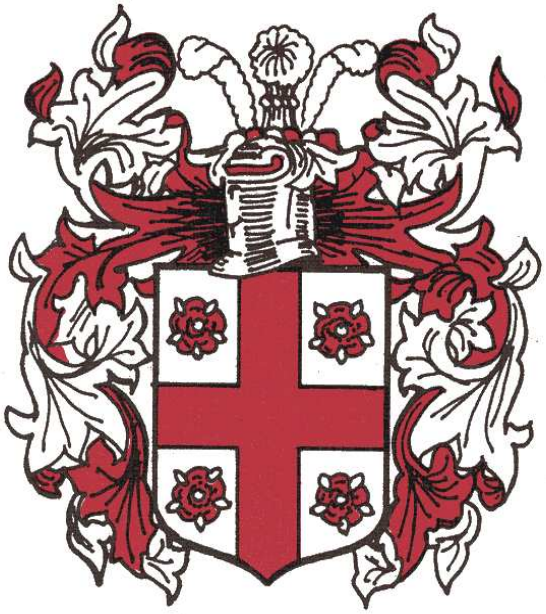
North Carolina Department of Transportation
Transportation Planning Branch



Comprehensive Transportation Plan

Town of Troutman

July 2009

Comprehensive Transportation Plan

Town of Troutman

Prepared by the: Transportation Planning Branch
N.C. Department of Transportation

In Cooperation with: The Town of Troutman
The Lake Norman Rural Planning Organization
The Federal Highway Administration
U.S. Department of Transportation

July 2009

Acknowledgments

Persons responsible for this report:

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Western Unit Manager:	Earlene Thomas, P.E.
Transportation Planning Branch, Manager:	Mike Bruff, P.E.

Executive Summary

In July of 2003, the Transportation Planning Branch of the North Carolina Department of Transportation and the Town of Troutman made a formal agreement to begin an update of the 1991 Town of Troutman Thoroughfare Plan. The Town of Troutman Comprehensive Transportation Plan (CTP), as shown in Figure 1, resulted from the implementation of long-range transportation planning principles.

It is important to realize that the CTP is based on anticipated growth and development of the planning area, reflecting current demographic trends as provided by the Town. Prior to the implementation of specific projects, more detailed studies will be required to reconsider development trends, determine specific design requirements and further evaluate environmental impacts.

The Comprehensive Transportation Plan for the Town of Troutman includes three planning maps: the highway map, the public transportation and rail map and the bicycle map. The format for the pedestrian map has not been finalized so it was not developed as part of this study. The highway map was determined by a hand allocation application of the standardized four-step travel demand process, which includes trip generation, trip distribution, mode choice and trip assignment. The public transportation and rail map and bicycle map were developed through discussions with agency resources and the local officials, focusing on their overall goals for the area.

This report documents the findings of the CTP study along with the resulting recommendations for improvements. In addition, this report presents transportation cross-section recommendations, cost estimates for the recommended improvements, and environmental features found in the recommended improvement areas.

After coordination with the Town Manager, the Board of Alderman and the citizens of the planning area, the Town of Troutman CTP was adopted by the Town of Troutman on December 13, 2007 and by NCDOT on April 3, 2008.

Implementation of the CTP rests largely with the policy boards and citizens of the planning area. Transportation needs throughout the State exceed the available funding; therefore, local areas should aggressively pursue funding for the projects they desire.

The recommendations for major improvements are listed below. A more detailed discussion of these recommendations can be found in Chapter 2.

- Interstate 77 (TIP Project # I-4750)
  The Strategic Highway Corridors (SHC) initiative designates I-77 as a freeway through Troutman. It is recommended that the facility be widened from four to eight lanes with interchange improvements implemented.

- Old Mountain Road (SR 1005)
  It is recommended that Old Mountain Road be improved to boulevard standards from the western PAB to US 21/NC 115. This facility will be widened from a two-lane to a four-lane divided facility.

- Perth Road (SR 1303)
  It is recommended that Perth Road be improved to boulevard standards from the southern PAB to the Town limits (Wagner Street SR 1303) to accommodate the projected traffic volumes and anticipated growth and development along this roadway. This facility will be widened from a two-lane to a four-lane divided facility.

- US 21/NC 115 (TIP Project # R-2522)
  It is recommended that US 21/NC 115 be improved to boulevard standards by widening from a two-lane to a four-lane divided facility with partial control access.

  In conjunction with this recommendation, Eastway Drive should be improved to boulevard standards. This roadway should function as a one-way pair with US 21/NC 115 from the beginning of South Eastway Drive to the merge of North Eastway Drive into US 21/NC 115. Along this section of US 21/NC 115, this roadway will remain a two-lane facility.

- Wagner Street (SR 1303)
  It is recommended that Wagner Street be improved to boulevard standards from the Town limits to US 21/NC 115 and realigned to three lanes on new location at the intersection of US 21/NC 115 to accommodate the projected traffic volumes and the anticipated growth and development along this roadway. This facility will be widened from a two-lane to a four-lane divided facility linking US 21/NC 115 and the proposed Troutman Bypass.

- Perry Road Extension
  It is recommended that Perry Road be extended to Murdock Road to provide access to a proposed major residential development and to provide an alternate north-south route to alleviate congestion on US 21/NC 115. The two-lane extension is a new location roadway.

- Troutman Southwest Bypass
  It is recommended to provide a direct continuous route from Old Mountain Road to the southern portion of US 21/NC 115. The Troutman Southwest Bypass is comprised of existing portions of Troutman Road, Talley Street, Autumn Leaf Road, and Barkdale Road, which in the future will be improved to NCDOT standards and joined by newly constructed roadway connectors.

Adopted by:

Town of Troutman
Date: December 13, 2007

NCDOT
Date: April 3, 2008

Endorsed by:

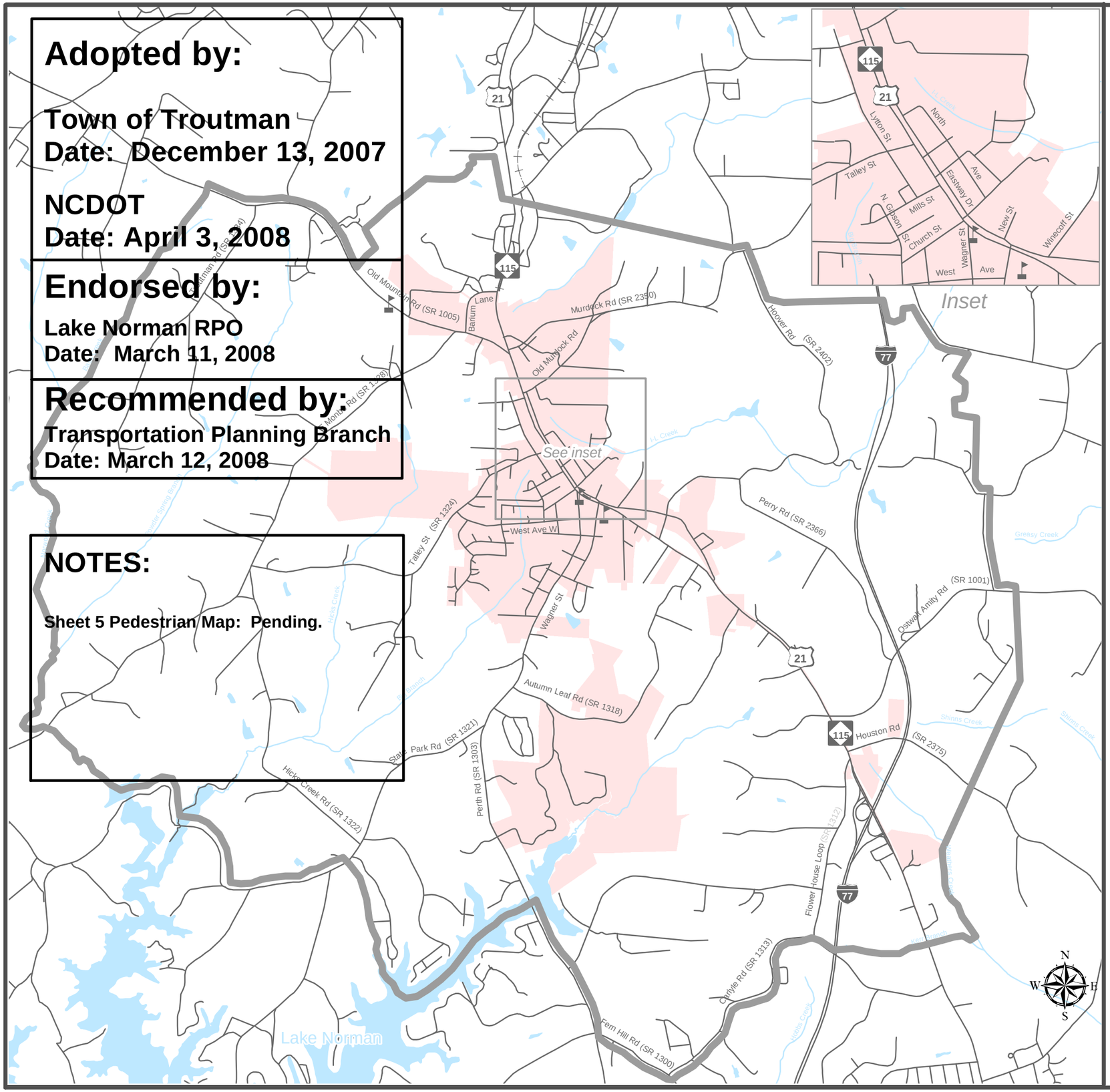
Lake Norman RPO
Date: March 11, 2008

Recommended by:

Transportation Planning Branch
Date: March 12, 2008

NOTES:

Sheet 5 Pedestrian Map: Pending.



Town of Troutman

Iredell County
North Carolina

Comprehensive Transportation Plan

Plan date: November 2, 2007

Legend

- Schools
- Roads
- Railroads
- Rivers and Streams
- Municipal Boundary
- Planning Boundary

0 0.2 0.4 0.8 1.2 Miles

Figure 1 - Sheet 1

Base map date: October 2004

Refer to CTP document for more details

Highway Map

Town of Troutman

Iredell County
North Carolina

Comprehensive Transportation Plan

Plan date: November 2, 2007

Freeways
- Existing
- Needs Improvement
- Recommended

Expressways
- Existing
- Needs Improvement
- Recommended

Boulevards
- Existing
- Needs Improvement
- Recommended

Other Major Thoroughfares
- Existing
- Needs Improvement
- Recommended

Minor Thoroughfares
- Existing
- Needs Improvement
- Recommended

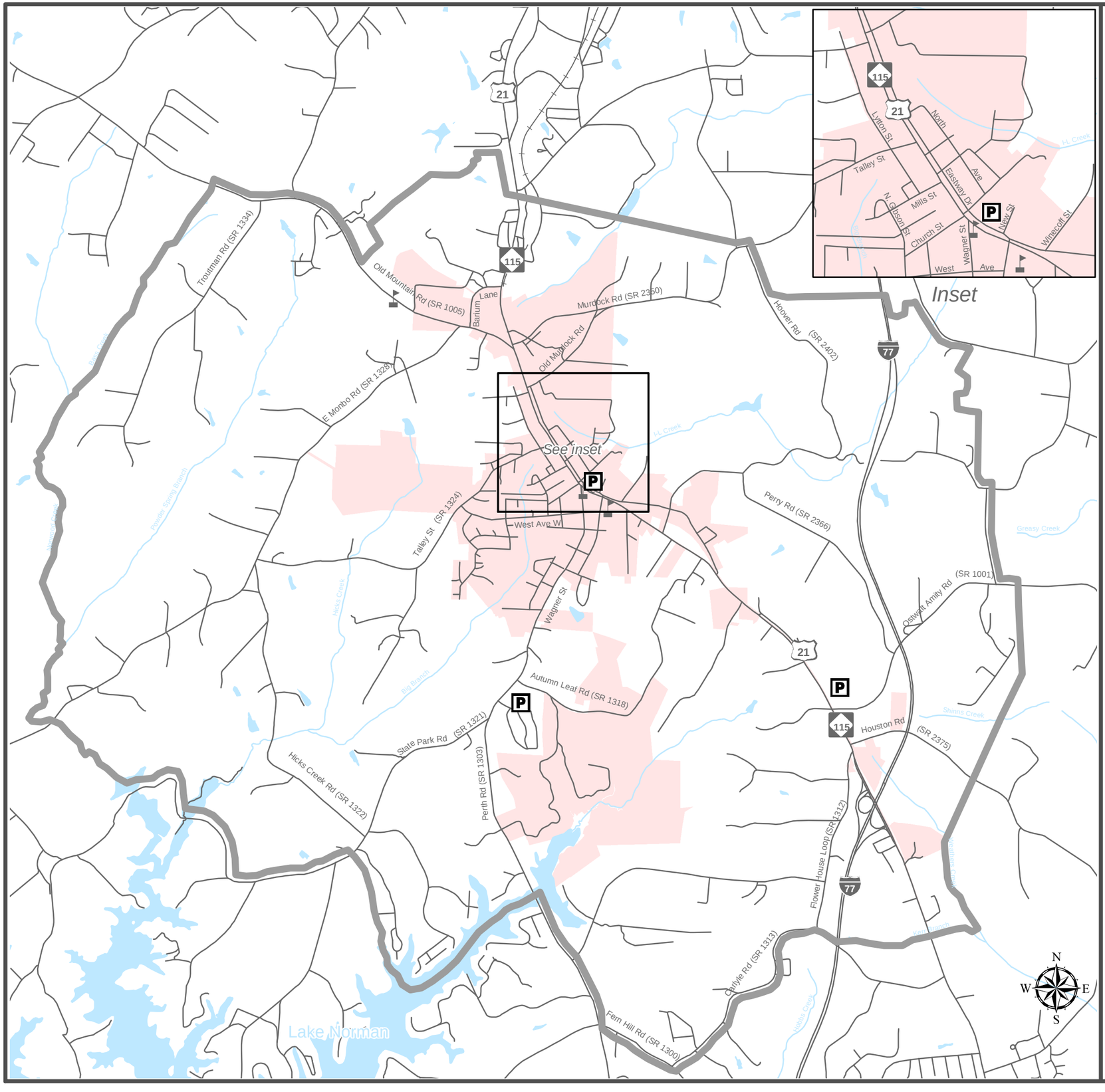
- Existing Interchange
- Proposed Interchange
- Existing Grade Separation
- Proposed Grade Separation

0 0.2 0.4 0.8 1.2 Miles

Figure 1 - Sheet 2

Base map date: October 2004

Refer to CTP document for more details



Public Transportation and Rail Map

Town of Troutman

Iredell County

North Carolina

Comprehensive Transportation Plan

Plan date: November 2, 2007

Bus Routes
- Existing
- Needs Improvement
- Recommended

Fixed Guideway
- Existing
- Needs Improvement
- Recommended

Operational Strategies
- Existing
- Needs Improvement
- Recommended

Rail Corridor
- Active
- Inactive
- Recommended

High Speed Rail
- Existing
- Recommended

Rail Stops
- Existing
- Recommended

Intermodal Connector
- Existing
- Recommended

Park and Ride
- Existing
- Recommended

0 0.2 0.4 0.8 1.2 Miles

Figure 1 - Sheet 3

Base map date: October 2004

Refer to CTP document for more details

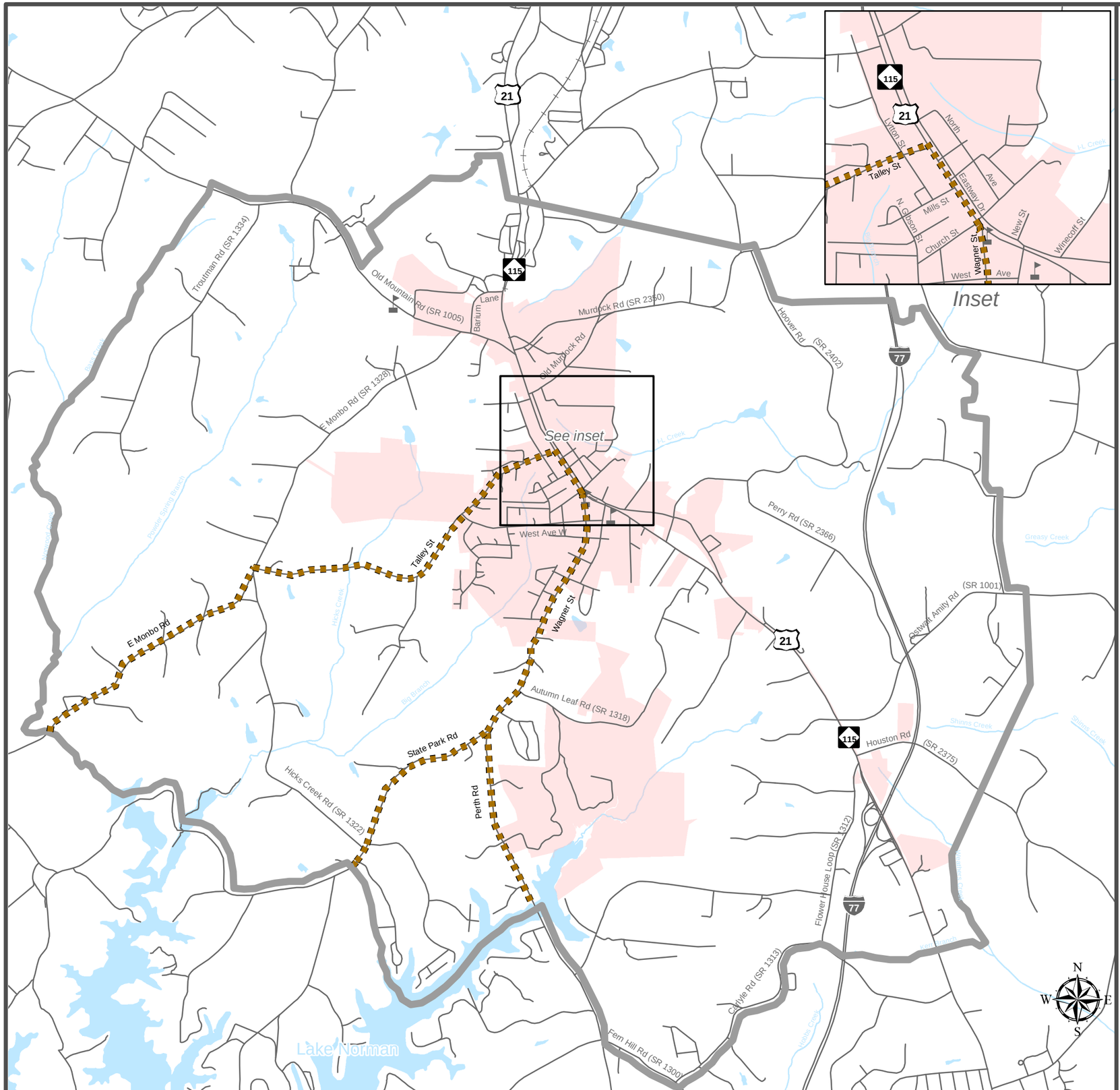
Bicycle Map

Town of Troutman

Iredell County
North Carolina

Comprehensive Transportation Plan

Plan date: November 2, 2007



On-road
- Existing
- Needs Improvement
- Recommended

Off-road
- Existing
- Needs Improvement
- Recommended

Miles
0 0.2 0.4 0.8 1.2

Figure 1 - Sheet 4

Base map date: October 2004

Refer to CTP document for more details

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I. Introduction

The transportation system of an area is its lifeline, contributing to its economic prosperity and social well being. The importance of a safe and efficient transportation infrastructure should be reflected in the development and continual growth anticipated in the area. This system should provide a means of transporting people and goods from one place to another efficiently, conveniently, and safely. A well-planned system will accommodate the existing travel demand, as well as keep pace with the growth of the region. The Town of Troutman recognizes the importance of planning for future transportation needs and requested transportation planning assistance from the Transportation Planning Branch of the North Carolina Department of Transportation (NCDOT) in July 2003.

The Troutman Planning Area is located in the mid-southern portion of Iredell County; approximately thirty miles north of Charlotte, between the municipalities of Statesville and Mooresville, and Lake Norman. The geographical location of the planning area is shown in Figure 2.

