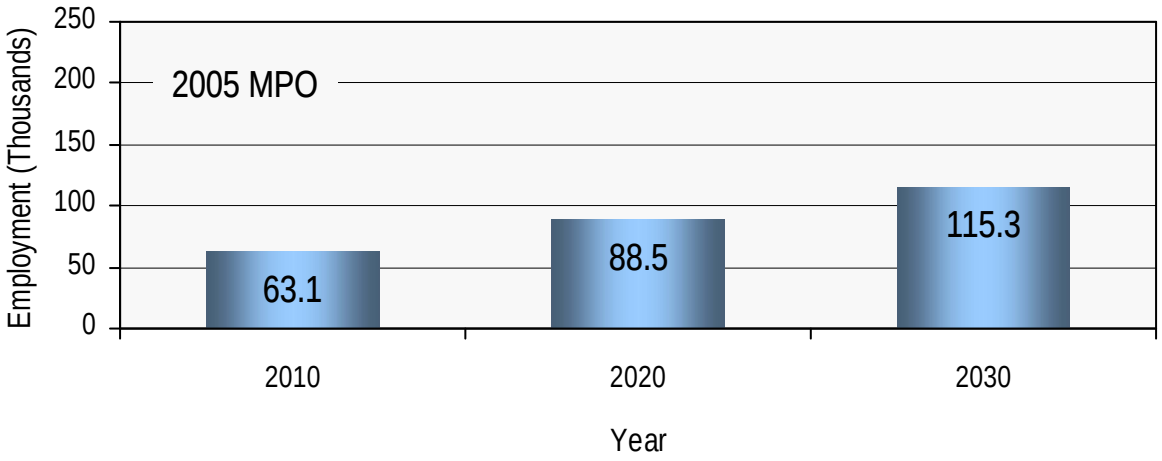
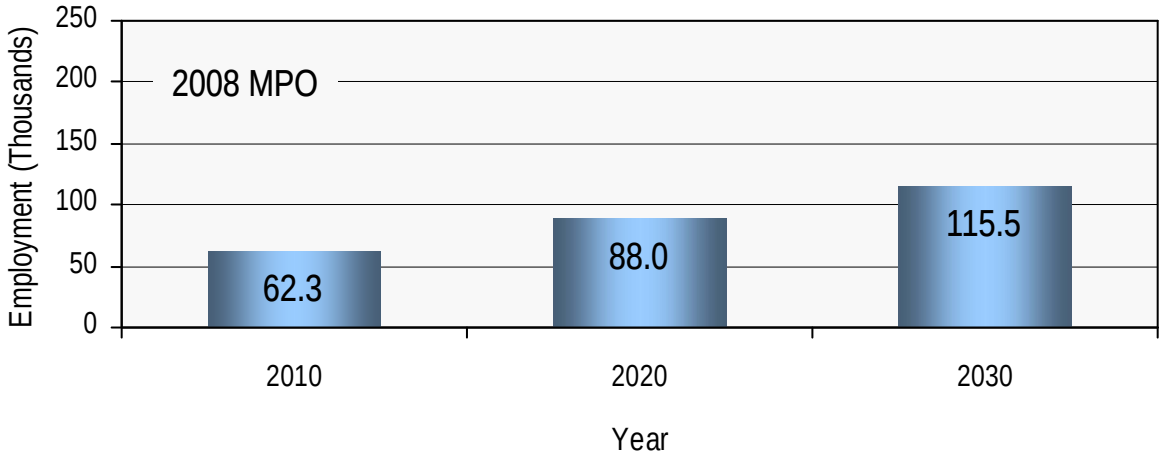
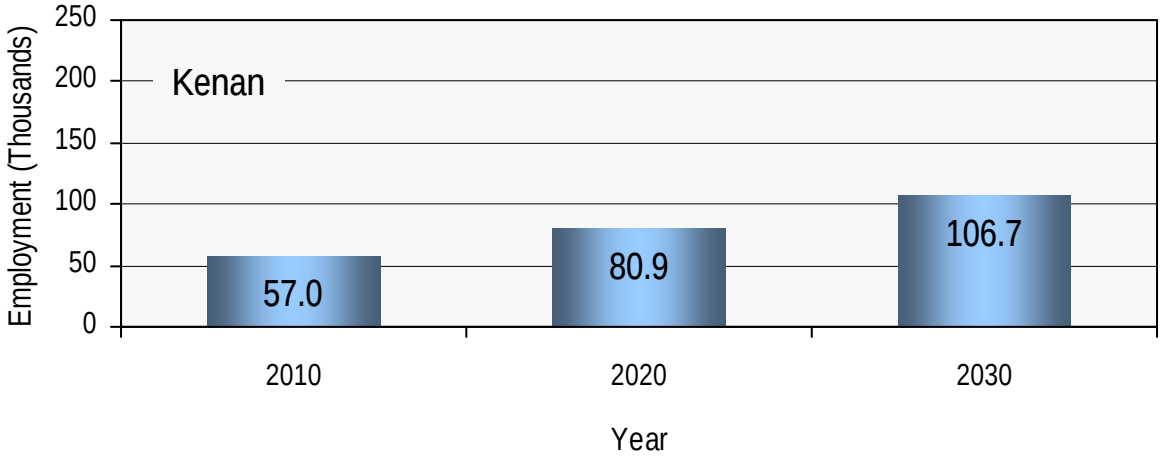
COMPARISON OF POPULATION PROJECTIONS IN THE MONROE CONNECTOR/BYPASS STUDY AREA

FIGURE 5-1







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COMPARISON OF EMPLOYMENT PROJECTIONS IN THE MONROE CONNECTOR/BYPASS STUDY AREA

FIGURE 5-2

GROWTH PROJECTIONS

The updated forecasts within the Monroe Connector/Bypass study area were analyzed further in order to gain additional insight into the locations where the changes in growth are expected. The study area was split up into 19 individual superzones, each comprised of a number of TAZs. These 19 zones are depicted in relation to the Monroe Connector/Bypass in Figure 5-3.

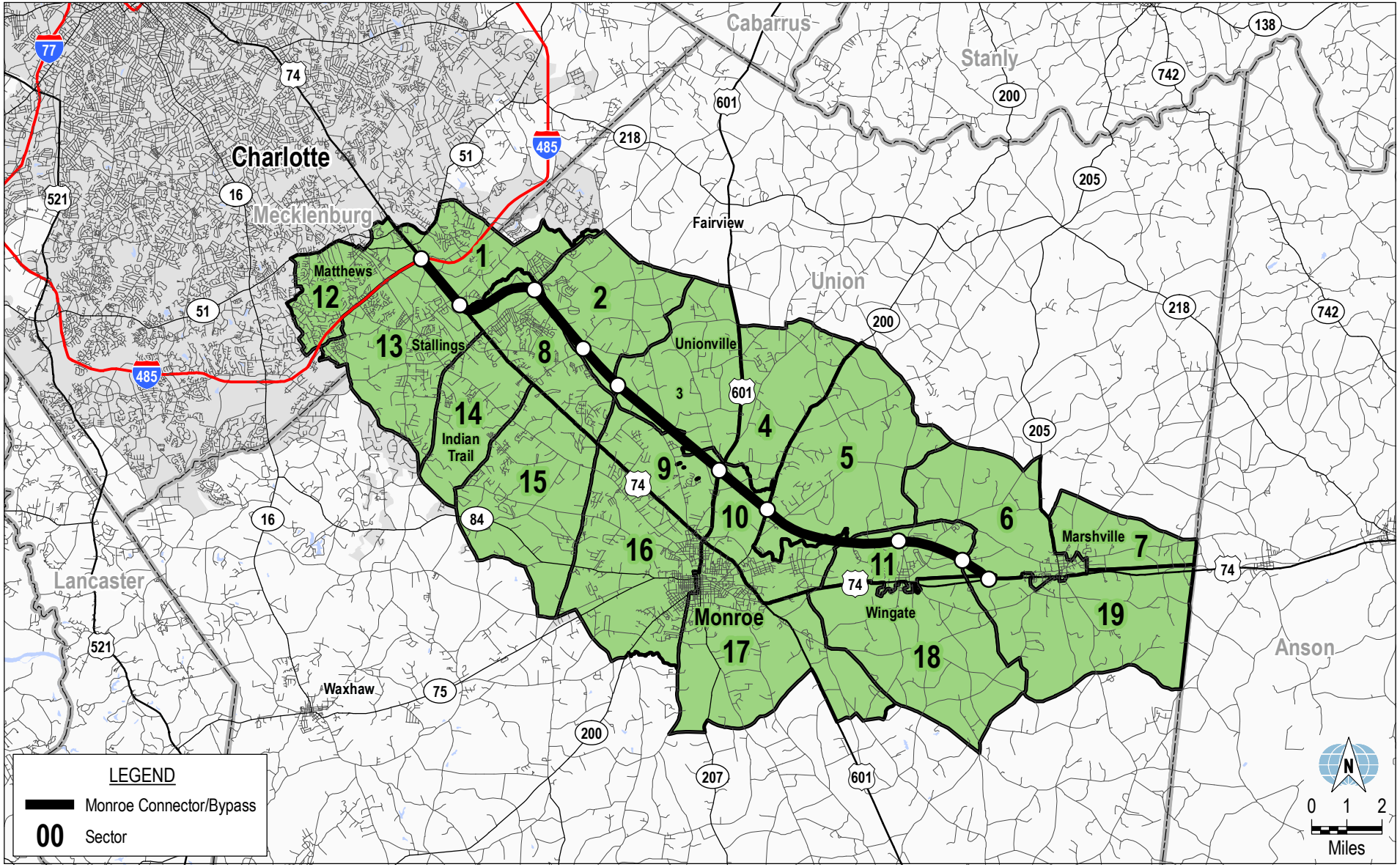
POPULATION FORECASTS

Table 5-3 summarizes population growth within the study area using the Kenan forecasts. In 2005, the Charlotte region had nearly 2.0 million residents with approximately 120,000 living within the Monroe Connector/Bypass study area, or 6.0 percent. By 2030, Kenan forecasts that the regional population will reach slightly over 2.9 million people, while the study area population will nearly reach 199,000. By 2030, the study area's share of the total region's population is expected to be 6.8 percent, a slight increase from 2005 levels. This demonstrates higher forecasted population growth in the study area than in the region. Overall, the study area is expected to experience annual growth of 2.0 percent between 2005 and 2030, whereas the entire region is expected to grow by only 1.5 percent annually.

Growth is estimated to be modest over the 25-year forecast period. Figure 5-4 highlights the growth for each of the superzones within the study area. Superzones where annual population growth is forecast to be greater than 3.0 percent are for the most part located north of the proposed toll facility. These zones, as well as the area which includes the southeast portion of the City of Monroe, are forecast to experience the greatest annual population growth within the study area. The area forecast to experience the slowest population growth lies to the south of US 74, west of the City of Monroe. This area, which includes superzones 12 through 16, is forecast to experience population growth of only 1.1 percent annually.

EMPLOYMENT FORECASTS

As shown in Table 5-4, study area total employment represented 5.1 percent of the Charlotte region's total employment in 2005. By 2030 though, this percentage is forecast to increase to 6.7 percent, a 30 percent increase. Employment in the study area is forecast to increase from approximately 51,000 to 107,000 between 2005 and 2030, an annual increase of 3.0 percent. This is significantly higher than the 1.9 percent annual employment growth forecast for the entire Charlotte region.



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STUDY AREA SECTOR MAP

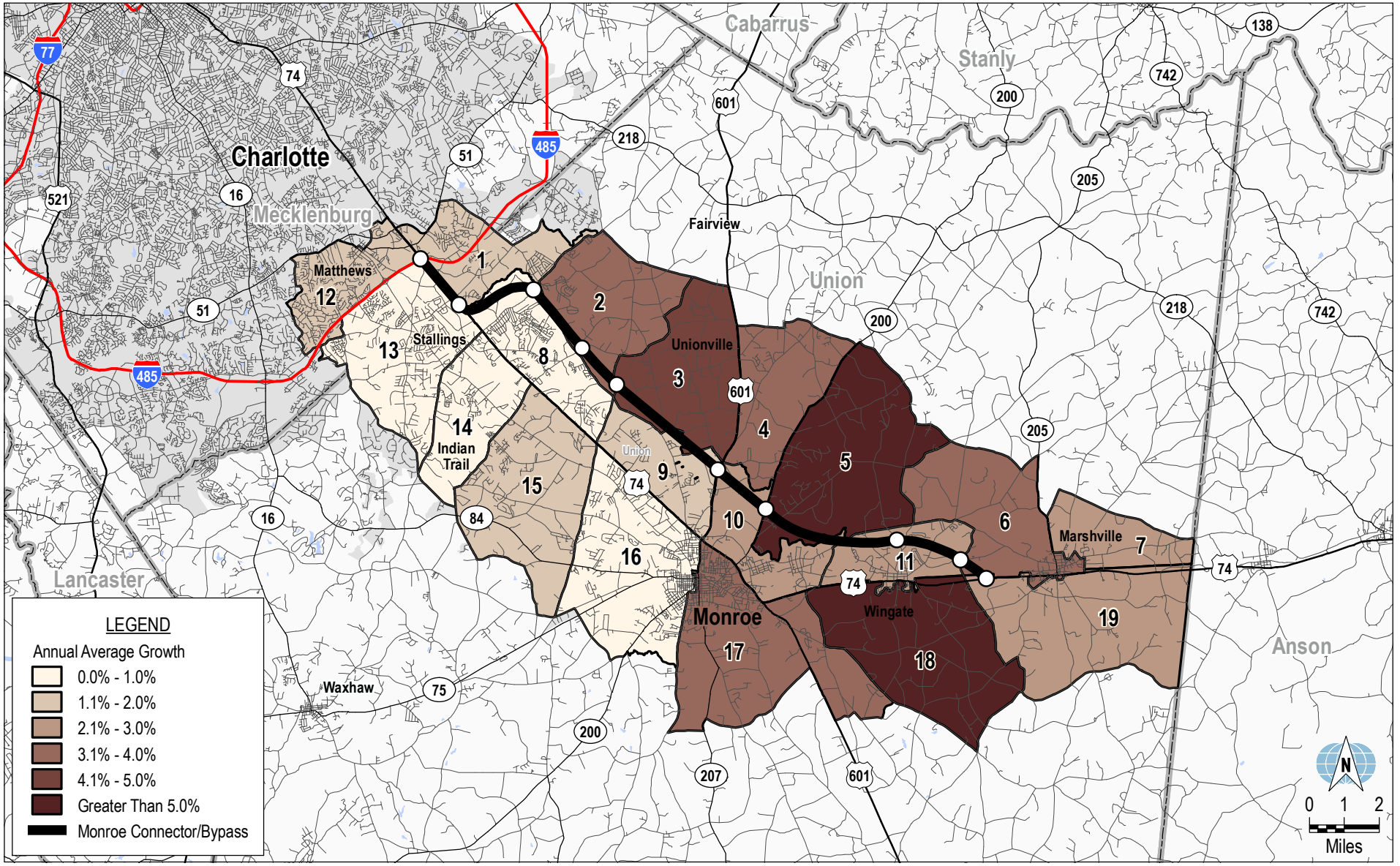
FIGURE 5-3

Table 5-3
Study Area Population Projections
Proposed Monroe Connector/Bypass

Study Area Sector	2005	Average Annual Growth	2010	Average Annual Growth	2020	Average Annual Growth	2030	Average Annual Growth 2005-2030	Total Growth 2005-2030
1	7,879	1.6%	8,532	1.6%	10,030	1.2%	11,297	1.5%	43.4%
2	3,312	3.7%	3,979	3.9%	5,823	3.2%	7,952	3.6%	140.1%
3	2,181	5.4%	2,843	4.6%	4,453	3.1%	6,070	4.2%	178.3%
4	2,455	3.1%	2,858	3.7%	4,128	3.0%	5,570	3.3%	126.9%
5	2,993	9.9%	4,798	6.8%	9,273	4.6%	14,559	6.5%	386.4%
6	2,265	3.0%	2,628	4.4%	4,023	3.7%	5,770	3.8%	154.7%
7	615	3.3%	723	3.1%	979	2.4%	1,240	2.8%	101.6%
8	10,482	0.3%	10,631	0.9%	11,652	0.7%	12,458	0.7%	18.9%
9	4,277	2.9%	4,934	2.1%	6,072	0.9%	6,611	1.8%	54.6%
10	4,215	1.9%	4,631	2.4%	5,857	2.1%	7,207	2.2%	71.0%
11	4,111	1.4%	4,414	2.2%	5,509	2.6%	7,091	2.2%	72.5%
12	14,570	0.7%	15,062	1.5%	17,416	0.9%	19,089	1.1%	31.0%
13	16,325	0.1%	16,434	1.3%	18,764	0.9%	20,485	0.9%	25.5%
14	8,350	0.3%	8,486	1.1%	9,507	1.1%	10,654	1.0%	27.6%
15	8,715	1.7%	9,497	1.9%	11,441	1.1%	12,778	1.5%	46.6%
16	13,946	0.5%	14,289	1.2%	16,097	0.9%	17,544	0.9%	25.8%
17	9,421	4.3%	11,603	3.3%	16,064	2.3%	20,244	3.1%	114.9%
18	2,481	6.0%	3,318	5.9%	5,909	4.4%	9,118	5.3%	267.5%
19	1,461	2.4%	1,647	3.0%	2,210	2.7%	2,876	2.7%	96.9%
Total Study Area Population	120,054	1.8%	131,307	2.3%	165,207	1.9%	198,613	2.0%	65.4%
Charlotte Regional Population	1,993,662	0.3%	2,026,471	2.0%	2,473,882	1.6%	2,912,200	1.5%	46.1%
Percent of Charlotte Region	6.0%		6.5%		6.7%		6.8%		

Study Area Sector	Population Change 2005-2010	2010-2020	2020-2030	2010-2030
1	653	1,498	1,267	3,418
2	667	1,844	2,129	4,640
3	662	1,610	1,617	3,889
4	403	1,270	1,442	3,115
5	1,805	4,475	5,286	11,566
6	363	1,395	1,747	3,505
7	108	256	261	625
8	149	1,021	806	1,976
9	657	1,138	539	2,334
10	416	1,226	1,350	2,992
11	303	1,095	1,582	2,980
12	492	2,354	1,673	4,519
13	109	2,330	1,721	4,160
14	136	1,021	1,147	2,304
15	782	1,944	1,337	4,063
16	343	1,808	1,447	3,598
17	2,182	4,461	4,180	10,823
18	837	2,591	3,209	6,637
19	186	563	666	1,415
Total Study Area Population Change	11,253	33,900	33,406	78,559
Triangle Regional Population Change	32,809	447,411	438,318	918,538

Source: Kenan Institute of Private Enterprise, Summarized by Traffic Analysis Zone



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STUDY AREA POPULATION GROWTH, 2005-2030

FIGURE 5-4

Table 5-4
Study Area Employment Projections
Proposed Monroe Connector/Bypass

Study Area Sector	2005	Average Annual Growth	2010	Average Annual Growth	2020	Average Annual Growth	2030	Average Annual Growth 2005-2030	Total Growth 2005-2030
1	1,447	5.3%	1,873	5.8%	3,304	4.2%	4,973	5.1%	243.7%
2	1,163	3.3%	1,367	3.8%	1,989	2.9%	2,657	3.4%	128.5%
3	280	7.1%	394	4.8%	630	3.3%	870	4.6%	210.7%
4	508	5.7%	670	3.9%	986	2.9%	1,315	3.9%	158.9%
5	238	14.0%	459	9.6%	1,143	5.4%	1,927	8.7%	709.7%
6	588	5.7%	776	7.1%	1,546	5.1%	2,536	6.0%	331.3%
7	496	3.0%	575	5.0%	934	4.0%	1,381	4.2%	178.4%
8	2,819	2.2%	3,148	3.5%	4,437	2.7%	5,807	2.9%	106.0%
9	1,430	3.1%	1,662	3.9%	2,432	2.8%	3,210	3.3%	124.5%
10	7,860	2.1%	8,731	3.3%	12,088	2.5%	15,465	2.7%	96.8%
11	1,010	3.4%	1,192	4.3%	1,812	3.1%	2,451	3.6%	142.7%
12	9,494	-0.8%	9,119	1.2%	10,315	1.3%	11,717	0.8%	23.4%
13	5,040	2.6%	5,744	3.9%	8,441	3.0%	11,341	3.3%	125.0%
14	1,525	2.8%	1,749	3.9%	2,563	2.9%	3,424	3.3%	124.5%
15	3,094	3.3%	3,640	4.1%	5,424	3.0%	7,268	3.5%	134.9%
16	6,833	1.8%	7,460	3.1%	10,115	2.5%	12,891	2.6%	88.7%
17	5,009	2.2%	5,574	3.5%	7,863	2.7%	10,308	2.9%	105.8%
18	1,114	4.2%	1,369	5.1%	2,245	3.6%	3,198	4.3%	187.1%
19	1,358	2.6%	1,544	5.4%	2,614	4.2%	3,951	4.4%	190.9%
Total Study Area Employment	51,306	2.1%	57,046	3.6%	80,881	2.8%	106,690	3.0%	107.9%
Charlotte Regional Employment	1,005,946	0.8%	1,044,592	2.4%	1,326,019	1.9%	1,594,963	1.9%	58.6%
Percent of Charlotte Region	5.1%		5.5%		6.1%		6.7%		

