Final Report

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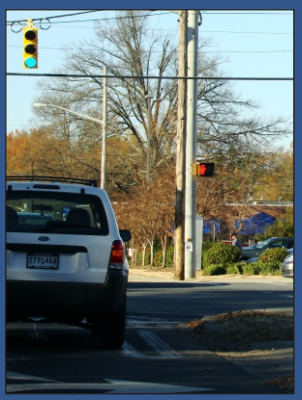
Rock Hill-Fort Mill Area Transportation Study Congestion Management Plan Update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Submitted to:

REATS
Rock Hill - Fort Mill Area Transportation Study

Submitted by:

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1. INTRODUCTION

1.1. Study Purpose

The Rock Hill-Fort Mill Area Transportation Study (RFATS) Congestion Management Process (CMP) Update represents Phase II of the Congestion Management System (CMS) Study completed in 2004. The current study update has been undertaken in accordance with the requirements of federal legislation, SAFETEA – LU[1].

This legislation replaced previous requirements for a CMS in TEA – 21[2], with those for a Congestion Management Process (CMP). This study has been undertaken to enable RFATS staff to effectively implement a congestion management process that will encompass multimodal system performance measures, as well as mitigation strategies that will improve transportation system management and operation.

1.1.1. RFATS Technical Team

The CMP Update was conducted for the RFATS Metropolitan Planning Organization (MPO) with the support and guidance of the RFATS Technical Team, comprising representatives of:

- RFATS MPO;
- York County;
- Town of Fort Mill;
- City of Tega Cay;
- South Carolina Department of Transportation; and,
- Federal Highway Administration.

1.1.2. Report Layout

Following an overview of the Congestion Management Process in this chapter, the remainder of the report follows the organization and content of six interim documents prepared during the course of this update, namely:

- Technical Memorandum 1 – Introduction to the CMP Update Process
- Technical Memorandum 2 – Existing Multimodal System Conditions
- Technical Memorandum 3 – Performance Monitoring Guidelines and Selection

[1] Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA – LU), August 10, 2005.
[2] Transportation Efficiency Act for 21st Century (TEA – 21), June 9, 1998.

- Technical Memorandum 4 – Congestion Management Strategies
- Technical Memorandum 5 – Implementation Process
- Technical Memorandum 6 – Evaluation and Assessment
- Technical Memorandum 7 – Subarea Traffic Analysis and Thoroughfare Planning

Some portions of the interim documents may be found in Appendices to this report.

1.2. The Congestion Management Process

The Congestion Management Process is a continuous cycle of planning, implementation, operation and monitoring activities intended to help an MPO to:

- Identify congested locations;
- Determine the causes of congestion;
- Identify strategies that best address the causes and impacts of congestion; and
- Track and evaluate the impact of previously implemented congestion management strategies.

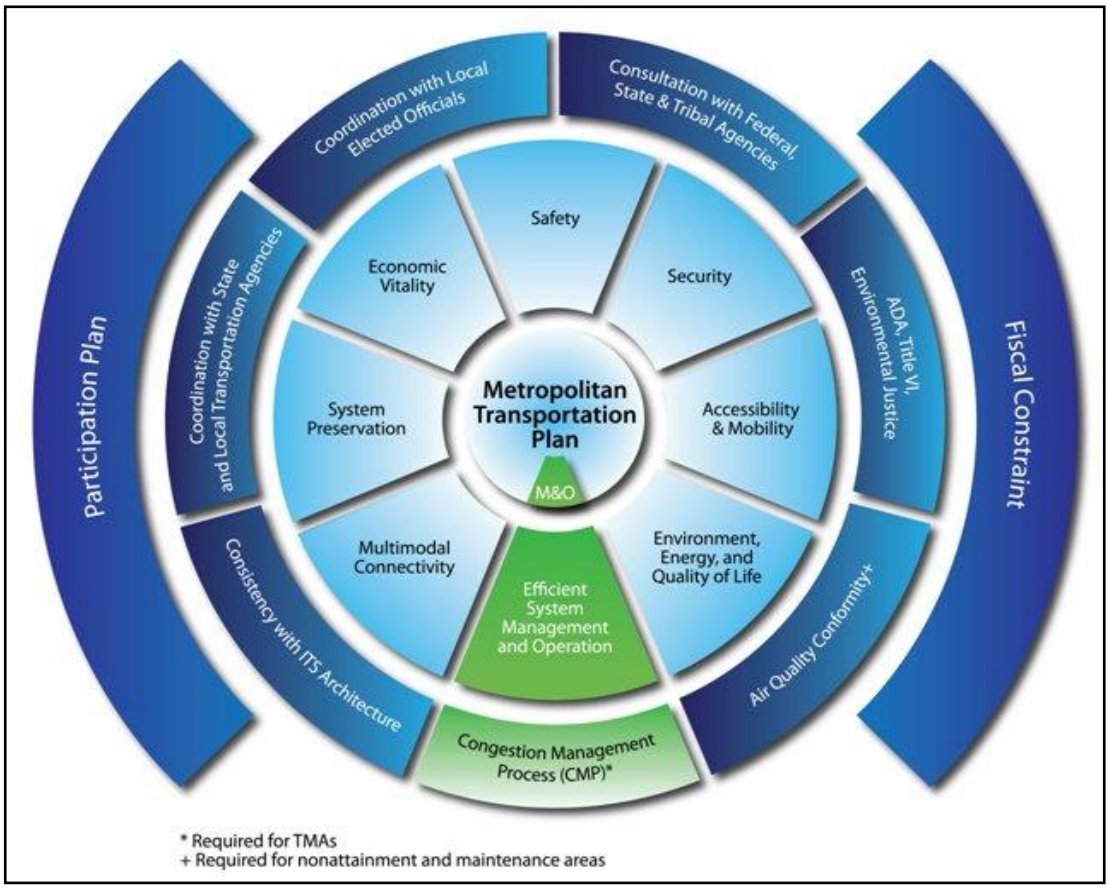
1.2.1. Metropolitan Planning Process

The Congestion Management Process is intended to be an integral part of the metropolitan planning process, rather than a stand-alone program or system. Furthermore it advances the integration of transportation systems management and operations (M & O) into the metropolitan planning process. The integration of the CMP into the Metropolitan Planning Process is illustrated in **Figure 1-1**.

1.2.2. Maintenance and Operations

M & O has emerged as a vitally important approach to addressing both short-range and long-term transportation challenges, including congestion. It is an integrated approach that seeks to optimize the performance of existing infrastructure through the implementation of multimodal, intermodal, and often cross-jurisdictional systems, services and projects.

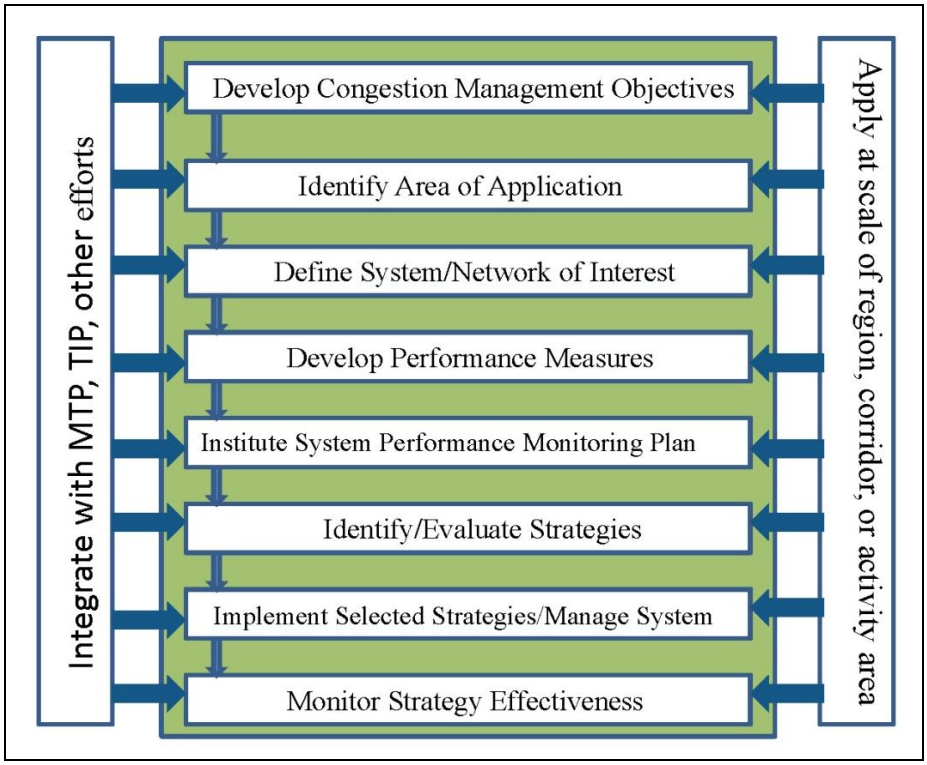
Figure 1-1: Components of the Metropolitan Planning Process



1.3. CMP Framework

The CMP may be considered as being made up of eight steps, as illustrated in **Figure 1-2**.

Figure 1-2: CMP Eight Steps



1.3.1. Develop Congestion Management Objectives

The RFATS 2035 Long-Range Transportation Plan (LRTP) identified the following overall goal for the LRTP[3]:

> *"Develop a Plan and strategies that promote an efficient and effective transportation system for all users in the RFATS Study Area"*

Specific goals identified for the Highway System, Congestion Management, and Transportation Alternatives are listed in **Table 1-1**. Additional Environmental goals were also identified, as were goals for Public Outreach and Awareness.

[3] Rock Hill – Fort Mill Area Transportation Study 2035 Long Range Transportation Plan, adopted April 24, 2009.

Table 1-1: RFATS 2035 LRTP Goals

Overall Goal:
Develop a Plan and strategies that promote an efficient and effective transportation system for all users in the RFATS Study Area.

Highway System:

- Enhance mobility by improving existing roads and corridors and street connectivity.
- Maintain and protect the existing transportation system and components and require maximum efficiency and utilization of existing arterials.
- Explore improvements to the street network that will most effectively handle capacity deficiencies.
- Protect existing corridors and reserve future rights-of-way affected by both public and private development.
- Provide a safe transportation system that will focus on reducing crashes at problematic intersections and providing better facilities for pedestrians and bicyclists.
- Encourage opportunities to engage freight providers in operational and transportation system upgrade planning.

Congestion Management:

- Continue to support the ongoing Congestion Management Process and fully integrate congestion measures and strategies into the project selection process.
- Continue to improve traffic signalization timing in jurisdictions throughout the Study Area.
- Encourage the incorporation of access management strategies on major roads and corridors and require development to provide adequate internal circulation and connectivity to maximize linkages with other nearby development.

Transportation Alternatives:

- Implement transit plans and strategies that encourage a more comprehensive transit system and accommodate more riders.
- Implement land use policies to encourage transit supportive development patterns along the rapid transit corridor.
- Seek public support and funding sources needed to implement long range transit projects.
- Incorporate pedestrian and bicycle accommodations in planned improvements to roads and corridors.
- Incorporate bicycle facilities/lanes in state and local maintenance and pavement marking projects where feasible.
- Pursue strategies and funding for a coordinated and comprehensive network of sidewalks and bicycle routes throughout the Study Area.
- Require developments to provide pedestrian and bicycle facilities and connections.

Objectives are specific steps that help to accomplish the goal and include outcome or output oriented measures. Objectives should be stated in such a way that performance measures can be

derived from the objectives. Performance measures and appropriate targets for congestion measures are discussed further in Section 3.

1.3.2. Identify Area of Application

A Congestion Management Process is required in all urbanized areas with a population above 200,000. While the RFATS Study Area does not meet that criteria, it is part of the Charlotte-Mecklenburg urbanized area, which does fall into that category. RFATS conducts transportation planning for a portion of that area, and is therefore required to have a CMP.

The geographic limits for the CMP are the RFATS MPO planning area boundary shown in **Figure 1-3**. The six planning organizations within the greater Charlotte region are illustrated in **Figure 1-4**.

1.3.3. System Definition

The RFATS CMP is intended to be multimodal in scope and address intermodal, transit, bicycle and pedestrian modes, as well as highways and freight movement. The 2004 CMS identified a Congested Monitoring Network (CMN) as discussed in Section 2. The network of roads that were the focus of this CMP Update are identified in Section 3. These roads are referred to as the CMP Corridors.

1.3.4. Developing and Using Performance Measures

Performance measures can provide an effective means of communications both with members of the public and with appointed and elected officials. To be most effective, measures should be:

- Clear and easy to understand;
- Descriptive of existing conditions and suitable for predicting changes;
- Easily calculated and collected, with consistent results;
- Applicable to multiple modes; and
- Responsive to actions (improved facilities or policies) under the control of the MPO.

CMP performance measures should be derived from the vision, goals, and objectives established for the region during the metropolitan transportation planning process, such as those for the 2035 LRTP and should be transformed from goals into specific objectives as part of the Congestion Management Process. Measures selected for the RFATS area are discussed in Section 3.

1.3.5. Developing a Performance Monitoring Plan

In the past the availability, reliability and cost of data has been a major challenge for planners and system operators. However, recent advances in technologies and communications have allowed many data collection activities to be automated, and further significant advances are anticipated.

During the CMP Update, existing sources of data were identified; data was collected using two distinct methodologies and a Performance Monitoring Plan developed, as discussed in Section 6.

Figure 1-3: RFATS Study Area

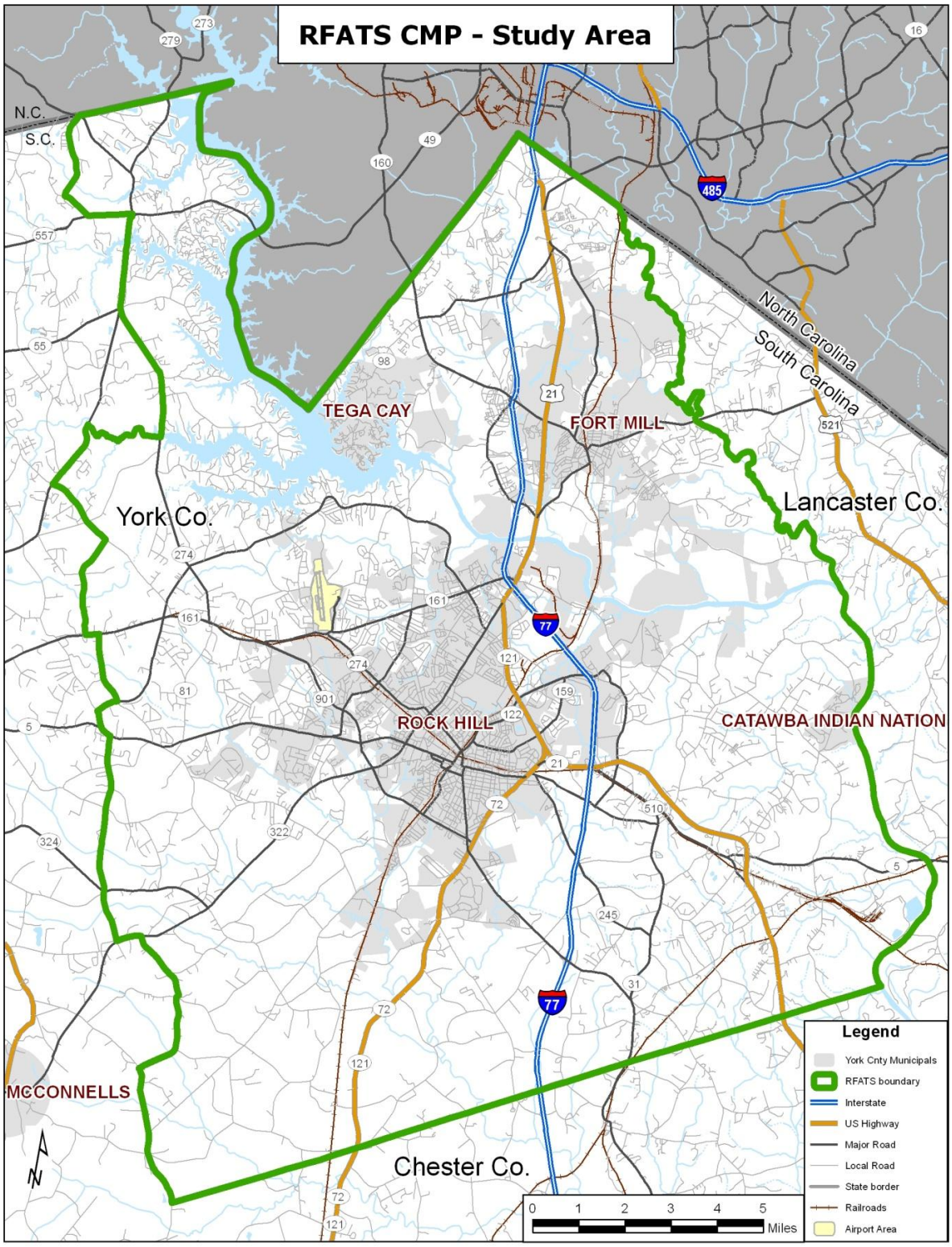
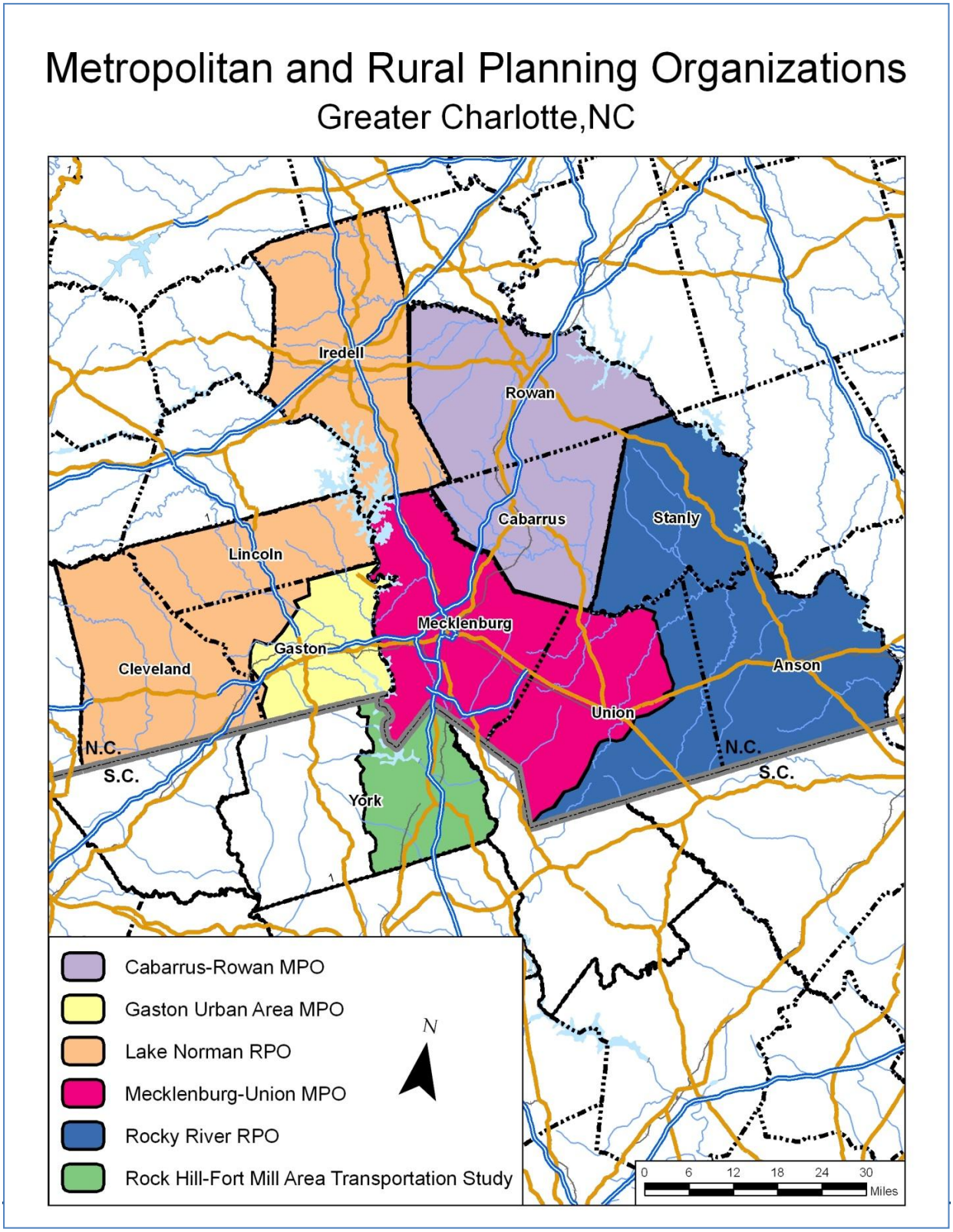


Figure 1-4: Greater Charlotte Region Planning Organizations



1.3.6. Identifying and Evaluating Strategies

Selection of appropriate performance measures, analytical tools, and available data enables the identification of congested locations. The most common type of congestion, recurring congestion, occurs repeatedly at the same locations and can often be traced to a specific cause, such as a bottleneck. Non-recurring congestion is less predictable and often the consequence of an accident that reduces capacity until the road is cleared. Available analysis tools range from sketch planning tools, the simplest and least costly, to microscopic simulation models, the most time consuming and difficult.

One of the major products of this study was a set of CMP Operational and Policy Matrices. The rows of the matrix correspond to each type of congestion problem identified, while the columns identify potential operational and policy options (strategies). At the intersection of a row and column is a symbol or text indicating the potential impact of that specific option on that specific type of congestion / problem, as discussed in Section 4.

1.3.7. Implement Selected Strategies / Manage Systems

Following completion of this study, the Congestion Management Process will be actively incorporated into the broader Metropolitan Planning Process (see **Figure 1-1**), and will be a source of potential projects during the development of the Transportation Improvement Program (TIP).

1.3.8. Monitoring Strategy Effectiveness

It is important to periodically evaluate the effectiveness of strategies identified through the CMP, using the CMP performance measures. In assessing the degree to which the CMP strategies addressed the problems of congestion, it is also important to assess how well, and to what extent, the strategies were implemented and to consider factors that may have contributed to the success or failure of the selected strategies or policies.

To achieve the above it is important that the ongoing monitoring process should be able to isolate those marginal changes in system performance that may be associated with an implemented strategy.

Based on the results of the assessment process the CMP should be reviewed and appropriate adjustments made as necessary with respect to:

- Strategies considered;
- Performance measures used;
- Data collection; and / or
- Analytical tools and methods used.

It is only through such a periodic review that the CMP will be refined, improved, and keep pace with current practice. The need for periodic evaluation of the CMP is discussed in Section 6.

2. EXISTING MULTIMODAL SYSTEM CONDITIONS

This section provides information on the RFATS Study Area addressing the following questions:

- Where are the critical congestion locations?
- What are the congestion and safety problems / issues in the study area?

2.1. Previous Studies

2.1.1. RFATS 2035 LRTP

The RFATS 2035 Long Range Transportation Plan (LRTP) was completed in 2009 and approved on April 24, 2009. Among other topics the Plan addressed were highways, congestion management, freight, and transit.

LRTP Highway Element - The highway element included the identification of existing congested and high volume locations. It also identified highway improvement projects in eight groups, primarily based on funding source. The groups were:

- Financially Feasible Plan (2035) – to which RFATS contributes funding through Guideshare;
- State Transportation Improvement Program (STIP) Projects – funded by FHWA and SCDOT;
- Funded One Cent Sales Tax Projects (1997);
- Funded One Cent Sales Tax Projects (2003);
- Privately-funded: Identified from I-77 Corridor Traffic Study;
- Unfunded Transportation Needs: Road Widenings/New Alignments;
- Unfunded Transportation Needs: Intersection Improvements; and,
- Sub-area Circulation and Collector Road Studies (2004 CMS Recommendations).

The Catawba River Bridge is considered the primary highway project in the LRTP designed to relieve congestion in the I-77 corridor and provide additional east-west access to I-77. This project is discussed further in Section 2.1.2.

The highway element contained two recommendations as follows:

- RFATS should consider supporting a third ‘Pennies for Progress’ program, to allow implementation of some of the projects that are currently unfunded.
- RFATS communities should adopt ‘complete streets’ policies. RFATS may be in the best position to lead this development on behalf of the communities.

LRTP Congestion Management Element - In addition to highways, the RFATS 2035 LRTP fully covered other modes and aspects of transportation, including congestion management. For the Congestion Management Process, the LRTP contained the following recommendations:

- RFATS should develop monitoring procedures and measures of effectiveness for the CMN.
- RFATS should study the role of urban goods movement in congestion. This should include updating earlier truck routing investigations and addressing ways in which in town truck movements could be made more efficient.
- RFATS should assist local jurisdictions to review existing and potential land development and access management regulations.
- RFATS should consider adopting a policy of CMP screening for all proposed projects. This screening process would ensure that the full range of congestion management options (trip reduction, increased use of high occupancy modes, optimization of highway system operations, and increased capacity) is considered during project development.
- RFATS should add a congestion management component to all corridor plans, sub-area plans and other special projects.
- RFATS should update the CMP on a four-year cycle.

LRTP Freight Element - The Freight element of the plan concluded with two recommendations, as follows:

- RFATS should consider undertaking a comprehensive Freight Study. This would help understand the specific needs of freight shippers and receivers, as well as how the RFATS Study Area could benefit from Charlotte's existing and planned intermodal facilities. It would also include the congestion impacts of freight and considering designated truck rotes, as described in the Congestion Management Process element. It would build upon the issues highlighted by stakeholders.
- RFATS should review existing policies and practices on preservation of rail-served industrial sites and preservation of industrial railroad corridors. This would aim to understand whether any additional efforts are needed to ensure convenience access to freight movement by rail.

LRTP Transit Element - Chapter 8 of the 2035 Long Range plan presents the Public Transportation Element for the overall plan, which consists of the existing conditions, future issues and a list of recommendations. The Plan was completed in 2009 and reflects recent trends for public transit at the state and national levels, including local bus, intercity bus, and commuter rail services. The

statewide 2008 South Carolina Multimodal Long Range Transportation Plan is discussed within the chapter and makes the important point of establishing consistent funding for public transportation in the state. In South Carolina this continues to be a challenge, particularly related to the $6 million annual state funds for transit through the $0.25 per gallon from motor fuel taxes. The Plan's vision is to increase the state funding to $35 million annually by 2030.

The RFATS study area has limited local transit service, some Greyhound intercity bus service, and no Amtrak rail service at this time. The limited services include:

- An Express Bus Route (known as the Rock Hill Express 82X) is operated by the Charlotte Area Transit System (CATS), from downtown Rock Hill to the Charlotte Transportation Center. This service operates Monday-Friday during the morning and evening peak travel times.

- A second Express Bus Route (known as the Celanese Corridor Express 78X), also operated by CATS, provides daily service Monday through Friday from northern Rock Hill to the LYNX Light Rail Station at I-485 during the morning and evening peak periods.

- Vanpool services sponsored by CATS. Several different size vanpools, ranging from 4- to 15-passenger vans, operate within the study area.

- York County Access (a demand response service), is operated by the York County Council on Aging and provides weekday public transit to the general public within the Rock Hill Urbanized Area; particular effort is directed towards meeting the basic mobility needs of seniors and those with special transportation needs. This service is is available Monday through Friday from 6:00 a.m. to 6:00 p.m., and must be scheduled two days in advance. On July 1, 2010 an employment geared peak period option was added to this program providing area residents with a reliable option for accessing local employment centers within the Rock Hill Urbanized Area as well. This option is also available Monday through Friday from 5:30am to 9:00am and again from 3:30pm to 6:00pm.

Other pertinent information in the Transit Element of the 2035 LRTP included long-range plans for connections to Charlotte, including bus rapid transit, trolley service, and local feeder services. This local vision and coordination with CATS' services will assist in providing congestion relief for several identified corridors within the plan. Specific recommendations in the chapter included:

- RFATS communities should continue BRT implementation activities focused on coordinating land use practices along US 21 (the endorsed rapid transit corridor), that will preserve planning options and are transit supportive.

- RFATS should continue to monitor opportunities for funding elements of the Transit Service Master Plan, including traditional and non-traditional sources, such as urban program funding and economic stimulus funding, etc. RFATS should ensure that at

least one small, low-cost scheme is 'ready to go,' in order to pursue funding opportunities as they arise.

- RFATS should consider raising awareness among local stakeholders of the role of public transportation within the available funding sources. This should include considering whether, and to what extent, the flexible surface transportation funds, which have traditionally been seen as highway funds, could also be used for public transportation projects.
- RFATS should explore options, such as ridesharing programs, for providing transportation alternatives for area residents.

2.1.2. Potential Catawba River Crossing

An Advanced Project Planning Report (APPR) prepared internally by SCDOT discusses a potential new location for an alternative transportation corridor that would cross the Catawba River northeast of Rock Hill (see **Figure 2-1**). The corridor would provide an alternative to SC 161, Celanese Road, an east-west arterial that connects the northern Rock Hill suburbs and Interstate 77. The corridor also provides a connection between Sutton Road and Mt. Gallant Road.

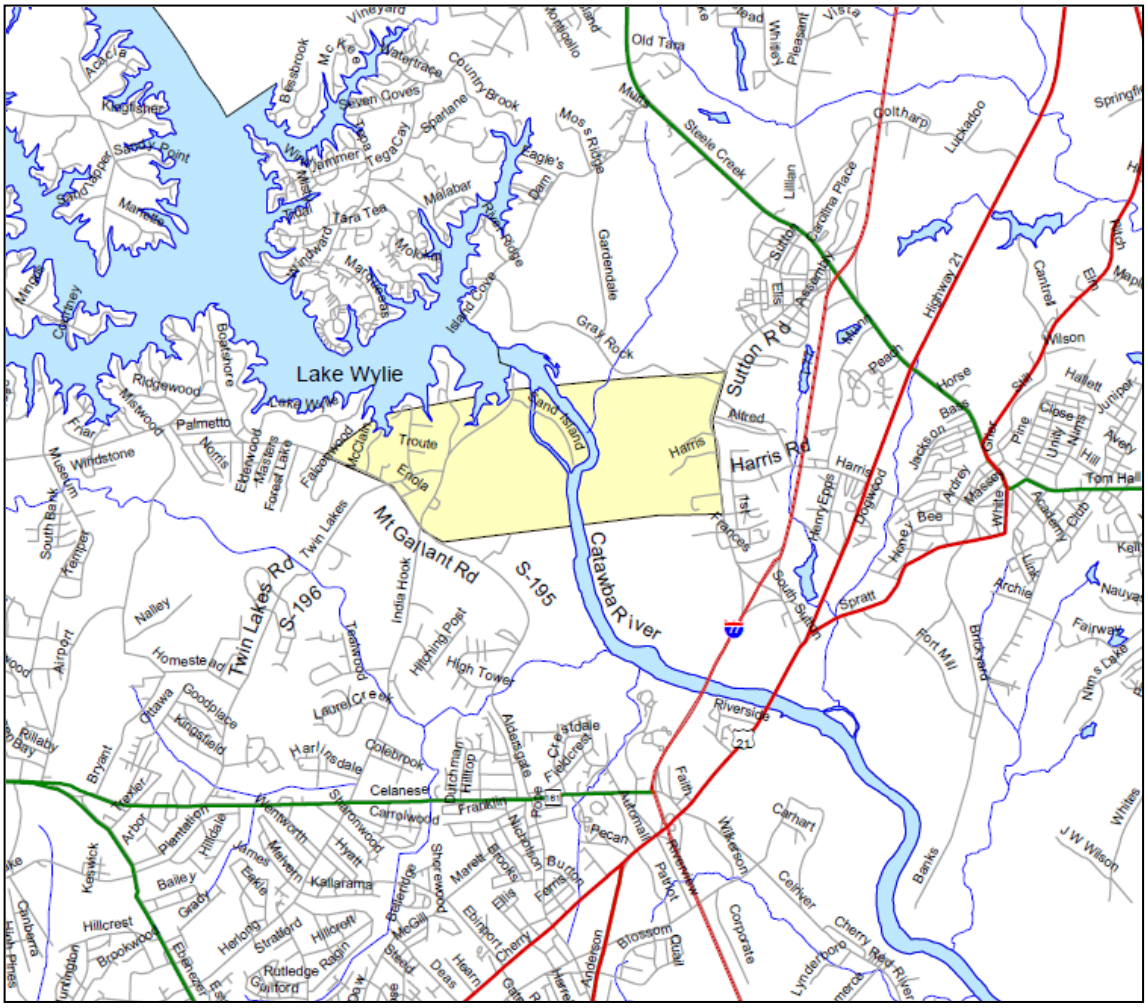
The new roadway and bridge project could potentially:

- Relieve increasing congestion in the region, especially on Celanese Road (SC 161);
- Connect two primary north-south corridors in the Rock Hill northern suburbs;
- Accommodate traffic traveling east-west to and from Fort Mill, Northeastern York County, and Charlotte;
- Enhance regional emergency management planning and options; and
- Serve as an evacuation route in an emergency management situation.

Summary of Issues - Potential traffic impacts in the region are significant. Highlights of the corridor's specific impact on existing roadway network traffic include:

- Celanese Road-bridge is forecast to reduce 2035 vpd for the segment from US 21 to S-195 by over 30 percent
- Mt. Gallant Road-bridge is forecast to increase 2035 vpd by over 30 percent for the segment between S-30 and SC 274 and decrease 2035 vpd by between five and 30 percent for the segment between SC 161 and S-30
- Sutton Road- bridge is forecast to increase 2035 vpd by ten percent

Figure 2-1: Catawba River Crossing Study Area



The study area's environmental issues related to a new bridge and corridor include:

- Environmental Justice - No minority and/or low income communities in study area
- Cultural Resources - One church at Twin Lakes Road and Mt. Gallant Road
- Water and wetlands - Impacts along Catawba River
- Threatened and Endangered Species - None but Carolina Heelsplitter and sunflower studies are recommended
- Waste sites and facilities, Water Quality Sites, Air Quality Sites - Sand mine (Dickerson, Inc., Fewell Island Sand) on Catawba River on the north side of the study area plus a surface water intake on Lake Wylie at the northern edge of the study area.

- Land Use - Mostly densely forested with residential primarily in the Twin Lakes Road / India Hook Road area west of the river, and along Sutton Road to the east of the river.

Potential characteristics of the proposed bridge and corridor may be summarized as follows:

- Two miles long with five-lanes,12-foot travel lanes with 15-foot median, and eight or 10 foot shoulders
- Bridge between 800 and 1200 feet long
- 160 ft right-of-way
- 2035 forecast traffic volume of 14,000 vpd
- Bicycle/pedestrian facilities to be incorporated
- Cost estimate - $10.5 million for roadway and $32 million for bridge

Next steps to advance the study and evaluation of a new Catawba River Crossing include:

- Development of a strong purpose and need statement - necessary because the area includes significant environmental concerns.
- Additional evaluation and assessment to examine potential alignments and to consider extending the current study area.

2.1.3. Recent Transit / Transportation Studies

Five recent area studies have analyzed the needs of public transportation and improved operational efficiency of the transportation network serving the RFATS Area. A thorough review of these studies was conducted to extract pertinent data relating to the area's current and future transportation needs. The focus of the studies discussed below relate to public transportation, the functionality / capacity of I-77 regarding the possible incorporation of HOV / HOT lanes, and subarea analysis' of the South Pointe High School Area and the Dave Lyle Blvd / Galleria Area – a regional destination with the RFATS Study Area.

Rock Hill Urban Transit Study - The Rock Hill-Fort Mill Area Transportation Study (RFATS) in coordination with the City of Rock Hill and the Catawba Regional Council of Governments (CRCOG) completed this transit study in 2005. The purpose of the study was to develop transit alternatives and an implementation plan for the Rock Hill urban area. The alternatives were based on transit needs, stakeholder input, and local area characteristics, such as development patterns, demographics, coordination, operating and capital costs, and ridership estimates.

The results of the study were a phased approach to services:

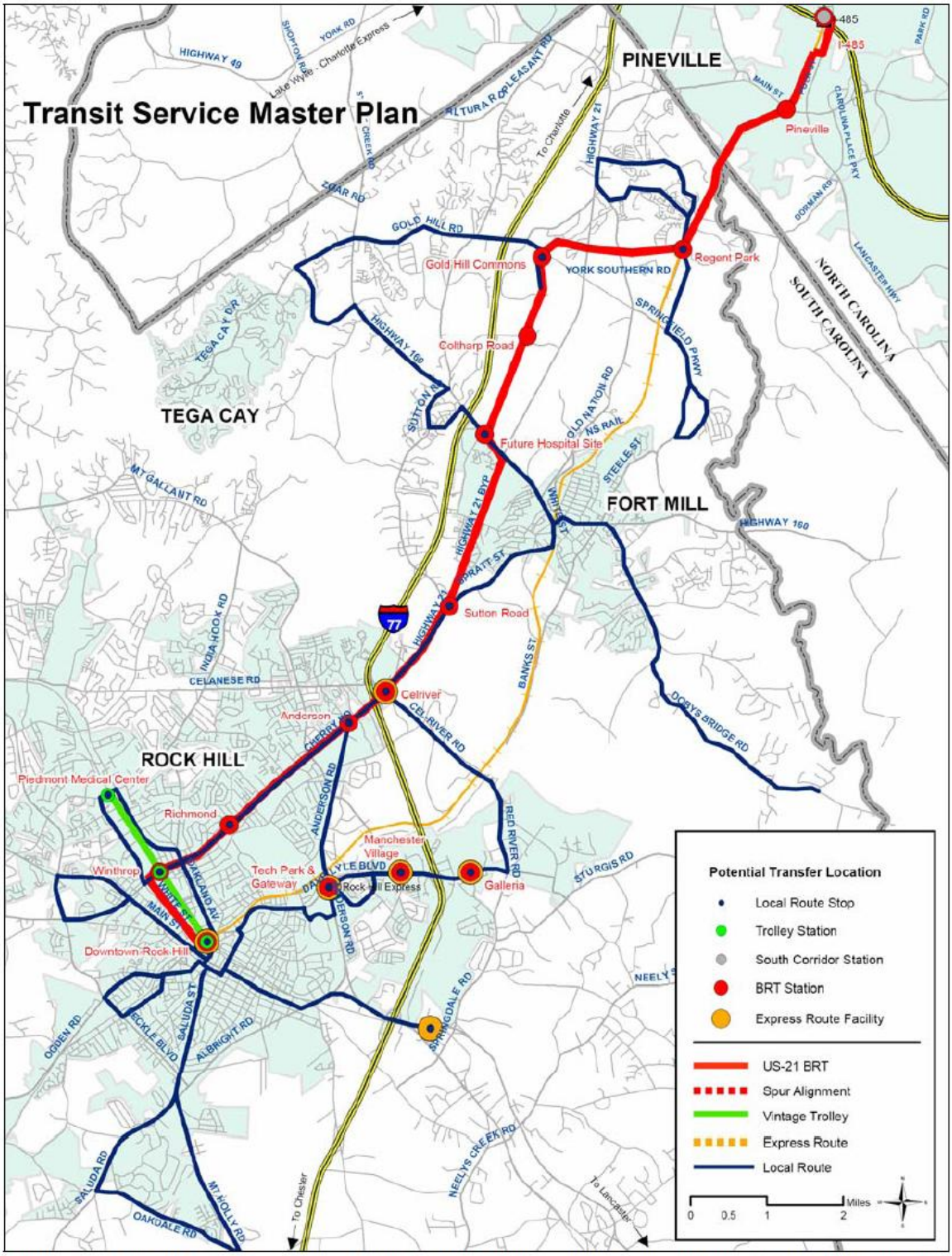
- Phase I – Continue the Rock Hill Express (CATS 82X).
- Phase II – Implement an express bus route between north Rock Hill (Celanese Road corridor) and Charlotte.
- Phase III – Reevaluate the potential for providing local fixed-route and / or demand response service for the study area.

Rapid Transit Study - The Rock Hill – York County – Charlotte Rapid Transit Study (RYC) was completed in 2007 and identified a Locally Preferred Alternative (LPA) for providing rapid transit service connections between Rock Hill -York County and the greater Charlotte region. The LPA satisfies early planning steps required by the Federal Transit Administration (FTA) and is necessary to compete for federal transit funds for the corridor. Recommendations include Bus Rapid Transit (BRT) service along the US 21 corridor connecting downtown Rock Hill to Charlotte at the I-485 light rail station.

Figure 2-2 provides an overall review of the corridor with connecting services. The estimated capital cost for all phases of the BRT corridor is approximately $515 million. A solid financial program, including a stable local funding source and organizational / governance structure, must be finalized to move the project into the federal grant funding process for new and small start funds.

BRT has the potential to play a significant role in congestion relief, providing land use patterns are supportive of transit along this corridor. The alignment presented within the BRT study should be included in the long range planning designs for the roadway; particularly related to US 21 and Cherry Road in Rock Hill.

Figure 2-2: Transit Service Master Plan



Source: Rock Hill-York County-Charlotte Rapid Transit Study Locally Preferred Alternative Refined Screening Analysis Report, April 2007

2.1.4. Charlotte Region Fast lanes Study

The ten-county, two-state Charlotte Region Fast Lanes Study focused on twelve primary corridors (approximately 334 miles) with potential for fast lanes (High-Occupancy Vehicle Lanes, High-Occupancy Toll Lanes, Truck-Only-Toll Lanes) to improve capacity. The project was divided into two phases:

- Phase 1 - Corridor screening; and
- Phase 2 - Corridor evaluation.

Interstate 77 in the Charlotte area was studied, including segments in both North Carolina and South Carolina. The South Carolina segments were:

- From the North Carolina state line to Gold Hill Rd (I-77 north of Gold Hill Rd); and
- Gold Hill Road south to the southern border of York County (I-77 south in York Co.).

Phase 1 - Corridor Screening - Screening in Phase 1 was conducted to recommend corridors for more detailed analysis in Phase 2. Results of Phase 1 corridors were grouped as follows:

- Corridor segments that ranked high on the screening process to be recommended for Phase 2 evaluation
- Segments that were found to be marginal to be recommended conditionally passing to Phase 2 evaluation
- Segments that were not recommended for further study in Phase 2.

The I-77 segment north of Gold Hill Road has a 70 / 30 split in the AM peak and could be considered for reversible lane operations by using one outbound lane. During the PM peak, an inbound I-77 lane would be used for outbound traffic. The I-77 segment south in York County did not meet the HOV demand criteria, nor did it have sufficient directional split to be considered for reversible lane operations. As a result, it did not pass the Phase 1 screen criteria.

Phase 2 Corridor Evaluation Impacting York County - The critical assumption made in Phase 2 includes widening I-77 south to ten lanes between I-277 in Center City Charlotte and Nation's Ford Road and to eight lanes between Nation's Ford Road and the North Carolina/South Carolina State Line.

Based on projected level of service (travel time, congestion and mobility), Phase 2 analyzed the costs, revenues and tolls by corridor and segment. According to Phase 2 analysis results, although I-77 South has very high demand for Fast Lanes, its travel time savings per mile are lower than the I-77 North, US-74 east and I-85 corridors.

Fast Lane Study Conclusions - In summary, the study identified key policy decisions, institutional relationships and operational strategies associated with the next steps in the planning

and design of managed lanes in the Charlotte region. According to the study SCDOT has expressed interest in Fast Lanes along I-77 in York County south of I-485. Study recommendations for I-77 in South Carolina were:

- The I-77 segment north of Gold Hill Road (SC 98) could be considered for reversible lane operation by using one outbound lane in the AM Peak. During the PM peak, an inbound I-77 lane would be used for outbound traffic.
- The I-77 segment south of Gold Hill Road (SC 98) did not meet the HOV demand criteria, nor did it have sufficient directional split to be considered for reversible lane operations.
- The South Carolina segment does not perform as well as the North Carolina segments, but SCDOT retains interest in exploring more detailed studies of Fast Lanes in York County in the future.

2.1.5 South Pointe High School Area Traffic Study

The purpose of this study was to examine existing and anticipated travel patterns and transportation needs in the vicinity of South Pointe High School in southern Rock Hill. Accelerated development in the area as well as large events at the school are contributing to increased congestion along SC 72 (Saluda Road), the principal arterial serving this area. Study participants included the City of Rock Hill, York County, and representatives from School District 3. From this study, six proposed project concepts were identified to better balance traffic demand / flow. These projects were incorporated into the planning process during the development of the 2035 Long Range Transportation Plan.

2.1.6 I-77 Traffic Study

The I-77 Traffic Study examined the cumulative impact of major development planning along the interstate near the Dave Lyle Blvd / Galleria Area. The primary focus of the study was from downtown Rock Hill to the west, the Catawba River to the east, I-77 / Sutton Road to the north, and I-77 / Anderson Road to the south. Primary study participants included the City of Rock Hill, York County, Town of Fort Mill, and the South Carolina Department of Transportation.

Specific study activities included a macro-level analyses that provided projected traffic demand information on selected road segments as well as projected congestion levels based on a comparison of roadway capacity and traffic demand. Additionally, this study included a micro-level analyses that involved both qualitative and quantitative data at three localized focus areas (Dave Lyle Boulevard; Celanese Road; and the Mt. Gallant Corridor) to determine likely intersection improvement needs based on projected travel demand. From this study approximately eight projects were identified and incorporated into the 2035 Long Range Transportation Plan.

2.2. Congested Locations

Information on congested locations was gathered from a number of sources:

- RFATS Congestion Management Study (CMS), 2004;
- RFATS Technical Team;
- Metrolina Regional Model; and
- Average Daily Traffic (ADT) volumes.

2.2.1. RFATS CMS Plan

The RFATS 2004 Congestion Management Study (CMS) identified a Congestion Monitoring Network (CMN) made up of two categories of roadways, as illustrated in **Figure 2-3.**

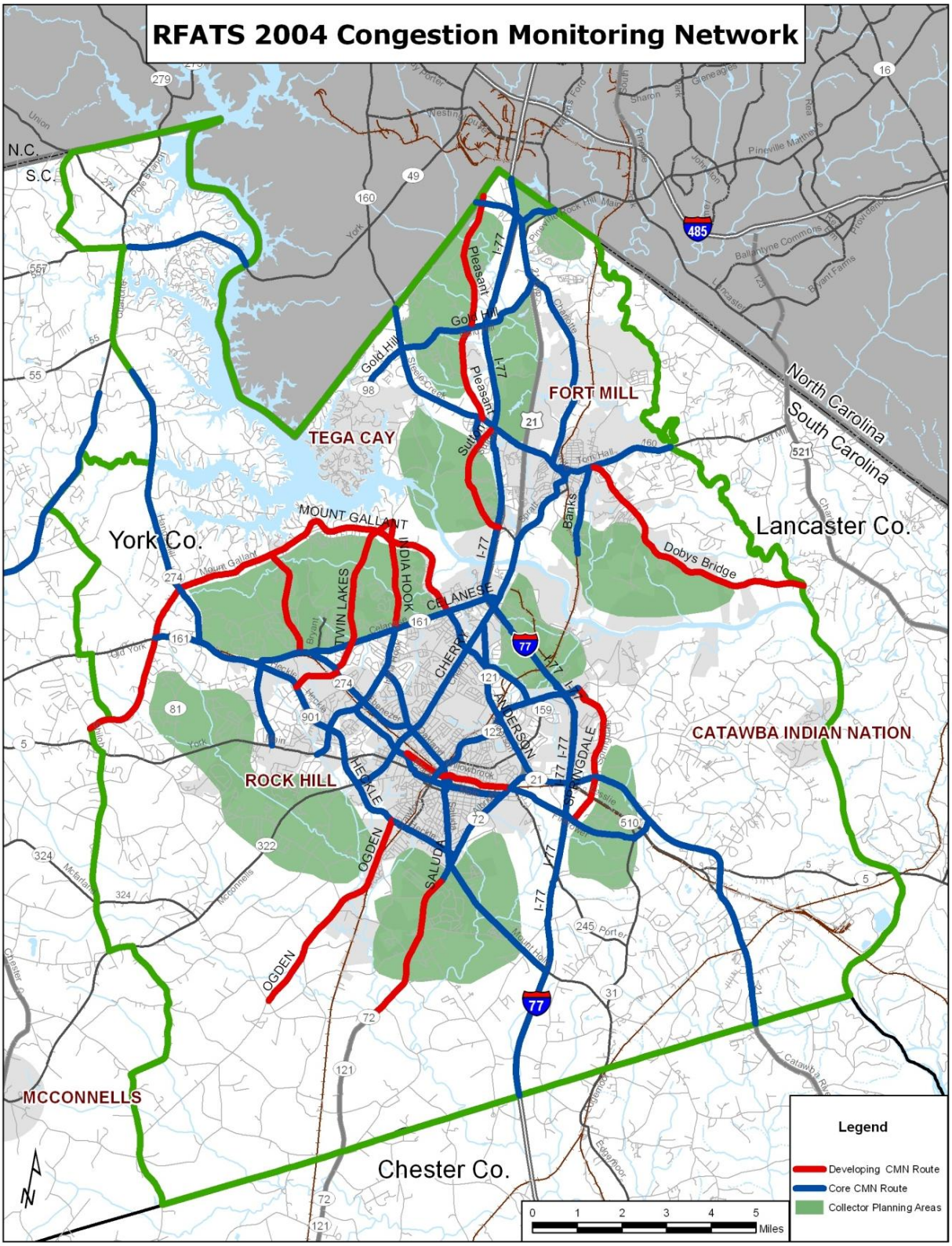
- Core CMN Routes – well established major corridors; and
- Developing CMN Routes – those that are expected to become increasingly important for regional travel as growth and development continue in the future.

The 2004 CMS also identified eleven congested locations in 2004, as follows:

1. Carowinds Boulevard
2. Truck traffic on SC 160 in Fort Mill
3. SC 160 at Steele/Bank Street and Dobys Bridge Road
4. I-77 Interchange at Celanese Road
5. Eden Terrace and Mount Gallant Road
6. Dave Lyle Boulevard at I-77
7. Cherry Road, west of Dorchester / Patten Streets
8. Oakland Avenue at Eden Terrace
9. Main Street West at Constitution Boulevard and West Black Street
10. Saluda Road near Saluda Trail and Oakdale Schools
11. Mt. Gallant Road at SC 161 (Celanese Road)

Improvement projects that have been implemented in 2004 to address congestion at these locations are discussed below.

Figure 2-3: 2004 Congestion Monitoring Network



1. CAROWINDS BOULEVARD - This project was not only listed in the 2004 CMS, but was repeatedly raised during the development of the 2035 LRTP project list. This project is summarized as part of a needed congestion corridor improvement effort; specifically, that traffic volumes are extremely high throughout the day and evening causing frequent backups. Additionally, intersections and driveways are scattered throughout the area causing conflicting movements and less than clear traffic patterns.

Current Status and Proposed Improvements - York County has been approved for a Congestion Mitigation and Air Quality (CMAQ) grant to undertake intersection improvements to Springhill Farm Road and US 21 (Carowinds Boulevard). These CMAQ funds will allow for the installation of additional left turn storage, a dedicated free-flow right turn movement, and a realignment of the Springhill Farm-SC 51 intersection. The combination of these improvements will reduce the dependency on Springhill Farm Road and lesson the congestion in the immediate I-77 area.

However, these improvements are only the first of many steps that need to be taken to help this interchange area. Additional improvements that may help provide congestion relief at the I-77 interchange between SC Highway 51 and Pleasant Road would include:

- Raised concrete medians to help create strategic, shared access points to lesson conflicting turn movements and help general traffic flow.
- Shared access between parcels limiting the number of curb cuts throughout.
- Implementation of frontage roads that will provide additional access to businesses once the medians are constructed.
- Easy to read directional signage.
- Implementation of new traffic patterns within the Plaza Fiesta, Comfort Inn and Carowinds area.
- Removal of one-way streets and split entrances to business locations to provide a more traditional traffic pattern.

2. TRUCK TRAFFIC ON SC 160 IN FORT MILL - This project is a traffic flow improvement effort designed to resolve the congestion issues created from truck traffic utilizing the downtown streets of Main, White, and Tom Hall Streets.

Current Status and Proposed Improvements – Although the completion of the Fort Mill Northern Bypass and signed SC 160 has been completed, additional improvements are needed and summarized below:

- Specific project improvements would include an additional lane on westbound SC 160 approaching US 21. It should be noted that westbound traffic regularly queues 700-800 feet at the signal. Therefore, delay can be significantly reduced with this

additional lane. Please note that this new lane would give two westbound lanes feeding through the signal and into the existing two lanes departing the signal at US 21.

3. SC 160 AT STEELE / BANK STREET AND DOBYS BRIDGE ROAD - Periodic congestion was / continues to cause problems on SC 160 (Tom Hall Street) as well as at Steele Street / Bank Street and at Dobys Bridge Road due to the close proximity of two signalized intersections and the lack of alignment of Steele Street and Bank Street. Improvements have been made to smooth traffic flow, including the realignment of Bank Street to align with Steele Street and implementing lane geometry changes at Dobys Bridge Road.

4. I-77 INTERCHANGE AT CELANESE ROAD - This project involves traffic backups on the I-77 southbound off-ramp at Exit 82C, Celanese Road (SC 161). The likely causes identified in the 2004 CMS included: (1) heavy I-77 SB off-ramp traffic during the evening peak period, with the majority of traffic turning right (westbound) on Celanese Road; and (2) a traffic signal located just west of the off-ramp at Riverchase Blvd (which facilitates access to residential and commercial developments), is also a strong contributor.

Current Status and Proposed Improvements - The following improvements have been made since the 2004 CMS:

- At the end of the southbound exit ramp, 1 of 2 left turn lanes was transformed into a combination right / left turn lane;
- March 2005 System Retiming – Riverchase intersection cycle revised from 110 to 220 seconds to increase green time on Celanese so that more vehicles can exit I-77;
- September 2005 System Retiming;
- February 2007 System Retiming;
- May 2008 System Retiming and replaced 170 controllers with 2070 controllers.

Additional project improvements would include redesigning southbound off-ramp intersection at Celanese to allow 2 or 3 right turn lanes in addition to a channelized free flow right. It should also be noted that completion of Ligon Drive -- an access road that would connect Riverview Road to Riverchase Boulevard, will help in better balancing side street congestion levels in the area.

5. EDEN TERRACE / MOUNT GALLANT ROAD - The 2004 CMS described this project as: congestion during peak periods at the signalized intersection of two arterial roadways in a residential neighborhood. The signalization is not presently actuated, nor does it include a protected left turn phase on any approach.

Current Status and Proposed Improvements - The York County Pennies for Progress Program will be 3-laning Mt. Gallant through this intersection and, as a result, will add additional left turn storage to both Mt Gallant approaches. Unfortunately, the Eden Terrace

portion of the intersection will not receive any significant improvements, therefore, including left turn storage improvements to Eden Terrace would provide additional congestion relief to the intersection.

6. DAVE LYLE BOULEVARD / I-77 - The 2004 CMS described this intersection as one of the highest growth locations within RFATS Study Area, given its proximity to the Galleria Mall and Manchester Meadows. It should be noted that the need for improvements at this intersection were raised numerous times during the development of the 2035 Long Range Transportation Plan

Current Status and Proposed Improvements - The following improvements have been made since the 2004 CMS:

- Safety project that reconfigured the right turn lane on Dave Lyle at the northbound I-77 entrance ramp to utilize the signal;
- John Ross Parkway was extended to intersect Mt Gallant Road;
- September 2004 System retiming;
- March 2007 System retiming;
- May 2008 added left turn signals departing Springsteen and John Ross;
- May 2008 System retiming and replaced 170 signal controllers with 2070 controllers.

That said, further improvements would include:

- Incorporation of dual lefts from Dave Lyle Blvd to Chamberside Drive;
- Chamberside Drive redesign to accept dual lefts from Dave Lyle Blvd;
- Redesign of Tinsley Way to eliminate stop sign entering from Dave Lyle Blvd;
- Study and implement how to deal with right turns onto Tinsley from Dave Lyle Blvd;
- Modify shopping center driveway (Tinsley Way) to create adequate and uninterrupted storage approaching Dave Lyle Blvd signal. Eliminate interfering left turn traffic from the Marathon Gas Station direction that causes large gaps in traffic movement exiting the shopping center and interferes with signal operation.

7. CHERRY ROAD, WEST OF DORCHESTER / PATTEN STREETS - Periodic congestion was causing problems along Cherry Road, between Ebinport to the east and Main Street to the west. Causes included old signal controller and interconnect equipment resulting in unreliable coordination of timing between signals (eight signals within approximately 2.6 miles). Note that Cherry Road was undergoing geometric improvements and relocation of utilities underground east of Dorchester / Patten Streets at the time of the 2004 CMS.

8. OAKLAND AVENUE AT EDEN TERRACE - The intersection of Oakland Avenue and Eden Terrace is located at the main entrance to Winthrop University. Issues at the time of the 2004 CMS, included left-turning traffic blocking through movements and heavy pedestrian volumes. Over time, campus activities have been shifting to the west of campus, so left-turn conflicts are anticipated to become less of an issue in the future.

9. MAIN STREET WEST AT CONSTITUTION BOULEVARD AND WEST BLACK - 2004 CMS described the problem as two major arterials (Constitution Blvd & Main Street) intersecting at two closely spaced intersections, resulting in periodic congestion at peak periods. Both arterials provide access to the central downtown area of Rock Hill.

Current Status and Proposed Improvements - Specific project improvements would include the incorporation of a lane modification on Main Street; specifically, adding a right turn option in the center lane of Main Street to better facilitate vehicle movement for Westbound to Eastbound traffic during peak period hours. It should be noted that this traffic signal timing change has been made also.

10. SALUDA ROAD NEAR SALUDA TRAIL AND OAKDALE SCHOOLS - Saluda Road (SC 72 / 121) serves Saluda Trail Middle School and Oakdale Elementary School. At times of peak school traffic, particularly during the morning peak, it is difficult to make a left turn onto Saluda Road. Possible causes listed in the 2004 CMS included that there are no signals at the existing school driveways or access roads; additionally, the CMS noted that there are no traffic signals anywhere along Saluda, resulting in steady flows of traffic during peak periods – without regular breaks or gaps that can facilitate left-turns movements onto Saluda Road.

Current Status and Proposed Improvements - The York County Pennies for Progress Program (PFP) includes the 3-laning of SC 72 through this area. This 3-laning does not include any significant intersection improvements other than basic correction of any skewed angles or narrow lane widths to comply with current SCDOT standards. The realignment of Oakdale Road to intersect with SC 72 at the Saluda Trail Middle School entrance would create a signalized intersection with greater site distance and easier traffic movements between the middle school and elementary school campuses.

In addition, the Saluda Trail Middle School entrance provides a connection with the adjoining high school campus off Neely Road. By providing this new intersection, traffic could negotiate between the elementary, middle and high school campuses without further congesting the surrounding public road network. In addition, this project would add sidewalks to provide pedestrian connections from all three campuses to the surrounding residential neighborhoods. The limits of this project would be SC 72 between Oakdale Road and Harper Gault Road along the Saluda Trail Campus.

11. MOUNT GALLANT / CELANESE ROAD – 2004 CMS identified heavy commuter traffic and new residential development north of Celanese Road as primary contributors to elevated congestion at this intersection.

Current Status and Proposed Improvements - This project received $542,000 in CMAQ funding to install additional turns lanes on southbound Mt Gallant Road approaching Celanese Road. This project is currently in the design phase with construction anticipated in Fall 2011.

2.2.2. Technical Team Input

At a meeting held on June 16, 2010, members of the RFATS Technical Team identified routes within their respective jurisdictions with congestion concerns. A total of 31 routes, areas or intersections were identified, as shown in **Figure 2-4** and listed in **Table 2-1**.

Technical Team members brought a wealth of knowledge not only about the history, physical condition and operational performance of the transportation facilities in their local area, but also about the sensitivities and issues critical to residents, business owners and other stakeholders. The areas of congestion identified by the Technical Team provided a valuable supplement to purely numerical methods, such as traffic volumes and travel demand model outputs, and serve to strengthen the sources and extent of information used in the Congestion Management Process.

2.2.3. Average Daily Traffic

Average Daily Traffic (ADT) volumes for 2009[4], are shown in **Figure 2-5**. Metrics such as traffic volumes provide a convenient and readily available measure of demand on the transportation network. SCDOT provides traffic count data for numerous locations on an annual basis. This data source enables the identification of traffic growth patterns by time and by corridor in the RFATS area.

Interstate Traffic - As expected the highest traffic volumes in the study area are to be found on I-77, as shown in **Table 2-2**. Values ranged from 128,000 vehicles per day in the northernmost section south of the state line to 40,400 on the southernmost segment. The latter volume is slightly higher than on the most heavily travelled non-interstate road, which is SC 161 between U.S. 21 and S-195.

Non-Interstate Corridors - The top 20 segments of non-interstate roads are listed in **Table 2-3**. The top 10 roadway corridors are listed in **Table 2-4**, together with the highest and lowest volumes along each corridor and the number of corridor segments in the list of top 20 segments of non-interstate roads.