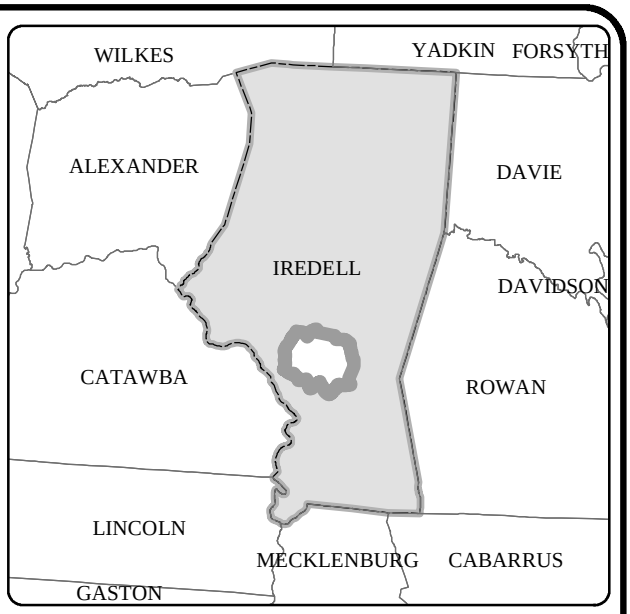
This report documents the development of the 2007 Town of Troutman Comprehensive Transportation Plan (CTP) shown in Figure 1, which replaces the 1991 Town of Troutman Thoroughfare Plan shown in Figure 3. In addition, this report presents recommendations for each mode of transportation. Documentation of the technical analysis completed for this study is included in Appendix F. Developing a CTP ensures that the transportation system will be progressively developed to meet the needs of the planning area. It will serve as an official guide for providing a well-coordinated, efficient, and economical transportation system that utilizes all modes of transportation. This document should be used by local officials to ensure that planned transportation facilities reflect the needs of the public, while minimizing the disruption to local residents, businesses, and the environment, and to protect future corridors when development is proposed.

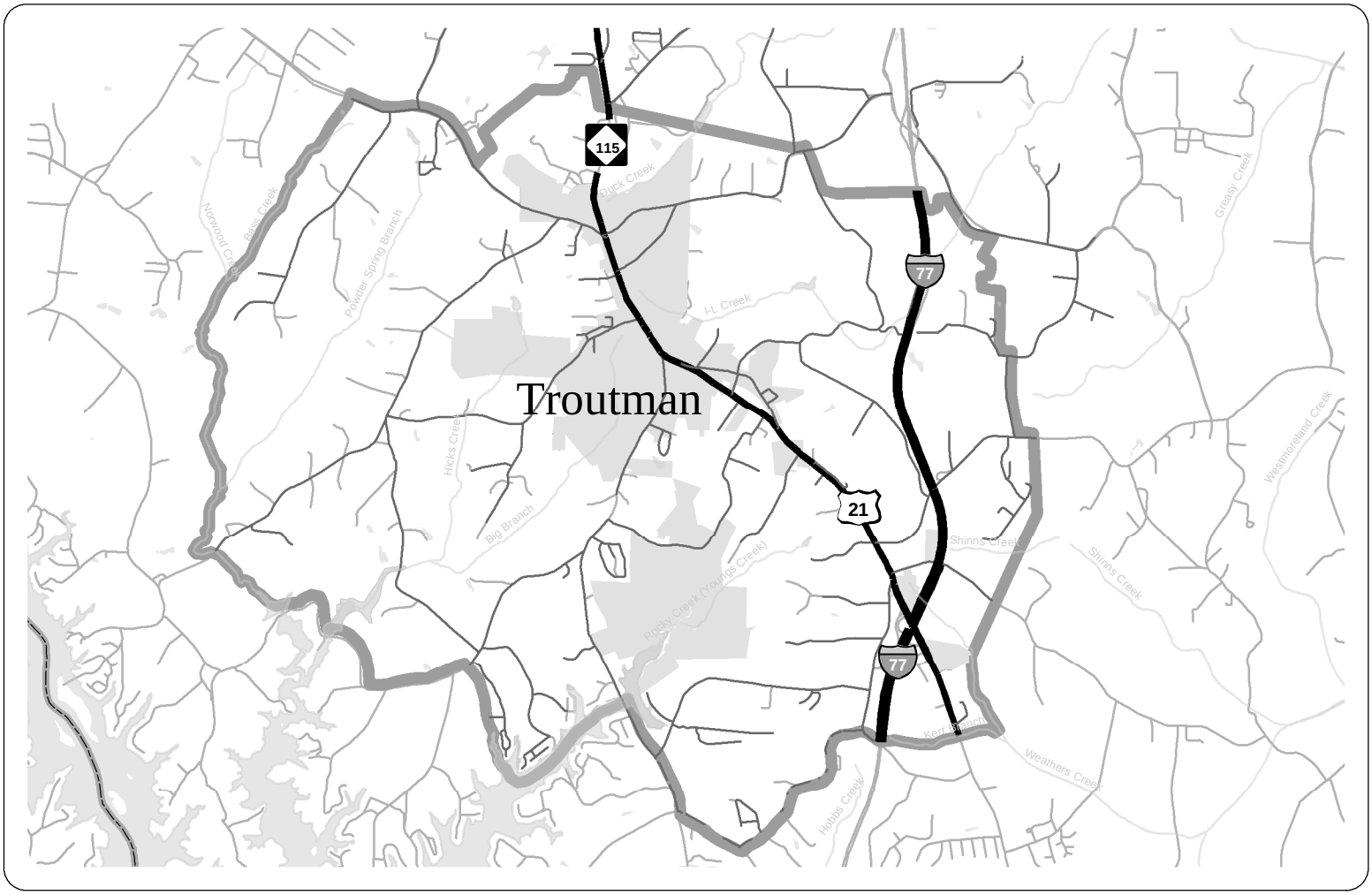
The purpose of this study is to examine present and future transportation needs of the planning area and to develop a CTP to meet these needs. The plan recommends those improvements that are necessary to provide an efficient transportation system within the 2002-2030 planning period. The recommended cross-sections outlined in Appendix D for these improvements are based on existing conditions and projected traffic volumes.

Initiative for implementing the CTP rests predominately with the policy boards and citizens of the planning area. Responsibility for proposed construction is shared by the Town of Troutman and NCDOT. As transportation needs throughout the state exceed available funding, it is imperative that the local planning area aggressively pursues funding for desired projects.

The CTP is based on the projected growth for the planning area as coordinated with the Town. It is possible that actual growth patterns will differ from those logically anticipated. As a result, it may be necessary to accelerate or delay the development of some recommendations associated with the CTP. Some portions of the CTP may require

revisions in order to accommodate unexpected changes in development. Any changes made to one element of the CTP should be consistent with the other elements.





LEGEND

- New Planning Area Boundary
- Town Limits
- Interstate
- US
- NC
- Roads
- Rivers and Streams

TOWN OF TROUTMAN

IREDELL COUNTY
NORTH CAROLINA

N
W E
S

BASE MAP DATE: OCTOBER 2004

GEOGRAPHIC LOCATION

FIGURE 2

ADOPTED BY THE TOWN
OF TROUTMAN 6/7/90

RECOMMENDED APPROVAL BY
PLANNING AND ENVIRONMENTAL BRANCH
10/15/90

ADOPTED BY THE NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
11/09/90

FIGURE 3

TROUTMAN THOROUGHFARE PLAN

N

TOWN OF
TROUTMAN
NORTH CAROLINA

JUNE 7, 1990

800 1600
SCALE IN FEET

LEGEND:

	EXISTING / PROPOSED
MAJOR THOROUGHFARE	
MINOR THOROUGHFARE	

II. Recommendations

This chapter presents the recommended improvements and associated problem statements resulting from the transportation needs assessment conducted during the development of the CTP for the Town of Troutman. These improvements are needed to enable the Troutman transportation system to serve anticipated travel desires as this area continues to grow.

Highway Map

The recommended highway map for the planning area is presented in Figure 1 - Sheet 2. This map classifies the major highway system into five categories depending on the type of service each roadway provides. These classifications (freeways, expressways, boulevards, other major thoroughfares and minor thoroughfares) are described in detail in Appendix B. Refer to Appendix C for an inventory of the existing and recommended highway attributes.

The recommended highway map includes several improvements needed to meet future travel demand. These improvements were developed based on the needs assessment, the goals and objectives of the area and the known environmental limitations of the planning area. The following problem statements document the purpose and need for each of the recommended improvements.

Major Improvements

I-77 (TIP Project # I-4750)

- Project Recommendation: The Strategic Highway Corridors (SHC) initiative designates I-77 as a freeway through Troutman. It is recommended that the facility be widened from four to eight lanes with interchange improvements. The length of this project within the PAB is approximately 6 miles.

- Transportation Demand: I-77 is functionally classified as an interstate and serves both intrastate and interstate travel. The facility transverses four states linking the Midwest (Ohio) and the southeast (South Carolina) portions of the United States. Improving existing I-77 will enable the facility to accommodate anticipated future traffic volumes by providing additional roadway capacity.

- Roadway Capacity and Deficiencies: The 2002 Annual Average Daily Traffic (AADT) volumes along I-77 ranged from 48,000 vehicles per day (vpd) to 52,000 vpd. The route's practical capacity is 56,200. The estimated 2030 traffic volumes along I-77 range between 128,700 vpd and 134,200 vpd, which exceeds the current practical capacity.

- Social Demands and Economic Development: Widening I-77 will improve intrastate and interstate travel within North Carolina. Accelerated growth in the

area is expected to increase through the year 2030, resulting in increased residential and commercial developments through the area. In addition, exit 45, along the intersection of Amity Hill Road and I-77 has been targeted for a village-style office and retail center development.

- System Linkages: I-77 is on the National Highway System (NHS), the National Freight Network and is a Strategic Highway Corridor (SHC). The primary purpose of this SHC is to provide a network of high-speed, safe, reliable highways throughout the State. This facility runs north-south through the eastern portion of the planning area, linking Statesville, Mooresville, and Lake Norman, while providing access to US 21/NC 115.

- Relationship to Other Plans: The recommended improvements are consistent with improvements in the 2006 Iredell County CTP and the 2008 Town of Mooresville CTP. The City of Statesville CTP is currently being developed and will be coordinated with this plan. The recommendations for I-77 are also consistent with the NC SHC Plan that designates this facility as a freeway.

Old Mountain Road (SR 1005)

- Project Recommendation: It is recommended that Old Mountain Road be improved to boulevard standards from the western PAB to US 21/NC 115. This facility will be widened from a two-lane to a four–lane divided facility. The length of this project within the PAB is approximately 2 miles.

- Transportation Demand: Old Mountain Road is functionally classified as a major collector on the Federal Function Classification System and primarily serves major intra-county travel corridors and traffic generators providing access to the arterial system. The facility begins at US 21/NC 115 and continues westward to I-40, which is outside the planning area. Improving existing Old Mountain Road will enable the facility to accommodate anticipated future traffic volumes by providing additional roadway capacity.

- Roadway Capacity and Deficiencies: The 2002 AADT volume along Old Mountain Road is approximately 7,000 vpd. The practical capacity of the existing roadway ranges between 12,000 and 13,300 vpd. Growth in the area is expected to increase through the year 2030, resulting in increased travel. By the year 2030, the traffic volumes along Old Mountain Road are projected to be between 28,400 vpd and 32,500 vpd.

- Social Demands and Economic Development: Widening Old Mountain Road will improve travel within the planning area. Accelerated growth in the area is expected to increase through the year 2030, resulting in increased residential and commercial developments towards the US 21/NC 115 intersection and the Troutman Road connector to East Monbo Road. The 2008 Troutman Pedestrian Plan proposes three crosswalks and a sidewalk connection from South Iredell High School to the YMCA.

- System Linkages: Old Mountain Road provides connectivity from US 21/NC 115 to I-40 and is designated as a boulevard on the CTP. The proposed Troutman Southwest Bypass will link Old Mountain Road to the southern portions of the planning area.

- Relationship to Other Plans: The 2006 Iredell County CTP and the 2008 Mooresville CTP were coordinated with this plan. The Statesville CTP is currently being developed with the consideration of the Troutman CTP and its recommendations.

Perth Road (SR 1303)

- Project Recommendation: It is recommended that Perth Road be improved to boulevard standards from the southern PAB to the Town limits (Wagner Street SR 1303) to accommodate the projected traffic volumes and the anticipated growth and development along this roadway. This facility will be widened from a two-lane to a four–lane divided facility. The length of this project within the PAB is approximately 1.5 miles.

- Transportation Demand: Perth Road is functionally classified as a minor collector on the Federal Function Classification System and primarily serves intra-county travel and traffic generators providing access to the arterial system. The facility begins at US 21/NC 115 and continues southward to NC 150, which is outside the planning area. Improvements to existing Perth Road will enable the facility to serve the anticipated traffic volume traveling from the southern planning area, Mooresville and Lake Norman.

- Roadway Capacity and Deficiencies: The 2002 AADT volume along Perth Road is approximately 5,100 vpd. The practical capacity of the existing roadway is 12,000 vpd. Development in the southern portion of the planning area is expected to increase through the year 2030, resulting in accelerated traffic growth along Perth Road. The 2030 traffic projections along Perth Road are between 18,200 and 36,400 vpd, which exceeds the current practical capacity.

- Social Demands and Economic Development: Widening Perth Road will improve travel within the planning area. Accelerated growth in the area is expected to increase through the year 2030, resulting in increased residential and commercial developments through the area.

- System Linkages: Perth Road serves the southern portion of the planning area, linking Troutman to Mooresville and Lake Norman, and provides access to US 21/NC 115. Additionally, there is a proposed bicycle route along this facility. Refer to Figure 1-Sheet 4.

- Relationship to Other Plans: The recommended improvements are consistent with improvements in the 2006 Iredell County CTP and the 2008 City of Mooresville CTP.

US 21 / NC 115 (TIP Project # R-2522)

- Project Recommendation: It is recommended that US 21/NC 115 be improved to boulevard standards by widening from a two-lane to a four-lane divided facility with partial control access. The length of this project within the PAB is approximately 6 miles.

  In conjunction with this recommendation, Eastway Drive should be improved to boulevard standards. This roadway should function as a one-way pair with US 21/NC 115 from the beginning of South Eastway Drive to the merge of North Eastway Drive into US 21/NC 115. Along this section of US 21/NC 115, this roadway will remain a two-lane facility.

- Transportation Demand: US 21/NC 115 is functionally classified as a major collector on the Federal Functional Classification System. This facility runs north-south through the center of the planning area and serves both intrastate and interstate travel. Currently, there is little access control along this highway and three signalized intersections. Improving existing US 21/NC 115 will enable the facility to accommodate anticipated future traffic volumes by providing additional roadway capacity.

- Roadway Capacity and Deficiencies: The 2002 AADT volumes along US 21/NC 115 ranged from 10,000 vpd to 18,000 vpd within the planning area. The route's practical capacity is 12,000. The estimated 2030 traffic volumes along US 21/NC 115 range between 23,900 vpd and 65,500 vpd, which exceeds the current practical capacity.

- Social Demands and Economic Development: Widening US 21/NC 115 will improve travel within the planning area. Accelerated growth in the area is expected to increase through the year 2030, resulting in predominantly residential, commercial and industrial developments through the area. In addition, exit 42, along the intersection of US 21/NC 115 and I-77 has increased commercial, office and retail center development.

- System Linkages: US 21/NC 115 is the primary north-south facility serving the Town. This facility runs north-south through the center of the planning area linking the Town to Statesville, Mooresville, and Lake Norman, while providing access to I-77. Additionally, there is a proposed bicycle route along this facility. Refer to Figure 1-Sheet 4.

- Relationship to Other Plans: The recommended improvements are consistent with improvements in the 2006 Iredell County CTP and the 2008 Town of Mooresville CTP. The City of Statesville CTP is currently being developed and will be coordinated with this plan.

Wagner Street (SR 1303)

- Project Recommendation: It is recommended that Wagner Street be improved to boulevard standards from the Town limits (Perth Road (SR 1303)) and US 21/NC 115 and realigned to three lanes on new location at the intersection of US 21/NC 115 to accommodate the projected traffic volumes and the anticipated growth and development along this roadway. This roadway runs from southwest to northeast in the planning area linking the proposed Troutman Bypass and US 21/NC 115. This facility will be widened from a two-lane to a four–lane divided facility. The length of this project within the PAB is approximately 3.0 miles.

- Transportation Demand: Wagner Street is functionally classified as a minor collector on the Federal Function Classification System and primarily serves intra-county travel and traffic generators. The facility begins at US 21/NC 115 and continues southward to Autumn Leaf Road (SR 1318). Improvements to existing Wagner Street will enable the facility to serve the anticipated traffic volume traveling from the southern planning area towards US 21/NC 115.

- Roadway Capacity and Deficiencies: The 2002 AADT volume along Wagner Street is approximately 7,300 vpd. The practical capacity of the existing roadway ranges between 11,000 and 12,000 vpd. Housing development along this roadway is expected to increase through the year 2030, resulting in accelerated traffic growth along Wagner Street. The 2030 traffic projections along Wagner Street range between 28,400 and 34,300 vpd, which exceeds the current practical capacity.

- Social Demands and Economic Development: Widening Wagner Street will improve travel within the Town and increase safety at the US 21/NC 115 intersection. Accelerated growth in the area is expected to increase through the year 2030, resulting in increased residential and commercial developments along this facility. Existing sidewalks along Wagner Street are substandard. Additionally, there are schools located in the vicinity that would benefit from the recommended improvements to Wagner Street.

- System Linkages: Wagner Street serves the southern portion of the Town, providing access to Perth Road and US 21/NC 115. It will also intersect the proposed Troutman Bypass. Additionally, there is a proposed bicycle route along this facility. Refer to Figure 1-Sheet 4.

- Relationship to Other Plans: The recommended improvements are consistent with improvements in the 2006 Iredell County CTP.

Perry Road Extension

- Project Recommendation: It is recommended that Perry Road be extended to Murdock Road to provide access to a proposed major residential development and to provide an alternate north-south route to alleviate congestion on US 21/NC 115. The two lane extension is a new location roadway.

- Transportation Demand: The Perry Road Extension will be classified as a minor thoroughfare. The extension begins at the Perry Road and Hoover Road intersection, and then continues northward to intersect Murdock Road. Improvements to existing Perry Road and Murdock Road will enable the facility to serve the anticipated traffic volume traveling from the southern planning area towards the northern planning area and I-77.

- Roadway Capacity and Deficiencies: The projected volume of 6,000 vpd along the Perry Road Extension is a result of a proposed housing development through the area and the anticipated alternate north-south traffic.

- Social Demands and Economic Development: Extending Perry Road will provide an alternate north-south route to help alleviate congestion along US 21/ NC 115 and to accommodate traffic for a major residential development proposed along this facility.

- System Linkages: The Perry Road Extension will serve the northeastern portion of the planning area, providing access to Murdock Road and I-77.

Troutman Southwest Bypass

- Project Recommendation: It is recommended to provide a direct continuous route from Old Mountain Road to the southern portion of US 21/NC 115. The Troutman Southwest Bypass is comprised of existing portions of Troutman Road, Talley Street, Autumn Leaf Road and Barkdale Road, which in the future will be improved to NCDOT standards and joined by newly constructed roadway connectors. The length of this project within the PAB is approximately 5.0 miles.

- Transportation Demand: These existing roadways (excluding Troutman Road and Barkdale Road, which are SR routes) that make up this bypass are all two-lane facilities that are functionally classified as minor collectors on the Federal Function Classification System and primarily serve intra-county travel and traffic generators. The completed facility will be classified as an "other major thoroughfare" in the Troutman CTP.

- Roadway Capacity and Deficiencies: The 2030 traffic projections along the Troutman Southwest Bypass are between 11,600 and 13,600 vpd, which is adequate for the future practical capacity of 14,900 vpd.

- Social Demands and Economic Development: The recommended Troutman Southwest Bypass will facilitate travel throughout the planning area, while lessening the demand on the congested portions of Old Mountain Road and US 21/NC 115 in the downtown area. The current land use along portions of the recommended bypass is predominantly farming. There are several undeveloped land parcels along the future bypass. Growth in the area is expected to increase through the year 2030, resulting in increased residential and commercial

developments along this facility. There are schools located in the vicinity that would benefit from these improvements.

- System Linkages: The Troutman Southern Bypass will serve the southwestern portion of the planning area, providing an alternate route for US 21/NC 115.

- Relationship to Other Plans: This facility is not directly related to any other transportation plan.

Minor Widening Improvements

The following routes do not have capacity issues, but are recommended to be upgraded to two 12-foot lanes with 2-foot paved shoulders to improve safety.

- **East Monbo Road (SR 1328):** from Old Mountain Road (SR 1005) to Southwest Troutman Planning Area Boundary (PAB); Realign East Monbo Road on new location to intersect Old Mountain Road at Barium Lane to improve safety and connectivity. Additionally, there is a proposed bicycle route along a portion of this facility. Refer to Figure 1-Sheet 4.

