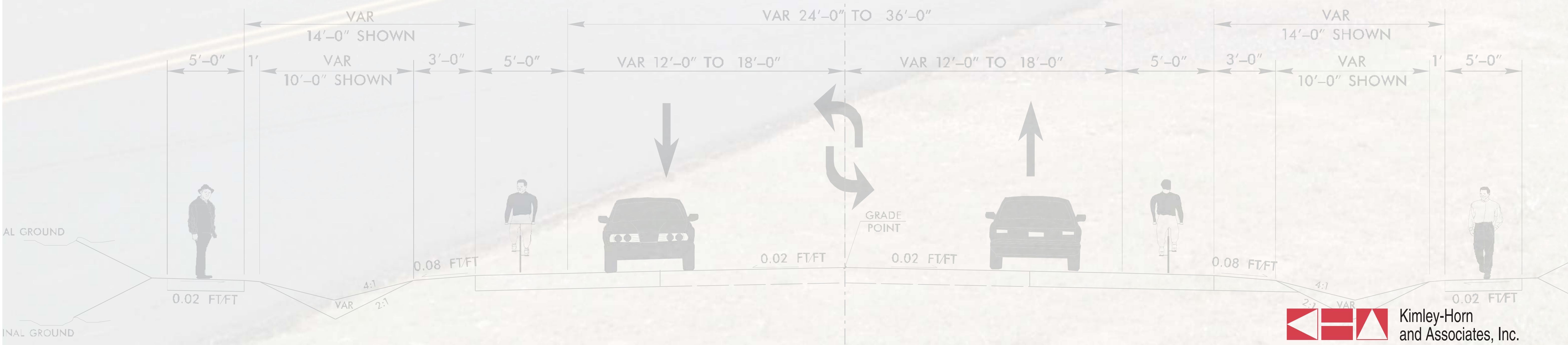
Final Report

Durham-Chapel Hill-Carrboro METROPOLITAN Planning Organization

Old Durham/Chapel Hill Road
Bicycle and Pedestrian Facilities Study



Kimley-Horn
and Associates, Inc.

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Acknowledgements

The development of the Old Durham-Chapel Hill Road Bicycle and Pedestrian Feasibility Study was a collaborative process that involved numerous stakeholders, including Policy and Technical Committees, the Durham Chapel Hill Carrboro (DCHC) MPO, and the North Carolina Department of Transportation Pedestrian and Bicycle Unit. While the following individuals have contributed their time, ideas, and expertise, the opinions contained herein are those of the consultants.

Policy Committee

Janice Rolli Mills (Durham)
Ronnie Griffin (Durham)
Al Beuhler (Durham)
Ellen Reckhow (Durham)
Ed Harrison (Chapel Hill)
Pete Schubert (Durham)
Claire Millar (Chapel Hill)
Brian Decker (Chapel Hill - alternate)
Matt Hopgood (Chapel Hill)
Jim Ward (Chapel Hill)
Laura Gilliom (Chapel Hill)

Kimley-Horn and Associates Consultants

Mike Rutkowski
Roger Henderson
Nik Nikolaev
Jason Johnson
Andy Kiley
Natalie Mengelkoch
Allison Lockwood
Matt West
Janet Doughty

Technical Committee

Alison Carpenter (Durham – Project Manager)
Andy Henry (Durham)
Felix Nwoko (Durham)
David Bonk (Chapel Hill)
Battle Whitley (NCDOT)
Gordon Sutherland (Chapel Hill)
Tom Norman (NCDOT)
Kumar Trivedi (NCDOT)

Toole Design Group (Subconsultants)

Jennifer Toole
Robert J. Schneider

The Old Durham-Chapel Hill Road Bicycle and Pedestrian Feasibility Study is scheduled for adoption by the Transportation Advisory Committee of the Durham-Chapel Hill-Carrboro (DCHC) MPO at their February 8, 2006 meeting. The study is also scheduled for review by the Durham City Council, Durham County Commissioners and Chapel Hill Town Council.

Project Overview/Introduction

Introduction

The purpose of this feasibility study was to prepare a bicycle and pedestrian plan that will not only serve as a prototype for other Durham/Chapel Hill corridors, but also serve as a guide for local, regional, and state agencies in developing and promoting safe, convenient facilities and services oriented to bicyclists and pedestrians. This project was sponsored by the Durham-Chapel Hill-Carrboro MPO and coordinated with the City of Durham; Town of Chapel Hill; a Policy Committee (citizen-based representatives); and a Technical Committee (professional staff and local bike/pedestrian specialists).

> *Study Goal*
> *"provide safe and convenient facilities and services for the people who choose to bicycle and walk"*

History

Old Durham-Chapel Hill Road has been recognized as a critical link for pedestrian and bicycle travel by Durham and Chapel Hill for more than10 years. Improving the safety and convenience of walking and bicycling along this corridor will help both communities accomplish a task that has long been identified as a critical connection between the two.

The *1993 Regional Bicycle Plan* for Durham and Orange Counties identified Old Durham-Chapel Hill Road as a key bicycle connection between Durham and Chapel Hill. The Plan listed non-motorized trip generators within the corridor and identified opportunities for adding bicycle lanes along the roadway. It can be viewed at the City of Durham website: www.durhamnc.gov/departments/works/transportation.cfm

Several other plans have also recommended Old Durham-Chapel Hill Road as a key corridor for pedestrian and bicycle improvements. The *Town of Chapel Hill Comprehensive Plan* (2000) established the goal of developing a "balanced, multi-modal transportation system that will enhance mobility for all citizens, reduce automobile dependence, and preserve/enhance the character of Chapel Hill." The *2004 Town of Chapel Hill Draft Bicycle and Pedestrian Action Plan*, adopted October 2004, recommends:

- Providing sidewalks on both sides of Old Durham-Chapel Hill Road
- Striping bicycle lanes along the road
- Improving pedestrian and bicycle conditions at the intersection of US 15/501 and Scarlett Drive

The plan can be viewed at the following website:

www.townhall.townofchapelhill.org/planning/bikeped/ BikePedPlan.htm

One of the goals of the Durham-Chapel Hill-Carrboro (DCHC) MPO *Draft 2030 Long Range Transportation Plan* (LRTP) is to establish a "pedestrian and bicycle system that provides an alternative means of transportation, allows greater access to public transit, and supports recreational opportunities." The 2030 LRTP specifically recommends that bike lanes be provided on Old Durham-Chapel Hill Road.

Need for Project

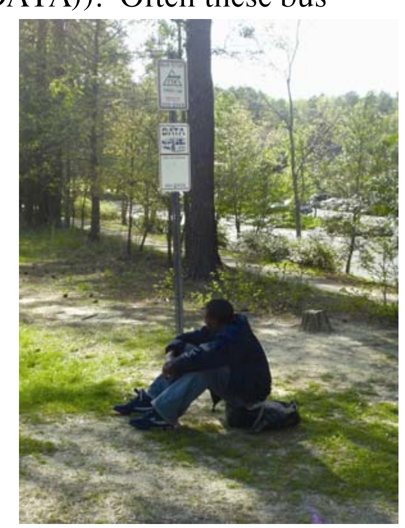
As noted in previous planning efforts, Old Durham-Chapel Hill Road is an important corridor for pedestrian and bicycle travel. The list below summarizes the need for pedestrian and bicycle facility improvements along the corridor. The list was developed based on research for the project as well as discussions with the DCHC planning staff.

- Old Durham-Chapel Hill Road is a key transportation connector between Chapel Hill and Durham. It serves as the only direct connection between Durham and Chapel Hill for people who wish to avoid US 15/501. The corridor provides access to a future public park, greenways, several existing and future apartment complexes, residential neighborhoods, churches, Githens Middle School, Blue Cross/Blue Shield, shopping, and offices on US 15/501. Both UNC-Chapel Hill and Duke University are within bicycling distance of the corridor.

- Existing pedestrian and bicycle facilities include discontinuous sidewalks and shoulders. There are few opportunities to cross the road, and where they do exist, they lack crosswalks, pedestrian signals, median crossing islands, pedestrian lighting, or other safety treatments. None of the transit stops have benches or shelters.

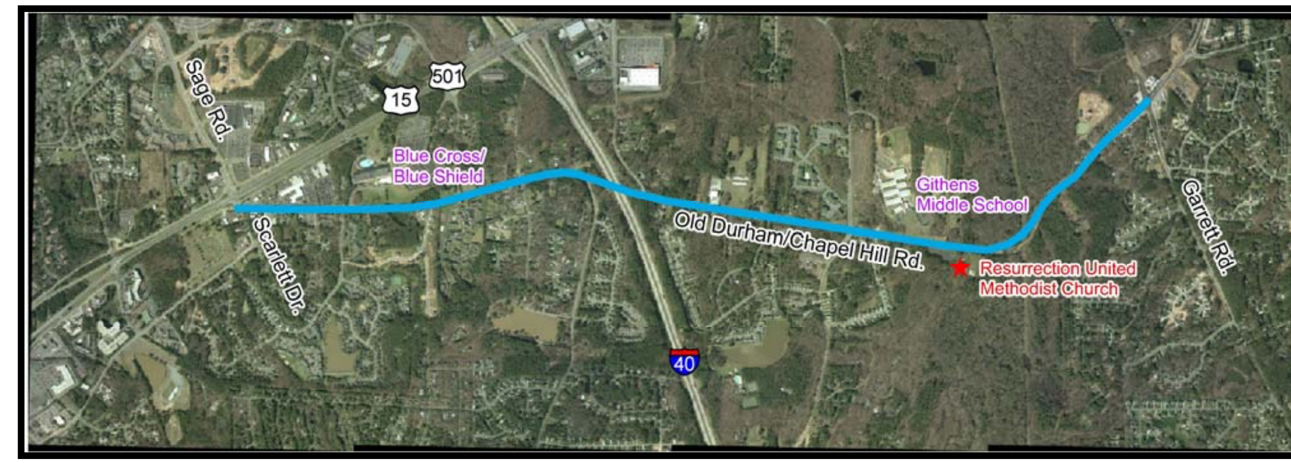
- Improvements in the area around Githens Middle School will make it safer for students and staff to walk and bicycle to school.
- New development is occurring along the roadway and in surrounding areas. It is important to take advantage of opportunities to add pedestrian and bicycle facilities while development occurs, rather than making expensive retrofits in the future after development is already established.

- The roadway has bus stops for several transit systems (Triangle Transit Authority (TTA), Chapel Hill Transit, and Durham Area Transit Authority (DATA)). Often these bus stops are isolated and difficult to access on foot or by bicycle. Providing safe and convenient pedestrian and bicycle access to transit can make bus service accessible to more customers and increase ridership.



- Pedestrian and bicycle facilities on Old Durham-Chapel Hill Road would provide residents of the area with more choices in how they travel to nearby destinations.
- Pedestrian and bicycle facilities offer opportunities for recreation. Residents of the Old Durham-Chapel Hill Road Corridor will have the option to run or bike from home rather than drive to a park, trail, or gym to get exercise. Furthermore, access to scenic greenways along the Booker Creek trail in Chapel Hill and the New Hope Creek trail in Durham will be possible with these improvements.
- Better pedestrian and bicycle facilities will make it safer for people who are already walking and bicycling along the roadway. New sidewalks, shared-use paths, bike lanes, and crosswalks will make the roadway more attractive to people who currently avoid this roadway because they feel it is unsafe.
- Pedestrian and bicycle improvements could improve air quality. As people feel more comfortable and begin making safe trips on foot and by bicycle on Old Durham-Chapel Hill Road, some automobile trips may be replaced by non-motorized trips.
- Providing bicycle and pedestrian facilities along Old Durham-Chapel Hill road will provide needed amenities for those who choose to ride because of age, economics or physical barriers to operating a vehicle.

The DCHC MPO identified a 2.7 mile section of the Old Durham-Chapel Hill Road between US 15/501 and Garrett Road to be included in this study.



Public Outreach/ Project Coordination

Technical Committee/Policy Committee

A technical committee made up of professional staff and bicycle and pedestrian specialists was formed to serve as a sounding board for the consultant's technical work and recommendations. This committee met with the project team as needed throughout the planning process. The technical committee provided valuable direction on the proposed improvements including addressing problem areas such as the busy intersection of US 15/501 and crossing the I-40 bridge.

