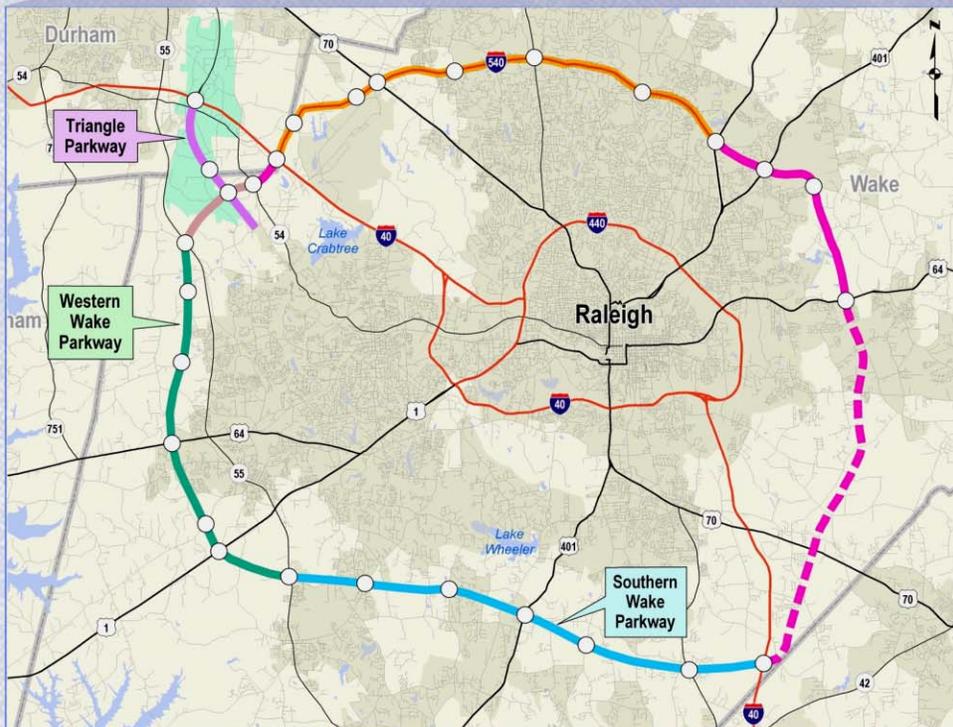
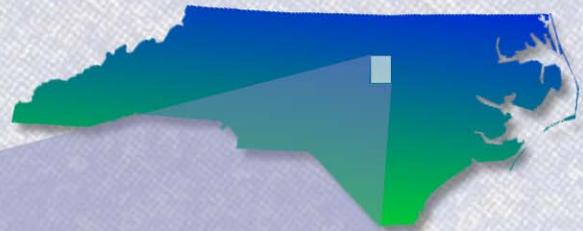


Proposed Western and Southern Wake Parkways

Preliminary Traffic and Revenue Study

Final Report



Proposed Western and Southern Wake Parkways

Preliminary Traffic and Revenue Study

Final Report

Prepared For



Prepared By



June 16, 2006



900 Chapel St., Suite 1400
New Haven, CT 06510-2802
(203) 865-2191
(203) 624-0484 fax
www.wilbursmith.com

June 16, 2006

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

Re: **Preliminary Traffic and Revenue Study – Proposed Western and Southern Wake Parkways**

Dear Mr. Joyner:

Wilbur Smith Associates (WSA) is most pleased to submit this report summarizing the results of our preliminary traffic and revenue study for the proposed Western and Southern Parkway projects in Wake County, North Carolina. The proposed Parkways were evaluated both individually and in combination with the proposed Triangle Parkway project, for which a similar study was completed by WSA earlier this year.

The proposed Western and Southern Wake Parkways would involve construction of portions of the I-540 beltway around Raleigh. The earliest action section, Western Wake Parkway, was assumed to be opened to traffic by 2011. The study also included a look at the proposed Southern Wake Parkway, although this portion of the project would be constructed at some point in the future following completion of the environmental studies.

Four scenarios were analyzed in the study, including two scenarios which would combine Western Wake Parkway with Triangle Parkway. The possibility of implementing additional tolls on a portion of I-540 now under construction is considered in one of the scenarios.

Please note that this study was conducted at a preliminary level of detail and is not sufficient to be used in support of actual project financing. The study was based on readily available information and travel demand models provided by the MPOs; its findings would be subject to some refinement in more detailed, comprehensive traffic and revenue studies needed before financing.

Our project manager, David Danforth, and other key members of the project team including Will Letchworth, Jannine Miller and Amit Thomas gratefully acknowledge the assistance provided by NCTA staff, CAMPO, DCHC, and others contacted during the course of the study. We have appreciated this opportunity to be of service to the Authority.

Very truly yours,

WILBUR SMITH ASSOCIATES

Edward J. Regan, III
Senior Vice President

Albany NY, Anaheim CA, Atlanta GA, Austin TX, Baltimore MD, Bangkok Thailand, Binghamton NY, Burlington VT, Charleston SC, Charleston WV, Chicago IL, Cincinnati OH, Cleveland OH, Columbia SC, Columbus OH, Dallas TX, Dubai UAE, Falls Church VA, Greenville SC, Harrisburg PA, Hong Kong, Hot Springs AR, Houston TX, Iselin NJ, Jacksonville FL, Kansas City MO, Kenmore WA, Knoxville TN, Lansing MI, Lexington KY, Lisle IL, London UK, Milwaukee WI, Mumbai India, Myrtle Beach SC, Nashville TN, New Haven CT, Orlando FL, Philadelphia PA, Pittsburgh PA, Portland ME, Poughkeepsie NY, Raleigh NC, Richmond VA, Riyadh Saudi Arabia, Salt Lake City UT, San Diego CA, San Francisco CA, St. Paul MN, Savannah GA, Tallahassee FL, Tampa FL, Tempe AZ, Trenton NJ, Washington DC

Employee-Owned Company

TABLE OF CONTENTS

	<u>PAGE NUMBER</u>
Chapter 1 – Introduction	1-1
Project Description	1-1
Scenario 1	1-3
Scenarios 1A and 1B Configurations	1-5
Scenario 2 Configuration	1-6
Scope of Work	1-6
Traffic Model Refinement	1-7
Corridor Growth Analysis	1-8
Traffic and Revenue Analysis	1-8
Report Structure	1-9
Chapter 2 – Existing Traffic Conditions	2-1
Existing Highway System	2-2
Western Wake Parkway Corridor	2-2
Southern Wake Parkway	2-3
Traffic Levels	2-3
Daily Traffic	2-4
Supplemental Traffic Counts	2-4
Speed and Delay Analysis	2-5
Chapter 3 – Corridor Growth Review	3-1
Growth Projections	3-1
Population Forecasts	3-2
Employment Forecasts	3-4
Number of Households	3-4
Research Triangle Park	3-7
Raleigh-Durham International Airport	3-7
Household Income	3-8
Adjustments to Triangle Regional Model	3-9
Socioeconomic Conclusions	3-9
Chapter 4 – Traffic and Revenue Analysis	4-1
Traffic Model Development and Refinement	4-1
Basic Assumptions	4-2
Roadway Improvements	4-4

(continued)

TABLE OF CONTENTS (CONT'D)

	<u>PAGE NUMBER</u>
Toll Scenarios	4-8
Toll Sensitivity	4-10
Toll Systems and Rates	4-10
Estimated Weekday Traffic Volumes	4-14
Estimated Traffic and Revenue	4-14
Conclusions	4-21
Disclaimer	4-23

ILLUSTRATIONS

<u>FIGURE</u>	<u>FOLLOWS PAGE</u>
1-1 Project Location Map	1-1
1-2 Scenario 1 Configuration	1-3
1-3 Scenarios 1A and 1B Configurations	1-4
1-4 Scenario 2 Configuration	1-6
2-1 Annual Average Daily Counts at Selected Study Area Locations	2-4
2-2 Location of Supplemental Traffic Counts	2-4
3-1 Study Area Population and Employment Projections	3-1
3-2 Population Growth by Corridor Sector	3-3
3-3 Employment Growth by Corridor Sector	3-5
4-1 Toll System Configurations Western Wake Parkway	4-8
4-2 Toll System Configuration Western and Southern Wake Parkways – Scenario 2	4-8
4-3 Scenario 1 – Estimated 2011 and 2015 Mainline Plaza Toll Sensitivity Curves	4-10
4-4 Scenario 2 – Estimated 2015 Mainline Plaza Toll Sensitivity Curves	4-10
4-5 Comparison of Toll Rate Assumptions – Scenarios 1, 1A and 1B	4-13
4-6 Assumed Passenger Car Toll Rates – Scenarios 1 and 2	4-13
4-7 Estimated Weekday Traffic Western Wake Parkway	4-14
4-8 Estimated 2015 Weekday Traffic Volumes Western and Southern Wake Parkways	4-14
4-9 Estimated 2030 Weekday Traffic Volumes Western and Southern Wake Parkways	4-14
4-10 Annual Transaction Forecasts Base Case Vs. Maximum Revenue Case	4-18
4-11 Annual Gross Revenue Forecasts Base Case Vs. Maximum Revenue Case	4-19
4-12 Incremental Contribution of Annual Toll Revenue by Scenario, Western Wake Parkway	4-19

TABULATIONS

<u>TABLE</u>		<u>PAGE</u>
2-1	Average Speeds on Selected Routes During Peak Periods	2-6
3-1	Study Area Population Projections	3-3
3-2	Study Area Employment Projections	3-5
3-3	Study Area Household Projections	3-6
3-4	Study Area Household Income	3-8
4-1	Major Highway Improvements in the TRM	4-5
4-2	Comparison of Per-Mile Rates for Selected Urban Toll Roads	4-11
4-3	Comparison of Toll Rates at Mainline Plazas	4-13
4-4	Annual Toll Transactions and Gross Revenue Forecasts at Base Toll Rates	4-17
4-5	Annual Toll Transactions and Gross Revenue Forecasts at Maximum Revenue Potential	4-18
4-6	Annual Net Toll Revenue Forecasts	4-22

CHAPTER 1

INTRODUCTION

The proposed Western and Southern Wake Parkway in the Raleigh-Durham area is one of several potential toll facility projects now under consideration by the North Carolina Turnpike Authority (NCTA). The primary objective of the study was to determine on a preliminary basis the potential toll revenue that could be expected on the facility.

The study was conducted at a preliminary feasibility study level, commonly referred to as a “level 2” traffic and revenue analysis. This level of analysis is intended to provide preliminary estimates of traffic, revenue and toll rate sensitivity. This level of study is not intended for use in direct support of project financing. A more detailed, comprehensive traffic and revenue study would be required for that purpose.

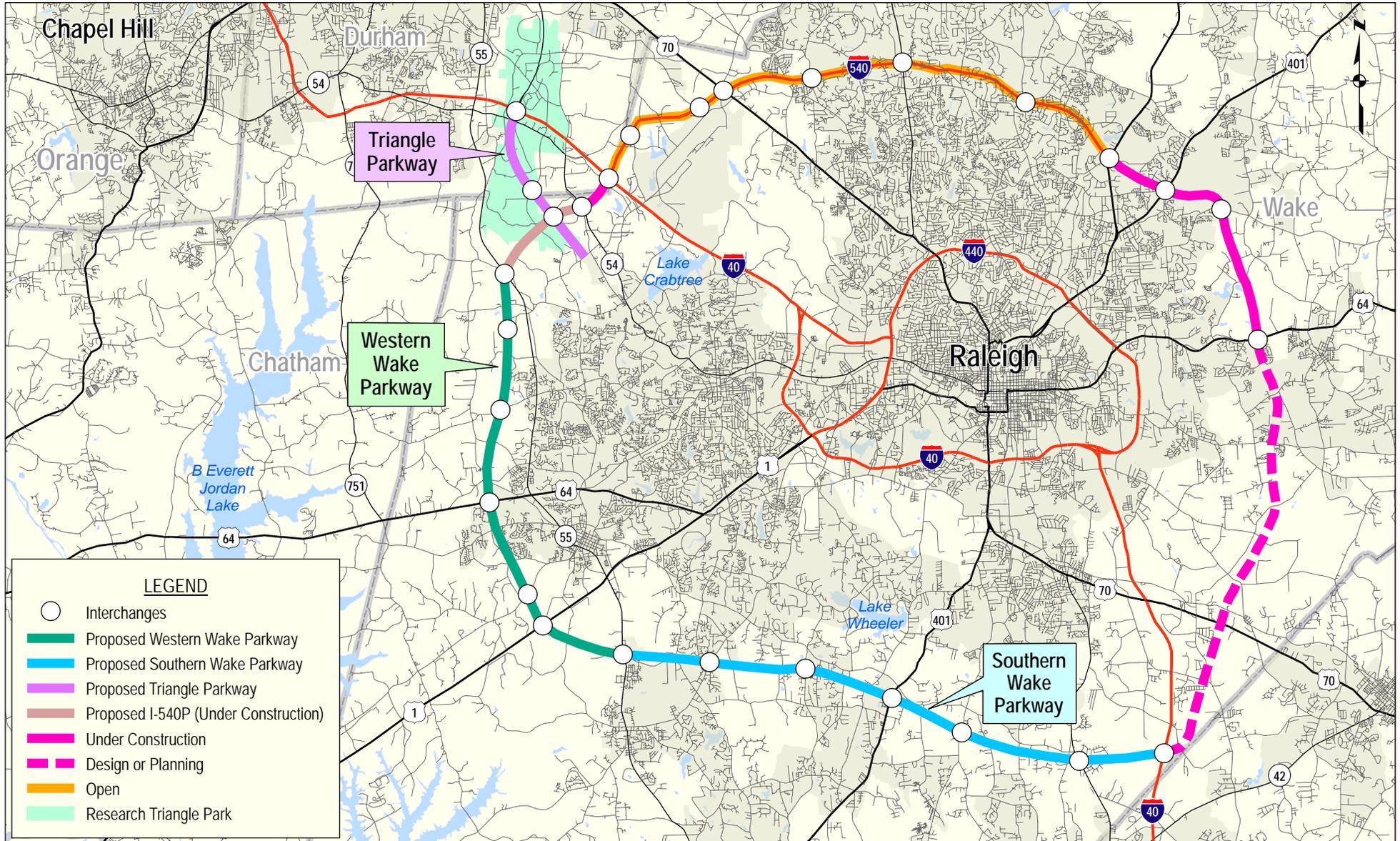
PROJECT DESCRIPTION

Figure 1-1 depicts the project location and its relationship to the surrounding transportation system. The proposed Western Wake Parkway would extend for approximately 12 miles from the interchange of NC-55/I-540 near Research Triangle Park at the northern end of the project to NC-55 at the southern end of the project. The Southern Wake Parkway would extend east/southeast for an additional 16 miles from NC-55 to an interchange with I-40 southeast of Raleigh. The portion of I-540 from I-40 to NC-55 is presently under construction.

The proposed Western Wake Parkway was studied independently of the Southern Wake Parkway. The proposed Western Wake Parkway could be open to traffic by 2011 since a Record of Decision was issued in April 2004. The Southern Wake Parkway could be open to traffic by 2015 as a toll road assuming that the necessary environmental documentation is complete. The primary focus of this preliminary study was the Western

Proposed Western and Southern Wake Parkways
 Preliminary Traffic and Revenue Study

NC 545110 / 02-14-06 / Project Location Map.mxd



Wake Parkway, although one scenario tested included the Southern Wake Parkway.

As shown in the figure, the Western and Southern Wake Parkways would partially complete the planned southern bypass of the greater Raleigh area. I-540 now terminates at I-40 northwest of Raleigh. The construction from I-40 to NC-55 west of Lake Crabtree is scheduled for completion by 2007. With the Western Wake Parkway in place, drivers would have a high-grade facility from I-40 to NC-55 west of Lake Wheeler, which would reduce congestion on the heavily-utilized NC-55, which parallels the proposed Western Wake Parkway. If Triangle Parkway is constructed as a toll facility also, improved access directly to the Research Triangle Park and other employment centers would be available to many employees. ⁽¹⁾

As shown in Figure 1-1, the Western Wake Parkway would follow a generally north-south orientation, and parallel NC-55. It would have seven interchanges, including the two end points on NC-55. This would provide significantly improved access to a rapidly developing area within the Triangle region, which, as noted below, is projected to have substantial increases in both population and employment over the next 25 years. NC-55 is currently being widened to a minimum of four lanes, with left turn lane provisions. This will be the primary competing route to the Western Wake Parkway. The improvement to NC-55 was taken into consideration in this preliminary study.

Major interchanges would be located at US 64 and US 1, both relatively high level controlled access facilities. Other competing routes include Davis Drive, a major arterial facility located east of NC-55, and NC-751 to the west.

The Southern Wake Parkway would extend from NC-55 to I-40, and would include a total of six additional interchanges. In addition to NC-55 and I-40, a major access point would be provided at US 401 near the center of the Southern Wake Parkway project.

As noted above, when both Wake Parkway projects are constructed, and especially if included with Triangle Parkway, an attractive bypass alternative to I-40 would be created. I-40 carries very high traffic levels, particularly between Research Triangle Park and Raleigh. Congestion levels are increasing during peak periods; the Western and Southern Wake Parkways would provide significant time savings for travelers moving between I-40

⁽¹⁾ Proposed Triangle Parkway Preliminary Traffic and Revenue Study, Wilbur Smith Associates for the North Carolina Turnpike Authority, March 30, 2006.

south of Raleigh and Research Triangle Parkway, Durham or points north and west.

The interrelationships of the various roadway segments depicted in Figure 1-1 are analyzed in this report in order to present sufficient information for decision-makers regarding the revenue potential of these facilities if they are constructed as toll roads. These segments were combined into different scenarios for analytical purposes as follows:

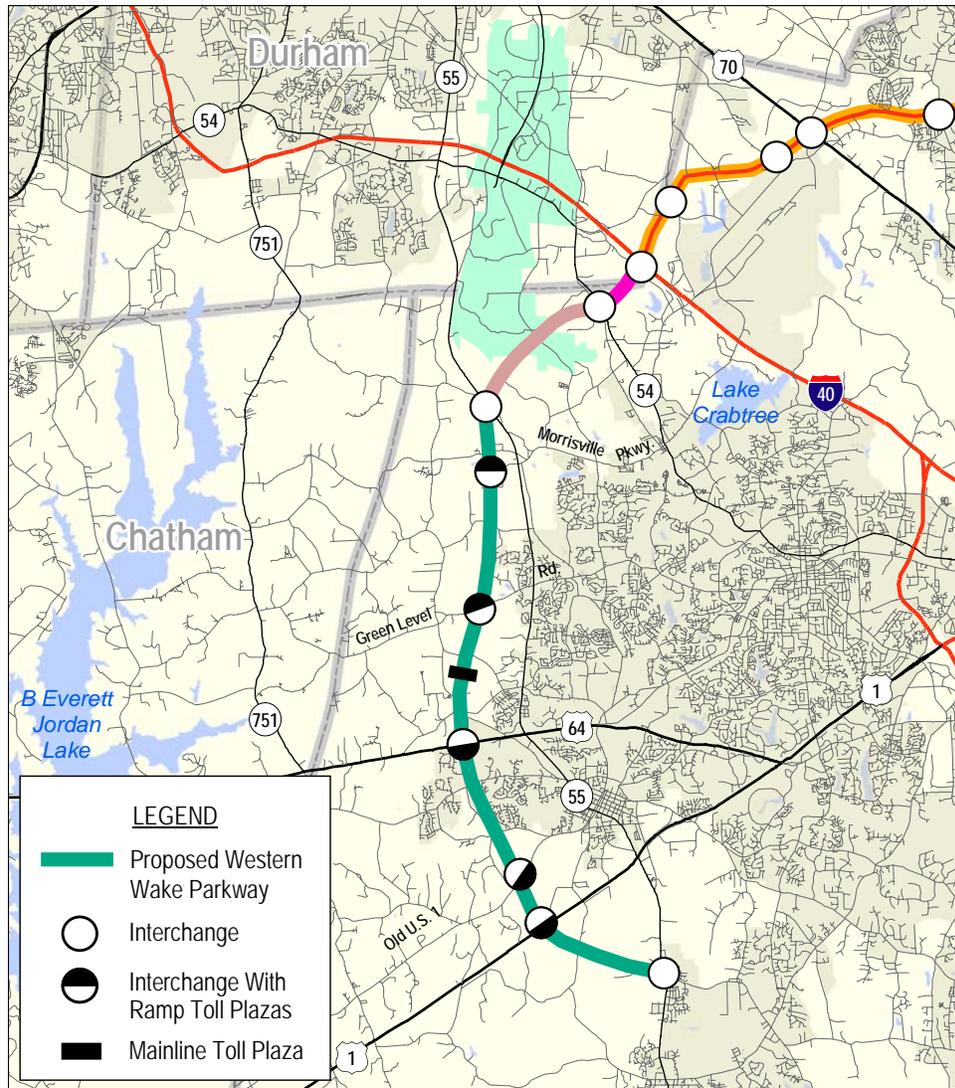
- **Scenario 1** – Western Wake Parkway as a toll facility beginning in 2011. I-540 as a freeway would connect to the Western Wake Parkway at NC-55. However, in this scenario the Triangle Parkway would not be constructed.
- **Scenario 1A** - Western Wake Parkway as a toll facility beginning in 2011. The portion of I-540 under construction from NC-54 to NC-55 would also be tolled. For purposes of this analysis this tolled segment of I-540 is designated as I-540P. Triangle Parkway from I-40 to McCrimmon Parkway would be tolled.
- **Scenario 1B** – This scenario is the same as Scenario 1A except that the I-540P segment from NC-54 to NC-55 would be a freeway. Triangle Parkway from I-40 to McCrimmon Parkway would be tolled.
- **Scenario 2** – Both the Western Wake Parkway and the Southern Wake Parkway would be constructed as a toll facility. The Western Wake Parkway would open in 2011, and the Southern Wake Parkway would open in 2015. I-540 would extend from I-40 to NC-55 as a freeway, but Triangle Parkway would not be constructed in this scenario.