- **Talley Street (SR 1324):** from US 21/NC 115 to East Monbo Street (SR 1328). Additionally, there is a proposed bicycle route along this facility. Refer to Figure 1-Sheet 4.

- **Ostwalt Amity Road (SR 1001):** from US 21/NC 115 to East Troutman PAB. The construction of turning bays are recommended along Ostwalt Amity Road (SR 1001) to decrease congestion.

- **Old Murdock Road (SR 2551):** from US 21/NC 115 to Murdock Road (SR 2350)

- **Hicks Creek Road (SR 1322):** from East Monbo Street (SR 1328) to State Park Road (SR 1321)

- **State Park Road (SR 1321/SR 1303):** from Perth Road (SR 1303) to South Troutman PAB. Additionally, there is a proposed bicycle route along this facility. Refer to Figure 1-Sheet 4.

- **Murdock Road (SR 2350):** from US 21/NC 115 to Hoover Road (SR 2402)

- **Perry Road (SR 2366):** from Hoover Road (SR 2402) to Ostwalt Amity Road (SR 1001)

- **Flower House Loop (SR 1312):** from US 21/NC 115 to South Troutman PAB; Realign Flower House Loop on new location to intersect US 21/NC 115 at Houston Road to improve safety and connectivity.

Unmet Needs

Barium Springs Parkway -
Summary of Unmet Need: There is a need to connect I-77 and US 21/NC 115 with a multi-lane divided facility on new location that will accommodate the future traffic volumes anticipated and relieve congestion on Murdock Road, due to the increased light-manufacturing and business development proposals in the area. The proposed facility will run east-west through Statesville and Troutman's planning area, serving to connect US 21/NC 115 and I-77.

Existing Conditions:
- Industrial and residential land use, wooded area with Duck Creek and Duck Creek Pond.
- Winding curves, rough terrain and elevation differences

Projected Conditions:
- No major improvements have been recommended for Murdock Road (SR 2350) to accommodate the anticipated traffic volumes associated with this development.
- The 2030 traffic projections along Murdock Road of 40,700 vpd will exceed the practical capacity of 13,300.
- The 2030 traffic projections along the proposed facility are expected to range between 24,700 vpd and 30,200 vpd.

Future Actions:
Improvements to Murdock Road, and/or construction of a new roadway that relieves congestion on Murdock Road, will be addressed through the development of the City of Statesville CTP. One alternative that will be considered, as a means to relieve future congestion, is a new-location roadway designated as Barium Springs Parkway. Any recommended improvements to roadways within or crossing the Town of Troutman PAB will require coordination with the Town and an amendment to the Town of Troutman CTP.

Public Transportation and Rail Map

The Public Transportation and Rail element of the CTP is a way to consider other modes of transportation and give the public other options for traveling within the planning area. The public transportation and rail plan for the planning area is presented on Figure 1-Sheet 3. See Appendix B for a more detailed description of each category and Appendix C for the public transportation and rail inventory.

Public Transportation

There are several public transportation services within the county, including vanpool and demand response service. Transportation services for the citizens of Iredell County are offered by The Iredell County Area Transportation System (ICATS), which is a community transportation program that serves the general public and human service transportation needs for Iredell County. Public trips, Medicaid trips, and trips through the Elderly and Disabled Transportation Assistance Program (EDTAP) are provided to people traveling throughout the county. The "Ride the Loop" service provides daily scheduled stops from Mooresville to Statesville.

The process of determining and evaluating recommendations for the public transportation element of the transportation plan involved many considerations including the goals and objectives of the area, existing properties, environmental impacts, and existing and anticipated land development. Consideration of these factors led to the cooperative development of the recommended improvements.

Park and ride lots will assist in relieving the growing congestion along the existing routes in the Town of Troutman by promoting carpools, vanpools, bicycling and walking. Park and ride lots are recommended at the following locations:

- US 21/NC 115 at Wagner Street
- US 21/NC 115 at Ostwalt Amity Road
- Perth Road at Autumn Leaf Road

The proposed park and ride lots will provide relief from future congestion on US 21/NC 115 and Perth Road, including commutes from the planning area to Lake Norman, Mooresville and the surrounding areas. The estimated cost for the proposed improvements is $450,000.

Rail

There is one existing rail line in the planning area and it is currently inactive. The old Norfolk Railway (NS) O-line that runs two miles south of Statesville to North Mooresville was abandoned in the 1970's. The right-of-way has since been encroached upon by heavy development and is no longer continuous through the planning area.

Currently, there are no proposed rail lines within the planning area of Troutman.

Bicycle Map

The recommended plan for the bicycle element is shown on Figure 1-Sheet 4. Refer to Appendix C for an inventory of the bicycle facilities and the recommended improvements.

Information about events, funding, maps, policies, projects, and processes that involve the bicycle and pedestrian system in North Carolina is available from the NCDOT Bicycle and Pedestrian Division.

Lake Norman Bicycle Route

- Project Recommendation: The recommended bicycle route will provide connectivity and promote bicycling within this area, while promoting a healthy lifestyle. The proposed Lake Norman Bicycle Route is designated as an on-road bicycle facility on the CTP that follows several existing roadways encompassing Lake Norman. It is a 150-mile loop around Lake Norman through four counties.

  Currently, there are several residential developments along the proposed Lake Norman Bicycle Route. Schools, businesses, and several residential developments are scattered throughout the corridor. Future growth along the proposed Lake Norman Bicycle Route is anticipated to include mostly residential and commercial developments.

  There are several wetlands included in the National Wetland Inventory along the proposed Lake Norman Bicycle Route. This is the only known natural environmental feature in this area.

Pedestrian Map

During the development of the CTP, the format for the CTP Pedestrian element had not yet been established; however a collaborative study between the Centralina COG, Troutman and the Bicycle and Pedestrian Division recently developed a Troutman Pedestrian Plan. This plan was adopted in February 14, 2008 and includes several improvements needed to provide adequate, safe and desirable facilities for use by pedestrians. For these recommendations to officially become part of the adopted CTP, the Troutman Pedestrian Plan will need to be adopted and formatted within CTP guidelines and part of an amended Town of Troutman CTP. The Troutman Pedestrian Plan can be viewed in Appendix E.

III. Population, Land Use, and Existing Transportation System

An adequate long-range transportation plan can be achieved by utilizing reliable forecasts of future travel patterns. Such forecasts depend on careful analysis of historic and potential population changes, significant economic trends, character and intensity of land development, and the ability of the existing transportation system to meet existing and future travel demand. Secondary items that influence these forecasts include the effects of legal controls such as zoning ordinances and subdivision regulations, the availability of public utilities and transportation facilities, and topographic and other physical features of the urban area.

Population

Since the volume of traffic on a roadway is relative to the size and distribution of the population that it serves, population data is used to assist in development of the transportation plan. Future population estimates typically rely on the observance of past population trends and development forecasted for the area. While statistics show that the population within the planning area has been increasing at a steady rate, the Town has suggested that the population will significantly increase in the next ten to fifteen years. The Iredell County population will be growing at a slower rate than the planning area, but the southwestern portion of the county should experience an increase in population. According to the Town, the population is expected to triple in the next ten to fifteen years, and will then level off to a steady trend. Table 1 represents the population trends for the Town of Troutman, Iredell County and North Carolina.

Table 1. Population Growth

Area Name	1970	1980	1990	2000	2010	2020	2030
Troutman	797	1,360	1,493	1,592	2,006	2,427	2,864
Planning Area	--	--	--	6,900	10,540	17,100	26,500
Iredell County	72,197	82,538	92,935	122,660	155,695	189,625	225,452
North Carolina	5,082,059	5,881,766	6,628,637	8,049,313	9,315,141	10,682,217	12,067,013

Historic trends for the Town of Troutman yielded a 2 - 3% growth rate. However, growth projections developed in the "South Iredell Forecast" ranged from 3 - 5%. Projections from this forecast were based on the 2000 census and used in the development of this plan.

Land Use

Land use refers to the physical patterns of activities and functions within an area. The transportation demand along a facility is related to the types and intensities of adjacent land uses. For example, a shopping center generates larger traffic volumes than a residential area. The spatial distribution of varying land uses is the predominant determinant of when, where, and why congestion occurs. The attraction between different land uses and their association with travel varies with the size, type, intensity, and spatial separation of each land use. When dealing with transportation planning, land use is divided into the following classifications:

- Residential – All land is devoted to the housing of people, with the exception of hotels and motels.

- Commercial – All land is devoted to retail trade including consumer and business services and their offices; this may be further stratified into retail and special retail classifications. Special retail would include high-traffic establishments, such as fast-food restaurants and service stations; all other commercial establishments would be considered retail.

- Industrial – All land is devoted to the manufacturing, storage, warehousing, and transportation of products.

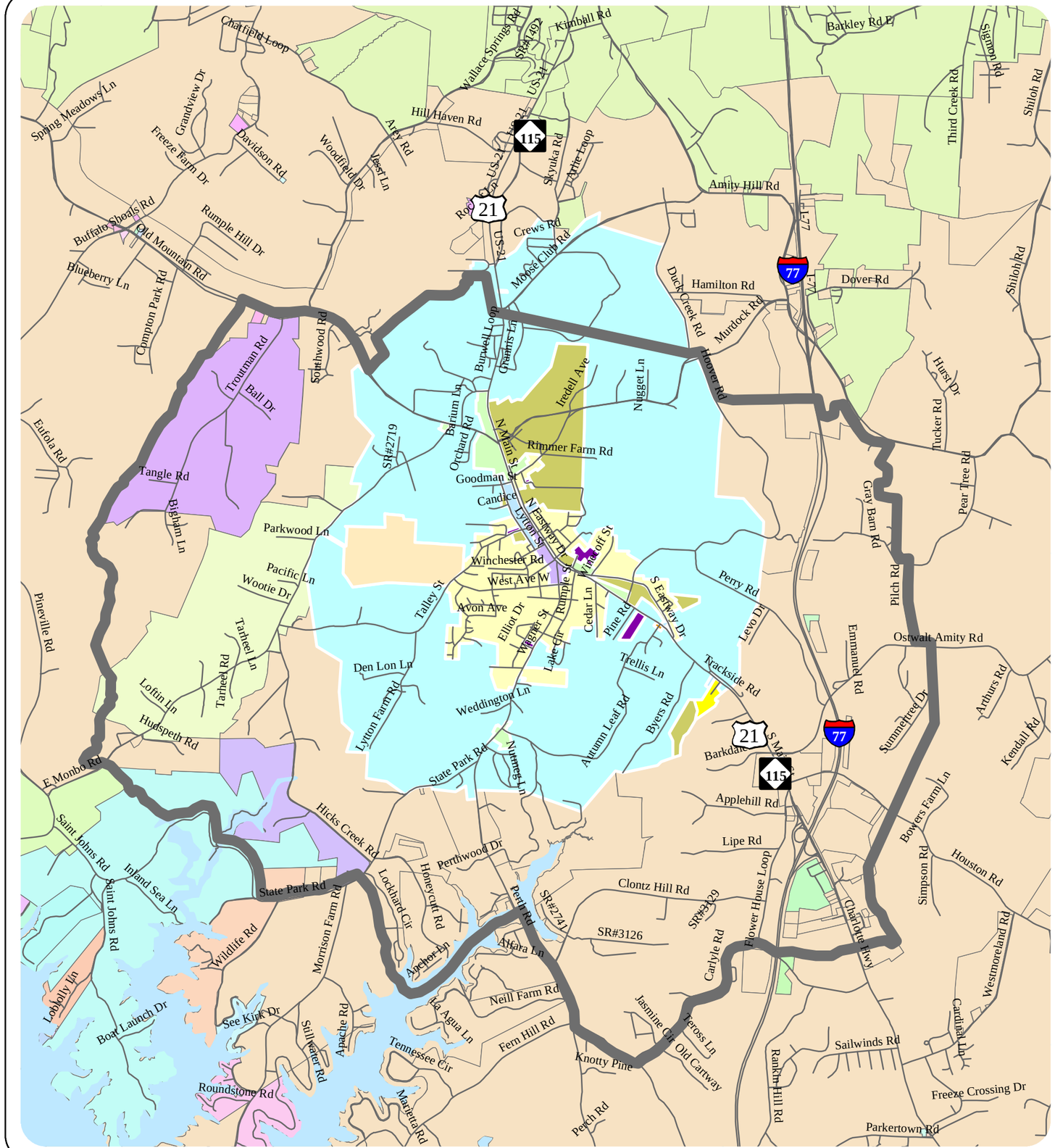
- Public – All land is devoted to social, religious, educational, cultural, and political activities; this would include the office and service employment establishments.

- Agricultural – All land is devoted to the use of buildings or structures for the raising of non-domestic animals and/or growing of plants for food and other production.

Figure 4 shows the existing zoning for the Town of Troutman. The anticipated land use for the planning area is predominantly residential, industrial, and commercial. Noticeable residential growth is expected mainly in the southern and northeastern portions of the planning area. The areas of highest employment growth are expected along the major roadway corridors throughout the planning area: Amity Hill Road, Old Murdock Road, US 21/NC 115, Moose Club Road and Murdock Road. The land use plan for the area, the *"Troutman Town and Country Plan,"* was published in March 2002 by the Town of Troutman and the Lawrence Group Architects of North Carolina, Inc. The major development along Amity Hill Road will help prepare for the planning area's vision for mixed-use development. Promoting high-density multi-land use in the planning area will in turn promote a multi-modal transportation system due to the ease of access through the alternative modes of transportation.

TROUTMAN ZONING MAP

FIGURE 4



Legend

- Planning Area Boundary
- Roads
- Community Business
- Commercial Planning Dev
- Highway Business
- Industrial
- Neighborhood Business
- Office Institution
- Residential -10
- Residential -20
- Residential Multiple Family
- Residential Multiple Housing
- Zoning Statesville
- Business -2
- Business -5
- Residential -15 M
- Residential -20
- Residential -8 MF
- Lakes

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0 0.2 0.4 0.8 1.2 Miles

Base map date: October 2004

Existing Transportation System

An important stage in the development of a CTP is the analysis of the existing roadway system and its ability to serve the areas travel desires. Emphasis is placed not only on detecting the existing deficiencies, but also on understanding the causes of these deficiencies. Travel deficiencies may be localized, resulting from problems with inadequate pavement width, intersection geometry, or intersection controls. Travel deficiencies may also result from system problems such as the need to construct missing travel links, bypass routes, loop facilities, or additional radial routes.

An analysis of the roadway system looks at both current and future travel patterns and identifies existing and anticipated deficiencies. This is usually accomplished through a traffic collision analysis, roadway capacity deficiency analysis, and a system deficiency analysis. This information is used to analyze factors that will impact the future system including population growth, economic development potential, and land use trends.

Traffic Crash Analysis

Traffic crashes are often used as an indicator for locating congestion problems. While often the result of drivers or vehicle performance, crashes may also be a result of the physical characteristics of the roadway. Roadway conditions and obstructions, traffic conditions, and weather may all be contributing factors resulting in a crash. While some crashes are the fault of the driver, others may be prevented with physical design or traffic control changes such as the installation of stop signs or traffic signals.

Crash data for the period from December 2000 to December 2002 was studied as part of the development of the plan. The crash analysis considered both crash frequency and severity. Crash frequency is the total number of reported collisions while crash severity is the crash rate based upon injuries and property damage incurred. These two factors helped to determine the most problematic intersections within an area. In a crash analysis, intersections are identified as a high crash location when 5 or more crashes occur within 150-ft of the intersection. For the Troutman study area, no intersections meet this criteria; thus yielding no high crash intersection locations.

To request a detailed crash analysis for any intersections located within the planning area, contact the Division Traffic Engineer. Contact information for the Division Traffic Engineer is included in Appendix A.

Bridge Conditions

Bridges are an important element of a roadway system. Any bridge deficiency will affect the efficiency of the entire transportation system. In addition, bridges present the greatest opportunity of all potential highway failures for disruption of community welfare and loss of life. Therefore, bridges must be constructed to the same, or higher, design standards as the system of which they are a part and must be inspected regularly to ensure the safety of the traveling public. Every effort should be made when replacing bridges as to not create a barrier for pedestrians and bicyclists. Coordination for bridge replacements should include the Division of Bicycle and Pedestrian Transportation.

The NCDOT Bridge Maintenance Unit inspects all bridges in North Carolina at least once every two years. A sufficiency rating for each bridge is calculated and establishes the eligibility and priority for replacement. Bridges having the highest priority are replaced as Federal and State funds become available.

A bridge is considered deficient if it is either structurally deficient or functionally obsolete. A bridge at least ten years old is considered structurally deficient if it is in relatively poor condition or has insufficient load-carry capacity, due to either the original design or to deterioration. The bridge is considered to be functionally obsolete if it is narrow, has inadequate under-clearances, has insufficient load-carrying capacity, is poorly aligned with the roadway, and/or can no longer adequately serve existing traffic.

A bridge must be classified as deficient in order to qualify for Federal replacement funds. To qualify for replacement, the sufficiency rating must be less than 50%; for rehabilitation, the sufficiency rating must be less than 80%. Deficient bridges within the planning area are given in Table 2 with the location of these bridges shown in Figure 5.

TABLE 2. DEFICIENT BRIDGES

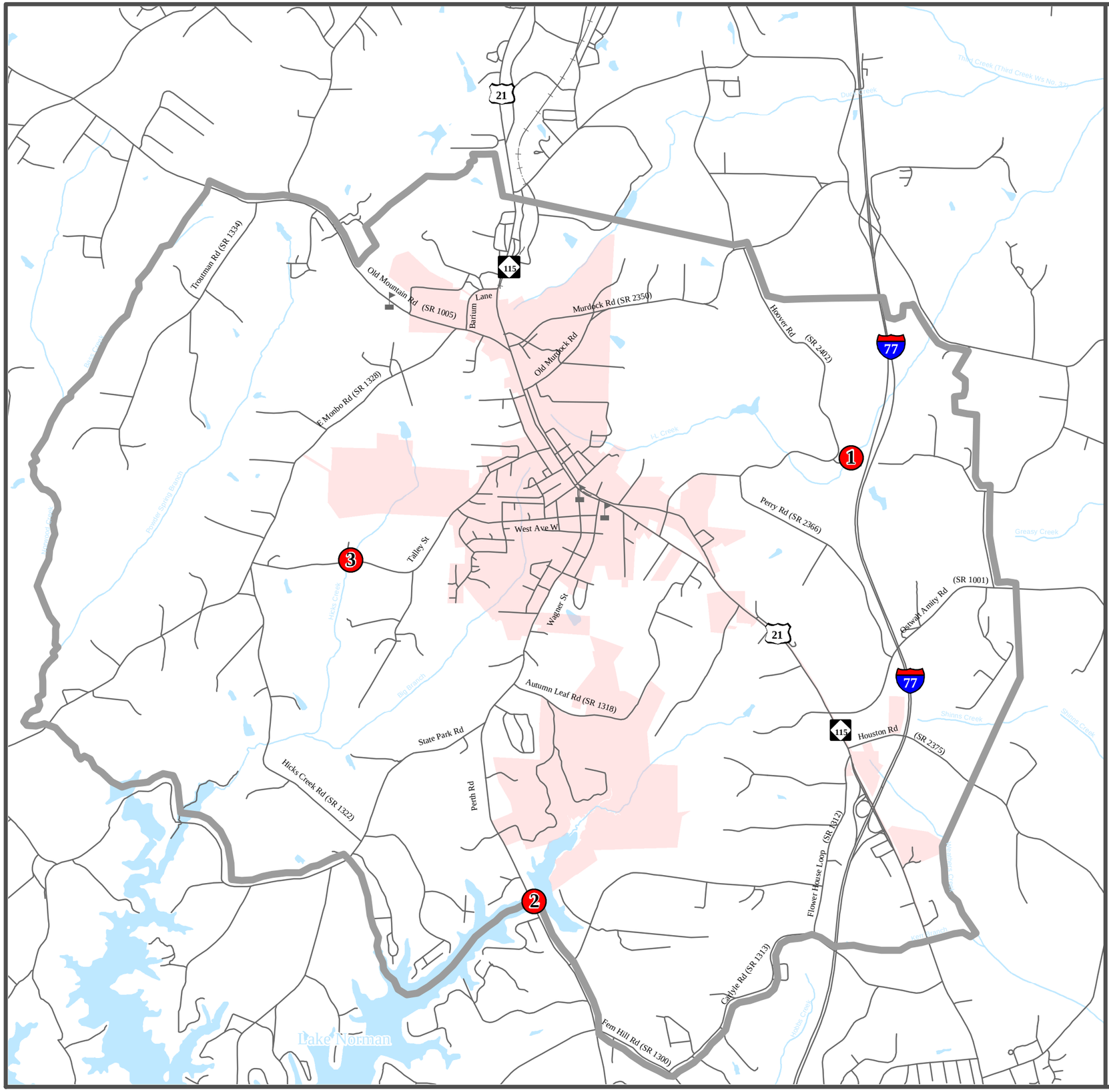
ID	BRIDGE #	SUFFICIENCY RATING	YEAR BUILT	REMAINING LIFE (YRS.)
1	20	30.7	1959	10
2	62	50.1	1961	35
3	76	60.8	1955	20

Deficient Bridges

Figure 5

Town of Troutman

Iredell County
North Carolina



Legend

- Deficient Bridges
- Planning Area Boundary
- Municipal Boundary
- Lakes
- Rivers and Streams

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FEDERAL HIGHWAY ADMINISTRATION

0 0.2 0.4 0.8 1.2 Miles

Base map date: October 2004

Refer to CTP document for more details

Roadway Capacity Deficiencies

Roadway capacity deficiencies occur when the traffic volume of a roadway is more than the capacity of that roadway. Travel demand volume is the total number of vehicles that actually use a roadway on a typical day. The existing travel demand volumes for the planning area roadways are based upon traffic count data taken by the NCDOT Traffic Survey Group and are shown in Figure 6 for the year 2002. The projected 2030 travel demand volumes, which are based upon historic and anticipated population, economic growth patterns, and land use trends, are shown in Figure 7.