Also, a citizen-based policy committee representing Durham and Chapel Hill municipalities with experience in bicycle and pedestrian planning activities was formed to help guide the planning process and study issues. This policy committee also helped communicate and affirm findings with the public, and will be asked to facilitate a decision by elected and appointed officials to determine a preferred plan. Several issues were addressed by the policy committee — most important was their development of the vision and goals of the study.

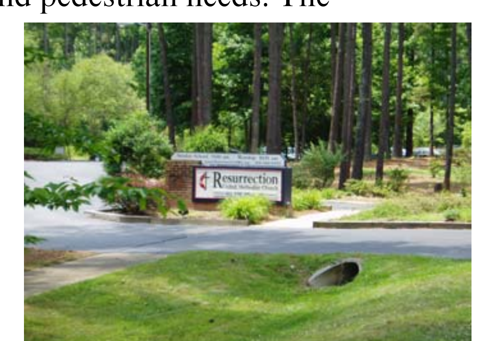
DCHC TAC/TCC Coordination

The Durham-Chapel Hill-Carrboro Metropolitan Planning Organization (DCHC MPO) is responsible for transportation planning activities within this region. The proposed improvements identified and outlined in this study will be considered by the DCHC MPO TAC on November 30, 2005.

Design Charrette/Open House

A public design charrette was conducted April 15 and 16, 2005 to engage the public, elected officials, and planning staff in the development of bicycle and pedestrian improvements along the Old Durham-Chapel Hill Road corridor. Invitations were mailed to residents and businesses along the corridor by the City of Durham. Over 50 participants attended the two-day event. The purpose of the design charrette was to give citizens the opportunity for "hands-on" involvement with the development of the Old Durham-Chapel Hill Road bicycle and pedestrian facilities. Local citizens, business owners, community groups, local staff, and the project team worked together as a collective group to identify issues and concerns, develop goals and a vision, and "brainstorm" possible solutions and recommendations.

Held at Resurrection United Methodist Church in the study corridor, the charrette format allowed interested groups the opportunity to share their thoughts about bicycle and pedestrian needs. The two-day event encouraged participation using mark-up maps and "Post-it" notes. Brainstorming sessions and planning activities specifically tailored to generate discussion were conducted to identify bicycle and pedestrian access and mobility throughout the corridor, natural and manufactured constraints, and to develop ideas for improvement. Key exercises conducted with the public included:



Day one:

- Issues identification exercise
- Brainstorm on key issues and needs
- Survey participants
- Establish a "vision"

Day two:

- View maps of alternative solutions
- Identify "pros" and "cons"
- Citizen comments on ideas

Landscape architectural renderings as well as before and after Photoshop renderings were used throughout the two-day charrette to provide a visual concept of what could be done with the corridor. These tools proved to be effective in developing community support.

Pedestrian facilities

Generic before

Generic after rendering

Bike facilities

Generic before

Generic after rendering

Supporting facilities

Numerous comments were received at the charrette that identified issues and needs for Old-Durham-Chapel Hill Road. Some of those comments, including questions and suggestions for improvements, are included below:

- Safe bike/pedestrian for children and intermediate users
- Attractive/viable alternative to driving
- If roadway is later widened, will the bike/pedestrian facilities be reduced?
- Intersection crosswalks — especially for transit users
- Bike lanes vs. wide outside lanes — preference for dedicated lane
- Lower speed limit to 35 mph
- Connections needed to New Hope Creek Greenway
- Intersection crossing for bike/pedestrian facilities need:
- ADA Curb Ramps
- Pedestrian refuge islands
- Bike activated traffic lights
- Provide plantable separation between road and sidewalk/multiuse path
- Pedestrian countdown at traffic signals
- Githens Middle School — key destination
- Resurrection Church — key destination
- School functions use church parking
- Pedestrian light, crosswalk, traffic calming may be appropriate
- Transit — bus pullouts
- New right-of-way — limit additional takings
- Maintenance of on-road facilities
- Debris issues — can we get it swept once a month?
- Bike lane (collects more debris) vs. wide outside
- Bus stops landscape (not grass)
- Shelters at bus stops with secure weather protected bike storage
- Use porous pavement — previous surface for walkway
- Lighting at all intersections
- Lighting at all bus stops
- Bench at all bus stops
- Lower posted speed limit to 35 mph from Mt. Moriah to Watkins
- Look for grade separation opportunities
- Bike/pedestrian detectors
- Shade with buffers
- Flex design — expansion potential
- Advanced stop ban for bikes

As a follow-up to the design charrette, a public open house was held on June 22, 2005 to present the draft plan and constructability drawings to the general public. Invitations were mailed to every address in the study corridor by the City of Durham. The forum was attended by 35 participants and provided an excellent opportunity to obtain valuable feedback from the public on specific recommendations and changes to the plans. Subsequent design changes were made to the constructability drawings as a result of the open house.

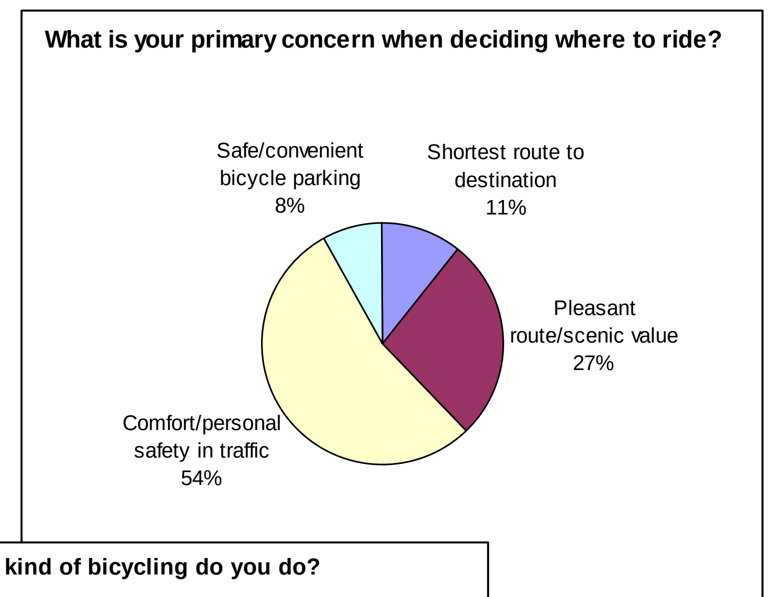
Overall, the recommendations and plans were generally supported by the attendees. Most of the comments were related to design changes and suggestions that were incorporated into the constructability drawings.

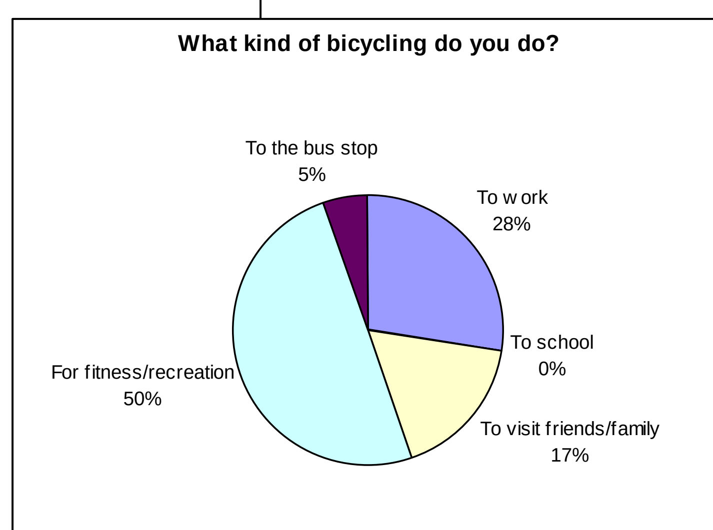
Today

Rendering of the Future

Public Survey Results

Public outreach was not limited to the charrette and open house. A public survey was distributed to committee members, planning staff, and the general public. The surveys were administered at the design charrette, open house, and committee meetings, as well as provided to individuals who could not attend the meetings but expressed an interest in bicycle and pedestrian planning. Twenty open-ended and multiple choice questions were included in the survey asking questions about bicycle and pedestrian choices and trade-offs. A total of 52 surveys were completed and compiled for consideration by the project team. The following provides a summary of select questions and results from the survey. See survey form in the appendix for a complete list of questions and results.





Goals and Objectives

The goals for this study were developed based on thoughtful community discussions including direct public outreach, community survey results, and meaningful planning staff and committee involvement. The following goals attempt to balance the vision and objectives expressed by committee members *and* comments received at the public design charrette and open house. The Consultant believes this design adequately addresses all of the goals listed below except minimization of right-of-way takings. This issue is addressed on page 16.

- Need for consistent cross section
- Improve travel safety for ALL modes
- Limit driver, pedestrian, and bicyclist confusion
- Use existing facilities where practical
- Need for facilities that serve pedestrians and bicyclists
- Avoid residential relocations
- Minimize right-of-way takings
- Provide for all types of cyclists and levels of experience
- Make corridor transit-friendly
- Avoid/minimize major bridge construction

Existing Conditions

Pedestrian and Bicycle Conditions

Pedestrians and bicyclists use all parts of the Old Durham-Chapel Hill Road corridor. It is essential to provide safe facilities for these non-motorized users.

The highest levels of pedestrian activity are found near pedestrian trip attractors, such as bus stops, schools, and apartment complexes. Sections of the roadway with undeveloped land currently have lower pedestrian volumes. This will change as parcels of land in the corridor are developed. Bicyclists use the entire length of Old Durham-Chapel Hill Road between US 15/501 and Garrett Road for access between Chapel Hill and Durham.

Existing pedestrian and bicycle facilities include several disconnected sidewalks and shoulders (illustrated in the constructability drawings included in the appendix). Few crossings of Old Durham-Chapel Hill Road have been improved with crosswalks, pedestrian signals, median crossing islands, or other treatments.

For pedestrians and bicyclists traveling along Old Durham-Chapel Hill Road, the intersections with US 15/501, Scarlett Drive, Pope Road, Mount Moriah Road, Farrington Road, and Garrett Road are challenging due to wider crossing distances and higher volumes of turning vehicles. The bridge over Interstate 40 is particularly difficult for pedestrians and bicyclists. This bridge has shoulders (4-feet wide) adjacent to concrete jersey barriers.

Pedestrian and bicycle lighting is minimal along the entire Old Durham-Chapel Hill Road corridor. This issue was identified by members of the public who reside along the corridor and find it difficult to travel on foot or bike at night. Some crosswalks and sidewalk sections could be made safer by adding low-level street lights.

Transit Service

Old Durham-Chapel Hill Road serves several bus systems — TTA, Chapel Hill Transit, and DATA. TTA and DATA serve the eastern portion and Chapel Hill Transit serves the western end of the roadway.

None of the existing bus stops have benches or shelters. Few have level landing areas for people with disabilities. Most of the Chapel Hill Transit bus stops are served by sidewalks, but many of the DATA and TTA bus stops have been placed in locations where passengers must wait in the grass or on the roadway shoulder.

Transit users often need to cross Old Durham-Chapel Hill Road to access the bus stop. High-speed, high-volume traffic makes these crossings difficult. The only bus stop served directly by a crosswalk is across from Githens Middle School.

Traffic Volumes

Traffic along Old Durham-Chapel Hill Road has steadily increased over the past several years. Traffic volumes along this corridor near Scarlett Road and Garrett Road are 7,300 vehicles per day (vpd) and 16,000 vpd, respectively. Since 1999, average daily traffic volumes have increased an average 3 to 4%. Level of service operations analyzed at the signalized intersections of US 15/501 and Garrett Road indicated LOS F and LOS C, respectively, for the peak hour. High traffic volumes along the corridor will continue to be problematic for safe pedestrian and bicycle mobility if provisions are not made for these alternative modes. For additional LOS information, please see the appendix.

It should be noted that traffic volumes along the US 15/501 corridor are 45,000 vpd. Since US 15/501 has become the mobility corridor, it stands to reason that Old Durham-Chapel Hill Road should be protected as a local facility which supports slower speeds and provisions for bicycle and pedestrians.

Traffic Crashes

Safety for bicyclists and pedestrians will not improve without measures being taken. By adding facilities, crashes will likely decrease, as shown through research published in FHWA's *Bicycle Safety-Related Research Synthesis* (publication no. FHWA-RD-94-062, April 1995) which indicated that adding bike lanes to communities in Oregon and Denmark reduced accident rates and improved the feeling of cyclists safety.