[4] ADT data provided by SCDOT

Figure 2-4: Congested Locations Identified by Technical Team

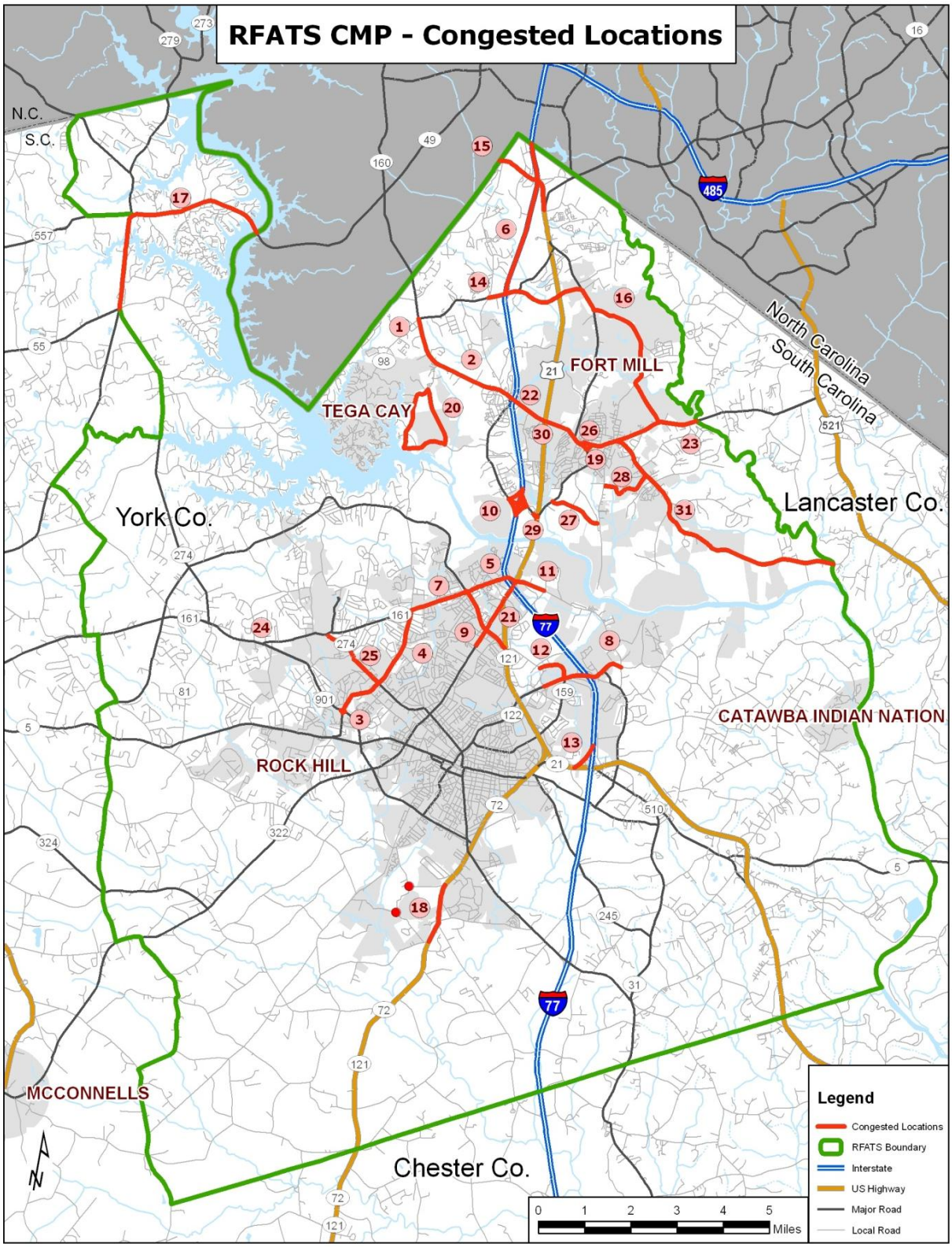


Table 2-1: Technical Team Congested Locations

Ref #	Location	Description
1	Gold Hill Road / SC 160 (1)	Intersection
2	SC 160	Gold Hill Road to NC State Line, Stonecrest Boulevard to Sutton Road
3	Heckle Blvd (SC 901) north and south of Herlong Avenue	Tyson's Forest Drive to Herlong Village Drive (at Wendy's)
4	Herlong Avenue	Heckle Boulevard (SC 901) to Celanese Road (SC 161)
5	I-77 / SC 161(1)	Exit 82C
6	I-77	Gold Hill Road to NC State Line
7	Celanese Rd (SC 161)	India Hook Road (S30) to N Cherry Road (US 21)
8	Dave Lyle Boulevard (SC 122)	Hood Center Drive to Red River Road
9	Mt. Gallant Rd (S-195)	Anderson Road (US 21 BYP) to Celanese Road (SC 161)
10	I-77 / Sutton Road (1)	
11	Red River Road	Eden Terrace Road to Celanese Road (SC 161)
12	John Ross Parkway	Dave Lyle Boulevard (SC 122) to East Mount Gallant Road (S-195)
13	I-77 at Anderson Rd (US 21) (1)	Exit 77 Southbound off-ramp backups
14	Gold Hill Road	Pleasant Road to I-77 interchange (Exit 88)
15	Carowinds Blvd from State Line to SC 21/SC 51 intersection	Includes I-77 ramps at Exit 90
16	Fort Mill Bypass (Springfield Parkway)	From I-77 to Tom Hall Road (SC 160)
17	SC 49 near Lake Wylie	Hwy 55 to NC State Line. Overlaps with 22.
18	SC 72 at Saluda Trail Middle School, specifically Saluda Road (SC 72 / SC 121) between Rawlsville Road (S-250) and E Rambo Road (S-163), and the two intersections on Neely Road with Rawlsville Road (S-250) and with E Robertson Road (S-998)	
19	Main Street, Fort Mill	White Street to Tom Hall Street / SC 160
20	Dam Road, Gardendale Road (S-741), and New Gray Rock Road (S-251) – south of Gold Hill Elementary and Middle Schools	
21	Cherry Road (US 21 Bus) between Ebinport Road and SC 161 (Cel-River Rd)	
22	SC 160 from US 21 BYP to Pleasant Road, incl. I-77 ramps at Exit 85 (overlaps #2)	
23	Tom Hall Rd (SC 160) from Dobys Bridge Road to Lancaster County Line (overlaps #2)	
24	Intersection of SC 901 and SC 161 (1)	Old York Road at Heckle Boulevard
25	Ebenezer Road (SC 274) between Herlong Avenue(India Hook Road) and Old York Road, Celanese Road (SC 161)	
26	Clebourne Street, Fort Mill	White Street to Main Street
27	Fort Mill Parkway, Fort Mill	Spratt Street to Brickyard Road
28	Fairway Drive, Fort Mill	Brickyard Road to Doby's Bridge Road
29	US 21 and Spratt Street/Sutton Rd(1)	Intersection
30	US 21 and Highway 160(1)	Intersection
31	Doby's Bridge Road	Tom Hall Street to Lancaster County Line

Note:
(1) Isolated intersection location. All other listings represent roadway corridors.

Figure 2-5: 2009 Average Daily Traffic Volumes Interstate Traffic

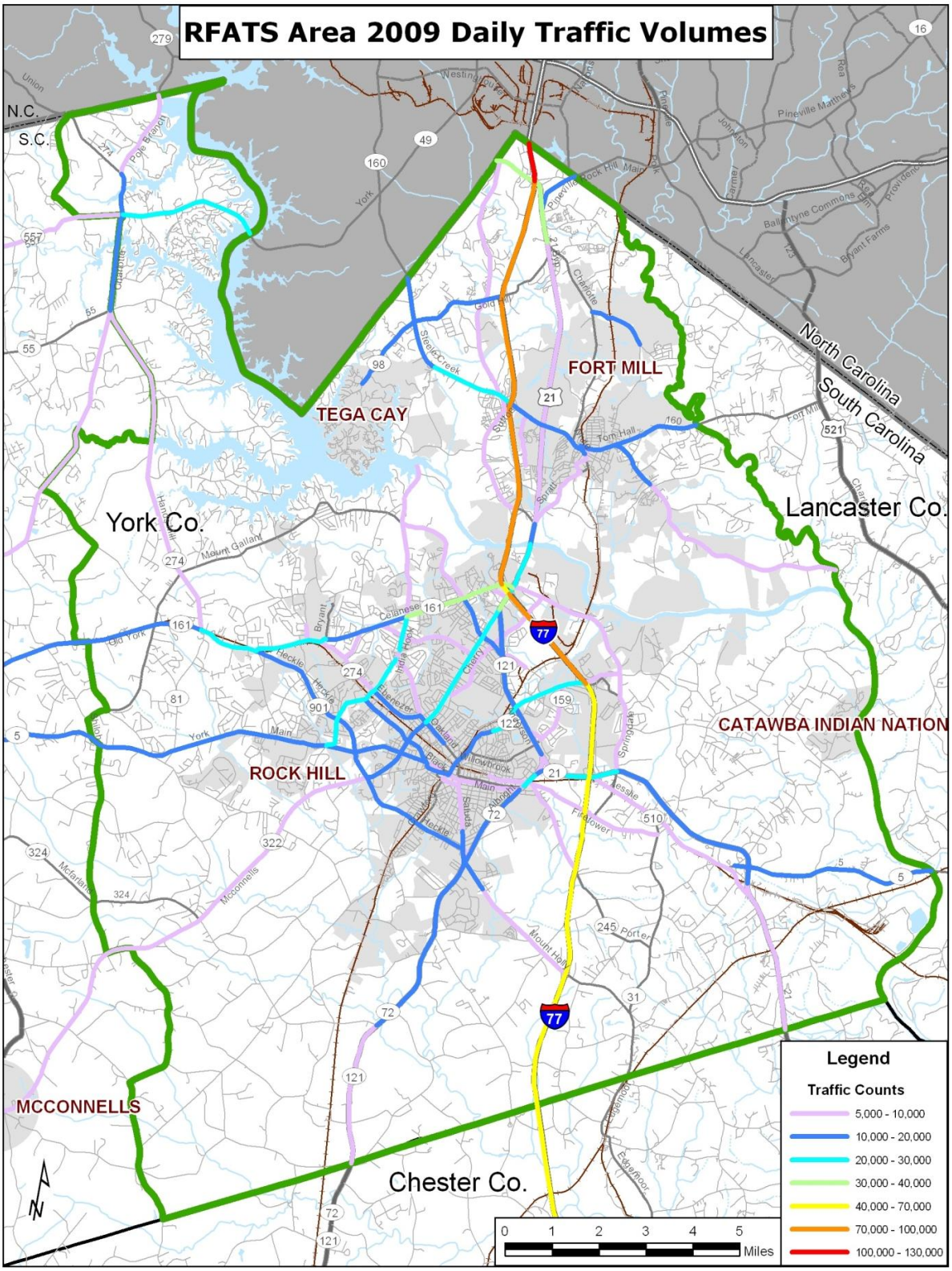


Table 2-2: Daily Traffic Volumes on I-77

Description of I-77 Segment										
Exit	**Exit**	**Intersecting Roads**	**1990**	**1995**	**2000**	**2005**	**2006**	**2007**	**2008**	**2009**
90	91	Carolina Place Drive to NC State Line	59,950	63,900	95,200	120,400	123,400	129,100	129,100	128,600
88	90	Gold Hill Road to Carolina Place Drive	45,900	56,200	71,900	91,800	95,600	101,100	99,100	99,300
85	88	Steele Creek Road to Gold Hill Road	41,700	53,400	69,000	86,000	89,500	94,800	91,700	92,000
83	85	Charlotte Highway to Gold Hill Road	42,800	55,800	73,000	89,100	92,400	96,000	93,500	93,400
82	83	Celanese Road to Charlotte Highway	44,200	58,900	73,900	90,700	94,100	98,000	96,400	96,300
81	82	Cherry Road to Celanese Road	35,600	46,600	57,300	68,200	68,900	71,800	71,100	69,900
79	81	Dave Lyle Blvd to Cherry Road	35,500	48,100	55,300	67,300	70,000	73,100	71,300	71,200
77	79	Cherry Road to Dave Lyle Blvd	29,300	39,500	45,800	53,100	55,200	58,200	57,300	57,500
75	77	Porter Road to Cherry Road	22,900	29,200	36,200	41,800	42,800	42,900	43,400	43,800
73	75	Heckle Boulevard to Porter Road	22,600	29,300	35,400	41,000	41,800	41,700	42,400	42,800
65	73	Lancaster Highway to Mt. Holly Road	21,100	27,500	33,300	39,100	39,200	41,800	39,700	40,400
Average I-77 ADT			**36,505**	**46,218**	**58,755**	**71,682**	**73,900**	**77,136**	**75,909**	**75,927**
Average Annual Growth Rate				**4.8%**	**4.9%**	**4.1%**	**3.1%**	**4.4%**	**-1.6%**	**0.0%**

Source: SCDOT

Table 2-3: Highest Non-Interstate Traffic Volumes

No.	Route	Location	2009 AADT
1	Celanese Road	Mt. Gallant Road to Cherry Road	37,200
2	Celanese Road	India Hook Road to Mt. Gallant Road	35,000
3	Cherry Road	Cherry Road Business. to N.C. State Line	33,800
4	Carolina Place Dr	North Carolina Line to Cherry Road and I-77	32,700
5	Cherry Road	Cherry Road Business to.I-77	30,600
6	Gold Hill Road	Gold Hill Road to I-77	29,200
7	Charlotte Highway	Hands Mill Hwy / Charlotte Hwy to N.C. State Line	25,600
8	Cherry Road	Dorchester Avenue to Cedar Grove Lane	25,000
9	Cherry Road	Cedar Grove Lane to Pecan Circle	24,500
10	Cherry Road	Hands Mill Highway to Dorchester Avenue	23,900
11	S. Herlong Avenue	Hands Mill Highway to East Black Street	23,800
12	Cherry Road	Celriver Road to I-77	23,200
13	Cherry Road	Albright Road / Anderson Road Bypass to East Main Street	23,000
14	Celanese Road	Hands Mill Highway to Trexler Lane	22,500
15	Herlong Avenue	Celanese Road to Kallaramo Road	21,700
16	Cherry Road	I-77 to Saluda Road	21,200
17	Dave Lyle Boulevard	Iredell Street to South Anderson Road	21,100
18	Herlong Avenue	Hands Mill Highway to Herlong Avenue	20,700
19	Cherry Road	I-77 to Catawba Bridge	20,300
20	Dave Lyle Boulevard	Anderson Road to I-77 Exit	20,100

Source: SCDOT

Table 2-4: Highest Traffic Corridors

No.	Route	2009 ADT		Segments in Top 20
		Maximum	Minimum	
1	I-77	128,600	40,400	N/A
2	Celanese Road	37,200	12,300	3
3	Cherry Road	33,800	1,800	9
4	Carolina Place Dr	32,700	32,700	1
5	Gold Hill Road	29,200	1,700	1
6	Charlotte Hwy	25,600	6,200	1
7	S. Herlong Avenue	23,800	23,800	1
8	India Hook Road	21,700	7,300	1
9	Dave Lyle Boulevard	21,100	5,500	2
10	Herlong Avenue	20,700	20,700	1

Source: SCDOT

After the I-77 Interstate, the most heavily travelled corridors in the RFATS area in 2009 were:

- Celanese Road (SC 161), between Heckle Boulevard and I-77;
- US 21 north of Garrison Farm Road to I-77; and
- Carowinds Boulevard from the state line to I-77.

All of these arterial corridors had sections with traffic volumes in excess of 30,000 vehicles per day.

Traffic Growth Since 1990 - Since 1990 average traffic volumes on I-77 have more than doubled with an average annual growth rate of 3.9 percent. As shown in **Figure 2-6**, for the first ten years since 1990 traffic increased almost 5 percent per year. Growth moderated to an average of 4.1 percent over the next five years. After two more years of similar growth in 2006 and 2007, traffic volumes fell by 1.6 percent in 2008 and remained static in 2009. The fall in traffic volume is likely to be attributable to the recent national economic recession.

2.2.4. Metrolina Regional Model

The Metrolina Regional Travel Demand Model (RTDM) is used by planners to project travel demand in the Charlotte urbanized area, including a portion of the RFATS area. The urbanized area includes Charlotte and the remainder of Mecklenburg County plus areas beyond the existing urbanized area boundary of Mecklenburg and Union counties that are expected to become urban within a twenty year planning period.

Projected Growth in Travel Demand - Travel demand in the RFATS area is projected to increase 62 percent between 2005 and 2035, as determined by projected growth in vehicle miles of travel (VMT) on RFATS roads. This growth is shown in **Table 2-5**.

Model estimated P.M. Peak volume to capacity ratios (V/C) in the RFATS area shown in **Figure 2-7** and **Figure 2-8**, for base year (2005) and future year (2035) traffic conditions, respectively.

Figure 2-6: I-77 Traffic Growth in the RFATS Area

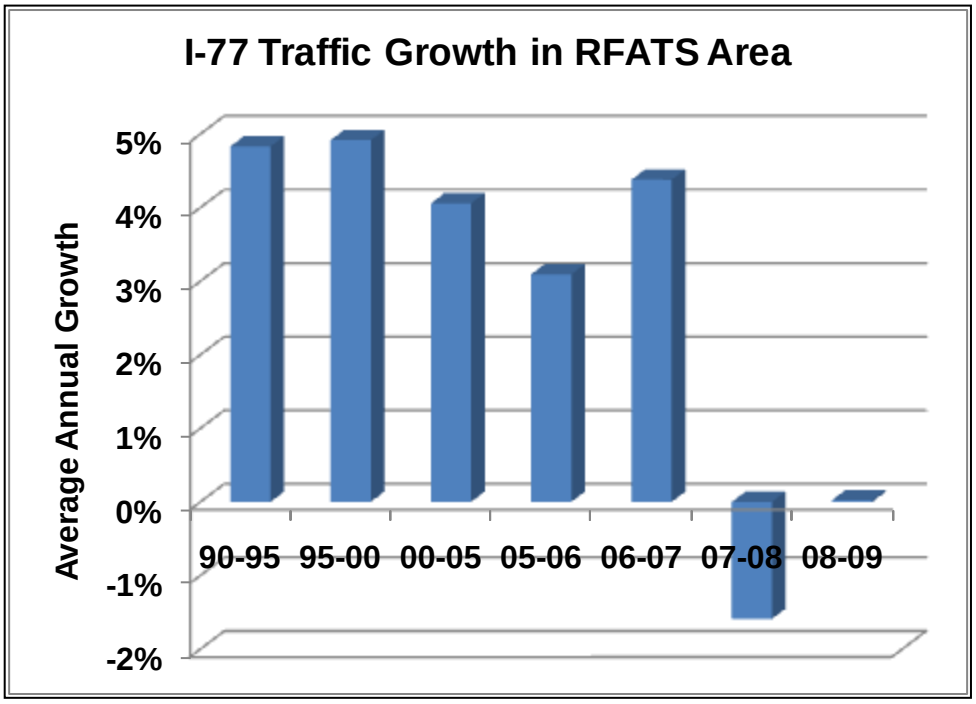


Table 2-5: Projected Growth in Travel Demand

Year	Daily Vehicle-Miles of Travel	Growth From 2005
2005	4,124,000	N/A
2015	4,967,000	20%
2025	5,897,000	43%
2035	6,683,000	62%

Figure 2-7: 2005 P.M. Peak V/C Ratios

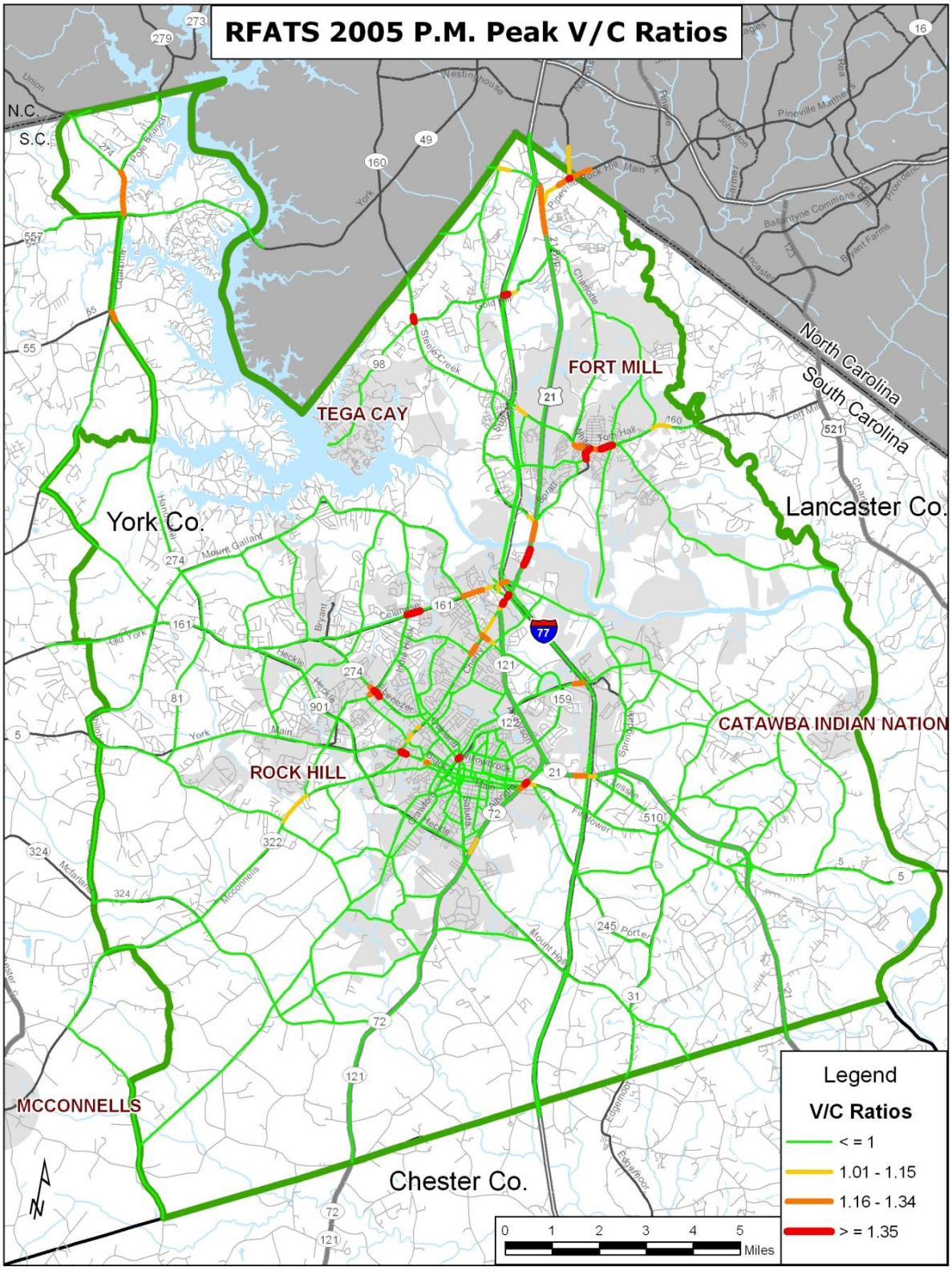
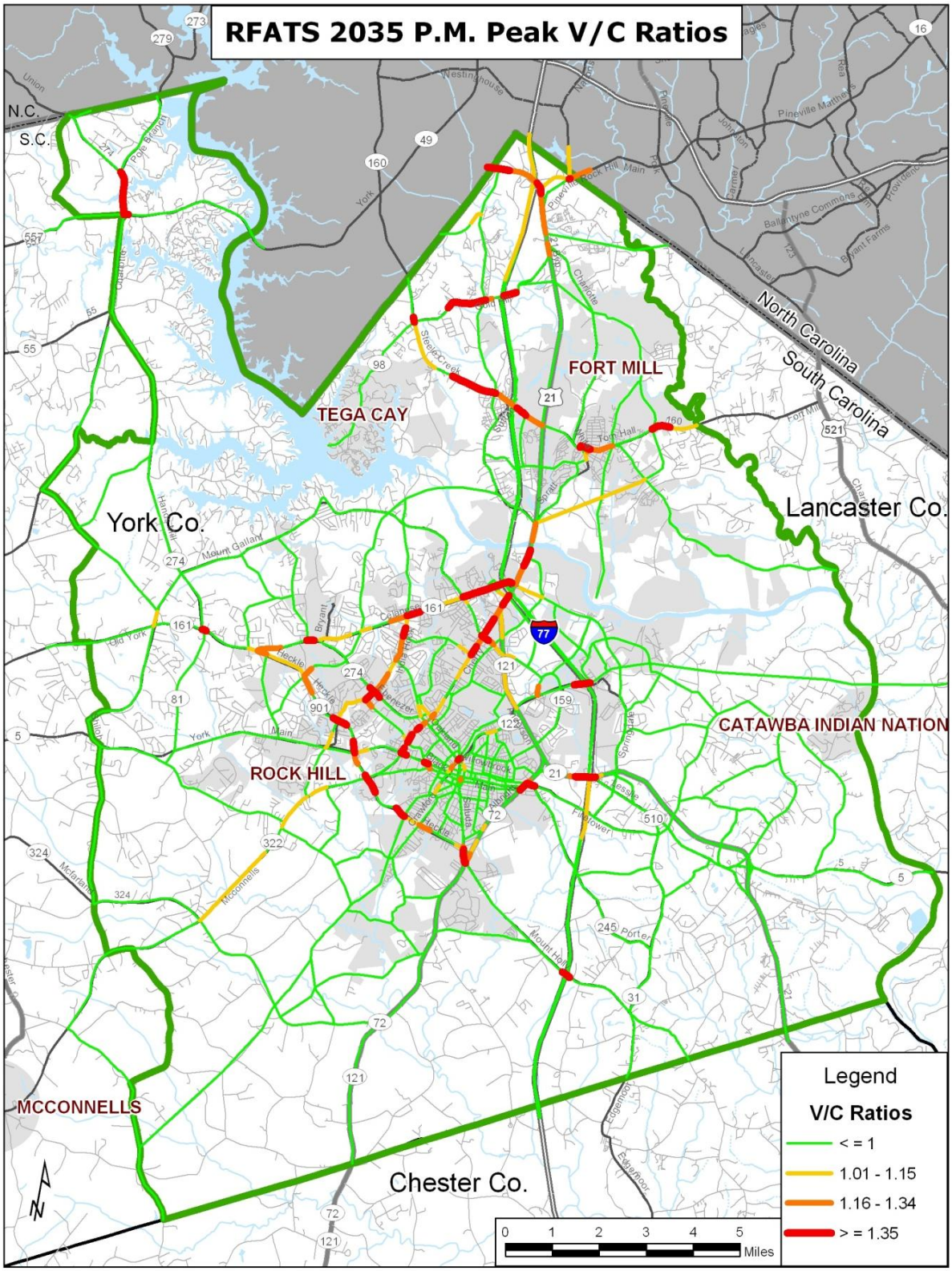


Figure 2-8: 2035 P.M. Peak V/C Ratios



The top ten roadways that the Metrolina Model projects to have high levels of congestion in the P.M peak (high values of volume to capacity ratio) are listed in **Table 2-6** for the model base year (2005) and for 2035. Among the top ten roads for projected P.M peak congestion in 2035 that were not in that category in 2005 are Dave Lyle Boulevard and Gold Hill Road, as well as south of Rock Hill on Albright Road (SC 72/121) at Main and Black Streets, and on Anderson Road (SC 21/121) at I-77 (Exit 77).

Table 2-6: Locations with High P.M. Peak V/C

2005 P.M. Peak Conditions		
No.	**Road**	**Location**
1	Cherry Road	McGuire Dr and Riverside Dr
2	White St	Main St and Spratt St, Fort Mill
3	Pineville-Rock Hill Road	Springhill Farm Rd and Nations Ford Rd.
4	Cherry Road	Anderson Rd and I-77 S (Exit 82)
5	Celanese Road	Mount Gallant Rd and India Hook Rd
6	Main St West	McFadden St and N Cherry Rd
7	Tom Hall Street	Main St and Steele St
8	Steele Creek Road	Gold Hill Rd and York County Line
9	Main Street	Tom Hall St and White St
10	Ebenezer Road	Camden Ave and Herlong Ave
2035 P.M. Peak Conditions		
No.	**Road**	**Location**
1	Pineville-Rock Hill Road	Springhill Farm Rd and Nations Ford Rd.
2	Dave Lyle Blvd	Charlotte Ave and Oakland Ave
3	Cherry Road	Anderson Rd and I-77 S (Exit 82)
4	Main St West	McFadden St and N Cherry Rd
5	Celanese Road	Mount Gallant Rd and India Hook Rd
6	Gold Hill Road	SC 21 BYP and I-77 (Exit 88)
7	Cherry Road	McGuire Dr and Riverside Dr
8	Cherry Road	Interchange with I-77 (Exit 90)
9	Anderson Road South	Interchange with I-77 (Exit 77)
10	Albright Road	Main St and Black St

Source: Metrolina model output. Listing above excludes individual I-77 off-ramp links.

Growth in Truck Traffic - Using the Metrolina Model, output files were summarized for truck traffic within the RFATS study area. The model output years analyzed included 2005, 2015, 2025, and 2035. Total trucks, consisting of commercial vehicles, medium trucks, and heavy trucks were analyzed along with heavy trucks separately.

The comparison of total VMT to truck VMT shows that in general truck travel is increasing faster than total travel within the RFATS study area. System-wide the truck VMT grows up to 0.6% per year faster than overall VMT.

System-wide the heavy truck VMT is projected to grow up to 0.5% per year faster than overall VMT. Due to the importance of freight movements to the region's economy and the projected growth in truck traffic, input was sought from members of the freight community to the CMP Update. The results are documented in **Appendix A**.

2.2.5. School Locations

The RFATS Technical Team identified schools as additional locations of congestion, particularly at times when children are being dropped off or picked up. School locations in the RFATS study area are shown in **Figure 2-9**.

The special needs for transportation infrastructure in the vicinity of schools should be carefully considered and incorporated when developing plans to implement congestion management strategies, safety projects and other road improvement projects. These needs may include convenient and safe access for school busses and cars, turn lanes, vehicle storage areas, adequate parking, pedestrian crossings and sidewalks.

2.3. Safety Concerns

Road accidents frequently result in congestion that may range from a few minutes to several hours in duration while the road capacity is temporarily reduced until the accident site is cleared. Information on accident locations was obtained from two sources:

- RFATS Technical Team; and
- SC Department of Public Safety.

2.3.1. Technical Team

The Technical Team identified 18 "locations" with safety concerns in the RFATS study area. These locations, which included individual intersections, segments of a roadway corridor, and general areas of the highway network, are shown in **Figure 2-10** and listed in **Table 2-7**.

2.3.2. State Traffic Safety Office

SCDOT's State Traffic Safety Engineer's office has identified seven other locations in York County (19-25) that have been identified and approved for safety improvements under the Highway Safety Improvement Program and are in various stages of project development. Of these, numbers 21, 22, and 25 are within the RFATS boundary, with the rest lying outside to the west.

The State Traffic Safety Engineer also confirmed that locations 1, 3 and 17 meet their program criteria and are currently under review to determine eligibility for selection into the Highway Safety Improvement Program.

Figure 2-9: School Locations

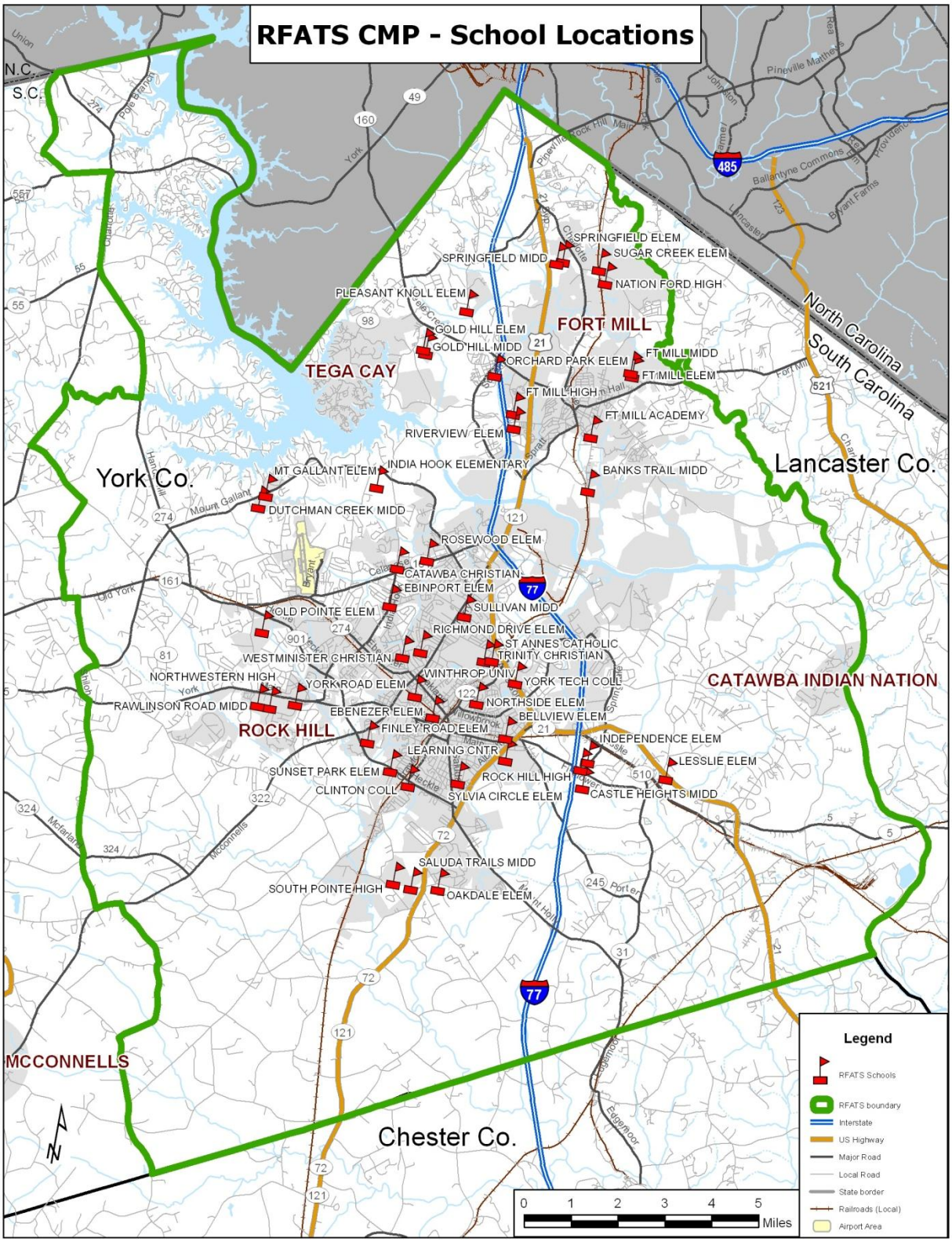


Figure 2-10: Locations with Safety Concerns

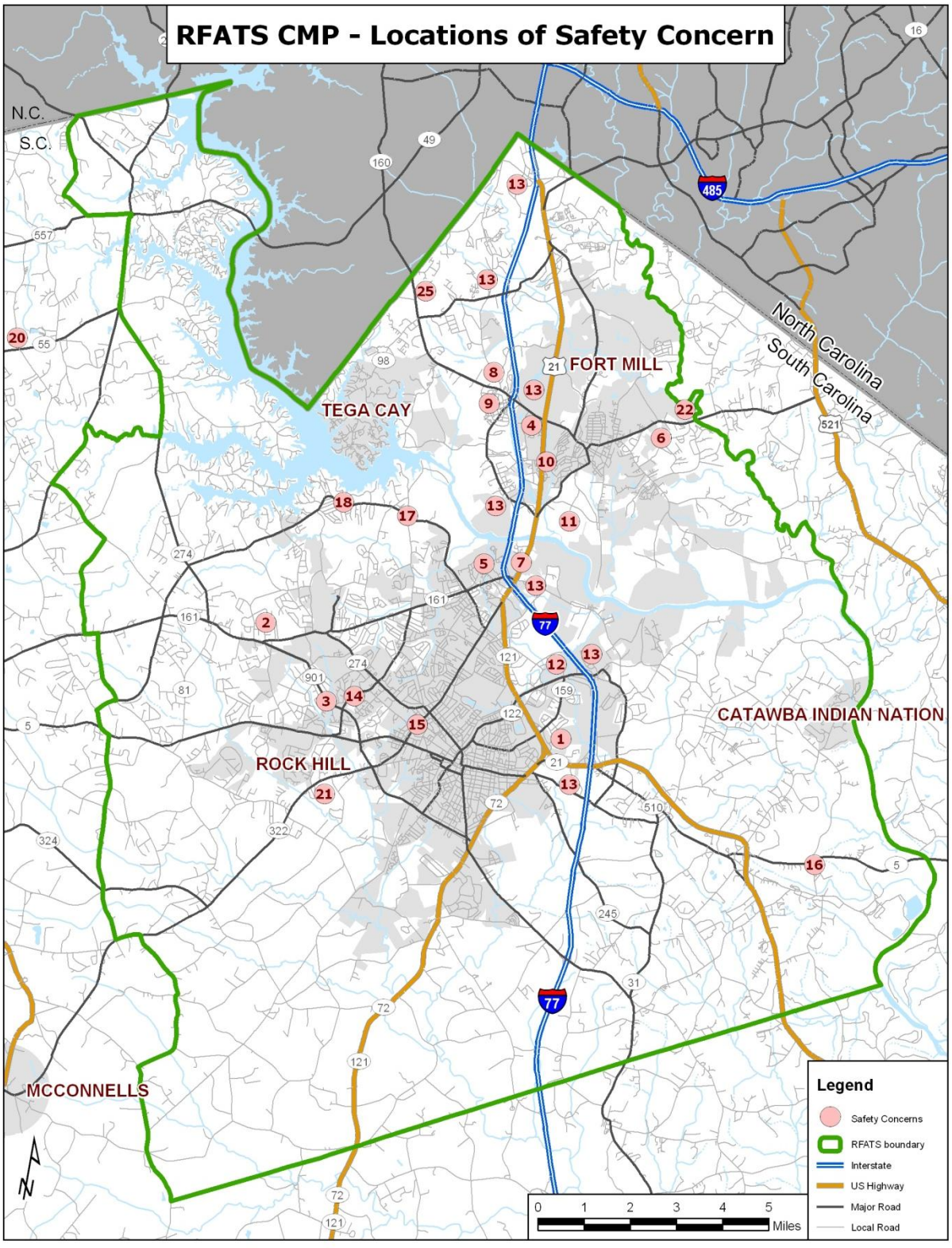


Table 2-7: Locations with Safety Concerns

Ref #	Locations	Description
1	SC 121 / SC 5 / US 21 (1)	Triangle of intersections formed by Anderson Road / Main Street / Cowan Road
2	SC 901 / SC 161 (1)	Old York Road at Heckle Blvd
3	Heckle Blvd (SC 901) north and south of Herlong Avenue	Specifically on Heckle Blvd (SC 901) from Rock Hill Fire Station to Wendy's Restaurant
4	SC 160 near Kingsley	
5	SC 161 / Riverchase Boulevard (1)	
6	SC 160 / Springfield Parkway	
7	SC 161 / I-77 (1)	Northbound on ramp EB / WB merge
8	I-77 / SC 160 (1)	SB to WB off ramp
9	SC 160 at Munn Road (1)	Left turns into Baxter Development
10	US 21 at Harris Street (1)	
11	Fort Mill Bypass / Banks Street / US 21	
12	SC 122 (1)	Dave Lyle Boulevard and Tinsley Way
13	I-77 Interchanges – Exit 77 to Exit 90 (1)	Traffic backs up on off-ramps to mainline
14	Herlong Avenue from Heckle Blvd (SC 901) to Ebenezer Road (SC 274)	
15	S. Cherry Road (SC 322) from Oakland Avenue (US 21) to Camden Avenue	Adjacent to Winthrop University
16	SC 5 from the Catawba River to Old Friendship Road	North of Catawba in SE York County
17	Intersection of Mt Gallant Road (S-195) and India Hook Road (S-30) (1)	
18	Intersection of Mt Gallant Road (S-195) and Redwood Drive (1)	
19	S-64, Lincoln Road and S-172, Old Limestone Road(1)	West of and outside the RFATS area
20	SC 55 and S-114, Kingburry Road(1)	West of and outside the RFATS area
21	SC 322, McConnells Hwy and S-561, Meadow Lakes Road(1)	
22	SC 160 and S-242, Hensley Road(1)	"T" intersection, 800' west of Sugar Creek
23	SC 5, Liberty Street and S-64, Congress Street(1)	City of York, outside the RFATS area
24	SC 55 and SC 557, Ole Cambridge Circle(1)	5.3 miles west of SC 274, outside the RFATS area
25	SC 160 and S-155, Zoar Road(1)	"T" intersection, 0.5 miles south of State line

Note:
(1) Isolated intersection location. All other listings represent roadway corridors.

3. PERFORMANCE MONITORING GUIDELINES AND SELECTION

The Congestion Management Process is designed to support an objectives-based approach to congestion management that focuses on achieving desired system-based outcomes rather than responding to problems on an individual and reactive basis. The purpose of this section is to provide performance measure guidelines and to answer the questions:

- What performance measures should be used in the 2010 CMP to identify and monitor the extent of congestion?
- What are the appropriate, realistic targets for congestion measures?
- Which corridors in the RFATS area should be the focus of CMP activities in the next few years?

This section begins by discussing how the CMP must be linked to the on-going RFATS long range transportation planning process. During the 2010 CMP update, RFATS' 2035 LRTP congestion management goals were reviewed and recommendations were made to include additional CMP goals to encourage expanded mobility options and encourage sustainable development in the region.

This report also provides guidelines on performance measures to effectively monitor the performance of the RFATS transportation system in future years. Once the performance measures were identified and a baseline (benchmark) was determined, targets were established. The purpose of the targets is to identify desired performance measure values that may be achieved through implementing congestion mitigation strategies such as those identified in Section 4 of this report.

Information for the selected performance measures is then presented and used, together with input received from the RFATS Technical Team, to develop a picture of locations with congestion concerns in the RFATS area.

3.1. Congestion Management within the Overall Planning Process

The Congestion Management Process is one of the primary ways RFATS staff examine roadway operational and management strategies using an objectives-based approach. Based on this examination, operational and demand management strategies to improve congested corridors and intersections are identified and solutions are recommended that will ultimately mitigate congestion. The recommended solutions are then included into the broader MPO planning process, which includes developing the overall MPO long range transportation plan with the eight federal planning factors and identifying Transportation Improvement Program (TIP) projects.

3.1.1. CMP and LRTP Linkages

The intent of the Federal CMP requirement is to ensure that roadway congestion is examined and identified improvements are developed as an integrated part of the MPO transportation planning process. The CMP must be coordinated with regional planning efforts and the regional programming process. The CMP should identify candidate congestion mitigation strategies and specific improvements that move forward into the LRTP and TIP planning processes for implementation consideration. Linking the CMP with the LRTP and TIP will ensure congestion mitigation strategies are addressed and integrated into RFATS' broader planning process.

3.1.2. CMP Goals

The *RFATS 2035 Long Range Transportation Plan* identified the following Congestion Management Process Goals:

- Continue to support the ongoing Congestion Management Process and fully integrate congestion measures and strategies into the project selection process.
- Continue to improve traffic signalization timing in jurisdictions throughout the Study Area.
- Encourage the incorporation of access management strategies on major roads and corridors and require development to provide adequate internal circulation and connectivity to maximize linkages with other nearby development.

It is recommended that the following CMP goals be added to encourage additional mobility options, encourage sustainable development, and improve air quality in the region:

- Provide additional mobility choices along congested corridors.
- Encourage and support sustainable development along congested corridors.
- Maintain and improve the natural environment through the implementation of transportation policies, programs, and projects that reduce vehicle emissions to improve regional air quality.

The 2010 CMP update is designed to strengthen the linkage between the CMP and the LRTP. The CMP should serve as a source for generating viable congestion management strategies and projects that advance to the LRTP planning process where further detailed examination will occur. After the CMP is adopted, the subsequent performance measures, data, and analysis should be the foundation for evaluating alternative improvement strategies along congested corridors and intersections. Once the evaluation is complete, it will assist in prioritizing projects identified in the fiscally constrained section of the LRTP.

3.2. Performance Measure and Monitoring Guidelines

The purpose of identifying performance measures is twofold. First, performance measures provide RFATS with quantitative and qualitative tools that can be used to clearly and efficiently

communicate information on transportation system performance to members of the public, as well as appointed and elected officials. Consequently, it is desirable to use performance measures that can be understood by a non-technical audience and have a direct relationship to agreed goals, such as reducing congestion or improving air quality.

Second, performance measures can be assessed over time to indicate whether congestion management strategies are successful and are producing meaningful and / or desired outcomes. By monitoring performance and the outcomes from implemented improvement strategies, the quality of decision-making in the planning process can be improved and limited financial resources can be expended more wisely and effectively. The requirement for on-going assessment of the performance measures leads to the need to identify measures that are quantifiable, without placing a heavy burden on time, cost or training on RFATS staff.

The following guidelines are suggested for selecting performance measures to be used to identify and evaluate RFATS transportation system congestion:

- Ensure measures are understandable;
- Focus on outcome-oriented measures; and
- Use measures supported by existing data sources (to the extent possible).

3.2.1. Identifying Performance Measures

The Federal CMP requirements do not mandate specific performance measures that must be used during the process. Identifying appropriate congestion performance measures is up to each MPO. Although a wide range of performance measures are available, those selected for the RFATS CMP must be understandable, outcome-oriented, and supported by readily available data sources.

The following questions were considered to assist in identifying appropriate congestion management performance measures:

- Does the measure provide the ability to track roadway congestion for the region overall, as well as for individual transportation facilities?
- Does the MPO have the ability and adequate funding to collect the data to track the measure on an on-going basis?
- Does the measure provide the ability to relate the data to traveler perceptions in a readily understandable way?

Sections 3.2.2 to 3.2.9 identify and discuss potential performance measures that may be used to identify congestion in the RFATS area.

3.2.2. Corridor Level of Service

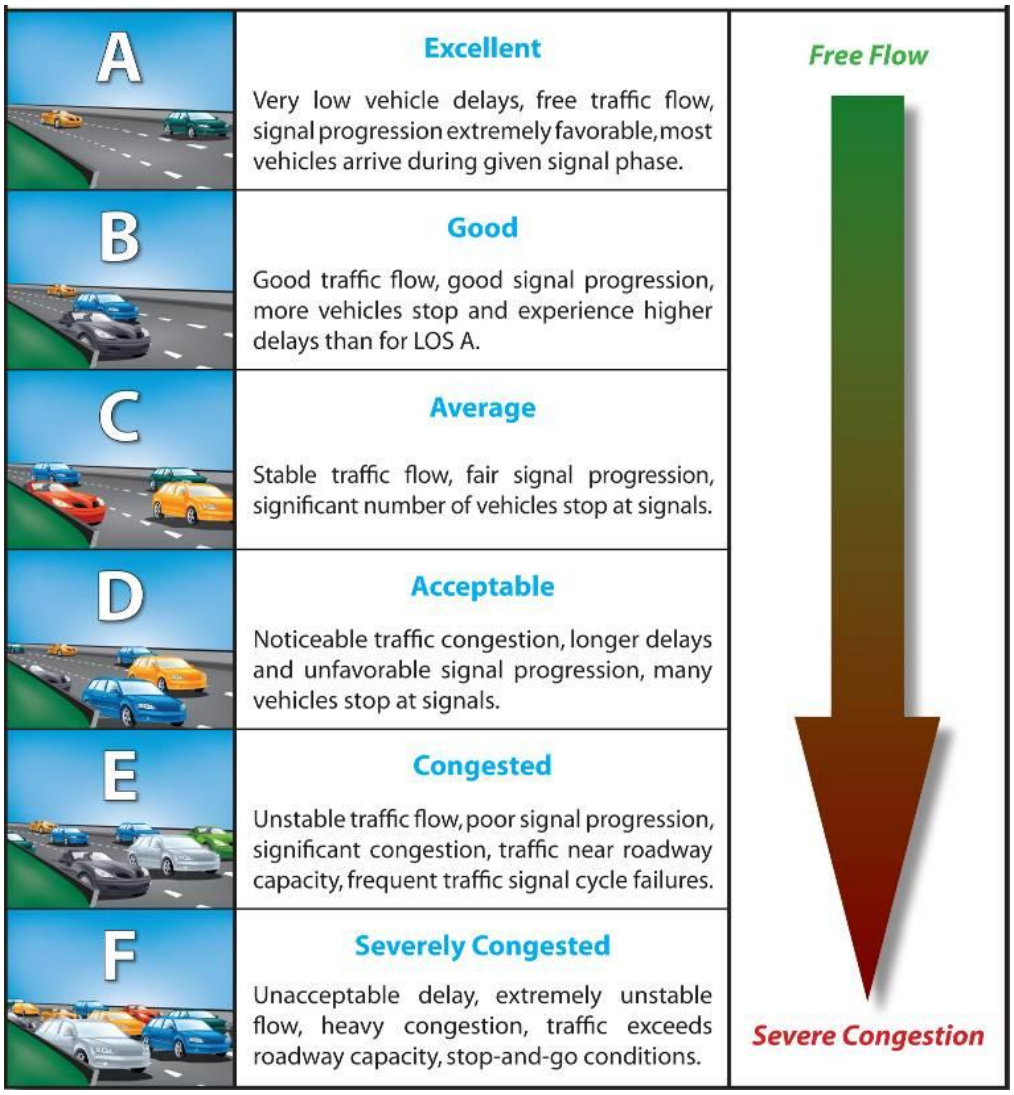
Level of Service (LOS) is defined as a qualitative measure from A (best) to F (worst) describing operational conditions within a traffic stream, generally described in terms of speed and travel

time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety. LOS along a corridor may be based on a number of parameters, including:

- V/C ratios – from travel demand models
- Density – on freeway mainline segments, using HCM methodologies
- Travel Speed – urban streets, using HCM methodologies

Figure 3-1 illustrates the level of service definitions between LOS A and LOS F.

Figure 3-1: Level of Service Definitions



At the planning level, corridor level of service is typically determined by the roadway volume and capacity it carries and can accommodate. At the operational level, corridor level of service may be more appropriately assessed using travel speed. This topic is discussed in more detail in Section 2.2.5.

Is Corridor Level of Service an Appropriate Measure? - Is corridor level of service an appropriate measure for the RFATS CMP?

- Does the measure provide the ability to track roadway congestion for the region overall, as well as for individual transportation facilities? **Yes**
- Does the MPO have the ability and adequate funding to collect the data to track the measure? **Yes**
- Does the measure provide the ability to relate the data to traveler perceptions in a readily understandable way? **Yes**

Partners and Cost to Collect - See Section 2.2.3 for information on potential partners and costs associated with the LOS performance measure at the planning level and Section 2.2.4 at the operational level.

3.2.3. Volume-to-Capacity Ratios

Measuring roadway congestion intensity along a corridor can be accomplished by examining volume-to-capacity (V/C) ratios. This measure is popular because data on existing traffic volumes are relatively easy to obtain and the measures (traffic volumes and roadway capacities) can be projected by the area's travel demand model (TDM). V/C ratio is defined as the ratio of demand flow rate to capacity for a traffic facility.

The Capacity Benchmark - When using the V/C ratio as a performance measure it is important to use a consistent definition of the concept of "capacity." The "capacity" of a road can be defined in many different ways and for many different purposes. Consequently a single road may be described as having different values of capacity, depending upon the context and use being discussed. The design hour capacity used by an engineer will be different from the capacity of the road under level of service conditions E used by a planner, which will be different again from the planning level value associated with LOS C.

Roadway capacity is an attribute contained in the travel demand model. However, different capacity values can be used depending upon the type of model (24-hour model versus peak-hour model) and the preferences of the agency developing, maintaining and operating the travel demand model.

Since the RFATS network is currently modeled by the Metrolina Model, the Metrolina definition of capacity is the most relevant to RFATS staff when the source of V/C information is the Metrolina Model. However, staff should also be aware of SCDOT's usage of capacity values when discussing levels of congestion with SCDOT and with other MPOs in the state.

Capacity in the Metrolina Model - Capacities are calculated for **Level of Service E**[5] and are calculated for each of the four time periods in the model:

- Morning Peak (6:30AM to 9:30AM)
- Midday (9:30AM to 3:30PM)
- Evening Peak (3:30PM to 6:30PM)
- Night (6:30PM to 6:30AM)

Capacity is calculated as a function of:

- Facility type (functional class and area type)
- Number of lanes
- Intersection control
- On-street parking
- Pedestrian activity
- Development density
- Driveway density

Based on the Metrolina model definition of capacity and for purposes of congestion discussions in this CMP Update, V/C may be approximately related to Level-of-Service using the relationships shown in **Table 3-1**.

Table 3-1: Metrolina Model V/C Ratios by Level of Service

Level of Service	V/C Ratio Range
A	0.00 – 0.29
B	0.30 – 0.49
C	0.50 – 0.69
D	0.70 – 0.84
E	0.85 – 1.00
F	1.01 - ∞

Source: Kimley Horn

Since the Metrolina model has the capability to evaluate peak hour conditions, it can provide peak time travel characteristics and provide the following V/C related performance measures:

[5] Metrolina Model Guide, Section 3.5.3, prepared for NCDOT, December 14, 2009. Version 1.0

- Peak period V/C ratio along a corridor
- Percent of regional system deficient during peak periods

Are V/C Ratios an Appropriate Measure? - Are V/C ratios, as determined by the Metrolina Model, an appropriate measure for the RFATS CMP?

- Does the measure provide the ability to track roadway congestion for the region overall, as well as for individual transportation facilities? **Yes**
- Does the MPO have the ability and adequate funding to collect the data to track the measure? **Yes**
- Does the measure provide the ability to relate the data to traveler perceptions in a readily understandable way? **Somewhat**

Capacity in SCDOT Models - South Carolina Department of Transportation (SCDOT) uses a **LOS of C** as their normal benchmark for modeling efforts. With the benchmark capacity set at LOS C this means the roadway volume is equal to the roadway capacity (Volume-to-Capacity Ratio equals 1.0) at the high end of the V/C range for LOS C. Below LOS C means the roadway volume is under capacity and above LOS C the roadway volume is over the level necessary to maintain driving conditions associated with LOS C. The range of Volume-to-Capacity ratios by LOS used by SCDOT is shown in **Table 3-2**.

Partners and Cost to Collect - RFATS and SCDOT staff have the Metrolina model and consequently have access to output files estimating V/C ratios for roads in the model network for the model's base year and future years.

Table 3-2: SCDOT Volume-to-Capacity Ratios by Level of Service

Level of Service	V/C Ratio Range
A	0.00 – 0.49
B	0.50 – 0.74
C	0.75 – 1.00
D	1.01 – 1.15
E	1.16 – 1.34
F	1.35 - ∞

Source: South Carolina Department of Transportation

3.2.4. Intersection Level of Service

The travel demand model does not measure congestion at intersections. Obtaining level of service at congested intersections requires collecting traffic volumes at each intersection, including turning movement counts. Level of service for unsignalized and signalized intersections is based on control delay. Control delay is a measure of driver discomfort and frustration, fuel consumption, and lost travel time. In general, control delay is the difference between the travel time actually experienced to the travel time experienced under ideal conditions in the absence of traffic control, geometric delay, incidents, and other vehicles.

Signalized Intersection LOS - At signalized intersections level of service is defined for the intersection as a whole or individual approaches based on average control delay. Control delay reflects the combined impact of a number of variables including cycle length, deceleration and acceleration delay, stopped delay, and the volume to capacity ratio for the lane group or approach in question. **Table 3-3** shows the signalized intersection traffic flow characteristics for each LOS value based on average delay for vehicles (in seconds).

Table 3-3: Signalized Intersection Traffic Flow Characteristics and Average Delays

Level of Service	Average Delay (seconds per vehicle)	Traffic Flow Characteristics
A	≤ 10	Most vehicles arrive during the green phase and do not stop at all
B	>10 - ≤ 20	More vehicles stop, causing higher delay
C	>20 - ≤ 35	Vehicle stopping is significant, but many still pass through the intersection without stopping
D	>35 - ≤ 55	Many vehicles stop, and the influence of congestion becomes more noticeable
E	>55 - ≤ 80	Very few vehicles pass through without stopping
F	>80	Considered unacceptable to most drivers. Intersection is not necessarily over capacity, even though arrivals exceed capacity of lane groups

Source: Highway Capacity Manual

To determine signalized intersection LOS, Highway Capacity Software (HCS) is required and the following data (inputs) are needed:

- Traffic Conditions:
  - Approach volumes (left, through, right)
  - Vehicle type
  - Location of bus stops
  - Pedestrian crossing flows
  - Parking movement
- Roadway Conditions:
  - Number and width of lanes
  - Grades
  - Lane use (including parking lanes)
- Signal Conditions:
  - Signal phasing
  - Signal timing

- Type of control
- Signal progression

Unsignalized Intersection LOS - Level of service for all-way stop-controlled (AWSC) intersections is defined as average control delay for the whole intersection. Control delay for unsignalized intersections is defined as the total elapsed time from when a vehicle stops at the end of the queue until the vehicle departs from the stop line. This time includes the time required for the vehicle to travel from the last-in-queue position to the first-in-queue position. Two-way stop-controlled (TWSC) intersections apply the same methodology, but only provide delay for the minor stop-controlled approaches and thus Level of Service for TWSC intersections is not defined for the intersection as a whole. **Table 3-4** shows the unsignalized intersection traffic flow characteristics, based on average delay of vehicles (in seconds).

Table 3-4: UnSignalized Intersection Traffic Flow Characteristics and Average Delays

Level of Service	Average Delay (seconds per vehicle)	Traffic Flow Characteristics
A	≤ 10	Free flow
B	>10 - ≤ 15	Stable flow (slight delays)
C	>15 - ≤ 25	Stable flow (acceptable delays)
D	>25 - ≤ 35	Approaching unstable flow (tolerable delays)
E	>35 - ≤ 50	Unstable flow (intolerable delays)
F	>50	Queuing on minor approaches and not enough gaps of suitable size to allow safe crossing of major streets. Signalization should be investigated at this point, but warrants must be satisfied before implementation.

Source: Highway Capacity Manual

To determine unsignalized intersection LOS, Highway Capacity Software (HCS) is required and the following data (inputs) are needed:

- Traffic Conditions:
  - Approach volumes (left, through, right)
  - Vehicle type
- Roadway Conditions:
  - Number and uses of lanes
  - Channelization
  - Intersection control type (AWSC or TWSC)
  - Storage area

Is Intersection LOS an Appropriate Measure? - Is conducting signalized or unsignalized level of service an appropriate measure for the RFATS CMP?

- Does the measure provide the ability to track roadway congestion for the region overall, as well as for individual transportation facilities? **No**
- Does the MPO have the ability and adequate funding to collect the data to track the measure? **Measuring signalized or unsignalized intersection LOS requires RFATS to collect turning movement counts, roadway, and traffic control data, as well as buying and running the Highway Capacity Software or hiring consultants.**
- Does the measure provide the ability to relate the data to traveler perceptions in a readily understandable way? **Yes**

Partners and Cost to Collect - Numerous agencies in the RFATS area may have completed traffic studies along corridors, based on signal warrant studies, intersection studies, etc. Partners to assist with collecting data associated with intersection LOS may include the following:

- SCDOT staff
- County engineering staff
- City engineering staff
- Private developers

RFATS will need to buy the Highway Capacity Software or hire consultants to run the program to determine LOS. If traffic turning movements need to be collected and updated regularly, this will be an added cost. Inputting the data into the Highway Capacity Software also has a cost.

3.2.5. Travel Time Measures

Travel time measures focus on the time needed to travel along a selected portion of a highway corridor. Common variations of travel time measures include the following:

- Travel time – the amount of time needed to traverse a corridor segment
- Travel speed – the length of a segment divided by the travel time
- Average delay – the difference between travel time and acceptable or free-flow travel time
- Travel time index – ratio of peak-period to non-peak-period travel time

These travel time measures can be used for specific roadway segments, intersections, or corridors.

Is Travel Time an Appropriate Measure? - Is conducting travel time measures an appropriate measure for the RFATS CMP?

- Does the measure provide the ability to track roadway congestion for the region overall, as well as for individual transportation facilities? **Yes**
- Does the MPO have the ability and adequate funding to collect the data to track the measure? **Measuring travel time requires RFATS to conduct the travel time runs or hire consultants. As part of the 2010 CMP update, the consultant team conducted travel time runs along ten corridors.**
- Does the measure provide the ability to relate the data to traveler perceptions in a readily understandable way? **Yes**

Partners and Cost to Collect - Collecting travel time measures is one of the tasks undertaken by the consultant team during the 2010 CMP. Collecting the baseline benchmark travel times along congested corridors and then updating them periodically has a cost associated with it. Partners to assist with collecting data associated with travel time measures may include the following:

- RFATS staff
- Consultant staff

If done in house, RFATS will need to buy the GPS travel time equipment or the MPO can hire consultants to complete travel time updates. Since travel time measures need to be collected and updated regularly, this will be an added cost.

3.2.6. Congestion Duration and Extent Measures

Congestion duration and extent measures identify the length of time over which a roadway is congested, the portion of the transportation system that experiences congestion, or the total amount of delay time experienced by drivers. Measures include the following:

- Hours of delay – total regional hours of delay experienced by drivers (average time delayed per driver times volume of traffic)
- Lane miles at LOS F
- Hours per day at LOS F (for specific facilities)

These three congestion duration and extent measures are suitable for RFATS because the Metrolina travel demand model can produce the information needed to determine measures. While these three measures produce useful information on the duration and extent of the congestion, hours of delay and hours per day at LOS F are centered on the regional transportation system and not specific corridors.

The travel demand model can produce hours of delay based on capacity improvements to the highway system. This overall measure may not provide adequate information on individual

corridor capacity improvements, but it can provide useful information on the hours of delay based on several capacity improvements that occur throughout the region. The travel demand model can produce data on the number of lane miles operating at LOS F and segmenting corridor lanes miles can be achieved by examining corridor segments in the travel demand model.

Are Congestion Duration and Extent Appropriate Measures? - Are congestion duration and extent measures appropriate for the RFATS CMP?

- Does the measure provide the ability to track roadway congestion for the region overall, as well as for individual transportation facilities? **Yes**
- Does the MPO have the ability and adequate funding to collect the data to track the measure? **Yes**
- Does the measure provide the ability to relate the data to traveler perceptions in a readily understandable way? **Yes**

Partners and Cost to Collect - Partners to assist with collecting data associated with congestion duration and extent measures may include the following:

- SCDOT staff
- RFATS staff

Use of these measures requires that model outputs be obtained, reviewed and evaluated on a regular basis.

3.2.7. Transit Travel Condition Measures

Transit travel condition measures provide information on the conditions experienced by public transit users. Aspects of transit travel conditions include vehicle ridership vs. load capacity and on-time performance reliability. Thus, transit travel condition measures in the RFATS area include the following:

- Transit ridership vs. load capacity along congested corridors
- Transit vehicle route reliability (on-time)

Two of the main factors in deciding a mode of travel include the availability and the reliability of the mode. Because automobiles provide both availability and reliability, most trips are completed using cars. Examining transit ridership vs. load capacities along congested corridors will assist in identifying potential route extensions and modifications that may encourage more transit "choice" ridership. If public transportation is not available along a congested corridor, this may be a potential corridor to review the feasibility of introducing alternative modes of transportation to reduce congestion.

Are Transit Travel Condition Measures Appropriate? - Are transit travel condition measures appropriate for the RFATS CMP?