Study Area Sector	Employment Change 2005-2010	2010-2020	2020-2030	2010-2030
1	426	1,431	1,669	3,526
2	204	622	668	1,494
3	114	236	240	590
4	162	316	329	807
5	221	684	784	1,689
6	188	770	990	1,948
7	79	359	447	885
8	329	1,289	1,370	2,988
9	232	770	778	1,780
10	871	3,357	3,377	7,605
11	182	620	639	1,441
12	-375	1,196	1,402	2,223
13	704	2,697	2,900	6,301
14	224	814	861	1,899
15	546	1,784	1,844	4,174
16	627	2,655	2,776	6,058
17	565	2,289	2,445	5,299
18	255	876	953	2,084
19	186	1,070	1,337	2,593
Total Study Area Employment Change	5,740	23,835	25,809	55,384
Charlotte Regional Employment Change	38,646	281,427	268,944	589,017

Source: Kenan Institute of Private Enterprise, Summarized by Traffic Analysis Zone

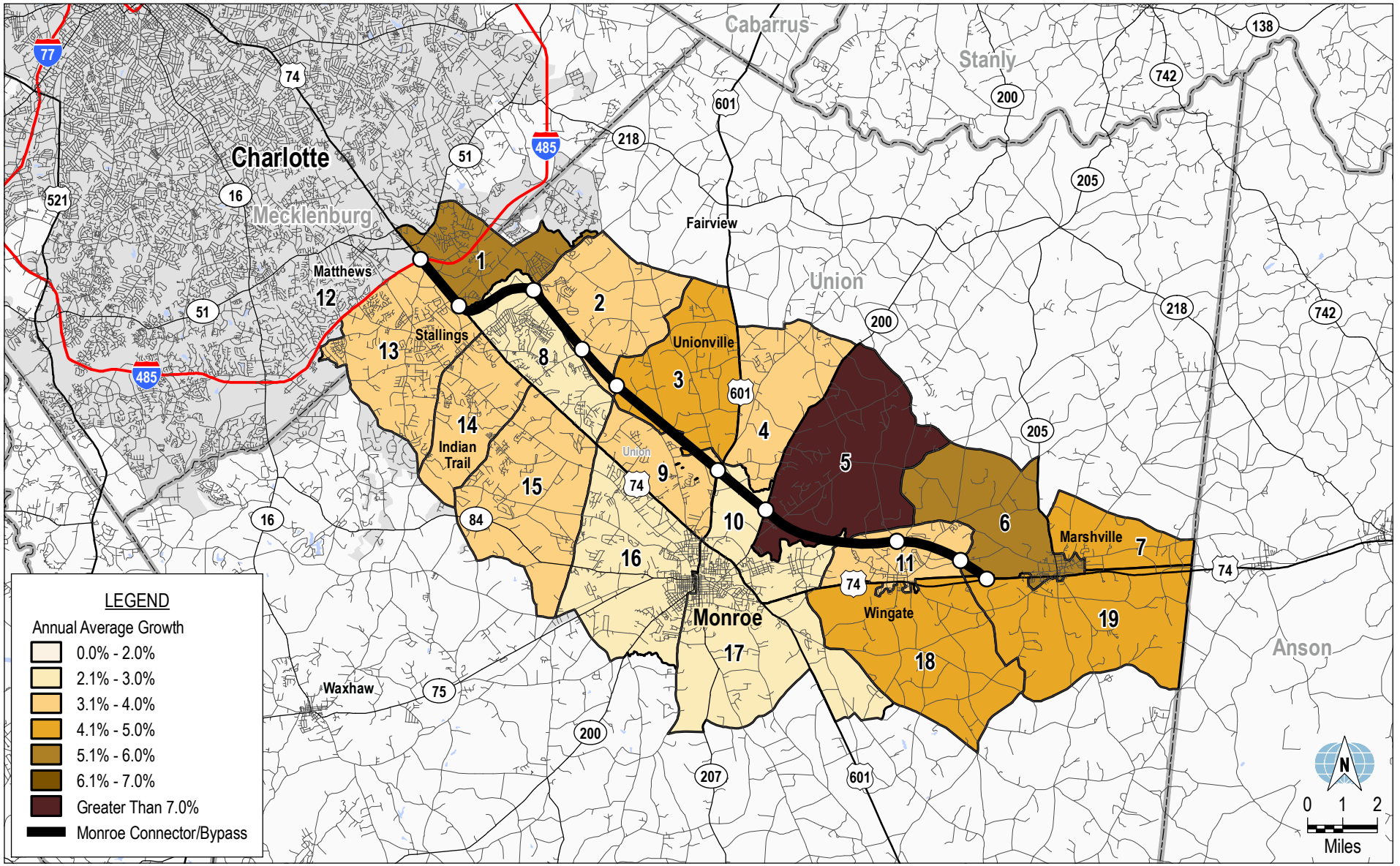
Figure 5-5 illustrates the projected employment growth between 2005 and 2030 for each superzone within the study area. While the entire area is expected to experience significant employment growth, the area north of the project and the southeastern portion of Monroe are expected to experience the greatest growth. For the most part, these zones are forecast to have annual growth of more than 4.0 percent.

NUMBER OF HOUSEHOLDS

The growth in the number of households within the study area closely mimics the expected population growth. Table 5-5 summarizes the households contained in the Kenan forecasts. In 2005, the number of households in the study area was estimated at approximately 43,000, or 5.4 percent of the total region's households. By 2030 the number of households within the study area is forecast to increase to nearly 70,000, which would be 6.2 percent of the region's households. The study area's forecasted annual household growth rate of 2.0 percent is significantly higher than the 1.4 percent annual growth rate anticipated for the region. Again, the highest growth rates are forecast in the superzones north of the Monroe Connector/Bypass and to the southeast of the City of Monroe.

HOUSEHOLD INCOME

Mean household incomes, by superzone, were calculated using a weighted average of the Kenan forecasts. These weighted average incomes are summarized in Table 5-6. All values shown are in 2000 dollars. In 2005, the median household income in the region was estimated at $59,649. The Monroe Connector/Bypass study area had a mean income nearly 7.4 percent greater than the region, at $64,065. Over the forecast period, regional incomes were forecast to gain on the study area incomes. As shown, by 2030, study area incomes are forecast to be only 2.6 percent higher than regional mean household incomes.



NORTH CAROLINA Turnpike Authority

STUDY AREA EMPLOYMENT GROWTH, 2005-2030

FIGURE 5-5

Table 5-5
Study Area Households Projections
Proposed Monroe Connector/Bypass

Study Area Sector	2005	Average Annual Growth	2010	Average Annual Growth	2020	Average Annual Growth	2030	Average Annual Growth 2005-2030	Total Growth 2005-2030
1	2,922	1.1%	3,082	1.5%	3,576	1.3%	4,060	1.3%	38.9%
2	1,274	3.4%	1,505	3.5%	2,133	3.0%	2,873	3.3%	125.5%
3	751	5.7%	992	4.7%	1,571	3.1%	2,137	4.3%	184.6%
4	842	3.3%	991	3.9%	1,451	3.0%	1,957	3.4%	132.4%
5	1,074	10.1%	1,734	7.0%	3,403	4.6%	5,332	6.6%	396.5%
6	806	3.1%	940	4.4%	1,449	3.7%	2,082	3.9%	158.3%
7	253	2.8%	291	2.8%	384	2.3%	480	2.6%	89.7%
8	3,830	0.1%	3,857	0.8%	4,191	0.7%	4,473	0.6%	16.8%
9	1,579	2.9%	1,822	2.0%	2,219	0.8%	2,404	1.7%	52.2%
10	1,083	3.0%	1,253	3.0%	1,691	2.4%	2,153	2.8%	98.8%
11	1,210	1.3%	1,292	2.6%	1,662	2.7%	2,173	2.4%	79.6%
12	5,378	-0.3%	5,294	1.1%	5,926	0.9%	6,501	0.8%	20.9%
13	5,818	-0.1%	5,793	1.2%	6,519	1.0%	7,169	0.8%	23.2%
14	2,857	0.3%	2,894	1.2%	3,249	1.2%	3,643	1.0%	27.5%
15	3,056	1.9%	3,361	1.8%	4,016	1.1%	4,485	1.5%	46.8%
16	5,287	0.4%	5,407	1.1%	6,024	0.8%	6,533	0.9%	23.6%
17	3,165	4.5%	3,941	3.5%	5,554	2.4%	7,013	3.2%	121.6%
18	881	6.5%	1,209	5.9%	2,151	4.5%	3,325	5.5%	277.4%
19	529	2.4%	596	3.1%	805	2.7%	1,050	2.8%	98.5%
Total Study Area Number of Households	42,595	1.7%	46,254	2.3%	57,974	1.9%	69,843	2.0%	64.0%
Charlotte Region Number of Households	786,871	0.1%	791,304	1.9%	954,935	1.6%	1,124,600	1.4%	42.9%
Percent of Charlotte Region	5.4%		5.8%		6.1%		6.2%		

Study Area Sector	Number of Households Change 2005-2010	2010-2020	2020-2030	2010-2030
1	160	494	484	1,138
2	231	628	740	1,599
3	241	579	566	1,386
4	149	460	506	1,115
5	660	1,669	1,929	4,258
6	134	509	633	1,276
7	38	93	96	227
8	27	334	282	643
9	243	397	185	825
10	170	438	462	1,070
11	82	370	511	963
12	-84	632	575	1,123
13	-25	726	650	1,351
14	37	355	394	786
15	305	655	469	1,429
16	120	617	509	1,246
17	776	1,613	1,459	3,848
18	328	942	1,174	2,444
19	67	209	245	521
Total Study Area Households Change	3,659	11,720	11,869	27,248
Charlotte Regional Households Change	4,433	163,631	169,665	337,729

Source: Kenan Institute of Private Enterprise, Summarized by Traffic Analysis Zone

Table 5-6
Study Area Median Household Income
Proposed Monroe Connector/Bypass
2000 Dollars

Study Area Sector	2005	2010	2020	2030
1	$63,398	$60,622	$58,324	$58,923
2	83,814	83,642	83,521	83,176
3	61,785	60,596	59,622	59,297
4	62,472	62,251	62,007	62,026
5	62,521	60,737	59,904	59,696
6	49,768	52,815	45,612	45,884
7	42,614	42,744	42,883	42,964
8	61,177	61,687	61,904	62,054
9	60,316	66,718	66,666	66,619
10	47,409	50,394	53,724	55,806
11	51,098	50,801	50,124	49,813
12	89,455	89,584	86,600	85,172
13	72,993	69,044	69,770	70,118
14	59,491	62,454	62,193	61,854
15	62,803	61,061	60,306	60,022
16	52,070	51,915	52,049	52,271
17	53,421	52,937	52,011	52,471
18	44,148	45,205	46,411	46,744
19	49,438	48,874	47,849	47,179
Total Study Area Average Income	$64,065	$63,205	$61,947	$61,455
Charlotte Region Average Income	$59,649	$60,002	$60,016	$59,908
Percent of Charlotte Region	107.4%	105.3%	103.2%	102.6%

Source: Kenan Institute of Private Enterprise, Summarized by Traffic Analysis Zone

CHAPTER 6

TRAFFIC AND REVENUE ANALYSIS

Chapter 6 presents a summary of the traffic and revenue analysis conducted for the proposed Monroe Connector/Bypass. In addition to an overview of the travel demand modeling process, this chapter also presents information on the regional highway improvement program, basic assumptions upon which the traffic and revenue forecasts are based, a toll rate sensitivity analysis, and the traffic and revenue forecasts for the proposed toll road.

Traffic and revenue forecasts included in this chapter reflect recent updates intended to recognize the impact of the current local and national economic downturn. Forecasts were originally developed during 2009, using the methodology described below. Updated estimates, prepared in March 2010, were based on a review of potential changes in corridor employment, congestion levels, and perceived values of time that had occurred since the original field work was completed in mid-2009. This review was performed to address the continuing recession and to assess any changes that might have occurred since the completion of the original field work.

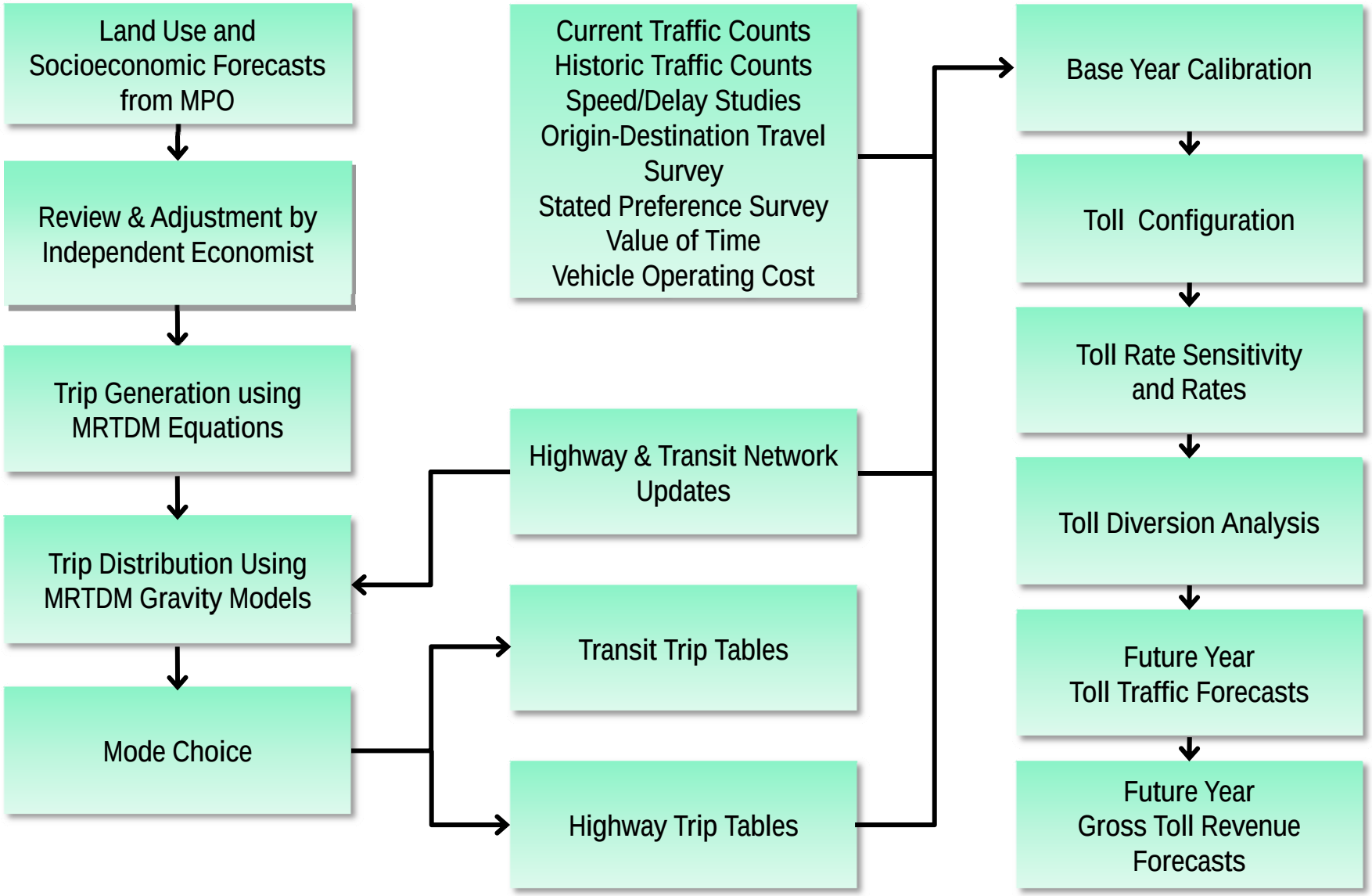
ANALYTICAL METHODOLOGY

This section describes the general procedures followed to prepare the forecasts of annual toll traffic and gross toll revenue. Figure 6-1 depicts the process schematically.

METROLINA REGIONAL TRANSPORTATION DEMAND MODEL

The two Metropolitan Planning Organizations[(1)] (MPOs) in the region maintain a regional travel demand model, referred to as the Metrolina Regional Transportation Demand Model (MRTDM) that was used for this traffic and revenue analysis. The model current at the time of the analysis (late 2009) was updated using the MPO's fiscally constrained future road

[(1)] Mecklenburg-Union Metropolitan Planning Organization (MUMPO)
Gaston Urban Area Metropolitan Planning Organization (GUAMPO)



NORTH CAROLINA Turnpike Authority

TOLL TRAVEL DEMAND MODELING PROCESS

FIGURE 6-1

project list in November 2009 along with other adjustments described below.

The following steps were used in the modeling process:

Model Network Updates – Future Roadway and Transit Improvements

The model current at the time of the analysis (late 2009) was updated using the MPO's fiscally constrained future road project list prepared in November 2009. Highways and transit routes included in the model network were compared with proposed roadway and transit improvements in the November 2009 project list that was later adopted in the MUMPO 2035 Long Range Transportation Plan. Special attention was paid to proposed roadway improvements in the Monroe Connector/Bypass study area. Detailed coding was added to represent the locations of proposed interchanges and tolling zones.

Land Use and Socioeconomic Data Used for the Trip Generation Process

Land use and socioeconomic data prepared by the MPOs in 2009 was reviewed by the independent economist. Adjustments to the socioeconomic data in the MRTDM were made by the economist for use in the trip generation process for this comprehensive study.

Transportation Analysis Zones

Extensive checking was performed to ensure that the socioeconomic data prepared by the independent economist was allocated properly to the Transportation Analysis Zone (TAZ) structure used in the current MRTDM. In addition, some of the TAZs were disaggregated into smaller TAZs to allow for a better representation of the roadway system within the study area. Trip tables were disaggregated accordingly to fit this revised TAZ structure.

Trip Generation, Distribution, and Mode Choice

Three standard steps – trip generation, distribution and mode choice – were performed in the modeling process because the input socioeconomic data was revised by the independent economist.

Model Calibration

The model was calibrated in the vicinity of the proposed Monroe Connector/Bypass by comparing model results with traffic volumes and travel speeds observed in the study area. Screenline analyses in the study area resulted in adjustments to travel speeds and trip tables for some movements in order to calibrate the model in the Monroe Connector/Bypass corridor.

VEHICLE OPERATING COST

Updates were made to the assumed operating costs of passenger vehicles and trucks using available data from AAA and other sources. Vehicle operating costs reflected an average gasoline price of approximately $3.00 per gallon (2010 dollars) inflated by 2.5 percent annually for future-year costs. Finally the vehicle operating cost per mile on the toll road was reduced by 15 percent in comparison to the cost on competing roads. This reduction reflects the relative fuel efficiency of a steady-speed facility in comparison to the stop-and-go traffic on competing congested arterial facilities.

VALUE OF TIME

Estimates of the value of time were calculated using updated median income information at the TAZ level and results of the stated preference survey described earlier. Values of time differed by trip purpose and TAZ. The overall average value of time for passenger cars was $0.182 per minute in the opening year (2015).

TRAFFIC DIVERSION ANALYSIS

Following calibration of the model, a series of traffic assignments were generated for 2015, 2020, 2025, 2030, and 2035 under no build, toll free, and tolled conditions. Several toll rates were tested for 2015 and 2030 in order to estimate the optimum toll rates.

The toll diversion analysis was conducted using trips tables disaggregated by time period, trip purpose, vehicle type, and toll payment class. This process involved comparing travel time and distance for a trip path on the Monroe Connector/Bypass with a path on the best toll-free alternative routes. The estimated traffic that would be expected to use the toll road is a function of travel time and distance savings, the assumed monetary value of these savings, and the toll rate being tested in any given assignment. In general, as the total costs to use the proposed toll road increase, estimated usage of the toll road decreases.

The model also recognizes capacity constraints on roadways. Speeds for future-year forecasts are calculated based on volume to capacity ratios and reflect increasing congestion over time on both the proposed toll facility and existing toll free roads.

FISCAL YEAR CONVERSION

The forecasts for this study were initially on a calendar-year basis because the MRTDM parameters were also on a calendar-year basis. These forecasts were later converted to a fiscal-year basis to conform to the NCTA's

fiscal year which begins on July 1. The details of the conversion process are presented later in this chapter.

REVENUE LEAKAGE

The main models are used to prepare estimates of gross toll revenue. However, some revenue will not be collected for various reasons. The final step of the process is to estimate the amount of uncollected revenue and revenue collected from administrative fees and civil penalties.