SCENARIO 1

The project configuration for Scenario 1 is shown in Figure 1-2. As noted above, the Western Wake Parkway would extend from NC-55 (north) to NC-55 (south). This is a distance of approximately 12 miles. Interchanges would be constructed at Morrisville Parkway, Green Level Road, US 64, Old US 1 and US 1. The southern terminus of this project would be at the NC-55 bypass south of US 1.

Figure 1-2 also shows the conceptual location of the mainline toll plaza, just north of US 64. Toll plazas would also be constructed on certain interchange ramps, to ensure no toll-free travel for users of the Parkway.

Under this tolling concept, however, motorists using any portion of the 12-mile Western Wake Parkway would pass through one, and only one, toll plaza. In this scenario, the section of I-540 between NC-54 and NC-55 is assumed to be toll free.

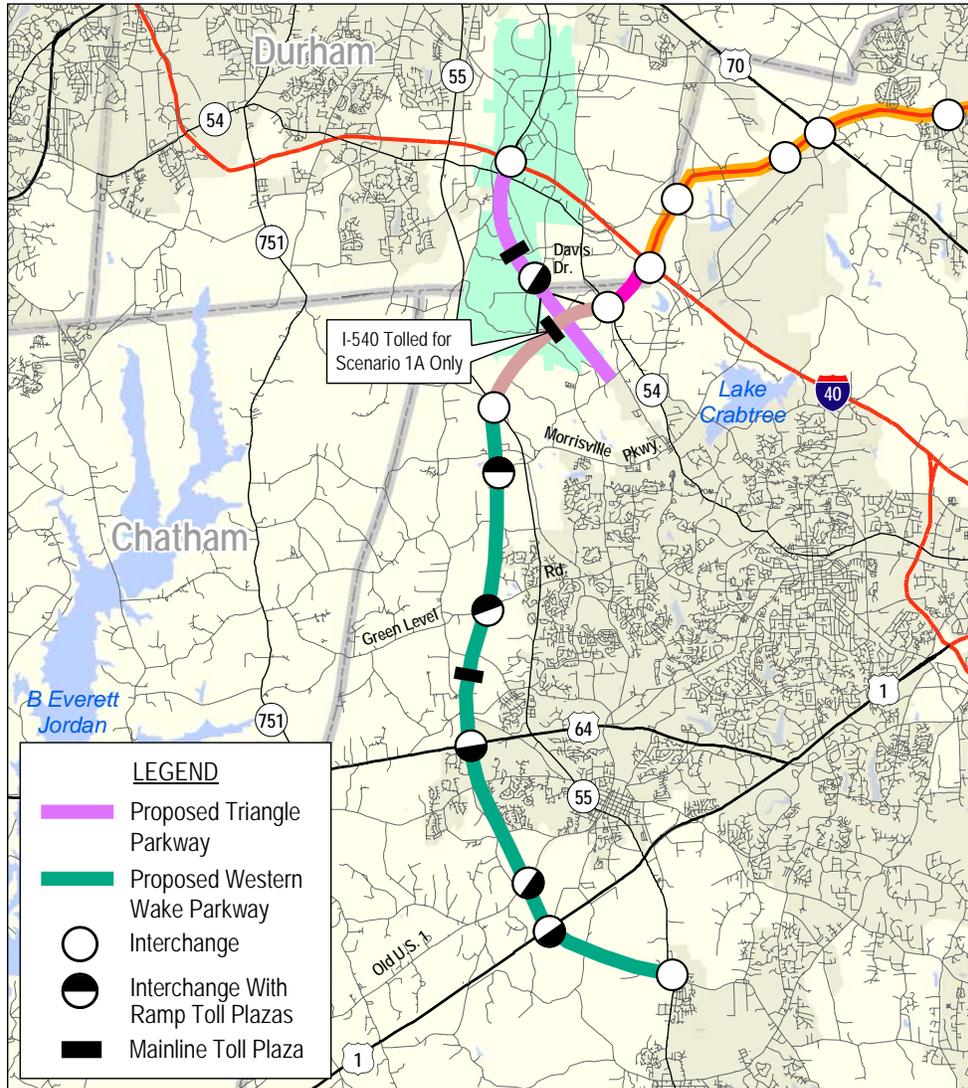


SCENARIO 1 CONFIGURATION

FIGURE 1-2

SCENARIOS 1A AND 1B CONFIGURATIONS

Figure 1-3 provides a closer look at Scenarios 1A and 1B. The same configuration is assumed for the Western Wake Parkway. However, in these scenarios, the Triangle Parkway is assumed to be constructed as a toll facility, with a mainline plaza located between I-40 and the Davis Drive Interchange.



SCENARIOS 1A AND 1B CONFIGURATIONS

FIGURE 1-3

Under Scenario 1A, a mainline toll plaza would be added to I-540 also between NC-55 and NC-54. This section of I-540, referred to as I-540P, is under construction but will not open to traffic until 2007. The toll plaza on I-540P would be constructed such that traffic using both Triangle Parkway and I-540P would not be required to pay a second toll on I-540P. Only travelers using I-540 between NC-54 and NC-55 would pass through the I-540P toll plaza.

Hence, with this configuration, motorists using Triangle Parkway, I-540P and Western Wake Parkway between I-40 and NC-55 would pass through two mainline plazas, for a trip of about 17 miles of total driving distance.

The toll plaza on I-540P, between NC-55 and NC-54, would only be implemented under Scenario 1A. Under Scenario 1B, no toll plaza would be constructed on I-540P; the tolls would be included on Triangle Parkway.

SCENARIO 2 CONFIGURATION

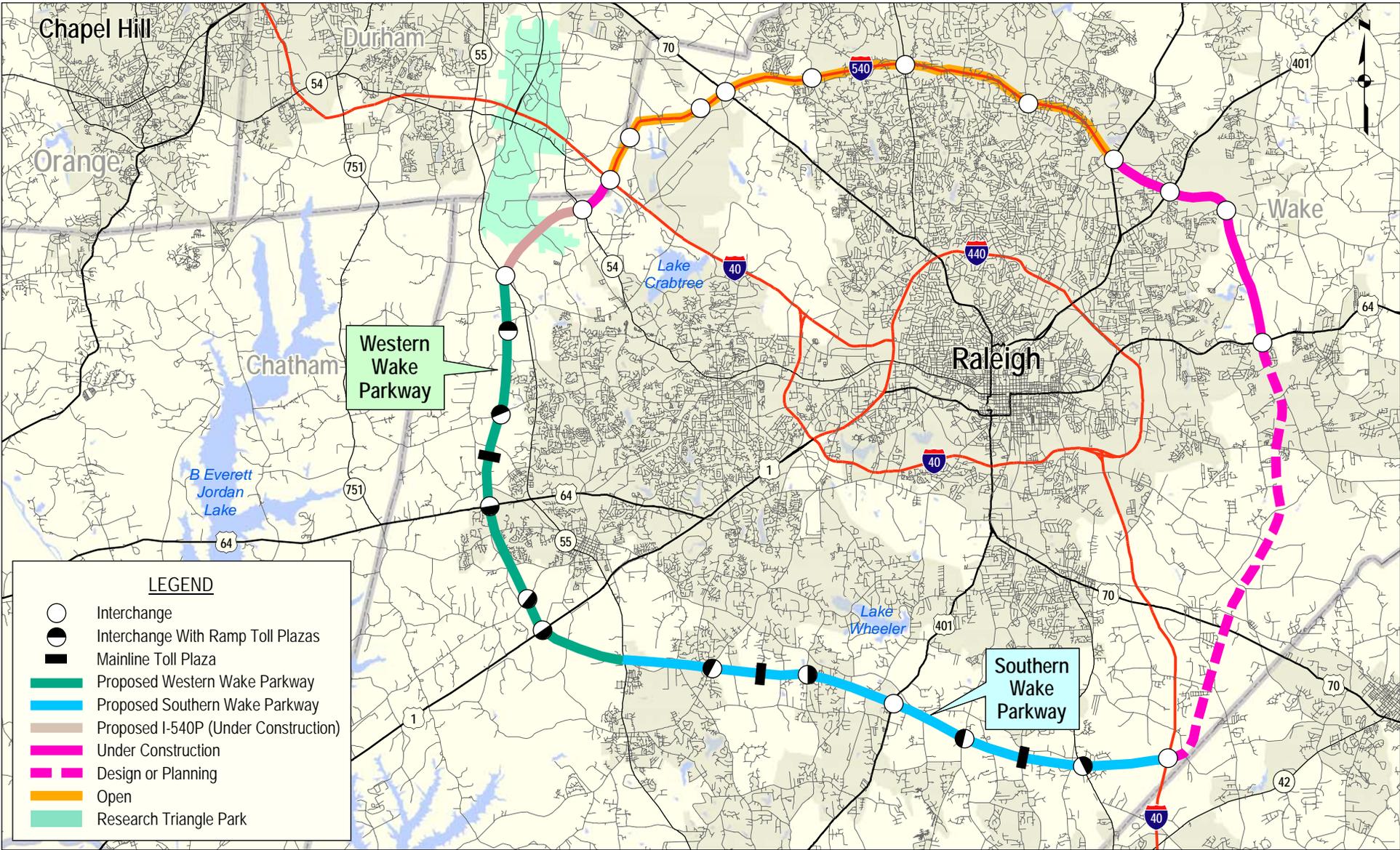
Figure 1-4 takes a closer look at Scenario 2. In this configuration, both the Western and Southern Wake Parkways would be constructed. However, Triangle Parkway is not assumed to be constructed and no toll facility would be established on I-540P.

The Southern Wake Parkway would be about 16 miles in length, about 4 miles longer than the Western Wake Parkway. As such, the toll concept developed would include two mainline plazas, one between US 1 and US 401 and one between US 401 and I-40. Ramp toll facilities would be constructed on the ramps as indicated on Figure 1-4.

SCOPE OF WORK

A kick-off meeting among NCTA staff and representatives of their general engineering consultant, HNTB Corporation, and WSA was held early in the study. The primary purpose of the meeting was to discuss the specifics of the project and to confirm the latest assumptions with respect to project configurations and/or alternatives.

As a part of this task, 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 feeder routes outside this area were conducted. Information on the planned transportation improvement program was reviewed to determine its prospective impact on traffic and revenue potential on the Western and Southern Wake Parkways. Much of this information was obtained as part



of the Triangle Parkway study and was augmented with increased focus on data applicable to the Western and Southern Wake Parkways.

Previous reports and study materials related to the proposed Western and Southern Wake Parkways were also reviewed. This information included previous traffic analysis and transportation modeling analysis prepared by the two Metropolitan Planning Organizations (MPOs) in the area, the Capital Area MPO (CAMPO) and the Durham-Chapel Hill-Carrboro MPO (DCHC).

Supplemental traffic counts were conducted in the project corridor. This information facilitated both the calibration of the travel demand model used in the analysis and provided a “base case” count condition for use in the traffic impact analysis as described below.

TRAFFIC MODEL REFINEMENT

As part of the Triangle Parkway study, WSA obtained the most recent version of the Triangle Regional Model (TRM). This traffic model covers all of Wake, Durham, and Orange Counties as well as adjacent portions of Chatham, Johnston, Harnett, Granville, and Franklin Counties. The same model was used for the Western and Southern Wake Parkways study.

Data obtained for the TRM included highway networks and trip tables at 2002, 2005, 2010, 2015, 2020, and 2030 levels as well as socioeconomic forecasts for each year by traffic analysis zone. The 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 from speed-delay runs. The model also was updated to reflect the proposed Western and Southern Wake Parkways as well as the other committed highway improvements.

A toll collection concept was developed in consultation with NCTA and HNTB, and both Parkways were coded into the network as toll facilities. As was the case for the Triangle Parkway study, considerable zone disaggregation was required along the Western and Southern Wake Parkways. The trip tables were disaggregated on a proportionate basis, while avoiding the need for a new trip generation and distribution process.

Future-year trip tables were also disaggregated to reflect the new disaggregated zone system. The project was coded in such a way that the project could be evaluated as separate configurations depicting the scenarios described earlier – four configurations included the Western Wake Park-

way only, while the second configuration included both the Western and Southern Wake Parkways.

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 proposed toll facility. This is a critical model parameter used for assessing motorists' willingness to pay tolls and for estimating motorists' sensitivity to toll rates for the facility. Vehicle operating cost parameters were also established specific to the study corridor.

CORRIDOR GROWTH ANALYSIS

Economic growth is particularly important for a start-up toll facility such as the proposed Western and Southern Wake Parkways. Given the strong employment-related growth in the Research Triangle region as well as population and employment growth in the Western Wake and Southern Wake Parkways corridors, analysis and validation of the projected economic activity is particularly important.

The socioeconomic forecast incorporated in the TRM by the MPOs was used in the analysis. Since this was a preliminary traffic and revenue study, an independent economic analysis was not conducted; however, an independent economic review would typically be necessary to support project financing.

TRAFFIC AND REVENUE ANALYSIS

The refined models were used to run a series of traffic assignments, both with and without the proposed Western and Southern Wake Parkways. In each case, traffic assignments were run at a.m. peak, p.m. 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. In the Scenario 1 assignments described above, Triangle Parkway was not assumed to be constructed.

Toll sensitivity curves were developed at 2011 and 2030 levels to determine optimum toll levels. 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 on the proposed Western and Southern Wake Parkways were developed for the base case condition from opening year 2011 through 2030. The forecasts beyond 2030 were based on a computational extrapolation of modeling results from 2030.

Finally, to enable the formulation of annual traffic and revenue forecasts, 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 and gradually phases in over a period of two to four years.

REPORT STRUCTURE

The remainder of this report consists of three chapters.

- Chapter 2 presents the traffic conditions in the corridor and surrounding area.
- Chapter 3 describes the socioeconomic characteristics of the corridor.
- Chapter 4 describes the development of the traffic forecast model, assumed roadway improvements, toll scenarios, toll sensitivity, traffic and revenue forecasts, and the net toll operating revenue analysis.

CHAPTER 2

EXISTING TRAFFIC CONDITIONS

A major part of the effort involved in this phase of the study included the collection of existing data to document the existing traffic conditions and travel behavior to:

- Understand the existing travel behavior as a context for the evolution of future travel behavior after the proposed Western and Southern Wake Parkways are built, along with the other facilities planned for construction over the forecast period; and
- Calibrate the base year of the forecasting models to current/baseline observed conditions to assure the forecasting tools are adequately replicating current conditions in the study area prior to forecasting future levels.

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

This current empirical documentation of the traffic network in the study area was augmented by available traffic trend data from NCDOT. Available information on programmed highway improvements scheduled in the study corridor were incorporated into the analysis.

This chapter describes the collection of data used to characterize the operational performance of the existing competing facilities in the Western and Southern Wake Parkways corridors. Where appropriate, this chapter separately describes existing traffic conditions for the Western Wake Parkway and the Southern Wake Parkway.

The battery of data collection described herein augments the data collection and model calibration performed for the recently completed preliminary traffic and revenue study on the proposed Triangle Parkway which

used the same travel demand model. The final report for the Triangle Parkway analysis may be referenced for detail on data collection and model calibration used in that study.

EXISTING HIGHWAY SYSTEM

WESTERN WAKE PARKWAY CORRIDOR

The proposed Western Wake Parkway would facilitate traffic movement in a north-south direction between I-40 in the northwest corner of the county and NC-55 southwest of Raleigh. Its northern terminus is near the Research Triangle Park, the dominant employment center in the corridor.

The Western Wake Parkway would provide a new limited access roadway in an area currently served by the following major facilities:

- I-40 is the major east-west route in the Raleigh-Durham area. It extends from Wilmington on the coast across the state to the Tennessee line and provides access to major cities along its length. In the area of the project, I-40 is six and eight lanes with interchanges at I-540, Page Road, Miami Boulevard, Davis Drive, Durham Freeway (NC-147), and NC-55. Speed limits are 65 mph in most locations.
- NC-55 extends north-south along the western side of the study area with an interchange at I-40. Its cross section varies between two and five lanes with some 25 signalized and numerous unsignalized intersections and curb cuts throughout its length. The majority of the road has a 45 mph speed limit. NC-55 is being widened to at least 4 lanes along much of its length in the Parkway vicinity at the time of this study.
- US 64 is primarily an east to west route with interchanges at US 1 and NC-55. US 64 which serves as a connector for Apex and Cary to Raleigh is a four-lane, median-divided highway. Speed limits on US 64 are 45 and 55 mph.
- US 1 is a major connector that runs north and south from Raleigh. It is primarily a four-lane, median-divided expressway facility with 65 mph speed limits and multiple interchanges. US 1 is being widened at the time of this study.
- Old US 1 runs parallel to US 1. It is a two-lane roadway with multiple unsignalized intersections.

- Green Level Road is an east to west local road with multiple unsignalized intersections. It is a two-lane roadway with a 45 mph speed limit.
- Morrisville Carpenter Road is an east to west local road. It is two to four lanes wide with a 45 mph speed limit.

SOUTHERN WAKE PARKWAY

The Southern Wake Parkway would provide a limited access facility south of Raleigh running east-west between I-40 southeast of Raleigh and NC-55 southwest of Raleigh.

- Ten-Ten Road (SR-1010) provides east to west travel southwest of the Raleigh metropolitan area. It has one interchange that crosses US 1 and is a two-lane roadway with a 45 mph speed limit.
- NC-50 extends north to south of Raleigh and Garner with an interchange located on US 70. It features primarily a two-lane cross section with 45 mph speed limit.
- Old Stage Road extends south from US 401 in Garner. It is a two-lane roadway with a 45 mph speed limit.
- Lake Wheeler Road/Simpkins Road runs north-south and is parallel to US 1. Lake Wheeler Road ends with an unsignalized intersection at US 401, south of Raleigh. Both roads are two lanes with 45 mph speed limits.
- Bells Lake Road runs north to south, parallel to Lake Wheeler Road. It begins at Ten-Ten Road and continues south to Johnson Pond Road. It is two lanes with 45 mph speed limits.
- Holly Springs Road runs parallel to US 1 in a north to south direction with an intersection at NC-55. Holly Springs Road is two lanes with a 45 mph speed limit.

TRAFFIC LEVELS

Existing traffic data from the NCDOT database and supplemental data from various reports were used to aid in the traffic model calibration process. This information was then supplemented for this study with new traffic counts within the Western and Southern Wake Parkways corridors and other key locations.

DAILY TRAFFIC

Figure 2-1 provides a summary of the annual average daily traffic (AADT) within the study area as available from NCDOT's 2002 AADTs. Traffic data depicted in this figure were adjusted to reflect 2005 conditions based on more recent information. All volumes are shown in thousands of vehicles per day (vpd). The dominant road within the study area is I-40 with volumes of 148,000 vpd west of the interchange with I-540 and 131,000 vpd east of the interchange. To the west of the Durham Freeway, the I-40 traffic volumes were reported to be 90,000 vpd.

NC-55 is also a major thoroughfare that serves as the demarcation of the proposed Western Wake Parkway and the proposed Southern Wake Parkway. It could attract drivers from the proposed Western Wake Parkway. It runs north-south with current traffic volumes in the range of 20,000 to 27,000 vpd.

Davis Drive, which is a major north-south route located east of NC-55, generally carries 15,000 to 21,000 vpd. NC-751, west of the proposed Parkway, carries 7,000 to 10,000 vpd.

Major east-west routes delivering traffic to the Western Wake portion of the proposed toll road total 44,600 as indicated below:

- | | |
|--------------------|------------|
| ▪ US 64 | 18,900 vpd |
| ▪ Green Level Road | 4,000 vpd |
| ▪ US 1 | 21,700 vpd |

Major north-south routes delivering traffic to the Southern Wake Parkway:

- | | |
|----------------------|------------|
| ▪ Holly Springs Road | 18,900 vpd |
| ▪ Bells Lake Road | 3,900 vpd |
| ▪ Lake Wheeler Road | 6,000 vpd |
| ▪ US 401 | 21,400 vpd |
| ▪ Old Stage Road | 8,700 vpd |
| ▪ NC-50 | 13,200 vpd |

Other east-west roads that could deliver traffic to the Southern Wake Parkway include:

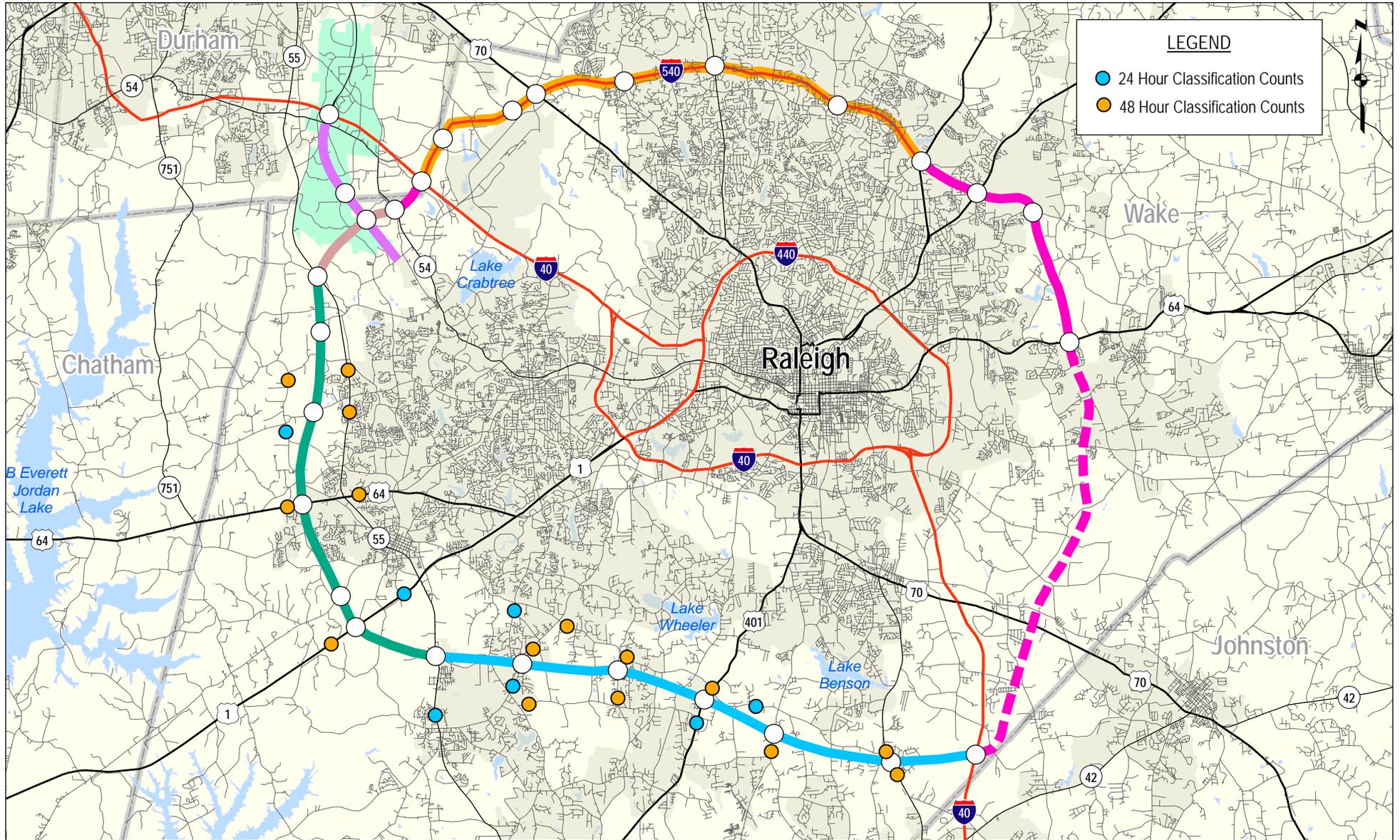
- | | |
|----------------------|----------------------|
| ▪ Ten-Ten Road | 11,100 to 13,500 vpd |
| ▪ Optimist Farm Road | 5,400 vpd |

SUPPLEMENTAL TRAFFIC COUNTS

Traffic volume counts were conducted specifically for this study at the locations shown in Figure 2-2. The major purpose of these supplemental

Proposed Western and Southern Wake Parkways Preliminary Traffic and Revenue Study

NC 545110 / 02-14-06 / Location of Supplemental Traffic Counts.mxd



traffic counts were to aid in calibrating the TRM provided by the MPOs. The following types of counts were obtained:

- 24-hour counts by day at seven locations; and
- 48-hour counts by hour at 15 locations.