- Does the measure provide the ability to track roadway congestion for the region overall, as well as for individual transportation facilities? **Somewhat**
- Does the MPO have the ability and adequate funding to collect the data to track the measure? **Yes, in coordination with Charlotte Area Transit System (CATS)**
- Does the measure provide the ability to relate the data to traveler perceptions in a readily understandable way? **Yes**

Partners and Cost to Collect - Partners to assist with collecting data associated with transit travel condition measures may include the following:

- SCDOT staff
- Charlotte Area Transit System staff

3.2.8. Accessibility Measures

Accessibility measures identify how connected a region is to employment sites, retail centers, activity centers, and other land uses that produce or attract a high percentage of local /regional travel demand. Measuring accessibility is typically completed at the regional level and involves calculating a percent of the population that can access employment sites, retail centers, activity centers, etc. within a specific amount of time.

Accessibility measures in the RFATS area could include the following:

- Percent of labor force within 20 minutes drive of employment centers
- Percent of population within 15 minutes of selected activities (retail, hospitals, elementary schools) using all modes
- Percent of population within a 5 miles of a park and ride lot
- Percent of population within ¼ mile walking distance to selected activities (retail, hospitals, elementary schools)
- Percent of population within a ½ mile of a public transportation stop

Strong mapping capabilities such as Geographic Information System (GIS) software, high-quality land use data, transportation network and service inventories are essential items required to develop accessibility measures. The large extent of information required, as well as the cost of collecting and developing the measures, and time required to calculate accessibility measures is a constraint. While most measures can be reviewed annually or bi-annually, accessibility measures may be more appropriate to review every five years.

Are Accessibility Measures Appropriate? - Are accessibility measures appropriate for the RFATS CMP?

- Does the measure provide the ability to track roadway congestion for the region overall, as well as for individual transportation facilities? **Yes**
- Does the MPO have the ability and adequate funding to collect the data to track the measure? **No. Examining accessibility measures requires extensive GIS data and update-to-date population information**
- Does the measure provide the ability to relate the data to traveler perceptions in a readily understandable way? **Yes**

Partners and Cost to Collect - Partners to assist with collecting data associated with accessibility measures may include the following:

- SCDOT staff
- RFATS staff
- County staff
- City staff

The collecting, compiling and evaluating of accessibility measures requires extensive GIS data and up-to-date population information.

3.2.9. Crash Measures

Crash measures identify if there is a high concentration of crashes at a particular location along a corridor or at a particular turning movement at an intersection or cross street. Crashes certainly impact travel conditions and can be the cause of nonrecurring congestion along corridors and intersections. Identifying "hot spot" crash locations and examining the location in the field can assist in identifying potential projects to improve the safety and function of the roadway corridor or intersection. Common improvements could include improving sight distance, adding turn lanes, adding traffic signals, implementing street calming devices, etc.

Crash measures in the RFATS area could include the following:

- Number of crashes along a specified corridor
- Number of crashes at a particular intersection
- Type of crashes along a specified corridor
- Type of crashes at a particular intersection
- Number of crashes per million vehicles entering a spot location
- Number of crashes per million vehicle-miles over a section of roadway

There are some constraints to using crash measures to alleviate congestion. For instance, the type of crashes, and the way they are recorded, make it difficult to measure congestion from reviewing crash data. There may also be reporting inconsistencies in the crash data that is documented by local enforcement agencies. For instance, all crashes are not reported and documented and the exact crash location is not always accurate or even documented. While examining crash data is important in the overall planning process, the inconsistencies within crash data may detract from the suitability of crash measures to identify congested corridors.

Are Crash Measures Appropriate? – Are crash measures appropriate for the RFATS CMP?

- Does the measure provide the ability to track roadway congestion for the region overall, as well as for individual transportation facilities? **No**
- Does the MPO have the ability and adequate funding to collect the data to track the measure? **No. Upon request, SCDOT provides the number of fatal, injury, and property damage crashes for corridor segments and intersections. Examining the type of crash and its exact locations, requires reviewing the individual crash reports and is time consuming.**
- Does the measure provide the ability to relate the data to traveler perceptions in a readily understandable way? **If the number, type, and location of the crash is accurate, this information can be easily related to local residents.**

Partners and Cost to Collect - Numerous agencies in the RFATS area and South Carolina respond to crashes. Partners to assist with collecting crash data may include the following:

- SCDOT staff
- County sheriff staff
- City police staff

If crash records were available in a GIS format, identifying the number, type of crash, and calculating crash rates would have a minimal cost. However, all the crash records SCDOT provides to date are based on reviewing the actual hand written crash report completed by the reporting officer at the scene of the crash. Based on the inconsistency with the crash data, it is recommended that this measure not be employed to identify congestion corridors. Safety improvements at intersections are typically identified during the LRTP planning process and it is recommended that it may not be the most useful measure to examine in the CMP until crash data become more consistent and are available in a GIS format.

3.3. Recommended Performance Measures

Based on the performance measure review, the measures recommended for consideration in the RFATS 2010 CMP update include the following:

- Volume / capacity ratios and Level of Service – obtained from the Metrolina model;

- Travel times and speeds – obtained through travel time surveys;
- Transit ridership vs. load capacity along congested corridors – obtained through Charlotte Area Transit System; and
- Transit vehicle route reliability (on-time metrics) – obtained through Charlotte Area Transit System.

Corridor V/C ratios and LOS were selected because these data are readily available by examining the travel demand model. Corridor travel times and travel speeds were selected because these data were collected during recent corridor travel time runs. Travel time surveys directly quantify delays encountered when using roads in the RFATS area. Transit travel condition measures (ridership versus load capacity and transit vehicle route reliability) were selected because this data are also readily available, quantifiable, and illustrate the reliability of using an alternative mode of transportation in the RFATS Area.

Everyone has experienced delays in traffic and inherently understands the negative impacts of lost productivity, increased emissions resulting from stop and go traffic, increased fuel consumption, and increased accident potential. Performance measures such as travel times, speeds and delays, and on-time performance evaluation – can therefore be readily understood and related directly to peoples' everyday experiences.

In a similar way everyone is familiar with the impacts of increasing traffic volumes (V) on a particular roadway. As volumes begin to increase there is a loss of freedom to maneuver and change lanes to overtake a slower car or truck. As the volume approaches the road's capacity (C) the smooth flow of traffic may breakdown, with a sudden reduction in speed and resulting increased potential for accidents, delays, emissions and fuel consumption. The V/C ratio is therefore a commonly used performance measure as it is easy to understand and the negative impact of a high value (approaching or exceeding 1.0) can be directly related to everyday driving experiences.

Analyzing intersection congestion requires turning movement data and detailed analyses using HCS software. Therefore, intersection LOS was not a performance measure included in the RFATS 2010 CMP update. Intersection congestion and subsequent improvements will be evaluated in the 2010 CMP by reviewing the operation of congested intersections through field work. RFATS staff should coordinate with other agencies, jurisdictions, and developers to ensure turning movement counts are collected for any planned improvements in the region. If traffic counts are collected, this data can be used during the next CMP update or upcoming corridor studies to evaluate intersection improvements, such as signal timing, signal coordination, and the incorporation of right and left turn lanes.

While congestion duration and extent measures, such as regional hours of delay and regional lane miles at LOS F, are available through the travel demand model, it is recommended that these measures be used during the development of major transportation investments studies in the region, such as a new bridge crossing, significant new road connections, or when updating the LRTP.

As noted earlier, measuring accessibility is typically completed at the regional level and involves calculating a percent of the population that can access employment sites, retail centers, and activity centers within a specific amount of time. Determining accessibility helps in developing a sustainable transportation system and measuring progress towards goals related to significant changes in land use policies. A key requirement in measuring accessibility is accurate and up-to-date population and employment data, as well as a robust Geographic Information System (GIS) database that includes employment, retail, and activity centers and transit routes, bicycle systems, and pedestrian facilities. It is recommended that the following accessibility measures be used during the next LRTP and CMP update because data from the 2010 Census will be readily available and current:

- Percent of labor force within 20 minutes drive of employment centers (establish baseline benchmark)
- Percent of population within 15 minutes of selected activities (retail, hospitals, elementary schools) using all modes (establish baseline benchmark)
- Percent of population within a 5 miles of a park and ride lot (establish baseline benchmark)
- Percent of population within ¼ mile walking distance to selected activities (retail, hospitals, elementary schools) (establish baseline benchmark)
- Percent of population within a ½ mile of a public transportation stop (establish baseline benchmark)

The remaining sections of this report describe the collection and analysis of data for the four selected performance measures. The results of these analyses are combined with input received from the RFATS Technical Team to compile a comprehensive picture of locations with congestion concerns.

3.4. Travel Time Surveys

The Congestion Management Process is intended to be an integral part of the metropolitan planning process, rather than a stand-alone program or system. Furthermore it is intended to advance the integration of transportation systems management and operations (M & O) into the metropolitan planning process. In operational evaluations of corridor performance, the travel speed along a corridor is a commonly used measure and is the basis for calculating Level of Service for urban streets in the Highway Capacity Manual[6]. During the 2010 CMP Update, travel speed was measured along ten corridors in the RFATS Study Area by conducting travel time surveys.

[6] Highway Capacity Manual, Chapter 15, Urban Streets Methodology, Table 15-2. Transportation Research Board.

3.4.1. Survey Routes

The ten survey routes were distributed throughout the RFATS Area and encompassed a total of 80.5 miles of roadway, as listed in **Table 3-5** and illustrated in **Figure 3-2**.

Table 3-5: Survey Route End Points and Lengths

ID	Route	Begin	End	Length
1	SC 161, Celanese Road	SC 274, Hands Mill Road	US 21, N. Cherry Road	7.0
2	US 21, Cherry Road	SC 901, Heckle Boulevard	SC 161, Cel-River Road	5.2
3	SC 122, Dave Lyle Boulevard	W. Black Street	Red River Road	4.6
4	SC 72, Albright Road	Rawlsville Road	Springdale Road	5.2
5	Mt. Gallant Road.	US 274, Hands Mill Highway	SC 122, Dave Lyle Boulevard	10.6
6	US 21, Carowinds Boulevard and SC 51	Pleasant Road	NC State Line	2.5
7	Gold Hill Road	SC 160	Garrison Farm Road	5.8
8	SC 160, Steele Creek Road	Gold Hill Road	Lancaster County Line	7.4
9	SC 49, Charlotte Highway	SC 55	NC State Line	5.1
10	I-77	S. RFATS Boundary	N. RFATS Boundary	27.1

Each route was surveyed on weekdays in the first two weeks of October 2010 during the morning peak period between 7:00 am and 8:00 am and during the evening peak period between 5:00 pm and 6:00 pm. Routes were surveyed in both durations. Each route and direction was surveyed a minimum of two times.

3.4.2. Survey Equipment

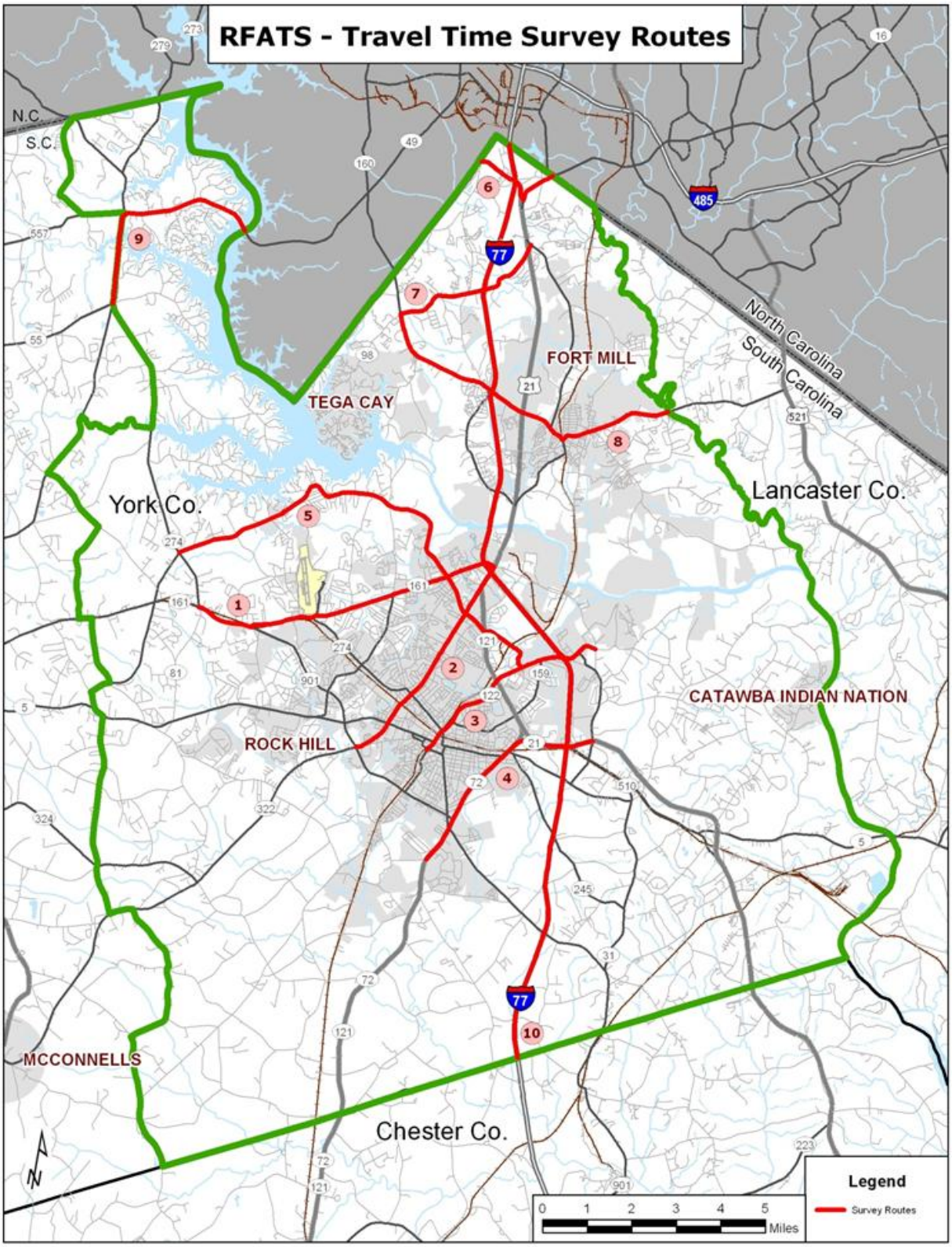
The survey equipment consisted of two principal items:

- GPS data collection units; and
- GPS data processing software.

GPS Data Collection Units - Commonly available GPS units were used to record time and location information as the survey vehicle was driven along each route. The specific make and model of the GPS unit employed was the Garmin GPSmap76. However due to frequent improvements in GPS technology for the consumer market it is not necessary and not anticipated that identical units will always be used in future years. The minimum requirements and characteristics of the GPS unit to effectively record and store travel time data are as follows:

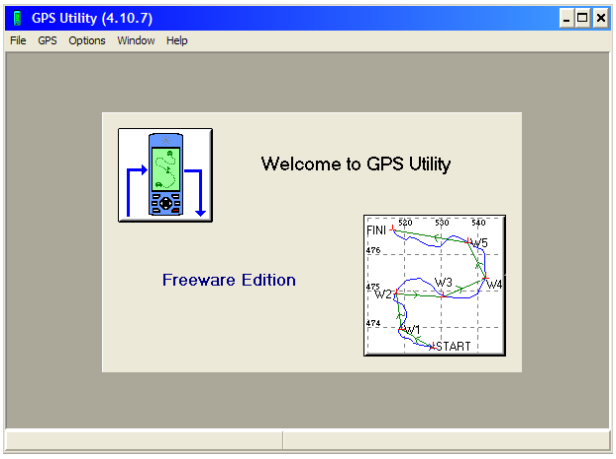
- Automatically determine and record time of day and location by latitude/longitude, in a moving vehicle.
- Record location at a minimum of 5 second intervals.
- Report location, speed between recorded intervals and travel time from start of run.

Figure 3-2: Travel Time Survey Routes



Detailed instructions on setting up the GPS unit are provided in **Appendix B**. The interval at which time and location data were recorded was 5 seconds on all routes in the RFATS area. It is recommended that this interval be maintained in future surveys.

GPS Data Processing Software - Software used to process GPS data was a free utility program called "GPS Utility." GPS Utility is a stand-alone application for manipulating waypoint, route and track point information.



The GPS utility program was used to access the GPSmap76 device and download recorded data to desktop computers. GPS Utility can convert and save the recorded data to a number of file types, including the following:

- txt file
- gps format file
- Autocad dxf
- Dbase (dbf + shp.shx)

For this project, the data were downloaded in txt format, and imported into Microsoft Excel for computational analyses. Spreadsheet computations were performed to determine arterial levels of service and to identify levels of delay at approaches to signalized intersection locations.

3.4.3. Duties of Survey Staff

The instructions given to drivers regarding their duties during the travel time surveys are summarized below.

- Begin surveys upstream of begin point queues, if any
- Travel in right hand lane on four / five lane facilities
- Travel in center lanes on six / eight lane facilities
- Eastbound SC 161: Travel in right hand lane from India Hook Rd. to I-77
- Eastbound Gold Hill Rd: Travel in left hand lane from Pleasant Road to I-77
- Travel at speeds consistent with surrounding flow of traffic
- Record/note any issues affecting traffic (i.e. construction/lane closures, crashes, etc.)

3.4.4. Processing of GPS Data

Following a session of data collection activity GPS data were downloaded to a computer to free up memory in the GPS unit for the next data collection session. This task and the subsequent processing of the data to provide useful travel time, speed and delay information are summarized in this section.

- Records from each data collection activity were downloaded in txt format to a separate file.
- Data files were imported into Microsoft Excel spreadsheets.
- GIS mapping was reviewed to identify and record lat / long locations of traffic signals along each roadway.
- Data in Excel were disaggregated into data listings representing arterial segments between traffic signals.
- Analyses and reports were developed to present relevant data, including arterial LOS, average travel speed, and intersection delay.

Processing Survey Data to Estimate Intersection Approach LOS - The travel time survey data were utilized to determine actual delay and LOS for the mainline arterial approaches to signalized intersections. The GIS survey equipment utilized in the travel time runs collected and stored vehicle locations in five second intervals. The reports from the runs provide location by latitude/longitude for each five second interval, and travel speed in mph between each interval. Traffic signal locations were identified in each run by coordinates, and intersection delays were identified for intervals recorded with travel speeds less than 5 mph, using the assumption that speeds below 5 mph were queued vehicles inching up in the stopped platoon. Total approach delay was then determined by summing the 5 second intervals identified as stopped delay.

It should be noted that the LOS values presented in this report indicate only the LOS for the specific approach through traffic. Levels of service for an intersection are normally presented for the weighted average of all approaches, and all movements. The LOS determination for the intersection operation as a whole may vary significantly from the mainline arterial LOS values presented in this report.

Processing Survey Data to Estimate Arterial Corridor LOS - Transportation Research Board (TRB) methods were followed for calculating Level of Service on the ten arterial facilities. These methods are outlined in the TRB "Highway Capacity Manual" (HCM), Chapter 15 – Urban Streets. Urban street LOS is based on the average through-vehicle travel speeds. HCM Exhibit 15-2 presents a tabulation of LOS criteria based on urban street class, and average travel speed. Nine of the ten facilities evaluated in this study fall within the definition of Class II streets, characterized as suburban arterial roadways with speed limits generally ranging from 40 to 45 mph. The exception is the I-77 corridor. HCM defines LOS for a basic freeway segment in terms of vehicle density, which is not directly measureable. For purposes of this study, the

segment of I-77 in the RFATS area was considered to be an urban arterial of Class 1 and its LOS was estimated accordingly.

Average travel speeds for the arterials in this study were calculated from travel survey data by dividing total distance traveled by total travel time, for each recorded run. The resulting speed data were then compared to HCM criteria to determine LOS values.

3.4.5. Recommended Use of Travel Time Surveys

Within the RFATS CMP, the travel time surveys are intended to assist planning staff in the following:

- Periodic assessment of key corridors by measuring peak period travel speed and assigning a level-of-service based on HCM methodologies.
- Assessment of impacts of improvement projects at the corridor or intersection level by comparing travel time surveys before and after project implementation – types of improvement projects could include:
  - Operational improvements – signal timing, phasing, detectors, adding coordination
  - Geometric improvements – adding turn lanes
  - Travel demand management strategies
  - Policy strategies – e.g. parking regulations, truck restrictions, etc.
  - Capacity enhancements – widening
- Prioritization of corridors or intersections for project implementation
- Identification of corridors or intersections with congestion-related needs or deficiencies.

Data collected during travel time surveys may also be of value to those responsible for maintenance of the Metrolina travel demand model.

3.4.6. Travel Time Survey Results

Delays Encountered on Approaches to Signals - To identify congested signalized intersections along survey routes the amount of delay on approaches to signals was calculated from GPS data. The delay was determined in seconds for each survey run. The average value from the two runs was then calculated and converted to a Level-of-Service value using Table 3-3.

Delays and level-of-service values experienced on approaches to signalized intersections are shown in **Table 3-6**. The survey data collected and processed to derive this table will be provided to RFATS staff in the form of a spreadsheet file. Seven of the nine routes with signals had one or more locations with LOS of E or F. This level of congestion was found at the following intersections:

- On SC 161 at:
  - India Hook Road – EB in AM, WB in PM
  - Mt. Gallant Road – EB in AM, WB in PM
  - US 21 – WB in AM, WB in PM
- Cherry Road at:
  - Mt. Gallant Road – SB in PM
- Mt. Gallant Road at:
  - SC 121 N. Anderson Road – EB in PM
  - US 21 Cherry Road – EB in AM and both directions in PM
  - SC 161 – both directions in AM and PM
  - Twin Lakes Road – EB in AM
- Carowinds Boulevard at:
  - Pleasant Road – WB in PM
- Gold Hill Road at:
  - SC 160 Steel Creek Road – both directions in PM
  - I-77 Northbound – WB in AM
- SC 160 Steel Creek Road at:
  - Springfield Parkway – WB in AM

Table 3-6: Delay and LOS on Approaches to Signalized Intersections

Traffic Signal Location	Approach Delay (seconds) and Level of Service							
Intersection	**WB AM**	**LOS**	**EB AM**	**LOS**	**WB PM**	**LOS**	**EB PM**	**LOS**
Route 1: SC 161								
Hands Mill Highway	15.0	B	25.0	C	0.0	A	25.0	C
Miller Pond Road	0.0	A	0.0	A	0.0	A	0.0	A
Pennington Road	0.0	A	0.0	A	0.0	A	0.0	A
Heckle Boulevard, SC 901	15.0	B	0.0	A	32.5	C	0.0	A
Rawlinson Road	0.0	A	0.0	A	10.0	A	0.0	A
Museum Road	0.0	A	17.5	B	0.0	A	0.0	A
Ebenezer Road	0.0	A	0.0	A	10.0	A	0.0	A
Twin Lakes Road	0.0	A	7.5	A	0.0	A	22.5	C
India Hook Road	22.5	C	97.5	F	60.0	E	15.0	B
Hilltop Road	7.5	A	0.0	A	0.0	A	0.0	A
Mt. Gallant Road	12.5	B	67.5	E	70.0	E	50.0	D
Riverview Road	0.0	A	37.5	D	0.0	A	0.0	A
Riverchase Boulevard	0.0	A	30.0	C	12.5	B	0.0	A
I-77 SB Ramps	0.0	A	0.0	A	15.0	B	2.5	A
Cherry Road, US 21	90.0	F	0.0	A	85.0	F	0.0	A
Intersection	**SB AM**	**LOS**	**NB AM**	**LOS**	**NB PM**	**LOS**	**SB PM**	**LOS**
Route 2: Cherry Road								
Celanese Road, SC 161	25.0	C	0.0	A	22.5	C	47.5	D
I 77 Southbound	0.0	A	0.0	A	0.0	A	0.0	A
Riverview Road	0.0	A	0.0	A	5.0	A	0.0	A
Automall Parkway	0.0	A	0.0	A	0.0	A	0.0	A
Anderson Road	0.0	A	0.0	A	35.0	D	0.0	A
Plaza Boulevard	2.5	A	0.0	A	0.0	A	17.5	B
BI-LO Shopping Center	0.0	A	0.0	A	5.0	A	30.0	C
Mt. Gallant Road	27.5	C	20.0	C	27.5	C	65.0	E
Ebinport Road	0.0	A	0.0	A	2.5	A	10.0	A
Deas Street	0.0	A	7.5	A	17.5	B	15.0	B
Dorchester Avenue	0.0	A	2.5	A	2.5	A	0.0	A
Richmond Drive	7.5	A	0.0	A	7.5	A	0.0	A
Evergreen Lane	0.0	A	0.0	A	10.0	A	7.5	A
Charlotte Avenue	0.0	A	0.0	A	0.0	A	0.0	A
Oakland Avenue	0.0	A	17.5	B	5.0	A	35.0	D
Camden Avenue	0.0	A	2.5	A	5.0	A	12.5	B
Constitution Boulevard	10.0	A	15.0	B	0.0	A	15.0	B
West Main Street	0.0	A	0.0	A	30.0	C	0.0	A
Heckle Boulevard, SC 901	0.0	A	5.0	A	10.0	A	0.0	A

Table 3-6: Delay and LOS on Approaches to Signalized Intersections (continued)

Intersection	EB AM	LOS	WB AM	LOS	EB PM	LOS	WB PM	LOS
Route 3: Dave Lyle Boulevard								
West Black Street	22.5	C	0.0	A	0.0	A	0.0	A
West Main Street	0.0	A	0.0	A	22.5	C	32.5	C
West White Street	2.5	A	2.5	A	0.0	A	5.0	A
Willowbrooke Avenue	0.0	A	2.5	A	2.5	A	0.0	A
Aragon Street	0.0	A	0.0	A	0.0	A	5.0	A
Gateway Boulevard	0.0	A	0.0	A	0.0	A	5.0	A
Mt. Gallant Road	2.5	A	7.5	A	5.0	A	0.0	A
John Ross Parkway	32.5	C	0.0	A	30.0	C	27.5	C
Chamberside Drive	0.0	A	0.0	A	0.0	A	0.0	A
I 77 Southbound	0.0	A	2.5	A	0.0	A	0.0	A
I 77 Northbound	0.0	A	0.0	A	0.0	A	0.0	A
Galleria Boulevard	0.0	A	12.5	B	0.0	A	25.0	C
Springdale Road	0.0	A	5.0	A	0.0	A	7.5	A
Meeting Boulevard	0.0	A	0.0	A	7.5	A	10.0	A
Red River Road	0.0	A	10.0	A	0.0	A	0.0	A
Intersection	**EB AM**	**LOS**	**WB AM**	**LOS**	**EB PM**	**LOS**	**WB PM**	**LOS**
Route 4: Albright Road								
Heckle Boulevard, SC 901	20.0	C	25.0	C	20.0	C	11.7	B
South Heckle Boulevard	0.0	A	7.5	A	8.3	A	6.7	A
Flint Street Extension	0.0	A	0.0	A	0.0	A	0.0	A
East Black Street	2.5	A	0.0	A	6.7	A	11.7	B
East Main Street	0.0	A	0.0	A	28.3	C	0.0	A
East White Street	0.0	A	0.0	A	53.3	D	25.0	C
Marine Drive/ I77 South	7.5	A	0.0	A	30.0	C	18.3	B
I 77 Northbound	0.0	A	0.0	A	0.0	A	0.0	A
Lesslie Highway	17.5	B	7.5	A	1.7	A	0.0	A
Intersection	**WB AM**	**LOS**	**EB AM**	**LOS**	**WB PM**	**LOS**	**EB PM**	**LOS**
Route 5: Mt. Gallant Road								
Dave Lyle Boulevard, SC 122	17.5	B	0.0	A	35.0	D	0.0	A
North Anderson Road, SC 121	20.0	C	17.5	B	2.5	A	127.5	F
Eden Terrace	0.0	A	10.0	A	25.0	C	7.5	A
Cherry Road, US 21	20.0	C	107.5	F	55.0	E	65.0	E
Celanese Road, SC161	82.5	F	57.5	E	110.0	F	90.0	F
India Hook Road	7.5	A	5.0	A	20.0	C	0.0	A
Twin Lakes Road	0.0	A	62.5	E	0.0	A	2.5	A
Museum Road	5.0	A	0.0	A	0.0	A	2.5	A
Hands Mill Highway, Hwy 274	0.0	A	20.0	C	0.0	A	5.0	A

Table 3-6: Delay and LOS on Approaches to Signalized Intersections (continued)

Intersection	EB AM	LOS	WB AM	LOS	EB PM	LOS	WB PM	LOS
Route 6: Carowinds Boulevard								
Flint Hill Road	7.5	A	37.5	D	27.5	C	27.5	C
Pineville-Rockhill Road, SC51	25.0	C	12.5	B	0.0	A	0.0	A
Springhill Farm Road	0.0	A	0.0	A	0.0	A	10.0	A
I 77 Southbound	10.0	A	0.0	A	5.0	A	2.5	A
Avenue of the Carolinas	22.5	C	15.0	B	50.0	D	0.0	A
Pleasant Road	7.5	A	0.0	A	10.0	A	117.5	F
Intersection	**EB AM**	**LOS**	**WB AM**	**LOS**	**EB PM**	**LOS**	**WB PM**	**LOS**
Route 7: Gold Hill Road								
Steele Creek Road, SC 160	32.5	C	60.0	E	82.5	F	185.0	F
Knightsbridge Road	0.0	A	7.5	A	0.0	A	2.5	A
Pleasant Road	27.5	C	45.0	D	5.0	A	10.0	A
I 77 Southbound	0.0	A	7.5	A	0.0	A	0.0	A
I 77 Northbound	7.5	A	135.0	F	15.0	B	42.5	D
Cherry Road, US 21	12.5	B	15.0	B	2.5	A	2.5	A
Old Nation Road (West)	2.5	A	0.0	A	0.0	A	0.0	A
Old Nation Road (East)	0.0	A	0.0	A	2.5	A	2.5	A
A O Jones Boulevard	0.0	A	25.0	C	0.0	A	0.0	A
Intersection	**EB AM**	**LOS**	**WB AM**	**LOS**	**EB PM**	**LOS**	**WB PM**	**LOS**
Route 8: SC 160 Steel Creek Road								
Gold Hill Road	15.0	B	0.0	A	17.5	B	42.5	D
Vandora Springs Road	47.5	D	0.0	A	5.0	A	2.5	A
Stonecrest Boulevard	0.0	A	2.5	A	7.5	A	12.5	B
Dam Road	10.0	A	0.0	A	0.0	A	0.0	A
Dave Gibson Boulevard	12.5	B	2.5	A	0.0	A	0.0	A
Sutton Road	12.5	B	20.0	C	12.5	B	7.5	A
Carolina Place Drive	32.5	C	0.0	A	2.5	A	10.0	A
I 77 Southbound	5.0	A	5.0	A	0.0	A	7.5	A
I 77 Northbound	0.0	A	0.0	A	0.0	A	0.0	A
Munn Road	0.0	A	0.0	A	0.0	A	2.5	A
Cherry Road, US 21	0.0	A	30.0	C	0.0	A	7.5	A
McCammon Street	15.0	B	12.5	B	0.0	A	0.0	A
S. White Street	7.5	A	2.5	A	7.5	A	0.0	A
Clebourne Street	0.0	A	0.0	A	10.0	A	25.0	C
Steele Street	2.5	A	5.0	A	15.0	B	12.5	B
Dobys Bridge Road	0.0	A	12.5	B	5.0	A	0.0	A
Springfield Parkway	10.0	A	90.0	F	5.0	A	27.5	C
Intersection	**NB AM**	**LOS**	**SB AM**	**LOS**	**NB PM**	**LOS**	**SB PM**	**LOS**
Route 9: SC 49								
State Highway, SC 55	0.0	A	2.5	A	0.0	A	7.5	A
Hands Mill Highway	20.0	C	95.0	F	0.0	A	120.0	F
Mill Pond Road	0.0	A	0.0	A	5.0	A	7.5	A
Robinwood Road	30.0	C	5.0	A	0.0	A	205.0	F
Heritage Drive	20.0	C	0.0	A	0.0	A	7.5	A

Level of Service Over Arterial Corridors - The overall level-of-service for an arterial road in an urban area is defined by the Highway Capacity Manual as a function of speed of travel, as illustrated in **Table 3-7**

Table 3-7: Urban Street LOS by Class

	Class I	Class II
Range of free-flow speeds (FFS)	**45 to 55 mph**	**35 to 45 mph**
Typical FFS	**50 mph**	**40 mph**
LOS	**Average Travel Speed (mph)**	
A	> 42	> 35
B	> 34 – 42	> 28 – 35
C	> 27 – 34	> 22 – 28
D	> 21 -27	> 17 – 22
E	> 16 – 21	> 13 – 17
F	≤ 16	≤ 13

Source: Highway Capacity manual, Chapter 15 – Urban Street Methodology, Exhibit 15-2, Transportation Research Board.

As shown in **Table 3-8**, all travel time survey corridors experienced a high value of LOS in the range of A to C, with only one LOS of D being encountered along survey route #6 consisting of US 21, Carowinds Boulevard and SC 51 westbound in the evening peak hour. The survey data collected and processed to derive this table will be provided to RFATS staff in the form of a spreadsheet file.

Table 3-8: Speeds and LOS Along Ten Urban Roadway Corridors

Direction and Peak	Average Duration	Average Miles	Average MPH	Class	Urban Street LOS
Route 1: SC 161					
Westbound in AM Peak	0:13:19	7.021	31.6	2	B
Eastbound in AM Peak	0:16:04	6.965	26.0	2	C
Westbound in PM Peak	0:16:08	7.087	26.4	2	C
Eastbound in PM Peak	0:12:04	6.716	33.7	2	B
Route 2: US 21, Cherry Road					
Southbound in AM Peak	0:10:02	5.101	31.8	2	B
Northbound in AM Peak	0:10:54	5.300	29.4	2	B
Northbound in PM Peak	0:15:05	5.405	22.0	2	C
Southbound in PM Peak	0:14:15	5.233	22.1	2	C
Route 3: SC 122, Dave Lyle Boulevard					
Eastbound in AM Peak	0:08:45	4.638	31.8	2	B
Westbound in AM Peak	0:08:41	4.593	31.8	2	B
Eastbound in PM Peak	0:08:30	4.550	32.9	2	B
Westbound in PM Peak	0:10:17	4.575	27.7	2	C
Route 4: SC 72, Albright Road					
Eastbound in AM Peak	0:09:47	5.231	32.4	2	B
Westbound in AM Peak	0:09:17	5.365	34.7	2	B
Eastbound in PM Peak	0:11:06	5.092	28.5	2	B
Westbound in PM Peak	0:09:23	4.970	31.6	2	B

Table 3-8: Speeds and LOS Along Ten Urban Roadway Corridors (continued)

Direction and Peak	Average Duration	Average Miles	Average MPH	Class	Urban Street LOS
Route 5: Mt. Gallant Road					
Westbound in AM Peak	0:18:56	10.443	33.1	2	B
Eastbound in AM Peak	0:22:18	10.656	28.9	2	B
Westbound in PM Peak	0:20:35	10.599	30.9	2	B
Eastbound in PM Peak	0:21:41	10.579	29.3	2	B
Route 6: US 21, Carowinds Boulevard and SC 51					
Eastbound in AM Peak	0:06:00	2.439	24.5	2	C
Westbound in AM Peak	0:05:00	2.496	29.9	2	B
Eastbound in PM Peak	0:05:50	2.395	25.0	2	C
Westbound in PM Peak	0:06:39	2.232	21.4	2	D
Route 7: Gold Hill Road					
Eastbound in AM Peak	0:11:04	5.879	32.2	2	B
Westbound in AM Peak	0:13:49	5.927	27.4	2	C
Eastbound in PM Peak	0:10:52	5.988	33.2	2	B
Westbound in PM Peak	0:13:16	5.978	28.8	2	B
Route 8: SC 160					
Eastbound in AM Peak	0:15:51	7.317	27.9	2	C
Westbound in AM Peak	0:17:10	7.480	26.7	2	C
Eastbound in PM Peak	0:14:22	7.330	30.7	2	B
Westbound in PM Peak	0:15:42	7.429	28.6	2	B
Route 9: SC 49					
Northbound in AM Peak	0:08:42	5.056	35.0	2	B
Southbound in AM Peak	0:08:35	5.199	36.3	2	A
Northbound in PM Peak	0:08:24	5.315	38.1	2	A
Southbound in PM Peak	0:13:37	5.231	23.3	2	C
Route 10: Interstate 77					
Southbound in AM Peak	0:24:05	27.343	68.2	1	A
Northbound in AM Peak	0:23:26	26.870	68.8	1	A
Southbound in PM Peak	0:19:34	22.779	69.8	1	A
Northbound in PM Peak	0:18:48	19.878	63.5	1	A

3.5. Volume to Capacity Ratios

The volume-to-capacity (V/C) ratio of a road segment is a frequently used measure of congestion. This measure is popular because data on existing traffic volumes are relatively easy to obtain and both volumes and capacities can be projected by the area's travel demand model (TDM) to gauge anticipated future levels of congestion.

3.5.1. RFATS Data Sources

Due to the unique location of the Rock Hill-Fort Mill area just south of the state line and on the southern edge of the Charlotte urban area, RFATS staff may need to draw upon information from both SCDOT and NCDOT, as well as other agencies in both states, such as York County and MUMPO.

SCDOT Traffic Volumes - SCDOT maintains a traffic counting program that records or estimates[7] daily traffic volumes at over 15,000 locations throughout the state, including 416 in York County and 285 within the RFATS area. Historical traffic counts are available for each year for many locations from 1987. Annual Average Daily Traffic (AADT) counts are available for the most recently available year from the SCDOT website[8]. Traffic count locations within RFATS are shown in **Figure 3-3**.

For MPOs in South Carolina that use a 24-hour travel demand model for long range transportation planning purposes, a 24-hour value of capacity is available within the model for direct comparison with 24-hour traffic volumes to provide a V/C ratio. However, this is not the case in the RFATS area as the more detailed, multi-modal, time-of-day Metrolina model is used instead.

Current **hourly** traffic volumes by direction are also available from SCDOT, as well as historical averages, for a limited number of permanent counting stations. In the RFATS area there are three, located on:

- I-77 between US-21 and S-122 (site 0069);
- I-77 at the NC state line (site 0025); and
- US-21 between 1-77 and Catawba Bridge in York County (site 0148).

Metrolina Volume and Capacity Data - For transportation planning purposes, the RFATS road network is modeled by the Metrolina Model, developed for NCDOT. This model covers the entire Charlotte urban area, as well as surrounding areas. The model is a source of V/C ratios for the model's base year and for each of the model's future forecast years. The most recent base year for which the model has been calibrated is 2005. Future years for which projections are currently available include 2015, 2025, and 2035. An analysis of V/C data from the Metrolina model for 2005 and 2035 was presented in Section 2[9].

Capacities are calculated for **Level of Service E**[10] and are calculated for each of the four time periods in the model as described previously.

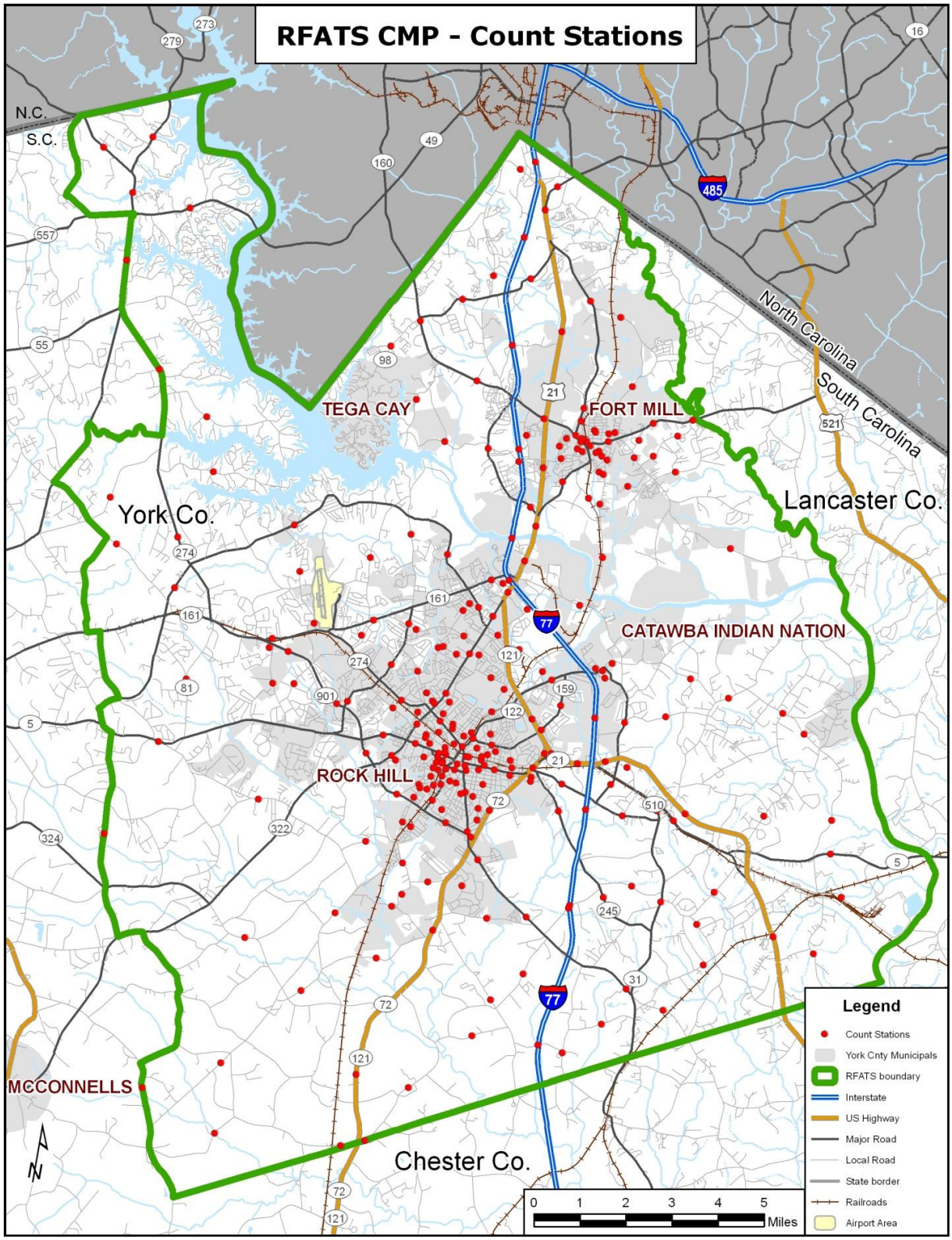
[7] Not all locations are counted every year. Some are counted on a rotating basis every few years.

[8] SCDOT AADT data are available from the following website: http://www.dot.state.sc.us/getting/aadt.asp

[9] Section 2, Existing Multimodal System Conditions, Figure 9: 2005 P.M. Peak V/C Ratios, Figure 10: 2035 P.M. Peak V/C Ratios, and Table 7: Locations with High P.M. Peak V/C.

[10] Metrolina Model Guide, Section 3.5.3, prepared for NCDOT, December 14, 2009. Version 1.0

Figure 3-3: SCDOT Counts Station Locations in RFATS Area



3.5.2. Recommended Use of V/C Ratios

Metrolina Considerations - Metrolina is a detailed transportation planning model capable of projecting travel demand by four different periods of the day and by the following modes:

- Single occupant vehicle (SOV)
- Two-person carpool vehicles (HOV-2)
- Three or more carpool vehicles (HOV-3)
- Commercial vehicles
- Medium Trucks
- Heavy Trucks

Specifically, the Model provides information for the base year for which the model is calibrated (currently 2005) and then projects travel demand (in ten year increments) for each horizon year covered by the current Long Range Transportation Plan. As a part of this process, detailed socio-economic data is updated annually to ensure that the model is operating with the latest available information.

For purposes of the RFATS Congestion Management Process the Metrolina model has the following advantages as a source of volume and capacity data.

- Provides a one-hour capacity value for major roads in the RFATS area, calculated from a wide range of location-specific factors, and;
- Provides projected traffic volumes for four time periods for selected future years.
- Model is updated on a regular annual basis.

Combining SCDOT and Metrolina Data - For the purposes of the RFATS CMP it is recommended that:

- SCDOT AADT data be used as the source of existing travel demand - this information is updated annually by SCDOT and is made available via their website; and
- Output files from the most recently calibrated base year run of the Metrolina model be used as the source of link specific hourly capacity values, as well as factors to convert AADT values to an estimated peak-hour volume.

These sources of data may be readily combined using standard GIS and spreadsheet software.

Annual Monitoring of Congestion Levels - The process of monitoring V/C values as outlined above is intended to facilitate the following:

- Measurement of changes in travel demand along key corridors year on year to answer questions such as:
  - How fast is demand growing?
  - Have travel demand management initiatives along a corridor reduced demand or slowed growth in comparison to similar corridors?
- Comparison of V/C ratios with benchmarks established to trigger implementation or study of remedial actions.
- Identification of the fastest growing corridors by comparison of growth rates to help establish priorities for implementation of improvement projects or to study improvement options, such as travel demand management, introduction or enhancement of transit services, operational improvements or capacity expansion improvements.

Procedures for Monitoring V/C Levels - Procedures for monitoring V/C ratios in the RFATS study area on an annual basis should start from two standard inputs:

- SCDOT Statewide Traffic Count Data as downloaded from the SCDOT website as a comma delimited text file named "traffic_count_data.txt".
- GIS files representing the output of the road network assignment for the most recent calibrated base year of the Metrolina model. These files are available from SCDOT who have a copy of the Metrolina model.

The recommended procedures will be documented in detail in Task 6, Evaluation and Assessment, which will develop a CMP evaluation process.

3.6. CMP Corridors

Information on congested locations has been gathered from multiple sources including:

- RFATS Technical Team members;
- Travel time surveys; and
- 2005 Metrolina Model – V/C Data.

3.6.1. Identification of CMP Corridors

From this information, a list of 24 CMP corridors has been identified as having potential congestion issues at one or more locations along the corridor. **Table 3-9** provides references to these sources for each of the corridors. The CMP corridors are listed in **Table 3-10** and illustrated in **Figure 3-4**. Not all identified corridors are currently experiencing severe

congestion. The need to focus CMP efforts on the most critical of these corridors will be addressed in Section 5, Implementation Process.

3.6.2. Planned Improvement Projects

Congestion mitigation projects identified and programmed in the RFATS 2035 Long Range Transportation Plan (LRTP) and the 2009 to 2015 Transportation Improvement Program (TIP) were reviewed during the CMP update process. This review was undertaken to ensure CMP recommendations did not duplicate or conflict with existing planned improvements.

Table 3-9: CMP Corridor Source References

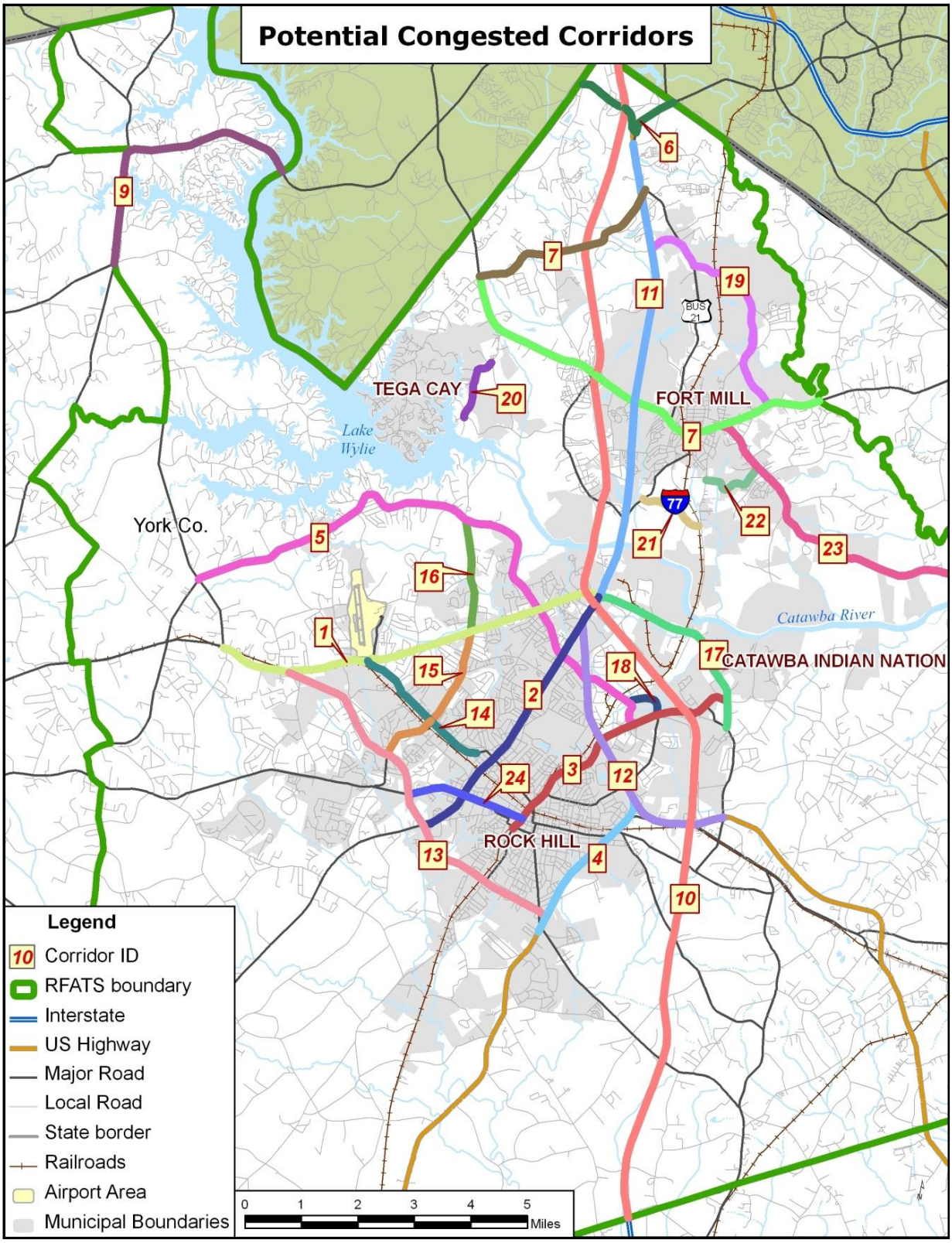
ID	Route	Technical Team (1)	Survey Route (2)	10 Highest 2005 V/C (3)	2005 V/C > 1.16 (4)
1	Celanese Road, SC 161/SC 274 Old York Rd	7	1	5	Yes
2	Cherry Road, US 21	21	2	1, 4	Yes
3	Dave Lyle Blvd, SC 122	8	3		
4	Albright Road / Saluda Road, SC 72		4		Yes
5	Mt. Gallant Road	9	5		Yes
6	Carowinds Boulevard, US 21 and SC 51	15	6	3	Yes
7	Gold Hill Road	14	7		Yes
8	Steele Creek Road, SC 160	2, 22, 23	8	7,8,9	Yes
9	Charlotte Highway, SC 49		9		
10	I-77	6	10		
11	US 21 BYP				Yes
12	Anderson Road, SC 121 / US 21 BYP				Yes
13	Heckle Boulevard, SC 901	3			
14	Ebenezer Road, SC 274	25		10	Yes
15	Herlong Avenue	4			
16	India Hook Road	4			
17	Red River Road, Cel-River Road	11			
18	John Ross Parkway	12			
19	Fort Mill Bypass, Springfield Parkway	16			
20	Dam Road	20			
21	Fort Mill Parkway	27			
22	Fairway Drive (Fort Mill)	28			
23	Doby's Bridge Road	31			
24	West Main Street, SC 5			6	Yes

Notes:
(1) Table 2, Technical Team Congested Locations in Section 2, Existing Multimodal System Conditions.
(2) Selected by Technical Team.
(3) Table 7, Section 2, (4) Figure 9, Section 2.

Table 3-10: Listing of Identified Corridors

ID	Corridor	From	To	Length (miles)
1W	Celanese Road / Hands Mill Highway Old York Road / Celanese Road	Hands Mill Road	India Hook Road	4.57
1E	Celanese Road / Hands Mill Highway Old York Road / Celanese Road	India Hook Road	US 21, N. Cherry Road	2.42
2	Cherry Road	Heckle Boulevard	SC 161, Cel-River Road	5.25
3W	Dave Lyle Boulevard (west of US 21 BYP)	W. Black Street	US 21 BYP / SC 121	2.20
3E	Dave Lyle Boulevard (east of US 21 BYP)	US 21 BYP / SC 121	Red River Road	2.41
4	Albright Road (SC 72) / Saluda Road	Rawlsville Road	Springdale Road	5.46
5N	Mt. Gallant Road. (north of Celanese Road)	Hands Mill Highway	Celanese Road	7.83
5S	Mt. Gallant Road. (south of Celanese Road)	Celanese Road	Dave Lyle Boulevard	2.85
6	Carowinds Boulevard, US 21 and SC 51	Pleasant Road	NC State Line	2.25
7	Gold Hill Rd	SC 160	Garrison Farm Road	3.47
8W	SC 160 (west of US 21 BYP)	SC State Line	US 21 BYP	4.62
8E	SC 160 (east of US 21 BYP)	US 21 BYP	Lancaster County Line	3.61
9	Charlotte Highway (SC 49)	SC 55	NC State Line	5.51
10S	I-77 (south of Dave Lyle Boulevard)	S. RFATS Boundary	Dave Lyle Boulevard	19.42
10N	I-77 (north of Dave Lyle Boulevard)	Dave Lyle Boulevard	N. RFATS Boundary	23.96
11	US 21 BYP	Cel-River Road, SC 161	Pineville – Rock Hill Road	8.15
12	Anderson Road (SC 121) / US 21 BYP	US 21, Cherry Road	Springdale Road	4.09
13	Heckle Boulevard (Hwy 901)	Celanese Road / Old York Road	Saluda Street / Anderson Road	6.63
14	Hands Mill Highway / Ebenezer Road	Old York Road / Celanese Road	Oakland Avenue / India Hook Road	2.80
15	Herlong Avenue	Heckle Boulevard	Celanese Road	2.86
16	India Hook Road	Celanese Road	Mt. Gallant Road	1.96
17	Red River Road, Cel-River Road	Celanese Road	Springdale Road	3.60
18	John Ross Parkway	Dave Lyle Boulevard	Mt. Gallant Road	0.63
19	Fort Mill Bypass, Springfield Parkway	I-77	SC 160, Tom Hall Road	1.11
20	Dam Road	Gardendale Road (S-741)	New Gray Rock Rd (S-251)	1.10
21	Fort Mill Parkway	Spratt Street	Brickyard Road	1.10
22	Fairway Dr (Fort Mill)	Brickyard Road	Doby's Bridge Road	1.20
23	Doby's Bridge Road	Tom Hall Road	Lancaster County Line	6.02
24	W. Main Street, SC 5	Heckle Boulevard	Dave Lyle Boulevard	2.10

Figure 3-4: CMP Corridors



3.6.3. Corridor Profiles

Identifying existing and future congested corridors within the RFATS region is one of the principal features of the CMP and is intended to guide future decision-making, not only at the project level, but through the institution of planning decisions and municipal policies that address congestion management. Profiles of the CMP corridors, including traffic characteristics, planned improvements, existing and projected corridor level of service (LOS) based upon Metrolina model output, and performance measure targets, are provided in **Appendix C**.

Metrolina Model datasets of base year 2005 and forecast year 2035 were used to evaluate level of service (LOS) within the RFATS region. The input roadway geographic files as well as the output model assignment files provided by SCDOT were utilized to determine the volume-to-capacity (V/C) ratios for the PM peak period for each corridor. V/C ratios were then converted to LOS. The roadway geographic files were used to obtain the roadway link geographies and attributes. The output assignment files were used to obtain the PM peak period V/C ratios. The PM peak time period is used in the CMP Update because it reflects the most congested conditions between the hours of 3:30 PM and 6:30 PM. The corridor V/C ratios were calculated by averaging the individual roadway link V/C ratios weighted by the link distance in miles. The resulting V/C ratios by PM peak period were converted to an LOS rating based on the Metrolina Model standards shown previously in Table 3-1.

Note that the model does not include corridors 20, 21 and 22 in its highway network at present. It is recommended that RFATS seek inclusion of these corridors in the next model update to facilitate congestion management planning in these developing areas.

3.7. Transit Travel Condition Measures

3.7.1. Transit ridership vs. load capacity along congested corridors

The monitoring of transit ridership vs. load capacity along congested corridors is a commonly used measure for congestion management. This measure is useful because it provides direct feedback on current and evolving needs. For reference, **Figure 3-5** illustrates where these transit routes are currently in operation. Data for these two routes is also provided below:

Transit Travel Conditions Targets - Based on data provided by the Charlotte Area Transit System, **Table 3-11** shows route 82X load capacity for the Fiscal Years (FY) 2007 through 2010 and a target of 60 percent. Annual capacity for route 82X totals 91,520. In order to reach the 60 percent capacity target, 54,912 passengers are needed on an annual basis or 211 passengers per day.

Table 3-11: Transit Route 82X Load Capacities

Route 82X	Load Capacity
2007	58.27%
2008	56.85%
2009	56.88%
2010	42.30%
Target	60%

Table 3-12 provides the FY 2010 load capacity for route 78X, which began operating in October of 2009 and thus the 4.5 percent load capacity reflect nine months (October 2009 to June 2010) of operations. Annual capacity for route 78X totals 43,680. In order to reach the 25 percent capacity target, 10,920 passengers are needed on an annual basis or 42 passengers per day.

Table 3-12: Transit Route 78X Load Capacity

Route 78X	Load Capacity
2010	4.53%
Target	25%

Source: Charlotte Area Transit System

3.7.2. Transit vehicle route reliability (on-time)

This measure is frequently used to assess the reliability of transit service; this is important as it is a critical element in whether the use of transit services are a viable alternative to single occupancy vehicle travel. On-time performance information for our two existing express bus routes are provided below:

Table 3-13 shows route 82X on-time performance for the Fiscal Years (FY) 2007 through 2010 and a target of 90 percent.

Table 3-13: Transit Route 82X On-Time Performance

Route 82X	On-Time Performance
2007	70%
2008	79%
2009	86%
2010	93%
Target	**90%**

Source: Charlotte Area Transit System

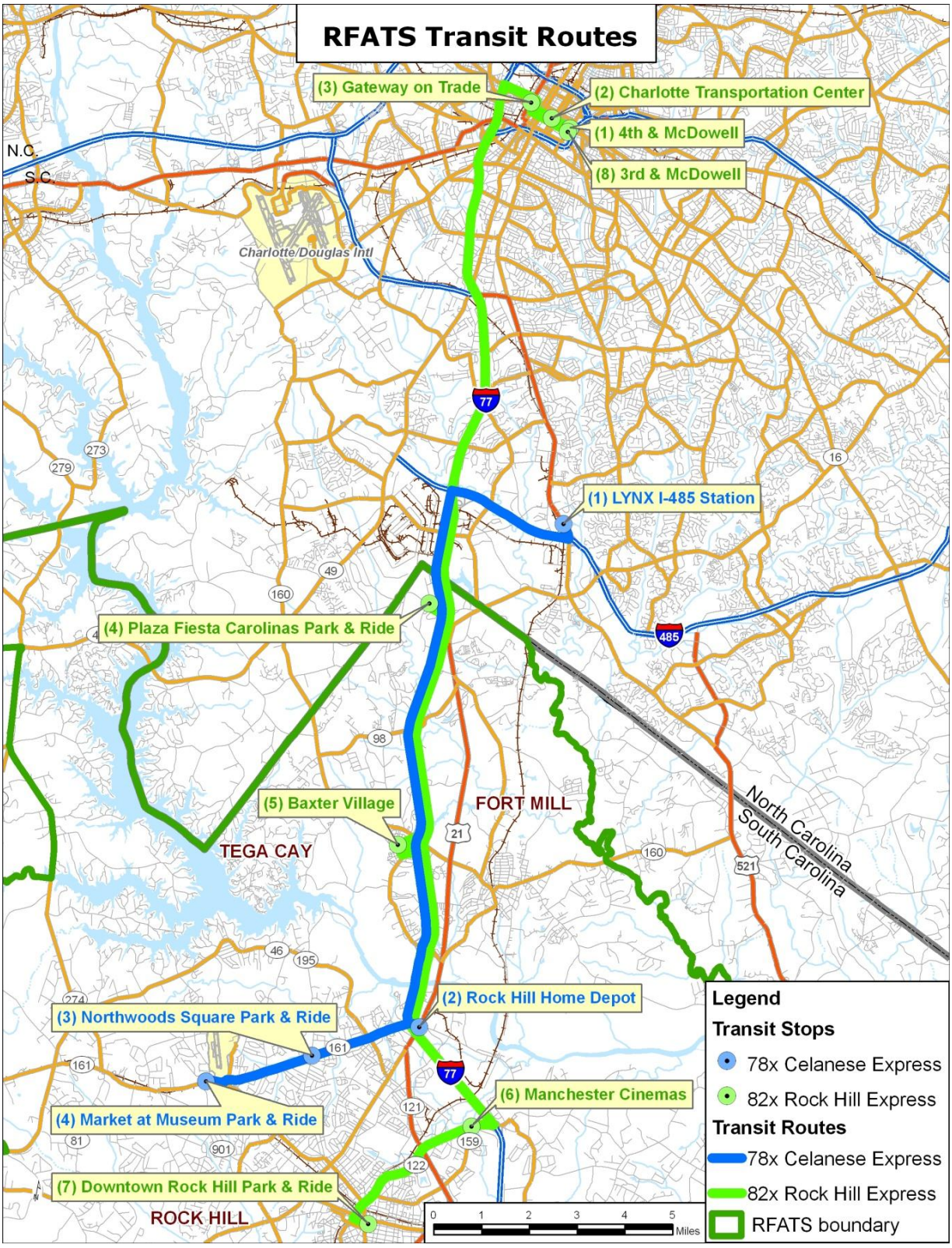
Table 3-14 shows that the FY 2010 on-time performance for route 78X was 75 percent and the target is 85 percent. Increasing the on-time performance in addition to other marketing strategies may improve ridership on route 78X.

Table 3-14: Transit Route 78X On-Time Performance

Route 78X	On-Time Performance
2010	75%
Target	**85%**

Source: Charlotte Area Transit System

Figure 3-5: Fixed Route Express Bus Services Serving RFATS



4. CONGESTION MANAGEMENT STRATEGIES

A critical step in the CMP is to identify congestion mitigation strategies that are appropriate for the RFATS region. This section identifies these strategies and introduces a set of operational and policy matrices that provides potential capital or policy related actions associated with mitigating different causes of congestion. The report discusses current and potential congestion management strategies in three categories:

- Operations and Management Strategies;
- Travel Demand Management Strategies; and
- Physical Roadway Capacity Strategies.

