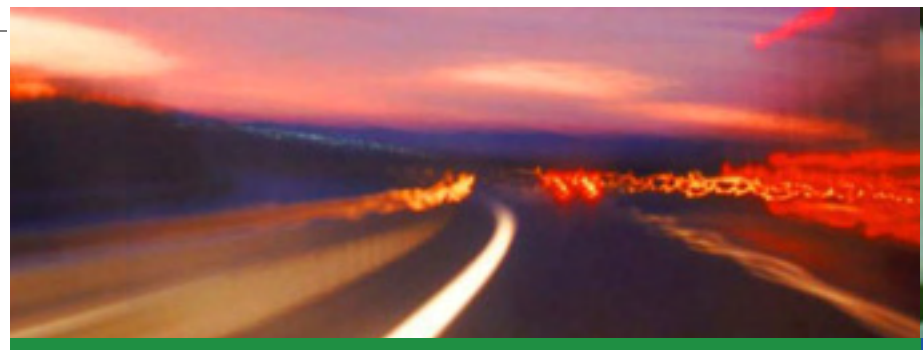

ADMINISTRATIVE ACTION ENVIRONMENTAL ASSESSMENT

TRIANGLE PARKWAY

February 2008

Submitted Pursuant to the National Environmental Policy Act

23 CFR 771.119 and 42 USC 4332(2)(c)

US Department of Transportation

Federal Highway Administration

North Carolina Turnpike Authority

North Carolina Department of Transportation

NORTH CAROLINA
Turnpike Authority

NORTH CAROLINA
Turnpike Authority

TRIANGLE PARKWAY
FROM NC 540 TO I-40
DURHAM AND WAKE COUNTIES, NORTH CAROLINA

FEDERAL AID PROJECT NUMBER NHS-54(7)
WBS ELEMENT 39942.1.TA1
S.T.I.P. PROJECT NUMBER U-4763B

ADMINISTRATIVE ACTION
ENVIRONMENTAL ASSESSMENT

SUBMITTED PURSUANT TO THE NATIONAL ENVIRONMENTAL POLICY ACT
42 USC 4332(2)(C)
US DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
AND
NORTH CAROLINA TURNPIKE AUTHORITY
AND
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

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Special Project Commitments

Triangle Parkway
Durham and Wake Counties

Federal-Aid Project Number NHS-54(7)
WBS Element 39942.1.TA1
STIP Project U-4763 B

In addition to the Section 404 Conditions, Regional Conditions, State Consistency Conditions, North Carolina Department of Transportation (NCDOT) Guidelines for Best Management Practices for the Protection of Surface Waters, General Certification Conditions, and Section 401 Conditions of Certification, the following special commitments have been agreed to by the North Carolina Turnpike Authority (NCTA):

Final Design

- The Triangle Parkway bridges crossing Burdens Creek will be designed to accommodate the existing Durham County sanitary sewer lines, including future maintenance access.
- NCTA will replace the multi-use path with a sidewalk along the north side of Davis Drive at the interchange with Triangle Parkway to maintain the connection along the existing multi-use path.
- NCTA will coordinate the designs for the multi-use paths proposed along Davis Drive, Hopson Road, and NC 54 with Research Triangle Foundation (RTF).

Construction

- During construction, NCTA will request contractors to incorporate measures to minimize the removal of trees along the entire length of the project.
- Based on the USACOE and NCDWQ requests, NCTA will require contractors to incorporate measures to minimize impacts to trees and buffers along Burdens Creek and unnamed tributaries to Burdens Creek during construction.

Post Construction

- NCTA will pay for the design and installation of a traffic signal at the entrance to the EPA property and the EISAI property at Hopson Road, when the intersection meets the NCDOT traffic signal warrants as identified in the Manual on Uniform Traffic Control Devices (MUTCD).

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Introduction

This report is an Environmental Assessment (EA) for the proposed Triangle Parkway in Wake and Durham Counties, North Carolina. Triangle Parkway is identified in the 2007-2013 North Carolina Department of Transportation State Transportation Improvement Program (STIP) as STIP project number U-4763B. The project location is shown on Figure I-1. As shown on Figure I-1, this EA refers to a "project area" and a "study area." The study area is bounded by NC 55 to the west, T.W. Alexander Drive to the north, McCrimmon Parkway to the south, and NC 54 to the east. The project area is a smaller area containing build alternatives reviewed in this document.

This EA has been prepared by the North Carolina Turnpike Authority (NCTA) in coordination with the Federal Highway Administration (FHWA) and the North Carolina Department of Transportation (NCDOT). It is intended to satisfy the requirements of both the National Environmental Policy Act (NEPA) and the North Carolina Environmental Policy Act. The document conforms to the Council on Environmental Quality (CEQ) guidelines, which implement the procedural provisions of NEPA, and the FHWA Guidance for Preparing and Processing Environmental and Section 4(f) Documents (Technical Advisory T6640.8A, 1987).

This project requires FHWA approval because it will be funded in part by Federal credit assistance under the Transportation Infrastructure Finance and Innovation Act (TIFIA) program (23 USC 601-609). TIFIA financing requires compliance with all generally applicable Federal laws and regulations for Federal-aid projects, including environmental review under NEPA and other Federal environmental laws. FHWA is the lead Federal agency in the NEPA process.

Proposed Action

The Proposed Action, known as Triangle Parkway, includes the construction of STIP Project U-4763B. Triangle Parkway is proposed as an approximate 3.4 mile multi-lane facility on new location from NC 540 in Wake County to I-40 in Durham County. The Proposed Action includes the widening of eastbound NC 540 with an additional 12-foot outside lane from NC 55 to northbound Triangle Parkway for a distance of 1.3 miles. The widening of eastbound NC 540 will include the widening of existing bridges over Davis Drive, Cisco Access Road, and the planned Louis Stephens Road. The improvements include the addition of a third lane to the flyover between eastbound NC 540 and northbound Triangle Parkway. While part of the Proposed Action, the NC 540 widening and flyover will not be included with the initial construction of Triangle Parkway. The NC 540 widening will be constructed at a later date when traffic volumes warrant its widening and in accordance with the Project Specific Agreement between the NCDOT and the NCTA. The traffic analysis indicates the NC 540 widening will be needed by 2024. Construction of a connector to Kit Creek Road is included as part of the Preferred Alternative. For additional description of the project, refer to Section 3.1. In addition, the Proposed Action includes the widening of northbound NC 147 from I-40 to T.W. Alexander Drive with an additional 12-foot inside lane for a distance of 1.9 miles.

Interchange connections for Triangle Parkway are proposed for access to NC 540, Davis Drive (SR 1999), Hopson Road (SR 1978), and I-40. The interchanges at these locations include new interchanges at Hopson Road and Davis Drive and existing interchanges at I-40 and NC 540.

Triangle Parkway, although identified in the State Transportation Improvement Program (STIP) as Project U-4763B, is not programmed for traditional (non-toll) state and Federal funds in the 2007-2013 STIP. The 2007-2013 STIP identifies Triangle Parkway as a NCTA project with "funding by others." For this project, the term "funding by others" refers to the use of toll revenues and other non-traditional funding sources.

The NCTA proposes Triangle Parkway as a tolled-roadway with full control of access (See Appendix A; Figures A-1 through A-6). The NCTA schedule for Triangle Parkway includes right-of-way acquisition and construction to begin in 2008.

Project Setting

Triangle Parkway is predominantly located within the Research Triangle Park (RTP). (See Figure I-2) RTP encompasses a campus of over 7,000 acres and is centrally located within the region known as the "Triangle" (See Figure I-1). RTP crosses both Wake and Durham County boundaries. Triangle Parkway was identified in the 2006-2012 NCDOT STIP for both counties but was not included for funding. The 2007-2013 STIP identifies Triangle Parkway as a NCTA project with "funding by others," which assumes that the project will be implemented as a toll road.

RTP was established in 1959 by leaders from business, academia, and industry. In the mid-1950's and into the 1960's the region was largely rural and agriculture was a primary land use. Since then, the Triangle region has gradually developed into a more urban area surrounded by bedroom communities.

RTP includes covenants that restrict development to businesses conducting research and research applications. RTP currently houses more than 157 businesses and research facilities, which employ approximately 39,000 full-time employees. Companies with facilities in RTP include U.S. Environmental Protection Agency (EPA), IBM, Biogen Idec, Cisco Systems, Nortel, Sony Ericsson Mobile Communications, and GlaxoSmithKline, among others. Since RTP businesses are limited to research oriented enterprises, people working within the area not only live outside the RTP but also must travel outside its boundaries to access restaurants, retail businesses, and gas stations during the work day.

Transportation Plans

Triangle Parkway has been designated by the NCDOT Board of Transportation as part of a statewide Strategic Highway Corridor (SHC) system. The SHC consists of several different roadway classifications, with the highest classification being a freeway, which requires full access control. Triangle Parkway has been designated as a "freeway" facility in the SHC system.

Triangle Parkway has been included in the long-range transportation plans of the two metropolitan planning organizations within the Triangle Region: the Capital Area Metropolitan Planning Organization (CAMPO) and the Durham-Chapel Hill-Carrboro Metropolitan Planning Organization (DCHC MPO). Each of these plans indicates the increasing transportation demands occurring within the Triangle Region and notes the importance of this roadway in the Triangle Region. In addition to these plans, NCDOT and the Triangle Transit Authority (TTA) each identified the importance and need for Triangle Parkway based on transportation studies they prepared in the early 2000's. These studies included the NCDOT I-40 High Occupancy Vehicle/Congestion Management Study; and TTA Regional Rail System study.

In May 2007, CAMPO and DCHC MPO amended their long range transportation plans to designate Triangle Parkway as a tolled-facility with construction tentatively scheduled to begin in 2008, several years prior to the timing feasible with traditional NCDOT funding. In addition, the NCTA signed a Memorandum of Understanding with CAMPO in June 2007 regarding issues relating to funding of the project, financing of the project, and access. A copy of the MOU can be found in Appendix D.

North Carolina Turnpike Authority

In October 2002, the North Carolina General Assembly created the NCTA with approval of HB 644 that amended the North Carolina General Statutes §§ 136-89.180 through §§ 136-89.197. In August 2005, House Bill 253 authorized the NCTA to develop, construct, operate, and maintain up to nine toll facilities.

Local officials may request that NCTA consider any planned road or bridge project for development as a toll facility. To be considered as a candidate turnpike project, the project must meet selection criteria approved by the NCTA Board of Directors in April of 2006, which include: full control of access, availability of free alternate routes, financial feasibility, reasonable expectation of local support, a high probability of being able to start construction within a reasonable time frame; and giving special consideration to those projects that would play a significant role in the statewide or regional highway system or serve major economic generators.

The NCTA 2006 Annual Report to the Joint Legislative Transportation Oversight Committee (JLTOC) notes the advantages and "…reality of these projects taking shape and delivering them to the motoring public years or decades sooner than would be possible through traditional means …" (NCTA is) "…proving that financing projects with tolls avoids the vastly inflated (construction) costs from project delay and reduces the risk of being able to build at all. In addition, with the NCTA's paying both construction and maintenance costs for the life of the projects, hundreds of millions of highly competitive public dollars will be returned to the TIP for other critical highway needs."

Transportation Funding and NCTA Traffic Revenue Studies

North Carolina roads traditionally have been built with taxpayer funds, either through the state transportation budget or Federal-aid highway funds allocated to the state. Using tolls as the funding mechanism for construction and maintenance allows needed capacity to be added when budget shortfalls would otherwise prevent or delay completion of critical projects. Tolls are often structured to maximize revenues and success is measured in terms of project cost recovery.

TIFIA – Federal Credit Program

The Transportation Infrastructure Finance and Innovation Act of 1998 (TIFIA) established a Federal credit program for eligible transportation projects of national or regional significance under which the U.S. Department of Transportation (DOT) may provide three forms of credit assistance: secured (direct) loans, loan guarantees, and standby lines of credit. The program's fundamental goal is to leverage Federal funds by attracting substantial private and other non-Federal co-investment in critical improvements to the nation's surface transportation system. The DOT awards credit assistance to eligible applicants, which include state departments of transportation, transit operators, special authorities, local governments, and private entities.

The TIFIA Program Guide was updated in January 2007 to reflect reauthorization legislation under SAFETEA-LU (Public Law 109-59), which was enacted in August 2005. The public policy underlying the TIFIA credit program asserts that the Federal Government can perform a constructive role in supplementing, but not supplanting, existing capital finance markets for large transportation infrastructure projects. Since the TIFIA program offers credit assistance, rather than grant funding, its potential users are infrastructure projects capable of generating their own revenue stream through user charges or other dedicated funding sources.

Traffic and Revenue Studies

The Proposed Triangle Parkway Preliminary Traffic and Revenue Study – Final Report (April 2006) (Preliminary T&R Study) concluded tolls collected on Triangle Parkway could potentially cover a significant portion of the project costs. This Preliminary T&R Study was prepared at a feasibility study level to provide preliminary estimates for revenue and toll rate sensitivity. The Preliminary T&R Study noted the traffic benefits Triangle Parkway would provide to other routes in the region, such as NC 55 and NC 54.

The preliminary study concluded the toll rate that produced the maximum revenue potential was in a range between $1.00 and $1.25, with declining revenue at higher toll levels. The study identified $1.00 as a potential opening year toll fee. Final toll rates will be determined based on the findings of the Investment Grade Traffic and Revenue Study which is currently being prepared.

NCTA Toll Revenues

Using preliminary information provided in the Preliminary T&R Study, a "broad-brush" financial feasibility assessment was prepared to estimate the extent to which tolls could be used to pay for the proposed project. Potential annual net revenues were estimated using operation and maintenance costs in relation to toll revenues generated from the use of the road.

The NCTA is still evaluating available toll options based on the need to finance operations, road maintenance, and the debt services. Examples of potential toll options that could be reviewed by NCTA may include time-of-day toll pricing.

Time-of-day or peak-period pricing (sometimes known as "value pricing") can be used as a congestion management option, with toll prices higher for peak travel times and lower for off-peak hours. This would encourage drivers to consider postponing nonessential trips to those hours when capacity demand is lower, thereby reducing congestion.

NCTA Project Funding

A generalized and preliminary bonding capacity analysis was included in the Preliminary T&R Study as a planning tool for NCTA to identify the potential bonding capacity for the project. This analysis concluded that this project has a bonding capacity ranging from $71 million to $105 million depending on the scenario. The Preliminary T&R Study concluded, "Tolls potentially can cover a significant portion (but not all) of the project cost."

The shortfall between the total of the project's revenue bond capacity and the total project cost is referred to as a financial "gap". The NCTA is reviewing options to fund these gaps, such as using state funds, turning to the private sector, or potentially vying for highly competitive, limited NCDOT dollars.

A more detailed Investment-Grade Traffic and Revenue Study is in progress. This study will be used to support project financing. The traffic and revenue estimates provided in the Preliminary T&R Study are subject to considerable refinements in the investment-grade study, based on updated information and evaluations of alternative financing strategies.

Traffic Forecasts

The traffic forecast used in the EA (the NEPA Forecast) is separate from the traffic forecast used in the Preliminary T&R Study (the T&R Forecast). The NEPA Forecast and the T&R Forecast have been prepared for different purposes, and therefore somewhat different methodologies were used for each, as explained below:

- NEPA Forecast - For purposes of evaluating impacts and determining the preliminary design of the facility, the traffic forecast was developed using standard procedures for FHWA NEPA documents. This forecast is documented in Traffic Forecasts for the Toll Scenarios for STIP Project No. U-4763, Triangle Parkway (March 2007). This forecast was developed based on the existing regional travel demand model, which is approved by local MPOs (CAMPO and DCHC-MPO), and state and Federal regulatory agencies for transportation studies in this region.[1] The NEPA Forecast assumes Triangle Parkway, NC 540, and Western Wake Freeway are tolled facilities. The NEPA Forecast was analyzed with two different traffic analysis tools. The overall operation and capacity of the existing and future traffic conditions were evaluated using Highway Capacity Software 2000 (HCS); and, a microsimulation model known as CORSIM was used to evaluate the constraints resulting from congestion throughout the network.
- T&R Forecast - For purposes of forecasting revenue, a separate traffic forecast was developed. The T&R Forecast is documented in Proposed Triangle Parkway Preliminary Traffic and Revenue Study – Final Report (April 2006). The T&R Forecast assumes Triangle Parkway, NC 540, and Western Wake Freeway are tolled facilities. In addition, the NCTA has commissioned a more detailed "investment-grade" T&R Study, which is in progress. The investment-grade study will be released when it is complete.

The two traffic forecasts differ in several ways:

- Purpose - The NEPA Forecast was developed based on the CAMPO and DCHC-MPO regional traffic model as part of the project development process. It was used to assess impacts and develop the preliminary design for the proposed roadway. The impacts to the human and natural environments that are discussed in the environmental document in this NEPA study are based on that design. The T&R Forecast was developed for the purpose of estimating the revenues the toll road is anticipated to generate over the bonding period.
- Population and Employment Assumptions - The NEPA Forecast was developed using a transportation model adopted by DCHC MPO and CAMPO, which includes assumptions of future population and employment within the region. The estimates of future population and employment affect the number of vehicles that are predicted to use regional roadways over a 20 year horizon. The NEPA Forecast uses the established, MPO-approved assumptions regarding demand, population, and employment growth. The T&R Forecast, on the other hand, may modify the

[1] The forecast is documented in Traffic Forecasts for the Toll Scenarios for TIP Project No. U-4763, Triangle Parkway (March, 2007)

assumptions regarding population and employment growth. This adjustment would be needed to ensure conservative estimates of future revenues.

- Calibration - The traffic model used to develop the NEPA Forecast is calibrated by CAMPO and DCHC MPO according to regional traffic volumes. This ensures consistency in traffic forecasts for different projects in the region. By contrast, the traffic model used to develop T&R Forecast may be calibrated according to observed volumes within the narrow confines of the project study area. As a result, the T&R Forecast is based on a version of the model that was not approved by DCHC MPO, CAMPO or NCDOT. The adjustments made in the T&R Study model are appropriate given the purpose of that study; it is used by the financial community to evaluate the financial return that could be expected from their investment. The T&R Study was not used for developing engineering designs or evaluating project impacts.
- Results - In general, the traffic volumes predicted for the proposed toll road in the T&R studies tend to be lower than the NEPA traffic forecast. The difference between the two forecasts is due to the purposes that each forecast serves, and the fact that each forecast utilizes different standards for analyses that were designed for that particular purpose.

In sum, there are differences between the NEPA and T&R Forecasts, but those differences reflect the different purposes that each forecast serves. The T&R Forecast is used by the financial community and potential investors to evaluate project financial risk and the financial return that could be expected from the investment. From the financial standpoint, a conservative assumption is one that is based on the low end of the predicted range for population and employment growth and traffic volumes, which correlates to lower toll revenues. These "low-end" assumptions help reduce the risk of overstating the revenue potential of the proposed toll road. The NEPA traffic forecast, as previously noted, is used to design the proposed roadway, to assess the potential impacts, to predict design year traffic demand and to document the environmental impacts associated with the construction of the road. Therefore, population and employment growth and traffic volumes are based generally on the higher end of the range, which reduces the risk of under-design and facility failure in the horizon years. The two sets of traffic forecasts are developed independently in two different engineering studies using traffic models that are calibrated based on different parameters and inputs. Therefore, the results are often different. For this project, the traffic forecast for the T&R Study predicts lower traffic volumes on Triangle Parkway than the NEPA Forecast. The difference is primarily attributed to population and employment assumptions made for each forecast.

NCTA Toll System in the Triangle Region

Triangle Parkway is one of three toll projects proposed in the Triangle area. (See Figure I-3) The other two projects are:

- Western Wake Freeway (STIP Project R-2635). NCDOT and FHWA issued a Final Environmental Impact Statement (FEIS) and Record of Decision (ROD) for the Western Wake Freeway project as a non-toll roadway in 2004. In 2007, NCTA and FHWA completed a Reevaluation Report that considers the potential impacts of constructing the Western Wake Freeway project as a toll road and also considered changes in the affected environment since the ROD. The Reevaluation Report concluded that a Supplemental Environmental Impact Statement is not required and the findings of the previous environmental document remain valid. Construction is scheduled to begin in 2008.

- NC 540 from NC 55 to NC 54 (STIP Project R-2000AD). NCDOT and FHWA issued an FEIS and ROD for the Northern Wake Expressway (STIP Project R-2000) in 1991. The only portion of the Northern Wake Expressway that will be tolled is the section from NC 55 to NC 54, known as NC 540. This section was open to traffic in July 2007. NCTA anticipates that toll collection will be instituted between NC 55 and NC 54. The NCTA will study the tolling of NC 540 as a separate project with the appropriate environmental documentation.

NCTA proposes to finance and operate these projects as part of an integrated toll system, which will be known as "Triangle Expressway." Financing and operating these projects together will provide more favorable financing terms and greater toll operating efficiency.

While these projects will be financed and operated as a single system, each project meets FHWA's criteria as a separate project. Each project has logical termini and independent utility, and does not limit consideration of alternatives for other reasonably foreseeable projects. In addition, the Preliminary T & R Study indicates that these projects would be financially feasible individually as toll roads.

Toll Collection Methods

For the purposes of the engineering and environmental analysis in this EA, it has been assumed that the Triangle Parkway project will include toll plazas, which would provide the option of on-site (cash) payment. Therefore, the impact estimates in this document include the impacts of toll plazas.

On November 14, 2007, the NCTA Board of Directors adopted a resolution stating that toll collection on the "Triangle Expressway" (Triangle Parkway, Western Wake Freeway, and NC 540) should be fully electronic, provided that the Investment Grade Traffic and Revenue Study confirms that the cashless collection would not adversely affect revenue or the bonding capabilities of the project. If these conditions are met, the project will be constructed without toll plazas. Using electronic toll collection for Triangle Expressway would reduce environmental impacts and is estimated to save approximately $65 million by avoiding the need to construct toll plazas, install toll plaza equipment, provide parking, and pay operational costs. In addition, the future demolition of the toll plazas and the associated impacts to the human and natural environment will be avoided.

Because a final decision to proceed with fully electronic toll collection has not been made, this EA continues to include the impacts of the toll plazas. This approach provides a reasonable "worst case" basis for assessing the impacts of the project.

1.0 Purpose of and Need for the Proposed Action

The road network within the Triangle Region (See Figure I-1) is currently experiencing travel demands beyond the capacity of the existing road system. The regional travel demand model demonstrates that the travel demands in the Triangle will continue to increase and diminish the level of transportation services provided to local and commuting traffic within the study area (See Figure 1-1).

The purpose and need for the Proposed Action is based on the need to address congestion on the north-south routes in the study area. The alternatives to help meet this need are based on local and state long-range transportation goals, traffic volumes, travel patterns within the study area, and traffic service deficiencies under existing and future conditions.

1.1 Summary of Purpose and Need

The Proposed Action is located central to RTP and included in the RTP Master Plan as a vital part of the RTP transportation infrastructure. The Proposed Action is located in an urbanized area with two metropolitan planning organizations (MPOs); and it is also included in Capital Area MPO (CAMPO) and Durham-Chapel Hill-Carrboro MPO (DCHC MPO) Long Range Transportation Plans for the region. In addition, the Proposed Action is designated by the North Carolina Department of Transportation (NCDOT) as a Strategic Highway Corridor (SHC), as are I-40, NC 147, and I-540.

The existing roads within RTP and the regional NC routes in the project area that serve north-south travel are heavily congested. Traffic volumes on these routes are projected to increase in the future. The travel patterns on these routes during the busiest times of the day flow predominantly north-south, from employment centers in Durham County and RTP to residential areas in Wake County. The increases in traffic demands by the year 2030 will continue to generate operating conditions with failing levels of service and increases in traffic congestion on these north-south routes. This congestion impairs mobility and accessibility for those traveling to and from the RTP and also impairs mobility and accessibility for travelers passing through the project area on existing north-south routes, including the section of NC 54 approaching the project area and NC 55.

Based on these needs, the purpose of this project is to:

- Improve commuter mobility, accessibility, and connectivity to Research Triangle Park employment center;
- Reduce congestion on existing north-south routes that serve the Triangle Region, primarily NC 55 and NC 54.

NCTA is proposing to implement the Triangle Parkway project as a tolled roadway, because tolling offers the opportunity to implement this project earlier than traditional transportation funding sources would allow. Prior to the Triangle Parkway becoming a candidate for tolling, the project was unfunded in the NCDOT STIP funding schedule.

1.2 The RTP Master Plan

RTP was established in 1959 by leaders from business, academia, and industry. The initial master plan and concept for RTP was a campus that would encourage cooperation among research and development organizations involved in science and technology. The Research Triangle Committee was formed in 1956 to explore the idea of creating a research park to be located between Duke University in Durham, NC State University in Raleigh, and the University of North Carolina at Chapel Hill.

The Committee included government, business, and university leaders from across the state of North Carolina. Over the years, the Research Triangle Committee was re-named the Research Triangle Foundation (RTF). The RTF markets the facilities at RTP and continually updates the RTP Master Plan based on projected growth in the area. (See Figure I-2)

RTP was established with covenants that restrict development to businesses conducting research and research applications. Development requirements for property setbacks and for leaving vegetated buffers in place have ensured large campus type developments for businesses allowing RTP to retain a natural "park-like" environment.

Mobility and access to RTP is an important part of the RTP Master Plan. Triangle Parkway is an important transportation link for RTP to sustain its economic vitality. Since the RTP was established, the RTF has continually reserved property for Triangle Parkway based on the RTP Master Plan. This indicates the crucial role that this roadway is anticipated to play in serving the research facilities and businesses within RTP.

1.3 Regional Growth Trends and Traffic Patterns

Travel demands on the existing transportation network in the Triangle Region, including the use of both existing roads and other modes of transportation, are continually increasing as the surrounding areas develop. The project is located within the center of a rapidly growing region with changing land uses and multiple types of new developments. These developments are major traffic generators and include combinations of large and small commercial businesses, industrial businesses, educational facilities, research facilities, and small neighborhoods in conjunction with larger surrounding bedroom communities. Travel patterns generated within the project area include local trips, commuting trips, and pass through trips accessing the adjacent NC highways and interstates.

The north-south travel pattern in the study area is extremely important, carrying commuters from homes in Wake County to jobs in RTP and Durham County. The principal routes serving this travel pattern are NC 54, Davis Drive and NC 55. I-40 serves a more east-west travel pattern from downtown Raleigh and Johnston County.

In order to meet the demands resulting from population and employment growth in the region, additional capacity is needed throughout the transportation system. The Triangle Parkway project is one of the projects needed to meet this demand and is just one part of the overall transportation solution. Even if the Triangle Parkway project and all other planned projects are implemented, there will still be congestion on the network.

1.3.1 Regional Area Growth

The Triangle Region is experiencing ongoing rapid growth and land use changes. There is visual evidence of the growth and land use changes throughout the project vicinity in the form of signs advertising land for sale that has been rezoned from rural agricultural to residential or commercial, newly constructed residential developments, and many newly graded construction sites for future

commercial buildings "to suit" prospective tenants. This visual evidence of growth is supported by U.S. Census Bureau statistics for growth in population and businesses in the area.

The US Census Bureau reports a population increase from 1990 to 2000 of 22.8 percent and 47.3 percent in Durham and Wake Counties, respectfully. The Wake County population increase is more than double the 21.4 percent increase experienced in the state during this time same period. The North Carolina State Demographics Unit indicates that between 2000 and 2030, the populations in Durham and Wake Counties are expected to grow 48.3 percent and 123.7 percent, respectively. The population growth rate for Wake County is relatively high when compared to North Carolina as a whole (50.2 percent) during the same time period.

Populations in both the Town of Morrisville and Town of Cary in Wake County located immediately south of RTP have more than doubled from 1990 to 2000 with percent increases of 409.6 percent in Morrisville and of 115 percent in Cary. The population increases in combination with the increasing development trends surrounding the project area are indicators that the region's urban centers are expanding such that existing transportation facilities would experience an increasing need for mobility.

In addition, as reported by the NC Employment Security Commission, Durham County has experienced an increase of 7.5 percent in average annual employment between 2000 and 2005 from 116,420 jobs to 125,130 jobs. Wake County's average annual employment has increased by 11.7 percent between 2000 and 2005 from 348,640 jobs to 389,384 jobs.

1.3.2 Major Traffic Generators in the Triangle Region

Three of the top ten largest cities in North Carolina are located in this region of the state. These major urban centers and bedroom communities surrounding RTP include Durham, Raleigh, Cary, Morrisville, Apex, and Chapel Hill. (See Figure 1-2) Data from U.S. Census Bureau employment statistics indicates over 709,000 employees live in the Durham-Raleigh-Cary area. When combined with employees living and commuting from communities in Chapel Hill, Carrboro, Apex, Holly Springs, Fuquay-Varina, Garner, Clayton, and undeveloped portions of surrounding counties, such as Johnston, Chatham, Granville and Franklin, more than one million employees are commuting on local roadways to employers. Employees are commuting to work at the RTP campus or commute through the area to other regional employment centers, including:

- RTP Campus – encompasses 7,000 acres with approximately 157 organizations, as of January 2007. Of these organizations, 132 are involved in research and development. According to a July 2006 estimate, there are 39,000 full-time employees in RTP.
- Major Universities
    - North Carolina State University: located in Wake County with 29,957 students and 1,825 faculty members.
    - University of North Carolina at Chapel Hill: located in Orange County with 27,500 students and 3,100 faculty members.
    - Duke University: located in Durham County with 13,088 students, 2,518 faculty members, and 7,901 campus employees.
    - North Carolina Central University: located in Durham County with over 8,600 students, 670 faculty members, and 1,557 employees.

- Public/Private Colleges – are located throughout the Triangle Region with more than 50,000 students enrolled in their programs. (Examples of these colleges include: Durham Technical Community College, ECPI College of Technology, Meredith College, NASCAR Technical Institute, North Carolina Wesleyan College, Peace College, Saint Augustine's College, Shaw University, TechSkills, and Wake Technical Community College)
- Major Medical Centers
  - Duke Raleigh Hospital with over 900 employees, 475 physicians, and 6,961 patients
  - Durham Regional Hospital with 1,500 employees, over 400 physicians, and 15,957 patients
  - Duke University Hospital with 5,094 employees, 762 physicians, and 15,957 patients
  - Rex Hospital with over 3,800 employees, 940 physicians, and 32,224 patients
  - WakeMed (Raleigh campus only) with over 7,000 employees, 1,000 medical staff, and over 90,000 patients
  - UNC Hospital with over 5,760 employees, 1,902 physicians, and 31,934 patients
- Medical Research Facilities – JPD Research LLC and Kendle
- Raleigh-Durham International Airport – includes over 450 daily arrivals and departures with a total of 9.4 million passengers a year

1.3.3 Commuting Travel Patterns

According to the 2000 US Census, six of the top twenty-five worker flows (commuting patterns) between North Carolina counties take place within the jurisdictional area covered by DCHC MPO and CAMPO. Table 1-1 shows the year 2000 commuting patterns for the eight counties contained within the DCHC MPO and CAMPO jurisdictional planning area. The largest of these county to county worker flows is the north-south commute of 43,351 (See highlighted area in Table 1-1) workers from their residences in Wake County to their jobs in Durham County. The Triangle Parkway would help to serve this commuting pattern.

Table 1-1 2000 Commuting Patterns in DCHC MPO and CAMPO Jurisdictional Counties

County of Residence	County of Work									
	Chatham	Durham	Franklin	Granville	Harnett	Johnston	Orange	Wake	Elsewhere	Total Living in County
Chatham	11,018	2,739	21	45	26	71	4,206	2,743	3,788	24,657
Durham	349	84,262	211	1,410	0	409	0	13,929	11,863	112,433
Franklin	47	951	7,772	616	28	282	54	10,347	2,151	22,248
Granville	12	4,609	238	10,957	2	82	249	2,489	1,856	20,494
Harnett	26	0	28	2	15,916	1,399	9	916	5,551	23,847
Johnston	124	1,645	92	107	1,399	26,971	246	23,628	4,463	58,675
Orange	792	16,470	83	196	9	105	35,053	4,212	3,940	60,860
Wake	873	43,351	2,430	1,422	916	4,050	3,552	272,432	9,576	338,602
Elsewhere	3,660	154,027	1,306	3,841	5,551	5,262	15,780	29,471	N/A	N/A
Total Working in the County	16,901	2,021	12,181	18,596	23,847	38,631	59,149	360,167	N/A	

Source: 2000 US Census County Commuting Patterns (Internet site: http://census.osbm.state.nc.us/lookup/, accessed February 2, 2007)

1.4 Existing Road Network

The existing road network serving the traffic demands and travel patterns for commuters within and through the project area includes a system of primary state routes and interstates surrounding and connecting with several local arterial RTP routes. (See Figure 1-2) These NC routes and interstates serve commuters traveling to and from multiple major employment centers both within the project area and surrounding areas.

1.4.1 Major Routes in the Study Area

There are two existing designated interstate routes and three existing primary NC routes in the study area. These routes provide transportation routes to RTP and other major thoroughfares. These routes include:

I-40

I-40 is a major east-west freeway that spans cross country through eight states from California to North Carolina (approximately 2,550 miles). Within North Carolina, I-40 is approximately 420 miles in length. Serving Asheville, Winston-Salem, Greensboro, Durham, Raleigh, and Wilmington, I-40 is especially congested in the segment shared with I-85 from Greensboro to Hillsborough. East of Hillsborough, I-40 extends east from I-85 approximately 30 miles into the study area.

Specifically, I-40 extends in a more north-south direction from NC 55 to Airport Boulevard with interchange connections to NC 55, NC 147, Davis Drive, Miami Boulevard, Page Road, I-540/NC 540, and Airport Boulevard. I-40 is the primary commuting artery in the Triangle Region, serving major employment centers in Raleigh, Durham, Chapel Hill, and the RTP. The section between NC 147 and I-540/NC 540 is one of the most congested areas of the I-40 corridor in North Carolina.

I-540 and NC 540

Within the vicinity of the study area, I-540 extends in an east-west direction and currently connects with I-40 southeast of the NC 147/I-40 Interchange. I-540 was constructed as NCDOT STIP Project R-2000. Project R-2000 was constructed with the I-540 designation from I-40 northeast to the US 64 Bypass near Knightdale, NC. The section of R-2000 from NC 55 to I-40 (STIP R-2000AD) was recently completed and designated NC 540. I-540 is considered part of the Interstate System and is a North Carolina Strategic Highway Corridor.

NC 54

NC 54 is a North Carolina state highway with no control of access and a semi-urban traffic arterial connecting Burlington to Raleigh. NC 54 westbound ends at US 70/NC 62 in Alamance County and eastbound ends at the Hillsborough Street exit of the US 1/I-440 Beltline in Wake County. NC 54 extends approximately 58 miles and crosses I-40 four times. NC 54 runs both north-south and east-west through the study area. The approach to the RTP is in a more north-south direction. The route transitions from a two lane facility to five-lane facility between Davis Drive and NC 55. Development along the roadway consists of a combination of industrial, commercial, and residential.

NC 55

Although signed east-west, the most used section of NC 55 actually extends north-south between Durham and Erwin. NC 55 traverses seven counties and is approximately 192 miles, starting at US 501 Business in Durham County and ending where the Neuse River empties into Pamlico Sound in Pamlico County. NC 55 within the study area parallels the proposed Triangle Parkway on the west side of the RTP. NC 55 is either four-lane divided or five-lanes throughout the study area with no control of access. Similar to NC 54, development along NC 55 also consists of a combination of industrial, commercial and residential.

NC 147 (I.L. "Buck" Dean Durham Freeway)

NC 147 is an east-west route located entirely within Durham County and is cosigned as the Durham Freeway. Other titles for this facility include East-West Expressway and Buck Dean Expressway. NC 147 connects I-85 on the western edge of Durham to I-40 and T.W. Alexander Drive in the RTP. NC 147 is approximately 13 miles in length. The entire length of NC 147 is a four-lane divided freeway facility and is a fairly urbanized commuter-route. The Proposed Action would essentially extend NC 147 south through the RTP to NC 540.

1.4.2 Designated Highway Systems in the Study Area

National Highway System

The National Highway System Map for the Raleigh Urbanized area was published April 2004 by the US Department of Transportation and Federal Highway Administration (FHWA). (http://www.fhwa.dot.gov/hep10/nhs/, accessed 9/19/05) The map shows I-40, I-85, and I-540 as part of the Eisenhower Interstate System. NC 147 and US 70 are shown as other National Highway System (NHS) routes.

North Carolina Strategic Highway Corridor System

Triangle Parkway has been designated by the NCDOT Board of Transportation as a Strategic Highway Corridor (SHC) on the statewide Strategic Highway Corridor (SHC) system. The SHC system consists of several different roadway classifications, with the highest classification being a freeway, which requires full access control. Triangle Parkway has been designated as a "freeway" facility in the SHC system. The "freeway" facility designation for Triangle Parkway requires that a minimum four-lane divided cross section be utilized and full control of access be maintained. Anything less than these minimums would not be consistent with the SHC designation.

Additional SHCs designated in the study area include I-40, NC 147, I-540, NC 540, and Western Wake Freeway.

The SHC concept, developed by the NCDOT and its stakeholders in 2002, is an initiative to identify, protect, and maximize the use of highway corridors that play a critical role in regional and statewide mobility. The SHC concept includes protecting the mobility and connectivity functions of critical highway facilities, while promoting environmental stewardship through the use of existing facilities to the maximum extent possible. The SHC concept also fosters economic prosperity by being able to move people and goods quickly and efficiently. The concept offers an opportunity to consider long-term vision, consistency in decision-making, land use partnerships, and overarching design and operational changes.

The 5,400 miles of designated SHCs including existing and proposed interstates account for only seven percent of the State's Highway System, but carry 45 percent of the traffic. Criteria are defined for the corridors identified on the plan based on the function and type of route. As shown on Figure 1-3, criteria are established for freeways, expressways, boulevards, and thoroughfares. Triangle Parkway is designated as a freeway on the SHC system. Figure 1-3 lists the design criteria for SHC freeways.

Strategic Highway Network (STRAHNET)

I-40, NC 147, and I-540, are also designated as routes on the Federal Strategic Highway Network (STRAHNET). The STRAHNET consists of approximately 61,000 miles of public highways necessary to support Department of Defense deployments. FHWA identifies STRAHNET as a network that links key military installations and ports, and provides defense access, continuity, and emergency capabilities for movement of personnel and equipment during times of peace and war.

Outer Wake Expressway

The Outer Wake Expressway is included in local and state long range transportation plans as an approximate 73-mile roadway "looping" completely around Raleigh. The complete Outer Wake Expressway is ultimately planned as a combination of the following routes:

- Northern Wake Expressway (I-540) – extends approximately 30 miles from I-40 west of Raleigh to the US 64 Bypass east of Raleigh.
- Northern Wake Expressway (NC 540) – extends approximately three miles from I-40 to NC 55. The portion of NC 540 from NC 55 to NC 54 will be operated and maintained by NCTA as a toll facility.[1] This section of NC 540 was open to traffic in July 2007 as a non-toll facility.
- Western Wake Freeway – extends approximately 13 miles from NC 55 west of Morrisville to the NC 55 Bypass near Holly Springs. The Western Wake Freeway is proposed by NCTA as a toll facility (NC 540).
- Southern Wake Expressway – extends approximately 16 miles from NC 55 Bypass near Holly Springs to I-40 southeast of Raleigh. The Southern Wake Expressway is referenced in the NCDOT STIP as a SHC and intrastate projects R-2721 and R-2828. There are currently no funds for this project included in the STIP funding schedule for 2007-2013.
- Eastern Wake Expressway – extends approximately 11 miles from I-40 southeast of Raleigh to the US 64 Bypass east of Raleigh. The Eastern Wake Expressway is referenced in the NCDOT STIP as Project R-2829 and a SHC. There are currently no funds for this project included in the STIP funding schedule for 2007-2013.

[1] The tolled portion of the Northern Wake Expressway (from NC 54 to NC 55) has been designated as NC 540, rather than I-540, because of limitations on tolling on the Interstate System. NCTA and FHWA anticipate that the Western Wake Freeway also will be designated as NC 540.

NCTA Toll System in Triangle Region

Triangle Parkway is one of three toll projects proposed in the Triangle area. (See Figure I-3) The other two projects are:

- Western Wake Freeway (STIP Project R-2635); NCDOT and FHWA issued a Final Environmental Impact Statement (FEIS) and Record of Decision (ROD) for the Western Wake Freeway project as a non-toll roadway in 2004. In 2007, NCTA and FHWA completed a Reevaluation Report that considers the potential impacts of constructing the Western Wake Freeway project as a toll road and also considered changes in the affected environment since the ROD. The Reevaluation Report concluded that a Supplemental Environmental Impact Statement is not required and the findings of the previous environmental document remain valid. Construction is scheduled to begin in 2008.
- NC 540 from NC 55 to NC 54 (STIP Project R-2000AD); NCDOT and FHWA issued an FEIS and ROD for the Northern Wake Expressway (STIP Project R-2000) in 1991. The only portion of the Northern Wake Expressway that will be tolled is the section from NC 55 to NC 54, known as NC 540. This section was open to traffic in July 2007. NCTA anticipates that toll collection will be instituted between NC 55 and NC 54. The impacts from the addition of operating NC 540 (between NC 55 and NC 54) as a toll facility will be analyzed, as necessary, with the appropriate environmental documentation.

NCTA proposes to finance and operate these projects as part of an integrated toll system, which will be known as "Triangle Expressway." This contiguous tolled roadway system would be approximately 18.8 miles in length. Financing, marketing and operating these projects together will provide more favorable financing terms and greater operating efficiency.

While these projects will be financed and operated as a single system, the projects meet FHWA's criteria as separate projects. Each project has logical termini and independent utility, and does not limit consideration of alternatives for other reasonably foreseeable projects. In addition, the preliminary Traffic & Revenue Studies for each project indicate that each of these projects could be implemented individually as toll roads.

1.5 Regional and Local Transportation Plans

To enhance the operations of the road network, there are regional and local transportation programs in place to plan roadway improvements needed to meet future transportation demands in areas across the state.

The project area is located in an urbanized area with two MPOs; the CAMPO and DCHC MPO. These organizations each adopted a Long Range Transportation Plan (LRTP) that includes multiple transportation projects to be considered for their metropolitan area. Both plans identify Triangle Parkway and define the project as a major thoroughfare in the transportation network.

1.5.1 Metropolitan Long Range Transportation Plans

Specific details regarding the inclusion of Triangle Parkway within the MPO plans and other local municipality plans are listed below:

Capital Area MPO (CAMPO) 2030 Long Range Transportation Plan Update (adopted September 15, 2004, amended May 2007)

Triangle Parkway is included in the Roadway System section of the 2030 LRTP. It is listed as a six-lane facility from the Durham County line to NC 540 and is designated as a 2020 project. The project is listed as regionally important project. In May 2007, CAMPO amended the LRTP, moving Triangle Parkway to a 2010 timeframe for construction, and designating it as a toll facility.

Durham-Chapel Hill-Carrboro Metropolitan Planning Organization (DCHC MPO) 2030 Long Range Transportation Plan (adopted April 13, 2005, amended May 2007)

Triangle Parkway is listed in the DCHC MPO 2030 LRTP as an important highway project. It is also identified as a regionally significant project. Triangle Parkway is listed as a new roadway from I-40 to NC 540. Approximately 2.4 miles of this project are located in Durham County. According to the LRTP, the project would provide mobility for fast growing Durham County and Wake County to the RTP employment center, City of Durham, and major thoroughfares such as I-40. The Triangle Parkway will also provide access to central and southern RTP. The document also states that parallel corridors such as NC 54, NC 55, and I-40 are experiencing up to eight percent annual growth rates. In May 2007, the DCHC MPO amended the LRTP to designate Triangle Parkway from I-40 south to the Durham County line as a toll facility to be constructed by 2010.

1.5.2 Local Transportation Plans

Draft Town of Cary Comprehensive Transportation Plan Thoroughfare Maps Classifications and Widths (January 22, 2004)

The Thoroughfare Classifications Map shows the Outer Wake Expressway intersecting with a new major thoroughfare between Davis Drive and Chapel Hill Road (NC 54). This new major thoroughfare would end at NC 540, and it appears to follow the general alignment of the Triangle Parkway.

Northwest Cary Area Plan - Chapter 3: Transportation (September 12, 2002)

The Northwest Cary Area Plan is a master plan for an 8,100 acre area in the northwestern portion of Cary's planning area, just south and west of RTP. The proposed Triangle Parkway is not located in the northwest Cary area, but it is shown on the Northwest Area Plan Roads and Transit Map as a recommended four-lane road with landscaped median.

Map 2 (Existing and Planned Trails) from the Northwest Cary Area Plan shows a future thoroughfare from NC 147 at I-40 to NC 540. The location shown is basically the same as indicated for the Triangle Parkway.

Draft Morrisville Transportation Plan

The existing transportation plan for Morrisville shows Triangle Parkway as a future freeway between the Durham/Wake County line and NC 540. Interchanges are proposed at Davis Drive and NC 540.

The plan states the Triangle Parkway would link NC 147 (Durham Freeway) with NC 540. The plan also recommends inclusion of wide outside lanes for bicyclists.

North Morrisville – Shiloh Small Area Transportation Plan (January 6, 2003)

The Triangle Parkway is included as four-lane expressway. The plan indicates that Triangle Parkway will transition into NC 540.

1.6 Planned Transportation Improvements in the Study Area

There are several planned transportation improvement projects within the study area identified in the NCDOT STIP. The status of the studies and construction schedules for these planned improvements in the state program are generally based on the CAMPO and DCHC MPO transportation needs, priorities, and funding availability.

The projects listed below would be funded from many different sources. Projects included in the NCDOT 2007-2013 STIP would be financed with traditional funding from NCDOT and FHWA as funding becomes available. Several projects planned by RTF within the RTP would be funded by a combination of private and public sources. Toll projects would be funded by NCTA with toll revenues and other sources. The transportation projects planned in the study area are listed below and shown on Figure 1-4.

1.6.1 NCTA Projects

- Western Wake Freeway (STIP Project R-2635) is a proposed 12.4-mile highway on new location from NC 55 west of Morrisville to NC 55 Bypass near Holly Springs. This project is designated as a SHC project. NCTA proposes to construct the project as a toll facility and has completed a reevaluation of the 2004 Final Environmental Impact Statement/Record of Decision completed by NCDOT for this project as a non-toll facility. Construction is scheduled to begin in 2008.
- Triangle Parkway (STIP Project U-4763B - Proposed Action) is a new location multi-lane facility proposed to extend from NC 540 to I-40. This project, which is the subject of this Environmental Assessment, is designated as a SHC. Construction is scheduled to begin in 2008.
- NC 540 (STIP R-2000AD) project involves operating NC 540 between NC 55 and NC 54 as a toll facility. The NCTA will study the tolling of NC 540 as a separate project with the appropriate environmental documentation.

1.6.2 NCDOT Projects

- McCrimmon Connector (STIP Project U-4763A) is a new location multi-lane facility from McCrimmon Parkway to Triangle Parkway at NC 540 (1.2 miles). This is planned as a non-toll roadway and would not necessarily be constructed to freeway design standards. It is only programmed for planning and environmental study in the 2007-2013 STIP.
- I-40 Widening (STIP Project I-3306) is proposed between I-85 in Orange County and NC 147 (Buck Dean Freeway) in Durham County (20.7 miles). Section A from I-85 to Durham County line is unfunded in the 2007-2013 STIP.
- NC 54 Widening (STIP Project R-2904) to multi-lanes is proposed from SR 1999 (Davis Drive) to SR 1959 (Miami Boulevard) and SR 1973 (Page Road) from NC 54 to I-40. The total project length is 1.1 miles. The STIP states the project to be let with U-4026, which is 5.7 miles in total length. Construction is underway.

- NC 55 Widening (STIP Project R-2906) to multi-lanes is proposed from US 64 in Wake County to SR 1121 (Cornwallis Road) in Durham County (13.0 miles). The project is under construction.
- T.W. Alexander Drive Widening (STIP Project U-3309) to a four-lane median divided facility is proposed from SR 1121 (Cornwallis Road) to SR 1959 (Miami Boulevard) (1.7 miles). Planning is in progress and right-of-way acquisition is scheduled for FFY 08 in the 2007-2013 STIP. Part of this project is complete and the remainder of the construction is scheduled to be completed in Federal Fiscal Year (FFY) 2009.
- McCrimmon Parkway Extension (STIP U-3620) is proposed as a multi-lane curb and gutter facility from NC 54 to Airport Boulevard (0.4 miles). The 2007-2013 STIP indicates that this is an unfunded project.
- Davis Drive Widening (STIP Project U-4026) to multi-lanes is proposed from SR 3014 (Morrisville-Carpenter Road) in Wake County to NC 54 in Durham County (5.7 miles). The project was let for construction with STIP Project R-2904 and construction is underway.
- Briggs Avenue (STIP Project U-2831B) is proposed to be extended from Riddle Road to SR 1951 (SO-HI Drive) (1.0 mile) with two lanes on multi-lane right-of-way. The 2007-2013 STIP indicates this project is unfunded.

1.6.3 Local Transportation Projects – Research Triangle Park Plan

- Hopson Road Realignment (RTF -7) is the extension of Hopson Road from Louis Stephens Road to NC 55. The project is under construction. NCDOT is funding utility relocation.
- Little Drive Realignment is proposed by a developer and includes extending Louis Stephens Road across NC 55.

1.7 Traffic Deficiencies

Traffic conditions were evaluated for the current year (2006) and future year (2030) traffic volumes on the major roadways in the study area. There are currently operational deficiencies on the existing NC routes and interstates with traffic volumes exceeding the roadway capacity of the network, particularly on north-south routes that serve traffic between employment centers in Durham County and the RTP and residential areas in Wake County. Traffic volumes are projected to increase in the future and will further compromise the available capacity of the existing roadways, even if the other identified planned transportation improvement projects are implemented by 2030.

Planning level capacity and operational analyses for existing roads were conducted to evaluate overall traffic conditions. The analyses are documented in the North Carolina Turnpike Authority NCDOT STIP Project U-4763B – Triangle Parkway Traffic Operations Technical Memorandum Northern Wake Expressway to I-40 Wake and Durham Counties (January 2008), which is incorporated by reference.

The traffic forecast for this EA was developed using the approved Triangle Regional travel demand Model (TRM) as of December 4, 2006. The TRM was approved by CAMPO and DCHC MPO. The TRM version used for the traffic forecasting task is consistent with the model version used for the regional air quality conformity determination. All projects included in the CAMPO and DCHC MPO 2030 LRTP and all projects included the 2007-2013 State Transportation Improvement Program are included in the TRM. The TRM includes a mode choice component (drive, transit, walk, etc.)

Western Wake Freeway (STIP Project R-2635), in it entirety, and NC 540 (STIP Project R-2000AD), from NC 55 to NC 54, are assumed as toll facilities in all the forecast scenarios. The remainder of the Outer Wake Expressway from NC 54 to US 64 near Knightdale was assumed to be a non-toll facility in all traffic forecast scenarios. The Triangle Parkway project is assumed as a toll facility in all the "Build" scenarios that include the project. STIP Project U-4763 A (McCrimmon Connector), between NC 540 and McCrimmon Parkway, is assumed to be constructed in the 2030 network as a non-toll facility. The McCrimmon Connector will not be constructed as part of this project. These assumptions are consistent with the 2030 LRTPs for both CAMPO and DCHC MPO.

1.7.1 Existing and Future Traffic Conditions

Both 2006 and 2030 traffic volumes on the road system within the study area were reviewed. The traffic forecast data for the year 2030 traffic volumes are from the Traffic Forecasts for the Toll Scenarios for STIP Project No. U-4763, Triangle Parkway (March 2007).

Appendix B includes figures showing both the 2006 and 2030 average annual daily traffic volumes (AADTs) in the study area. These figures include the travel direction arrows, the design hourly volume percentage, and truck percentages on these roads. Directional arrows for each roadway indicate the primary direction people tend to travel during the busiest hour of the evening (PM peak hour). This PM peak hour is typically the time people are leaving their jobs to return home. As stated in the traffic forecast report, this direction is reversed for the AM peak hour, which tends to also indicate that this larger percentage of traffic will make the return trips to their jobs using the same roadways during the busiest hour of the morning (AM peak hour).

Travel Patterns along NC 54 and NC 55

The data indicates the majority of traffic during the PM peak hour is traveling south to southeast from Durham County and RTP into Wake County. Approximately 60 percent of the total daily traffic is traveling from Durham County and RTP to Raleigh during the evening peak period.