The North Carolina average crash rate for a 2- to 3-lane undivided state route is 393 crashes per 100 million vehicle miles traveled (MVMT), according to the North Carolina Department of Transportation (NCDOT). Between August 31, 2001 and August 31, 2004, NCDOT reported 416 crashes along Old Durham-Chapel Hill Road. Four hundred and five of these crashes occurred along Old Chapel Hill Road in Durham County(www.doh.dot.state.nc.us/preconstruct/traffic/Safety/ses/rates/2002/statewide.pdf). This translates to a total crash rate of 1,758 crashes per 100 MVMT, which is almost five times the state average crash rate for a similar road. The Severity Index (a measure of crash severity relative to property damage and injury) is similar to the State average at 4.00. The appendix includes a crash summary for the Old Durham-Chapel Hill Road corridor.

Five pedestrian- or bicyclist-related crashes occurred within the 3-year time period, as described below:

- 9/30/2001 (just west of Five Oaks Drive) — a passenger car leaving a parked position struck a pedestrian; occurred at 9:00 pm under dark (no roadway lighting) conditions
- 4/09/2003 (at intersection with Buchanon Drive) — a passenger car traveling eastbound at 30 mph struck a pedestrian under daylight conditions (4:17 pm)
- 12/23/2001 (just west of Garrett Road) — a passenger car traveling at 45 mph struck and fatally wounded a pedestrian under dark (some roadway lighting) conditions; pedestrian was found to be under the impairment of alcohol
- 05/24/2003 (at intersection with Garrett Road) — a passenger car traveling eastbound at 50 mph struck and fatally wounded a pedestrian under daylight conditions at 2:31 pm; pedestrian was found to be under the impairment of alcohol
- 11/23/2002 (just west of University Drive) — a sport utility vehicle traveling 30 mph struck a bicyclist under daylight conditions; no injuries were reported

Although the causational factors contributing to these crashes involving bicycle and pedestrians are well-documented, no recurring trends were identified.

Field Observations

During the initial phase of the study, a “windshield survey” was conducted to identify and document key points of interests or “destinations” along the Old Durham-Chapel Hill Road corridor. It was important to identify these points along the corridor so that the proposed bicycle and pedestrian improvements could be tailored to users of these facilities. A good example of this is the provision of a 10-foot multiuse path near the Githens Middle School because parents expressed they felt that the path would be safer for their children to use rather than on-road bike facilities. With this in mind, key destination points along the corridor and in the surrounding area include:

- On Old Durham-Chapel Hill Road
  - Githens Middle School
  - Resurrection United Methodist Church
  - New Hope Creek Trail
  - Apartment complexes (The Verge, etc.)
  - Blue Cross/Blue Shield
  - Bus stops (TTA, Chapel Hill Transit, and DATA)
  - Residential neighborhoods
  - Businesses at intersection with US 15/501
- In surrounding area
  - Downtown Durham
  - Downtown Chapel Hill
  - UNC-Chapel Hill
  - Duke University
  - University hospitals
  - Businesses in the US 15/501 Corridor
  - Residential neighborhoods

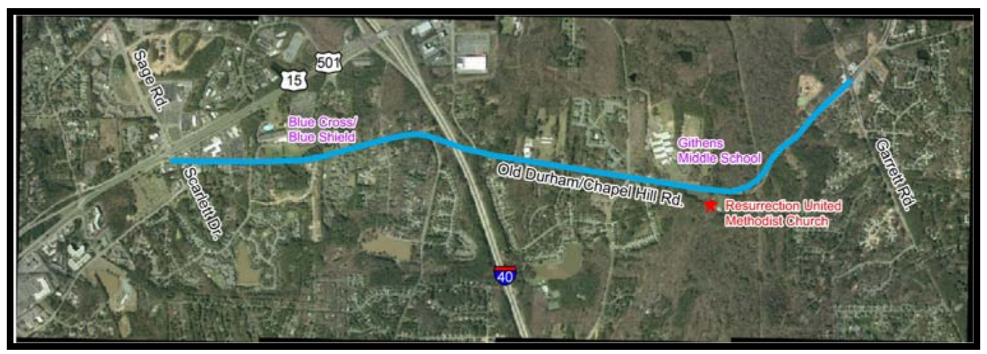
In addition to the “windshield survey,” a more detailed field survey was conducted using Trimble GPS units. The data gathered in the field survey was reviewed as the constructability drawings were developed. Therefore, it was important to gather specific locations (using Global Positioning System or GPS) of on-road facilities as well as potential obstructions within the existing right-of-way limits. Specific field data included:

- Presence of bike/pedestrian facilities (sidewalks, multiuse paths, etc.)
- On-road features (e.g., edge of pavement, curb and gutter, crosswalks)
- Posted speed limit
- Location of obstacles (e.g., poles, signs, fire-hydrants, landscaped areas)
- Barrier locations (e.g., bridges, culverts)

These features identified during the field survey can be viewed in the constructability drawings included in the appendix.

Alternatives Evaluation

Several types of pedestrian and bicycle facilities were considered for improving the safety and comfort of walking and bicycling in the Old Durham-Chapel Hill Road corridor. Bicycle and pedestrian alternatives were developed for the section of Old Durham-Chapel Hill Road between US 15/501 and the Garrett Road intersection.



Both on-road and off-road pedestrian and bicycle facility alternatives were considered for the length of the 2.7 mile roadway corridor. These facilities included:

- Sidewalks (on one side or both sides of the roadway)
- Multi-use paths adjacent to the roadway
- Wide outside travel lanes
- Paved shoulders
- Bike lanes

Various facility types also were considered to improve roadway crossings, including.

- High-visibility crosswalks
- Median refuge islands
- Raised crosswalks
- Flashing crosswalks
- Crosswalk warning signs
- Pedestrian-activated signals
- Pedestrian countdown signals
- Bike-friendly traffic signals
- Pedestrian-level lighting

After these facilities were considered, preferred alternatives were chosen and recommended for Old Durham-Chapel Hill Road.

Preferred Alternatives

The section below describes the pedestrian and bicycle facilities recommended for the Old Durham-Chapel Hill Road corridor. The final recommendations were prompted by the consultant and supported in concept by the policy committee and planning staff because they were the most consistent with the study goals and objectives. *Note: these facilities will need to comply with all requirements of the Americans with Disabilities Act Accessibility Guidelines (ADAAG) (1).*

Recommended Facilities for Length of Roadway Corridor

This study recommends a two- or three-lane roadway cross-section with bike lanes and sidewalks (where applicable) on both sides for the entire length of the Old Durham-Chapel Hill Road corridor. The facilities that were chosen for the length of the corridor (standard sidewalks, wide sidewalks, and bike lanes) are discussed below.

Standard Sidewalks

The typical sidewalk width along Old Durham-Chapel Hill Road should be a minimum of 5 feet. Sidewalks are recommended on both sides of the roadway (where feasible) to improve pedestrian safety. While it would be less expensive to provide a sidewalk on one side of the road, having sidewalks on both sides minimizes the need to cross the roadway in midblock locations.

These sidewalks should include accessible roadway and driveway crossings and meet all ADAAG requirements. A grass or tree-lined buffer should be provided between the sidewalks and the roadway to give added protection to pedestrians.

There is a short section on the south side of the street where the roadway right-of-way is constrained by a pond, making it difficult to provide a sidewalk. In this location, pedestrians on the south side of the road would use proposed new crosswalks to access the sidewalk on the north side.

Five-foot-wide sidewalks were chosen as the primary off-road facility because there is not enough pedestrian and bicycle activity in the corridor at this time to recommend wider sidewalks. As development occurs and pedestrian and bicycle volumes increase in the future, wider sidewalks may be needed throughout the corridor.

Wide Sidewalks

Two locations on the north side of the roadway are recommended for 10-foot multiuse paths. These wide paths will be designed to serve a variety of non-motorized users, including pedestrians and bicyclists. Wide paths provide a more comfortable place for bicyclists who do not feel safe riding on the road. However, bicyclists will retain the right to use the roadway travel lanes and bike lanes.

One stretch of 10-foot multiuse path will be near Githens Middle School. This wide path will likely serve more children and inexperienced cyclists than other places along the corridor because of its proximity to the school and the future New Hope Trail. The second section of wide path is near Blue Cross/Blue Shield. A narrower path has already been established along the roadway in this location that can be widened.

These wide paths are recommended in corridors with few driveways and intersections because conflicts between turning motorists and bicyclists are less of a problem. Where crossings occur, advance warning markings and signs should be provided for bicyclists on the path and drivers on the intersecting roadway.

Wide paths were not recommended along more sections of Old Durham-Chapel Hill Road because other parts of the road have more intersecting roadways and driveways. In addition, wide paths are more costly than standard sidewalks.

Bike Lanes

Bike lanes should be provided along the entire length of Old Durham-Chapel Hill Road. They were recommended over paved shoulders and wide outside travel lanes for several reasons. First, research has shown that bicyclists have an enhanced sense of comfort riding along a segment of roadway when there is a bike lane or paved shoulder stripe separating them from motor vehicle traffic. Therefore, it is likely that the bicycle lanes will be used by a greater variety of residents in the Old Durham-Chapel Hill Road Corridor.

Unlike paved shoulders and wide outside lanes, bike lanes have signs and markings that show bicyclists the proper direction to ride and the proper way to position themselves at an intersection. This can reduce bicycle crashes and increase the predictability of motor vehicle and bicycle traffic movements and to help visually narrow the road. In contrast, wide vehicle travel lanes make drivers feel like they can travel faster, which is less safe for pedestrians and bicyclists. Finally, the bike lanes will be a visible signal that bicycling is welcomed as a transportation option in the Durham and Chapel Hill area.

Recommended Facilities for Roadway Crossings

A variety of roadway crossing treatments are recommended along Old Durham-Chapel Hill Road to enhance the safety of pedestrians and bicyclists. This section describes standard treatments that should be used at all roadway crossings and special treatments that should be added at specific locations.

Standard Crossing Treatments

Each roadway crossing in the Old Durham-Chapel Hill Road corridor should have curb ramps (where applicable) and meet the accessibility requirements of ADAAG (which includes providing curb ramps, level landings, and stable surfaces).

All crossings should also have adequate lighting for pedestrians to reduce nighttime crashes. Lighting is particularly important along parts of Old Durham-Chapel Hill Road with frequent nighttime activity, specifically in commercial areas (near US 15/501 and future commercial developments), high-density residential areas (apartment complexes), and bus stops.

Preferred pedestrian-scale lighting is characterized by shorter light poles (i.e., 15-foot tall posts) and shorter spacing between lamp posts than lighting for motor vehicles. Crosswalks should be illuminated by a standard street lamp.

High-visibility crosswalk markings should be installed at all designated crossing locations. These markings will raise driver awareness and provide safe pedestrian channelization and delineation.

A recent national research project completed by the Federal Highway Administration (FHWA) provides specific guidance on the installation of crosswalks and other safety measures at uncontrolled locations. This results of the study clearly indicate the safety benefits of enhancing pedestrian crosswalks with additional safety measures, such as pedestrian crossing islands, shortened crossing distances, traffic and pedestrian signals (where warranted), and other traffic-calming treatments (e.g., roundabouts, reduced turning radii at intersections, and variable message signs that show drivers their current speed).

The FHWA study recommends that uncontrolled midblock crossings on roadways like Old Durham-Chapel Hill Road (with an AADT of more than 15,000) include high-visibility crosswalks plus an engineering treatment when the posted speed limit is 35 mph and be served by a pedestrian signal or bridge when the posted speed is 40 mph or faster. Specific crossing enhancements are recommended in this study to meet these guidelines and improve pedestrian safety in the corridor.

Special Crossing Treatments at Specific Locations

A critical location for pedestrian crossing improvements is at Githens Middle School. This crossing is in a section of Old Durham-Chapel Hill Road with a posted speed of 40 mph. It is recommended that the existing marked crosswalk at this location be improved with the following combination of treatments:

- Lower posted speed limit to 35 mph
- A new pedestrian-activated traffic signal with pedestrian countdown signals
- Recessed stop bars on both sides of the crosswalk
- Accessible curb ramps at both ends of the crosswalk
- Crosswalk warning signs at the crosswalk and in advance of the crosswalk
- Better pedestrian-level lighting

A pedestrian-activated signal would stop traffic completely so that pedestrians can cross Old Durham-Chapel Hill Road. While many pedestrians would use this crossing before and after school, it is unlikely that the signal would be activated regularly throughout the day, so it would not add significantly to motor vehicle delay on the roadway.