For each congestion category, potential strategies are discussed and related to the problems or conditions where they may be most applicable.

4.1. Types of Congestion

As noted in Section 3, congestion is generally classified as either recurring or non-recurring. This section identifies different types of congestion under each classification, while the following section identifies potential strategies to help mitigate the congestion type. The types of congestion include:

- Recurring Congestion
  - Peak period
  - Freight
  - Intersection
  - Freeway corridor
  - Non freeway corridor
  - School related
  - Central Business District
  - Bottleneck or Hot spot
  - Railroad crossing
  - Parking related
- Non-Recurring Congestion
  - Incident related
  - Special event traffic

4.2. Congestion Mitigation Strategies

The CMP is a tool that is used in the RFATS region to ensure that existing and new transportation systems are effectively managed, operated, and maintained. There are many congestion management strategies that differ in terms of effectiveness, cost, complexity, and difficulty of implementation. Congestion management strategies are not one size fits all. Rather, congested roadways and intersections have to be properly examined to evaluate which congestion mitigation strategy will effectively improve the congestion related problem(s). The CMP identifies numerous congestion mitigation strategies that can individually or collectively improve the operational efficiency of the RFATS transportation system.

SAFETEA-LU emphasizes maintaining and improving existing transportation infrastructure rather than investing in major infrastructure changes. This emphasis focuses on congestion management strategies that enhance mobility, reduce traffic congestion operations and manage regional travel demand. When suitable strategies are implemented, the improvements impact auto, transit, pedestrian, and bicycle usage.

The results of the CMP are used to develop project recommendations for the RFATS Transportation Improvement Program (TIP) and to provide viable strategies and policies for the congestion management element of the RFATS Long Range Transportation Plan. The following sections identify several proven congestion management strategies that can be used to mitigate congestion in the RFATS region.

4.2.1. Operations and Management Strategies

Enhancing the efficiency of the transportation system can be achieved by implementing operational and management strategies (O&M). O&M strategies are designed to allow more effective management of the supply and use of existing roadway facilities. O&M strategies can increase effective capacity by optimizing traffic operations without constructing additional general purpose lanes.

Due to the importance of preserving the existing transportation system, SAFETEA-LU, 23 CFR 450 emphasizes that O&M strategies are the preferred method to manage congestion. O&M strategies are typically low cost, require minimal right-of-way, and can be constructed or implemented quicker than other congestion management strategies.

O&M strategies include a variety of categories, such as Access Management, Transportation Systems Management, Incident Management, and Intelligent Transportation Systems. Each of these categories consists of a number of specific strategies that address different types of congestion. Typical strategies include signal re-timing, signal coordination, and geometric improvements. These traffic operation improvements are implemented at a specific location or at the facility level. However, there are also operational strategies that are best implemented at the corridor and regional levels, such as ramp metering and constructing traffic control centers.

Access Management is defined by FHWA as “the proactive management of vehicular access points to land parcels adjacent to all manner of roadways.” Thus, access management strategies

control the entrance and exit of vehicles on the roadway to remove potential conflict points between vehicles. Access management strategies include the following:[11]

- **Access Spacing**: Increasing the distance between traffic signals improves the flow of traffic on major arterials, reduces congestion, and improves air quality for heavily traveled corridors.
- **Driveway Spacing**: Driveways spaced further apart improve traffic flow, and reduce merging conflict points along roadways.
- **Safe Turning Lanes**: Dedicated left and right-turn, indirect left-turns, U-turns, and roundabouts keep through traffic flowing.
- **Median Treatments**: Two-way left-turn lanes (TWLTL) and non-traversable, raised medians are examples of some of the most effective means to regulate access and reduce crashes.
- **Right-of-Way Management**: Preserving right-of-way for future capacity improvements, sight distance improvements, and other access-related improvements.

Access management is typically effective where an arterial roadway is in or is serving an emerging growth area and has a high percentage of through trips. Access management strategies may also be applied along existing developed corridors where uncontrolled access causes congestion and safety issues. Implementing access management strategies along existing developed corridors requires the support of local government officials, community leaders, and the highway owner to facilitate solutions acceptable to adjacent property owners. All RFATS jurisdictions must coordinate access management approaches and commit to implementing these solutions to reduce the possibility of areas annexing into another jurisdiction that do not support access management techniques.

Transportation Systems Management (TSM) strategies optimize the efficiency of the transportation system by improving vehicle flow. The TSM approach to congestion mitigation seeks to identify operational improvements to enhance the capacity of existing transportation systems. TSM improvements are designed to improve traffic flow and the movement of vehicles and goods, which in turn improves air quality, system accessibility, and safety. TSM strategies include the following:

- Highway geometric improvements
- Traffic signal improvements
- Wayfinding and signage improvements

[11] U.S. DOT, Federal Highway Administration, Office of Operations

Incident Management strategies respond to roadway incidents, such as crashes that may cause non-recurring congestion. Incident management strategies include the following:

- Motorist assistance patrols
- Strategies to improve response times
- Strategies to reduce clearance times

South Carolina DOT Incident Response serves motorists traveling 1-77 between Mt. Holly Road (Exit 73) and Carowinds Boulevard (exit 90), which is the last exit before entering North Carolina. SCDOT incident responders assist with traffic control, incident management, provide first aid until emergency services arrive, and assist in minor vehicle repairs (gas, flat tire, etc.). SCDOT incident responders patrol I-77 seven days a week during specified times and motorist can request service by calling *HP and asking for SCDOT Incident Response.

Intelligent Transportation Systems (ITS) strategies use information technology to improve the functionality of the transportation system. ITS strategies include the following:

- Ramp metering
- Traveler information and rerouting systems
- Electronic commercial vehicle clearance and tolls

Within the RFATS region, SCDOT operates 32 traffic cameras along I-77 between Firetower Road and the North Carolina State line. Each camera can be accessed via the internet, which provides real time visual traffic information on I-77 congestion in the RFATS region. The information from the cameras is transmitted to SCDOT and department personnel can also notify motorists of congestion by updating the Dynamic Message Signs along I-77. **Figure 4-1**, shows the camera image along I-77 at the South Carolina/North Carolina border.

4.2.2. Travel Demand Management Strategies

Travel Demand Management (TDM) measures are aimed at affecting travel demand by reducing the need for travel, increasing vehicle occupancy or the use of alternative modes, or shifting the timing of trips to periods outside of the peak travel times. TDM strategies can improve system performance by reducing and / or re-distributing the demand for single occupancy vehicle (SOV) travel. TDM measures are typically targeted to influence peak travel times by reducing either the number of total work trips or the number of SOV work trips taken during the most congested travel periods. Thus, TDM strategies increase the efficiency of the transportation system by promoting alternative travel modes, such as ridesharing, vanpooling, transit, bicycling, and walking. TDM strategies include the following:

Figure 4-1: I-77 Camera Image at State Line

Source: South Carolina Department of Transportation http://www.scdot.org/getting/cams/RockHillCam.asp

Increasing rideshare strategies encourage carpooling and vanpooling. Typically, ridesharing has minimal costs because it makes use of empty vehicle seats, and it is most suitable for work commute trips. Increasing rideshare strategies include the following:

- Initiating and managing a Rideshare Program
- Constructing park-and-ride facilities in suburban areas
- Connecting public transportation routes to park-and-ride facilities
- Constructing High Occupancy Vehicle (HOV) lanes can also be considered a strategy that can support ridesharing in an urbanized area; it is also listed under Section 3.3

Alternative work time strategies try to reduce the number of commuters traveling at peak morning and afternoon periods. Educating and supporting local businesses is essential when identifying alternative work strategies. Alternative work strategies include the following:

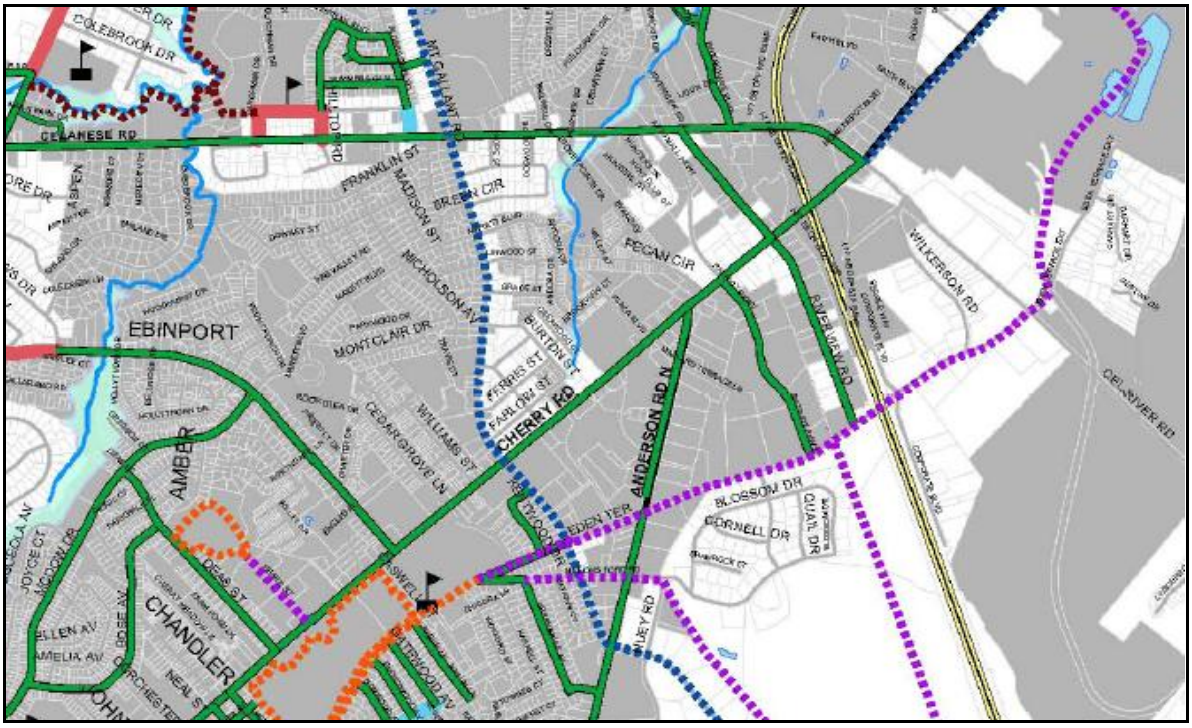
- Flexible work hours
- Telecommuting
- Satellite offices

For these strategies to effectively work, the MPO will need support from government agencies and the local business community.

Alternative commute mode strategies encourage the use of public transportation, bicycling, or walking as a commute mode. Thus, these strategies can address congestion by reducing the number of vehicle trips. Specific measures include the following:

- Bicycle paths or lanes
- Sidewalks
- Pedestrian signals
- Bicycle racks

Figure 4-2: Pedestrian and Bicycle Accommodations Inventory Map



Source: RFATS

These measures may be applied at the facility or corridor levels. In addition to physical improvements, these strategies may include policy-oriented measures, such as a requirement that new or reconstructed roads include sidewalks.

Land use management directly impacts how the transportation system operates and it also influences how commuters select their travel mode. Typically, SOV travel is used when densities are low, land uses are separated, and when transit services, bicycle facilities and pedestrian accommodations are inadequate. Integrating land use planning and transportation planning is

essential to effectively managing growth and mitigating congestion. These strategies are handled outside of the MPO planning process, but it is critically important that land-use and transportation planning be integrated. Since land-use and transportation planning recommendations are both made within York County, integrating and coordinating the Comprehensive Land Use Plan and the Long Range Transportation Plan is applicable to mitigating congestion through the following land use management strategies:

- Zoning
- Land use allocation
- Urban design techniques that integrate land use planning, site planning, and landscaping with the transportation system

As discussed above, TDM strategies include a wide range of potential measures, but most have the following common features:

- Most strategies focus on addressing the congestion issues at the trip origination point and / or destination point.
- Some strategies require public and private sector coordination.
- Primary emphasis is concentrated on work trips.

Changing individuals work commute habits is difficult to achieve. Implementing TDM strategies will not provide successful results unless ways are identified to make alternative modes more convenient and cost-effective. Thus, TDM strategies become more effective when they are implemented in conjunction with other strategies, such as measures to encourage HOV travel or encourage using park-and-ride facilities. It becomes easier to convince commuters to carpool if a travel time advantage, such as cost savings is provided with the alternative mode.

Subarea traffic analysis and thoroughfare planning evaluations were conducted during the 2010 CMP Update and are documented in Section 7 of this report. The evaluations identified strengths and weaknesses in the RFATS transportation system and deficiencies and probable causes of congestion (operations and management, land use, etc.) within the boundaries of each subarea were documented. By proactively evaluating and identifying potential congestion generators within these high growth areas, staff at the respective RFATS communities will be able to factor this information into the review of development proposals – with an increased focus on assuring connectivity to existing facilities, circulation patterns for adjacent developments as well as other physical improvements that may be needed to sustain and / or enhance of the efficiency of the existing transportation network.

4.2.3. Physical Roadway Capacity Strategies

Federal regulations state that any project proposing an increase in SOV capacity should show that congestion management strategies have been considered. Thus, if O&M and TDM strategies do not adequately mitigate congestion, then physical roadway capacity strategies should be carefully reviewed. Increasing roadway capacity is a common strategy for addressing

recurring delay. Roadway capacity increases may be needed along congested corridors for a several reasons including bottleneck removal, safety improvements, economic development, and other reasons. However, increased roadway capacity is typically ineffective in addressing non-recurring congestion. Physical roadway capacity strategies include constructing the following improvements to mitigate congestion:

- Intersection turn lanes
- Roundabout intersections
- Acceleration / deceleration lanes
- Hill-climbing lanes
- Grade-separated railroad crossings
- Grade-separated intersections
- New or converted HOV lanes
- New SOV travel lanes (widening)
- New location roadways

RFATS staff participated in a cooperative planning effort with federal, state, and local partner communities in the Charlotte Region to evaluate the potential use of managed lanes as an appropriate congestion management tool. This effort focused primarily on the I-77 Corridor.

4.3. Operational and Policy Matrices

Each congested facility on the RFATS CMP network should be evaluated to identify particular strategies that have the potential for mitigating congestion. To assist in identifying appropriate strategies to mitigate congestion, operational and policy matrices were developed. **Table 4-1** provides a matrix that shows how O&M strategies can assist in mitigating different types of recurring and non-recurring congestion. **Table 4-2** provides a matrix that shows how TDM strategies can assist in mitigating different types of congestion, while **Table 4-3** provides a matrix that shows how physical roadway capacity strategies can assist in mitigating recurring congestion.

As shown below, the O&M, TDM, and physical capacity strategies are graded based on the effectiveness of reducing congestion and the associated cost to implement. If a cell on one of the tables is empty, that means the particular strategy is not appropriate for that particular type of congestion. As an example, freeway corridor congestion is listed as one of the types of congestion in Table 4-1 and traffic signal improvements and new traffic signal are empty cells because those strategies will not mitigate congestion on freeway corridors. However, signage and ramp metering are two examples strategies that may assist in mitigating freeway corridor congestion that are considered high in effectiveness and low in cost.

		Cost →		
Effectiveness		Low	Medium	High
↓	Low	$	$$	$$$
	Medium	$	$$	$$$
	High	$	$$	$$$

Table 4-1: Operations and Management Strategies Matrix

Effectiveness \ Cost	Low	Medium	High
Low	$	$$	$$$
Medium	$	$$	$$$
High	$	$$	$$$

	Traffic Signal Improvements	New Traffic Signal	Roadway Geometric Improvements	Ramp Metering	Signage	Reversible Lanes	Turn Restrictions	Time of Day Restrictions	Management of Work Zones	Special Event and Emergency Evacuation Plan	Lane and/or Parking Restrictions	Speed Reductions	Traveler Information System (DMS, Radio)	Access Management	Incident Detection and Management
Recurring Congestion															
Commuter Peak Period Congestion	$	$	$$	$	$	$$	$	$	$	$	$	$	$$	$$	$$
Freight Congestion	$		$$		$	$$	$	$	$		$		$$	$$	$$
Signalized Intersection Congestion	$		$$		$		$							$$	$$
Unsignalized Intersection Congestion	$	$	$$		$		$							$$	
Freeway Corridor Congestion			$$	$	$	$$		$	$	$	$	$	$$		$$
Non freeway Corridor Congestion	$	$	$$		$		$	$	$		$	$	$$	$$	$$
Incident Related Congestion	$	$	$$		$		$	$	$			$	$$	$$	$$
Ingress and Egress patterns	$		$$		$		$				$			$$	
Central Business District Congestion	$	$	$$		$		$	$	$		$				
Bottleneck or Hot Spot	$	$	$$	$	$		$	$	$		$		$$	$$	$$
Railroad Crossing	$	$			$								$$		
Parking Congestion			$$		$		$	$			$		$$	$$	
Non-recurring Congestion															
Special event traffic congestion	$	$	$$		$	$$	$	$	$	$	$		$$	$$	$$
Incident Related Congestion	$	$	$$		$							$	$$	$$	$$

Table 4-2: Travel Demand Management Strategies Matrix

Effectiveness	Cost: Low	Cost: Medium	Cost: High
Low	$	$$	$$$
Medium	$	$$	$$$
High	$	$$	$$$

	Rideshare Program	Telecommuting	Alternative Work Arrangements	Transit/Carpool Incentives	Parking Management	Guaranteed Ride Home Programs	Parking Fees	Smart Growth	Land use Policy	Transit-Oriented Development	Mixed Use Development	Exclusive Transit Right-of-Way Facilities	Transit fleet Improvements (expansion, vehicle replacement/ upgrades)	Transit Support Services (Park-and-ride lots, transit centers,)	Transit Service Improvements (frequency, operating hours, routing)	Transit Marketing/Information (transfers, information systems, marketing)	Fare Incentives (fare reductions, fare packages)	Traffic Operations for Transit (signal priority, coordination)	Pedestrian Facilities	Bicycle Facilities	Pedestrian Crossing
Recurring Congestion																					
Commuter Peak Period Congestion	$	$	$	$	$	$	$	$	$	$	$	$$$	$$$	$$	$$	$	$$	$	$$	$$	$$
Freight Congestion																					
Signalized Intersection Congestion	$	$	$	$	$	$		$	$	$	$							$		$$	$$
Unsignalized Intersection Congestion		$	$	$	$	$														$$	$$
Freeway Corridor Congestion	$	$	$	$	$	$	$	$	$	$	$	$$$	$$$	$$	$$	$	$$	$			
Non freeway Corridor Congestion	$	$	$	$	$	$	$	$	$	$	$	$$$	$$$	$$	$$	$	$$	$	$$	$$	$$
School related congestion	$			$	$				$	$	$	$$$	$$$	$$	$$	$	$		$$	$$	$$
Ingress and Egress patterns								$	$	$	$										
Central Business District Congestion	$	$	$	$	$	$	$	$	$	$	$	$$$	$$$	$$	$$	$	$	$	$$	$$	$$
Bottleneck or Hot Spot	$	$	$	$	$	$	$	$	$	$	$	$$$	$$$	$$	$$	$	$	$			
Railroad Crossing																					
Parking Congestion	$	$	$	$	$	$	$	$	$					$$					$$	$$	$$
Non-recurring Congestion																					
Special event traffic congestion	$			$	$		$					$$$	$$$	$$	$$	$	$	$	$	$	$
Incident Related Congestion																					

Table 4-3: Physical Roadway Capacity Strategies Matrix

Effectiveness		Cost → Low	Medium	High
↓	Low	$	$$	$$$
	Medium	$	$$	$$$
	High	$	$$	$$$

	Intersection Turn Lanes	Roundabout	Accelleration/Deceleration Lanes	Hill-Climbing Lanes	Grade-Separated Railroad Crossings	Grade Separated Intersection	New Travel Lanes (General Purpose)	New or converted HOV Lanes	New Location Roadway
Recurring Congestion									
Commuter Peak Period Congestion	$$	$$	$$		$$$	$$$	$$$	$$$	$$$
Freight Congestion	$$			$$$	$$$	$$$			$$$
Signalized Intersection Congestion	$$	$$			$$$	$$$			
Unsignalized Intersection Congestion	$$	$$			$$$	$$$			
Freeway Corridor Congestion			$$	$$$			$$$	$$$	$$$
Non freeway Corridor Congestion	$$				$$$	$$$	$$$		$$$
School related congestion	$$				$$$	$$$	$$$		$$$
Ingress and Egress patterns									
Central Business District Congestion	$$								
Bottleneck or Hot Spot	$$		$$				$$$		
Railroad Crossing					$$$				
Parking Congestion									

4.4. Congested Corridors

Identifying the type or cause of congestion must be completed before developing specific congestion mitigation strategies. **Table 4-4** shows the relevant types of congestion for the 24 corridors identified in Section 3.6. Based on the type(s) of congestion, mitigation strategies can be selected using the strategy matrices to identify improvements that will assist in meeting the performance targets established for each corridor.

Table 4-4: Type of Congestion by CMP Corridor

ID	Corridor	Commuter Peak Period Congestion	Intersection Congestion	Freeway Corridor Congestion	School related congestion	Ingress and Egress patterns	Bottleneck or Hot Spot
1W	Old York Road / Celanese Road (SC 161/SC 274)	Yes	Yes			Yes	
1E	Old York Road / Celanese Road (SC 161/SC 274)	Yes	Yes		Yes	Yes	
2	Cherry Road	Yes	Yes		Yes	Yes	
3W	Dave Lyle Boulevard (west of US 21 BYP)	Yes	Yes		Yes		
3E	Dave Lyle Boulevard (east of US 21 BYP)	Yes	Yes				
4	Albright Rd (SC 72) /Saluda Rd	Yes	Yes		Yes		
5N	Mt. Gallant Road (north of Celanese Road)	Yes	Yes		Yes		Yes
5S	Mt. Gallant Road (south of Celanese Road)	Yes	Yes				Yes
6	Carowinds Boulevard, US 21 and SC 51	Yes	Yes				Yes
7	Gold Hill Road	Yes	Yes			Yes	Yes
8W	SC 160 (west of US 21 BYP)	Yes	Yes			Yes	Yes
8E	SC 160 (east of US 21 BYP)	Yes	Yes		Yes	Yes	Yes
9	Charlotte Hwy (SC 49)	Yes	Yes				Yes
10S	I-77 (south of Dave Lyle Blvd)	Yes		Yes			Yes
10N	I-77 (north of Dave Lyle Blvd)	Yes		Yes			Yes
11	US 21 BYP	Yes	Yes		Yes	Yes	
12	Anderson Road (SC 121) / US 21 BYP				Yes	Yes	
13	Heckle Boulevard (SC 901)		Yes		Yes	Yes	Yes
14	Ebenezer Road		Yes			Yes	
15	Herlong Avenue	Yes	Yes		Yes	Yes	Yes
16	India Hook Road	Yes	Yes		Yes	Yes	
17	Red River Road, Cel-River Road		Yes			Yes	
18	John Ross Parkway		Yes			Yes	
19	Fort Mill Bypass, Springfield Parkway		Yes		Yes	Yes	
20	Dam Road		Yes			Yes	
21	Fort Mill Parkway		Yes			Yes	
22	Fairway Drive (Fort Mill)		Yes			Yes	
23	Doby's Bridge Road	Yes	Yes			Yes	
24	W. Main Street, (SC 5)	Yes	Yes			Yes	

4.5. Congestion Management Strategies Summary

The congestion mitigation strategies identified in the operation and policy matrices provide effective ways to mitigate different types of congestion. The matrices were used to identify viable 2010 CMP projects, which are presented in Section 5. The operation and policy matrices should also be used during the development of the RFATS LRTP and any other transportation planning study completed in the region. While all congestion mitigation strategies identified in the operation and policy matrices may not be appropriate to implement today in the RFATS region, it is important to note that as the region grows new and expanded strategies will need to be identified and evaluated.

5. IMPLEMENTATION PROCESS

This section identifies strategies recommended for implementation to help manage congestion in the RFATS region. Each category of strategies is discussed in turn. Corridor specific improvements for each of the CMP Corridors are identified for each category of strategies. Projects are also categorized as having an implementation timeframe of short (1 to 5 years), medium (6 to 10 years), or long (more than 10 years). However, no formal prioritization of projects reflected as CMP Priorities over the next five years was conducted, as it is understood that this will be undertaken by SCDOT (Act 114 – Statewide Ranking Criteria) for those projects adopted by RFATS for inclusion in the next TIP.

As discussed previously, the identification of the following recommended projects are a product of input / review from the RFATS Technical Team, SCDOT traffic count data and crash information, operational / capacity data from the Metrolina Regional Travel Demand Model, as well as data collected from travel time surveys. From these three data sources as well as from related transit and subarea studies, 24 priority CMP Corridors have been identified where specific project improvements and / or policies are being recommended.

Consistent with federal guidance on congestion management strategies and best practices, recommended actions should be specific, measurable, realistic, and time-bound. By structuring the project / policy recommendations in this way, it is expected that the timing and coordination of project implementation can be synchronized (as is practicable), so as to maximize the expected benefits from each recommended action.

5.1. Operations and Management Strategies

Due to the importance of preserving the existing transportation system, SAFETEA-LU, 23 CFR 450 emphasizes that Operational and Maintenance (O&M) strategies are the preferred method to manage congestion. O&M strategies are typically low cost, require minimal right-of-way, and can be constructed or implemented quicker than other congestion management strategies.

O&M strategies cover a variety of categories, including geometric and signal operations improvements. Since safety studies or safety audits frequently result in recommendations for geometric or signal improvements, locations where safety audits should be considered are also identified in this section. Finally, access management projects are identified as the third recommended focus area within O&M.

5.1.1. Intersection Geometric and Signal Operations Improvements

These projects should be added to existing lists of candidate projects for consideration to be moved forward in the normal transportation planning process and eventual inclusion in a future TIP update. CMP projects focused on geometric and signal operation improvements at intersections are listed in **Table 5-1**.

Table 5-1: CMP Geometric and Signal Operations Improvements

Ref #	Project Description[(1)]	Timeframe	Cost Est.
1.B	Signal geometric and phasing improvements on Celanese Road as recommended by CRH December 2008 CMAQ Signal Timing Study.; additionally, particular attention should be devoted to evaluating needed improvements at the intersection of India Hook / Celanese Road.	Short	City Budget
2.A	Signal geometric and phasing improvements on Cherry Road as recommended by CRH December 2008 CMAQ Signal Timing Study: • Construct a southbound left-turn lane on Dorchester Road.	Short	$270/lf
2.B	Prior to the planned widening of Cel-River Road, consideration should be given to converting the westbound outside lane on Cel-River Road at Cherry Road from a right turn only lane to a through right lane.	Maintenance Activity	N/A
3.A	Add a second northbound Left-turn lane on Galleria Boulevard at Dave Lyle Boulevard.	Short	$270/lf
3.B	At I-77 Southbound Ramp on Dave Lyle Boulevard - Add a second southbound Right-turn lane and develop side street capacity/operation improvements at Chamberside – This is understood to be an upcoming CMAQ funded project.	Short	$270/lf
3.E	Traffic signal priority for express bus services on Dave Lyle Boulevard.	Medium	$5k/signal
4.A	Review and update signal operations and timings at signals on SC 72 not addressed in the 2008 CMAQ Signal Timing Study; it is recommended that an evaluation of a traffic adaptive system such as InSync be considered for use on Albright Road (SC 72).	Short	$2k/signal
4.D	On SC 72/SC 5 realign Paddock Parkway to the east to develop a 4-way intersection with Lesslie Highway.	Medium	$50,000
4.E	On SC 72/SC 5/US 21 reconstruct NB and SB separated legs of SC 121 into a single T intersection.	Medium	$600,000
4.G	On SC 72 construct a new connector from Saluda Trail entrance to Harper Gault/Oakdale Road, as identified in South Pointe traffic study.	Medium	$787,000
4.H	On SC 72 realign Oakdale road to Forest Road, as identified in South Pointe traffic study.	Medium	$60,000
4.I	On SC 72 extend Robertson Road to SC 72 and Cul-de-Sac Rambo Road (as identified in South Pointe traffic study).	Medium	$25,000
4.J	On SC 72 widen SC 72 to five lanes from Rawlsville to SC 901, Heckle Boulevard (included in York County 2011 referendum project list).	Medium	$2.61 m
5.F	Preserve 90 feet of right of way along Mt. Gallant Road from SC 161 to west of Museum Road to accommodate the potential for a four-lane divided road with sidewalks.	Short	TBD
6.A	The westbound left turning movement is heavy from Carowinds Boulevard to Pleasant Road. Dual left is not possible because there is only one receiving lane on Pleasant Road. Consider lengthening the left turn lane while retaining a physical median for access management purposes.	Short	$270/lf
6.F	Three eastbound through lanes begin at the intersection of Carowinds Blvd and Pleasant Rd. Currently only two through lanes exist on the westbound approach to this intersection. Consider adding a through westbound lane on Carowinds Blvd from Choate Circle to Pleasant Road, while retaining access management control and the potential for future sidewalks.	Medium	$117,500

Ref #	Project Description[(1)]	Timeframe	Cost Est.
7.C	A new interchange at Gold Hill Road and I-77 may be needed to accommodate the higher volumes that are developing with the growth of Tega Cay. Consideration should be given to conducting an Interchange Justification Study. (Same as Project 10.A). This project is listed as a potential 2011 Pennies for Progress project.	Long	$150,000
8.D	The westbound movement at SC 160 at Springfield Pkwy intersection is the only east-west access to Fort Mill from the east. The intersection is also on a heavily used truck route. Although the single westbound through lane is a limiting factor in the intersection's operations, several small changes should be considered to improve operations with the existing geometry: • Improve radius in northeast corner; • Consider signalizing the southbound right turn overlap with the eastbound left turn; • Consider remarking the westbound approach to include a left turn lane – this may be difficult because the turning path for trucks turning southbound to eastbound means the stop bar for the westbound left turn lane would be set back. The lane would be helpful, however, by removing the occasional left turn from the westbound through movement; • Examine signal timing for changes in timing to accommodate different peak volumes.	Short	$15,000
8.I	Consider realignment of I-77 SB exit ramp onto SC Highway 160 to line up with Market Street (previously Sutton Road)	Short	TBD
8.J	Both ends of Fairway Drive need to have turn lanes installed to accommodate conflicting turn movements and reduce backups. Also, site distance should be improved in both directions along with turn lanes on the intersecting streets as well.	Short	TBD
8.K	Consider installation of right bound turn lane from Clebourne St onto N. White Street as well as re-configuration of N. White, Clebourne, and Tom Hall Streets to help accommodate traffic flows in and around downtown Fort Mill. These improvements would need to coordinate to allow for a more free –flow traffic movement, especially during railroad operations that block Main Street	Short	TBD
9.A	Review signal timings and operations at the intersections of SC 49 at SC 274 and at Robinwood Road – very long delays experienced in the PM Peak during the Travel Time Surveys.	Short	$2,000
9.B	Preserve 90 feet of right of way along SC 49 from south of Big Allison Creek to Lake Wylie and along SC 274 from south of Campbell Road to US 49.	Short	TBD
9.C	Improve intersection capacity at SC 274/SC 49 and SC 49/SC 557.	Medium	TBD
10.A	A new interchange at Gold Hill Road and I-77 may be needed to accommodate the higher volumes that are developing with the growth of Tega Cay. Consideration should be given to conducting an Interchange Justification Study. (Same as Project 7.C). This project is listed as a potential 2011 Pennies for Progress project.	See 7.C	See 7.C
11.F	Improve triangular intersections of US 21 with Gold Hill Road and with Old Nation Road.	Medium	TBD
12.A	On SC 72/SC 5 realign Paddock Parkway to the east to develop a 4-way intersection with Lesslie Highway. (Same as Project 4.D).	See 4.D	See 4.D
19.B	Old Nations Road / Springfield Parkway – consider dual left turn lanes into the school complex; also, a dedicated right turn is also advisable	Short	TBD

Ref #	Project Description[(1)]	Timeframe	Cost Est.
21.A	Preserve 90 feet of right of way along Fort Mill Parkway from Spratt Street to Brickyard Road.	Short	TBD
23.A	Preserve 90 feet of right of way along Doby's Bridge Road from north of Williams Road to south of the potential extension of Holbrook Road.	Short	TBD

Notes:

(1) A review and update of signal operations and timing should be conducted at regular intervals for all corridors with signalized intersections.

5.1.2. Conducting Safety Audits

Road Safety Audits (RSA) include field evaluation of locations with known or suspected safety issues with the intent of identifying potential remedial measures to reduce accident frequency and/or severity in the future. The audit typically involves a number of steps, such as:

- Obtain traffic and crash history data.
- Data are summarized and crash diagrams developed.
- A field review is conducted that is attended by the consultant, regional state engineers, safety engineers from the state office, and local officials.
- A crash analysis is conducted to determine if the location's crash rate exceeds the statewide average or critical crash rate. If it exceeds the critical crash rate, then it can be concluded that there are causative factors that are correctable.
- A set of recommendations are developed to mitigate the problems.
- A cost estimate is developed for implementing the recommendations. The potential recommendations may be evaluated and selected based on FHWA's Highway Safety Manual criteria, which quantifies likely benefit of implementing improvement options.

Safety audits may be conducted by RFATS staff, consultants or by SCDOT's State Traffic Safety Engineer's office. Locations where safety audits should be considered are in **Table 5-2**.

Table 5-2: Locations Where Safety Audits Should be Considered

Ref #	Project Description	Timeframe	Cost Est.
2.C	Conduct Safety Audit along the Cherry Road corridor from Oakland Avenue to Camden Avenue	Short	$24,000
5.B	Conduct Safety Audit along the Mt. Gallant Road corridor between Redwood Drive and India Hook Road	Short	$24,000
8.E	The intersection of SC 160 at Hensley Road is also on the truck route and has been recently signalized. One eastbound truck held up traffic because of the grades eastbound past the intersection. There is no westbound left turn lane, and the side street has one wide approach lane. Intersection should be reexamined for turn lane needs and signal timing refinements. Long term, the narrow lanes, nonexistent shoulders and grades on this section should be examined for their ability to accommodate truck traffic safely. Problems at this intersection are being addressed by SCDOT in a safety project, which is currently under design	Short	TBD
8.F	Conduct Safety Audit on SC 160 at Springfield Parkway	Short	$12,000
11.C	Conduct Safety Audit at the intersection of US 21 BYP and Harris Street	Short	$12,000
13.A	Conduct Safety Audit at the intersection of Heckle Boulevard and Old York Road, as well as along Heckle Boulevard north and south of Herlong Avenue	Short	$24,000
15.A	Conduct Safety Audit along Herlong Avenue between Heckle Boulevard and Ebenezer Road	Short	$36,000

5.1.3. Access Management Strategies and Projects

The RFATS 2004 CMS identified a number of access management strategies. Those not already implemented are listed in **Table 5-3**, together with three additional locations to focus access management efforts in the short term:

- SC 161, Celanese Road;
- Cherry Road; and
- SC 160, Tom Hall Road, in Fort Mill.

The northern section of Cherry Road from Cherry Park to the Catawba River has seen re-development initiatives in recent years. As these efforts continue, opportunities should be taken to incorporate beneficial access management strategies into the planning, design and approval processes for re-development projects. The ongoing College Town Plan in the vicinity of Winthrop University on Cherry Road should also be reviewed for access management opportunities. Targeted access management studies along the other two corridors (SC 161 and SC 160) may be warranted to develop a comprehensive approach to access management along these key routes.

Table 5-3: Access Management Projects

Ref #	Project Description	Timeframe
1.E	Conduct an Access Management review along the SC 161 corridor to identify opportunities to improve access management.	Short
2.E	Seek opportunities to incorporate access management strategies into the planning, design and approval processes for redevelopment that may occur in the northern section of Cherry Road from Cherry Park to the Catawba River and in implementing recommendations from the ongoing College Town Plan in the vicinity of Winthrop University.	Short
3.C	RFATS 2004 CMS identified access management improvements for Dave Lyle Boulevard related to access to and from Tinsley Way, such as: • Redesign of Tinsley Way to eliminate stop sign entering from Dave Lyle; • Study and implement how to deal with right turns onto Tinsley from Dave Lyle; • Modify shopping center driveway (Tinsley Way) to create adequate and uninterrupted storage approaching Dave Lyle signal. Eliminate interfering left turn traffic from the Marathon Gas Station direction that causes large gaps in traffic movement exiting the shopping center and interferes with signal operation.	Short
3.D	Conduct Access Management Evaluation Study on Dave Lyle Boulevard at John Ross Parkway.	Short
6.E	Access management measures on Carowinds Boulevard between Pleasant Road and SC 51 identified in the RFATS 2004 CMS: • Raised concrete medians to help create strategic, shared access points to lesson conflicting turn movements and help general traffic flow; • Shared access between parcels limiting the number of curb cuts throughout; • Implementation of frontage roads that will provide additional access to the business once the medians are constructed; • Easy to read directional signage; • Implementation of new traffic patterns within the Plaza Fiesta, Comfort Inn and Carowinds area; • Removal of one-way streets and split entrances to the business location to provide a more traditional traffic pattern.	Short
8.H	Conduct an Access Management review along SC 160, Tom Hall Road, in Fort Mill to identify opportunities to improve access management.	Short

5.2. Travel Demand Management Strategies

Travel Demand Management (TDM) measures are aimed at affecting travel demand by reducing the need for travel, increasing vehicle occupancy or the use of alternative modes, or shifting the timing of trips to periods outside of peak travel times. TDM strategies can improve system performance by reducing and / or re-distributing the demand for single occupancy vehicle (SOV) travel. TDM measures are typically targeted to influence peak travel times by reducing either the number of total work trips or the number of SOV work trips taken during the most congested travel periods. Thus, TDM strategies increase the efficiency of the transportation system by promoting alternative travel modes, such as ridesharing, vanpooling, transit, bicycling, and walking.

While the Travel Demand Management Strategies Matrix developed in Section 4 identifies 21 individual strategies, it is suggested that initial efforts be focused on the following areas:

- Expanding Rideshare Programs;
- Encouraging large employers to institute alternative work arrangements for its employees:
- Identifying areas to include Transit Oriented Development and Mixed-Use Development; and
- Transit improvements.

5.2.1. Rideshare Initiatives

Over the next year, the Charlotte Area Transit System (CATS), local jurisdictions, and businesses should work together to encourage further rideshare initiatives throughout the RFATS region. To be successful, individual jurisdictions within the RFATS region must support rideshare initiatives to realize the benefits of this congestion mitigation strategy. As discussed in Section 4, ridesharing strategies include vanpool or carpool initiatives. Typically, a centralized organization provides services such as providing vans for vanpools, coordinating ridesharing initiatives, and promoting these programs. Currently, CATS serves as the organizer of the existing rideshare initiatives in the RFATS region. Greater coordination between CATS, local jurisdictions, and businesses is recommended to identify promising commute corridors that have the potential to mitigate congestion. The following initiatives are successfully used in other urbanized areas and these initiatives should be considered as a way to improve participation in the RFATS region:

- Create Employer Sponsored Carpool initiatives that provide incentives to employees using alternative forms of transportation for their commutes. Incentives include cash payments, pre-tax transportation benefits, and preferential parking.
- Create a Guarantee Ride Home Program to reimburse participants in carpools or vanpools when there is an emergency and they cannot use their carpool or vanpool to return home.
- Reduce or increase the cost of parking in downtown areas to encourage commuters to join rideshare programs.
- Identify and construct Park and Ride facilities to allow carpool and vanpool participants to meet at a central location. These new facilities can also serve as potential transit stop locations in the near or long-term future.

Rideshare Implementation - Implementing additional rideshare initiatives may take several years, but if it is supported by CATS, local jurisdictions, and businesses it should increase local participation rates and in turn mitigate corridor congestion. Over the next year, CATS, local jurisdictions, and local businesses should meet to discuss expanding the ridesharing initiatives

throughout the RFATS region. Businesses leaders have direct access to solicit their employees to participate in ridesharing initiatives. Identifying commuters who live and work in the same areas will require developing a commute match program, which is typically done through the internet.

Rideshare Benefits - Commuters that participate in ridesharing initiatives decrease their transportation costs and in turn that increases their disposable income, which can be used for other activities. If successful rideshare initiatives are developed, roadways in the RFATS region will become more efficient and as more carpools and vanpools are formed, remove single occupancy vehicles from the roadways; travel times and congestion will be reduced for all travelers.

Rideshare Funding Sources - Specific highway funding programs, such as the Surface Transportation Program (STP), National Highway System (NHS), and Congestion Mitigation and Air Quality (CMAQ) Improvement Program, fund ridesharing programs, as long as the activities meet the goals of the funding program. Federal Transit Administration (FTA) funding, such as 5307 and 5311, support carpool and vanpool programs. Another program that includes ridesharing as a specifically-eligible expense is the Job Access and Reverse Commute (JARC) program.[12] County and city funding sources, as well as private businesses can also provide funding that will help develop and operate ridesharing programs.

5.2.2. Alternative Work Arrangements

Over the next year, large employers in the area should be encouraged to implement alternative work arrangements. As discussed in Section 4, instead of changing how employees get to work, the purpose of alternative work arrangements is adjusting when employees arrive and leave work. Driving during off-peak times can improve roadway efficiency and in turn reduce congestion on major commuting corridors in the RFATS region. Alternative work arrangements can include the following:

- Compressed work weeks allow employees to work 10 hour days four days a week, thus eliminating one travel day to work.
- Set a new schedule that allows employees to arrive at work before 7:00 or after 9:30 a.m.
- Provide telecommuting options to allow employees to work from home one or two days a week.

Implementation - There are probably numerous employers in the RFATS region that currently support flexible work hours. An on-line survey could be developed to get an understanding of how local businesses are currently using flexible work hours and to identify where gaps exist. The local Chamber of Commerce may be able to distribute the on-line survey and also provide a forum to educate members on the benefits of alternative work arrangements.

[12] Federal Highway Administration

Benefits - Alternative work arrangements provide numerous benefits to the employer, employee, and the community. The following provides a summary of these benefits:[13]

- Employer benefits include enhanced retention and recruitment, extended hours of service, and expanded use of equipment.
- Employee benefits include boosting morale and improved performance.
- Community benefits include less congestion on roadways during peak times and improved air quality.

Funding Sources - Alternative work arrangements are not for every business, however most businesses can and do implement alternative employee work options. The cost of implementing such programs is minimal and thus direct funding is not needed to begin such programs. RFATS staff could use a small portion of the annual MPO Planning funds to develop and analyze an on-line survey to determine if encouraging flexible work hours in the region could mitigate corridor congestion.

5.2.3. Land Use Management

As noted in Section 4, land use management directly impacts how the transportation system operates and it also influences how commuters select their travel mode. Since land use and transportation planning recommendations are both made within the RFATS Study Area, integrating and coordinating the four communities' Comprehensive Land Use Plan and RFATS Long Range Transportation Plan are applicable to mitigating congestion.

Land Use Management Implementation - During the next Comprehensive Land Use Plan update, areas that would support Transit Oriented Development and Mixed Use Development should be identified and included in the adopted plan.

Land Use Management Benefits - The benefits of Transit Oriented Development and Mixed Use Development must be communicated to elected officials, local citizens, and developers. Providing areas of higher densities will improve transit ridership and over time will reduce corridor congestion. Providing areas where residents can live, work, and play will improve the quality of life and will also reduce corridor congestion since other modes (walking, biking and transit) will be used more frequently.

Funding Sources for Land Use Management - The cost of implementing Transit Oriented Development and Mixed Use Development is minimal to RFATS and thus direct funding is not needed to encourage these land use management strategies.

5.2.4. Transit Improvements

The Rock Hill-York County-Charlotte Rapid Transit Study analyzed transportation and land use conditions and recommended rapid transit service connections between Rock Hill-York County

[13] The Clean Air Campaign

and the greater Charlotte region. More specifically, the study recommended implementing a Bus Rapid Transit (BRT) service along the US 21 corridor to connect to CATS' southern light rail line at I-485. This project was recommended to be implemented over four phases, which stretch from the short-term planning horizon of 2011-2012 to the long term planning horizon of 2030 and beyond. To ensure the BRT service would have adequate ridership, the study also recommended an extensive feeder network of local and express buses to and from Fort Mill, Tega Cay, Pineville, Lancaster, and Chester.

Implementing the BRT service along the US 21 corridor and developing a feeder system from local communities will mitigate congestion in the RFATS area. Corridor specific CMP projects to continue planning for this proposed BRT line are included for CMP corridors 2 (US 21, Cherry Road) and 11 (US 21 Bypass).

5.2.5. TDM Projects and Policies

The strategies discussed above are all characterized as being low cost to implement and exhibiting a high level of effectiveness to address commuter peak period congestion, as well as other types of recurring congestion problems. The recommended TDM projects and policies for the CMP Update are listed in **Table 5-4**.

5.2.6. Adding Bicycle Lanes

While not having a high impact on peak-hour congestion, opportunities should also be sought to add bicycle lanes in Priority Areas identified by York County. To minimize costs it is preferable to construct bike lanes in conjunction with other improvement projects along the corridor. CMP corridors that are located in Priority Areas for bike lanes are listed in **Table 5-5**.

While York County allocated priority levels of High, Medium High, and Medium to these corridors the addition of bicycle lanes is shown with a CMP timeframe of "Long," since from a congestion reduction perspective bicycle lanes may be less effective than some other CMP strategies.

Table 5-4: Travel Demand Management CMP Projects and Policies

Ref #	Project Description	Timeframe
2.D	Continue planning for the BRT line on Cherry Road from downtown Rock Hill to the I-485 light rail station.	Short
11.E	Continue planning for the BRT line on US 21 BYP from downtown Rock Hill to the I-485 light rail station	Short
Policy 1	If they have not done so already municipalities and other governmental agencies should adopt consistent Access Management standards that, at a minimum, meet the requirements of the latest SCDOT Access and Roadside Management Standards (ARMS), and subsequent updates.	Short
Policy 2	It is recommended that RFATS planning staff continue work with their existing partners in the Rideshare Program, including Charlotte Area Transit System and SCDOT to improve the effectiveness of the existing program and park-and-ride facilities and to seek opportunities to expand the existing program.	Short
Policy 3	Alternative Work Arrangements: If not already in place, the formation of a Task Force should be considered to guide efforts to implement alternative work time strategies, consisting of representatives of local government, the Chamber of Commerce, major public and private employers in the area, and other business organizations.	Short
Policy 4	During the next Comprehensive Land Use Plan update, areas that would support Transit Oriented Development and Mixed Use Development should be identified and included in the adopted plan.	Short

Table 5-5: CMP Corridors Located in Priority Areas for Bike Lanes

Ref #	Project Description	Timeframe	Cost Est.
1.C	Add Bike Lanes between SC 274, Ebenezer Rd and Mt Gallant Rd [(1)]	Long	$940,000
5.C	Add Bike Lanes between West Oak road / Aragon Beach Road and Twin Lakes Road. [(1)] A 2003 Pennies for Progress project is planned to add bike lanes from Twin Oaks Road south to Dave Lyle Boulevard.	Long	$740,000
7.B	Add Bike Lanes between SC 160 and I-77 [(3)]	Long	$440,000
8.H	Add Bike Lanes between Zoar Road and Dam Road [(3)]	Long	$320,000
11.D	Add Bike Lanes between SC 161, Cel-River Road and the Catawba River [(1)]	Long	$180,000
14.B	Add Bike Lanes between SC 161, Celanese Road and Herlong Rd [(3)]	Long	$310,000
15.B	Add Bike Lanes between SC 274, Ebenezer Road and SC 161, Celanese Road. [(2)] Bike lanes are proposed to continue north of Celanese Road on India Hook Road (see CMP Project 16.A).	Long	$370,000
16.A	Add Bike Lanes between SC 161, Celanese Road and Mt Gallant Road. [(2)] Bike lanes are proposed to continue south of Celanese Road on India Hook Road/Herlong Avenue (see CMP Project 15.B).	Long	$420,000
17.B	Add Bike Lanes on Cel-River Road from US 21, N Cherry Road, to SC 122, Dave Lyle Boulevard [(2)]	Long	$620,000
19.A	Add Bike Lanes on Springhill Parkway from the Carolina Thread Trail (south of the Southern Railway Line) to SC 160, Tom Hall Road [(1)]	Long	$580,000
21.B	Add Bike Lanes on Fort Mill Parkway between Spratt Street and Brickyard Road [(3)]	Long	$250,000
22.A	Add Bike Lanes on Fairway Drive between Brickyard Road and Doby's Bridge Road [(3)]	Long	$250,000
23.B	Add Bike Lanes on Doby's Bridge Road between Williams Road and Lee Road [(1)]	Long	$420,000

Ref #	Project Description	Timeframe	Cost Est.
23.C	Add Bike Lanes on Doby's Bridge Road between Fairway Drive and Williams Road (2)	Long	$40,000
23.D	Add Bike Lanes on Doby's Bridge Road between Kimbrell Road and Hensley Road (3)	Long	$80,000
23.E	Add Bike Lanes on Doby's Bridge Road between Lee Road and the Lancaster County Line (3)	Long	$560,000

Notes:

(1) High Priority Bike Route on map "Priority Areas for Bike Lanes in York County," August 2008, produced by York County Planning Department.

(2) Medium High Priority Bike Route on map "Priority Areas for Bike Lanes in York County," August 2008, produced by York County Planning Department.

(3) Medium Priority Bike Route on map "Priority Areas for Bike Lanes in York County," August 2008, produced by York County Planning Department.

5.3. Physical Roadway Capacity Strategies

5.3.1. 2009-2015 TIP Projects

A number of projects designed to increase roadway capacity along sections of CMP corridors have been identified previously, and are already programmed in the current RFATS Transportation Improvement Program. Following project construction, the RFATS CMP planning staff should include the project locations in areas considered for monitoring in the next round of CMP monitoring activities (see Section 6.5 of this report). CMP projects already in the TIP are listed in **Table 5-6**.

Table 5-6: CMP Projects in the RFATS 2009-2015 TIP

Ref #	Project Description	Timeframe	Cost Est.	Funding(1)
1.A	At Celanese Road and Mt Gallant Road: Add second SB LT lane and add WB RT lane – this is understood to be an existing CMAQ project (TIP). This project is identical to 5.A.	Short	$542,000	CMAQ
1.D	Develop improvements at Riverview Road and Riverchase Boulevard to improve flow (CMAQ, TIP). The RFATS 2004 CMS identified a new access road from Riverview to Paces River to help alleviate side street congestion on Riverchase Boulevard. Conduct study to evaluate needed turn lanes for the I-77 southbound off-ramp at Celanese Road consistent with proposed improvements at Riverview Road and Riverchase Boulevard.	Short	$1,270,000	CMAQ
4.B	Widen SC 72, Albright Road to 5 lanes between Black Street to Heckle Boulevard (TIP).	Short	$8,700,000	1997 PP and Federal match
4.C	Widen SC 72 from Heckle Boulevard (SC 901) to Rambo Road, south of Rawlsville Road, from 2 to 3 lanes (TIP). See Project 4.K also.	Short	$6,771,000	2003 PP
4.F	On Albright Road: Add capacity on NB and SB lanes of White Street (CMAQ, TIP).	Medium	$771,750	CMAQ
5.A	At Celanese Road and Mt Gallant Road: Add second SB LT lane and add WB RT lane – this is understood to be an existing CMAQ project (TIP). This project is identical to 1.A.	Short	See 1.A	See 1.A
5.D	Widen Mt. Gallant Road for 2.5 miles from Twin Lakes Road to SC 161, Celanese from 2 to 3 lanes (TIP).	Short	$4,971,000	2003 PP

Ref #	Project Description	Timeframe	Cost Est.	Funding[1]
5.E	RFATS 2004 CMS noted that the signal at Mt. Gallant and Eden Terrace was not actuated and did not include protected left-turn phases. Note a TIP project widens Eden Terrace through this intersection from 2 to 3 lanes from Bradley to Anderson Road and will include additional left-turn storage on both Mt. Gallant approaches (TIP, funded by the 2003 Pennies for Progress).	Short	N/A	2003 PP
6.B	Springhill Farm Road – construct dedicated right turn lane on Springhill Farm Road from Stateview Road to Carowinds Boulevard (CMAQ, TIP).	Short	$2,250,500	CMAQ
6.C	Widen Springhill Farm Road from 2 to 5 lanes from US 21 to SC 51 (TIP).	Short	$4,600,000	2003 PP
6.D	Widen SC 51 from 2 to 5 lanes from US 21 to NC State Line (TIP)	Short	$5,900,000	2003 PP
7.A	Goldhill Road / Steele Creek Road intersection improvement: This project is a traffic flow improvement effort involving the addition of turn lanes and the upgrading of the traffic signal controller. (TIP) – Same as Project 8.A.	Short	$1,375,000	CMAQ
8.A	Goldhill Road / Steele Creek Road intersection improvement: This project is a traffic flow improvement effort involving the addition of turn lanes and the upgrading of the traffic signal controller. (TIP) – same as Project 7.A.	Short	See 7.A	See 7.A
8.B	Steele Creek Road Expansion: Widen to 3 lanes between Gold Hill Road and Zoar Road.(TIP).	Short	$1,600,000	2003 PP
8.C	SC 160 / SC 21 intersection improvement: This project is a traffic flow improvement effort that will widen the Westbound Lane of SC 160 to include a turn lane with a straight right function. (CMAQ, TIP).	Short	$400,000	CMAQ
11.A	US 21 BYP Widening: Widen from two to five lane facility between Cel-River Road and Sutton Road. (TIP).	Short	$22,000,000	2003 PP
11.B	US 21 Bridge replacement over the Catawba River (TIP).	Short	$24,736,210	STP, ARRA[2]
14.A	Ebenezer Road Widening: Widen roadway from two lanes to three lanes between SC 161, Celanese Road, and Frank Gaston Boulevard (TIP).	Short	$2,016,000	2003 PP
17.A	Cel-River Road Widening: Widen roadway from two lanes to five lane facility between Cherry Road / US 21 and north of S-645 (TIP).	Short	$4,575,000	Developer Funded Project

Notes:

(1) PP – Pennies for Progress; CMAQ – Congestion Mitigation and Air Quality Improvement Program; ARRA – American Recovery and Reinvestment Act; DFP – Developer Funded Project

(2) Funded by STP ($12,900,000) and ARRA ($11,000,000 (Economic Stimulus Project) plus $836,210 (Pedestrian Enhancements))

5.4. RFATS CMP Priorities

The identification of CMP priorities represents the output of the selected performance measures listed in Section 3 (i.e., travel time surveys, volume-to-capacity ratios, travel transit conditions), as well as related studies and technical team input. All of these data sources provide operational and safety information that directly correlate with the reliability and efficiency of the existing transportation network as well as highlight emerging areas of congestion.

For example, by examining roadway congestion along the major corridors within the RFATS region and documenting the nature and extent of area congestion, provided useful information for identifying and prioritizing needed congestion mitigation projects and strategies. With this in mind, those roadway segments with the highest recurring congestion levels were identified as the most immediate needs; and therefore, are being recommended with a short-term (1 to 5 year) implementation schedule. It should be noted that areas and/or corridors with the potential for high growth (development activity), transit potential, and/or safety related concerns have also been identified as high priorities warranting a short term implementation schedule. Lastly, please note that projects previously identified during the 2004 Congestion Management Study that have yet to be implemented or receive funding are included as continuing project priorities as well. All of these projects are reflected in Table 5-7.

Table 5-7: Proposed Priority CMP Projects for Next Five Years

Ref #	Corridor	Project Description	Type
1.B	Celanese Road, SC 161	Other signal geometric and phasing improvements on Celanese Road as recommended by CRH December 2008 CMAQ Signal Timing Study; additionally, particular attention should be devoted to evaluating needed improvements at the intersection of India Hook / Celanese Road.	Geometric / Signal
1.E	Celanese Road, SC 161	Conduct an Access Management review along the SC 161 corridor to identify opportunities to improve access management.	Access Man.
2.A	Cherry Road, US 21	Signal geometric and phasing improvements on Cherry Road as recommended by CRH December 2008 CMAQ Signal Timing Study: • Construct a southbound left-turn lane on Dorchester Road.	Geometric / Signal
2.D	Cherry Road, US 21	Continue planning for the BRT line on Cherry Road (US 21) from downtown Rock Hill to the I-485 light rail station.	Transit
2.E	Cherry Road, US 21	Seek opportunities to incorporate access management strategies into the planning, design and approval processes for redevelopment that may occur in the northern section of Cherry Road from Cherry Park to the Catawba River and in implementing recommendations from the College Town Plan in the vicinity of Winthrop University.	Access Man.
3.B	Dave Lyle Boulevard, SC 122	At I-77 Southbound Ramp on Dave Lyle Boulevard, add a second southbound right-turn lane and develop side street capacity/operation improvements at Chamberside – This is understood to be an upcoming CMAQ funded project	Geometric / Signal
5.B	Mt. Gallant Road	Conduct Safety Audit along the Mt. Gallant Road corridor between Redwood Drive and India Hook Road	Safety
6.A	Carowinds Boulevard	The westbound left turning movement is heavy from Carowinds Boulevard to Pleasant Road. Dual left is not possible because there is only one receiving lane on Pleasant Road. Consider lengthening the left turn lane while retaining a physical median for access management purposes.	Geometric / Signal

Ref #	Corridor	Project Description	Type
6.E	Carowinds Boulevard	Access management measures on Carowinds Boulevard between Pleasant Road and SC 51 identified in the RFATS 2004 CMS: • Raised concrete medians to help create strategic, shared access points to lesson conflicting turn movements and help general traffic flow. • Shared access between parcels limiting the number of curb cuts throughout. • Implementation of frontage roads that will provide additional access to the business once the medians are constructed. • Easy to read directional signage. • Implementation of new traffic patterns within the Plaza Fiesta, Comfort Inn and Carowinds area. • Removal of one-way streets and split entrances to the business location to provide a more traditional traffic pattern. This project has received funding from the South Carolina State Tourism Commission and is pending implementation	Access Man.
8.H	SC 160	Conduct an Access Management review along SC 160, Tom Hall Road, in Fort Mill to identify opportunities to improve access management.	Access Man.
8.I	SC 160	Consider realignment of I-77 SB exit ramp onto SC Highway 160 to line up with Market Street (previously Sutton Road)	Geometric / Signal
8.J	SC 160	Both ends of Fairway Drive need to have turn lanes installed to accommodate conflicting turn movements and reduce backups. Also, site distance should be improved in both directions along with turn lanes on the intersecting streets as well.	Geometric / Signal
8.K	SC 160	Consider installation of right bound turn lane from Clebourne St onto N. White Street as well as re-configuration of N. White, Clebourne, and Tom Hall Streets to help accommodate traffic flows in and around downtown Fort Mill. These improvements would need to coordinate to allow for a more free –flow traffic movement, especially during railroad operations that block Main Street	Geometric / Signal
11.E	US 21 BYP	Continue planning for the BRT line on US 21 BYP from downtown Rock Hill to the I-485 light rail station	Transit
13.A	SC 901, Heckle Boulevard	Conduct Safety Audit at the intersection of Heckle Boulevard and Old York Road, as well as along Heckle Boulevard north and south of Herlong Avenue. This project is currently being undertaken by the South Carolina Department of Transportation	Safety
19.B	Springfield Pkwy	Old Nations Road / Springfield Parkway – consider dual left turn lanes into the school complex; also, a dedicated right turn is also advisable	Geometric / Signal
2004 CMS	I-77 / Celanese Road	The southbound ramp at Exit 82C is heavy during pm peak period. Redesign of off-ramp intersection to allow 2 or 3 right turn lanes in addition to a channelized free flow lane is recommended	Geometric / Signal
2004 CMS	Eden Terrace / Mount Gallant Road	Due to congestion during peak periods at the signalized intersection of two arterial roadways, additional left turn storage improvements are recommended for the Eden Terrance portion of this intersection.	Geometric / Signal
Policy 1		If they have not done so already municipalities and other governmental agencies should adopt consistent Access Management standards that, at a minimum, meet the requirements of the latest SCDOT Access and Roadside Management Standards (ARMS), and subsequent updates.	

Ref #	Corridor	Project Description	Type
Policy 2		It is recommended that RFATS planning staff continue work with their existing partners in the Rideshare Program, including Charlotte Area Transit System and SCDOT to improve the effectiveness of the existing program and park-and-ride facilities and to seek opportunities to expand the existing program.	
Policy 3		Alternative Work Arrangements: If not already in place, the formation of a Task Force should be considered to guide efforts to implement alternative work time strategies, consisting of representatives of local government, the Chamber of Commerce, major public and private employers in the area, and other business organizations.	
Policy 4		During the next Comprehensive Land Use Plan update, areas that would support Transit Oriented Development and Mixed Use Development should be identified and included in the adopted plan.	

6. EVALUATION AND ASSESSMENT

6.1. The Congestion Management Process

6.1.1. Metropolitan Planning Process

As the congestion management process is intended to be an integral part of the metropolitan planning process, active and ongoing monitoring of implemented strategies is an essential component to continuously improving transportation system management and operations. With this in mind, the 2010 CMP update has involved the identification of appropriate performance measures for the RFATS Area as well as collected baseline data that will be used in subsequent years to evaluate progress achieved, and to outline expected future conditions on the most heavily traveled corridors in the RFATS region.

It is important to note that this information will also serve as a critical data source for completing the periodic updating to the RFATS' Long Range Transportation Plan (LRTP). As the LRTP (within the broader metropolitan planning process), is the central planning document that lists transportation system needs and priorities for a particular area, the importance of continuously monitoring current congestion levels as well as emerging patterns of congestion is fundamental to sound, long term transportation decision-making.

6.2. Monitoring CMP Impacts

6.2.1. Frequency of Monitoring

As discussed in Section 3 of this report, the principal performance measures recommended for the RFATS CMP are V/C ratios from the Metrolina Travel Demand Model (TDM) and Travel Time Surveys. Additionally, Transit Travel Condition measures are also recommended for on-going monitoring, though it must be noted that given the focused nature of the existing transit program (i.e., two express bus routes providing weekday service from the Rock Hill Urbanized Area to Charlotte), that the importance of these measures will tend to increase as additional transit options / routes are introduced over time.

The Metrolina model is typically updated and recalibrated in connection with the periodic update to the RFATS LRTP. Since RFATS lies within an air quality non-attainment area, the LRTP must be updated every four years. However, since the CMP is a continuous planning effort, it is recommended that the latest output from the model be incorporated into on-going CMP monitoring activities – so that this information can be used for project identification, selection, and prioritization that occurs between LRTP updates.