BASIC ASSUMPTIONS

The traffic and revenue estimates for the Monroe Connector/Bypass are predicated on the following basic assumptions, which are considered reasonable for purposes of the base case forecast:

1. The Monroe Connector/Bypass (US 74 near Wingate to I-485 near Matthews) will open to traffic by January 1, 2015;

2. In addition a 1.29-mile section of US 74 from the junction of the Connector/Bypass to I-485 near Matthews will be upgraded and tolled. Drivers on US 74 will have the option of paying a toll or using non-tolled alternative routes via parallel service roads;

3. Tolls would be charged for three vehicle classes and two payment types and will be increased annually. The toll rates and tolling zone locations will be as shown later in this chapter;

4. No new toll-free facilities or additional capacity will be constructed during the projection period, other than those in the current Transportation Improvement Plan;

5. The system will operate in a cashless environment whereby both electronic toll collection and video tolling will be used. However, provisions will be made for drivers to pay with cash at off-site locations;

6. The percentage of ETC and video customers will be as described later in this chapter;

7. Revenue leakage due to unreadable or uncollectible ETC or video transactions, or any transactions that cannot be processed and payment collected will occur. The leakage estimates contained in this report are dependent upon the selection of appropriate toll collection technology and the adoption of business rules and enforcement procedures designed to minimize the loss of revenue;

8. Economic growth in the project study area and associated travel demand would occur as forecast by the independent economist;

9. Inflation will average 2.5 percent per year over the forecast period;

10. The Monroe Connector/Bypass will be well maintained, efficiently operated, effectively signed, and promoted to encourage maximum usage and to reach the assumed percentage goals for ETC and VTC usage;

11. Motor fuel will remain in adequate supply throughout the forecast period. Fuel prices are assumed to be approximately $3.00 per gallon in 2010 dollars, and remain at that level, in real terms after adjustment for inflation, throughout the forecast period; and

12. No national or regional emergency will arise that would abnormally restrict the use of motor vehicles.

Any significant departure from these basic assumptions could materially affect traffic and revenue potential on the proposed Monroe Connector/Bypass.

FUTURE TRANSPORTATION IMPROVEMENTS

ROADWAYS

People's travel behavior and the number of vehicles that would use the proposed Monroe Connector/Bypass would be heavily influenced by the operating conditions on other area roadways in the study area. The process of transportation project development and funding makes it impossible to know with certainty which proposed transportation improvements will be implemented and when. However, it is important that reasonable assumptions are made regarding future improvements, since such improvements could have a considerable effect on the number of vehicles that would use the Monroe Connector/Bypass.

The MRTDM contains all future highway improvements listed in the two MPOs' fiscally constrained 2035 transportation improvement programs in effect at the time of the analysis. A list of the planned road improvements that could affect traffic volumes on the Monroe Connector/Bypass is provided in Table 6-1. The improvements that would have the most significant impact on the operation of the toll road and the year that they are programmed in the MRTDM include:

Table 6-1
Major Highway Improvements Contained in
Metrolina Regional Travel Demand Model

Name and Location	Project Description	Model Year
Fred D. Alexander Boulevard	NC 16 to NC 27(Freedom Drive), New Road (4), Median	2015
Ikea Development-Phase 2	City Blvd, North Tryon, McCullough, New Roads	2015
McKee Road	Pleasant Plains Road to John Street (U-4713A), New Road(2), Bike Lanes	2015
NC 51 (U-3447)	South Carolina State Line to Downs Circle, Widening (4), Median	2015
US 29 - I-85 Connector Intersection	At-grade Intersection-US 29 and I-85 Connection, Intersection	2015
Martin Luther King Jr Drive	Goldmine Road to NC 200 (U3412A), 2-lanes	2015
Beatties Ford Road	Capps Hill Mine Road to Sunset Road, Widening (4), Median	2015
Idlewild Road	Piney Grove Road to Drifter Road, Widening (4), Median, Bike Lanes	2015
City Boulevard Extension	Neal Road to Mallard Creek Road Extension, New Road (4), Median	2015
NC 73 (Sam Fur Road)	US 21 to NC 115, Widening (4), Median	2015
Northcross Drive (U-5108)	Bailey Road Extension to Westmoreland Road, New Road (3)	2015
Rea Road	Colony Road to NC 51 (Pineville Matthews Road), Widening (4), Median	2015
Statesville Road	Sarita Road to Keith Drive, Widening (4), Median, Bike Lanes	2015
Westmoreland Road	US 21 to Washam-Potts, Widening (4), Median	2015
Westmoreland Road	West Catawba to US 21, Widening (4), Median+B41	2015
South Trade Street	Fullwood to Pleasant Plains, Widening (4), Median, Bike Lanes	2015
Charles Street	Franklin Street to Sunset Drive, Widening (3)	2015
Stallings Road (SR 1326)	Union County US 74 to SR 1009 (Old Charlotte Highway), Widening (4)	2015
I-277 (Belk Freeway) Westbound	At I-77 (U-3850), 3rd Westbound Lane	2015
I-485 / Weddington Road	I-485 to McKee Road, Interchange and Widening (4)	2015
US 74 Expressway (U-209B)	Sharon Amity Road to Conference Drive, Freeway(6+), Interchanges, Busway	2015
McKee Road Extension	John Street to Campus Ridge Road (U-4713B), New Road (4), Median, Bike Lanes	2015
Monroe Parkway	I-485 to US 74 (Wingate), New Tollroad	2015

(continued)

Table 6-1 (cont'd.)
Major Highway Improvements Contained in
Metrolina Regional Travel Demand Model

Name and Location	Project Description	Model Year
Alexanderana Road	NC 115 to Eastfield (R-2248E), New Road / Widen (4), Median, Bike Lane	2020
US 74 Expressway	Conference Drive to Krefeld, Freeway (6+ HOV or BW)	2020
I-485 South	I-77 to Johnston Road (R-4902), Widening (6)	2020
I-485	NC 115 to I-85 (R-2248E), New Freeway (8)	2020
Community House Road Extension	Endhaven Lane to South of I-485, New Road (4), Median, Bike Lanes	2020
Clanton Road Extension	West Boulevard to Wilkinson Boulevard, New Road (2), Median, Bike Lanes	2025
Gilead Road	US 21 to NC 115, Widening (4), Bike Lanes	2025
NC 115 (Old Statesville Road)	Potts Street to County Line, Widening (4), Median, Bike Lanes	2025
NC 115 (Old Statesville Road)	Bailey Road to Potts Street, Widening (2)	2025
Northeast Parkway Extension	New NC 51 to Old NC 51, New Road (2), Bike Lanes	2025
John Street / Old Monroe Road	I-485 to Indian Trail Road, Widening (4), Median	2025
Airport Road	Goldmine Road to NC 84, Widening (4), Median, Bike Lanes	2025
I-485	NC 16 (Providence Road) to US 74, Widening (6)	2025
I-485	Johnston Road to NC 16 (Providence Road), Widening (6) Freeway	2025
NC 51 (Matthews-Mint Hill Road)	Matthews Township Parkway to Lawyers Road, Widening (4), Median	2030
Arequipa Drive / Northeast Parkway	Margaret Wallace Road to Sam Newell Road, New Road (2), Median, Bike Lanes	2030
Hucks Road Extension	Old Statesville Road (NC 115) to Statesville Road (US 21), New Road (4), Median, Bike Lanes	2030
I-485	I-77 to Johnston Road, Widening (8), Johnston Road Flyover	2030
US 74 Expressway	Krefeld to Hayden Way, Freeway (6+ HOV or BW)	2020
Eastern Circumferential	NC 49 to Rocky River Road, New Road (4), Median, Bike Lanes	2035
US 21	Harris Boulevard to Gilead Road, Widening (4), Median, Bike Lanes	2035
I-485	US 74 to Albermarle Road, Widening (6)	2035
US 74 Expressway	Hayden Way to NC 51, Freeway (6+ HOV or BW)	2035

Source: 2035 Long Range Transportation Plan Update, April 2010

- **Model Year 2015**
  - Improvements to US 74 inside the Charlotte Outer Loop (I-485);
- **Model Year 2020**
  - Improvements to US 74 inside the Charlotte Outer Loop (I-485);
  - I-485 widening;
- **Model Year 2025**
  - Improvements to US 74 inside the Charlotte Outer Loop (I-485);
  - I-485 widening;
- **Model Year 2030**
  - Improvements to US 74 inside the Charlotte Outer Loop (I-485);
  - I-485 widening;
- **Model Year 2035**
  - Improvements to US 74 inside the Charlotte Outer Loop (I-485);
  - I-485 widening; and
  - Eastern Circumferential from NC 49 to Rocky River Road.

None of these highway improvements would compete directly with the proposed Monroe Connector/Bypass; rather some would complement the proposed toll road by providing better access to the toll road interchanges.

PUBLIC TRANSPORTATION

Transit service is currently limited within the corridor providers, and no major changes are expected that could affect the proposed toll road.

TOLL STRUCTURE

The recommended toll structure was established for three vehicle classes. This study evaluated six combinations of vehicle class and toll rate in order to estimate the anticipated traffic and revenue for the Monroe Connector/Bypass.

VEHICLE CLASSES[2]

Three vehicle classes are recommended in order to simplify the toll structure for the public. The three vehicle classes are as follows:

[2] Following the selection of a toll technology and system integrator during the conduct of this study, the NCTA decided to change the vehicle classification system. The classification system assumed in the study included three classes: light vehicles, single-unit trucks, and multi-unit trucks. Following a review of the two different classification systems, it was estimated that the effects of the change on system traffic and revenue would be minimal.

- **Class 1, Two-axle Vehicles** – Included in this class are any two axle vehicle regardless of the number of tires;

- **Class 2, Three-axle Vehicles** – Included in this class are vehicles with three axles including two-axle vehicles towing a single-axle trailer. Class 2 toll rates are two times the Class 1 rates; and

- **Class 3, Four or More-axle Vehicles** – Included in this class are vehicles with four or more axles, including two-axle vehicles towing a two-axle trailer. Class 3 toll rates are four times the Class 1 rates.

COLLECTION METHODS

Toll rates for the Monroe Connector/Bypass would be established for two collection methods – electronic toll collection (ETC) and video toll collection (VTC). Collectively, these two methods are also referred to as All Electronic Tolling (AET):

Electronic Toll Collection (ETC) – This toll rate is based on the use of an electronic transponder or tag, which identifies the vehicle as it passes through each tolling zone and debits the user's account accordingly. ETC is the preferred methodology for toll collection on the project. ETC is considered highly reliable and is the most convenient and economical method for collecting tolls. It is expected that ETC will be strongly promoted by the North Carolina Turnpike Authority. The ETC toll rate will be the base rate upon which other rates are set.

Video Toll Collection (VTC) **–** This toll rate is based on the use of digital video technology to capture an image of the license plate as the vehicle passes through each tolling zone. The video toll rate will be 54 percent higher than the ETC rate because of the additional costs associated with video toll collection.

Toll road users that do not register for an ETC account will be identified through license plate video imaging and vehicle registration information provided by the Department of Motor Vehicles or similar agencies in other states. These non-registered users will be considered potential customers and provided an opportunity to pay before they are assessed any fees or penalties. The Authority will not collect cash payments for tolls on the Monroe Connector/Bypass. However, cash payments will be accepted at a designated location in the vicinity of the toll facility where drivers may also open an ETC account prior to using the facility.

TOLL COLLECTION PERCENTAGES BY COLLECTION METHOD

Table 6-2 shows the model input assumptions of ETC users and video toll users for each modeling year. These "input percentages" are shown sepa-

rately for Class 1 vehicles and Class 2 and 3 vehicles. The "input percentages" were used as a starting point in apportioning the total number of trips into theoretical market shares.

Table 6-2
Toll Collection Percentages of Total Transactions
Monroe Connector/Bypass

Model Input Assumptions

	Class 1 Vehicles			Class 2 and 3 Vehicles		
Year	ETC	VTC	Total	ETC	VTC	Total
2015	65.0%	35.0%	100.0%	85.0%	15.0%	100.0%
2020	75.0%	25.0%	100.0%	89.0%	11.0%	100.0%
2025	81.0%	19.0%	100.0%	89.0%	11.0%	100.0%
2030	84.0%	16.0%	100.0%	89.0%	11.0%	100.0%
2035	84.0%	16.0%	100.0%	89.0%	11.0%	100.0%

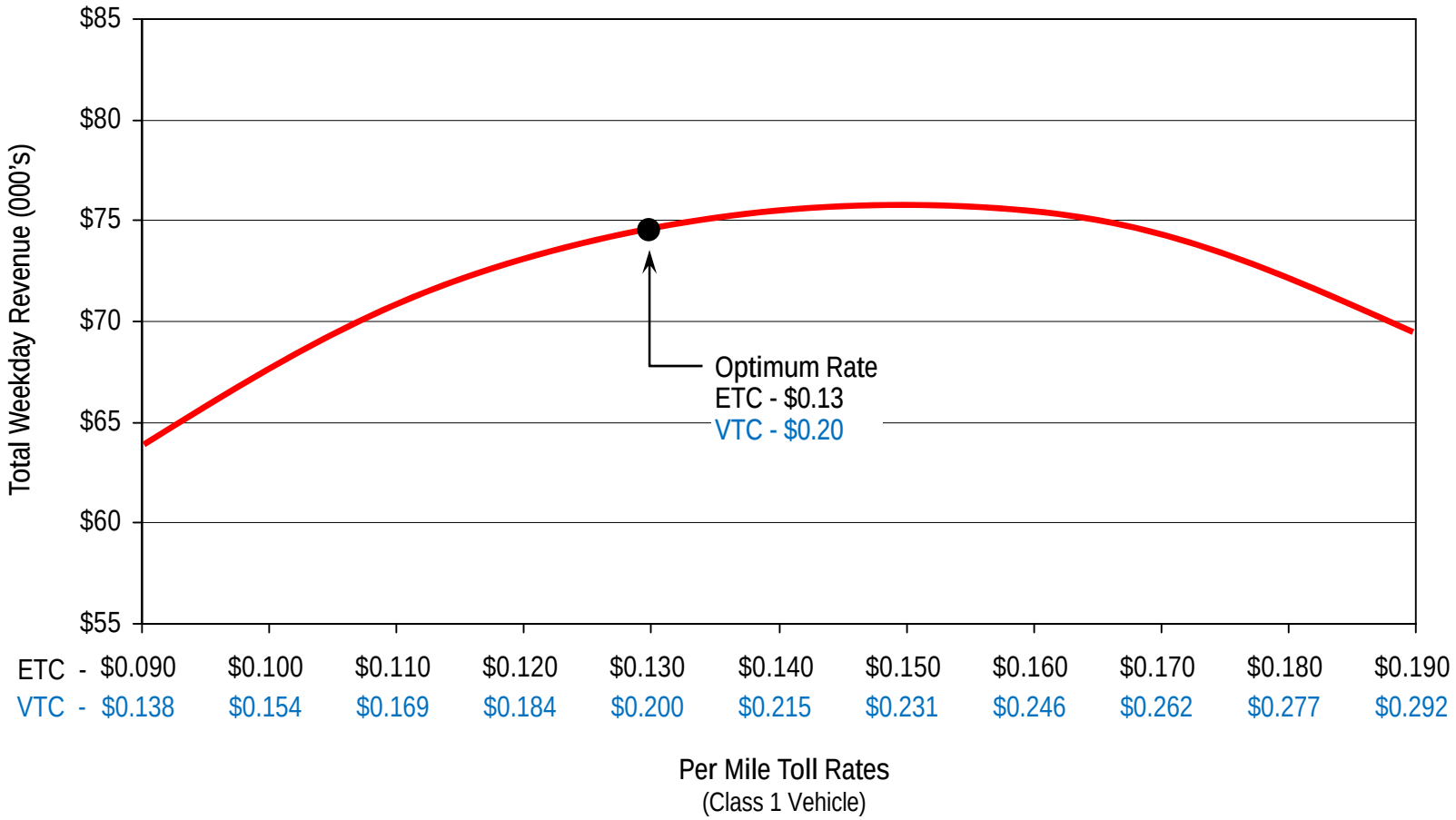
Diversion Model Results

	Class 1 Vehicles			Class 2 and 3 Vehicles		
Year	ETC	VTC	Total	ETC	VTC	Total
2015	74.1%	25.9%	100.0%	88.5%	11.5%	100.0%
2020	78.2%	21.8%	100.0%	91.3%	8.7%	100.0%
2025	83.7%	16.3%	100.0%	91.8%	8.2%	100.0%
2030	86.6%	13.4%	100.0%	91.9%	8.1%	100.0%
2035	86.7%	13.3%	100.0%	91.9%	8.1%	100.0%

The lower section of Table 6-2 for each class of vehicle shows the "output percentages" of VTC users following the toll diversion analysis. Since VTC users would be subjected to higher toll rates than ETC users, the "output percentages" for video users decreased; hence, the output proportion of video users is lower than the input assumptions. Conversely, the proportion of actual users on the Monroe Connector/Bypass with ETC is expected to be higher than the nominal input assumptions.

TOLL RATE SENSITIVITY

Figure 6-2 shows the 2015 Class 1 vehicle toll sensitivity curve for ETC and VTC assuming the entire toll road was in operation. This year was used to determine the optimum base case toll rate, which is the electronic toll rate for Class 1 vehicles.



NORTH CAROLINA Turnpike Authority

ESTIMATED 2015 LEVEL SYSTEM TOLL SENSITIVITY CURVE

FIGURE 6-2

As shown in the figure, the ETC base-case video toll rate for a Class 1 vehicle traveling the full length of the toll road would be approximately $0.13 per mile. The VTC rate (54 percent premium) for the same trip for a Class 1 vehicle would be $0.20 per mile. Tolls for ETC-equipped vehicles would be deducted from the owner's account as the vehicle passes through each toll collection zone. Tolls collected in each zone would be based on the maximum length of travel.

The base toll rate is set slightly below the rate which would maximize toll revenue in order to provide a limited "margin of safety" for setting future rates. Rates were assumed to increase annually as discussed later in this chapter. Table 6-3 compares the ETC toll rate for the Monroe Connector/Bypass in 2015 with toll rates for ETC at other comparable toll road facilities. At $0.13 per mile, the Monroe Connector/Bypass ETC rate for Class 1 vehicles would be slightly below the average ETC rates for comparable urban toll roads, which is $0.15 per mile.

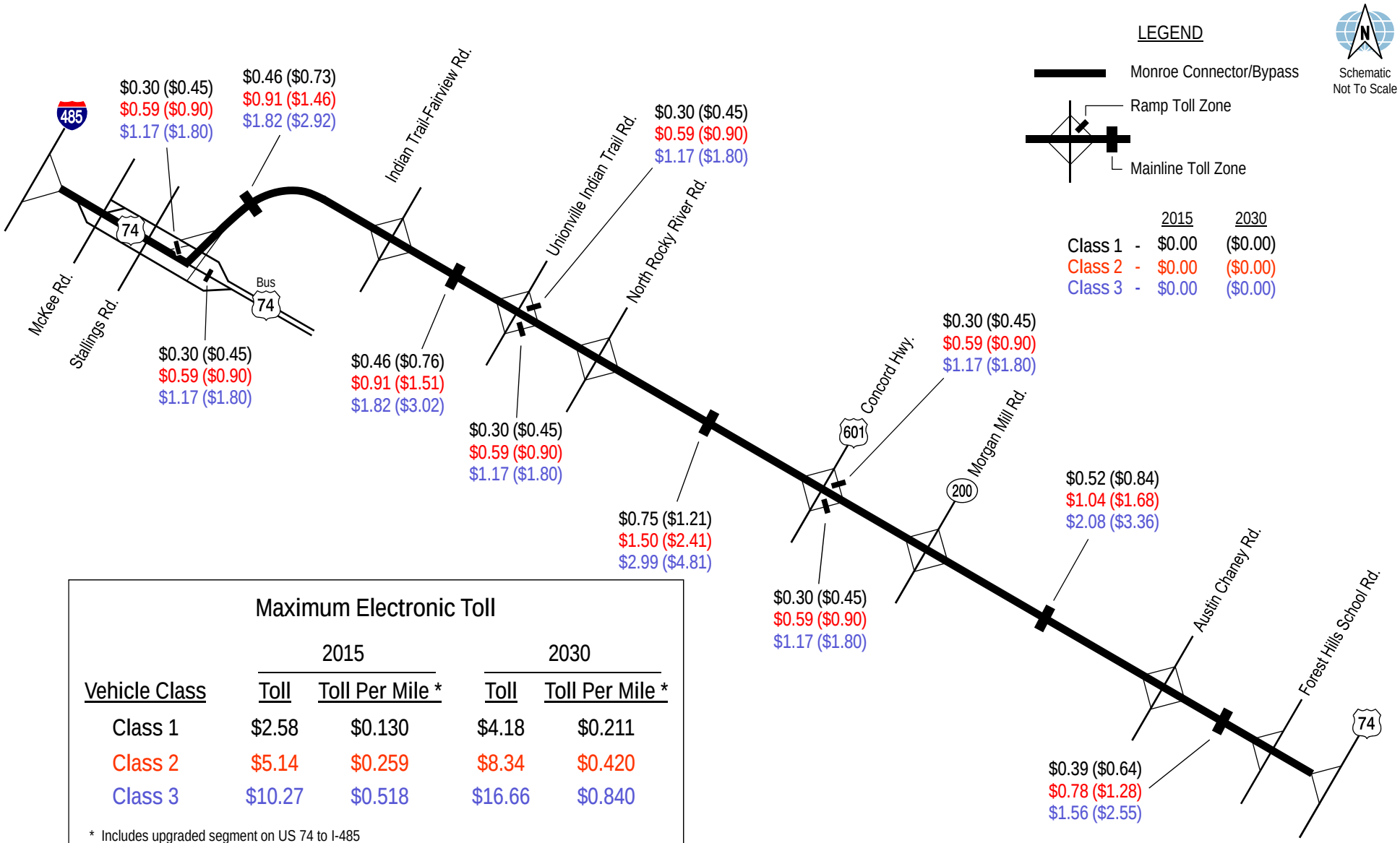
Also shown in the table is the proposed rate for the Triangle Expressway, which is under construction. The Triangle Expressway rate is slightly higher than the rate for the Monroe Connector/Bypass at $0.153 per mile in 2013 dollars. The higher rate for the Triangle Expressway is due to higher income levels and values of time in the Triangle Expressway corridor compared to the Monroe Connector/Bypass corridor.