SPEED AND DELAY ANALYSIS

Another important component in model calibration is Speed-Delay Analysis. This features capturing data related to the travel speeds and delays drivers experience along key roads. Speed and delay runs using global positioning system units were performed on key roads in the study area.

Speed and delay vehicle runs were made during peak and off-peak periods in order to provide information on average speeds to use in the traffic model. Speeds during off-peak periods were generally found to be near the speed limits. However, during peak periods, the speeds were considerably lower particularly on I-40, Ten-Ten Road, and key north-south routes such as NC-55 and US 1.

Peak speeds on the limited access facilities were as low as 20 mph depending upon the direction of travel in certain sections. On roads such as NC-55, peak speeds were around 30 mph in contrast to off-peak speeds of more than 40 mph.

Table 2-1 provides a summary of average observed speeds during peak periods on critical competing roads near the Parkways corridors. NC-55 would be the primary competing route for the Western Wake Parkway. Travel times along NC-55 between I-40 and New Hill Road in Holly Springs, a distance of just under 20 miles, were recorded. The average peak operating speed was 30 mph or less in the peak direction. The slowest speeds in the morning peak were in the northbound direction due to the majority of the commuting traffic traveling toward the major employment centers in or near Research Triangle Park. As might be expected, slowest speeds in the afternoon peak were in the southbound direction. In the off-peak periods, which is also characteristic of midday operating conditions, average speeds were in the range of 36 to 38 mph.

It should be noted that NC-55 was under construction in several locations during the time of the study. However, construction was typically taking place adjacent to the existing travel lanes; the facility is being widened. Hence, operating conditions of the existing two lanes were not significantly impeded by construction activity. Therefore, the observed travel speeds are considered indicative of the current two lane roadway.

**Table 2-1
Average Speeds on Selected Routes during Peak Periods
Western and Southern Wake Parkways**

Facility	Start Point	End point	Direction	Distance	Average Observed Speed (mph)	
					AM Peak	PM Peak
NC-55	New Hill Road	I-40	Northbound	18.6	28	36
	I-40	New Hill Road	Southbound	18.6	38	30
Ten-Ten Road	US 1	Benson Road	Eastbound	13.8	32	26
	Benson Road	US 1	Westbound	13.8	25	33
I-40	NC-147	NC-42	Eastbound	33.8	66	53
	NC-42	NC-147	Westbound	33.8	47	61

Once widening is completed, some improvement in operating speeds are anticipated, although much of the delay along this route occurs at traffic signals, particularly in the vicinity of Apex, Cary and Holly Springs. Future-year operating conditions are expected to be slightly better than observed conditions today, due to the widening of NC-55 and the shift of a considerable portion of traffic from this route to the proposed Parkway.

Average operating speeds along Ten-Ten Road (SR-1010), which are typical of conditions in the Southern Wake Parkway corridor, averaged about 25 mph during peak hours and about 32 mph in the off-peak direction. Along SR-1010, the morning peak direction was westbound and the afternoon peak direction was eastbound. This again shows the dominance of employment centers in the vicinity of Research Triangle Park and other locations along the Western Wake Parkway corridor.

The major directional peak period speeds along I-40 averaged between 47 and 53 mph. In the off-peak direction, generally free-flow conditions were observed.

However, it is important to recognize that average operating speeds on some portions of I-40 are considerably below the overall averages shown in Table 2-1. This is particularly true between downtown Raleigh and the RDU Airport, where congestion is routinely experienced in the westbound direction in the morning peak and the eastbound direction in the afternoon peak. Conditions on I-40 would be expected to deteriorate in the future, unless major widening is undertaken.

CHAPTER 3

CORRIDOR GROWTH REVIEW

Economic growth is particularly important for any start-up toll facility such as the proposed Western and Southern Wake Parkways. Given the strong nature of employment-related growth in the region, anticipated economic activity is particularly important.

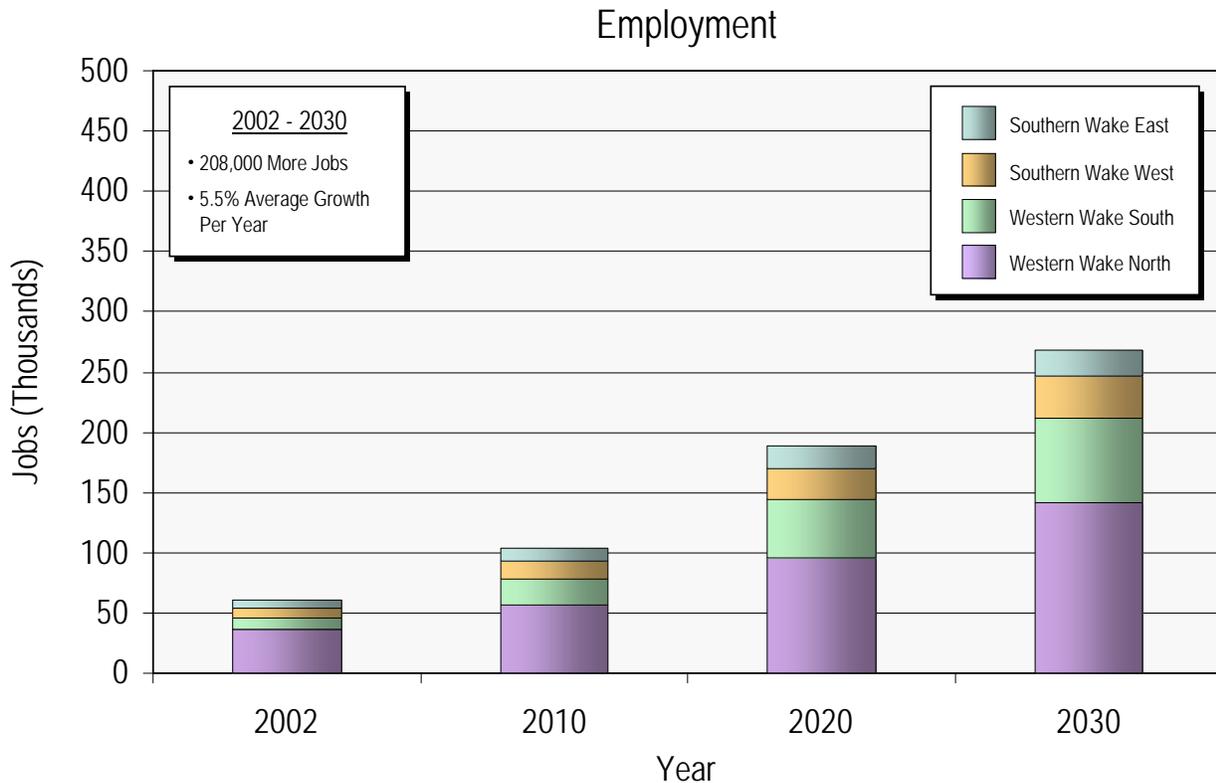
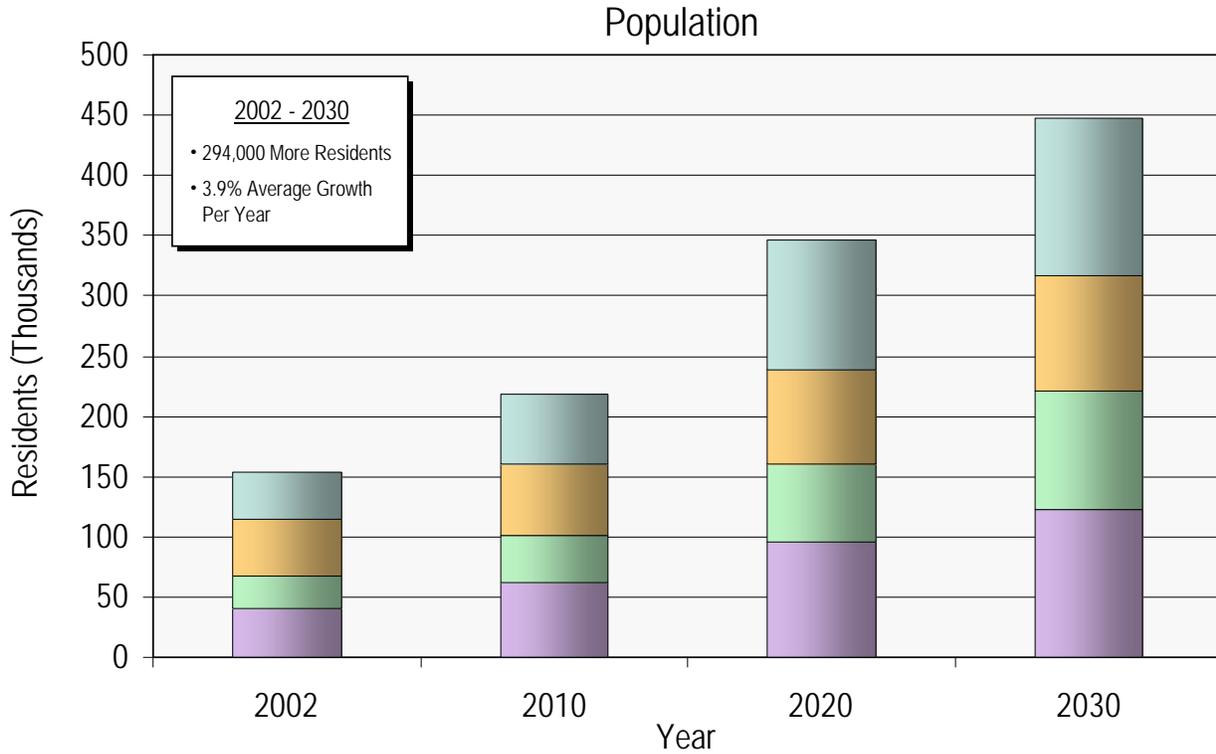
The latest socioeconomic forecast incorporated by the MPOs into the TRM was used in the analysis. Since this is a preliminary traffic and revenue study, an independent economic analysis was not conducted; however, an independent economic analysis would be necessary for any later study that would be used in support of project financing.

GROWTH PROJECTIONS

The population and employment within the Western and Southern Wake Parkways corridors is expected to grow extensively over the next three decades. According to forecasts contained in the TRM, employment in the study area is expected to grow from over 58,000 in 2002 to over 266,000 by 2030. Population over the same period is expected to grow from 153,700 to over 447,000. Figure 3-1 depicts this growth graphically.

This growth is very rapid and represents an average annual growth rate of 3.9 percent and 5.6 percent for population and employment, respectively. It is emphasized that the population and employment forecasts are contained in the TRM and directly related to the model growth rates of traffic in the area.

For purposes of presentation of economic forecasts, the study area was divided into four sectors based on the traffic analysis zones contained within the TRM. The northern sector of the Western Wake portion begins at the intersection of I-40 and I-540 (currently under construction) and continues south to the intersection at US 64. The southern sector of the Western Wake Parkway begins at US 64 southward through the proposed intersec-



tion with US 1 and terminates at the second intersection with NC-55. The western sector of the Southern Wake Parkway begins at NC-55 and continues eastward to the intersection at US 401. Finally, the eastern sector of the Southern Wake Parkway begins at US 401 and extends eastward to the intersection at I-40 southeast of Raleigh.

POPULATION FORECASTS

Table 3-1 summarizes population growth within the Western and Southern Wake Parkways corridors and compares the corridor to the rest of the Triangle region.

In 2002, the Triangle region had approximately 1.1 million residents with nearly 154,000 people (13.4 percent) residing within the Western and Southern Wake Parkways study area. By 2030, the regional population is forecast to grow to about 2.3 million people, and the corridor's population will grow to more than 447,000. By that time the corridor's share of the population is expected to be 19.8 percent of the regional population, which means that the corridor population is growing faster than the regional population. In fact the average annual growth rate for both corridors is expected to grow at 3.9 percent annually whereas the entire region is expected to grow at only 2.5 percent annually.

The growth rates in the Western and Southern Wake Parkways corridors are significantly higher than the regional rates throughout the time periods shown. For example, between 2010 and 2020 the Western and Southern Wake Parkways corridors' population is forecast to grow at an annual rate of 4.7 percent in comparison to the region's growth rate of 2.9 percent annually.

As shown in Table 3-1 and Figure 3-2, the western sector of the Southern Wake Parkway corridor has the lowest population expansion in the study area, but according to the model is forecast to grow 2.6 percent annually between 2002 and 2030. In the initial period through 2010, the most rapid growth is forecast to occur in the northern sector of the Western Wake Parkway with an annual average growth rate of 5.6 percent.

The southern sector of Western Wake Parkway and eastern sector of Southern Wake Parkway are also expected to exhibit fast rates of growth with 4.7 and 4.4 percent annual growth forecast between 2002 and 2030, respectively.

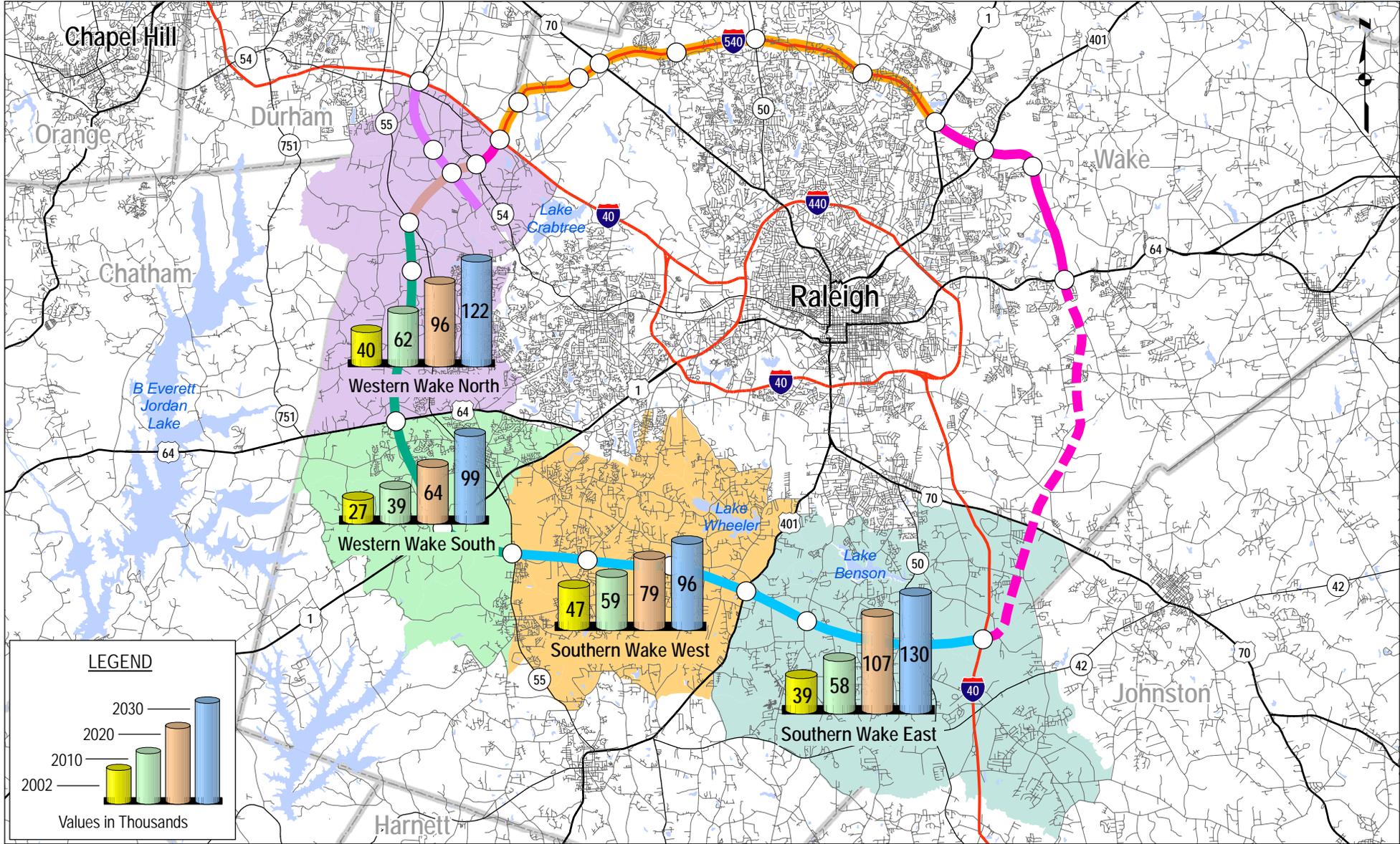
**Table 3-1
Study Area Population Projections
Proposed Western and Southern Wake Parkways**

Study Area Sector	2002	Average Annual Growth		2010	2020	Average Annual Growth		2030	Average Annual Growth		Total Growth 2002-2030
		Annual Growth	%			Annual Growth	%		Annual Growth	%	
Western Wake N	39,862	5.7%		62,225	95,776	2.4%		121,957	4.1%		205.9%
Western Wake S	27,272	4.4%		38,631	63,550	4.6%		99,443	4.7%		264.6%
Southern Wake W	47,256	2.9%		59,214	79,115	2.0%		96,215	2.6%		103.6%
Southern Wake E	39,314	4.9%		57,545	106,833	2.0%		129,619	4.4%		229.7%
Total Study Area Population	153,704	4.4%		217,615	345,274	2.6%		447,234	3.9%		191.0%
Percent of Triangle Region	13.4%			15.2%	18.2%			19.8%			
Wake County	699,253	2.6%		856,970	1,160,658	1.8%		1,387,111	2.5%		98.4%
Triangle Region Population	1,149,114	2.8%		1,431,859	1,901,600	1.8%		2,264,048	2.5%		97.0%
Study Area Sector		2002-2010	2010-2020		2020-2030				2002-2030		
Western Wake N Change		22,363	33,551		26,181			82,095			
Western Wake S Change		11,359	24,919		35,893			72,171			
Southern Wake W Change		11,958	19,901		17,100			48,959			
Southern Wake E Change		18,231	49,288		22,786			90,305			
Total Study Area Population Change		63,911	127,659		101,960			293,530			
Wake County Change		157,717	303,688		226,453			687,858			
Triangle Region Population Change		282,745	469,741		362,448			1,114,934			

Source: Triangle Regional Model

Proposed Western and Southern Wake Parkways
 Preliminary Traffic and Revenue Study

NC 545110 / 03-14-06 / Population Growth by Location.mxd



POPULATION GROWTH BY CORRIDOR SECTOR

FIGURE 3-2

EMPLOYMENT FORECASTS

As shown in Table 3-2 and Figure 3-3, employment in the Western and Southern Wake Parkways study area represented 9.9 percent of the region in 2002 and is expected to increase to 21.4 percent of the region by 2030. This growth from 59,000 employees in 2002 to nearly 267,000 employees in 2030 represents a 5.6 percent average annual growth rate in comparison to the regional growth rate of 3 percent per annum, which is forecast to increase from 591,000 employees in 2002 to more than 1.2 million in 2030.

Figure 3-3 shows the projected employment in 2010, 2020, and 2030 for each sector of the study area, Wake County, and the Triangle Region. Average annual growth rates are also shown. While significant employment growth is exhibited throughout the study area, the northern sector of the Western Wake Parkway is expected to add the most jobs (105,000 new jobs between 2002 and 2030). This is likely due to its proximity to the Research Triangle Park and the affiliated ripple effect of economic development.

Yet the most rapid rate of employment growth is predicted for the southern sector of the Western Wake Parkway (7.3 percent average annual growth). Even though growth in this sector is expected to taper off to a level on par with the other three sectors, the southern sector of the Western Wake Parkway is the site of double digit growth (10.3 percent) between 2002 and 2010, which is the anticipated opening year of the proposed Parkway.