Capacity is the maximum number of vehicles that can pass over a given section of roadway during a given time period under prevailing roadway and traffic conditions while still maintaining a service level that is acceptable to drivers. Many factors contribute to the capacity of a roadway including:

- Geometry of the road, including number of lanes, horizontal and vertical alignment, and proximity of perceived obstructions to safe travel along the road;
- Typical users of the road, such as commuters, recreational travelers, and truck traffic;
- Access control, including streets and driveways, or lack thereof, along the roadway;
- Development of the road, including residential, commercial, and industrial developments;
- Number of traffic signals along the route;
- Peaking characteristics of the traffic on the road;
- Characteristics of side-roads feeding into the road; and
- Directional split of traffic or the percentages of vehicles traveling in each direction along a road at any given time.

When the ratio of volume to capacity on a roadway is between 0.0 and 0.8, it is considered to be *adequate*. If the volume to capacity ratio is between 0.8 and 1.0, it is considered to be *near capacity*. Once the volume to capacity ratio is equal to 1.0 or greater, it is then considered to be *over capacity*.

2002 Traffic Capacity Analysis

The comparison of the 2002 travel demand volumes for the major roadways in the planning area to the current practical capacities for these roadways identified some deficiencies within the planning area, as summarized in Table 3 and shown in Figure 6.

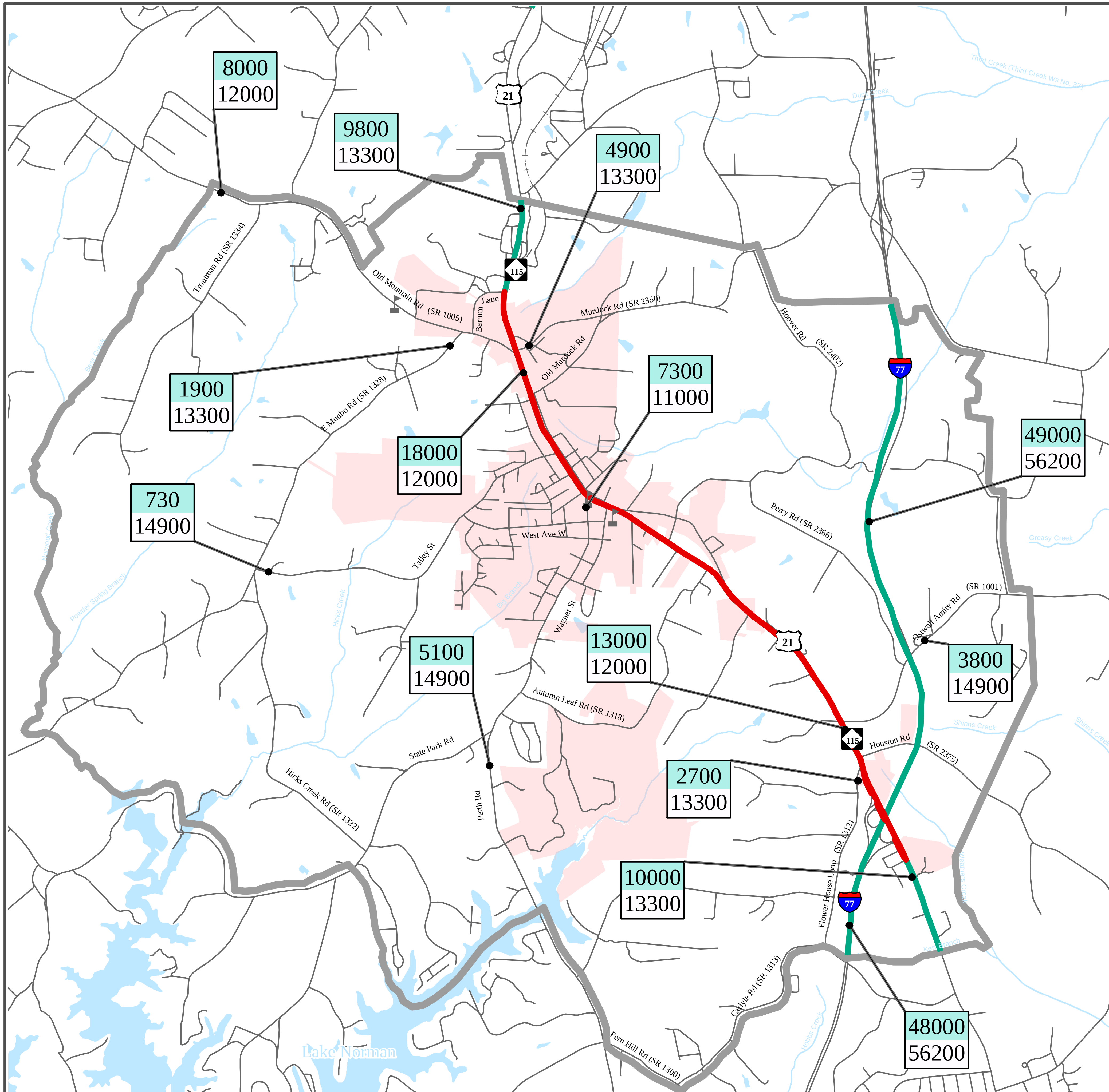
Table 3. Existing Capacity Deficiencies		
ROADWAY AND SECTION		**DEFICIENCY**
US 21 / NC 115		
Southern Planning Area Boundary	South of the I-77 Interchange	Near Capacity
South of the I-77 Interchange	Barium Lane	Over Capacity
Barium Lane	Northern Planning Area Boundary	Near Capacity
Interstate 77		
Southern Planning Area Boundary	Northern Planning Area Boundary	Near Capacity

2030 Traffic Capacity Analysis

The capacity deficiency analysis for the 2030 design year examined the existing street system and determined that several roadway facilities will exceed practical capacity by the design year, as summarized in Table 4 and shown in Figure 7.

Table 4. Future Capacity Deficiencies		
ROADWAY AND SECTION		**DEFICIENCY**
US 21 / NC 115		
Southern Planning Area Boundary	Northern Planning Area Boundary	Over Capacity
Interstate 77		
Southern Planning Area Boundary	Northern Planning Area Boundary	Over Capacity
Old Mountain Road (SR 1005)		
US 21/NC 115	Western Planning Area Boundary	Over Capacity
E. Monbo Road (SR 1328)		
Old Mountain Road (SR 1005)	Southwestern Planning Area Boundary	Over Capacity
Wagner Street (SR 1303)		
US 21/NC 115	State Park Road (SR 1321)	Over Capacity
Perth Road (SR 1303)		
State Park Road (SR 1321)	Southern Planning Area Boundary	Over Capacity
Ostwalt Amity Road (SR 1001)		
US 21/NC 115	Eastern Planning Area Boundary	Over Capacity
Murdock Road (SR 2350)		
US 21/NC 115	Hoover Road (SR 2402)	Over Capacity

2002 AADT Volumes
and
Roadway Deficiencies
Figure 6



Town of Troutman
Iredell County
North Carolina

Legend

- Near Capacity
- Over Capacity
- Planning Area Boundary
- Municipal Boundary
- 2002 AADT
- Capacity

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Base map date: October 2004
Refer to CTP document for more details

2030 Future Volumes
and
Roadway Deficiencies

Figure 7

Town of Troutman

Iredell County
North Carolina

48000
12000

48000
13300

40700
13300

16600
13300

34300
11000

83200
12000

128700
56200

2200
14900

18200
14900

35600
12000

18500
14900

3700
13300

40700
13300

134200
56200

Troutman Rd (SR 1334)
Old Mountain Rd (SR 1005)
Barium Lane
Murdock Rd (SR 2350)
Old Murdock Rd
Hoover Rd (SR 2402)
E Monbo Rd (SR 1329)
Talley St
West Ave W
Wagner St
Perry Rd (SR 2366)
Bertwal Amity Rd (SR 1001)
Autumn Leaf Rd (SR 1318)
State Park Rd
Hicks Creek Rd (SR 1322)
Perth Rd
Houston Rd (SR 2375)
Flower House Loop (SR 1012)
Cabble Rd (SR 1313)
Fern Hill Rd (SR 1300)
Lake Norman
Third Creek (Third Creek Ws No. 2)
Duke Branch
Greasy Creek
Shinns Creek
Hicks Creek
Powder Spring Branch
Bell Branch

21
115
77

Legend

- Over Capacity
- Planning Area Boundary
- Municipal Boundary
- 2030 AADT
- Capacity

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0 0.2 0.4 0.8 1.2 Miles

Base map date: October 2004
Refer to CTP document for more details

IV. Environmental Screening

In recent years, the environmental considerations associated with transportation construction have come to the forefront of the planning process. Section 102 of the National Environmental Policy Act (NEPA) requires the completion of an Environmental Impact Statement (EIS) for projects that have a significant impact on the environment. The EIS includes impacts on wetlands, wildlife, water quality, historic properties, and public lands. While this report does not cover environmental issues to the detail of an EIS, consideration for many of these factors was incorporated into the development of the CTP and related recommended improvements. Environmental features found in the planning area are shown in Figure 8. The environmental data used in the evaluation of the CTP was obtained in 2002 from the NCDOT Geographic Information System (GIS) Unit and the Center for Geographic Information and Analysis (CGIA) and reflects the most current data available at that time. Further environmental analysis will be required prior to implementing any recommended transportation improvements.

Wetlands

Wetlands are those lands where saturation with water is the dominant factor in determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface. Wetlands are crucial ecosystems in our environment. They help regulate and maintain the hydrology of our rivers, lakes, and streams by storing and slowly releasing floodwaters. Wetlands help maintain the quality of water by storing nutrients, reducing sediment loads, and reducing erosion. They are also critical to fish and wildlife populations by providing an important habitat for approximately one-third of the plant and animal species that are federally listed as threatened or endangered.

The National Wetland Inventory showed several wetlands throughout the planning area, specifically west of US 21/NC 115 and continuing south of Old Mountain Road, towards Lake Norman.

Threatened and Endangered Species

The Threatened and Endangered Species Act of 1973 allows the U. S. Fish and Wildlife Service to impose measures on the Department of Transportation to mitigate the environmental impacts of a transportation project on endangered animal and plant species as well as critical wildlife habitats. Locating any rare species that exist within the planning area during this early planning stage will help to avoid or minimize impacts.

A preliminary review of the Federally Listed Threatened and Endangered Species in the planning area was completed to determine what effects, if any, the recommended improvements may have on wildlife. Mapping from the N.C. Department of Environment and Natural Resources revealed occurrences of threatened or endangered plant and/or animal species in the planning area which are summarized in Table 5. These species are not impacted by any CTP recommendations.

Table 5. Threatened or Endangered Species within the Planning Area		
Species	**Common Name**	**Major Group**
Neotoma magister	Alleghany woodrat	Vertebrates
Clemmys muhlenbergii	Bog turtle	Vertebrates
Lotus helleri	Heller's trefoil	Vascular Plant
Delphinium exaltatum	Tall larkspur	Vascular Plant

Historic Sites

Section 106 of the National Historic Preservation Act requires the Department of Transportation to identify historic properties listed in, as well as eligible for, the National Register of Historic Places (NRHP). The NCDOT must consider the impacts of transportation projects on these properties and consult with the Federal Advisory Council on Historic Preservation.

N.C. General Statute 121-12(a) requires the NCDOT to identify historic properties listed on the National Register, but not necessarily those that are eligible to be listed. The NCDOT must consider the impacts and consult with the N.C. Historical Commission, but is not bound by their recommendations.

The location of historic sites within the planning area was investigated to determine any possible impacts resulting from the recommended improvements. This investigation identified only one property listed on the NRHP, which is the Davidson House, located on Arey Road. However, this historic building site will not be impacted by any of the recommended improvements.

Archaeological Impacts

An investigation completed for this plan identified no known archaeological sites within the planning area boundary, but archaeological sites are often difficult to identify without actual field excavation. As a result, possible sites may not be identified during the initial planning process and each proposed project should be evaluated individually prior to construction.

Educational Facilities

The location of educational facilities in the planning area was considered during the development of the CTP. No proposed facilities or improvements shall displace any school or other educational facility. The implementation of the CTP will result in positive effects on the existing educational facilities in the planning area and will provide access to potential schools in the future.

Environmental Features

Figure 8

Town of Troutman

Iredell County
North Carolina

Legend

- Schools
- National Wetland Inventory
- Land Trust Conservation Properties
- Hazardous Substance Disposal Sites
- New Planning Area Boundary
- Municipal Boundary
- Lake Norman State Park
- Water Supply Watersheds
- Lakes
- Rivers and Streams

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0 0.3 0.6 0.9 1.2 Miles

Base map date: October 2004

Refer to CTP document for more details

Old Mountain Rd (SR 1005)
Troutman Rd (SR 1334)
Barium Lane
Murdock Rd (SR 2350)
Old Murdock Rd
Hoover Rd (SR 2402)
E Monbo Rd (SR 1329)
West Ave W
Talley St
Wagner St
Perry Rd (SR 2366)
Greasy Creek
Third Creek (Third Creek Ws No. 32)
Duck Creek
I-L Creek
Oswalt Amity Rd (SR 1001)
Autumn Leaf Rd (SR 1318)
State Park Rd
Hicks Creek Rd (SR 1322)
Perth Rd
Houston Rd (SR 2375)
Flower House Loop (SR 1312)
Shimms Creek
Cahsle Rd (SR 1313)
Fern Hill Rd (SR 1300)
Lake Norman
21
115
77

V. Public Involvement

Overview

Since the passage of the Federal Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), the emphasis on public involvement in transportation has increased. Although public participation has been an element of long range transportation planning in the past, these regulations call for a much more proactive approach. The NCDOT Transportation Planning Branch has a long history of making public involvement a key element in the development of any long-range transportation plan, no matter the size of the city and/or planning area. This chapter is designed to provide an overview of the public involvement elements implemented into the development of the CTP for the planning area.

Study Initiation

The Town of Troutman requested a transportation plan update on November 25, 2002. The official letter from the Lake Norman RPO dated October 14, 2002 requested the update on the existing thoroughfare plan for the Town of Troutman. The Transportation Planning Branch met with the Town of Troutman on July 7, 2003 to identify the primary transportation concerns and to define the scope of the study.

Board of Aldermen Presentation

A presentation was made to the Board of Aldermen on September 11, 2003 to explain the comprehensive transportation planning process.

Public Workshop

A public workshop was held on November 28, 2006. The purpose of the workshop was to present and discuss the deficiencies and recommended improvements to the transportation system that resulted from the study. Comments received included the following:

US 21/NC 115

- Crossing the median at particular intersections; value of property; noise level and truck vibrations; fire truck's u-turn abilities at intersections; pedestrian cross-walk signals; and park-n-ride commuter shuttles to and from Charlotte, Mooresville and Statesville areas.

Southwest Bypass

- Consider paved shoulders

Public Hearings

- A public hearing was held on February 8, 2007 during the Town of Troutman Board of Alderman meeting. The CTP was adopted by the Town during this meeting.
- Lake Norman RPO Technical Coordinating Committee (TCC) recommended endorsement of the CTP by the Technical Advisory Committee (TAC) on February 14, 2007. The LNRPO TAC did not endorse the plan because the City of Statesville was not in agreement with the alignment of the proposed Barium Springs Parkway. It was decided that the TAC would endorse the plan once Statesville and Troutman mutually resolved their issues. Since that meeting, the Town of Troutman rescinded the February 8, 2007 adoption. A signed agreement between Troutman, Statesville, Mooresville and Iredell County (April 2007) was established to support a new annexation boundary, reflecting the mutually agreed upon planning area boundaries of all partners.
- A public hearing was held December 13, 2007 in the Town of Troutman. The Troutman CTP was then adopted by the Town.
- Lake Norman RPO TCC recommended the Troutman CTP (February 13, 2008) to be endorsed by the Lake Norman RPO TAC (February 26, 2008). The LNRPO TAC could not endorse the plan because the TAC did not meet quorum. The meeting was rescheduled for March 11, 2008 and the TAC endorsed the plan.

APPENDIX A

NCDOT
Contacts

Appendix A
Resources and Contacts

North Carolina Department of Transportation

Customer Service Office

Contact information for other units within the NCDOT that are not listed in this appendix is available by calling the Customer Service Office or by visiting the NCDOT homepage:

1-877-DOT-4YOU
(1-877-368-4968)
https://apps.dot.state.nc.us/dot/directory/authenticated/ToC.aspx

Secretary of Transportation

Eugene A. Conti, Jr., Ph.D.
1501 Mail Service Center
Raleigh, NC 27699-1501
(919) 733-2520
http://www.ncdot.org/about/leadership/secretary.html

Board of Transportation Member

Mr. Robert "Bob" Collier, Jr.
Post Office Box 346
Statesville, NC 28687
(704) 878-9233
judgebcollier@bellsouth.net
http://www.ncdot.gov/about/board/default.html

Highway Division Engineer

Contact the Division Engineer with general questions concerning NCDOT activities within each Division and for information on Small Urban Funds.

Mr. Mike L. Holder, PE
P. O. Box 47
1710 E. Marion Street (US 74 Business)
Shelby, NC 28151-0047
(704) 480-9025
MHolder@ncdot.gov
http://www.ncdot.gov/doh/operations/division12/

Division Project Manager

Contact the Division Project Manager with questions concerning transportation projects within each Division.

Mr. Steve Rackley, PE
P. O. Box 47
1710 E. Marion Street (US 74 Business)
Shelby, NC 28151-0047
(704) 480-9027
srackley@ncdot.gov

Division Construction Engineer

Contact the Division Construction Engineer for information concerning major roadway improvements under construction.

Mr. Dan Grissom, PE
P. O. Box 47
1710 E. Marion Street (US 74 Business)
Shelby, NC 28151-0047
(704) 480-9024
dgrissom@ncdot.gov

Division Traffic Engineer

Contact the Division Traffic Engineer for information concerning traffic signals, highway signs, pavement markings and crash history.

Mr. Sam Nichols
P. O. Box 47
1710 E. Marion Street (US 74 Business)
Shelby, NC 28151-0047
(704) 480-9033
snichols@ncdot.gov

Division Operations Engineer

Contact the Division Operations Engineer for information concerning facility operations.

Mr. Mark Stafford, PE
P. O. Box 47
1710 E. Marion Street (US 74 Business)
Shelby, NC 28151-0047
(704) 480-9023
mstafford@ncdot.gov

Division Maintenance Engineer

Contact the Division Maintenance Engineer information regarding maintenance of all state roadways, improvement of secondary roads and other small improvement projects. The Division Maintenance Engineer also oversees the District Offices, the Bridge Maintenance Unit and the Equipment Unit.

Mr. J. Mark Taylor, PE
124 Prison Camp Road
Statesville, NC 28625
(704) 876-1696
jmtaylor@ncdot.gov

District Engineer

Contact the District Engineer for information on outdoor advertising, junkyard control, driveway permits, road additions, subdivision review and approval, Adopt A Highway program, encroachments on highway right of way, issuance of oversize/over-width permits, paving priorities, secondary road construction program and road maintenance.

Mr. Patrick Norman, PE
124 Prison Camp Road
Statesville, NC 28625
(704) 876-3947
pnorman@ncdot.gov

Transportation Planning Branch (TPB)

Contact the Transportation Planning Branch for information on long-range multi-modal planning services.