Davis Drive is an arterial that provides direct north-south travel into and through the central part of RTP. During the PM peak hours, the directional flow of traffic on Davis Drive splits within RTP, with trips traveling to the north and south to connect with I-40 and McCrimmon Parkway and Morrisville-Carpenter Road to the south.

Hopson Road and Page Road are the primary east and west arterials through RTP. The major direction of travel along these routes during the PM peak is shown to split directions in the vicinity of RTP to connect with north-south routes NC 55 west of RTP and NC 54 east of RTP. The higher percentages of traffic traveling during the PM peak hour on both NC 55 and NC 54 also demonstrate a primarily north-to-south travel pattern from Durham County and RTP to Wake County.

2006 and 2030 Traffic Volumes

Table 1-2 shows a comparison of traffic volumes on the existing roads for the year 2006 and both the existing and planned roads for the year 2030 using the No-Build Traffic. The average traffic volumes in the study area are projected to increase within the study area's system of roads by the year 2030. However, the north-south travel patterns remain dominant with the higher percentage of traffic traveling between Wake County and Durham County during both AM and PM peak hours.

By the year 2030, traffic volumes along most of the arterials and NC routes are more than double the 2006 traffic volumes and the traffic volumes along I-40 increase by approximately 53 percent between NC 55 and NC 147 and approximately 60 percent between NC 147 and Davis Drive.

For I-540, traffic volumes are expected to increase from 51,500 to 145,800 vehicles per day. The increase (almost triple) in the volume on the east-west route, I-540, is attributed to the growth in the region; however, some travel pattern changes are likely to occur and are anticipated from the opening of NC 540 and Western Wake Freeway. Both facilities did not exist in the 2006 network. Both provide additional east-west connectivity within the study area. Commuters currently using NC 55 and Davis Drive are expected to use the Western Wake Freeway and NC 540 to access the RTP in the future.

Table 1-2 Traffic Demands (Average Daily Traffic Volumes)

Roadway	Current 2006 Average Daily Traffic Volumes	Future 2030 (No-Build) Average Daily Traffic Volumes	Percent Change (%)
Davis Drive (south of NC 54)	21,000	41,400	97%
Miami Boulevard (south of I-40; north of NC 54)	22,400	41,000	83%
NC 54 (east of T.W. Alexander Drive)	18,400	36,800	100%
NC 55 (south of I-40)	26,000	75,000	188%
I-40 (west of NC 147)	101,800	156,000	53%
I-40 (east of NC 147)	142,800	229,200	60%
NC 147 (north of I-40)	62,500	137,800	120%
I-540 (north of I-40)	51,500	145,800	183%

Source: Traffic Forecasts for the Toll Scenarios for TIP Project No. U-4763 Triangle Parkway (March 2007)

1.7.2 Existing and Future Operational and Capacity Analyses

An increase in traffic demand, as shown between the years 2006 and 2030 will substantially exceed the capacity of the transportation network. To evaluate the operation and capacity of the network, the existing and future traffic conditions were evaluated using Highway Capacity Software 2000 (HCS) 2000 for freeway segments and arterials, which is based on the methodologies of the Highway Capacity Manual (HCM) 2000. Synchro Professional was used for signalized intersections and North Carolina Level of Service (NCLOS) was used to estimate capacity of arterials for use in the volume to capacity analysis. NCLOS was developed by the Institute for Transportation and Research (ITRE) for NCDOT.

In addition, a network traffic analysis was performed in order to consider the impacts of the capacity-constrained roadways feeding the Triangle Parkway. The CORSIM microsimulation model was selected as the analysis tool to complete this task. In contrast to the HCS software, CORSIM considers all locations simultaneously on a network basis. Evaluating the network facilities allows CORSIM to assess how congestion at one location impacts capacity at another location. Chapter 2.3.4 contains further discussion of the CORSIM microsimulation analysis.

Operation Analysis Methodology

Operational conditions are characterized by quality of service within a traffic stream or "flow", generally in terms of density, speed, travel time, freedom to maneuver, traffic interruptions, comfort, and convenience. These operational conditions are defined in the HCM by introducing the concept of levels of service (LOS). LOS is measured by letter designations A through F representing the driver's perception of the operating conditions. LOS A represents the best operating conditions and LOS F the worst. The analysis predicts the traffic flow or "service flow rates" for a range of operating conditions, except for LOS F where flows are unstable and delay is high. Service flow rates are maximum hourly rates which persons or vehicles can be expected to traverse a point or uniform segment of a lane or roadway during a given period under prevailing roadway traffic and control conditions while maintaining a designated level of service. Each facility has five service flow rates, one for each level of service (LOS A through E). For LOS F, the flow rate is difficult to predict due to varying stop-and-go conditions present within the traffic stream.

Levels of Service

Table 1-3 provides LOS for the major north-south roads in the study area. These LOS are the worse case levels of service recorded for both the AM and PM peak hours.

Table 1-3 Level of Service (LOS) Analysis

Roadway Link (limits)	Analysis Type	2006 Traffic Conditions	2030 (No-Build) Traffic Conditions
		Performance Measure	Performance Measure
		LOS	LOS
Davis Dr. (NC 54 to Hopson Rd.)	N/S Arterial	F	F
Davis Dr. (Hopson Rd. to Morrisville Carpenter Rd)	N/S Arterial	F	F
Miami Blvd. (I-40 to Surles St.)	N/S Arterial	F	F
NC 54(Surles St. to NC 540)	N/S Arterial	N/A	F
NC 54 (NC 540 to Morrisville Carpenter Rd.)	N/S Arterial	E	F
NC 54 (T.W. Alexander Dr. to Davis Dr.)	E/W Arterial	D	F
NC 54 (Davis Dr. to Miami Blvd.)	E/W Arterial	F	F
NC 55 (NC 54 to NC 540)	N/S Arterial	F	F

Source: North Carolina Turnpike Authority NCDOT TIP Project No. U-4763B – Triangle Parkway Traffic Operations Technical Memorandum Northern Wake Expressway to I-40 Wake and Durham Counties (January 2008)

Based on the analysis, one location in the study area currently operates (2006 Traffic) with an acceptable flow of traffic with LOS D in both peak hours: an east to west link of NC 54 from T.W. Alexander Drive to Davis Drive. The remaining roads, including the central RTP north-south route Davis Drive and the north-south routes NC 55 and NC 54 west and east of RTP, currently operate at LOS F in at least one peak hour. During the year 2030, all the analyzed roadway links shown in Table 1-3 are projected to operate at LOS F.

Capacity Analysis Methodology

The traffic demands on the roadways in 2006 and 2030 for the study area resulted in an operational LOS F on the majority of the roads. Since the effectiveness of the roadway based on the flow rate is difficult to measure under these traffic conditions due to varying stop-and-go conditions, a comparison of the ratio of available capacity to the demand (volume to capacity ratio) for these roads was reviewed as another method to evaluate the effectiveness of the existing and planned roadways in serving traffic demands in 2006 and 2030.

Capacity is the maximum sustainable flow rate of a facility. This analysis provides a tool to assess existing facilities, plan future facilities, and design improvements to the facilities. The principal objective is to estimate the maximum number of vehicles a facility can accommodate reasonably during a specific time period and compare that to the available capacity of that facility.

A measure for roadway operations is provided in terms of the "Volume to Capacity" ratio (V/C). This ratio reflects the demand (i.e. the projected volume) on the road in comparison to the amount of traffic the road can reasonably carry (i.e. capacity). For example, a V/C ratio of 1.0 indicates the number of vehicles on that road is exactly the number of vehicles that road is theoretically able to carry without exceeding capacity. This is the point the LOS moves from LOS E to LOS F or from moderate congestion to serious congestion.

Volume to Capacity Ratio

The V/C ratios were calculated for several links of major roads in the study area; including NC 54, NC 55, Davis Drive, and Miami Boulevard. Table 1-4 lists the V/C ratios for the current and projected traffic conditions. The future 2030 V/C ratios reflect any planned improvements that are programmed in the STIP or included in the LRTP that would be implemented by 2030. (See Chapter 1.6)

For the current year 2006, the V/C ratios range from 0.68 to 1.42. Major roadway links in the study area, except at one location, are over their theoretical traffic carrying ability. The location with adequate capacity includes the east-west link of NC 54 from T.W. Alexander Drive to Davis Drive with a V/C of 0.68.

For the future year 2030, the V/C ratios increase on all of the major existing roadway links as shown in Table 1-4. Therefore, even with the assumption that there would be increased road capacity provided by other planned transportation improvements within the study area by 2030, these roadways will continue to be over capacity. In comparing the V/C ratios from 2006 to 2030, all V/C ratios would increase in the year 2030; however, the largest increases in the V/C ratio are along two north-south routes; NC 55 with an increase of 1.44 and NC 54 with an increase of 1.26.

Table 1-4 Volume to Capacity Analysis

Roadway Link (limits)	*Link Direction and Analysis Type	2006 Traffic Conditions			2030 (No-Build) Traffic Conditions		
		Performance Measure			Performance Measure		
		Volume	Capacity	V/C Ratio	Volume	Capacity	V/C Ratio
Davis Dr (NC 54 to Hopson Rd)	N/S Arterial	20,600	14,500	1.42	41,400	26,700	1.55
Davis Dr (Hopson Rd to Morrisville Carpenter Rd)	N/S Arterial	24,600	17,700	1.39	56,600	28,000	2.02
Miami Blvd (I-40 to Surles St)	N/S Arterial	24,600	18,600	1.32	41,000	22,700	1.81
NC 54 (Surles St to NC 540)	N/S Arterial	N/A	N/A	N/A	37,400	28,900	1.29
NC 54 (NC 540 to Morrisville Carpenter Rd)	N/S Arterial	18,200	17,300	1.05	71,000	30,700	2.31
NC 54 (T.W. Alexander Dr to Davis Dr)	E/W Arterial	20,200	29,500	0.68	49,200	29,500	1.67
NC 54 (Davis Dr to Miami Blvd)	E/W Arterial	13,300	10,100	1.32	44,000	20,300	2.17
NC 55 (NC 54 to NC 540)	N/S Arterial	24,900	18,900	1.32	84,800	30,700	2.76

*NOTE: N/S= north to south directional route in the study area and E/W = east to west directional route in the study area

Source: North Carolina Turnpike Authority NCDOT TIP Project No. U-4763B – Triangle Parkway Traffic Operations Technical Memorandum Northern Wake Expressway to I-40 Wake and Durham Counties (January 2008)

1.7.3 Traffic Service Deficiencies Conclusions

The 2006 and 2030 traffic volumes, levels of service, and roadway capacities for the major roads in the study area demonstrate a need for additional travel capacity, primarily in the north-south direction in the study area. Traffic volumes are projected to increase along the major roadways throughout the study area while the primary directional flow of traffic is anticipated to remain in the north-south direction. This north-south direction serves commuters traveling from Durham County and RTP to Wake County.

During the evening (PM) peak hour, the primary direction of travel in the study area is to the south from the north. This travel pattern is consistent with employment center locations in the Triangle Region and represents people traveling to and through the study area during the PM peak hour from their jobs in Durham County and RTP to their homes in Wake County. The morning (AM) peak hour, as expected, is the reverse of this with the primary direction of travel in the study area from to the north from the south.

Through the study area, NC 55 and NC 54 are the major north-south arteries and have approximately 60 percent of their daily PM peak hour traffic traveling south and southeast from Durham County toward Wake County. Currently during the peak travel times, the traffic volumes are well over the carrying capacity of these roadways. With the increase in traffic volumes projected for 2030, these two north-south routes will continue to experience increasing demands and further exceed the existing carrying capacity provided in the north-south direction through the study area.

The 2006 and 2030 levels of service and volume to capacity ratios demonstrate traffic deficiencies in the study area with undesirable operational conditions on the major roads. Currently, traffic congestion on major routes is present with start-and-stop traffic flow conditions causing unpredictable delays and associated increases in travel time for commuters. Since traffic volumes indicate such a high travel demand throughout the road network and the operations were predicted to be LOS "F" with unstable flows, the traffic volumes to roadway capacities (V/C ratios) were compared to identify the degree of congestion present on the roadway.

As shown with increasing V/C ratios, the amount of traffic projected in the study area is much higher in comparison to the available capacity provided by the roadways within the transportation network. Therefore, traffic congestion experienced by commuters throughout the study area will continue to intensify through the year 2030. The planned transportation improvements located in the study area (see Chapter 1.6) are not anticipated to provide sufficient capacity in the year 2030 or reduce congestion for commuters traveling north and south on NC 55 or NC 54. Additional capacity for the transportation system is needed to enhance the north-south access to RTP and enhance the north-south connectivity through RTP between Wake County and Durham County.

1.8 Purpose of the Proposed Action

The purpose for the Proposed Action is based on the RTP master plan, MPO long-range transportation goals, and the transportation needs in the study area. The transportation network within the Triangle Region is predicted to be over capacity in the year 2030.

The predominant travel pattern through the study area is in the north–south direction. There are major north-south routes in the study area that are currently experiencing deficient traffic operations and congestion. Without additional travel capacity within the network, congestion on the major roads will continue to intensify as the future travel demands increase. Therefore, the following purposes for the project are defined based on the transportation goals and needs in the study area:

- Improve commuter mobility, accessibility, and connectivity to RTP employment center.
- Reduce congestion on existing north-south routes that serve the Triangle Region, primarily NC 55 and NC 54.

2.0 Alternatives

Based on the purpose and need for the project, a range of alternatives were evaluated during the planning and environmental studies. This Chapter reviews the No-Build Alternative, the preliminary alternative evaluations, development of the Build Alternative-Toll Road, and the identification of the Preferred Alternative.

2.1 No-Build Alternative

The No-Build Alternative provides only for regular maintenance of the existing transportation routes and systems. It is considered to be the status quo, in that no improvements would be made other than regular maintenance to existing roads and other projects included in the long range plans. Examples of regular maintenance on existing roads include patching, pavement resurfacing, and shoulder and ditch maintenance. The No-Build Alternative would not acquire property or impact resources within the project area by converting existing land uses into road right-of-way.

2.1.1 Existing Roadway Congestion

As discussed in Chapter 1, traffic volumes were projected for 2030 under the No-Build scenario. The traffic forecasts and operational analyses indicate the following roads in the study area would be over capacity in 2030 resulting in heavily congested traffic conditions with unstable (i.e., start and stop) traffic flows (See Figure 2-1):

- Davis Drive, from I-40 to Morrisville Carpenter Road (approximately 6 miles).
- Miami Boulevard, from I-40 to NC 54 (approximately 0.5 mile).
- NC 54, from T.W. Alexander Drive to Morrisville Carpenter Road (approximately 6.2 miles).
- NC 55, from I-40 to NC 540 (approximately 5 miles).
- I-40, from NC 55 to Aviation Parkway (approximately 7.3 miles).
- NC 147, from Cornwallis Road to I-40 (approximately 1 mile).

2.1.2 Traffic Congestion Impacts

Traffic congestion impacts quality of life. A variety of traffic congestion impacts were enumerated in a 1994 report from the University of California Berkeley's Institute for Transportation Studies. These congestion impacts would be consistent with the traveling experiences along NC 55 and NC 54 in the year 2030 under the No-Build Alternative. These roadways are projected to be heavily congested with failing levels of service (LOS F) and would contribute to the following congestion impacts experienced by the people traveling in the Triangle Region:

- Creates unreliable travel times due to delays.
- Contributes to excessive fuel consumption through inefficient vehicle operations due to delays and associated stop and go traffic conditions.

- Reduces safety due to increased potential risk for crashes.
- Increases insurance premiums for vehicles due to increased number of accidents.
- Impacts personal health from increased stress, increased accidents, and higher incidence of respiratory illness from breathing higher concentration of emissions fumes.
- Reduces business productivity and economic vitality throughout the region because goods cannot be transported economically. It could also result in people bypassing businesses or deciding to live in another area.
- Creates inefficiencies and failures of transportation systems.
- Contributes to environmental damage of air and water quality from concentrated emission levels.

2.1.3 No-Build Alternative Retained in Study

The No-Build Alternative is not consistent with local and state transportation planning objectives to improve traffic congestion circulating within the RTP or to improve mobility through the Triangle Region. This alternative only includes maintenance and other planned projects in the long range transportation plans. Based on projected 2030 traffic demands, these planned improvements will not be sufficient to alleviate traffic congestion. Although the No-Build Alternative is not consistent with the purpose and need for the project, this alternative has been retained through the project studies as a baseline for evaluation of the other alternatives.

2.2 Preliminary Alternatives Considered

Preliminary alternatives considered transportation system management (TSM) treatments; transportation demand management (TDM); high-occupancy vehicle (HOV) lanes on existing Interstates, widening existing roads, mass transit (bus), mass transit (rail), building a non-toll roadway on new location; and building a toll roadway on new location.[1] These preliminary alternatives were evaluated based on their ability to meet the purpose and need, which includes two elements:

- *Improve mobility, accessibility, and connectivity to Research Triangle Park employment center.* This purpose is met if the alternative provides increased capacity for commuter trips to and from RTP, and also provides improved access from major existing commuter routes into the RTP campus.
- *Reduce congestion on existing north-south routes that serve the Triangle Region, primarily NC 55 and NC 54.* This purpose is met if the alternative reduces congestion during peak periods on NC 55 and NC 54.

To meet these elements of the purpose and need, an alternative must provide more than a minor improvement. An improvement would be considered minor if it is localized, temporary, and/or largely unnoticeable to the typical user of the transportation system. Alternatives that provide only a minor improvement do not meet the purpose and need and therefore are not reasonable alternatives.

If an alternative failed to meet one or both elements of the Purpose and Need, it was eliminated from consideration. If an alternative met both elements of the Purpose and Need, it was further evaluated to

[1] The preliminary alternatives were developed with the goal of addressing transportation needs in the study area. See Figure 1-1 (showing the study area boundaries). Some of the preliminary alternatives include or could be developed to include, improvements that extend somewhat beyond the study area boundaries-for example, HOV improvements and mass transit. The study area boundaries did not in any way limit the consideration of those preliminary alternatives.

determine whether there were any other factors that would make it unreasonable, including:

- Impacts to both the human and natural environment,
- Lack of economic feasibility.

As further discussed in the following section, all of the preliminary alternatives were eliminated, except for the Build Alternative, which involves constructing a toll roadway on new location.

2.2.1 Transportation System Management (TSM) Alternative Description of Alternative

TSM Alternatives include modest physical and operational enhancements to improve performance, safety, and management of traffic operations without major construction. These improvements may include installing or optimizing traffic signals, adding medians or turn lanes, and other simple measures to improve traffic flow within the study area. When used, these alternatives generally have fewer impacts on the environment, shorter implementation schedules, and lower costs.

The roadway projects planned in the STIP include some of these TSM components. As discussed in Chapter 1, the transportation improvement projects planned within the study area were included in the traffic projections and considered in the operational and capacity analyses evaluated for the 2030 No-Build traffic conditions.

Assessment and Conclusions

TSM improvements for individual intersections, interchange ramps, or other similar types of minimal improvements could enhance mobility somewhat due to increase intersection capacities at the specific locations of the improvements. However, these spot improvements would only marginally expand the capacity of the transportation system. The effectiveness of TSM improvements would likely be overwhelmed by widespread existing traffic congestion, as well as the substantial increase in traffic volumes expected by 2030. The TSM improvements would provide little, if any, noticeable improvement in traffic flow on NC 55 and NC 54. Therefore, TSM improvements would not meet the purpose of reducing congestion on NC 54 and NC 55. In addition, TSM improvements would not create a new or significantly improved link from major commuter routes into the RTP campus, and therefore would not meet the RTP component of the purpose and need.

For all of these reasons, the TSM alternative would not meet the purpose and need of the project and therefore it is not a reasonable alternative.

2.2.2 Traffic Demand Management (TDM) Alternative

The Transportation Demand Management (TDM) Alternative includes measures and activities that change traveler behavior. Typically TDM improvements do not involve major capital improvements. For this study, the TDM Alternative is assumed to include demand management strategies currently implemented in Wake and Durham Counties, such as staggered work hours and flex-time (employer focused) and ridesharing. Ridesharing, such as carpools and vanpools, is generally viewed as more convenient than bus transit with regard to access, door-to-door travel times, and comfort.

Assessment and Conclusions

As discussed in Chapter 4, the Triangle Region and RTP promote and participate in TDM programs. However, the transportation demand in the study area is predicted to exceed the capacity of the roadway system by the year 2030. The TDM Alternative would have the same shortcomings as the TSM Alternative described above: in general, it would have minimal ability to improve access to RTP from major commuter routes, and would provide minimal (if any) noticeable improvement in congestion on NC 54 or NC 55. Therefore, the TDM Alternative does not meet the project's purpose and need and thus is not a reasonable alternative. In addition, the feasibility of implementing more extensive TDM measures is highly uncertain, because many TDM measures are implemented by private employers on a voluntary basis; transportation agencies generally have only a supporting role in a TDM program. The uncertainty about implementation provides additional support for finding that this alternative is not reasonable.

2.2.3 I-40 High Occupancy Vehicle (HOV) Lane Alternative

The NCDOT commissioned a High Occupancy Vehicle and Congestion Management Study (HOV Study) to review a broad range of strategies for addressing congestion in the Research Triangle region. The final report, I-40 High Occupancy Vehicle/Congestion Management Study, was published in March 2003. The purpose of the HOV Study was to find additional ways to maximize both existing and planned transportation system facilities, with a focus on I-40 because it is the Triangle region's most important transportation artery.

While the I-40 HOV Study considered a broad approach to congestion management, particular attention was given to the potential use of HOV lanes to improve traffic mobility on I-40. As stated in the I-40 HOV Study, "While the focus of the study is the I-40 corridor, other major transportation facilities that intersect or parallel I-40 (such as Triangle Parkway) are considered in the analysis also." A total of 100 miles of freeway was identified during the study as having potential feasibility for HOV lanes. The termini of the potential 100-mile HOV system are shown in Figure 2-2. The I-40 HOV Study determined that the highest priority segment for HOV on I-40 is in RTP between NC 147 and I-540, which is within the study area for the Triangle Parkway project. Therefore, for purposes of this EA, the "I-40 HOV Lane Alternative" is defined as implementing HOV lanes on I-40 between NC 147 and I-540.

The I-40 HOV Lane Alternative was considered as a potential alternative in this screening analysis because it involves potential improvements to a major commuter route that passes directly through the study area for this project.

Assessment and Conclusions

The I-40 HOV Lane Alternative would help to improve mobility and relieve traffic congestion on I-40 by re-distributing some of the I-40 through-traffic to HOV lanes. However, I-40 in the study area is primarily an east-west route, and thus serves different traffic movements than those that are addressed by this project. Implementing HOV lanes on I-40 could help improve traffic flows on I-40 itself, because they would more efficiently accommodate the east-west flows on that route; but, given the generally east-west orientation of I-40 in this area, HOV lanes on I-40 are unlikely to divert substantial traffic off the existing north-south routes in the study area (NC 54 and NC 55). Therefore, while the I-40 HOV lanes would be valuable in their own right, they are unlikely to reduce congestion on NC 54 or NC 55. In addition, the I-40 HOV lanes would not improve access

from major commuter routes to the RTP employment center, because they would not create any new connection from I-40 or NC 540 or other major routes into the RTP complex. Therefore, the I-40 HOV Lane Alternative would not meet the purpose and need for this project and thus is not a reasonable alternative.

In summary, the "I-40 HOV Lane Alternative" can best be understood as a separate project that serves a distinct purpose from Triangle Parkway; it would complement the Triangle Parkway, not eliminate the need for it. This conclusion is consistent with the recommendations of the HOV study, which was to consider implementation of an HOV system on I-40 and other roads in conjunction with the construction of Triangle Parkway, not as an alternative to Triangle Parkway. The HOV study noted that "One key addition that should be investigated is the extension of NC 147 south to Western Wake Freeway (known locally as the Triangle Parkway)."

2.2.3 Widening Existing Roads Alternatives

Based on the planning level capacity analysis discussed in Chapter 1, a majority of the transportation network within and around the RTP is currently over capacity. Improvements to several of the major existing roadways in the study area (including Davis Drive, NC 55, and NC 54) are already planned as part of a region-wide effort to address increasing traffic congestion. These improvements are included in the CAMPO and DCHC MPO LRTPs and therefore were assumed to be implemented in the 2030 capacity analysis for the No-Build Scenario. Despite the implementation of these planned roadway improvements by 2030, as discussed in Chapter 1, the major roads in the project area are still projected to function with unstable traffic flows and have increasing V/C ratios beyond their capacity.

The following widening projects are planned or are underway:

- Davis Drive is currently under construction and being widened to a four-lane divided, uncontrolled-access facility from Morrisville-Carpenter Road in Wake County to NC 54 in Durham County.
- The NC 55 widening project is nearing completion. NC 55 is being widened to a combination of four-lane divided and five-lane sections from US 64 near Apex to Cornwallis Road in Durham. Access will be uncontrolled (i.e., at-grade intersections).
- NC 54 is planned to be widened to multi-lanes from Davis Drive to Miami Boulevard. The total project length is 1.1 miles. Construction is currently underway for this section of NC 54. It is being constructed with the Davis Drive project. Access will be uncontrolled (i.e., at-grade intersections).

These widening projects will be complete by 2030; however, as shown in Table 1-4 for the No-Build condition, these roadways will remain over capacity with V/C ratios well over 1.0 (from 1.55 to 2.76) in the year 2030. In addition, none of these projects would provide any control of access.

For purposes of this EA, two basic versions of the Widening Existing Roads Alternative have been considered. These are (1) widening existing NC 54 and NC 55 in the study area, while maintaining their basic character as at-grade arterials; and (2) converting NC 54 and/or NC 55 in the study area to a fully access-controlled freeway.

Widen Existing Roads as At-Grade Arterials

As explained above, widening projects are already planned for the existing north-south routes in the study area. These projects will widen Davis Drive, NC 55, and NC 54 to multi-lane roadways, while maintaining their existing facility type – that is, at-grade arterials, which allow for continued direct access to intersecting streets and to adjacent residences and businesses. The purpose and need for the Triangle Parkway project is based on the capacity analysis for the 2030 No-Build scenario, which assumes all of these widening projects are fully implemented. This capacity analysis shows that widening existing roads, without controlling access, provides limited relief.

This alternative would involve additional widening projects – above and beyond those currently planned on Davis Drive, NC 55, and/or NC 54 in the study area. Widening these roadways further would include adding additional 12-foot lanes in each direction and purchasing additional right-of-way accordingly. If these roadways were widened the following typical sections would be constructed:

- Davis Drive and NC 55 would be widened from four-lane divided roadways to potentially a six or eight-lane divided roadway with a minimum in 24 to 48 feet of additional right-of-way.
- NC 54, as a five-lane roadway, would require additional modifications with the addition of one or two additional lanes in each direction. Regarding traffic operations, the center turn lane may not be as effective for a total of seven and/or nine lane roadway resulting in slower speeds. Therefore, additional modification such as providing a median with strategically placed turn-lanes for access to adjacent businesses may need to be included in the widening and require purchasing additional right-of-way.

Assessment and Conclusions

This alternative would improve access to RTP and reduce congestion on NC 54 and NC 55 to some extent, but the degree of improvement would be limited because these roads would remain at-grade with signalized intersections and multiple uncontrolled access points (e.g., driveways). The intersections and uncontrolled access points would continue to impede the flow of traffic.

Nonetheless, this type of alternative would include additional lanes and intersection improvements, and could even be designed to include grade-separations at high-volume intersections. In principle, these types of improvements could make it possible for a widen-existing alternative (even as an arterial) to meet one or both elements of the project purpose. However, if these improvements were made, they would have severe impacts on the existing commercial, residential, and industrial developments located adjacent to the existing rights-of-way on Davis Drive, NC 54, and NC 55. Driveway accesses, parking lots, buildings, gas pumps, and other similar types of facilities would be impacted as a result of the widening. Therefore, even if this widen-existing alternative were defined in a manner that allowed it to meet both elements of the purpose and need, it would not be a reasonable alternative because of its impacts on adjacent development.

Lastly, a widen-existing alternative could not be tolled because State law prohibits the conversion of an existing road to a toll road (with limited exceptions that are not applicable here). Without toll revenues, it is unlikely that this alternative would be economically feasible.

The lack of economic feasibility is an additional factor that also reinforces the support for eliminating the widen-existing alternative. In summary, for the reasons stated above, this version of the Widen Existing Roadways Alternative is not a reasonable alternative and is not carried forward.

Convert Existing Road to a Freeway

This alternative would involve converting an existing north-south arterial in the study area such as Davis Drive, NC 54, or NC 55 to a fully-access controlled freeway. Any of these alternatives would require substantial right-of-way acquisition along the upgraded route in order to eliminate existing access points, add new travel lanes, and provide alternative means of access (e.g., collector/distributor roads) to serve adjacent development, which would no longer have direct access to the upgraded route.

Assessment and Conclusions

Converting any of the three existing north-south routes in the study area – NC 55, Davis Drive, or NC 54 – to a fully-controlled facility would meet the congestion-relief element of the purpose and need for the project, because it would provide new capacity on an existing north-south route in the study area. However, converting NC55 and NC 54 to freeway would not improve access to RTP, because these routes skirt the edges of the RTP campus, and do not lead directly into the campus itself. Therefore, converting NC 55 and NC 54 to a freeway would not meet the RTP component of the purpose and need. Converting Davis Drive to a freeway could meet the purpose of improving access to RTP, but it would close existing driveway access and displace several of the large employers in RTP that it is intended to serve – and thus would not achieve the desired benefits of the proposed action. Therefore, converting an existing route to a freeway could meet the congestion-relief purpose, but would not meet the project's purpose of improving mobility, accessibility, and connectivity to RTP. Because that purpose is not met, this alternative would not meet the purpose and need of the project

In addition, even if this alternative met the purpose and need, it would not be reasonable because of its impacts. It is clear that widening an existing north-south route to a freeway would result in impacts to the commercial, office and industrial businesses located along the routes. The potential impacts of converting these roadways to freeways are discussed individually below.

- **Convert NC 55 to a Freeway** NC 55 is heavily developed with fast food restaurants and office buildings for one mile heading south from I-40. Closing access and purchasing property for right-of-way would impact the businesses.
- **Convert Davis Drive to a Freeway** Widening Davis Drive to a freeway would result in substantial right-of-way impacts to the Keystone office complex located in the vicinity of Hopson Road as well as impacts to the Davis Park development. This roadway extends through RTP and is adjacent to and directly accesses several large businesses within RTP. Widening this road to a freeway would impact several of the largest employers in RTP, including Biogen, Sony Ericsson, and Cisco.
- **Convert NC 54 to a Freeway** Widening NC 54 to a freeway from NC 540 to I-40 would result in substantial impacts to the commercial and office developments along the

route. This development is located in close proximity to NC 54 for the entire length from NC 540 to I-40.

Lastly, if an existing at-grade arterial were converted to a freeway, it could not be tolled because State law prohibits the conversion of an existing road to a toll road (with limited exceptions that do not apply here). Without toll revenues, it is unlikely that this alternative would be economically feasible. The lack of economic feasibility is an additional factor that also reinforces the support for eliminating the widen-existing alternative.

In summary, the Widen Existing Roads (Convert to Freeway) Alternative was eliminated from further consideration because (1) it would not improve access for commuters to RTP employment center and thus is not consistent with the purpose and need; (2) it would have severe impacts to adjacent development; and, (3) it is not economically feasible because it could not be tolled.

Finally, any alternative that involves converting an existing route to a freeway could be developed with an HOV lane (or HOV/Toll or "HOT" lane) on the freeway. An HOV lane would provide a faster trip for those who are able to car-pool; a HOT lane would provide a faster trip for those who are willing to pay a toll for the right to use a car-pool lane. With or without the HOV or HOT lane, conversion to a freeway is unreasonable for all of the reasons described in this section above.

2.2.4 Mass Transit Alternative

For purposes of this EA, two versions of the Mass Transit Alternative have been considered: (1) improving bus service within the study area and (2) implementing a rail system within the Triangle Region.

Improving Bus Service

Existing public transportation service within and surrounding the study area primarily involves bus service, which is provided by three public agencies: Triangle Transit Authority (TTA); Durham Area Transit Authority (DATA); and Capital Area Transit (CAT). Service provided by TTA routes connect with local buses in Durham, Chapel Hill and Raleigh, as well as buses operated by Duke University and North Carolina State University. In the morning and afternoon rush hours, the TTA provides four shuttle routes to several major employers in RTP. Shuttle service is provided to other RTP employers upon request. TTA also supports and promotes a Vanpooling Program for commuters who live and work near each other and have similar work hours.

As identified above there are several opportunities available for shuttle and bus services within the project area. Based on the TTA October 2007 records [2], these services provided a record ridership in October 2007 with 87,721 riders within the Triangle Region. This ridership was stated to be equivalent to "taking 30,000 auto trips off the road" during the month.

Assessment and Conclusions

Because bus transit serves a small portion of the existing north-south trips in the study area, even a substantial increase in bus transit (e.g., a doubling of bus trips) would have a minimal

[2] http://www.ridetta.org/Home/News_Events, TTA Ridership for October 2007 Sets New monthly Record, November 2007

effect on traffic volumes on NC 54 and NC 55. Increasing transit service would have benefits, because it would provide additional options for commuters, which would help to some degree to offset the increasing traffic volumes. But improved bus service, even if successful in attracting additional riders, would not be sufficient to reduce congestion on NC 54 and NC 55 to a noticeable extent because bus trips make up such a small fraction of all commuter trips. The traffic currently on each of these roadways is from approximately 18,000 to 26,000 vehicles per day, with traffic predicted to increase in 2030 from 36,000 to 75,000 vehicles per day. Therefore, while shuttle services could provide better access to RTP for those who take transit, that improvement would affect only a small fraction of all commuter trips to the RTP campus. Therefore, this alternative would not meet the purpose of improving access for commuters to RTP, nor would it meet the purpose of reducing congestion on NC 54 and NC 55. For these reasons, this alternative is not reasonable and is not carried forward for detailed study.

Implementing a Rail System

TTA completed a Record of Decision (ROD) in January 2003 for a Regional Rail System in the Triangle Region. It is currently projected by TTA and included in the Triangle Regional Travel Demand Model that a transit system within the Triangle Region would provide a 3 percent reduction in vehicle miles traveled in the region and a 15 percent reduction in delays within RTP. One of the options studied by TTA included a segment of rail-line passing through locations in RTP, Morrisville, and Cary and ending in downtown Raleigh.

Assessment and Conclusions

Implementing the Regional Rail System in the Triangle Region could improve access for commuters to RTP (if the rail service includes a station on the RTP campus). In addition, if the Rail System was implemented in its entirety, it eventually could help reduce congestion on the north-south roadways within the study area, such as NC 54 and NC 55. However, even with the Rail System in place, the Triangle Regional Travel Demand Model still projects an increase of 53 to 60 percent in traffic volumes within this same area by 2030. Implementing the Rail System alone would not accommodate this large increase in transportation demand. In addition, the Rail System would not provide improved access into the RTP campus from existing commuter routes, such as I-40 and NC 540. Therefore, while a Rail System would have benefits, it would not meet the needs for this proposed action. Based on this finding, the Mass Transit Alternative was determined to be an unreasonable alternative for this project and was eliminated from further consideration.

2.2.5 Build Alternative - Non-Toll Roadway on New Location

This alternative involves construction of Triangle Parkway as a new non-tolled roadway. It is essentially identical to the proposed action, except that all traffic would be allowed to use the road without paying a toll. Because it would be non-tolled, the road would likely attract higher traffic volumes and therefore could provide even greater congestion relief for existing arterials than would be provided by a new tolled roadway.

Assessment and Conclusions

The construction of Triangle Parkway as a new non-tolled roadway would meet purpose and need. In fact, as noted above, a non-tolled Triangle Parkway could provide even greater congestion relief for existing routes than a tolled Triangle Parkway, because a non-tolled Triangle Parkway would tend to attract higher traffic volumes from existing roads.

However, while this alternative would meet the purpose and need, it is not economically feasible. The current NCDOT STIP does not include funding for right-of-way acquisition or construction for this project, and traditional (non-toll) transportation funding for this project is not likely in the foreseeable future. There are many other priority projects statewide and, due to funding constraints, there is not enough funding available from traditional sources in the foreseeable future to construct Triangle Parkway as a non-toll road. The limited funding has resulted in indeterminate delays for several needed transportation projects. The MPOs, as part of the metropolitan planning process, have decided to allocate the limited available federal and state funds to other projects, while developing Triangle Parkway as a toll road. This funding decision provided the basis for the MPOs' financial plan for their long-range plans, which in turn provided the basis for FHWA's finding of fiscal constraint for the plans. Based on these planning decisions, a non-toll option to construct Triangle Parkway is not economically feasible and therefore is not a reasonable alternative. Therefore, this alternative was not carried forward for detailed study.

2.2.6 Build Alternative - Toll Roadway on New Location

Based on the preliminary traffic and revenues forecasts, the NCTA determined Triangle Parkway is financially feasible with the collection of toll fees. Using these toll fees, the NCTA can provide the funding needed and construct the project many years earlier than with traditional funding sources. Moreover, as stated above, the construction of a new roadway would meet purpose and need and, if constructed in the reserved corridor, impacts would be minor. Therefore based on the screening criteria summarized below, constructing Triangle Parkway as a toll roadway on new location was determined to be a reasonable alternative for NCTA and was carried forward for detailed study.

In summary, constructing Triangle Parkway is consistent with all aspects of the project purpose and need, in addition to the state and local land use and transportation plans. This alternative is also considered viable at this time with NCTA funding. Therefore, this alternative was retained and developed further for implementation and minimization of impacts to both the human and natural environment.

2.2.7 Preliminary Alternative Evaluation Conclusion

As described above, the Preliminary Alternatives were evaluated based on their ability to meet purpose and need and other factors, including economic feasibility and potential impacts to the environment. Based on that analysis, the only alternatives carried forward for detailed study in the EA are the No-Build Alternative and a Build Alternative that involves constructing a toll road on new location. Therefore, as discussed below, the Build Alternative, Triangle Parkway as a Toll Road, was developed further to identify the location that would have the least impacts to the human and natural environment.

2.3 Development of Build Alternative – Triangle Parkway Toll Road

The Build Alternative consists of constructing major tolled roadway improvements in the project area. These improvements would include constructing Triangle Parkway on new location as a multi-lane facility through the RTP as identified in the RTP Master Plan and the regional long range transportation plans.

Criteria for toll roads stipulated in the North Carolina General Statues, such as full control of access and the availability of free alternate routes was considered throughout the development of Triangle Parkway as the Build Alternative. Major factors such as road location, access points, and toll plaza locations were developed based on local transportation planning efforts, legislative requirements and additional criteria to maintain the needed transportation service to the area, minimize impacts, and maintain tolled access to the roadway. The development process including determining logical termini, locating a corridor, and evaluating the above major factors for Triangle Parkway as a toll road are discussed in the following sections.

2.3.1 Logical Termini and Independent Utility

In accordance with CFR 771.111(f) an evaluation of the logical termini and independent utility was conducted to justify the project termini at NC 540 and I-40. Based on this evaluation, these termini were concluded appropriate based on three criteria. These criteria and determinations are provided as follows:

1. Connect logical termini – Triangle Parkway serves an identified need within the regional and local comprehensive plans. It extends 3.4 miles between two major freeway facilities, NC 540 to I-40, which would each serve on some sections of roadway between 100,000 to 200,000 vehicles per day in the design year 2030. The project is of sufficient length to connect these two major freeways with a controlled access facility that on its own merit will provide transportation improvements for the public traveling within RTP and between NC 540 to I-40.
2. Have independent utility – The termini established for Triangle Parkway are sufficient in providing independent utility for transportation needs identified in the regional plans. The purpose for constructing and need for Triangle Parkway is not dependent on the completion or implementation of any other projects in the area. In relation to the toll revenue projections, Triangle Parkway is anticipated to generate sufficient revenue with or without the construction of the future NCTA projects identified as Triangle Expressway.
3. Would not restrict consideration of alternatives for future projects – There are several projects proposed in the vicinity, including the widening of Davis Drive and construction of the McCrimmon Connector along with two other NCTA projects. The construction of Triangle Parkway would not require construction of these projects. In addition, the construction of Triangle Parkway would not restrict the considerations of alternatives for these other projects or prohibit their construction.

2.3.2 New Location Corridors

During the development of the project, preliminary corridors, approximately 1000 feet wide with wider areas to accommodate interchanges and toll plazas, were identified to determine potential locations for the new road. The two new location corridors reviewed for the project are described below.

Triangle Parkway Corridor A (Green)

Corridor A is located approximately within the reserved corridor (112 acres of the 168 acres needed for construction are in the reserved corridor) identified in the current RTP Master Plan, which is developed and periodically updated by the Research Triangle Foundation; the current reserved corridor is consistent with the corridor reserved in the original 1958 RTP Master Plan. Corridor A extends from NC 540 to I-40 with interchange connections proposed at NC 540, Davis Drive, Hopson Road and I-40. This corridor is shown in green on Figure 2-3.

Triangle Parkway Corridor B (Yellow)

Corridor B begins at NC 540 and curves to the west outside of the reserved corridor to the I-40/NC 147 Interchange. This corridor was developed based on agency input to avoid several stream crossings between Hopson Road and Davis Drive and a parallel stream impact at the north end of the project between Hopson Road and I-40. Corridor B is shown in yellow on Figure 2-3. Interchange connections are proposed at NC 540, Davis Drive, Hopson Road and I-40.

Corridor Evaluation

During the July 20, 2006 agency review meeting, NCTA reviewed the results of the preliminary evaluation between Corridors A and B between NC 540 and I-40. As shown in Table 2-1, Corridor A demonstrated more benefits than Corridor B. Corridor B would extend further to the west into the water supply watershed, which has a boundary extending on the west side of the project area. Corridor B would impact existing and future RTP development plans and several existing research facilities and businesses, including the EPA Air Quality Testing Facility and Federal property owned by EPA and the National Institute of Environmental Health Sciences (NIEHS). Additional wetland impacts from Corridor B also include the pond owned by the Durham Wildlife Club.

Table 2-1 Preliminary Corridor Evaluation

Corridor	Business	*Protected Species	Wetland and Stream	Water Supply Watershed	Consistency with Local Plans
Corridor A Green Corridor	No Direct Business Impacts	No	-Impacts Streams between Davis Drive and Hopson Road -Longitudinal Stream Impacts between Hopson Road and I-40	No	- Consistent with RTP Master Plan
Corridor B Yellow Corridor	- RTP, EPA, NIEHS, EISAI Expansion and Durham Wildlife Club - NIEHS/EPA is Federal land which can not be condemned	No	-Impacts Wetland at Durham Wildlife Club - Impacts Streams between Davis Drive and Hopson Road	Yes	-Inconsistent with RTP Master Plan

*Note: The USFWS noted at the agency coordination meeting that no impacts to protected species were anticipated. The Bald Eagle was delisted as a protected species in August 2007.

NCTA reviewed the locations of Corridors A and B with EPA and NIEHS in order to evaluate potential impacts. Both EPA and NIEHS noted Corridor B would have major impacts to both of their campuses, their security requirements, and overall operations. NIEHS was not in favor of the Corridor B location.

NIEHS noted that right-of-way from their property would be required for Corridor B; and they would not support selling property to NCTA or swapping land with NCTA for other property. Since their property is federally owned, NCTA can not condemn this property for use as road right-of-way. Therefore, the inability to obtain the right-of-way and the extensive impacts to Federal property, as well as the other businesses, were considered fatal flaws in the location of Corridor B.

Corridor A generally follows the reserved corridor within the RTP Master Plan and would not impact or require Federal property for right-of-way. Corridor A also would not be within the water supply watershed or have major impacts to existing RTP businesses or other adjacent properties. Corridor A was identified as the preferred location for Triangle Parkway. This corridor location was developed further with functional design plans to evaluate features such as interchange connections and toll plaza locations.

2.3.3 Interchange Connections and Toll Collection Locations

Since all toll projects must be full-control-of-access facilities, Triangle Parkway is proposed as a full control of access road for the entire length. Access would be provided with interchanges at the major road crossings: NC 540, Hopson Road, Davis Drive, and I-40. The Hopson Road and Davis Drive interchanges are included to maximize the access to the RTP employment center and to remain consistent with the RTP master plan.

Tolls for the use of the roadway would be collected from people either getting on or off Triangle Parkway. To evaluate access and toll operations at Hopson Road and Davis Drive, two design options for the new interchange connections were reviewed during the development of the functional design plans (See Figures 2-4 and 2-5). The partial cloverleaf design and the split diamond design options were evaluated based on the feasibility of collecting the tolls at the ramps, the ability to minimize impacts from construction activities and right-of-way acquisition, as well as the ability to maintain reasonable traffic operations along Triangle Parkway, Davis Drive, and Hopson Road. The description of these interchange design options and reasons for selecting Option 2 – the split diamond design option as the preferred design are discussed below.

Davis Drive and Hopson Road Interchange Design Option 1 – Partial Cloverleaf

Option 1 would construct a partial cloverleaf at both Hopson Road and Davis Drive. The Hopson Road cloverleaf design would include exit and entrance loops located to the north of the intersection and the Davis Drive cloverleaf would include exit and entrance loops located to the south of the intersection. Based on preliminary traffic operational analyses, this interchange design would function at an acceptable Level of Service (LOS), but would include an undesirable short distance in spacing between the Davis Drive and Hopson Road interchanges.

The preliminary evaluation of toll plaza locations determined that the loop ramp designs were not as effective as a traditional diamond ramp for operating toll plazas. Based on functional

design, Option 1 would also impact an existing commercial office building located at 4105 Hopson Road and, as shown in Table 2-2, has approximately 198 more feet of perennial stream impacts than Design Option 2. Therefore, the cloverleaf designs at these roadways were eliminated from further consideration.

Table 2-2 Stream and Wetland Impacts - Design Options 1 and 2

Resource	Design Option 1 Split Clover Leaf	Design Option 2 Split Diamond
Wetlands (acres)	1.94 acres	1.94 acres
Perennial Streams (feet)	4704 feet	4506 feet
Intermittent Streams (feet)	3806 feet	4082 feet

Clearing impacts are based on 40 feet beyond slope stake limits

Davis Drive and Hopson Road Interchange Design Option 2 – Split Diamond (Preferred)

Option 2 would construct a split diamond design at each intersection with separated north and south bound service roads between Davis Drive and Hopson Road. This design would increase the distance between the exit and entrance ramps along Triangle Parkway and require less area for construction. With less construction area needed for the interchange, Option 2 would minimize wetland and perennial stream impacts at Davis Drive. This information was presented to the regulatory agencies on December 15, 2006. At that meeting the agencies agreed that Design Option 2 was preferred over Design Option 1. The split diamond configuration also improves the choices in toll collection methods; such as if needed, toll plaza locations relative to maximizing traffic operations. Therefore, the split diamond interchange design for the Triangle Parkway connections to Hopson Road and Davis Drive was included in the Preferred Alternative and developed further in the functional design stages of the project.

2.3.4 Potential Modifications at I-40 and NC 540

The NCDOT requested, after their review of the HCS analysis and coordination meetings with the NCTA on April 13, 2007 and May 18, 2007, that NCTA include the following modifications to Triangle Parkway, I-40, NC 147 and NC 540 as part of the Preferred Alternative:

- Construction of Triangle Parkway as an eight-lane facility instead of a six-lane facility.
- Construction of a flyover ramp (or bridged ramp) at the I-40 Interchange between the northbound Triangle Parkway and westbound I-40 including the necessary widening of I-40 to NC 55.
- Widening of eastbound I-40 by one-lane from NC 55 to southbound Triangle Parkway.
- Widening of northbound NC 147 to the T.W. Alexander Drive interchange.
- Widening of the westbound NC 540 by one-lane from southbound Triangle Parkway to NC 55.
- Widening of eastbound NC 540 by one-lane from NC 55 to Triangle Parkway including the addition of a third lane to the flyover ramp.

The NCDOT-requested modifications that were reviewed by NCTA are discussed in more detail in the following sections. The NCTA performed an analysis of the requested modifications using

CORSIM (see analysis summaries below) to determine if they were currently needed and reasonable and feasible. The HCS analysis is documented in North Carolina Turnpike Authority STIP Project U-4763B - Triangle Parkway Traffic Operations Technical Memorandum Northern Wake Expressway to I-40 (January 2008); and the CORSIM analysis is documented in the North Carolina Turnpike Authority STIP Project U-4763B - Triangle Parkway CORSIM Peak Hour Microsimulation Analysis Report – Northern Wake Expressway to I-40 (January 2008). Both of those reports are incorporated by reference in this EA.

I-40 Flyover and Widening of Westbound I-40

Functional designs were developed to evaluate an I-40 flyover and widening of westbound I-40. The functional design analyzed along I-40 included the construction of a 4,500-foot, two-lane, flyover ramp from northbound Triangle Parkway to westbound I-40. The length of bridge required for the flyover is 770 feet. The remainder of the flyover would be built on fill material. The current loop ramp from westbound I-40 to northbound NC 147 would be eliminated. The improvements would add an additional outside lane along westbound I-40 to NC 55, a distance of 1.2 miles. The NC 54 bridge over Triangle Parkway is expected to be replaced with the construction of the Triangle Parkway because the clearance in relation to the existing bent under the bridge may not be adequate to meet the lane requirements for Triangle Parkway. However, the flyover would require the bridge be lengthened by 225 feet. In addition, this modification would require an additional 11,500 feet of retaining walls. The bridge over Alston Avenue would require widening. The bridge on T.W. Alexander Drive over I-40 has sufficient horizontal clearance to accommodate the widening of westbound I-40. The modifications are shown in Figure 2-6. A discussion of the potential impacts to the human and natural environment associated with this modification can be found in Appendix F.

Eastbound I-40 Widening

The functional designs analyzed along eastbound I-40 included the construction of an additional outside lane along eastbound I-40 from NC 55 to southbound Triangle Parkway, a distance of 1.2 miles. The bridges over Alston Avenue and over the CSX railroad would require widening. The bridge on T.W. Alexander Drive over I-40 has sufficient horizontal clearance to accommodate the widening of eastbound I-40. The modifications are shown in Figure 2-6. A discussion of the potential impacts to the human and natural environment associated with this modification can be found in Appendix F.

Widening of Westbound NC 540

The functional design along westbound NC 540 included the construction of an additional outside lane along NC 540 from the Triangle Parkway to NC 55 for a distance of 0.8 miles. The modifications are shown in Figure 2-7.

Widening of Eastbound NC 540 and Widening of NC 540 Flyover

The modifications along eastbound NC 540 include the construction of an additional outside lane along NC 540 from NC 55 to northbound Triangle Parkway for a distance of 1.3 miles. The modifications include the addition of a third lane to the flyover between eastbound NC 540 and northbound Triangle Parkway. The length of bridge required for the flyover

widening is 1,025 feet. The remainder of the flyover widening will be built on fill material. The modifications are shown in Figure 2-7.

The HCS traffic analysis tool, which is typically used for NEPA design analysis and was used for this EA, is not well-suited for comparing the additional modifications requested by NCDOT, primarily involving the number of lanes needed on adjoining facilities to accommodate projected traffic volumes in the design year (2030). Therefore, NCTA performed an additional analysis of the requested modifications using the CORSIM microsimulation model. HCS and CORSIM are both generally accepted tools to analyze traffic operations. Each analysis package utilizes similar input data such as toll traffic projections, roadway geometry, and other roadway characteristic information to complete an operational analysis. For further discussion of the CORSIM analysis, see below under "Microsimulation Analysis."

Traffic Volumes – Design Year 2030

Projected toll traffic volumes used in the two traffic operations analyses within the project vicinity are shown in Appendix B.

Operational Analysis with the Requested Modifications

An operational analysis using HCS was performed for the interchange ramps (acceleration and deceleration lanes), as well as the weaving sections for the projected 2030 traffic on Triangle Parkway. An operational analysis is performed to determine the ability of a road to serve the traffic projected to use it. These operational conditions are defined in the HCM by introducing the concept of levels of service (LOS). LOS is measured by letter designations A through F representing the driver's perception of the operating conditions. LOS A represents the best operating conditions and LOS F the worst. The analysis predicts the traffic flow or "service flow rates" for a range of operating conditions, except for LOS F where flows are unstable and delay is high. Each facility has five service flow rates, one for each level of service (LOS A through E). For LOS F, the flow rate is difficult to predict due to varying stop-and-go conditions present within the traffic stream. Tables 2-3 and 2-4 list the results of the operational analysis.

The HCS analysis undertaken for NEPA found that most of the major roadway facilities are expected to operate over capacity with or without the construction of Triangle Parkway by the design year of 2030. While HCS can effectively analyze isolated facilities with moderate congestion, it is limited in its ability to analyze network or system effects. Due to capacity limitations of the roadway network, it is anticipated that the forecasted traffic will not reach the Triangle Parkway during the peak hour in 2030. An analysis tool was therefore needed to analyze traffic on Triangle Parkway in light of constraints resulting from congestion throughout the network. As discussed below, the CORSIM microsimulation model was used for this purpose.