Both the western and eastern sectors of the Southern Wake Parkway study area are also expected to notice a tremendous rate of employment growth between 2002 and 2010 (7.4 percent and 9.2 percent, respectively). However, the number of jobs represented by this rate is smaller during that period (around 6,500 and 5,700 jobs, respectively).

NUMBER OF HOUSEHOLDS

The growth in the number of households in the corridor is relative to the expected population growth. Table 3-3 summarizes the households as contained in the TRM.

In 2002, the number of households in the corridor was estimated at nearly 56,000, which is an 11.2 percent share of the regional number of households.

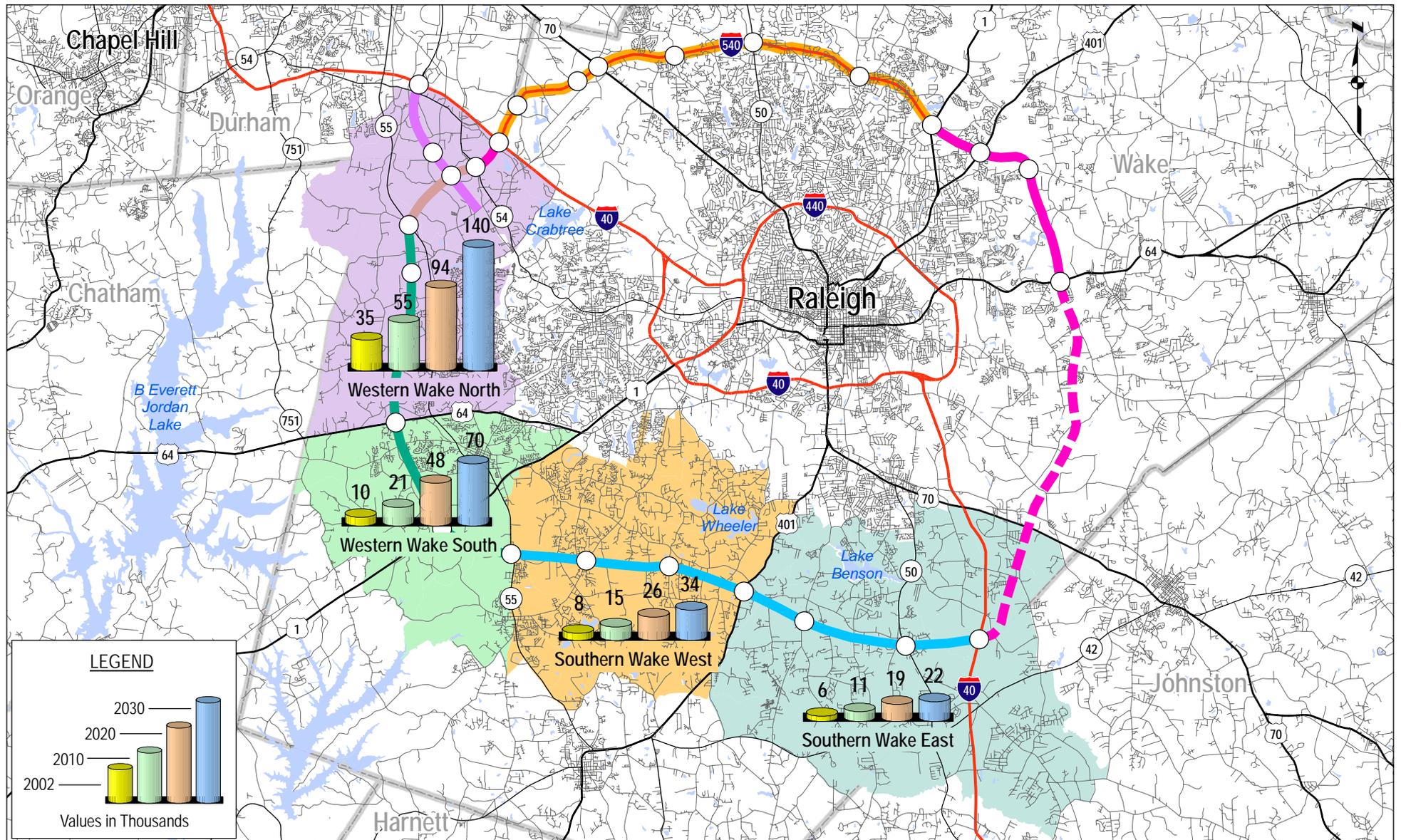
**Table 3-2
Study Area Employment Projections
Proposed Western and Southern Wake Parkways**

Study Area Sector	2002	Average Annual Growth	2010	Average Annual Growth	2020	Average Annual Growth	2030	Average Annual Growth	2002-2030	Total Growth 2002-2030
		%		%		%		%		%
Western Wake N	34,886	5.9%	55,181	5.5%	94,126	4.1%	140,198	5.1%	105,312	301.9%
Western Wake S	9,750	10.3%	21,413	8.4%	47,905	3.9%	70,337	7.3%	60,587	621.4%
Southern Wake W	8,452	7.4%	15,012	5.7%	26,190	2.8%	34,472	5.1%	26,020	307.9%
Southern Wake E	5,609	9.2%	11,351	5.2%	18,808	1.5%	21,732	5.0%	16,123	287.4%
Total Study Area Employment	58,697	7.3%	102,957	6.2%	187,029	3.6%	266,739	5.6%	208,042	354.4%
Percent of Triangle Region	9.9%		13.5%		18.3%		21.4%			
Wake County	358,265	3.5%	471,140	3.3%	654,758	2.2%	810,065	3.0%	652,825	126.1%
Triangle Region Employment	591,389	3.2%	760,664	3.0%	1,019,561	2.0%	1,244,214	2.7%	1,019,561	110.4%
Study Area Sector		2002-2010		2010-2020		2020-2030		2002-2030		
Western Wake N Change		20,295		38,945		46,072		105,312		
Western Wake S Change		11,663		26,492		22,432		60,587		
Southern Wake W Change		6,560		11,178		8,282		26,020		
Southern Wake E Change		5,742		7,457		2,924		16,123		
Total Study Area Employment Change		44,260		84,072		79,710		208,042		
Wake County Change		112,875		183,618		155,307		451,800		
Triangle Region Employment Change		169,275		258,897		224,653		652,825		

Source: Triangle Regional Model

Proposed Western and Southern Wake Parkways Preliminary Traffic and Revenue Study

NC 545110 / 03-14-06 / Employment Growth by Location.mxd



**Table 3-3
Study Area Household Projections
Proposed Western and Southern Wake Parkways**

Study Area Sector	2002	Average Annual Growth	2010	Average Annual Growth	2020	Average Annual Growth	2030	Average Annual Growth	2002-2030	Total Growth 2002-2030
	Western Wake N	14,798	6.2%	23,979	4.6%	37,754	2.5%	48,504	4.3%	
Western Wake S	10,027	4.9%	14,680	5.4%	24,887	4.8%	39,593	5.0%		294.9%
Southern Wake W	17,085	3.2%	21,986	3.2%	30,134	2.1%	37,142	2.8%		117.4%
Southern Wake E	14,505	5.1%	21,610	6.7%	41,217	2.0%	50,286	4.5%		246.7%
Total Study Area Number of Households	56,415	4.8%	82,255	5.0%	133,992	2.7%	175,525	4.1%		211.1%
Percent of Triangle Region	11.2%		13.2%		16.3%		18.0%			
Wake County	288,913	2.6%	353,870	3.1%	478,690	1.8%	572,549	2.5%		98.2%
Triangle Region Number of Households	505,857	2.7%	625,152	2.8%	821,364	1.7%	973,214	2.4%		92.4%

Study Area Sector	2002-2010	2010-2020	2020-2030	2002-2030
	Western Wake N Change	9,181	13,775	10,750
Western Wake S Change	4,653	10,207	14,706	29,566
Southern Wake W Change	4,901	8,148	7,008	20,057
Southern Wake E Change	7,105	19,607	9,069	35,781
Total Study Area Number of Households Change	25,840	51,737	41,533	119,110
Wake County Change	64,957	124,820	93,859	283,636
Triangle Region Number of Households Change	119,295	196,212	151,850	467,357

Source: Triangle Regional Model

By 2030 the corridor is forecast to increase in households to over 175,000, which would be 18 percent of the region's households. This growth rate of 4.1 percent annually between 2002 and 2030 is significantly higher than the 2.5 percent annual growth rate anticipated for the region. The highest growth rate in the number of households is expected to be in the southern sector of the Western Wake Parkway with 5 percent annual growth between 2002 and 2030.

RESEARCH TRIANGLE PARK

The Research Triangle Park (RTP) is a major economic driver in the region. The RTP reports that its corporate occupants employ approximately 44,000 staff and contractors. This employment is expected to grow to 85,000 as the Park builds out its remaining space over the next 20 years. Employees of Park companies would be expected to be potential customers of the proposed toll road.

The RTP occupies approximately 7,000 acres with around two thirds of the Park lying south of I-40. The southern portion of RTP is less developed than the northern portion, and it will accommodate the extensive growth that is anticipated as the Park develops its remaining 1,100 acres. The proposed Western and Southern Wake Parkways would provide a limited access route to the Research Triangle Park via a connection with the section of I-540 that is currently under construction.

RTP officials provided additional insights on the Park's operation and future development. The master plan for the southern portion of the RTP served as a guide in refining the TRM to locate potential access roads to each of the major development areas. In addition, it was confirmed that the RTP provided input to the MPOs in the development of the future socioeconomic scenarios as contained in the TRM.

RALEIGH-DURHAM INTERNATIONAL AIRPORT

The Raleigh-Durham International Airport is the major airport serving the Triangle region, which logged more than 4.6 million boardings in 2005. It is located northwest of the northern terminus of the proposed Western and Southern Wake Parkways and is readily accessed from I-40 and I-540. After completion of the sections of I-540 currently under construction, it is presumed that users of the Raleigh-Durham International Airport whose trips originate southwest of Raleigh will be customers of the Western and Southern Wake Parkways.

HOUSEHOLD INCOME

Average household incomes by location are summarized in Table 3-4. All values shown are in 2002 dollars. In 2002, the average household income in the region covered by the TRM was \$54,411. The Western and Southern Wake Parkways study area has a 133 percent higher average household income (\$72,556) than the regional average (\$54,411). By 2030, the forecast average household income in the study area is assumed to be 117 percent above the regional average.

Study Area Sector	2002	2010	2020	2030
Western Wake N	\$81,833	\$75,580	\$72,948	\$72,227
Western Wake S	69,480	68,092	67,648	67,329
Southern Wake W	78,086	75,678	73,896	73,144
Southern Wake E	58,705	59,378	59,184	59,904
Total Study Area	72,556	70,013	67,943	67,786
Percent of Region	133.3%	124.9%	118.7%	117.1%
Wake County	58,157	59,486	60,233	60,650
Durham County	49,140	50,987	52,497	53,486
Total Triangle Region	54,411	56,042	57,234	57,899

Source: Triangle Regional Model

The relatively high household income level correlates with the study area's high incidence of residents with college degrees. According to 2000 census data, 44 percent of the study area's population age 25 and older has achieved an education level of Bachelor's Degree or higher compared to the national average of around 24 percent. This important statistic is likely related to the higher skill and knowledge level required by much of the employment in the region, especially that which is affiliated with Research Triangle Park.

ADJUSTMENTS TO TRIANGLE REGIONAL MODEL (TRM)

As discussed earlier, this study relied upon the socioeconomic forecasts contained within the TRM. Adjustments that might have been made as part of an independent economic review, as would be the case for an investment-grade study, are not included.

However, the review of the structure and size of the transportation analysis zones (TAZs) contained in the model revealed that certain zones along the Parkway's corridors were not adequate to provide reliable estimates of traffic through proposed toll plazas and from zones. In effect, certain zones were deemed too large geographically to reflect traffic at the level of detail necessary for the traffic and revenue analysis.

Accordingly, certain zones in the northern sector of the corridor in the RTP area were disaggregated into multiple zones, as were select zones in the northern sector of the Western Wake Parkway. These new zones were coded into the network. This procedure is considered to be appropriate at this level of preliminary study. However, under an investment-grade study in support of potential project financing, the underlying socioeconomic assumptions would be independently evaluated, and the transportation model modified accordingly to reflect the finer level of zone detail.

SOCIOECONOMIC CONCLUSIONS

This chapter summarized the socioeconomic forecasts underlying the traffic and revenue forecasts that are presented in the next chapter.

In general, the study area is forecast to exhibit extremely strong economic growth based on the socioeconomic forecasts contained in the TRM. Strongest growth in the first study period between 2002 and 2010 is expected in the Western Wake Parkways study area. A prudent observer would therefore want to confirm if these basic socioeconomic growth rates can be sustained. As this study is considered to be preliminary in nature and not to be used in support of project financing, the socioeconomic forecasts (as well as other parameters and techniques) will be subject to review in the investment-grade study.

CHAPTER 4

TRAFFIC AND REVENUE ANALYSIS

Chapter 4 presents a summary of the traffic and revenue analysis conducted for the proposed Western and Southern Wake Parkways. 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 traffic and revenue forecasts for the proposed Parkways.

TRAFFIC MODEL DEVELOPMENT AND REFINEMENT

The two Metropolitan Planning Organizations (MPOs) in the region maintain a regional travel demand model (TRM) that was used for this preliminary traffic and revenue analysis. The MPOs used this model to develop their 2030 Transportation Improvement Programs, which contain the highway projects identified for construction. Certain refinements and adjustments were made to the original TRM in order to conduct this analysis. This section describes the model refinement process.

The TRM was developed jointly by the Capital Area MPO, Durham Chapel Hill Carrboro MPO, North Carolina Department of Transportation and the Triangle Transit Authority. Inputs for the base years of 2002, 2010, 2020, and 2030, including socioeconomic data, highway networks, trip tables, and specialized modeling software were obtained from the TRM.

Highways proposed for future improvement in the model were compared with proposed roadway improvements in the Transportation Improvement Plans and Long Range Plans developed by the two MPOs. Special attention was paid to proposed roadway improvements within the study areas for the Western and Southern Wake Parkways and the Triangle Parkway. Detailed coding was added to represent the interchanges and toll plaza locations.

As discussed in Chapter 3, some of the Traffic Analysis Zones (TAZs) were disaggregated into smaller TAZs to allow for a better representation of the roadway system within the corridor. Trip tables were disaggregated accordingly to fit the new zone structure.

The base year 2002 model then was run using inputs supplied by the MPOs. A series of traffic assignments were run and compared with ground counts supplied by the NCDOT and those collected specifically for this study. Adjustments were made in input network speeds and trip tables in the project corridor in order to improve the calibration of the model in comparison with ground counts.

After the best calibration was obtained, a series of traffic assignments were made at the future years of 2010, 2015, 2020, 2025, 2030, 2035, and 2040 under no build, toll free, and tolled conditions. Several toll rates were tested for the years 2010 and 2030 in order to estimate the optimum toll rates.

Toll traffic assignments were made using a diversion assignment technique. This process involved a comparison of travel time and distance for trips that might use the Parkways with the best toll-free alternative routes. The estimated share of total traffic that would be expected to use the facilities was a function of travel time and distance savings, a monetary value placed on these savings and the toll rate being tested in any given assignment. In general, as the total costs to use the proposed Parkways increased, including toll charges, in comparison to the best alternative routes, the share of traffic on the Parkways would decrease. At lower toll levels, a higher share would be estimated.

The model also recognizes capacity constraints on roadways in the corridors. Speeds are adjusted in future conditions to reflect increasing congestion levels on both the toll facilities and competing roads. The proposed Parkways were assumed to be six lanes at all locations for purposes of this preliminary analysis.

BASIC ASSUMPTIONS

These preliminary traffic and revenue estimates for the Western and Southern Wake Parkways are predicated on the following basic assumptions, which are considered reasonable for purposes of this preliminary analysis:

1. The Western Wake Parkway would be opened to traffic by January 1, 2011, and the Southern Wake Parkway would be opened to traffic by January 1, 2015 (Scenario 2 only);
2. The proposed Triangle Parkway would not be constructed for Scenarios 1 and 2. However, it would be built under certain scenarios discussed in this chapter. If the Triangle Parkway is built, the existing southern terminus of NC-147 at T.W. Alexander Drive would be closed upon the completion of the Parkway in January 2010;
3. If the Triangle Parkway is built, it would extend from I-40 to McCrimmon Parkway.
4. In Scenario 1A only, tolls would be added to the section of I-540 now under construction between NC-54 and NC-55.
5. Improvements in the current Transportation Improvement Program, including some widening of competing routes and HOV lanes on I-40 by 2030 would be implemented;
6. For the base case, I-540 would be completed as a toll-free facility between I-40 and NC-55, prior to the opening of the Western Wake Parkway;
7. Toll rates and toll plaza locations would be as shown later in this chapter;
8. No other competing facilities or additional capacity would be constructed during the projection period, other than those in the current Transportation Improvement Plan;
9. For purposes of this preliminary analysis, both cash and electronic toll collection options would be made available at all toll plaza locations, although it is assumed that at least 75 percent of users would use electronic toll collection;
10. Economic growth in the project corridor, and associated travel demand will be as represented in the approved TRM used in this analysis;
11. For purposes of this study, it was assumed that inflation will average 2.5 percent per year;

12. Approximately 97 percent of traffic using the proposed Parkways would be passenger cars with approximately 3 percent being trucks.
13. Operating costs for toll collection were included in net revenue estimates; however, roadway maintenance and rehabilitation costs were not included;
14. The Western and Southern Wake Parkways would be well maintained, efficiently operated, effectively signed, and promoted to encourage maximum usage; and
15. Motor fuel would remain in adequate supply and no national or regional emergency would 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 Western and Southern Wake Parkways.

ROADWAY IMPROVEMENTS

People's travel behavior and number of vehicles that would use the proposed Parkways in the future would be heavily influenced by the operating conditions of other area roadways. 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 using the Parkways.

The TRM contains all future highway improvements listed in the MPO's fiscally constrained 2030 transportation improvement programs. A list of the planned road improvements that could affect traffic volumes on the Western and Southern Wake Parkways is provided in Table 4-1. The improvements that would have the most significant impact on the operations of the Parkways and the year that they are programmed in the TRM include:

**Table 4-1
Major Highway Improvements Contained in the Triangle Regional Model
Proposed Western and Southern Wake Parkways**

Name and Location	Project Description	Model Year
Garner Road	Walnut Creek Bridge to Martin Luther King Jr., 2-Lanes to 3-Lanes	2011
Edwards Mill Road Extension-Part II	Trinity Road to Chapel Hill Road, New 4-Lane	2011
Davis Drive	Morrisville - Carpenter Road to Farm Pond Road, 2-Lane to 4-Lane	2011
Davis Drive	Morrisville - Carpenter Road. to Durham County line, 2-Lane to 4-Lane	2011
South Loop Road	Louis Stephan Drive to Davis Drive, New 4-Lane	2011
NC-54	Trinity Road to Maynard Road, 2-Lane to 4-Lane	
I-540 (Northern Wake Expressway)	Triangle Town Boulevard to US 64 (Knightdale), New 6-Lane freeway	2011
I-540 (Eastern Wake Expressway)	US 64 to US 64 Bypass, New 6-Lane freeway	2011
I-540 (Northern Wake Expressway)	I-40 to NC-55 (Morrisville/Cary), New 6-Lane freeway	2011
High House Road	Davis Drive to NC-55, 2 Lane to 4 Lane	2011
US 70 (Clayton) Bypass	I-40 (South) to US 70 Business, 4 New Lanes	2011
US 1-64	US 64 to Walnut Street, 4-Lanes to 6-Lanes	2011
Louis Stephens Drive Extension	Morrisville Parkway to High House Road, new 2-Lane	2011
Tryon Road	Keisler to Cary Parkway, 2-Lane to 4-Lane	2011
Tryon Road	Cary Parkway to Jones Franklin Road, 2-Lane to 4-Lane	2011
Tryon Road	Jones Frankin Road to Dillard Drive, 2-Lane to 4-Lane	2011
Tryon Road	Gorman Street to Lake Wheeler Road, 2-Lane to 4-Lane	2011
Tryon Road	Norfolk Southern Rail to Existing Tryon Road, 2-Lane to 4-Lane	2011
Tryon Road	New Tryon Road Alignment to South Wilmington Street	2011
County Line Road	North of O'Kelly Chapel to Yates Store Road	2011
NC-55	Carpenter Fire Station Road to Durham County line, 2-Lane to 4-Lane	2011
NC-55	Carpenter Fire Station Road to High House Road, 2-Lane to 4-Lane	2011
NC-55	High House Road to US 64, 2-Lane to 4-Lane	2011
NC-55	Holly Springs Bypass to Wake Chapel Road, 2-Lane to 4-Lane	2011
Airport Boulevard Extension	NC-54 to Davis Drive, New 4-Lane	2020
Timber Drive East	White Oak Road to New Rand Road, New 4-Lane	2020
Hillsborough Street Safety	Gorman Street to Woodburn Road, 4 Lane to 2-Lane	2020
Sunset Lake Road Connector	NC-55 to Optimist Farm Road, 2-Lane to 4-Lane	2020
Davis Drive	Farm Pond Road to US 64, 2-Lane to 4-Lane	2020
Trinity Road	Edwards Mill Road Extension to Trenton Road, 2-Lane to 4-Lane	2020
S.W. Maynard Road	W. Gatham Street to Kildare Farm Pond, 2-Lane to 4-Lane	2020
Old Apex Road	High House Road to Cary Parkway, 2-Lane to 4-Lane	2020

(continued)

**Table 4-1 (cont'd.)
Major Highway Improvements Contained in the Triangle Regional Model
Proposed Western and Southern Wake Parkways**