1554 Mail Service Center
Raleigh, NC 27699-1554
(919) 733-4705
http://www.ncdot.gov/doh/preconstruct/tpb/

Lake Norman Rural Planning Organization (RPO)

Contact the RPO for information on long-range multi-modal planning services.

Mr. Bjorn E. Hansen, AICP
Transportation Program Coordinator
Centralina Council of Government
1300 Baxter Street, Suite 450
Charlotte, NC 28235
(704) 688-6501
bhansen@centralina.org
www.centralina.org

Strategic Planning Office

Contact the Strategic Planning Office for information concerning prioritization of transportation projects.

Mr. Don Voelker
1501 Mail Service Center
Raleigh, NC 27699-1501
(919) 715-0951
https://apps.dot.state.nc.us/dot/directory/authenticated/UnitPage.aspx?id=11054

Project Development & Environmental Branch (PDEA)

Contact PDEA for information on environmental studies for projects that are included in the TIP.

1548 Mail Service Center
Raleigh, NC 27699-1548
(919) 733-3141
http://www.ncdot.gov/doh/preconstruct/pe/

Secondary Roads Office

Contact the Secondary Roads Office for information regarding the status for unpaved roads to be paved, additions and deletions of roads to the State maintained system and the Industrial Access Funds program.

1535 Mail Service Center
Raleigh, NC 27699-1535
(919) 733-3250
http://www.ncdot.gov/doh/operations/secondaryroads/

Program Development Branch

Contact the Program Development Branch for information concerning Roadway Official Corridor Maps, Feasibility Studies and the Transportation Improvement Program (TIP).

1534 Mail Service Center
Raleigh, NC 27699-1534
(919) 733-2039
http://www.ncdot.org/planning/development/

Public Transportation Division

Contact the Public Transportation Division for information public transit systems.

1550 Mail Service Center
Raleigh, NC 27699-1550
(919) 733-4713
http://www.ncdot.org/transit/nctransit/

Rail Division

Contact the Rail Division for rail information throughout the state.

1553 Mail Service Center
Raleigh, NC 27699-1553
(919) 733-7245
http://www.bytrain.org/

Division of Bicycle and Pedestrian Transportation

Contact this Division for bicycle and pedestrian transportation information throughout the state.

1552 Mail Service Center
Raleigh, NC 27699-1552
(919) 807-0777
http://www.ncdot.gov/transit/bicycle/

Bridge Maintenance Unit

Contact the Bridge Maintenance Unit for information on bridge management throughout the state.

1565 Mail Service Center
Raleigh, NC 27699-1565
(919) 733-4362
http://www.ncdot.gov/doh/operations/dp_chief_eng/maintenance/bridge/

Highway Design Branch

The Highway Design Branch consists of the Roadway Design, Structure Design, Photogrammetry, Location & Surveys, Geotechnical, and Hydraulics Units. Contact the Highway Design Branch for information regarding design plans and proposals for road and bridge projects throughout the state.

1584 Mail Service Center
Raleigh, NC 27699-1584
(919) 250-4001
http://www.ncdot.gov/doh/preconstruct/highway/

Other State Government Offices

Department of Commerce – Division of Community Assistance

Contact the Department of Commerce for resources and services to help realize economic prosperity, plan for new growth and address community needs.

http://www.nccommerce.com/en/CommunityServices/

APPENDIX B

Comprehensive Transportation Plan Definitions

Appendix B
Comprehensive Transportation Plan Definitions

Highway Map

For visual depiction of facility types for the following CTP classification, visit http://www.ncdot.gov/doh/preconstruct/tpb/SHC/facility/.

Facility Type Definitions

- **Freeways**
  - Functional purpose – high mobility, high volume, high speed
  - Posted speed – 55 mph or greater
  - Cross section – minimum four lanes with continuous median
  - Multi-modal elements – High Occupancy Vehicles (HOV)/High Occupancy Transit (HOT) lanes, busways, truck lanes, park-and-ride facilities at/near interchanges, adjacent shared use paths (separate from roadway and outside ROW)
  - Type of access control – full control of access
  - Access management – interchange spacing (urban – one mile; non-urban – three miles); at interchanges on the intersecting roadway, full control of access for 1,000ft or for 350ft plus 650ft island or median; use of frontage roads, rear service roads
  - Intersecting facilities – interchange or grade separation (no signals or at-grade intersections)
  - Driveways – not allowed

- **Expressways**
  - Functional purpose – high mobility, high volume, medium-high speed
  - Posted speed – 45 to 60 mph
  - Cross section – minimum four lanes with median
  - Multi-modal elements – HOV lanes, busways, very wide paved shoulders (rural), shared use paths (separate from roadway but within ROW)
  - Type of access control – limited or partial control of access;
  - Access management – minimum interchange/intersection spacing 2,000ft; median breaks only at intersections with minor roadways or to permit U-turns; use of frontage roads, rear service roads; driveways limited in location and number; use of acceleration/deceleration or right turning lanes
  - Intersecting facilities – interchange; at-grade intersection for minor roadways; right-in/right-out and/or left-over or grade separation (no signalization for through traffic)
  - Driveways – right-in/right-out only; direct driveway access via service roads or other alternate connections

- **Boulevards**
  - Functional purpose – moderate mobility; moderate access, moderate volume, medium speed
  - Posted speed – 30 to 55 mph

- Cross section – two or more lanes with median (median breaks allowed for U-turns per current NCDOT *Driveway Manual*
- Multi-modal elements – bus stops, bike lanes (urban) or wide paved shoulders (rural), sidewalks (urban - local government option)
- Type of access control – limited control of access, partial control of access, or no control of access
- Access management – two lane facilities may have medians with crossovers, medians with turning pockets or turning lanes; use of acceleration/deceleration or right turning lanes is optional; for abutting properties, use of shared driveways, internal out parcel access and cross-connectivity between adjacent properties is strongly encouraged
- Intersecting facilities – at grade intersections and driveways; interchanges at special locations with high volumes
- Driveways – primarily right-in/right-out, some right-in/right-out in combination with median leftovers; major driveways may be full movement when access is not possible using an alternate roadway

- **Other Major Thoroughfares**
  - Functional purpose – balanced mobility and access, moderate volume, low to medium speed
  - Posted speed – 25 to 55 mph
  - Cross section – four or more lanes without median
  - Multi-modal elements – bus stops, bike lanes/wide outer lane (urban) or wide paved shoulder (rural), sidewalks (urban)
  - Type of access control – no control of access
  - Access management – continuous left turn lanes; for abutting properties, use of shared driveways, internal out parcel access and cross-connectivity between adjacent properties is strongly encouraged
  - Intersecting facilities – intersections and driveways
  - Driveways – full movement on two lane roadway with center turn lane as permitted by the current NCDOT *Driveway Manual*

- **Minor Thoroughfares**
  - Functional purpose – balanced mobility and access, moderate volume, low to medium speed
  - Posted speed – 25 to 45 mph
  - Cross section – ultimately three lanes (no more than one lane per direction) or less without median
  - Multi-modal elements – bus stops, bike lanes/wide outer lane (urban) or wide paved shoulder (rural), sidewalks (urban)
  - ROW – no control of access
  - Access management – continuous left turn lanes; for abutting properties, use of shared driveways, internal out parcel access and cross-connectivity between adjacent properties is strongly encouraged
  - Intersecting facilities – intersections and driveways
  - Driveways – full movement on two lane with center turn lane as permitted by the current NCDOT *Driveway Manual*

Other Highway Map Definitions

- **Existing** – Roadway facilities that are not recommended to be improved.
- **Needs Improvement** – Roadway facilities that need to be improved for capacity, safety, or system continuity. The improvement to the facility may be widening, other operational strategies, increasing the level of access control along the facility, or a combination of improvements and strategies. *"Needs improvement" does not refer to the maintenance needs of existing facilities.*
- **Recommended** – Roadway facilities on new location that are needed in the future.
- **Interchange** – Through movement on intersecting roads is separated by a structure. Turning movement area accommodated by on/off ramps and loops.
- **Grade Separation** – Through movement on intersecting roads is separated by a structure. There is no direct access between the facilities.
- **Full Control of Access** – Connections to a facility provided only via ramps at interchanges. No private driveway connections allowed.
- **Limited Control of Access** – Connections to a facility provided only via ramps at interchanges (major crossings) and at-grade intersections (minor crossings and service roads). No private driveway connections allowed.
- **Partial Control of Access** – Connections to a facility provided via ramps at interchanges, at-grade intersections, and private driveways. Private driveway connections shall be defined as a maximum of one connection per parcel. One connection is defined as one ingress and one egress point. These may be combined to form a two-way driveway (most common) or separated to allow for better traffic flow through the parcel. The use of shared or consolidated connections is highly encouraged.
- **No Control of Access** – Connections to a facility provided via ramps at interchanges, at-grade intersections, and private driveways.

Public Transportation and Rail Map

- **Bus Routes** – The primary fixed route bus system for the area. Does not include demand response systems.
- **Fixed Guideway** – Any transit service that uses exclusive or controlled rights-of-way or rails, entirely or in part. The term includes heavy rail, commuter rail, light rail, monorail, trolleybus, aerial tramway, included plane, cable car, automated guideway transit, and ferryboats.
- **Operational Strategies** – Plans geared toward the non-single occupant vehicle. This includes but is not limited to HOV lanes or express bus service.
- **Rail Corridor** – Locations of railroad tracks that are either active or inactive tracks. These tracks were used for either freight or passenger service.
  - Active – rail service is currently provided in the corridor; may include freight and/or passenger service
  - Inactive – right of way exists; however, there is no service currently provided; tracks may or may not exist

- Recommended – It is desirable for future rail to be considered to serve an area.

- **High Speed Rail Corridor** – Corridor designated by the U.S. Department of Transportation as a potential high speed rail corridor.
  - Existing – Corridor where high speed rail service is provided (there are currently no existing high speed corridor in North Carolina).
  - Recommended – Proposed corridor for high speed rail service.
- **Rail Stop** – A railroad station or stop along the railroad tracks.
- **Intermodal Connector** – A location where more than one mode of public transportation meet such as where light rail and a bus route come together in one location or a bus station.
- **Park and Ride Lot** – A strategically located parking lot that is free of charge to anyone who parks a vehicle and commutes by transit or in a carpool.

Bicycle Map

- **On Road-Existing** – Conditions for bicycling on the highway facility are adequate to safely accommodate cyclists.
- **On Road-Needs Improvement** – At the systems level, it is desirable for **an existing** highway facility to accommodate bicycle transportation; however, highway improvements are necessary to create safe travel conditions for the cyclists.
- **On Road-Recommended** – At the systems level, it is desirable for **a recommended** highway facility to accommodate bicycle transportation. The highway should be designed and built to safely accommodate cyclists.
- **Off Road-Existing** – A facility that accommodates bicycle transportation (may also accommodate pedestrians, e.g. greenways) and is physically separated from a highway facility usually on a separate right-of-way.
- **Off Road-Needs Improvement** – A facility that accommodate bicycle transportation (may also accommodate pedestrians, e.g. greenways) and is physically separated from a highway facility usually on a separate right-of-way that will not adequately serve future bicycle needs. Improvements may include but are not limited to, widening, paving (not re-paving), and improved horizontal or vertical alignment.
- **Off Road-Recommended** – A facility needed to accommodate bicycle transportation (may also accommodate pedestrians, e.g. greenways) and is physically separated from a highway facility usually on a separate right-of-way. This may also include greenway segments that do not necessarily serve a transportation function but intersect recommended facilities on the highway map or public transportation and rail map.

Pedestrian Map

Definitions for this element are pending.

APPENDIX C

Comprehensive
Transportation
Plan
Tabulations
&
Recommendations

HIGHWAY

FACILITY AND SEGMENT		Existing System										Proposed System		
							2002		2030					
From	To	Speed Limit (mph)	Distance (mi)	Lanes	Roadway Width (ft)	ROW (ft)	Capacity (vpd)	AADT (vpd)	Capacity (vpd)	Future (vpd)	Cross-Section	ROW (ft)	Other Maps
Autumn Leaf Road (SR 1318)													
US 21/NC 115	Southern Town Limits	35	0.55	2	20	60	12,000	380		1,160		ADQ	
Southern Town Limits	Wagner Street (SR 1303)	55	1.30	2	24	60	14,900	380	17,500	1,160	K	70	
Carlyle Road (SR 1313)													
Fern Hill Road (SR 1300)	Flower House Loop (SR 1312)	45	1.37	2	18	60	13,300	870		1,600		ADQ	
East Monbo Road (SR 1328)													
Old Mountain Road (SR 1005)	Southwest Troutman Planning Area Boundary	45	5.02	2	20	60	13,300	1,900	17,500	16,600	K	70	
East Monbo Road (SR 1328) (Realignment)													
E. Monbo Road (SR 1328)	Old Mountain Road (SR 1005)	45	0.269	n/a	n/a	n/a	n/a	1,900	17,500	16,600	K	70	
Eastway Drive (SR 2371) - See US 21/NC 115 (Northbound)													
Fern Hill Road (SR 1300)													
Perth Road (SR 1303)	Carlyle Road (SR 1313)	55	0.52	2	18	60	14,900	680		1,600		ADQ	
Flower House Loop (SR 1312)													
US 21/NC 115	Carlyle Road (SR 1313)	45	2.0	2	18	60	13,300	2,700	17,500	3,700	K	70	
Flower House Loop (SR 1312) (Realignment)													
Flower House Loop (SR 1312)	US 21/NC 115	45	0.2	n/a	n/a	n/a	n/a	n/a	17,500	3,700	K	70	
Hicks Creek Road (SR 1322)													
E. Monbo Street (SR 1328)	State Park Road (SR 1321)	45	2.03	2	18	60	13,300	780	17,500	2,900	K	70	
Hoover Road (SR 2402)													
Murdock Road (SR 2350)	Perry Road (SR 2366)	45	1.55	2	20	60	13,300	450		4,800		ADQ	
Houston Road (SR 2375)													
US 21	East Troutman Planning Boundary	55	0.74	2	18	60	14,900	790		2,500		ADQ	
Interstate 77													
South Troutman Planning Area Boundary	US 21/NC 115 Interchange	65	0.88	4	48	180	56,200	48,000	135,800	134,200	M	380	
US 21/NC 115 Interchange	North Troutman Planning Area Boundary	65	5.32	4	48	180	56,200	49,000	135,800	128,700	M	380	
Murdock Road (SR 2350)													
US 21/NC 115	Hoover Road (SR 2402)	45	1.72	2	22	60	13,300	4,900	14,900	43,100	K	70	

The Other Maps column means that these facilities are included on other Comprehensive Transportation Plan elements and these elements should be reviewed.

Highway Public Transportation and Rail Bicycle Pedestrian

HIGHWAY

FACILITY AND SEGMENT					Existing System						Proposed System		
							2002		2030				
From	To	Speed Limit (mph)	Distance (mi)	Lanes	Roadway Width (ft)	ROW (ft)	Capacity (vpd)	AADT (vpd)	Capacity (vpd)	Future (vpd)	Cross-Section	ROW (ft)	Other Maps
Old Mountain Road (SR 1005)													
US 21/NC 115	Milepost Town Limits	35	0.39	2	24	60	12,000	8,000	43,100	28,400	G	90	
Milepost Town Limits	West Troutman Planning Area Boundary	45	1.81	2	24	60	13,300	8,000	46,100	31,500	F	120	
Old Murdock Road (SR 2551)													
US 21/NC 115	Murdock Road (SR 2350)	35	0.67	2	22	60	12,000	3,200	17,500	16,800	K	70	
Ostwalt Amity Road (SR 1001)													
US 21	East Troutman Planning Boundary	55	2.38	2	20	60	14,900	3,800	18,600	18,500	K	70	
Perry Road (SR 2366)													
US 21/NC 115	Hoover Road (SR 2402)	35	1.00	2	20	60	12,000	830	17,500	2,300	K	70	
Hoover Road (SR 2402)	Ostwalt Amity Road (SR 1001)	55	2.20	2	20	60	14,900	830	18,600	2,300	K	70	
Perry Road Extension (Rec.)													
Perry Road (SR 2366)	Murdock Road (SR 2350)	15	1.31	n/a	n/a	n/a	n/a	n/a	14,900	6,000	K	70	
Perth Road (SR 1303)													
State Park Road (SR 1321)	South Troutman Planning Area Boundary	55	1.37	2	28	60	14,900	5,100	39,600	18,200	F	120	
Pilch Road (SR 2368)													
Pear Road (SR 2582)	Ostwalt Amity Road (SR 1001)	45	0.58	2	18	60	13,300	1,000		2,600		ADQ	
State Park Road (SR 1321/SR 1330)													
Perth Road (SR 1303)	South Troutman Planning Area Boundary	45	0.70	2	18	60	13,300	3,200	14,900	10,000	K	70	
Talley Street (SR 1324)													
US 21/NC 115	Western Town Limits	35	0.75	2	18	60	12,000	730	14,900	2,200	K	70	
Western Town Limits	E. Monbo Street (SR 1328)	55	1.40	2	18	60	14,900	730	17,500	2,200	K	70	
US 21 / NC 115 (Southbound)													
South Troutman Planning Area Boundary	South of the I-77 Interchange	45	0.54	2	24	60	13,300	10,000	48,500	40,700	F	120	
South of the I-77 Interchange	I-77 Interchange	45	0.40	4	48	60	48,500	13,000		35,600		ADQ	
I-77 Interchange	North of the I-77 Interchange	55	0.29	4	48	60	48,500	13,000		35,600		ADQ	
North of the I-77 Interchange	Houston Road (SR 2375)	35	0.08	2	22	60	12,000	13,000	48,500	35,600	F	120	
Houston Road (SR 2375)	Eastway Drive (SR 2371)	35	1.34	2	22	60	12,000	13,000	48,500	23,900	F	120	
Eastway Drive (SR 2371)	Wagner Street (SR 1303)	35	1.02	2	22	60	12,000	14,000	48,500	17,000	K	70	
Wagner Street (SR 1303)	Old Murdock Road (SR 2551)	35	0.98	2	22	60	12,000	18,000	48,500	32,300	K	70	
Old Murdock Road (SR 2551)	North City Limits - Troutman	45	0.37	2	24	60	13,300	9,800	48,500	48,000	F	120	
North City Limits	North Troutman Planning Area Boundary	35	0.90	2	24	60	12,000	10,000	48,500	27,000	F	120	

The Other Maps column means that these facilities are included on other Comprehensive Transportation Plan elements and these elements should be reviewed.

Highway Public Transportation and Rail Bicycle Pedestrian

HIGHWAY														
					Existing System						Proposed System			
FACILITY AND SEGMENT		Speed Limit			Roadway Width	ROW	2002 Capacity	2002 AADT	2030 Capacity	2030 Future		ROW	Other
From	To	(mph)	Distance (mi)	Lanes	(ft)	(ft)	(vpd)	(vpd)	(vpd)	(vpd)	Cross-Section	(ft)	Maps
US 21 / NC 115 (Northbound) [Eastway Drive recommended improvements]													
Eastway Drive (SR 2371)	Field Drive	55	0.17	2	24	60	14,300	1,100	18,600	17,000	K	70	
Field Drive	Plum Drive	35	0.08	2	24	60	12,000	1,100	17,500	17,000	K	70	
Plum Drive	Perry Road (SR 2366)	35	0.24	2	24	60	12,000	1,100	17,500	17,000	K	70	
Perry Road (SR 2366)	Winecoff Road	35	0.30	2	24	60	12,000	1,500	17,500	17,000	K	70	
Winecoff Road	New Street	35	0.14	2	24	60	12,000	1,500	17,500	17,000	K	70	
New Street	East Church Street	35	0.09	2	24	60	12,000	1,900	17,500	17,000	K	70	
East Church Street	Morgan Street	35	0.13	2	24	60	12,000	1,900	48,500	22,000	K	70	
Morgan Street	Johnson Street	35	0.06	2	24	60	12,000	2,000	48,500	27,000	K	70	
Johnson Street	Scroggs Street	35	0.1	2	24	60	12,000	n/a	48,500	30,000	K	70	
Scroggs Street	Old Murdock Street	35	0.25	2	24	60	12,000	n/a	48,500	32,300	K	70	
Wagner Street (SR 1303)													
US 21/NC 115	Milepost 0.06	20	0.06	2	28	60	11,000	7,300	46,100	34,300	E	110	
Milepost 0.06	Milepost 1.50	35	1.50	2	28	60	12,000	7,300	46,100	34,300	E	110	
Milepost 1.50	South City Limits - Troutman	45	0.88	2	28	60	13,300	7,300	46,100	28,400	E	110	
South City Limits - Troutman	State Park Road (SR 1321)	55	1.10	2	28	60	14,900	7,300	46,100	28,400	F	120	
Wagner Street (SR 1303) (Realignment)													
US 21/NC 115	Wagner Street (SR 1303)	35	0.09	n/a	n/a	n/a	n/a	7,300	36,400	34,300	H	80	
Troutman Southwest Bypass													
Old Mountain Road (SR 1005)	End of Troutman Rd (SR 1334)	55	2.11	2	18	60	14,900	470	17,500	11,600	K	70	
End of Troutman Rd (SR 1334)	E. Monbo Road (SR 1328)	n/a	0.98	n/a	n/a	n/a	n/a	n/a	17,500	11,600	K	70	
E. Monbo Road (SR 1328)	Talley Street (SR 1324)	55	0.97	2	18	60	14,900	730	17,500	13,600	K	70	
Talley Street (SR 1324)	Perth Road (SR 1303)	n/a	1.00	n/a	n/a	n/a	n/a	n/a	17,500	13,600	K	70	
Perth Road (SR 1303)	Autumn Leaf Road (SR 1318)	55	0.73	2	18	60	14,900	380	17,500	11,700	K	70	
Autumn Leaf Road (SR 1318)	Barkdale Road	n/a	1.21	n/a	n/a	n/a	n/a	n/a	17,500	11,700	K	70	
Barkdale Road	US 21/NC 115	35	0.12	2	18	60	12,000	n/a	17,500	11,700	K	70	

The Other Maps column means that these facilities are included on other Comprehensive Transportation Plan elements and these elements should be reviewed.