6.2.2. Selection of CMP Corridors for Monitoring

The V/C ratios from the Metrolina model should be monitored for all CMP corridors that are covered by the model's highway network. These currently include all CMP corridors, except:

- Corridor 20: Dam Road;

- Corridor 21: Fort Mill Parkway; and
- Corridor 22: Fairway Drive (Fort Mill).

Due to the cost and time required to conduct travel time surveys it is recommended that a subset of CMP corridors be surveyed at any one time. Corridors should be selected based on the following criteria:

- Funds available for surveys – to determine the maximum number of corridors
- Most congested corridors, as determined by peak period V/C ratios from the latest Metrolina Model base year
- Corridors where improvement projects or programs have recently been implemented

6.2.3. Monitoring Procedures

Metrolina Model V/C Ratios - For transportation planning purposes, the RFATS road network is modeled by the Metrolina Model, developed for NCDOT. This model covers the entire Charlotte urban area, as well as surrounding areas. The model is a source of V/C ratios for the model's base year and for each of the model's future forecast years. Capacities are calculated for **Level of Service E**[14] and are calculated for each of the four time periods in the model.

Monitoring of CMP corridors using Metrolina Model V/C ratios involves the following:

- GIS map of CMP corridors
- Metrolina model assignment output files
- TransCad software

Within the TransCad software environment the CMP corridor map is overlaid on the model network to capture model output specific to each corridor. These data may then be exported to a spreadsheet application for purposes of preparing summaries by corridor.

Travel Time Surveys - Conducting travel time surveys is a common and routine activity in connection with transportation planning and traffic management. The procedures used to collect travel time data for the 2010 CMP Update were described in Section 3

Depending on RFATS staffing and budget considerations, travel time surveys may be undertaken by RFATS staff, by their consultants or by firms specializing in data collection activities, such as traffic counts and travel time surveys.

[14] Metrolina Model Guide, Section 3.5.3, prepared for NCDOT, December 14, 2009. Version 1.0

6.2.4 Monitoring of Operations & Maintenance Strategies

In addition to the quantifiable performance measures outlined above, it is also recommended that staff actively monitor (annual review) the implementation status of recommended O&M strategies such as geometric / signal improvements, access management standards, especially in high growth areas; transportation demand management (TDM) strategies, such as rideshare initiatives and BRT service planning – as well as continue coordination with the South Carolina Department of Transportation regarding the completion of road safety audits at locations with suspected safety issues.

This oversight review should be reflected as a standing item for the RFATS Study Team and incorporated into their evaluation of recommended projects (irrespective of funding source), for consistency with the recommendations developed with this CMP update. This action is designed to document implemented strategies and will result in an annual CMP Progress Report.

6.2.5 Integration into the overall RFATS Planning Process

The integration of the CMP into the overall RFATS planning process began with an evaluation of the existing transportation network and system performance within the RFATS Area. This was accomplished through a combination of input from the RFATS Technical Team and by utilizing the selected congestion management performance measures outlined in Section 3 (V/C Ratios from the Metrolina Regional Travel Demand Model, Travel Time Surveys, and Transit Travel Condition Measures).

The output of this process included the identification of the most heavily congested corridors; locations with potential safety problems; as well as a recommended project priority list. This list, as illustrated in Section 5, is broken down into three implementation periods on a short (1-5 years), intermediate (6-10 years), and longer-term basis (10+ years). As the 2010 CMP has generated a number of recommended congestion management projects, priorities and policies – this information will be incorporated during the development of an unfunded needs list during the next LRTP update. And, as the RFATS Study Area is a designated non-attainment area for ground level ozone, it should be noted that Congestion Mitigation & Air Quality Improvement Funding (CMAQ) is available for implementing our CMP priority projects. Also, dependent on emerging circumstances and trends, RFATS may evaluate the current statewide ranking criteria to assess whether modifications may be needed to meet local CMP needs.

Additionally, it is important to emphasize that as the RFATS Study Area is a designated non-attainment area for ground level ozone, all federally funded projects that seek to add SOV capacity will need to go through a CMP evaluation / documentation process **(as outlined in appendix E)** to determine if additional SOV capacity is the appropriate solution. Additionally, please note that non-federally funded projects for which a federal decision document may be requested (i.e., NEPA, etc.), are strongly encouraged to undergo a CMP evaluation / documentation review as well – so as to avoid potential disruption to the implementation of a project should federal funding become part of a project's funding source at a later date.

7. SUBAREA TRAFFIC ANALYSIS AND THOROUGHFARE PLANNING

This section provides results and recommendations from transportation planning studies of five subareas defined and evaluated during the 2010 CMP. A discussion of the development of the subarea locations and limits, along with anticipated issues and transportation system management and improvements needs are presented.

7.1. Background

The RFATS CMP process was initially documented in 2004. The 2004 study report included Chapter 7, "Next Steps for RFATS CMS," which identified elements of focus for future phases of the CMP. These elements included identification of potential routes to consider for inclusion in the congestion monitoring network (CMN).

In addition to identification of core CMN routes, the 2004 study identified "developing CMN routes", routes that are expected to become increasingly important for regional travel as growth and development within the RFATS region continues into the future. The developing routes are of particular importance to RFATS as they are predominantly located within regions anticipated to experience accelerated growth and development pressures. The areas expected to experience the highest levels of development were mapped as "Collector Planning Areas", and were documented for future emphasis in transportation planning and corridor protection efforts.

This report continues the process initiated in 2004. A reassessment of the collector planning areas is presented herein. Studies conducted during the CMP update process for preservation of existing corridors and identification of future capacity needs are discussed and mapped.

7.1.1. Origins and Growth

The City of Rock Hill was founded adjacent to what is now the Norfolk Southern (NS) Railroad, and has grown from the access to commerce that the railroad has historically provided. The city's transportation system originally developed around textile commerce activities, which relied upon the supply of goods to and from the rail line. The central city grid system, while bisected by the railroad, is the hub of highway crossroads US Route 21, SC Route 21, SC Route 5, SC Route 122, and SC Route 72. These facilities connect the downtown area with expanding suburban and rural communities within the RFATS area. Accelerated development growth has historically occurred north of the downtown area. York County's population is expected to continue to increase at an accelerated rate. Population forecasts for the County are as follows:

Year	Population
2005	203,054
2025	287,465
2035	336,768

The municipalities of Fort Mill and Tega Cay are located north of Rock Hill, and are separated from Rock Hill by Lake Wylie and the Catawba River. Transportation crossings of the Catawba

River between Rock Hill and locations north are limited to Interstate 77, US Route 21 and SC Route 49. Accelerated development growth has also occurred north of the Catawba River, partly due to the accessibility and proximity of these areas to Charlotte, North Carolina. The RFATS area contributes a significant labor force to employment centers in the Charlotte metropolitan area. Commuter trips between RFATS and Charlotte contribute to peak hour congestion, especially along I-77 and highways that interchange with I-77.

York County's Comprehensive Plan notes the area's development growth history has been largely unmanaged and has resulted in sprawl. Low density residential development has occurred sporadically in rural locations. Increased densities and smaller single family lot sizes are found mostly in urban areas that provide water and sewer utilities. The availability of sewer service allows for smaller lot sizes by eliminating drain field needs. Unmanaged development without regulation for interconnectivity has resulted in linear "strip development" patterns.

7.1.2. Managing Development

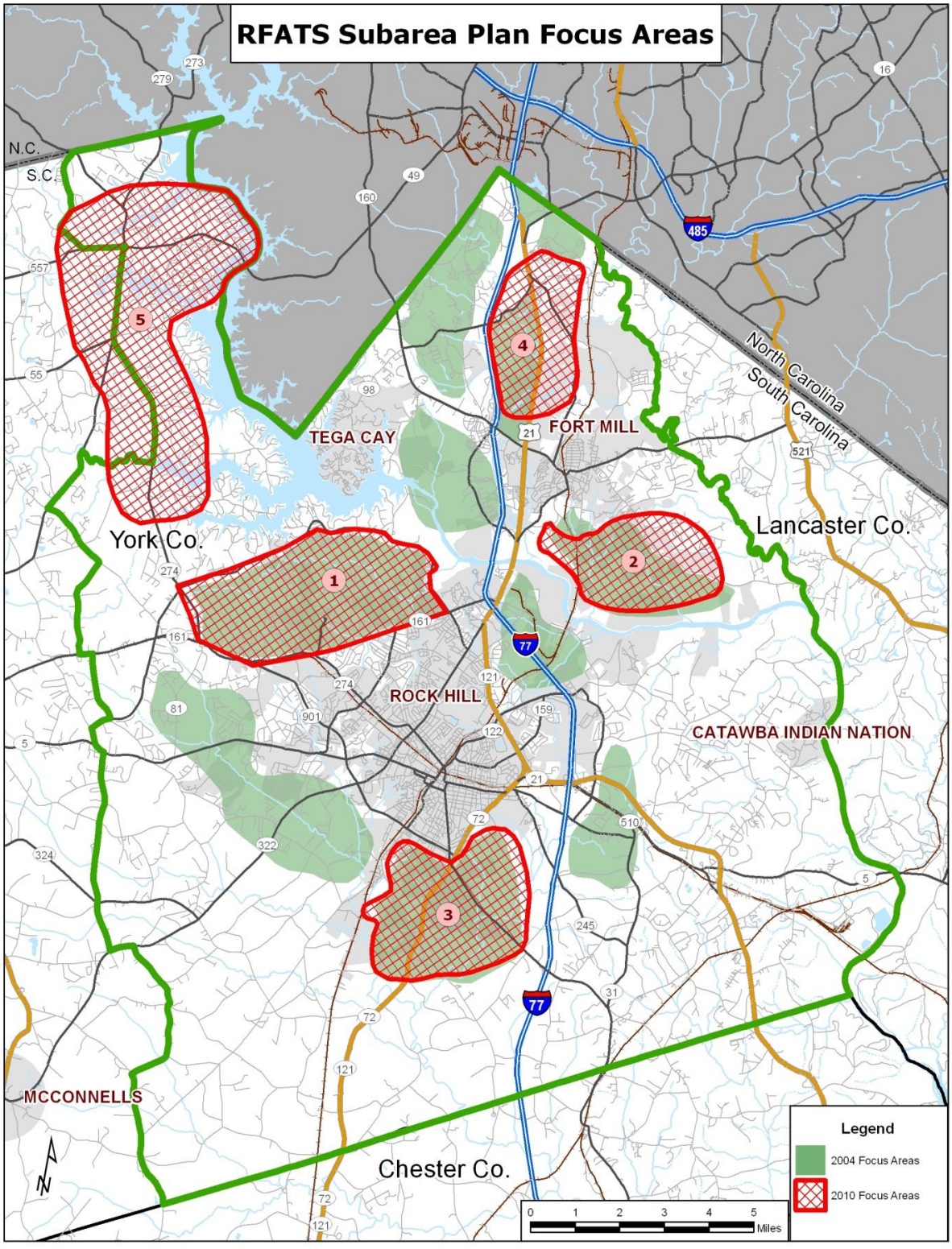
In recent years SCDOT and local municipalities have improved development regulations and implemented more stringent requirements for interconnection of streets and access. Traffic impact studies are required for new development proposals, which assist reviewers in making sound decisions for location and spacing of access points. SCDOT has also issued an updated "Access and Roadside Management Standards" (ARMS) manual with increased restrictions for driveway spacing and intersection design elements.

Planning efforts by all of the municipalities in RFATS have included a concentration on improving and preserving the transportation system through better planning for development growth. Controlling development, planning for pedestrian and bicycle facilities, transportation demand management efforts and transit planning have all been emphasized in recent planning activities.

7.2. Subarea Boundaries and Key Issues

During the CMP Update's first meeting of the Technical Team, a review of subareas defined in the 2004 CMP was conducted. The Team reviewed the area boundaries and locations, and adjusted the previous areas. The selections were primarily based on the team's local knowledge of development potential and traffic conditions within the RFATS region. Areas in Fort Mill west of Interstate 77 were eliminated due to their current level of development and relatively low potential for future growth. Subareas defined in the 2004 CMP along the Interstate 77 corridor in Rock Hill were evaluated in a separate study, and were therefore not included in this evaluation. An area west/southwest of SC 901 was also eliminated due to its rural nature and low potential for future development. **Figure 7-1** illustrates the locations and boundaries of the subareas evaluated in this study, as well as the areas presented in the previous CMP.

Figure 7-1: Subarea Boundaries



7.2.1. Preserving and Improving Subarea Roadways

Preserving Arterial Rights of Way - RFATS communities should consider methods to secure preservation of highway rights of way to protect them from development pressures. Existing two lane facilities may need to be widened to provide left turn lanes and/or right turn lanes as new developments occur. Some of these facilities may have no documented right of way or insufficient right of way to accommodate such widenings. SCDOT typically requires a 66-foot right of way along two lane arterial roadways. Where a 66-foot right of way is not currently recorded by SCDOT documentation, future development proposals should include provisions for a minimum 66-foot right of way width.

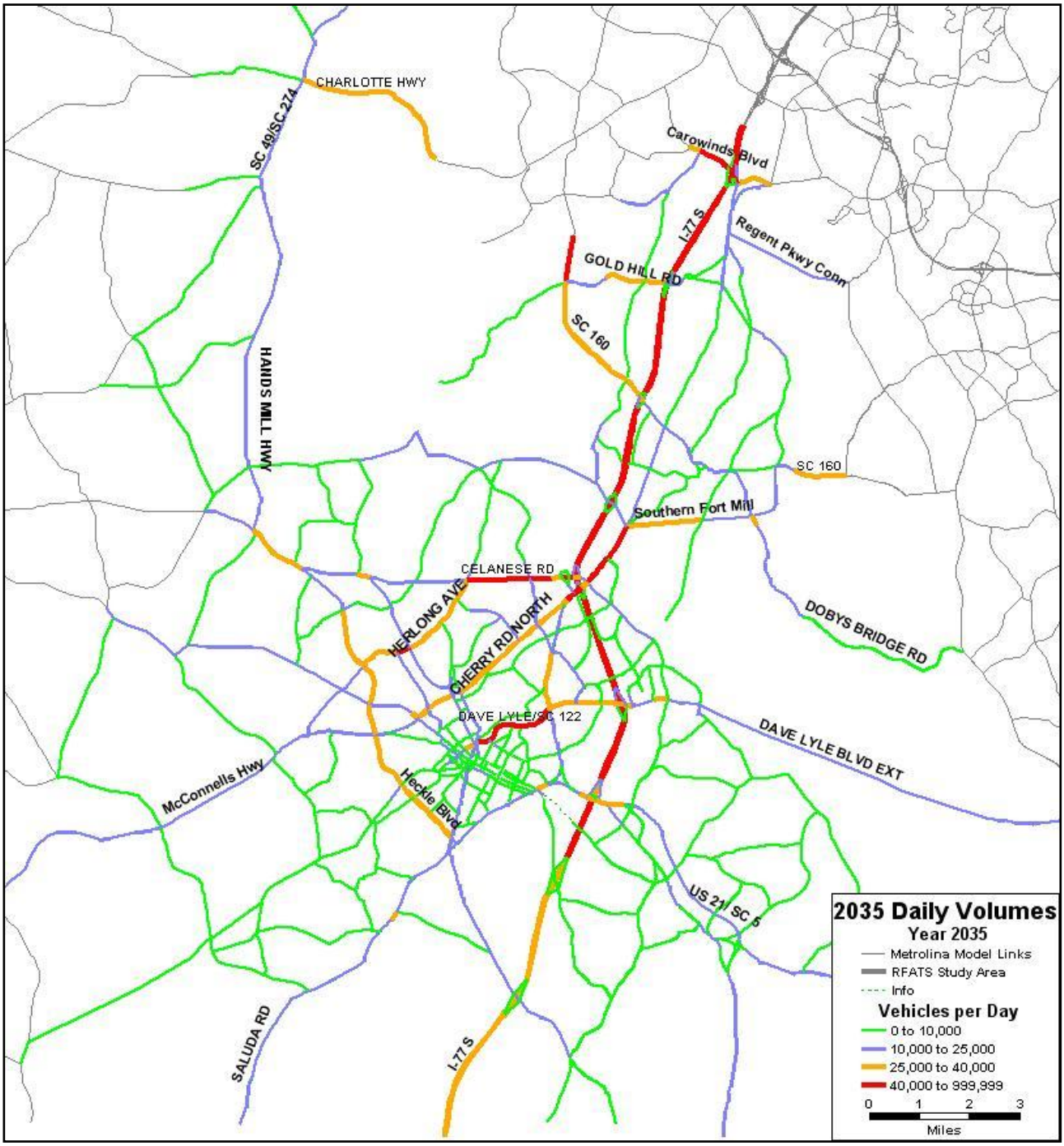
Multi-laned facilities will need increased rights of way. Minimum SCDOT right of way for multi-lane facilities is needed to accommodate one 14-foot shared use lane in each direction, one 12-foot vehicular lane in each direction, and a 15-foot center median two-way left turn lane. 2-foot curb and gutter and 5-foot sidewalk should be planned for on both sides of the roadway. A minimum right of way width of 90 feet is needed to accommodate a multi-lane roadway. 100 feet should be preserved within 500 feet of major intersections for double left turn and/or extra right turn lanes.

A review of the Metrolina Regional Planning Model was conducted to evaluate capacity needs of existing arterials within the subareas. **Figure 7-2** illustrates year 2035 average daily traffic projections estimated by the model within the RFATS area. Facilities shown in green are expected to be travelled by less than 10,000 vehicles per day (vpd), a volume that can be accommodated by a 2-lane facility. Facilities shown in blue are expected to be travelled by 10,000 to 25,000 vpd, and would need 4 lanes to operate at an acceptable level of service. Facilities shown in red would need at least 3 lanes in each direction.

Preserving Intersection Rights of Way - Intersection locations need concentrated attention, as arterial capacity and congestion are most greatly controlled by the capacity of the intersections along the facility. Intersection improvement plans should continue to be implemented to add auxiliary lanes for capacity improvements. Driveways should not be permitted near major intersection locations. SCDOT ARMS manual[15] presents minimum distances between driveways and intersections. For 45 mph facilities, driveways should not be permitted closer than 325 feet. Existing driveways closer than the SCDOT required spacing should be eliminated as part of intersection improvement projects. Driveways close to intersections often block traffic, creating queues that back into the intersection, reducing capacity and creating unsafe conditions.

[15] SCDOT Access and Roadside Management Standards, 2008 Edition, Figure 3-7

Figure 7-2: Projected 2035 RFATS Daily Traffic Volumes



7.2.2. Maintaining and Improving Arterial Flow

Access Management - Access management strategies are needed to minimize disruptions to arterial flow between signalized intersection locations. Coordinated traffic signal systems move platoons or groups of vehicles between signalized intersections. The number of unsignalized streets and driveways between signals, and the volume of traffic accessing these unsignalized locations, are major contributors to "platoon dispersion", breaking up the organization of vehicles, and degrading the efficiency of the arterial system. Access management strategies include, but are not limited to, the following:

- Limit new access driveways to right in/right out only, where possible
- Require new developments to utilize existing side roads for access
- Encourage consolidation of parcels and driveways
- Encourage interconnection of property access to allow for circulation between businesses
- Install new medians to convert full access points to right in/right out

Preserving Operations and Arterial Progression - Stewardship of the arterial system will be necessary to maintain or improve current levels of congestion. Signalized intersections and unsignalized access to the arterial system disrupt the major traffic flows. In many cases, pressure from citizen complaints and/or political pressure result in decisions to allow new accesses or changes in existing access that are not prudent. Following are typical requests that can have a negative impact on arterial traffic flow and congestion:

- Installation of new traffic signals
- Installation of new driveway access
- Increasing green time to side streets
- Adding protected left turn phases (main road and/or side street)

The volume of traffic on the main line arterial normally exceeds the volume of traffic on the intersecting street by a significant amount. The types of access changes noted above may improve side street conditions, but they are done so at the expense of the higher volume main line, and result in overall increases in delay and congestion. Engineering studies that show access changes are warranted should be required prior to approval.

7.3. Subarea 1 – Mt. Gallant

7.3.1. Mt. Gallant Subarea Features

Subarea 1 is bounded by SC Route 161 (Old York Road and Celanese Road) to the south, SC Route 274 (Hands Mill Road) to the west, and S-195 (Mt. Gallant Road) to the north and east. SC Route 161 is the most heavily travelled arterial corridor in the RFATS area, and is the only 7-lane arterial facility in RFATS. The SC 161 corridor is mainly developed with small to medium sized commercial businesses. The remainder of Subarea 1 is generally developed with single family and multi-family residential uses. The Rock Hill-York County Airport is also located within Subarea 1. Undeveloped parcels within the area have exhibited accelerated residential development in recent years, and the area is anticipated to continue to develop rapidly with new residential projects in the near future. Access to Lake Wylie and proximity to SC 161 and I-77 are catalysts to development in this area, attracting developers and home buyers.

7.3.2. Mt. Gallant Subarea System Improvements

As development occurs within the subarea, system improvements and new transportation facilities need to be pursued to maintain moderate traffic volumes. New facilities should be planned with new developments to disperse generated traffic that will otherwise be loaded onto existing facilities. Introducing new competing routes that provide for through traffic will reduce spacing between arterial roadways, providing options for travel and reducing overall traffic volumes on existing arterial facilities.

Opportunities to alleviate existing congestion and prevent future congestion include the following proposals:

- Mt. Gallant Road - The 2035 Metrolina model indicates that ADT volumes will exceed capacity for a two/three lane facility near SC Route 161, and between Museum
  Road and India Hook Road. The section of Mt. Gallant Road from India Hook Road to near SC Route 161 is expected to remain within capacity for a two lane facility, but could experience additional traffic volumes if the proposed north Catawba River Bridge is not funded. Right of way preservation (90 feet) should therefore be secured along Mt. Gallant Road from SC Route 161 to west of Museum Road to accommodate the potential for a four-lane divided road with sidewalks.

- Control future access drives to new developments; promote connectivity within developments to reduce travel on the arterial system.

- A significant amount of undeveloped property exists in the northwest portion of Subarea 1. Future development of the parcels in this area should include consideration for new collector roadways in both east/west and north/south configuration.

- Promote parcel consolidation with redevelopment. Consolidate/eliminate driveways with redevelopment. Promote reduction of left turn locations. Install medians to

restrict left turns from future developments. Promote connectivity with redevelopment to improve/provide access without travel on arterial roadways.

7.3.3. Mt. Gallant Existing Thoroughfare Preservation

Preserve rights of way along major arterial routes for future capacity/widening improvements. Additional right of way width should be preserved at intersection locations to accommodate additional auxiliary (left/right turn) lane needs.

As shown in **Figure 7-3**, right of way preservation should be planned along the following facilities within the subarea:

- SC Route 161 100 feet
- Mt. Gallant Road 90 feet
- Museum Road 66 feet
- Twin Lakes Road 66 feet
- India Hook Road 90 feet

Maintaining safe and efficient intersections is a key element in congestion management. Additional right of way widths area needed at intersections to plan for future auxiliary lane needs. The SCDOT Access and Roadside Management Standards states that driveways should not be allowed closer than 325 feet from intersections on 45 mph facilities. Efforts should be made to eliminate driveways closer than 325 feet to improve traffic flow and safety at intersection locations. Intersection right of way preservation efforts should be implemented at the following intersection locations within the subarea:

- SC 161 and SC 274
- SC 161 and Pennington Road
- SC 161 and Museum Road
- SC 161 and Twin Lakes Road
- SC 161 and India Hook Road
- SC 161 and Mt. Gallant Road
- SC 161 and Riverview Road
- SC 161 and US 21
- Mt. Gallant and SC 274
- Mt. Gallant and Museum Road

- Mt. Gallant and Homestead Road
- Mt. Gallant and Twin Lakes Road
- Mt. Gallant and India Hook Road

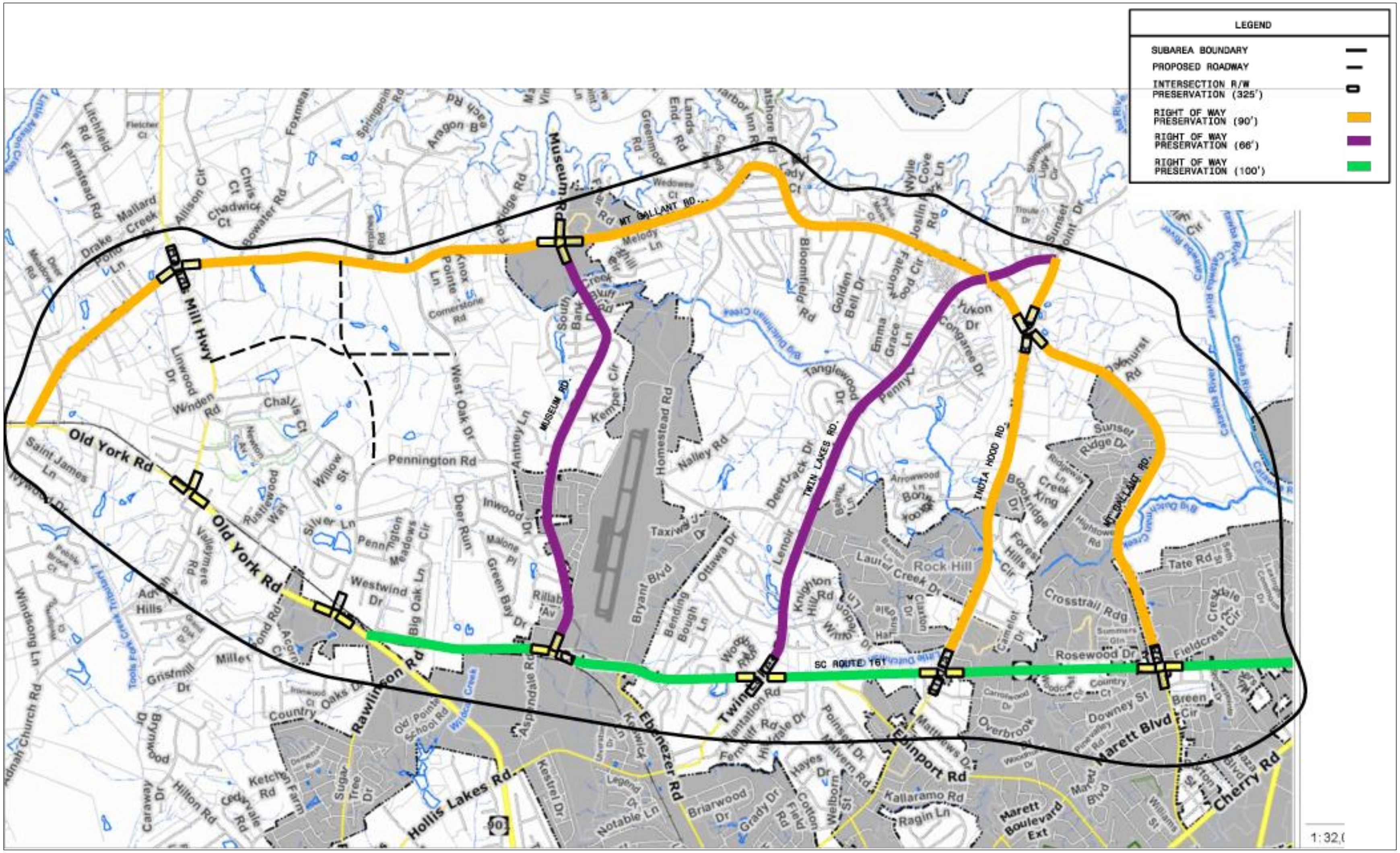
7.4. Subarea 2 – South Fort Mill

7.4.1. South Fort Mill Subarea Features

Subarea 2 is bounded by the Catawba River to the south, Spratt Street to the west, Williams Road to the north, and Sugar Creek to the east. Subarea 2 is generally developed with single family and multi-family residential uses. A section of the proposed Fort Mill Southern Bypass is planned to be located in this area, which has exhibited accelerated development of residential land uses in recent years and is anticipated to continue to develop rapidly with new residential projects in the near future. New schools are also proposed along the proposed Southern Bypass, including a high school and a middle school. The opening of these schools will affect traffic volumes and patterns in the area.

Much of this subarea is either residential or undeveloped (especially along the Catawba River); numerous areas exist for future development south of Dobys Bridge Road and the future Fort Mill Southern Bypass. All major corridors are two lane roads. Most of the current congestion exists along Dobys Bridge Road.

Figure 7-3: Mt. Gallant Subarea



7.4.2. South Fort Mill Subarea System Improvements

As development occurs within the subarea, system improvements and new transportation facilities need to be pursued to maintain moderate traffic volumes. New facilities should be planned with new developments to disperse generated traffic that will otherwise be loaded onto existing facilities. Introducing new competing routes that provide for through traffic will reduce spacing between arterial roadways, providing options for travel and reducing overall traffic volumes on existing arterial facilities.

Opportunities to alleviate existing congestion and prevent future congestion include the following proposals:

- Consider widening Dobys Bridge Road to two lanes each way, with a shared left turn lane and sidewalks
- Consider widening future Fort Mill Southern Bypass to two lanes each way, with a shared left turn lane and sidewalks
- Future development of properties near the Catawba River should include consideration for a new east/west alignment (Banks St./Dobys Bridge Conn.) through undeveloped areas north of the Catawba River
- Extend Whites Road to the Banks St./Dobys Bridge Connector
- Consider extension of Holbrook Road to Dobys Bridge Road
- Control future access drives along Dobys Bridge Road and the future Fort Mill Southern Bypass as development occurs; promote connectivity with development to improve/provide access without travel on major corridors
- Promote reduction of left turn locations. Install medians to restrict left turns from future developments

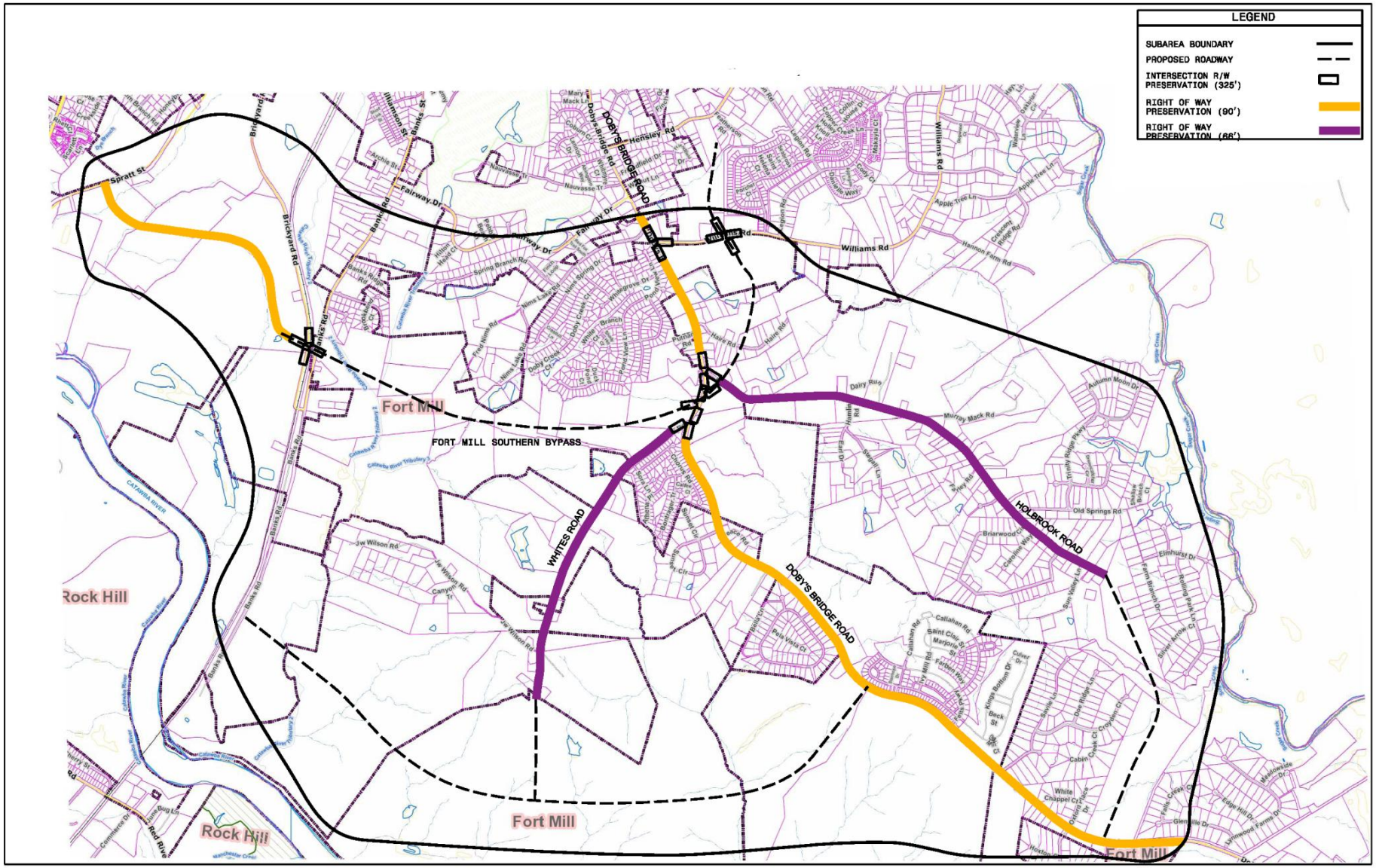
7.4.3. South Fort Mill Existing Thoroughfare Preservation

Preserve rights of way along major arterial routes for future capacity/widening improvements. Additional right of way width should be preserved at intersection locations to accommodate additional auxiliary (left/right turn) lane needs.

As shown in **Figure 7-4**, right of way preservation should be planned along the following facilities within the subarea:

- Dobys Bridge Road 90 feet
- Future Fort Mill Southern Bypass 90 feet
- Holbrook Road 66 feet
- Whites Road 66 feet

Figure 7-4: South Fort Mill Subarea



Intersection right of way preservation should be planned at the following intersection locations within the subarea:

- Dobys Bridge Road and Williams Road
- Dobys Bridge Road and Holbrook Road
- Dobys Bridge Road and Whites Road with future Fort Mill Southern Bypass

7.5. Subarea 3 – South Pointe

7.5.1. South Pointe Subarea Features

Subarea 3 is bounded by Ogden / Vernsdale Roads to the west, SC 91/SC 72 to the north, and I-77 to the east. Subarea 3 is generally developed with mixed uses, including residential development in the western section, with industrial development to the east near I-77. A large portion of industrially zoned land near I-77 remains undeveloped. This area has exhibited accelerated development of residential land uses in recent years since completion of South Pointe High School, and is anticipated to continue to develop rapidly with new residential projects in the near future. A separate study was conducted in 2007 to evaluate traffic conditions and transportation system needs in the vicinity of South Pointe High School due to the introduction of new school traffic to the area as well as anticipated development growth. The high school study recommendations were reviewed and utilized in development of this study.

This subarea is mostly residential, with industrial sites and undeveloped areas as well. New facilities should be planned to provide access to the undeveloped areas and alleviate future congestion on existing major corridors.

7.5.2. South Pointe Subarea System Improvements

As development occurs within the subarea, system improvements and new transportation facilities need to be pursued to maintain moderate traffic volumes. New facilities should be planned with new developments to disperse generated traffic that will otherwise be loaded onto existing facilities. Introducing new competing routes that provide for through traffic will reduce spacing between arterial roadways, providing options for travel and reducing overall traffic volumes on existing arterial facilities. The capacity and spacing of these new routes will be dependent on the types of developments that occur in the area and their trip generating characteristics. Where a potential route is displayed, two or more evenly spaced parallel routes may be needed to provide capacity and distribute traffic.

Opportunities to alleviate existing congestion and prevent future congestion include the following proposals:

- Control future access drives along SC 72, Mt. Holly Road and Oakdale Road as development occurs; promote connectivity with development to improve/provide access without travel on major corridors

- Consider development community funded/constructed east/west facility to access undeveloped areas from Mt. Holly Road to Porter Road
- Consider development community funded/constructed north/south facility to access undeveloped areas from Albright Road to Long Meadow Road
- Improve intersection of Oakdale Road with SC 72
- Improve intersections of Harper Gault Road with Oakdale Road and with SC 72
- Promote parcel consolidation with development. Consolidate/eliminate driveways with development and redevelopment
- Promote reduction of left turn locations. Install medians to restrict left turns from future developments

7.5.3. South Pointe Existing Thoroughfare Preservation

Preserve rights of way along major arterial routes for future capacity/widening improvements. As shown in **Figure 7-5**, additional right of way width should be preserved at intersection locations to accommodate additional auxiliary (left/right turn) lane needs.

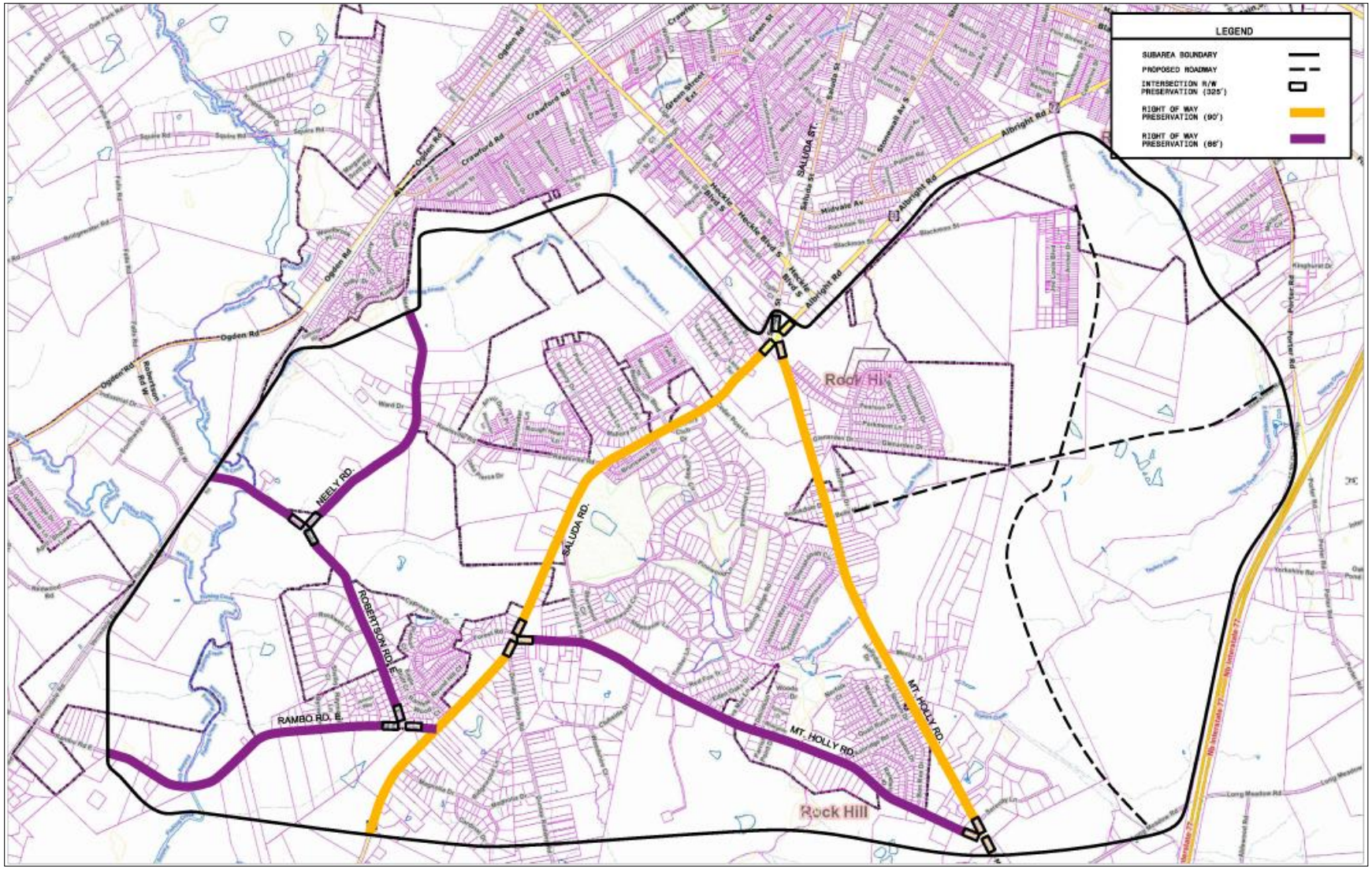
Right of way preservation should be planned along the following facilities within the subarea:

- SC 72 (Saluda Road) 90 feet
- Mt. Holly Road (SC 901) 90 feet
- Oakdale Road 66 feet
- Robertson Road 66 feet
- Neely Road 66 feet
- Robertson Road 66 feet
- Rambo Road 66 feet

Intersection right of way preservation should be planned at the following intersection locations within the subarea:

- SC 72 and Mt. Holly Road
- SC 72 and Oakdale Road
- Mt. Holly Road and Oakdale Road
- Neely Road and Robertson Road
- Robertson Road and Rambo Road

Figure 7-5: South Pointe Subarea



7.6. Subarea 4 – North Fort Mill

7.6.1. North Fort Mill Subarea Features

Subarea 4 is located to the north of the Town of Fort Mill. The subarea is bounded by Interstate 77 to the west, Regent Parkway to the north, and a NS rail line to the east. This area is generally developed with single family and multi-family residential uses. Subarea 4 also houses a minor league baseball stadium. This area encompasses a portion of the Anne Close Springs Greenway. The recent completion of Springfield Parkway has improved access to this area. Alternate proposed hospital sites are currently being planned within and near this subarea. Subarea 4 includes land areas that are part of a development agreement between the Town of Fort Mill and Clear Springs, which will permit the construction of up to 1,705 residential units, and 2,112,200 SF of commercial, office and retail space.

Subarea 4 encompasses a portion of the proposed Bus Rapid Transit route recommended in the Rock Hill-York County-Charlotte Rapid Transit Study (RYC). Details from the RYC are also noted in Technical Memorandum 1, Existing Multimodal System Conditions.

7.6.2. North Fort Mill Subarea System Improvements

As development occurs within the subarea, system improvements and new transportation facilities need to be pursued to maintain moderate traffic volumes. New facilities should be planned with new developments to disperse generated traffic that will otherwise be loaded onto existing facilities. Introducing new competing routes that provide for through traffic will reduce spacing between arterial roadways, providing options for travel and reducing overall traffic volumes on existing arterial facilities.

Opportunities to alleviate existing congestion and prevent future congestion include the following proposals:

- Widen US 21 to a multi-lane facility (2009-2015 TIP project)
- Control future access drives along US 21 and Springfield Parkway as development occurs; promote connectivity with development to improve/provide access without travel on major corridors
- Improve interchange at I-77 and Gold Hill Road (Exit 88)
- Consider a new interchange at I-77 just north of Coltharp Road to provide for future development parallel to I-77 between Highway 160 and Gold Hill Road
- Consider a new facility extending from US 21 (connecting the proposed interchange at I-77) to SC 160 near Len Patterson Road
- Improve triangular intersections of US 21 with Gold Hill Road and with Old Nation Road

- Promote parcel consolidation with development. Consolidate/eliminate driveways with development and redevelopment
- Promote reduction of left turn locations. Install medians to restrict left turns from future developments
- Continue Bus Rapid Transit (BRT) planning activities.

7.6.3. North Fort Mill Existing Thoroughfare Preservation

Preserve rights of way along major arterial routes for future capacity/widening improvements. As shown in **Figure 7-6**, additional right of way width should be preserved at intersection locations to accommodate additional auxiliary (left/right turn) lane needs.

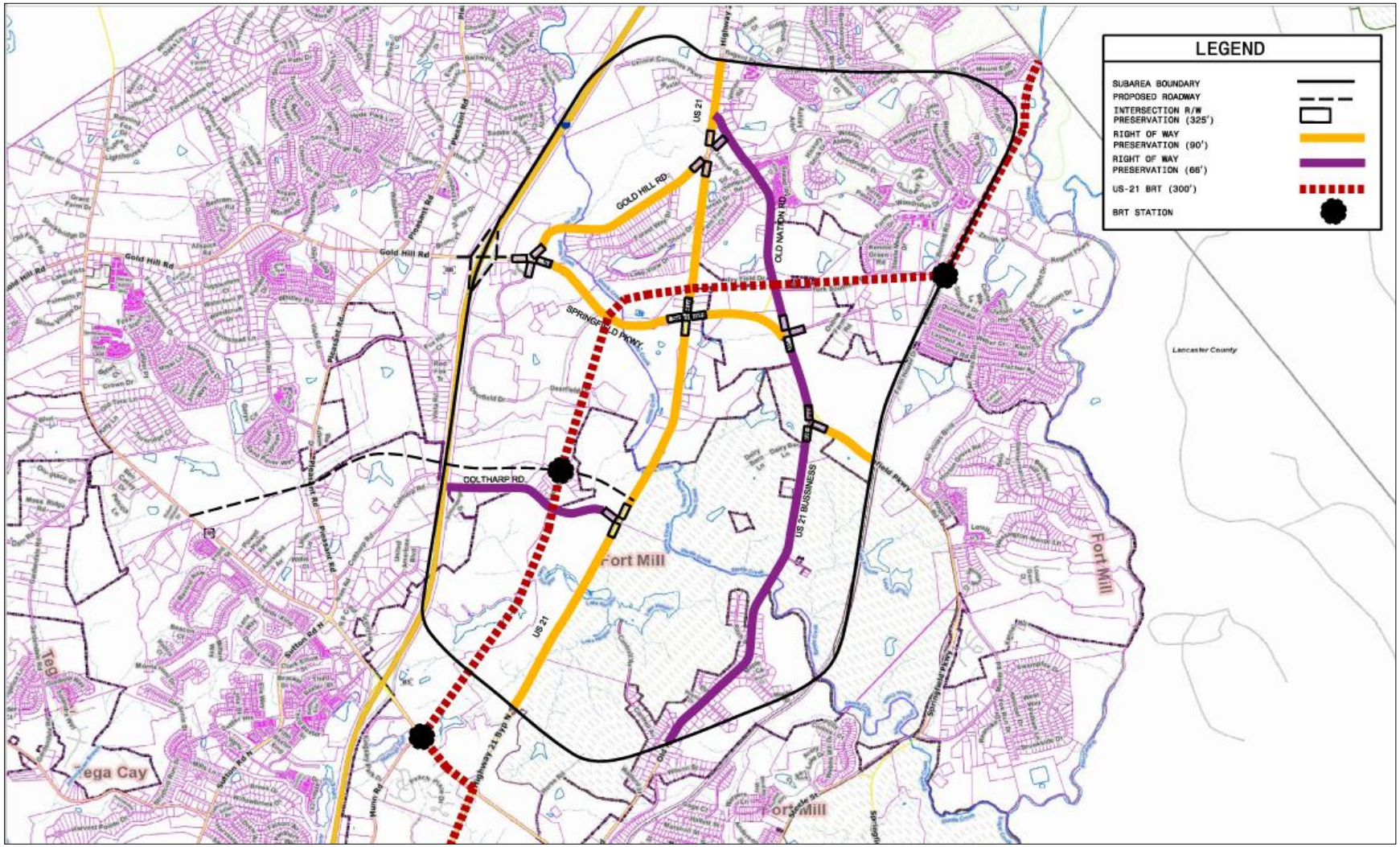
Right of way preservation should be planned along the following facilities within the subarea:

- US 21 90 feet
- US 21 Business 66 feet
- Springfield Parkway 90 feet
- Gold Hill Road 90 feet
- Coltharp Road 66 feet
- BRT Route 300 feet

Intersection right of way preservation should be planned at the following intersection locations within the subarea:

- Gold Hill Road/Springfield Parkway and Deerfield Drive
- Gold Hill Road and US 21
- Springfield Parkway and US 21
- Springfield Parkway and Old Nation Road
- Springfield Parkway and US 21 Business/Old Nation Road
- Coltharp Road and US 21

Figure 7-6: North Fort Mill Subarea



7.7. Subarea 5 – Lake Wylie

7.7.1. Lake Wylie Subarea Features

Subarea 5 is located in the northwest corner of the RFATS area in the Lake Wylie community. The subarea is bounded by Lake Wylie to the east. The subarea was identified due to the lack of transportation facility choices and the need to identify opportunities to improve commuter travel along SC 49 to and from North Carolina. Lake Wylie limits access between Subarea 5 and other nearby labor forces and Charlotte, NC, where the area's major employers are located. Commuting traffic between this area and Charlotte has no choice other than SC 49.

Subarea 5 is generally developed with single family and multi-family residential uses, with medium sized commercial businesses located along SC 49. SC 274 and SC 49 are the current western boundaries of the RFATS area. The western boundary of Subarea 5 overlaps the RFATS boundary in order to encompass land areas that access the main north/south corridor.

A review of area mapping identified a number of obstacles to a future north/south facility that would alleviate traffic on SC 274 and SC 49, the main issues being terrain and existing developments. A number of tributaries that drain into Lake Wylie cross the subarea from west to east, and would require new bridges. The cost of the structures, environmental impacts and impacts on development will be significant issues in development of new north/south facilities. Opportunities exist further to the west and beyond the RFATS area. A similar but separate study may be needed by York County to evaluate new corridors and/or improvements to existing facilities beyond the RFATS limits.

7.7.2. Lake Wylie Subarea System Improvements

As development occurs within the subarea, system improvements and new transportation facilities need to be pursued to maintain moderate traffic volumes. New facilities should be planned with new developments to disperse generated traffic that will otherwise be loaded onto existing facilities. Introducing new competing routes that provide for through traffic will reduce spacing between arterial roadways, providing options for travel and reducing overall traffic volumes on existing arterial facilities

Opportunities to alleviate existing congestion and prevent future congestion include the following proposals:

- Control future access drives along SC 274, SC 49, SC 557, and SC 55 as development and redevelopment occurs; promote connectivity with development to improve/provide access without travel on major corridors
- Improve intersection capacity at SC 274/SC 49 and SC 49/SC 557; consider constructing a grade separated intersection
- Promote parcel consolidation with development. Consolidate/eliminate driveways with development and redevelopment

- Promote reduction of left turn locations. Install medians to restrict left turns from future developments

7.7.3. Lake Wylie Existing Thoroughfare Preservation

Preserve rights of way along major arterial routes for future capacity/widening improvements. As shown in **Figure 7-7**, additional right of way width should be preserved at intersection locations to accommodate additional auxiliary (left/right turn) lane needs.

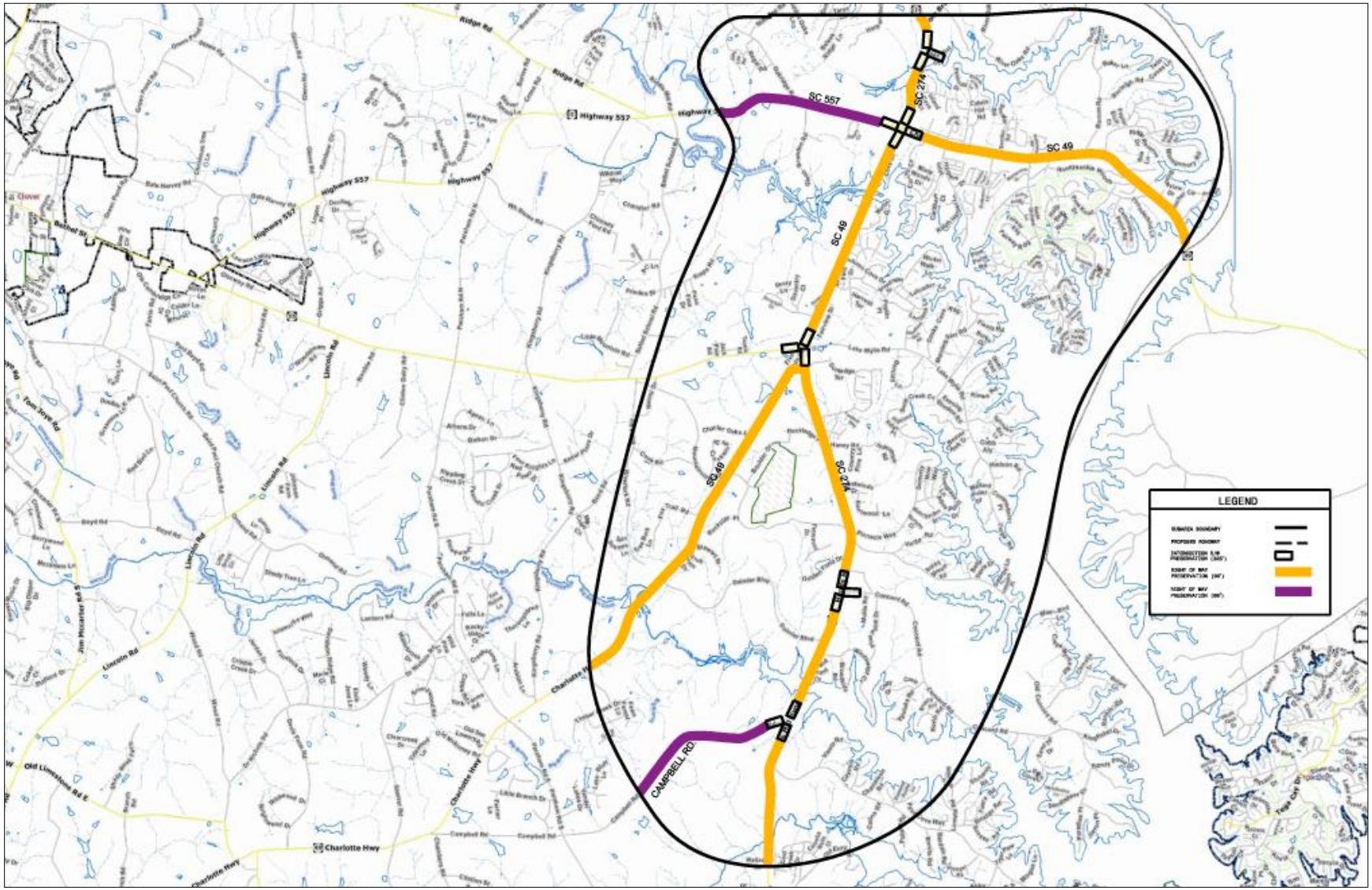
Right of way preservation should be planned along the following facilities within the subarea:

- SC 274 90 feet
- SC 49 90 feet
- SC 557 66 feet
- Campbell Road 66 feet

Intersection right of way preservation should be planned at the following intersection locations within the subarea:

- SC 274 and Campbell Road
- SC 274 and Concord Road
- SC 274 and Lake Wylie Road/SC 55
- SC 274 and SC 49/SC 557
- SC 274 and Pole Branch Road

Figure 7-7: Lake Wylie Subarea



7.8. Summary of Subarea Issues

Development pressures continue to be evident in all five of the subareas studied. These areas are presented with signs of future development potential that will result in accelerated growth. Attention is needed in these areas to preserve the capacity, operation and rights of ways along the existing roadways to ensure they continue to function as traffic volumes increase with new development.

Development proposals will need to be considered based on their impact on transportation as they are presented. Opportunities for new facilities that can be coordinated and constructed with new developments will be essential in order to prevent overloading of the existing transportation system.

RFATS municipalities may need to consider adoption of ordinances to enforce efforts to preserve rights of way and intersection access points. Planning efforts for current and future development proposals should continue to be coordinated with transportation needs in efforts to manage the transportation system and control system congestion.

Appendix A
FREIGHT STAKEHOLDER OUTREACH

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FREIGHT STAKEHOLDER OUTREACH

The RFATS Study Area has continued to grow as a center for goods movement as part of the greater Charlotte, NC, market area. With this growth, shippers and transportation providers in the area have found their local operations influenced by this expanding movement of goods. To identify the concerns of this important group of road users, interviews were conducted with a cross-section of the trucking industry.

1. The Importance of Freight to the Study Area

Freight movement is a critical element of an advanced industrial economy, and the ease of freight movement is one component of a region's economic competitiveness for attracting and retaining heavy industry, manufacturing, warehousing and other light industrial functions[1]. Freight movements can also have an impact on a region's quality of life, particularly with the need to ensure heavy truck traffic has suitable routes to/from the national highway or rail networks, avoiding established residential areas.

Federal legislation has recently placed additional emphasis on the role of freight in regional transportation planning. Freight must be considered both in its own right and in terms of supporting an area's economic vitality and competitiveness.

Highway freight and rail freight play complementary, and sometimes competing, roles in the freight transportation system. The RFATS Study Area has strong highway and rail connections for freight, including a major north-south interstate connecting Charlotte and Columbia and main lines of two Class I railroads, as shown in **Figure 1**. These connections serve a wide range of industries including distribution centers and automobile component manufacturing. In addition, the northern edge of the RFATS Study Area flows into the light-industrial region along I-77 and I-485 near Pineville. Indeed, the RFATS Study Area's relationship with Charlotte is a key factor influencing its freight needs.

1.1. The Charlotte Metro Area

Due to its proximity to Charlotte, a key freight hub in the Carolina region, the RFATS freight community relies heavily upon the facilities in the metro area. These facilities provide access to markets in the other areas of the country and the greater Carolina region. Many transportation providers in the Charlotte area are located in the northern sectors of the city. A number of these are concentrated around Exit 40 on I-85 as shown in **Figure 2**.

As described in the 2004 RFATS CMS, truck movements dominate freight flows in the area and are projected to do so in 2035. This reliance on truck usage is reflective of many communities in the United States. With limited on-site rail access and significantly less direct access to aircraft, trucks provide a vital link between freight generators and other modes. Trucks may be employed as not only a single source of transport, but as part of a total transportation solution.

[1] Rock Hill – Fort Mill Area Transportation Study 2035 Long Range Transportation Plan - Approved April 24, 2009

Figure 1: Railroads in the RFATS Area

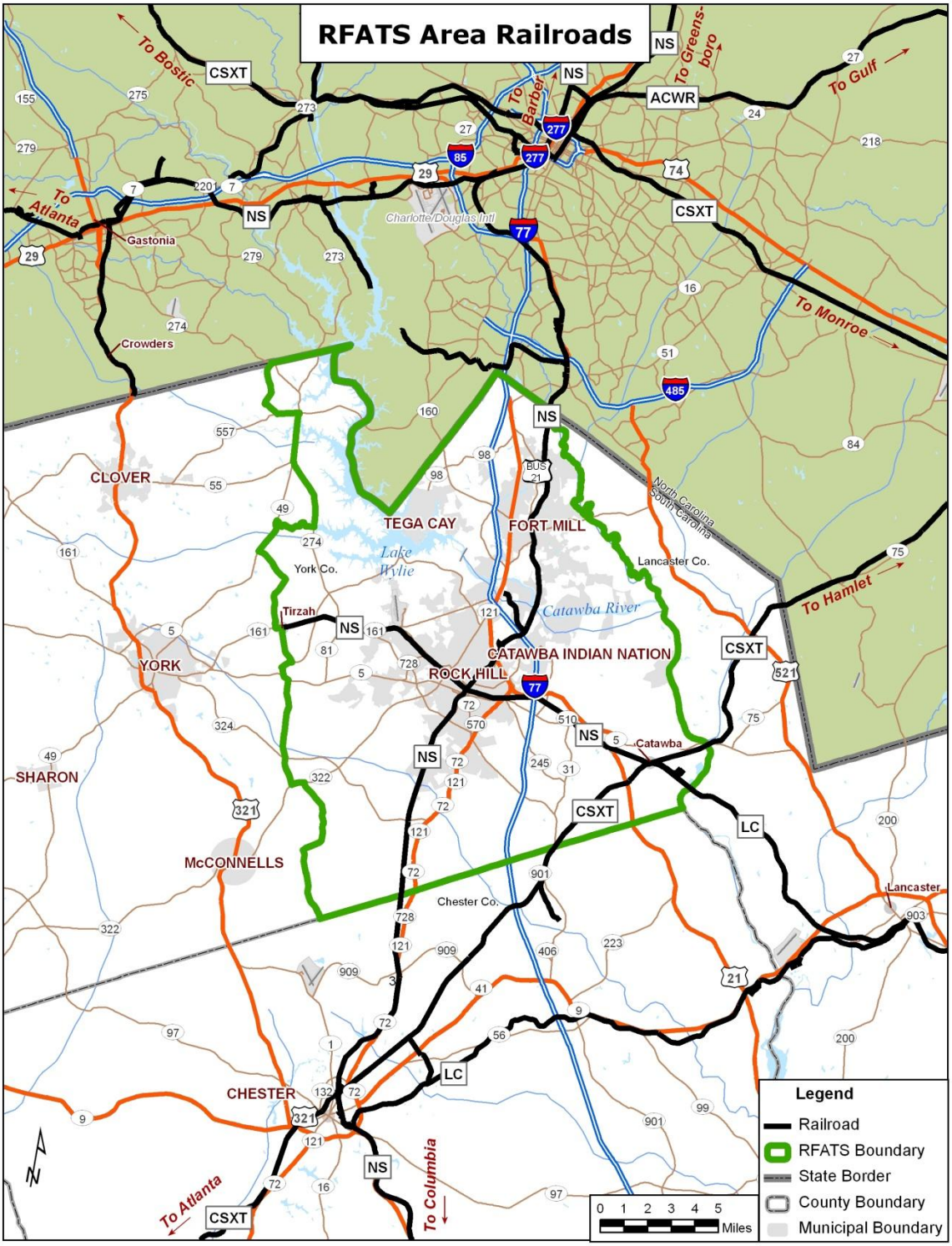


Figure 2: Motor Carrier Locations, Near Exit 40 on I-85, Charlotte

Source Google Maps

	FACILITY	TYPE		FACILITY	TYPE
1	Southeastern Freight Lines	LTL	7	Colonial Container Services	Drayage
2	UPS	Parcel	8	Campbell-Brown	TL
3	Charlotte Truck Center	Truck Stop	9	Huck's Piggyback Services	Drayage
4	Southeastern Freight Lines	LTL	10	Saia	LTL
5	G&P Trucking	TL	11	Milan Express	LTL
6	Barr-Nunn	TL	12	Central Transport International	LTL

1.2. Congestion Management and Freight Movements

Congestion management planning typically manages general traffic activity. As trucks are a component of the overall traffic flow, this planning has sought to administer an effective plan for truck movements. Greater appreciation for the relationship between efficient freight transportation systems and economic development has led to federal guidelines, first outlined in SAFETEA-LU, that require agencies to undertake planning with a specific component addressing truck needs. Engagement of the general motor carrier community describes the operational environment in user terms. This view can be perceived as skewed, when compared to that of the public sector planner. The industry's planning horizon differs significantly from that of the public sector. Typically less than five years, most operational views, at the local level, are managed in a one year or less timeframe. Though this is shorter than the required 20-year (minimum) horizon for long-range transportation plans, the validity of this engagement is sound for the following reasons:

- Most transportation planning studies, including LRTPs, include a phased implementation plan, with short-term projects being included for implementation within a 1 to 3 or 1 to 5 year period.
- Some strategies beneficial to the freight community are operational in nature, low cost, and quick to implement.