Name and Location	Project Description	Model Year
Morrisville Parkway	Davis Drive to NC-55, 2-Lane to 4-Lane	2020
Ten-Ten Road	Holly Springs Road to US 1, 2-Lane to 4-Lane	2020
Blue Ridge Road	Duraleigh Road to Glen Eden Drive, 2-Lane to 4-Lane	2020
Holly Springs Road	Sunset Lake Road to Old Holly Springs Apex., 2-Lane to 4-Lane	2020
Center Street/1010	US 1 to Apex Peakway, 2-Lane to 4-Lane	2020
Lake Wheeler Road	I-40/I-440 to Tryon Road, 2-Lane to 4-Lane	2020
Tryon Road	Lake Wheeler Road to Norfolk Southern Rail, 2-Lane to 4-Lane	2020
Tryon Road Extension	Garner Road to Rock Quarry Road, New 4-Lane	2020
McCrimmon Parkway	Airport Boulevard to Aviation Parkway, New 4-Lane	2020
NC-55	Olive Chapel Road to US 64, 2-Lane to 4 Lane	2020
NC-55	Apex Peakway (South) to Olive Chapel Road, 2-Lane to 4-Lane	2020
Evans Road	NW Maynard Road to Dynasty Drive, 2-Lane to 4-Lane	2020
I-401 (South)	US 70 to East Parkway, 4-Lane to 6-Lane	2020
I-40(South)	US 1-64 to Wade Avenue, 4-Lane to 6-Lane	2020
I-40(South)	I-440 to US 70, 4-Lane to 8-Lane	2020
I-40(South)	US 70 to NC 42, 4-Lane to 8-Lane	2020
Smithfield Road	Carrington Drive to Forestville Road, 2-Lane to 4-Lane	2020
Cary Parkway Extension	Harrison Avenue to Trinity Road, New 2-Lane	2020
Jones Franklin Road	I-440 to Western Boulevard, 2-Lane to 4-Lane	2020
Johnson Pond Road	US 401 to North to Bells Lake Road, 2-Lane to 3-Lane	2030
Ten-Ten Road	Holly Springs Road to Bells Lake Road, 2-Lane to 4-Lane	2030
Kit Creek Road	NC-55 to Green Level to Durham, New 4-Lane	2030
Kit Creek Road	Davis Drive to NC-54, 2-Lane to 3-Lane	2030
Green Level to Durham	Green Level West to Jenks Road, 2-Lane to 4-Lane	2030
Green Level to Durham	Green Level West to Durham County Line, 2-Lane to 4-Lane	2030
Kelly Road	Jenks Road to Old US 1, 2-Lane to 4-Lane	2030
Olive Chapel Road	Kelly Road to NC-55, 2-Lane to 4-Lane	2030
Apex Peakway	NC-55 to NC-55, 4 New Lanes	2030
Reedy Creek Road	NE Maynard Road to Harrison Avenue, 2-Lane to 3-Lane	2030
New Hope Road	Old Pool Road to Rock Quarry Road, 2-Lane to 4-Lane	2030
NC-55	NC-42 to Harnett County, 2-Lanes to 4-Lanes	2030
Bells Lake Road	Ten-Ten Road to Johnson Pond Road, 2-Lane to 4-Lane	2030
Sunset Lake Road	US 401 to Hilltop-Needmore Road, 2-Lane to 4-Lane	2030
Sunset Lake Road	Hilltop-Needmore Road to Optimist Farm Road, 2-Lane to 4-Lane	2030
Creech/Jones Sausage Connector	Creech Road to Jones Sausage Road, 4 New Lanes	2030
Rock Quarry Road	New Hope Road to Battle Bridge Road, 2-Lane to 4-Lane	2030

(continued)

**Table 4-1 (cont'd.)
Major Highway Improvements Contained in the Triangle Regional Model
Proposed Western and Southern Wake Parkways**

Name and Location	Project Description	Model Year
NC-54	NE Maynard Road to NW Maynard Road	2030
East Garner Road	Rock Quarry Road to Shotwell Road, 2-Lane to 4-Lane	2030
Bethlehem Road	Smithfield Road to Grasshopper Road, 2-Lane to 4-Lane	2030
Old Holly Springs Apex Road	Holly Springs Road to Jessi Drive, 2-Lane to 4-Lane	2030
Jessi Drive Part (NL)	Ten-Ten Road to Holly Springs Road, 2-Lane to 4-Lane	2030
Western Boulevard	Gorman Street to Avent Ferry Road, 4-Lane to 6-Lane	2030
Louis Stephens Drive Extension (part	Durham County Line to O'Kelly Chapel Road, 2-Lane to 4-Lane	2030
Dillard Drive	Jones Franklin Road to Walnut Street, 2-Lane to 4-Lane	2030
Dillard Drive	Tryon Road to Jones Franklin Road, 2-Lane to 4-Lane	2030
Eastern Parkway	US 401 to US 401, New 4-Lane	2030
Hilltop-Needmore Extension (Part	NC-55 (Broad Street) to US 401 New 3-Lane	2030
Western Parkway (Fuquay Varina)	NC-55 to US 401, New 4-Lane	2030
Rock Quarry Road	Old Birch Road to New Hope Road, 2-Lane to 4-Lane	2030
Kildaire Farm Road	Ten-Ten Road to Kildaire Farm Connector, 2-Lane to 4-Lane	2030
Lake Pond Drive/Old Raleigh Road	Cary Parkway to Apex Peakway, 2-Lane to 4-Lane	2030
Penny Road	Ten-Ten Road to Holly Springs Road, 2-Lane to 4-Lane	2030
NC-55 (Main Street)	Holly Springs Road to Bobbitt Road, 2-Lane to 4-Lane	2030
Trinity Road Extension	NC-54 to Cary Town Boulevard, New 4-Lane	2030
New Rand Road	NC-50 to Old Garner Road, 2-Lane to 4-Lane	2030
I-540 (Eastern Wake Expressway)	I-40 (South) to US 64 Bypass, 6 New Lanes	2030
I-40 HOV/HOT Project	Durham County Line to I-440/US 1-64	2030
I-40 HOV/HOT Project	I-440/US 1-64 to Johnson County	2030
Morrisville Carpenter Road	NC-54 to Davis Drive, 2-Lane to 4-Lane	2030
Morrisville Carpenter Road	Davis Drive to NC-55, 2-Lane to 4-Lane	2030
Holly Springs Road	Cary Parkway to Penny Road, 2-Lane to 6-Lane	2030
Holly Springs Road	Penny Road to Ten-Ten Road, 2-Lane to 6-Lane	2030
Holly Springs Road	Ten-Ten Road to Kildaire Farm Connector, 2-Lane to 6-Lane	2030
McCrimmon Parkway Extension	Townhall Drive to Louis Stevens Road, 2-Lane to 4-Lane	2030
McCrimmon Parkway Extension	Louis Stevens Rd. to NC-55, New 4-Lane	2030
McCrimmon Parkway Extension	NC-55 to I-540, 2-Lane to 4-Lane	2030
McCrimmon Parkway Extension	I-540 to Green Level to Durham, New 4-Lane	2030
McCrimmon Parkway Extension	Green Level to Durham to Durham County line, New 2-Lane	2030
NC-54	Cary Parkway to McCrimmon Parkway, 2-Lane to 4-Lane	2030

Source: North Carolina Capital Area Metropolitan Planning Organization, 2030 Long Range Transportation Plan, September, 15, 2004
 Durham-Chapel Hill-Carrboro Metropolitan Planning Organization, FY 2006-2012 Metropolitan Transportation Improvement Program, August 10, 2005

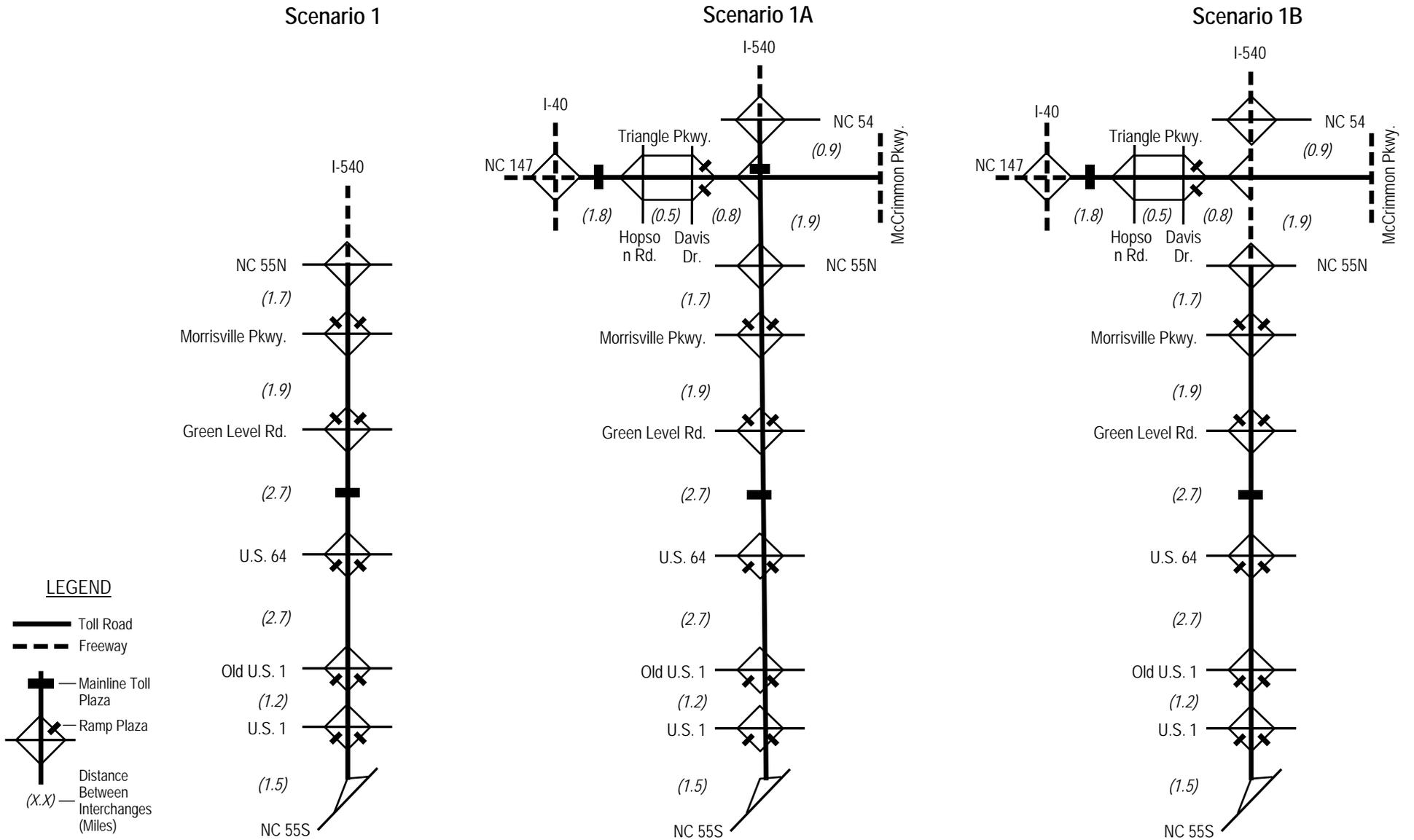
- **Model Year 2011**
 - I-540 (Northern Wake Expressway), I-40 to NC-55;
 - Widening of T.W. Alexander Drive, Davis Drive, and NC-55;
- **Model Year 2020**
 - New roads – Airport Boulevard Extension, McCrimmon Parkway from Airport Boulevard to Aviation Parkway and from Davis Drive to NC-55, New section from US 70 to Leesville Road for T.W. Alexander;
 - Widening of T.W. Alexander Drive, Davis Drive, McCrimmon Parkway, Morrisville Parkway, NC-54, US 401, I-40 (South), and Ten-Ten Road;
- **Model Year 2030**
 - I-40 –Widening and HOV/HOT Lanes;
 - Other new roads – Extensions of Kit Creek Road and McCrimmon Parkway; and Western Parkway (NC-55 to US 401); and
 - Widening of Morrisville Carpenter Road, NC-147, NC-54, and Ten-Ten Road.

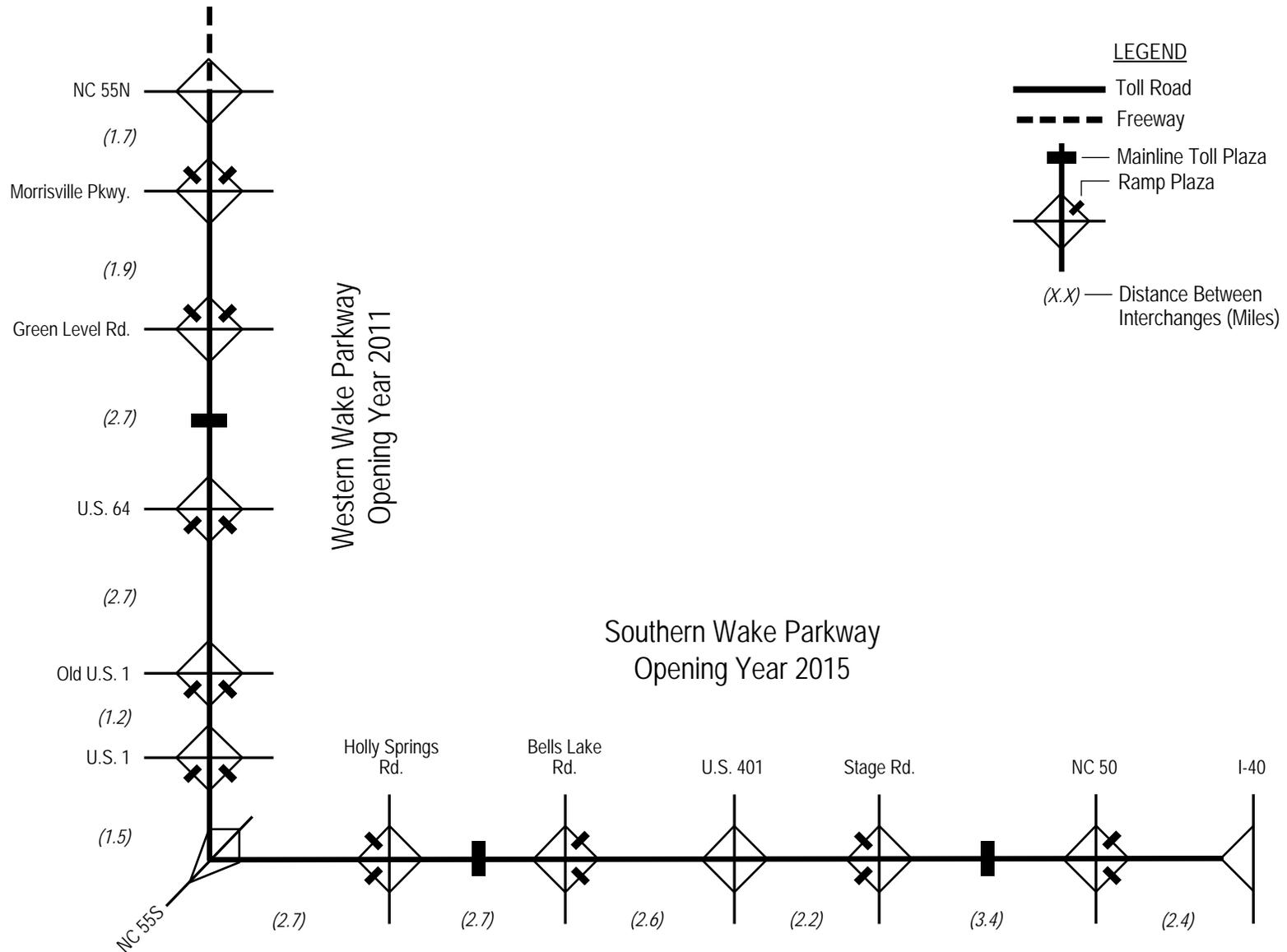
Several of these highway improvements would either compete directly with or complement the proposed Western and Southern Wake Parkways. For example, the widening of NC-55 parallel to the Western Wake Parkway will affect toll road traffic by increasing free road capacity in the corridor. Similarly, Ten-Ten Road is generally parallel to the Southern Wake Parkway and would also add free capacity in proximity to the toll road. The widening of I-40 (south) would add capacity and would compete with the Parkways for through trips. Other new roads will complement the proposed toll road by providing better access to the toll road interchanges. Examples of complementary roads include the extensions or widenings of Kit Creek Road, Green Level Road, and Bells Lake Road.

TOLL SCENARIOS

A series of traffic and revenue forecasts for four alternative scenarios are as described below and illustrated in Figures 4-1 and 4-2:

- **Scenario 1, Base Case, Western Wake Parkway**
 - The Western Wake Parkway would have one mainline plaza and five ramp plazas as illustrated in Figure 4-1;
 - The Southern Wake Parkway would not be built in this scenario;





- Free interchanges would be as indicated in Figure 4-1. The tolls at other interchanges would be designed to capture appropriate revenue from movements to and from these free interchanges.
 - Opening year for the Western Wake Parkway would be 2011;
 - I-540 from I-40 to NC-55 would be a freeway;
 - The proposed Triangle Parkway is not included in this scenario;
- **Scenario 1A, Western Wake Parkway, Triangle Parkway and I-540 from NC-54 to NC-55 Tolled**
- This scenario builds on Scenario 1. Triangle Parkway from I-40 to McCrimmon Parkway and the section of I-540 from NC-54 to NC-55 would be added as tolled facilities as shown in Figure 4-1;
 - This scenario has mainline toll plazas between the Green Level Road and US 64 interchanges on the Western Wake Parkway, between I-40 and Hopson Road on the Triangle Parkway, and between the ramps on I-540 at the junction with Triangle Parkway;
 - This scenario has seven ramp plaza locations;
 - Rates at each mainline plaza and ramp plaza would be set to cover the appropriate section of the toll facility;
- **Scenario 1B, Western Wake Parkway, Triangle Parkway Tolled, and I-540 from NC-54 to NC-55 Not Tolled**
- This scenario is the same as Scenario 1A except that the section of I-540 from NC-54 to NC-55 would not be tolled;
- **Scenario 2, Western and Southern Wake Parkways, I-540 from NC-54 to NC-55 Not Tolled, and Triangle Parkway Not Built**
- This scenario would have one mainline plaza on the Western Wake Parkway and two mainline plazas on the Southern Wake Parkway as illustrated in Figure 4-2;
 - Nine intermediate interchanges would be tolled. Free interchanges would be as indicated in Figure 4-2. The tolls at other interchanges would be designed to capture appropriate revenue from movements to and from these free interchanges.
 - Opening year for the Western Wake Parkway would be 2011, and opening year for the Southern Wake Parkway would be 2015;
 - I-540 from I-40 to NC-55 would be a freeway; and
 - The proposed Triangle Parkway is not included in this scenario.

The emphasis for this study is on the Western Wake Parkway. The Southern Wake Parkway was analyzed as a concept but did not include the combinations of Triangle Parkway and I-540 from I-40 to NC-55.

TOLL SENSITIVITY

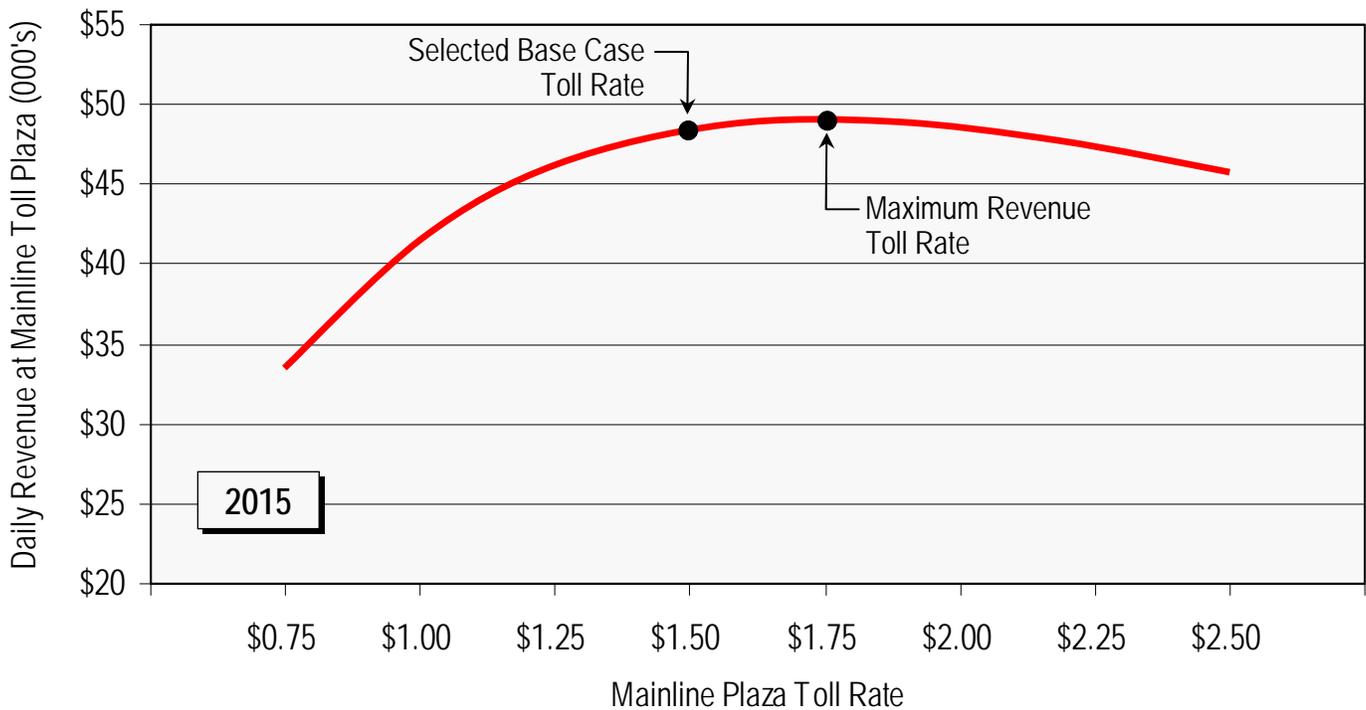
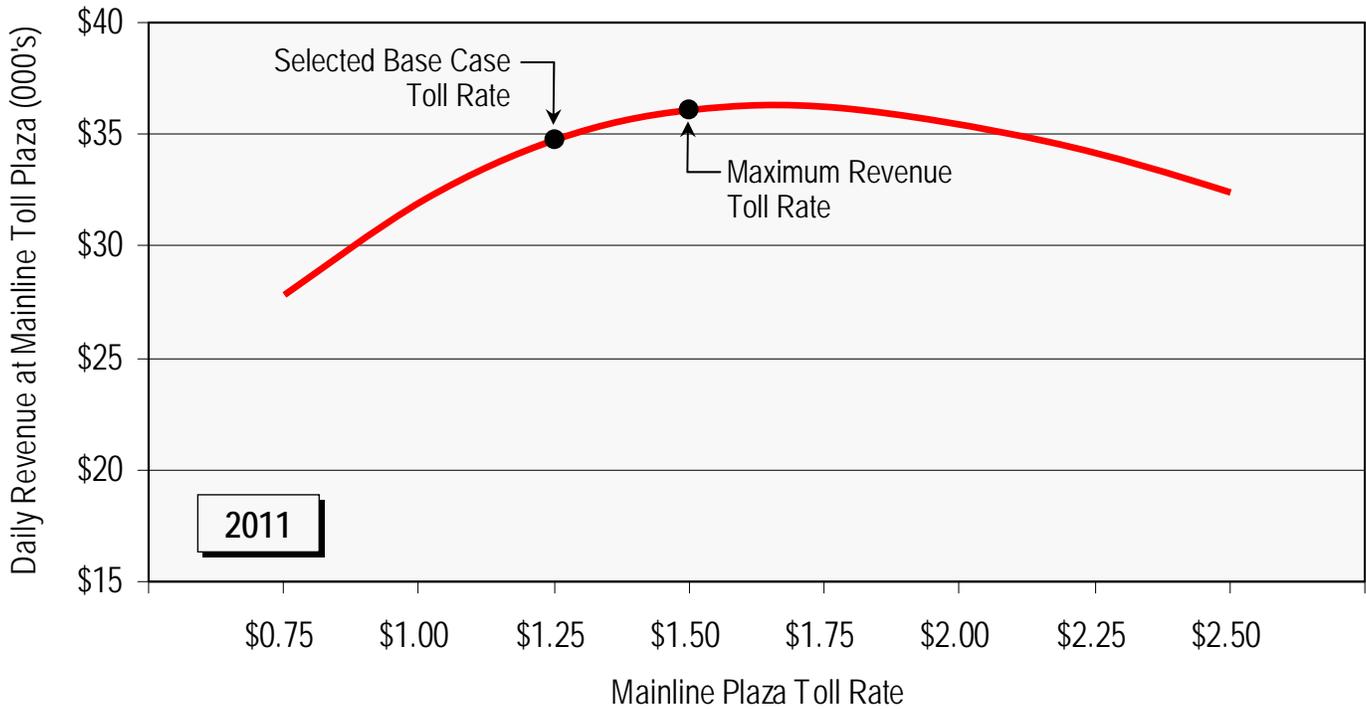
A series of alternative toll rates were tested from 2011, the assumed opening year of the Western Wake Parkway, through 2030. The results of the toll sensitivity analysis are shown in Figures 4-3 and 4-4. Toll rates at the ramps were varied in proportion to the mainline toll rates assumed at each toll level. All tolls were also assumed to be rounded to \$0.25 increments for purposes of the toll sensitivity analysis. Maximum revenue potential for the Western Wake Parkway was shown to be in the range between \$1.25 and \$1.50, with declining revenue at higher toll levels. For the Southern Wake Parkway, the maximum revenue potential was shown to be between \$1.00 and \$1.25.