Highway Public Transportation and Rail Bicycle Pedestrian

Bicycle and Pedestrian							
FACILITY AND SEGMENT			**Existing System**		**Proposed System**		
		Distance	**Cross-Section**		**Type**	**Cross-**	**Other**
From	**To**	**(mi)**	**(ft)**	**lanes**		**Section**	**Maps**
East Monbo Road (SR 1328)							
Southwest Troutman Planning Area Boundary	Talley Street (SR 1324)	2.12	20	2	On-road	B-4	
Perth Road (SR 1303)							
South Troutman Planning Area Boundary	State Park Road (SR 1321)	1.37	28	2	On-road	B-4	
State Park Road (SR 1321)	Milepost 1.1	1.1	28	2	On-road	B-4	
Milepost 1.1	South City Limits - Troutman	0.88	28	2	On-road	B-4	
State Park Road (SR 1321)							
Perth Road (SR 1303)	South Troutman Planning Area Boundary	0.7	18	2	On-road	B-4	
Talley Street (SR 1324)							
US 21/NC 115	Western Town Limits	0.75	18	2	On-road	B-4	
Western Town Limits	E. Monbo Street (SR 1328)	1.4	18	2	On-road	B-4	
US 21/NC 115							
Talley Street (SR 1324)	Wagner Street (SR 1303)	0.3	22	2	On-road	B-4	
Wagner Street (SR 1303)							
South City Limits - Troutman	Milepost 1.5	1.5	28	2	On-road	B-4	
Milepost 1.5	US 21/NC 115	0.06	28	2	On-road	B-4	

The Other Maps column means that these facilities are included on other Comprehensive Transportation Plan elements and these elements should be reviewed.

Highw  Public Transportation and Rail  Bicycle  Pedestrian 

APPENDIX D

Typical
Comprehensive
Transportation
Plan
Cross-Sections

Appendix D
Typical Cross Sections

Cross section requirements for roadways vary according to the capacity and level of service to be provided. Universal standards in the design of roadways are not practical. Each roadway section must be individually analyzed and its cross section determined based on the volume and type of projected traffic, existing capacity, desired level of service, and available right-of-way. These cross sections are typical for facilities on new location and where right-of-way constraints are not critical. For widening projects and urban projects with limited right-of-way, special cross sections should be developed that meet the needs of the project.

On all existing and proposed roadways delineated on the CTP, adequate right-of-way should be protected or acquired for the recommended cross sections. In addition to cross section and right-of-way recommendations for improvements, Appendix C may recommend ultimate needed right-of-way for the following situations:

- roadways which may require widening after the current planning period,
- roadways which are borderline adequate and accelerated traffic growth could render them deficient, and
- roadways where an urban curb and gutter cross section may be locally desirable because of urban development or redevelopment.

Typical Cross Sections

A: Four Lanes Divided with Median - Freeway

Cross section "A" is typical for four-lane divided highways in rural areas that may have only partial or no control of access. The minimum median width for this cross section is 46 feet, but a wider median is desirable.

B: Seven Lanes - Curb & Gutter

Cross section "B" is typically not recommended for new projects. When the conditions warrant six lanes, cross section “D” should be recommended. Cross section “B” should be used only in special situations such as when widening from a five-lane section where right-of-way is limited. Even in these situations, consideration should be given to converting the center turn lane to a median so that cross section “D” is the final cross section.

C: Five Lanes - Curb & Gutter

Typical for major thoroughfares, cross section "C" is desirable where frequent left turns are anticipated as a result of abutting development or frequent street intersections.

D: Six Lanes Divided with Raised Median - Curb & Gutter
E: Four Lanes Divided with Raised Median - Curb and Gutter

Cross sections "D" and "E" are typically used on major thoroughfares where left turns and intersection streets are not as frequent. Left turns would be restricted to a few selected intersections. The 16-ft median is the minimum recommended for an urban boulevard-type cross section. In most instances, monolithic construction should be utilized due to greater cost effectiveness, ease and speed of placement, and reduced future maintenance requirements. In certain cases, grass or landscaped medians result in greatly increased maintenance costs and an increase danger to maintenance personnel. Non-monolithic medians should only be recommended when the above concerns are addressed.

F: Four Lanes Divided - Boulevard, Grass Median

Cross section "F" is typically recommended for urban boulevards or parkways to enhance the urban environment and to improve the compatibility of major thoroughfares with residential areas. A minimum median width of 24 ft is recommended, with 30 ft being desirable.

G: Four Lanes - Curb and Gutter

Cross section "G" is recommended for major thoroughfares where projected travel indicates a need for four travel lanes but traffic is not excessively high, left turning movements are light, and right-of-way is restricted. An additional left turn lane would likely be required at major intersections. This cross section should be used only if the above criteria are met. If right-of-way is not restricted, future strip development could take place and the inner lanes could become de facto left turn lanes.

H: Three Lanes - Curb and Gutter

In urban environments, thoroughfares that are proposed to function as one-way traffic carriers would typically require cross section “H”.

I: Two Lanes – Curb and Gutter, Parking both sides
J: Two Lanes – Curb and Gutter, Parking one side

Cross section “I” and “J” are usually recommended for urban minor thoroughfares since these facilities usually serve both land service and traffic service functions. Cross-section “I” would be used on those minor thoroughfares where parking on both sides is needed as a result of more intense development.

K: Two Lanes - Paved Shoulder

Cross section "K" is used in rural areas or for staged construction of a wider multilane cross section. On some thoroughfares, projected traffic volumes may indicate that two travel lanes will adequately serve travel for a considerable period of time. For areas that are growing and future widening will be necessary, the full right-of-way of 100 ft should be required. In some instances, local ordinances may not allow the full 100-ft. In those cases, 70 ft should be preserved with the understanding that the full 70-ft will be preserved by use of building setbacks and future street line ordinances.

L: Six Lanes Divided with Grass Median - Freeway

Cross section “L” is typical for controlled access freeways. The 46-ft grass median is the minimum desirable width, but variation from this may be permissible depending upon design considerations. Right-of-way requirements are typically 228 ft or greater, depending upon cut and fill requirements.

M: Eight Lanes Divided with Raised Median - Curb and Gutter

Also used for controlled access freeways, cross section "M" may be recommended for freeways going through major urban areas or for routes projected to carry very high volumes of traffic.

N: Five Lanes with Curb & Gutter, Widened Curb Lanes
O: Two Lanes/Shoulder Section
P: Four Lanes Divided with Raised Median – Curb & Gutter, Widened Curb Lanes

If there is sufficient bicycle travel along the thoroughfare to justify a bicycle lane or bikeway, additional right-of-way may be required to contain the bicycle facilities. The North Carolina Bicycle Facilities Planning and Design Guidelines should be consulted for design standards for bicycle facilities. Cross sections “N”, “O” and “P” are typically used to accommodate bicycle travel.

General

The urban curb and gutter cross sections all illustrate the sidewalk adjacent to the curb with a buffer or utility strip between the sidewalk and the minimum right-of-way line. This permits adequate setback for utility poles. If it is desired to move the sidewalk farther away from the street to provide additional separation for pedestrians or for aesthetic reasons, additional right-of-way must be provided to insure adequate setback for utility poles.

The right-of-way shown for each typical cross section is the minimum amount required encompassing the street, sidewalks, utilities, and drainage facilities. Cut and fill requirements may require either additional right-of-way or construction easements. Obtaining construction easements is becoming the more common practice for urban roadway construction.

Bicycle Cross Sections

Cross sections B-1, B-2, B-3, B-4, and B-5 are typical bicycle cross sections. Contact the NCDOT Division of Bicycle and Pedestrian Transportation for more information regarding these cross-sections.

B-1: Four Lanes Divided with Wide Outside Lanes
B-2: Five Lanes with Wide Outside Lanes

A widened outside lane is an effective way to accommodate bicyclists riding in the same lane with motor vehicles. With a wide outside lane, motorists do not have to change lanes to pass a bicyclist. The additional width in the outside lane also improves sight distance and provides more room for vehicles to turn onto the roadway. Therefore, on roadways with bicycle traffic, widening the outside lane can improve the capacity of that roadway. Also, by widening the outside lane by a few extra feet both motorists and bicyclists have more space in which to maneuver. This facility type is generally considered for use in urban, suburban, and occasionally

rural conditions on roadways where there is a curb and gutter. Wide outside lanes can be applied to several different roadway cross sections.

B-3: Bicycle Lanes on Collector Streets

Bicycle lanes may be considered when it is desirable to delineate road space for preferential use by cyclists. Streets striped with bicycle lanes should be part of a connected bikeway system rather than being an isolated feature. Bicycle lanes function most effectively in mid-block situations by separating bicyclists from overtaking motor vehicles. Integrating bicyclists into complicated intersection traffic patterns can sometimes be problematic. Strip development areas, or roadways with a high number of commercial driveways, tend to be less suitable for bicycle lanes due to frequent and unpredictable motorist turning movements across the path of straight-through cyclists. Striped bike lanes can be effective as a safety treatment, especially for less experienced bicyclists. Two-lane residential/collector streets with lower traffic volume, low-posted speed limit, adequate roadway width for both bike lanes and motor vehicle travel lanes, and an absence of complicated intersections. A median-divided multi-lane roadway with lower traffic volumes and a low volume of right and left turning traffic would be a more appropriate location for bicycle lanes than a high traffic volume undivided multi-lane roadway with a continuous center turn lane. Most bicyclists will choose a route that combines direct access with lower traffic volumes. An origin and destination of less than 4 miles is desirable to generate usage on a facility.

B-4: Wide Paved Shoulders

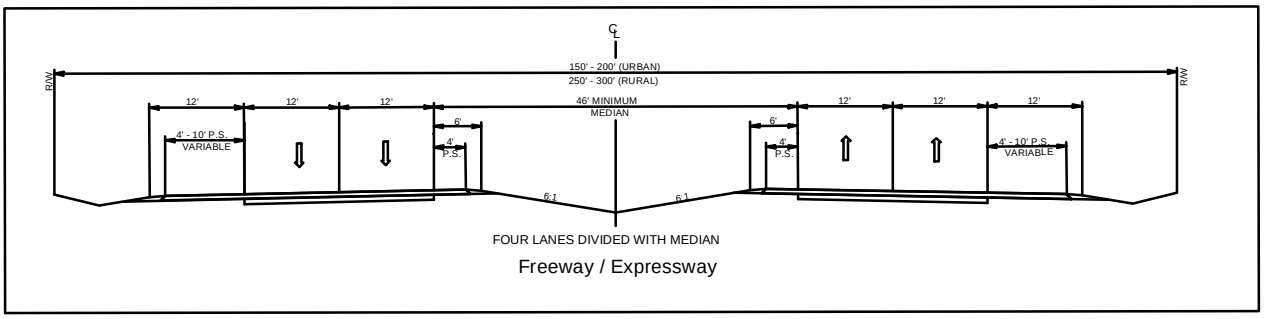
On urban streets with curb and gutter, wide outside lanes and bicycle lanes are usually the preferred facilities. Shoulders for bicycle use are not typically provided on roadways with curb and gutter. On rural roadways where bicycle travel is common, such as roads in coastal resort areas, wide paved shoulders are highly desirable. On secondary roadways without curb and gutter where there are few commercial driveways and intersections with other roadways, many bicyclists prefer riding on wide, smoothly paved shoulders.

B-5: Multi-use Pathway

When properly located, multi-use pathway can be a safer type of facility for novice and child bicyclists because they do not have to share the path with motor vehicles. The design standards used for this cross section provides adequate width for two-directional use by both cyclists and pedestrians, provisions of good sight distance, avoidance of steep grades and tight curves, and minimal cross-flow by motor vehicles. A multi-use pathway can serve a variety of purposes, including recreation and transportation. This pathway should not be located immediately adjacent to a roadway because of safety considerations at intersections with driveways and roads. Sidewalks should never be used as a multi-use pathway.

TYPICAL HIGHWAY CROSS SECTIONS

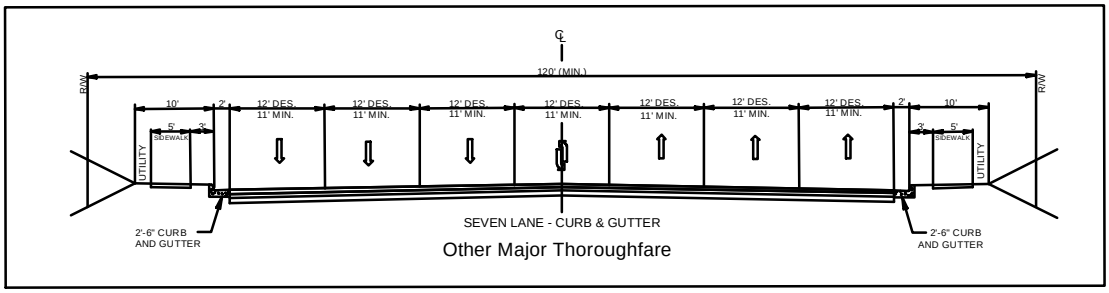
A



FOUR LANES DIVIDED WITH MEDIAN

Freeway / Expressway

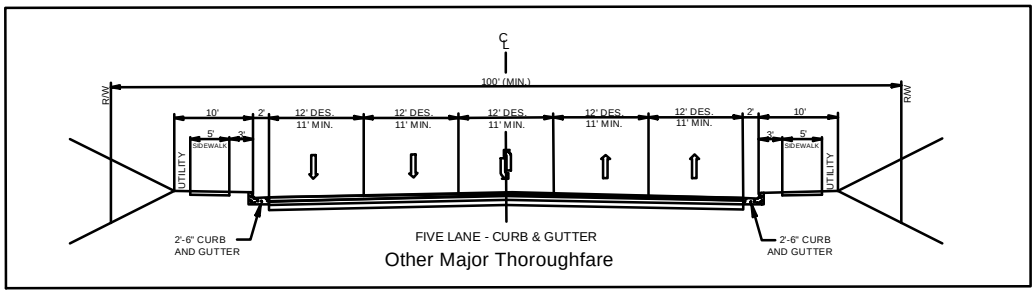
B



SEVEN LANE - CURB & GUTTER

Other Major Thoroughfare

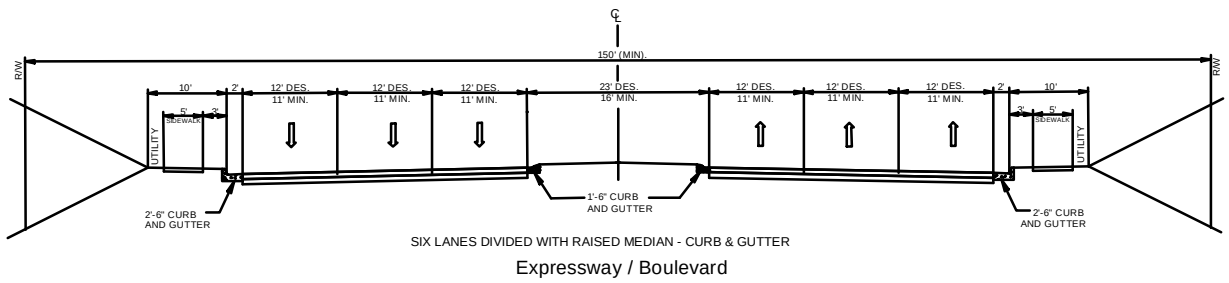
C



FIVE LANE - CURB & GUTTER

Other Major Thoroughfare

D



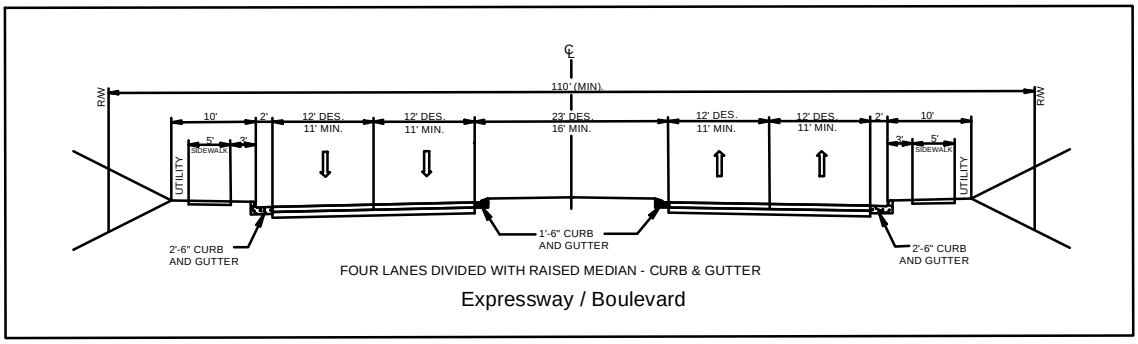
SIX LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