RECOMMENDED TOLL RATES BY LOCATION

Table 6-4 shows annual electronic toll and video toll rates for Class 1 vehicles for each tolling zone in the opening year and extending through 2035. Since the Monroe Connector/Bypass will operate as a cashless toll collection system, tolls can be increased relatively easily. In the preliminary study, tolls were assumed to increase every five years beginning in 2015. However, in the current study, small annual increases in toll rates are assumed, rather than larger increases every five years.

A Class 2 vehicle would be charged a rate double the Class 1 vehicle rate; and a Class 3 vehicle would be charged four times the Class 1 vehicle rate. The VTC rates would be at a 54 percent premium over the ETC rates.

Figure 6-3 graphically displays the base ETC toll rates in 2015 and 2030 at each tolling zone location for Class 1, Class 2 and Class 3 vehicles. The opening-year ETC toll for a full-length trip through five tolling zones on the Monroe Connector/Bypass would be $2.58 for Class 1 vehicles, rising to $4.18 by 2030.



Maximum Electronic Toll

Vehicle Class	2015 Toll	2015 Toll Per Mile *	2030 Toll	2030 Toll Per Mile *
Class 1	$2.58	$0.130	$4.18	$0.211
Class 2	$5.14	$0.259	$8.34	$0.420
Class 3	$10.27	$0.518	$16.66	$0.840

* Includes upgraded segment on US 74 to I-485

NORTH CAROLINA Turnpike Authority

ETC TOLL RATE ASSUMPTIONS

FIGURE 6-3

Table 6-3

Comparison of Per-mile Electronic Toll Collection Rates
for Selected Urban Toll Roads
Passenger Vehicles
June, 2010

Agency and Facility Name	Length (Miles)		ETC Toll (1)	Cost/ Mile
Harris County Toll Road Authority (Houston, TX) - Fort Bend Parkway	7.6		$2.55	$0.336
Northwest Parkway, LLC (Denver, Co) - Northwest Parkway	9.5		$3.10	$0.326
Transportation Corridor Agencies (Orange County, CA) - San Joaquin Hills Tollway (SR 73)	15.0		$4.75	$0.317
Transportation Corridor Agencies (Orange County, CA) - Route 241	24.0		$5.75	$0.240
E-470 Public Highway Authority (Denver, CO) - E-470 Tollway	46.1		$11.00	$0.239
Transportation Corridor Agencies (Orange County, CA) - Route 261	6.6		$1.50	$0.227
Miami-Dade Expressway Authority - Gratigny Parkway (SR 924)	4.5		$1.00	$0.222
Harris County Toll Road Authority (Houston, TX) - Westpark Tollway	19.0		$3.80	$0.200
Orlando-Orange County Expressway Authority - John Land Apoka Expressway (SR 414)	5.5		$1.00	$0.182
Tampa-Hillsborough Expressway Authority - Lee Roy Selmon Crosstown Expressway	14.0		$2.50	$0.179
Central Texas Regional Mobility Authority (Austin, TX) - 183A Toll	11.6		$2.00	$0.172
Texas Tollways (Austin, TX) - Loop 1	4.0		$0.68	$0.170
North Carolina Turnpike Authority - Triangle Expressway (Under Construction)	17.8	(2)	$2.72	$0.153
Harris County Toll Road Authority (Houston, TX) - Sam Houston Tollway	64.3		$9.30	$0.145
North Texas Tollway Authority (Dallas, TX) - President George Bush Turnpike (PGBT)	30.5		$4.34	$0.142
Orlando-Orange County Expressway Authority - East-West Expressway (SR 408)	25.0		$3.50	$0.140
Miami-Dade Expressway Authority - Don Shula (South Dade) Expressway (SR 874)	7.2		$1.00	$0.139
North Texas Tollway Authority (Dallas, TX) - Dallas North Tollway (DNT)	32.0		$4.37	$0.137
Florida Turnpike Enterprise - Daniel Webster Western Beltway Part C (SR 429)	11.0		$1.50	$0.136
Texas Tollways (Austin, TX) - SH 45 Southeast	7.5		$1.00	$0.133
North Carolina Turnpike Authority - Monroe Connector/Bypass	**19.8**	**(3)**	**$2.58**	**$0.130**
Florida Turnpike Enterprise (Orlando, FL) - Beachline (SR 528)	8.0		$1.00	$0.125
Harris County Toll Road Authority (Houston, TX) - Hardy Toll Road	21.1		$2.60	$0.123
North Texas Tollway Authority (Dallas, TX) - Sam Rayburn Tollway (SR 121)	26.0		$3.08	$0.118
Miami-Dade Expressway Authority - East-West Expressway (Dolphin) (SR 836)	10.8		$1.25	$0.116
Orlando-Orange County Expressway Authority - Central Florida Greeneway (SR 417)	36.0		$4.00	$0.111
Texas Tollways (Austin, TX) - SH 130	49.0		$5.40	$0.110
Osceola County, FL - Osceola Parkway (SR 522)	15.9		$1.75	$0.110
Texas Tollways (Tyler, TX) - Loop 49	7.0		$0.75	$0.107
Orlando-Orange County Expressway Authority - Daniel Webster Western Beltway (SR 429)	23.6		$2.50	$0.106
Texas Tollways (Austin, TX) - SH 45	13.0		$1.36	$0.105
Orlando-Orange County Expressway Authority - Beachline Expressway (SR 528)	24.0		$2.50	$0.104
Florida Turnpike Enterprise (Orlando, FL) - Seminole Expressway (SR 417)	17.0		$1.50	$0.088
Florida Turnpike Enterprise (Tampa, FL) - Veterans Expressway (SR 589)	16.0		$1.25	$0.078
Florida Turnpike Enterprise (Broward County, FL) - Sawgrass Expressway (SR 869)	23.0		$1.50	$0.065
Average of Other Agencies (Excludes North Carolina Turnpike Authority)				$0.150

(1) Tolls for peak conditions.

(2) 2013 ETC rates
Maximum distance from NC 147 at I-40 to NC 55 Bypass at Holly Springs

(2) 2015 ETC rates
Maximum distance from US 74 to I-485

Source: Toll Agency Web Sites

Table 6-4
Recommended Annual Toll Rates by Tolling Zone
Class 1 - ETC and Video
Monroe Connector/Bypass

Year	Mainline Zone 1 US 74 - Austin Chaney Road		Mainline Zone 2 Austin Chaney Road - NC 200		US 601 Ramps		Mainline Zone 3 US 601 - Rocky River Road		Unionville - Indian Trail Road Ramps		Mainline Zone 4 Unionville-Indian Trail Road - Indian Trail Fairview Road		Mainline Zone 5 Indian Trail - Fairview Road - US 74		US 74 Ramps		Maximum Toll	
	ETC	VTC	ETC	VTC	ETC	VTC	ETC	VTC	ETC	VTC	ETC	VTC	ETC	VTC	ETC	VTC	ETC	VTC
2015	$0.39	$0.60	$0.52	$0.80	$0.30	$0.45	$0.75	$1.15	$0.30	$0.45	$0.46	$0.70	$0.46	$0.70	$0.30	$0.45	$2.58	$3.95
2016	$0.41	$0.62	$0.54	$0.82	$0.30	$0.46	$0.77	$1.18	$0.30	$0.46	$0.47	$0.72	$0.47	$0.72	$0.30	$0.46	$2.66	$4.06
2017	$0.42	$0.64	$0.55	$0.84	$0.31	$0.47	$0.79	$1.21	$0.31	$0.47	$0.49	$0.74	$0.49	$0.74	$0.31	$0.47	$2.74	$4.17
2018	$0.43	$0.66	$0.56	$0.86	$0.32	$0.48	$0.81	$1.24	$0.32	$0.48	$0.51	$0.77	$0.50	$0.76	$0.32	$0.48	$2.81	$4.29
2019	$0.45	$0.68	$0.58	$0.88	$0.32	$0.49	$0.83	$1.27	$0.32	$0.49	$0.52	$0.80	$0.51	$0.78	$0.32	$0.49	$2.89	$4.41
2020	$0.46	$0.70	$0.60	$0.92	$0.34	$0.52	$0.86	$1.32	$0.34	$0.52	$0.54	$0.83	$0.52	$0.80	$0.34	$0.52	$2.98	$4.57
2021	$0.48	$0.73	$0.63	$0.96	$0.36	$0.54	$0.90	$1.37	$0.36	$0.54	$0.56	$0.86	$0.54	$0.83	$0.36	$0.54	$3.11	$4.75
2022	$0.50	$0.76	$0.65	$1.00	$0.37	$0.56	$0.93	$1.42	$0.37	$0.56	$0.58	$0.89	$0.56	$0.86	$0.37	$0.56	$3.22	$4.93
2023	$0.52	$0.79	$0.68	$1.04	$0.38	$0.58	$0.96	$1.47	$0.38	$0.58	$0.60	$0.92	$0.58	$0.89	$0.38	$0.58	$3.34	$5.11
2024	$0.54	$0.82	$0.71	$1.08	$0.39	$0.60	$0.99	$1.52	$0.39	$0.60	$0.62	$0.95	$0.60	$0.92	$0.39	$0.60	$3.46	$5.29
2025	$0.55	$0.84	$0.73	$1.11	$0.39	$0.60	$1.03	$1.58	$0.39	$0.60	$0.65	$1.00	$0.63	$0.96	$0.39	$0.60	$3.59	$5.49
2026	$0.57	$0.87	$0.75	$1.14	$0.41	$0.62	$1.06	$1.63	$0.41	$0.62	$0.67	$1.03	$0.65	$0.99	$0.41	$0.62	$3.70	$5.66
2027	$0.59	$0.90	$0.77	$1.17	$0.42	$0.64	$1.10	$1.68	$0.42	$0.64	$0.69	$1.06	$0.67	$1.02	$0.42	$0.64	$3.82	$5.83
2028	$0.61	$0.93	$0.79	$1.21	$0.43	$0.66	$1.13	$1.73	$0.43	$0.66	$0.71	$1.09	$0.69	$1.05	$0.43	$0.66	$3.93	$6.01
2029	$0.63	$0.96	$0.82	$1.25	$0.45	$0.68	$1.17	$1.79	$0.45	$0.68	$0.73	$1.12	$0.71	$1.08	$0.45	$0.68	$4.06	$6.20
2030	$0.64	$0.98	$0.84	$1.29	$0.45	$0.69	$1.21	$1.85	$0.45	$0.69	$0.76	$1.16	$0.73	$1.12	$0.45	$0.69	$4.18	$6.40
2031	$0.66	$1.01	$0.87	$1.33	$0.47	$0.71	$1.24	$1.90	$0.47	$0.71	$0.78	$1.19	$0.75	$1.15	$0.47	$0.71	$4.30	$6.58
2032	$0.68	$1.04	$0.90	$1.37	$0.48	$0.73	$1.27	$1.95	$0.48	$0.73	$0.80	$1.22	$0.77	$1.18	$0.48	$0.73	$4.42	$6.76
2033	$0.70	$1.07	$0.92	$1.41	$0.49	$0.75	$1.30	$2.00	$0.49	$0.75	$0.82	$1.25	$0.79	$1.21	$0.49	$0.75	$4.53	$6.94
2034	$0.72	$1.10	$0.95	$1.45	$0.51	$0.77	$1.34	$2.05	$0.51	$0.77	$0.84	$1.28	$0.81	$1.24	$0.51	$0.77	$4.66	$7.12
2035	$0.73	$1.12	$0.97	$1.48	$0.52	$0.80	$1.38	$2.11	$0.52	$0.80	$0.87	$1.33	$0.84	$1.28	$0.52	$0.80	$4.79	$7.32

Note:
Class 2 tolls are two times the Class 1 video tolls.
Class 3 tolls are four times the Class 1 video tolls.
Video rates are 54 percent higher than electronic rates.

Similarly, Figure 6-4 illustrates the VTC toll rates for Class 1 vehicles by location for 2015 and 2030. These rates reflect a 54 percent premium over the ETC toll rates. The 2015 VTC rate for a full-length trip would be $3.95, rising to $6.40 by 2030.

All rates are in future-year dollars; that is, there would be no further increase for inflation beyond the rates shown. The increase in tolls between the opening year and the later years of operation is slightly greater than the direct effect of inflation, reflecting the need for some level of "real increase" in rates based on the significant increase in traffic demand. The assumed average annual rate increases over time for a full-length Class 1 ETC vehicle trip are:

- 2015 – 2020: 2.9 percent;
- 2020 – 2025: 3.8 percent;
- 2025 – 2030: 3.0 percent;
- 2030– 2035: 2.8 percent; and
- After 2035: 4.5 percent decreasing to 3.5 percent.

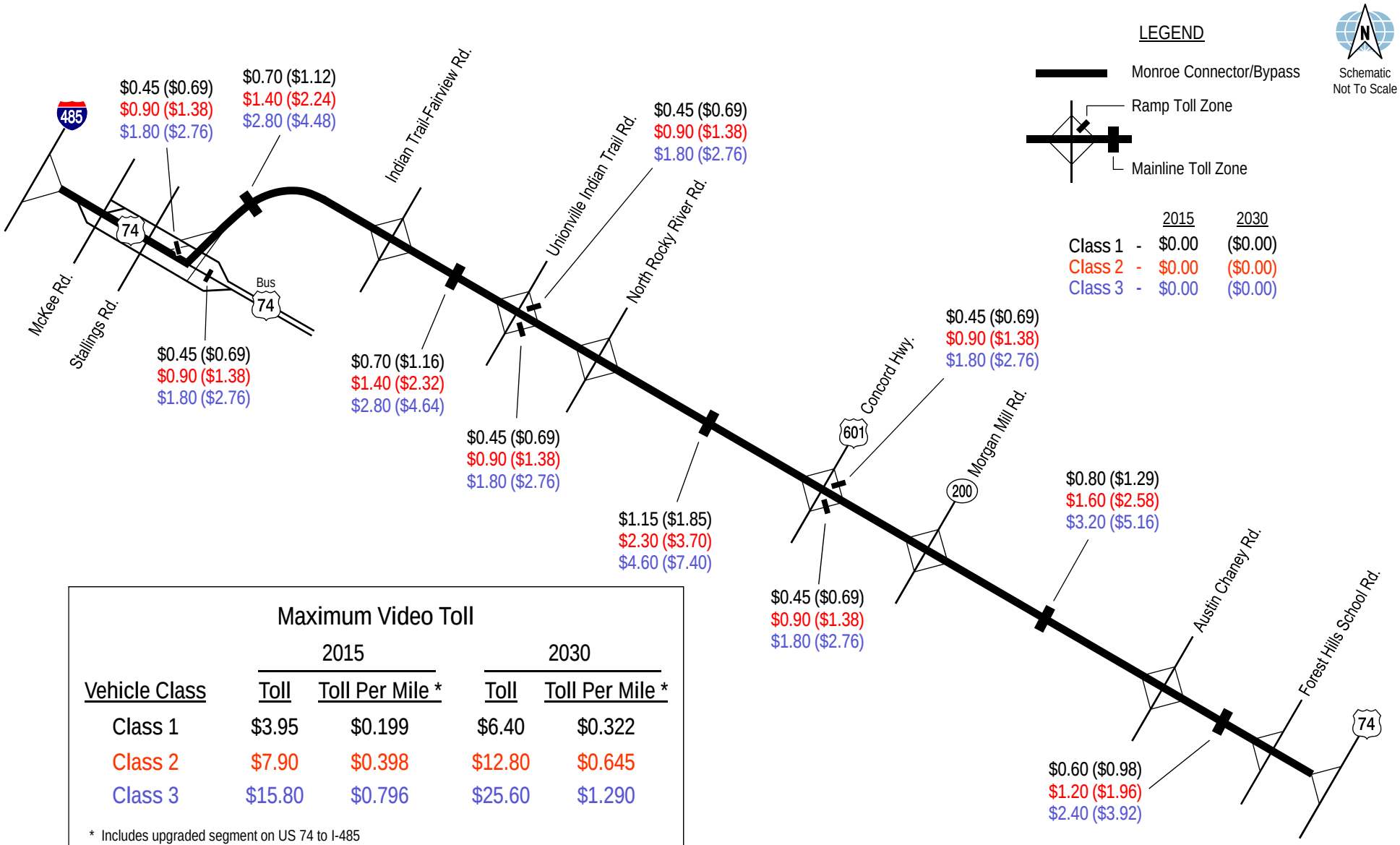
The five proposed mainline tolling zones are indicated in Figure 6-3:

- Between Forest Hills School Road and Austin Chaney Road;
- Between Austin Chaney Road and NC 200;
- Between US 601 and North Rocky River Road;
- Between Unionville-Indian Trail Road and Indian Trail-Fairview Road; and
- Between Indian Trail-Fairview Road and US 74.

Tolling zones would be established on ramps to and from the east at the US 601 interchange and to and from the east at the Unionville-Indian Trail Road interchange. Tolling zones would also be established on the ramps to and from US 74 Business.

ESTIMATED WEEKDAY TRAFFIC VOLUMES

Estimates of weekday traffic volumes in 2015, 2020, and 2030 are shown in Figure 6-5. The opening year highest volume on the Parkway is estimated to occur between Unionville-Indian Trail Road and Indian Trail-Fairview Road where the opening year traffic is estimated to be 31,600 vehicles per day. On the US 74 tolled segment that includes both Connector/Bypass and US 74 traffic, the opening year traffic is estimated at 40,600 vehicles per day. The traffic volumes shown do not reflect down-



Maximum Video Toll

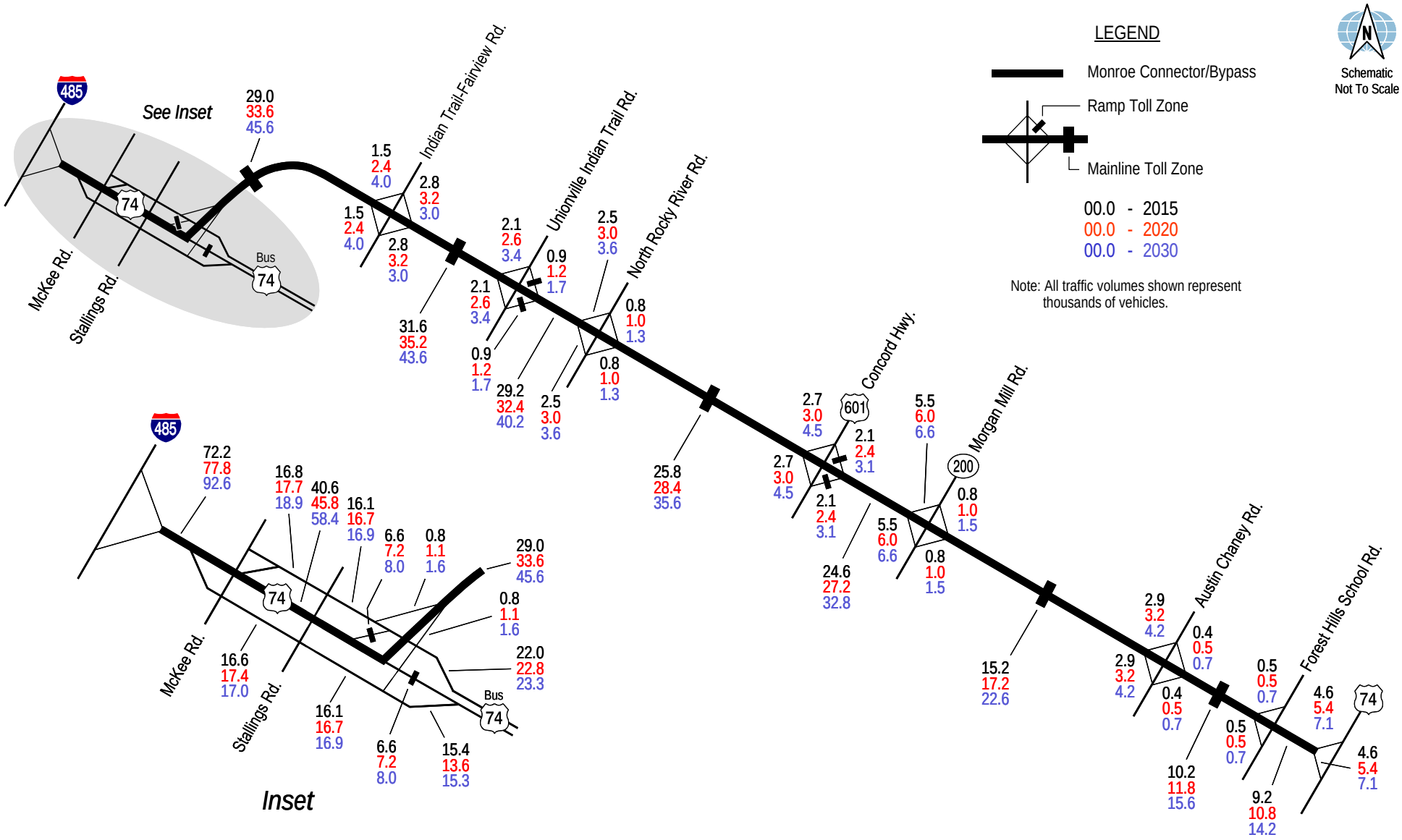
Vehicle Class	2015 Toll	2015 Toll Per Mile *	2030 Toll	2030 Toll Per Mile *
Class 1	$3.95	$0.199	$6.40	$0.322
Class 2	$7.90	$0.398	$12.80	$0.645
Class 3	$15.80	$0.796	$25.60	$1.290

* Includes upgraded segment on US 74 to I-485

NORTH CAROLINA Turnpike Authority

VTC TOLL RATE ASSUMPTIONS

FIGURE 6-4



NORTH CAROLINA Turnpike Authority

ESTIMATED 2015, 2020 AND 2030 WEEKDAY TRAFFIC VOLUMES CALENDAR YEAR BASIS

FIGURE 6-5

ward "ramp-up" adjustments, which are incorporated later in the annual forecasts.