Note that the Congestion Management Process called for in SAFETEA-LU was intended to advance the integration of transportation systems management and operations (M&O) into the metropolitan planning process. Consequently, operational improvements are an important component of the CMP being developed in this study.

2. Motor Carrier Engagement Methodology

A cross section of the trucking industry was contacted for participation in the interview process. Available motor carriers were found to operate in the three broad industry segments:

- Truckload;
- Less than truckload; and
- Small package.

Within each of these segments, there are a variety of business models and market areas. After consultation with RFATS staff, a list was compiled of twelve carriers. This list provided a mix of different commodities, equipment, and coverage areas. Contact was initiated by email, followed by phone calls to request direct participation. Four carriers agreed to participate. To provide a more diverse sample, two additional carriers were identified and contacted, with each agreeing to participate. Each carrier performs city pick-up and delivery services in the Study Area. This type of operational characteristic was important for inclusion in the interview process. Carriers that perform only "over the road" or long haul movements could be expected to have limited practical experience navigating non-interstate roadways.

The collection effort assured the participants that complete anonymity would be exercised, to foster an honest and candid environment. The six carriers interviewed are described in **Table 1**.

Table 1: Motor Carrier Characteristic

CARRIER	TYPE	COMMODITIES	EQUIPMENT	COVERAGE (Approximated)
1	For Hire - LTL	General	Class 8 Tractor 27, 48, 53 foot dry van trailers	N-Statesville, E-Monroe/Matthew, W-Shelby, S-Chester
2	For Hire - LTL	General	Class 8 Tractor 27, 48, 53 foot dry van trailers	N-Statesville, E-Monroe/Matthew, W-Shelby, S-Chester
3	For Hire - LTL	General	Class 8 tractor 53 foot dry van trailers	N-Statesville, E-Monroe/Matthew, W-Shelby, S-Chester
4	For Hire - LTL	General	Class 8 tractor 48, 53 foot dry van trailers	N-Statesville, E-Monroe/Matthew, W-Shelby, S-Chester
5	Private	Outdoor power equipment	Straight truck 24, 27 foot (CDL and non-CDL)	North and South Carolina
6	Private	Aggregate, Concrete	Concrete Mixer, Dump	North and South Carolina

An interview guide was developed to assess the carrier's view of the Study Area's current conditions regarding:

- Locations and conditions of congestion;
- Effects of resultant delays on operational and business costs; and
- Observed mitigation strategies.

To provide context for the carrier's views, the following topics were also explored:

- General observations of how the Study Area compared in operational and revenue importance to other areas of coverage;
- Resource allocation provided to the Study Area; and
- How congestion was viewed in other areas of coverage.

Each carrier was provided a copy of the interview guide shown in **Figure 3.** A map illustrating the Study Area was also provided to maintain relevance to the comments.

2.1. Motor Carrier Descriptions

Four of the six carriers serviced a broad range of shippers. These services provided movement for a variety of commodity types. Shipper requirements varied somewhat, across the various carriers. One carrier delivers to a predominantly warehouse and retail environment, where a high proportion of delivery appointments are required. Another carrier provides general delivery service with no set requirements, and two operate in a "high service" oriented operation. The latter operation seeks to differentiate the carrier. This alters the carrier's operations by providing deliveries earlier and pick-ups later, than the industry norm. This is performed in conjunction with providing transit standards, or travel times, that are quicker than the industry norm. All four of these carriers operate from terminals located in the Charlotte metro area.

Figure 3: Interview Guide

RFATS CONGESTION MANAGEMENT PLAN (CMP) UPDATE 2010

INTERVIEW GUIDE (MOTOR CARRIER)

1. *Have you previously worked with or interacted with RFATS (Rock Hill-Fort Mill Area Transportation Study, a regional planning authority that helps prioritize and plan transportation needs)?*
    a. *If so, in what manner?*
    b. *If not, have you been aware of RFATS efforts in the area of freight transportation?*
2. *What is your role at _____?*
3. *Could you please describe your facility's operations?*
4. *What is the coverage area for your facility?*
    a. *How many total drivers do you employ?*
        i. *Over the road (Linehaul)?*
        ii. *City delivery and pick-up (Peddle)?*
            1. *How many work in the RFATS Area?*
            2. *How many of these are dedicated to that area?*
5. *What percentage of business or hours of operation does the RFATS area comprise, of your total operation?*
    a. *Do you service this area daily? Weekly?*
    b. *Do you envision this level of business to increase, decrease, or remain the same in the next five, ten, and twenty years?*
6. *How would you compare the levels of experienced congestion to the remainder of your coverage area?*
7. *Are there specific areas of congestion that you recognize:*
    a. *On a regular (reoccurring) basis?*
    b. *On a random (non-reoccurring) basis?*
8. *As each of the previous two are experienced, how do these influence, or impact your business?*
    a. *Can you alter your operations to compensate for these influences?*
    b. *If so, what are your alternative operational plans?*
    c. *If not, are there identifiable solutions to these areas?*
9. *Do you have any comments related to this topic that you would like to express?*
10. *Are you willing to be contacted again, should there be an opportunity to continue this discussion or another discussion related to RFATS study of freight transportation in the area?*

Two carriers performed distinctly different services. One carrier, servicing primarily the construction industry, was located and initiated truck trips outside the Study Area. Drivers were found to travel across the Study Area from four to ten times a day. These trips may be "through" trips or be destined to locations within the area. The other carrier provides distribution to a fixed number of retail outlets. The route selected, and times of day, change little in this last operation.

Of the five that responded to the question of "percentage of their total business residing in the Study Area", all placed it between 10 to 20 percent, with three at 20 percent. The percentage of each carrier's total work force and equipment, assigned to the Study Area, corresponded to the level of perceived business. The number of trucks assigned could be expected to increase or decrease in proportion to business levels, over time.

All except the outdoor power equipment distributor serviced the Study Area daily. All six saw the area as having an increasing effect on driver and equipment allocation in the near and distant future. One carrier observed that the area had seen significant growth compared to the remainder of their overall coverage area over the last five years, 2004-2009. Resulting from increased levels of freight volumes, a new facility, shown in **Figure 4**, has been constructed in the area south of Charlotte.

3. Motor Carrier Congestion Observations

The sample carriers were evenly split with how the Study Area's conditions compared with the remainder of their coverage area; two stated "worse than," two observed "less than," with the other two noted "less than or equal to". These comparisons were subjective in nature, influenced by the locations of that carrier's customer base. An additional influence on this perception is the number of drivers operating in the area. The latter is significant as it directly correlates to the impact congestion has on a carrier's operation. Where business levels allow for a greater number of drivers to operate in an area, miles driven in any one truck are reduced. This reduces or eliminates the events where congestion interferes with the driver's ability to move within the Study Area.

The significant measure used to determine how many drivers are assigned to an area is "Stop density". This is the number of stops producing freight in a specific area. Where stop density was noted as high, e.g. Fort Mill-addressed locations, low levels of congestion were specifically noted. In Rock Hill, where stops were noted as being more dispersed by the carrier, more congestion was noted. Areas such as Tega Cay, were not noted as areas of congestion as most carriers interviewed did not perform a high number of residential deliveries or pick-ups.

Important to note is that areas where stop density is high and congestion is not perceived as a concern, there are higher numbers of trucks assigned. This elevated number of trucks may be contributing to the overall congestion of the area for other vehicles.

Figure 4: New Trucking Terminal to Service Areas South of Charlotte

Source: Google Maps, Wilbur Smith Associates

3.1. Northern Area of RFATS

Much of the congestion was centered on the routes providing access to the Study Area from Charlotte. The northern area of the RFATS Study Area is shown in **Figure 5**.

- With a significant percentage of the motor carrier operations based in the Charlotte metro area, the ability to access the Study Area is paramount to future economic sustainability. This need is expected to continue until the RFATS region has sufficient business volumes to warrant repositioning these operations to the Study Area. A commercial vehicle accident occurring on I-77 in August 2010, illustrated the limited number of routes to and from the Study Area. **Figure 6** shows the congestion resulting from the accident. This accident occurred on a Monday afternoon in August 2010, disrupting access between Charlotte and the Study Area. Delays were logged between one and six hours. Each carrier noted that because the alternatives to cross the Catawba River are limited, incidents involving the interstate or during periods of high commuter activity cause serious congestion and the three locations noted in **Figure 7** are key points of congestion affecting access. The three crossings of the Catawba River are located at:
    - U.S. 49, Lake Wylie
    - I-77
    - SC 5
- As both commercial and residential development has occurred on SC 160 within the Study Area and to the north, significant congestion is noted between 4:30 PM and 6:15 PM. This is likely to increase as carriers and new businesses have recognized the location's advantageous position, relative to both the Charlotte and RFATS areas. Significant construction, north of the South Carolina state border with North Carolina, has already occurred.
- Located in the northern portion of the Study Area, the Carowinds Boulevard / US 21 interchange with I-77 was the second most noted area. This interchange affects both access to the north and to the south, as well as to the business areas of Fort Mill, from Charlotte. Seasonal variation is noted, though that seasonality is expected to dissipate as more development takes place along US 21, south of the interchange.
- Gold Hill Road was frequently mentioned as both a commercial and general traffic concern for access to the northern areas of the Study Area.
- A truck prohibition on SC 160 was noted by one carrier as detrimental to both access and a generator of congestion. As truck traffic diverted to the bypass around Fort Mill, this concentration of commercial vehicles was placed on a two-lane roadway, which also contained the Fort Mill Elementary School, Springfield Middle School, and numerous residential developments. This interaction raised concerns over congestion during school session and commuter hours.

Figure 5: RFATS Northern Area

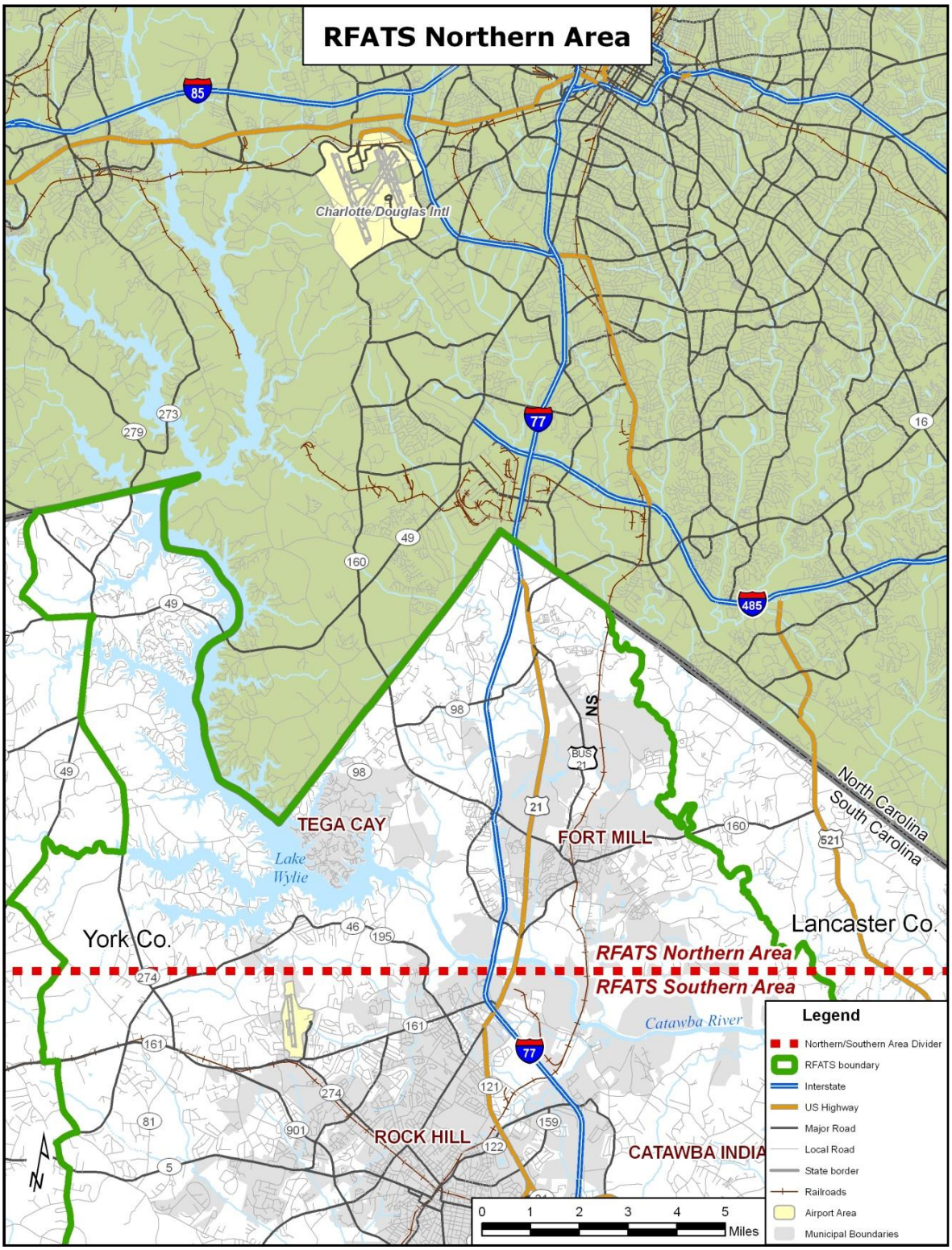
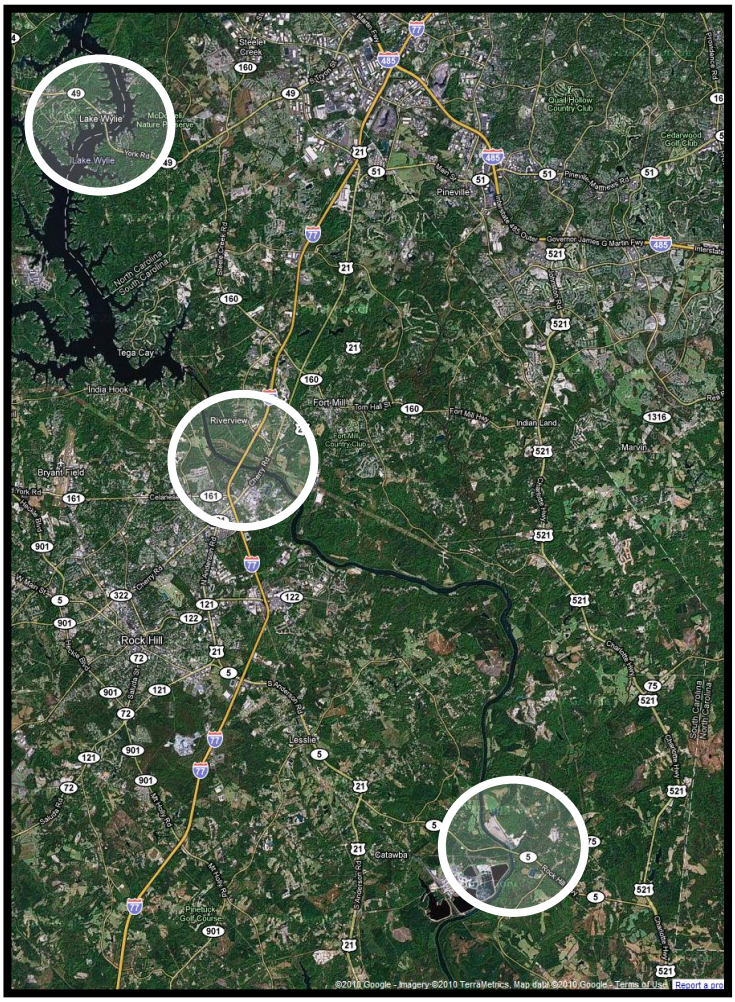


Figure 6: I-77 and Gold Hill Road, Post-accident on I-77

Figure 7: Crossing Locations for the Catawba River



3.2. Southern Area of RFATS

Congested locations were frequently noted at intersections of arterial and collector roadways and I-77, north of the Catawba River, and in the Fort Mill area. Other less frequently mentioned locations were noted in the Rock Hill area. Many comments reflected the lower volume of traffic in the Rock Hill area. "Don't get jammed up in Rock Hill," "easy to get around in," and "a function more of cars" than other commercial vehicles, were typical observations made during the interviews. The southern area of RFATS, including Rock Hill, is shown in **Figure 8**.

- Dave Lyle Boulevard, both at the interchange with I-77 and within the confines of the highly commercial/retail build-out adjacent to I-77, was identified as an area to avoid in a truck. Though most drivers did attempt to divert around this location, this added cost to the operation in both time and fuel. The area could not be avoided when required to provide deliveries or pick-ups at these same locations. Dave Lyle Boulevard is shown in **Figure 9**.
- Cherry Road and the interchange with I-77 have received numerous improvement projects, each of which has enhanced truck access. Drivers noted that the complex of Exit 82 A, B, and C on I-77 and the associated signage is confusing and difficult to maneuver during high volumes of general traffic.

3.3. Key Freight Corridors

In general, carrier concerns focused on the limited accessibility of the area as a whole. This led to areas of high congestion downstream as traffic was provided more avenues to disperse.

During conversations of locations for congestion, several roadways were repeatedly identified as utilized corridors across, into, or out of the area:

- US 21
- US 521
- SC 5
- SC 72
- SC 160
- SC 322

The effects experienced resulting from this congestion were cited as:

- Lost time and wages of drivers;
- Higher fuel cost resulting from extended idle;
- Higher maintenance cost and lowered utilization of equipment;
- Failed service to customer, possibly resulting in lost or reduced business;
- Re-handling and storage costs of freight due to missed appointment;
- Increased number of drivers and equipment needed to service area due to lost productivity; and
- Lack of service to lower volume customers located in areas of high congestion.

Figure 8: RFATS Southern Area

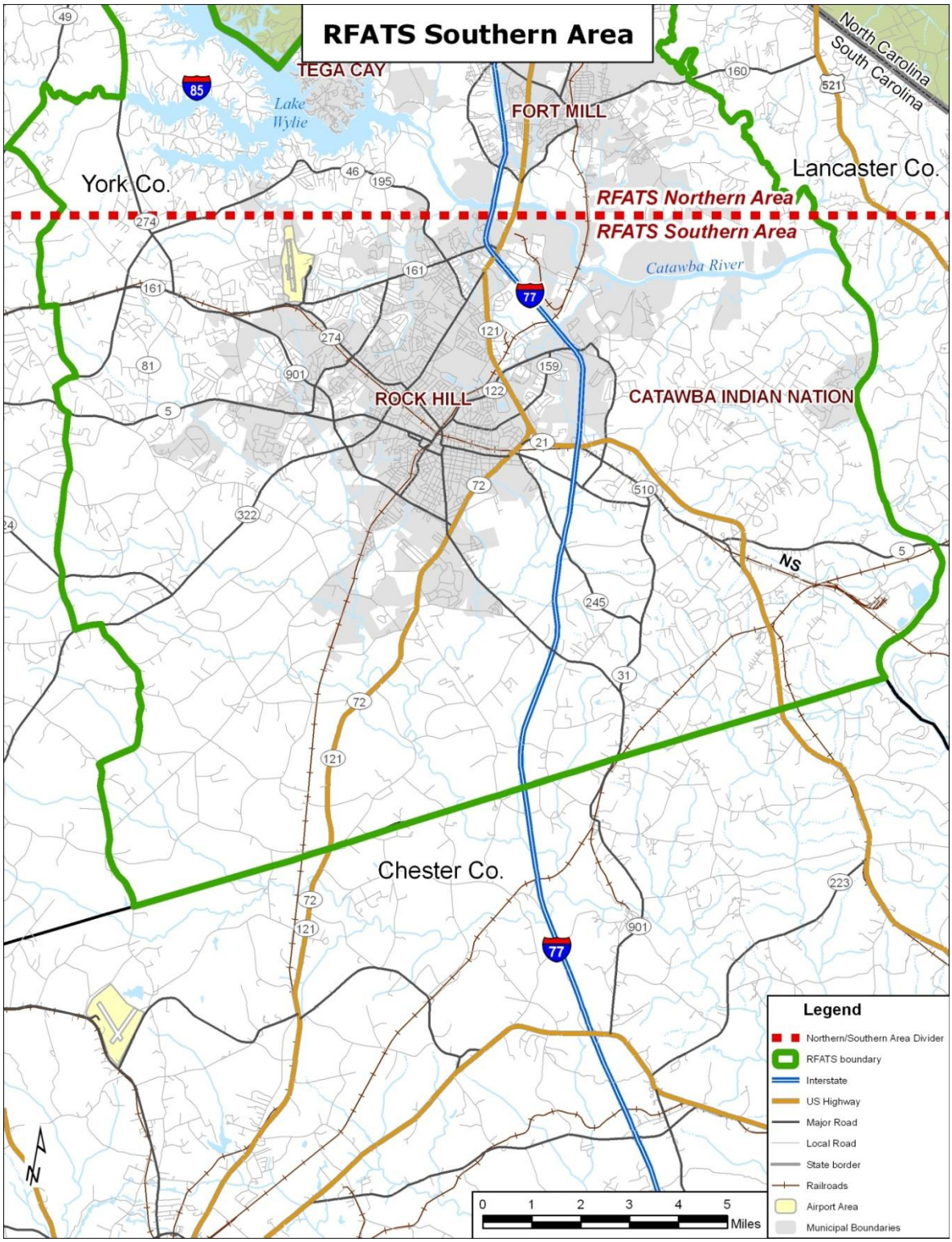


Figure 9: Truck Making Deliveries on Dave Lyle Blvd, Rock Hill

Source: Wilbur Smith Associates

4. Suggested Mitigation Strategies

The leading comment was the integration of land use planning when developing route alternatives for truck use. Roadways such as Gold Hill Road, which one carrier commented, "…don't want a truck on Gold Hill Road, but have to get to our customers…", have become primary truck routes in order to access lands developed as commercial, industrial, or retail. The concentration of "stop density" areas along corridors of "truck friendly" design would enhance carrier productivity. This would also reduce the interaction of trucks and cars on other roadways.

An interesting observation made by two carriers was the lack of an organized "grid" network. The area has inherited a network of roadways that were not developed in a planned environment. Thus, alternatives that offer the most efficient alternative route do not necessarily exist. This condition is present in many metropolitan areas in the region.

The overall lack of mitigation strategies may result from two common occurrences; past lack of interaction by carriers in these types of discussions and the propensity of the industry, as a whole, to have developed a "work around" historical approach to infrastructure. In both cases, it may be expected that the private sector input would increase significantly with regular interaction in the form of a sustained Freight Advisory Task Force or other cooperative setting.

Appendix B
INSTRUCTIONS FOR GPS DATA COLLECTION

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INSTRUCTIONS FOR GPS DATA COLLECTION

1. GPS Unit Setup / Data Collection

Speed and delay efforts should use the standards and settings contained in this Appendix in order to collect the type of the data needed to consistent create quality speed and delay analysis.

2. GPS Unit Setup

The GPS unit collects location and time data transmitted by satellite at specified intervals. It places a time and a location stamp on each data point and also associates it with other data, such as instantaneous speed. Data Collection Personnel should use the following settings in order to collect a standard quality of data and to facilitate the data post-processing effort.

2.1. General Settings

Hit the Menu button twice to access the Main Menu, use the cursor button to select the "Setup" option and then press enter. In the "General" tab, use the cursor button to scroll through the various options. To change one of the options, use the cursor button to highlight it, press enter and use the cursor button to select the appropriate setting.

As shown in **Figure 1**, the General Settings should be configured as follows:

Mode:	Normal
WAAS:	Disabled
Backlight:	15 Seconds
Beeper:	Key and Message
Language:	English

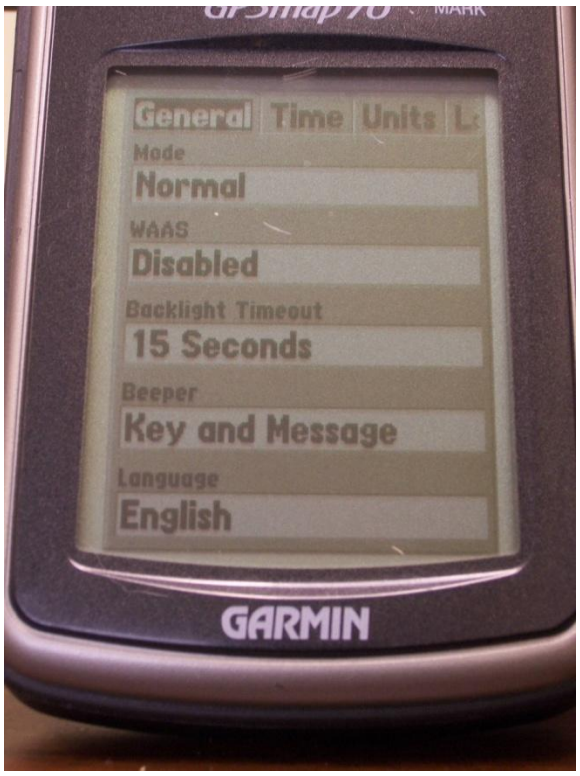

Figure 1: General Settings Menu

2.2. Time Settings

Hit the Menu button twice to access the Main Menu, use the cursor button to select the "Setup" option and then press enter. Use the cursor button to select the "Time" tab and then use the cursor button to scroll through the various options. To change one of the options, use the cursor button to highlight it, press enter and then use the cursor button to select the appropriate setting.

As shown in **Figure 2**, the Time Settings should be configured as follows:

Time:	24 Hour
Time Zone:	{Selected Appropriate Time Zone}
Daylight Savings Time:	{Selected Yes or No}

The appropriate time zone should be selected based on the location of the data collection effort. This ensures that the time stamp matches the local time. This simplifies data processing and reduces the errors that may be introduced if the time stamps need to be corrected.

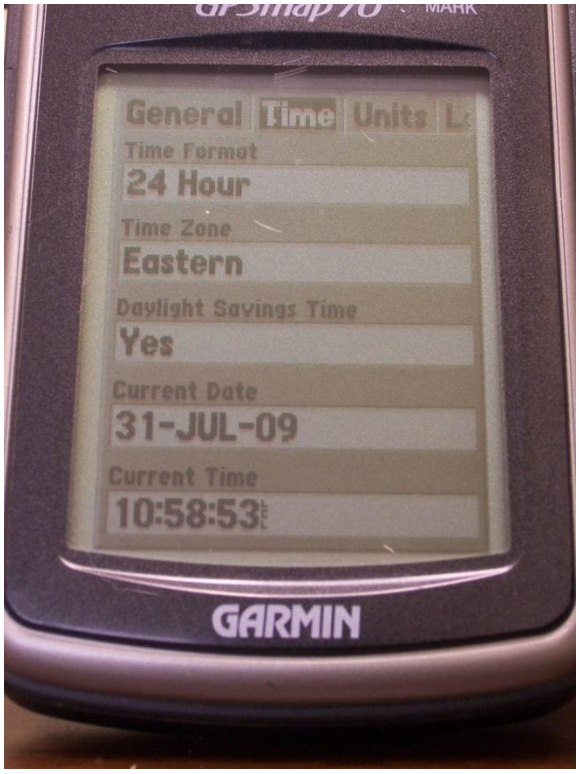

Figure 2: Time Settings Menu

2.3. Units Settings

Hit the Menu button twice to access the Main Menu, use the cursor button select the "Setup" option and then press enter. Use the cursor button to select the "Units" tab and then use the cursor button to scroll through the various options. To change one of the options, use the cursor button to highlight it, press enter and use the cursor button to select the appropriate setting.

As shown in **Figure 3**, the Units Settings should be configured as follows in order to ensure that the speed and delay data are recorded in the proper units:

Elevation:	Feet
Depth:	Statute
Distance and Speed:	Fahrenheit
Direction Display:	Numeric Degrees
Speed Filter:	Auto

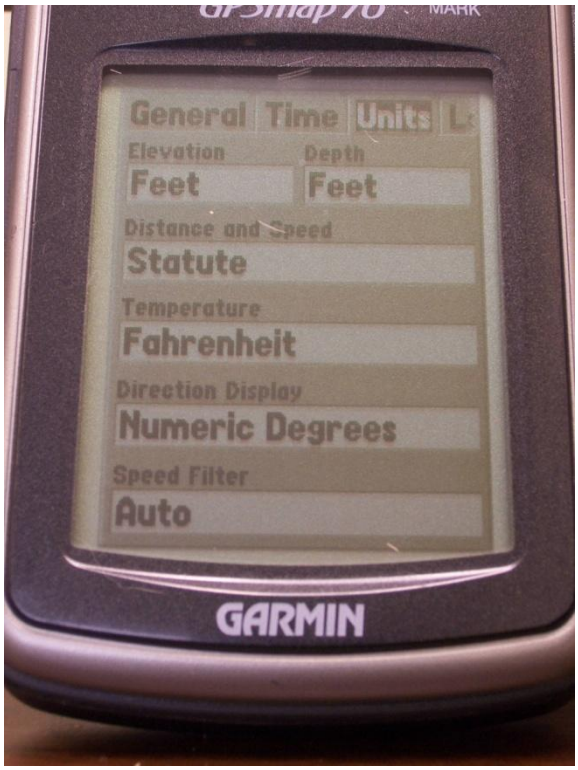

Figure 3: Units Settings Menu

2.4. Location Settings

Hit the Menu button twice to access the Main Menu, use the cursor button select the "Setup" option, and then press enter. Use the cursor button to select the "Location" tab and then use the cursor button to scroll through the various options. To change one of the options, use the cursor button to highlight it, press enter and use the cursor button to select the appropriate setting.

As shown in **Figure 4**, the Location Settings should be configured as follows in order to ensure that latitude and longitude are recorded in the correct format:

Location Format:	hddd,ddddd°
Map datum:	WGS 84
North Reference:	True
Magnetic Variation:	{Blank}

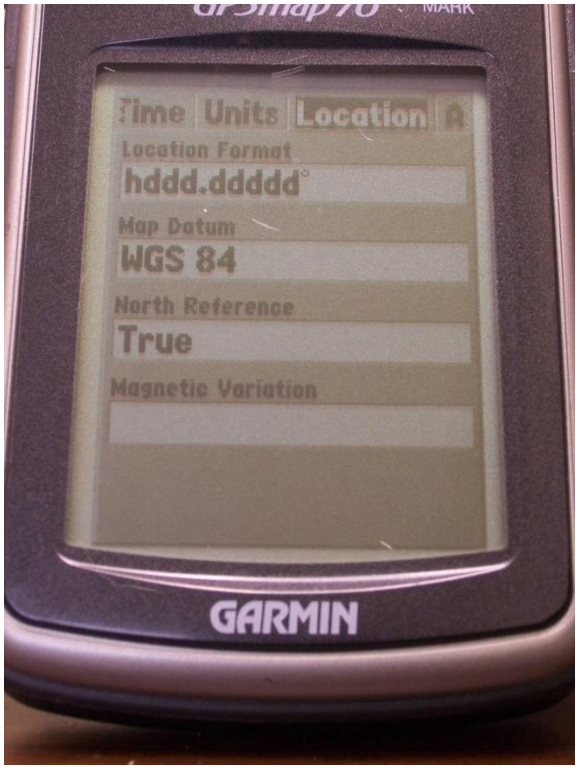

Figure 4: Location Settings Menu

2.5. Interface Settings

Hit the Menu button twice to access the Main Menu and use the cursor button to select the "Setup" option, and then press enter. Use the cursor button to select the "Interface" tab and then use the cursor button to scroll through the various options. To change one of the options, use the cursor button to highlight it, and then press enter and use the cursor button to select the appropriate setting.

As shown in **Figure 5**, the Interface Settings should be configured as follows in order to ensure that GPS Unit is able to properly communicate with the GPS Utility download software (Discussed in Chapter 3):

Serial Data Format: Garmin

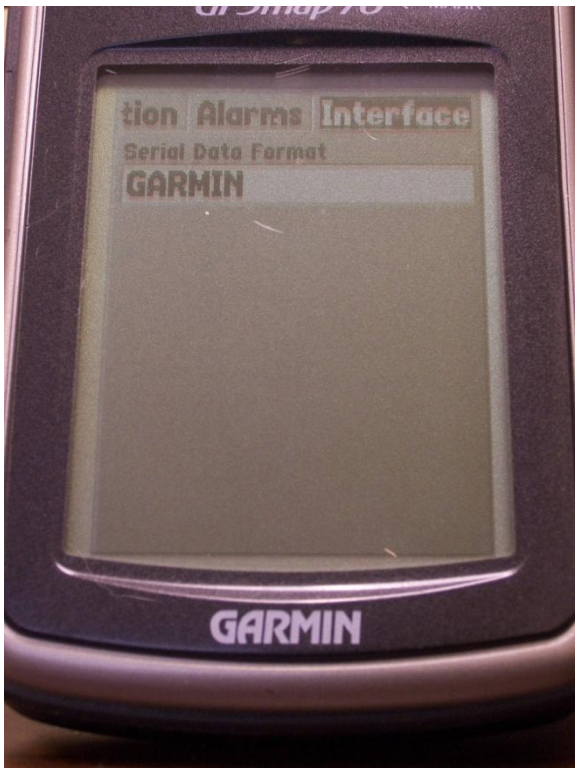

Figure 5: Interface Settings Menu

2.6. Setup Track Log

Hit the Menu button twice to access the Main Menu, use the cursor button to select the "Tracks" option and then press enter. Press Menu and then select the "Setup Track Log" option by pressing the Enter button. To change one of the options, use the cursor button to highlight it, press Enter and use the cursor button to select the appropriate setting.

As shown in **Figure 6**, the Track Log should be configured as follows in order to ensure that the GPS Unit collects data with the necessary detail for speed and delay analysis:

Recording:	Stop when full
Recording Method:	Time
Interval:	00:00:05 (See Table 1)

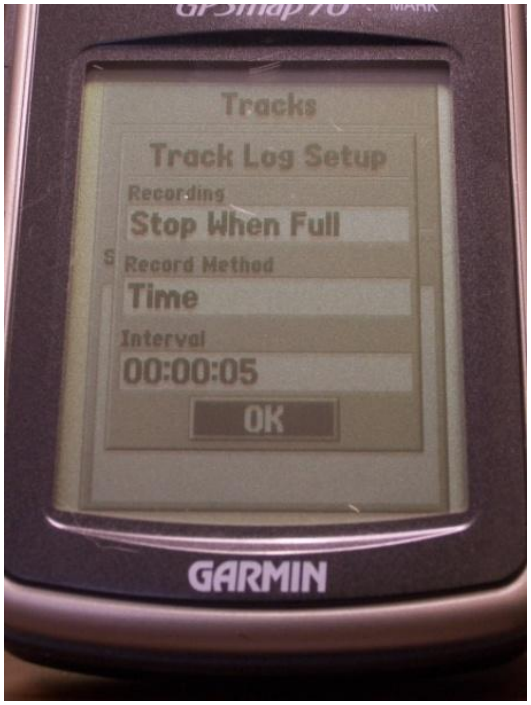

Figure 6: Track Log Setup

Recording - Selecting the "Stop When Full" setting for the Recording option instructs the GPS Unit to stop recording when the memory capacity has been reached. The other two available options are undesirable for speed and delay data collection: selecting "Off" will shut off the recording device and selecting "Wrap When Full" will instruct the GPS Unit to begin recording over earlier collected data once the memory has been filled.

Recording Method - Selecting the "Time" option instructs the GPS Unit to collect data at regular intervals of time. The alternative option, "Distance," instructs the GPS Unit to collect data at regular intervals of distance. GPS data points should be collected in intervals of time to ensure that the GPS Unit collects data even when traffic is stopped or slow moving, that the speeds are consistently measured, and that the standard data analysis tools can be used during post-processing.

Interval - The speed and delay data should generally be collected in intervals of 5 seconds. **Table 1** details the various roadway types where speed and delay data could possibly be collected. If the routes are a mix of congested and uncongested segments, Data Collection Personnel should use time intervals of 5 seconds. In the case of intercity routes, storing data every 5 seconds could result in large amounts of data being collected, which may be impractical. As indicated in the table, a data point interval of 10 seconds may be used over long distances where speed and delay data collection is being performed in order to determine total driving time or average speeds where there is no congestion. If there is enough memory to store data in 5 second intervals even considering the length of the route, Data Collection Personnel could consider leaving the interval setting at 5 seconds. In these cases, judgment should be applied and the Project Manager should be made aware of any changes from 5 seconds.

Under no circumstances should Data Collection Personnel use a data point interval of more than 20 seconds.

Table 1: Data Point Intervals for Use in Data Collection

Roadway Type	Data Collection Purpose	Data Point Interval
Arterial Streets	Any	5 Seconds
Mixed	Any	5 Seconds
Limited Access (Intracity)	Measure Congestion	5 Seconds
Limited Access (Intercity)*	Measure Time or Average Speeds	10 Seconds

This should only be done if all routes that are being run are long intercity routes where no congestion is anticipated. If it is anticipated that some congestion will need to be measured, Data Collection Personnel should consider using 5 second intervals if memory allows.

2.7. GPS Simulator

From the Signal Display Screen, hit the Menu button once to access the Signal Display Menu. Use the cursor button select the "Start Simulator / Stop Simulator" option and press enter to turn this feature on or off, as shown in **Figure 7**.

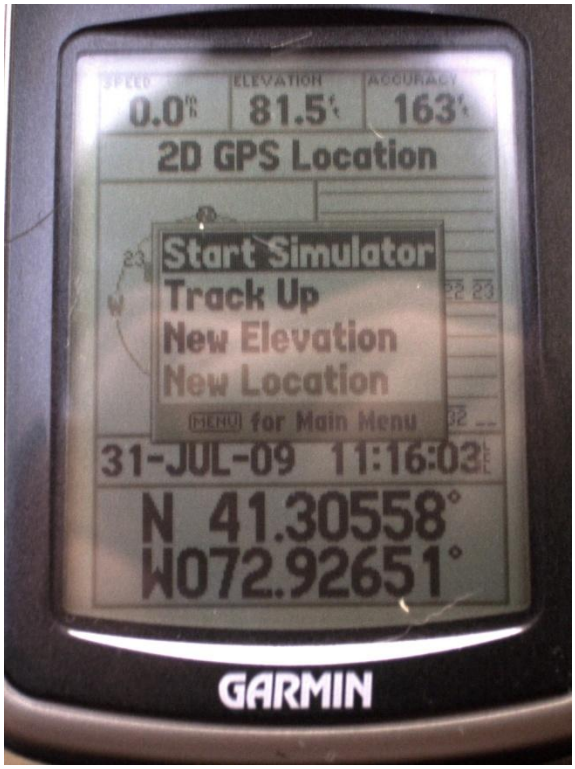

Figure 7: GPS Simulator Menu

Figures 8 and **Figure 9** illustrate the difference between the normal GPS data collection and the GPS Simulator. If the simulator is on, then the GPS Unit is not actually recording data points, it is only "simulating" that function for the user. As a result, it is vitally important that:

- GPS Simulator Should be OFF / STOPPED
- All Data Collection Personnel should check that the Simulator is "Stopped" before beginning any speed and delay data collection.

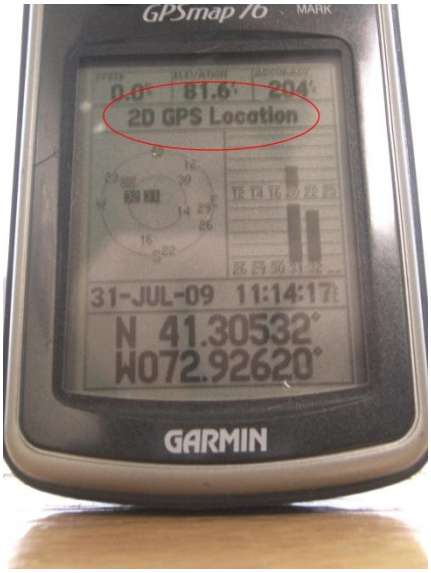

Figure 8: Simulator Off

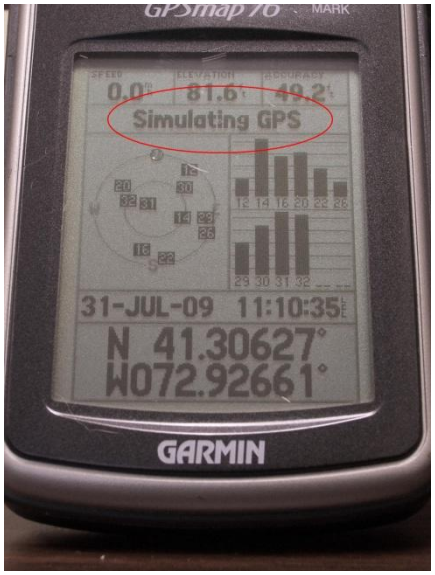

Figure 9: Simulator On

3. Data Collection Standards

In order to collect quality speed and delay data, the manner in which the data is collected should be consistent. Towards that end, the standards contained in this section should be followed.

3.1. Speed and Delay Routes

Data Collection Personnel will need to plan out their speed and delay runs for each time period in advance in order to maximize their data collection effort.

The Data Collection Supervisor will indicate the speed and delay runs to be collected during a given time period. Data Collection Personnel should follow the requested routes exactly, unless one of the following circumstances arises:

- Route is Obstructed or Unavailable
- Serious Roadway Accident
- Severe Weather (i.e. Tornado, Flooding, etc…)

In these cases, the /TFT Data Collection Personnel should contact their supervisor immediately in order to receive instructions on how to proceed with the data collection effort.

In the case of a roadway accident or construction, data collection should continue to the end of the run or until a point where the Data Collection Supervisor can be contacted without disrupting the collection of data on the affected run. The Data Collection Personnel should then contact their supervisor and obtain instructions on whether to proceed with the speed delay runs as planned or whether to take an alternative route.

3.1.1. Notes and Route Reconnaissance

All Data Collection Personnel should take notes during their speed and delay data collection effort. These notes can be written or provided by tape recorder. Each note made should include a time and location so that during post-processing these notes can be properly associated with the speed and delay data being collected. The following items should be noted about every five minutes in order to corroborate the data collected by the GPS Unit:

- Time / Location of the Note
- Posted Speed Limits
- Estimated Average Travel Speed
- Number of Travel Lanes
- Description of Traffic Congestion
- Area Development (i.e. Residential, Commercial, etc…)

Any impedance to traffic flow of data collection efforts should also be recorded, with a time and location:

- Time / Location of the Note
- Interrupted GPS Signal
- Stop in Data Collection (i.e. Break)
- Weather Conditions (especially Rain, Fog, Snow etc…)
- Accident (if applicable)
- Construction (if applicable)
- Other Lane Closures / Road Obstructions (if applicable)
- Malfunctioning Traffic Lights (if applicable)
- Local Events (i.e. Annual Fair, Parade, Political Protest, etc…)
- Other Relevant Information Affecting the Speed / Flow of Traffic

3.1.2. Data Collection Timing

Speed and delay runs are to start at exactly the time instructed by the Data Collection Supervisor. Speed and delay runs should continue past the ending time instructed by the Data Collection

Supervisor. This means that Data Collection Personnel should not avoid a final run because it cannot be finished before the ending time. Instead, Data Collection Personnel should begin the final run, continue past the ending time and complete the final run before returning from any data collection effort.

Data Collection Personnel should plan meals and breaks outside of the speed and delay data collection period. In the extreme instance that this is not possible, any stop in data collection should occur at the end of a particular run. If the speed and delay effort is long distance, i.e. between New York City and Boston, then any stop in data collection should occur at a rest stop, interchange or other natural stopping point.

In the case of a break in data collection, the existing data should be saved (as explained below) and the GPS Unit should be turned off. The break in data collection should be recorded by the Data Collection Personnel in their notes.

3.1.3. Powering the GPS Unit

The GPS Unit can be powered by battery or by car charger. The GPS Unit is configured to use two "AA" Batteries that are installed in the back of the unit, as shown in **Figure 10**. The GPS Units are designed to last for many hours using battery power. However, it is recommended that Data Collection Personnel using GPS units on battery power keep several extra sets of fresh batteries available in the event that the batteries fail.

Figure 10: Installing Batteries

The GPS Unit can also be powered by car charger. As shown in **Figure 11**, the charger is plugged into the port on the back of the GPS Unit. Powering a GPS Unit using the car charger is preferable to battery power as it allows for a longer lasting and more stable supply of energy. If however, the power provided to the GPS Unit from the Car Charger is interrupted (i.e. the car is shut off) the GPS Unit will beep and display a menu screen. At this point, Data Collection Personnel can choose to shut of the GPS Unit through this menu or to switch the GPS Unit to battery power. If no option is selected, the GPS Unit will automatically shut off after 30 seconds. Data Collection Personnel using a car charger as a power source should be aware of this feature so that when they exit their vehicle they remember to indicate to the GPS Unit whether to shut off or switch to battery power. Additionally, Data Collection Personnel should keep an extra set of batteries available, just in case there is an unexpected malfunction in the car charger.

Figure 11: Powering the GPS Unit via Car Charger

3.1.4. GPS Signal

The GPS Unit should be placed on the dashboard or in some other unobstructed area in order to ensure that a strong satellite signal is achieved. The GPS Unit will indicate if it has lost the satellite signal by beeping or by displaying the message "Lost Satellite Reception," as shown in **Figure 12**. If the GPS signal is lost, Data Collection Personnel should take the following actions:

- Put GPS Unit in an open unobstructed area of the vehicle
- Move to a different location with the vehicle

If the GPS signal is still unavailable, the Data Collection Personnel should contact their supervisor and obtain instructions as to how to proceed. Any interruption in the GPS signal should be recorded in the notes of the Data Collection Personnel.

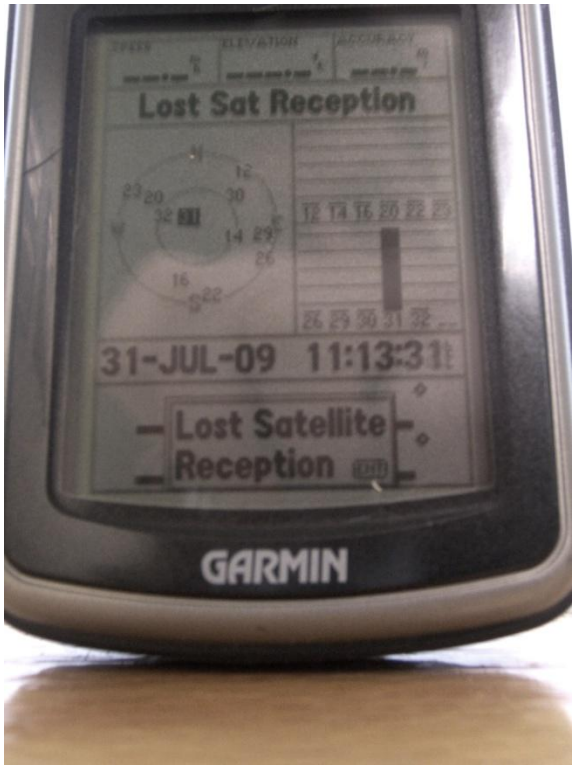

Figure 12: Lost Satellite Reception

3.1.5. Lane and Speed Selection

The idea behind speed and delay data collection is to capture the average speed of vehicles using the roadway. In order to achieve this, Data Collection Personnel should keep up with the average speed of traffic, even if it is above the speed limit, unless otherwise instructed. If the vehicle conducting data collection is constantly being passed, it is going too slow. If the vehicle conducting data collection is passing other vehicles, it is going too fast. A popular method for obtaining the correct speed is to match the speed of an average car in front of the vehicle conducting data collection. Data Collection Personnel should use their better judgment to ensure that the average travel speed of traffic is properly captured.

Data Collection Personnel should try to stay in the proper lane, as provided in **Table 2**, unless otherwise directed. On a two lane limited access facility, Data Collection Personnel should try to stay in the left lane in order to avoid any delays that might occur due to exiting or entering traffic. Congestion or reduced speeds due to exiting or entering traffic should be entered into the notes of the Data Collection Personnel.

Table 2: Desired Travel Lane for Use in Data Collection

Roadway Type	Desired Lane
Two-Lane Limited Access	Left Lane
Three-Lane Limited Access	Center Lane
Full Access	Through Lanes

On a limited access facility with more than two lanes, the Data Collection Personnel should try to stay in the center lane in order to avoid both the slower speeds of the entering and exiting traffic as well as higher speeds of the passing traffic.

On a full access facility with two or more lanes, the Data Collection Personnel should try to stay in the lane that carries the through traffic. This means avoiding turn lanes and, if possible, combination turn and through lanes.

3.1.6. Saving Data Using Tracks

The data points and the associated time and location stamps collected by the GPS Unit are automatically saved to the memory. If the GPS Unit were to lose a signal or were to be turned off and on, no data would be lost. However, Data Collection Personnel should make a habit saving their data as a "track." The track feature allows users to group blocks of data points together and facilitates the data downloading process.

To save data using the "Tracks" feature, hit the Menu button twice to access the Main Menu and use the cursor and enter button select the "Tracks" option. Use the cursor button to select the "Save" option and then press enter, as shown in **Figure 13**. The GPS Unit will then provide a number of options for the beginning time of the track. Use the cursor button to select the most appropriate time. The ending time of the track will be the current time. The GPS Unit has memory for up to 10 tracks.

Figure 13: Saving Tracks

Data Collection Personnel should track save their data at the end of every data collection time period (i.e. AM Period, Mid-Day Period, etc…). If a break is taken during the middle of the data collection time period, then Data Collection Personnel should track save their data before shutting off the GPS Unit. In the case that the speed and delay run is long distance or spans several time periods, Data Collection Personnel may use their judgment as to how often to track save their data.

3.1.7. Deleting Data Using Tracks

Data Collection Personnel should monitor the available memory. Memory usage can be checked by pressing the Menu button twice to access the Main Menu, as shown in **Figure 14**. The percent of memory used is displayed at the bottom of the screen. If memory is nearing capacity or there are no longer any available tracks, then some data will need to be deleted in order to make room for additional data.

Before anything is deleted, all data should be downloaded first from the GPS Unit (See Chapter 3). This will ensure that no data is destroyed. Always check twice that the data have been properly downloaded.

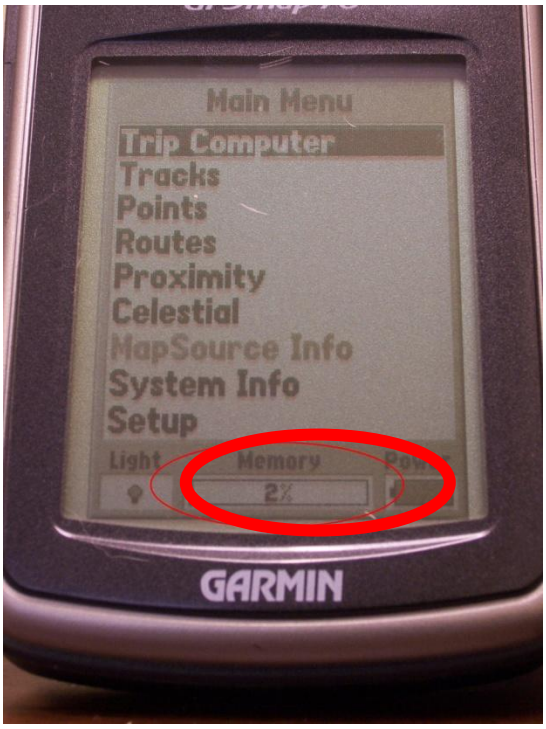

Figure 14: Memory Usage

To delete a single track from the GPS Unit, hit the Menu button twice to access the Main Menu and use the cursor and enter button to select the "Tracks" option. Use the cursor button to select the track you wish to clear and then press enter. Use the cursor button to select "Delete" and press enter. The GPS Unit will prompt you "Do you really want to delete track (Track Name)?" as shown in **Figure 15**. Use the cursor and enter button to select "Yes." Tracks cannot be deleted all at once. They must be deleted individually.

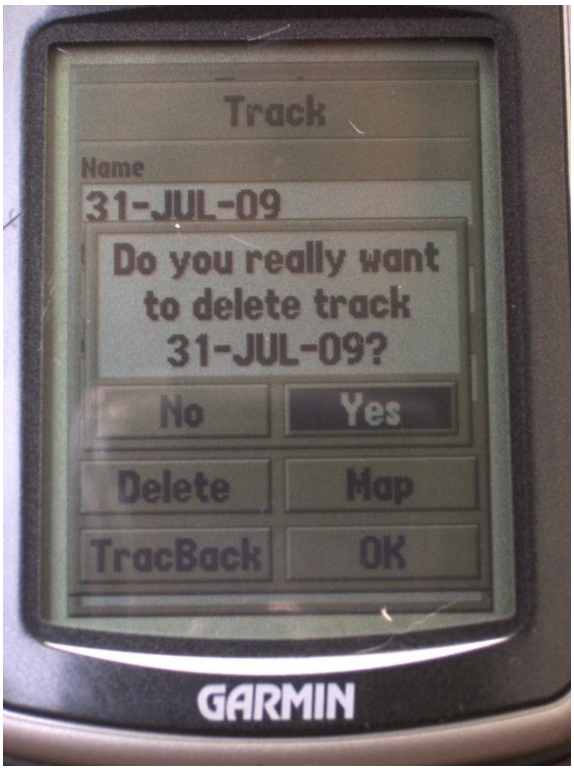

Figure 15: Clearing a Single Track

To delete all data from the GPS Unit, hit the Menu button twice to access the Main Menu and use the cursor and enter button to select the "Tracks" option. Use the cursor button to select the "Clear" option and then press enter. The GPS Unit will prompt you "Do you really want to clear the track log?" as shown in **Figure 16**. Use the cursor and enter button to select "Yes."

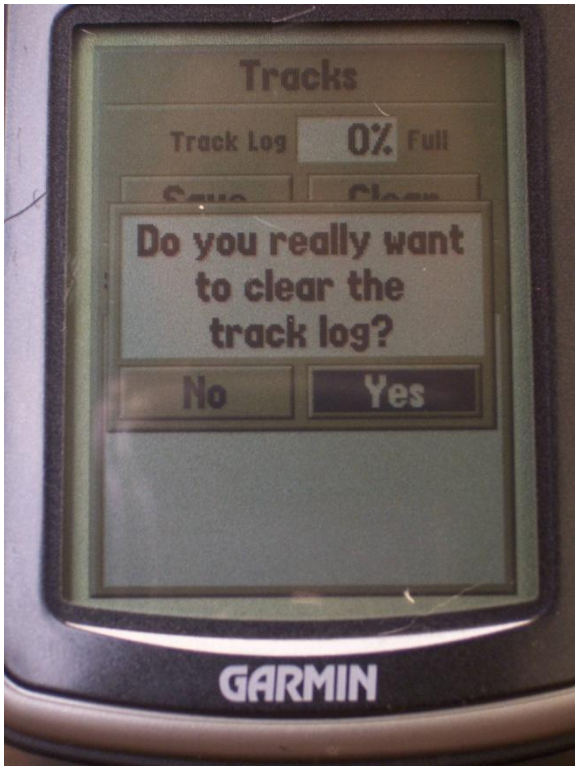

Figure 16: Clearing the Track Log

Data Collection Personnel should wait until it is absolutely necessary before deleting ANY speed and delay data. If possible, Data Collection Personnel should wait until the speed and delay data collection effort is completed before deleting any data. If memory does not permit this, then data should be downloaded first and checked twice before being deleted. Data should only be deleted after it has been downloaded.

Appendix C
CMP CORRIDOR PROFILES

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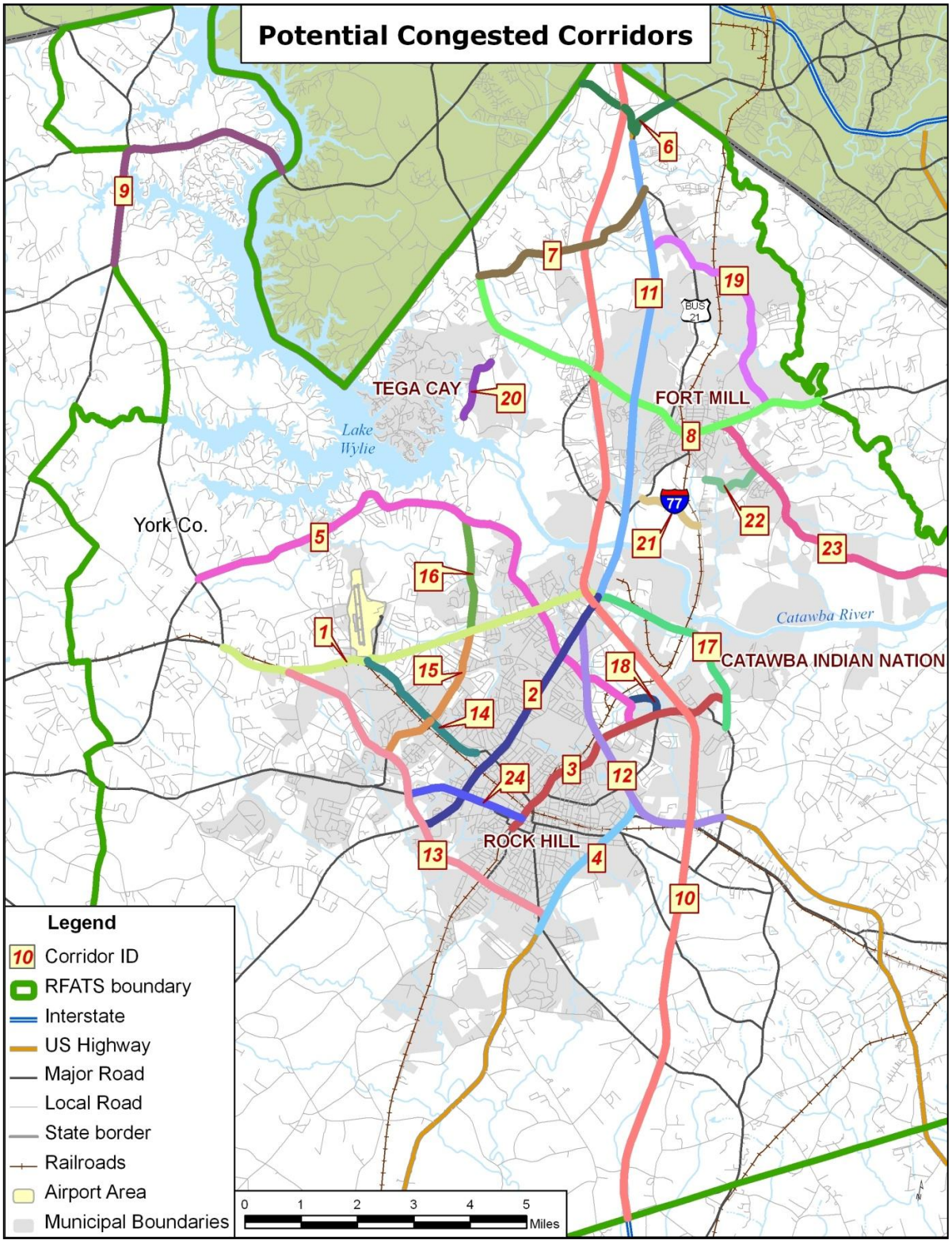
CMP CORRIDOR PROFILES

The CMP corridors are listed in **Table 1** and illustrated in **Figure 1**.

Table 1: Listing of Identified Corridors

ID	Corridor	From	To	Length (miles)
1W	SC 161/SC 274 Old York Rd / Celanese Rd	SC 274, Hands Mill Rd	India Hook Rd	4.57
1E	SC 161/SC 274 Old York Rd / Celanese Rd	India Hook Rd	US 21, N. Cherry Rd	2.42
2	Cherry Rd	SC 901, Heckle Boulevard	SC 161, Cel-River Rd	5.25
3W	Dave Lyle Boulevard (west of US 21 BYP)	W. Black St	US 21 BYP/SC 121, Anderson Rd	2.20
3E	Dave Lyle Boulevard (east of US 21 BYP)	US 21 BYP/SC 121, Anderson Rd	Red River Rd	2.41
4	SC 72, Albright Rd/Saluda Road	Rawlsville Rd	Springdale Rd	5.46
5N	Mt. Gallant Rd. (north of Celanese Rd)	SC 274, Hands Mill Highway	SC 161, Celanese Rd	7.83
5S	Mt. Gallant Rd. (south of Celanese Rd)	SC 161, Celanese Rd	SC 122, Dave Lyle Boulevard	2.85
6	US 21, Carowinds Boulevard and SC 51	Pleasant Rd	NC State Line	2.25
7	Gold Hill Rd	SC 160	Garrison Farm Rd	3.47
8W	SC 160 (west of US 21 BYP)	SC State Line	US 21 BYP	4.62
8E	SC 160 (east of US 21 BYP)	US 21 BYP	Lancaster Co. Line	3.61
9	SC 49, Charlotte Highway	SC 55	NC State Line	5.51
10S	I-77 (south of Dave Lyle Boulevard)	S. RFATS Boundary	SC 122, Dave Lyle Boulevard	19.42
10N	I-77 (north of Dave Lyle Boulevard)	SC 122, Dave Lyle Boulevard	N. RFATS Boundary	23.96
11	US 21 BYP	SC 161, Cel-River Rd	SC 51	8.15
12	US 21 BYP/SC 121 (Anderson Rd)	US 21, Cherry Rd	Springdale Rd	4.09
13	SC 901, Heckle Boulevard	SC 161/SC 274 Old York Rd	SC 72 / SC 121	6.63
14	SC 274 Ebenezer Rd	SC 161 Old York Rd/Celanese Rd	Oakland Ave / India Hook Rd	2.80
15	Herlong Ave	SC 901, Heckle Boulevard	SC 161 Celanese Rd	2.86
16	India Hook Rd	SC 161 Celanese Rd	Mt. Gallant Rd.	1.96
17	Red River Road, Cel-River Rd	SC 161 Celanese Rd	Springdale Rd	3.60
18	John Ross Parkway	SC 122, Dave Lyle Boulevard	Mt. Gallant Rd.	0.63
19	Fort Mill Bypass, Springfield Parkway	I-77	SC 160, Tom Hall Road	1.11
20	Dam Road	Gardendale Rd (S-741)	New Gray Roack Rd (S-251)	1.10
21	Fort Mill Parkway	Spratt St	Brickyard Rd	1.10
22	Fairway Dr (Fort Mill)	Brickyard Rd	Doby's Bridge Rd	1.20
23	Doby's Bridge Rd	Tom Hall Rd	Lancaster Co. Line	6.02
24	W. Main St, SC 5	SC 901, Heckle Boulevard	SC 122, Dave Lyle Boulevard	2.10

Figure 1: CMP Corridors



Corridor 1 (W): SC 161/SC 274 Old York Rd/Celanese Rd
between SC 24 and India Hook Rd

Length: 4.57 miles

Transportation Characteristics:

- Five lane roadway with center left turn lane
- Signalized intersections at Hands Mill Highway, Miller Pond Road, Pennington Road, Heckle Boulevard, Rawlinson Road, Museum Road, Ebenezer Road, Twin Lakes Road and India Hook Road
- No bicycle lanes or sidewalks along the corridor.
- Transit: Express Bus Service 78X
- Congestion regularly occurs eastbound during the morning peak hour and westbound during the afternoon peak hour
- The intersection of Celanese Rd and India Hook Road experiences long delays (97 seconds) during the peak hour, based upon the travel time runs.
- Apart from the congestion on Celanese Rd, congestion was noted along the cross streets of this corridor during field visits.