Expressway / Boulevard

revised 04-01-05

TYPICAL HIGHWAY CROSS SECTIONS

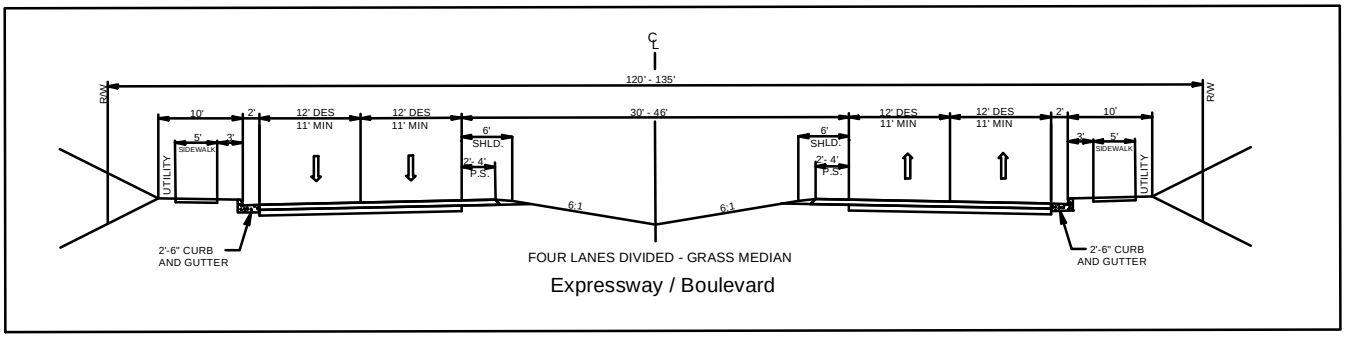
E



FOUR LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

Expressway / Boulevard

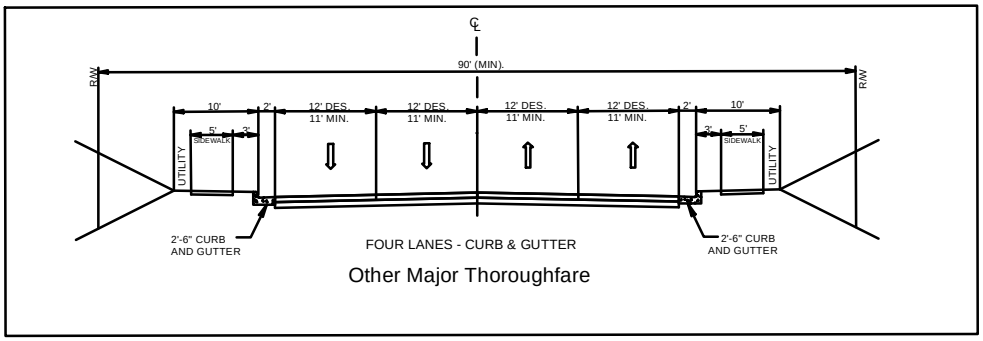
F



FOUR LANES DIVIDED - GRASS MEDIAN

Expressway / Boulevard

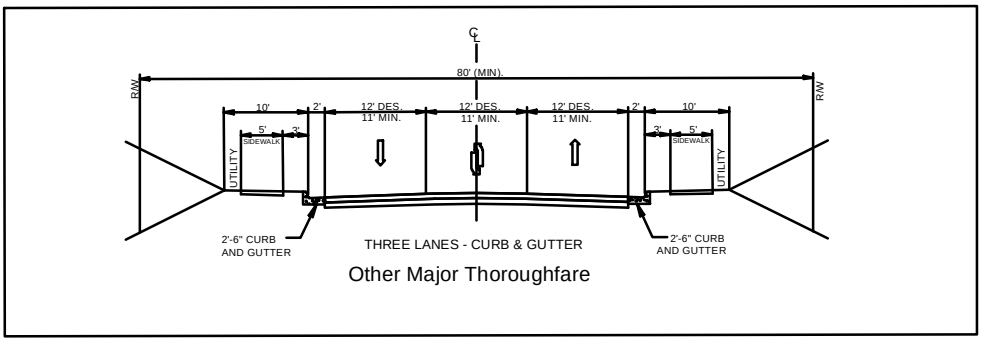
G



FOUR LANES - CURB & GUTTER

Other Major Thoroughfare

H

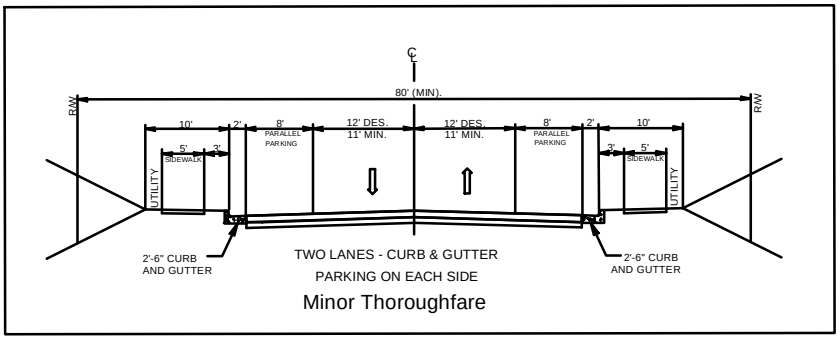


THREE LANES - CURB & GUTTER

Other Major Thoroughfare

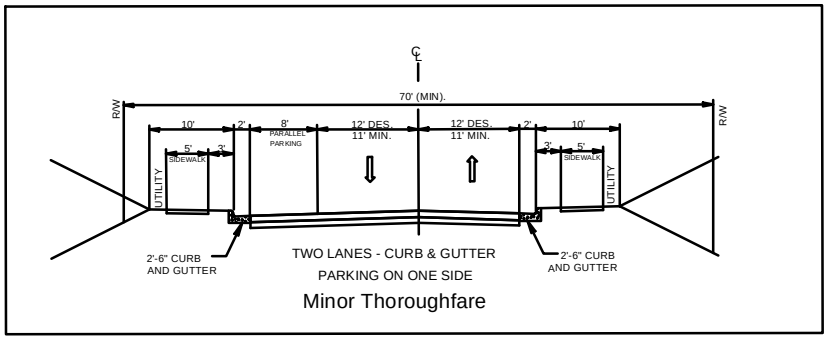
TYPICAL HIGHWAY CROSS SECTIONS

I



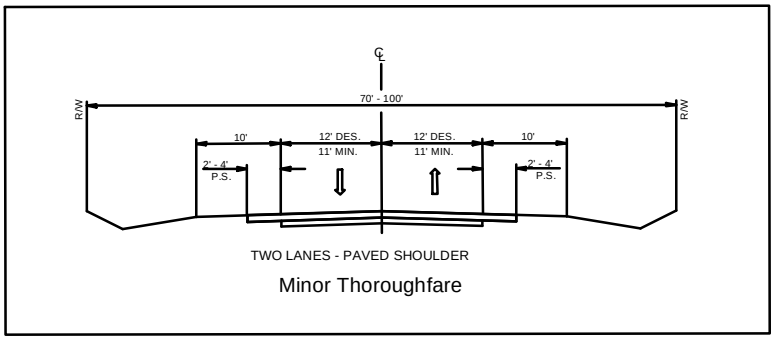
TWO LANES - CURB & GUTTER
PARKING ON EACH SIDE
Minor Thoroughfare

J



TWO LANES - CURB & GUTTER
PARKING ON ONE SIDE
Minor Thoroughfare

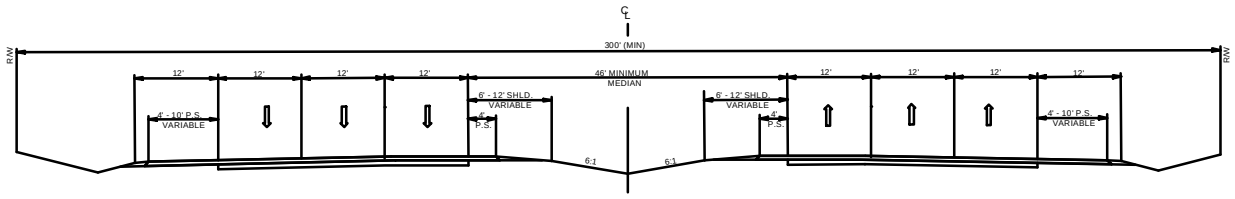
K



TWO LANES - PAVED SHOULDER
Minor Thoroughfare

TYPICAL HIGHWAY CROSS SECTIONS

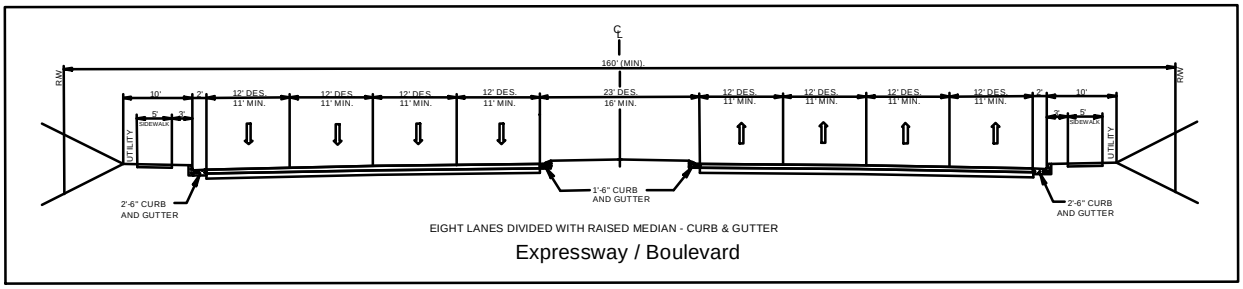
L



SIX LANES DIVIDED WITH GRASS MEDIAN

Freeway / Expressway

M



EIGHT LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

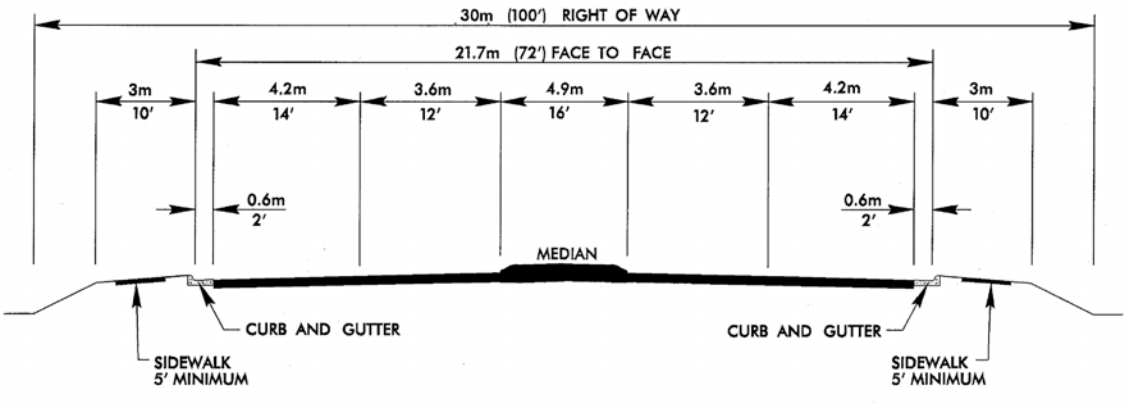
Expressway / Boulevard

Typical Bicycle Cross Sections

WIDE CURB LANES

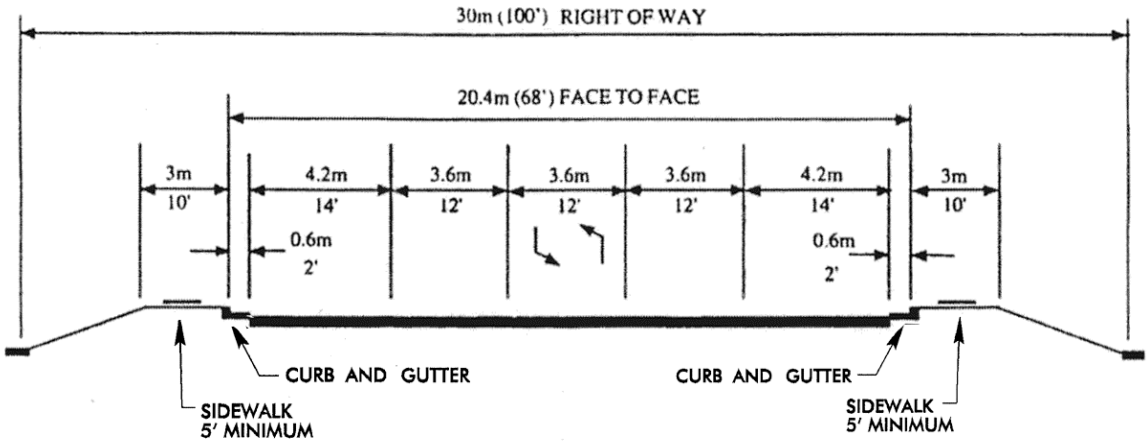
B –1 4-LANE MEDIAN DIVIDED TYPICAL SECTION

With Wide Outside Lanes



B-2 5-LANE TYPICAL SECTION

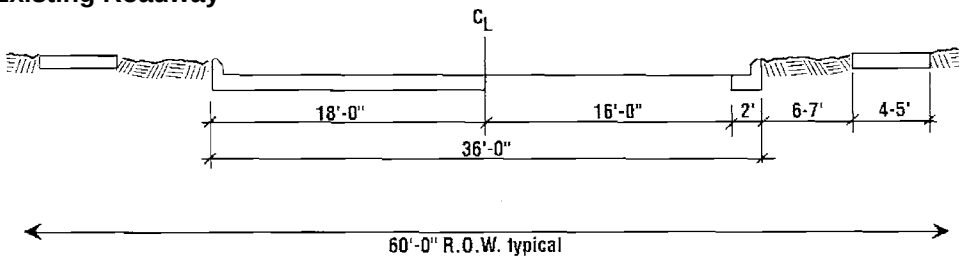
With Wide Outside Lanes



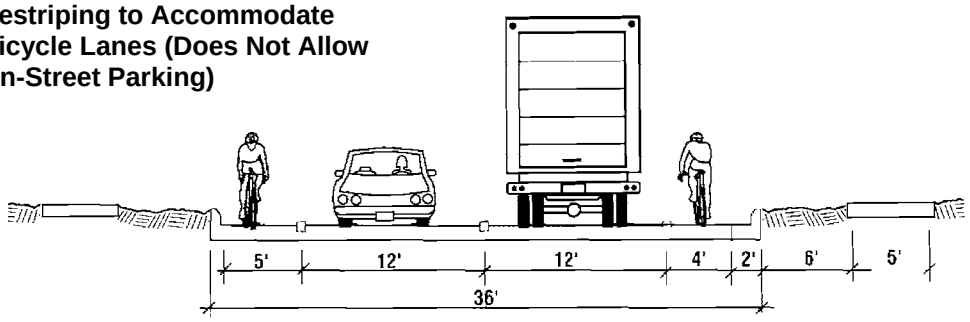
Typical Bicycle Cross Sections

B-3 BICYCLE LANES ON COLLECTOR STREETS

Existing Roadway



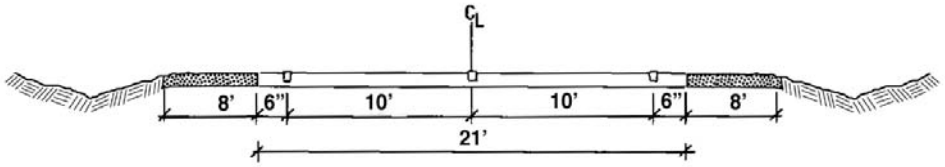
Restriping to Accommodate Bicycle Lanes (Does Not Allow On-Street Parking)



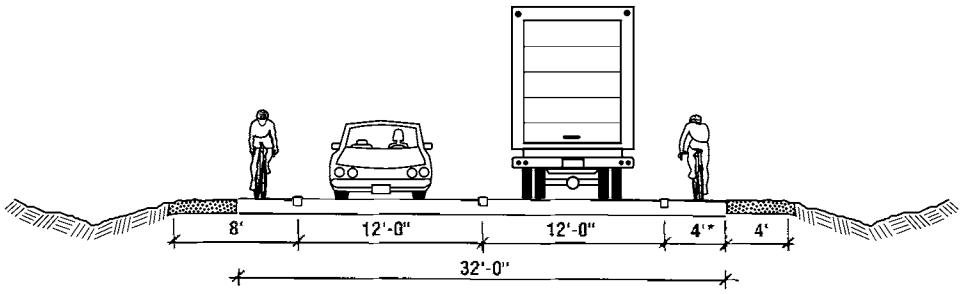
Typical Bicycle Cross Sections

B-4 WIDE PAVED SHOULDERS

Existing Roadway



Roadway Retrofitted with 4-Ft Paved Shoulders

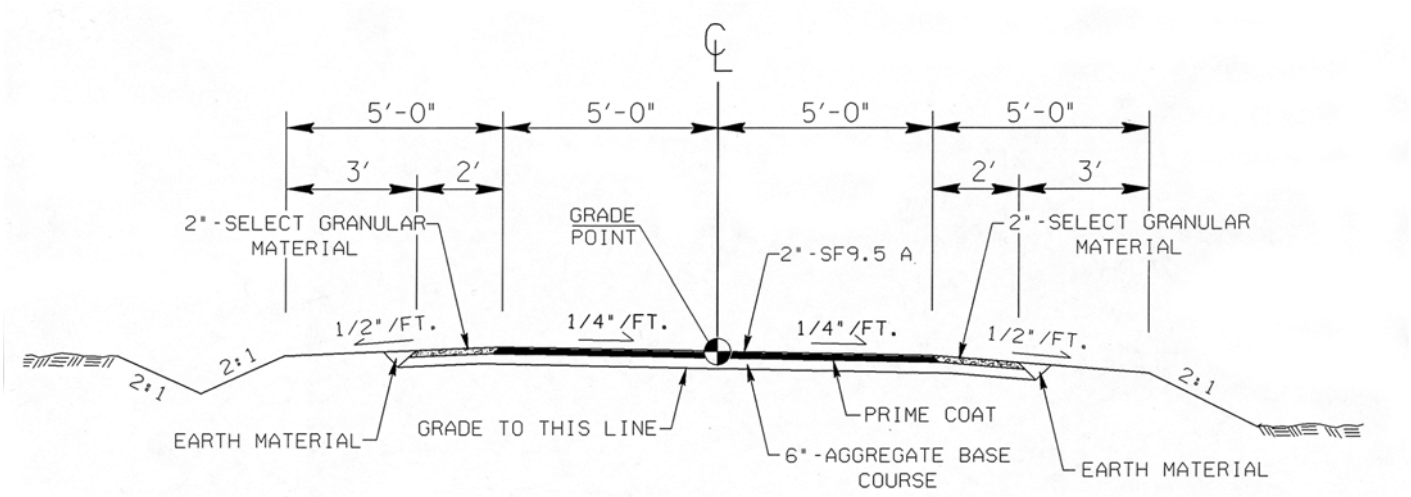


* If speeds are higher than 40 mph, shoulder widths greater than 4' are recommended.

Typical Bicycle Cross Sections

B-5 RECOMMENDED TYPICAL SECTION OF 10-FT ASPHALT PATHWAY

With 2-Ft Select Material Shoulder



APPENDIX E

Troutman
Pedestrian Plan

Troutman Pedestrian Plan

EXECUTIVE SUMMARY

January 2008

THE VISION

A safe pedestrian environment.
Start with making the Town's existing facilities safer. Slow down traffic and make crossing the street safe for people on foot.

Desirable destination points connected
Provide practical and convenient walkable linkages.

Outdoor exercise opportunities abounding
Provide safe, attractive and interesting pathways and encourage their use in the daily activities of citizens.

A healthy economic environment
Create viable opportunities for foot traffic businesses.

THE ISSUES

1. **High volume of through traffic commuters**
   Residents must compete with thousands of commuters traveling daily through Town down Main Street to go elsewhere.
2. **Low connectivity**
   Getting around Troutman, whether on foot or in a vehicle, requires frequent trips to and across an already overloaded Main Street.
3. **Explosive growth**
   Troutman's prime location will continue to draw new residents for years to come. Development pressures will make the sale of larger tracts in Troutman increasingly more attractive. Large undeveloped or redevelopable tracts in Town need more focused planning.
4. **Street Crossings**
   Existing crosswalks are in total disrepair and inadequately visible to drivers. Additional crosswalk facilities are needed at select locations.
5. **Inadequate sidewalk and trail facilities**
   Besides its one central path, Troutman has very little to offer in terms of off-road trails. More sidewalks are needed to accommodate pedestrian traffic. A number of existing sidewalks are uneven, broken up, or obstructed by obstacles making passage unmanageable or unsafe.
6. **Lighting**
   Lighting is inadequate for safe and comfortable evening pedestrian use throughout much of the Town.

RECOMMENDED ACTIONS

Form a stakeholder-based Pedestrian Needs Committee (PNC).
The Town appoints PNC members and invests them with the authority and charge to follow-up on the Pedestrian Plan.

Coordinate with NCDOT on the CTP to address Town planning goals.
To begin a process of amending the CTP, submit a request in a resolution form for the Lake Norman RPO to adopt and to recommend to the regional NCDOT Planning Branch.

Develop and Adopt a Comprehensive Land Use Plan.
Distribute the Pedestrian Plan to those involved in that process and charge them to publicly consider its analysis and recommendations, and integrate appropriate measures into the Land Use Plan.

Work with Iredell County on areas outside of Troutman's ETJ.
Monitor land development in the Troutman vicinity with the Iredell County Planning Department.

Adopt the Lake Norman Bike Route.
Review the Route Plan available from Centralina Council of Governments for adoption by the Town Board.

Enact ordinance changes.
Examine the Pedestrian Plan ordinance modifications table. A planning consultant can guide the Planning Board and Town Board through an ordinance revision and adoption process.