Table 2-3 Analysis of Potential Triangle Parkway, NC 147, and I-40 Modifications - 2030 LOS

Segment (limits)	LOS Without Modifications	LOS With All Modifications
NB Triangle Parkway diverge to I-40 Flyover	N/A	F
NB Triangle Parkway diverge to EB I-40	D	N/A
NB Triangle Parkway merge from EB I-40	NA	C
NB Triangle Parkway weave at I-40	F	N/A
Flyover diverge to EB I-40	N/A	C
Flyover merge from SB NC 147	N/A	F
WB I-40 merge from SB NC 147 / Triangle Parkway	F	NA
WB I-40 merge from NC 147/Triangle Parkway	N/A	F
WB I-40 weave at Triangle Parkway	F	N/A
WB I-40 weave Triangle Parkway to NC 55	N/A	F
WB I-40 basic freeway segment, Triangle Parkway to NC 55	F	F
WB I-40 diverge to SB Triangle Parkway	N/A	D
EB I-40 basic freeway segment, NC 55 to Triangle Parkway	F	F
EB I-40 ramp to SB Triangle Parkway	Under Capacity	Under Capacity
EB I-40 basic freeway segment, east of diverge to SB Triangle Parkway	F	F

Source: North Carolina Turnpike Authority NCDOT STIP Project No. U-4763B – Triangle Parkway Traffic Operations Technical Memorandum Northern Wake Expressway to I-40 Wake and Durham Counties (January 2008))

Table 2-4 Analysis of Triangle Parkway and NC 540 Modifications 2030 LOS

Segment (limits)	LOS Without Modifications	LOS With All Modifications
Triangle Parkway, SB weave, Davis Drive to NC 540	E	E
SB Triangle Parkway ramp to NC 540	Over Capacity	Under Capacity
SB Triangle Parkway ramp to WB NC 540	Over Capacity	Over Capacity
NC 540 WB CD merge with Triangle Parkway SB ramp	F	C
WB NC 540 CD merge	D	C
WB NC 540 diverge to NB NC 55	C	C
WB NC 540 diverge to SB NC 55	F	F
EB NC 540 basic freeway segment, NC 55 to Triangle Parkway	E	D
EB NC 540 flyover exit to Triangle Parkway	Over Capacity	Under Capacity
EB NC 540 flyover merge from WB NC 540	F	D
Triangle Parkway, NB weave, NC 540 to Davis Drive	E	D
NB Triangle Parkway, 4th lane merge, north of Davis Drive	N/A	D

Source: North Carolina Turnpike Authority NCDOT STIP Project No. U-4763B – Triangle Parkway Traffic Operations Technical Memorandum Northern Wake Expressway to I-40 Wake and Durham Counties (January 2008)

Microsimulation (CORSIM) Analysis

The CORSIM microsimulation model was selected as the analysis tool to consider the impacts of the capacity constrained roadways feeding the Triangle Parkway. Traffic microsimulation models simulate the behavior of individual vehicles within a predefined road network and are used to predict the likely impact of changes in traffic patterns resulting from changes to traffic flow or from changes to the physical environment.

In contrast to the HCS software, CORSIM considers all locations simultaneously on a network basis. Evaluating the network facilities allows CORSIM to assess the effect of congestion building up at one location, and its resulting impacts on capacity at other locations. Therefore, CORSIM is better suited to recognize and evaluate the impact from adjacent network locations and has the ability to consider the capacity constraints – that is, congested conditions – that exist on other roadways in the network. Taking these constraints into account allows the CORSIM model to depict the future flows of traffic on the network, including traffic on Triangle Parkway in light of congestion on I-40.

The CORSIM model was used to develop the following additional Measures of Effectiveness (MOEs) to assist in the decision making process:

- average speed in miles per hour (mph),
- total travel time in seconds per vehicle (sec/veh),
- delay time, which is the total travel time per vehicle minus the move time per vehicle, in seconds per vehicle (sec/veh),
- vehicle-miles of travel, which is the total distance traveled by all vehicles for the duration of the simulation.

Inspection of the CORSIM animation files was also used in the evaluation and development of conclusions. The MOEs were evaluated for the following segments:

- I-40 Westbound – East of Airport Boulevard to west of NC 55
- I-40 Eastbound – West of NC 55 to east of Airport Boulevard
- NC 540 Eastbound – West of NC 55 to east of I-40
- NC 540 Westbound – East of I-40 to west of NC 55

For the purposes of this evaluation, the following four scenarios were evaluated to determine the effects that congestion on the freeway facilities feeding Triangle Parkway (i.e., I-40, I-540, NC 540) would have on traffic operations in the design year of 2030:

- Scenario 1 – Triangle Parkway without modifications to NC 540 or I-40. (Widening of I-40 is not currently planned in the CAMPO or DCHC MPO LRTPs.)
- Scenario 2 – Triangle Parkway with design modifications along I-40.
- Scenario 3 – Triangle Parkway with design modifications along NC 540.
- Scenario 4 – Triangle Parkway with design modifications along I-40 and NC 540.

Ten design year 2030 CORSIM runs were performed for the AM and PM peak hour for each of these scenarios. Average MOEs were developed for Scenarios 1 – 4 by individual link and total length. These MOEs were evaluated to develop conclusions regarding the traffic

operational impact of the construction of Triangle Parkway (Scenario 1) and how those impacts compare to impacts associated with Scenarios 2-4.

- **Triangle Parkway to I-40 Westbound**

  As proposed in Scenario 1, in the 2030 design year, the CORSIM analysis shows the weave[3] on I-40 westbound at the NC 147/Triangle Parkway interchange is anticipated to function without experiencing breakdown conditions. The HCS analyses predicted that with the construction of Triangle Parkway there would be breakdown conditions at the weave on I-40 westbound in the 2030 design year.

  The difference in the two analyses is the CORSIM analysis clarifies how the oversaturated conditions of the network (especially on I-40 near the NC 540 interchange) prevent a considerable amount of the projected design year peak-hour traffic from reaching this weave area. The CORSIM analysis also showed that this weave area is anticipated to experience more congestion in the PM peak hour than the AM peak hour, even though the projected volumes are considerably higher in the AM peak hour. The reason for this is that the AM peak within the network is so oversaturated with traffic backed-up (on the network as a whole) that fewer vehicles actually reach the weaving location in the AM peak. In addition, the northbound weave on Triangle Parkway at the I-40 interchange would experiences congestion which meters the traffic accessing the westbound weave on I-40. This metering results in higher speeds and less delay at this specific location in the AM peak.

  Based upon the forecasted volumes and the HCS predicted failure of the weave on I-40 westbound, traffic operations with a flyover from northbound NC 147 to westbound I-40 were evaluated. With or without a flyover, the northbound direction of NC 147 just south of I-40 would operate at LOS E. With the provision of a two lane flyover, the exit to the flyover, the two lanes of the flyover, and the NC 147 lanes north of the flyover would operate at acceptable levels of service. However, the entrance of the two-lane flyover onto I-40 westbound would fail in 2017, prior to the 2030 design year. In addition, the next weave along I-40 westbound, between the I-40 westbound flyover entrance and the NC 55 lane exit, would reach LOS E by 2011 with failing conditions by the year 2014, within one and four years from time of construction in 2010. These operational failures occur within a short timeline because I-40 is functioning over capacity. Specifically, I-40 is predicted to degrade from LOS C in 2016 to LOS F in 2017.

  Since I-40 would be operating over capacity, the flyover would improve operations along NC 147 by removal of the northbound weave movement; however, it would generate failing operations when merging with I-40 in the westbound direction. In comparison, the same analysis conducted with the weave on westbound I-40 (without the flyover) is anticipated to reach LOS E in 2014 and LOS F in 2018, failing one year later than the failure on I-40 westbound with the flyover.

  I-40 was determined to need widening in the future with or without the addition of Triangle Parkway. If improvements with the flyover were made at this interchange; these

[3] A weave is the length along a roadway where there are conflicting traffic movements which require vehicles to change lanes. As intended in this EA, the location or length of roadway where vehicles are entering and exiting the freeway within or between interchanges would be considered the "weave".

improvements would be obsolete within a few years pending the need to widen I-40. In addition, the current CAMPO and DCHC LRTPs do not include plans to widen I-40. Given that there are no studies or designs in place to widen I-40, if the flyover was constructed, it would require re-construction pending any ultimate design potentially developed for improvements or the widening of I-40.

- **Triangle Parkway to I-40 Eastbound**

  The NCDOT proposed modifications to I-40 eastbound would result in minimal benefit over the proposed NCTA design based on the MOE results demonstrated by the CORSIM analysis. The I-40 eastbound exit to Triangle Parkway southbound is not expected to experience considerable delay or congestion as proposed by NCTA (Scenario 1).

- **NC 540 Eastbound / Triangle Parkway Northbound**

  Without the addition of the third-lane to the flyover from NC 540 eastbound to Triangle Parkway northbound, severe congestion and queuing is expected along NC 540 eastbound between the interchanges of NC 55 and Triangle Parkway. The addition of the third-lane will alleviate this situation, resulting in noteworthy improvements to travel time, delay and congestion in the design year.

- **NC 540 Westbound / Triangle Parkway Southbound**

  Based on the CORSIM model runs, modifications to the southbound Triangle Parkway ramps to NC 540 westbound are not required. The CORSIM model runs did not indicate operational problems with the NCTA proposed design.

Conclusion

After additional analysis using CORSIM software, the NCTA determined that:

- Widening eastbound NC 540 and widening the flyover from eastbound NC 540 to northbound Triangle Parkway will be not be needed when the project opens, but will be needed by 2024 to meet future traffic operational needs.
- The westbound NC 540 widening is not needed to meet traffic operational needs for the project through the design year of 2030.
- The widening of northbound NC 147 beyond to the T.W. Alexander Drive interchange is needed to improve the operations of NC 147.
- The I-40 flyover and widening of eastbound I-40 or westbound I-40 would not provide much improvement due to existing network constraints and the ultimate need to widen I-40 with or without the construction of Triangle Parkway. Specifically if the flyover was constructed, operations at two locations along I-40 westbound would actually fail one year prior to the year I-40 westbound is projected to fail without the flyover.
- The widening of Triangle Parkway from six-lanes to eight-lanes would not be needed until the McCrimmon Connector (STIP No. U-4763A) is constructed. The widening of Triangle Parkway between NC 540 and I-40 will be reviewed as part of that project.

The future construction of any of the requested modifications will be performed in accordance with the Project Specific Agreement between the NCDOT and the NCTA.

2.4 Consistency of Build Alternative with Purpose and Need

The Triangle Regional Travel Demand Model was used to determine if the Build Alternative as a toll road would be consistent with the purpose and need for the project. Traffic volumes were projected for the study area and compared using two scenarios in the future year 2030; one, with the construction of a new toll road - Triangle Parkway (Build Traffic), and the second, without the construction of Triangle Parkway (No-Build Traffic).

With Triangle Parkway added as the one major parameter changed in the travel demand model between the No-Build and Build traffic model scenarios, the traffic service operations on the roads during the peak morning and evening (AM and PM) hour traffic conditions were evaluated. Triangle Parkway is just one component within the long range transportation plans for the Triangle Region and would not be expected to alleviate all the traffic congestion and operational problems experienced within the study area during these extreme peak-hour travel times.

A review of the volume to capacity (V/C) information with and without the project in Table 2-5 shows if Triangle Parkway was constructed, several existing roads would experience a decrease in V/C. Therefore, the project, as part of the regional transportation network, would decrease traffic congestion within the study area during peak travel hours, improve traffic operations, and improve service during other travel times during the day.

In particular, the construction of the Triangle Parkway would improve the north-south routes NC 55 and NC 54 by providing additional network capacity. The analysis in Table 2-5 shows the V/C for NC 55 from NC 54 to NC 540 reduces from 2.76 to 1.64, a 40.6 percent reduction. In addition, NC 54 from Surles Street to NC 540 has a reduction in V/C from 1.29 to 0.99, a 23.3 percent reduction.

This daily improvement in operational service provided by Triangle Parkway would also open an additional north-south route through the study area. With the construction of Triangle Parkway, people traveling to RTP employment center would have freeway access to the area from NC 540 from the south and I-40 from the north. At full traffic-carrying capacity, Triangle Parkway could carry from 111,700 to 149,000 vehicles per day in a north-south direction through the central area of RTP. It is projected to serve from 104,200 to 130,000 vehicles per day in the year 2030.

The predominant direction of travel within the study area during the evening (PM) peak hour is from Durham County and the RTP employment center toward Wake County residential areas. Approximately 37,000 vehicles per day traveling to and from RTP are projected to use the interchange access provided from Triangle Parkway directly to Hopson Road and Davis Drive. Hopson Road and Davis Drive are each primary arterial routes extending through RTP.

A review of the study area indicates that during the highest travel periods of the day, morning and evening, the primary travel pattern is predominately in the north-south direction between Durham County north of the project area and Wake County south-east of the project area. Comparing the Build and No-Build 2030 average daily traffic volumes, shown in Appendix B, indicated that the Build Alternative would result in a reduction in the daily traffic volumes and ultimately less congestion on two existing north-south routes, NC 55 and NC 54. In addition, the average daily traffic volumes along I-40 east of NC 147 would be reduced by 33,000 vehicles per day.

As shown in Table 2-5, the V/C ratio along the north-south links of NC 55 and NC 54 would decrease. The largest reduction in the V/C ratio in the study area would be the reduction of 1.12 along NC 55. (2.76 V/C ratio in 2030 without the project and 1.64 V/C ratio with the project)

Table 2-5 Volume to Capacity Analysis

Segment (limits)	Analysis Type	2030 No-Build Performance Measure			2030 Build Performance Measure			
		Volume	Capacity	V/C Ratio	Volume	Capacity	V/C Ratio	Percent Reduction in V/C Ratio (%)
Davis Dr. (NC 54 to Hopson Rd.)	N/S Arterial	41,400	26,700	1.55	38,400	26,700	1.44	7.1%
Davis Dr. (Hopson Rd. to Morrisville Carpenter Rd.)	N/S Arterial	56,600	28,000	2.02	51,800	26,800	1.93	4.5%
Miami Blvd. (I-40 to Surles St.)	N/S Arterial	41,000	22,700	1.81	36,000	25,000	1.44	20.4%
NC 54/Miami Blvd. (Surles St. to NC 540)	N/S Arterial	37,400	28,900	1.29	31,600	31,800	0.99	23.3%
NC 54 (NC 540 to Morrisville-Carpenter Rd.)	N/S Arterial	71,000	30,700	2.31	67,600	30,700	2.20	4.8%
NC 54 (T.W. Alexander Dr. to Davis Dr.)	E/W Arterial	49,200	29,500	1.67	47,800	29,500	1.62	3.0%
NC 54 (Davis Dr. to Miami Blvd.)	E/W Arterial	44,000	20,300	2.17	42,800	20,300	2.11	2.8%
NC 55 (NC 54 to NC 540)	N/S Arterial	84,800	30,700	2.76	50,200	30,700	1.64	40.6%
Triangle Parkway (I-40 to Hopson Rd.)	N/S Freeway				104,200	111,700	0.93	N/A
Triangle Parkway (Hopson Rd. to Davis Dr.)	N/S Freeway				98,500	111,700	0.88	N/A
Triangle Parkway (Davis Dr. to NC 540)	N/S Freeway				130,000	149,000	0.87	N/A

*NOTE: N/S= north to south directional route in the study area and E/W = east to west directional route in the study area

Source: North Carolina Turnpike Authority NCDOT STIP Project No. U-4763B – Triangle Parkway Traffic Operations Technical Memorandum Northern Wake Expressway to I-40 Wake and Durham Counties (January 2008)
Information in this table is based on North Carolina Level of Service (NCLOS) guidelines. NCLOS was developed by the Institute for Transportation and Research (ITRE) for NCDOT.

If Triangle Parkway was constructed, the 2030 daily traffic volumes would decrease by approximately 50 percent along the entire length of NC 55 from NC 540 to NC 54 (as compared to the 2030 No-Build condition). For the north-south link of NC 54 from NC 540 to Miami Boulevard, the traffic volumes would decrease approximately 15 percent. The V/C ratios corresponding to these roadways also decrease indicating that the people traveling throughout the day along these routes would experience improved operational service and less traffic congestion. In addition, the Vehicle Miles Travels (VMTs) reduced by 1.85 percent with the Build Alternative in comparison to the No-Build Alternative (See Table 2-6).

Table 2-6 Vehicle Miles Traveled (VMT) by Alternative

	No-Build Alternative	Build Alternative	Difference
VMT	3,808,843	3,738,557	-70,286 (-1.85 %)

Therefore, evaluating the traffic volumes with the capacity analysis and daily operations on the roadways with and without Triangle Parkway, Triangle Parkway was determined to be consistent with the purpose and need of the project by:

- Providing direct freeway access for approximately 37,000 vehicles per day to and from RTP
- Increasing travel capacity by over 100,000 vehicles per day in the study area, and
- Reducing the 2030 travel demand on major north-south routes in the study area.

The operational analysis specifically used to design the roadway capacity and parameters for the proposed Triangle Parkway and to evaluate the level of service provided for the peak hour traffic volumes by the new road are provided in Chapter 3.

2.5 Preferred Alternative Identified

The Build Alternative - Triangle Parkway as a Toll Road is identified as the Preferred Alternative. The Triangle Parkway location was preliminarily identified based on area long range transportation plans and then specifically reviewed along Corridor A to minimize impacts to resources within the study area. The Preferred Alternative also includes widening NC 540 by one lane in the eastbound direction from NC 55 to Triangle Parkway, widening the flyover ramp between eastbound NC 540 and northbound Triangle Parkway, widening NC 147 by one lane in the northbound direction from I-40 to T.W. Alexander Drive, and the construction of the Kit Creek Road connector. For additional description of the project, refer to Chapter 3. Based on the evaluation of preliminary alternatives and the comparison with the No-Build Alternative, this alternative would meet the purpose and need for the project and provide for the transportation needs within a timely schedule. The Preferred Alternative with details of the functional plans in relation to construction and right-of-way limits is discussed in Chapter 3.

3.0 Preferred Alternative

Based on the evaluation of alternatives described in Chapter 2, the Build Alternative - Triangle Parkway Toll Road has been identified as the Preferred Alternative. This chapter reviews the functional designs and associated traffic operations for the Preferred Alternative. The designs identified in this section are preliminary and are subject to change based on comments received on this document and at the public hearing.

3.1 Preferred Alternative Description

The NCTA proposes to construct a six-lane tolled-freeway facility known locally as the Triangle Parkway (STIP No. U-4763 B). Triangle Parkway is located in southern Durham County and western Wake County, predominately within RTP. The project includes the following improvements:

- Constructing a full control access road extending approximately 3.4 miles in length from NC 540 to I-40. (See Appendix A; Figures A-1 through A-6);
- Constructing a compressed split diamond interchange between Davis Drive and Hopson Road with one-way frontage roads connecting Davis Drive and Hopson Road.
- Constructing dual bridges over Burdens Creek.
- Constructing toll plazas on the interchange ramps at Hopson Road.
- Constructing toll plazas on the ramp between westbound NC 540 and northbound Triangle Parkway and the flyover ramp between southbound Triangle Parkway and eastbound NC 540.
- Widening in the median of northbound NC 147 from I-40 to the T.W. Alexander Drive interchange (approximately 1.7 miles).
- Widening the outside lane of eastbound NC 540 by one-lane (The total length of the widening along NC 540 is approximately 1.3 miles).
- Widening the two-lane flyover ramp from eastbound NC 540 to Triangle Parkway to three-lanes.
- Widening the existing bridges on NC 540 over Davis Drive, Cisco Access Road and proposed Louis Stephens Road.
- Constructing the Kit Creek Road connector.

The widening of NC 540 and the widening of the two-lane flyover ramp from eastbound NC 540 to northbound Triangle Parkway, which NCTA added to the project at the request of NCDOT, will not be included in the initial construction but will be constructed at a time in the future when traffic demand requires these improvements and per the Project Specific Agreement between the NCTA and the NCDOT. Based on the current traffic analysis, these improvements will not be required until 2024.

3.1.1 Project Location

The Preferred Alternative includes the construction of Triangle Parkway as a new roadway within Corridor A, as previously shown on Figure 2-3 and shown in Appendix A. The new roadway would extend from the NC 540 interchange to the north, crossing Kit Creek Road, Davis Drive, Hopson Road, NC 54, and I-40, to connect with NC 147. This new roadway is proposed as a multi-lane, median-divided, toll road.

3.1.2 Control of Access and Interchange Connections

Triangle Parkway would be a full control of access transportation facility for the entire length with interchange connections at major road crossings. Bridges with interchange connections would be provided at road crossings with NC 540, Hopson Road, Davis Drive, and I-40. The compressed split diamond interchange configuration (Design Option 2) is the preferred design for Hopson Road and Davis Drive. Bridges over Triangle Parkway would be provided for NC 54 to maintain the connections from Davis Drive and T.W. Alexander Drive and for Kit Creek Road to provide a connection between Davis Drive and Church Street. The temporary detour along NC 54 will include the construction of a detour bridge to maintain the NC 147 spur between I-40 and T.W. Alexander Drive for as long as feasible during the construction of the project.

3.1.3 Toll Collection Locations

Based on preliminary traffic and revenue studies, Triangle Parkway will have tolls collected at the Hopson Road interchange southbound exit and northbound entrance ramps. Additional ramp toll collections will be located on the NC 540 interchange at the ramp from westbound NC 540 to northbound Triangle Parkway and the ramp from southbound Triangle Parkway to eastbound NC 540. (See Appendix A) There will also be toll collection on the mainline of NC 540 between the Triangle Parkway and NC 55. The NCTA will study the tolling of NC 540 as a separate project with the appropriate environmental documentation.

3.2 Traffic Volumes – Design Year 2030

The projected toll traffic volumes along Triangle Parkway range from 104,200 vehicles per day (vpd) to 130,000 vpd in 2030 for the Preferred Alternative. Projected traffic volumes for other roadways within the project vicinity are shown in Appendix B.

3.3 Operational Analysis

An operational analysis for the project using HCS was performed to determine the level of service for the projected 2030 traffic on Triangle Parkway. The typical section for the Triangle Parkway is a six-lane median divided section. (See Figure 3-1) To fully evaluate the project, operational analyses were also performed for the interchange ramps (acceleration and deceleration lanes) and the interchange ramp/cross road intersections, as well as weaving sections. Table 3-1 lists the results of the operational analysis for 2030 traffic along the Triangle Parkway (2030 Build Scenario).

3.3.1 Triangle Parkway – Basic Freeway Segments

By 2030, all freeway segments on Triangle Parkway are anticipated to operate at LOS E in the heaviest peak hour traffic condition with the northbound direction heavier in the AM peak hour and southbound direction heavier in the PM peak hour. The project will redistribute traffic at the NC 147 / I-40 Interchange and will widen northbound NC 147 to three lanes; with these changes,

northbound operations on NC 147 north of I-40 to the T.W. Alexander Drive interchange will improve over the 2030 No-Build scenario.

The "McCrimmon Connector," planned to extend from Triangle Parkway south from NC 540 to McCrimmon Parkway, is a separate project – STIP No. U-4763 A. It is included in the CAMPO Long Range Transportation Plan for construction by 2030. Consequently, the project-level toll traffic forecast and analysis assumes that this project has been constructed by another entity (not NCTA) as a non-toll facility by 2030. With this project in place, the weaving sections created between NC 540 and Davis Drive are expected to operate at LOS E.

Table 3-1 2030 Triangle Parkway Peak Hour LOS

Segment (limits)	LOS
NB Triangle Parkway weave from NC 540 to Davis Drive	E
NB Triangle Parkway basic freeway segment from Davis Drive to Hopson Road	E
Ramp from Hopson Road merge to NB Triangle Parkway	D
NB Triangle Parkway basic freeway segment from Hopson Road to I-40	E
SB Triangle Parkway basic freeway segment from I-40 to Hopson Road	E
Ramp from SB Triangle Parkway diverge to Hopson Road	D
SB Triangle Parkway basic freeway segment from Hopson Road to Davis Drive	E
SB Triangle Parkway weave from Davis Drive to NC 540	E
Ramp from EB NC 540 to Triangle Parkway	Under Capacity
Ramp from SB Triangle Parkway to WB NC 540	Over Capacity
Ramp from SB Triangle Parkway to EB NC 540	Under Capacity

*Note: NB=Northbound, SB=Southbound, EB=Eastbound, WB=Westbound
Source: North Carolina Turnpike Authority NCDOT TIP Project No. U-4763B – Triangle Parkway Traffic Operations Technical Memorandum Northern Wake Expressway to I-40 Wake and Durham Counties (January 2008)

3.3.2 Triangle Parkway – Interchanges

I-40

As with the 2030 No-Build scenario, traffic projections for I-40 exceed the capacity of the freeway. As a result, all ramps that merge and diverge directly onto or off of I-40 would operate at a LOS F during the heaviest peak hour in 2030.

NC 540

Based on the HCS analysis, the southbound Triangle Parkway to westbound NC 540 ramp and the eastbound NC 540 flyover to northbound Triangle Parkway are projected to have 2030 peak hour traffic volumes that will exceed capacity. The CORSIM microsimulation analysis indicates metering from adjacent and nearby interchanges would reduce the impact on the southbound Triangle Parkway to westbound NC 540 ramp by limiting the amount of traffic that will reach the interchange. The proposed widening of the eastbound NC 540 flyover to Triangle Parkway northbound will allow the ramp to operate under capacity during the heaviest peak hour in 2030.

Hopson Road

In the 2030 Build scenario, the Triangle Parkway ramp junctions with Hopson Road are anticipated to operate at a peak hour LOS D.

Davis Drive

In the 2030 Build scenario, the Triangle Parkway ramp junctions with Davis Drive are anticipated to operate at a peak hour LOS E.

3.3.3 Connecting Road Intersections

Davis Drive and Hopson Road Intersection

Davis Drive is a four-lane facility and Hopson Road is a two-lane facility in the vicinity of the intersection. Under existing traffic conditions, this intersection operates at a desirable LOS C in the peak hour, with manageable queues and delays. In the 2030 No-Build scenario, this intersection is expected to operate at LOS F with extensive queues and delays in the peak hour.

NCDOT STIP Project U-4026 is under construction to widen Davis Drive to a four-lane facility from Morrisville Carpenter Road in Wake County to NC 54 in Durham County. The intersection of Davis Drive and Hopson Road will be improved to increase intersection capacity. With completion of this project, the northbound, southbound and eastbound approaches will include dual left-turn lanes, two through lanes and an exclusive right-turn lane. The westbound approach will include dual left-lanes, one exclusive through lane and one shared through-right turn lane. In 2030, with these improvements, the Hopson Road and Davis Drive intersection is still expected to operate at LOS F with extensive queues and delays in the peak hour

With construction of Triangle Parkway, the intersection of Triangle Parkway northbound on-ramp and Hopson Road is proposed to be located approximately 800 feet from the Davis Drive and Hopson Road intersection. The intersection of Triangle Parkway northbound off-ramp and Davis Drive is proposed to be located approximately 2,400 feet from the Davis Drive and Hopson Road intersection.

In the 2030 Build scenario, the intersection as designed with the U-4026 improvements is expected to operate at LOS F with considerable queues and delays as it does in the 2030 No-Build scenario.[1] The queues may have the potential to impact the Triangle Parkway interchange ramp intersections with Hopson Road and Davis Drive. Therefore, additional geometric improvements to the Hopson Road/Davis Drive intersection are planned as part of the Triangle Parkway project. These additional intersection improvements consist of two additional right-turn lanes on the westbound approach and one additional right-turn lane on both northbound and southbound approaches. These proposed improvements at this intersection will not provide a desirable level of service (LOS D or better) in the peak hour.

[1] The U-4026 project is a separate project, which is being implemented by the NCDOT. The U-4026 project involves widening Davis Drive from Morrisville-Carpenter Road to NC 54 to a multi-lane facility.

Triangle Parkway Northbound Ramp and Hopson Road Intersection

This intersection was analyzed in the Design Year 2030 with dual left-turn lanes, a single through lane and a single right-turn lane on the northbound frontage road which operates as a northbound one-way facility. Hopson Road is assumed as a four-lane facility with a single eastbound left and a single westbound right-turn lane onto the Triangle Parkway northbound ramp. In the 2030 Build scenario, the intersection is expected to operate at an acceptable level of service B or better with acceptable queues and delay.

Triangle Parkway Southbound Ramp and Hopson Road Intersection

This intersection was analyzed with exclusive left, through and right-turn lanes on the southbound ramp. Hopson Road is assumed as a four-lane facility with dual eastbound right-turn lanes and dual westbound left-turn lanes accessing the southbound frontage road. This southbound frontage road will operate as a two-lane southbound one-way facility serving as a connector between Hopson Road and Davis Drive. In the 2030 Build scenario, the intersection is expected to operate at an acceptable level of service B or better, with acceptable queues and delay.

Triangle Parkway Northbound Ramp and Davis Drive Intersection

The Triangle Parkway northbound ramp was analyzed with dual left-turn lanes, two through lanes, and dual right-turn lanes on the northbound ramp. Davis Drive is a four-lane facility with two exclusive eastbound left-turn lanes and an exclusive westbound right-turn lane accessing the northbound frontage road. This northbound frontage road will operate as a two-lane northbound one-way facility serving as a connector between Davis Drive and Hopson Road. In the 2030 Build scenario, the intersection is expected to operate at an acceptable LOS D with manageable queues and delay.

Triangle Parkway Southbound Ramp and Davis Drive Intersection

The southbound frontage road was analyzed with an exclusive left-turn lane, two through lanes and an exclusive right-turn lane. This frontage road will operate as a two-lane southbound one-way facility. Davis Drive is a four-lane facility with dual westbound left-turn lanes and an exclusive right-turn lane onto the Triangle Parkway southbound ramp. In the 2030 Build scenario, the intersection is expected to operate at an undesirable LOS E with considerable queues and delay.

3.4 Right-of-Way and Typical Section

Triangle Parkway is proposed as a six-lane tolled-freeway with three travel lanes in each direction that are divided by a 46-foot wide median. The typical roadway section, shown in Figure 3-1 includes 12-foot travel lanes, a 12-foot shoulder on each side, and ditches or side-slopes to connect with the existing terrain. The total construction width is approximately 250 feet and would acquire an estimated 300-foot width of property for right-of-way. Additional right-of-way areas will be needed at interchange, access road, and toll collection locations.

The RTF reserved property through RTP to allow for the future construction of Triangle Parkway during the development of the original RTP Master Plan. Since this 1958 plan, RTF has retained ownership and prevented development within this property. There is approximately 168 acres of right-

of-way required for the project. Approximately 112 acres of this required right-of-way is owned by the RTF and the remaining 56 acres is owned by other private land owners.

The Environmental Protection Agency (EPA) and the National Institute of Environmental Health Sciences (NIEHS) own property adjacent to the reserved corridor. A retaining wall along the property boundary is proposed to avoid right-of-way acquisition from the federally owned property.

Jenkins Road, an abandoned state route, is located east of the EPA campus on both RTF property and EPA property. EPA staff currently access the northern portion of their campus using the RTF-owned section of Jenkins Road. Jenkins Road is gated at the EPA property and the general public does not have access to it. The EPA is aware that their access agreement with RTF allowed EPA access until other needs for this RTF-owned portion of Jenkins Road were identified. With the environmental constraints at this location, the proposed Triangle Parkway will require the portion of RTF property where Jenkins road is located as right-of-way for the project. The EPA is negotiating with NCDOT to obtain access to the northern portion of the EPA campus from the NC 147 Spur.

Eastbound NC 540 is proposed to be widened by one 12-foot lane between NC 55 and Triangle Parkway including the widening of the two-lane flyover ramp to three lanes from eastbound NC 540 to northbound Triangle Parkway. The typical section for the proposed widening is shown on Figure 3-2.

3.5 Alignment

Preliminary locations, or alignments, were developed for the Preferred Alternative from NC 540 to I-40. These alignments were used to determine the feasibility of the roadway construction and to locate the roadway where impacts to the human and natural environment could be minimized. The preliminary alignments for Triangle Parkway and the widening of eastbound NC 540 were developed in accordance with the current NCDOT Roadway Design Guidelines and the 2004 AASHTO Policy on Geometric Design of Highways and Streets (Green Book).

The alignment for the Preferred Alternative was designed to utilize RTF property as much as possible to minimize impacts to adjacent properties; however, additional adjustments and shifts in the alignment were included to accommodate toll collections and to avoid and minimize impacts to other resources within the project area, such as streams, wetlands, and the federally-owned property (USEPA).

The alignment for the NC 540 widening was designed to widen to the outside of the eastbound lane along NC 540 and along the flyover ramp. The Bridge Widening Report[2] (September 2007) indicates that widening the bridges over Louis Stephens Road and Davis Drive will not result in substandard vertical clearances over either road. In addition, the Bridge Widening Report (September 2007) determined the flyover bridge could be widened to the outside by adding an additional bent (vertical center support) and not result in any substandard vertical or horizontal clearances.

The figures showing the alignment for the Preferred Alternative are provided in Appendix A and the project design criterion is included in Appendix B. Figures A-1 through A-6 illustrate the location of the travel lanes, interchange connections, and proposed right-of-way limits. The figures are considered preliminary for use as concepts and will continue to be revised through final design based on comments received on this EA and comments received at the Public Hearing. If revisions or changes in the design are anticipated to increase environmental impacts, the appropriate agencies will be notified and the

[2] The Bridge Widening Report (September 2007) evaluated the feasibility of widening bridges along NC 540 between NC 55 and Triangle Parkway to provide one additional 12-foot wide travel lane.

appropriate updates to this document prepared. NCTA will continue to coordinate with review agencies during final design, permitting, and construction of this project.

3.6 Access Control

Direct access to and from Triangle Parkway from driveways or intersecting side-roads will not be permitted. Access to Triangle Parkway will be limited to interchange connections at NC 540, Davis Drive, Hopson Road and I-40. NC 540 and I-40 are also controlled access facilities with no direct access. Driveways and other roads connecting with Davis Drive and Hopson Road will remain the same except in the vicinity of the Triangle Parkway interchanges. Control of access will be required on each side of the ramp intersections to maintain safe access and efficient traffic operations within the interchange areas. Purchasing control of access at these locations along Hopson Road and Davis Drive may require the relocation of driveways, which would require the relocation of one residence but would not require the relocation of any businesses. In the vicinity of the interchange, access may be altered from full access to right-in and right-out or left-in and right-out access to provide more efficient travel and fewer traffic conflicts.

3.7 Interchanges, Intersections and Signalization

There are no at-grade un-signalized or signalized intersections included along the Triangle Parkway. Table 3-2 lists the types of interchanges associated with the Preferred Alternative. The two Triangle Parkway interchanges with I-40 and NC 540 are existing interchanges. A new split-diamond interchange is proposed for Davis Drive and Hopson Road.

NC 147 currently terminates just south of its interchange with I-40 at T.W. Alexander Drive. To maintain control of access along Triangle Parkway, the Preferred Alternative will close the temporary NC 147 Spur, which provides access between T.W. Alexander Drive and I-40. (See Figure A-4) Access to T.W. Alexander Drive from NC 54, NC 147 (north of Cornwallis Road), Cornwallis Road, Alston Avenue, and Hopson Road will remain unchanged.

Table 3-2 Proposed Interchanges

Intersecting Road Name	Configuration*	Type of Control
NC 147/Cornwallis Road	Partial Cloverleaf	Full
I-40/NC 147	Semi-direct with Weaving	Full
Hopson Road	Split Diamond	Full
Davis Drive	Split Diamond	Full
NC 540	Free-Flow/Trumpet	Full

*Definitions Per AASHTO Green Book, Chapter 8

The campuses for the EPA and NIEHS are located between and adjacent to T.W. Alexander Drive, Hopson Road, and the RTF property reserved for the Preferred Alternative. Representatives from EPA and NIEHS noted concerns with the closing the direct access provided along the NC 147 Spur, connecting the NC 147/I-40 Interchange with T.W. Alexander Drive, in relation to their employees' access to the main entrance on T.W. Alexander Drive. (See Chapters 5 and 6)

When the NC 147 Spur is closed and the Hopson Road interchange with Triangle Parkway is opened, EPA anticipates that many of the employees will choose to use a second un-signalized access available on Hopson Road instead of the main entrance at T.W. Alexander Drive. The Hopson Road entrance to

EPA/NIEHS will remain as an un-signalized full movement intersection. The intersection would not meet the necessary warrants to add a traffic signal when the project opens in 2010. However, in the future the NCTA will design and construct a traffic signal at this location when it meets the NCDOT traffic signal warrants as outlined in the Manual of Uniform Traffic Control Devices (MUTCD).

The Preferred Alternative includes new signalized intersections on Davis Drive and Hopson Road for the frontage connector road and ramp terminal intersections. Along Hopson Road, the existing Davis Drive and Hopson Road intersection is currently signalized. This intersection is located just east of the proposed facility and in close proximity to the proposed interchanges; therefore, the potential of coordinating these signals' timing will be reviewed during final design to improve the traffic flow.

3.7.1 NC 540 Connection

An interchange for NC 540 including a connection with the future Triangle Parkway was planned as part of previous NCDOT planning and environmental studies for STIP Project No. 2000AA/AB. This construction included the required bridging and preliminary grading for future ramp connections to the Triangle Parkway. NCTA proposes to construct Triangle Parkway ramp connections for each direction along NC 540. The interchange will ultimately include non-stop directional ramps to provide access to and from both NC 540 and the Triangle Parkway.

3.7.2 Davis Drive and Hopson Road Connection

Triangle Parkway proposes a "split" diamond interchange to connect with Davis Drive and Hopson Road. Accesses for Davis Drive and Hopson Road with Triangle Parkway are important given both roadways have several driveway connections with large business centers such as Davis Industrial Park, Keystone, Eisai, Inc., and EPA.

The proposed design compresses or brings the interchange ramps closer together on each side of the main roadway to minimize impacts and the right-of-way area required. The "split" design provides optimal locations for the toll collection plazas with the use of connector or access roads. These connector roads are proposed for one-way travel and function similar to a "one-way" pair of roads providing access to the exit and entrance ramps for Triangle Parkway. This design also maximizes the spacing between ramp entrances and exits along Triangle Parkway while providing access to both Davis Drive and Hopson Road. The current design does not allow any access to the "one-way" roads between the intersections with Davis Drive and Hopson Road.

As shown in Appendix A, a total of four signalized intersections will be provided where the ramps and collector roads intersect: two signals on Davis Drive and two signals on Hopson Road. The coordination of these signals and/or the individual signal timing will be determined during final design.

To improve safety, driveway access along Davis Drive and Hopson Road will be limited in the vicinity of these intersections. There are driveways and entrances to businesses along Hopson Road and Davis Drive that may require access changes based on the ramp locations and traffic capacity. The access changes could include converting full movement driveways into right-in and right-out or left-in and right-out access.

Operational analyses were conducted for the frontage roads and their connections with Davis Drive and Hopson Road. The findings from these analyses will be coordinated with the property owners in conjunction with the Public Hearing and development of the final designs.

3.7.3 I-40 Connection

Triangle Parkway will extend through the existing I-40/NC 147 interchange. The existing I-40 Interchange was designed, constructed, and graded as a full-clover interchange. The existing I-40 bridge over NC 147 will accommodate the through traffic lanes proposed and connecting the Triangle Parkway to NC 147. The existing I-40/NC 147 interchange also planned for all movements to and from I-40 to NC 147 north. Southbound interchange ramps connecting with the future Triangle Parkway were planned, designed, and graded in the field. To provide access to and from I-40 with Triangle Parkway, all ramps will have free flow connections. In addition, a second lane will be added to the eastbound I-40 ramp to southbound Triangle Parkway.

3.8 Speed Limits

Triangle Parkway is designed based on a freeway facility with a 70 mile per hour (mph) design speed and will be posted at 65 mph.

3.9 Toll Access and Collection

Access to Triangle Parkway will require the people using the roadway to pay tolls. The price and method of collection of the toll is still under consideration by NCTA. Based on the Preliminary T&R Study, completed in 2006, this analysis assumes toll rate of $1.00 for passenger vehicles in the opening year 2010. Toll rates for trucks would be higher than rates for cars. The toll collection method and toll fee amounts will be reviewed in the Investment Grade Traffic and Revenue Study, which is currently in progress.

The price of the toll could change throughout the life of the proposed action based on variables such as managing demand, financing the initial construction of the project, and paying for roadway operations, maintenance, and future upgrades. Tolling to manage demand may involve changing tolls by time-of-day, in order to maintain free-flowing traffic; this is commonly known as value pricing. NCTA has not made any final decisions about toll rates or about the use of value pricing. In addition, NCTA has not established a process to evaluate periodic increases in the price of the tolls.

NCTA is considering two potential toll collection methods: electronic toll collection (ETC) and on-site payment. ETC would generally involve pre-registration with NCTA and a transponder/receiver system that would allow the user to move through the toll-collection plaza at highway speeds. On-site payment would allow a user to pay the toll with cash or potentially credit/debit cards at the collection plaza. The toll sensitivity analysis for the Preliminary Traffic and Revenue Study (T&R Study) assumed that electronic and cash toll collection would be available at each toll plaza in the opening year and assumed that cash tolling on Triangle Parkway would be phased out over a five year period.[3]

As discussed in Section 3.1.3, toll collection locations are currently proposed on the ramps connecting NC 540 and Triangle Parkway and along the ramps connecting Triangle Parkway to Hopson Road. For

[3] On November 14, 2007, the NCTA Board of Directors adopted a resolution stating that toll collection on the "Triangle Expressway" (Triangle Parkway, Western Wake Freeway, and NC 540) should be fully electronic, provided that the Investment Grade Traffic and Revenue Study confirms that the cashless collection would not adversely affect revenue or the bonding capabilities of the project. If these conditions are met, the project will be constructed without toll plazas. Using electronic toll collection for Triangle Expressway would reduce environmental impacts and is estimated to save approximately $65 million by avoiding the need to construct toll plazas, install toll plaza equipment, provide parking, and pay operational costs. In addition, the future demolition of the toll plazas and the associated impacts to the human and natural environment will be avoided. Because a final decision to proceed with fully electronic toll collection has not been made, the EA continues to show the impacts of the toll plazas. This approach provides a reasonable "worst-case" basis for assessing the impacts of the project.

the purposes of the engineering and environmental analysis in this EA, it has been assumed that the Triangle Parkway project will include toll plazas, which would provide the option of on-site (cash) payment. Cash collections with toll plazas represent a worst case condition regarding the amount of right-of-way required and potential impacts to resources. Therefore, the impact estimates in this document include the impacts of toll plazas.

If the option of cash payment is provided, toll plazas would be constructed, and additional property for right-of-way would be required at these toll plaza locations. The Preferred Alternative designs for the ramp toll plazas assume one ETC lane and one lane to be used for both cash tolls and ETC. The ramp toll collection plazas would each include a small parking area, a small building to house an emergency electric generator, an overhead structure to hold signs and lighting, and toll collection equipment. The facility may also include additional pole-mounted overhead lighting, particularly at toll collection plazas and interchanges, as needed.

3.10 Culverts, Retaining Walls, and Bridges

Structures required for drainage crossings, minimizing construction impacts, and crossing existing roadways for the construction of Triangle Parkway were identified based on the functional design information. A preliminary hydraulic study to identify required drainage structures equal to or greater than 72-inches was prepared for the project. The hydraulic designs will be reviewed further with the agencies during the preparation of the preliminary design plans.

3.10.1 Drainage Structures

Triangle Parkway and NC 540 cross a total of 11 streams and/or drainages which would require hydraulic structures greater than 72-inches in diameter. The structure recommendations for the Preferred Alternative include:

- Retain and extend the existing culverts located at two (2) separate crossings of Burdens Creek Tributary (Existing sizes include: two 8-foot x 6-foot Reinforced Concrete Box Culvert (RCBC) and two 7-foot x 7-foot RCBC)
- Retain and extend the existing culvert at crossing of Unnamed Tributary to Kit Creek (Existing size is one 8-foot x 6.5-foot RCBC)
- Retain and extend the existing culvert at Kit Creek (Existing size is two 15-foot x 10-foot RCBC)
- Retain and extend the existing culvert at Unnamed Tributary to Kit Creek Tributary 2 (Existing size is two 11-foot x 6-foot RCBC)
- Retain and extend the existing culvert at Kit Creek Tributary 2 (Existing size is two 9-foot x 7-foot RCBC)
- Construct an approximate 270-foot long bridge(s) at the crossing of Burdens Creek
- Construct new culverts at the two (2) crossings of Kit Creek Tributary 1 (New Structures: two 29-foot x 7-foot RCBC and two 9-foot x 7-foot RCBC)
- Construct new culverts at the two (2) crossings of Unnamed Tributary to Kit Creek (New Structures: two 5-foot x 5-foot RCBC and one 9-foot x 8-foot RCBC)

There are waters within Wake and Durham Counties that are crossed by the Preferred Alternative. The specific waters crossed in Wake County are not regulated by the Federal Emergency

Management Agency (FEMA); however, the waters crossed in Durham County are regulated by FEMA. Based on the May 2, 2006 Flood Insurance Study for Durham County, there are detailed studies for Burdens Creek Tributary and Burdens Creek; and the Proposed Action has the potential to raise the base flood water surface elevation at this location:

- The proposed bridge crossing over Burdens Creek

The structure and quantity of fill at this location will be evaluated further during final design and if a change in base flood water surface elevation or encroachment into the floodway occurs, a Conditional Letter of Map Revision (CLOMR) and/or FEMA Floodway Modification will be prepared and submitted to FEMA prior to construction. No substantial upstream flooding is anticipated from the construction of the Preferred Alternative. However, properties which have any increase in flood elevation will be identified in the CLOMR; and if appropriate, NCTA could obtain drainage easements and/or right-of-way at these locations. For confirmation, a Letter of Map Revision (LOMR) will be prepared post-construction using as-built plans and submitted for FEMA approval.

Additional drainage structures less than 72-inches in diameter will be identified during the final design stages of the project. The hydraulic designs for the project will be coordinated with the review agencies for comments prior to completion. The details of the preliminary hydraulic study are provided in the Preliminary Hydraulic Study for Environmental Impact (June 2007), Addendum to Preliminary Hydraulic Study for Environmental Impact (August 2007) and Addendum 2 to Preliminary Hydraulic Study for Environmental Impact (October 2007).

3.10.2 Retaining Walls

Retaining walls are proposed at six locations. One retaining wall is located adjacent to the EPA property line to avoid right-of-way impacts to the Federal property and minimize impacts to the Unnamed Tributary to Burdens Creek. The second retaining wall is proposed adjacent to a private property accessing Hopson Road. This retaining wall extends along the proposed interchange ramp exiting Triangle Parkway and accessing Hopson Road. The third wall is located adjacent to the Sigma Xi property to minimize impacts to their parking. The forth wall is located along both sides of the Hopson Road interchange. The fifth wall is located on both side of the Davis Drive interchange; and the sixth wall is proposed to minimize wetland impacts north of the toll plaza on the NC 540 ramp from westbound NC 540 to northbound Triangle Parkway.

3.10.3 Roadway Bridges

In addition to structures proposed for hydraulic needs, bridges are also proposed at interchanges and roadway crossings to span the proposed project or existing roadways. Currently, existing bridges are located at the proposed Louis Stephens Road, Cisco Access Road, Davis Drive, NC 540 interchange with Triangle Parkway, NC 54, and the I-40 Interchange with NC 147. Substantial design or construction modifications to the existing bridges at the I-40 interchange and the NC 540 interchange with the exception of the NC 540 flyover ramp between eastbound NC 540 and northbound Triangle Parkway are not anticipated for this project. The NC 540 flyover will be widened to the outside by one lane. The NC 54 bridge over Triangle Parkway will be replaced because the horizontal clearance under the bridge will not be sufficient to allow for the widening of the ramp from eastbound I-40 to southbound Triangle Parkway. The eastbound lane of NC 540

over Louis Stephens Road, Cisco Access Road and Davis Drive would all be widened by one lane to the outside of the structure.

New bridges are proposed at the following roadway crossings:

- Bridges on Triangle Parkway over Hopson Road
- Bridges on Triangle Parkway over Davis Drive
- Bridge on NC 54 over Triangle Parkway
- Bridge on Kit Creek Road over Triangle Parkway

A temporary bridge is proposed at the following roadway crossing:

- Bridge on NC 54 for detour over Triangle Parkway

Preliminary bridge sizes were determined based on the Preferred Alternative alignments to determine feasibility, estimate cost, and identify potential environmental impacts. Bridge designs will be refined during final design in accordance with the current NCDOT Bridge Policy Manual and the AASHTO Standard Specifications for Highway Bridges.

3.11 Noise Barriers

Noise barriers were reviewed for properties that experienced substantial noise increases or noise levels above the criteria (see Section 5.1.13). Based on the NCDOT's Highway Traffic Noise Analysis and Abatement Policy, a noise wall was preliminarily determined to be cost-effective at one impacted location. At this time, the NCTA has determined a noise wall at the First Environments Early Learning Center (FEELC) is reasonable and feasible.

Final decisions on noise mitigation will be made during final design, based on a noise study prepared in accordance with NCDOT's noise policy. The recommendations in this EA for noise mitigation are preliminary and could be modified during final design.

3.12 Sidewalks and Multi-Use Paths

Sidewalks and multi-use paths are not included along Triangle Parkway since pedestrian, bicycle, and other similar uses are not compatible with the proposed multi-lane controlled access freeway facility. There are existing pedestrian sidewalks and multi-use paths along Davis Drive, Hopson Road and NC 54 within the RTP.

In addition to the existing RTP multi-use path along Davis Drive, there is a current NCDOT project to widen Davis Drive, which relocates the multi-use path. NCTA coordinated the Preferred Alternative with representatives from the RTF and NCDOT to ensure the proposed alignments would not impact the connectivity of the path and were consistent with the current NCDOT project. (See Figure A-3) Based on this coordination, NCTA will replace the multi-use path with sidewalks along the north side of Davis Drive at the interchange location to maintain the connection along the existing multi-use path.

Future sidewalks would be accommodated along Hopson Road under the proposed Triangle Parkway bridges to allow for connection to the multi-use path along Hopson Road. The new bridge over NC 54 includes sidewalks on both sides of the bridge to connect to the existing sidewalks along NC 54.

3.13 Construction

The majority of the construction for the Preferred Alternative will occur on new location. There will be a temporary detour, including a detour bridge, constructed to maintain traffic on NC 54 as the new bridge over Triangle Parkway is constructed. There are several locations along the project that will require care to avoid additional impacts during construction. These include the following:

- EPA property tree line between the FEELC and the road
- Delineated streams and wetlands, including Burdens Creek and unnamed tributaries to Burdens Creek and Kit Creek
- Kitts Creek subdivision detention pond

The NCTA's construction contractor will coordinate blasting activities with property owners within or adjacent to the project prior to and during construction. Prior to construction the NCTA will prepare a vibration study of businesses located along the project.

The NCDOT has begun construction of the Davis Drive widening project which crosses the Triangle Parkway. Close coordination between the NCTA and NCDOT will be maintained during the construction of the Triangle Parkway project. Impacts to traffic during construction would be limited to NC 540, the existing roads where new bridges and ramps are proposed for interchanges, and the Davis Drive/Hopson Road intersection.

3.14 Cost Estimates

The total estimated cost for this project in year 2007 dollars is $164,500,000. This cost includes the construction cost ($133.3 million), right-of-way cost ($26.0 million) and utility costs ($5.2 million). The cost of the project projected through the project opening in year 2010 includes $147.1 million in construction cost, $27.8 million in right-of-way cost, and $5.5 million in utility costs, totaling $180,400,000.

3.15 Project Schedule, Status and Construction Staging

The NCTA proposes to construct the project from NC 540 to I-40 including the proposed interchanges using design-build methods. The NCTA schedule for constructing the Triangle Parkway roadway includes right-of-way acquisition and construction beginning in 2008, and the completion of the roadway in 2010.

The widening of eastbound NC 540 and the flyover will not be included in the initial construction of Triangle Parkway; construction will begin when the traffic volumes on the facility dictate the need and per the Project Specific Agreement between NCDOT and NCTA.

3.16 Avoidance and Minimization

Measures to avoid and minimize impacts were incorporated into the early planning and design of the Preferred Alternative. The avoidance and minimization measures are as follows:

- The planning measures included selecting the project corridor location that collectively avoids and minimizes impacts to resources within the project area.
- The inclusion of the retaining wall at the EPA property reduced the impacts to the Unnamed Tributary to Burdens Creek by 2,450 linear feet of perennial streams and reduced the impacts to wetlands by 0.57 acres.