By 2030, the maximum traffic section for the Connector/Bypass is expected between Indian Trail-Fairview Road and US 74 at 45,600 vehicles per day. Along the US 74 tolled section, the 2035 daily volume is expected to be 58,400.

ANNUALIZATION AND RAMP-UP ESTIMATION PROCEDURES

FY 2015 TRANSACTIONS AND REVENUE

Weekday traffic by vehicle class was calculated for each tolling zone and multiplied by the recommended ETC or video toll rate to develop estimates of weekday revenue. The weekday revenue estimates were then annualized and converted to fiscal years. Table 6-5 shows the toll transactions and gross revenue projections by vehicle class and toll rate for 2015 and the conversion process to yield FY 2015 forecasts of transactions and gross toll revenue.

FISCAL YEAR CONVERSION AND ANNUALIZATION

Transaction and revenue forecasts on a calendar-year basis were divided in half and allocated to the appropriate fiscal year, which is assumed to run from July 1 of one calendar year to June 30 of the following calendar year. Since the Monroe Connector/Bypass will open in January 2015, the opening year transaction and revenue forecasts are for a half fiscal year. This process, shown in detail in Table 6-5 for FY 2015, yields annual transaction forecasts of 20.9 million and $13.2 million in gross toll revenue assuming no adjustments for ramp-up. This annualization is based on 319 equivalent weekdays per year and assumes lower weekend and holiday traffic. For annualization purposes, it was assumed that average weekend-day traffic would be 60 percent of average weekday traffic.

RAMP-UP ADJUSTMENT

The annualized transactions and revenues in 2015 were further adjusted to reflect "ramp-up." Ramp-up is the phenomenon experienced on most start-up toll facilities in which high levels of growth may be experienced over the first three years or so of operation as the motoring public gradually becomes aware of and begins using the new facility.

There are a number of reasons for the "ramp-up" phenomenon. For example, not all motorists who will use the facility are from the local area, therefore it may take several months before certain travelers are aware that the roadway is there, or where it goes. It will also take several months for the project to begin appearing on new maps and for motorists to become

Table 6-5
Toll Transactions and Gross Toll Revenue Estimates, Fiscal Year 2015
Monroe Connector/Bypass

Toll Zone	Class 1 ETC	Class 1 VTC	Class 2 ETC	Class 2 VTC	Class 3 ETC	Class 3 VTC	Total
Weekday Transactions - Calendar Year 2015							
Mainline 1,US 74 - Austin Chaney Road	7,094	2,457	297	39	277	36	10,200
Mainline 2, Austin Chaney Road - NC 200	10,689	3,634	403	51	375	48	15,200
Ramp 1, NC 601	2,949	1,049	92	13	85	12	4,200
Mainline 3, US 601 - Rocky River Road	17,834	6,011	899	113	837	105	25,799
Ramp 2, Unionville - Indian Trail Road	1,346	395	28	3	26	2	1,800
Mainline 4, Unionville-Indian Trail Road - Indian Trail Fairview Road	21,711	7,543	1,075	140	1,001	130	31,600
Mainline 5 B, Indian Trail-Fairview Road - US 74	19,875	6,993	977	127	909	119	29,000
Ramp 3, US 74	8,897	3,538	341	55	318	51	13,200
Weekday Total Transactions	90,395	31,620	4,112	541	3,828	503	130,999
Toll - 2015							
Mainline 1,US 74 - Austin Chaney Road	$0.39	$0.60	$0.78	$1.20	$1.56	$2.40	
Mainline 2, Austin Chaney Road - NC 200	$0.52	$0.80	$1.04	$1.60	$2.08	$3.20	
Ramp 1, NC 601	$0.30	$0.45	$0.59	$0.90	$1.17	$1.80	
Mainline 3, US 601 - Rocky River Road	$0.75	$1.15	$1.50	$2.30	$2.99	$4.60	
Ramp 2, Unionville - Indian Trail Road	$0.30	$0.45	$0.59	$0.90	$1.17	$1.80	
Mainline 4, Unionville-Indian Trail Road - Indian Trail Fairview Road	$0.46	$0.70	$0.91	$1.40	$1.82	$2.80	
Mainline 5 B, Indian Trail-Fairview Road - US 74	$0.46	$0.70	$0.91	$1.40	$1.82	$2.80	
Ramp 3, US 74	$0.30	$0.45	$0.59	$0.90	$1.17	$1.80	
Weekday Gross Toll Revenue - Calendar Year 2015							
Mainline 1,US 74 - Austin Chaney Road	$2,767	$1,474	$232	$47	$432	$86	$5,038
Mainline 2, Austin Chaney Road - NC 200	5,558	2,907	419	82	780	154	9,900
Ramp 1, NC 601	885	472	54	12	99	22	1,544
Mainline 3, US 601 - Rocky River Road	13,376	6,913	1,349	260	2,503	483	24,884
Ramp 2, Unionville - Indian Trail Road	404	178	17	3	30	4	636
Mainline 4, Unionville-Indian Trail Road - Indian Trail Fairview Road	9,987	5,280	978	196	1,822	364	18,627
Mainline 5 B, Indian Trail-Fairview Road - US 74	9,143	4,895	889	178	1,654	333	17,092
Ramp 3, US 74	2,669	1,592	201	50	372	92	4,976
Weekday Total Transactions	$44,789	$23,711	$4,139	$828	$7,692	$1,538	$82,697

Annualization Procedure [1]
(Rounded to Thousands)
Annualization Factor: 319 days per year

Period	Total Annual Transactions	Total Annual Gross Revenue
Calendar 2015	41,789,000	$26,380,000

Conversion to Fiscal Year
(Rounded to Thousands)

Period	Total Transactions	Total Gross Revenue
Half of Calendar 2015	20,894,000	$13,189,000

Ramp-up Factors

	Total Transactions	Total Gross Revenue
January-June 2015	0.550	0.550

2015 Transactions and Gross Revenue After Ramp-up

	Total Transactions	Total Gross Revenue
Fiscal Year 2015	**11,492,000**	**$7,255,000**

[1] Excludes any allowance for uncollectible revenue

accustomed to using the facility. The duration and level of ramp-up adjustments can be directly affected by a well-conceived promotion and signing program.

For purposes of this study, a 36-month ramp-up period was assumed. The nominal traffic and revenue estimates prepared for the opening three years are adjusted downward on a six-month basis to reflect the time it will take to gradually build up demand. Table 6-6 shows the ramp-up factors by time period.

Table 6-6
Ramp-up Factors
Monroe Connector/Bypass

Fiscal Year	Factor [1] July - December	Factor [1] January - June
2015		0.550
2016	0.670	0.773
2017	0.854	0.915
2018+	0.975	1.000

[1] Average 6-month factor applied to forecast of total traffic.

After application of these ramp-up factors, the Monroe Connector/Bypass is estimated to have 11.5 million transactions and $7.2 million in gross toll revenue in FY 2015 as shown in Table 6-5.

FY 2020 AND FY 2030 TRANSACTIONS AND REVENUE

Tables 6-7 and 6-8 show the anticipated transactions and gross toll revenue for FY 2020 and FY 2030, respectively, based on the weekly traffic estimates contained in Figure 6-5. In both of these cases, no ramp-up adjustments were made. The annualization factor of 319 days was also used in these future-year forecasts, based on the assumption that weekend day traffic is 60 percent of weekday traffic.

ESTIMATED ANNUAL TOLL TRANSACTIONS AND REVENUE

GROSS TRANSACTIONS AND REVENUE

Estimated annual toll transactions by vehicle class and year are shown in Table 6-9 and in Figure 6-6. Annual transactions are expected to increase from about 11.5 million in FY 2015 to 59.4 million by FY 2030. Traffic

Table 6-7
Toll Transactions and Gross Toll Revenue Estimates, Fiscal Year 2020
Monroe Connector/Bypass

Toll Zone	Class 1 ETC	Class 1 VTC	Class 2 ETC	Class 2 VTC	Class 3 ETC	Class 3 VTC	Total
Weekday Transactions - Calendar Year 2019							
Mainline 1,US 74 - Austin Chaney Road	8,365	2,376	335	33	312	30	11,451
Mainline 2, Austin Chaney Road - NC 200	12,308	3,425	488	46	454	43	16,764
Ramp 1, NC 601	3,445	1,006	102	11	95	10	4,669
Mainline 3, US 601 - Rocky River Road	20,086	5,520	1,055	99	982	92	27,834
Ramp 2, Unionville - Indian Trail Road	1,760	432	35	3	33	2	2,265
Mainline 4, Unionville-Indian Trail Road - Indian Trail Fairview Road	24,699	7,000	1,283	125	1,194	116	34,417
Mainline 5 B, Indian Trail-Fairview Road - US 74	23,359	6,729	1,183	115	1,101	107	32,594
Ramp 3, US 74	9,995	3,279	399	49	371	45	14,138
Weekday Total Transactions	104,017	29,767	4,880	481	4,542	445	144,132
Weekday Transactions - Calendar Year 2020							
Mainline 1,US 74 - Austin Chaney Road	8,716	2,357	345	31	321	29	11,799
Mainline 2, Austin Chaney Road - NC 200	12,749	3,375	512	45	476	42	17,199
Ramp 1, NC 601	3,581	995	105	11	98	10	4,800
Mainline 3, US 601 - Rocky River Road	20,692	5,403	1,098	96	1,022	89	28,400
Ramp 2, Unionville - Indian Trail Road	1,882	442	37	2	34	2	2,399
Mainline 4, Unionville-Indian Trail Road - Indian Trail Fairview Road	25,508	6,870	1,341	121	1,247	113	35,200
Mainline 5 B, Indian Trail-Fairview Road - US 74	24,322	6,665	1,241	113	1,155	105	33,601
Ramp 3, US 74	10,290	3,217	415	47	386	44	14,399
Weekday Total Transactions	107,740	29,324	5,094	466	4,739	434	147,797

Toll Zone	Class 1 ETC	Class 1 VTC	Class 2 ETC	Class 2 VTC	Class 3 ETC	Class 3 VTC
Toll - 2019						
Mainline 1,US 74 - Austin Chaney Road	$0.45	$0.68	$0.89	$1.36	$1.77	$2.72
Mainline 2, Austin Chaney Road - NC 200	$0.58	$0.88	$1.15	$1.76	$2.29	$3.52
Ramp 1, NC 601	$0.32	$0.49	$0.64	$0.98	$1.28	$1.96
Mainline 3, US 601 - Rocky River Road	$0.83	$1.27	$1.66	$2.54	$3.31	$5.08
Ramp 2, Unionville - Indian Trail Road	$0.32	$0.49	$0.64	$0.98	$1.28	$1.96
Mainline 4, Unionville-Indian Trail Road - Indian Trail Fairview Road	$0.52	$0.80	$1.04	$1.60	$2.08	$3.20
Mainline 5 B, Indian Trail-Fairview Road - US 74	$0.51	$0.78	$1.02	$1.56	$2.03	$3.12
Ramp 3, US 74	$0.32	$0.49	$0.64	$0.98	$1.28	$1.96
Toll - 2020						
Mainline 1,US 74 - Austin Chaney Road	$0.46	$0.70	$0.91	$1.40	$1.82	$2.80
Mainline 2, Austin Chaney Road - NC 200	$0.60	$0.92	$1.20	$1.84	$2.40	$3.68
Ramp 1, NC 601	$0.34	$0.52	$0.68	$1.04	$1.36	$2.08
Mainline 3, US 601 - Rocky River Road	$0.86	$1.32	$1.72	$2.64	$3.44	$5.28
Ramp 2, Unionville - Indian Trail Road	$0.34	$0.52	$0.68	$1.04	$1.36	$2.08
Mainline 4, Unionville-Indian Trail Road - Indian Trail Fairview Road	$0.54	$0.83	$1.08	$1.66	$2.16	$3.32
Mainline 5 B, Indian Trail-Fairview Road - US 74	$0.52	$0.80	$1.04	$1.60	$2.08	$3.20
Ramp 3, US 74	$0.34	$0.52	$0.68	$1.04	$1.36	$2.08

Toll Zone	Class 1 ETC	Class 1 VTC	Class 2 ETC	Class 2 VTC	Class 3 ETC	Class 3 VTC	Total
Weekday Gross Toll Revenue - Calendar Year 2019							
Mainline 1,US 74 - Austin Chaney Road	$3,764	$1,616	$298	$45	$552	$82	$6,357
Mainline 2, Austin Chaney Road - NC 200	7,139	3,014	561	81	1,040	151	11,986
Ramp 1, NC 601	1,102	493	65	11	122	20	1,813
Mainline 3, US 601 - Rocky River Road	16,671	7,010	1,751	251	3,250	467	29,400
Ramp 2, Unionville - Indian Trail Road	563	212	22	3	42	4	846
Mainline 4, Unionville-Indian Trail Road - Indian Trail Fairview Road	12,843	5,600	1,334	200	2,484	371	22,832
Mainline 5 B, Indian Trail-Fairview Road - US 74	11,913	5,249	1,207	179	2,235	334	21,117
Ramp 3, US 74	3,198	1,607	255	48	475	88	5,671
Weekday Total Transactions	$57,193	$24,801	$5,493	$818	$10,200	$1,517	$100,022
Weekday Gross Toll Revenue - Calendar Year 2020							
Mainline 1,US 74 - Austin Chaney Road	$4,009	$1,650	$314	$43	$584	$81	$6,681
Mainline 2, Austin Chaney Road - NC 200	7,649	3,105	614	83	1,142	155	12,748
Ramp 1, NC 601	1,218	517	71	11	133	21	1,971
Mainline 3, US 601 - Rocky River Road	17,795	7,132	1,889	253	3,516	470	31,055
Ramp 2, Unionville - Indian Trail Road	640	230	25	2	46	4	947
Mainline 4, Unionville-Indian Trail Road - Indian Trail Fairview Road	13,774	5,702	1,448	201	2,694	375	24,194
Mainline 5 B, Indian Trail-Fairview Road - US 74	12,647	5,332	1,291	181	2,402	336	22,189
Ramp 3, US 74	3,499	1,673	282	49	525	92	6,120
Weekday Total Transactions	$61,231	$25,341	$5,934	$823	$11,042	$1,534	$105,905

Annualization Procedure [1]
(Rounded to Thousands)
Annualization Factor: 319 days per year

Period	Total Annual Transactions	Total Annual Gross Revenue
Calendar 2019	45,978,000	$31,907,000
Calendar 2020	47,147,000	$33,784,000

Conversion to Fiscal Year
(Rounded to Thousands)

Period	Total Transactions	Total Gross Revenue
Half of Calendar 2019	22,989,000	$15,955,000
Half of Calendar 2020	23,574,000	$16,893,000
Total Fiscal Year 2020	**46,563,000**	**$32,848,000**

[1] Excludes any allowance for uncollectible revenue

Table 6-8
Toll Transactions and Gross Toll Revenue Estimates, Fiscal Year 2030
Monroe Connector/Bypass

Toll Zone	Class 1 ETC	Class 1 VTC	Class 2 ETC	Class 2 VTC	Class 3 ETC	Class 3 VTC	Total	Class 1 ETC	Class 1 VTC	Class 2 ETC	Class 2 VTC	Class 3 ETC	Class 3 VTC	Total
	Weekday Transactions - Calendar Year 2029							Weekday Transactions - Calendar Year 2030						
Mainline 1,US 74 - Austin Chaney Road	12,250	1,931	407	36	379	33	15,036	12,788	1,932	419	37	390	34	15,600
Mainline 2, Austin Chaney Road - NC 200	17,795	2,737	615	52	572	48	21,819	18,539	2,733	634	54	590	50	22,600
Ramp 1, NC 601	4,997	802	109	10	101	10	6,029	5,170	797	110	11	102	10	6,200
Mainline 3, US 601 - Rocky River Road	27,941	4,240	1,206	101	1,122	94	34,704	28,839	4,191	1,229	102	1,144	95	35,600
Ramp 2, Unionville - Indian Trail Road	2,802	382	41	3	38	3	3,269	2,928	385	42	3	39	3	3,400
Mainline 4, Unionville-Indian Trail Road - Indian Trail Fairview Road	34,239	5,379	1,472	129	1,370	120	42,709	35,167	5,291	1,497	130	1,393	121	43,599
Mainline 5 B, Indian Trail - Fairview Road - US 74	35,682	5,758	1,431	127	1,331	118	44,447	36,840	5,697	1,458	129	1,357	120	45,601
Ramp 3, US 74	12,570	2,306	445	50	414	46	15,831	12,777	2,253	452	51	420	47	16,000
Weekday Total Transactions	148,276	23,535	5,726	508	5,327	472	183,844	153,048	23,279	5,841	517	5,435	480	188,600
	Toll - 2029							Toll - 2030						
Mainline 1,US 74 - Austin Chaney Road	$0.63	$0.96	$1.25	$1.92	$2.50	$3.84		$0.64	$0.98	$1.28	$1.96	$2.55	$3.92	
Mainline 2, Austin Chaney Road - NC 200	$0.82	$1.25	$1.63	$2.50	$3.25	$5.00		$0.84	$1.29	$1.68	$2.58	$3.36	$5.16	
Ramp 1, NC 601	$0.45	$0.68	$0.89	$1.36	$1.77	$2.72		$0.45	$0.69	$0.90	$1.38	$1.80	$2.76	
Mainline 3, US 601 - Rocky River Road	$1.17	$1.79	$2.33	$3.58	$4.66	$7.16		$1.21	$1.85	$2.41	$3.70	$4.81	$7.40	
Ramp 2, Unionville - Indian Trail Road	$0.45	$0.68	$0.89	$1.36	$1.77	$2.72		$0.45	$0.69	$0.90	$1.38	$1.80	$2.76	
Mainline 4, Unionville-Indian Trail Road - Indian Trail Fairview Road	$0.73	$1.12	$1.46	$2.24	$2.92	$4.48		$0.76	$1.16	$1.51	$2.32	$3.02	$4.64	
Mainline 5 B, Indian Trail - Fairview Road - US 74	$0.71	$1.08	$1.41	$2.16	$2.81	$4.32		$0.73	$1.12	$1.46	$2.24	$2.92	$4.48	
Ramp 3, US 74	$0.45	$0.68	$0.89	$1.36	$1.77	$2.72		$0.45	$0.69	$0.90	$1.38	$1.80	$2.76	
	Weekday Gross Toll Revenue - Calendar Year 2029							Weekday Gross Toll Revenue - Calendar Year 2030						
Mainline 1,US 74 - Austin Chaney Road	$7,718	$1,854	$509	$69	$948	$127	$11,225	$8,184	$1,893	$536	$73	$995	$133	$11,814
Mainline 2, Austin Chaney Road - NC 200	14,592	3,421	1,002	130	1,859	240	21,244	15,573	3,526	1,065	139	1,982	258	22,543
Ramp 1, NC 601	2,249	545	97	14	179	27	3,111	2,327	550	99	15	184	28	3,203
Mainline 3, US 601 - Rocky River Road	32,691	7,590	2,810	362	5,229	673	49,355	34,895	7,753	2,962	377	5,503	703	52,193
Ramp 2, Unionville - Indian Trail Road	1,261	260	36	4	67	8	1,636	1,318	266	38	4	70	8	1,704
Mainline 4, Unionville-Indian Trail Road - Indian Trail Fairview Road	24,994	6,024	2,149	289	4,000	538	37,994	26,727	6,138	2,260	302	4,207	561	40,195
Mainline 5 B, Indian Trail - Fairview Road - US 74	25,334	6,219	2,018	274	3,740	510	38,095	26,893	6,381	2,129	289	3,962	538	40,192
Ramp 3, US 74	5,657	1,568	396	68	733	125	8,547	5,750	1,555	407	70	756	130	8,668
Weekday Total Transactions	$114,496	$27,481	$9,017	$1,210	$16,755	$2,248	$171,207	$121,667	$28,062	$9,496	$1,269	$17,659	$2,359	$180,512