Performance Measures

- In 2005, this corridor operated at a LOS C
- By 2035, this corridor is expected to operate at LOS E if no actions are taken.

Performance Measure Targets

- Maintain LOS C
- Reduce intersection delays to 55 seconds or less for through traffic along the corridor.

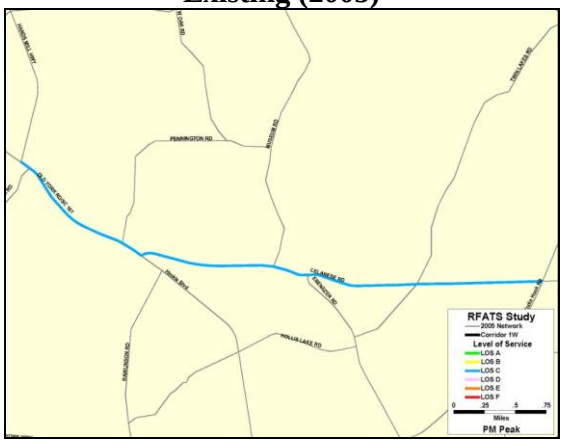
Route 78X	Load Capacity	On-Time Performance
2010	4.53%	75%
Target	25%	85%

Planned Improvement Projects

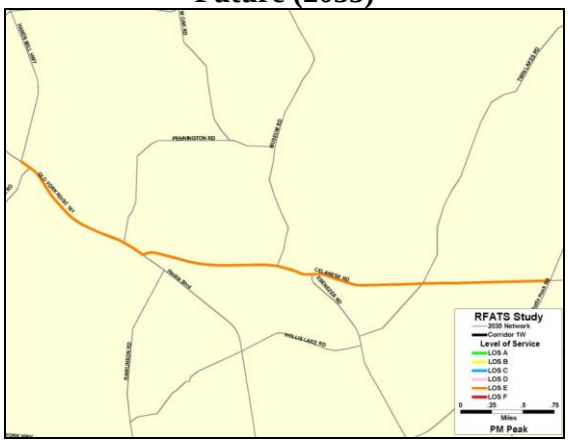
- No planned improvements along this corridor

Average Corridor PM Peak LOS from Metrolina Model

Existing (2005)



Future (2035)



Corridor 1 (E): SC 161/SC 274 Old York Rd / Celanese Rd
between India Hook Rd and US 21/Cherry Rd

Length: 2.42 miles

Transportation Characteristics

- Seven lane roadway with center left turn lane
- Signalized intersections at Hilltop Road, Mt. Gallant Road, Riverview Road, Riverchase Boulevard, I-77 SB Ramps and Cherry Road
- No bicycle lanes along the corridor
- Sidewalks are provided along the corridor
- Transit: Express Bus Service 78x
- Rosewood Elementary school is along the corridor
- Congestion regularly occurs eastbound during the morning peak hour and westbound during the afternoon peak hour
- The intersection of SC 161 at Mt. Gallant Road experiences long delays (85 seconds) during the peak hour based upon the travel time runs.
- The technical team has identified intersections along Celanese Road at River Chase Boulevard and I-77 northbound ramp as locations with safety concerns

Performance Measures

- In 2005, this corridor operated at a LOS E
- By 2035, this corridor is expected to operate at LOS F, if no improvements are implemented

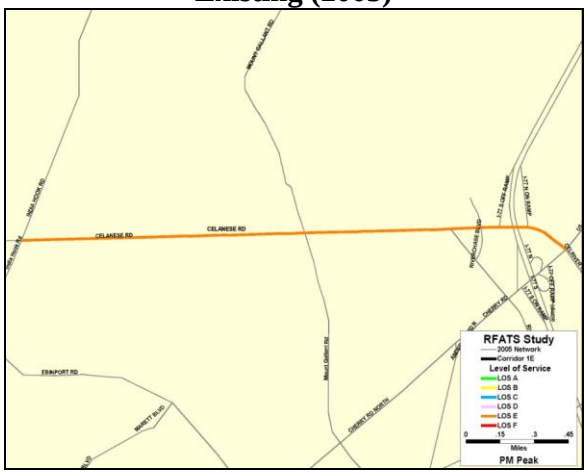
Performance Measure Targets

- Maintain LOS D
- Reduce intersection delays to 55 seconds or less for through traffic along the corridor.

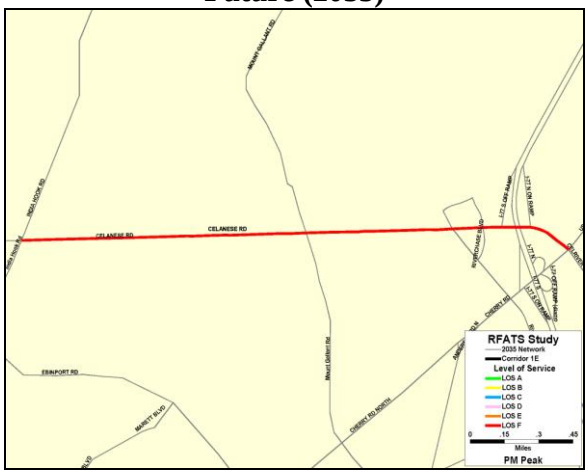
Route 78X	Load Capacity	On-Time Performance
2010	4.53%	75%
Target	25%	85%

Average Corridor PM Peak LOS from Metrolina Model

Existing (2005)



Future (2035)



Planned Improvement Projects

- Mt Gallant Road and Celanese Road intersection improvement: This project is a traffic flow improvement effort involving the addition of turning lanes to increase mobility and reduce congestion at the intersection. (TIP)

Field Review Observations

- Delays between Mt. Gallant Road intersection and I-77 on Celanese Road are high, but no plans for additional through lanes are being considered.
- SC 161 at Mt. Gallant is an intersection, however, at which there is turning movement delay that could be addressed with additional turn lanes. Adding lanes based on the CMAQ plan will reduce delay for these movements and may free up some green time to reduce delay for the through movements on all approaches

Corridor 2: US 21 / Cherry Road
between SC 901, Heckle Boulevard and SC 161, Cel-River Road

Length: 5.25 miles

Transportation Characteristics

- Corridor transitions between four lane roadway with center left turn lane and four lane undivided facility. For the most part, the corridor is a four lane facility with center left turn lane.
- This corridor has 19 signalized intersections at an average spacing of 0.29 miles
- No bicycle lanes are provided along the corridor
- Sidewalks are provided along most of the corridor
- No transit provided along corridor
- Finely Road Elementary, Winthrop College, Sullivan Middle School, and Cherry Park are located along the corridor.
- Congestion was observed westbound during both morning peak hour and afternoon peak hour during field visit.
- The intersection of Cherry Road at Mt. Gallant Road experiences long delays (65 seconds) during the PM peak hour based upon the travel time runs
- The corridor between Oakland Ave and Camden Ave is identified to have safety concerns by the technical team.

Performance Measures

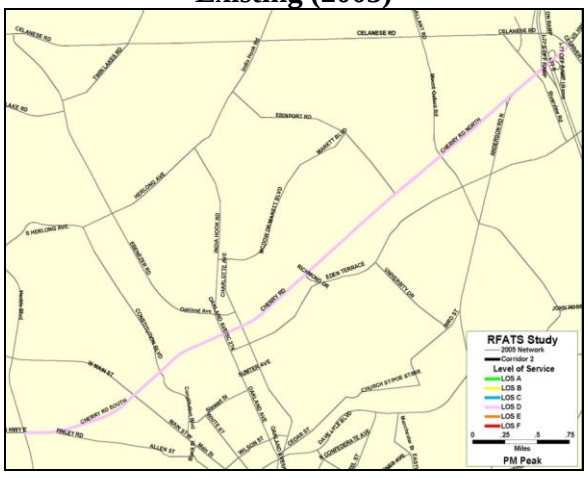
- In 2005, the corridor operated at LOS D
- In 2035, the corridor is expected to operate at LOS F, if no actions are taken.

Performance Measure Targets

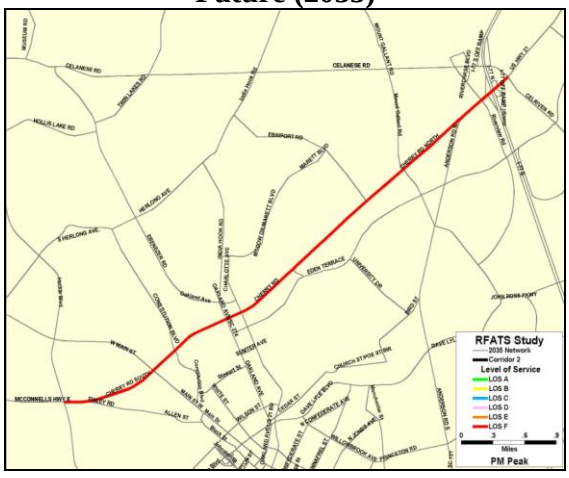
- Maintain LOS D along corridor
- Reduce intersection delays to 55 seconds or less for through traffic along the corridor.

Average Corridor PM Peak LOS from Metrolina Model

Existing (2005)



Future (2035)



Planned Improvement Projects

- Cherry Road / US 21 widening: Expand from two lanes to five lanes facility between Heckle Road and York Ave. (TIP)

Field Review Observations

- The movements experiencing delay are all through movements at the Mt. Gallant and Celanese Road / SC 161 intersections. Without additional through lanes, the only potential improvement is constant refinement of signal timing.
- Widening of Cel-River Road to provide a five lane section, including two westbound through lanes at the Cherry Road (US 21) and Celanese Road (SC 161) intersection should be under construction in the next five years. In the interim, however, consideration should be given to converting the westbound outside lane from a right turn only lane to a through/right lane.

Corridor 3 (W): SC 122, Dave Lyle Boulevard
between West Black Street and US 21 BYP/SC 121, Anderson Road

Length: 2.2 miles

Transportation Characteristics

- Four lane roadway divided by raised median for most of the corridor
- Signalized intersections at W. Black Street, W. Main Street, W. White Street, Willowbrooke Ave, Aragon Street, and Gateway Boulevard.
- No bicycle lanes are provided along the corridor
- Sidewalks are not provided along most of the corridor
- Transit: Express Bus route 82X
- North side Elementary school is along the corridor.

Performance Measures

- In 2005, the corridor operated at LOS C
- In 2035, the corridor is expected to operate at LOS D, if no actions are taken.

Performance Measure Targets

- Maintain LOS C along corridor

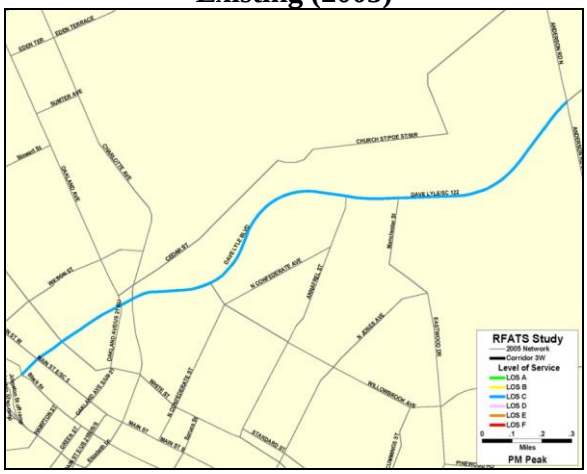
Route 82X	Load Capacity	On-Time Performance
2010	42.30%	93%
Target	60%	90%

Planned improvement projects

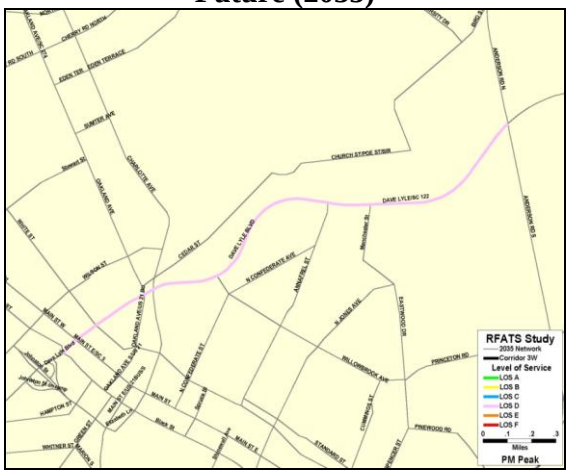
- No planned improvements along the corridor

Average Corridor PM Peak LOS from Metrolina Model

Existing (2005)



Future (2035)



Corridor 3 (E): SC 122, Dave Lyle Boulevard
between US 21 BYP/SC 121, Anderson Road and Red River Road

Length: 2.41 miles

Transportation Characteristics

- Four lane roadway divided by raised median for most of the corridor
- This corridor has nine signalized intersections at an average spacing of 0.30 miles
- No bicycle lanes are provided along the corridor
- Sidewalks are provided along most of the corridor
- Intersection of Dave Lyle Boulevard at Tinsley Way was identified to have safety concerns
- Transit: Express Bus route 82X. This service uses this corridor (an established park-n-ride is located at the Manchester Cinemas), on its way to the Charlotte Transportation Center during the morning and evening peak periods.

Performance Measures

- In 2005, the corridor operated at LOS C
- In 2035, the corridor is expected to operate at LOS E , if no actions are taken

Performance Measure Targets

- Maintain LOS C along corridor

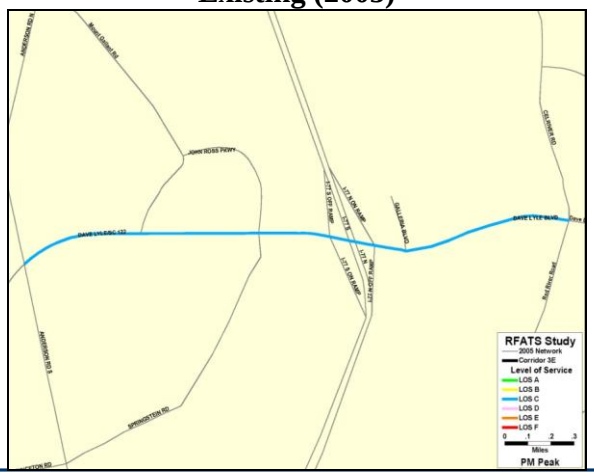
Route 82X	Load Capacity	On-Time Performance
2010	42.30%	93%
Target	60%	90%

Planned improvement projects

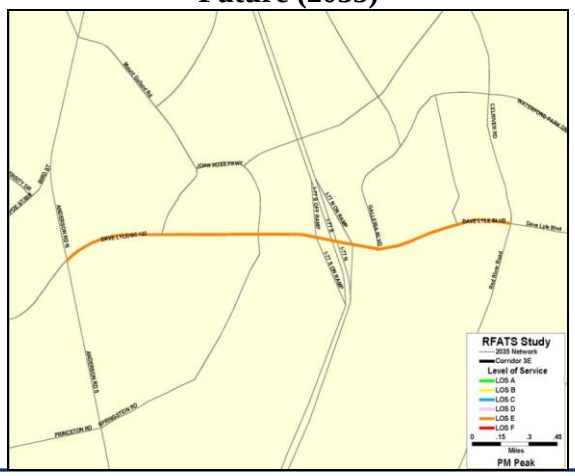
- A Congestion Mitigation & Air Quality Improvement (CMAQ) grant was approved during the FY 2009-10 funding cycle to implement operational and safety related improvements at Dave Lyle Blvd / I-77 SB Exit Ramp / Chamberside Dr intersection area. Specific improvement include an additional turn lane on the I-77 southbound ramp; expanded storage capacity approaching the Dave Lyle Blvd / Chamberside Dr intersection as well as the incorporation of a dual left turn facility at this intersection as well.

Average Corridor PM Peak LOS from Metrolina Model

Existing (2005)



Future (2035)



Corridor 4: SC 72
between Rawlsville Road and Springdale Road

Length: 5.46 miles

Transportation Characteristics

- Corridor is predominantly a two lane facility and transitions to a four lane facility between Mt. Holly Road and Heckle Boulevard.
- The corridor becomes two lane divided along the Plaza Shopping Center and transforms to two lane roadway with center left turn lane between Flint St and Springdale Road.
- This corridor has nine signalized intersections at an average spacing of 0.68 miles
- No bicycle lanes are provided along the corridor
- Sidewalks are not provided along most of the corridor, but are periodically available.
- No transit provided along corridor
- Belleview Elementary School and the Phoenix Academy are located along the corridor

Performance Measures

- In 2005, the corridor operated at LOS C
- In 2035 the corridor is expected to operate at LOS E , if no actions are taken

Performance Measure Targets

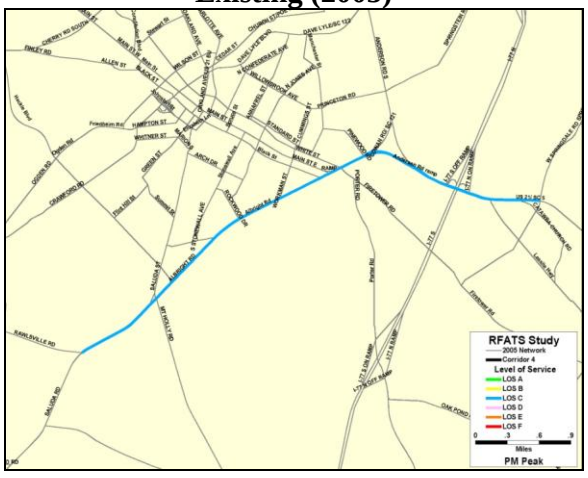
- Maintain LOS C along corridor

Planned improvement projects

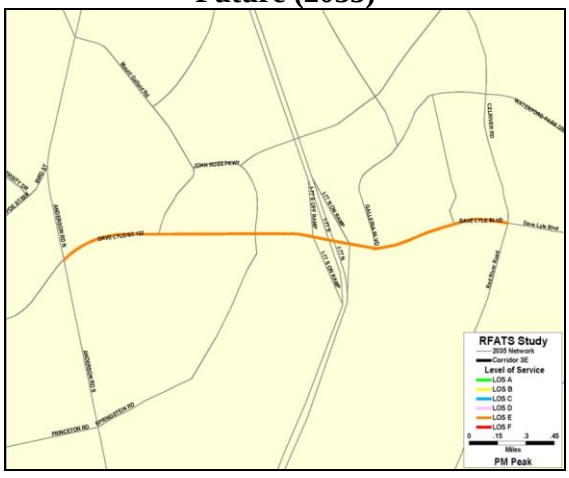
- SC 72 (Black Street to Heckle Boulevard) – widen 1.8 miles to five lanes (TIP)

Average Corridor PM Peak LOS from Metrolina Model

Existing (2005)



Future (2035)



Corridor 5 (N): Mt. Gallant Road
between SC 274, Hands Mill Highway and SC 161/Celanese Road

Length: 7.83 miles

Transportation Characteristics

- Corridor is a two lane undivided facility
- Signalized intersections at SC 274, Museum Road, Twin Lakes Road, India Hook Road and Celanese Road.
- No bicycle lanes are provided along the corridor
- Sidewalks are not provided along most of the corridor
- No transit provided along corridor
- Dutchman Creek Middle school, Mt. Gallant Elementary, India Hook Elementary and the Museum of York are educational / cultural institutions located
- Congestion occurs eastbound in the morning peak hour and westbound in the afternoon peak hour.
- During travel time runs Mt. Gallant Road and Twin Lakes Road intersection experienced heavy congestion (65 seconds)
- Mt. Gallant Road and Celanese Road intersection also experienced heavy congestion (110 seconds)
- Intersections along Mt. Gallant Road at Redwood Drive and India Hook Road are identified to have safety concerns

Performance Measures

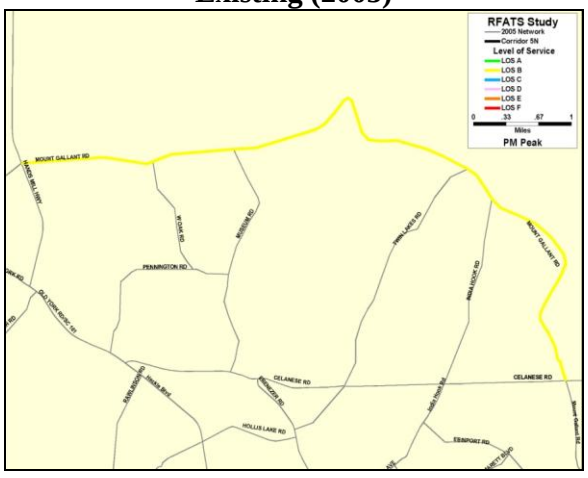
- In 2005, the corridor operated at LOS B
- In 2035, the corridor is expected to operate at LOS C, if no actions are taken

Performance Measure Targets

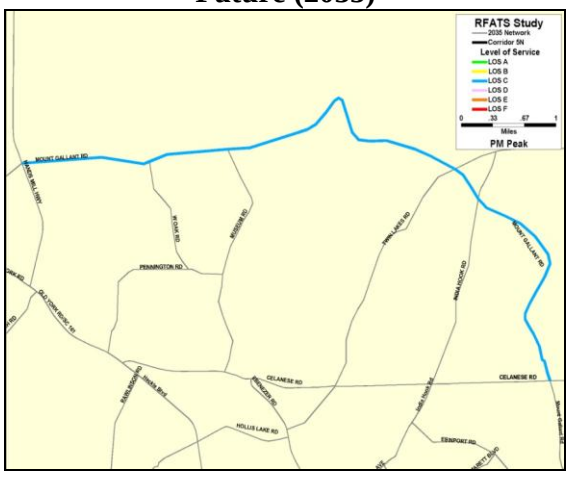
- Maintain Corridor LOS at C
- Reduce intersection delays to 55 seconds or less for through traffic along the corridor.

Average Corridor PM Peak LOS from Metrolina Model

Existing (2005)



Future (2035)



Planned Improvement Projects

- Mt Gallant Road and Celanese Road intersection improvement: This project will construct turn lanes to increase mobility and reduce congestion at the intersection. (TIP)
- Mt. Gallant Road Widening. Widen roadway between Twin lakes Road and Celanese Road to a three lane facility. (TIP)

Field Review Observations

- Delays between Mt. Gallant Road intersection and I-77 on Celanese Road are high, but no plans for additional through lanes are being considered.
- It is likely that additional turn lanes, turn lane length extensions, and signal timing designed for specific times of day could reduce congestion at the Mt. Gallant and Twin Lakes Road intersection.

Corridor 5 (S): Mt. Gallant Road
between SC 161/Celanese Road and SC 122/Dave Lyle Boulevard

Length: 2.85 miles

Transportation Characteristics

- This corridor is mainly a two lane undivided facility
- Signalized intersections at Cherry Road, Eden Terrace, Anderson Road and Dave Lyle Boulevard.
- No bicycle lanes are provided along the corridor
- Sidewalks are provided along most of the corridor (excluding the industrial area between Anderson and Cherry Road).
- No transit provided along corridor
- Mt. Gallant Road and Anderson Road intersection experienced heavy congestion (127 seconds) during PM travel time runs
- During the field visit conducted for this project, the queues along Mt. Gallant Road were long at the Mt. Gallant Road and Anderson Road intersection
- Congestion occurs at the Mt. Gallant Road and Cherry Road intersection, southbound during the morning peak hour and westbound, northbound, and southbound during the afternoon peak hour

Performance Measures

- In 2005, the corridor operated at LOS C
- In 2035, the corridor is expected to operate at LOS D , if no actions are taken

Performance Measure Targets

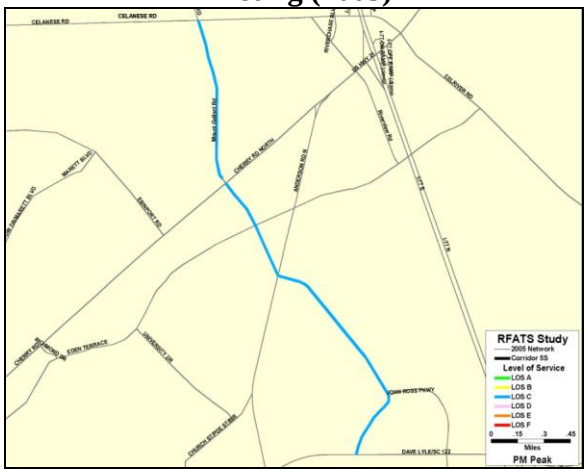
- Maintain LOS C along corridor
- Reduce intersection delays to 55 seconds or less for through traffic along the corridor.

Planned Improvement Projects

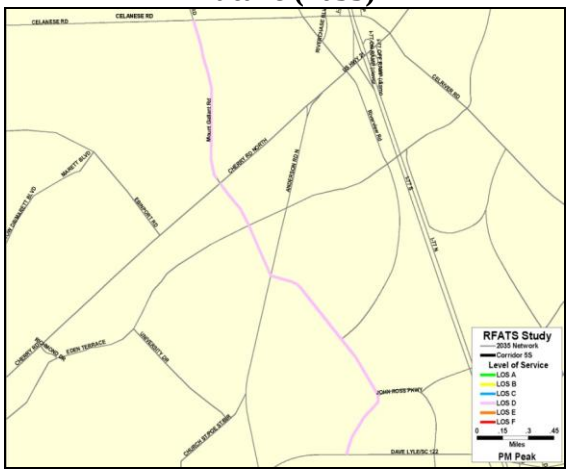
- Mt. Gallant Road Widening. Widen roadway between Celanese Road and Anderson Road to

Average Corridor PM Peak LOS from Metrolina Model

Existing (2005)



Future (2035)



a three lane facility. (TIP)

Field Review Observations

- Signal timing should be examined to determine if more green time could be given to Mt. Gallant in the afternoon peak period at Mt. Gallant R and Anderson Road intersection.
- Mt. Gallant Road is under construction to provide a three-lane section at the Cherry Road intersection, but the project will not result in any additional approach lanes at this intersection. The movements experiencing delay are all through movements – southbound in both the morning and afternoon and westbound and northbound in the afternoon. Without additional through lanes on these approaches, the only potential operational improvement is constant refinement of signal timing.

Corridor 6: US 21, Carowinds Boulevard and SC 51
between Pleasant Road and the North Carolina State Line

Length: 2.25 miles

Transportation Characteristics

- Carowinds Boulevard is a six lane divided facility between Pleasant Road and I-77
- US 21 is a four lane divided facility between I-77 and Pine Rock Hill Road.
- Pine Rock Hill Road (SC 51) is mainly a two lane undivided facility
- Signalized intersections are located at Flint Hill Road, Pineville-Rockhill Road, Springhill Farm Road, I-77 Southbound, Avenue of the Carolinas, and Pleasant Road
- No bicycle lanes are provided along the corridor
- Sidewalks are provided along most of the corridor
- No transit provided along corridor
- Carowinds Park is located along this corridor
- Congestion occurs eastbound in the morning peak hour and westbound in the afternoon peak hour.
- Carowinds Boulevard and Pleasant Road intersection experiences heavy congestion (117 seconds) during travel time runs

Performance Measures

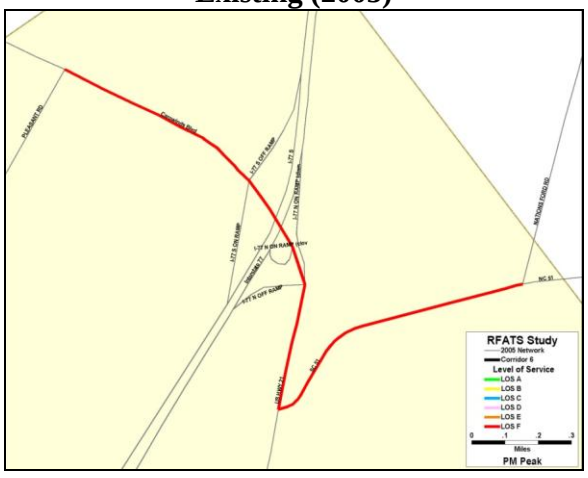
- In 2005, the corridor operated at LOS F
- In 2035, the corridor will continue to operate at LOS F , if no actions are taken

Performance Measure Targets

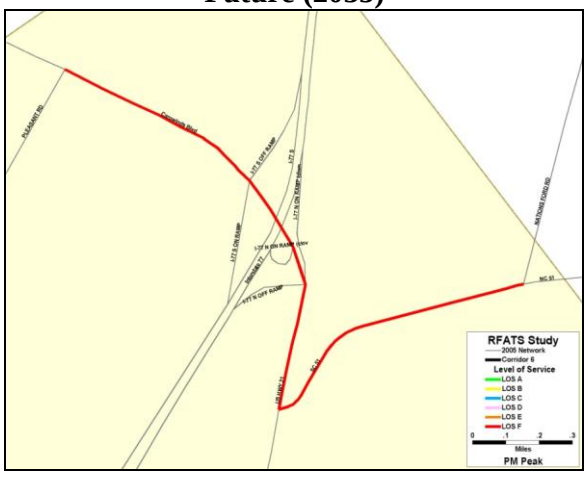
- Maintain LOS D along corridor
- Reduce intersection delays to 55 seconds or less for through traffic along the corridor.

Average Corridor PM Peak LOS from Metrolina Model

Existing (2005)



Future (2035)



Planned improvement projects

- Carowinds Boulevard and Springhill Farm Road intersection improvement: This project is a traffic flow improvement effort that involves the construction of a dedicated right turn lane on Springhill Farm Road from the intersection of Stateview Road to Carowinds Boulevard.(TIP)

Field review observations

- Three eastbound through lanes begin at the intersection of Carowinds Boulevard and Pleasant Road, but only two westbound through lanes exist.
- The westbound left turning movement is heavy from Carowinds Boulevard to Pleasant Road. Dual left is not possible because there is only one receiving lane on Pleasant Road. The left turn lane could easily be lengthened by removing some of the grass median.

Corridor 7: Gold Hill Road
between SC 160 and Old Nations Road (Garrison Farm Road)

Length: 3.47 miles

Transportation Characteristics

- Gold Hill Road is a four lane roadway with center left turn lane from Steele Creek Road (SC 160) to Springfield Parkway
- Gold Hill Road is a two lane undivided facility with turn lanes between Springfield Parkway and Old Nations Road (Garrison Farm Road)
- This corridor has nine signalized intersections with an average spacing of 0.43 miles
- No bicycle lanes are provided along the corridor
- Sidewalks are provided along most of the corridor
- No transit provided along corridor
- Based on the travel time runs the intersections Gold Hill Road at SC 160 and Gold Hill Road at I-77 North bound frontage Road experienced heavy delay (185 seconds and 135 seconds respectively)
- Field visits revealed the heavy westbound right turn at the Gold Hill Road and Steele Creek Road intersection. This movement is currently served from a through/right lane

Performance Measures

- In 2005, the corridor operated at LOS C
- In 2035, the corridor will operate at LOS F , if no actions are taken

Performance Measure Targets

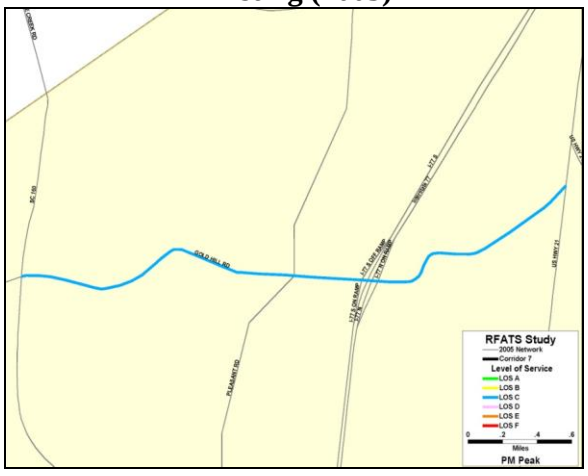
- Maintain LOS D along corridor
- Reduce intersection delays to 55 seconds or less for through traffic along the corridor.

Planned Improvement Projects

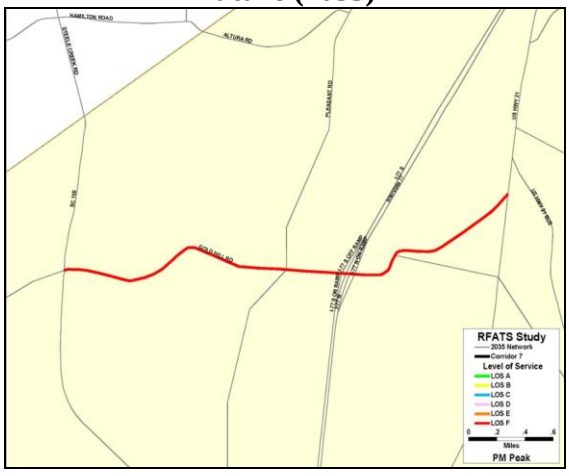
- Goldhill Road / Steele Creek Road intersection improvement: This project is a traffic flow improvement effort involving the addition of turn lanes and the upgrading of the traffic signal

Average Corridor PM Peak LOS from Metrolina Model

Existing (2005)



Future (2035)



controller. (TIP)

Field Review Observations

- The westbound left from Gold Hill to go south on I-77 operates as protected/prohibited because there was an accident pattern involving the westbound lefts and eastbound through.
    - Long term - a new interchange is needed to accommodate the higher volumes that are developing with the growth of Tega Cay.
    - Short term - restriping of the bridge to provide side by side left turn storage (five lanes on the bridge) should be explored. It appears that this restriping could be accommodated, but the lanes would be narrower than standard. Therefore, the benefits from greater left turn storage would have to be weighed against the narrow lanes. The District office of SCDOT has recently conducted counts at the interchange. Therefore, a quick analysis of this potential restripe would allow the benefits to be quantified.

Corridor 8 (W): SC 160 / Steele Creek Road
between SC state line and US 21 BYP

Length: 4.62 miles

Transportation Characteristics

- SC 160 / Steele Creek Road is a four lane roadway with center left turn lane from Gold Hill Road to US 21 BYP
- The corridor is a two lane undivided facility between SC state line and Gold Hill Road
- This corridor has 11 signalized intersections with an average spacing of 0.46 miles
- No bicycle lanes or continuous sidewalks are present along this corridor
- No transit provided along corridor
- The intersection of Steele Creek Road at Zoar Road, Munn Road, I-77 SB frontage Road, and Kingsley Park Drive were identified as having safety concerns

Performance Measures

- In 2005, the corridor operated at LOS D
- In 2035, the corridor will operate at LOS F , if no actions are taken

Performance Measure Targets

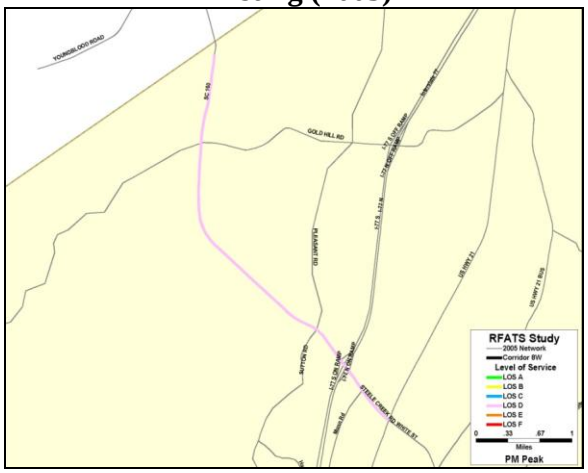
- Maintain the corridor LOS at D in future
- Reduce intersection delays to 55 seconds or less for through traffic along the corridor.

Planned improvement projects

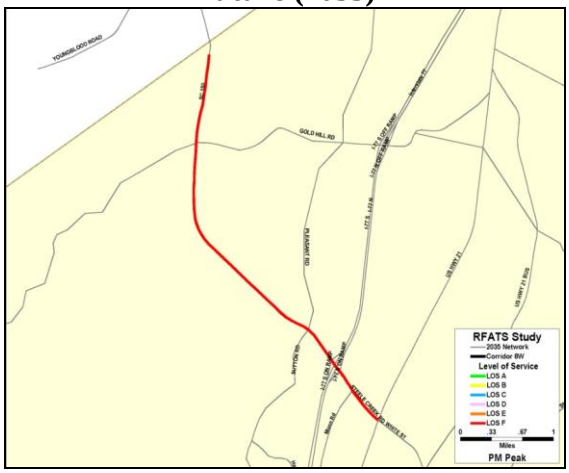
- Goldhill Road / Steele Creek Road Intersection Improvement: This project is a traffic flow improvement effort involving the addition of turn lanes and the upgrading of the traffic signal controller. (TIP)
- Steele Creek Road Expansion: Widen to 3 lanes between Gold Hill Road and Zoar Road.(TIP)
- SC 160 / SC 21 intersection improvement: This project is a traffic flow project that will widen the Westbound Lane of SC 160 to include a turn lane with a straight right function.

Average Corridor PM Peak LOS from Metrolina Model

Existing (2005)



Future (2035)



Corridor 8 (E): SC 160
between US 21 BYP and Lancaster County Line

Length: 3.61 miles

Transportation Characteristics

- SC 160 / N White St is a two lane undivided facility between US 21 BYP and Main Street
- The corridor becomes two lane facility with center left turn lane from Main Street
- The corridor becomes a two lane facility with center left turn lane from Main St to Lancaster County Line
- No bicycle lanes or continuous sidewalks are present along this corridor
- This corridor has seven signalized intersections.
- No transit provided along corridor
- Fort Mill Middle School and Fort Mill Elementary School are the educational institutions in this corridor
- Congestion noted westbound on SC 160/Tom Hall Road in the morning peak hour during field visit.
- Based on the travel time runs the intersection SC 160/ Tom Hall St at Springfield parkway experienced heavy delay (95 seconds)
- The intersection of SC 160 at Springfield Parkway was identified to have safety concerns
- The intersection of SC 160 at Hensley Road has recently been signalized and has to be evaluated for turning lanes as per comments from steering committee members. This intersection was also identified to have safety concerns.

Performance Measures

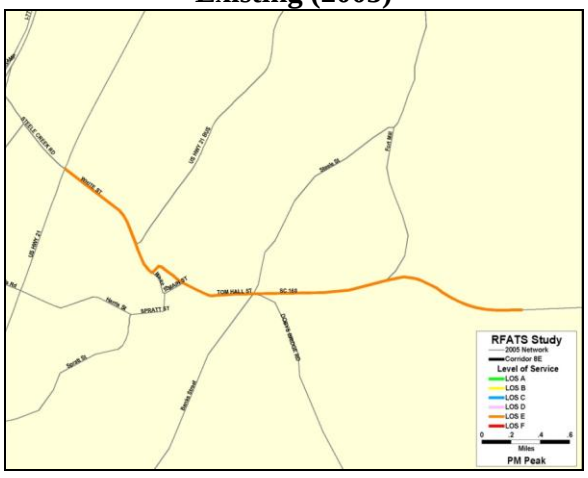
- In 2005, the corridor operated at LOS E
- In 2035, the corridor will operate at LOS E , if no actions are taken

Performance Measure Targets

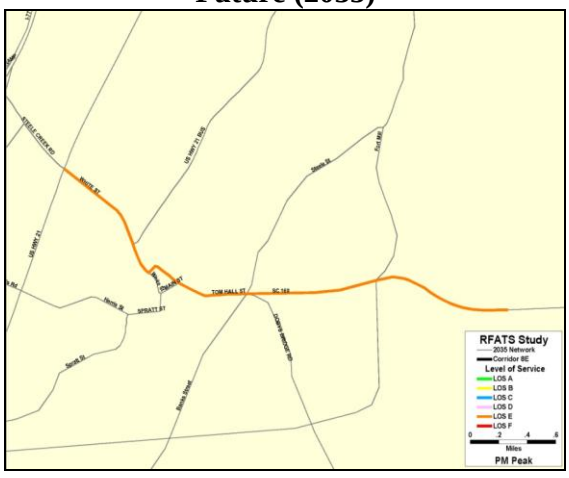
- Reduce the corridor LOS to D in future
- Reduce intersection delays to 55 seconds or less for through traffic along the corridor.

Average Corridor PM Peak LOS from Metrolina Model

Existing (2005)



Future (2035)



Planned Improvement Projects

- Fort Mill Southern Bypass: This project will provide an alternate route for traffic that typically uses SC 160 from I-77 through the business district in the Town of Fort Mill.(TIP)

Field Review Observations

- The westbound movement at SC 160 at Springfield Pkwy intersection is the only east-west access to Fort Mill from the east. The intersection is also on a heavily used truck route. Although the single westbound through lane is a limiting factor in the intersection's operations, several small changes should be considered to improve operations with the existing geometry:
    - Improve radius in northeast corner
    - Consider signalizing the southbound right turn overlap with the eastbound left turn
    - Consider remarking the westbound approach to include a left turn lane – this may be difficult because the turning path for trucks turning southbound to eastbound means the stop bar for the westbound left turn lane would be set back. The lane would be helpful, however, by removing the occasional left turn from the westbound through movement.
    - Examine signal timing for changes in timing to accommodate different peak volumes.
- The intersection of SC 160 at Hensley Road is also on the truck route and appears to have been recently signalized. One eastbound truck held up traffic because of the grades eastbound past the intersection. There is no westbound left turn lane, and the side street has one wide approach lane. Intersection should be reexamined for turn lane needs and signal timing refinements. Long term, the narrow lanes, nonexistent shoulders and grades on this section should be examined for their ability to accommodate truck traffic safely.

Corridor 9: SC 49, Charlotte Highway
between SC 55 and NC State Line.

Length: 5.51 miles

Transportation Characteristics

- Charlotte Highway is a four lane roadway with center left turn lane
- This corridor has seven signalized intersections.
- No bicycle lanes or continuous sidewalks are present along this corridor
- No transit provided along corridor
- Signalized intersections at SC 55, SC 274, Mill Pond Road, Robinwood Road, and Heritage Drive.
- Based on the travel time runs the intersection of SC 49 at SC 274 and Robinwood Road experienced huge delay in PM peak period (120 seconds and 205 seconds respectively)

Performance Measures

- In 2005, the corridor operated at LOS B
- In 2035, the corridor will operate at LOS D , if no actions are taken

Performance Measure Targets

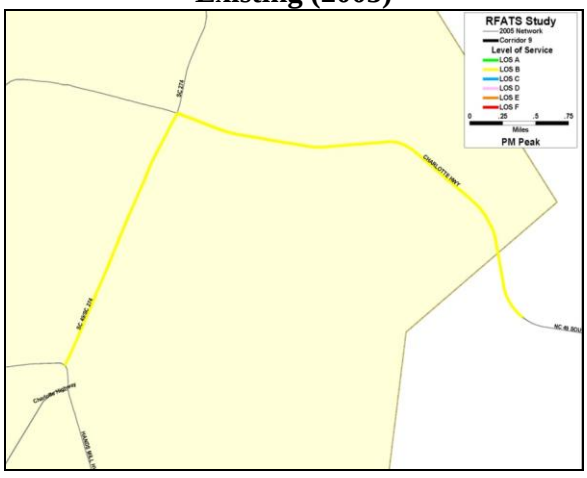
- Maintain the corridor LOS at C in future.
- Reduce intersection delays to 55 seconds or less for through traffic along the corridor.

Planned improvement projects

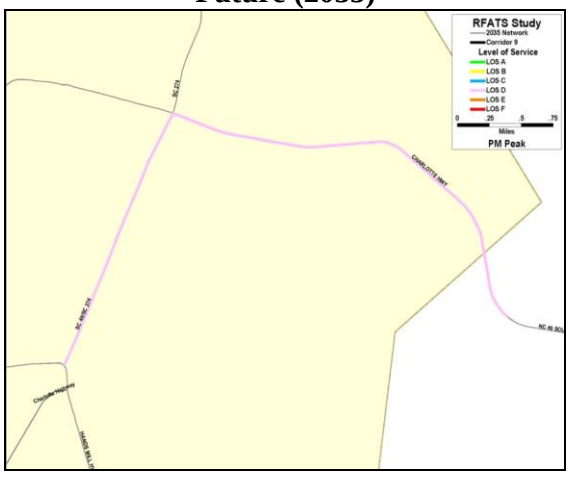
- No planned improvements along this corridor.

Average Corridor PM Peak LOS from Metrolina Model

Existing (2005)



Future (2035)



Corridor 10 (S): I-77
between RFATS Boundary and SC 122, Dave Lyle Boulevard

Length: 19.42 miles

Transportation Characteristics

- Four lane to eight lane fully access controlled freeway

Performance Measures

- In 2005, the corridor operated at LOS B
- In 2035, the corridor will operate at LOS D , if no actions are taken

Performance Measure Targets

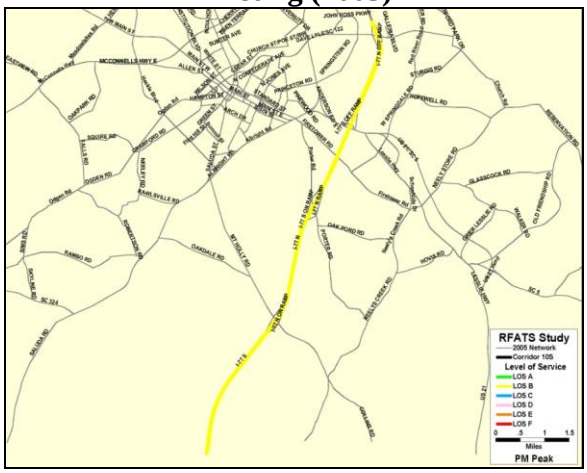
- Maintain the Corridor LOS at D

Planned improvement projects

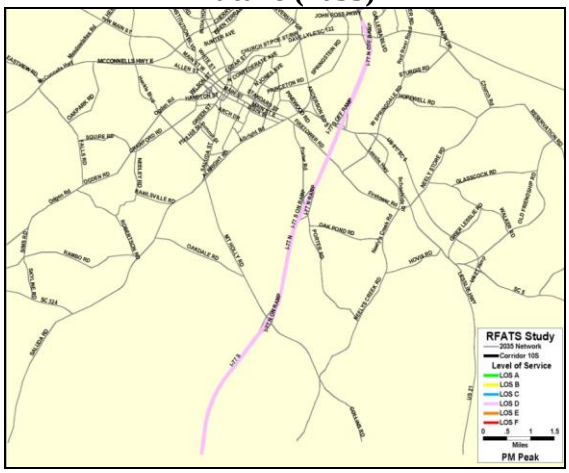
- No planned improvements along this corridor.

Average Corridor PM Peak LOS from Metrolina Model

Existing (2005)



Future (2035)



Corridor 10 (N): I-77

between SC 122, Dave Lyle Boulevard and NC State Line

Length: 23.96 miles

Transportation Characteristics

- Four lane to eight lane fully access controlled freeway
- The section of corridor between exits 77 and exit 99 is identified to have safety concerns as traffic backs up off ramps to main lanes.

Performance Measures

- In 2005, the corridor operated at LOS C
- In 2035, the corridor will operate at LOS D, if no actions are taken

Performance Measure Targets

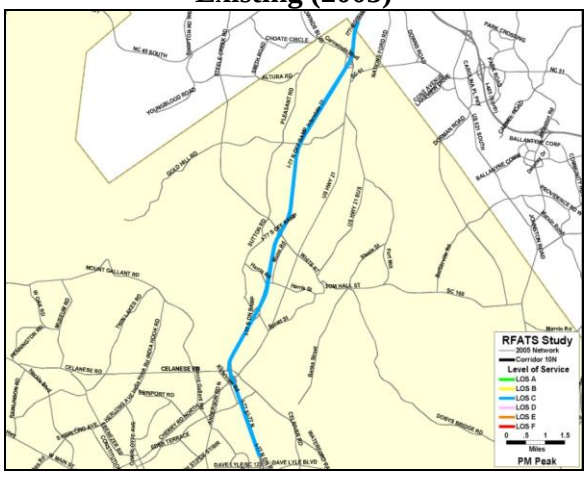
- Maintain the Corridor LOS at D

Planned improvement projects

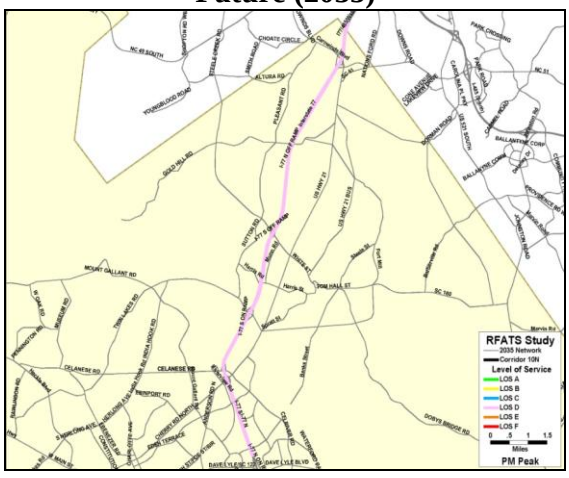
- No planned improvements along this corridor.

Average Corridor PM Peak LOS from Metrolina Model

Existing (2005)



Future (2035)



Corridor 11: US 21 BYP
between SC 161, Cel-River Road and SC 51

Length: 8.15 miles

Transportation Characteristics

- The corridor is predominantly a two lane undivided facility
- No bicycle lanes or continuous sidewalks are present along this corridor
- Riverview Elementary School is near the corridor.
- The intersection of US 21 BYP at Harris St was identified to have a safety concern

Performance Measures

- In 2005, the corridor operated at LOS C
- In 2035, the corridor will operate at LOS E , if no actions are taken

Performance Measure Targets

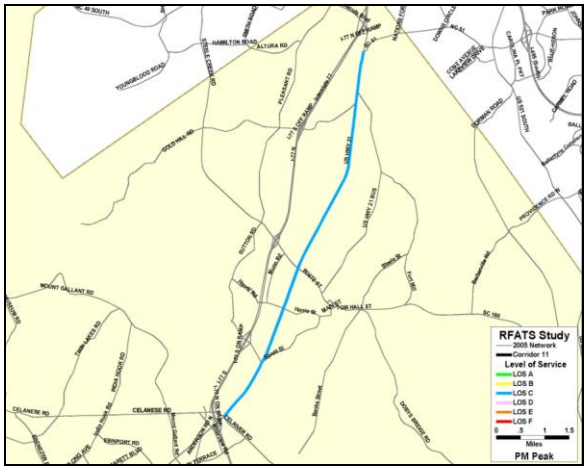
- Maintain the corridor LOS at D in the future

Planned improvement projects

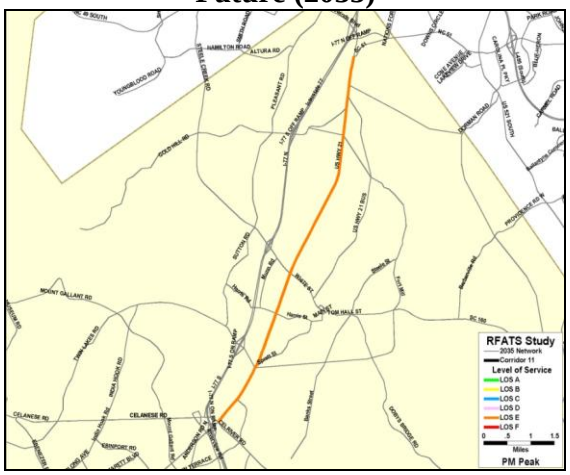
- US 21 BYP Widening: Widen from two to five lane facility between Cel-River Road and Sutton Road. (TIP)

Average Corridor PM Peak LOS from Metrolina Model

Existing (2005)



Future (2035)



Corridor 12: US 21 BYP / SC 121 (Anderson Road)
between US 21, Cherry Road and Springdale Road

Length: 4.09 miles

Transportation Characteristics

- The corridor is predominantly a four lane facility with center left turn lane
- No bicycle lanes or continuous sidewalks are present along this corridor
- No transit provided along corridor
- St. Ann Catholic School and York Technical College are the educational institutions along the corridor

Performance Measures

- In 2005, the corridor operated at LOS C
- In 2035, the corridor will operate at LOS D , if no actions are taken

Performance Measure Targets

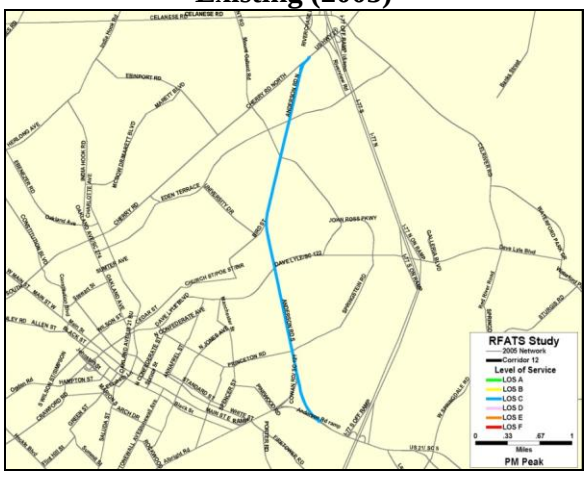
- Maintain the Corridor LOS at D

Planned improvement projects

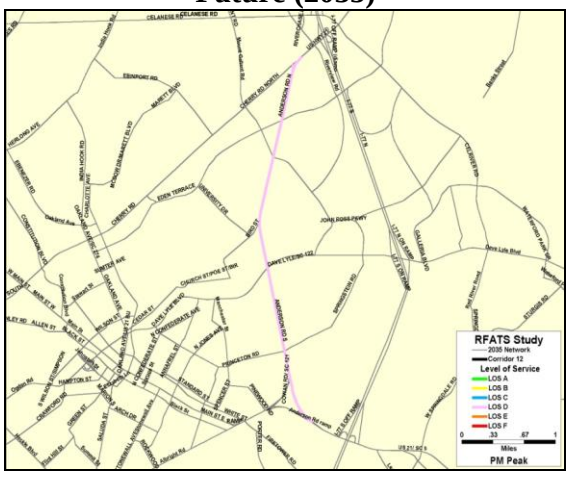
- No planned improvements along this corridor

Average Corridor PM Peak LOS from Metrolina Model

Existing (2005)



Future (2035)



Corridor 13: SC 901, Heckle Boulevard
between SC 161/SC 274, Old York Road and SC 72/SC 121

Length: 6.63 miles

Transportation Characteristics

- The corridor is a four lane divided facility between SC 161/ Old York Road and Main St
- The corridor transforms to a four lane facility with center left turn lane between Main St and SC 72.
- No bicycle lanes or continuous sidewalks are present along this corridor
- No transit provided along corridor
- Sunset Park Elementary School and Clinton Jr College are near the corridor
- The intersection of Heckle Boulevard and Old York Road and the section of Heckle Boulevard north and south of Herlong Ave was identified to have safety concerns

Performance Measures

- In 2005, the corridor operated at LOS C
- In 2035, the corridor will operate at LOS F , if no actions are taken

Performance Measure Targets

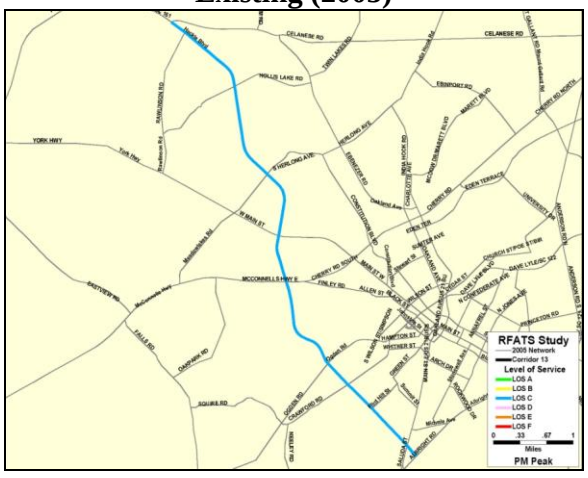
- Maintain the corridor LOS at D in future

Planned improvement projects

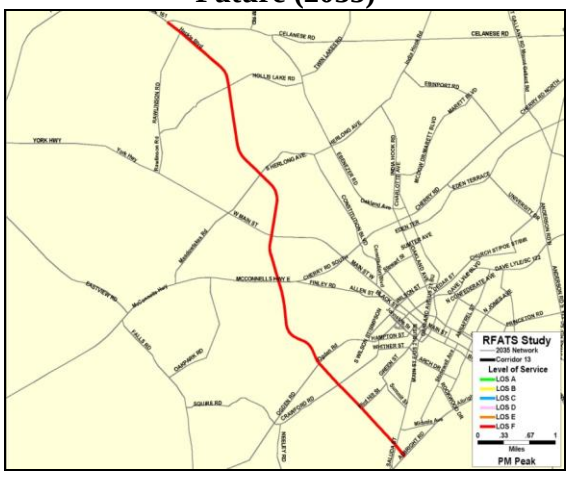
- No planned improvements along this corridor

Average Corridor PM Peak LOS from Metrolina Model

Existing (2005)



Future (2035)



Corridor 14: SC 274, Ebenezer Road
between SC 161/SC 274, Celanese Road and Oakland Ave/India Hook Road

Length: 2.8 miles

Transportation Characteristics

- The corridor is a two lane undivided facility between Celanese Road and Herlong Ave
- The corridor changes to a two lane facility with center left turn lane between Herlong Ave and India Hook Road.
- No bicycle lanes or continuous sidewalks are present along this corridor
- No transit provided along corridor

Performance Measures

- In 2005, the corridor operated at LOS C
- In 2035, the corridor will operate at LOS D , if no actions are taken

Performance Measure Targets

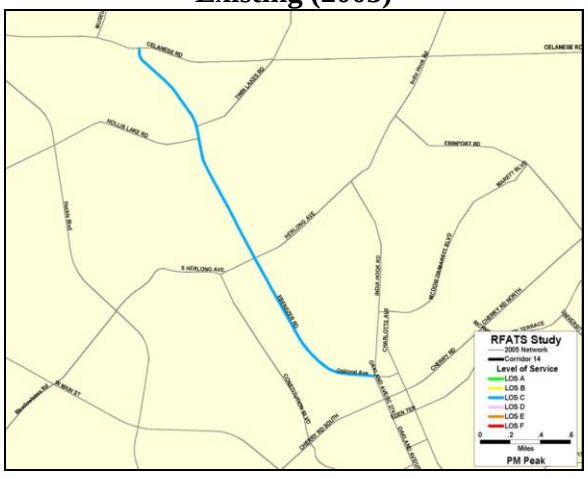
- Maintain Corridor LOS at D in future

Planned improvement projects

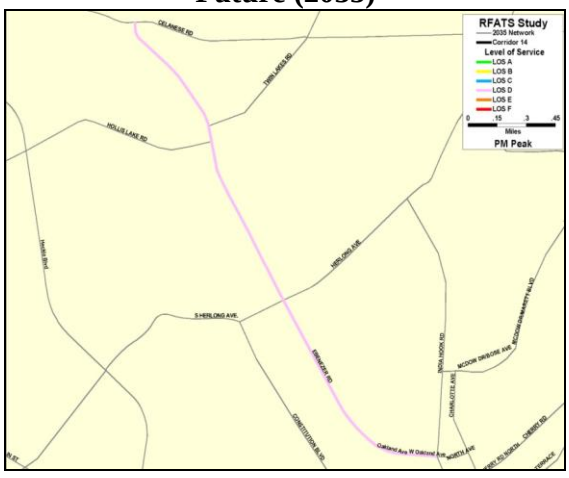
- Ebenezer Road Widening: Widen roadway from two lanes to three lanes between SC 161/ Celanese Road and Frank Gaston Boulevard. (TIP)

Average Corridor PM Peak LOS from Metrolina Model

Existing (2005)



Future (2035)



Corridor 15: Herlong Avenue
between SC 901, Heckle Boulevard and SC 161, Celanese Road

Length: 2.86 miles

Transportation Characteristics

- The corridor is a four lane facility with center left turn lane
- No bicycle lanes or continuous sidewalks are present along this corridor
- No transit provided along corridor
- Piedmont Medical Center and Ebinport Elementary School are along this corridor
- The corridor between Heckle Boulevard and Ebenezer Road was identified to have safety concerns

Performance Measures

- In 2005, the corridor operated at LOS D
- In 2035, the corridor will operate at LOS F, if no actions are taken

Performance Measure Targets

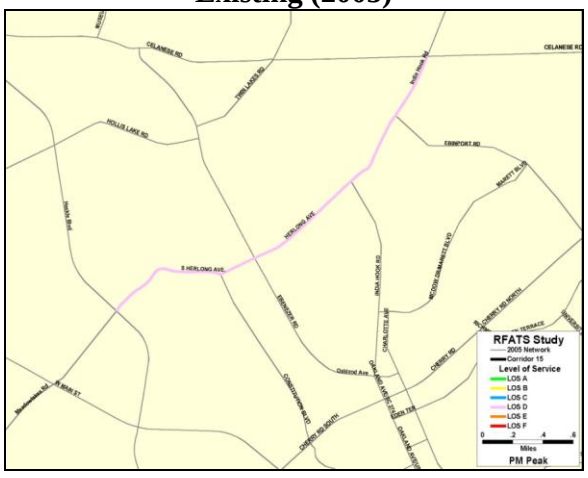
- Maintain Corridor LOS at D in future

Planned improvement projects

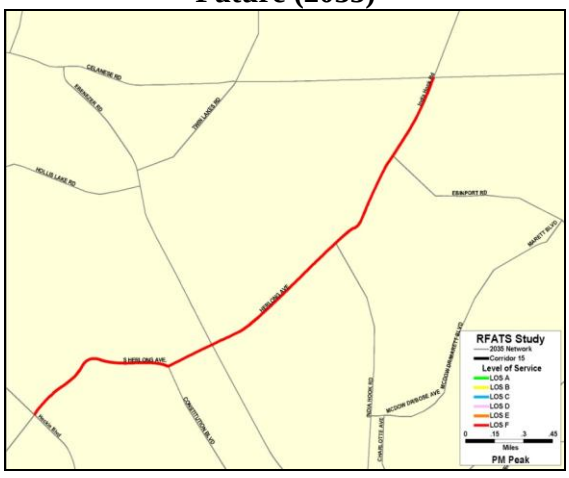
- No planned improvements in this corridor

Average Corridor PM Peak LOS from Metrolina Model

Existing (2005)



Future (2035)



Corridor 16: India Hook Road
between SC 161, Celanese Road and Mt. Gallant Road

Length: 1.96 miles

Transportation Characteristics

- The corridor is a two lane undivided facility
- No bicycle lanes or continuous sidewalks are present along this corridor
- No transit provided along corridor

Performance Measures

- In 2005, the corridor operated at LOS A
- In 2035, the corridor will operate at LOS A , if no actions are taken

Performance Measure Targets

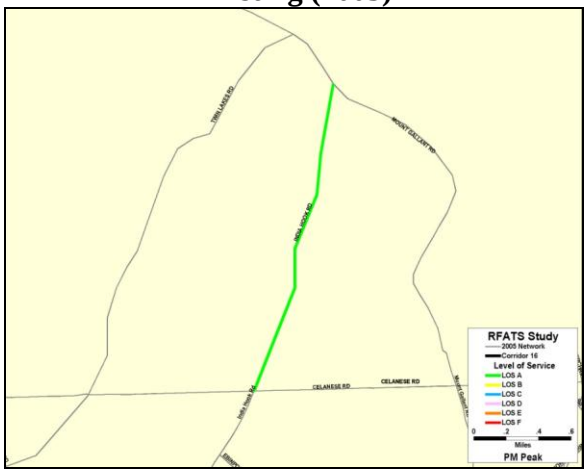
- Maintain the corridor LOS at A in future

Planned improvement projects

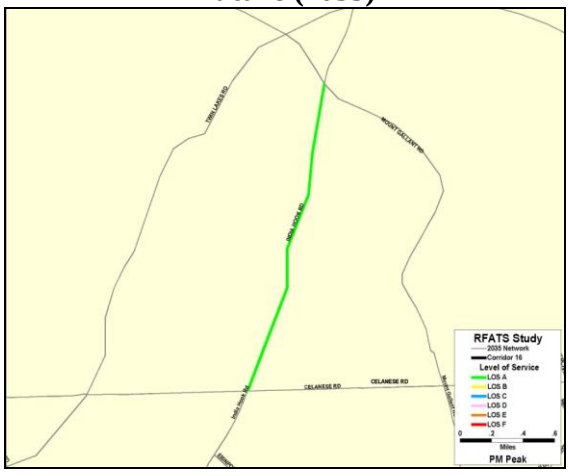
- No planned improvements along this corridor

Average Corridor PM Peak LOS from Metrolina Model

Existing (2005)



Future (2035)



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Corridor 17: Red River Road, Cel-River Road
between SC 161, Celanese Road and Springdale Road

Length: 3.6 miles

Transportation Characteristics

- The corridor is a two lane undivided roadway
- No bicycle lanes or continuous sidewalks are present along this corridor
- No transit provided along corridor

Performance Measures

- In 2005, the corridor operated at LOS B
- In 2035, the corridor will operate at LOS C , if no actions are taken

Performance Measure Targets

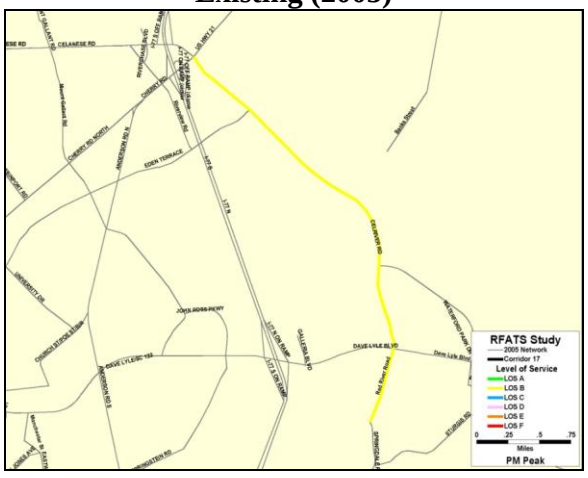
- Maintain Corridor LOS at C in future

Planned improvement projects

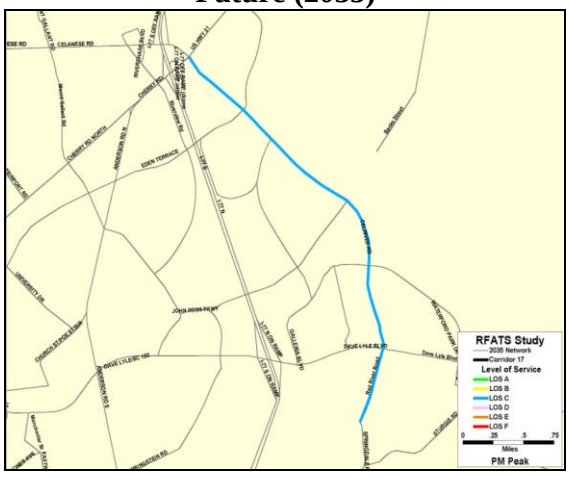
- Cel-River Road Widening: Widen roadway from two lanes to five lane facility between Cherry Road / US 21 and SC 645 (TIP). This project represents Phase I of planned improvements along this corridor. Five lanning the remainder of Cel-River Road from SC 645 to Dave Lyle Blvd is projected to be complete by 2025.