- The decision to utilize the split diamond interchange at Davis Drive and Hopson Road reduced perennial stream impacts to Kit Creek by 198 linear feet. (See Chapter 2)
- A retaining wall is proposed at the toll plaza on the ramp from westbound NC 540 to northbound Triangle Parkway to avoid impacting 600 linear feet of perennial stream at an unnamed tributary to Kit Creek.
- The alignment for the Preferred Alternative was designed to avoid impacts to the EPA and Keystone properties and to avoid the relocation of the office building located on 4105 Hopson Road.

Additional measures and potential opportunities to avoid and minimize impacts to environmental resources will be coordinated with the review agencies throughout the remaining project development, final design, and construction staging of the project. Any additional measures to avoid and minimize impacts will be included in the final environmental document.

3.17 Proposed Mitigation

Compensatory Mitigation is proposed, as appropriate, for unavoidable impacts associated with the Preferred Alternative. A conceptual stream relocation report for unavoidable impacts to Burdens Creek and its tributaries was prepared and coordinated with the US Army Corps of Engineers (USACE) and the NC Division of Water Quality (NCDWQ). (See Appendix D) The report Conceptual Stream Relocation Plan U-4763 (December 2006) is incorporated by reference.

Mitigation measures proposed for this project using the USACE and EPA's step-down procedure discussed in Chapter 5.5.6 include using the in-lieu fee program through the NC Ecosystem Enhancement Program and the relocation of perennial streams on-site using natural channel design, where feasible. The mitigation and stream relocation design will be coordinated, developed and finalized in conjunction with the Section 404 and Section 401 permit applications.

4.0 Affected Environment

The existing human, physical, cultural and natural environments within the study area are described in this chapter of the EA. The inventory and evaluation of the existing affected environment provides the necessary baseline from which to determine the impacts of roadway construction.

4.1 Human Environment

The human environment is described in the Community Impact Assessment (CIA) and Indirect and Cumulative Effects Assessment (October 2007) Memorandum for Kit Creek Road Addendum (October 2007) and Memorandum for NC 540 Widening Addendum (October 2007) which were prepared to assess the community within and surrounding the project. The CIA assessed the community based upon two study areas: the Direct Community Impact Area (DCIA) and the Demographic Area. (See Figure 4-1) The DCIA includes persons and traits within the community that could be most directly affected by the project. The Demographic Area is comprised of US Census Bureau demographic data that best represents the DCIA; the Demographic Area encompasses the DCIA. Field visits and interviews with local planners were conducted as part of the assessment. The assessment of direct impacts was prepared in accordance with Community Impact Assessment, A Quick Reference for Transportation (Federal Highway Administration, 1996). See Chapter 6 for the indirect and cumulative effects discussion.

4.1.1 Community Profile

The dominant feature in the community is RTP. This research park contains a mix of large and small companies and institutions that employ more than 37,000 people. Land use in RTP is reserved for research oriented facilities so employees must travel outside of RTP boundaries for services such as food and retail. Focal points for these services are located along NC 54 and NC 55. There are approximately 1,100 acres in RTP available for development.

The Town of Morrisville to the south and east of the Preferred Alternative is growing quickly. Many new housing developments are planned or under construction in Morrisville, including Kitts Creek, which will be to the east of the Preferred Alternative. There are several newer neighborhoods just south of RTP boundaries. The Shiloh community, which is locally important for its history as an African American community, is located in Morrisville to the southeast of the Preferred Alternative. The Town of Cary is another nearby rapidly growing area. The Town has many new residential developments planned in the northwest portion of their jurisdiction, which is near RTP.

4.1.2 Community Demographics

The following sections provide an overview of population, race and ethnicity, age, housing, and economic status for the Demographic Area. Data for surrounding municipalities was included since the demographics for these areas demonstrate regional trends, highlight differences between portions of the Demographic Area and nearby communities, and account for travelers from these destinations using the existing roadway network.

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Population

The population in the Demographic Area in the year 2000 was 4,743 persons. Table 4-1 shows the population growth in the Demographic Area from 1990 to 2000 was 175.4 percent. This growth is exceeded in the geographic areas studied only by the Town of Morrisville, which had an increase in population of 409.6 percent from 1990 to 2000. These figures indicate the past and continuing trend of substantial growth in the area, in particular in the southern portion of the Demographic Area.

Table 4-1. Population Growth Trends 1990-2000

	1990 Total Population	2000 Total Population	Population Change 1990-2000	Percent of Population Change 1990-2000
North Carolina	6,628,637	8,049,313	1,420,676	21.4%
Durham County	181,835	223,314	41,479	22.8%
Wake County	423,380	627,846	204,466	48.3%
City of Durham	136,611	187,035	50,424	36.9%
Town of Morrisville	1,022	5,208	4,186	409.6%
Town of Cary	43,858	94,536	50,678	115.6%
City of Raleigh	207,951	276,093	68,142	32.8%
Triangle Pkwy. Demographic Area	1,722	4,743	3,021	175.4%

Source: US Census Bureau, 1990 and 2000

Age

The Demographic Area is relatively young by comparison the region as a whole. The Demographic Area has the highest percentage of persons age 19 years and younger, at 32.4 percent, among the geographic areas studied (Table 4-2). In comparison, this age group comprises 26.3 percent of the population in Durham County and 28.0 percent in Wake County. The Town of Morrisville has a high percentage of persons in the 20-44 years age group, at 60.2 percent. The Demographic Area is comprised of 42.4 percent of this age group, and Durham and Wake Counties are similar at 44.2 percent and 44.3 percent, respectively. The Demographic Area is comprised of a lower amount of persons age 65 and older than Durham or Wake Counties; however, both counties have a lower median age than the Demographic Area.

Race and Ethnicity

Table 4-3 provides a summary of major racial and ethnic groups represented in the overall population. The Demographic Area is less racially diverse than the region as a whole. Within the Demographic Area, 79.5 percent of the population is white. In comparison, the white population in Durham County is 50.9 percent, and in Wake County it is 72.4 percent.

The Hispanic or Latino population is most abundant in the City of Durham, at 8.6 percent. In Durham and Wake Counties, the Hispanic or Latino population is 7.6 percent and 5.4 percent, respectively. The Demographic Area is 3.1 percent Hispanic or Latino. The Asian population is highest in the Town of Morrisville, at 9.1 percent. A Town of Morrisville special census taken

in 2004 revealed that the Asian population there had risen to 18.0 percent, doubling since the 2000 census. The Asian population is 8.3 percent in the Demographic Area.

Table 4-2. Age Distribution, 2000

	19 Years and Younger	20-44 Years	45-64 Years	65 Years and Older	Median Age
North Carolina	2,193,360 27.2%	3,078,043 38.2%	1,808,862 22.5%	969,048 12.0%	35.3
Durham County	58,773 26.3%	98,767 44.2%	44,200 19.8%	21,574 9.7%	32.2
Wake County	175,572 28.0%	278,011 44.3%	127,891 20.4%	46,372 7.4%	32.9
City of Durham	49,742 26.6%	86,115 46.0%	33,763 18.1%	17,415 9.3%	31.0
Town of Morrisville	1,127 21.6%	3,134 60.2%	738 14.2%	209 4.0%	30.3
Town of Cary	29,100 30.8%	41,079 43.5%	19,288 20.4%	5,069 5.4%	33.7
City of Raleigh	69,023 25.0%	133,389 48.3%	50,686 18.4%	22,995 8.3%	30.9
Triangle Pkwy. Demographic Area	1,539 32.4%	2,009 42.4%	952 20.1%	243 5.1%	35.0

Source: US Census Bureau 2000
Rows do not total exactly 100% due to rounding.

Housing Characteristics

Table 4-4 shows the age of available housing. US Census data indicates that most of the homes in the state, Durham and Wake Counties, the City of Durham, and the City of Raleigh were built in the 1970s and 1980s. The Town of Cary had a fairly even distribution in home construction over the 1980s, early to mid 1990s, and mid to late 1990s. Among the geographic areas studied, the Town of Morrisville has the newest homes, with 48.6 percent built between 1999 and March 2000, and 23.8 percent built between 1995 and 1998. The Demographic Area is similar to Morrisville, with 23.0 percent of the homes constructed between 1999 and March 2000, and 39.3 percent constructed between 1995 and 1998. Within the Demographic Area, growth is occurring from north to south. In the northern portion of the Demographic Area (Census Tract 20.14, BG 2) approximately 40 percent of the structures were built between 1980 and 1989, with only 3.3 percent being constructed since 1995. Conversely, in the southern portion of the Demographic Area (Census Tract 536, BG 2), approximately 74 percent of the structures have been built since 1995.

Table 4-3. Race and Ethnicity, 2000

	Total Population	White Alone	Hispanic White	Black or African American Alone	Hispanic Black or African American	American Indian or Alaskan Native	Hispanic or Latino American Indian or Alaska Native	Asian Alone	Hispanic or Latino Asian	Pacific Islander	Hispanic or Latino Pacific Islander	Some Other Race	Hispanic or Latino Some Other Race	Two or More Races	Hispanic or Latino Two or More Races	Total Hispanic or Latino (any race)
North Carolina	8,049,313	5,647,155	157,501	1,723,301	14,244	95,333	4,218	112,416	1,273	3,165	818	9,015	177,614	79,965	23,295	378,963
	100%	70.2%	2.0%	21.4%	0.2%	1.2%	0.1%	1.4%	<0.1%	<0.1%	<0.1%	<0.1%	2.2%	1.0%	0.3%	4.7%
Durham County	223,314	107,371	6,327	87,516	593	531	129	7,311	39	65	14	436	8,968	3,045	969	17,039
	100%	48.1%	2.8%	39.2%	0.3%	0.2%	0.1%	3.3%	<0.1%	<0.1%	<0.1%	<0.1%	4.0%	1.4%	0.4%	7.6%
Wake County	627,846	439,160	15,384	122,648	1,172	1,821	331	21,183	66	178	34	842	14,706	8,029	2,292	33,985
	100%	69.9%	2.5%	19.5%	0.2%	0.3%	0.1%	3.4%	<0.1%	<0.1%	<0.1%	<0.1%	2.3%	1.3%	0.4%	5.4%
City of Durham	187,035	79,277	5,849	81,370	567	455	120	6,782	33	58	13	360	8,515	2,721	915	16,012
	100%	42.4%	3.1%	43.5%	0.3%	<0.1%	<0.1%	3.6%	<0.1%	<0.1%	<0.1%	0.2%	4.6%	1.5%	0.5%	8.6%
Town of Morrisville	5,208	3,883	99	570	3	22	1	471	1	0	0	5	56	87	10	170
	100%	74.6%	1.9%	10.9%	<0.1%	0.4%	<0.1%	9.0%	<0.1%	0.0%	0.0%	0.1%	1.1%	1.7%	0.2%	3.3%
Town of Cary	94,536	75,299	2,384	5,744	69	197	54	7,636	7	25	3	173	1,219	1,415	311	4,047
	100%	79.7%	2.5%	6.1%	0.1%	0.2%	0.1%	8.1%	<0.1%	<0.1%	<0.1%	0.2%	1.3%	1.5%	0.3%	4.3%
City of Raleigh	276,093	166,386	8,400	75,931	825	795	186	9,282	45	100	18	377	8,569	3,914	1,265	19,308
	100%	60.3%	3.0%	27.5%	0.3%	0.3%	0.1%	3.4%	<0.1%	<0.1%	<0.4%	0.1%	3.1%	1.4%	0.5%	7.0%
Triangle Pkwy. Demographic Area	4,743	3,672	98	453	0	15	0	393	0	1	0	3	47	61	0	145
	100%	77.4%	2.1%	9.6%	0.0%	0.3%	0.0%	8.3%	0.0%	0.0%	0.0%	0.1%	1.0%	1.3%	0.0%	3.1%

Source: US Census Bureau 2000. Rows may not total exactly 100% due to rounding.

Table 4-4. Year Structure Built

Year Structure Built	North Carolina	Durham County	Wake County	City of Durham	Town of Morrisville	Town of Cary	City of Raleigh	Triangle Pkwy. Demographic Area
1999 to March 2000	4.1%	3.9%	6.8%	4.2%	48.6%	5.8%	4.6%	23.0%
1995 to 1998	12.3%	10.2%	17.8%	10.7%	23.8%	27.0%	12.4%	39.3%
1990 to 1994	10.6%	9.9%	13.1%	10.0%	8.3%	21.4%	9.3%	3.3%
1980 to 1989	19.7%	20.6%	25.0%	20.4%	12.1%	24.9%	26.6%	12.8%
1970 to 1979	18.2%	18.4%	15.6%	16.6%	2.7%	13.8%	17.6%	8.5%
1960-1969	12.7%	14.2%	9.6%	13.9%	1.4%	4.5%	12.9%	4.6%
1940-1959	15.2%	16.5%	8.4%	17.4%	1.8%	2.0%	11.8%	5.3%
1939 or earlier	7.3%	6.4%	3.7%	6.7%	1.4%	0.8%	4.9%	3.2%

Source: US Census Bureau 2000

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Table 4-5 shows household growth between 1990 and 2000. Households in the Town of Morrisville grew almost 500 percent between 1990 and 2000, by far the largest growth in the area. Within the Demographic Area, household growth occurred at a rate of 137.4 percent. Similar to population, most growth in the Demographic Area between 1990 and 2000 occurred in the southern portion (Census Tract 536, BG 2). Households in the southern portion of the Demographic Area grew from 394 in 1990 to 1,379 in 2000 (250 percent).

Table 4-5. Household Growth, 1990-2000

	1990 Total Households	2000 Total Households	Percent of Household Change 1990-2000
North Carolina	2,517,026	3,132,013	24.4%
Durham County	72,297	89,015	23.1%
Wake County	165,743	242,040	46.0%
City of Durham	56,001	74,981	33.9%
Town of Morrisville	415	2,476	496.6%
Town of Cary	16,908	34,906	106.5%
City of Raleigh	85,822	112,608	31.2%
Triangle Pkwy. Demographic Area	699	1,659	137.4%

Source: US Census Bureau 1990 and 2000

The Demographic Area has a higher percentage of owner-occupied housing than the state or surrounding counties (Table 4-6); however, there are large differences between the two block groups that comprise the Demographic Area. Census Tract 20.14 Block Group 2, located within Durham County, consists of 100 percent renter-occupied housing and a total of only 502 persons in occupied housing units. In Census Tract 536 Block Group 2, located within Wake County, only 8.6 percent of the housing units are renter-occupied, and 91.4 percent are owner-occupied, with a total of 4,133 persons in occupied housing units. These differences in owner and renter occupied houses appear to be consistent with the larger household growth rates (Table 4-5) that are exhibited in Wake County in comparison to Durham County. After the Demographic Area, the jurisdiction with the next highest rate of owner-occupied housing is the Town of Cary, also located in Wake County, at 72.8 percent,

The median value of owner-occupied housing units in the Demographic Area is substantially higher than the other areas shown in Table 4-6. This value is expected to remain high, as many of the newer housing developments observed during field visits consisted of higher end homes fairly recently constructed or under construction.

Table 4-6. Housing Characteristics, 2000

	Percent of Owner-Occupied Housing	Percent of Renter-Occupied Housing	Median Value Owner-Occupied units
North Carolina	69.4%	30.6%	$108,300
Durham County	54.3%	45.7%	$129,000
Wake County	65.9%	34.1%	$162,900
City of Durham	48.9%	51.1%	$126,100
Town of Morrisville	30.3%	69.7%	$173,200
Town of Cary	72.8%	27.2%	$196,700
City of Raleigh	51.6%	48.4%	$156,000
Triangle Pkwy. Demographic Area	81.5%	18.5%	$312,800*

Source: US Census Bureau 2000
* No value for Census Tract 20.14 Block Group 2 was available.

Education

Table 4-7 shows that the population near the Preferred Alternative and in surrounding municipalities is well educated. The Town of Cary has persons with the highest level of educational attainment, with more than 60 percent having a Bachelors degree or higher. The Demographic Area is a close second in this category. The state ranks much lower, with only 22.5 percent of the population attaining a Bachelors degree or higher.

Table 4-7 Educational Attainment, 2000

	Percent of Population 25 Years and Over with High School Degree or Higher	Percent of Population 25 Years and Over with Bachelors Degree or Higher
North Carolina	78.1%	22.5%
Durham County	83.0%	40.1%
Wake County	89.3%	43.9%
City of Durham	82.6%	41.8%
Town of Morrisville	94.2%	55.5%
Town of Cary	95.1%	60.7%
City of Raleigh	88.5%	44.9%
Triangle Pkwy. Demographic Area	93.3%	60.3%

Source: US Census Bureau 2000
Census tract data was used because some information was not available at the block group level.

Income

The Demographic Area has the highest 1999 median household income among the areas studied, at $93,333 (Table 4-8), and the largest median income growth between 1989 and 1999 (193 percent). The Town of Cary has the next highest median household income, at $75,122. The state's median household income, at $39,184, is lower than all other areas studied.

The City of Durham has the highest percentage of individuals below the poverty level at 15 percent (Table 4-8). The Demographic Area has the lowest percentage of individuals below the poverty level, at 2.8 percent, with the Town of Cary following at 3.4 percent. The Demographic Area had the largest decline in the percentage of individuals below the poverty level from 1989 to 1999, falling from 10.0 percent to 2.8 percent.

Table 4-8. Income Level and Poverty Status (1989, 1999)

	1989 Median Household Income	1999 Median Household Income	1989 Percent of Individuals Below Poverty Level	1999 Percent of Individuals Below Poverty Level
North Carolina	$26,647	$39,184	13.0%	12.3%
Durham County	$30,526	$43,337	11.9%	13.4%
Wake County	$36,222	$54,988	8.4%	7.8%
City of Durham	$27,256	$41,160	14.9%	15.0%
Town of Morrisville	$36,806	$56,548	7.4%	4.6%
Town of Cary	$46,259	$75,122	3.2%	3.4%
City of Raleigh	$32,451	$46,612	11.8%	11.5%
Triangle Pkwy. Demographic Area	$29,834	$91,844	10.0%	2.8%

Source: US Census Bureau 1990 and 2000

Business and Employment Characteristics

Research Triangle Park is centrally located between three major universities. It was developed in 1959 to attract companies doing research and development in scientific and technological disciplines. Six of the top RTP employers provide jobs for approximately 24,800 of the 37,000 people who work in the Park. The top six employers are IBM, GlaxoSmithKline, Cisco Systems, Nortel Networks, RTI International, and the EPA. All six of these employers are within the DCIA. Table 4-9 provides labor force statistics.

Cisco Systems at Kit Creek Road and Davis Drive

Table 4-9. Labor Force, 2000

	Percent of Population in Labor Force (16 Years and Over)
North Carolina	65.7%
Durham County	68.1%
Wake County	73.8%
City of Durham	63.1%
Town of Morrisville	83.0%
Town of Cary	76.3%
City of Raleigh	72.7%
Durham Tract 20.14	75.9%
Wake Tract 536	74.6%

Source: US Census Bureau 2000

Table 4-10 shows that persons in Durham Census Tract 20.14 have the lowest mean travel time to work among the areas studied. Additional Census research indicated that the majority of persons in the areas studied drive to work alone, and that the City of Durham has the highest percentage of carpoolers, at 17.0 percent. Public transportation use is low, with the highest percentage of users, at 3.5 percent, located in the City of Durham. Commuters travel to the DCIA and Demographic Area via regional commuting routes such as I-85, I-40, NC 540, I-540, I-440, US 70, US 1, US 64, US 401, NC 147, NC 55, and NC 54. Other heavily used routes within the DCIA include Davis Drive, Hopson Road, and Cornwallis Road.

Table 4-10. Travel Time, 2000

	Mean Travel Time to Work (minutes) for Population 16 Years and Over
North Carolina	24.0
Durham County	21.2
Wake County	24.7
City of Durham	20.7
Town of Morrisville	21.1
Town of Cary	22.9
City of Raleigh	22.0
Durham Tract 20.14	18.8
Wake Tract 536	21.6

Source: US Census Bureau 2000

Table 4-11 shows that in 1990 both Durham County and Wake County had annual average unemployment rates lower than the state (www.ncesc.com). In 2006, annual average unemployment rates were higher than 1990 rates for both counties and the state, with the state's rate remaining the highest.

Table 4-11. Annual Average Unemployment, 1990 and 2006

	1990	2006
North Carolina	4.2%	4.8%
Durham County	2.7%	3.9%
Wake County	2.6%	3.6%

Source: North Carolina Employment Security Commission

Table 4-12 shows how employment by industry sector changed from 1990 to 2005 in North Carolina and Durham and Wake Counties (www.ncesc.com). At the state level, the largest numbers of people were employed in manufacturing in 1990. This remained true in 2005, though the industry had declined by about 30 percent. The largest area of growth for the state between 1990 and 2005 on a percentage basis was administrative and waste services. The largest percent decline was in utilities.

Manufacturing employed the largest number of people in Durham County in 1990 as well as 2005. Unlike the state, this industry grew rather than declined in Durham County during this period. A large area of growth on a percentage basis in Durham County between 1990 and 2005 was agriculture, forestry, fishing and hunting. This industry grew by 475 percent, though only a small number of people were employed in it compared to other industries. Wholesale trade and educational services grew by strong percentages in Durham between 1990 and 2005, while management of companies and enterprises declined by 59.2 percent.

In Wake County, the retail trade industry employed the largest number of people in both 1990 and 2005. Strong growth occurred on a percentage basis in the management of companies and enterprises, information, and professional and technical services industries. There was a large decline on a percentage basis in the mining industry, which did not employ substantial numbers of people in either 1990 or 2005.

US Census Bureau data from the year 2000 indicate that in the Demographic Area manufacturing; professional, scientific, and management; and education, health and social services were strong areas of employment.

Including the six major employers previously noted, other large employers within the DCIA include Cisco Systems, Biogen Idec, Eisai, the, BASF, Underwriters Laboratories, Sumitomo Electric Lightwave, National Institute of Environmental Health Sciences, Sony Ericsson Mobile Communications, , and Bayer Biological. Among these companies, IBM employs the largest number of people, at more than 13,000.

Table 4-12. Employment by Industry Sector, 1990 and 2005

Industry	North Carolina		NC Percent (%) Change	Durham County		Durham Co. Percent (%) Change	Wake County		Wake Co. Percent (%) Change
	1990	2005		1990	2005		1990	2005	
Agriculture, Forestry, Fishing & Hunting	21,827	29,328	34.4	36	207	475	492	796	61.8
Mining	3,993	3,499	-12.4	*	*	N/A	600	215	-64.2
Utilities	27,287	14,383	-47.3	*	260	N/A	*	*	N/A
Construction	166,733	232,326	39.3	5,116	5,178	1.2	15,708	29,625	88.6
Manufacturing	820,249	569,308	-30.3	27,327	32,251	18.0	24,704	21,480	-13.1
Wholesale Trade	139,697	170,524	22.1	2,282	5,894	158.3	13,769	18,591	35.0
Retail Trade	381,041	450,486	18.2	11,476	13,126	14.4	29,758	48,747	63.8
Transportation and Warehousing	102,720	136,571	33.0	1,984	2,429	22.4	12,228	11,226	-8.2
Information	58,588	78,013	33.2	2,964	2,837	-4.3	6,725	16,668	147.9
Finance and Insurance	103,041	142,751	38.2	2,644	5,869	122.0	11,336	14,277	25.9
Real Estate and Rental and Leasing	32,493	50,132	54.3	1,200	1,894	57.8	4,081	7,894	93.4
Professional and Technical Services	91,327	162,927	78.4	8,568	15,901	85.6	13,941	32,741	134.9
Mgmt. of Companies and Enterprises	35,104	63,407	80.6	4,244	1,733	-59.2	2,127	9,646	353.5
Administrative and Waste Services	110,979	225,671	103.3	5,991	10,002	67.0	16,885	30,410	80.1
Educational Services	233,161	344,234	47.6	6,152	17,303	181.3	20,875	34,687	66.2
Health Care and Social Assistance	261,592	488,681	86.8	25,214	30,706	21.8	14,952	38,987	160.7
Arts, Entertainment, and Recreation	31,090	50,017	60.9	1,194	1,246	4.4	3,117	5,283	69.5
Accommodation and Food Services	206,014	313,509	52.2	8,146	11,113	36.4	18,904	32,087	69.7
Other Services, Ex. Public Admin.	80,279	98,537	22.7	2,925	3,953	35.1	11,025	13,094	18.8
Public Administration	171,716	220,236	28.3	5,900	7,120	20.7	24,047	36,373	51.3
Unclassified	*	12,531	N/A	Not provided	378	N/A	*	1,441	N/A
Total	3,078,931	3,857,071		123,363	169,400		245,274	404,268	

Source: North Carolina Employment Security Commission;* Disclosure suppression

4.1.3 Other Related Development Projects

There is an abundance of land within and surrounding the DCIA currently under construction or planned for construction in relation to transportation and private development. Chapter 1 lists the planned transportation projects and the following section discusses the other development projects occurring within the project area and surrounding areas.

There are several single-family and multi-family residential developments in the southernmost end of the project area near NC 55, Davis Drive, and McCrimmon Parkway. Numerous residential developments have been approved by the Town of Cary and Town of Morrisville and will be located in the vicinity of the Preferred Alternative. Some notable projects include the following:

- Lenovo (IBM) is currently constructing new office and industrial facilities off Lichtin Boulevard in the Town of Morrisville.
- Amberly is a 5,000-homesite master-planned community being developed in Cary near O'Kelley Chapel Road. The Amberly Planned Development District (PDD) is located to the southwest of the Preferred Alternative.
- Cary Park is a large residential master-planned community that is part of the Cary Park PDD, which will include office, retail, and commercial development.
- Weston is a 1,000-acre master-planned mixed-use development in Cary that is adjacent to I-40 and near RTP. Within the development, Westview at Weston will provide approximately 70,000 square feet of commercial space in five new buildings.
- The Town of Cary's Alston Regional Activity Center district encompasses the four quadrants of the NC 55 and NC 540 interchange. The Town anticipates approval of mixed-use, office and institutional, or office and industrial developments in this area.
- Parkside is a new mixed-use development planned for the northeast corner of the NC 540 and NC 55 interchange. This project will provide multi-family, retail, and commercial space in numerous buildings.
- Phillips Place residential development on over 77 acres has been approved by the Town of Cary near the Good Hope Church Road and Louis Stephens Road intersection, south of the Preferred Alternative.
- The Town of Cary has approved an activity center overlay district called Village at the Park for the intersection of Alston Avenue and Kitts Creek Parkway. This activity center covers approximately 268 acres.
- The Greystone planned residential development is located at the intersection of Green Level to Durham Road and Green Level Church Road in the southwest vicinity of the Preferred Alternative. Over 600 homes are planned for this nearly 200 acre development.
- The Panther Creek Planned Development District has numerous tracts being developed for residential, commercial, and industrial uses. These sites are located off McCrimmon Parkway near NC 55 and are south of the Preferred Alternative.
- The Kitts Creek residential development is under construction off SR 1637 (Church Street) in Morrisville, just south of the Durham and Wake County line and to the east of the Preferred Alternative.

- Twin Lakes is a PDD covering more than 300 acres located between Davis Drive, Morrisville-Carpenter Road, and McCrimmon Parkway. Development plans call for construction of approximately 1,044 residential units.
- Shiloh Crossing planned for over 115 acres near the NC 54 and NC 540 interchange in the Town of Morrisville. The proposed project includes retail space for big-box retail such as Wal-Mart and Sam's Club as well as smaller retail out parcels.
- Bethany Village mixed-use development is proposed in the Town of Morrisville for the intersection of Davis Drive and Morrisville-Carpenter Road. Development plans call for nearly 100,000 square feet of grocery, pharmacy, office, and retail space.
- The Town of Morrisville Town Center Plan calls for further development of municipal facilities in the Town Hall Drive and McCrimmon Parkway area.
- Wyndmoor at the Park, near the intersection of Alston Avenue and Rustica Drive, is a small subdivision in Durham County that will include approximately 30 single family home sites.
- In Durham County, Alston Station will have over 7,000 square feet of office space near the intersection of South Alston Avenue and Dial Drive.
- Phase 2 of Wynterfield Townhomes includes 144 townhouse units west of NC 55 and north of East Cornwallis Road in Durham.
- Alexander Village is proposed as a nearly 107,000 square foot shopping center at the northeast corner of Page Road and T.W. Alexander Drive in Durham.
- The Southern Oaks complex is a 287 unit apartment community planned for the northeast corner of Hopson Road and Davis Drive.

4.2 Land Use and Transportation Planning

4.2.1 Land Use

There are several land use planning resources applicable to the DCIA area. These resources are noted below, and described as appropriate.

The Research Triangle Park Southern Portion Conceptual Development Plan (September 2003) includes Triangle Parkway extending along the eastern boundary of RTP, and shows interchanges at Davis Drive and NC 540. The Plan notes that Triangle Parkway will improve regional access into RTP for commuters and ensure RTP's ability to attract new businesses.

Triangle Parkway is shown in the Morrisville Land Use Plan (November 8, 1999) as a proposed thoroughfare on the Land Use Plan Map. The more recently dated *Town of Morrisville Land Use Plan Map* available on the Town's website also shows Triangle Parkway; however, some of the land uses adjacent to the proposed road have changed.

The North Morrisville – Shiloh Small Area Plan (January 2003) indicates that the area around Kit Creek Road may become isolated following the construction of NC 540 and Triangle Parkway. The Plan says that this potential isolation, along with the abundance of commercially zoned properties and the demand for housing in RTP, may make the area suitable for lower density residential development.

The Town of Morrisville Project Map shows all land development projects approved or under review within the extraterritorial jurisdictional boundary of the Town. There are several proposed developments near the project area.

The Durham Comprehensive Plan (Adopted February 2005, Amended September 2006) includes a series of development Tiers to guide growth and development in the Durham area. New development and redevelopment are to be guided in each Tier through the establishment of policies and development regulations that draw on their distinct character.

The Northwest Cary Area Plan (September 2002) is a master plan for the northwestern portion of Cary's planning area, just south and west of RTP. The Plan shows Triangle Parkway on mapping, but the Plan study area is largely to the south and west of the proposed road.

Triangle Parkway is included in the Center of the Region Enterprise (CORE) Planning and Design Workshop Report (September 2002). CORE is comprised of local governments, regional organizations, and private sector leaders. CORE strives to contribute to a balanced, sustainable pattern of development in the region. The report details key development, transportation and green space opportunities that can support the goal of a balanced and sustainable pattern of development. It suggests terminating Triangle Parkway at NC 540 with an access ramp to Davis Drive to provide connectivity to NC 540 from the southern end of RTP. This suggestion is meant to alleviate some of the traffic burden expected by transitioning Triangle Parkway into already congested roads in Morrisville. (Note: The Proposed Action would terminate Triangle Parkway at NC 540, as recommended in this Plan.)

The Town of Cary's Carpenter Community Plan (September 8, 2005) includes some of the DCIA in the far southwest portion. Triangle Parkway is not mentioned in the Plan.

Several local governments have zoning jurisdiction in the project area. Durham City-County Planning's zoning map includes the northern portion. Wake County's zoning map covers much of the southern portion of the area. The Towns of Cary and Morrisville zoning maps include southern and southeastern portions of the DCIA. Because several jurisdictions are included in the DCIA, similar zoning districts were generalized and combined for the zoning map presented in Figure 4-2. Each jurisdiction's detailed zoning map is included in Appendix C.

4.2.2 Transportation Plans

The numerous transportation and thoroughfare planning documents relevant to the Triangle Region were reviewed for the proposed project. These planning documents include the following as briefly described:

North Carolina Strategic Highway Corridor System

Triangle Parkway has been designated by the NCDOT Board of Transportation as a Strategic Highway Corridor (SHC) on the statewide Strategic Highway Corridor (SHC) system. Triangle Parkway has been designated as a "freeway" facility in the SHC system. The "freeway" facility designation for Triangle Parkway requires that a minimum four-lane divided cross section be utilized and full control of access be maintained.

CAMPO Long Range Plan

Triangle Parkway is included in the CAMPO 2030 Long Range Transportation Plan Update. The Triangle Parkway is a six-lane facility from the Durham County line (the CAMPO Plan boundary) to NC 540. It is designated as a 2010 project. CAMPO updated its Long Range Transportation Plan in May 2007 to identify the Triangle Parkway as a toll facility.

The 2030 CAMPO Long Range Transportation Plan Bike Element (June 2005/ www.campo-nc.us) indicates that many of the roads surrounding and within the project area need improvements for bicycle accommodations. CAMPO's Bicycle and Pedestrian Plan (www.campo-nc.us) indicates that NC 54, NC 55, and Davis Drive are "Priority Corridors of Greater Needs."

DCHC MPO Long Range Plan

The DCHC MPO 2030 Long Range Transportation Plan shows Triangle Parkway as a new six-lane facility from I-40 to the Durham/Wake County line (the DCHC MPO planning boundary). The document identifies Triangle Parkway as a regionally significant project and shows "toll" as the funding source. The DCHC MPO amended its Long Range Transportation Plan in May 2007 to designate the Triangle Parkway as a 2010 project.

Local Plans

In addition to the RTP Master Plans, other local municipalities and communities also have plans that include the project. The general alignment of Triangle Parkway is shown extending north/south between Davis Drive and NC 54, intersecting with NC 540 in the Draft Town of Cary Comprehensive Transportation Plan Thoroughfare Maps – Classifications and Widths. The Thoroughfare Widths Map shows the route as a four-lane road with a landscaped median.

The Transportation chapter of the Northwest Cary Area Plan (Approved September 12, 2002) does not include the Triangle Parkway Project. However, it is shown on the Northwest Area Plan Roads and Transit Map as a recommended four-lane road with a landscaped median.

The Draft Morrisville Transportation Plan has an Existing Thoroughfare Plan and a Recommended Thoroughfare Plan (February 2002) that shows Triangle Parkway as a future freeway from the Durham/Wake County line to NC 540. The Town of Morrisville is currently in the process of updating its Transportation and Land Use Plan.

Triangle Parkway is included in the Transportation component of the North Morrisville – Shiloh Small Area Plan (Approved January 6, 2003) as a four-lane expressway. The Plan notes that the road will provide much needed relief to parallel routes, but that it will also act as a barrier to east-west travel because it will be a limited access facility.

Wake County's Transportation Plan, Collectors & Thoroughfares map shows NC 540 but does not show Triangle Parkway.

The CORE Pedestrian-Bicycle-Green Space Plan (April 22, 2005) includes that there is an interest in connecting transportation and green space systems within a 60-square mile area in the center of the Triangle. The Plan shows Davis Drive as a "Top Priority Project for Trails," indicating that it is a key north-south spine in the CORE trail system. The Plan shows three Top Priority Projects for on-road bicycle facilities in the project area: T.W. Alexander Drive, Davis Drive, and NC 54 (the Nelson-Chapel Hill Highway portion).

Durham and Orange Counties Regional Bicycle Plan (November 2006) (www.durhamnc.gov), shows several roadways within and surrounding the project area that are designated for bicycle improvements. These roads include Davis Drive, NC 54 (Nelson-Chapel Hill Highway), T.W. Alexander Drive, Alston Avenue, and South Miami Boulevard.

4.2.3 Bicycle and Pedestrian Facilities

The bicycle plans covering the vicinity of the project indicate no existing on-road bicycle facilities within the project area. Most of the major routes are heavily used by commuters in motor vehicles, though there are cyclists who use the local roads to travel to work in the RTP area or for recreational purposes.

The project area is mostly within RTP which is not used extensively by pedestrians or bicycles as a mode of access or travel. There are no restaurants, service businesses, or other similar type uses that typically attract pedestrian and bicycle use within RTP.

Within RTP's Jogging Trail Master Plan (July 2003), there are jogging trails in the Park that extend along T.W. Alexander Drive, Cornwallis Road, Page Road, Davis Drive, Louis Stephens Road, Kit Creek Road, and Development Drive. The trails total approximately 12 miles in length and are also open to cyclists and skaters. Walkers were observed using these trails during the site visits. The trails are intended for recreational use within the RTP and do not connect residential areas to work areas or to areas of goods and services.

According to local plans, several roads within and surrounding the project area are recommended for future bicycle facilities. Town of Morrisville planners expressed concern about Triangle Parkway impeding east/west bicycle access between Kit Creek Road and Davis Drive. They would like the current Davis Drive bicycle and pedestrian accommodations to be connected with the future Kit Creek Road. They also discussed their desire for a new bridge over Triangle Parkway to provide access to future Kit Creek Road. The Kit Creek Road connector is currently included as part of the Preferred Alternative for the project.

4.2.4 Transportation Services

Although not based in RTP, there are several types of transportation services that serve the project area.

Public Transportation and Transit

Regional bus service is provided in the project area by the Triangle Transit Authority (TTA) connecting Raleigh, Durham, Chapel Hill, Apex, Cary, Garner, and RTP. The regional bus service is complemented by several local service providers: Durham Area Transit Authority (DATA), Capital Area Transit (CAT), Duke Transit, Cary Transportation (C-Tran), NC State Wolfline, and Orange Public Transit (OPT), as well as shuttles to RTP and Raleigh-Durham International Airport. In the morning and afternoon rush hours, the TTA provides four shuttle routes to several major employers in RTP. Shuttle service is provided to other RTP employers upon request.

TTA also supports and promotes a Vanpooling Program for commuters who live and work near each other and have similar work hours. For TTA to support a Vanpool, one termini of the vanpool's trip must begin or end in Wake, Durham, or Orange County. TTA provides the van, pays for gas and insurance; and arranges, oversees, and pays for all maintenance. Riders

pay a low monthly fare based on the average daily round-trip mileage. To date, of the sixty-one total active Vanpools, seventeen have destinations to RTP (November 2007; http://www.ridetta.org/Ride_Sharing/Vanpool/currentVPRoutes.html.)

Rail Facilities

There are two freight rail service providers in the vicinity of the project: CSX Transportation and Norfolk Southern. There are no AMTRAK stations located in or routes that currently extend through the project area. There are two daily AMTRAK Routes that extend through the state; the Carolinian/Piedmont and Silver Service/Palmetto. The closest stations for these routes are the Cary Amtrak Station, approximately 10 miles east of the project and the station located in downtown Raleigh, over 30 miles east of the project.

Airports

There are no airports within the project area. Raleigh-Durham International Airport (RDU), however, is located less than ten miles to the east.

4.3 Physical Environment

4.3.1 Floodplains and Floodways

A Hydraulics Study for Environmental Impact (April 2007) and an Addendum to Hydraulics Study for Environmental Impact (August 2007), and Addendum 2 to Preliminary Hydraulic Study for Environmental Impact (October 2007) were prepared for the project. The reports are incorporated by reference.

Maps showing floodplain locations are included in Appendix A (See Figures A-1 to A-6). Floodplains provide beneficial values, including control or containment of flood waters and provision of wildlife habitat. Floodplain and floodway protection is required under several federal, state, and local laws, including:

- National Flood Insurance Act of 1968 (as amended, 42 U.S.C. 4001 et seq.);
- Flood Disaster Protection Act of 1973 (Public Law 93-234, 87 Star. 975);
- Executive Order (EO) 11988, Floodplain Management;
- EO 11990 Protection of Wetlands;
- US DOT Order 5650.2, Floodplain Management and Protection;
- FHPM 6-7-3-2; 23 CFR 650; the Durham City/County Flood Damage Protection Ordinance (Chapter 6);
- Town of Cary Flood Damage Prevention Ordinance (Chapter 7.5); and
- Wake County Development Ordinances (Article 14).

These regulations require avoidance or minimization of encroachments within or impacts to 100-year (base) floodplains where practicable. The Towns of Morrisville and Cary, the City/County of Durham, and Wake County participate in the National Flood Insurance Regular Program. The proposed project crosses several streams systems and this project will affect designated flood hazard zones.

According to Flood Insurance Rating Maps (FIRM) published by the Federal Emergency Management Agency (FEMA), the majority of the project area is not located in a flood hazard area. The flood hazard designations shown on FIRM Community Panels for the proposed stream crossings are described in the Hydraulics Study for Environmental Impact (April 2007) and the Addendum to Hydraulics Study for Environmental Impact (October 2007) reports.

4.3.2 Utilities

There are multiple utility services extending through the project area. These utility services are supplied and maintained by a variety of providers based on the service locations, such as: Wake County, Durham County, Town of Morrisville and RTP.

Water and sewer services are readily available throughout the project area. In the Durham County portion of RTP, most water and wastewater lines have been constructed by the county. The City of Durham supplies potable water and Durham County treats the wastewater. The Durham County areas outside of RTP are served by the City of Durham for potable water and Durham County for wastewater treatment. Durham planners indicated that a wastewater treatment plant for the area is located west of NC 55 at the T.W. Alexander Drive intersection.

In the Wake County portion of RTP, water and sewer lines are constructed by Wake County. The Town of Cary provides sewage treatment and potable water. Though the Wake County portion of RTP is less developed than the Durham County portion, water and wastewater services are accessible for development. The Towns of Cary and Morrisville provide water and wastewater treatment in other Wake County portions of the DCIA outside of RTP. The two towns have merged water and wastewater services, which are managed by the Town of Cary.

4.3.3 Hazardous Materials

There are no hazardous material sites or underground storage tanks anticipated within the project area. A screening of NCDOT GIS records search revealed several hazardous substance disposal areas in the project vicinity with the two largest located at IBM, east of Davis Drive, and General Electric, located east of IBM. These and several other smaller sites are shown on Figure 4-3.

4.3.4 Protected Lands

There are no streams or rivers in Durham or Wake County that qualify for listing as wild and scenic river systems in accordance with the Wild and Scenic Rivers Act (Public Law 90-542). There are no state or national forests, gamelands or preservation areas in the project area.

4.3.5 Air Quality

The Clean Air Act (CAA) requires EPA to set National Ambient Air Quality Standards (NAAQS) (40 CFR part 50) for pollutants considered harmful to public health and the environment. The CAA established two types of national air quality standards. Primary standards set limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings.

The EPA Office of Air Quality Planning and Standards (OAQPS) has set NAAQS for six principal pollutants, which are called "criteria" pollutants. They are listed in Table 4-13. Units of measure for

the standards are parts per million (ppm) by volume, milligrams per cubic meter of air (mg/m3), and micrograms per cubic meter of air (µg/m3).

Table 4-13 National Ambient Air Quality Standards

Pollutant	Primary Stds.	Averaging Times	Secondary Stds.
Carbon Monoxide	9 ppm (10 mg/m^3)	8-hour(1)	None
	35 ppm (40 mg/m^3)	1-hour(1)	None
Lead	1.5 µg/m^3	Quarterly Average	Same as Primary
Nitrogen Dioxide	0.053 ppm (100 µg/m^3)	Annual Arithmetic Mean	Same as Primary
Particulate Matter (PM_{10})	150 µg/m^3	24-hour(2)	
Particulate Matter ($PM_{2.5}$)	15.0 µg/m3	Annual (3) (Arith. Mean)	Same as Primary
	35 µg/m^3	24-hour(4)	
Ozone	0.08 ppm	8-hour(5)	Same as Primary
Sulfur Oxides	0.03 ppm	Annual (Arith. Mean)	-------
	0.14 ppm	24-hour(1)	-------
	-------	3-hour(1)	0.5 ppm (1300 µg/m^3)

Source: U.S. EPA National Ambient Air Quality Standards
(1) Not to be exceeded more than once per year.
(2) Not to be exceeded more than once per year on average over 3 years.
(3) To attain this standard, the 3-year average of the weighted annual mean PM2.5 concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m3.
(4) To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m3 (effective December 17, 2006).
(5) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.

The proposed project is located in Durham and Wake Counties, which is in non-attainment for Ozone (O_3), in maintenance for Carbon Monoxide (CO) and in attainment for all other criteria pollutants. However, due to improved monitoring data, this area was redesignated as maintenance for O_3 under the eight-hour standard on December 26, 2007.

Carbon Monoxide

CO is a colorless, odorless and poisonous gas produced by incomplete burning of carbon in fuels. When CO enters the bloodstream, it reduces the delivery of oxygen to the body's organs and tissues. Health threats are most serious for those who suffer from cardiovascular disease, particularly those with angina or peripheral vascular disease. Exposure to elevated CO levels can cause impairment of visual perception, manual dexterity, learning ability and performance of complex tasks. Fifty-six percent of the nationwide CO emissions are from transportation sources. The largest emissions contribution comes from highway motor vehicles. Thus, the focus of CO monitoring has been on traffic-oriented sites in urban areas where the main source of CO is motor vehicle exhaust. A microscale air quality analysis using "CAL3QHC (2.0) – A Modeling Methodology for Predicting Pollutant Concentrations Near Roadway

Intersections" was used to predict the CO concentration at the intersection of Davis Drive and Hopson Road. This intersection was chosen to represent the "worst case" condition, based on traffic volumes, level of service (LOS) and its close proximity to human activity. The analysis can be found in Chapter 5.1.14.

Designations

EPA uses certain designations to describe the air quality in a given area for the criteria pollutants named above. If an area has violated a NAAQS, it is considered in non-attainment. The designation is attainment/unclassified if an area has not violated a NAAQS or if there is not enough information to determine the air quality in the area.

An area designated as maintenance is any geographic region of the United States previously designated non-attainment pursuant to the CAA Amendments of 1990 and subsequently re-designated to attainment subject to the requirement to develop a maintenance plan under section 175A of the CAA, as amended.

If an area is designated as non-attainment, steps must be taken to reduce the pollution such that ambient levels are below the NAAQS. States detail how they will achieve these lower emissions in state air quality implementation plans (SIPs). These documents must be submitted to EPA within three years after the Agency makes final designations.

Non-attainment and maintenance areas are subject to measures known as "transportation conformity," which requires local transportation and air quality officials to coordinate planning to ensure that transportation projects, such as road construction, do not affect an area's ability to reach its clean air goals. Transportation conformity requirements become effective one year after an area is designated as non-attainment.

The Raleigh-Durham-Chapel Hill area was designated non-attainment for O_3 under the eight-hour ozone standard effective June 15, 2004. However, as stated above due to improved monitoring data, this area was redesignated as maintenance for O_3 under the eight-hour standard on December 26, 2007. Section 176(c) of the CAA requires that transportation plans, programs, and projects conform to the intent of the SIP. The current SIP does not contain any transportation control measures for Durham and Wake Counties. The Durham-Chapel Hill-Carrboro and the Capital Area Metropolitan Planning Organizations 2030 Long Range Transportation Plans (LRTP) and the 2007-2013 Metropolitan Transportation Improvement Programs (MTIPs) must conform to the intent of the SIP. The USDOT determined the LRTPs and the MTIPs were in conformity on June 29, 2007. The conformity determination is consistent with the transportation conformity regulations found in 40 CFR Part 93. There are no significant changes in the project's design concept or scope, as used in the conformity analyses.

Mobile Source Air Toxics

Recently, concerns for Mobile Source Air Toxics (MSATs) impacts are more frequent on transportation projects during the NEPA process. MSAT analysis is a continuing area of research where, while much work has been done to assess the overall health risk of air toxics, many questions remain unanswered. In particular, the tools and techniques for assessing project-specific health impacts from MSATs are limited. These limitations impede FHWA's ability to evaluate how mobile source health risks should factor into project-level decision-

making under NEPA. Also, EPA has not established regulatory concentration targets for the six relevant MSAT pollutants appropriate for use in the project development process. FHWA has several research projects underway to more clearly define potential risks from MSAT emissions associated with transportation projects. While this research is ongoing, FHWA has issued interim guidance (February 2006) recommending the type of analysis needed in NEPA documents to address MSATs and their relationship to a specific highway project. FHWA will continue to monitor the developing research in this emerging field. A quantitative analysis of MSATs for this project appears in its entirety in Chapter 5.1.14.

4.3.6 Noise

The FHWA's Noise Abatement Criteria (NAC) and North Carolina Department of Transportation (NCDOT's) FHWA approved Traffic Noise Abatement Policy for implementing the NAC, are used in the analysis of the acoustic impact of proposed highway projects. The NAC, which is presented in the Code of Federal Regulations, Title 23 Part 772, revised August 1996, provides procedures whereby the acoustic impact of a proposed action can be assessed, and the needs for abatement measures can be determined. Sound pressure levels are referred to as Leq(h). The hourly Leq, or equivalent sound level is the level of constant sound, that over an hour of time interval, would contain the same acoustic energy as the time-varying sound. In other words, the fluctuating sound levels of traffic noise are represented in terms of steady noise level with the same energy content.

Noise mitigation measures must be considered when future noise levels either approach or exceed the criteria levels, or if there are substantial increases over the ambient noise levels. Title 23 CFR, Section 772.11(a) states, "In determining and abating traffic noise impacts, primary consideration is to be given to exterior areas. Abatement is usually necessary only where frequent human use occurs and a lowered noise level would be of benefit."

Project Setting

There are five noise sensitive areas located in the project area. Three subdivisions are located in the project area. The first is the Kitts Creek subdivision located to the east of the proposed project just north of the NC 540. The second is the Davis Park mixed-use subdivision located on the east side of the proposed project north of Hopson Road along the east and west side of Davis Drive. The last is Breckenridge subdivision located to the south of NC 540. (See Appendix C)

Additionally, there are two daycare centers adjacent to the project. First Environments Early Learning Center (FEELC) is located on the Environmental Protection Agency/National Institute of Environmental Health Sciences (EPA/NIEHS) campus. The other, RTI Parent's Child Care Cooperative Organization (RTI), is adjacent to NC 147 just north of I-40.

Noise Characteristics

Sound is a form of vibration that causes pressure variations in elastic media such as air and water. Noise is defined as unwanted and disruptive sound. The ear is sensitive to this pressure variation and perceives it as sound. The intensity of these pressure variations causes the ear to discern different levels of loudness. These pressure differences are most commonly measured in decibels.

The decibel (dB) is the unit of measurement for sound. The decibel scale audible to humans spans approximately 140 dB. A level of zero-dB corresponds to the lower limit of audibility,

while 140 dB produces a sensation more akin to pain than sound. The decibel scale is a logarithmic representation of the actual sound pressure variations. Therefore, a 26 percent change in the energy level only changes the sound level one-dB. The human ear would not detect this change except in an acoustical laboratory. A doubling of the energy level would result in a three-dB increase, which would be barely perceptible in the natural environment. A tripling in energy sound level would result in a clearly noticeable change of five-dB in the sound level. A change of ten times the energy level would result in a ten-dB change in the sound level. This would be perceived as a doubling (or halving) of the apparent loudness.

The human ear has a non-linear sensitivity to noise. To account for this in noise measurements, electronic weighting scales are used to define the relative loudness of different frequencies. The "A" weighting scale is widely used in environmental work because it closely resembles the non-linearity of human hearing. Therefore, the unit of measurement for an A-weighted noise level is dBA.

Traffic noise is not constant. It varies as each vehicle passes a point. The time-varying characteristics of environmental noise are analyzed statistically to determine the duration and intensity of noise exposure. In an urban environment, noise is made up of two distinct parts. One is ambient or background noise. Wind noise and distant traffic noise make up the acoustical environment surrounding the project. These sounds are not readily recognized, but combine to produce a non-irritating ambient sound level. This background sound level varies throughout the day, being lowest at night and highest during the day. The other component of urban noise is intermittent and louder than the background noise. Transportation noise and local industrial noise are examples of this type of noise. It is for these reasons that environmental noise is analyzed statistically.

The statistical descriptor used for traffic noise is L_{eq}. L_{eq} is the constant, average sound level, which over a period of time contains the same amount of sound energy as the varying levels of the traffic noise. The L_{eq} correlates reasonably well the effects of noise on people. It is also easily measurable with integrating sound level meters. The time period for traffic noise is one-hour. Therefore, the unit of measure for traffic noise is L_{eq}(1h) dBA.

Highway noise sources have been divided into five types of vehicles; automobiles (A), medium trucks (MT), heavy trucks (HT), Buses (B) and Motorcycles (M). Each vehicle type is defined as follows:

- Automobiles – all vehicles with two axles and four tires, includes passenger vehicles and light trucks, less than 10,000 pounds.
- Medium trucks – all vehicles having two axles and six tires, vehicle weight between 10,000 and 26,000 pounds.
- Heavy trucks – all vehicles having three or more axles, vehicle weight greater than 26,000 pounds.
- Buses – all vehicles designed to carry more than nine passengers.
- Motorcycles – all vehicles with two or three tires and an open-air driver/passenger compartment.