An opening-year toll rate at the Western Wake Parkway mainline plaza of \$1.25 was selected. This rate would allow some limited flexibility in future rate setting, in the event revenue enhancement would be necessary. This rate would be the equivalent of approximately \$0.11 per mile for a full length trip on the Western Wake Parkway, which is considered to be near the middle of average toll rates in urban areas. However, this rate is in 2011 dollars and the range of rates in use nationally will likely be higher by then.

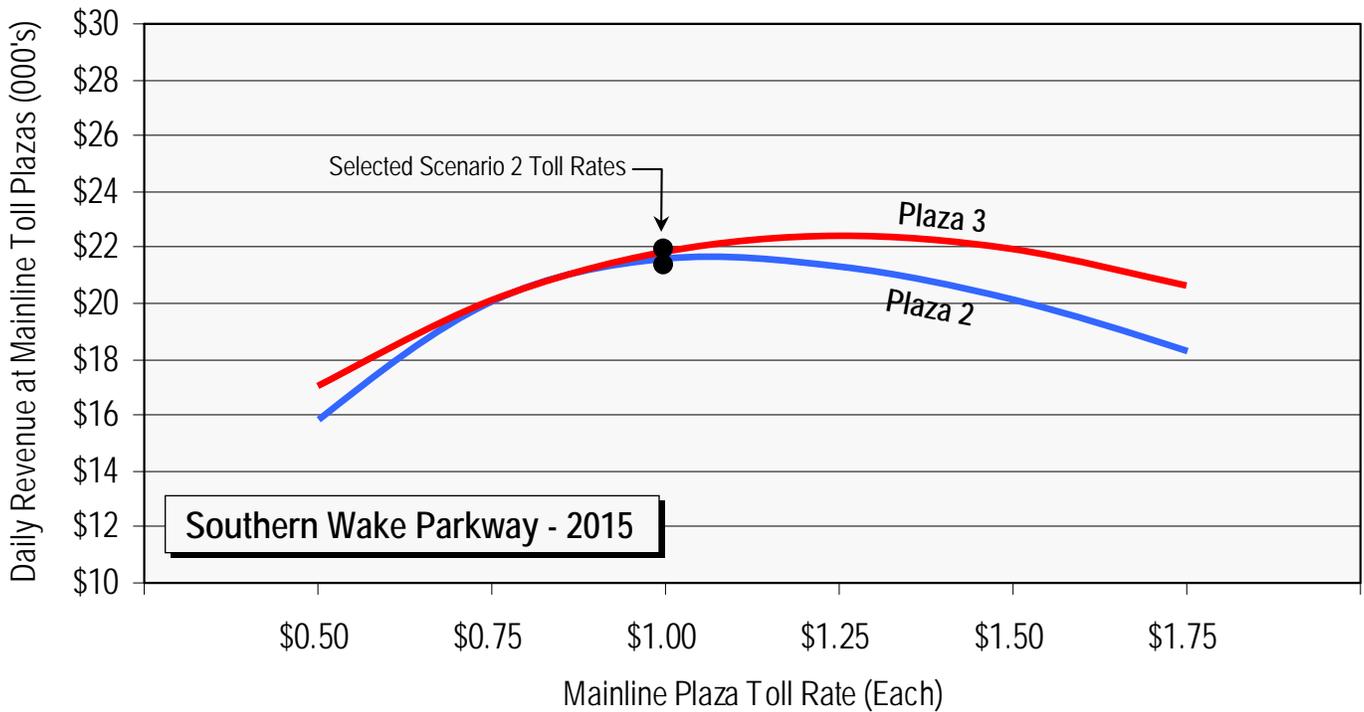
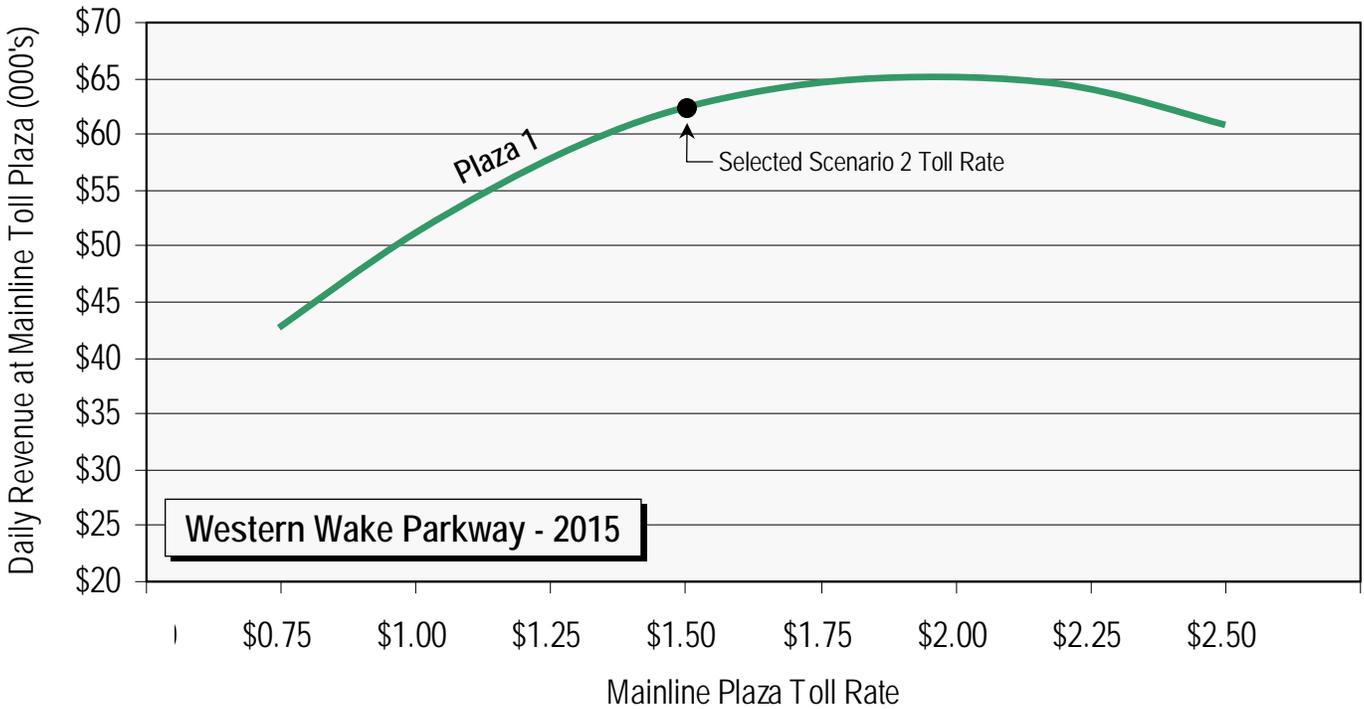
In 2015, the Southern Wake Parkway would be open with a mainline toll rate at the Western Wake Plaza of \$1.50 and the rates of each Southern Wake mainline plaza set at \$1.00. The per mile rate for a full length trip on the Western and Southern Wake Parkways would be approximately \$0.13 per mile, which is also in the mid-range of other toll properties as shown in Table 4-2.

TOLL SYSTEMS AND RATES

For the Western Wake Parkway, one mainline toll plaza would be established between Green Level Road and US 64. Tolls would also be established on ramps to and from the north at Morrisville Parkway and Green Level Road. Ramps to and from the south would be established at US 64, Old US 1, and US 1. The endpoints at NC-55 would be toll free. Under Scenarios 1A and 1B, a mainline toll plaza would be established on Triangle Parkway with ramp tolls at the Hopson Road/Davis Drive Interchange.



● Selected Passenger Vehicle Toll Rate



**Table 4-2
Comparison of Per-Mile Rates for Selected Urban Toll Roads
Passenger Car Toll Rates**

FACILITY	LENGTH (1) (miles)	CASH	ETC	PER MILE RATE: CASH	PER MILE RATE: ETC
Barrier Systems					
San Joaquin Hills Transportation Corridor - CA (Peak)	15.0	\$4.25	\$3.50	\$0.2833	\$0.2330
San Joaquin Hills Transportation Corridor - CA (Off-Peak)	15.0	\$3.75	\$3.00	\$0.2500	\$0.2000
Eastern Transportation Corridor (East Leg) - CA	16.9	\$4.00	\$3.50	\$0.2367	\$0.2071
Gratigny Expressway	5.4	\$1.25	\$1.00	\$0.2315	\$0.1852
E-470 - Colorado	46.1	\$9.75		\$0.2115	
Northwest Parkway - CO	9.5	\$2.00		\$0.2105	
Foothill Transportation Corridor - CA	13.5	\$2.75	\$2.50	\$0.2037	\$0.1852
Dulles Greenway - Virginia	14.0	\$2.70		\$0.1929	
Richmond Expressway- Downtown	2.6	\$0.50		\$0.1923	
Holland East West Expressway - Florida	21.0	\$3.75		\$0.1786	
Don Shula Expressway	7.3	\$1.25	\$1.00	\$0.1712	\$0.1366
Richmond Expressway - Virginia	6.3	\$1.00		\$0.1587	
Airport Expressway - Florida (2)	4.1	\$1.25	\$1.00	\$0.1520	\$0.1219
Tampa South Crosstown Expressway -Florida	15.5	\$2.25	\$1.75	\$0.1452	\$0.1129
Richmond Expressway Powhite Pkwy	3.8	\$0.50		\$0.1316	
Western and Southern Wake Parkway (2015)	27.7	\$3.50		\$0.1264	
Sam Houston Tollway - Texas (5)	60.0	\$7.50	\$6.00	\$0.1250	\$0.1000
President George Bush Turnpike - Texas	30.5	\$3.75	\$3.00	\$0.1230	\$0.0984
Hardy Toll Road - Texas	21.7	\$2.50	\$2.00	\$0.1152	\$0.0922
Western Wake Parkway (opening year 2011)	11.7	\$1.25		\$0.1068	
Dallas North Tollway	22.0	\$2.25	\$1.80	\$0.1023	\$0.0818
Dulles Toll Road - Virginia	13.0	\$1.25		\$0.0961	
Kilpatrick Turnpike - Oklahoma City, Oklahoma	24.5	\$2.00	\$1.90	\$0.0816	\$0.0776
Creek Turnpike - Tulsa, Oklahoma	35.2	\$2.45	\$2.30	\$0.0696	\$0.0653
East-West Expressway (2)	11.8	\$1.25	\$1.00	\$0.0530	\$0.0847

(1) Full-length trip on the facility
(2) Round-trip toll and distance (one-way toll system).

Under Scenario 1A only, a mainline toll plaza would be established on I-540P such that only travelers using I-540P between NC-54 and NC-55 would pay a toll. There would not be any tolls at the interchange between Triangle Parkway and I-540P.

For the Southern Wake Parkway, two mainline tolling zones would be established, one between Holly Springs Road and Bells Lake Road and the other between Stage Road and NC-50. Ramp toll plazas would be established on Holly Springs Road, Bells Lake Road, Stage Road, and NC-50.

Table 4-3 shows the rates used at the mainline plazas for Western Wake Parkway for the opening year through 2040. Rates under Scenario 1

would start at \$1.25 and move to \$3.00 by 2030 with increases assumed every five years. Under Scenarios 1A and 1B, travelers would pay two tolls if they used the entire Western Wake Parkway plus either Triangle Parkway or I-540P. In these cases, the mainline toll rates would begin at \$1.00 for each mainline plaza. By 2030, the mainline rate on the Western Wake Parkway would be \$2.50, and the rates on Triangle Parkway and I-540P would be \$2.00.

Rates for the ramp plazas would be proportionately lower. Figure 4-5 compares the rates for each tolling zone for the Western Wake Parkway. All rates are in future-year dollars; that is, already adjusted for inflation, assumed for this study to average 2.5 percent per year. The increase in tolls between the opening year and the later years of operation is slightly greater than the direct effect of inflation, reflecting both inflationary pressures and significant increases in traffic demand resulting in the need for some level of “real increase” in rates beyond inflation.

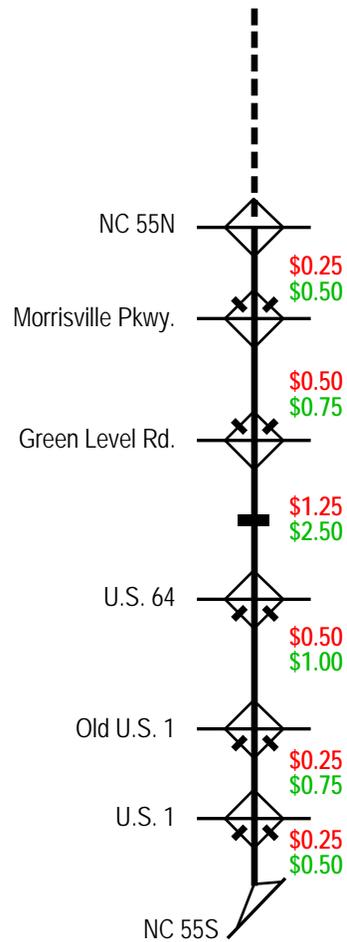
Figure 4-6 shows representative rates for 2015 and 2030 Scenario 2, Western and Southern Wake Parkways. Under this scenario with both Parkways in operation, tolls on Western Wake would start at \$1.50 and rise to \$2.50 by 2030. The Southern Wake is longer than the Western Wake and thus two mainline plazas would be established. Each would have a \$1.00 toll in 2015, and by 2030, the tolls at each plaza would be \$1.75. These rates are proportionately lower than the Western Wake mainline plaza in order that the average rates per mile traveled would be similar to those of the Western Wake Parkway.

Table 4-3 also shows toll rates at each location under a revenue-maximizing scenario in order to illustrate rates that would be near the maximum point of the sensitivity curves shown earlier. These rates would yield maximum revenue but are not recommended because rates at this level leave little or no room for further increases since total revenue would decrease at rates higher than the maximum point on the toll sensitivity curve. Normally rates would be set somewhat below the maximum point. As shown later, the maximum gross toll revenues represent a theoretical maximum potential amount.

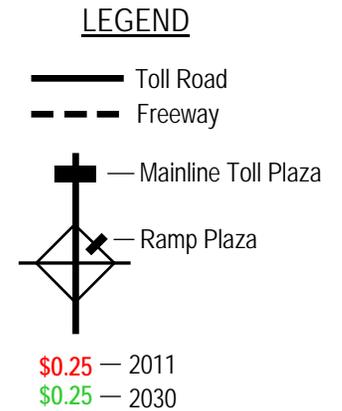
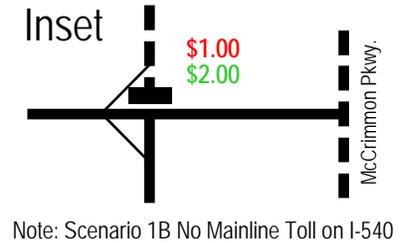
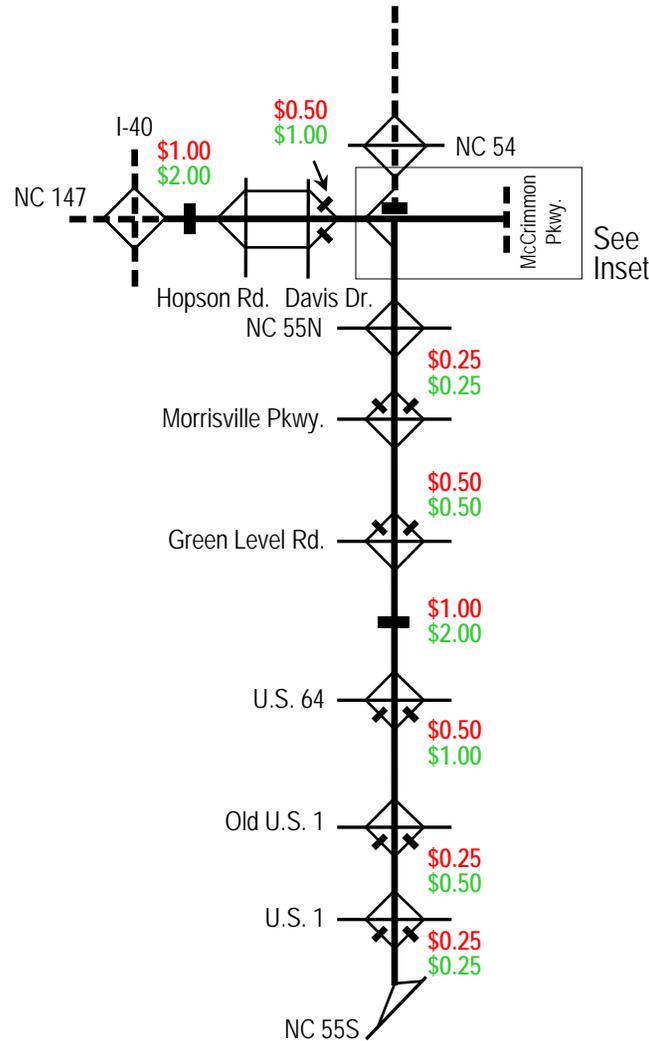
**Table 4-3
Comparison Of Toll Rates at Mainline Plazas
Passenger Cars**