Average Corridor PM Peak LOS from Metrolina Model

Existing (2005)



Future (2035)



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Corridor 18: John Ross Parkway
between SC 122, Dave Lyle Boulevard and Mt. Gallant Road

Length: 0.63 miles

Transportation Characteristics

- The corridor is a two lane divided roadway
- No bicycle lanes or continuous sidewalks are present along this corridor
- Sidewalks are present near major developments
- No transit provided along the corridor

Performance Measures

- In 2005, the corridor operated at LOS B
- In 2035, the corridor will operate at LOS B, if no actions are taken

Performance Measure Targets

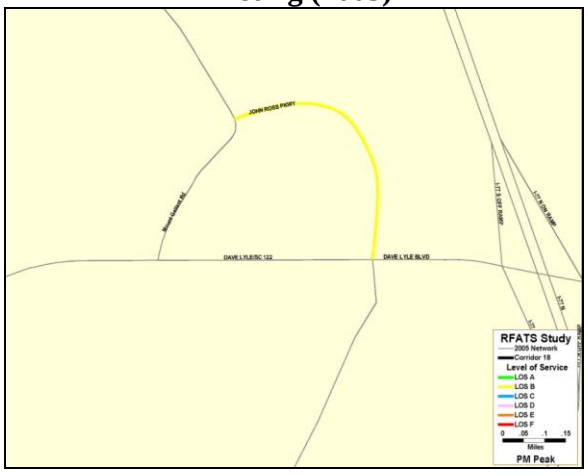
- Maintain Corridor LOS at B in future

Planned improvement projects

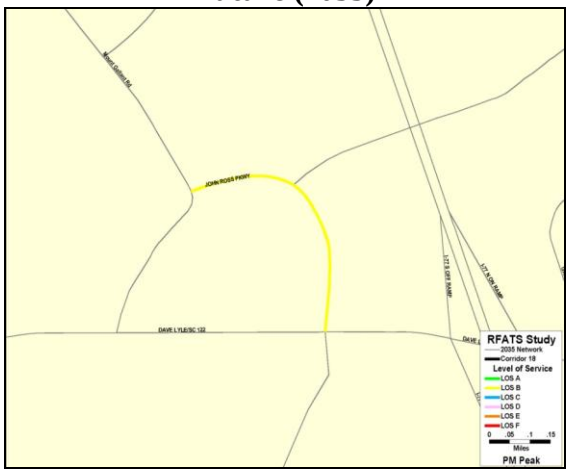
- No planned improvements along this corridor

Average Corridor PM Peak LOS from Metrolina Model

Existing (2005)



Future (2035)



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Corridor 19: Fort Mill Bypass, Springfield Parkway
between I-77 and SC 160, Tom Hall Road

Length: 4.3 miles

Transportation Characteristics

- The corridor is a two lane undivided roadway
- No bicycle lanes or continuous sidewalks are present along this corridor
- No transit provided along the corridor
- Fort Hill Middle School, Fort Hill Elementary School, Nation Ford High School, Springfield Middle School, and Springfield Elementary School are along the corridor

Performance Measures

- In 2005, the corridor operated at LOS B
- In 2035, the corridor will operate at LOS D , if no actions are taken

Performance Measure Targets

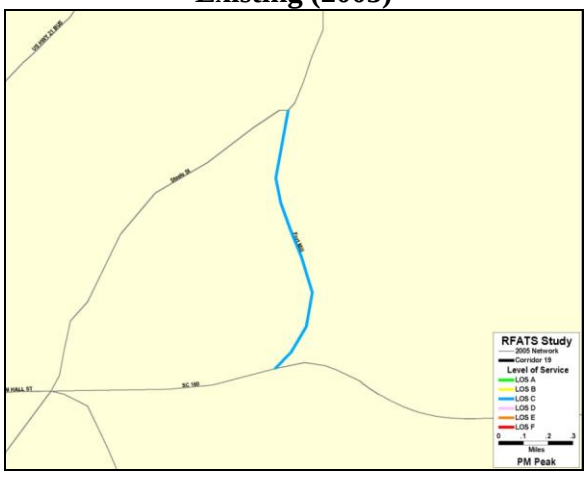
- Maintain Corridor LOS C in future

Planned improvement projects

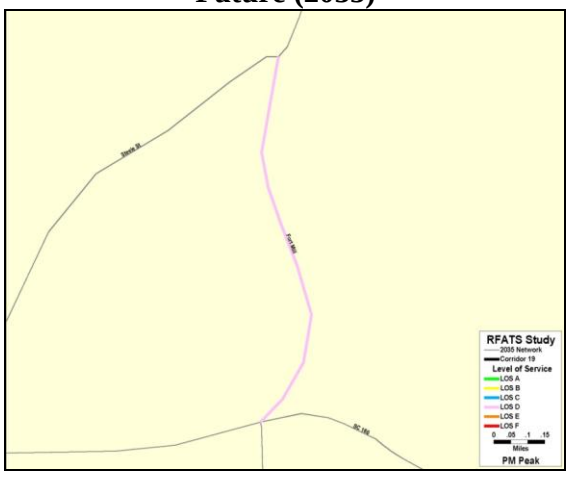
- No planned improvements along this corridor

Average Corridor PM Peak LOS from Metrolina Model

Existing (2005)



Future (2035)



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Corridor 20: Dam Road
between Gardendale Road (S-741) and New Gray Rock Road (S-251)

Length: 1.1 mile

Transportation Characteristics

- The corridor is a two lane undivided roadway
- No bicycle lanes or continuous sidewalks are present along this corridor
- No transit provided along the corridor

Performance Measures

- The Metrolina model does not include this corridor at present, so no performance measure is currently available

Performance Measure Targets

- Maintain Corridor LOS at C in future

Planned improvement projects

- No planned improvements along this corridor

Corridor 21: Fort Mill Parkway
between Spratt Street and Brickyard Road

Length: 1.1 mile

Transportation Characteristics

- The corridor is a two lane undivided roadway
- No bicycle lanes or continuous sidewalks are present along this corridor
- No transit service provided along the corridor

Performance Measures

- The Metrolina model does not include this corridor at present, so no performance measure is currently available

Performance Measure Targets

- Maintain Corridor LOS C in future

Planned improvement projects

- No planned improvements along this corridor

Corridor 22: Fairway Drive (Fort Mill)
between Brickyard Road and Doby's Bridge Road

Length: 1.2 mile

Transportation Characteristics

- The corridor is a two lane undivided roadway
- No bicycle lanes or continuous sidewalks are present along this corridor
- No transit provided along corridor

Performance Measures

- The Metrolina model does not include this corridor at present, so no performance measure is currently available

Performance Measure Targets

- Maintain Corridor LOS C in future

Planned improvement projects

- None No planned improvements along this corridor

Corridor 23: Doby's Bridge Road
between Tom Hall Road and Lancaster Co. Line

Length: 6.02 miles

Transportation Characteristics

- The corridor is a two lane undivided roadway
- No bicycle lanes
- Sidewalks are present along developments
- No transit provide along the corridor

Performance Measures

- In 2005, the corridor operated at LOS B
- In 2035, the corridor will operate at LOS B , if no actions are taken

Performance Measure Targets

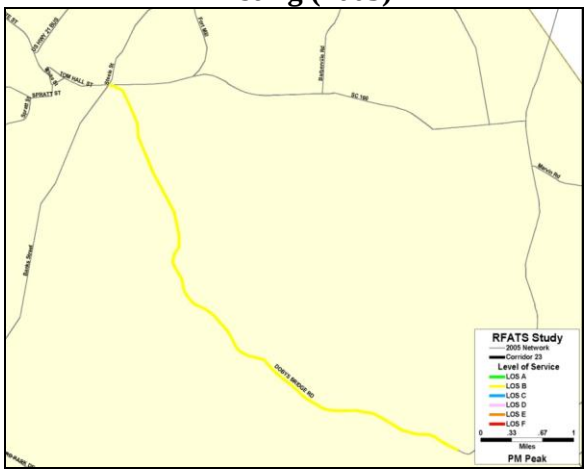
- Maintain Corridor LOS B in future

Planned improvement projects

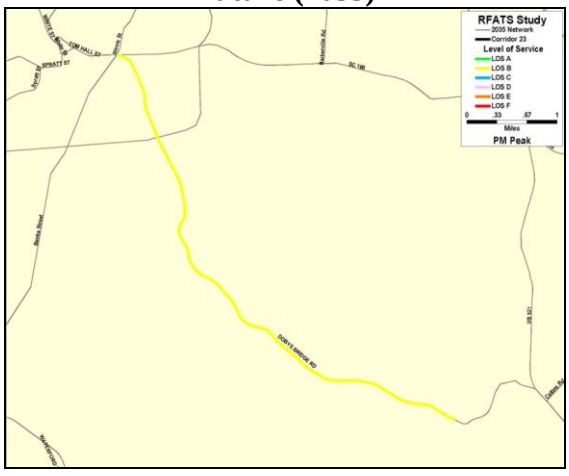
- No planned improvements along this corridor; however it should be noted that the Fort Mill Southern Bypass will result in the realignment of the section of this road where the Bypass crosses Doby's Bridge Road

Average Corridor PM Peak LOS from Metrolina Model

Existing (2005)



Future (2035)



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Corridor 24: W. Main St, SC 5

between SC 901, Heckle Boulevard and SC 122, Dave Lyle Boulevard

Length: 2.1 miles

Transportation Characteristics

- The corridor is a four lane roadway with center left turn lane between SC 901/Heckle Boulevard and S Cherry Road.
- The corridor is a four lane undivided roadway S Cherry Road and W Black St.
- The corridor becomes a two lane undivided roadway between W Black St and SC 122/ Dave Lyle Boulevard.
- No bicycle lanes
- Sidewalks are present along developments
- No transit provided along the corridor

Performance Measures

- In 2005, the corridor operated at LOS B
- In 2035, the corridor will operate at LOS E , if no actions are taken

Performance Measure Targets

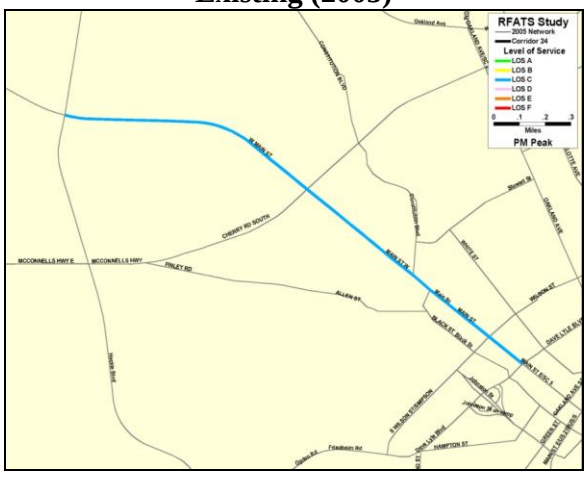
- Maintain Corridor LOS at C in future

Planned improvement projects

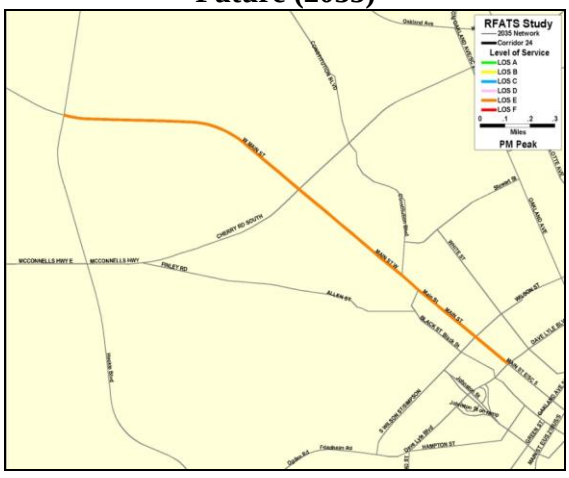
- No planned improvements along this corridor

Average Corridor PM Peak LOS from Metrolina Model

Existing (2005)



Future (2035)



Appendix D
CORRIDOR SPECIFIC PROJECTS

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CORRIDOR SPECIFIC PROJECTS

The CMP corridors are listed in **Table 1** and illustrated in **Figure 1**. A timeframe for implementation of each project has been suggested as follows:

- Short term – 1 to 5 years;
- Medium term – 6 to 10 years; and
- Long term – more than 10 years.

Corridor 1: SC 161, Celanese Road

Full corridor title: Corridor 1: SC 161/SC 274 Old York Road / Celanese Road between SC 24 and US 21 / Cherry Rd

Key issues and factors along this corridor include:

- Major commuter route
- Multiple signals (retimed in 2008)
- Heavy traffic on intersecting roads, as well as along corridor
- Served by Express Bus route 78x
- Metrolina model Level of Service:
    - West of India Hook Road is C (2005) and E (2035)
    - East of India Hook Road is E (2005) and F (2035)

It is recommended that the CMP projects listed below be considered for this corridor.

Corridor 1: SC 161, Celanese Road CMP Projects

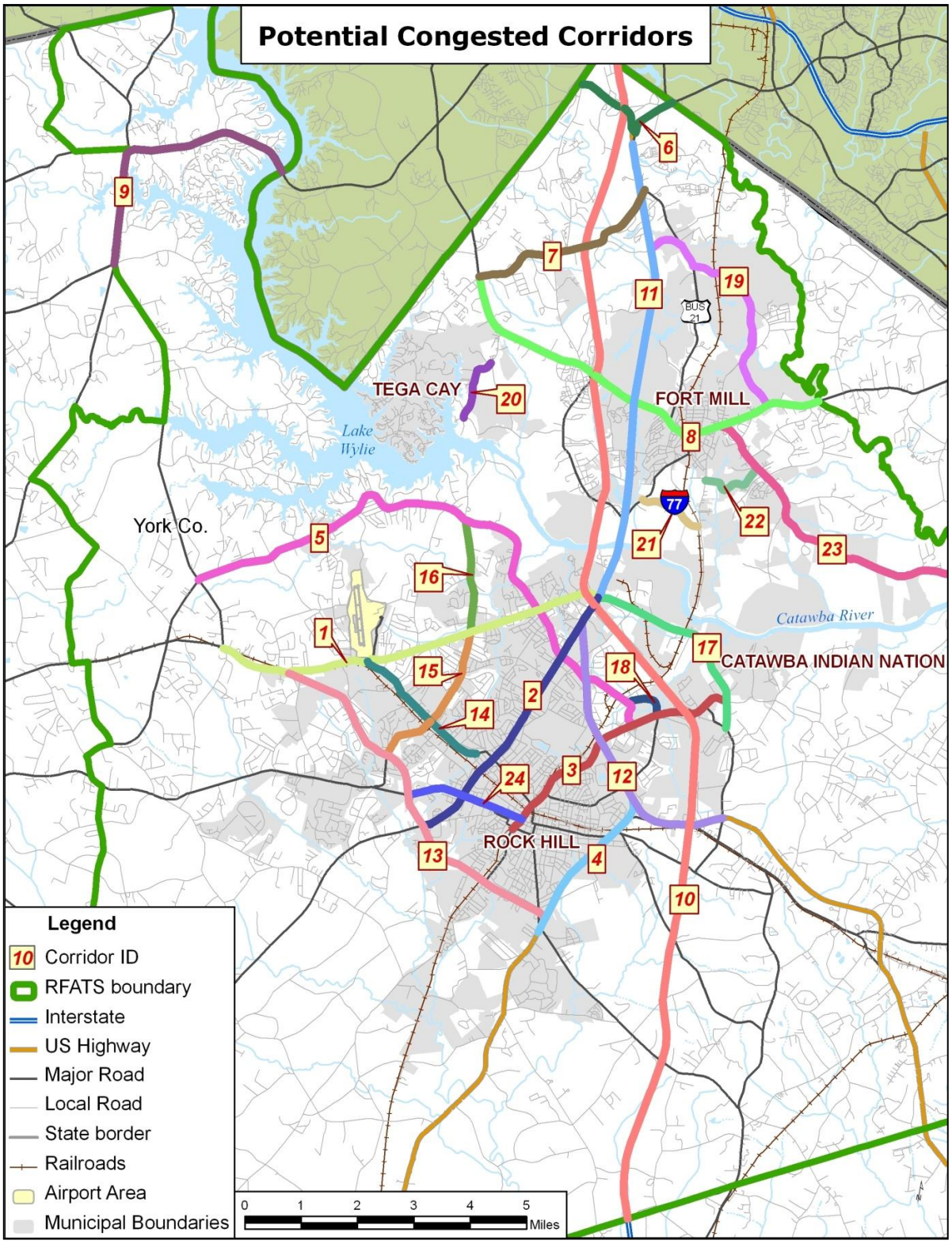
Ref #	Project Description	Timeframe	Cost Est.
1.A	At Celanese Road and Mt Gallant Road: Add second southbound left-turn lane and add westbound Right-turn lane – this is understood to be an existing CMAQ (TIP). This project is identical to 5.A	Short	$542,000
1.B	Other signal geometric and phasing improvements as recommended by December 2008 CMAQ Signal Timing Study	Short	
1.C	Add Bike Lanes between SC 274, Ebenezer Road and Mt Gallant Road (1)	Long	$940,000
1.D	Develop improvements at Riverview Road and Riverchase Boulevard to improve flow (CMAQ, TIP). The RFATS 2004 CMS identified a new access road from Riverview to Paces River to help alleviate side street congestion on Riverchase Boulevard. Conduct study to evaluate needed turn lanes for the I-77 southbound off-ramp at Celanese Road consistent with proposed improvements at Riverview Road and Riverchase Boulevard.	Short	$870,000
1.E	Conduct an Access Management review along the SC 161 corridor to identify opportunities to improve access management.	Short	
1.F	Review and update signal operations and timing at regular intervals	Periodic	2k/yr/signal

Notes: (1) High Priority Bike Route on map "Priority Areas for Bike Lanes in York County," August 2008, produced by York County Planning Department.

Table 1: Listing of Identified Corridors

ID	Corridor	From	To	Length (miles)
1W	SC 161/SC 274 Old York Rd / Celanese Rd	SC 274, Hands Mill Rd	India Hook Rd	4.57
1E	SC 161/SC 274 Old York Rd / Celanese Rd	India Hook Rd	US 21, N. Cherry Rd	2.42
2	Cherry Rd	SC 901, Heckle Boulevard	SC 161, Cel-River Rd	5.25
3W	Dave Lyle Boulevard (west of US 21 BYP)	W. Black St	US 21 BYP/SC 121, Anderson Rd	2.20
3E	Dave Lyle Boulevard (east of US 21 BYP)	US 21 BYP/SC 121, Anderson Rd	Red River Rd	2.41
4	SC 72, Albright Rd/Saluda Road	Rawlsville Rd	Springdale Rd	5.46
5N	Mt. Gallant Rd. (north of Celanese Rd)	SC 274, Hands Mill Highway	SC 161, Celanese Rd	7.83
5S	Mt. Gallant Rd. (south of Celanese Rd)	SC 161, Celanese Rd	SC 122, Dave Lyle Boulevard	2.85
6	US 21, Carowinds Boulevard and SC 51	Pleasant Rd	NC State Line	2.25
7	Gold Hill Rd	SC 160	Garrison Farm Rd	3.47
8W	SC 160 (west of US 21 BYP)	SC State Line	US 21 BYP	4.62
8E	SC 160 (east of US 21 BYP)	US 21 BYP	Lancaster Co. Line	3.61
9	SC 49, Charlotte Highway	SC 55	NC State Line	5.51
10S	I-77 (south of Dave Lyle Boulevard)	S. RFATS Boundary	SC 122, Dave Lyle Boulevard	19.42
10N	I-77 (north of Dave Lyle Boulevard)	SC 122, Dave Lyle Boulevard	N. RFATS Boundary	23.96
11	US 21 BYP	SC 161, Cel-River Rd	SC 51	8.15
12	US 21 BYP/SC 121 (Anderson Rd)	US 21, Cherry Rd	Springdale Rd	4.09
13	SC 901, Heckle Boulevard	SC 161/SC 274 Old York Rd	SC 72 / SC 121	6.63
14	SC 274 Ebenezer Rd	SC 161 Old York Rd/Celanese Rd	Oakland Ave / India Hook Rd	2.80
15	Herlong Ave	SC 901, Heckle Boulevard	SC 161 Celanese Rd	2.86
16	India Hook Rd	SC 161 Celanese Rd	Mt. Gallant Rd.	1.96
17	Red River Road, Cel-River Rd	SC 161 Celanese Rd	Springdale Rd	3.60
18	John Ross Parkway	SC 122, Dave Lyle Boulevard	Mt. Gallant Rd.	0.63
19	Fort Mill Bypass, Springfield Parkway	I-77	SC 160, Tom Hall Road	1.11
20	Dam Road	Gardendale Rd (S-741)	New Gray Roack Rd (S-251)	1.10
21	Fort Mill Parkway	Spratt St	Brickyard Rd	1.10
22	Fairway Dr (Fort Mill)	Brickyard Rd	Doby's Bridge Rd	1.20
23	Doby's Bridge Rd	Tom Hall Rd	Lancaster Co. Line	6.02
24	W. Main St, SC 5	SC 901, Heckle Boulevard	SC 122, Dave Lyle Boulevard	2.10

Figure 1: CMP Corridors



Corridor 2: US 21 / Cherry Road

Full corridor title: Corridor 2: US 21 / Cherry Road between SC 901, Heckle Boulevard and SC 161, Cel-River Road

Key issues and factors along this corridor include:

- Major commuter route
- The Rock Hill-York County-Charlotte Rapid Transit Study (2007) concluded that the best option would be a Bus Rapid Transit (BRT) line running from downtown Rock Hill via US 21 to the I-485 light rail station (see Section 5).
- Multiple signals: (18 signals retimed in 2008)
- Delays experienced for through traffic at the Mt Gallant and Celanese Road intersections
- Metrolina model Level of Service is D (2005) and F (2035)
- Major improvements are planned at or near the end points of this corridor:
    - Cherry Road / US 21 widening: Expand from two lanes to five lanes facility between Heckle Road and York Ave. (TIP)
    - Widening of Cel-River Road to provide a five lane section, including two westbound through lanes at the Cherry Road (US 21) and Celanese Road (SC 161) intersection should be under construction in the next five years.

It is recommended that the CMP projects listed below be considered for this corridor.

Corridor 2: US 21 / Cherry Road CMP Projects

Ref #	Project Description	Timeframe	Cost Est.
2.A	Signal geometric and phasing improvements on Cherry Road as recommended by December 2008 CMAQ Signal Timing Study: • Construct a southbound left-turn lane on Dorchester Road.	Short	$270/lf
2.B	Prior to the planned widening of Cel-River Road, consideration should be given to converting the westbound outside lane on Cel-River Road at Cherry Road from a right turn only lane to a through/right lane.	Maintenance Activity	N/A
2.C	Conduct Safety Audit along the Cherry Road corridor from Oakland Avenue to Camden Avenue	Short	$24,000
2.D	Continue planning for the BRT line on Cherry Road from downtown Rock Hill to the I-485 light rail station.	Short	N/A
2.E	Seek opportunities to incorporate access management strategies into the planning, design and approval processes for redevelopment that may occur in the northern section of Cherry Road from Cherry Park to the Catawba River and in implementing recommendations from the ongoing College Town Plan in the vicinity of Winthrop University.	Short	N/A
2.F	Review and update signal operations and timing at regular intervals	Periodic	2k/yr/signal

Notes:

Corridor 3: SC 122, Dave Lyle Boulevard

Full corridor title: Corridor 3: SC 122, Dave Lyle Boulevard between West Black Street and Red River Road

Key issues and factors along this corridor include:

- Major commuter route
- Multiple signals (8 retimed in 2008)
- Served by Express Bus route 82x
- Subject to extensive studies in recent years:
  - CMAQ Signal Timing Study, December 2008
  - Dave Lyle Boulevard Traffic Improvement Study, July 2008
- Metrolina model Level of Service:
  - West of US 21 BYP / SC 121, Anderson Road is C (2005) and D (2035)
  - East of US 21 BYP / SC 121, Anderson Road is C (2005) and E (2035)

It is recommended that the CMP projects listed below be considered for this corridor.

Corridor 3: SC 122, Dave Lyle Boulevard CMP Projects

Ref #	Project Description	Timeframe	Cost Est.
3.A	Add a second northbound Left-turn lane on Galleria Boulevard at Dave Lyle Boulevard	Short	$270/lf
3.B	At I-77 Southbound Ramp on Dave Lyle Boulevard, add a second southbound Right-turn lane and develop side street capacity/operation improvements at Chamberside – This is understood to be an upcoming CMAQ funded project	Short	$270/lf
3.C	RFATS 2004 CMS identified access management improvements related to access to and from Tinsley Way, such as: • Redesign of Tinsley Way to eliminate stop sign entering from Dave Lyle; • Study and implement how to deal with right turns onto Tinsley from Dave Lyle; • Modify shopping center driveway (Tinsley Way) to create adequate and uninterrupted storage approaching Dave Lyle signal. Eliminate interfering left turn traffic from Petro Express direction that causes large gaps in traffic movement exiting the shopping center and interferes with signal operation.		
3.D	Conduct Access Management Evaluation Study on Dave Lyle Boulevard at John Ross Parkway	Short	
3.E	Traffic signal priority for express bus services on Dave Lyle Boulevard	Medium	5k/signal
3.F	Review and update signal operations and timing at regular intervals	Periodic	2k/signal/yr

Notes:

Corridor 4: SC 72

Full corridor title: Corridor 2: SC 72, Albright Road/Saluda Road between Rawlsville Road and Springdale Road

Key issues and factors along this corridor include:

- This corridor is predominantly a two lane facility and transitions to a four lane facility between Mt. Holly Road and Heckle Boulevard
- Commuter route from the south of the City of Rock Hill
- Multiple signals: 9 in total, of which 3 were retimed in 2008
- Metrolina model Level of Service is C (2005) and E (2035)

It is recommended that the CMP projects listed below be considered for this corridor.

Corridor 4: SC 72 CMP Projects

Ref #	Project Description	Timeframe	Cost Est.
4.A	Review and update signal operations and timings at signals on SC 72 not addressed in the 2008 CMAQ Signal Timing Study; it is recommended that an evaluation of a traffic adaptive system such as InSync be considered for use on Albright Road (SC 72)	Short	2k/signal
4.B	Widen SC 72, Albright Road to 5 lanes between Black Street to Heckle Boulevard (TIP)	Short	$8,700,000[(2)]
4.C	Widen SC 72 from Heckle Boulevard (SC 901) to Rambo Road, south of Rawlsville Road, from 2 to 3 lanes (TIP). See Project 4.K also.	Short	$6,771,000
4.D	On SC 72/SC 5 realign Paddock Parkway to the east to develop a 4-way intersection with Lesslie Highway	Medium	$50,000
4.E	On SC 72/SC 5/US 21 reconstruct NB and SB separated legs of SC 121 into a single T intersection	Medium	$600,000
4.F	On Albright Road: Add capacity on NB and SB lanes of White Street (CMAQ, TIP)	Medium	$771,750
4.G	On SC 72 construct a new connector from Saluda Trail entrance to Harper Gault/Oakdale Road, as identified in South Pointe traffic study	Medium	
4.H	On SC 72 realign Oakdale road to Forest Road, as identified in South Pointe traffic study	Medium	$60,000
4.I	On SC 72 extend Robertson Road to SC 72 and Cul-de-Sac Rambo Road (as identified in South Pointe traffic study	Medium	$25,000
4.J	On SC 72 widen SC 72 to five lanes from Rawlsville to SC 901, Heckle Boulevard (included in York County 2011 referendum project list)	Medium	$2.61 m
4.K	Review and update signal operations and timing at regular intervals	Periodic	2k/signal/yr

Note:
(1) Traffic Movement Analysis Report for 2009, City of Rock Hill.
(2) Funded by 1997 Pennies for Progress, plus Federal Match Program.

Corridor 5: Mt. Gallant Road

Full corridor title: Corridor 5: Mt. Gallant Road between SC 274, Hands Mill Highway and SC 122/Dave Lyle Boulevard

Key issues and factors along this corridor include:

- Major commuter route
- Multiple signals:
- Delays experienced for through traffic on Mt Gallant Road at:
  - Twin Lakes Road
  - Celanese Road
  - Anderson Road
  - Cherry Road
- Metrolina model Level of Service:
  - North of SC 161/ Celanese Road is B (2005) and C (2035)
  - South of SC 161/ Celanese Road is C (2005) and D (2035)
- Planned improvements along this corridor include:
  - Mt Gallant Road and Celanese Road intersection improvement: This project will construct turn lanes to increase mobility and reduce congestion at the intersection. (TIP)
  - Mt. Gallant Road Widening. Widen roadway between Twin lakes Road and SC 161, Celanese Road to a three lane facility. (TIP)

It is recommended that the CMP projects listed below be considered for this corridor.

Corridor 5: Mt. Gallant Road CMP Projects

Ref #	Project Description	Timeframe	Cost Est.
5.A	At Celanese Road and Mt Gallant Road: Add second southbound Left-turn lane and add westbound Right-turn lane – this is understood to be an existing CMAQ project (TIP). This project is identical to 1.A	Short	$542,000
5.B	Conduct Safety Audit along the Mt. Gallant Road corridor at Redwood Drive and India Hook Road	Short	$24,000
5.C	Add Bike Lanes between West Oak Rd / Aragon Beach Rd and Twin Lakes Rd. [(1)] A 2003 Pennies for Progress project is planned to add bike lanes from Twin Oaks Rd south to Dave Lyle Blvd.	Long	$740,000
5.D	Widen Mt. Gallant Road for 2.5 miles from Twin Lakes Road to SC 161, Celanese from 2 to 3 lanes (TIP).	Short	$4,971,000
5.E	RFATS 2004 CMS noted that the signal at Mt. Gallant and Eden Terrace was not actuated and did not include protected left-turn phases. Note a TIP project widens Eden Terrace through this intersection from 2 to 3 lanes from Bradley to Anderson Road and will include additional left-turn storage on both Mt. Gallant approaches (TIP, funded by the 2003 Pennies for Progress);	Short	N/A
5.F	Preserve 90 feet of right of way along Mt. Gallant Road from SC 161 to west of Museum Road to accommodate the potential for a four-lane divided road with sidewalks.	Short	Unknown

Ref #	Project Description	Timeframe	Cost Est.
5.G	Review and update signal operations and timing at regular intervals	Periodic	2k/signal/yr

Notes:

(1) High Priority Bike Route on map "Priority Areas for Bike Lanes in York County," August 2008, produced by York County Planning Department.

Corridor 6: US 21, Carowinds Boulevard and SC 51

Full corridor title: Corridor 6: US 21, Carowinds Boulevard and SC 51 between Pleasant Road and the North Carolina State Line

Key issues and factors along this corridor include:

- Major commuter route
- Provides access to major tourist attraction (Carowinds Park)
- Multiple signals
- Delays experienced at the intersection of Carowinds Boulevard and Pleasant Road
- Metrolina model Level of Service is F (2005) and F (2035)
- Intersection improvement planned for Carowinds Boulevard and Springhill Farm Road. This project is a traffic flow improvement effort that involves the construction of a dedicated right turn lane on Springhill Farm Road from the intersection of Stateview Road to Carowinds Boulevard.(CMAQ, TIP)

It is recommended that the CMP projects listed below be considered for this corridor.

Corridor 6: US 21, Carowinds Boulevard and SC 51 CMP Projects

Ref #	Project Description	Timeframe	Cost Est.
6.A	The westbound left turning movement is heavy from Carowinds Boulevard to Pleasant Road. Dual left is not possible because there is only one receiving lane on Pleasant Road. Consider lengthening the left turn lane while retaining a physical median for access management purposes.	Short	$270/lf
6.B	Springhill Farm Road – construct dedicated right turn lane on Springhill Farm Road from Stateview Road to Carowinds Boulevard (CMAQ, TIP)	Short	$2,250,500
6.C	Widen Springhill Farm Road from 2 to 5 lanes from US 21 to SC 51 (TIP)	Short	$4,600,000
6.D	Widen SC 51 from 2 to 5 lanes from US 21 to NC State Line (TIP)	Short	$5,900,000
6.E	Access management measures on Carowinds Boulevard between Pleasant Road and SC 51 identified in the RFATS 2004 CMS: • Raised concrete medians to help create strategic, shared access points to lesson conflicting turn movements and help general traffic flow. • Shared access between parcels limiting the number of curb cuts throughout. • Implementation of frontage roads that will provide additional access to the business once the medians are constructed. • Easy to read directional signage. • Implementation of new traffic patterns within the Plaza Fiesta, Comfort Inn and Carowinds area. • Removal of one-way streets and split entrances to the business location to provide a more traditional traffic pattern.	Short	

6.F	Three eastbound through lanes begin at the intersection of Carowinds Boulevard and Pleasant Road. Currently only two through lanes exist on the westbound approach to this intersection. Consider adding a through westbound lane on Carowinds Boulevard from Choate Circle to Pleasant Road, while retaining access management control and the potential for future sidewalks.	Medium	$117,500
6.G	Review and update signal operations and timing at regular intervals	Periodic	2k/signal/yr

Notes:

Corridor 7: Gold Hill Road

Full corridor title: Corridor 7: Gold Hill Road between SC 160 and Garrison Farm Road

Key issues and factors along this corridor include:

- Gold Hill Road is a four lane roadway with center left turn lane from Steele Creek Road (SC 160) to Springfield Parkway and is then a two lane undivided facility with turn lanes between Springfield Parkway and Garrison Farm Road.
- Commuter route from Tega Cay to Charlotte
- Multiple signals: 9 in total, with average spacing of less than half a mile
- Metrolina model Level of Service is C (2005) and F (2035)

It is recommended that the CMP projects listed below be considered for this corridor.

Corridor 7: Gold Hill Road CMP Projects

Ref #	Project Description	Timeframe	Cost Est.
7.A	Goldhill Road / Steele Creek Road intersection improvement: This project is a traffic flow improvement effort involving the addition of turn lanes and the upgrading of the traffic signal controller. (TIP) – same as Project 8.A	Short	$1,375,000
7.B	Add Bike Lanes between SC 160 and I-77 (1)	Long	$440,000
7.C	A new interchange at Gold Hill Road and I-77 may be needed to accommodate the higher volumes that are developing with the growth of Tega Cay. Consideration should be given to conducting an Interchange Justification Study. (Same as Project 10.A)	Long	$150,000
7.D	Review and update signal operations and timing at regular intervals	Periodic	2k/signal/yr

Notes:

(1) Medium Priority Bike Route on map "Priority Areas for Bike Lanes in York County," August 2008, produced by York County Planning Department.

Corridor 8: SC 160

Full corridor title: Corridor 8: SC 160 between SC state line and Lancaster County Line

Key issues and factors along this corridor include:

- The corridor is a two lane undivided facility between SC state line and Gold Hill Road and then becomes a four lane roadway with center left turn lane from Gold Hill Road US 21 BYP where it reverts to a two lane undivided facility to Main Street in Fort Mill, before becoming a two lane facility with center left turn lane to the Lancaster County Line

- Commuter route paralleling I-77 on west side of I-77 and commuter route providing access to I-77 for the Fort Mill area
- Multiple signals: 11, with average spacing of less than half a mile, west of US 21 BYP and 7 more east of there
- The planned Fort Mill Southern Bypass will provide an alternate route for traffic that typically uses SC 160 from I-77 through the business district in the Town of Fort Mill.(TIP)
- Metrolina model Level of Service:
  - West of US 21 BYP is D (2005) and F (2035)
  - East of US 21 BYP is E (2005) and E (2035)

It is recommended that the CMP projects listed below be considered for this corridor.

Corridor 8: SC 160 CMP Projects

Ref #	Project Description	Timeframe	Cost Est.
8.A	Goldhill Road / Steele Creek Road intersection improvement: This project is a traffic flow improvement effort involving the addition of turn lanes and the upgrading of the traffic signal controller. (TIP) – same as 7.A	Short	$1,375,000
8.B	Steele Creek Road Expansion: Widen to 3 lanes between Gold Hill Road and Zoar Road.(TIP)	Short	$1,600,000
8.C	SC 160 / SC 21 intersection improvement: This project is a traffic flow improvement effort that will widen the Westbound Lane of SC 160 to include a turn lane with a straight right function. (CMAQ, TIP)	Short	$400,000
8.D	The westbound movement at SC 160 at Springfield Pkwy intersection is the only east-west access to Fort Mill from the east. The intersection is also on a heavily used truck route. Although the single westbound through lane is a limiting factor in the intersection's operations, several small changes should be considered to improve operations with the existing geometry: • Improve radius in northeast corner • Consider signalizing the southbound right turn overlap with the eastbound left turn • Consider remarking the westbound approach to include a left turn lane – this may be difficult because the turning path for trucks turning southbound to eastbound means the stop bar for the westbound left turn lane would be set back. The lane would be helpful, however, by removing the occasional left turn from the westbound through movement. • Examine signal timing for changes in timing to accommodate different peak volumes.	Short	$15,000
8.E	The intersection of SC 160 at Hensley Road is also on the truck route and has been recently signalized. One eastbound truck held up traffic because of the grades eastbound past the intersection. There is no westbound left turn lane, and the side street has one wide approach lane. Intersection should be reexamined for turn lane needs and signal timing refinements. Long term, the narrow lanes, nonexistent shoulders and grades on this section should be examined for their ability to accommodate truck traffic safely. Problems at this intersection are being addressed by SCDOT in a safety project, which is currently under design	Short	N/A
8.F	Conduct Safety Audit on SC 160 at Springfield Parkway	Short	$12,000
8.G	Conduct an Access Management review along SC 160, Tom Hall Road, in Fort Mill to identify opportunities to improve access management.	Short	

Ref #	Project Description	Timeframe	Cost Est.
8.H	Add Bike Lanes between Zoar Road and Dam Road [(1)]	Long	$320,000
8.I	Review and update signal operations and timing at regular intervals	Periodic	2k/signal/yr

Notes:

(1) Medium Priority Bike Route on map "Priority Areas for Bike Lanes in York County," August 2008, produced by York County Planning Department.

Corridor 9: SC 49, Charlotte Highway

Full corridor title: Corridor 9: SC 49, Charlotte Highway between SC 55 and NC State Line

Key issues and factors along this corridor include:

- This corridor is a four lane roadway with center left turn lane
- Commuter route from the west to Charlotte via the Buster Boyd Bridge over Lake Wylie
- Multiple signals: 5 in total
- Metrolina model Level of Service is B (2005) and D (2035)

It is recommended that the CMP projects listed below be considered for this corridor.

Corridor 9: SC 49, Charlotte Highway CMP Projects

Ref #	Project Description	Timeframe	Cost Est.
9.A	Review signal timings and operations at the intersections of SC 49 at SC 274 and at Robinwood Road – very long delays experienced in the PM Peak during the Travel Time Surveys	Short	$2,000
9.B	Preserve 90 feet of right of way along SC 49 from south of Big Allison Creek to Lake Wylie and along SC 274 from south of Campbell Road to US 49.	Short	Unknown
9.C	Improve intersection capacity at SC 274/SC 49 and SC 49/SC 557.	Medium	
9.D	Review and update signal operations and timing at regular intervals	Periodic	2k/signal/yr

Notes:

Corridor 10: I-77

Full corridor title: Corridor 10: I-77 between RFATS Boundary and NC State Line

Key issues and factors along this corridor include:

- I-77 has nine interchanges between Exits 73 and 90, inclusive
- Commuter route from Rock Hill, Fort Mill and points north to Charlotte
- I-77 related congestion is most severe at Exit 82 at US 21. The bridge at this interchange is being replaced using funds provided by the American Recovery and Reinvestment Act (ARRA). See project 10.A.
- Metrolina model Level of Service:
    - South of Dave Lyle Boulevard is B (2005) and D (2035)
    - South of Dave Lyle Boulevard is C (2005) and D (2035)

It is recommended that the CMP projects listed below be considered for this corridor.

Corridor 10: I-77 CMP Projects

Ref #	Project Description	Timeframe	Cost Est.
10.A	A new interchange at Gold Hill Road and I-77 should be evaluated by completing an Interchange Justification Study to accommodate the higher volumes that are developing with the growth of Tega Cay. (Same as Project 7.C)	Long	$150,000
10.B	Consider conducting an Interchange Justification Study for a new I-77 interchange just north of Coltharp Road for proposed roadway running west to SC 160.	Long	$150,000

Notes:

Corridor 11: US 21 BYP

Full corridor title: Corridor 11: US 21 BYP between SC 161, Cel-River Road and SC 51

Key issues and factors along this corridor include:

- This corridor is predominantly a two lane facility
- Commuter route to the east of and parallel to I-77
- The Rock Hill – York County – Charlotte Rapid Transit Study (2007) concluded that the best option would be a Bus Rapid Transit line running from downtown Rock Hill via US 21 to the I-485 light rail station (see Section 5)
- Metrolina model Level of Service is C (2005) and E (2035)

It is recommended that the CMP projects listed below be considered for this corridor.

Corridor 11: US 21 BYP CMP Projects

Ref #	Project Description	Timeframe	Cost Est.
11.A	US 21 BYP Widening: Widen from two to five lane facility between Cel-River Road and Sutton Road. (TIP)	Short	$22,000,000
11.B	US 21 Bridge replacement over the Catawba River (TIP)	Short	$24,736,210(2)
11.C	Conduct Safety Audit at the intersection of US 21 BYP and Harris Street	Short	$12,000
11.D	Add Bike Lanes between SC 161, Cel-River Road and the Catawba River (1)	Long	$180,000
11.E	Continue planning for the BRT line on US 21 Bypass from downtown Rock Hill to the I-485 light rail station	Short	N/A
11.F	Improve triangle of intersections at US 21, Gold Hill Road, and Old Nation Road.	Medium	
11.G	Review and update signal operations and timing at regular intervals	Periodic	2k/signal/yr

Notes:

(1 High Priority Bike Route on map "Priority Areas for Bike Lanes in York County," August 2008, produced by York County Planning Department.

(2) Funded by STP ($12,900,000) and ARRA ($11,000,000 (Economic Stimulus Project) plus $836,210 (Pedestrian Enhancements))

Corridor 12: US 21 BYP / SC 121 (Anderson Road)

Full corridor title: Corridor 12: US 21 BYP / SC 121 (Anderson Road) between US 21, Cherry Road and Springdale Road

Key issues and factors along this corridor include:

- The corridor is predominantly a four lane facility with center left turn lane
- Metrolina model Level of Service is C (2005) and D (2035)

It is recommended that the CMP projects listed below be considered for this corridor.

Corridor 12: US 21 BYP / SC 121 (Anderson Road) CMP Projects

Ref #	Project Description	Timeframe	Cost Est.
12.A	On SC 72/SC 5 realign Paddock Parkway to the east to develop a 4-way intersection with Lesslie Highway. (Same as Project 4.D)	Medium	$50,000
12.B	Review and update signal operations and timing at regular intervals	Periodic	2k/signal/yr

Notes:

Corridor 13: SC 901, Heckle Boulevard

Full corridor title: Corridor 13: SC 901, Heckle Boulevard between SC 161/SC 274, Old York Road and SC 72 / SC 121

Key issues and factors along this corridor include:

- The corridor is a four lane divided facility between SC 161/ Old York Road and Main St and transforms to a four lane facility with center left turn lane between Main Street and SC 72
- Metrolina model Level of Service is C (2005) and F (2035)

It is recommended that the CMP projects listed below be considered for this corridor.

Corridor 13: SC 901, Heckle Boulevard CMP Projects

Ref #	Project Description	Timeframe	Cost Est.
13.A	Conduct Safety Audit at the intersection of Heckle Boulevard and Old York Road, as well as along Heckle Boulevard north and south of Herlong Avenue	Short	$24,000
13.B	Review and update signal operations and timing at regular intervals	Periodic	2k/signal/yr

Notes:

Corridor 14: SC 274, Ebenezer Road

Full corridor title: Corridor 14: SC 274, Ebenezer Road between SC 161/SC 274, Celanese Road and Oakland Ave / India Hook Road

Key issues and factors along this corridor include:

- The corridor is a two lane undivided facility between Celanese Road and Herlong Ave and then changes to a two lane facility with center left turn lane between Herlong Ave and India Hook Road
- Metrolina model Level of Service is C (2005) and D (2035)

It is recommended that the CMP projects listed below be considered for this corridor.

Corridor 14: SC 274, Ebenezer Road CMP Projects

Ref #	Project Description	Timeframe	Cost Est.
14.A	Ebenezer Road Widening: Widen roadway from two lanes to three lanes between SC 161, Celanese Road, and Frank Gaston Boulevard (TIP)	Short	$2,106,000
14.B	Add Bike Lanes between SC 161, Celanese Road and Herlong Road (1)	Long	$310,000
14.C	Review and update signal operations and timing at regular intervals	Periodic	2k/signal/yr

Notes:

(1) Medium Priority Bike Route on map "Priority Areas for Bike Lanes in York County," August 2008, produced by York County Planning Department.

Corridor 15: Herlong Avenue

Full corridor title: Corridor 15: Herlong Avenue between SC 901, Heckle Boulevard and SC 161, Celanese Road (Herlong Avenue becomes India Hook Road north of its intersection with India Hook Road.

Key issues and factors along this corridor include:

- The corridor is a four lane facility with center left turn lane
- Metrolina model Level of Service is D (2005) and F (2035)

It is recommended that the CMP projects listed below be considered for this corridor.

Corridor 15: Herlong Avenue CMP Projects

Ref #	Project Description	Timeframe	Cost Est.
15.A	Conduct Safety Audit along Herlong Avenue between Heckle Boulevard and Ebenezer Road	Short	$36,000
15.B	Add Bike Lanes between SC 274, Ebenezer Road and SC 161, Celanese Road. (1) Bike lanes are proposed to continue north of Celanese Road on India Hook Road (see CMP Project 16.A).	Long	$370,000
15.C	Review and update signal operations and timing at regular intervals	Periodic	2k/signal/yr

Notes:

(1) Medium High Priority Bike Route on map "Priority Areas for Bike Lanes in York County," August 2008, produced by York County Planning Department.

Corridor 16: India Hook Road

Full corridor title: Corridor 12: India Hook Road between SC 161, Celanese Road and Mt. Gallant Road

Key issues and factors along this corridor include:

- The corridor is a two lane undivided facility
- Metrolina model Level of Service is A (2005) and A (2035)
- As a result of the proposed new crossing of the Catawba River, India Hook Road between SC 161 and Mt. Gallant has been identified for widening.

It is recommended that the CMP projects listed below be considered for this corridor.

Corridor 16: India Hook Road CMP Projects

Ref #	Project Description	Timeframe	Cost Est.
16.A	Add Bike Lanes between SC 161, Celanese Road and Mt Gallant Road. (1) Bike lanes are proposed to continue south of Celanese Road on India Hook Road/Herlong Avenue (see CMP Project 15.B).	Long	$420,000
16.B	Review and update signal operations and timing at regular intervals	Periodic	2k/signal/yr

Notes:

(1) Medium High Priority Bike Route on map "Priority Areas for Bike Lanes in York County," August 2008, produced by York County Planning Department.

Corridor 17: Red River Road, Cel-River Road

Full corridor title: Corridor 17: Red River Road, Cel-River Road between SC 161, Celanese Road and Springdale Road

Key issues and factors along this corridor include:

- The corridor is a two lane undivided roadway
- Metrolina model Level of Service is B (2005) and C (2035)

It is recommended that the CMP projects listed below be considered for this corridor.

Corridor 17: Red River Road, Cel-River Road CMP Projects

Ref #	Project Description	Timeframe	Cost Est.
17.A	Cel-River Road Widening: Widen roadway from two lanes to five lane facility between Cherry Road / US 21 and north of S-645. (TIP)	Short	$4,575,000
17.B	Add Bike Lanes on Cel-River Road from US 21, N Cherry Road, to SC 122, Dave Lyle Boulevard (1)	Long	$620,000
17.C	Review and update signal operations and timing at regular intervals	Periodic	2k/signal/yr

Notes:

(1) Medium High Priority Bike Route on map "Priority Areas for Bike Lanes in York County," August 2008, produced by York County Planning Department.

Corridor 18: John Ross Parkway

Full corridor title: Corridor 18: John Ross Parkway between SC 122, Dave Lyle Boulevard and Mt. Gallant Road

Key issues and factors along this corridor include:

- The corridor is a two lane divided roadway
- Metrolina model Level of Service is B (2005) and B (2035)

It is recommended that the CMP projects listed below be considered for this corridor.

Corridor 18: John Ross Parkway CMP Projects

Ref #	Project Description	Timeframe	Cost Est.
	No CMP projects at this time		

Notes:

Corridor 19: Fort Mill Bypass, Springfield Parkway

Full corridor title: Corridor 19: Fort Mill Bypass, Springfield Parkway between I-77 and SC 160, Tom Hall Road

Key issues and factors along this corridor include:

- The corridor is a two lane undivided roadway
- Fort Hill Middle School, Fort Hill Elementary School, Nation Ford High School, Springfield Middle School, and Springfield Elementary School are along the corridor
- Metrolina model Level of Service is B (2005) and D (2035)

It is recommended that the CMP projects listed below be considered for this corridor.

Corridor 19: Fort Mill Bypass, Springfield Parkway CMP Projects

Ref #	Project Description	Timeframe	Cost Est.
19.A	Add Bike Lanes on Springhill Parkway from the Carolina Thread Trail (south of the Southern Railway Line) to SC 160, Tom Hall Road (1)	Long	$580,000

Notes:

(1) High Priority Bike Route on map "Priority Areas for Bike Lanes in York County," August 2008, produced by York County Planning Department.

Corridor 20: Dam Road

Full corridor title: Corridor 20: Dam Road between Gardendale Road (S-741) and New Gray Rock Road (S-251)

Key issues and factors along this corridor include:

- The corridor is a two lane undivided roadway
- Metrolina model does not include this corridor at present

It is recommended that the CMP projects listed below be considered for this corridor.

Corridor 20: Dam Road CMP Projects

Ref #	Project Description	Timeframe	Cost Est.
	No CMP projects at this time		

Notes:

Corridor 21: Fort Mill Parkway

Full corridor title: Corridor 21: Fort Mill Parkway between Spratt Street and Brickyard Road

Key issues and factors along this corridor include:

- The corridor is a two lane undivided roadway
- Metrolina model does not include this corridor at present

It is recommended that the CMP projects listed below be considered for this corridor.

Corridor 21: Fort Mill Parkway CMP Projects

Ref #	Project Description	Timeframe	Cost Est.
21.A	Preserve 90 feet of right of way along Fort Mill Parkway from Spratt Street to Brickyard Road.	Short	Unknown
21.B	Add Bike Lanes on Fort Mill Parkway between Spratt Street and Brickyard Road (1)	Long	$250,000

Notes:

(1) Medium Priority Bike Route on map "Priority Areas for Bike Lanes in York County," August 2008, produced by York County Planning Department.

Corridor 22: Fairway Drive (Fort Mill)

Full corridor title: Corridor 22: Fairway Drive (Fort Mill) between Brickyard Road and Doby's Bridge Road

Key issues and factors along this corridor include:

- The corridor is a two lane undivided roadway
- Metrolina model does not include this corridor at present

It is recommended that the CMP projects listed below be considered for this corridor.

Corridor 22: Fairway Drive (Fort Mill) CMP Projects

Ref #	Project Description	Timeframe	Cost Est.
22.A	Add Bike Lanes on Fairway Drive between Brickyard Road and Doby's Bridge Road (1)	Long	$250,000

Notes:

(1) Medium Priority Bike Route on map "Priority Areas for Bike Lanes in York County," August 2008, produced by York County Planning Department.

Corridor 23: Doby's Bridge Road

Full corridor title: Corridor 23: Doby's Bridge Road between Tom Hall Road and Lancaster Co. Line

Key issues and factors along this corridor include:

- The corridor is a two lane undivided roadway
- Metrolina model Level of Service is B (2005) and B (2035)

It is recommended that the CMP projects listed below be considered for this corridor.

Corridor 23: Doby's Bridge Road CMP Projects

Ref #	Project Description	Timeframe	Cost Est.
23.A	Preserve 90 feet of right of way along Doby's Bridge Road from north of Williams Road to south of the potential extension of Holbrook Road.	Short	Unknown
23.B	Add Bike Lanes on Doby's Bridge Road between Williams Road and Lee Road (1)	Long	$420,000
23.C	Add Bike Lanes on Doby's Bridge Road between Fairway Drive and Williams Road (2)	Long	$40,000
23.D	Add Bike Lanes on Doby's Bridge Road between Kimbrell Road and Hensley Road (3)	Long	$80,000
23.E	Add Bike Lanes on Doby's Bridge Road between Lee Road and the Lancaster County Line (3)	Long	$560,000

Notes:

(1) High Priority Bike Route on map "Priority Areas for Bike Lanes in York County," August 2008, produced by York County Planning Department.

(2) Medium High Priority Bike Route on map "Priority Areas for Bike Lanes in York County," August 2008, produced by York County Planning Department.

(3) edium Priority Bike Route on map "Priority Areas for Bike Lanes in York County," August 2008, produced by York County Planning Department.

Corridor 24: W. Main St, SC 5

Full corridor title: Corridor 24: W. Main St, SC 5 between SC 901, Heckle Boulevard and SC 122, Dave Lyle Boulevard

Key issues and factors along this corridor include:

- The corridor is a four lane roadway with center left turn lane between SC 901/Heckle Boulevard and S Cherry Road, becomes a four lane undivided roadway from S Cherry Road to W Black Street and then becomes a two lane undivided roadway between W Black St and SC 122/ Dave Lyle Boulevard.
- Metrolina model Level of Service is B (2005) and E (2035)

It is recommended that the CMP projects listed below be considered for this corridor.

Corridor 24: W. Main St, SC 5 CMP Projects

Ref #	Project Description	Timeframe	Cost Est.
24.A	Review and update signal operations and timing at regular intervals	Periodic	2k/signal/yr

Notes:

Appendix E

CMP DOCUMENTATION - EVALUATION FORM

June 10, 2011

CONGESTION MANAGEMENT PROCESS: SINGLE OCCUPANT VEHICLE (SOV) CAPACITY PROJECTS

SAFETEA-LU legislation mandates that "in a TMA designated as a non-attainment area for ozone or carbon monoxide, federal funds may not be programmed for any project that will result in a significant increase in the carrying capacity for SOV's, (i.e., a new general purpose highway on a new location or adding general purpose lanes, with the exception of safety improvements or the elimination of bottlenecks), unless the project is addressed through a Congestion Management Process."

The legislation further requires that the congestion management process shall provide an appropriate analysis of all reasonable travel demand reduction and operational improvement strategies for the corridor in which a capacity increasing project is proposed. If an SOV project is warranted, then the CMP should identify the strategies to manage the corridor efficiently. For the RFATS CMP, the definition of a regionally significant capacity project is consistent with the definition used for the purposes of air quality conformity analysis.

Additionally, it is important to emphasize that all non-federally funded projects for which a federal decision document may be requested (i.e., NEPA, etc.), are strongly encouraged to undergo a CMP evaluation / documentation review as well – so as to avoid potential disruption to the implementation of a project should federal funding become part of a project's funding source at a later date.

RFATS
Rock Hill - Fort Mill Area Transportation Study

1. RFATS PROJECT SPONSOR	
2. CONTACT PERSON	
3. ADDRESS	
4. PHONE NUMBER **FAX NUMBER**	
5. EMAIL	
6. PROJECT NAME	
7. PROJECT LIMITS	
8. PROJECT DESCRIPTION [Attach additional sheets if necessary]	
9. WHAT ARE THE SOURCES OF PROJECT FUNDING?	_____Federal _____State _____Local _____Other (i.e., Developer Funded)
10. HOW READY IS THE PROJECT TO BE CONSTRUCTED?	
11. PROJECT COST ESTIMATE	_____Preliminary Engineering _____Right-of-Way _____Construction _____Total
12. WHAT IS THE ROADWAY'S FUNCTIONAL CLASSIFICATION	
13. WHAT IS THE CURRENT AADT?	
14. WHAT IS THE CURRENT LEVEL OF SERVICE DURING PEAK PERIODS?	_____A _____B _____C _____D _____E _____F

15. ALTERNATIVES TO SOV CAPACITY (OPM OPTIONS CONSIDERED / IMPLEMENTED)	_____Access Management _____Transportation Demand Mgmt _____Signal Retiming _____Intersection Improvement(s) _____Operational Improvements to Parallel facilities
A. ACCESS MANAGMENT	
B. TDM	
C. SIGNAL RETIMING	
D. INTERSECTION IMPROVEMENT(S)	
E. OPERATIONAL IMPROVEMENTS TO PARALLEL FACILITIES	
16. WILL ALTERNATIVES PRODUCE DESIRED CONGESTION REDUCTION	_____Yes _____No
17. NEEDED FOLLOW-UP ACTIVITIES?	