Noise levels produced by highway vehicles can be attributed to three major categories:

- Running gear and accessories (tires, drive train, fan and other auxiliary equipment)

- Engine (intake and exhaust noise, radiation from engine casing)
- Aerodynamic and body noise

Tires are the dominant noise source at speeds greater than 50 mph for trucks and automobiles. Tire sound levels increase with vehicle speed but also depend upon road surface, vehicle weight, tread design and wear. Change in any of these can vary noise levels. At lower speeds, especially in trucks and buses, the dominant noise source is the engine and related accessories.

Ambient Noise Levels

As part of this evaluation, ambient noise levels were measured along the proposed corridor (this project is primarily on new location, therefore, ambient measurements were taken in locations that were in close proximity to the proposed corridor). The FHWA's Traffic Noise Model® version 2.5 (TNM) compared noise levels for the design year (2030) to current (2006) noise levels to determine if traffic noise impacts can be expected from the proposed project.

The field measurements were taken using the NL-31 RION Type I Integrating Sound-Level Meter and the accompanying traffic was recorded with a hand held traffic counter (Jamar DB-400). Nine ambient measuring sites were taken in the vicinity of the project to determine existing noise levels as shown in Table 4-14. These sites were chosen for their proximity to the project area. The purpose of this noise level information was to quantify the existing acoustic environment and to provide a base for assessing the impact of noise level increases.

The measured noise levels currently in the project area ranged from 54 to 79 dBA. These are presented in Table 4-14. Also included in Table 4-14 are the TNM calculated noise levels for existing conditions. The calculated noise levels were within ± three-dBA of the measured noise levels. Hence, the computer model is a reliable tool in the modeling of noise levels.

4.4 Cultural Resources

This project is subject to compliance with Section 106 of the National Historic Preservation Act of 1966, as amended, and implemented by the Advisory Council on Historic Preservation's regulations for compliance with Section 106, codified as 36 CFR Part 800. Section 106 requires Federal Agencies to take into account the effect of their undertakings (federally-funded, licensed, or permitted) on properties included in or eligible for inclusion in the National Register of Historic Places.

Review of records at the North Carolina Department of Cultural Resources indicated that there are no cultural resources under study for or included in the National Register of Historic Places within the project area. A scoping response letter from the State Historic Preservation Office dated February 15, 2006 stated that they had conducted a review of the project, and were aware of no historic resources that would be affected by the project. (See Appendix D)

Field reviews and further agency coordination with the NC State Historic Preservation Office concluded there are no eligible historic architecture or archaeological resources within the project area; therefore, no further studies are required.

Table 4-14 Ambient Noise Levels

Site	Location	Date Time Traffic Speed	Description	Noise Level (dBA) Current Analysis Measured	TNM Noise Level (dBA) Calculated	Difference in noise levels calculated minus measured (dBA)
1	Along Hopson Road eastbound side lot, 100 feet from travelway and 500 feet off Davis Drive northbound travelway.	December 5, 2006 7:30-7:50 a.m. 50 mph	Asphalt: Source of traffic noise from Hopson Road, east of Davis Drive.	62	65	+3
2	Along Hopson Road eastbound, 88 feet from travelway in the Keystone Office Park parking lot, 800 feet from Davis Drive northbound travelway.	December 5, 2006 8:00-8:20 a.m. 50 mph	Asphalt: Source of traffic noise from Hopson Road, west of Davis Drive.	62	65	+3
3	Along NC 54 northbound side, 150 feet from NC 147 bridge and 25 feet from NC 54 travelway	December 5, 2006 8:30-8:50 a.m. 50 mph	Asphalt: Source of traffic noise from NC 54 and NC 147	74	76	+2
4	Davis Drive Northbound, 20 feet from Davis Drive travelway, 700 feet from NC 540 interchange and 200 feet south of CISCO entrance.	December 5, 2006 9:00-9:20 a.m. 60 mph	Asphalt: Source of traffic noise 20 feet from Davis Drive travelway	79	82	+3
5	Davis Drive northbound, 250 feet from Biogen Idec, Phil Sharp Drive and 25 feet off Davis Drive travelway.	December 5, 2006 9:30-9:50 a.m. 60 mph	Asphalt: Source of traffic noise from Davis Drive.	77	80	+3
6	Within the Breckenridge subdivision at the end of Berlin Way 10 feet from west end of cul-de-sac.	October 1, 2007 7:00-7:20 a.m. 50 mph	Asphalt: Source of traffic noise from neighborhood traffic and NC 540	60	62	+2
7	Within the Breckenridge subdivision, along Willingham Road 100 feet from edge of travelway near Millicent Way.	October 1, 2007 7:30-7:50 a.m. 50 mph	Asphalt: Source of traffic noise from neighborhood traffic and NC 540.	54	57	+3
8	Along Weaver Road 20 feet from travelway.	October 2, 2007 8:00-8:20 a.m. 50 mph	Asphalt: Source of traffic noise from local and NC 540	64	67	+2
9	Kit Creek Road east where it dead ends at the back end of the Kitts Creek subdivision, 100 feet from Davis Drive off ramps from NC 540.	October 2, 2007 8:30-8:50 a.m. 60 mph	Asphalt: Source of traffic noise from NC 540	72	73	+1

4.5 Section 4(f) Resources

Section 4(f) of the US Department of Transportation Act of 1966 and the Federal regulations 23 CFR 771.135 (49 U.S.C. 303) protect publicly owned parks, recreation areas, and refuges, as well as historic sites (whether publicly or privately owned) that are listed in or eligible for the National Register of Historic Places. Section 4(f) prohibits the use of any Section 4(f)-protected resource for a transportation project, unless (1) there is no feasible and prudent alternative to the use of such land, and (2) the project includes all possible planning to minimize harm.

There are no Section 4(f) resources located within the project area. As noted above, there are no historic sites. There also are no publicly owned parks, recreation areas, or refuges. The RTF owns and maintains a Jogging Trail which extends through RTP along T. W. Alexander Drive, Cornwallis Road, Page Road, Davis Drive, Louis Stephens Road, Kit Creek Road, and Development Drive. (See Chapter 4.2.3) However, while this jogging trail is accessible to the public, it is privately owned and therefore is not a Section 4(f) resource.

4.6 Natural Environment

Natural systems were inventoried during the preliminary development stages of the project location study. Field investigations and pedestrian surveys were conducted by qualified biologists and stream scientists during January, February, and March 2006 to assess the existing natural environment and to document natural communities, wildlife, Waters of the United States (US), and the presence of protected species or their habitats. The study area boundaries used for the natural resource investigations and results of these investigations are discussed in detail in the Natural Resources Technical Report (NRTR) (February 2007) Memorandum and Memorandum for NC 540 Widening Addendum (October 2007) which are incorporated by reference.

4.6.1 Geology

The study area crosses the Triassic Basin in the Piedmont physiographic region and has an underlying geology consisting of sandstones and mudstones. The landscape is characterized by gently sloping and rolling hills with fairly broad ridges and wide floodplains along the streams. Elevations in the project area range from approximately 280 feet above mean sea level (MSL) along the creeks to approximately 390 feet above MSL on surrounding ridges.

4.6.2 Soils

The process of soil development depends on both biotic and abiotic influences such as past geologic activities, nature of parent materials, environmental and human influences, plant and animal activity, time, climate and topographical position.

Prime Farmland Soils

The Natural Resources Conservation Service (NRCS) has established three categories of important farmlands defined by soil types in North Carolina: prime, unique, and statewide. In general, prime farmland soils are those with slopes between zero percent and eight percent that also have few limitations or only moderate limitations that reduce the choice of plants or require moderate conservation practices. Unique farmland soils are those that have a special set of properties that are unique for producing certain high-value crops (such as blueberries).

Farmland soils designated for statewide importance are those that do not quite meet the requirements for prime farmland and do not have use restrictions because of drainage problems; are stony or rocky; have slopes greater than 15 percent; severe erosion; or frequent flooding. Table 4-15 lists farmland soils in the study area. Although these soils will be used for roadway right-of-way, the project area does not include any active farming operations and is zoned for research type businesses and facilities.

Table 4-15 Farmland Soils Occurring in Study Area*

County	Soils Classification	Soil Type	Acres	Total Acres
Durham	Prime and Prime If Drained	Cartecay and Chewacla (Cc)	47.92	90.44
		Chewacla and Wehadkee (Ch)	29.69	
		Creedmoor (CrB)	9.96	
		Granville (GrB)	2.86	
	Statewide Importance	Creedmoor (CrC)	3.09	487.64
		Iredell (IrB)	10.63	
		Iredell (IrC)	6.59	
		Mayodan (MfC)	6.44	
		White Store (WsB)	149.91	
		White Store (WsC)	245.49	
		White Store (WsE)	65.49	
	Unimportant	Gullied (Gu)	7.26	169.88
		Pinkston (PfC)	11.97	
		Pinkston (PfE)	16.01	
		Urban (Ur)	133.28	
Wake	Prime If Drained	Chewacla (Cm)	4.24	4.24
	Statewide Importance	White Store (WsB2)	18.07	92.34
		White Store (WsC2)	28.84	
		White Store (WsE)	34.65	
		White Store (Wvd3)	10.78	
	Unimportant	Gullied (Gu)	8.31	20.6
		Mantachie (Me)	5.23	
		Pinkston (PkF)	7.06	

* Note: These are soils identified within the study corridor; the Preferred Alternative would require approximately 168 acres of the total shown. (Source: Current NRCS Soil Survey data and mapping; http://soils.usda.gov/survey)

4.6.3 Hydric Soils

One of the three parameters used in wetland delineations is the presence of hydric soils. The NRCS defines a hydric soil as one that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part of the soil. Hydric soils are further classified as either "A" or "B." Soils referred to as hydric "A" are completely hydric throughout the mapped soil unit. Hydric "B" soils are non-hydric but contain inclusions of hydric "A" soils, usually in depressional areas or along the border with other soil units.

There are three hydric soils mapped in the Wake County portion of the study area: Chewacla (Cm), Mantachie (Me), and Worsham (Wy) soils. The Worsham soil unit is classified as hydric "A:" and the Chewacla and Mantachie soil units are classified as hydric "B." Approximately 7.3 acres of the wetlands delineated in the Wake County portion of the project were identified in these hydric soil map units.

There are two hydric soils mapped in the Durham County portion of the study area: Chewacla and Wehadkee (Ch) and Cartecay and Chewacla (Cc) soils. The Chewacla and Wehadkee soil unit is classified as hydric "A" and the Cartecay and Chewacla soil unit is classified as hydric "B." Approximately 6.9 acres of the wetlands delineated in the Durham County portion of the study area were identified in either hydric "A" or "B" soil units.

Water Resources

Descriptions of water resources identified in the study area during field investigations include physical and water quality characteristics, best usage classifications, and relationships to major regional drainage systems. The stream systems within the study area are shown on Figure 4-3. All streams and wetlands identified within the study area were GPS mapped and the streams and wetlands located within the study area are shown in the NRTR document. Additional information about the aquatic habitats is provided in Chapter 4.6.5 and the jurisdictional status of surface waters in the study area is provided in Chapter 4.6.6 of this document.

Stream Characteristics

The USGS hydrologic unit cataloging (HUC) system organizes and numbers watersheds based on hydrologic features. Each HUC has a defined eight-digit number; unnamed tributaries (UTs) to streams are assigned the same hydrologic unit as the stream it flows to (receiving water). All delineated streams in the study area are within HUC 03030002, Sub-basin 03-06-05 of the Cape Fear River Basin.

Two named streams, Burdens Creek and Kit Creek, and their UTs account for the surface waters in the study area. Burdens Creek flows in a westerly direction across the study area south of the NC 147/NC 54 intersection. The portion of Burdens Creek located in the study area is a perennial stream. Kit Creek, located in the southern portion of the study area, flows in a northwesterly direction from its origin north of McCrimmon Parkway toward the NC 540 interchange. Kit Creek originates as an intermittent stream and becomes a perennial stream within the study area boundaries. During field investigations, a total of 16 jurisdictional perennial streams and 28 jurisdictional intermittent streams were delineated in the study area.

Wetlands

The United State Army Corps of Engineers (USACE) defines wetlands as those areas that are inundated or saturated by surface or groundwater long enough and frequently enough under normal conditions to support a prevalence of vegetation adapted for life in saturated soil conditions. During field investigations, 21 jurisdictional wetlands were delineated within the study area.

Other Water Quality Classifications

The North Carolina Division of Water Quality (NCDWQ) classifies surface waters of the state based on their intended best uses. As of July 25, 2006 the NCDWQ waterbody classification report for sub-basin 03-06-05, both Burdens Creek and Kit Creek and their UTs within the study area carry a C-NSW classification. The class "C" designation denotes fresh waters protected for secondary recreation, fishing, wildlife, fish and aquatic life propagation and survival, and other uses. Nutrient Sensitive Waters (NSW) is a supplemental surface water classification intended for waters needing additional nutrient management because they are

subject to excessive growth of microscopic or macroscopic vegetation. Based on the most recent waterbody classification data, there are no Outstanding Resource Waters (ORW), High Quality Waters (HQW), or drinking water supply (WS-I or WS-II) waters within a one mile radius of the study area (NCDWQ, 2006a). There are no anadromous fish or trout waters in the study area.

Section 303(d) of the Clean Water Act (CWA) requires states to develop a list of waters not meeting water quality standards or which have impaired uses. Waters may be excluded from the list if existing control strategies for point and non-point source pollution will achieve the standards or uses. There is currently one 303(d) listed stream within a one-mile radius (downstream) of the study area: Northeast Creek. Northeast Creek, from NC 55 to the New Hope Creek-arm of B. Everett Jordan Lake, is included on the 2006 Final 303(d) list due to fecal coli form, turbidity, low dissolved oxygen, and impaired biological function.

4.6.4 Biotic Resources

The study area is composed of different vegetative communities depending on topography, soils, hydrology, and disturbance. These systems are interrelated, and in many aspects interdependent. This chapter summarizes the existing vegetation and associated wildlife that occur within the study area.

Plant Communities (Flora)

During field surveys, four primary vegetative communities were identified that cover the study area: Piedmont alluvial forest, mixed pine-hardwood forest, oak-hickory forest, and man-dominated urban/disturbed land. These communities cover nearly 1,210 acres, which includes approximately 165 acres of Piedmont alluvial forest, 375 acres of mixed pine-hardwood forest, 15 acres of oak-hickory forest, and 655 acres of urban/disturbed land.

Piedmont Alluvial Forest

The Piedmont alluvial forest community occurs along river and stream floodplains and is characterized by small, indistinguishable fluvial landforms and vegetation zones with an open canopy. This community represents approximately 165 acres of the study area. It is best classified as a variation of Schafale and Weakley's (1990) Piedmont Alluvial Forest type. There were three distinct sub-types within this vegetative community: wooded floodplains, wooded wetlands, and disturbed corridors.

The non-wetland wooded floodplains of streams that flood somewhat regularly comprise the greatest amount of area in the Piedmont Alluvial Forest community. These areas are dominated by red maple (*Acer rubrum*), American elm (*Ulmus americana*), and sycamore (*Platanus occidentalis*) in the canopy, with Christmas fern (*Polystichum acrostichoides*) and muscadine grape (*Vitis rotundifolia*) the dominant species in the understory. Other plant species commonly seen throughout this community include river birch (*Betula nigra*), eastern red cedar (*Juniperus virginiana*), yellow poplar (*Liriodendron tulipifera*), musclewood (*Carpinus caroliniana*), black cherry (*Prunus serotina*), sweet gum (*Liquidambar styraciflua*), black walnut (*Juglans nigra*), black gum (*Nyssa sylvatica*), red bud (*Cercis canadensis*), flowering dogwood (*Cornus florida*), green ash (*Fraxinus pennsylvanica*), persimmon (*Diospyros virginiana*), shagbark hickory (*Carya ovata*), spicebush (*Lindera benzion*), and greenbrier (*Smilax rotundifolia*).

The wooded wetland areas are located within the floodplains of perennial streams and are dominated by red maple, sweet gum, and sycamore in the canopy. The herbaceous and vine layers typically contain more grasses, especially Japanese creeping grass (*Microstegium vimineum*), and various sedges (*Carex spp.*) than the non-wetland floodplain areas. Other plant species present include American elm, eastern red cedar, yellow poplar, river birch, musclewood, willow oak (*Quercus phellos*), silky dogwood (*C. amomum*), and giant cane (*Arundinaria gigantea*).

Areas referred to as disturbed corridors have had major disturbance due to utility construction (primarily sewer lines) in the past and are generally located in the bottomland landscapes. Representative areas consist of community edges along periodically maintained right-of-way easements which are flooded temporarily to seasonally. These areas are dominated by tree saplings such as sweet gum, red maple, and black willow (*Salix nigra*), with blackberry (*Rubus spp.*), various goldenrods (*Solidago spp.*), and Japanese honeysuckle (*Lonicera japonica*) dominating the other vegetative layers. Other species present include box elder (*Acer negundo*), elderberry (*Sambucus canadensis*), hawthorn (*Cretaegus uniflora*), wild rose (*Rosa multiflora*), and greenbrier. Wetland areas or pockets of standing water on or along these easements contain soft rush (*Juncus effusus*), cattail (*Typha latifolia*), bulrush (*Scirpus cyperinus*), and false nettle (*Boehmeria cylindrica*).

Mixed Pine-Hardwood Forest

The mixed pine-hardwood forest community is found on moderate elevations throughout the study area, usually immediately upslope of the alluvial forest community, and is approximately 380 acres. This community is a variation of the Mesic Mixed Hardwood Forest (Piedmont Subtype) identified by Schafale and Weakley (1990), with an increased amount of pine. These communities occur on acidic soils in lower slopes, steep north-facing slopes, ravines, and occasionally well-drained small stream bottoms. Under natural conditions they are uneven-aged with scattered old trees (over 60 years old estimated) present; however, there are only a few locales within the project study area that contain older trees. This lack of older trees or large areas of uneven aged timber can be attributed to past disturbance activities such as agriculture and forest management. This community commonly represents the stage in the succession of forest development following disturbance. Reproduction occurs mainly in canopy gaps, with disturbed areas having increased amounts of young pine and weedy hardwoods such as yellow poplar and sweet gum (Schafale and Weakley, 1990).

The dominant species of mixed pine-hardwood communities include loblolly pine (*Pinus taeda*), sweet gum, northern red oak (*Quercus rubra*), eastern red cedar, and red maple. Other species include American beech (*Fagus grandifolia*), white oak (*Quercus alba*), yellow poplar, shortleaf pine (*Pinus echinata*), and Virginia pine (*Pinus virginiana*). A number of species more common to the oak-hickory forest are often found in low concentrations as forest succession continues from a mixed pine-hardwood forest to an oak-hickory forest.

A small sub-type of the mixed pine-hardwood forest found occupying central portions of the study area are early successional (cutover) areas. These locations were logged within the past five years and are in early forest succession stages. Young loblolly and shortleaf pines are common; growing beneath larger shrub and herbaceous species that are first to establish dominance in such disturbed areas. Aside from pines, dominant species include sweet gum, red maple, eastern red cedar, elderberry, wax myrtle [*Myrica cerifera* (*Weakley's Morella cerifera*)],

greenbrier, blackberry, Japanese honeysuckle, broomsedge (*Andropogon virginicus*), and goldenrods. The herbaceous layer is often dense with numerous plants in the understory.

A unique mixed pine-hardwood forest sub-type often occurs in locations adjacent to small streams. These areas are typically found in the headwaters to a stream or ditch where the topography surrounding the water body is steep, making this sub-type community into relatively thin, non-wetland corridors. Flooding in these areas occurs rarely to never. Often this sub-type is found in residential areas where the small stream has not been disturbed for numerous years and the vegetation has been allowed to develop distinct layers. However, it can also be found within larger mixed pine-hardwood forests. These thin corridors are dominated by loblolly pine, red maple, yellow poplar, and beech in the canopy, with greenbrier, eastern red cedar, and Japanese honeysuckle present in the understory. Other species often found in these areas include American elm, sweet gum, northern red oak, sycamore, black cherry, and Christmas fern.

Oak-Hickory Forest

The oak-hickory forest covers nearly 15 acres and is the least represented natural community in the study area. This is likely due to the land conversions that have taken place over the past 100 years. The oak-hickory forest typically succeeds the pine-hardwood forest following the original clearing; therefore, much time has to pass before the forest returns to the oak-hickory vegetative community. The oak-hickory forest is located in areas that have not had disturbance for more than 40 years. Often these areas were found to be either too steep, too rocky, or the soils too basic to be good agricultural land. This community appears to be a variation of the Dry Oak-Hickory Forest and the Basic Oak-Hickory Forest identified by Schafale and Weakley (1990). These oak-hickory communities occur primarily along the highest ridges and along large rounded, shallow side-slopes of the Piedmont.

There are a few examples of this type of vegetative community within the study area. The areas of oak-hickory forest have a canopy dominated by northern red oak, southern red oak (*Quercus falcata*), white oak, and post oak (*Quercus stellata*), with pignut hickory (*Carya glabra*), shagbark hickory (*Carya ovata*), and mockernut hickory (*Carya alba*) spread throughout. Other species commonly present include red maple, flowering dogwood, eastern red cedar, southern sugar maple (*Acer saccharum*), and American holly (*Ilex opaca*).

Urban/Disturbed Community

The urban/disturbed community is the dominant vegetative community in the study area and consists of areas that are periodically maintained by human influences, such as roadside and power line rights-of-way, regularly mowed lawns, commercial and industrial properties, and open areas. This community represents 659 acres in the study area and is especially prevalent in the northern portion where commercial properties and impervious surfaces dominate and at the NC 540 interchange. Vegetation in these areas tends to be low growing and contain many species of annuals; however, because the majority of the vegetation surveys were conducted in the winter months many of these species were not observed.

All of the varying types of land use in the urban/disturbed community tend to have similar vegetation, with few large trees and abundant herbaceous cover. The tree species often observed include eastern red cedar, red maple, sweet gum, sycamore, black cherry, American

elm, white oak, and loblolly pine; however, many of the commercial properties have been landscaped with large tree species such as river birch, southern magnolia (*Magnolia grandiflora*), weeping willow (*Salix babylonica*), and Bradford pear (*Pyrus calleryana*). Two common shrubs to this vegetative sub-type that occur both naturally and as escaped plants are wild and cultivated roses (*Rosa spp.*) and wax myrtle. Fescue (*Festuca spp.*) is the dominant groundcover species. Other groundcover and herbaceous species include goldenrod, panic grass (*Panicum spp.*), broomsedge, dog-fennel (*Eupatorium capillifolium*), Bermuda grass (*Cynodon dactylon*), and Japanese honeysuckle. Maintained easements such as power lines and road shoulders are comprised of the vegetation listed above as well as large amounts of blackberry, greenbrier, and poison ivy (*Toxicodendron radicans*).

Wildlife (Fauna)

The forested and urban/disturbed communities in the study area offer good diversity of foraging, nesting, and cover habitat for many species of amphibians, reptiles, birds, and mammals. Species that may be associated with these types of communities are described below. An asterisk (*) indicates the species that were directly observed or species for which evidence was noted during field reconnaissance.

Terrestrial reptile species may include snakes such as the rough green snake (*Opheodrys aestivus*) and eastern milk snake (*Lampropeltis triangulum triangulum*). These animals inhabit fields, woodlands, and stream edges of the Piedmont and lower mountains in North Carolina. Rough green snakes forage on spiders, moth and butterfly larvae, crickets, and grasshoppers and will often forage among vines or shrubs along stream banks. The eastern milk snake forages for rodents in fields and woodlands and will frequently enter barns in search of food. Other reptiles such as the eastern box turtle* (*Terrapene carolina*), eastern fence lizard (*Sceloporus undulatus*), and five-lined skink (*Eumeces fasciatus*) may also be present within the study area. The eastern box turtle is a docile turtle that feeds on a wide variety of plants and small animals. The eastern fence lizard is commonly found in the urban/disturbed environment feeding on small to medium sized invertebrates. The five-lined skink is often observed scurrying along fences or rocks in full sunlight, feeding on arthropods such as spiders, crickets, grasshoppers, and beetles.

Many bird species may inhabit or migrate through the study area. Birds generally tend to nest and forage within distinct vegetative communities depending upon many factors including food source, protection, and predation. Inhabitants of Piedmont alluvial forests generally require a water source for foraging and in certain instances for nesting. Birds observed within this community include belted kingfisher* (*Ceryle alcyon*), great blue heron* (*Ardea herodias*), Canada goose* (*Branta canadensis*), rusty black bird* (*Euphagus carolinus*), and mallard* (*Anas platyrhynchos*). Inhabitants of the mixed pine-hardwood community and the oak-hickory forest community often prefer medium to large tracts of upland timber to forage and for nest protection. Bird species observed within these areas include the northern flicker* (*Colaptes auritus*), eastern towhee* (*Pipilo erythrophthalmus*), wood thrush* (*Hylocichla mustelina*), downy woodpecker* (*Picoides. pubescens*), and tufted titmouse* (*Baeolophus bicolor*). Inhabitants of the urban/disturbed community tend to be songbirds and birds who utilize man-made structures for nesting. The birds often observed in the urban/disturbed community include mourning dove* (*Zenaida macroura*), blue jay* (*Cyanocitta cristata*), Carolina chickadee* (*Parus carolinensis*), American robin* (*Turdus migratorius*), northern cardinal* (*Cardinalis cardinalis*),

northern mockingbird* (*Mimus polyglottos*), house finch* (*Carpodacus mexicanus*), Carolina wren* (*Thryothorus ludovicianus*), and dark-eyed junco (*Junco hyemalis*). Predatory species are usually found wherever food opportunities exist and are therefore, not bound to the same small areas as other bird species. These species may include American crow* (*Corvus brachyrhynchos*), red-tailed hawk* (*Buteo jamaicensis*), turkey vulture* (*Cathartes aura*), eastern screech owl (*Otus asio*), and great horned owl* (*Bubo virginianus*).

A wide variety of mammals are expected to inhabit the study area and surrounding landscape. Mammals tend to move through vegetative communities readily in search of food or shelter. Some mammals are observed in residential and commercial areas at night due to their nocturnal feeding habits. These species include Virginia opossum* (*Didelphis virginiana*), raccoon* (*Procyon lotor*), and eastern spotted skunk (*Spilogale putorius*). Some mammals such as the bobcat (*Felis rufus*) and red fox* (*Vulpes vulpes*) are very secretive and hide as deep as possible in undisturbed wooded areas. Still other mammals, such as the coyote (*Canis latrans*) and eastern harvest mouse (*Reithrodontomys humulis*) take advantage of agricultural land and forest edge ecotones. Some mammals truly can be found throughout the vicinity, from urban development to mature forests to lake shore. These mammals include the eastern gray squirrel* (*Sciurus carolinensis*), chipmunk (*Tamias striatus*), eastern cottontail* (*Sylvilagus floridanus*), beaver* (*Castor canadensis*), and white-tailed deer* (*Odocoileus virginianus*).

Bats such as the eastern pipistrelle (*Pipistrellus subflavus*), the eastern red (*Lasiurus borealis*), and the evening bat (*Nycticeius humeralis*) may be present in the study area. The eastern pipistrelle is a common bat found in structures, caves, and crevices, often in places with more light than tolerated by other bats. The eastern red bat has a widespread distribution, and is found in similar habitats to the eastern pipistrelle but considerably closer to water. The evening bat is commonly found roosting beneath bridge structures but it also roosts in trees and buildings, and, as its name implies, is strictly nocturnal.

4.6.5 Aquatic Communities

Aquatic Habitats

The waters within the study area are varied in their sizes and flow rates. This situation creates habitat for a diversity of amphibians, reptiles, mammals, and fish species.

The majority of the study area likely has amphibian populations limited to certain areas. Several locations, especially the large floodplain wetlands in the study area, are expected to contain a rich and diverse population of salamanders and frogs. Salamanders forage on insects, both aquatic and terrestrial, crustaceans, worms, and other organisms in forest floodplains and vernal pools. Salamanders can be found in a variety of habitats, although most are associated with small streams and seepages. They can also be found along streams where stones, large branches and other woody debris offer shelter for both the salamander and their food. They are most active at night, but can be found during the day by overturning logs and stones in wet areas along the stream banks. Salamanders such as the northern dusky salamander (*Desmognathus fuscus*) and slimy salamander (*Plethodon glutinosus*) are likely to occur. Other amphibians such as spring peepers* (*Hyla crucifer*), pickerel frogs* (*Rana palustris*), bullfrogs (*Rana catesbeiana*), and upland chorus frogs (*Pseudacris triseriata*) are likely to be present. Spring peepers and upland chorus frogs mainly inhabit woodlands, while pickerel frogs and bullfrogs are found along shaded streams and wet areas.

Reptiles that spend the majority of their lives in aquatic communities and are somewhat common throughout this portion of North Carolina include the snapping turtle (*Chelydra serpentina*), eastern musk turtle (*Sternotherus odoratus*), yellowbelly slider (*Chrysemys scripta*), and northern water snake (*Nerodia sipedon*). Turtles eat small invertebrates, insects, snails, and small aquatic plants, and they nest both in the water and on dry land. The northern water snake will eat primarily small fish and amphibians and is often found on the edges of streams, in wetlands, and on low, overhanging vegetation.

There are only a few aquatic mammals in the Piedmont. Perhaps the two most common are the muskrat (*Ondatra zibethicus*) and the beaver* (*Castor canadensis*). Both animals are nocturnal; the muskrat is most often only noticed through the occurrence of tracks. Beaver activity was observed during field investigations through the presence of slides, gnaws, and dams.

Species composition of fish varies to some degree with the size, flow rate, and type of food present within any given water body. Therefore, the types of fish found in the perennial streams are likely to be somewhat different than species found in the various lakes and ponds within the study area. Fish that are likely to utilize the perennial streams include largemouth bass (*Micropterus salmoides*), American eel (*Anguilla rostrata*), rosyside dace (*Clinostomus funduloides*), and creek chub* (*Semotilus atromaculatus*). These fish thrive in the moderately flowing, soft substrate waters present within study area. The overhanging vegetation provides good locales for foraging on vegetation and benthic organisms, and hiding from predators. The wetland delineated as number "MWH" provides a large body of open water for species such as grass carp (*Ctenopharyngodon idella*), brown bullhead (*Ameiurus nebulosus*), largemouth bass, and bluegill (*Lepomis macrochirus*). These fish prefer slower, deeper waters with good benthic microtopography and regular amounts of organic material and detritus entering the system.

The NCDWQ collected several species of resident native fish from New Hope, Northeast, and Third Creek in the Cape Fear Subbasin 03-06-05. These native species include redbreast sunfish (*Lepomis auratus*), bluegill (*L. macrochirus*), satinfin shiner (*Cyprinella analostana*), white catfish (*Ameiurus catus*), eastern mosquitofish (*Gambusia holbrooki*), and redfin pickerel (*Exos americanus*). It is expected that fish species observed within the subbasin would be similar to the fish species found in the study area. There are no streams identified as critical aquatic habitat for any protected species within a 1-mile radius of the study area.

4.6.6 Section 404 Jurisdictional Areas

Section 404 of the Clean Water Act (33 U.S.C. 1344) prohibits the discharge of dredged or fill material into waters of the United States, except in accordance with a permit. The US Environmental Protection Agency (USEPA) defines the criteria that govern permitting decisions; these criteria are defined in regulations known as the Section 404(b)(1) Guidelines 40 CFR Part 230. The USACE has the responsibility for permitting and enforcement of the provisions of the Act. The USACE regulatory program is defined in 33 CFR 320-330. Surface waters, including lakes, rivers, and streams are subject to USACE jurisdiction under the Section 404 program. Wetlands are also subject to USACE jurisdiction, as defined in 33 CFR 328.3. Any action that proposes to place fill into these areas falls under the jurisdiction of the USACE.

Section 401 of the CWA (33 USC 1341) requires an applicant for a Section 404 permit to obtain certification from the State that the project complies with State water quality standards. The agency responsible for issuing Section 401 water quality certification in North Carolina is the NCDWQ. The NCDWQ issues an Individual Water Quality Certification which corresponds to the USACE

Individual Permit. Impacts to waters deemed isolated by the USACE will require an isolated waters permit from the NCDWQ.

The study area is located in the Cape Fear River basin, which currently does not include riparian buffer rules. During field investigations, a total of 28 intermittent streams and 16 perennial streams were delineated in the study area. Of these 44 stream segments, two are reaches of Burdens Creek, one is a reach of Kit Creek, 19 are unnamed tributaries (UTs) to Burdens Creek, and 22 are UTs to Kit Creek. In addition to these locations, one isolated stream was also delineated in the study area. Burdens Creek, Kit Creek, their UTs, and the isolated stream are all located entirely within the Cape Fear River basin as they occur in the study area.

The USACE determined that 23 of the wetlands delineated during field investigation are 404 jurisdictional Waters of the US. In addition, the USACE determined that two ponds and two wetlands delineated within the study area are isolated waters. These isolated waters were confirmed by NCDWQ to be 401 jurisdictional waters during field review meetings.

Field investigations and the associated impacts for NC 540 and the NC 540 interchange with Triangle Parkway were conducted as part of the NCDOT's TIP project R-2000AB, and are not included as part of this project or within this EA since the interchange was constructed as part of the R-2000AB project.

4.6.7 Protected Species

Some populations of fauna and flora have been, or are, in decline due to either natural forces or their inability to coexist with humans. Federal law (under the provisions of Section 7 of the Endangered Species Act (ESA) of 1973, as amended) requires that any Federal action likely to adversely affect a species listed as federally protected be subject to review by the United State Fish & Wildlife Service (USFWS) or National Marine Fisheries Service (NMFS). Prohibited actions which may affect any species protected under the ESA are outlined in Section 9 of the Act. Other species may receive additional protection under separate laws such as the Lacey Act Amendments of 1981, the Migratory Bird Treaty of 1999, the Marine Mammal Protection Act of 1972, or the Eagle Protection Act of 1940.

As defined by the ESA, an endangered species is any plant or animal which is in danger of extinction throughout all or a significant portion of its range within the foreseeable future. A threatened species is any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Species which are listed, or are proposed for listing, as endangered or threatened are recorded in Section 4 of the ESA.

Species identified as Endangered, Threatened, or Special Concern (SC) by the NCNHP list of rare plant and animal species are afforded state protection under the State Endangered Species Act and the North Carolina Plant Protection and Conservation Act of 1979.

Federally Protected Species

The study area is located in southeastern Durham County and northwestern Wake County, and is less than three miles east of the Chatham County boundary. Since the study area is within a similar physiographic area as the adjacent Chatham County, species listed by the USFWS for all three counties were reviewed. Table 4-16 lists the species identified by the USFWS as potentially occurring in Chatham, Durham, and Wake Counties as of the May 10, 2007 list. The bald eagle was delisted as a federally protected species on August 8, 2007;

however, it will still receive protection under the Bald and Golden Eagle Protection Act (Eagle Act). Under the Eagle Act, bald eagles continue to receive protection from harm similar to the protections described in Section 9 of the ESA. According to the North Carolina Wildlife Resources Commission (NCWRC) and the USFWS, there are no bald eagle nests or foraging activities occurring in the Triangle Parkway study area. The USFWS provided written response on their concurrence with a Biological Conclusion of "May Affect, Not Likely to Adversely Affect." A copy of the letter, dated April 11, 2007, can be found in Appendix D.

Natural Heritage Program maps were reviewed on February 13, 2006 to determine if any species receiving Federal protection have been identified near the study area. This map review confirmed that no federally protected species are known to occur within a one-mile radius of the study area. A description of habitat requirements is provided for each species in the following sections.

Table 4-16. Species Receiving Federal Protection

Species (Scientific Name)	Federal Status	State Status	County	Habitat Present
Red-cockaded woodpecker (*Picoides borealis*)	Endangered	Endangered	Chatham, Durham, Wake	No
Cape Fear shiner (*Notropis mekistocholas*)	Endangered	Endangered	Chatham	No
Dwarf wedge mussel (*Alasmidonta heterodon*)	Endangered	Endangered	Wake	No
Smooth coneflower (*Echinacea laevigata*)	Endangered	Endangered – Special Concern	Durham, Wake	Yes
Harperella (*Ptilimnium nodosum*)	Endangered	Endangered	Chatham	No
Michaux's sumac (*Rhus michauxii*)	Endangered	Endangered-Special Concern	Durham, Wake	Yes

Red-cockaded Woodpecker *(Picoides borealis)*

Federal Status: Endangered
State Status: Endangered

This bird is a small, seven to eight-inch tall woodpecker with a black and white barred back and conspicuous large white cheeks surrounded by a black cap, nape, and throat. Males have a very small red mark at the upper edge of the white cheek and just behind the eye. Red-cockaded woodpeckers (RCW) are found in open pine forests in the southeastern United States where they use open old-growth stands of southern pines, particularly longleaf pine (*Pinus palustris*), for foraging and nesting habitat. A forested stand optimally should contain at least 50 percent pine and lack a thick understory. The RCW is unique among woodpeckers because it nests almost exclusively in living pine trees. These birds excavate nests in pines greater than 60 years old that are contiguous with open, pine dominated foraging habitat. The foraging range of the RCW may extend 500 acres and must be contiguous with suitable nesting sites.

Living pines infected with red-heart disease (*Formes pini*) are often selected for cavity excavation because the inner heartwood is usually weakened and therefore easier to excavate. Cavities are located from 12 to 100 feet above ground level and below live branches. These

trees can be identified by "candles," a large encrustation of running sap that encrusts the tree trunk. The sap encrustation serves as a deterrent for predatory species such as snakes and may be used by the RCW as a visual indicator of nesting or foraging territories. Clusters consist of one to many of these candle trees. The RCW lays its eggs in April, May, and June; the eggs hatch approximately ten to 12 days later (USFWS, 1992).

Suitable habitat for RCW does not exist within the study area since there are no pine dominated stands of appropriate diameter or age present. Vegetated communities are described in Chapter 4.6.4 and include alluvial forest, mixed pine-hardwood, oak-hickory forest, and urban/disturbed areas. While pines are present in these communities, it occurs as a minor component of the canopy.

Cape Fear Shiner *(Notropis mekistocholas)*

Federal Status: Endangered
State Status: Endangered

The Cape Fear shiner is a small fish, rarely exceeding two inches in length. The top and sides of the body are pale silvery yellow to golden. A black stripe runs along the sides and scales are outlined in black. The fins are yellowish and somewhat pointed. The upper lip is black, and the lower lip bears a thin black bar along its margin. This species can be distinguished from similar species by the black upper and lower lips and nearly horizontal position of the mouth. During the spring spawning season, the golden body color is intensified in males while females take on a silvery cast. Males also develop numerous small tubercles on the upper body from the snout to the dorsal fin during the spawning season. Spawning occurs in mid May and there may be a secondary spawning during the late summer (USFWS, 1991). Critical habitat for the Cape Fear shiner has been designated in portions of central Chatham, northern Moore, and southeastern Randolph Counties. Constituent elements of this habitat include clean streams with gravel, cobble, and boulder substrates with pools, riffles, shallow runs and slack water areas with large rock outcrops and side channels and pools with water of good quality with relatively low silt loads.

The species is generally associated with gravel, cobble, and boulder substrates and has been observed to inhabit slow pools, riffles, and slow runs. The most obvious features of their preferred habitat are large islands and bars of water willow (*Justicia americana*). This shiner species is typically associated with schools of other related species, but it is never the numerically dominant species. Juveniles are often found in slow runs among large rock outcrops in midstream, and in flooded side channels and pools. During winter months, they may migrate into smaller tributary streams (USFWS, 1991).

Appropriate habitat for the Cape Fear shiner consisting of clean streams with gravel, cobble, and boulder substrates is not available in the study area. Streams in the project vicinity are typical Triassic Basin systems which have severely eroded and become entrenched. Water flow is generally turbid, and may even dry up during late summer due to water table draw down. Study area streams carry a heavy load of sediments washed from numerous construction sites in the vicinity.

Dwarf Wedge Mussel *(Alasmidonta heterodon)*

Federal Status: Endangered
State Status: Endangered

The dwarf wedge mussel is relatively small, rarely exceeding 1.5 inches in length. The shell's outer surface is usually brown or yellowish brown in color, with faint green rays that are most noticeable in young specimens. Unlike some mussel species, the male and female shells differ slightly, with the female being wider to allow greater space for egg development. A distinguishing characteristic of this mussel is its dentition pattern: the right valve possesses two lateral teeth, while the left valve has only one. This trait is opposite of all other North American species having lateral teeth (Clarke, 1981). This mussel inhabits creeks and rivers that have a slow to moderate current with a sand, gravel, or muddy bed. These streams must be nearly silt free in order to support dwarf wedge mussels (Moser, 1993).

The dwarf wedge mussel is considered to be a long-term brooder, with gravid females reportedly observed in fall months. Like other freshwater mussels, this species' eggs are fertilized in the female by sperm that are taken in through their siphons as they respire. The eggs develop within the female's gills into larvae (glochidia). The females later release these glochidia, which then attach to the gills or fins of specific host fish species. Based on anecdotal evidence, such as dates when gravid females are present or absent, it appears that release of glochidia occurs primarily in April in North Carolina (Michaelson and Neves, 1995). While the USFWS notes that the host fish species is unknown, evidence indicates that an anadromous fish which migrates from ocean waters to fresh waters for spawning may be the likely host species (USFWS, 1993a). However, recent research has confirmed at least three potential fish host species for the dwarf-wedge mussel in North Carolina to be the tessellated darter, Johnny darter, and mottled sculpin (Michaelson and Neves, 1995). These fish species are found in Atlantic coast drainages of North Carolina.

According to biologists working for the Natural Heritage Program, the dwarf wedge mussel does not occur in the Cape Fear River basin (Personal Communication, 2004). Appropriate habitat for this mussel consisting of clean, silt-free streams does not occur within the study area. The highly erodable streams of the Triassic Basin typically carry a heavy silt load; urban development in the project vicinity has contributed to siltation in streams located within the study area.

Smooth Coneflower (*Echinacea laevigata*)

Federal Status: Endangered
State Status: Endangered – Special Concern

Smooth coneflower is a rhizomatous perennial herb that grows up to five feet tall from a vertical root stock. The stems are smooth, with few leaves. The largest leaves are the basal leaves, which reach eight inches in length and three inches in width, have long stems, and are elliptical to broadly lanceolate, tapering to the base, and smooth to slightly rough. Mid-stem leaves have shorter stems or no stems and are smaller in size than the basal leaves. The rays of the flowers (petal-like structures) are light pink to purplish, usually drooping, and two to 3.2 inches long. Flower heads are usually solitary, with flowering occurring from May through July (USFWS, 1993b).

The habitat of smooth coneflower is open woods, cedar barrens, roadsides, clearcuts, dry limestone bluffs, and power line rights-of-way, usually on magnesium- and calcium-rich soils associated with limestone (in Virginia), gabbro (in North Carolina and Virginia), diabase (in

North Carolina and South Carolina), and marble (in South Carolina and Georgia). Optimal sites are characterized by abundant sunlight and little competition in the herbaceous layer (Gaddy, 1991). Natural fires, as well as large herbivores, are part of the history of the vegetation in this species' range (USFWS, 1993b).

High-voltage powerline easements crossing the study area along three separate transects in the northern portion of the project area, both north and south of Hopson Road, provide potential smooth coneflower habitat in the study area.

Harperella *(Ptilimnium nodosum)*

Federal Status: Endangered
State Status: Endangered

Harperella is an herbaceous species six to 36 inches tall with leaves that are reduced to hollow, quill-like structures. Small white flowers occur in umbels similar to those of Queen Anne's lace (*Daucus carota*). These flowers have five regular parts and are bisexual or unisexual, with each umbel containing both perfect and male florets. Riverine populations flower beginning in late June or July and continuing until frost. Pollination biology of the species has not been studied, but seed set is apparently profuse since high densities and number of individual plants can occur each year in localized areas. The riverine form is a perennial or possibly biennial species that can flower in both years (USFWS, 1990).

Harperella is native to seasonally flooded rocky streams in the southeast and typically occurs in two habitat types: palustrine and riverine. Palustrine habitats include edges of intermittent pineland ponds in the coastal plain. Riverine habitats include either rocky or gravel shoals and margins of clear, swift-flowing stream sections. Moisture requirements limit this plant to a narrow band of water that is neither too shallow nor too deep for it to complete its life cycle. Changes in hydrologic regime of streams such as upstream impoundments, declining water quality, and pond drainage are important threats to this plant (USFWS, 1990).

Appropriate riverine habitat for harperella consisting of rocky or gravel shoals and margins of clear, swift-flowing streams do not exist in the study area. Streams delineated within the study area are characterized as entrenched, and in some cases incised with actively eroding banks. Bed materials are predominantly silts and fine sands with periodic bedrock intrusions occurring in the channel.

Michaux's sumac *(Rhus michauxii)*

Federal Status: Endangered
State Status: Endangered – Special Concern

Michaux's sumac is a rhizomatous, densely hairy shrub with erect stems from one to three feet in height. The compound leaves contain evenly serrated, oblong to lanceolate, acuminate leaflets. Most plants are unisexual; however, more recent observations have revealed plants with both male and female flowers on one plant. The flowers are small, borne in an erect terminal, dense cluster and colored greenish yellow to white. Flowering usually occurs from June to July with the fruit, a red drupe, produced from August to October. Only 36 extant populations are known, with 31 occurring in North Carolina, three in Virginia, and two in Georgia (USFWS, 1993c).

Michaux's sumac grows in sandy or rocky open woods in association with basic soils. It spreads by producing cloning shoots from the roots of mature plants. Apparently, this plant survives best in areas where some form of periodic disturbance provides open areas. At least

12 of the plant's populations in North Carolina are on highway rights-of way, roadsides, or on the edges of artificially maintained clearings (USFWS, 1993c).

The study area provides appropriate habitat for Michaux's sumac in the open areas found along the routinely maintained roadway right-of-ways and two open fields.

4.6.8 Federal Species of Concern and State Status

Federal Species of Concern (FSC) are not legally protected under the Endangered Species Act and are not subject to any of its provisions, including Section 7. Species designated as FSC are defined as taxa which may or may not be listed in the future. These species were formerly Candidate 2 (C2) species or species under consideration for listing for which there is insufficient information to support listing.

In addition to the federally protected species referred to above, the USFWS lists a combined total of 41 FSC for Chatham, Durham, and Wake Counties as of the January 29, 2007 protected species list. The NCNHP lists (dated August 11, 2006) also included five species in Chatham County, nine species in Durham County, and 17 species in Wake County as receiving protection under state laws. The species are listed in the NRTR, which is incorporated by reference.

On September 1, 2006 the NCNHP designated the Jenkins Road diabase dike formation as a Significant Natural Heritage Area (Site ID 2527). The site is situated approximately two miles south of the I-40/NC 147 interchange (see Figure 4-4). It includes both sides of Jenkins Road, beginning approximately 0.15 miles north of the intersection with Hopson Road and continuing to one mile north of that intersection. Figure 4-4 identifies the location of this NCNHP site. The site contains a basic oak-hickory forest unique to Durham County as well as a population of Earle's blazing star (*Liatris squarrulosa*), which is listed by the NCNHP as a State Rare (SR) species. The rare plant population occurs in the roadway ditches and in the cleared powerline easement east of Jenkins Road, and the forest is primarily associated with Iredell soils that occur on both sides of Jenkins Road (Franklin, 2006). Another potentially rare species, *Marshallia* sp.1, may also be located at the site. Verification of the species identification is pending review by the North Carolina Herbarium (Personal Communication, 2006b).

5.0 Environmental Consequences

This Chapter identifies the consequences of constructing the Preferred Alternative. The No-Build Alternative (See Chapter 2) was evaluated and determined to be inconsistent with the project purpose and need. However, where applicable, the potential impacts associated with the No-Build Alternative are included in this Chapter for comparison purposes with the proposed Triangle Parkway.

Both human and natural environmental resources within the project area were identified; and the potential for direct impacts to these resources are discussed. Table 5-1 summarizes these impacts and Figures A-1 through A-6 in Appendix A illustrate preliminary right-of-way and construction limits for Triangle Parkway. For unavoidable negative impacts, measures to minimize harm were also identified, and where feasible, mitigation measures to assist in compensating for these impacts are identified and incorporated into the project as part of the Preferred Alternative.

5.1 Human Environment Impacts

Impacts to the human environment were identified based on the presence of resources within the construction and right-of-way limits as described in Chapter 3 for the Triangle Parkway. The surrounding communities are identified in Chapter 4; and, the potential indirect and cumulative effects associated with the project are discussed in Chapter 6.

As discussed in Chapter 4, Triangle Parkway is centrally located within RTP and in the high growth Triangle Region of Wake and Durham Counties. The types of growth in the region include large research facilities, residential neighborhoods and commercial type developments. The type of development specifically within the project area include large research oriented businesses and facilities located and planned according to the RTF Master Plan.

The project is consistent with local, regional and state long range plans; therefore, negative impacts to land use or air quality are not anticipated. There are no active farms, historic architecture resources, or archaeological resources located in the project area. Since the project area is located primarily within land owned and reserved by the RTF for the Triangle Parkway, there would be no business relocations required for the construction of the Preferred Alternative. There would be two residents relocated, one by the construction of the Hopson Road interchange and one by the construction of the Kit Creek Road connector.

Human environment impacts identified in the project area are primarily related to community issues, such as changes in access, to travel patterns and in noise levels. There would also be land disturbed for construction resulting in impacts to existing resources such as utilities, businesses, and existing roadways crossed by the project.

Table 5-1 Preferred Alternative – Impact Summary

Resource	Impact		
Right-of-way	167.6 acres		
Number of relocations	2 Residences 0 Businesses		
Number of property parcels	14 parcels		
Historic Properties	None		
Chapter 4(f) Properties	None		
Archaeological Sites	None		
Jurisdictional Streams Linear Feet (LF)	4,647 LF Perennial 4,082 LF Intermittent		
Wetlands Split Diamond Option	2.05 acres		
Floodplains	12.6 acres		
Protected Species	None		
Natural Communities	Dry Oak-Hickory Forest	8.5 acres	
	Piedmont Bottomland Forest	33.2 acres	
	Mixed Pine/Hardwood Forest	64.0 acres	
	Urban/Disturbed Land	47.0 acres	
Noise Impacts – without abatement	Residences	13	
	Recreational Facilities	1	
	Businesses	2	
Air Quality	No Violation of CO NAAQS[1]		
Cost[2]		2007 Dollars	Dollars Through Project Opening 2010
	Construction[3]	$133.3 Million	$147.1 Million
	Right-of-Way	$26.0 Million	$27.8 Million
	Utilities	$ 5.2 Million	$ 5.5 Million
	Total	$ 164.5 Million	$ 180.4 Million

[1]CO NAAQS – Carbon Monoxide National Ambient Air Quality Standard

[2]For consistency, both 2007 and 2010 cost estimates include the costs needed to implement the NC 540 improvements.

[3] NC 540 eastbound widening and flyover ramp widening will not be part of initial construction planned to open to traffic in 2010.

5.1.1 Land Use

The Preferred Alternative is compatible with area land use plans and long range transportation plans. Local governments with zoning jurisdiction in the project area include business-type uses on zoning maps. The zoning plans for the project area and surrounding areas discussed in Chapter 4.2 and shown in Figure 4-2. The Preferred Alternative is located within and/or in the vicinity of the following planning areas:

- Research Triangle Foundation (RTF)
- Durham County
- Wake County
- Capital Area Metropolitan Planning Organization (CAMPO)
- Durham-Chapel Hill-Carrboro Metropolitan Planning Organization (DCHC MPO)
- City of Raleigh
- Town of Cary
- Town of Morrisville

The Preferred Alternative is not expected to disrupt (or change) existing land use patterns or result in new land use patterns. A majority of the project area for Triangle Parkway extends through reserved property owned by the RTF. The RTF reserves land for research oriented businesses and has continued to reserve property through the central area of RTP as a corridor for this project. In addition to these development plans for RTP, local municipalities have planned for the future Triangle Parkway in their long-range plans and maps since the 1960's.

The No-Build Alternative is not considered consistent or compatible with land use plans or local long range transportation plans. In comparison to the Preferred Alternative, the No-Build Alternative would not provide transportation infrastructure improvements needed for this area to meet the transportation demands projected and identified in the local and regional plans. Since traffic congestion would not be improved, the No-Build Alternative would potentially have a negative impact on the implementation of the future land-use and long-range transportation plans developed by the RTF, local municipalities, CAMPO, DCHC MPO, and NCDOT.

5.1.2 Community

The project area is located in RTP, which consists mainly of large, research oriented facilities. More than 37,000 people work in the Park. RTP has covenants in place that restrict the area to businesses that conduct research and research applications. Since RTP is designated for research oriented businesses, people within the area must travel outside of RTP boundaries to access businesses such as restaurants, retail, and gas stations.