Two recommended mid-block crossings on the west end of the corridor are in locations with a posted speed limit of 35 mph. These locations might be served by marked crosswalks, pedestrian crosswalk warning signs, and median refuge islands. Median islands would help improve pedestrian safety by serving as a refuge and allowing pedestrians to cross one lane of traffic at a time. Pedestrian warning signs should be provided at and in advance of pedestrian crossings, in accordance with MUTCD guidelines, and signs should be the fluorescent yellow-green color described in the MUTCD. Pedestrian-activated signals are not recommended due to the probability that other safety measures can be installed to adequately enhance pedestrian safety at these locations.

Two other recommended mid-block crossing locations near Blue Cross/Blue Shield include crosswalks and fluorescent yellow-green pedestrian warning signs. However, these crossings are in locations that currently have a 40 mph posted speed limit. Therefore, traffic calming measures should be used to slow vehicles on the roadway so that the posted speed limit can be reduced to 35 mph. With a posted speed of 35 mph, it might be appropriate to provide in-street pedestrian signs at these crosswalks.

In-street retro-reflective pedestrian signs display a “YIELD TO PEDESTRIAN IN CROSSWALK” sign and are placed in the center of the median. These signs should be made of a flexible material that will not present a hazard when touched or struck by a vehicle.

The signalized crossings at US 15/501, Farrington Road, and Garrett Road (and future signalized crossings) should have pedestrian countdown signals. This will help provide more information to pedestrians about how much time they have to cross the roadway. The clearance interval at these signals (amount of time between the beginning of the flashing UPRAISED HAND/ "DON'T WALK" signal and the green light in the opposite direction) should be timed to allow pedestrians who travel at 3.5 feet per second (slower than the average pedestrian) to reach the opposite curb safely.

Photo by Mary Ann Koos, Florida DOT

These traffic signals should also be made more suitable for bicyclists. Special bicycle detection equipment can be installed, such as loop sensors or detection cameras. In addition, the traffic signals can be timed to allow bicycles enough adequate clearance during the green and yellow phases.

As properties are developed in the future along the length of Old Durham-Chapel Hill Road, existing pedestrian crossings should receive safety treatments, such as median refuge islands, pedestrian-activated signals, raised crosswalks, etc. Additional locations for safe crossings should also be studied when pedestrian demand increases.

Constructability Drawings

Utilizing the base mapping, field reconnaissance, GPS survey data, alternative evaluation and input received at the public design charrette and open house, the project team developed constructability drawings for the proposed bicycle and pedestrian improvements. This effort included an evaluation of physical and property impacts associated with the constructability of the proposed improvements.

Typical sections in conjunction with horizontal and vertical conditions were developed using the Microstation and GIS information obtained from local agencies and from the field review. Ultimately, the constructability drawings were used to identify potential impacts to the right-of-way and quantify probable construction costs. The constructability drawings and the design criteria are included in the appendix.

Other Approved or Planned Projects

According to local planning staff and NCDOT, there are no planned roadway (public) projects along the study corridor. However, two private development related projects are slated to occur within the near future. The Performance Auto Park redevelopment project site plan has been approved by the Town of Chapel Hill. This project includes some on-road improvements along the western section of the Old Durham-Chapel Hill Road corridor between Scarlett Drive and just east of Cooper Street.

As a result of this project, the constructability drawings have been revised to include a continuous left-turn lane along this section of the corridor. In addition, a pedestrian crosswalk has been located on the west side of Cooper Street to accommodate the expected increased use of employee parking located on the south side of Old Durham Chapel Hill Road.

The Patterson Place development project is a phased project that includes a roundabout at the intersection of Old Durham-Chapel Hill Road and Mt. Moriah. The idea of a roundabout at this location is very favorable to the local planning staff, the public participants of this study, and the developer as it will provide a needed traffic calming affect along the corridor as well as a gateway to the corridor.

Areas of Interest

Several locations along Old Durham-Chapel Hill Road have particularly challenging conditions for pedestrians and bicyclists. More complex solutions are often needed at these locations because of high volumes of turning traffic, fast vehicle speeds, long-distance crossings, and right-of-way constraints.

US 15/501 — Scarlett Road Intersection

The US 15/501 intersection is at the west end of the Old Durham-Chapel Hill Road corridor. There are many activity destinations within one-quarter mile of this intersection, including restaurants, stores, residential neighborhoods, and a bicycle route into the Town of Chapel Hill. Conditions are challenging for pedestrians and bicyclists due to the extremely high volume and speed of traffic on US 15/501, high volume of traffic on Sage Road and Scarlett Drive, and large numbers of turning vehicles at the intersection.

Currently, there is one planned intersection improvement project that would impact the operation of this intersection. The project calls for converting the service road located adjacent to the Hardee's restaurant from two-way to one-way (westbound)operation using a channelized median at the intersection with Old Durham-Chapel Hill Road (please see the constructability drawings in the appendix). This improvement should help to limit driver, pedestrian, and cyclist confusion at this congested intersection.

Recommended bicycle and pedestrian improvements

As a part of this study, it is recommended that improvements to this intersection include new pedestrian countdown signals, better roadway lighting, traffic signals at Old Durham-Chapel Hill Road and Scarlett Drive, and more organized turning movements from Scarlett Drive to US 15/501. It also is recommended that an eastbound bike land be included adjacent to the median island at the service road.

New crosswalks will be striped on three legs of the intersection to enhance the visibility of pedestrians and re-enforce the requirement for vehicle drivers to yield to crossing pedestrians. Stop bars will also be added to the motor vehicle travel lanes to help keep the crosswalks clear of encroaching vehicles.

No crosswalk will be provided on the northeast side of the intersection (across US 15/501) at this time. If a crosswalk is provided in the future, it should be perpendicular to US 15/501 (not angled) to reduce total crossing distance. The crosswalk should pass through the roadway median so that pedestrians would have a refuge while crossing. Finally, pedestrians should have an exclusive pedestrian signal to prevent conflicts with turning vehicles.

Bicycle lanes will be striped through the intersection to help direct bicyclists traveling straight across US 15/501 to the new bike lanes on Sage Road.

A new left-turn bicycle lane will be provided to the right side of the exclusive left-turn lane for motor vehicles to provide additional space for bicyclists and a short shared-use path will be constructed from the west corner of the intersection to Dobbins Road. Both of these facilities will help bicyclists make the transition from the Old Durham-Chapel Hill Road bike lanes to the bicycle route on Dobbins Road that leads cyclists to the Booker Creek Greenway.

Githens Middle School

The improvements to Old Durham-Chapel Hill Road will make it safer and more comfortable for students and teachers to walk and bicycle in the area near Githens Middle School. New bike lanes, sidewalks, and multiuse paths along the roadway will improve conditions for non-motorized travel along Old Durham-Chapel Hill Road. On the school side of the road, a 10-foot wide multiuse path is proposed. This facility will provide space away from the road for bicyclists who do not feel comfortable riding in the bicycle lanes. It would also be connected to the New Hope Creek Greenway through a future public park adjacent to Old Durham-Chapel Hill Road.

Before

After Rendering

The existing crosswalk across Old Durham-Chapel Hill Road connects the TTA/DATA bus stop with the school driveway. Motor vehicles travel at high-speeds in this section of the road, making it difficult for pedestrians (especially young students) to cross. Rush hour periods are particularly difficult because of high traffic volumes.

Recommended bicycle and pedestrian improvements

Several improvements could be made at this crossing, including:

- Installing new pedestrian-activated traffic signal with pedestrian countdown signals
- Adding recessed stop bars on both sides of the crosswalk to increase the prominence of the crossing and to make drivers stop
- Constructing a sidewalk connection to the crosswalk
- Providing curb ramps at both ends of the crosswalk
- Posting crosswalk warning signs at the crosswalk and in advance of the crosswalk
- Installing better pedestrian-level lighting

Crosswalks could also be provided at locations where the multiuse path crosses the driveway near the school. Recessed stop bars would make drivers more aware of their responsibility to stop for path users, and pavement markings and signs can be provided on the path/trail to warn trail users of upcoming intersections. In the future, a new bench and shelter should be provided at the bus stop.

New Hope Creek Bridge Crossing

The New Hope Creek bridge crossing presented a slight challenge to this study and the project team. The bridge itself is 40 feet wide from face-to-face of the bridge rail. With 12-foot travel lanes, this leaves 8-foot shoulders to accommodate bicyclists and pedestrians. As noted previously, one of the goals of this study was to limit new bridge construction. Therefore, a separate bridge was cost-prohibitive.

Recommended bicycle and pedestrian improvements

Several improvements could be made at this bridge crossing, including:

- Transition area from bike lane and sidewalk to shared-use bicycle and pedestrian shoulder on both ends of bridge
- Paint the shoulder area red so that it visually narrows the road for drivers and adds prominence to the shared pedestrian and bicycle space
- Use wide (8”) stripes between the travel lane and the shoulder (stripes could be dashed with long dashes and small spaces to add prominence). This treatment will communicate to pedestrians and bicyclists that they should continue to pay attention to

motor vehicles because they could cross the line.

- Advance warning signs and markings to make drivers aware of pedestrian and bicycle shoulder
- Add pedestrian-level lighting to bridge
- Connect to future extension of the New Hope Creek Greenway

Mount Moriah — I-40 — Pope Road Section

The section of Old Durham-Chapel Hill Road between Mount Moriah and Pope Road may be the toughest challenge along the corridor. Currently, there are plans to improve the two intersections of Mount Moriah and Pope Road into future roundabouts. The existing I-40 bridge is only 30-feet wide from face-to-face of the bridge rail. With 12-foot lanes, this only leaves 3-foot shoulders to accommodate bicyclists and pedestrians.

Recommended bicycle and pedestrian improvements

Several improvements could be made along this section of Old Durham-Chapel Hill Road, including:

- New roundabouts at Mount Moriah Road and Pope Road would improve intersection efficiency and help to calm traffic
- New roundabouts would help define area across I-40 bridge as a slow speed zone to improve safety for motor vehicles, pedestrians, and bicyclists
- Transition area from bike lane and sidewalk to shared-use bicycle and pedestrian shoulder on both ends of I-40 bridge
- Provide 3-foot shared-use bicycle and pedestrian shoulder on both sides of bridge or provide 6-foot shared-use bicycle and pedestrian shoulder on one side of bridge
- Paint the shoulder area red so that it visually narrows the road for drivers and adds prominence to the shared pedestrian and bicycle space
- Use wide (8”) stripes between the travel lane and the shoulder (these could be dashed with long dashes and small spaces to add prominence). This treatment will communicate to pedestrians and bicyclists that they should continue to pay attention to motor vehicles because they could cross the line.
- Add pedestrian-level lighting at roundabouts and to I-40 bridge
- Possibly add new pedestrian/bicycle bridge in the future (could cantilever or add as separate structure on northeast side or southwest side)

Garrett Road Intersection

Within the past few years, the Garrett Road intersection was widened to include left-turn bays at all of the approaches. Based on existing traffic counts (provided by the City of Durham) and an operational analysis (using Synchro software) of peak hour traffic conditions, the level of services (LOS) of the intersection is more than adequate at LOS “C.”

The Old Durham-Chapel Hill Road approach to this intersection is seven lanes with curb and gutter. To limit the cost of construction and utilize the wide existing cross section, the project team considered removing one of the two left-turn bays at the approach of the Garrett Road intersection. A capacity analysis of this approach showed that removal of one of the two left-turn bays was acceptable. In fact, capacity analysis shows that the left-turn traffic volume could triple in the future and still adequately be served in one left-turn lane.

Recommended bicycle and pedestrian improvements

Several improvements are recommended at the approach to this intersection, including:

- Current geometry is extremely wide, with double left-turn lanes
- Remove left-turn lane from eastbound Old Durham-Chapel Hill Road, add median refuge space, and reduce curb return radii
- Bike lanes will be provided on the left side of the right-turn only lanes
- Pedestrian countdown signals will be added to all legs of the intersection
- Better pedestrian-level lighting will be provided at each crosswalk
- More potential pedestrian and bicycle activity from new development occurring nearby

These and other areas of interest as well as the associated proposed improvements for bicycle and pedestrians can be viewed in the constructability drawings in the appendix.