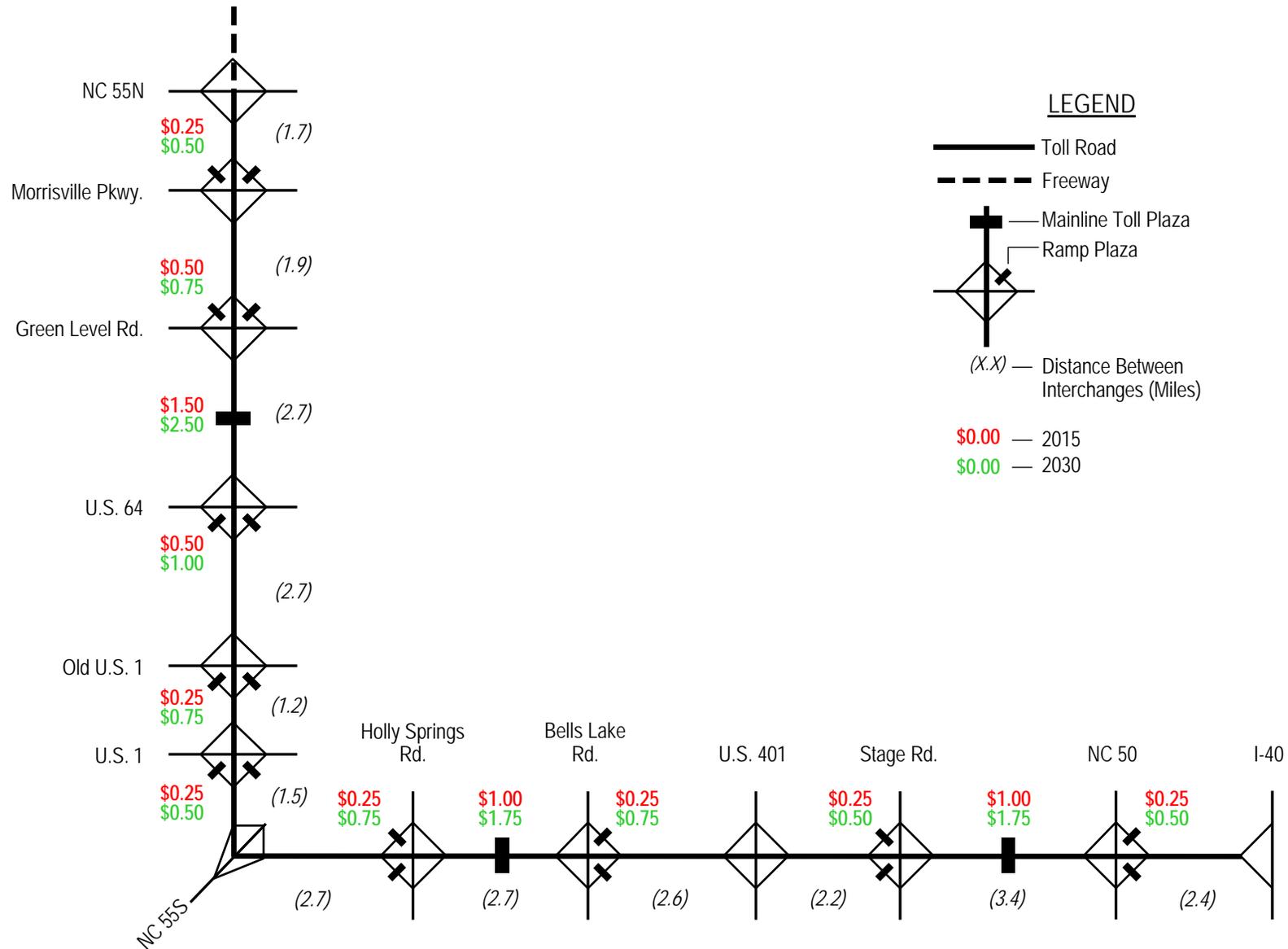
<u>Scenario</u>	<u>Year</u>	<u>West Wake Mainline</u>		<u>Triangle Parkway Mainline</u>		<u>I-540 P Mainline</u>		
		<u>Base Case</u>	<u>Maximize Revenue Case</u>	<u>Base Case</u>	<u>Maximize Revenue Case</u>	<u>Base Case</u>	<u>Maximize Revenue Case</u>	
Scenario 1	2011	\$1.25	\$1.50					
	2015	\$1.50	\$1.75					
	2020	\$1.75	\$2.00					
	2025	\$2.00	\$2.25					
	2030	\$2.50	\$2.75					
	2035	\$2.75	\$3.00					
	2040	\$3.00	\$3.25					
Scenario 1A	2011	\$1.00	\$1.50	\$1.00	\$1.00	\$1.00	\$1.00	\$1.00
	2015	\$1.25	\$1.75	\$1.25	\$1.25	\$1.25	\$1.25	\$1.25
	2020	\$1.50	\$2.00	\$1.50	\$1.50	\$1.50	\$1.50	\$1.50
	2025	\$1.75	\$2.25	\$1.75	\$1.75	\$1.75	\$1.75	\$1.75
	2030	\$2.00	\$2.75	\$2.00	\$2.00	\$2.00	\$2.00	\$2.00
	2035	\$2.25	\$3.00	\$2.25	\$2.25	\$2.25	\$2.25	\$2.25
	2040	\$2.50	\$3.25	\$2.50	\$2.50	\$2.50	\$2.50	\$2.50
Scenario 1B	2011	\$1.00	\$1.50	\$1.00	\$1.00	\$1.00	\$1.00	\$1.00
	2015	\$1.25	\$1.75	\$1.25	\$1.25	\$1.25	\$1.25	\$1.25
	2020	\$1.50	\$2.00	\$1.50	\$1.50	\$1.50	\$1.50	\$1.50
	2025	\$1.75	\$2.25	\$1.75	\$1.75	\$1.75	\$1.75	\$1.75
	2030	\$2.00	\$2.75	\$2.00	\$2.00	\$2.00	\$2.00	\$2.00
	2035	\$2.25	\$3.00	\$2.25	\$2.25	\$2.25	\$2.25	\$2.25
	2040	\$2.50	\$3.25	\$2.50	\$2.50	\$2.50	\$2.50	\$2.50

Scenario 1
(No Triangle Parkway)



Scenario 1A & 1B
(With Triangle Pkwy. Tolled and
I-540 Tolled for Scenario 1A Only)





**ASSUMED PASSENGER CAR TOLL RATES
WESTERN AND SOUTHERN WAKE PARKWAYS
SCENARIOS 1 AND 2**

Rates shown in these figures are for passenger cars; trucks would have proportionally higher toll rates. In developing preliminary revenue estimates for these preliminary study findings, it was assumed that truck rates would average three times passenger car rates at each toll plaza location.

ESTIMATED WEEKDAY TRAFFIC VOLUMES

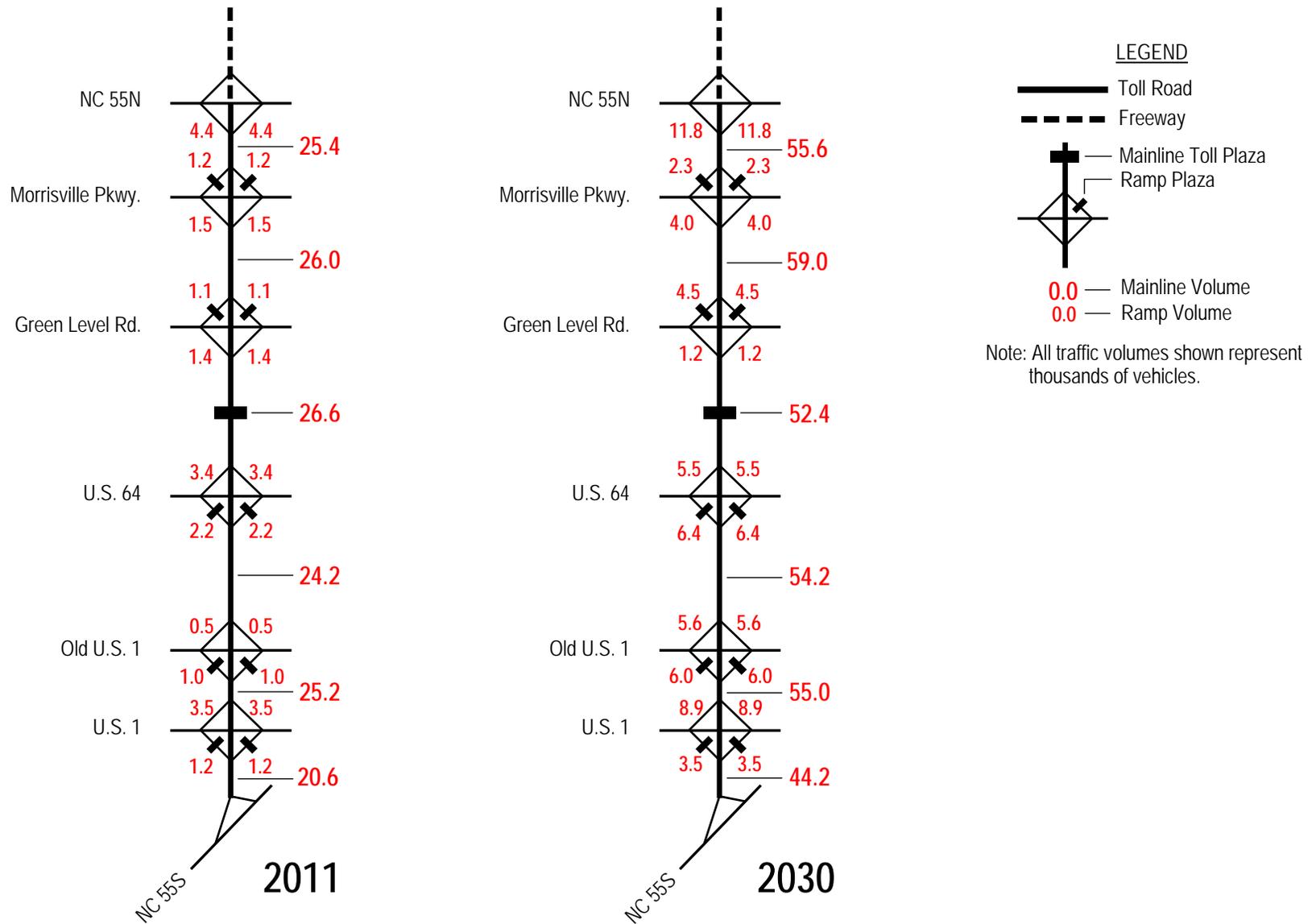
Preliminary estimates of weekday traffic on the Western Wake Parkway and are shown, at 2011 and 2030 levels, in Figure 4-7. These are under a toll condition, and recognize the toll of \$1.25 and \$2.50 for passenger cars at the Western Wake mainline tolling zone in 2011 and 2030, respectively. Toll-free traffic would be somewhat higher. The traffic volumes shown do not reflect ramp-up effects, which have been incorporated later in the annual forecasts.

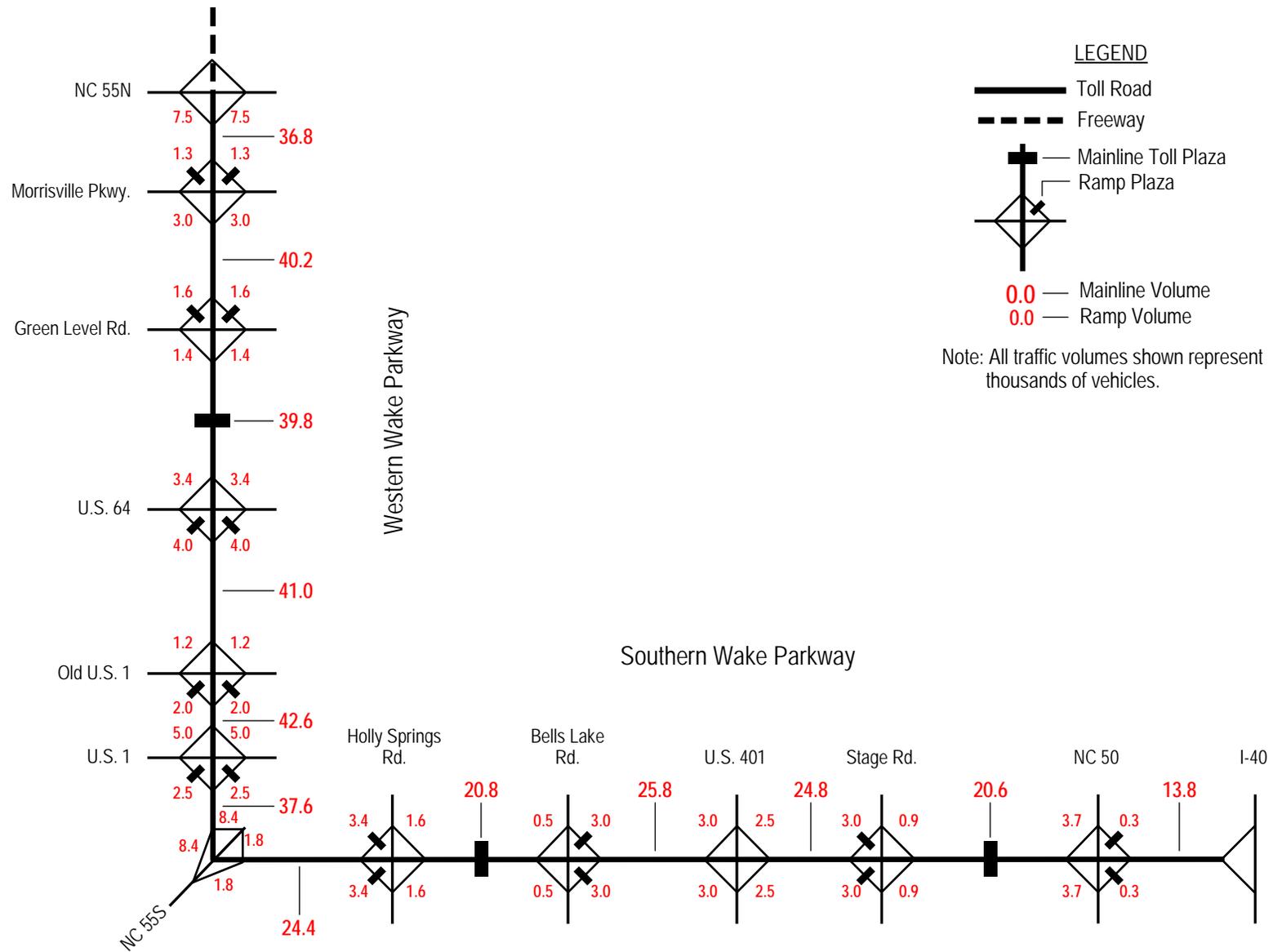
Traffic at the mainline plaza for Western Wake is estimated in the range of 20,500 to 26,600 vpd for Scenario 1 in the opening year. By 2030 the range of traffic would range from 44,200 to 59,000 vpd, which reflects very high growth in the corridor due mainly to the high growth assumptions for employment and population.

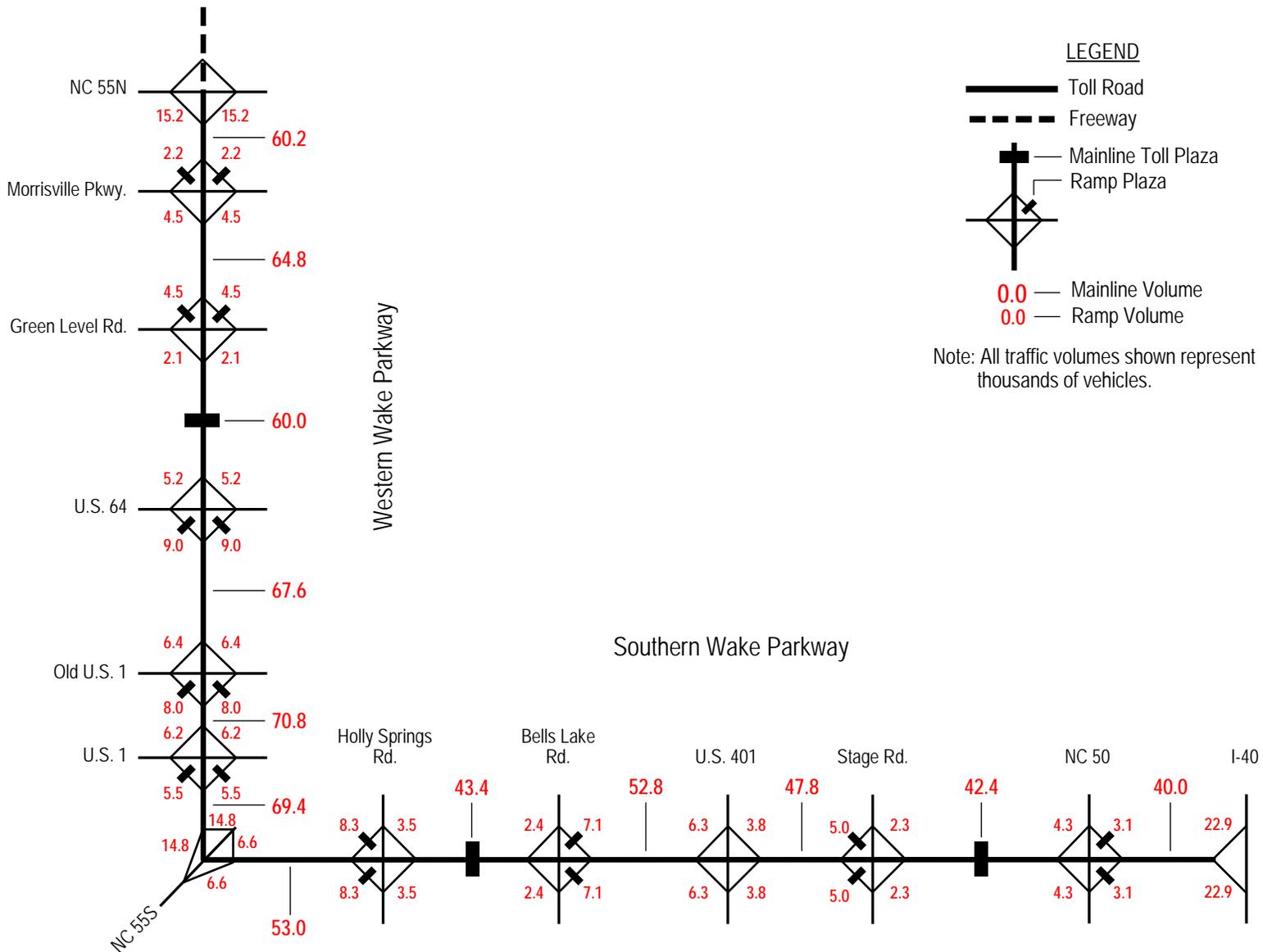
Similarly, toll traffic forecasts for Scenario 2, Western and Southern Wake Parkways, are presented in Figures 4-8 and 4-9 for 2015 and 2030, respectively. Under this scenario, I-540 north of NC-55 would be toll free and Triangle Parkway would not be constructed. Traffic levels on the Western Wake Parkway would range from 37,600 to 40,200 vpd in 2015, the year that the entire Parkway would be operational. On the Southern Wake Parkway in 2015, the traffic volumes would range from 13,800 to 25,800 vpd. By 2030, the mainline plaza traffic levels would reach 60,000 vpd at the Western Wake mainline plaza, 43,400 vpd at one Southern Wake mainline plaza and 42,400 vpd at the other Southern Wake mainline plaza.

ESTIMATED TRAFFIC AND REVENUE

Weekday transactions and revenues were calculated separately for each tolling area (the mainline location and the ramps as shown earlier). The traffic for each tolling area was multiplied by the assumed average toll to develop estimates of typical weekday revenue at each tolling zone. Note that the average tolls at the mainline plaza are slightly higher than those discussed previously; this is due to the assumption that approximately 3







percent of total traffic on the Parkways would be made by trucks which would be assessed higher tolls.⁽¹⁾

This weekday traffic would be expected to produce about 12.8 million transactions and \$12.5 million annually assuming a full year of operation and no adjustment for ramp-up. This annualization is based on 319 equivalent weekdays per year to account for expected lower weekend and holiday traffic.

The annualized transactions and revenues at 2011 levels have been further adjusted to reflect “ramp-up.” Ramp-up is the phenomenon experienced on most new 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 the facility and begins using it.

There are a number of reasons for the “ramp-up” phenomenon. For example, since not all motorists who will use the facility are from the local area, it may take several months before certain travelers are aware that the project is even there, or where the facility goes. It will also take several months for the project to begin to appear on new maps and for motorists to become 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 to reflect the time it will take to gradually build up demand. For example, in the first year of operation, traffic is estimated to be 61 percent of the baseline estimated result, increasing to about 95 percent of nominal by the end of the third full year of operation.

Preliminary estimates of annual toll revenue were prepared for each of the scenarios between the nominal assumed opening year of 2011 and the 39th year of operation in 2050. These estimates were based on the toll rates shown previously; the modeling results from 2011, 2015, 2020 and 2030 levels; and the assumed ramp-up between 2011 and 2013 for the Western Wake Parkway and between 2015 and 2017 for the Southern Wake Parkway. Intermediate years between these control points were estimated

⁽¹⁾ For the Triangle Parkway Preliminary Traffic and Revenue Study, the assumed truck percentage was 2.5 percent of the traffic mix. A higher rate was assumed for the Western and Southern Wake Parkways because once completed, it should attract more trucks since it would provide for better through movements that would avoid the congested I-40 corridor.

through interpolation. Beyond 2035, traffic and revenue growth was estimated nominally at 1 percent per year.

As shown in Table 4-4 under Scenario 1, opening-year revenue is estimated at about \$7.8 million, growing to \$18.4 million by 2015 when tolls are assumed to be increased. By 2030, the revenue is estimated to increase to \$55.1 million. Figures in Table 4-4 reflect the base case toll rate assumption.

Under Scenario 1A, in which both Triangle Parkway and I-540P are tolled, revenue is forecasts to increase from nearly \$13 million in the opening year to \$106 million by 2030.

Less revenue is expected under Scenario 1B because only the Triangle Parkway would be tolled in combination with Western Wake Parkway. Revenues would rise for Scenario 1B from \$11 million annually to \$88 million by 2030.

Under Scenario 2, which was analyzed in somewhat less detail as discussed earlier, transactions would rise from 30.9 million in 2015 when both the Western and Southern Wake Parkways would be open to 77.9 million transactions by 2030. Revenue would rise from \$31.2 million in 2015 to \$116.9 million by 2030 for this scenario.

These increases in traffic and revenue illustrate a relatively high level of sustained growth, and are indicative of the long-term economic growth potential of the two Parkways, particularly for Western Wake. It should be noted, however, that this level of sustained future growth would be considered a significant risk factor in the ultimate financial analysis for the project. In essence, revenue potential on Western and Southern Wake Parkways is heavily dependent on future development in the corridors which, in itself, would be market driven and subject to fluctuations.

It should be recognized that the growth in revenue for each scenario reflects both the significant increases in traffic demand and the effect of toll increases every five years beginning in 2015.