There are no shopping centers, commercial type businesses, community facilities, or recreational facilities located within the project area that would be directly impacted by construction. The surrounding Triangle Region does have these types of development typically associated with cohesive communities (See Chapter 4); however, this type of cohesive multi-use community is not within the immediate project area.

There is one neighborhood, the Kitts Creek subdivision, which is currently under development on the eastern end of Kit Creek Road. The Preferred Alternative includes the construction of the bridge connecting Kit Creek Road between Davis Drive and Church Street through this subdivision. This connection was included on the site plan for the neighborhood and was requested by the Town of Morrisville to maintain connectivity for the neighborhood to Davis Drive.

Property along Kit Creek Road owned by an African American family would be impacted by the construction of the Preferred Alternative. Their land had previously been impacted by the construction of NC 540. One resident of this family would be relocated by the construction of the Kit Creek Road connector.

Research Triangle Park

RTP is internationally known and RTP located business employees appear to share a sense of pride in working there. There are several programs in place that allow employees from different companies to interact. Among the programs is "Techie Tuesdays," which is a networking event for RTP employees. The goal is to build a sense of community within the RTP and provide an opportunity to highlight various activities undertaken by RTP companies.

Environment@RTP is another RTP program that involves employees of multiple companies. This program works to address environmental issues in areas such as air, water, waste, and wildlife. SmartCommute@RTP encourages RTP employees to carpool together, or find other means of transport to work besides driving alone. The program offers a challenge in which employees take pledges, and prizes are offered. The 2005 challenge involved over 12,000 Triangle employees, 43 percent of which worked in RTP.

The RTP also has a recreational softball league. Many companies participate in this league, and scores for the games are posted on a website. These programs allow RTP employees to interact, work towards common goals, and enjoy recreational time together. These activities combined with the pride in the international reputation of the area provide an opportunity to form a sense of cohesion in the RTP business community.

RTP research facilities in combination with a few adjacent businesses located just outside the RTP boundaries are the types of uses within the immediate project area. Triangle Parkway is not expected to disrupt this sense of cohesion. The road would not prevent employees from participating in interactive activities, and would not form a barrier changing patterns of interaction.

Impacts to the companies in RTP, individually or collectively as a business community, are anticipated to be positive overall based on the Preferred Alternative providing an additional route to and from RTP and its consistency with the RTP Master Plan. There could be some temporary negative impacts associated with the inconveniences of construction; however, Triangle Parkway is proposed on new location within an area of RTP that has been reserved for the project. Therefore, construction impacts experienced by RTP based employees would primarily be associated with travel along the existing roads crossed by the project and construction activities occurring adjacent to businesses that border the project. Construction activities and associated impacts are discussed in more detail in Chapter 5.3.

Community Facilities

RTP development is currently managed by RTF with land uses limited to research type businesses and facilities. Therefore, there are no relocations or direct impacts to schools, parks, recreational facilities, community centers, libraries, churches, or cemeteries from the construction of the Preferred Alternative, because there are not any of these facilities present within the project area. The playground and pool for the Kitts Creek subdivision are just outside of the project area. The Kit Creek Road connector would tie to the section of Kit Creek Road going through the subdivision and past these recreational facilities. There would be no impact to these facilities and the subdivision was planned with the expectation that the connector would be built.

There are several RTP employers that provide these types of services or facilities to their employees. There is one employer, the US Environmental Protection Agency (EPA), with a day-care facility located adjacent to the Preferred Alternative. The EPA day care facility, which is known as the First Environments Early Learning Center (FEELC), is located just west of the proposed right-of-way. The EPA established this facility in proximity to the reserved Triangle Parkway right-of-way in 2005. During coordination with EPA, EPA representatives expressed their concerns with the effects of tree removal adjacent to their property, potential increases in noise, and the safety of the children at the daycare. A noise wall between the daycare and the roadway has been preliminarily determined reasonable and feasible based on the NCDOT's Traffic Noise Abatement Policy (September 2004). The final decision on the construction of this noise wall will be determined during the final design of the project and the outcome of the public involvement process.

In addition, parents have raised concerns relating to air quality and the potential impact to the children at the daycare. The air quality analysis performed for the project determined the project will not cause carbon monoxide levels to exceed the National Ambient Air Quality Standard. Additional information relating to the air quality analysis can be found in Chapter 5.1.14.

Triangle Parkway is located between EPA property and a stream extending parallel with the proposed roadway. Alternatives to avoid impacts to both resources were reviewed and eliminated because of the extent of the overall impacts from these alternatives. Therefore, the location of the Triangle Parkway includes efforts to minimize impacts to both EPA property on the west and the stream located to the east. (See Chapter 2.3)

Since there were resources located on both sides of the project with minimization measures incorporated into the design, the location of the roadway could not be shifted to avoid clearing trees on the RTF property adjacent to the EPA property. Retaining walls are proposed as part of the project to avoid right-of-way impacts to the EPA property.

Triangle Parkway will be a controlled access facility with fencing provided along the proposed right-of-way line. Since neither cars nor pedestrians would be provided access between the EPA and new roadway, this fence is anticipated to deter potential safety problems because there would not be a break in the fence line.

Pedestrian and Bicycle Facilities

Bicycle and pedestrian accommodations are not proposed along the freeway section of the Preferred Alternative. Triangle Parkway is proposed as a controlled access roadway facility

which anticipates over 100,000 vehicles using the roadway per day in the year 2030. Large roadway facilities are in general not conducive to bicycle traffic.

The Preferred Alternative will cross the RTP multi-use path located along Davis Drive. NCDOT STIP Project U-4026 is under construction to widen Davis Drive to a four-lane facility from Morrisville Carpenter Road to NC 54. As part of this widening project, the RTP multi-use path will be re-located.

A bridge extending over the multi-use path and Davis Drive is proposed at this location. The connectivity of the trail would be maintained and the bridge would not negatively impact the use of this trail or any future jogging trail plans. Coordination with RTF indicates that constructing the bridge and sidewalks adjacent to Davis Drive for connectivity is acceptable.

Sidewalks are proposed on both sides of the bridge on NC 54 over the Triangle Parkway to match the sidewalks on the current bridge. These sidewalks will connect to the existing sidewalks along NC 54. In addition, sidewalks are proposed along Hopson Road. The Triangle Parkway bridges over Hopson Road are designed to accommodate future sidewalks along both sides of Hopson Road to allow for pedestrian passage.

The Town of Morrisville requested a bridge be constructed between Kit Creek Road and Davis Drive as part of the Triangle Parkway to maintain connectivity from Church Street to Davis Drive. The bridge connecting Kit Creek Road between Davis Drive and Church Street is included as part of the proposed project. This bridge would benefit bicycle and pedestrian users with an east-west connection across Triangle Parkway. However, sidewalks and bicycle lanes are not included as part of the proposed construction.

There are not any other impacts to pedestrian or bicycle facilities in the project area anticipated from the Preferred Alternative.

5.1.3 Farmland

The Farmland Protection Policy Act requires all Federal agencies or their representatives to consider the impact of land acquisition and construction projects on prime and important farmland soils. Federal regulations pertaining to the Act (7 CFR 658) established criteria for identifying the effects of Federal programs on the conversion of farmland soils to non-agricultural uses. Public Law 97-97, Subtitle 1, Chapter 1540 subdivides farmland soils into three categories, prime farmland, unique farmland, and state and locally important farmland, based on the underlying soil types. In addition, North Carolina Executive Order Number 96, Preservation of Prime Agricultural and Forest Lands, requires all state agencies to consider the impact of similar projects on prime farmland as designated by the U.S. Natural Resources Conservation Service (NRCS).

Completion of a 'Farmland Conversion Impact Rating for Corridor Type Projects' form was coordinated with the NRCS. The rating system on the form is based upon a total of 260 points, which are acquired according to various criteria on potential impacts. Since soils are assessed differently depending upon county, two forms were completed, one for Wake County and one for Durham County. The assessment included the entire project length for the new location section from NC 540 to I-40. The widening section of the project along NC 540 remains within the existing right-of-way of NC 540. The Durham County portion of the project received 41 total points out of a possible 260. The Wake County portion of the project received 50 total points out of a possible 260. Since the scores were below 160 points, no further analysis is required per 7 CFR 685.4(c)(2). The farmland rating forms are located in Appendix C.

The project area does not include active farms and is zoned and restricted to research type facilities. Triangle Parkway also would not cross or disrupt the operation of any existing farms. The Preferred Alternative would not have an impact on farmland located within the counties.

5.1.4 Historic Cultural Resources

This project is subject to compliance with Chapter 106 of the National Historic Preservation Act of 1966, as amended, and implemented by the Advisory Council on Historic Preservation's regulations for compliance with Chapter 106, codified as 36 CFR Part 800. Chapter 106 requires Federal agencies to take into account the effect of their undertakings (Federally-funded, licensed, or permitted) on properties included in or eligible for inclusion in the National Register of Historic Places.

Review of records at the North Carolina Department of Cultural Resources indicated there are no cultural resources under study for or included in the National Register of Historic Places within the project area. A scoping response letter from the State Historic Preservation Office dated February 15, 2006 stated that they had conducted a review of the project, and were aware of no historic resources that would be affected by the project. (See Appendix D)

Field reviews and further agency coordination with the NC State Historic Preservation Office concluded there is no eligible historic architecture or archaeological resources within the project area and no further studies are required.

5.1.5 Chapter 4(f) Resources

Chapter 4(f) of the US Department of Transportation Act of 1966 and the Federal regulations 23 CRF 771.135 protect publicly owned parks, recreation areas, and refuges, as well as historic sites (whether publicly or privately owned) that are listed in or eligible for the National Register of Historic Places. There are no Chapter 4(f) resources impacted by the construction of the Triangle Parkway; therefore, the Preferred Alternative does not require a Chapter 4(f) Evaluation.

5.1.6 Wild and Scenic Rivers

There are no streams or rivers in Durham or Wake County that qualify for listing as wild and scenic river systems in accordance with the Wild and Scenic Rivers Act (Public Law 90-542). Therefore, the Preferred Alternative will not impact wild or scenic rivers.

5.1.7 Hazardous Materials

There are no hazardous material sites or underground storage tanks anticipated within the project area. A GIS records search revealed several hazardous substance disposal areas outside of the project area. The two largest located at IBM, east of Davis Drive, and General Electric, located east of IBM. The construction of the Preferred Alternative will not impact any of these sites.

5.1.8 Emergency Services

There are no emergency service facilities or operations located in the project area; therefore, construction of the Preferred Alternative would not require property or the relocation of any buildings from emergency service facilities. Triangle Parkway would offer and potentially change travel patterns through RTP and emergency service access to areas within RTP. Travel patterns and access changes are discussed in Chapter 5.1.12.

5.1.9 Relocation and Right-of-way Impacts

Relocation reports were prepared for this project and are included in Appendix C[1]. The Preferred Alternative will not relocate any businesses or research facilities in the project area. Two residents will be relocated by the construction of Triangle Parkway. One property is located on Hopson Road and includes a house and out building. The other property is located on the east side of the proposed Kit Creek Road Connector. (See Figures A-2 and A-3)

The Preferred Alternative will require acquiring land from property owners for roadway rights-of-way within the project construction limits. Property required for the project would include purchasing: fee-simple property for right-of-way, permanent construction and maintenance easements, and/or compensating property owners to acquire temporary easement needed for construction.

During the alternative development for the project (See Chapter 2) and during the development of the functional design, measures to minimize right-of-way impacts to adjacent properties were reviewed. A majority of the property required for right-of-way is owned by RTF. From the 168 acres of right-of-way estimated for the Preferred Alternative, approximately 112 acres are within the RTF property.

The remaining 56 acres of property would be required from private land owners. Retaining walls to minimize right-of-way impacts were incorporated at five locations; the first is along the EPA property boundary to avoid the need of Federal property for project right-of-way; the second at 4105 Hopson Road, and the third is located at the Sigma Xi property near I-40, the forth is along both sides of Hopson Road at the interchange with Triangle Parkway and the fifth is along both sides of Davis Drive at the interchange with Triangle Parkway. (See Figures A-1 through A-6)

NCTA will follow the standard FHWA and NCDOT policies for property acquisition and relocation assistance. As required by the Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646) and the North Carolina Relocation Assistance Act (GS-133-5 through 133-18), NCDOT right-of-way acquisition policy provides a relocation program to help property owners when unavoidable relocations occur because of roadway construction. The relocation program offers assistance, moving payments, or replacement housing payments or rent. Another component of the relocation policy is to provide "last resort housing" when comparable replacement housing is not available or is unavailable within an individual's financial means. Through the last resort housing program NCDOT has greater latitude in offering replacement payments which exceed federal or state legal requirements.

5.1.10 Utilities

There are multiple utility services extending through the project area. These utility services are supplied and maintained by a variety of providers based on the service locations, such as: Wake County, Durham County, Town of Morrisville, and RTP.

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[1] Appendix C includes three relocation reports titled based on the alternative discussions provided in Chapter 2. The first report is for Option 1 –Partial Cloverleaf interchange design at Davis Drive/Hopson Road, which was eliminated from further study.

The second and third reports combine to provide the total relocation information for the Preferred Alternative. These two reports include one for "Option 2", the preferred Split Diamond interchange design at Davis Drive/Hopson Road, and one for the preferred corridor location with the Kit Creek Road connector labeled "Kit Creek Road Connector – Triangle Parkway Corridor A – Design Option 2."

The following entities have utilities that would require relocation for this project:

- Duke Power – 100v Transmission Line, 100v Tap Bent, and four Steel Towers
- City of Durham – Water and Sewer lines
- Durham County – Sewer Line
- Wake County – Sewer Lines
- City of Cary - Water and Sewer Lines
- Town of Morrisville – Water Lines
- Piedmont Natural Gas – Multiple Gas Lines
- Time Warner Cable
- AT&T Communications
- Bell South Communications
- Progress Energy
- Verizon Business (MCI)
- BTI Communications
- Georgia Electric VIASYS Communications
- Tel Cove Communications

In addition to the above utility services requiring relocation, there are also several privately owned water/sewer systems and communication facilities which could be impacted by the project.

Prior to construction, NCTA will ensure contractors coordinate with all appropriate service providers to minimize impacts to utilities and to ensure that service disruption, if needed, will be temporary and minimized as much as possible. The NCTA plans to bridge the water and sewer lines that cross the project area at Burdens Creek to avoid impacting them.

5.1.11 Transportation Services

The Preferred Alternative will not directly impact or require right-of-way from other transportation facilities such as bus terminals, airports, or railroad rights-of-way. Although not based in RTP, there are several types of transportation services that serve the project area that would experience a benefit from Triangle Parkway as an additional route through RTP.

Public Transportation and Transit

Regional bus service is provided in the project area by the Triangle Transit Authority (TTA) connecting Raleigh, Durham, Chapel Hill, Apex, Cary, Garner, and RTP. The regional bus service is complemented by several local service providers: Durham Area Transit Authority (DATA), Capital Area Transit (CAT), Duke Transit, Cary Transportation (C-Tran), NC State Wolfline, and Orange Public Transit (OPT), as well as shuttles to RTP and Raleigh-Durham International Airport. In the morning and afternoon rush hours, the TTA provides four shuttle routes to several major employers in RTP. Shuttle service is provided to other RTP employers upon request.

The Preferred Alternative would not directly impact the public services provided by TTA or the local bus services. The Project could potentially benefit these public transportation services by providing an additional choice in routes through RTP. As a toll road, this route would require paying a toll. The Preliminary Traffic and Revenue Study indicates toll fees could be in the $1.00 range.

Rail Facilities

There are two freight rail service providers in the vicinity of the project: CSX Transportation and Norfolk Southern. Facilities for these rail systems are not located in the project area and would not require right-of-way or impact to rail property or facilities, such as railroad tracks. The Project is not anticipated to have a negative or positive impact on these rail line services.

Airports

There are no airports within the project area and no impacts to airport facilities or services anticipated from the Preferred Alternative. Raleigh-Durham International Airport (RDU), however, is located less than ten miles to the east.

Transportation Safety

Designs for Triangle Parkway were prepared in accordance with federal and state guidelines for highway design. Appropriate design parameters, such as roadway width, curvature, and roadside clear zones, were included in the design as required to maximize driver safety. No design exceptions are needed at this time. In addition to the safety aspects of the new road, transportation safety would likely improve since Triangle Parkway would remove traffic from the existing roads.

5.1.12 Access Changes

The Project includes construction of a new 3.4-mile control of access roadway. Access would be controlled to prevent direct driveway and side road access to the Triangle Parkway. Access to Triangle Parkway would be provided with interchanges located at NC 540, Hopson Road, Davis Drive and I-40. Existing access to and from Hopson Road and Davis Drive through RTP will remain relatively the same since their connections to roads such as McCrimmon Parkway, T.W. Alexander Drive, NC 54, and NC 55 will remain. The project will provide more direct access to the RTP.

There would be access changes required at several locations within the project area. These locations involve existing road connections and businesses. The access changes and potential impacts from these changes include:

- Kit Creek Road includes a short section of roadway which connects with Davis Drive just north of the NC 540 interchange. This part of Kit Creek Road temporarily provides access to NC 540. The other end of Kit Creek Road connects with Church Street and extends toward Davis Drive through the Kitts Creek neighborhood and ends with a cul-de-sac. The NCTA has included the construction of the Kit Creek Road connector as part of the project. This connection would provide direct access between Church Street and Davis Drive through the Kitts Creek subdivision.

- T.W. Alexander Drive – NC 147 currently terminates at T.W. Alexander Drive. This NC 147 Spur currently provides direct access to I-40 from T.W. Alexander Drive. Since NC 147 will connect with Triangle Parkway at the I-40 Interchange, this existing spur connection with T.W. Alexander Drive will be closed.

  There were several comments received from the public related to closing the NC 147 Spur connection with T.W. Alexander Drive. The most common comment included losing the convenience of using I-40 to access T.W. Alexander Drive and NC 54. People explained that using I-40 avoided the need for extended travel along the two-lane section of NC 54. Another concern with closing the NC 147 Spur was expressed from representatives and employees with EPA and NIEHS. Meetings that discussed access concerns were held with EPA and/or NIEHS on the following dates: June 27, 2006 (EPA), October 30, 2006 (NIEHS), November 15, 2006 (NIEHS), January 11, 2007 (Both), January 25, 2007 (Both), July 19, 2007 (Both), August 9, 2007 (Both), November 7, 2007 (Both), December 4, 2007 (Both) and January 10, 2008 (Both), and February 13, 2008 (EPA and NIEHS employees). The NCTA in coordination with NCDOT determined that the current un-signalized full movement EPA entrance on Hopson Road would remain a full movement intersection after completion of the project. In addition, the NCTA will design and install a traffic signal at this location when it meets the NCDOT traffic signal warrants as outlined in the Manual of Uniform Traffic Control Devices (MUTCD).

  The EPA and NIEHS have separate main entrances into their campuses located on T.W. Alexander Drive. When the NC 147 Spur is closed, employees will have choices of travel; employees could exit from I-40 onto Triangle Parkway and then exit on Hopson Road for access to T.W. Alexander Drive; they could exit at Cornwallis Road from NC 147 to access T.W. Alexander Drive; they could exit I-40 at Davis Drive to Hopson Road to T.W. Alexander Drive; and, from the west, they could exit I-40 at NC 55 to NC 54 to T.W. Alexander Drive.

  As part of the Preferred Alternative, a detour bridge will be constructed along the NC 54 detour to allow the NC 147 Spur between I-40 and T.W. Alexander Drive to remain open during construction as long as feasible.

- NC 147 currently goes under I-40 and terminates at T.W. Alexander Drive. Triangle Parkway is proposed to connect with NC 147, which would provide NC 147 traffic new access through RTP to Hopson Road, Davis Drive, and NC 540.

- Business Access and/or driveways along Hopson Road and Davis Drive were reviewed in relation to the proposed location of the Triangle Parkway interchange connections based on the NCDOT Policy on Street and Driveway Access to North Carolina Highways. Several business driveways along these roads are under review. The specific changes in driveway access will be determined during final design and reviewed with business owners during the Public Hearing. If changes to accesses are made, appropriate alternative access points would be provided to minimize effects to the viability of the business.

5.1.13 Noise

A noise analysis for the project was conducted and is documented in the Traffic Noise Technical Memorandum - Triangle Parkway from Northern Wake Expressway to I-40 (October 2007), Traffic Noise Technical Memorandum (NC 540 Addendum) - Triangle Parkway from NC 540 to I-40 (January 2008) and Traffic Noise Technical Memorandum (NC 147 Addendum) – Triangle Parkway

from NC 540 to I-40 (February 2008) which are incorporated by reference. Traffic noise impacts were assessed in accordance with Title 23 Part 772 of the Code of Federal Regulations and the NCDOT Traffic Noise Abatement Policy. Where traffic noise impacts were predicted, the analysis included an evaluation of noise abatement measurements for reducing or eliminating the noise impacts.

In accordance with the NCDOT's Traffic Noise Abatement Policy, Federal/State governments are not responsible for providing noise abatement measures for new developments where building permits are issued within the noise impact area of a proposed highway after the "Date of Public Knowledge." The Date of Public Knowledge is the approval date of final environmental document, e.g., CE, FONSI or ROD. The noise analysis produced the following findings:

Noise Impacts

Receptors expected to experience traffic noise impacts either by approaching or exceeding the NCDOT noise abatement criteria (NAC) or by a substantial increase in exterior noise levels, are considered "impacted." Design year 2030 traffic noise levels from the project are expected to approach or exceed the NAC or substantially increase for 16 receptors.

Of these 16 impacted receptors, two receptors, both of which are day-care centers, are categorized as special use areas (RTI Parent's Child Care Cooperative Organization (RTI) and the First Environments Early Learning Center (FEELC), which is located on the EPA/NIEHS campus). The licensed capacity of the RTI facility is 80 and the FEELC facility is 188; both are NAC activity category 'B'. Seven of the impacted receptors are NAC activity categories 'B/E' and are located in the Finsbury Phase of the Davis Park subdivision. Four receptors are located in the Breckenridge subdivision. Two receptors are isolated single-family dwellings and one receptor is a recreational facility adjacent to NC 147. (See Table 5-2)

Land use along the corridor is predominately characterized by office and research & development facilities (collectively referred to a "commercial" uses). Interior noise levels were considered in those situations where there are no exterior activities of frequent human use that would benefit from reduced noise levels. Since no frequent outside human activities were identified for the commercial buildings along the corridor, they are categorized under the NAC activity category 'E'. Therefore the interior criterion is used for these receptors. Structural insertion loss of commercial buildings with fixed thermo-pane, storm windows, or double glazing ranges from 25 to 35 dB. The lower value, 25 dB was subtracted from the exterior peak hour levels developed with TNM to establish the peak hour Leq noise levels. There are no impacts due to traffic noise for commercial establishments.

The residential buildings in the Finsbury phase of the Davis Park development, which consist of lofts, flats, and rowhouses are, according to NCDOT's Traffic Noise Abatement Policy, considered residential multi-unit complexes and were evaluated under activity categories 'B' and 'E'. The residential buildings are masonry in construction; therefore, a 25 dB structural insertion loss from exterior levels was used to calculate interior levels. Within Davis Park there were 12 receptors that are expected to approach or exceed the NAC (receptors Davis Park 25-28, Davis Park 52-55, Davis Park 67, Davis Park 69, Davis Park 71 and Davis Park 73). However, these receptors were not considered impacted by the project or considered for mitigation because the influence of traffic noise came from their proximity to Davis Drive and not the proposed project. The residential buildings in Breckenridge are single family homes and were evaluated under category 'B'.

The modeled noise level increases for this project, prior to mitigation, range from +1 to +12 dBA (exterior levels) in 2030. According to acoustical studies, a noise level change of two to three dBA is barely noticeable by the human ear. A five dBA change is more readily noticeable while a ten dBA change is judged by most people as a doubling or a halving of the loudness of the sound.

Table 5-2 Noise Abatement Criteria

Hourly A – Weighted Sound Level in Decibels (dBA)

Activity Category	Leq(h)	Description of Activity Category
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its purpose
B	67	Residences, churches, schools, libraries, hospitals, motels, hotels, parks, picnic, and recreation areas, active sports areas, and playgrounds
C	72	Developed lands, properties or activities not included in Categories A or B
D	Not Applicable	Undeveloped lands
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals and auditoriums

Source: 2004 NCDOT Traffic Noise Abatement Policy

Noise Abatement

Noise abatement measures were evaluated for 16 impacted receptors in the project study area: receptor 18 (RTI Parent's Child Care Cooperative Organization), receptor 29 (First Environments Early Learning Center), receptors Davis Park 74-76 and Davis Park 78-81 (Finsbury Phase in the Davis Park Subdivision) receptors Breckenridge 1-4, receptor 5, a recreational facility adjacent to NC 147, and receptors 82 and 121 (residential uses), which were impacted but isolated receptors. NCDOT's Traffic Noise Abatement Policy states that, unless unusual circumstances exist, it is generally not reasonable to provide noise abatement for isolated receptors. There are no unusual circumstances here that would warrant providing noise abatement for these two isolated receptors. The results of the noise abatement analysis are provided in the Noise Mitigation Analysis. (See Appendix C for locations of the receptors and impact tables)

There are two subdivisions in the project area that will require further assessment; the Kitts Creek subdivision located to the east of the proposed project just north of NC 540 and the Davis Park mixed-use subdivision located on the east side of the proposed project north of

Hopson Road along the east and west side of Davis Drive. Both developments are partially completed with new phases either planned or underway. It is anticipated that new building permits could be issued in Kitts Creek and Davis Park prior to FONSI approval. Further noise studies of the remaining phases of Kitts Creek and Davis Park may be necessary where building permits have been approved prior to the FONSI.

Traffic System Management Measures

Traffic management measures that limit vehicle type, speed, volume and time of operations are often effective noise abatement measures. For this project, traffic management measures are not considered appropriate for noise abatement due to their effect on the capacity and level of service of the proposed roadway.

Noise Barriers

Noise barriers reduce noise levels by blocking the sound path between a noise sensitive area and a roadway. This measure is most often used on high-speed, limited-access facilities where noise levels are high and there is adequate space for continuous barriers. For isolated receptors, or where the application of physical abatement may not achieve at least a five dBA reduction, the probable noise reduction may not be feasible or reasonable relative to the cost.

For a noise barrier to provide sufficient noise reduction, it must be high enough and long enough to shield the receptor from significant sections of the highway. Access openings in the barrier created by driveways or intersections severely reduce the noise reduction provided by the barrier. It then becomes economically unreasonable to construct a barrier for a small noise reduction. Safety at access openings (driveways, crossing streets, etc.) due to restricted sight distance is also a concern. Furthermore, to provide a sufficient reduction, a barrier's length would normally be eight times the distance from the barrier to the receptor. For example, a receptor located 50 feet from the barrier would normally require a barrier 400 feet long. An access opening of 40 feet, or ten percent of the area, would limit its noise reduction to four dBA (Fundamentals and Abatement of Highway Traffic Noise, Report No. FHWA-HHI-HEV-73-7976-1, USDOT, chapter 5, section 3.2, page 5-27). These factors would not allow noise walls to be acceptable abatement measures along right-of-way that is not controlled. In addition, businesses, churches, and other related establishments located along a particular highway normally require accessibility and high visibility. TNM was used to model noise barriers at noise sensitive locations and these barriers were analyzed to determine if they would meet the minimum noise reduction goals, by estimating the cost of the barrier (assuming an approximate cost of $\$15/ft^2$) and determining the cost per benefited receptor. The NCDOT defines benefited receptors as one that would receive a minimum noise level reduction of five dBA as a result of placing of the noise mitigation measure.

After it has been determined to consider noise abatement, several factors must be examined to determine if construction of sound barriers is feasible and reasonable. In order for a noise barrier to be considered feasible, it must meet, among other factors, the following conditions:

Feasibility

Feasibility deals primarily with design and engineering considerations. The following issues should be considered in order to determine feasibility:

1. The topography of the location should be considered when determining if a noise wall can be built.
2. A readily noticeable noise reduction "insertion loss" should be achieved by the placement of the noise abatement measure, a minimum of five dBA for front row receptors.
3. Site-specific access, drainage, safety and maintenance requirements should be considered when determining noise reduction levels.
4. Other noise sources in the area should be considered.
5. Noise abatement on non-controlled or partial access control highways usually is not feasible. However, in areas where property owners have agreed to voluntarily relinquish access rights to the highway, noise abatement may be considered.

Reasonableness

Reasonableness is a more subjective measure. This consideration should show that good judgment and common sense were used in making a decision. A finding of reasonableness will include the following:

1. Noise barrier cost - The abatement measure will be constructed at a reasonable allowable cost per benefited receptor (cost effective). This cost per benefited receptor will be less than or equal to the value determined by dividing the number of benefited receptors into the total cost of the barrier system. A benefited receptor is one that experiences a five dBA or more reduction in noise levels by the construction of the noise wall. The cost of the barrier system will be based on $15.00 per square foot for the noise mitigation measure plus any other major items necessary for the construction of the measure. These other items could include cost for structure improvements, additional earthwork, additional right-of-way, etc. The reasonable cost effective amount for an impacted area will be $35,000 per benefited receptor plus an incremental increase of $500 per dBA average increase in the predicted exterior noise levels of the impacted receptors of the area.
2. Noise Wall Height and Scale – A major consideration of the reasonableness of a noise wall is the visual impact on the adjoining lands. Specifically, a high noise wall alongside low, single-family residences could have a severe adverse visual effect. Considering these factors, the height of the noise wall above the ground should not exceed 25 feet. Furthermore, the horizontal distance of the noise wall from the residences should be greater than four times the height of the noise wall from the residences.
3. Difference between Existing and Future Noise Levels – When noises are heard, most people find it difficult to detect noise level changes of two to three dBA. If the differences between the existing and future noise levels are three dBA or less, sound mitigation measures are generally considered unreasonable.

4. Opinions of Impacted Residents – Support for the proposed noise barrier by front row receptors must be documented due to the visual effect of the proposed measures. The NCTA will solicit the opinions of these receptors and a majority of these receptors must support the construction of the noise abatement measure.
5. Isolated Receptors – The cost of abatement measures for isolated receptors versus the noise reduction benefits provided are usually excessive. Therefore, unless special conditions exist, it generally is not considered reasonable to provide noise abatement for isolated receptors.
6. Commercial Areas – Businesses usually prefer visibility and accessibility from the highway rather than noise abatement. Therefore, noise abatement for impacted businesses will not be considered unless requested by the business affected.
7. Residential Multi-unit Complexes – The NCTA will evaluate residential multi-unit complexes under activity category "E" (interior condition) of the NAC Table. If activity category "B" (exterior condition) of the NAC Table is also determined in areas of the complex, NCTA will evaluate both categories "B" and "E" conditions of the multi-unit complex. Noise mitigation benefits for qualifying NAC activity category "B" will consider all units of the multi-unit building structure. However, noise mitigation benefits for NAC activity category "E" will consider only first floor units due to noise wall height constraints. Owner occupied units (apartment, townhouse, etc.) will be treated as a separate voting member.
8. Special Use Areas – Special use areas include, but are not limited to school, pre-school and daycare facility playgrounds; special exterior areas of churches, hospitals, retirement homes; parks and camps that would be evaluated for NAC activity category "B" (exterior condition). Note: A minimum of 25 students is required to qualify for exterior activity "B" for playgrounds for pre-school and daycares.

Other Mitigation Measures Considered

The acquisition of property in order to provide buffer zones to minimize noise impacts is not considered to be a feasible noise mitigation measure for this project. The cost to acquire impacted receptors for buffer zones would exceed the abatement threshold of $35,000 per benefited receptor plus the incremental increase of $500 per dBA average increase in the modeled exterior noise levels of the impacted receptors of the area. The use of buffer zones to minimize impacts to future sensitive areas is not recommended because this could be accomplished through land use control.

The use of vegetation for noise mitigation is not considered reasonable for this project, due to the substantial amount of right-of-way necessary to make vegetative barriers effective. FHWA research has shown that a vegetative barrier should be approximately 100 feet wide to provide a three dBA reduction in noise levels. In order to provide a five dBA reduction, substantial amounts of additional right-of-way would be required. The cost of the additional right-of-way for these vegetative barriers are estimated to exceed the abatement threshold of $35,000 per

benefited receptor plus the incremental increase of $500 per dBA average increase in the modeled exterior noise levels of the impacted receptors of the area.

Noise Mitigation Analysis

The first potential barrier location (Barrier B) is located along Triangle Parkway north along the Hopson Road on-ramp. This barrier is shown in Appendix C. The optimized design of a noise wall that would provide a minimum five dBA (from 66 dBA to 61 dBA) reduction is approximately 1,394 feet long with an exposed height ranging from 15 to 25 feet. The barrier would benefit three receptors (receptors Davis Park 74, Davis Park 78 and Davis Park 79). These three receptors are located in the Finsbury Phase of Davis Park, which has a total of nine dwelling units. The barrier would benefit these nine residents at an estimated cost of $455,655. Dividing this cost ($455,655) by these residents equates to approximately $50,628 per benefited receptor. Reasonable cost per benefited receptor is such that the cost of noise mitigation divided by the number of benefited receptors must be equal to or less than $35,000 plus $500 multiplied by the average increase in predicted exterior noise levels (from 50 dBA to 66 dBA). This equates to $43,000 which is less than the $50,628 cost per benefited receptor. Based on the NCDOT Traffic Noise Abatement Policy, the noise wall is not reasonable and, therefore, not recommended for construction.

The second potential barrier location (Barrier C) is located along NC 147 in proximity to the Cornwallis Road interchange. This barrier is shown in Appendix C. The optimized design of a noise wall that would provide a minimum five dBA (from 67 dBA to 62 dBA) reduction is approximately 1,614 feet long with an exposed height of 13 feet. The barrier would benefit one receptor (receptor 18). This receptor is the RTI Parent's Child Care Cooperative Organization facility with a licensed capacity of 80, which according to the NAC is the equivalent of four residents. This is calculated as Equivalent Number of Residents = 80 students divided by 3 times (4 hrs per day/ 24 hrs per day). The barrier would benefit these four residents at an estimated cost of $314,730. Dividing this cost ($314,730) by these four residents equates to approximately $78,683 per benefited receptor. Reasonable cost per benefited receptor is such that cost of noise mitigation divided by the number of benefited receptors must be equal to or less than $35,000 plus $500 multiplied by the average increase in predicted exterior noise levels (from 64 dBA to 67 dBA). This equates to $36,500 which is less than the $78,683 cost per benefited receptor. Based on the NCDOT Traffic Noise Abatement Policy, the noise wall is not reasonable and, therefore, not recommended for construction.

The third potential barrier location (Barrier E) is located along Triangle Parkway southbound toward the Hopson Road interchange and is depicted in Appendix C. The optimized design of a noise wall that would provide a minimum five dBA reduction (from 68 dBA to 63 dBA) is approximately 1,651 feet long with an exposed height of ten feet. The barrier would benefit one receptor (receptor 29). This receptor is the First Environments Early Learning Center facility with a licensed capacity of 188, which according to the NAC is the equivalent of ten residents. This is calculated as "Equivalent Number of Residents" = 188 students divided by 3 times (4 hrs per day/ 24 hrs per day). The barrier would benefit these ten residents at an estimated cost of $247,650. Dividing this cost ($247,650) by these ten residents equates to approximately $24,765 per benefited receptor. Reasonable cost per benefited receptor is such that cost of noise mitigation divided by the number of benefited receptors must be equal to or less than $35,000 plus $500 multiplied by the increase in predicted exterior noise levels (from

43 dBA to 68 dBA). This equates to $47,500 which is more than the $24,765 cost per benefited receptor. Based on the NCDOT Traffic Noise Abatement Policy, the noise wall appears to be reasonable and feasible and, therefore, preliminarily recommended for construction.

The forth potential barrier location (Barrier I) is located along NC 540 eastbound adjacent to the Breckenridge subdivision. This potential barrier is depicted in Appendix C. The optimized design of a noise wall that would provide a minimum five dBA reduction is approximately 1200 feet long with an exposed height range of five to 11 feet. The barrier would benefit four receptors. These receptors are located within the Breckenridge subdivision. The barrier would benefit these four receptors at an estimated cost of $177,015. Dividing this cost ($177,015) by these residents equates to approximately $44,254 per benefited receptor. Reasonable cost per benefited receptor is such that the cost of the noise mitigation measure divided by the number of benefited receptors must be equal to or less than $35,000 plus $500 multiplied by the average increase in predicted exterior noise levels (seven dBA). This equates to $38,500 which is less than the $44,254 cost per benefited receptor. Based on the NCDOT Traffic Noise Abatement Policy, the noise wall is not reasonable and, therefore, not recommended for construction.

As previously stated, the Kitts Creek and Davis Park developments will be further evaluated for traffic noise impacts and noise mitigation will be considered for impacted receivers with approved building permits issued prior to the FONSI.

Based on NCDOT Traffic Noise Abatement Policy, the NCTA has preliminarily determined that a noise barrier for the First Environments Early Learning Center is reasonable and feasible. During final design, more in-depth TNM modeling will be performed at this location to verify this mitigation is both feasible and reasonable. The final decision on the installation of abatement measures will be made upon completion of the project design and the public noise involvement process.

Construction Noise

The major construction elements of this project are expected to be earth removal, hauling, grading, and paving. General construction noise impacts, such as temporary speech interference for passers-by and those individuals living or working near the project, can be expected particularly from paving operations and from the earth moving equipment during grading operations. However, considering the relatively short-term nature of construction noise, these impacts are not expected to be substantial. The transmission loss characteristics of nearby natural elements and man-made structures are believed to be sufficient to moderate the effects of intrusive construction noise.

5.1.14 Air Quality

An air quality study was performed for the project and is documented in the Air Quality Analysis - Triangle Parkway from Northern Wake Expressway to I-40 (June 2007) which is incorporated by reference. This study included performing a quantitative carbon monoxide (CO) "hotspot" analysis to determine if the Preferred Alternative would cause CO levels to exceed the National Ambient Air Quality Standard (NAAQS). In addition a quantitative analysis of Mobile Source Air Toxics (MSATs) was prepared.

A microscale air quality analysis using "CAL3QHC (2.0) – A Modeling Methodology for Predicting Pollutant Concentrations Near Roadway Intersections" was used to predict the CO concentration near sensitive receptors. The analysis produced the following findings:

The signalized intersection at Davis Drive and Hopson Road was selected as the site for this analysis. The site represents a residential and commercial location where the highest CO concentrations can be expected and human activity is anticipated. This intersection was chosen to represent the "worst case" condition, based on traffic volumes, level of service (LOS) and its close proximity to human activity. Appendix C shows the intersection and the location of receptors.

Carbon monoxide vehicle emission factors were calculated for the years 2010, 2015, and 2030 using the EPA's MOBILE6.2 mobile source emissions computer model. The North Carolina Department of Environment and Natural Resources (NCDENR) guidance indicates that the average background concentration of CO used for impact modeling analysis in Durham and Wake Counties is 2.9 parts per million (ppm).

Air Quality Impacts

The predicted one-hour average CO concentrations for 2010, 2015 and 2030 are 4.3, 4.9, and 4.9 ppm, respectively and the accompanying eight-hour CO concentrations for 2010, 2015, and 2030 are 3.1, 3.4, and 3.4 ppm, respectively. None of these concentrations exceed either the one-hour (35 ppm) or eight-hour (9 ppm) NAAQS for CO.

Mobile Source Air Toxics (MSAT)

Daily forecasted traffic volumes in 2030 are projected to exceed 140,000 vehicles per day (average daily traffic (ADT)) on two segments of the proposed project[2]: NC 540 between NC 55 and Davis Drive and NC 147 between I-40 and T.W. Alexander Drive. The ADT on these two roadway segments ranges from 141,000 to 145,600 vehicles per day. The NC 540 section is adjacent to the residential neighborhood of Breckenridge and the NC 147 segment is adjacent to a childcare facility known as the RTI Parent's Child Care Cooperative Organization. Based on the Federal Highway Administration's (FHWA's) Interim Guidance on Air Toxic Analysis in NEPA Documents (February 3, 2006), the traffic volumes and project setting suggest that the project has a higher potential for Mobile Source Air Toxics (MSATs) effects. This means that a quantitative assessment of air toxic emissions must be conducted for the six priority MSATs for each alternative, to use as a basis of comparison. The results of the MSAT analysis are documented in the Air Quality Analysis Technical Report Addendum: Quantitative Mobile Source Air Toxics Analysis (January 2008).

In addition to the criteria air pollutants for which there are NAAQS, the Environmental Protection Agency (EPA) also regulates air toxics. Most air toxics originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners) and stationary sources (e.g., factories or refineries).

MSATs are a subset of the 188 air toxics defined by the Clean Air Act. The MSATs are compounds emitted from highway vehicles and non-road equipment. Some toxic compounds

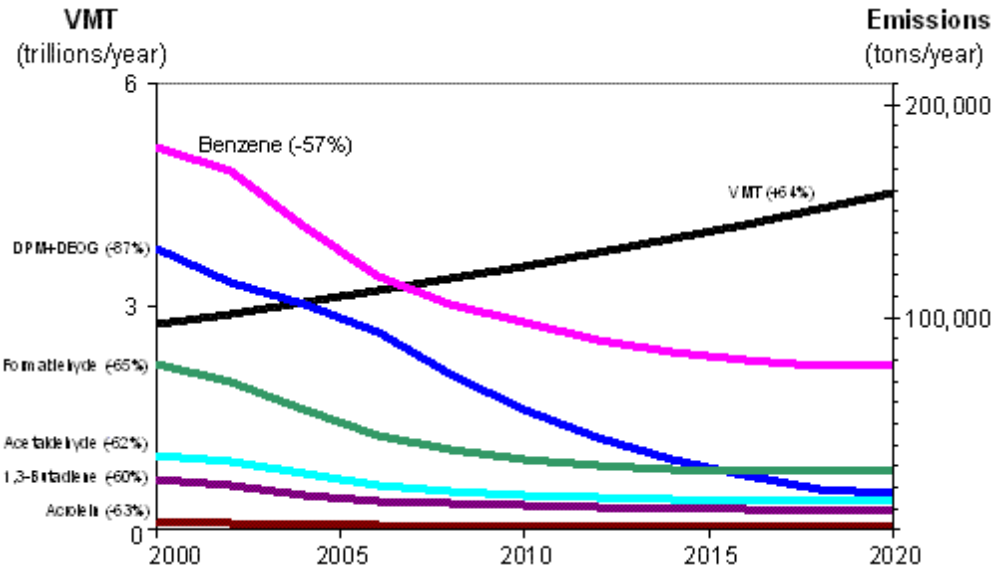
[2] The traffic volumes for the new location segment of Triangle Parkway between NC 540 and I-40 range from 104,200 ADT to 130,000 ADT.

are present in fuel and are emitted to the air when the fuel evaporates or passes through the engine unburned. Other toxics are emitted from the incomplete combustion of fuels or as secondary combustion products. Metal air toxics also result from engine wear or from impurities in oil or gasoline.

The EPA is the lead Federal Agency for administering the Clean Air Act and has certain responsibilities regarding the health effects of MSATs. The EPA issued a Final Rule on *Controlling Emissions of Hazardous Air Pollutants from Mobile Sources*. 66 FR 17229 (March 29, 2001). This rule was issued under the authority in Chapter 202 of the Clean Air Act (CAA). In its rule, EPA examined the impacts of existing and newly promulgated mobile source control programs, including its reformulated gasoline (RFG) program, its national low emission vehicle (NLEV) standards, its Tier 2 motor vehicle emissions standards and gasoline sulfur control requirements, and its proposed heavy duty engine and vehicle standards and on-highway diesel fuel sulfur control requirements. Between 2000 and 2020, FHWA projects that even with a 64 percent increase in vehicle miles traveled (VMT), these programs will reduce on-highway emissions of benzene, formaldehyde, 1,3-butadiene, and acetaldehyde by 57 percent to 65 percent, and will reduce on-highway diesel particulate matter (PM) emissions by 87 percent, as shown in Chart 5-1.

Chart 5-1

U.S. Annual Vehicle Miles Traveled (VMT) vs. Mobile Source Air Toxics Emissions, 2000-2020



Notes: For on-road mobile sources. Emissions factors were generated using MOBILE6.2. MTBE proportion of market for oxygenates is held constant, at 50%. Gasoline RVP and oxygenate content are held constant. VMT: Highway Statistics 2000, Table VM-2 for 2000, analysis assumes annual growth rate of 2.5%. "DPM + DEOG" is based on MOBILE6.2 generated factors for elemental carbon, organic carbon and SO4 from diesel-powered vehicles, with the particle size cutoff set at 10.0 microns.

On February 9, 2007 and under authority of CAA Chapter 202(l) EPA signed a final rule, *Control of Hazardous Air Pollutants from Mobile Sources*, which sets standards to control MSATs from motor vehicles. Under this rule, EPA is setting standards on fuel composition, vehicle exhaust emissions, and evaporative losses from portable containers. The new standards are estimated to reduce total emissions of MSATs by 330,000 tons in 2030, including 61,000 tons of benzene. Concurrently, total emissions of volatile organic compounds (VOC) will be reduced by over 1.1 million tons in 2030 as a result of adopting these standards.

Quantitative MSAT Analysis

As discussed above, there are technical shortcomings of emissions and dispersion models and uncertain science with respect to health effects prevent meaningful or reliable estimates of MSAT emissions and effects of this project. However, even though reliable methods do not exist to accurately and precisely estimate the health impacts of MSATs at the project level, it is possible to quantitatively assess future MSAT emissions trends due to the project. Although a quantitative analysis cannot identify and measure health impacts from MSATs, it can give a basis for identifying and comparing the potential differences among MSAT emissions - if any - from the various alternatives. The quantitative assessment presented below is derived in part from a study conducted by the FHWA entitled A Methodology for Evaluating Mobile Source Air Toxic Emissions Among Transportation Project Alternatives, found at:

www.fhwa.dot.gov/environment/airtoxic/msatcompare/msatemissions.htm

Scope and Methodology

For this project, the study area (Figure 5-1) included the project-level traffic forecast area plus any intersecting traffic analysis zones. Once this area was established, the Affected Transportation Network (Figure 5-1) was identified. Analysis years included base year 2006, first full opening year 2011 and design year 2030.

The simplest scope of analysis is to only calculate emissions for those roadway segments that would be constructed as part of the project. But in order to better capture the MSAT emissions that would be generated as a result of implementing the project, it's best to define an Affected Transportation Network. This would include the constructed roadway segments, as well as other links where traffic volumes are expected to change as a result of the project.

As a practical consideration, a volume change threshold needed to be adopted as the basis for including or excluding links in the affected transportation network. A volume change threshold of plus or minus five percent[3] was used and these thresholds were applied consistently for all analysis years and project alternatives.

Consequently, the vehicle miles traveled (VMT) estimates provided below do not reflect total VMT on the road network in the Triangle Parkway study area; rather, they reflect only the

[3] According to FHWA, the typical accuracy threshold of travel demand forecasting is plus or minus five percent AADT. Also, changes of plus or minus five percent AADT can affect changes of plus or minus ten percent or more in emissions on congested roadways.

VMT for roadway segments that meet the volume change threshold – that is roadway links experience a volume change of plus or minus five percent.

The MSAT emissions analysis was completed using FHWA's Easy Mobile Inventory Tool—or EMIT—released November 20, 2007. EMIT produced emissions for the six priority air toxic pollutants in tons per year using the following locale-specific input files:

- Vehicle Age Distributions
- VMT Fraction by Vehicle Classification
- VMT Fraction by Hour of Day
- Inspection/Maintenance Program
- Anti-Tampering Program
- Seasonal Fuel Specifications, Temperatures and Humidity
- Ramp Travel as a Percent of Interstate/Other Freeway VMT
- Emissions Due to Vehicle Engine Starts (Discounted from the Analysis)
- Highway Network Travel Data

The above data were obtained from a variety of sources, including the North Carolina Department of Environment and Natural Resources-Division of Air Quality, the National Climatic Data Center and the Triangle Regional Travel Demand Model (TRM). Where appropriate, the input parameters were the same as those used for the Triangle Area Transportation Conformity Determination Report (approved June 29, 2007). Highway Network Travel Data was developed from the TRM for the affected transportation network, and included the following information for each link: 1) length, average annual daily traffic (AADT), number of lanes, Highway Performance Monitoring System (HPMS) Area Type, HPMS Functional Classification, free flow speed and capacity.

MSAT Analysis Results

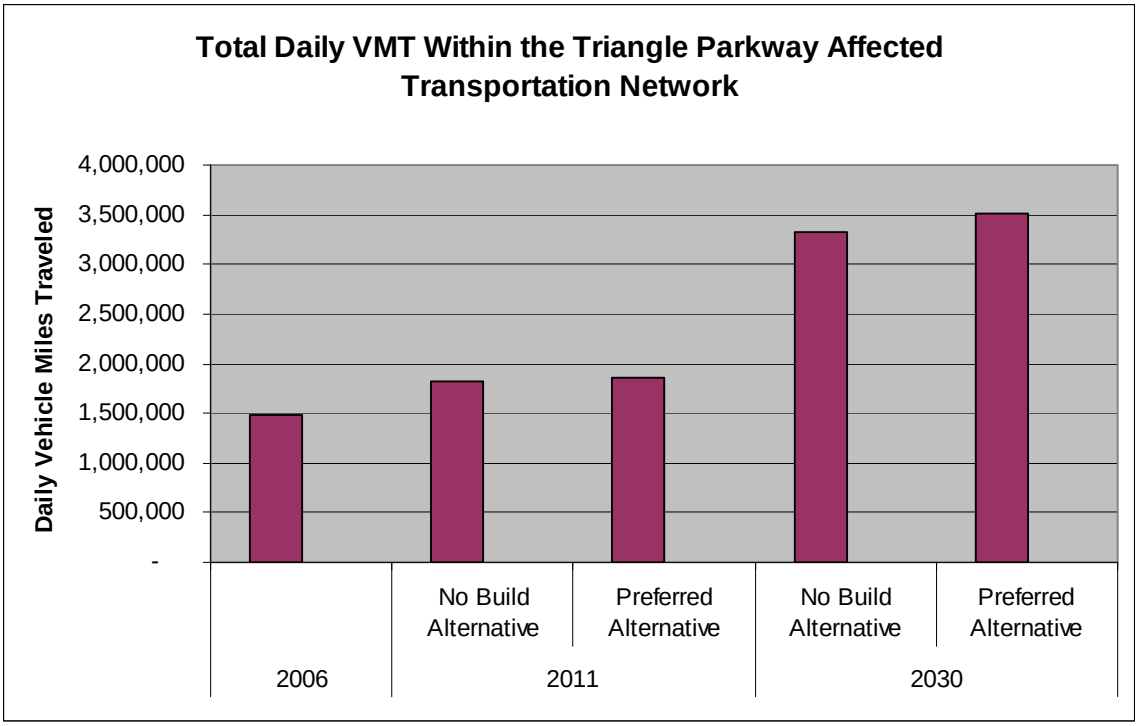
The amount of MSATs emitted in the region would be proportional to VMT. However, because of improvements in emissions technologies, total MSAT emissions will decline over time, even while VMT increases.

Within the Affected Transportation Network, VMT is expected to increase by 136 percent between 2006 and 2030. The majority of the increase in VMT would occur regardless of whether Triangle Parkway is completed. The estimated VMT in 2030 under the Preferred Alternative is approximately 5.7 percent higher than under the No-Build Alternative on the Affected Transportation Network[4] (Chart 5-2). This additional VMT contributes to the Preferred Alternative having slightly higher MSAT emissions compared to the No-Build

[4] Chapter 2.4 of the EA states that VMT in 2030 for the Preferred Alternative is predicted to decline by 1.85% compared to the No-Build Alternative. This calculation includes all roadway links that fall within the project's study area (Figure 1-1 in the EA). The disparity in VMT predicted for the affected transportation network and that predicted for the project's study area is due to the different geographic limits assumed for the calculations. The study area is much larger than the affected transportation network and encompasses a greater number of roadway links.

Alternative. However, the higher emissions could be somewhat offset by the operational improvements and reduced congestion on several north-south routes as a result of constructing the project, including NC 55, NC 54 and Davis Drive.

Chart 5-2



Regardless of the alternative chosen, MSAT emissions will be lower than present levels in the design year as a result of EPA's national control programs. On a national basis, these programs are projected to reduce MSAT emissions by 57 to 87 percent from 2000 to 2020. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions are likely to be lower in the future in virtually all locations.