Implementation/ Funding Strategies

Completion of this feasibility study represents an important step forward toward implementing bicycle and pedestrian improvements in the Old Durham Chapel Hill Road corridor. The plans depicted in this report, however, are not suitable for contractors to use in construction. Furthermore, additional right-of-way may be needed from 65 parcels (a total of less than 2.9 acres) in order to realize the vision depicted in these drawings. Last, but certainly not least, the identified funding for construction is sufficient to build only a portion of the entire project, so additional funds or selective phasing of construction will be necessary.

The purpose of the Implementation Plan is to recognize these challenges and suggest strategies to address each challenge.

The metropolitan planning organization has secured $1.2 million for construction from the federal Surface Transportation Program – Direct Allocation (STP-DA). The MPO has set this project as its top priority for bicycle/pedestrian improvements. The State of North Carolina and local governments have matched the federal funds with $400,000 in state funds and $300,000 in local funds. While there is currently $1.9 million available for improvements to Old Durham-Chapel Hill Road, this is not enough funding to make all the improvements recommended in this report. Therefore, the recommendations should be prioritized and the most essential improvements should be made first. Future implementation will require additional funding.

Some potential sources for future funding are listed below.

Probable Construction Cost and ROW Acquisition

A probable construction cost estimate (based on planning level unit cost estimates provided by NCDOT) was developed for the proposed improvements identified on the constructability drawings. The following major construction items are included.

Environmental Study	$ 100,000
Planning and Design	$ 350,000
ROW Acquisition	$ 375,000
Construction (without roundabouts)	
On-road improvements (widening)	$2,080,000
10 foot multi-use path (asphalt)	$ 153,000
5 foot sidewalks (north side of road)	$ 94,000
5 foot sidewalks (south side of road)	$ 176,000
Construction Administration	$ 250,000
Utility Relocation	$ 250,000
Total:	$3,828,000

Right-of-way (ROW) requirements were also estimated for the project. A total of 2.86 acres of additional ROW will be needed to accommodate the bicycle and pedestrian improvements along the corridor. For a detailed breakdown of probable construction costs and ROW requirements, see the appendix.

It should be noted that the two roundabouts may be funded using other sources. Construction of the Mt. Moriah roundabout is a requirement placed by the City of Durham on a local developer of the Patterson Place development. Also, the Pope Road roundabout has been identified as a potential for state "Small Urban" funds according to Durham city staff. The estimated cost for the two roundabouts is $600,000, which is a total savings for this project because the roundabouts will be constructed by other means.

Curb and Gutter vs. Shoulders

Prior to the next phase of project design, a decision will be made regarding the tradeoff between retaining the open ditches where they exist in this corridor or an option to install storm water pipes in the ditch, cover them with fill, and install curb and gutter. Factors to consider in the decision-making process include the following:

- Environmental impact from degradation of water quality with the introduction of piped storm water runoff
- Impacts on adjacent property owners, residents, and businesses from the additional right-of-way that would be needed to build the project with open ditches
- Public safety related to motorists running off the road into a ditch
- Aesthetics along the corridor

Consultation with environmental permitting agencies and NCDOT is needed, along with perhaps further study, to inform the decision-makers regarding environmental impacts.

Right-of-way (ROW) acquisition could be reduced by replacing the ditches (shoulder section) with pipes to carry storm water runoff. Replacing the existing shoulder sections with curb and gutter would add approximately $600,000 to the construction cost but save ROW.

A quick-sketch analysis prepared by Kimley-Horn suggests that if land values exceed $6 per square foot (or $250,000 per acre) in this corridor, then the added cost of installing storm water pipes as well as curb and gutter would be well-spent to save on the right-of-way cost and aggravation to property owners. However, if land values do not exceed $6 per square foot, then the MPO is advised to engage a right-of-way agent (city/town, state, or private) to weigh the "real" costs of acquiring property in this corridor. The "real" cost should include benevolence factors that a city/town might encounter when negotiating with citizens over the use or acquisition of their land for public purpose.

To determine the approximate ROW cost associated with this project, the City of Durham General Services Department completed a comparative market analysis for the area to estimate land values. This research was based on land values listed in the Triangle Multiple Listing Service. Through this process, it was determined that the approximate land value along this corridor was estimated at $131,000 per acre or $3 per square foot, well below the $6 threshold estimated for curb and gutter to be cost-feasible.

Based on the constructability drawings, the total estimated ROW needed for a shoulder section is 2.86 acres. Using the $131,000 per acre cost value estimated by the City, an approximate ROW cost of $375,000 was determined for a shoulder section.

Public safety issues are always taken into consideration with any roadway project. This study will consider these factors when treatments are recommended. Aesthetics also are a consideration. It is believed that aesthetics would be improved by filling in the ditches and installing street trees. However, state approval is not guaranteed since the introduction of trees near the street may pose a safety risk to motorists. This factor should be further explored.

Phasing Options

To match the project description with likely available funds, Kimley-Horn offers the following suggestions for splitting the overall project into constructible phases; that is, a project with logical termini that could be built in phases yet not have the appearance of an unfinished project between phases.

Option 1 — Build phase 1 of the bicycle and pedestrian improvements from US 15/501 on the west to connect with the New Hope Creek and Greenway on the east. Kimley-Horn's opinion of probable construction cost for such a phase 1 is $1.92 million. Additional funds would still be necessary to cover right-of-way, utilities, survey, design and contingencies.

On-road Improvements (widening)	$1,780,000
10 foot Multi-use Path (north side)	$ 93,000
5 foot Sidewalks (north side of road)	$ 47,000
Total:	$1,920,000

Phase 2 would extend the project east from the New Hope Creek Greenway.

Option 2 — Build phase 1 of the project from US 15/501 on the west to Garrett Road on the east, building only the pedestrian improvements first. Kimley-Horn's opinion of probable construction cost for such a phase 1 is nearly $425,000, leaving funds for right-of-way, utilities, survey, design, contingencies, and perhaps a portion of the roundabout at Pope Road. Additional funds would still be necessary to come back and widen the road to provide bicycle lanes, which would be expedited because right-of-way would not be needed at that time.

Option 3 — Build phase 1 of the project from US 15/501 on the west to Garrett Road on the east, building only the bicycle lanes first. Kimley-Horn's opinion of probable construction cost for such a phase 1 is estimated at $2.1 million. This option exceeds the current construction funds available. Additional funds would also be required to acquire any miscellaneous right-of-way, utilities, survey, design, and contingencies. For a phase 2, additional funds would be necessary to build the sidewalks and multi-use path.

Option 4 — Due to the high level of traffic volumes along the eastern section of the project between Pope Road and Garrett Road, the general public expressed a need for bicycle and pedestrian improvements. The high traffic volumes along this section (16,000 vpd) of the project increase the potential conflict between vehicles and cyclists. Option 4 recommends building phase 1 of the project from Pope Road on the west to Garrett Road on the east. Kimley-Horn's opinion of probable construction cost for such a phase 1 is nearly $1,464,000, leaving funds for right-of-way, utilities, survey, design, and contingencies.

On-Road Improvements (widening)	$1,203,000
10 foot Multi-Use Path (north side)	$ 90,000
5 foot Sidewalks (north and south sides of road)	$ 171,000
Total:	$1,464,000

Phase 2 would extend the project west from Pope Road to 15/501.

Implementation/Funding

To improve Old Durham-Chapel Hill Road, the following is recommended:

- Request changes to the posted speed limit from NCDOT. The current posting of 40 mph should be changed to 35 mph, except between roundabouts at Pope Road and Mt. Moriah Road where a 20 mph posting is recommended.
- Pursue additional funds through related programs targeting bridge reconstruction projects, greenway improvements, and residential and commercial developments. Piggybacking on other program funds will stretch the project dollars.
- Pursue opportunities for additional matching funds in the future from federal, state, and local agencies and organizations.
- Seek Safe Routes to Schools funding for improvements near Githens Middle School.
- Work with health, safety, environmental, and pedestrian and bicycle advocacy organizations to obtain political support and possible grants. One possible sponsor could be Blue Cross/Blue Shield of North Carolina, an organization that is promoting physical activity and whose employees use this corridor to commute and travel between their various building sites.
- Coordinate conceptual plans with implementing agencies
  - NCDOT
  - TTA, DATA, Chapel Hill Transit
  - City of Durham and Town of Chapel Hill engineering and public works
- Continue to promote final conceptual plans to local businesses, residents, property owners and other stakeholders.

Schedule

The following tentative schedule outlines the major tasks and associated milestones for each. Final construction schedule will be based on securing adequate project funding as well as right-of-way negotiation.
Final Design — 2007
Right-of-Way Acquisition — 2008
Construction — 2009

Promotion

Promoting walking and bicycling on Old Durham-Chapel Hill Road can help build political support and increase the potential for additional funding. Potential ideas for promotion include:

- Make an announcement of the pedestrian and bicycle improvements through the newspaper, television, press releases, and local agency websites
- Produce fliers about the health benefits of walking and bicycling. Include statements about how many calories a 1-mile walk or 3-mile bike ride along Old Durham-Chapel Hill Road will burn. Also consider including information about economic and environmental benefits of making trips by walking and biking.
- Distribute fliers about walking and bicycling on Old Durham-Chapel Hill Road to new apartment residents and at new store openings
- Hold a walk/bike to school day or other walking or biking event at Githens Middle School
- Start a Safe Routes to School program at Githens Middle School
- Organize a walk, run, or bicycle ride soon after the shoulders and sidewalks are added to the roadway
- List Old Durham-Chapel Hill Road as a roadway that has been improved for pedestrian and bicycle travel on the City of Durham, Town of Chapel Hill, DCHC, and Triangle J Council of Governments websites and bicycle maps
- Work with local restaurants to offer discounts to people who come by walking or biking rather than driving
- Take baseline pedestrian and bicycle counts at five main intersections in corridor. Take counts in the future to benchmark increases and build support for further improvements.

Issues for Final Design

Outside of the efforts addressed in this feasibility study, the following issues need to be carried into the final design stage for resolution. These include:

- Construction administration — which public entity will manage the contract?
- Maintenance issues need to be addressed — specifically, will NCDOT or municipalities maintain sidewalks and bike lanes on a routine schedule? The difference in maintenance costs for curb-and-gutter vs. shoulder section needs to be explored.
- Roundabout design and implementation:
  - — Coordinate with Ron Horvath on Mt. Moriah roundabout. The roundabout design may need to be shifted to the northeast quadrant in order to accommodate wide sidewalks on the southern side between the I-40 guardrail and travel lane.
  - — Need to explore funding options for the Pope Rd. roundabout
- Address intersection issues at Sage/Scarlett/Old Durham-Chapel Hill/15-501:
  - — Performance Auto SUD approved on June 27 by Chapel Hill Town Council; includes median design to block service road entrance at Sage/15-501 intersection — the design is contingent upon NCDOT approval (shown on sheet 1 in the appendix)
- Exploration of curb-and-gutter options:
  - — For shoulder sections, consider including curb-and-gutter at corners of intersections for better definition of curb ramps.
  - — This report recommends a combination of curb-and-gutter and shoulder section. Final design and the environmental assessment will address specific location of curb-and-gutter and shoulder use.
- Utility Relocation:
  - — Investigate the cost of utility relocations
  - — If NCDOT administers project, they can require utility companies to move utilities without cost to public; local government doesn't have same authority.
  - — NCDOT design standards will require many utility poles to be moved due to expansion of pavement width
- Bridge treatments:
  - — Colored pavement is recommended for shoulder sections on bridges
  - — Investigate Bike/Pedestrian Division's interest in 10' travel lanes over I-40 bridge to allow 4-foot shoulders for bike and pedestrian traffic
- Right-of-way acquisition – 18 months would be needed for ROW appraisal and acquisition.

Appendix

Constructability Drawings

Public Workshop Fliers

User Survey

User Survey Results

Traffic Counts

Crash Data

Statement of Probable Construction Costs

Proposed Design Criteria

ROW Acquisition

Public Workshop Fliers

You can get there on a bike,
You can get there on a hike,
But we can't get there without
some help from you.

Give us your views -- don't stop!
Visit the Old Durham/Chapel Hill Road Workshop
To make your walking and biking dreams come true!