Annualization Procedure [1]
(Rounded to Thousands)
Annualization Factor: 319 days per year

Period	Total Annual Transactions	Total Annual Gross Revenue
Calendar 2029	58,646,000	$54,615,000
Calendar 2030	60,163,000	$57,583,000

Conversion to Fiscal Year
(Rounded to Thousands)

Period	Total Transactions	Total Gross Revenue
Half of Calendar 2029	29,323,000	$27,307,000
Half of Calendar 2030	30,082,000	$28,792,000
Total Fiscal Year 2030	**59,405,000**	**$56,099,000**

[1] Excludes any allowance for uncollectible revenue

Table 6-9
Estimated Annual Toll Transactions
Monroe Connector/Bypass
(Thousands)

Fiscal Year	Class 1 ETC	Class 1 VTC	Class 1 Total Class 1	Class 2 ETC	Class 2 VTC	Class 2 Total Class 2	Class 3 ETC	Class 3 VTC	Class 3 Total Class 3	Total Transactions	Percent ETC
2015 [1]	7,930	2,774	10,704	361	47	408	336	44	380	11,492	75.1%
2016	21,195	7,216	28,411	968	123	1,091	901	114	1,015	30,517	75.6%
2017	26,905	8,720	35,625	1,239	146	1,385	1,152	136	1,288	38,298	76.5%
2018	31,096	9,590	40,686	1,442	158	1,600	1,342	147	1,489	43,775	77.4%
2019	32,608	9,568	42,176	1,524	156	1,680	1,418	145	1,563	45,419	78.3%
2020	33,775	9,425	43,200	1,591	151	1,742	1,480	141	1,621	46,563	79.1%
2021	35,044	9,192	44,236	1,631	149	1,780	1,517	139	1,656	47,672	80.1%
2022	36,421	8,874	45,295	1,643	149	1,792	1,528	139	1,667	48,754	81.2%
2023	37,855	8,567	46,422	1,655	149	1,804	1,540	139	1,679	49,905	82.3%
2024	39,347	8,272	47,619	1,667	150	1,817	1,551	139	1,690	51,126	83.3%
2025	40,900	7,987	48,887	1,679	150	1,829	1,562	140	1,702	52,418	84.2%
2026	42,359	7,804	50,163	1,702	152	1,854	1,584	141	1,725	53,742	84.9%
2027	43,714	7,717	51,431	1,737	154	1,891	1,616	144	1,760	55,082	85.4%
2028	45,115	7,633	52,748	1,772	157	1,929	1,649	146	1,795	56,472	85.9%
2029	46,564	7,549	54,113	1,808	160	1,968	1,682	149	1,831	57,912	86.4%
2030	48,061	7,467	55,528	1,845	163	2,008	1,717	152	1,869	59,405	86.9%
2031	49,413	7,521	56,934	1,869	165	2,034	1,739	154	1,893	60,861	87.1%
2032	50,610	7,714	58,324	1,879	166	2,045	1,748	155	1,903	62,272	87.1%
2033	51,838	7,911	59,749	1,889	167	2,056	1,758	156	1,914	63,719	87.1%
2034	53,098	8,115	61,213	1,899	168	2,067	1,767	156	1,923	65,203	87.1%
2035	54,392	8,324	62,716	1,910	169	2,079	1,777	157	1,934	66,729	87.0%
2036	55,597	8,514	64,111	1,934	171	2,105	1,800	159	1,959	68,175	87.0%
2037	56,709	8,684	65,393	1,973	175	2,148	1,836	163	1,999	69,540	87.0%
2038	57,843	8,858	66,701	2,012	178	2,190	1,872	166	2,038	70,929	87.0%
2039	59,000	9,035	68,035	2,052	182	2,234	1,910	169	2,079	72,348	87.0%
2040	60,180	9,216	69,396	2,093	186	2,279	1,948	173	2,121	73,796	87.0%
2041	61,232	9,377	70,609	2,130	189	2,319	1,982	176	2,158	75,086	87.0%
2042	62,150	9,517	71,667	2,162	192	2,354	2,012	178	2,190	76,211	87.0%
2043	63,083	9,660	72,743	2,194	194	2,388	2,042	181	2,223	77,354	87.0%
2044	64,029	9,805	73,834	2,227	197	2,424	2,072	184	2,256	78,514	87.0%
2045	64,989	9,952	74,941	2,261	200	2,461	2,104	186	2,290	79,692	87.0%
2046	65,800	10,076	75,876	2,289	203	2,492	2,130	189	2,319	80,687	87.0%
2047	66,458	10,177	76,635	2,312	205	2,517	2,151	191	2,342	81,494	87.0%
2048	67,123	10,279	77,402	2,335	207	2,542	2,173	193	2,366	82,310	87.0%
2049	67,794	10,382	78,176	2,358	209	2,567	2,194	194	2,388	83,131	87.0%
2050	68,472	10,485	78,957	2,382	211	2,593	2,216	196	2,412	83,962	87.0%
2051	69,157	10,590	79,747	2,406	213	2,619	2,238	198	2,436	84,802	87.0%
2052	69,848	10,696	80,544	2,430	215	2,645	2,261	200	2,461	85,650	87.0%
2053	70,547	10,803	81,350	2,454	217	2,671	2,283	202	2,485	86,506	87.0%
2054	71,252	10,911	82,163	2,479	220	2,699	2,306	204	2,510	87,372	87.0%
2055	71,965	11,020	82,985	2,503	222	2,725	2,329	206	2,535	88,245	87.0%

[1] FY 2015, January - June only.

Note: Forecasts for FY 2015 - 2018 reflect an assumed ramp-up to full traffic volumes beginning in the second half of FY 2018.

estimates for FY 2015 through FY 2018 were adjusted downward to reflect the impact of a three year ramp-up period as discussed above and shown in Table 6-6.

Electronic toll transactions are expected to be the largest proportion of users and are estimated to increase from about 75 percent market share in the opening year to nearly 87 percent by FY 2030. Transaction estimates through FY 2035 are based on a detailed modeling analysis. Transactions between FY 2035 and FY 2055 were assumed to grow at the rates shown in Table 6-10.

Table 6-10
Annual Transaction and Revenue
Growth Rate Assumptions, 2035 - 2055
Monroe Connector/Bypass

	Annual Growth Rate	
Period	**Transactions**	**Toll Revenue**
2035 - 2040	2.0%	4.5%
2040 - 2045	1.5%	4.0%
2045 - 2055	1.0%	3.5%

In developing the assumed extrapolated growth rates beyond FY 2035, the patterns of growth determined by the travel demand modeling over years prior to FY 2035 were considered. In general, overall transaction growth rates were assumed to moderate, dropping to an overall average growth rate of 2 percent per year subsequent to FY 2040. Prior to FY 2035, model results showed an annual decline in the growth of video transactions, largely due to assumed continued increases in the penetration of electronic toll collection.

However, experience on other facilities suggests that ETC penetration typically reaches a maximum level in the range of 90 percent. Accordingly, WSA assumed declines in video transactions would "bottom out" between FY 2030 and FY 2035, with zero growth assumed in that category during that period. Subsequent to FY 2035, video transactions were assumed to grow at a declining rate ranging from 2 percent to 1 percent after 2045. This resulted in the stabilization of the ETC share at approximately 87 percent of total transactions from 2035 to the end of the forecast period.

Annual revenue estimates are provided in Table 6-11 and illustrated in Figure 6-6. Revenue estimates are presented for each vehicles class. The total annual gross revenue is expected to increase from about $7.2 million

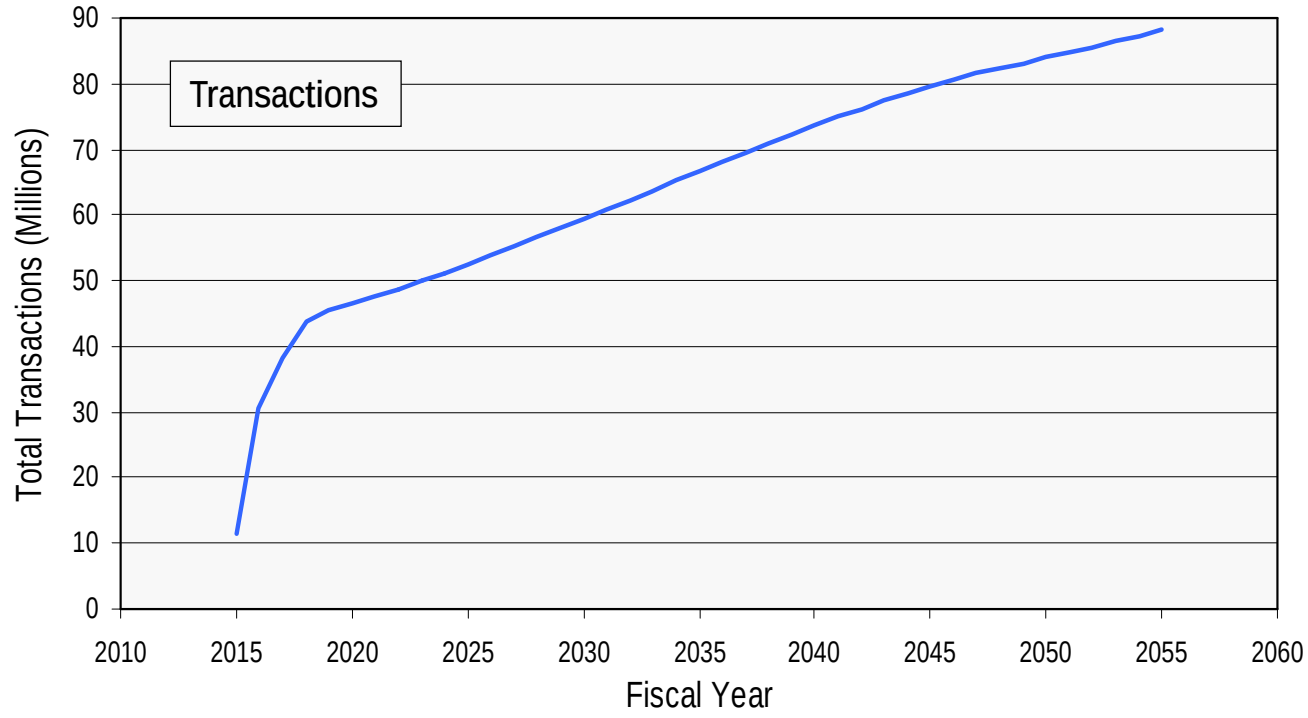
Table 6-11
Estimated Annual Gross Toll Revenue
Monroe Connector/Bypass
(Thousands)

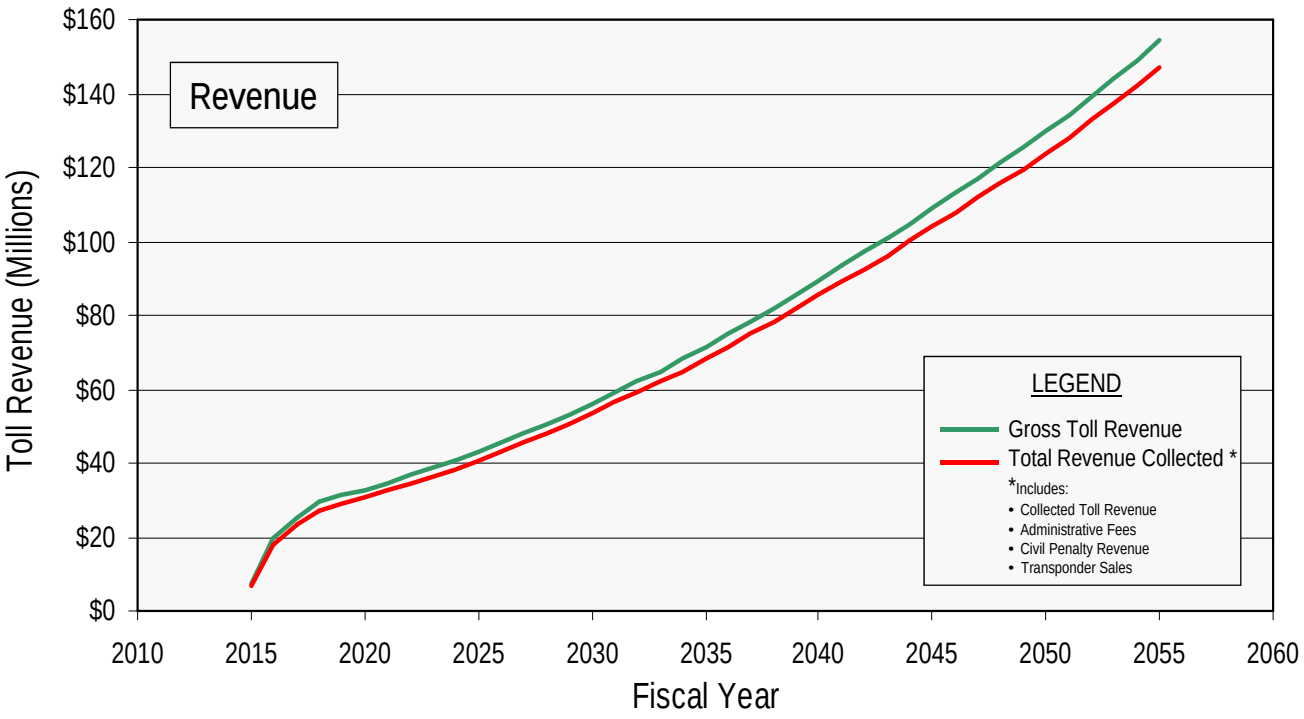
Fiscal Year	Class 1 ETC	Class 1 VTC	Class 1 Total	Class 2 ETC	Class 2 VTC	Class 2 Total	Class 3 ETC	Class 3 VTC	Class 3 Total	Total Gross Revenue [2]	Percent ETC
2015 [1]	$3,929	$2,080	$6,009	$363	$73	$436	$675	$135	$810	$7,255	68.5%
2016	10,641	5,487	16,128	990	190	1,180	1,841	353	2,194	19,502	69.1%
2017	13,887	6,799	20,686	1,304	232	1,536	2,419	432	2,851	25,073	70.2%
2018	16,512	7,675	24,187	1,561	259	1,820	2,894	481	3,375	29,382	71.4%
2019	17,737	7,865	25,602	1,694	261	1,955	3,143	486	3,629	31,186	72.4%
2020	18,889	7,998	26,887	1,823	262	2,085	3,388	488	3,876	32,848	73.4%
2021	20,361	8,094	28,455	1,938	268	2,206	3,603	499	4,102	34,763	74.5%
2022	21,984	8,108	30,092	2,025	279	2,304	3,766	519	4,285	36,681	75.7%
2023	23,642	8,113	31,755	2,114	289	2,403	3,931	538	4,469	38,627	76.9%
2024	25,420	8,107	33,527	2,204	300	2,504	4,096	558	4,654	40,685	78.0%
2025	27,371	8,109	35,480	2,299	311	2,610	4,273	579	4,852	42,942	79.0%
2026	29,338	8,196	37,534	2,412	325	2,737	4,483	605	5,088	45,359	79.9%
2027	31,256	8,355	39,611	2,537	341	2,878	4,716	635	5,351	47,840	80.5%
2028	33,237	8,514	41,751	2,666	358	3,024	4,956	666	5,622	50,397	81.1%
2029	35,377	8,681	44,058	2,804	376	3,180	5,211	699	5,910	53,148	81.6%
2030	37,668	8,859	46,527	2,953	395	3,348	5,489	735	6,224	56,099	82.2%
2031	39,862	9,193	49,055	3,119	411	3,530	5,723	775	6,498	59,083	82.4%
2032	41,967	9,686	51,653	3,219	425	3,644	5,906	800	6,706	62,003	82.4%
2033	44,086	10,198	54,284	3,280	438	3,718	6,091	816	6,907	64,909	82.4%
2034	46,373	10,731	57,104	3,381	452	3,833	6,277	842	7,119	68,056	82.3%
2035	48,907	11,320	60,227	3,493	468	3,961	6,487	870	7,357	71,545	82.3%
2036	51,348	11,900	63,248	3,633	487	4,120	6,751	906	7,657	75,025	82.3%
2037	53,659	12,435	66,094	3,797	509	4,306	7,055	947	8,002	78,402	82.3%
2038	56,073	12,995	69,068	3,967	532	4,499	7,372	990	8,362	81,929	82.3%
2039	58,597	13,580	72,177	4,146	556	4,702	7,704	1,034	8,738	85,617	82.3%
2040	61,233	14,191	75,424	4,333	581	4,914	8,051	1,081	9,132	89,470	82.3%
2041	63,832	14,793	78,625	4,516	605	5,121	8,392	1,127	9,519	93,265	82.3%
2042	66,386	15,385	81,771	4,697	630	5,327	8,728	1,172	9,900	96,998	82.3%
2043	69,041	16,000	85,041	4,885	655	5,540	9,077	1,219	10,296	100,877	82.3%
2044	71,803	16,640	88,443	5,080	681	5,761	9,440	1,267	10,707	104,911	82.3%
2045	74,675	17,306	91,981	5,284	708	5,992	9,818	1,318	11,136	109,109	82.3%
2046	77,472	17,954	95,426	5,482	735	6,217	10,186	1,367	11,553	113,196	82.3%
2047	80,183	18,582	98,765	5,673	760	6,433	10,542	1,415	11,957	117,155	82.3%
2048	82,990	19,233	102,223	5,872	787	6,659	10,911	1,465	12,376	121,258	82.3%
2049	85,894	19,906	105,800	6,077	815	6,892	11,293	1,516	12,809	125,501	82.3%
2050	88,900	20,602	109,502	6,290	843	7,133	11,688	1,569	13,257	129,892	82.3%
2051	92,012	21,323	113,335	6,510	873	7,383	12,097	1,624	13,721	134,439	82.3%
2052	95,232	22,070	117,302	6,738	903	7,641	12,521	1,681	14,202	139,145	82.3%
2053	98,566	22,842	121,408	6,974	935	7,909	12,959	1,740	14,699	144,016	82.3%
2054	102,015	23,642	125,657	7,218	967	8,185	13,412	1,800	15,212	149,054	82.3%
2055	105,586	24,469	130,055	7,471	1,001	8,472	13,882	1,864	15,746	154,273	82.3%

[1] FY 2015, January - June only.

[2] Excludes any allowance for uncollectible revenue.

Note: Forecasts for FY 2015 - 2018 reflect an assumed ramp-up to full traffic volumes beginning in the second half of FY 2018.





NORTH CAROLINA Turnpike Authority

ANNUAL TOLL TRANSACTIONS AND REVENUE

FIGURE 6-6

in FY 2015 to $56.1 million by FY 2030. This reflects the impact of both traffic growth and periodic toll adjustments. Again, revenue estimates during the first three years of operation were adjusted to reflect a progressive ramp-up pattern. Assumed annual growth rates for gross toll revenue are shown in Table 6-10. ETC and VTC revenue growth rates were assumed to be 4.5 percent annually between FY 2040 and declining to 3.5 percent annually from 2045.

Electronic tolls are expected to account for between 72 and 82 percent of total revenue after the ramp-up period. This is a lower percentage than the proportion of transactions, but reflects the fact that VTC users are assessed a significant premium over the base ETC toll charge.