Table 4-5 provides transactions and revenue estimates for Scenarios 1, 1A and 1B, assuming slightly higher toll rates than the base case. Under this

**Table 4-4
Annual Toll Transactions and Gross Revenue Forecasts
Proposed Western and Southern Wake Parkways at Base Toll Rates
(Thousands)**

Year	Scenario 1 Western Wake Parkway Only		Scenario 1-A Western Wake Parkway, Triangle Parkway and I-540 Tolled		Scenario 1-B Western Wake Parkway, Triangle Parkway Tolled		Scenario 2 Western & Southern Wake Parkways	
	Total Transactions	Total Revenue	Total Transactions	Total Revenue	Total Transactions	Total Revenue	Total Transactions	Total Revenue
2011	7,784	\$7,778	14,672	\$12,933	12,999	\$11,042	7,784	\$7,778
2012	11,255	11,180	21,194	18,581	18,782	15,876	11,255	11,180
2013	14,193	14,008	26,692	23,270	23,659	19,897	14,193	14,008
2014	16,314	15,989	30,632	26,550	27,158	22,718	16,314	15,989
2015	16,588	18,401	30,943	32,885	27,370	28,102	30,903	31,233
2016	17,607	19,475	33,223	35,282	29,318	30,051	36,665	36,046
2017	18,693	20,613	35,677	37,857	31,409	32,141	41,449	40,089
2018	19,849	21,819	38,316	40,623	33,656	34,380	44,970	43,127
2019	21,081	23,097	41,156	43,594	36,069	36,780	47,510	45,375
2020	20,990	27,102	41,917	51,320	36,876	43,319	47,306	53,954
2021	22,314	28,706	44,432	54,360	38,976	45,662	49,956	56,640
2022	23,728	30,410	47,113	57,589	41,209	48,139	52,778	59,478
2023	25,239	32,220	49,972	61,020	43,585	50,757	55,784	62,478
2024	26,855	34,143	53,020	64,664	46,114	53,525	58,987	65,651
2025	27,498	39,469	53,018	77,122	46,191	64,254	62,403	79,773
2026	28,634	41,037	55,841	81,178	48,636	67,585	66,046	83,878
2027	29,819	42,669	58,820	85,451	51,216	71,092	69,935	88,225
2028	31,054	44,366	61,962	89,952	53,939	74,785	74,088	92,828
2029	32,343	46,132	65,278	94,694	56,812	78,675	78,524	97,704
2030	31,198	55,120	64,502	106,040	56,208	88,139	77,872	116,881
2031	31,822	56,223	65,792	108,161	57,332	89,902	79,429	119,219
2032	32,459	57,347	67,108	110,325	58,479	91,700	81,018	121,603
2033	33,108	58,495	68,450	112,532	59,649	93,535	82,638	124,035
2034	33,770	59,665	69,819	114,783	60,842	95,406	84,291	126,516
2035	33,984	65,531	69,746	128,916	60,884	107,452	85,977	141,692
2036	34,664	66,842	71,141	131,495	62,102	109,601	87,697	144,526
2037	35,357	68,179	72,564	134,125	63,344	111,794	89,450	147,417
2038	36,065	69,543	74,016	136,808	64,611	114,030	91,239	150,366
2039	36,786	70,934	75,496	139,544	65,903	116,311	93,064	153,373
2040	37,085	76,173	75,637	152,009	66,127	126,370	94,926	168,016
2041	37,455	76,935	76,393	153,529	66,788	127,634	96,824	169,697
2042	37,830	77,704	77,157	155,064	67,456	128,910	98,761	171,394
2043	38,208	78,481	77,929	156,615	68,130	130,199	100,736	173,108
2044	38,590	79,266	78,708	158,181	68,812	131,501	102,750	174,839
2045	38,976	80,059	79,495	159,763	69,500	132,816	104,805	176,587
2046	39,366	80,859	80,290	161,360	70,195	134,144	106,902	178,384
2047	39,760	81,668	81,093	162,974	70,897	135,486	109,040	180,137
2048	40,157	82,485	81,904	164,604	71,606	136,841	111,220	181,939
2049	40,559	83,309	82,723	166,250	72,322	138,209	113,445	183,758
2050	40,965	84,143	83,550	167,912	73,045	139,591	115,714	185,599

Note: Forecasts for 2011 - 2013 reflect an assumed ramp-up to full traffic levels beginning in 2014 for Western Wake Parkway.
 Forecasts for 2015 - 2017 reflect an assumed ramp-up to full traffic levels beginning in 2018 for Southern Wake Parkway.
 Western Wake Parkway assumed to open in 2011. Southern Wake Parkway assumed to open in 2015.
 Base case toll rates used for Western and Southern Wake Parkways.

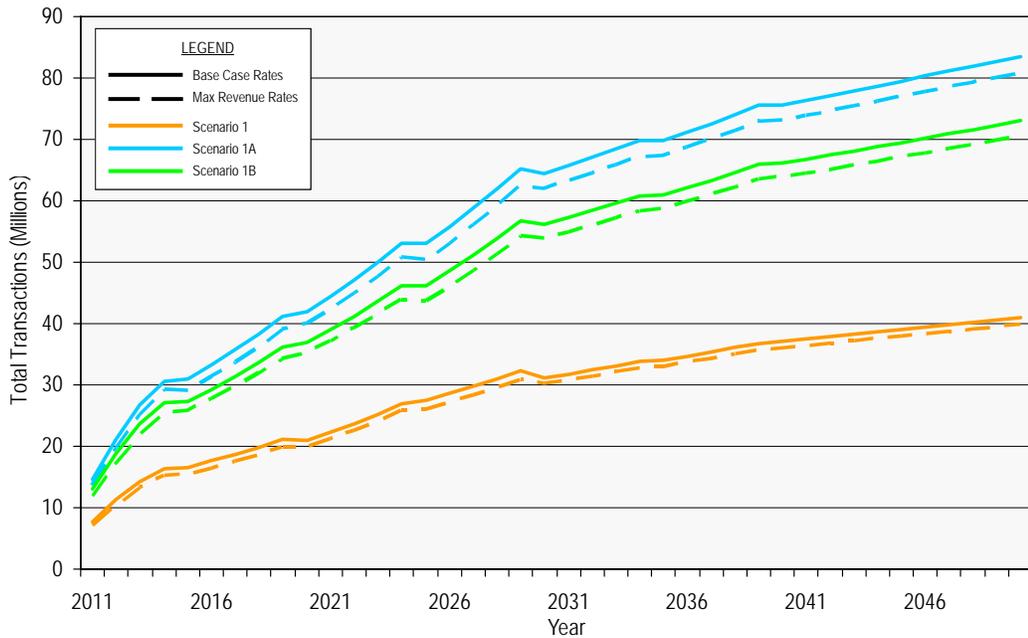
**Table 4-5
Annual Toll Transactions and Gross Revenue Forecasts
Proposed Western Wake Parkway at Maximum Revenue Potential
(Thousands)**

Year	Scenario 1 Western Wake Parkway Only		Scenario 1-A Western Wake Parkway, Triangle Parkway and I-540 Tolled		Scenario 1-B Western Wake Parkway, Triangle Parkway Tolled	
	Total Transactions	Total Revenue	Total Transactions	Total Revenue	Total Transactions	Total Revenue
2011	7,200	\$8,215	13,621	\$14,214	11,909	\$12,506
2012	10,439	11,838	19,859	20,568	17,313	18,042
2013	13,201	14,870	25,244	25,946	21,945	22,692
2014	15,216	17,014	29,242	29,821	25,350	26,002
2015	15,440	20,118	29,029	35,986	25,711	31,802
2016	16,406	21,347	31,254	38,714	27,607	34,109
2017	17,439	22,655	33,653	41,651	29,647	36,586
2018	18,544	24,046	36,240	44,814	31,843	39,246
2019	19,725	25,526	39,032	48,219	34,205	42,102
2020	19,842	28,852	39,939	56,554	35,154	49,287
2021	21,168	30,710	42,364	59,885	37,136	51,925
2022	22,589	32,691	44,954	63,426	39,246	54,714
2023	24,113	34,806	47,722	67,191	41,494	57,664
2024	25,746	37,062	50,682	71,195	43,890	60,785
2025	26,030	43,486	50,338	83,239	43,639	71,338
2026	27,127	45,186	53,142	87,833	46,053	75,199
2027	28,272	46,955	56,109	92,688	48,610	79,278
2028	29,469	48,795	59,250	97,818	51,318	83,588
2029	30,720	50,710	62,576	103,241	54,188	88,143
2030	30,177	58,020	61,950	117,074	53,783	100,573
2031	30,781	59,181	63,189	119,416	54,859	102,585
2032	31,397	60,365	64,453	121,805	55,956	104,637
2033	32,025	61,572	65,742	124,241	57,076	106,730
2034	32,665	62,804	67,057	126,726	58,217	108,865
2035	32,931	68,274	67,317	139,001	58,598	119,067
2036	33,590	69,640	68,664	141,782	59,770	121,449
2037	34,262	71,033	70,037	144,618	60,965	123,878
2038	34,947	72,454	71,438	147,510	62,185	126,356
2039	35,646	73,903	72,867	150,461	63,429	128,884
2040	35,979	79,058	73,153	162,741	63,801	138,855
2041	36,338	79,848	73,885	164,369	64,439	140,244
2042	36,702	80,647	74,624	166,013	65,084	141,646
2043	37,069	81,453	75,370	167,673	65,735	143,063
2044	37,440	82,268	76,124	169,349	66,392	144,493
2045	37,814	83,090	76,885	171,043	67,056	145,938
2046	38,192	83,921	77,654	172,753	67,726	147,398
2047	38,574	84,761	78,430	174,481	68,404	148,872
2048	38,960	85,608	79,215	176,226	69,088	150,360
2049	39,349	86,464	80,007	177,988	69,779	151,864
2050	39,743	87,329	80,807	179,768	70,476	153,383

Note: Forecasts for 2011 - 2013 reflect an assumed ramp-up to full traffic levels beginning in 2014 for Western Wake Parkway. Western Wake Parkway assumed to open in 2011.

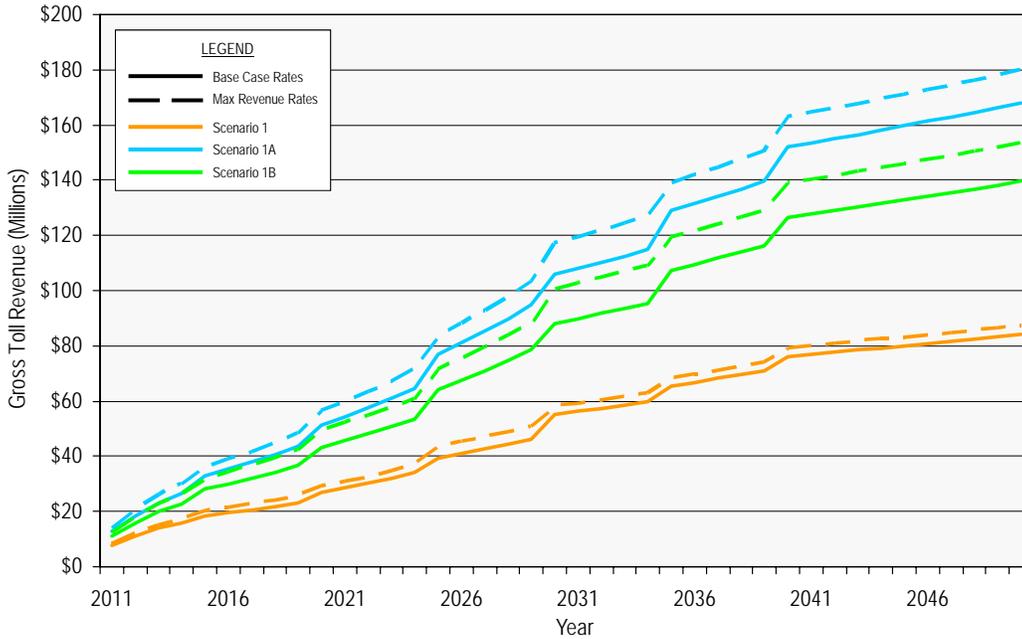
condition, toll rates were set to achieve maximum revenue potential, as described previously. As might be expected, annual revenue is slightly higher than under the base case conditions, but transactions are somewhat lower. No “maximum revenue” toll rates were tested for Scenario 2.

Figures 4-10 and 4-11 show the transaction and revenue forecasts for the Western Wake Parkway in graphical form for the recommended toll rates and at the rates that would achieve maximum revenue potential. In each scenario, the traffic at the maximum revenue level is lower than the traffic for the recommended toll rates. As tolls increase, traffic decreases as fewer drivers are willing to pay higher tolls. However, total system revenue would rise until the increased toll rate would cause more traffic to leave the system, which would then result in decreasing total revenue as tolls increase. Figure 4-12 illustrates the revenue contribution of each section of Western Wake, Scenario 1A in which both Triangle Parkway and I-540P are included as tolled facilities.



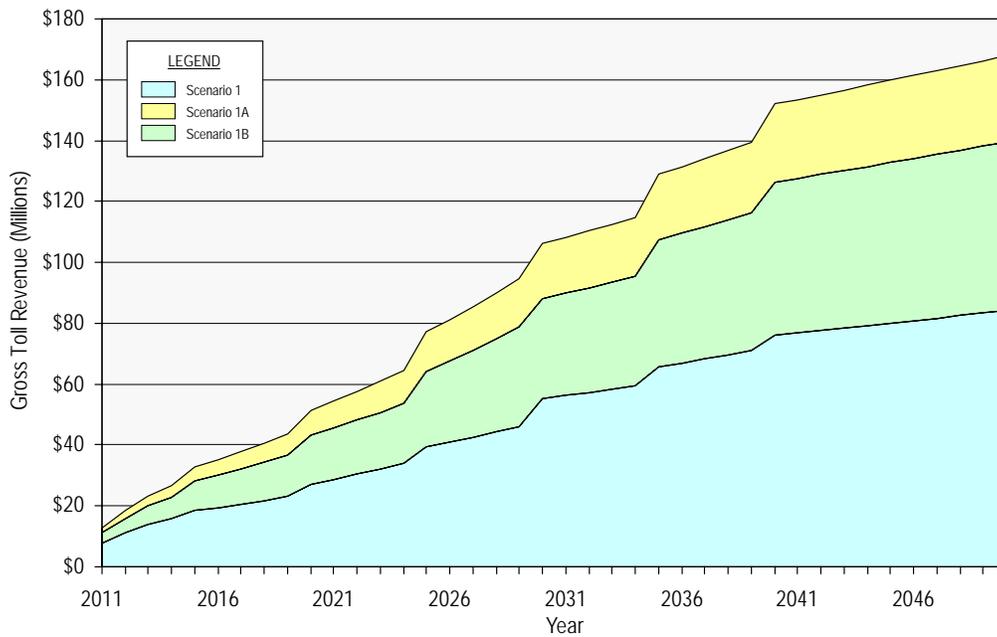
ANNUAL TRANSACTION FORECASTS BASE CASE vs. MAXIMUM REVENUE CASE

FIGURE 4-10



ANNUAL GROSS REVENUE FORECASTS BASE CASE vs. MAXIMUM REVENUE CASE

FIGURE 4-11



INCREMENTAL CONTRIBUTION OF ANNUAL TOLL REVENUE BY SCENARIO - WESTERN WAKE PARKWAY

FIGURE 4-12

Table 4-6 provides estimates of annual net revenue. This table assumes use of the “base case” toll rates – not the revenue maximizing rates. Preliminary estimates of operating costs related to toll collection were developed for the analysis, including a nominal fixed component and a variable component per transactions. The nominal fixed component was assumed to increase at 2.5 percent per year for inflation, while a variable component of operating cost increased in proportion with traffic growth. Note, these operating costs do not include costs for roadway maintenance and rehabilitation.

Under Scenario 1, net revenue is estimated at \$5.3 million in 2011, increasing to \$23 million by 2020 and \$50 million by 2030. Net revenue estimates would be significantly higher for Scenarios 1A and 1B due to the addition of additional toll facilities.

CONCLUSIONS

The conclusions of this preliminary study of the proposed Western and Southern Wake Parkways can be summarized as follows:

- **Western Wake Parkway Along with Triangle Parkway and I-540P Generates Significant Revenue** – The combination of Western Wake Parkway and Triangle Parkway adds much better access for travelers because it provides important links to the high employment areas of Wake County. In 2020, for example, traffic would nearly double under Scenario 1A in comparison to Scenario 1. Revenues would increase by 62 percent for these two scenarios in 2020.
- **Extremely Strong Economic Growth Forecast for Study Area** – The growth rates of socioeconomic parameters contained in the TRM are high as discussed in Chapter 3. Some of the areas contained within the corridor have relatively small levels of economic activity now. Growth is certainly occurring, but these growth rates will be subject to considerable review by the financial community before this proposed project was to receive financing. In an investment-grade study, the underlying socioeconomic parameters on which the traffic forecasts are based will have to be assessed by an independent economist; and
- **The Addition of Southern Wake Parkway Would Provide Major Transportation Benefits to the Region.** The Southern Wake Parkway combined with the Western Wake Parkway and Triangle Parkway would “complete” the southern loop of the Raleigh area and thus

**Table 4-6
Annual Net Toll Revenue Forecasts
Proposed Western Wake Parkway
(Thousands)**

Year	Scenario 1			Scenario 1-A			Scenario 1-B		
	Western Wake Parkway Only			Western Wake Parkway, Triangle Parkway and I-540 Tolloed			Western Wake Parkway, Triangle Parkway		
	Gross Toll Revenue	Operating Expense	Net Toll Operating Revenue	Gross Toll Revenue	Operating Expense	Net Toll Operating Revenue	Gross Toll Revenue	Operating Expense	Net Toll Operating Revenue
2011	\$7,778	\$2,484	\$5,294	\$12,933	\$4,098	\$8,835	\$11,042	\$3,608	\$7,434
2012	11,180	2,743	8,437	18,581	4,570	14,011	15,876	4,026	11,850
2013	14,008	2,971	11,037	23,270	4,982	18,288	19,897	4,391	15,506
2014	15,989	3,151	12,838	26,550	5,303	21,247	22,718	4,675	18,043
2015	18,401	3,222	15,179	32,885	5,409	27,476	28,102	4,764	23,338
2016	19,475	3,338	16,137	35,282	5,634	29,648	30,051	4,959	25,092
2017	20,613	3,461	17,152	37,857	5,873	31,984	32,141	5,164	26,977
2018	21,819	3,589	18,230	40,623	6,124	34,499	34,380	5,381	28,999
2019	23,097	3,722	19,375	43,594	6,390	37,204	36,780	5,610	31,170
2020	27,102	3,778	23,324	51,320	6,534	44,786	43,319	5,744	37,575
2021	28,706	3,921	24,785	54,360	6,785	47,575	45,662	5,959	39,703
2022	30,410	4,070	26,340	57,589	7,049	50,540	48,139	6,183	41,956
2023	32,220	4,227	27,993	61,020	7,326	53,694	50,757	6,418	44,339
2024	34,143	4,392	29,751	64,664	7,617	57,047	53,525	6,665	46,860
2025	39,469	4,500	34,969	77,122	7,728	69,394	64,254	6,767	57,487
2026	41,037	4,639	36,398	81,178	8,011	73,167	67,585	7,014	60,571
2027	42,669	4,783	37,886	85,451	8,306	77,145	71,092	7,271	63,821
2028	44,366	4,932	39,434	89,952	8,614	81,338	74,785	7,539	67,246
2029	46,132	5,086	41,046	94,694	8,936	85,758	78,675	7,819	70,856
2030	55,120	5,096	50,024	106,040	9,015	97,025	88,139	7,893	80,246
2031	56,223	5,214	51,009	108,161	9,221	98,940	89,902	8,074	81,828
2032	57,347	5,335	52,012	110,325	9,431	100,894	91,700	8,259	83,441
2033	58,495	5,459	53,036	112,532	9,647	102,885	93,535	8,448	85,087
2034	59,665	5,585	54,080	114,783	9,868	104,915	95,406	8,641	86,765
2035	65,531	5,687	59,844	128,916	10,005	118,911	107,452	8,768	98,684
2036	66,842	5,819	61,023	131,495	10,234	121,261	109,601	8,969	100,632
2037	68,179	5,954	62,225	134,125	10,469	123,656	111,794	9,175	102,619
2038	69,543	6,093	63,450	136,808	10,709	126,099	114,030	9,385	104,645
2039	70,934	6,234	64,700	139,544	10,954	128,590	116,311	9,600	106,711
2040	76,173	6,353	69,820	152,009	11,124	140,885	126,370	9,755	116,615
2041	76,935	6,478	70,457	153,529	11,334	142,195	127,634	9,939	117,695
2042	77,704	6,606	71,098	155,064	11,548	143,516	128,910	10,128	118,782
2043	78,481	6,737	71,744	156,615	11,767	144,848	130,199	10,320	119,879
2044	79,266	6,872	72,394	158,181	11,991	146,190	131,501	10,517	120,984
2045	80,059	7,009	73,050	159,763	12,220	147,543	132,816	10,718	122,098
2046	80,859	7,149	73,710	161,360	12,454	148,906	134,144	10,923	123,221
2047	81,668	7,292	74,376	162,974	12,693	150,281	135,486	11,133	124,353
2048	82,485	7,439	75,046	164,604	12,938	151,666	136,841	11,348	125,493
2049	83,309	7,588	75,721	166,250	13,188	153,062	138,209	11,567	126,642
2050	84,143	7,742	76,401	167,912	13,443	154,469	139,591	11,791	127,800

Note: Forecasts for 2011 - 2013 reflect an assumed ramp-up to full traffic levels beginning in 2014 for Western Wake. Western Wake opening year - 2011. Triangle Parkway and I-540P opening year - 2011 for Scenarios 1A and 1B

would provide better opportunities to avoid congestion on I-40 closer to the central area of the city and better access for a growing area of Wake County.

DISCLAIMER

Current professional practices and procedures were used in the development of these preliminary traffic and revenue study findings. However, there is considerable uncertainty inherent in future traffic and revenue forecasts for any toll facility. There may sometimes be differences between forecasted and actual results caused by events and circumstances beyond the control of the forecasters. These differences could be material. Also, it should be recognized that traffic and revenue forecasts in this document are intended to reflect the overall estimated long-term trend. Actual experience in any given year may vary due to economic conditions and other factors.

It is also emphasized that this study is considered preliminary and findings are subject to considerable refinement. It was not performed at a sufficient level of detail to be used in project financing and is not intended for that purpose. Considerably more detailed studies would be required prior to project financing.