Old Chapel Hill Road Bicycle/Pedestrian Corridor Study

Public Workshop

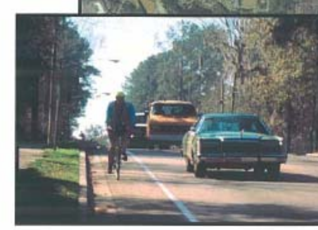
WHAT **A 2-day design charrette**
The purpose of the study is to develop a plan to promote future connectivity and accommodation for pedestrians and bicycles.

WHERE **Resurrection United Methodist Church**
4705 Old Chapel Hill Road, Durham


entrance to Resurrection United Methodist Church

WHEN **Friday, April 15: Noon to 5 PM**
Saturday, April 16: 1 to 4:30 PM

Questions? Call Alison Carpenter, Bicycle Pedestrian Coodinator
City of Durham, (919) 560-4366



Old Chapel Hill Road Bicycle/Pedestrian Corridor Study

Public Open House

What **Open House**
The Open House will provide an opportunity for the public to view maps and provide feedback on proposed bike and pedestrian improvements along the corridor. Drop in any time!

Where **Resurrection United Methodist Church**
4705 Old Chapel Hill Road, Durham

When **Wednesday June 22: 5 p.m. to 8 p.m.**

Questions? Call Alison Carpenter, Bicycle/Pedestrian Coordinator
City of Durham, (919) 560-4366

User Survey

April 15, 2005

Old Durham/Chapel Hill Road Bike and Pedestrian Plan

User Survey

1. Do you live or work within the Old Durham/Chapel Hill Corridor? ☐ Yes ☐ No

2. What kind of bicycling do you do? (check all that apply)
- ☐ To work
- ☐ To school
- ☐ To visit friends or family
- ☐ For fitness/recreation
- ☐ To the bus stop

3. How often do you ride a bicycle?
- ☐ Daily
- ☐ Once or twice a week
- ☐ Once every 2-3 weeks
- ☐ 2-3 times a year
- ☐ I don't ride a bicycle

4. What is your general skill level?
- ☐ advanced
- ☐ basic
- ☐ child (under 12)

5. What is your primary concern when deciding where to ride? (check one)
- ☐ Shortest route to destination
- ☐ Pleasant route/scenic value
- ☐ Comfort/personal safety in traffic
- ☐ Safe/convenient bicycle parking
- ☐ Other ____________

6. Would bike lanes or trails on Old Durham/Chapel Hill Road encourage you to make more short trips?
- ☐ Yes
- ☐ No

7. What affects your decision to ride? (check all that apply)
- ☐ Presence of bike paths or shoulders
- ☐ Amount of traffic on the road
- ☐ Speed of traffic
- ☐ Amount of large trucks and/or buses
- ☐ Number of major intersections
- ☐ Weather/time of day
- ☐ Bicycle parking at destinations

8. What are the bicycling conditions on Old Durham/Chapel Hill Road?
- ☐ Good
- ☐ Fair
- ☐ Poor

9. Do you go on organized recreational bike rides?
- ☐ Yes
- ☐ No

10. Where would you like to see bicycle racks installed? (check all that apply)
- ☐ Workplace
- ☐ Schools/Parks
- ☐ Public bus stops
- ☐ Mounted on public buses
- ☐ Other ____________

11. Do you have children under the age of 16 in your household that ride bicycles?
- ☐ Yes
- ☐ No

(OVER)

April 15, 2005

12. (If the answer to Question 11 is Yes) where do you allow them to ride (either supervised or unsupervised)?
- ☐ Bike trails or paths
- ☐ Residential streets
- ☐ Major roads
- ☐ Other ____________

13. What kind of walking do you do? (check all that apply)
- ☐ To work
- ☐ To school
- ☐ To visit friends or family
- ☐ For fitness/recreation
- ☐ To the bus stop

14. Which affects your decision to go on a walk? (check all that apply)
- ☐ Availability of sidewalks or trails
- ☐ Amount of traffic on the adjacent road
- ☐ Presence of crosswalks/pedestrian signals
- ☐ Number of major intersections
- ☐ Weather/time of day
- ☐ Other ____________

15. What makes you decide where to walk? (check one)
- ☐ Shortest route to destination
- ☐ Scenic value of route
- ☐ Comfort/separation in traffic
- ☐ Personal safety/security
- ☐ Other ____________

16. Are you in favor of building walkways and bikeways on Old Durham/Chapel Hill Road?
- ☐ Yes
- ☐ No

17. What are the walking conditions in your community?
- ☐ Good
- ☐ Fair
- ☐ Poor

18. Where do you have trouble crossing the street?

____

19. Did this workshop help your understanding of Bike/Pedestrian issues along Old Durham/Chapel Hill Road?
- ☐ Yes
- ☐ No
- ☐ Somewhat

20. What is the most important message you would like to send to the study team?

____

Please leave this survey form with the study team before you leave. Thanks again for your participation.

(OVER)

User Survey Results

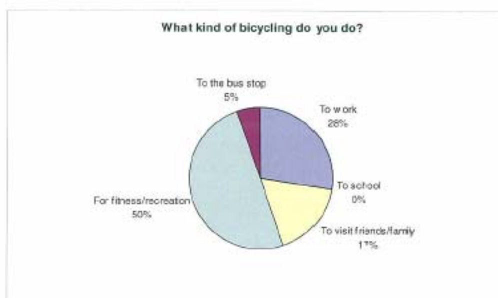
Old Durham/Chapel Hill Road Bike/Pedestrian Plan
(52 total surveys)

1. Do you live or work within the Old Durham/Chapel Hill Corridor?

	Number	*Percentage*
Yes	27	73%
No	10	27%

2. What kind of bicycling do you do?

	Number	*Percentage*
To work	16	28%
To school	0	0%
To visit friends/family	10	17%
For fitness/recreation	29	50%
To the bus stop	3	5%



3. How often do you ride a bicycle?

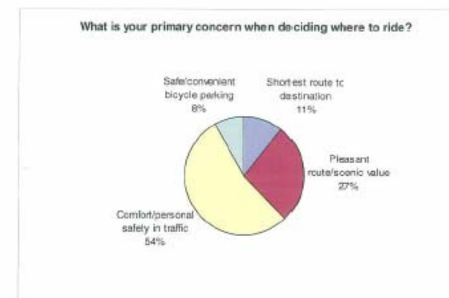
	Number	*Percentage*
Daily	7	19%
Once or twice a week	17	46%
Once every 2-3 weeks	3	8%
2-3 times a year	7	19%
I don't ride a bicycle	3	8%

4. What is your general skill level?

	Number	*Percentage*
Advanced	18	55%
Basic	15	45%
Child	0	0%

5. What is your primary concern when deciding where to ride?

	Number	*Percentage*
Shortest route to destination	4	11%
Pleasant route/scenic value	10	27%
Comfort/personal safety in traffic	20	54%
Safe/convenient bicycle parking	3	8%

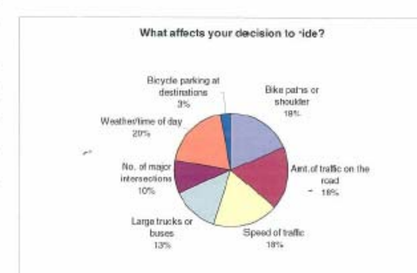


6. Would bike lanes or trails on Old Durham/Chapel Hill Road encourage you to make more short trips?

	Number	*Percentage*
Yes	28	82%
No	6	18%

7. What affects your decision to ride?

	Number	*Percentage*
Bike paths or shoulder	23	18%
Amt of traffic on the road	23	18%
Speed of traffic	23	18%
Large trucks or buses	17	13%
No. of major intersections	12	10%
Weather/time of day	24	20%
Bicycle parking at destinations	4	3%



8. What are the bicycling conditions on Old Durham/Chapel Hill Road?

	Number	*Percentage*
Good	0	0%
Fair	2	6%
Poor	32	94%

9. Do you go on organized recreational bike rides?

	Number	*Percentage*
Yes	15	42%
No	21	58%

10. Where would you like to see bicycle racks installed?

	Number	*Percentage*
Workplace	22	28%
Schools/Parks	23	29%
Public bus stops	12	15%
Mounted on public buses	20	25%
Other	2	3%

11. Do you have children under the age of 16 in your household that ride bicycles?

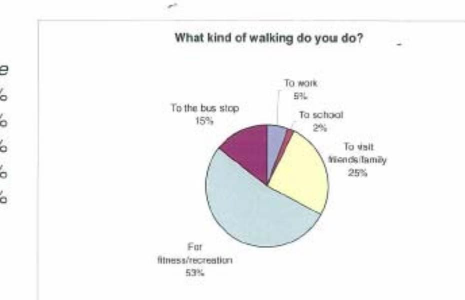
	Number	*Percentage*
Yes	12	34%
No	23	66%

12. (If the answer to Question 11 is Yes) Where do you allow them to ride?

	Number	*Percentage*
Bike trails or paths	10	43%
Residential streets	11	48%
Major roads	1	4%
Other	1	4%

13. What kind of walking do you do?

	Number	*Percentage*
To work	3	5%
To school	1	2%
To visit friends/family	14	25%
For fitness/recreat on	29	53%
To the bus stop	8	15%



14. Which affects your decision to go on a walk?

	Number	Percentage
Availability of sidewalks or trails	33	35%
Amount of traffic on the adjacent road	21	22%
Presence of crosswalks/ pedestrian signals	9	10%
Number of major intersections	9	10%
Weather/time of day	21	23%
Other	0	0%

15. What makes you decide where to walk?

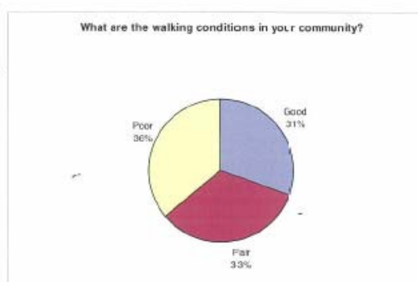
	Number	Percentage
Shortest route to destination	10	14%
Scenic value of route	19	26%
Comfort/separation in traffic	20	28%
Personal safety/security	22	31%
Other	1	1%

16. Are you in favor of building walkways and bikeways on Old Durham/Chapel Hill Road?

	Number	Percentage
Yes	35	100%
No	0	0%

17. What are the walking conditions in your community?

	Number	Percentage
Good	11	31%
Fair	12	33%
Poor	13	36%



18. Did this workshop help your understanding of Bike/Pedestrian issues along Old Durham/Chapel Hill Road?

	Number	Percentage
Yes	25	78%
No	5	16%
Somewhat	2	6%

19. Where do you have trouble crossing the street?

- Old Chapel Hill-Durham - Lakeside
- Five Oaks and Chapel Hill Road
- US15-501
- Intersection of Pope and Old Chapel Hill Road
- Between White Oak and Chapel Hill Road
- Airport Road
- I-40 Bridge
- Mt. Mariah
- Major Roacs
- All intersections
- US15-501 at Scarlett Drive

20. What is the most important message you would like to send to the study team?

- Residents support this idea
- Keep Old Chapel Hill/Durham Road as a two lane road only
- Make 15-501 the speed corridor
- Get it constructed ASAP!
- Every street would benefit from safe walking and biking access
- Opportunities for biking on major roads improve public health
- Emphasis on slowing motor vehicle traffic
- Sidewalks are needed
- This is a good idea
- Use good signage