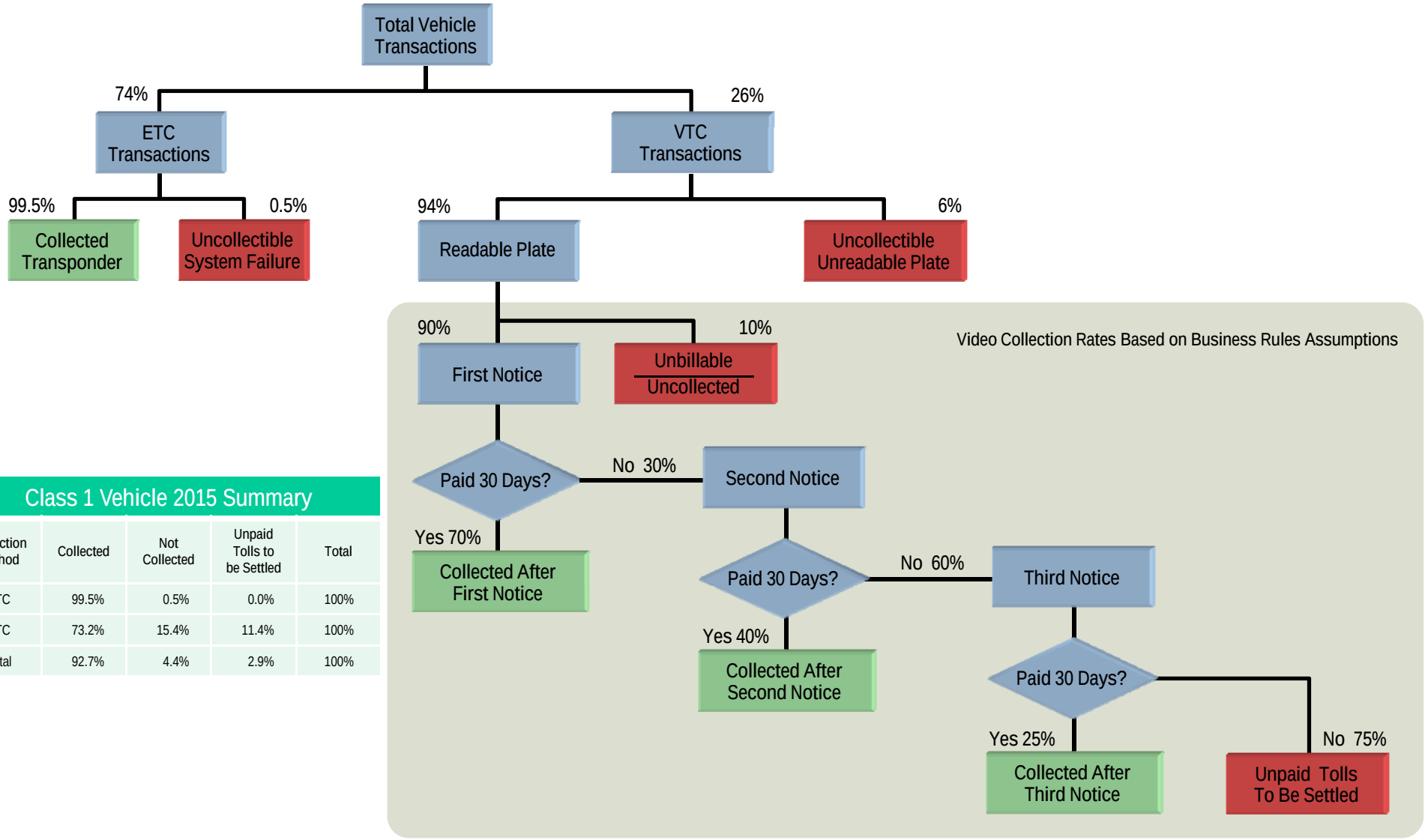
Revenue Collection, Enforcement, and Leakage

The system being developed for the Monroe Connector/Bypass is an adaptation of two toll collection systems: All electronic tolling (AET) using ETC supplemented by automated video imaging that will serve as the video processing system.

The lane-level hardware required for implementing AET and video processing/toll collection includes vehicle mounted transponders, overhead antennas, and roadside equipment such as readers, controllers, electrical circuit protection and distribution equipment, vehicle detection trigger devices, cameras, and supplemental lighting, as well as image processors and transmission equipment housed in an environmentally controlled roadside cabinet. Taken together with the necessary software and operational procedures, an AET collection system can be quite complex resulting in a potential for lost revenue unless appropriate technology is used and business rules followed.

Payment and Collection Structure - Figure 6-7 illustrates the toll collection process and revenue collection flow which will be used on the Monroe Connector/Bypass. As noted previously, no option will be provided for direct payment in cash at the time of passage through an electronic toll zone. However, opportunities for payment in cash will be provided in the vicinity of the toll road. In addition to showing the flow of potential transactions, Figure 6-7 also shows assumed collection rates and percentages of uncollectable revenue at each point for the opening year.

ETC and VTC Proportions - Each vehicle that passes through an electronic toll zone will fall into one of two categories, either equipped with an electronic toll transponder or not. The share of traffic distribution between ETC and VTC transactions, by vehicle class, was a direct output in each year of the modeling process, and the differential tolls in effect at



Class 1 Vehicle 2015 Summary

Collection Method	Collected	Not Collected	Unpaid Tolls to be Settled	Total
ETC	99.5%	0.5%	0.0%	100%
VTC	73.2%	15.4%	11.4%	100%
Total	92.7%	4.4%	2.9%	100%

NORTH CAROLINA Turnpike Authority

TOLL PAYMENT AND COLLECTION STRUCTURE CLASS I VEHICLE 2015 ASSUMPTIONS

FIGURE 6-7

each location. In the example shown in Figure 6-7, which reflects 2015 conditions, the model estimated approximately 74 percent of Class 1 vehicles would be equipped with ETC transponders and 26 percent would not.

Electronic Toll Collection - Of the ETC transactions, 99.5 percent were expected to be valid transactions, resulting in collected revenue. This collection rate appears high when compared to typical ETC express lane operations on other toll facilities today. However, on those facilities, any vehicles in ETC express toll lanes not equipped with transponders are considered violators. In the NCTA system, vehicles without transponders would fall into the "video transaction" category and be processed as shown on the right side of the chart. Hence, the 0.5 percent uncollectable rate for ETC transactions would only relate to unusual system failure conditions.

Video Toll Collection - Video transactions are estimated to represent approximately 26 percent of total Class 1 transactions in 2015. Potential for uncollectable transactions are shown in the red boxes at several locations along the video transaction process.

Collection assumptions were made by the NCTA based on draft business rules. The collection amounts included both the toll and the administrative fees and civil penalties. The appendix contains the NCTA assumptions and estimates for the pending revenue category.

Collectability assumptions were modified slightly over time to reflect anticipated improvements in technology and billing practices. Table 6-12 shows revenue collection assumptions for each class of vehicle for each of the various decision points shown in Figure 6-7.

Most (94 percent) of the video transactions are assumed to contain readable license plate images. Six percent of video transactions are assumed to have unreadable license plates such as plates which are obscured by trailer hitches or inclement weather conditions. For the remaining 94 percent, it was assumed that registered owners could be identified for 90 percent of the readable plates and that bills for this group would be mailed. The chart shows the estimated collection rates for each of the bills that would be sent before unpaid transactions would be considered to be unpaid violations.

Table 6-12
Revenue Collection Assumptions
All Vehicle Classes
Monroe Connector/Bypass

Assumption	Percent by Year 2015	2020	2025	2030	2035
	Electronic Toll Collection				
ETC Collectible	99.5%	99.5%	99.5%	99.5%	99.5%
ETC Uncollectible	0.5%	0.5%	0.5%	0.5%	0.5%
Total ETC Transactions	100.0%	100.0%	100.0%	100.0%	100.0%
	Video Toll Collection				
Readable Plates	94%	94%	95%	95%	96%
Unreadable Plates	6%	6%	5%	5%	4%
Total Plates Imaged	100%	100%	100%	100%	100%
Billable Plates	90%	90%	90%	90%	90%
Unbillable Plates	10%	10%	10%	10%	10%
Total Billable and Unbillable Plates	100%	100%	100%	100%	100%
Collected - First Notice	70%	70%	70%	70%	70%
Not Collected - First Notice	30%	30%	30%	30%	30%
Total First Notice	100%	100%	100%	100%	100%
Collected - Second Notice	40%	40%	40%	40%	40%
Not Collected - Second Notice	60%	60%	60%	60%	60%
Total Second Notice	100%	100%	100%	100%	100%
Collected - Third Notice	25%	25%	25%	25%	25%
Not Collected - Third Notice	75%	75%	75%	75%	75%
Total Third Notice	100%	100%	100%	100%	100%

The figure also summarizes the collection rates by collection method for Class 1 vehicles in 2015. In total, the revenue from approximately 93 percent of Class 1 vehicle transactions in 2015 is estimated to be collected with another 3 percent to be collected through the violation enforcement process.

Toll Collection Enforcement – The NCTA has developed an enforcement plan based on state legislation.

- **Payment Procedures and Processing Fees** – If a customer uses the Monroe Connector/Bypass, the Authority will send an invoice after the fifteenth day to the registered owner of the motor vehicle for the amount of any unpaid tolls that occurred between the time of the first

toll and the fifteenth day. A person who receives an invoice for an unpaid toll(s) must either pay the invoice or request a review of the invoice by the Authority. If the person invoiced does not take one of such actions within 30 days from the date of the invoice, the Authority will add a $6 processing fee to the toll amount the person owes with a maximum of $48 in processing fees allowed against that person within a twelve-month period;

- **Civil Penalties –** A person who receives one or more invoices for unpaid tolls during a six-month period and who does not pay the amount on these invoices within 30 days from the date of the invoice is subject to a civil penalty of $25. Only one civil penalty may be assessed for a six-month period. The NCTA can retain only the actual costs of collecting the penalty not to exceed 20 percent of the amount collected. The remaining portion of the penalty, by law, will be deposited to the State's Civil Penalty and Forfeiture Fund;
- **Registration Block –** The failure of a person to pay a toll invoiced to the person, including any processing fee and any civil penalty, is grounds to withhold the North Carolina registration renewal of a motor vehicle registered in that person's name. When the Authority notifies the North Carolina Department of Motor Vehicles of a person who owes a toll, processing fee or civil penalty, the North Carolina Commissioner of Motor Vehicles must withhold the registration renewal of any motor vehicle registered in that person's name until the required payment is made. A person whose motor vehicle registration renewal is blocked must pay the Authority the amount owed for unpaid tolls, processing fees, and civil penalties due before their vehicle registration can be renewed;
- **Collection Agencies –** The Authority may submit unpaid tolls, fees and civil penalties for out-of-state patrons to a collection agency; and
- **Review and Disputes –** If a person receiving an invoice asks for a review of the invoice for use of the Monroe Connector/Bypass, then the Authority is to conduct an informal review and determine whether the person is liable for the toll. If the Authority determines that the person is liable for the toll, the person may contest this determination by filing a petition for a contested case hearing at the North Carolina Office of Administrative Hearings.

Transponder Sales - The NCTA has decided to sell transponders for the electronic toll collection. The NCTA used the estimated gross ETC transactions and its business polices to estimate the total number of transponders sold to customers. Estimates of the transponder sales revenue are provided in the appendix.

Estimated Collected Revenue – Table 6-13 summarizes the total annual collected toll revenue, administrative fees, civil penalties, and transponders sales. The percent of collected toll revenue ranges from 91.2 percent in the opening year to 95.1 percent in the later years. When the fee, penalty, and transponder sales revenue is included, the total revenue collected is slightly higher. Figure 6-6 presented earlier also illustrates the toll revenue collected in comparison to the gross toll revenue.

Table 6-13
Annual Toll Transactions and Collected Revenue Forecasts
Monroe Connector/Bypass
(Thousands)

Fiscal Year	Total Gross Transactions	Gross Toll Revenue	Collected Toll Revenue [1]	Collected Toll Revenue Percent of Gross Toll Revenue	Administrative Fees and Civil Penalty Revenue [2]	Transponder Sales Revenue [3]	Total Revenue Collected [4]	Collected Toll Revenue Percent of Total Revenue Collected	Uncollectible Toll Revenue [5]	Pending Toll Revenue for Unpaid Violations to be Settled [6]	Total Uncollected Revenue	Percent Uncollected
2015 [7]	11,492	$7,255	$6,615	91.2%	$42	$263	$6,920	95.6%	$378	$262	$640	8.8%
2016	30,517	19,502	17,817	91.4%	101	232	18,150	98.2%	994	691	1,685	8.6%
2017	38,298	25,073	22,982	91.7%	112	238	23,332	98.5%	1,239	852	2,091	8.3%
2018	43,775	29,382	27,020	92.0%	113	222	27,355	98.8%	1,400	962	2,362	8.0%
2019	45,419	31,186	28,765	92.2%	103	170	29,038	99.1%	1,439	982	2,421	7.8%
2020	46,563	32,848	30,382	92.5%	91	169	30,642	99.2%	1,467	999	2,466	7.5%
2021	47,672	34,763	32,258	92.8%	79	173	32,510	99.2%	1,493	1,012	2,505	7.2%
2022	48,754	36,681	34,154	93.1%	67	177	34,398	99.3%	1,511	1,016	2,527	6.9%
2023	49,905	38,627	36,080	93.4%	64	184	36,328	99.3%	1,526	1,021	2,547	6.6%
2024	51,126	40,685	38,122	93.7%	62	192	38,376	99.3%	1,539	1,024	2,563	6.3%
2025	52,418	42,942	40,429	94.1%	61	200	40,690	99.4%	1,474	1,039	2,513	5.9%
2026	53,742	45,359	42,800	94.4%	60	178	43,038	99.4%	1,505	1,054	2,559	5.6%
2027	55,082	47,840	45,216	94.5%	59	153	45,428	99.5%	1,544	1,080	2,624	5.5%
2028	56,472	50,397	47,711	94.7%	58	159	47,928	99.5%	1,588	1,098	2,686	5.3%
2029	57,912	53,148	50,390	94.8%	58	164	50,612	99.6%	1,631	1,127	2,758	5.2%
2030	59,405	56,099	53,264	94.9%	57	170	53,491	99.6%	1,681	1,154	2,835	5.1%
2031	60,861	59,083	56,137	95.0%	58	167	56,362	99.6%	1,749	1,197	2,946	5.0%
2032	62,272	62,003	58,907	95.0%	59	163	59,129	99.6%	1,837	1,259	3,096	5.0%
2033	63,719	64,909	61,659	95.0%	61	167	61,887	99.6%	1,928	1,322	3,250	5.0%
2034	65,203	68,056	64,643	95.0%	62	171	64,876	99.6%	2,024	1,389	3,413	5.0%
2035	66,729	71,545	68,051	95.1%	64	175	68,290	99.7%	2,017	1,477	3,494	4.9%
2036	68,175	75,025	71,358	95.1%	66	176	71,600	99.7%	2,116	1,551	3,667	4.9%
2037	69,540	78,402	74,570	95.1%	67	176	74,813	99.7%	2,212	1,620	3,832	4.9%
2038	70,929	81,929	77,925	95.1%	68	179	78,172	99.7%	2,310	1,694	4,004	4.9%
2039	72,348	85,617	81,431	95.1%	70	183	81,684	99.7%	2,417	1,769	4,186	4.9%
2040	73,796	89,470	85,096	95.1%	71	187	85,354	99.7%	2,525	1,849	4,374	4.9%
2041	75,086	93,265	88,708	95.1%	72	184	88,964	99.7%	2,630	1,927	4,557	4.9%
2042	76,211	96,998	92,256	95.1%	73	180	92,509	99.7%	2,736	2,006	4,742	4.9%
2043	77,354	100,877	95,946	95.1%	75	183	96,204	99.7%	2,845	2,086	4,931	4.9%
2044	78,514	104,911	99,783	95.1%	76	186	100,045	99.7%	2,959	2,169	5,128	4.9%
2045	79,692	109,109	103,775	95.1%	77	189	104,041	99.7%	3,078	2,256	5,334	4.9%
2046	80,687	113,196	107,661	95.1%	78	188	107,927	99.8%	3,195	2,340	5,535	4.9%
2047	81,494	117,155	111,431	95.1%	79	187	111,697	99.8%	3,304	2,420	5,724	4.9%
2048	82,310	121,258	115,333	95.1%	79	189	115,601	99.8%	3,420	2,505	5,925	4.9%
2049	83,131	125,501	119,367	95.1%	80	191	119,638	99.8%	3,540	2,594	6,134	4.9%
2050	83,962	129,892	123,545	95.1%	81	193	123,819	99.8%	3,663	2,684	6,347	4.9%
2051	84,802	134,439	127,868	95.1%	82	194	128,144	99.8%	3,792	2,779	6,571	4.9%
2052	85,650	139,145	132,344	95.1%	83	196	132,623	99.8%	3,925	2,876	6,801	4.9%
2053	86,506	144,016	136,975	95.1%	83	198	137,256	99.8%	4,064	2,977	7,041	4.9%
2054	87,372	149,054	141,770	95.1%	84	200	142,054	99.8%	4,205	3,079	7,284	4.9%
2055	88,245	154,273	146,732	95.1%	85	202	147,019	99.8%	4,352	3,189	7,541	4.9%

[1] Transponder revenue collected at time of transaction. Video revenue collected after up to three notices.
[2] Adminstrative fees and civil penalties and fees collected in connection with second and third notices for video transactions.
[3] Sales of transponders for electronic toll collection.
[4] Total toll revenue collected plus any administrative fees, civil penalty revenue, and transponder sales received.
[5] Revenue not collectible due to system failure, bad accounts, unreadable license plates, or unbillable transactions.
[6] Revenue not collected after three notices have been sent.
[7] FY 2015, January - June only.

Note: All collected revenue, administrative fees, civil penalties, and transponder sales estimated based on NCTA business rules and estimated collection rates. Forecasts for FY 2015 - 2018 reflect an assumed ramp-up to full traffic volumes beginning in the second half of FY 2018.

DISCLAIMER

Current accepted professional practices and procedures were used in the development of these traffic and revenue forecasts. However, as with any forecast of the future, it should be understood that there may be differences between forecasted and actual results caused by events and circumstances beyond the control of the forecasters. In formulating its forecasts, WSA has reasonably relied upon the accuracy and completeness of information provided (both written and oral) by North Carolina Turnpike Authority and other local and state agencies. WSA also has relied upon the reasonable assurances of some independent parties and are not aware of any facts that would make such information misleading.

WSA has made qualitative judgments related to several key variables in the development and analysis of the traffic and revenue forecasts that must be considered as a whole; therefore selecting portions of any individual result without consideration of the intent of the whole may create a misleading or incomplete view of the results and the underling methodologies used to obtain the results. WSA gives no opinion as to the value or merit to partial information extracted from this report.

All estimates and projections reported herein are based on WSA's experience and judgment and on a review of information obtained from multiple state and local agencies, including North Carolina Turnpike Authority, by an independent third party. These estimates and projections may not be indicative of actual or future values, and are therefore subject to substantial uncertainty. Future developments cannot be predicted with certainty, and may affect the estimates or projections expressed in this report, such that WSA does not specifically guarantee or warrant any estimate or projections contained within this report.

While WSA believes that some of the projections or other forward-looking statements contained within the report are based on reasonable assumptions as of the date in the report, such forward looking statements involve risks and uncertainties that may cause actual results to differ materially from the results predicted. Therefore, following the date of this report, WSA will take no responsibility or assume any obligation to advise of changes that may affect its assumptions contained within the report, as they pertain to socioeconomic and demographic forecasts, proposed residential or commercial land use development projects and/or potential improvements to the regional transportation network.

CHAPTER 7
SENSITIVITY TESTS

A series of tests were conducted to provide a measure of the sensitivity of annual transactions and revenue to changes in key study assumptions. The sensitivity tests were conducted for FY 2015, FY 2020, and FY 2030. The results of the sensitivity tests are presented in Table 7-1 and illustrated in Figure 7-1. The sensitivity tests included the following assumptions:

- **MPO Socioeconomic Forecasts** – The updated socioeconomic forecasts from MUMPO form the basis for future travel demand instead of the forecasts from the independent economist;
- **Revised Long Term Economic Growth** – The base trip table rate of growth increases and decreases plus or minus 30 percent from the baseline growth rate;
- **Value of Time (VOT)** – 20 percent increases and decreases in base VOT's;
- **Electronic Toll Collection (ETC) Participation** – Higher and lower participation rates of ETC have a correspondingly lower and higher rate of video tolling; and
- **Higher Motor Fuel Prices** – 5 percent reduction in regional travel demand.