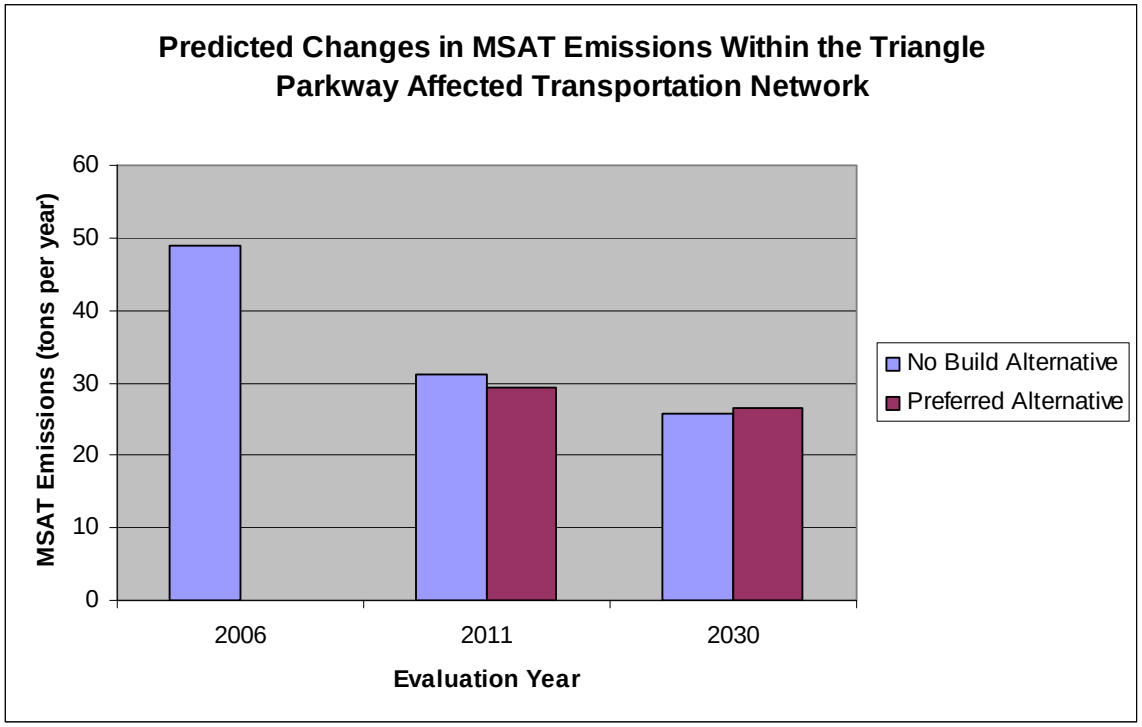
As shown in Table 5-3, MSAT emissions for the affected transportation network are predicted to decrease by 46 percent between 2006 and 2030 despite increases in VMT. Chart 5-3 also indicates that the differences in MSAT emissions between the No-Build Alternative and Preferred Alternative are nearly the same, varying by just 1.9 tons per year in 2011 and only 0.8 tons per year in 2030. In 2030 the MSAT emissions with the Preferred Alternative would be only slightly higher than under the No-Build Alternative, even though the Preferred Alternative accommodates 5.7 percent more VMT on the Affected Transportation Network. The greatest reductions in MSAT emissions are expected for Diesel Particulate Matter (DPM), Benzene and 1,3 Butadiene. Smaller reductions are anticipated for the remaining pollutants. Variations between the No-Build Alternative and Preferred Alternative are minor.

Table 5-3 Total Emissions for Each Air Toxic Pollutant in Tons per Year*

	2006	2011		2030		Percent change: 2006 to 2030
		No-Build Alternative	Preferred Alternative	No-Build Alternative	Preferred Alternative	
Benzene	21.22	13.97	12.58	12.24	12.53	-41%
DPM	13.83	7.10	7.22	1.86	1.97	-86%
1,3 Butadiene	2.25	1.60	1.48	1.50	1.55	-31%
Formaldehyde	8.20	5.97	5.62	7.20	7.45	-9%
Acetaldehyde	2.97	2.22	2.09	2.64	2.74	-8%
Acrolein	0.43	0.30	0.28	0.34	0.35	-18%
Totals	48.9	31.16	29.27	25.78	26.59	-46%

*For the Triangle Parkway Affected Transportation Network.

Chart 5-3



Because of the specific characteristics of the Triangle Parkway, which is a new roadway connecting NC 540 with I-40 and NC 147, there may be localized areas where VMT would increase, and other areas where VMT would decrease. Therefore it is possible that localized increases and decreases in MSAT emissions may occur. The localized increases in MSAT emissions would likely be most pronounced along the new Triangle Parkway. The new travel lanes to be constructed would have the effect of moving some traffic closer to nearby homes, schools and businesses; therefore, under the Preferred Alternative there may be localized areas where ambient concentrations of MSATs could be higher than under the No-Build Alternative. Diversion of other traffic to the Triangle Parkway would create a reduction in MSAT emissions along the majority of roadways that parallel the corridor. However, even if these increases do occur, they too would be substantially reduced in the future due to implementation of EPA's vehicle and fuel regulations.

In summary, MSAT emissions in 2030 are expected to be relatively similar under the Preferred Alternative relative to the No-Build Alternative. In comparing the Preferred Alternative to the No-Build Alternative, MSAT levels could be higher in some locations than others, but current tools and science are not adequate to reliably quantify them. However, on a regional basis, EPA's vehicle and fuel regulations, coupled with fleet turnover, will over time cause substantial reductions that will cause region-wide MSAT levels to be significantly lower than today. As this analysis shows, despite VMT increases from 2006 to 2030, MSAT emissions are still anticipated to decline considerably over the same period. The proposed project would not interfere with the substantial emissions reductions forecasted in the project area due to the implementation of EPA's regulations.

Unavailable Information for Project Specific MSAT Impact Analysis

This EA includes a basic analysis of the likely MSAT emission impacts of this project. However, available technical tools do not enable us to reliably predict the project-specific health impacts of the emission changes associated with the alternatives evaluated in the forthcoming EA. Due to these limitations, the following discussion is included in accordance with CEQ regulations (40 CFR 1502.22(b)) regarding incomplete or unavailable information:

Information that is Unavailable or Incomplete

Evaluating the environmental and health impacts from MSATs on a proposed highway project would involve several key elements, including emissions modeling, dispersion modeling in order to estimate ambient concentrations resulting from the estimated emissions, exposure modeling in order to estimate human exposure to the estimated concentrations, and then final determination of health impacts based on the estimated exposure. Each of these steps is encumbered by technical shortcomings or uncertain science that prevents a more complete determination of the MSAT health impacts of this project.

Emissions: The EPA tools to estimate MSAT emissions from motor vehicles are not sensitive to key variables determining emissions of MSATs in the context of highway projects. While MOBILE6.2 is used to predict emissions at a regional level, it has limited applicability at the project level. MOBILE6.2 is a trip-based model--emission factors are projected based on a typical trip of 7.5 miles, and on average speeds for this typical trip.

This means that MOBILE6.2 does not have the ability to predict emission factors for a specific vehicle operating condition at a specific location at a specific time. Because of this limitation, MOBILE6.2 can only approximate the operating speeds and levels of congestion likely to be present on the largest-scale projects, and cannot adequately capture emissions effects of smaller projects. For particulate matter, the model results are not sensitive to average trip speed, although the other MSAT emission rates do change with changes in trip speed. Also, the emissions rates used in MOBILE6.2 for both particulate matter and MSATs are based on a limited number of tests of mostly older-technology vehicles. Lastly, in its discussions of PM under the conformity rule, EPA has identified problems with MOBILE6.2 as an obstacle to quantitative analysis.

These deficiencies compromise the capability of MOBILE6.2 to estimate MSAT emissions. MOBILE6.2 is an adequate tool for projecting emissions trends, and performing relative analyses between alternatives for very large projects, but it is not sensitive enough to capture the effects of travel changes tied to smaller projects or to predict emissions near specific roadside locations.

Dispersion: The tools to predict how MSATs disperse are also limited. The EPA's current regulatory models, CALINE3 and CAL3QHC, were developed and validated more than a decade ago for the purpose of predicting episodic concentrations of carbon monoxide to determine compliance with the NAAQS. The performance of dispersion models is more accurate for predicting maximum concentrations that can occur at some time at some location within a geographic area. This limitation makes it difficult to predict accurate exposure patterns at specific times at specific highway project locations across an urban area to assess potential health risk. Along with these general limitations of dispersion models, FHWA is also faced with a lack of monitoring data in most areas for use in establishing project-specific MSAT background concentrations.

Exposure Levels and Health Effects: Finally, even if emission levels and concentrations of MSATs could be accurately predicted, shortcomings in current techniques for exposure assessment and risk analysis preclude us from reaching meaningful conclusions about project-specific health impacts. Exposure assessments are difficult because it is difficult to accurately calculate annual concentrations of MSATs near roadways, and to determine the portion of a year that people are actually exposed to those concentrations at a specific location. These difficulties are magnified for 70-year cancer assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over a 70-year period. There are also considerable uncertainties associated with the existing estimates of toxicity of the various MSATs, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population. Because of these shortcomings, any calculated difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with calculating the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against other project impacts that are better suited for quantitative analysis.

Summary of Existing Credible Scientific Evidence Relevant to Evaluating the Impacts of MSATs

Research into the health impacts of MSATs is ongoing. For different emission types, there are a variety of studies that show that some either are statistically associated with adverse health outcomes through epidemiological studies (frequently based on emissions levels found in occupational settings) or that animals demonstrate adverse health outcomes when exposed to large doses. Exposure to toxics has been a focus of a number of EPA efforts. Most notably, the agency conducted the National Air Toxics Assessment (NATA) in 1996 to evaluate modeled estimates of human exposure applicable to the county level. While not intended for use as a measure of or benchmark for local exposure, the modeled estimates in the NATA database best illustrate the levels of various toxics when aggregated to a national or state level.

The EPA is in the process of assessing the risks of various kinds of exposures to these pollutants. The EPA Integrated Risk Information System (IRIS) is a database of human health effects that may result from exposure to various substances found in the environment. The IRIS database is located at http://www.epa.gov/iris. The following toxicity information for the six prioritized MSATs was taken from the IRIS database Weight of Evidence Characterization summaries. This information is taken verbatim from EPA's IRIS database and represents the Agency's most current evaluations of the potential hazards and toxicology of these chemicals or mixtures.

- **Benzene** is characterized as a known human carcinogen.
- The potential carcinogenicity of **acrolein** cannot be determined because the existing data are inadequate for an assessment of human carcinogenic potential for either the oral or inhalation route of exposure.
- **Formaldehyde** is a probable human carcinogen, based on limited evidence in humans, and sufficient evidence in animals.
- **1,3-butadiene** is characterized as carcinogenic to humans by inhalation.
- **Acetaldehyde** is a probable human carcinogen based on increased incidence of nasal tumors in male and female rats and laryngeal tumors in male and female hamsters after inhalation exposure.
- **Diesel exhaust** (DE) is likely to be carcinogenic to humans by inhalation from environmental exposures. Diesel exhaust as reviewed in this document is the combination of diesel particulate matter and diesel exhaust organic gases.
- **Diesel exhaust** also represents chronic respiratory effects, possibly the primary non-cancer hazard from MSATs. Prolonged exposures may impair pulmonary function and could produce symptoms, such as cough, phlegm, and chronic bronchitis. Exposure relationships have not been developed from these studies.

There have been other studies that address MSAT health impacts in proximity to roadways. The Health Effects Institute, a non-profit organization funded by EPA, FHWA, and industry, has undertaken a major series of studies to research near-roadway MSAT hot spots, the health implications of the entire mix of mobile source pollutants, and other topics. The final summary of the series is not expected for several years.

Some recent studies have reported that proximity to roadways is related to adverse health outcomes -- particularly respiratory problems.[5] [6]

Much of this research is not specific to MSATs, instead surveying the full spectrum of both criteria and other pollutants. The FHWA cannot evaluate the validity of these studies, but more importantly, they do not provide information that would be useful to alleviate the uncertainties listed above and enable us to perform a more reliable, comprehensive evaluation of the health impacts specific to this project.

Relevance of Unavailable or Incomplete Information to Evaluating Reasonably Foreseeable Significant Adverse Impacts on the Environment, and Evaluation of impacts based upon theoretical approaches or research methods generally accepted in the scientific community

Because of the uncertainties outlined above, a quantitative assessment of the effects of air toxic emissions impacts on human health cannot be reliably made at the project level. While available tools do allow us to reasonably predict relative emission changes between alternatives for larger projects, the amount of MSAT emissions from each of the project alternatives and MSAT concentrations or exposures created by each of the project alternatives cannot be predicted with enough accuracy and precision to be useful in estimating health impacts. (As noted above, the current emissions model is not capable of serving as a meaningful emissions analysis tool for smaller projects.) Therefore, the relevance of the unavailable or incomplete information is that it is not possible to make a determination of whether any of the alternatives would have "significant adverse impacts on the human environment."

In this EA, FHWA and NCTA have provided a quantitative analysis of MSAT emissions relative to the various alternatives, and has acknowledged that the Preferred Alternative may result in increased exposure to MSAT emissions in certain locations, although the concentrations and duration of exposures are uncertain, and because of this uncertainty, the health effects from these emissions cannot be reliably estimated.

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[5] South Coast Air Quality Management District, Multiple Air Toxic Exposure Study-II (2000); Highway Health Hazards, The Sierra Club (2004) summarizing 24 Studies on the relationship between health and air quality); NEPA's Uncertainty in the Federal Legal Scheme Controlling Air Pollution from Motor Vehicles, Environmental Law Institute, 35 ELR 10273 (2005) with health studies cited therein.

[6] Department of Preventive Medicine, University of Southern California Los Angeles, et. al. *Effect of exposure to traffic on lung development from 10 to 18 years of age: a cohort study*. The Lancet, (2007).

5.1.15 Economic Impacts

The construction of the project would have an immediate benefit to the economy during the construction phase of the project. This effect from construction would be temporary. Once construction is complete, the Preferred Alternative will provide long term improvements to the Triangle transportation network.

Triangle Parkway would provide an additional connection to major freeways within the Triangle Region in addition to removing traffic from several of the roads through RTP. Each of these improvements would economically benefit people traveling through the area by freeway, within the Triangle region, and directly within RTP though travel time savings.

The tolls collected would have the potential of impacting people from the cost of using the roadway. These costs are anticipated to be minimal in comparison to the expense of continued traffic congestion without the project and time savings potentially gained with the project. For people who do not wish to benefit from the new roadway, existing non-toll routes will still be available. These alternative routes include I-40, NC 54, NC 55, and Davis Drive. The choice to use the existing roads would reduce potential hardships or personal financial impacts that could potentially be created by the toll fee.

The tolls collected for the use of the roadway could be considered a type of payment for service or user fee. Current legislation requires the toll money collected to be used specifically to pay the bond money borrowed to build the road in addition to operating costs and maintenance cost needed for roadway. After the bonds for the roadway are completely paid, the tolls for the roadway will be removed and the road would be owned and maintained by the North Carolina Department of Transportation (NCDOT).

Using bonds and the toll fees to support the construction of the project could ultimately benefit the State, counties, and local municipalities since the use of the traditional transportation funds are not being expended. The continued availability of these funds could allow other types of improvements in the area to be implemented.

Overall the Preferred Alternative currently proposed with tolls, and in the distant future with the potential removal of the tolls, is anticipated to have positive impact for users and the area's economy.

5.2 Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, provides that "each Federal agency make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health and environmental effects of its programs, policies, and activities on minority populations and low-income populations." In many ways, the Executive Order is an affirmation of Title VI of the Civil Rights Act of 1964, which already requires there be no discrimination on the basis of race, color, national origin, age, sex, or disability, in all Federally-assisted programs.

The project area has a lower percentage of low-income and minority populations than in the surrounding area. There is one minority or low-income property directly impacted by the project. To the extent that low-income or minority residents are impacted, the impacts are not disproportionately higher.

The surrounding regions, as discussed in Chapter 4, do include some low-income areas where people could choose to use the Triangle Parkway. Some low-income persons may be less likely to choose Triangle Parkway because of the toll fee, which was estimated at $1.00 in the Preliminary Traffic and Revenue Study. A daily toll fee would comprise a greater percentage of a low-income budget as opposed to a higher income budget. . In addition to paying tolls, electronic toll collection involves establishing an account and some low-income users may not be willing or able to establish an account. The specific payment options have not yet been determined.

One of the criteria for toll roads is that there must be a free alternative route. Free alternative routes such as I-40, NC 54, NC 55 and Davis Drive are currently available. NC 55 and NC 54 provide parallel existing routes to the west and east of Triangle Parkway, and Davis Drive extends throughout the project vicinity. If the toll fee causes financial hardship on some individuals, the free transportation status of these three routes, along with I-40, are still available for use. In addition, some persons who do not use the toll facility may still gain benefit from its effects on travel time savings with the reduced traffic volume on surrounding free routes. Lastly, it is also important to note that the project is located in, and primarily serves, a relatively high-income area. For further information on income levels in the project area, refer to Chapter 4.

The construction of the Preferred Alternative will not have a disproportionately high and adverse impact to minorities or low-income populations by acquiring property, changing land use patterns, eliminating transportation services, or by substantially impacting human health or the natural environment.

5.3 Construction

Impacts from ground disturbing activities will occur during construction within the project right-of-way. Construction activities related to the project are estimated to extend over an approximate two year time span; examples of some of the construction activities would include:

- Clearing and Grubbing
- Maintenance of Traffic
- Bridge Construction
- Utility Relocations
- Traffic Signal Construction
- Toll Collection Construction
- Roadway Paving

Clearing and grubbing of approximately 170 acres of land will be required to construct the project. This area includes land specifically needed for the roadway based on the roadway typical section shown in Chapter 3, in addition to areas needed at the base of the slopes for mechanized clearing. Additional activities during the construction would include coordination with the utility companies and maintaining traffic during the construction of the interchanges at Hopson Road and Davis Drive.

A temporary peak in economic benefit from working contractors and construction workers would be a benefit from the Preferred Alternative. Typical types of negative impacts from construction would include noise from construction equipment, driver time delays at existing road crossings, and dust from construction sites. The natural environment impacts associated with the construction of the Triangle Parkway and the permits required prior to construction are identified in Chapter 5.5. Since construction operations would be limited to the time needed to complete the project, both benefits and impacts to resources would be considered temporary. To minimize these temporary impacts, NCTA will follow the NCDOT standards and specifications to ensure that these impacts are minimized.

5.4 Aesthetics

There are no natural features identified within the project area that would have any unique visual or aesthetic values for which public scenic protection or designation would be needed. Given the growth plan described in local planning documents, residential and commercial development in the area is expected to change the somewhat rural atmosphere of undeveloped land to one of a more developed, suburban character. Currently, this growth plan is visually apparent throughout the project area with many construction projects in progress.

Constructing a major facility such as Triangle Parkway in close proximity to established businesses could cause some visual and aesthetic effects by removal of areas of vegetation. While some businesses are set back some distance from the proposed roadway, others are quite close to the proposed project and some visual effects may occur. Some residents in the Kitts Creek neighborhood, which is currently under construction, may be able to see the Triangle Parkway from their homes.

Overall, Triangle Parkway is not anticipated to have a substantial visual or aesthetic impact to community resources within the project area or in the surrounding areas.

5.5 Natural Environment Impacts

Impacts from the construction of the Preferred Alternative are summarized in Table 5-1. Impacts were quantified using functional design plans developed based on land disturbing activities anticipated from the construction of the Preferred Alternative. The following sections summarize potential impacts and compensatory mitigation measures, as appropriate for negative impacts, to natural resources located within the project area.

5.5.1 Water Resource Impacts

Triangle Parkway would be built entirely on new location. Construction activities will include building new bridges and culverts over surface waters or placing pipes in stream channels. The construction activities associated with the project will strictly follow NCDOT's Best Management Practices for Construction and Maintenance Activities (BMP-CMA) and Protection of Surface Waters (BMP-PSW). Sedimentation control guidelines will be strictly enforced during the construction stages of the project. (See Table 5-4 for details on stream and wetland impacts)

Table 5-4 Preferred Alternative Jurisdictional Wetland and Stream Impacts

WETLAND IMPACTS (acres)				
Feature Name	Cut/Fill Impacts	Clearing Impacts[1]	Temporary Impacts[2]	Total
Wetland MWA	0.025	0.029	0.000	0.054
Wetland MWB*	0.110	0.000	0.000	0.110
Wetland MWD*	0.705	0.000	0.000	0.705
Wetland MWF*	0.412	0.000	0.000	0.412
Wetland NWC*	0.064	0.000	0.000	0.064
Wetland NWD*	0.304	0.000	0.000	0.304
Wetland NWE	0.081	0.203	0.000	0.284
Wetland NWH	0.000	0.008	0.000	0.008
3	0.014	0.025	0.000	0.039
4	0.024	0.045	0.000	0.069
TOTAL ACRES	**1.739**	**0.310**	**0.000**	**2.049**
PERENNIAL STREAM IMPACTS (feet)				
Feature Name	Cut/Fill Impacts	Clearing Impacts[1]	Temporary Impacts[2]	Total
Stream MSA	269.0	92.0		361.0
Stream MSB	287.0	104.0		391.0
Stream MSC	1427.0	129.0		1556.0
Stream MSCB*	606.0	0.0		606.0
Stream NSB	45.0	0.0		45.0
Stream NSD	0.0	0.0	1126.0	1126.0
Stream NSL	164.0	132.0	125.0	421.0
3	15.0	65.0		80
4	20.0	41.0		61
TOTAL FEET	**2833.0**	**563.0**	**1251.0**	**4647.0**
INTERMITTENT STREAM IMPACTS (feet)				
Feature Name	Cut/Fill Impacts	Clearing Impacts[1]	Temporary Impacts[2]	Total
Stream MSBA	141.0	133.0		274.0
Stream MSBB*	169.0	0.0		169.0
Stream MSCB*	677.0	0.0		677.0
Stream MSCBA*	278.0	0.0		278.0
Stream MSCC	183.0	40.0		223.0
Stream NSD*	1504.0	293.0		1797.0
Stream NSF*	32.0	0.0		32.0
Stream NSLA	24.0	241.0		265.0
Stream NSLF*	156.0	211.0		367.0
TOTAL FEET	**3164.0**	**918.0**	**0.0**	**4082.0**

[1] Clearing impacts based on 40 feet beyond slope stake limits.

[2] Temporary impact totals include clearing impacts.

* Indicates a "Total Take"

5.5.2 Flood Hazard Evaluation

The proposed project crosses several streams systems and this project will affect designated flood hazard zones.

According to Flood Insurance Rating Maps (FIRM) published by the Federal Emergency Management Agency (FEMA), the majority of the project area is not located in a flood hazard area. However, the proposed alignment of Triangle Parkway will cross several streams that have designated flood hazard areas or for which base flood elevations have been determined. Floodplain impacts are summarized in Table 5-5 and shown in Appendix A; and flood hazard designations shown on FIRM Community Panels for the proposed stream crossings are described below.

The Preferred Alternative will impact designated floodway zones in the project area by placement of new culverts, extension of existing culverts, and placement of a bridge at Burdens Creek. Hydraulic design for these drainage systems will not create constraints to flow so that floodways upstream of the project will not be affected by placement of these structures.

Table 5-5 Anticipated Impacts to Floodplains

Community Type	Estimated		
	Acres Present in Project Area	Percentage of Study Area	Impacts (acres)
Floodplain: Panel 0746	9.5	1.0	0.0
Floodplain: Panel 0747	18.1	2.0	0.0
Floodplain: Panel 0737	18.6	2.0	12.3
Floodplain: Panel 0738	17.1	1.9	0.3

5.5.3 Biotic Resources

This chapter summarizes the potential impacts to the existing vegetation and associated wildlife that occur within the project area. The biotic communities are described in Chapter 4.6.4.

Plant Communities (Flora)

As noted in Chapter 4.6.4, there are nearly 1,210 acres of plant communities in the project area. Potential impacts to these communities are identified in Table 5-6.

Table 5-6 Anticipated Impacts to Terrestrial Communities

Community Type	Impacts (acres)
Piedmont Alluvial Forest	33.2
Mixed Pine/Hardwood Forest	64.0
Oak-Hickory Forest	8.5
Urban/Disturbed Community	49.0
Totals	154.7

Wildlife (Fauna)

Species that may be associated with the plant communities described previously are described in Chapter 4.6.4. Temporary fluctuation in populations of animal species which utilize terrestrial areas is anticipated during the course of construction. Many of the vertebrate species occupying the project area have adapted to man-dominated environments and readily move through the local communities. Slow-moving, burrowing, and subterranean organisms will be directly impacted by construction activities, while mobile organisms will be displaced to adjacent communities. Habitat reduction can occur when project construction affects undisturbed areas surrounding an existing man-dominated environment. When this occurs, competitive forces in the adapted communities will result in a redefinition of population equilibrium.

Impacts to Terrestrial Communities

Habitat fragmentation is not likely to be a major effect from the Preferred Alternative. Most of the area in the project vicinity is already fragmented; there are few large areas of contiguous terrestrial forested habitats. Estimates of impacts to terrestrial communities are based on the construction limits of the Preferred Alternative and are expected to be less depending on final design requirements for cut and fill slopes. Table 5-9 provides an overview of anticipated terrestrial community impacts from the Preferred Alternative.

5.5.4 Impacts to Aquatic Communities

Aquatic organisms are very sensitive to the discharges and inputs resulting from construction activities. Impacts usually associated with in-stream construction include increased channelization and scouring of the streambed. In-stream construction alters the substrate and impacts adjacent stream-side vegetation. Such disturbances within the substrate lead to increased siltation that can clog the gills and feeding mechanisms of benthic organisms, fish, and amphibian species. The populations of these organisms are slow to recover and may not do so once a stream has been severely impacted.

5.5.5 Chapter 401 and Chapter 404 Jurisdictional Areas

In accordance with Chapter 404 of the Clean Water Act (33 U.S.C. 1344) and Chapter 401 of the CWA (33 USC 1341), impacts to the jurisdictional areas from the Preferred Alternative were identified and coordinated with the responsible regulatory agencies; USACE and NCDWQ. The impacted areas are located within the Cape Fear River basin, which currently does not include riparian buffer rules regulated by the NCDWQ.

Impacts to Jurisdictional Areas

The Preferred Alternative will directly impact 4,647 linear feet of perennial streams and 4,082 linear feet of intermittent streams based on preliminary design cut and fill slopes and clearing limits. There are no isolated stream impacts. The Preferred Alternative will also impact 2.05 acres of jurisdictional wetlands. There are no isolated wetlands or surface water impacts. Table 5-4 provides details on stream and wetland impacts. Due to the location of certain stream channels within the project area, it is possible that stream relocation will be necessary as a result of construction activities.

5.5.6 Permitting and Mitigation

Permits will be required for roadway encroachment into jurisdictional wetlands and surface waters. The type of activity, the extent of the impacts, and the specific environment impacted will be considered by the Wilmington District of the USACE before a determination is made to authorize use of a permit, the requirements attached to the permit, and the type of permit to be issued by the agency. The USACE issues general and individual permits. Nationwide permits (NWP) are a type of general permit used throughout the United States that authorize certain activities that are considered routine and that are expected to have minimal adverse consequences to the environment. A regional general permit (GP) is specific to the Wilmington District for waters and wetlands of North Carolina; the District establishes the associated conditions. These permits are issued for specific activities that are expected to result in limited environmental impact. Individual permits are required for projects that do not meet the requirements for an NWP or GP. An individual permit requires a full public interest review, including public notices and coordination with involved agencies, interested parties, and the general public.

Permit Issues

The USACE Wilmington District issues an Individual Permit (IP) for projects that result in 0.5 acre or more of fill to aquatic resources or 300 linear feet or more of stream impacts or if the project is considered by the agency to be a major action. The Raleigh Regional Field Office of the USACE reviews and approves permit applications for Durham and Wake Counties. Since more than 300 linear feet of stream are being impacted and more than 0.5 acre of wetland are being impacted, the project will require an IP.

A Chapter 401 General Water Quality Certification (WQC) is required for any activity, including maintenance or construction activities which may result in a discharge into Waters of the US. The NCDWQ issues a Water Quality Certification which corresponds to the Chapter 404 Permit. In addition, impacts to waters deemed isolated by the USACE will require an isolated waters permit from the NCDWQ

Compensatory Mitigation

Mitigation policy, which has been established by Chapter 404(b)(1) Guidelines of the Clean Water Act (40 CFR 230), FHWA step-down procedures (23 CFR 777.1 et seq.), Executive Order 11990 (42 FR 26961 [1977]), USFWS mitigation policy directives (46 FR 7644-7663 [1981]), and the Council on Environmental Quality (CEQ), embraces the concepts of "no net loss of wetlands" and sequential consideration of avoidance, minimization, and mitigation. Compensatory mitigation is sought only after all reasonable efforts have been made to avoid or minimize impacts.

Avoidance

According to a 1990 Memorandum of Agreement (MOA) between the USEPA and the USACE in determining "appropriate and practicable" measures to offset unavoidable impacts, such measures should be appropriate to the scope and degree of those impacts and practicable in terms of cost, existing technology, and logistics in light of overall project purposes.

The Preferred Alternative incorporates measures to avoid streams and wetlands. Bridging is proposed in the functional designs for Burdens Creek in the northern part of the project area.

Minimization

Minimization typically focuses on decreasing the footprint of the proposed project through the reduction of median widths, right-of-way widths, fill slopes, and/or road shoulder widths.

The Preferred Alternative includes a split-diamond interchange at Davis Drive and Hopson Road. This design minimizes stream and wetland impacts when compared to Design Option 1, a modified cloverleaf interchange. In addition, a retaining wall is recommended along the EPA property line, minimizing impacts to the unnamed tributary to Burdens Creek. Additional minimization could be achieved through use of bottomless culverts and steeper fill slopes, where feasible.

Compensatory Mitigation

Appropriate and practicable compensatory mitigation is required for unavoidable adverse impacts which remain after all appropriate and practicable minimization measures have been incorporated. It is the decision of the USACE and the NCDWQ whether to require mitigation for impacts associated with project construction.

The USACE has the discretion to require compensatory mitigation for any impacts to Waters of the US. In some cases, compensatory mitigation requirements may be offset by on-site mitigation activities. On-site restoration can include removal of existing fill materials at old bridge end bents, stabilization of degraded streams, and restoration of floodplains surrounding new bridges.

An off-site mitigation program based on in-lieu fee payments made to the North Carolina Department of Environment and Natural Resources (DENR) Ecosystem Enhancement Program (EEP) was established by the "Memorandum of Agreement Among the North Carolina Department of Environment and Natural Resources, the North Carolina Department of Transportation, and the US Army Corps of Engineers, Wilmington District" (MOA), dated July 22, 2003. Coordination with the regulatory agencies during NCTA monthly meetings determined that payment of an in-lieu fee would be an available option for off-site mitigation to satisfy any Federal Clean Water Act compensatory mitigation requirements for this project.

5.5.7 Federally Protected Species

Species identified by the United States Fish and Wildlife Service (USFWS) as occurring in the project area are described in Chapter 4.6.7 and are listed in Table 4-16. Appropriate habitat for smooth coneflower and Michaux's sumac was found during natural resources investigations in the study area. The effect on these species is discussed below.

Smooth coneflower (*Echinacea laevigata*)

Federal Status: Endangered

State Status: Endangered – Special Concern

Biological Conclusion: **No Effect**

High-voltage powerline easements crossing the study area along three separate transects in the northern portion of the study area, both north and south of Hopson Road, provide potential smooth coneflower habitat in the project area. A bloom time field survey was conducted on

June 30, 2006 and no populations of smooth coneflower were found after ten man-hours of search time. In a letter dated August 11, 2006, the USFWS Raleigh Regulatory Office concurred with a biological conclusion of No Effect for this species (see Appendix D).

Michaux's sumac (*Rhus michauxii*)

Federal Status: Endangered

State Status: Endangered – Special Concern

Biological Conclusion: **No Effect**

The study area provides appropriate habitat for Michaux's sumac in the open areas found along the routinely maintained roadway right-of-ways and two open fields. A review of NCNHP maps confirms that no known populations of Michaux's sumac occur within a one-mile radius of the project study area boundaries. A bloom time field survey was conducted on June 30, 2006 and no populations of Michaux's sumac were found after ten man-hours of search time. In an August 11, 2006 letter (see Appendix D) the USFWS concurred with a biological conclusion of No Effect for this species. Appropriate habitat for the remaining four species listed in Table 4-16 was not found during field investigations in the study area. These species are red-cockaded woodpecker (*Picoides borealis*); Cape Fear shiner (*Notropis mekistocholas*); dwarf wedge mussel (*Alasmidonta heterodon*); and harperella (*Ptilimnium nodosum*). The appropriate biological conclusion for these species is **No Effect**.

5.5.8 Federal Species of Concern and State Listed Species

As discussed in Chapter 4.6.8 the Jenkins Road diabase dike formation has been designated by the NCNHP designated as a Significant Natural Heritage Area (Site ID 2527). The Hopson Road interchange will impact 3.4 acres along the forested east side of this NCNHP site.

6.0 Indirect and Cumulative Effects

The Council on Environmental Quality describes indirect impacts as those "that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable" (40 CFR 1508.8). Cumulative effects are "impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions" (40 CFR 1508.7).

A Community Impact Assessment and Qualitative Indirect and Cumulative Effects Assessment for Triangle Parkway TIP Project No. U-4763B (January 2008) and two addendums (Triangle Parkway U-4763B Addendum to CIA/ICE Report for NC 540 Widening and Triangle Parkway U-4763B Kit Creek Road Addendum to CIA/ICE Report) have been incorporated by reference. These reports were prepared to assess the potential indirect and cumulative effects of the project. The information from the indirect and cumulative effects assessment is summarized in this Chapter as it relates to the Preferred Alternative.

6.1 Methodology

The methodology used to identify and assess the potential indirect and cumulative effects (ICE) for the project followed the NCDOT Guidance for Assessing Indirect and Cumulative Impacts of Transportation Projects in North Carolina (North Carolina Department of Transportation / Department of Environment and Natural Resources, November 2001) and the NCDOT/NCDENR Indirect and Cumulative Impact Assessment Guidance Integrated NEPA/SEPA/401 Eight-Step Assessment Process (January 2004).

This methodology included, as first steps, defining ICE study boundaries and inventorying notable features within this ICE study area. Several techniques are identified in the NCDOT Guidance on Indirect and Cumulative Impacts Assessment for setting physical boundaries for an ICE study area. Study area boundaries are typically based upon municipal boundaries, commute sheds (or travel patterns), growth boundaries, service area limit, watersheds, and natural features. NCDOT Guidance defines notable features as an overarching term encompassing the following aspects of the environment:

- Sensitive species and habitats
- Valuable environmental components
- Relative uniqueness, recovery time, and unusual landscape features, and
- Vulnerable elements of the population
- Man-made (i.e. schools, railroad corridors, etc.)

The local perspective, specifically for the Triangle Parkway project, was gained through interviews with planners from the Durham City/County Planning Department; the Town of Morrisville; the Town of Cary; and the RTF, which manages the RTP. Potential indirect and cumulative effects generated from the project were then evaluated through identifying impact-causing activities and assessing these activity effects on both the human and natural environmental resources. Based upon conversations with local planners and the projected time-lines of the land use and transportation plans, a 20-year timeframe was used for this ICE study.

6.2 ICE Study Area Description

The study area for ICE generally represents indirect effect boundaries for the project plus the cumulative effect boundaries. The cumulative effect boundaries incorporate other past and present projects within the project vicinity in addition to projects planned within the foreseeable future. Factors considered in defining the boundaries included:

- Availability of developable land and infrastructure,
- The presence of the preserved corridor,
- Properties with restrictions on development,
- Areas where the Triangle Parkway users could save travel time, and
- Areas where cumulative impacts of this project could occur.

Field data was collected on March 30, 2006 and April 3, 2006. Available written materials related to local/regional regulations, geographic data, watershed boundaries, and municipal boundaries were also obtained, including several land use plans, transportation plans, comprehensive plans, and zoning guidelines. This information was gathered through local town and county websites, interviews with local planners, RTF and state agencies, GIS databases, and other sources.

The resulting boundaries define an area called the Future Land Use Study Area (FLUSA) or ICE Study Area. Based upon current travel patterns, land use and transportation plans, existing neighborhoods and businesses, and future development plans, the FLUSA encompasses an approximate two-mile area around the project corridor (See Figure 6-1). The FLUSA is the area within which Triangle Parkway has the potential to induce land use changes and will determine the data collection and analysis area, but will not necessarily be the extent of the growth impact that is expected to occur.

For the FLUSA, an Extended Demographic Area (EDA) was defined with several census block groups to represent the demographic trends within the FLUSA (see Figure 6-1). The EDA includes distinct areas defined within the 2000 Census and is larger than the demographic area discussed in Chapter 4. The EDA includes the following census block groups:

- Durham County Census Tract 20.10, Block Group 2;
- Durham County Census Tract 20.14, Block Groups 1, 2, and 3;
- Durham County Census Tract 20.13, Block Groups 1, 2, and 3; and
- Wake County Census Tract 536, Block Groups 1 and 2.

6.3 ICE Study Area Direction and Goals

In order to assess the community's goals for development, a thorough understanding of the demographic economic, social, and environmental trends within the ICE Study Area (FLUSA) is necessary. Understanding these trends is also a key component to understanding potential induced growth issues. City and County land use plans, accompanying zoning ordinances, regional open space plans, sewer/water service areas, and engineering evaluation data were collected and reviewed. Economic Development Agency forecasts and reports, thoroughfare plans, and other relevant studies were also reviewed. In addition, interviews were held with planners from the Durham City/County Planning Department; the Town of Morrisville; the Town of Cary; and the RTF. Watershed and water supply protection areas and accompanying land use restrictions and permitting regulations were also evaluated.

6.3.1 Population Trends

A comparison in population growth between 1990 and 2000 of the EDA was made to surrounding counties in the region, as well as in the state. As shown in Table 6-1, growth during this decade was strong, with population more than doubling for the EDA. Wake County also experienced strong growth, although not nearly as much as the previously mentioned areas. In comparison, growth in Durham County and the state was more moderate. There is still land available for development in the EDA, and it is reasonable to assume, given the past trends and the field observations of land for sale and areas under construction, that residential, commercial and industrial growth will remain strong for some time.

Table 6-1 Regional Population Growth Trends, 1990-2000

	1990 Total Population	2000 Total Population	Population Percent Change 1990-2000
North Carolina	6,628,637	8,049,313	21.4%
Durham County	181,835	223,314	22.8%
Wake County	423,380	627,846	48.3%
Extended Demographic Area	10,271	22,319	117.3%

Source: US Census Bureau, 1990 and 2000

Table 6-2 shows population growth trends with projections between 1980 and 2020 in Durham County, Wake County, and the state. Between 1980 and 1990, Wake County had a strong growth rate, especially compared to the state's 12.8 percent growth during the same period. Between 1990 and 2000 Durham County and the state had similar growth percentages, while Wake County grew at a faster rate than either Durham County or the state. Wake County is projected in the future during both 2000 through 2010 and 2010 through 2020 to continue to outpace both Durham County and the state in population growth.

Table 6-2 County and State Population Growth Trends and Projections 1980-2020

Year	Durham County	Wake County	North Carolina	Durham County Growth by Decade	Wake County Growth by Decade	North Carolina Growth by Decade
1980	152,235	301,429	5,880,095	1980-1990 19.4%	1980-1990 41.4%	1980-1990 12.8%
1990	181,844	426,311	6,632,448	1990-2000 22.8%	1990-2000 47.3%	1990-2000 21.3%
2000	223,318	627,866	8,046,813	2000-2010 16.4%	2000-2010 36.9%	2000-2010 15.8%
2010	260,010	859,649	9,315,141	2010-2020 14.4%	2010-2020 28.7%	2010-2020 14.7%
2020	297,461	1,106,218	10,682,217			

Source: North Carolina State Data Center in February 2007

The North Carolina State Demographics Center provides a listing of the top 72 fastest growing municipalities in North Carolina for the period between April 2000 and July 2005. Morrisville ranked number five on the list, with a growth in population of 132.83 percent during the studied time period. Raleigh and Cary also were included on the list, at 17.79 percent and 16.39 percent growth, respectively.

6.3.2 Land Use and Development Trends

Several existing and future land use plans are in place within the FLUSA; these plans are discussed in Chapter 4.2. These plans outline types of land use currently maintained with existing policies such as zoning ordinances and identify the land use patterns planned ten to 20 years in the future. In addition, each of the local and municipal plans includes or references the proposed Triangle Parkway. For example, Triangle Parkway was identified within the original RTP Master Plan; RTF prevented development on RTP property reserved for the Triangle Parkway; and Triangle Parkway has continued to be included within updated and adopted land use plans.

The Research Triangle Park Southern Portion Conceptual Development Plan notes that Triangle Parkway will improve regional access into RTP for commuters and ensure RTP's ability to attract new businesses. There are still approximately 530 acres available within the Park for development. This provides open opportunities for a large number of additional research-oriented businesses and jobs. Based on RTP Planning, research-oriented businesses and jobs are expected to remain the dominant force in the FLUSA and have shown increased growth in the past without the Triangle Parkway. The RTF is studying options to increase the density of development within RTP. Based on the projected census data, RTP is projected to continue this growth. Discussions with RTP representatives indicated that the growth within RTP would continue with or without the project; however, the rate of this growth would likely increase in the area since the project would provide additional roadway capacity within the area. The Preferred Alternative would provide access and remain consistent with plans for local business development and improved traffic flow to those businesses.

Triangle Parkway is included in the Town of Morrisville Land Use Plan (November 2003). The Plan shows low density residential land use adjacent to the parkway. The plan shows Triangle Parkway extending from Durham County to the McCrimmon Parkway; however, the very southern portion of this proposed road (from NC 540 to McCrimmon Parkway) is shown as major thoroughfare rather than a freeway. Interchanges are proposed at Davis Drive and the NC 540. The non-freeway portion corresponds to STIP Project No. U-4763 A and is not part of the Triangle Parkway project.

The North Morrisville – Shiloh Small Area Plan (January 2003) indicates that the area around Kit Creek Road may become isolated following the construction of NC 540 and Triangle Parkway, which may make the area suitable for lower density residential development. A major objective of this plan is to disperse traffic over as may different travel corridors as possible. The plan notes that Triangle Parkway will limit east-west travel except at planned overpasses and underpasses. The Preferred Alternative includes construction of the Kit Creek Connector with a bridge over Triangle Parkway. This connection from Church Street to Davis Drive would provide an east-west connection consistent with the goals of this plan. The Kit Creek Road connector is included at the request of the Town of Morrisville. The most recent Town of Morrisville Project Map (August 2005) shows both commercial and residential land development projects approved or under review within the extraterritorial jurisdictional boundary of the Town. Local planners indicated that the map is current for the FLUSA with the addition of Lenovo. There are several residential developments

shown on the map near the proposed Triangle Parkway. These include Shiloh Grove subdivision, Providence Place subdivision, and Kitts Creek subdivision.

The Durham Comprehensive Plan (Adopted February 2005, Amended August 2007) established a series of development "Tiers" to guide growth and development in the Durham area. New development and redevelopment are to be guided in each Tier through the establishment of policies and development regulations that draw on their distinct character. Triangle Parkway is located within the Suburban Tier. The development focus of this Tier is to ensure that there is sufficient land to accommodate anticipated population growth and its demands for housing, employment, goods, and services, including opportunities for affordable housing and recreation. The plan identifies the area through which the Triangle Parkway passes as Research/Research Application. The section of Triangle Parkway is located in Durham County, within the RTP, and is consistent with this classification. Therefore, it is expected that the Preferred Alternative would be compatible with Suburban Tier goals and objectives.

Although Durham Planners agree Triangle Parkway will provide better access to developed areas, they indicated it is not likely the project will have economic implications for the city.

The Town of Cary's Carpenter Community Plan (September 2005) does not show the Triangle Parkway (STIP Project U-4763B) because the Plan's northern boundary is south of the corridor. The northernmost part of the Plan extends near McCrimmon Parkway which is within the FLUSA. The Carpenter Community Plan is meant to be a master plan for approximately 475 acres in the northwestern portion of Cary's planning area. It establishes the Town's long-range vision for future land use, parks, roads, sidewalks, and greenways. The Carpenter Historic District is the focal point of the Plan's vision, which is to make the Carpenter area a unique regional destination and a highly attractive place to live, work, and recreate. It is not anticipated that the Preferred Alternative would be in conflict with the Carpenter Community Plan.

The Northwest Cary Area Plan (September 2002) is a master plan for the northwestern portion of Cary's planning area, just south and west of RTP. The Plan considers Triangle Parkway, but the Plan study area is largely to the south and west of the proposed Preferred Alternative. The Plan includes a Regional Activity Center at NC 540 and NC 55 interchange, which is just west of the Triangle Parkway interchange with NC 540. Intended land uses include Office/Institutional, Mixed-Use, and Medium Density Residential.

Cary planners stated that an improved road system is needed. The town has a policy which states if rush hour traffic cannot be maintained with a LOS D in a particular area, development in that area must halt. Town decisions and assumptions have been made based on the construction of NC 540 and a lesser extent, Triangle Parkway.

6.3.3 Economic Growth Trends

The employment within Wake and Durham Counties is also anticipated to increase, which indicates that the area is expected to continue developing and flourishing economically. The relationship in population growth trends to employment is consistent with the information obtained from the Triangle Regional Model Socio-Economic Data Browser. This regional data indicates that the number of employees in Wake County is expected to increase by 35.8 percent between the years 2010 and 2020. In comparison, the number of Durham County employees is expected to increase by 20.8 percent during this same time period. In keeping with past and current growth trends, Morrisville employees are projected to increase by 103.0 percent between 2010 and 2020.

Residential, commercial and industrial development trends in the FLUSA include development that is ongoing and progressive. According to the RTP website, there are currently 530 acres still remaining for development in the Park. Sixteen sites are shown as available, plus space is available in several buildings. Developed square footage has grown over the years from 204,000 square feet in 1960, to 6,468,912 square feet in 1980, to 19,125,842 square feet in 2002. An RTP representative indicated that 91,000 employees are projected to work in the Park at final build-out. Growth in RTP has slowed since the 2000 but the RTP continues to grow with the arrival of new businesses.

Surrounding municipalities are also growing, some quite rapidly. The Town of Morrisville special census taken in March 2004 showed that the population was 11,915 persons, which is an increase of more than 128 percent from Census 2000 figures. According to the Town's website, Morrisville has enjoyed significant commercial and industrial growth in recent years. The Town's tax base grew from $153 million in 1989 to $525 million in 1999. In 1999 the Town's land use plan identified the tax base as roughly 70 percent commercial/industrial and 30 percent residential. Current calculations show the tax base as 51 percent commercial/industrial and 49 percent residential, indicating that a large amount of recent growth in Morrisville has been residential.

The Town of Cary's Growth Management Plan (January 13, 2000) says that Cary faces many growth-related challenges. Among those are affordable housing, the provision of water and wastewater services in the coming years, overcrowded roadways, and serious overcrowding in public schools. The Plan notes that RTP and Raleigh-Durham International Airport continue to act as major growth engines for Cary and the surrounding region. The Plan comments on the need to work collaboratively with other jurisdictions to ensure NC 540 is constructed and NC 55 is improved, in order to alleviate some of the problems caused by traffic passing through the community. Continued planning for roads to serve new growth, especially in western Cary, is deemed important. An improved roadway system to serve this rapidly growing population should be beneficial to the area.

6.3.4 Growth Management: Existing Plans, Policies, and Regulations

Growth and indirect effects associated with changes in an area can be managed and controlled to a large extent by land use policies, transportation policies, zoning controls, and the degree to which these provisions are followed and enforced in permitting development. The evaluation of the policies, implementing regulations, and the degree of compliance will help to predict the effect of induced growth that may result from the project, and where these effects are likely to occur.

Transportation Plans

The Triangle Parkway is included in several local transportation plans, including:

- CAMPO 2030 Long Range Transportation Plan Update,
- DCHC MPO 2030 Long Range Transportation Plan,
- Town of Cary Comprehensive Transportation Plan
- County Thoroughfare Maps
- Morrisville Transportation Plan, and
- Wake County's Transportation Plan, Collectors & Thoroughfares.

Inclusion in these plans indicates awareness of the project among local planning officials and the anticipation that it will be constructed. Additional information regarding these plans and other projects proposed are included in Chapters 1.5 and 1.6.

Local Zoning and Policies

Several local governments have zoning jurisdiction within the FLUSA. Figure 4-2 provides generalized zoning in the FLUSA and detailed maps are included in Appendix C. Durham City-County Planning's zoning map includes the northern portion of the ICE Study Area. The most prominent district is "Science Research Park," which indicates the location of RTP. Other prominent districts include "Industrial Light" and "Office Institutional."

Wake County's zoning map shows much of the southern portion of the FLUSA zoned as "Research Applications," again, indicating RTP. The western part of this area is overlain by a Water Supply Watershed Overlay District. The Towns of Cary and Morrisville zoning maps include southern and southeastern portions of the ICE Study Area.

The Town of Cary's Secondary and Cumulative Impacts Master Mitigation Plan, Cary, North Carolina (Cary SCI) discusses secondary and cumulative impacts for all planned infrastructure in the Town's planning area. The document summarizes the types of expected secondary and cumulative impacts relative to environmental resources, and discusses mitigation programs to address the impacts. The Town has created regulations more stringent than minimum state and Federal regulations to protect these resources. As growth occurs, impacts to surface waters will be minimized by existing stream buffer regulations, the Town's Phase II stormwater program and nitrogen stormwater regulations, water supply watershed management efforts, erosion and sediment control, and open space preservation.

The FLUSA includes a small portion of the Cary SCI planning area, specifically, the northwest portion near the Wake - Durham – Chatham County lines.

Local, State and Federal Environmental Regulations

Local, State and Federal government agencies regulate and enforce laws and/or issue permits to protect environmental resources. These regulations and guidelines generally apply to both private and public development that could occur within the FLUSA.

The study area is located in the Cape Fear River basin, which currently does not include riparian buffer rules. However, both Durham and Wake County have ordinances which provide riparian buffer protection. In Wake County, stormwater control ordinances require protection of the existing 50-foot riparian buffers for all intermittent and perennial surface waters shown on either the most recent version of the Wake County soil survey map or a USGS 7.5-minute topographic quadrangle map. The 50-foot buffer consists of 30 feet of undisturbed forest adjacent to the stream with the next 20 feet consisting of maintained grass or vegetation. Durham County's natural resource protection standards require the same type of 50-foot buffer for intermittent and perennial streams.

NCDOT's Best Management Practices for Construction and Maintenance Activities (BMP-CMA) and Protection of Surface Waters (BMP-PSW) will be adhered to during construction. Sedimentation control guidelines will be strictly enforced during the construction stages of the project.

The US Fish and Wildlife Agency implements the Endangered Species Act for the federally protected species listed in each county; and the NC Wildlife Service maintains a list of state protected species. The NC Department of Environment and Natural Resources (NCDENR) Natural Heritage Program designates sites that contain rare species, critical habitats, natural areas, and high quality natural communities.

The NC Division of Water Quality (NCDWQ) classifies waters within the state and monitors impacts to associated buffer zones. WS-IV waters are located within the FLUSA. WS-IV waters are waters protected as water supplies which are generally in moderately to highly developed watersheds or Protected Areas and involve no categorical restrictions on discharges.

Nutrient Sensitive Waters (NSW) is a supplemental classification intended for waters needing additional nutrient management due to their being subject to excessive growth of microscopic or macroscopic vegetation. In general, management strategies for point and non-point source pollution control require control of nutrients (nitrogen and/or phosphorus usually) such that excessive growths of vegetation are reduced or prevented and there is no increase in nutrients over target levels. Management strategies are site-specific.

Permits are required for encroachments into any Water of the US; these include all jurisdictional wetlands and streams. The United States Army Corps of Engineers (USACE) issues permits for projects that result in fill to aquatic resources or stream impacts. A Section 401 Water Quality Certification is also required for any activity, including maintenance or construction activities, which may result in a discharge into Waters of the US. Required Mitigation for the associated wetland and stream impacts are reviewed by the USACE and NCDWQ. Requirements and conditions for this mitigation are documented in the approved Permit and Water Quality Certification.

6.4 Inventory of Notable Features

Notable features in the FLUSA were inventoried and are shown on Figure 6-2. Information was collected through a variety of methods, including GIS databases, internet research, field reviews, agency coordination, interviews with local planners and information from the Natural Resources Technical Report, STIP U-4763,Triangle Parkway From Northern Wake Expressway to NC 147, Durham and Wake Counties, North Carolina (February 2007)and Addendum to Natural Resources Technical Report, STIP U-4763B,NC 540 from NC 55 to Triangle Parkway, Wake Count, North Carolina (September 2007).