Traffic Counts

3: Chapel Hill Road & Garrett Road

Lanes, Volumes, Timings

Existing AM

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50	50	50	50	50	50	50	50	50	50	50
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	1770	3539	1583	1770	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			73			65			167			61
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		3783			3881			3904			3280	
Travel Time (s)		86.0			88.2			88.7			74.5	
Volume (vph)	59	545	67	189	375	60	126	301	521	82	203	56
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Lane Group Flow (vph)	64	592	73	205	408	65	137	327	566	89	221	61
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	5
Permitted Phases			2			6			8			4
Detector Phases	5	2	3	1	6	7	3	8	1	7	4	5
Minimum Initial (s)	7.0	12.0	7.0	7.0	12.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Minimum Split (s)	15.0	23.1	13.1	15.0	23.1	13.5	13.1	23.0	15.0	13.5	23.0	15.0
Total Split (s)	15.0	30.0	15.0	15.0	30.0	15.0	15.0	30.0	15.0	15.0	30.0	15.0
Total Split (%)	17%	33%	17%	17%	33%	17%	17%	33%	17%	17%	33%	17%
Yellow Time (s)	5.0	5.0	4.0	5.0	5.0	4.0	4.0	5.0	5.0	4.0	5.0	5.0
All-Red Time (s)	3.0	2.1	2.1	3.0	2.1	2.5	2.1	2.0	3.0	2.5	2.0	3.0
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Min	None	None	Min	None	None	None	None	None	None	None
Act Effct Green (s)	11.1	20.7	35.2	11.4	25.0	36.6	10.7	14.8	30.4	10.5	14.6	28.7
Actuated g/C Ratio	0.15	0.29	0.48	0.16	0.36	0.53	0.15	0.21	0.43	0.14	0.21	0.39
v/c Ratio	0.12	0.57	0.09	0.37	0.32	0.07	0.53	0.44	0.73	0.35	0.30	0.09
Uniform Delay, d1	28.6	20.9	0.0	27.9	18.1	0.0	30.9	25.8	12.6	30.1	25.1	0.0
Delay	29.8	22.4	3.1	30.0	20.4	3.2	31.7	25.8	14.1	31.2	25.4	4.5
LOS	C	C	A	C	C	A	C	C	B	C	C	A
Approach Delay		21.1			21.7			20.1			23.3	
Approach LOS		C			C			C			C	

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 70.3
Natural Cycle: 75
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.73
Intersection Signal Delay: 21.2 Intersection LOS: C
Intersection Capacity Utilization 67.3% ICU Level of Service B

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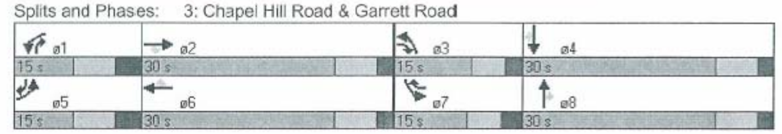
3: Chapel Hill Road & Garrett Road

Lanes, Volumes, Timings

Existing AM

Splits and Phases: 3: Chapel Hill Road & Garrett Road



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SLP Page 2
kimleylvl7-ff51

3: Chapel Hill Road & Garrett Road

Lanes, Volumes, Timings

Existing PM

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SET	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50	50	50	50	50	50	50	50	50	50	50
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	1770	3539	1583	1770	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			139			120			221			128
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		3783			3881			3904			3280	
Travel Time (s)		86.0			88.2			88.7			74.5	
Volume (vph)	89	461	128	345	487	110	70	334	266	64	338	118
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Lane Group Flow (vph)	97	501	139	375	529	120	76	363	289	70	367	128
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	5
Permitted Phases			2			6			8			4
Detector Phases	5	2	3	1	6	7	3	8	1	7	4	5
Minimum Initial (s)	7.0	12.0	7.0	7.0	12.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Minimum Split (s)	15.0	23.1	13.1	15.0	23.1	13.5	13.1	23.0	15.0	13.5	23.0	15.0
Total Split (s)	15.0	30.0	15.0	15.0	30.0	15.0	15.0	30.0	15.0	15.0	30.0	15.0
Total Split (%)	17%	33%	17%	17%	33%	17%	17%	33%	17%	17%	33%	17%
Yellow Time (s)	5.0	5.0	4.0	5.0	5.0	4.0	4.0	5.0	5.0	4.0	5.0	5.0
All-Red Time (s)	3.0	2.1	2.1	3.0	2.1	2.5	2.1	2.0	3.0	2.5	2.0	3.0
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Min	None	None	Min	None	None	None	None	None	None	None
Act Effct Green (s)	11.1	19.8	33.8	11.4	24.1	37.6	10.2	15.5	31.1	10.4	15.7	29.8
Actuated g/C Ratio	0.15	0.28	0.46	0.16	0.34	0.52	0.14	0.22	0.44	0.14	0.22	0.41
v/c Ratio	0.19	0.50	0.17	0.67	0.43	0.14	0.31	0.46	0.35	0.28	0.46	0.18
Uniform Delay, d1	28.7	20.9	0.0	29.3	19.4	0.0	30.0	25.3	3.0	29.7	25.2	0.0
Delay	29.9	22.4	2.4	36.3	21.7	2.6	31.2	25.2	4.5	31.0	25.1	3.2
LOS	C	C	A	D	C	A	C	C	A	C	C	A
Approach Delay		19.6			24.8			17.6			20.9	
Approach LOS		B			C			B			C	

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 70.1
Natural Cycle: 75
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.67
Intersection Signal Delay: 21.1 Intersection LOS: C
Intersection Capacity Utilization 53.9% ICU Level of Service A

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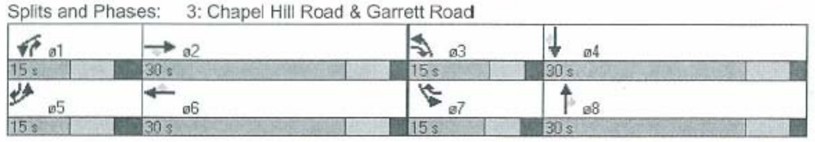
3: Chapel Hill Road & Garrett Road

Lanes, Volumes, Timings

Existing PM

Splits and Phases: 3: Chapel Hill Road & Garrett Road



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kimleylvl7-ff51

3: Chapel Hill Road & Garrett Road

Lanes, Volumes, Timings

Single EB LT - AM

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50	50	50	50	50	50	50	50	50	50	50
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Satd. Flow (prot)	1770	3539	1583	3433	3539	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	3539	1583	3433	3539	1583	1770	3539	1583	1770	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			73			65			167			61
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		3783			3881			3904			3280	
Travel Time (s)		86.0			88.2			88.7			74.5	
Volume (vph)	59	545	67	189	375	60	126	301	521	82	203	56
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Lane Group Flow (vph)	64	592	73	205	408	65	137	327	566	89	221	61
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	5
Permitted Phases			2			6			8			4
Detector Phases	5	2	3	1	6	7	3	8	1	7	4	5
Minimum Initial (s)	7.0	12.0	7.0	7.0	12.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Minimum Split (s)	15.0	23.1	13.1	15.0	23.1	13.5	13.1	23.0	15.0	13.5	23.0	15.0
Total Split (s)	15.0	30.0	15.0	15.0	30.0	15.0	15.0	30.0	15.0	15.0	30.0	15.0
Total Split (%)	17%	33%	17%	17%	33%	17%	17%	33%	17%	17%	33%	17%
Yellow Time (s)	5.0	5.0	4.0	5.0	5.0	4.0	4.0	5.0	5.0	4.0	5.0	5.0
All-Red Time (s)	3.0	2.1	2.1	3.0	2.1	2.5	2.1	2.0	3.0	2.5	2.0	3.0
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Min	None	None	Min	None	None	None	None	None	None	None
Act Effct Green (s)	11.1	20.7	35.2	11.4	25.0	38.6	10.7	14.8	30.4	10.5	14.6	28.7
Actuated g/C Ratio	0.15	0.29	0.48	0.16	0.36	0.53	0.15	0.21	0.43	0.14	0.21	0.39
v/c Ratio	0.24	0.57	0.09	0.37	0.32	0.07	0.53	0.44	0.73	0.35	0.30	0.09
Uniform Delay, d1	29.1	20.9	0.0	27.9	18.1	0.0	30.9	25.8	12.6	30.1	25.1	0.0
Delay	30.7	22.4	3.1	30.0	20.4	3.2	31.7	25.8	14.1	31.2	25.4	4.5
LOS	C	C	A	C	C	A	C	C	B	C	C	A
Approach Delay		21.2			21.7			20.1			23.3	
Approach LOS		C			C			C			C	

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 70.3
Natural Cycle: 75
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.73
Intersection Signal Delay: 21.2 Intersection LOS: C
Intersection Capacity Utilization 67.3% ICU Level of Service B

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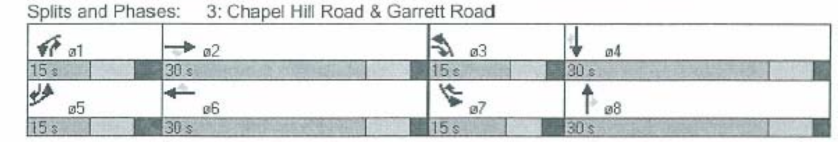
kimleylvl7-ff51

3: Chapel Hill Road & Garrett Road

Lanes, Volumes, Timings

Single EB LT - AM

Splits and Phases: 3: Chapel Hill Road & Garrett Road



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SLP Page 2
kimleylvl7-ff51

3: Chapel Hill Road & Garrett Road

Lanes, Volumes, Timings

Single EB LT - PM

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50	50	50	50	50	50	50	50	50	50	50
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Satd. Flow (prot)	1770	3539	1583	3433	3539	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	3539	1583	3433	3539	1583	1770	3539	1583	1770	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			139			120			221			128
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		3783			3881			3904			3280	
Travel Time (s)		86.0			88.2			88.7			74.5	
Volume (vph)	89	461	128	345	487	110	70	334	266	64	338	118
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Lane Group Flow (vph)	97	501	139	375	529	120	76	363	289	70	367	128
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	5
Permitted Phases			2			6			8			4
Detector Phases	5	2	3	1	6	7	3	8	1	7	4	5
Minimum Initial (s)	7.0	12.0	7.0	7.0	12.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Minimum Split (s)	15.0	23.1	13.1	15.0	23.1	13.5	13.1	23.0	15.0	13.5	23.0	15.0
Total Split (s)	15.0	30.0	15.0	15.0	30.0	15.0	15.0	30.0	15.0	15.0	30.0	15.0
Total Split (%)	17%	33%	17%	17%	33%	17%	17%	33%	17%	17%	33%	17%
Yellow Time (s)	5.0	5.0	4.0	5.0	5.0	4.0	4.0	5.0	5.0	4.0	5.0	5.0
All-Red Time (s)	3.0	2.1	2.1	3.0	2.1	2.5	2.1	2.0	3.0	2.5	2.0	3.0
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Min	None	None	Min	None	None	None	None	None	None	None
Act Effct Green (s)	11.1	19.8	33.8	11.4	24.1	37.6	10.2	15.5	31.1	10.4	15.7	29.8
Actuated g/C Ratio	0.15	0.28	0.46	0.16	0.34	0.52	0.14	0.22	0.44	0.14	0.22	0.41
v/c Ratio	0.36	0.50	0.17	0.67	0.43	0.14	0.31	0.46	0.35	0.28	0.46	0.18
Uniform Delay, d1	29.5	20.9	0.0	29.3	19.4	0.0	30.0	25.3	3.0	29.7	25.2	0.0
Delay	31.2	22.4	2.4	36.3	21.7	2.6	31.2	25.2	4.5	31.0	25.1	3.2
LOS	C	C	A	D	C	A	C	C	A	C	C	A
Approach Delay		19.8			24.8			17.6			20.9	
Approach LOS		B			C			B			C	

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 70.1
Natural Cycle: 75
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.67
Intersection Signal Delay: 21.1 Intersection LOS: C
Intersection Capacity Utilization 53.9% ICU Level of Service A

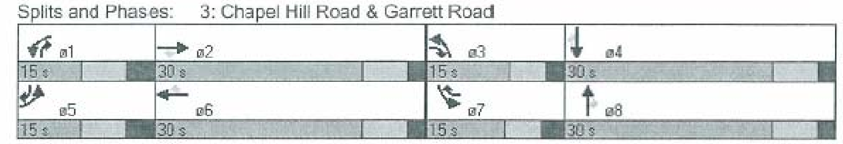
H:\PN\011494030_Old_Durham_Bike-Ped\Traffic\Traffic Counts\PM - Single EB LT.sy6 Synchro 5 Report - 6/27/2005
SLP Page 1
kimleylvl7-ff51

3: Chapel Hill Road & Garrett Road

Lanes, Volumes, Timings

Single EB LT - PM

Splits and Phases: 3: Chapel Hill Road & Garrett Road



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Crash Data

Crash Data Summary – Old Durham Road
From August 31, 2001 to August 31, 2004

The 2000-2002 North Carolina average crash rate for a 3-lane undivided State Route 393.36 crashes per 100 million vehicle miles traveled, according to the North Carolina Department of Transportation. Source: (http://www.doh.dot.state.nc.us/preconstruct/traffic/Safety/ses/rates/2002/statewide.pdf).