MPO SOCIOECONOMIC FORECASTS

The base case traffic and revenue forecasts for this study were estimated using the socioeconomic forecasts that were prepared by the independent economist rather than those prepared by MUMPO. The MPO's socioeconomic forecasts for the Metrolina region were somewhat higher than those developed by the independent economist as discussed in more detail in Chapter 4. For this sensitivity test, the travel demand model used the MPO socioeconomic forecast in the trip generation step of the model. This resulted in gross toll revenues that were nearly unchanged for FY 2015, 1.6 percent higher for FY 2020, and 5.5 percent higher in FY 2030

Table 7-1
Annual Toll Transactions and Gross Revenue Forecasts
Sensitivity Tests
Monroe Connector/Bypass
(Thousands)

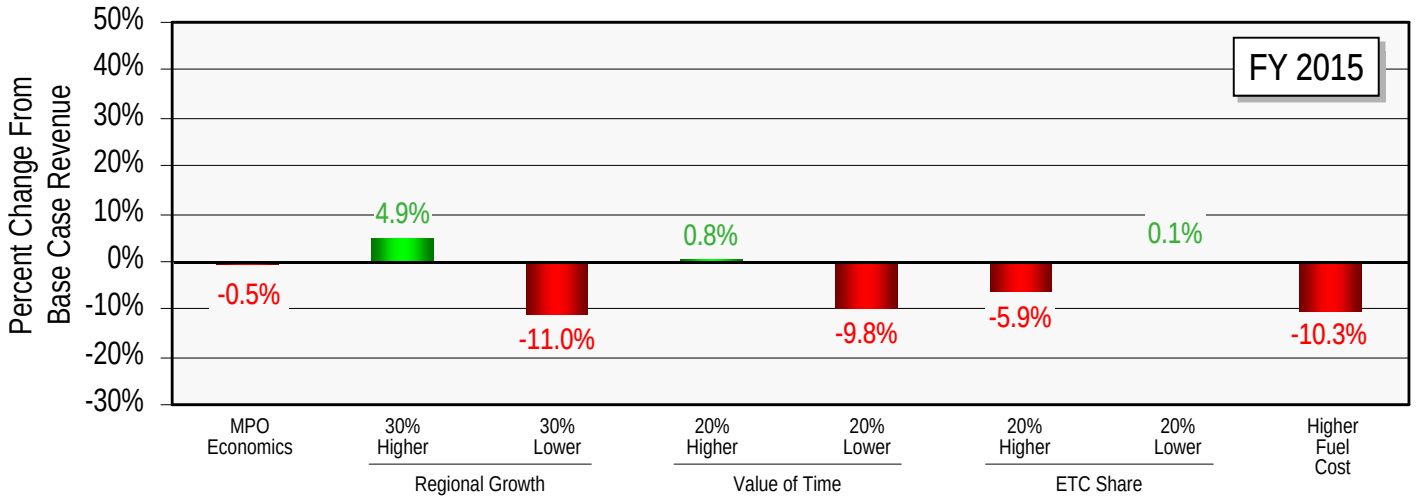
	Fiscal Year 2015 [1]					
			Difference from Base Case		Percent Difference from Base Case	
Test	Transactions	Gross Revenue	Transactions	Gross Revenue	Transactions	Gross Revenue
Base Case	**11,492**	**$7,255**				
Sensitivity Test						
MPO Economic Forecast	12,212	7,219	720	-$36	6.3%	-0.5%
30 Percent Higher Traffic Growth	12,158	7,610	666	355	5.8%	4.9%
30 Percent Lower Traffic Growth	10,228	6,454	-1,264	-801	-11.0%	-11.0%
20 Percent Higher Value of Time	11,580	7,310	88	55	0.8%	0.8%
20 Percent Lower Value of Time	10,474	6,545	-1,018	-710	-8.9%	-9.8%
20 Percent Higher ETC Share	11,211	6,827	-281	-428	-2.4%	-5.9%
20 Percent Lower ETC Share	10,720	7,262	-772	7	-6.7%	0.1%
Higher Fuel Costs, 5 Percent Traffic Reduction	10,370	6,510	-1,122	-745	-9.8%	-10.3%

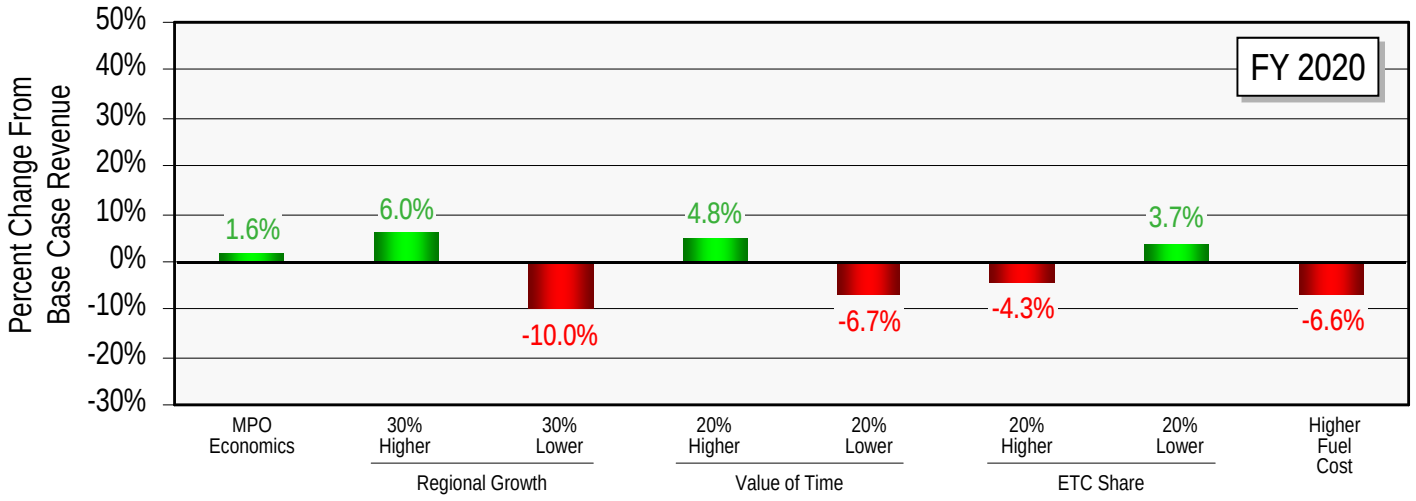
	Fiscal Year 2020					
			Difference from Base Case		Percent Difference from Base Case	
Test	Transactions	Gross Revenue	Transactions	Gross Revenue	Transactions	Gross Revenue
Base Case	**46,563**	**$32,848**				
Sensitivity Test						
MPO Economic Forecast	50,823	33,389	4,260	$541	9.1%	1.6%
30 Percent Higher Traffic Growth	49,496	34,817	2,933	1,969	6.3%	6.0%
30 Percent Lower Traffic Growth	41,798	29,547	-4,765	-3,301	-10.2%	-10.0%
20 Percent Higher Value of Time	48,638	34,437	2,075	1,589	4.5%	4.8%
20 Percent Lower Value of Time	43,769	30,653	-2,794	-2,195	-6.0%	-6.7%
20 Percent Higher ETC Share	47,601	31,438	1,038	-1,410	2.2%	-4.3%
20 Percent Lower ETC Share	45,961	34,077	-602	1,229	-1.3%	3.7%
Higher Fuel Costs, 5 Percent Traffic Reduction	43,554	30,672	-3,009	-2,176	-6.5%	-6.6%

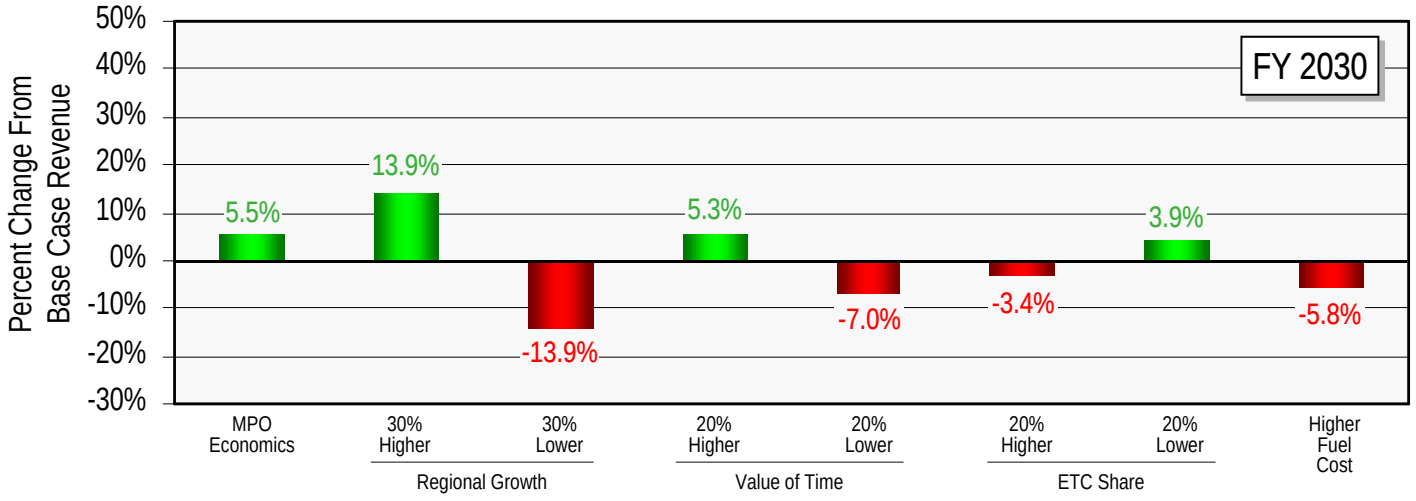
	Fiscal Year 2030					
			Difference from Base Case		Percent Difference from Base Case	
Test	Transactions	Gross Revenue	Transactions	Gross Revenue	Transactions	Gross Revenue
Base Case	**59,405**	**$56,099**				
Sensitivity Test						
MPO Economic Forecast	66,700	59,162	7,295	3,063	12.3%	5.5%
30 Percent Higher Traffic Growth	67,955	63,923	8,550	7,824	14.4%	13.9%
30 Percent Lower Traffic Growth	50,977	48,312	-8,428	-7,787	-14.2%	-13.9%
20 Percent Higher Value of Time	62,247	59,050	2,842	2,951	4.8%	5.3%
20 Percent Lower Value of Time	55,531	52,195	-3,874	-3,904	-6.5%	-7.0%
20 Percent Higher ETC Share	60,778	54,188	1,373	-1,911	2.3%	-3.4%
20 Percent Lower ETC Share	57,699	58,307	-1,706	2,208	-2.9%	3.9%
Higher Fuel Costs, 5 Percent Traffic Reduction	55,908	52,848	-3,497	-3,251	-5.9%	-5.8%

[1] FY 2015, January - June only

Note: Forecasts for FY 2015 - 2018 reflect an assumed ramp-up to full traffic volumes beginning in the second half of FY 2018.







NORTH CAROLINA Turnpike Authority

REVENUE SENSITIVITY TESTS
FY 2015, 2020, 2030

FIGURE 7-1

as compared to estimated revenue for the base case. In the early years, the two sets of socioeconomic forecasts are similar. However, the forecasts diverge in the later years, and the differences are correspondingly larger between the base case and the MPO forecast sensitivity test.

LOWER OR HIGHER LONG TERM TRAFFIC GROWTH

Increases and decreases in the long term regional traffic growth rates were tested to examine the effects of such delays or accelerations on annual transactions and revenues. This was emulated by adjusting the rate of trip growth in the trip tables by plus or minus 30 percent from the base case forecast.

INCREASED GROWTH

This test assumed that the total traffic growth rate in the base-year trip tables would increase by 30 percent. For example, a 4.0 percent annual growth rate for a specific movement in the base case was increased to 5.2 percent annual growth in the sensitivity test. Under this higher growth rate test, the gross toll revenue increased by approximately 5 percent in FY 2015 and over 14 percent by FY 2030.

DECREASED GROWTH

Conversely, the lower traffic growth sensitivity test assumed a 30 percent decrease for each movement in the trip tables. As indicated in Table 7-1, the reduction in gross toll revenue is 11 percent in FY 2015 and about 14 percent in FY 2030.

Based on this analysis of higher and lower traffic growth rates, it appears that the gross revenue is more sensitive to lower traffic growth than higher traffic growth in the early years and about the same in the later years.

VALUE-OF-TIME

Individual value-of-time (VOT) is a critical parameter in the toll diversion model because a driver's decision to use a toll road is heavily influenced by the travel time saved by using a toll road relative to the toll charged. Values-of-time for individual movements are based on the stated preference (SP) survey results, the estimates of median household income and the annual hours worked by traffic analysis zone (TAZ). In these two sensitivity tests, the base case value-of-time for each movement was increased and decreased by 20 percent.

HIGHER VALUE OF TIME

Higher values-of-time would favor the Monroe Connector/Bypass because more drivers would be willing to pay a toll to save travel time in comparison to the base case. This test increased the median VOT for all trip purposes in the traffic assignment process by 20 percent. Under this scenario, as presented in Table 7-1, the total annual gross revenue increased by less than 1 percent in FY 2015 and approximately 5 percent in FY 2020 and FY 2030.

LOWER VALUE-OF-TIME

Lowering the base case value-of-time by 20 percent had the opposite effect on the Monroe Connector/Bypass because fewer people would be willing to pay a toll to save travel time. The reduction in gross toll revenue in comparison to the base case is estimated at nearly 10 percent in the opening year and approximately 7 percent in the later years.

Thus the forecast model is slightly more sensitive to lower values-of-time than to higher values-of-time.

ELECTRONIC TOLL COLLECTION PARTICIPATION

The base-case assumptions for ETC participation are that participation rates would increase as drivers become more familiar with the lower costs and convenience of ETC. Conversely the use of video tolling (VTC) would decrease over the years as ETC increases.

Two sensitivity tests were conducted. The first test assumed higher levels of initial ETC participation and the second test assumed lower levels of ETC participation. Table 7-2 shows the percentages of ETC and VTC participation for the base case and for the two sensitivity tests.

HIGHER ETC PARTICIPATION

This test assumes that FY 2015 base case ETC participation would increase from 65 to 78 percent for Class 1 vehicles and from 85 to 96 percent for Class 2 and 3 vehicles. The toll diversion model indicates that this increase would have a negative impact on gross toll revenues. The FY 2015 revenue is estimated to be 6 percent less than the base-case revenue. By FY 2020, the impact would be reduced to 4 percent, and by FY 2030 the revenue would decrease by 3 percent compared to the base case. With higher ETC participation, the percentage of video tolling customers would decrease.

Table 7-2
Toll Collection Percentages of Total Transactions -
ETC Participation Sensitivity Tests
Monroe Connector/Bypass

Base Case

Fiscal Year	Model Input Assumptions - Class 1		Model Input Assumptions - Class 2/3	
	ETC	VTC	ETC	VTC
2015	65%	35%	85%	15%
2020	75%	25%	89%	11%
2030	84%	16%	89%	11%

Higher ETC Participation

Fiscal Year	Model Input Assumptions - Class 1		Model Input Assumptions - Class 2/3	
	ETC	VTC	ETC	VTC
2015	78%	22%	96%	4%
2020	92%	8%	99%	1%
2030	99%	1%	99%	1%

Lower ETC Participation

Fiscal Year	Model Input Assumptions - Class 1		Model Input Assumptions - Class 2/3	
	ETC	VTC	ETC	VTC
2015	52%	48%	64%	36%
2020	62%	38%	71%	29%
2030	67%	33%	71%	29%

REDUCED ETC PARTICIPATION

An assumed reduction in ETC participation is estimated to have a slightly positive effect on gross toll revenues because of the price differential of the payment types.

Although these two sensitivity tests indicate that changes in the share of ETC participation have some impact on gross toll revenue, this analysis did not include any allowances for revenue losses due to uncollectible video tolling charges. Under the lower ETC share sensitivity test, more video tolling would occur, which means that more revenue would be lost due to leakage than with the base case. Toll revenue estimates displayed in Table 7-1 reflect gross estimates.

INCREASED FUEL COST

This sensitivity test was based on the assumption that significantly higher fuel prices would result in fewer vehicles traveling in the region. Therefore, in order to reflect gas price increases in the range of 65 percent, the FY 2015, FY 2020, and FY 2030 base trip tables were reduced by 5 percent. This reduction was based on observed elasticities of the reduction in regional vehicle miles of travel and fuel prices during the 2008 surge in fuel prices. Under this hypothetical scenario, total annual revenues were reduced by approximately 10 percent in the opening year and by lesser amounts (6 percent to 7 percent) in the later years.

APPENDIX

Transponder and Pending Revenue

HNTB Corporation
Engineers Architects Planners

343 E. Six Forks Road
Suite 200
Raleigh, NC 27609

Telephone (919) 546-8997
Facsimile (919) 546-9421
www.hntb.com

Memorandum

Date August 9, 2010

To James Eden, NCTA
Grady Rankin, NCTA

From Jeff O'Neill

Subject Transponder and Pending Revenue

The following provides documentation of a collaborative effort by the NCTA in conjunction with its consultants, Wilbur Smith Associates (WSA) and HNTB to develop estimates of transponder sales and fee revenue as well as video tolls to be settled associated with the video tolling process for the agency.

As part of their most recent updates to the traffic and revenue forecasts (dated August 9, 2010), WSA provided estimates of the total number of gross transactions, total electronic toll transactions (ETC) and total transactions that would be included as part of the video toll noticing process. WSA assumed the initial amount to be collected through our invoicing process and business rules in their revenue estimates and from this set, the notices not paid were labeled "pending". This was where the calculation of revenue by WSA was concluded. WSA recommended that the NCTA use the "pending" transaction volumes along with NCTA's operations plan and the applicable enforcement legislation to estimate what amount of the "pending" transactions would be projected to be realized as revenue and what amount would be considered "unpaid video tolls to be settled". In addition, NCTA used the total number of ETC transactions with their business policies to estimate the total number of transponders sold to customers.

The following inputs and factors were assumed in calculating the "transponder sales revenue", "pending revenue" and "unpaid video tolls to be settled" amounts:

- Average toll rates for "pending" transactions (WSA T&R)
- Anticipated "pending" notice and transaction volumes (HNTB O&M model)
- Fees and penalty amounts anticipated for paid "pending" transactions (NCTA and HNTB)
- Adjustments to fees based on limitations of maximum amounts (NCTA and HNTB)
- Leakage rates for each invoice escalation type (NCTA)
- Transponder volumes sold to customers (NCTA and HNTB)
- A weighted average transponder price based on actual costs for each transponder type (NCTA and HNTB)
- Per legislation, fees and penalty amounts were not escalated over time

The table on the last page provides the summary of projected values. Please note that "Total Pending Video Toll Revenue" amounts do not include other types of uncollected transactions such as unreadable license plate images, unable to obtain DMV information or undeliverable mail which might also be considered as part of the overall "uncollected revenue". Furthermore, these estimates

only represent planning level documentation by the overall team (NCTA, WSA, and HNTB) and therefore should not be considered a formal portion by HNTB of the overall revenue projection. We recommend that the NCTA take these estimates into consideration with their own internal estimates of revenue and uncollected revenue as part of the development of any financing plans.

Video, Fee and Transponder Revenue Summary					
Values in $000's					
	Toll Only				
	Total Pending Video Toll Revenue	Video Toll Revenue Collected	Outstanding Video Toll Revenue to be Settled	Fee and Penalty Revenue	Transponder Sales Revenue
2015	$ 1,936	$ 1,674	$ 261	$ 42	$ 263
2016	$ 5,101	$ 4,413	$ 689	$ 101	$ 232
2017	$ 6,314	$ 5,461	$ 852	$ 112	$ 238
2018	$ 7,119	$ 6,158	$ 961	$ 113	$ 222
2019	$ 7,286	$ 6,302	$ 984	$ 103	$ 170
2020	$ 7,401	$ 6,402	$ 999	$ 91	$ 169
2021	$ 7,496	$ 6,484	$ 1,012	$ 79	$ 173
2022	$ 7,534	$ 6,517	$ 1,017	$ 67	$ 177
2023	$ 7,563	$ 6,542	$ 1,021	$ 64	$ 184
2024	$ 7,584	$ 6,560	$ 1,024	$ 62	$ 192
2025	$ 7,694	$ 6,655	$ 1,039	$ 61	$ 200
2026	$ 7,803	$ 6,749	$ 1,053	$ 60	$ 178
2027	$ 7,978	$ 6,901	$ 1,077	$ 59	$ 153
2028	$ 8,155	$ 7,054	$ 1,101	$ 58	$ 159
2029	$ 8,341	$ 7,215	$ 1,126	$ 58	$ 164
2030	$ 8,541	$ 7,388	$ 1,153	$ 57	$ 170
2031	$ 8,874	$ 7,676	$ 1,198	$ 58	$ 167
2032	$ 9,329	$ 8,070	$ 1,259	$ 59	$ 163
2033	$ 9,791	$ 8,470	$ 1,322	$ 61	$ 167
2034	$ 10,281	$ 8,893	$ 1,388	$ 62	$ 171
2035	$ 10,937	$ 9,460	$ 1,476	$ 64	$ 175
2036	$ 11,485	$ 9,935	$ 1,550	$ 66	$ 176
2037	$ 12,002	$ 10,382	$ 1,620	$ 67	$ 176
2038	$ 12,543	$ 10,849	$ 1,693	$ 68	$ 179
2039	$ 13,107	$ 11,337	$ 1,769	$ 70	$ 183
2040	$ 13,697	$ 11,848	$ 1,849	$ 71	$ 187
2041	$ 14,278	$ 12,350	$ 1,927	$ 72	$ 184
2042	$ 14,850	$ 12,845	$ 2,005	$ 73	$ 180
2043	$ 15,443	$ 13,358	$ 2,085	$ 75	$ 183
2044	$ 16,060	$ 13,892	$ 2,168	$ 76	$ 186
2045	$ 16,703	$ 14,448	$ 2,255	$ 77	$ 189
2046	$ 17,328	$ 14,989	$ 2,339	$ 78	$ 188
2047	$ 17,934	$ 15,513	$ 2,421	$ 79	$ 187
2048	$ 18,563	$ 16,057	$ 2,506	$ 79	$ 189
2049	$ 19,213	$ 16,619	$ 2,594	$ 80	$ 191
2050	$ 19,884	$ 17,200	$ 2,684	$ 81	$ 193
2051	$ 20,580	$ 17,802	$ 2,778	$ 82	$ 194
2052	$ 21,301	$ 18,425	$ 2,876	$ 83	$ 196
2053	$ 22,047	$ 19,070	$ 2,976	$ 83	$ 198
2054	$ 22,817	$ 19,737	$ 3,080	$ 84	$ 200
2055	$ 23,617	$ 20,428	$ 3,188	$ 85	$ 202