This inventory defined those environmental features as notable because of their importance and potential to be affected indirectly and/or cumulatively through time by the project. Given that the project is predominantly located within the designated RTP boundaries and surrounding developing land uses, the notable features identified within the FLUSA included both human and natural resources as discussed below.

6.4.1 Natural Communities and Water Resources

Four primary vegetative communities were identified within the area: Piedmont alluvial forest, mixed pine-hardwood forest, oak-hickory forest, and man-dominated urban/disturbed land. Parts of the Piedmont alluvial forest contain wooded wetlands.

Urban/disturbed land is the most prevalent community type. This community consists of areas of impervious surfaces and built-upon areas that have been altered such that the original natural vegetation no longer exists. Examples may include roadside areas and lawns of private properties.

Water resources such as streams, ponds, lakes, and National Wetlands Inventory sites identified in the FLUSA are shown on Figure 6-2. Also shown is the conservation easement RTF maintains within their boundaries. This easement is maintained to preserve wetland and/or riparian resources and other natural values of the property.

There are no Outstanding Resource Waters (ORW), High Quality Waters (HQW), drinking water supply (WS-I or WS-II) waters, or Wild and Scenic Rivers within the ICE Study Area. Most streams are located in the Cape Fear River Basin. A small portion of the FLUSA is located within the Neuse River Basin. Triangle Parkway will not cross the nearby Water Supply Watershed Boundary; however stream and tributaries crossed by the project corridor flow to this water shed. These streams, however, are not designated as Water Supply streams at the Triangle Parkway crossing locations.

Northeast Creek is the only named 303(d) [1] stream in the FLUSA. Northeast Creek, from NC 55 to the New Hope Creek arm of B. Everett Jordan Lake, is included on DENR's Final 2006 303(d) list due to fecal coliform, turbidity, low dissolved oxygen, and impaired biological function. Tributaries to Crabtree Creek are within the FLUSA. They are noted here because they flow into Crabtree Creek, which is a 303(d) stream outside of the FLUSA. Crabtree Creek, from its source to the mouth of Richlands Creek, is listed as a 303(d) stream because of turbidity, low dissolved oxygen, and impaired biological function.

Additionally, headwaters of Crabtree Creek located in the FLUSA are classified as "B NSW" or "C NSW". Class "B" waters are used for primary recreation and other uses suitable for Class C. The class "C" designation denotes fresh waters protected for secondary recreation, fishing, wildlife, fish and aquatic life propagation and survival, and other uses. Primary recreational activities include swimming, skin diving, water skiing, and similar uses involving human body contact with water where such activities take place in an organized manner or on a frequent basis. There are no restrictions on watershed development or types of discharges.

Five waters within the FLUSA are designated by NCDWQ as "WS-IV NSW" Water Supply Watershed waters, which are sources of potable (drinkable) water and include:

- Northeast Creek,
- Burdens Creek,
- Kit Creek, Long Branch,
- Nancy Branch, and
- Morris Branch.

[1]Section 303(d) of the Clean Water Act, a Federal law, requires States to maintain a list of streams with impaired water quality.

6.4.2 Federally-Protected Species and Natural Heritage Elements

Information regarding the presence of federally protected species and habitat and natural heritage elements were identified within the FLUSA using the US Fish & Wildlife Service's (USFWS) list of protected species and the North Carolina Natural Heritage Program (NHP) database of rare species and unique habitats.

A review of the USFWS January 29, 2007 list and the NHP maps on February 13, 2006, noted that no federally-protected species are known to occur within a one-mile radius of the project corridor.

A GIS review revealed eight NC Natural Heritage Program element occurrences within the FLUSA (Figure 6-2), some of which are documented terrestrial communities rather than species occurrences. Although there are eight occurrences identified on Figure 6-2, there are only six listed in Table 6-3 since some elements occur more than once on the map.

Table 6-3 Natural Heritage Element Occurrences

Common Name	Scientific Name	Federal Status	State Status
Piedmont/mountain swamp forest	None	None	None
Piedmont/mountain bottomland forest	None	None	None
Douglass's bittercress	*Cardamine douglassii*	None	SR-P
Veined skullcap	*Scutellaria nervosa*	None	SR-P
American bluehearts	*Buchnera americana*	None	SR-P
Earle's blazing star	*Liatris squarrulosa*	None	SR-P

Source: North Carolina Natural Heritage Program database accessed in February 2007.
SR-P – Significantly Rare-Proposed

There are three Significant Natural Heritage Areas in the FLUSA: Limestone and Chert Nature Area (near NC 55), Northeast Creek Floodplain Forest (along Northeast Creek), and Jenkins Road Diabase Dike Formation (within the project corridor). The Jenkins Road site was recently designated and is associated with the Earle's blazing star population. This site is within the project corridor and is discussed further in the previous Chapters 4.6.8 and 5.5.7.

6.4.3 Community Resources

RTP contains a dense area of research oriented businesses and is central to the remaining areas with the FLUSA. As mentioned previously, land use in the surrounding areas is changing to denser developments. This is apparent in that several areas have been converted from farmland and zoned for other uses. The Shiloh Community, located within the FLUSA and southeast of the NC 540 interchange is another area that is experiencing changes from the large amount of growth. The Shiloh Community is a locally recognized historic African-American community located at Morrisville's northern edge. Morrisville provided formal recognition of this to the Shiloh Community with a town-funded plaque in October 2006 when the Morrisville Appearance Committee realized how quickly new commercial and residential development was overtaking the historic area. The community includes the Shiloh Missionary Baptist Church as a focal point in the community where free African-Americans formed as early as the 1820s. This Church also provides a central base for the community, which still contains descendents of some of the founding families.

Relatives of families have sold property for development and the Shiloh Community still remains under heavy commercial and residential development. For example, one family in the area owned about 40 or 50 acres in the community. The family sold most of it, leaving just four acres which now contain a white house near the corner of McCrimmon Parkway. Developments like the Kitts Creek subdivision, a new 600-plus home community that held a grand opening in October 2006, are springing up in town. Kitts Creek is densely developed with tight clusters. The current design for the Kit Creek Road connector relocates one resident from the Shiloh community. In addition, the family had property acquired as part of the construction of NC 540.

6.4.4 Underground Storage Tanks, Solid Waste Facilities, and Superfund Sites

GIS records search revealed several hazardous substance disposal areas in the FLUSA (CGIA, 2004). The two largest are at IBM, which is located east of Davis Drive, and General Electric, which is located east of IBM. There are several other smaller sites, all of which are shown on Figure 6-2. In addition, NCDOT performed a screening of the study area for hazardous waste sites and Environmental Data Research, Inc. prepared a report outlining the hazardous waste sites in the project area.

6.4.5 Other Human, Cultural, and Social Resources

Two daycares are located in the study area, the RTI Parent's Child Care Cooperative Organization facility located near the I-40/NC 147 interchange and the First Environments Early Learning Center facility located on the EPA/NIEHS campus just west of the project between Hopson Road and I-40. No other human, cultural, or social resources anticipated to potentially experience indirect or cumulative effects as a result of implementation of the Preferred Alternative were noted within the FLUSA. Historic and archaeological sites eligible for listing in the National Register of Historic Places (NRHP) were not identified within the study area, and other communities outside of the study area were estimated to be to far from the study area too experience effects.

6.5 Activities That May Cause Effects and Potential Conflicts

According to Guidance for Assessing Indirect and Cumulative Impacts of Transportation Projects in North Carolina, several factors are taken into consideration when evaluating the potential for indirect and cumulative effects and to determine if further analysis is warranted.

Examples may include whether a project conflicts with local planning, whether it serves economic and/or specific development purposes, if the project could stimulate complementary development, and how the project could affect human and natural resources. The Preferred Alternative is proposed as a toll road; therefore, the collection of toll fees is also included in this list of activities that may cause effects and potential conflicts.

6.5.1 Local Planning

The Preferred Alternative for Triangle Parkway is consistent with local plans; including the RTP Master Plan. Property within the project corridor was reserved for the project with adjacent planned business and research development. Land Use plans in the FLUSA include mixed use developments

including residential, business, and commercial type facilities. As the Triangle regional development continues the trend in growth, Triangle Parkway would provide an alternative route to other congested roads, such as NC 55, which serves existing and future development on a regional basis.

6.5.2 Explicit Economic Development Purpose

Triangle Parkway was initiated within the RTP Master Plan, however, its purpose is not explicitly economic development for RTP. The Preferred Alternative complements RTP's development plans while also providing additional transportation capacity within the Triangle Region and easing congestion on other roadways, such as NC 55. Based on conversations with RTF representatives, the developments in RTP are planned, marketed, and would likely take place regardless of the construction of Triangle Parkway. Triangle Parkway could, however, contribute to the rate of development and potentially the types of businesses that locate in the RTP by improving the region's mobility.

6.5.3 Planned to Serve Specific Development

Part of Triangle Parkway's purpose is to improve commuter mobility, access, and connectivity to the RTP employment center. The Preferred Alternative will also provide connectivity throughout the region by linking two major freeway facilities, NC 540, and I-40. This new link, as a component within the regional transportation plan, would provide new access to these facilities in addition to increasing traveling capacity within the network.

6.5.4 Stimulation of Complementary Land Development

Stimulation of complementary land development is most likely to occur when projects are located near interchanges in rural areas, where property values were originally low. Typical types of development may include highway-oriented businesses such as gas stations, rest stops, and hotels. Complementary development can occur in urban and suburban areas as well, and is more likely to be associated with a greater proportion and mix of higher density uses.

Triangle Parkway will create new interchanges, but most of the land adjacent to the interchanges is located within RTP and/or zoned for research and development type facilities. There are some exceptions. Some of the land north of Hopson Road is undeveloped and could provide space for some complementary uses. It is currently zoned as "Commercial Center." Land on the northeast and southeast sides of the Triangle Parkway/NC 540 interchange is also outside of RTP boundaries. There is limited potential here for complementary land development because of a lack of access and residential development that is underway in the northeastern quadrant of the interchange.

The Preferred Alternative includes constructing an overpass for Kit Creek Road to reconnect Kit Creek Road between Davis Drive and Church Street. This connection would provide additional east-west access to the Town of Morrisville, which the community has requested. However, the current lower density development located in this area could potentially experience pressure to shift to higher density development given the improved access.

6.5.5 Influence on Intraregional Land Development Location Decisions

Typically, if a region is undergoing urbanization or conditions are favorable for development, improvements in transportation infrastructure could influence where development is most likely to occur. Development patterns associated with the approved land use plans include the RTP designation for large research oriented businesses. It is likely that most of the development in the FLUSA is taking place to serve the heavy housing demand in the area, and is not necessarily related to the anticipation of Triangle Parkway.

6.5.6 Toll Fees

Triangle Parkway is proposed as a toll facility. The toll fees required for using the roadway could influence how people choose to travel to work. To a lesser extent, the cost of the tolls could indirectly effect where people decide to live and work. Travel patterns for people who do not choose to pay the toll would not be expected to change since existing free routes would still be available. For others that choose to pay the toll, the traffic patterns would change and remove traffic from several existing roadways.

6.5.7 Notable Features in the FLUSA

Notable features within the FLUSA with potential for indirect and cumulative effects include Water Supply Watershed designated streams, Significant Natural Heritage Areas (SNHA), NC Natural Heritage Program element occurrences, and community resources.

Potential indirect effects to Water Supply Watershed streams could include degradation in water quality because of an increase in impervious surface and possible erosion and sedimentation from the potential of related complementary development. It is not expected that there will be substantial induced growth adjacent to the project corridor because of control of access and limitations on uses due to RTP restrictions. These limitations on adjacent development could help to avoid or minimize effects to Water Supply Watershed streams. In addition, local stream buffer regulations in Wake and Durham County as well as the Town of Cary along with floodplain ordinances will assist in minimizing these impacts.

Cumulatively, this project with the implementation of the other projects proposed and/or planned in the foreseeable future could also affect Water Supply Watershed streams. Current land use plans, zoning ordinances, and water quality regulations are in place to assist in minimizing these effects. The Indirect and Cumulative Impact analysis performed by NCDOT for the Western Wake Freeway identified the Triangle Parkway as a reasonably foreseeable future transportation project in the study area for that project.

According to the North Carolina Natural Heritage Program, Significant Natural Heritage Area (SNHA) has no state or Federal protection, however, Durham County has an ordinance in place that requires a permit for impacts to SNHAs which offers some protection through coordination. Further effects to the SNHA and other Natural Heritage element occurrences, either indirectly from the project or cumulatively with other planned projects, could reduce rare habitat, which would negatively impact plants and animals that may not easily thrive in other environments.

6.5.8 Major Projects Proposed In the Vicinity

Several major projects, including private developments and transportation improvements, are planned in the vicinity of the Preferred Alternative. Activities associated with development such as

these large residential developments can be catalysts for indirect and/or cumulative effects. For example, *Old Maynard* is a residential development proposed west of Davis Drive south of the existing Breckenridge development. According to the Town of Cary FGD map, it will consist of 151 single-family lots.

West Martin is a development proposed east of NC 54. This development will consist of 525 multi-family units, 30,000 square feet of commercial space, and 10,000 square feet of office/institutional space. *Village at the Park* is planned west of NC 55 at Kit Creek Road. This development will include 120 single-family lots, 599 multi-family units, 161,090 square feet of retail space, and 360,268 square feet of office institutional space, including a 150-room hotel.

Other large developments near NC 540 and the future Western Wake Freeway include *Stonewater* and *Amberly*. *Stonewater* will consist of 456 single-family lots, 1,114 multi-family units, and 229,800 square feet of commercial space. *Amberly* will consist of 2,630 single-family lots, 2,370 multi-family units, 280,000 square feet of commercial space, and 135,000 square feet of office/institutional space.

A list of the development proposals are provided below. These developments planned in the FLUSA reflect the rapid growth in the area. These proposals were known at the time of the research for this report. Growth in the FLUSA is dynamic and it is expected that many new additions would be added to this list over time.

Development	Type
Town Hall Commons Phase 3	Residential
Town Hall Terraces	Residential
Chessington	Residential
McCrimmon at the Park	Residential
Providence Place	Residential
Kitts Creek	Residential
Shiloh Grove	Residential
Twin Lakes	Residential
Old Maynard	Residential
Alston Avenue townhomes	Residential
Davis Drive townhomes/condos	Residential
S. Miami Boulevard townhomes/single-family	Residential
Retail center	Residential
Kids R Kids	Commercial
Lenovo (IBM)	Commercial
Davis Park	Residential/Commercial
West Martin	Residential/Commercial
Village at the Park	Residential/Commercial
Stonewater	Residential/Commercial
Amberly	Residential/Commercial

Table 6-4 lists the recent, current, and future transportation projects planned in the vicinity of Triangle Parkway. These projects could combine with the Triangle Parkway project to cumulatively effect resources in the study area. Although not a part of this action or programmed in the 2007-2013 STIP, widening of I-40 and the construction of a flyover ramp on Triangle Parkway at I-40 were considered but not included as part of the Preferred Alternative. Discussion of I-40 modifications considered and their associated impacts is included in Appendix F.

Table 6-4 Transportation Improvement Projects

Agency	Description	Schedule
NCDOT	TIP I-3306 - Proposed widening of I-40 between I-85 in Orange County and NC 147 in Durham County.	Partially complete. Resurfacing
NCDOT	TIP R-2635 - Western Wake Freeway on new location from NC 55 (south) to NC 55 (north), Wake County.	Right-of-way and construction scheduled in 2008 as toll project
NCDOT	TIP R-2904 - NC 54 widening to multi-lanes from SR 1999 (Davis Drive) to SR 1959 (Miami Boulevard), and SR 1973 (Page Road) widening from NC 54 to I-40, Durham County.	Under Construction
NCDOT	TIP R-2906 - NC 55 widening to multi-lanes from US 64 in Wake County to SR 1121 (Cornwallis Road) in Durham County.	Under Construction
NCDOT	TIP U-3309 - Widening of SR 2028 (T.W. Alexander Drive) to four-lane median divided facility from Cornwallis Road to Miami Boulevard, Durham County.	Right-of-way scheduled in 2008, construction partially complete, remainder in 2009
NCDOT	TIP U-3620 - Extension of McCrimmon Parkway as a multi-lane curb and gutter facility from NC 54 to Airport Boulevard, Wake County.	Construction in post year*, unfunded
NCDOT	TIP U-4026 - Widening of SR 1613-SR 1999 (Davis Drive) to multi-lanes from SR 3014 (Morrisville-Carpenter Road) in Wake County to NC 54 in Durham County.	Under construction
RTP	Hopson Road Realignment (RTF -7) and extension of Hopson Road from Louis Stephens Road to NC 55.	Under Construction
RTP	Little Drive Realignment is proposed by a developer and includes extending Louis Stephens Road across NC 55.	N/A
Town of Morrisville	Extend Barbee Road between Church Street and Triangle Parkway	N/A
Town of Morrisville	Proposed widening and extension of McCrimmon Parkway to a four-lane, median divided road.	N/A

* Post Year represents an undefined schedule occurring after the 2013, which is the last year covered in the current NCDOT TIP Source: NCDOT 2007-2013 Transportation Improvement Program.

6.6 Assessment of Land Development Changes

Transportation improvements can have multiple effects in relation to land development and can potentially cause indirect land use changes and effects that are commonly recognized, such as localized commercial development around a new highway. However, because transportation projects are usually planned over a long period of time, land use changes within the project vicinity are usually anticipated, and thus both accommodated and planned by local municipalities. Several factors were evaluated within the FLUSA to assess the potential for land development changes.

6.6.1 Change in Accessibility (Travel Time Savings)

Triangle Parkway will improve accessibility to RTP from the north via NC 147 and I-40, and from the south via NC 540. Due to its connectivity to other major commuting routes, accessibility to a regional employment center, and changes in travel patterns that should reduce congestion, Triangle Parkway has good potential to have an overall positive effect on travel time savings. Land use is not expected to change substantially because of the project's influence on accessibility or travel time. When combined with other planned projects, including the Triangle Expressway system (See Chapter 1.4.2), travel time savings should be more apparent; there would be a cumulative increase in capacity and corresponding traffic operations provided within the Triangle Region.

6.6.2 Change in Property Values

As RTP has developed, the roadways that serve it have become increasingly congested. Deteriorating traffic conditions could have a negative effect on the value of remaining developable properties in RTP. In contrast, Triangle Parkway may have the opposite effect by providing better traffic service that would make the area more appealing.

6.6.3 Forecasted Growth

Much of the northern part of the FLUSA, which includes Durham County, is already densely developed. Durham County is expected to grow around 1.5 percent annually over the next decade and a half. The portion of the FLUSA that is in Wake County has more land available for development. Wake County is expected to grow at more than twice the rate of Durham County in the coming years. Forecasted growth in the FLUSA, especially in Wake County, indicates good potential for land use change; however, development restrictions and environmental regulations will temper this growth.

6.6.4 Land Supply vs. Land Demand

Land in the FLUSA is in demand for both business and residential uses. It is expected that RTP will build out and that many of the surrounding areas will fill in with residential/mixed -use developments. Most of the land within the FLUSA is rapidly urbanizing and it is anticipated that remaining developable land at the end of the project study field will be part of the planned growth within the RTP research campuses.

6.6.5 Availability of Water and Sewer

Water and sewer services are readily available in the FLUSA, which is a benefit to development initiatives. Potential land use changes are not expected to be influenced by a lack of these services.

6.6.6 Market for Development

The market for development is strong in the FLUSA. There is an abundance of land under construction, both for business and residential uses. In addition, the population is increasing, in some areas quite rapidly. The strong development market and increasing population are both indicative of impending land use change; however land use restrictions and environmental regulations will have an influence on the kinds of land uses allowed within the area.

6.6.7 Local Public Policy

The amount of construction in progress and land for sale and lease in the FLUSA are indications that local policies are supportive of growth. Also, there are several incentives for companies considering locating in the area. The state can issue industrial revenue bonds for new and expanding industry. These bonds can offer a more favorable tax status for businesses. The state also offers technology based equity funds for financing technology based enterprises. RTP companies are eligible through the William S. Lee Act to potentially receive a $500 tax credit per new job created and a four percent investment tax credit for machinery and equipment investments over $2,000,000.

While there is support for growth, there are also many restrictions and regulations in place to temper growth and its effects. As mentioned previously, these include land use restrictions within RTP (which limit RTP to research oriented facilities), land use/zoning plans, and the following environmental regulations for natural resources:

- **WS-IV Water Supply Watershed** has no categorical restrictions on discharges. NCDWQ's development guidelines includes two dwelling units per acre or 24 percent built-upon area for low density development, 24 to 70 percent built-upon area for high density development and one-third acre lots, or 36 percent built upon area for projects without curb and gutter street drainage systems.
- **Nutrient Sensitive Waters (NSW)** have site specific management strategies for point and non-point source pollution control of nutrients (nitrogen and/or phosphorus usually) such that excessive growths of vegetation are reduced or prevented and there is no increase in nutrients over target levels.
- **Neuse River Basin waters** is subject to riparian buffer protection under 15A NCAC 2B .0233 of the North Carolina Administrative Code, which requires establishment of 50-foot protective streamside buffers on all new development. This 50-foot distance requires the first 30 feet of the buffer to remain undisturbed and the remaining 20 feet to be vegetated.
- **Floodplain and floodway protection** is required under Federal and State laws, including the National Flood Insurance Act of 1968 (as amended, 42 U.S.C. 4001 et seq.); the Flood Disaster Protection Act of 1973 (Public Law 93-234, 87 Star. 975); Executive Order (EO) 11988, Floodplain Management; EO 11990 Protection of Wetlands; US DOT Order 5650.2, Floodplain Management and Protection; and FHPM 6-7-3-2; 23 CFR 650.
- **Best Management Practices** are implemented for construction activities and require contractors to follow both the NCDOT's Best Management Practices for Construction and Maintenance Activities and the NCDOT's Best Management Practices for the Protection of Surface Waters.
- **Sedimentation and erosion control** guidelines are applicable according to the North Carolina Division of Land Resources Sediment and Erosion Control Act.

- **Phase II Regulations - Federal Phase II National Pollutant Discharge Elimination System (NPDES)** rules are applicable to regulate discharges of stormwater to surface waters and control suspended solids, fecal coliform, and nutrients. Point source dischargers throughout North Carolina are regulated through the NPDES program and are required to register for a permit.

6.6.8 Potential for Land Use Change

Table 6-5 shows relative ratings of factors that could influence land use change in the FLUSA. For this particular project and FLUSA, two of the factors in the table specifically relate to the project - accessibility and potential changes in property values - while the remaining five more generally reflect the conditions of the FLUSA. The project is a controlled access facility with development in place at the interchanges. The weak-to-medium rating for accessibility reflected that there could be some improvement in access from travel time savings along adjacent routes and access to RTP. The weak-to-medium rating for changes to property values reflects the additional improvement the project provides to the overall infrastructure in the area.

Table 6-5 Potential for Land Use Changes

Rating	Change in Accessibility	Change in Property Values	Forecasted Growth	Land Supply vs. Land Demand	Availability of Water and Sewer	Market for Development	Local Public Policy
Strong ↑ * Medium * ↓ Weak	X	X	X	X	X	X	X
Cause	Increased accessibility potential with some travel time savings; but little locally to undeveloped land because of access control and development restrictions	Some increase from improved infrastructure in RTP	Strong forecasted growth, regulations will temper	Good present demand for available land, land currently rapidly developing; possibly still available at end of study period	Services readily available in most of the FLUSA	Strong development market and increasing population	Supportive growth policies and incentives, land use and development/ environmental regulations to temper growth

In general, the FLUSA has been continually experiencing growth, high demands for land development, and expansions in water and sewer due to the growth and job opportunities available within the cluster of municipalities and research facilities that comprise this Triangle Region. Therefore, for this project, the medium to strong ratings given for the remaining five factors in Table 6-5 are primarily influenced by the growth in the FLUSA and not specifically from the influence of the project.

While there is good infrastructure in place and high demand for land in the FLUSA, the construction of this 3.4-mile project within this FLUSA is anticipated to have a low potential for land use changes based on several factors; current established development, future development planned, and regulated factors; such as land use/zoning plans adopted by municipalities, RTP covenant restrictions, and numerous environmental regulations.

6.7 Evaluation of Indirect and Cumulative Effects

6.7.1 Indirect Effect

Key potential indirect effects that could result from the project are categorized below:

Commercial and Industrial Growth

There is limited potential for land use change at Triangle Parkway interchanges. The proposed service roads associated with the Split Diamond Design concept do not provide new access to undeveloped land. Most of the land adjacent to the interchanges is zoned for research and development type facilities, which would ensure the land remains available for these expected uses. Some of the land north of Hopson Road is undeveloped and is currently zoned as Commercial Center. Substantial commercial and industrial growth and resultant land use changes in the FLUSA are not expected to take place as a result of the project.

Residential Development

Most residential development in the FLUSA is taking place to serve the current housing demand in the area and is not likely related to the anticipation of Triangle Parkway. Triangle Parkway is proposed as a full control of access facility. Continued residential development is expected, but it is not likely occurring as a result of the project.

The Preferred Alternative includes constructing a bridge over Triangle Parkway to reconnect Kit Creek Road between Davis Drive and Church Street. This connection would provide additional east-west access to the Town of Morrisville, which the community has requested. However, this connection would encourage more through traffic within the neighborhood and would need to be considered by the local community in relation to their current and future planning.

The Kit Creek Road connection would also provide additional access to the Shiloh community. Current lower density development located in this area could potentially experience pressure to shift to higher density development given the improved access.

6.7.2 Cumulative Effects

Cumulatively, Triangle Parkway together with other planned, proposed, and existing roadway improvements in the FLUSA should enhance accessibility and improve travel time locally and regionally.

Many of the roadway projects under consideration in the FLUSA include either widening of existing roads or are further development of controlled access facilities. These types of improvements would not be expected to open substantial new access to undeveloped land. Therefore, cumulative growth effects would not be expected to be substantial because of the construction of the project.

The Western Wake Freeway and the Triangle Parkway, along with other NCDOT STIP projects, and projects in CAMPO's and DCHC MPO's fiscally constrained long range transportation plans, would help improve regional mobility and enhance system linkage through the area. There is a high potential for a shift in development patterns or induced growth throughout the area as a result of the combination of these projects; however, rapid growth and development are already occurring without construction of either the Western Wake Freeway or the Triangle Parkway. Growth and development are occurring because RTP and the Triangle Region are attractive places to live and work. There is plenty of developable land; and water and sewer services are readily available. In addition, the Research Triangle Park, the Raleigh – Durham International Airport, and the major universities of North Carolina State (in Raleigh), Duke (in Durham), and North Carolina (in Chapel Hill) are all in close proximity.

Cumulatively, the transportation projects proposed in the vicinity with Triangle Parkway should help to improve traffic flow and reduce congestion in the FLUSA. The construction of the Western Wake Freeway and the Triangle Parkway would likely enhance the attractiveness of western Wake County, which may accelerate growth to a certain extent, but other factors are also contributing to the growth. In general, the municipalities and counties within the area encourage new development, as long as the development is compatible with adopted plans for growth and satisfies development regulations.

Continued outreach to the public to enhance understanding on toll facilities will occur to keep the public educational process moving forward. Since toll roads are new to the state, clear signage near toll plazas may be helpful to lessen driver confusion and the likelihood of associated accidents.

Many of the municipalities and counties have residential density limits based on the suitability of the land for development, and environmental regulations are in place to protect natural resources, particularly water resources. Environmental and development regulations are in place to guide growth and minimize effects to the area's resources. As the project and others are constructed, the cumulative effects to area streams should be noted, especially since there is a Water Supply Watershed in the area. As impervious surfaces become more prevalent, there is increased potential to harm aquatic resources from the associated increase in stormwater runoff.

Cumulative effects of the project and continuing development could be evident in the loss of habitat for the Natural Habitat elements and Significant Natural Heritage Areas. Habitat loss will occur with the proposed project, as well as when other roadway and development projects occur in the area. Coordination is recommended with the NCNHP to minimize impacts to the SNHA that includes the rare plant Earle's blazing star. The NCNHP may be interested in taking measures to protect rare species in the area by relocation or other methods.

6.8 Indirect and Cumulative Effect Conclusions

Potential growth and land use changes from the project is anticipated to be limited because Triangle Parkway is a full control of access facility and the proposed service roads do not provide new access to vacant land on adjacent properties. Triangle Parkway is largely within a reserved corridor in a planned business community and is mostly adjacent to land that is restricted to research oriented facilities with covenants in place to limit built-upon or impervious surfaces. There is potential for limited indirect effects to streams as a result of road construction and minor complementary development, and potential for cumulative effects from this and other planned projects. However, there are development restrictions and environmental regulations in place to temper these effects.

Development in the FLUSA is expected to take place regardless of project construction. The conclusions of the ICE analysis of the proposed project include the following:

- Triangle Parkway is predicted to provide an increase in the capacity within the regional roadway transportation system for over 100,000 vehicles per day in the design year. Given that fewer cars would be using the adjacent existing roads such as NC 54 and NC 55, reducing traffic volumes on adjacent roadways (as compared to the 2030 No-Build Alternative) is anticipated as one of the positive indirect effects of the Preferred Alternative.
- The cost of tolls may influence the extent of the changes in travel patterns since commuters would have a choice to travel on the existing free routes still available or pay a toll to use the less congested freeway.
- Cumulatively, the STIP projects in the FLUSA, along with Triangle Parkway, should help to improve traffic flow and reduce congestion in the FLUSA. Triangle Parkway and other proposed roadway improvements in the region should further enhance accessibility, reduce congestion, and improve travel time locally and regionally. There may be some local negative effects to east-west travel because of the project's limited access.
- Cumulatively, Triangle Parkway, in combination with other STIP projects, could also affect streams from road construction. Implementing best management practices during construction of the STIP projects would assist in minimizing these impacts.
- Triangle Parkway could cause limited indirect effects and in combination with other projects, cumulative effects to water resources as a result of runoff from more impervious surfaces associated with road construction and minor complementary development. Associated development is expected to be limited because of control of access and RTP land use restrictions that limit development to business uses. In addition, there are local land use controls, buffer regulations, and floodplain ordinances in place to accommodate this growth.
- Impacts to the Significant Natural Heritage Area (SNHA) that contains a population of Earle's blazing star could result in less diversity within the species as a whole, which can cause negative effects relating to species survival. Impacts to the SNHA would reduce rare habitat, which could negatively impact associated plants and animals that may not easily thrive in other environments.
- Cumulative effects of the project and continuing development could be evident in the loss of wildlife habitat. The project is within a protected corridor. Habitat loss will occur there, as well as when other roadway and development projects are constructed in the area.
- Due to its connectivity to major commuting routes, increased accessibility to a regional employment center, and changes in travel patterns that should reduce congestion, Triangle Parkway has good potential to have an overall positive effect on travel time savings.

- Triangle Parkway may result in a positive economic benefit to RTP. Property values could increase with the improved infrastructure.
- By reducing congestion on existing roadways, Triangle Parkway could make undeveloped properties in RTP more appealing to potential businesses and could positively influence decisions existing businesses make regarding expansion of their existing services.
- Potential growth and land use changes from the project is anticipated to be limited because Triangle Parkway is a full control of access facility and the proposed service roads do not provide new access to vacant land on adjacent properties. In addition, RTP land use restrictions limit potential development to research-oriented business uses, which substantially influences the types of future development that would be allowed near the project.
- The Kit Creek Road connection provided with the Preferred Alternative would improve connectivity for vehicular traffic to Davis Drive; however, there is the future potential for an increase in traffic through the Kitts Creek neighborhood.
- The Kit Creek Road connector would also provide additional access in the area of the Shiloh community, which could potentially increase pressures within this lower density development to shift to higher density development.

7.0 Agency Coordination and Public Involvement

The project development process for the Preferred Alternative was coordinated with federal, state, and local agencies. Coordination efforts included scoping meetings, start of study letters, and agency coordination meetings. A Public Involvement Plan was also developed and implemented as part of the project to encourage public participation and input into the decision-making process.

7.1 Start of Study Notification

As part of the development of this Environmental Assessment, a start of study letter was mailed on December 16, 2005 to federal and state regulatory agencies and local officials to request comments and information regarding the proposed project studies. Comments were incorporated into the project as appropriate; a summary of the comments with copies of the start of study letter, mailing list, and responses received are included in Appendix D.

The agencies contacted for comments via scoping letters are listed below. An asterisk (*) next to the name indicates that a written response was received.

- Federal Emergency Management Agency
- U.S. Environmental Protection Agency
- U.S. Army Corps of Engineers *
- U.S. Fish and Wildlife Service *
- U.S. Geological Survey - Raleigh Field Office
- U.S. Department of Agriculture – Agricultural and Environmental Quality
- State Clearing House – Department of Administration *
- North Carolina Board of Transportation (Division 5)
- North Carolina Department of Cultural Resources *
    - Division of Archives and History
- North Carolina Department of Environment and Natural Resources (NCDENR) *
    - Division of Water Quality *
    - NC Wildlife Resources Commission *
- North Carolina Department of Public Instruction
    - School Planning *
- North Carolina Department of Transportation
    - Bicycle & Pedestrian Division
    - Division of Aviation
    - Geotechnical Unit

  - Highway Division 5
  - Hydraulics Unit
  - Location and Surveys Unit
  - Natural Environment Unit
  - Right of Way Branch *
  - Roadside Environmental Unit
  - Traffic Engineering & Safety Systems Branch *
  - Utilities Coordination Unit
- City of Durham
- Town of Cary
- Town of Morrisville *
- Durham-Chapel Hill-Carrboro Metropolitan Planning Organization (DCHC-MPO)
- Capital Area Metropolitan Planning Organization (CAMPO)
- Triangle Transit Authority*
- Wake County Planning Department

7.2 Agency Coordination Scoping Meeting

The Start of Study letter included an invitation to a project scoping meeting. This scoping meeting was held on January 13, 2006 with federal and state agency personnel and local municipal officials. The following groups participated: NCDOT Division 5, Transportation Planning, Geotechnical, Traffic Engineering, Right of Way and Roadside Environmental, Town of Cary, Town of Morrisville, CAMPO, Triangle Transit Authority, US Army Corps of Engineers, NC State Historic Preservation Office, NC Wildlife Resources Commission, US Environmental Protection Agency and DCHC-MPO.

The timing of this January scoping meeting was intentionally scheduled during the early stages in the project development process to assist in data collection and identify any environmental concerns in the project area. Discussions at the meeting included project development approach, project status, environmental constraints, and purpose and need for the project.

A second scoping meeting was held on January 25, 2006 with representatives from U.S. Army Corps of Engineers and the NC Division of Water Quality Transportation Planning. The agencies provided comments related to the NCTA Toll Legislation, the potential impacts to stream and wetlands, and the potential for studying improvements to the existing roadways. Minutes of these scoping meetings are provided in Appendix D.

7.3 Agency Coordination

During the development of this project, NCTA, NCDOT, and the regulatory agencies reviewed methods for agency coordination on NCTA candidate projects. Currently when coordinating projects with regulatory agencies, NCDOT follows procedures outlined in the "Merger 01 Process" to incorporate agency input into the project decision-making. The Merger 01 Process is based on a May 1992 agreement between the US Department of Transportation, the US Army Corps of Engineers and the North Carolina Department of Transportation. A modified version was signed in June 2005 which included the Department of Environment and Natural Resources as a signatory to the agreement.

The first NCTA agency coordination meeting was held on July 20, 2006 in the NCDOT Board Room at the Transportation Building. Triangle Parkway was reviewed at this meeting with members of the Merger Team, which includes agency representatives who participate with NCDOT in the Merger 01 Process. These Merger Team members include: FHWA, NCDOT, USACE, MPOs, USFWS, NCWRC, DWQ, NMF, SHPO, and EPA.

The purpose of the July 20th meeting was to review the Triangle Parkway project status, environmental studies, potential impacts, and alternative screening information. During this meeting, the Merger Team agreed the Triangle Parkway did not have a large magnitude of impacts and the project development studies would be exempt from the Merger 01 Process. Although the project would not follow this process during the planning stages, the Merger Team requested that the project be coordinated with them during final design and prior to construction to review minimization, hydraulic design, and permitting.

NCTA and the Merger Team decided to initiate regularly scheduled, monthly meetings to benefit both the NCTA and agencies. These monthly meetings, referred to as Turnpike Environmental Agency Coordination (TEAC) meetings, would be held to review the status of the current NCTA projects, environmental concerns, and permitting requirements.

The first NCTA monthly TEAC meeting was held December 15, 2006. At the December 15, 2006 meeting the following items regarding Triangle Parkway were discussed: the location of the toll plazas, minimization efforts along the unnamed tributary to Burdens Creek, impact differences between the cloverleaf design and the split diamond design, the financial feasibility of including the McCrimmon Connector as part of the Triangle Parkway, and the draft stream relocation plan.

Additional TEAC meetings regarding Triangle Parkway studies were held January 17, 2007, February 14, 2007, October 17, 2007, November 14, 2007 and December 5, 2007. At the January 17, 2007 meeting the following was discussed: the toll traffic forecast, the conceptual stream relocation plan along with a list of advantages and disadvantages associated with stream relocation and on-site mitigation opportunities, and a discussion of natural resources in the project area. At the February 14, 2007 meeting the following topics were discussed: a review of agency comments since January 17, 2007, a review of the February 6, 2007 field visit, a review of wetland and stream impacts and the USACE public notice process. At the October 17, 2007 meeting the NCTA reviewed the avoidance and minimization measures taken to date relative to the human and natural environment. In addition, the TEAC approved the qualitative CIA/ICE [A Community Impact Assessment and Qualitative Indirect and Cumulative Effects Assessment for Triangle Parkway TIP Project No. U-4763B (October 2007)] and agreed that a quantitative ICE study was not warranted. At the November 14, 2007 the NCTA reviewed the hydraulic design plans. At the December 5, 2207 meeting the NCTA reviewed the permit drawings. The minutes of these meetings are provided in Appendix D.

The NCTA held coordination meetings with the NCDOT on April 13, 2007 and May 18, 2007 to review the operational needs for the project. On May 18, 2007 the NCDOT requested additional modifications to the Preferred Alternative. The results of NCTA's analysis of the requested modifications can be found in Chapter 2.3.3 and Appendix F.

As part of the NCTA's coordination with the Capital Area Metropolitan Planning Organization (CAMPO), the NCTA signed a Memorandum of Understanding with CAMPO in June 2007 regarding issues related to funding of the project, financing of the project, and access. A copy of the MOU can be found in Appendix D.

7.4 Public Involvement and Participation

A public involvement program was developed to inform the public of the project and encourage people to provide input and participate in the project studies. Several types of public outreach methods were incorporated for this project. Appendix E includes copies of the meeting notices, copies of the public involvement materials, and a summary of the public comments received and used during the Triangle Parkway studies.

7.4.1 Local Officials Meeting

A local officials meeting was held on June 20, 2006 at the Sigma Xi facility located at 3106 East NC 54 in Research Triangle Park. A letter dated June 9, 2006 announcing the local officials meeting was mailed to over 100 recipients. The meeting was conducted from 1:00 to 2:00 p.m. Representatives from NCTA, NCDOT, Durham, Raleigh, Morrisville, the counties, and other areas in the Triangle attended the meeting.

7.4.2 Citizens Informational Meeting

A Citizens Informational Meeting (CIM) was held on June 20, 2006 at the Sigma Xi facility located at 3106 East NC Highway 54 in Research Triangle Park from 4:00 to 8:00 p.m. The purpose of the workshop was to introduce the project study, identify community concerns, solicit comments, and answer questions on the proposed project corridor and other aspects of the project.

The format for the workshop was informal. A sign-in sheet and comment forms were located at the entrance. Copies of the newsletter were also available. Auxiliary aids and services for disabled persons were available in accordance with Americans with Disabilities Act. Several project boards were displayed for citizens to view.

Approximately 57 people attended the CIM along with seven local officials and one member of the media. At the workshop, a welcome station was set up to greet citizens, provide instructions and handouts, and to record attendance. Another station, the Kids Center, was set up to provide an area for children to draw with crayons and coloring books. Two continually running PowerPoint presentations, one for NCTA toll information and the second for the Triangle Parkway project, were also provided for review. Several project maps on aerial mosaics were also displayed and attended by project team members to answer questions.

A comment station with comment sheets, several maps, and tables available for writing comments was also provided at the meeting. Several people commented on the need to protect the environment in addition to their feelings that the traffic in the area was too heavy. There were several discussions concerning the use of tolls to finance the roadway; including support for tolls to provide better commutes within and to RTP, and concerns about how much money the tolls would cost when using the facility daily. Several people noted they would prefer not to pay the toll and would probably still use the existing facilities unless they were in a hurry. One email and 16 comment sheets were received at the meeting. A summary of the comments is provided in Appendix E.

A Citizens Informational Workshop for the Western Wake Parkway was held February 8, 2007 in Apex. A display with Triangle Parkway project information was available at this workshop. A majority of the attendees were interested in the Western Wake Expressway and types of tolling operations NCTA proposes for the toll roads. There were several people that did stop and review the project map. There were nine written comments received at the Triangle Parkway display. All of the comments related to concerns regarding the Western Wake Freeway.

7.4.3 Notices and Newsletters

A comprehensive mailing list was developed for distribution of a project notice to introduce the project and to announce the CIM. NCTA prepared a press release on June 6, 2006 announcing the CIM in several of the local newspapers, such as the Raleigh News and Observer and the Durham Herald Sun. Copies of the June 2006 meeting notice and press release are included in Appendix E.

The postcard meeting notice was sent to over 2,000 individuals and agencies. The project mailing list included state, federal, and local agencies, property owners within one mile of the study area, and citizens who previously requested to be added to the mailing list. In an effort to notify people commuting to the area from outside of the project area, notices were also emailed to the RTF and human resources departments of RTP businesses for distribution to their employees within RTP.

7.4.4 NCTA Website

NCTA maintains a public website, www.ncturnpike.org, as a resource for people to learn about the agency, current NCTA events, and the status of the NCTA projects. Each of the NCTA projects has a page on the website, including the Triangle Parkway. The Triangle Parkway web page includes project maps, schedule information, meeting notices, and readable versions of the latest studies conducted for the project. NCTA contact information and a comment section are also provided on the website for people to inquire about the project, provide comments, and ask questions. Two comments have been received through the website, both comments related to concerns regarding the Kit Creek Road connector and the Kitts Creek subdivision.

7.4.5 Stakeholder Meetings

In addition to the workshops and agency meetings held for the project, several stakeholder or "small group" meetings were held for the project. Stakeholder meetings were held to clarify property owner needs, in addition to thoroughly evaluating the potential impacts from the construction of Triangle Parkway. Stakeholder meetings were held with the following property owners in the project area.

- Research Triangle Foundation
- US General Services Administration (GSA)
- National Institute of Environmental Health Sciences (NIEHS)
- US Environmental Protection Agency, RTP
- EISAI
- Keystone Corporation
- Kitts Creek subdivision
- Kit Creek Road residents
- Davis Park Development
- Biogen

Meetings were held with EPA and/or NIEHS on the following dates: June 27, 2006 (EPA), October 30, 2006 (NIEHS), November 15, 2006 (NIEHS), January 11, 2007 (Both), January 25, 2007 (Both), July 19, 2007 (Both), August 9, 2007 (Both), November 7, 2007 (Both), December 4, 2007 (Both) and January 10, 2008 (Both)), and February 13, 2008 (EPA and NIEHS employees). The meetings discussed the EPA and NIEHS concerns relating to the closure of the NC 147 spur,

the proximity of the project to the FEELC, the Hopson Road entrance to EPA, access to the air quality testing facility, and vibration concerns at their testing facilities and the National Computing Center.

The February 13, 2008 meeting with the employees from EPA and NIEHS was held at the EPA facility in RTP. Over 100 employees and representatives of both EPA and NIEHS attended the meeting. Representatives from NCTA provided a formal presentation at the meeting followed by an hour session for comments and questions. Comments and questions received at the meeting included interests in pursuing transit services, concerns with the inconvenience in closing the NC 147 Spur, concern with the toll fees that would add-up for each trip they make to and from their office, and questions regarding the traffic and revenue studies. Comment sheets were distributed at the meeting, which NCTA will compile these comments with the Public Hearing comments and comments received on this EA. Responses to comments will be provided in the final environmental document.

In a January 4, 2008 letter, the DCHC MPO Transportation Advisory Committee (TAC) requested information regarding the concerns expresses by employees from EPA and NIEHS. NCTA responded on January 25, 2008 and also attended their TAC meeting on February 13, 2008 to review the information and outcome of the meeting with EPA and NIEHS employees. A formal presentation was provided as an update on the project and future NCTA commitments related to Hopson Road access. Several members noted their concern with closing the NC 147 Spur and discussed the designs further with the representatives from NCTA. The NCTA and DCHC correspondence letters are included in Appendix D.

7.5 Distribution of the Environmental Assessment

This Environmental Assessment (EA) will be circulated to the same agencies that received the scoping letters for review and comment. The EA will be available on the NCTA web site at www.ncturnpike.org. In addition, copies of the EA will be distributed to locations in the vicinity of the project area for public access prior to the Public Hearing. The EA will be available for a minimum of 15 days in advance of the Public Hearing for review and at the Public Hearing. Comments shall be submitted in writing to the NCTA within 30 days of the availability of the EA (23 CFR 771.119(e)). Responses to comments regarding the project and EA will be provided in a final environmental document.

7.6 Public Hearing

Following the distribution of this Environmental Assessment, a Corridor/Design Public Hearing will be held. Maps showing the engineering designs of the Preferred Alternative for Triangle Parkway and requirements for right-of-way will be available at the meeting for the public to review and ask questions. Formal notices will be included in the local newspapers a minimum of 30 days prior to the Hearing. Additional notices for the meeting will also be sent to persons on the project mailing list.

The Public Hearing could include a formal presentation. Topics such as right-of-way procedures and project schedules will be discussed at the hearing. Public comments received will be included and addressed as appropriate in the final document. These comments will also be considered during the decision-making process for the recommended alternative identified in the final environmental document. Representatives from the NCTA, NCDOT, and the FHWA will be present at the Public Hearing to answer questions and respond to comments. This Public Hearing will be recorded and a transcript prepared to formally document comments.

8.0 Conclusions and Recommendations

This Environmental Assessment (EA) documents the purpose and need for the Triangle Parkway (STIP Project U-4763B), the alternatives evaluated, and the potential impacts associated with the Preferred Alternative. Triangle Parkway as a tolled roadway on new location is the Preferred Alternative and would increase travel capacity in the project area by over 100,000 vehicles per day. This Preferred Alternative is consistent with the project purpose and need.

Triangle Parkway is a North Carolina Strategic Highway Corridor and is projected by 2030 to serve approximately 104,200 to 130,000 vehicles per day traveling in the Triangle Region. Constructing Triangle Parkway would improve commuter mobility, access, and connectivity to Research Triangle Park (RTP) by providing direct freeway access to and from RTP for approximately 37,000 vehicles per day accessing Hopson Road and Davis Drive. The project would also reduce congestion on existing north-south routes that serve the Triangle Region, primarily NC 55 and NC 54.

8.1 Human Environment Impact Summary

The environment surrounding Triangle Parkway is primarily RTP and is zoned for research oriented development. The project vicinity is located within areas of Durham and Wake Counties that are continuing to experience residential development and commercial growth. The Triangle Parkway is consistent with local, state, and regional transportation plans and local zoning.

The project is not anticipated to have substantial impacts to the human environment within the project area. Constructing Triangle Parkway will change access, revise travel patterns, relocate two residents, and have noise impacts to seven residential complexes, seven residencies, and two businesses. Based on the NCDOT's Highway Traffic Noise Analysis and Abatement Policy a noise wall was determined to be cost-effective at one impacted location; the NCTA has preliminarily determined a noise wall at the First Environments Early Learning Center (FEELC) is reasonable and feasible.

The recommendations in this EA for noise mitigation are preliminary and could be modified during final design. Final decisions on noise mitigation will be made based on a design level noise study prepared in accordance with NCDOT's noise policy.

The project will not impact any registered historic architectural or historic archaeological sites.

8.2 Natural Environment Impact Summary

The construction of the Preferred Alternative would impact 4,647 feet of perennial stream, 4,082 feet of intermittent stream, and 2.05 acres of wetlands. Coordination with the regulatory agencies during NCTA Turnpike Environmental Agency Coordination (TEAC) meetings determined that payment of an in-lieu fee to Ecosystem Enhancement Program (EEP) would be an available option for off-site mitigation to satisfy any Federal Clean Water Act compensatory mitigation requirements for this project. The Preferred Alternative would not adversely impact threatened and endangered species.

8.3 Indirect and Cumulative Effect Summary

Triangle Parkway is projected to increase capacity within the regional roadway transportation system by up to approximately 130,000 vehicles per day in the design year 2030. Triangle Parkway will provide an alternative route through RTP and for other adjacent commuting roadways within the ICE Study Area. It will be a full control of access with service roads in the vicinity of Hopson Road and Davis Drive. A majority of the project is within a reserved corridor in RTP, and proposed service roads will not provide new access to adjacent properties. Local plans include Triangle Parkway and there are development controls and environmental regulations in place to accommodate the planned growth within the ICE Study Area [Future Land Use Study Area (FLUSA)].

Due to its connectivity to major commuting routes, increased accessibility to a regional employment center, and anticipated changes in travel patterns, Triangle Parkway has good potential to have an overall positive effect by reducing congestion and travel time.

There is limited potential for complementary development associated with the project because most of the Preferred Alternative is in a reserved corridor within a planned business community where land use is restricted to research oriented applications. RTP land use restrictions limit potential development to research-oriented business uses, which substantially influences the types of future development that would be allowed near the project.

The cost of tolls may influence the extent of the changes in travel patterns given that existing free routes will still be available for commuters. However, it is anticipated that fewer cars would be using the adjacent existing roads such as NC 54 and NC 55, which is considered a positive effect of the Preferred Alternative.

There are other transportation improvement projects planned within the FLUSA that are intended to help improve traffic flow and reduce congestion in the FLUSA. Cumulatively, Triangle Parkway with these other planned roadway improvements in the region should further enhance accessibility, reduce congestion, and improve travel time locally and regionally. An overall improved infrastructure could result in a positive economic benefit to RTP by making the area more appealing for potential businesses, positively influencing decisions existing businesses make regarding future expansions, and potentially increasing property values.

In response to a request from the Town of Morrisville, the Kit Creek Road connection is included as part of the Preferred Alternative. This connection would improve connectivity for vehicular traffic to Davis Drive. However with this connection, there is the potential for an increase in through traffic within the Kitts Creek neighborhood. The Town of Morrisville could implement various types of traffic calming measures to slow traffic and discourage the use of this facility as a "cut-through" in the future if the neighborhood experiences problems.

The Kit Creek Road connector would provide additional access to a large tract of land within the Shiloh area. This large tract of land is currently owned by ancestors of the Shiloh community. These property owners have expressed interest in maintaining ownership of their properties to preserve the Shiloh area history. Providing additional access to these properties, combined with other transportation projects and the continuous growth in the FLUSA, could increase the development pressures on these property owners and increase the probability that these properties become designated for other uses. The attractiveness for denser development of the large tracts of land within the Shiloh community and adjacent to the Kit Creek Road connector could be reduced with limited access provisions from the new roadway and/or using provisions within the Town of Morrisville's zoning and land use plans.

Triangle Parkway in combination with other transportation projects planned in the area could cause indirect and cumulative effects to streams as a result of road construction and potential future complementary development. RTF land use restrictions limit potential development to research-oriented business uses within RTP. Development associated with the proposed project is expected to be limited not only by the RTF restrictions, but also because the Preferred Alternative includes full control of access with only interchange connections. In addition, current environmental regulations combined with other Local, State and Federal plans would limit growth and minimize cumulative effects.

8.4 Recommendation

The Preferred Alternative includes constructing a new multi-lane toll road with full access control on new location from NC 540 to I-40. In addition to coordination with agencies and the public, measures to avoid and minimize impacts to the human and natural have been incorporated throughout the planning stages and during the development of the functional designs for the Preferred Alternative. Continued outreach to the public to enhance understanding on toll facilities is recommended to keep the public educational process moving forward. Since toll roads are new to the state, clear signage near toll plazas may be helpful to lessen driver confusion and the likelihood of associated accidents.

The Preferred Alternative utilizes RTF property reserved for this route since the creation of the RTP, which substantially reduced impacts to the human and natural environments. Based on the project technical studies and coordination with the public and regulatory agencies, there is no indication that constructing the Preferred Alternative would have a significant impact on the environment.

It is anticipated from the findings of this Environmental Assessment that a Finding of No Significant Impact would be appropriate for this project. However, the determination on the format for the final National Environmental Policy Act documentation for this project will be based on the comments received at the Public Hearing and the comments received on this document.

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