Severity Index = (76.8*(F+A) + 8.4*(B+C) + PDO)/ TOTAL CRASHES

__Segments__
Old Chapel Hill Road (Durham County)

- Total crash rate: 1758.04 crashes per 100 million vehicle miles traveled; This crash rate is extremely high for this type of roadway
  - 405 total crashes
  - 2 fatal crashes (0.49%)
  - 113 non-fatal injury crashes (27.90%)
  - 104 night crashes (25.68%)
  - 64 wet crashes (15.80%)
  - 19 DUI crashes (4.69%)
- Severity Index = 3.95
- Five pedestrian/bicyclist related crashes in the time period analyzed:
  - 9/30/2001 (Just west of Five Oaks Drive) – Passenger car leaving a parked position strikes a pedestrian; occurred at 9:00 pm under dark (no roadway lighting) conditions
  - 4/09/2003 (At intersection with Buchanon) – Passenger car traveling eastbound at 30 mph struck a pedestrian under daylight conditions (4:17 pm) at a stop and go traffic signal
  - 12/23/2001 (Just west of Garrett Road) – Passenger car traveling northbound at 45 mph struck and fatally wounded a pedestrian under dark (some roadway lighting) conditions; pedestrian was found to be under the impairment of alcohol
  - 05/24/2003 (At intersection of Garrett Road) – Passenger car traveling eastbound at 50 mph struck and fatally wounded a pedestrian under daylight conditions at 2:31 pm; pedestrian was found to be under the impairment of alcohol
  - 11/23/2002 (Just west of University Drive) – Sport utility vehicle traveling 30 mph struck a cyclist under daylight conditions; no injuries were reported

Old Durham Road (Orange County)
- Total crash rate: 313.35 crashes per 100 million vehicle miles traveled, this crash rate is slightly lower than the state average for this type of roadway
  - 11 total crashes
  - No fatalities
  - 6 non-fatal injury crashes (54.55%)
  - 1 night crash (9.09%)
  - 2 wet crashes (18.18%)
- Severity Index = 5.04
- No pedestrian/bicyclist related crashes in analysis period

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__Intersections__
Old Chapel Hill Road and Mount Moriah Road (Durham County)

- Total crash rate: 98.75 crashes per 100 million vehicles entering
  - 13 total crashes
  - No fatalities
  - 4 non-fatal injuries (30.77%)
  - 2 night crashes (15.38%)
  - 3 wet crashes (23.08%)
- Severity Index = 3.28
- No pedestrian/bicyclist related crashes in analysis period

Old Chapel Hill and Garret Road (Durham County)

- Total crash rate: 425.40 per 100 million vehicles entering (extremely high)
  - 70 total crashes
  - No fatalities
  - 17 non-fatal injury crashes (24.29%)
  - 22 night crashes (31.43%)
  - 8 wet crashes (11.43%)
  - 1 DUI crashes (1.43%)
- Severity index = 2.80
- No pedestrian/bicyclist related crashes in analysis period

Old Chapel Hill and Farrington Road (Durham County)

- Total crash rate: 182.32 per 100 million vehicles entering
  - 16 total crashes
  - 6 non-fatal injury crashes (37.50%)
  - 6 night crashes (37.50%)
  - 2 wet crashes (12.5%)
  - 2 DUI crashes (12.5%)
- Severity Index = 8.05
- No pedestrian/bicyclist related crashes in analysis period

Old Durham Road and US 15-501 (Orange County)

- Total crash rate: 44.39 crashes per 100 million vehicles entering (extremely high)
  - 39 total crashes
  - 1 fatal crash (2.56%): 10/29/01, Angle crash occurred between vehicles traveling south at 40 mph and vehicle traveling west at 10 mph, driver of slower vehicle was found to be impaired by alcohol
  - 9 non-fatal injury crashes (23.08%)
  - 8 night crashes (20.51%)
  - 5 wet crashes (12.82%)
  - 4 DUI crashes (10.26%)
- Severity Index = 4.65
- No pedestrian/bicyclist related crashes in analysis period

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Statement of Probable Construction Costs

STATEMENT OF PROBABLE CONSTRUCTION COST
KIMLEY-HORN AND ASSOCIATES, INC.

Estimated By EDH Checked By Date 6-21-05 Sheet 1 of 1

Project Title OLD DURHAM/CHAPEL HILL RD Job No.

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE MAT. & LAB.	ESTIMATED AMOUNT
1	ROAD WIDENING	20,400	SY	93.00±	1,897,200
2	10' MULTI-USE PATH (ASPH)	6210	SY	21.00±	130,400
3	5' CONCRETE SIDEWALK	8,180	SY	30.00	245,400
	(65% ON SOUTHSIDE @ $160k)				
			TOTAL		2,273,000
			SAY		2,275,000
	BASIS: MID YR 2005 COSTS				
	ROAD WIDENING $650,000/MI/12' LN				
	SW - $30.00/SY				
	10' ASPH MULTI USE PATH 2"/6"	21.00/SY			
	ROUNDABOUT - $250,000/per				
	COST - $ 2,275,000				
	+ 10% CONTINGENCY				
	TOTAL COST $ 2,500,000				
	(CONSTRUCTION COST ONLY)				
	*UNIT COSTS BASED ON NCDOT STANDARDS				
	TOTAL				

"The Engineer has no control over the cost of labor, materials, or equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs, as provided here, are made on the basis of the Engineers experience and qualifications and represent the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from opinions of probable cost prepared for the Owner."

Proposed Design Criteria

PROPOSED DESIGN CRITERIA

STATE PROJECT: NA
F. A. PROJECT: NA
COUNTY: Durham
PROJECT DESCRIPTION: Bicycle / Pedestrian Improvements

PAGE: 1 of 1
DATE: June 7, 2005

PREPARED BY: Kimley-Horn and Associates, Inc.

ROUTE	Old Durham Chapel Hill Road		Comment	REFERENCE
LINE	L			OR REMARKS
TRAFFIC DATA				
ADT LET YR =				
ADT DESIGN YR =				
TTST				
DUALS				
DHV				
DIR				
CLASSIFICATION	Collector			NCDOT p. 1-1A
TERRAIN TYPE	Level			NCDOT p. 1-1D
DESIGN SPEED km/hr or mph	40			
POSTED SPEED km/hr or mph	35 mph			
PROP. R/W WIDTH m or ft	NA			
CONTROL OF ACCESS	N			
RUMBLE STRIPS (Y/N)	N			
TYPICAL SECTION TYPE	Shoulder			
LANE WIDTH m or ft	12 ft			
SIDEWALKS (Y/N)	Y			
BICYCLE LANES (Y/N)	Y			
MEDIAN WIDTH m or ft	N/A			
MED. PROTECT. (GR/BARRIER)	N/A			
SHOULDER WIDTH (total)	8			
MEDIAN m or ft	NA			
OUTSIDE w/o GR m or ft	8			NCDOT P. 1-4B
OUTSIDE w/ GR m or ft	11			NCDOT P. 1-4B
PAVED SHOULDER				
OUTSIDE TOTAL/FDPS m or ft	5		Bike Path	
MEDIAN TOTAL/FDPS m or ft	NA			
GRADE				
MAX.	7		Match Exist.	AASHTO p.427
MIN.	0.3		Match Exist.	AASHTO p. 242
K VALUE				
SAG	64		Match Exist.	AASHTO p: 426
CREST	44		Match Exist.	AASHTO p. 426
HORIZ. ALIGN.				
MAX. SUPER.	.08		Match Exist.	NCDOT 1-15
MIN. RADIUS m or ft	465		Match Exist.	AASHTO p. 145
SPIRAL (Y/N)	N			NCDOT Y1-11
CROSS SLOPES				
PAVEMENT (%)	2		Match Exist.	NCDOT 1-3B
PAVED SHOULDER (%)	5		Bike Path	
TURF SHOULDER (%)	3		See Attached Typical	
MEDIAN DITCH (%)	N/A			
DITCH TYPICAL (A,B,C)	* B			
TYPICAL SECTION NO.				

Design_Assumptions.xls

ROW Acquisition

Old Durham/Chapel Hill Road - ROW Acquisition

ROW Taken (From ROW_take.dgn)

ROW	Area (Square Feet)	Area (Square Yards)	Area (Acres)
A	0	0	0
B	550.3741	61.15267778	0.012634851
C	434.8868	48.32075556	0.009983627
D	281.1001	31.23334444	0.00645317
E	376.9223	41.88025556	0.008652945
F	48.6524	5.405822222	0.001116905
G	192.1499	21.34998889	0.004411155
H	122.8787	13.65318889	0.002820907
I	164.3291	18.25878889	0.003772477
J	157.2948	17.4772	0.003610992
K	0	0	0
L	229.4886	25.49873333	0.005268333
M	326.2725	36.2525	0.007490186
N	0	0	0
O	0	0	0
P	0	0	0
Q	0	0	0
R	0	0	0
S	0	0	0
T	5284.077	587.1196667	0.121305716
U	669.7631	74.41812222	0.015375645
V	0	0	0
W	0	0	0
X	180.9775	20.10861111	0.004154672
Y	1184.7644	131.6404889	0.027198448
Z	431.4718	47.94131111	0.00990523
A1	19.6379	2.181988889	0.000450824
B1	0	0	0
C1	0	0	0
D1	0	0	0
E1	0	0	0
F1	1599.6292	177.7365778	0.036722433
G1	922.8701	102.5411222	0.021186182
H1	947.9797	105.3310778	0.021762619
I1	814.9827	90.55363333	0.018709428
J1	1303.3837	144.8204111	0.029921573
K1	9195.3892	1021.709911	0.211097089
L1	7954.9894	883.8877111	0.182621428
M1	7386.7846	820.7538444	0.16957724
N1	1260.8563	140.0951444	0.028945278
O1	1204.3751	133.8194556	0.027648648
P1	1167.9918	129.7768667	0.026813402
Q1	1803.6007	200.4000778	0.041404975
R1	546.0947	60.67718889	0.012536609
S1	2970.2685	330.0298333	0.068187982
T1	268.7571	29.8619	0.006169814
U1	1904.8819	211.6535444	0.043730071
V1	602.9476	66.99417778	0.013841772
W1	8308.6524	923.1836	0.190740413
X1	3569.7662	396.6406889	0.081950555
Y1	2761.4376	306.8264	0.063393884
Z1	1210.7744	134.5304889	0.027795556
A2	232.1064	25.7896	0.00532843
B2	96.1452	10.6828	0.00220719
C2	0	0	0
D2	0	0	0
E2	0	0	0
F2	0	0	0
G2	0	0	0
H2	0	0	0
I2	0	0	0
J2	0	0	0
K2	0	0	0
L2	0	0	0
M2	0	0	0
N2	0	0	0
O2	0	0	0
P2	0	0	0
Q2	820.6288	91.18097778	0.018839045
R2	0	0	0
S2	1038.0736	115.3415111	0.023830891
T2	0	0	0
U2	0	0	0
V2	0	0	0
W2	0	0	0
X2	5340.7496	593.4166222	0.12260674
Y2	5523.5649	613.7294333	0.126803602
Z2	0	0	0
A3	2294.3922	254.9324667	0.052671997
B3	4643.815	515.9794444	0.106607323
C3	2730.4169	303.3796556	0.062681747
D3	819.9515	91.10572222	0.018823496
E3	0	0	0
F3	0	0	0
G3	2001.5787	222.3976333	0.045949924
H3	1031.6417	114.6268556	0.023683235
I3	258.4943	28.72158889	0.005934213
J3	0	0	0
K3	4544.9441	504.9937889	0.10433756
L3	6097.4745	677.4971667	0.139978753
M3	1065.3198	118.3688667	0.024456377
N3	1589.0823	176.5647	0.03648031
O3	2047.0984	227.4553778	0.046994913
P3	1542.2305	171.3589444	0.035404741
Q3	2255.7017	250.6335222	0.051783786
R3	1732.1628	192.4625333	0.039764986
S3	686.2372	76.24857778	0.015753838
T3	697.8889	77.54321111	0.016021325
U3	2888.5394	320.9488222	0.06631174
V3	1014.1195	112.6799444	0.02328098
W3	994.7533	110.5281444	0.022836393
X3	2337.246	259.694	0.053655785
Y3	0	0	0
Z3	0	0	0
A4	0	0	0
TOTAL	124685.8111	13853.97901	2.862392354