Troutman Pedestrian Plan

Comprehensive System Map

CROSSWALK PROJECTS

C-1	Main and Wagner CW
C-2	Old Mountain Road CW
C-3	Old Murdock Road CW
C-4	Eastway CW
C-5	Monbo Road CW
C-6	Barium Springs Village X-ing

OTHER PROJECT TYPES

O-1	School Loop
O-2	N. Main & Old Mountain Rd. Intersection Improvements

TRAIL PROJECTS

T-1	North Track TR
T-2	Murdock Farms TR
T-3	Streamwood TR
T-4	St. Lawrence TR
T-5	YMCA TRs
T-6	Eastside TR
T-7	Fairground Plaza TR
T-8	Town Hall TR
T-9	Brookside TR
T-10	Brookside TR Extension
T-11	Fairgrounds TR

RECOMMENDED PROJECTS

SIDEWALK PROJECTS

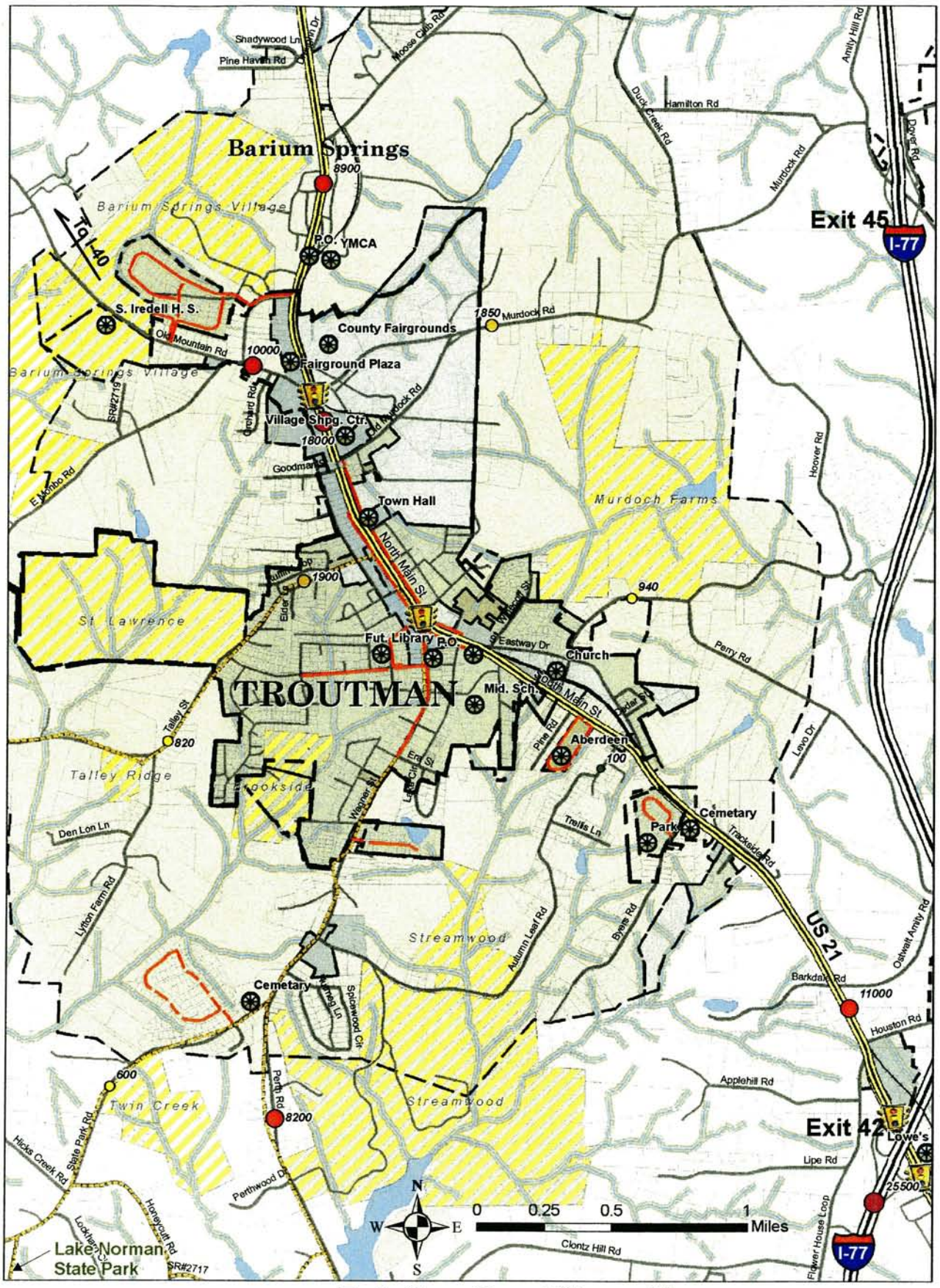
S-1	North Main St. SW (east)
S-2	Old Mountain Road SW
S-3	North Main St. SW (west)
S-4	South Main SW repair
S-5	Rumple Loop
S-6	Eastway SW
S-7	Talley Rd. & West Ave. SW
S-8	Church Street SW
S-9	Perry Road SW
S-10	Autumn Leaf SW
S-11	Perth Road SW
S-12	Massey Street SW
S-13	Thomas Brown Loop
S-14	Winecoff SW
S-15	South Main SW
S-16	Houston Road SW
S-17	Talley Street SW extension

Centralina Council of Governments

Division of Bicycle & Pedestrian Transportation

LAKE NORMAN RPO

For further information contact: Town of Troutman 704-528-7600 www.townoftroutman.org



Troutman Pedestrian Plan

12.03.07

Centralina Council of Governments

Existing Conditions Map

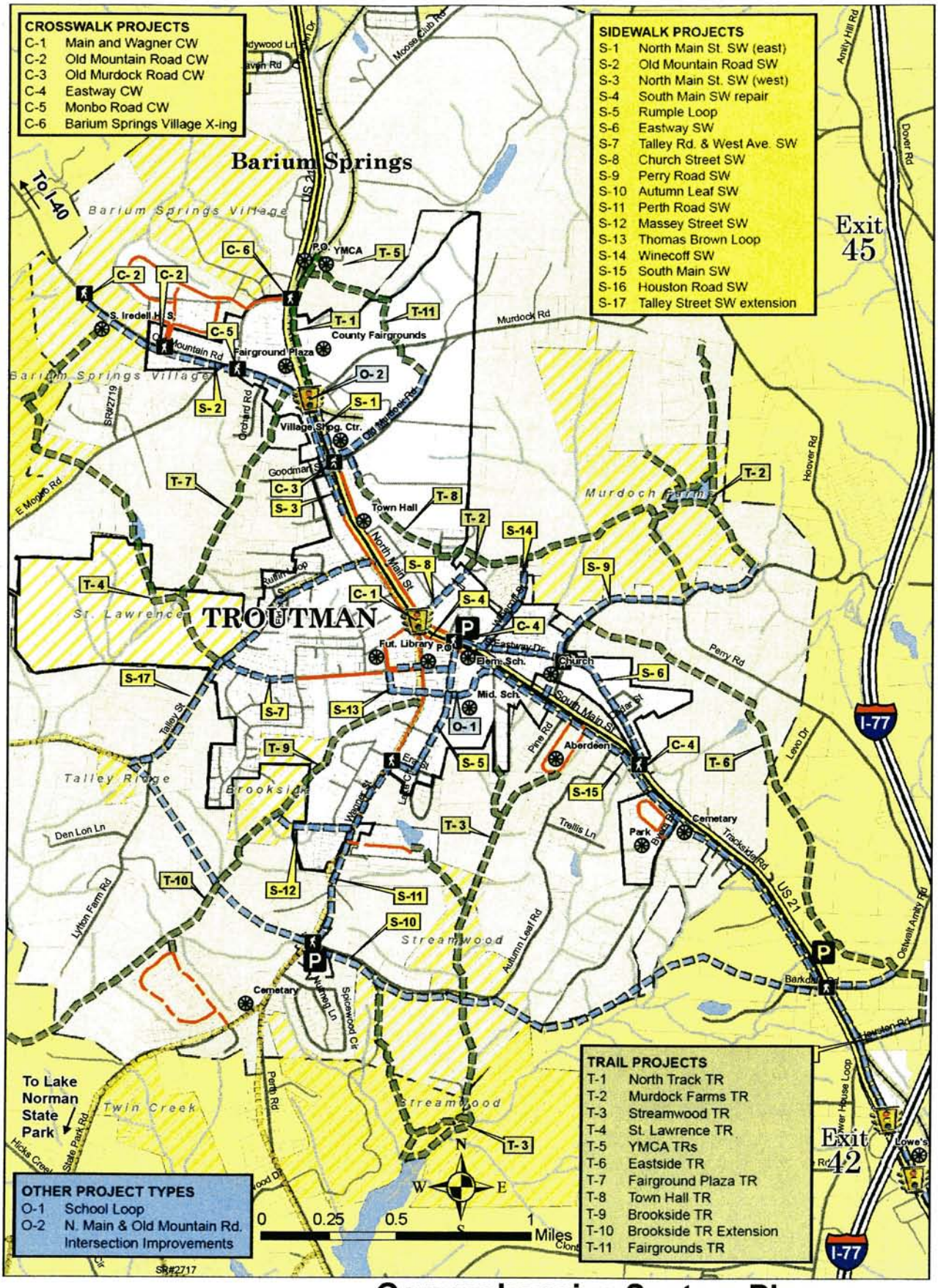
- Destinations
- Traffic Lights
- LKN State Park
- LNBR (Lake Norman Bike Route)
- Sidewalks
- Streets
- US 21
- I-77
- Railroads
- Creeks
- Parcels
- New Subdivisions
- Town Limits
- ETJ
- Water bodies

Traffic (AADT)

- 0 - 100
- 101 - 1000
- 1001 - 7500
- 7501 - 15000
- 15001 - 25500

ZONING

- C-B
- H-B
- I
- N-C
- O-I
- R-M
- R-MH
- R-S
- R-T



Troutman Pedestrian Plan

12.03.07

Centralina Council of Governments

Comprehensive System Plan

- S-1 Projects*
- Crosswalk (CW)
- Sidewalk (SW)
- Trail (TR)
- Street
- * See insets for project names.
- Destinations
- Park & Ride
- Traffic Light
- I-77
- Railroad Bed
- Existing Sidewalk
- Street
- US 21
- Creek
- LNBR (Lake Norman Bike Route)
- Water body
- New Subdivision
- Town Limits
- Troutman ETJ
- County Jurisdiction

6 ACTIONS RECOMMENDED

Troutman officials OK pedestrian plan

Proposal aims for safe walking options in growing community

DAVE VIESER

Special Correspondent

The Troutman Town Board has unanimously adopted a pedestrian plan designed to help planners develop and maintain a safe pedestrian environment in this rapidly growing community.

The 106-page report, funded by a $16,000 N.C. Department of Transportation grant, was produced by the Centralina Council of Governments, a regional planning agency.

"What we have here is a cogent plan that addresses the need to make our town more pedestrian friendly," Mayor Elbert Richardson said before the board's 5-0 vote adopting it.

In a presentation to the board prior to their vote, Centralina's Regional Planner Blair Israel cautioned that some of the current conditions can discourage walking in the town and will be a challenge to reverse.

"The heavy volume of commuter traffic using Highway 21, a lack of alternative connecting streets, inadequate crosswalk facilities and underdeveloped/inadequately lit sidewalks all work to limit pedestrian activity in this town," he said.

The report recommends six steps the town should take:

• Form a pedestrian needs committee of residents to keep the plan in the public's eye and update it as needed.
• Coordinate with N.C. DOT to address town planning goals.
• Develop and adopt a comprehensive land-use plan.
• Work with Iredell County on areas outside of the incorporated town limits, so that planning is consistent.
• Adopt the Lake Norman bike route, a regional bike route developed by Centralina.
• Enact ordinance changes to address pedestrian concerns currently not included in Troutman's Unified Development Ordinance.

Funding for the initiatives outlined in the plan is expected to come from a mix of public and private sources, such as developers.

Alderman Amanda Weiser raised concerns about the state's future roadway plans. "How can we be assured that they will coincide with this plan?" she asked. But Israel said that if a comprehensive transportation plan is adopted and is in place, DOT will do its best to honor the specific projects in the transportation plan.

Copies of the plan are available by contacting the town of Troutman at 704-528-7600.

APPENDIX F

Supplemental
Technical Analysis

SUPPLEMENTAL TECHNICAL ANALYSIS

The highway element of the CTP was developed with a hand allocation travel model, which is used in small urban areas that have a population of less than 5,000 and applies the traditional four-step planning process (*trip generation, trip distribution, mode choice, and trip assignment*).

Development of this model required the delineation of the planning area and development of a base year (2002) roadway network. Socioeconomic (SE) data and traffic data were applied to the four-step process to simulate base year traffic to identify system deficiencies. The SE data was then projected to the future year and the four-step process was repeated. The existing street system was loaded with the projected traffic volumes to highlight anticipated future capacity problems and identify system deficiencies.

DEFINITION OF THE PLANNING AREA

The planning area is defined as the region expected to have urban characteristics in the future planning year. The planning area for the Town of Troutman is shown in Figure 9**.** The original planning area, shown in gray, was modified to the yellow boundary during the course of the study. This was necessary to accommodate an Annexation Agreement (adopted in April 2007) between Troutman, Statesville, Mooresville, and Iredell County.

The Troutman PAB (planning area boundary) mostly follows water features with the exception of the shared annexation boundary. The western boundary follows along Bass Creek and Norwood Creek. The southern boundary follows along Lake Norman and three roadways: Perth Road, Fern Hill Road and Carlyle Road. The eastern boundary borders Kerr Branch and Greasy Creek.

IDENTIFICATION OF THE ROAD NETWORK

The road network is a representation of the major roads within the planning area boundary used to simulate actual travel patterns. It is the model used for reproducing the actual travel patterns existing on the road network, as well as, deficiencies and problems occurring on the roadway system. The previous thoroughfare plan is a good source of information for determining which roadways should be designated as a network road because of changes based on anticipated future growth and travel patterns. The system of functionally classified facilities that are designated as collector streets are also included in the network.

The network roads for the Town of Troutman, shown in Figure 10**,** are as follows:

I-77
US 21/NC 115
Perth Road (SR 1303)/Wagner Street (SR 1303)
Old Mountain Road (SR 1005)
Murdock Road (SR 2350)
Ostwalt Amity Road (SR 1001)
North Avenue
East Church Street
Talley Street/Road (SR 1324)
Old Murdock Road (SR 2551)
Houston Road (SR 2375)
East Monbo Road (SR 1328)
State Park Road (SR 1330)
Hicks Creek Road (SR 1322)
Perry Road (SR 2369)
Rumple Street
West Church Street
West Avenue West
Hoover Road (SR 2402)
Flower House Loop Rd (SR1312)

The recommended CTP improvements for the design year that would be added to the road network are:

Troutman Southwest Bypass (from Old Mountain Road to US 21/NC 115)

Several key data elements for each roadway in the street network were needed to aid the development of the hand allocation model and to supplement the documentation of the resulting CTP. Roadway capacity, which is the measure of how much traffic a roadway is designed to carry under given physical conditions, was input to the hand allocation model to determine operational deficiencies. For planning studies, the capacity assigned to each network roadway is based upon capacity for each roadway at level of service (LOS) D. In the absence of standardized LOS capacities for North Carolina roadways, the Florida Department of Transportation LOS tables were used to establish the capacity at LOS D for each roadway street network. The following information was required for each roadway in order to employ the Florida LOS tables:

- Number of lanes;
- Number of signals per mile;
- Presence of medians; and
- Presence of left turn lanes.

PLANNING AREA BOUNDARY

FIGURE 9

Town of Troutman

Iredell County
North Carolina

Legend

- New PAB
- Previous PAB
- Municipal Boundary
- Annexation Boundary
- Roads
- Lakes and Streams

N
W E
S

PREPARED BY THE
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
TRANSPORTATION PLANNING BRANCH

IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

0 0.2 0.4 0.8 1.2 Miles

BASE MAP DATE: OCTOBER 2004
Refer to CTP document for more details

TROUTMAN
Lake Norman
Hill Haven Rd
Wallace Springs Rd
Mouse Club Rd (SR 2348)
Amity Hill Rd (SR 2342)
Duck Creek Rd
Troutman Rd
Old Mountain Rd
Murdock Rd
Old Murdock Rd
Hoover Rd
Amity Hill Rd
E Monbo Rd
Pilch Rd
Perry Rd
Talley St
Ostwalt Amity Rd
Autumn Leaf Rd
State Park Rd
Hicks Creek Rd
Perth Rd
Clontz Hill Rd
Flower House Loop
21
77
115

Traffic Analysis Zones and Study Model Network

Figure 10

Town of Troutman

Iredell County
North Carolina

Zone 1
Zone 2
Zone 3
Zone 4
Zone 5

TROUTMAN

Lake Norman

Hill Haven Rd
Wallace Springs Rd
Moose Club Rd (SR 2348)
Amity Hill Rd (SR 2342)
Duck Creek Rd
Troutman Rd
Old Mountain Rd
Murdock Rd
Old Murdock Rd
Hoover Rd
Amity Hill Rd
E Monbo Rd
Talley St
Perry Rd
Pitch Rd
Ostwalt Amity Rd
Autumn Leaf Rd
State Park Rd
Hicks Creek Rd
Perth Rd
Clontz Hill Rd
Flower House Loop

21
115
77

1
2
3
4
5
6
7
8
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10
11
12
13
14
15

Legend

- Station
- Model Network
- Planning Area Boundary and Zones
- Municipal Boundary
- Rivers and Streams
- Lakes

N
W E
S

PREPARED BY THE
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
TRANSPORTATION PLANNING BRANCH

IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

0 0.2 0.4 0.8 1.2 Miles

BASE MAP DATE: OCTOBER 2004
Refer to CTP document for more details

The Highway Inventory table located in the Town of Troutman CTP report has a listing of the pavement width, number of lanes, posted speed limit and right-of-way for each network roadway. This data and other information used to determine each roadway capacity was collected through field investigations and the NCDOT Mileage Inventory.

TRAFFIC COUNT ANALYSIS

Traffic Count information is used in the calibration of the hand allocation model to ensure that model generated traffic volumes are consistent with measured traffic volumes and to establish past traffic growth characteristics in order to project target volumes for the design year. In order to facilitate the completion of the model in a timely process, annual average daily traffic (AADT) counts were used for this hand allocation analysis. The Traffic Surveys Unit of the NCDOT Transportation Planning Branch compiles AADT counts yearly on numerous roads across the state. This analysis used volumes collected from the years 1983 to 2002 for each roadway in the street system.

The 2002 AADT counts, which are presented in Figure 6, served as the base year volumes for the calibration of the hand allocation model. These base year AADT volumes were projected to the 2030 design year in order to determine a rough estimate of the future travel within the planning area. The projected volumes were established through the application of the simple interest formula and regression analysis.

An analysis of the growth trends observed between 1983 and 2002 was performed for the AADT volumes on each of the network roadways using the following simple interest formula:

$$\text{Growth Rate} = (AADT_{Present}/AADT_{Past}) \text{ ^ } (1/Year_{Present} - Year_{Past}) - 1$$

The resulting growth rate observed at each station was applied to the 2002 AADT, resulting in the target volume for the 2030 design year. A regression analysis of the past AADT volumes was completed by determining the graphical trendlines for these observed volumes and then projecting these trendlines to the design year, resulting in target volumes for the 2030 design year. A comparison of the two methods resulted in some inconsistencies in some areas because the regression analysis simple interest rate does not reflect the aggressively anticipated growth of the planning area. A summary of the existing and projected volumes is presented in Table 6.

Table 6. Traffic Count Summary			
Roadway	**Section**	**2002 AADT**	**2030 Projected Volumes**
Shelton Avenue	S of Moose Club Road	**9800**	**19400**
N. Main Street	N of Old Murdock Road	**18000**	**36200**
E. Monbo Road	S of Old Mountain Road	**n/a**	**4700**
Perth Road	S of State Park Road	**5100**	**17600**
State Park Road	W of Perth Road	**n/a**	**6800**
Fern Hill Road	Southern PAB	**n/a**	**2100**
Amity Hill Road	N of Moose Club Road	**1900**	**5700**
Arey Road	NW of Wallace Springs Road	**1100**	**3300**
Old Mountain Road	E of East Monbo Road	**7000**	**24000**
Houston Road	E of US 21/NC 115	**790**	**2400**
Ostwalt Amity Road	E of Perry Road	**3500**	**13700**
Amity Hill Road	E of Pilch Road	**2700**	**10600**
I-77	N of Southern PAB	**52000**	**155900**
US 21 and NC 115	N of Southern PAB	**10000**	**33500**
I-77	S of Northern PAB	**48000**	**143700**

SOCIOECONOMIC DATA ANALYSIS

The socioeconomic data required included population and housing data, general employment data, existing zoning and known future development information. This information was used to determine the existing population, housing, and employment data needed for the base year assignment and then the projected population, housing, and employment data was used to project the future year assignment.

Population and Housing

The base year population and housing data were obtained from the North Carolina State Data Center and the Decennial US Census. Population and housing unit information were collected for the years 1970, 1980, 1990 and 2000. The townships, tracts, group blocks and blocks were subdivided to coincide with the planning area boundary. The summation of each group block and block were calculated based on their total population within the planning area. The blocks that were divided by the planning area boundary were further investigated for population density, to make sure that the area had housing within the specified borders of the block. The housing data was done in the same format. The study area population was calculated to be approximately 7,000 persons. The sum of each group block for the population and the housing data (dwelling unit data) is shown in Table 7**.**

A local future year study, involving Southern Iredell County, was performed to reflect the future development and anticipated growth within the area. The forecast, completed prior to the analysis of the Troutman CTP, included Mooresville, Troutman and the surrounding areas, spreading to the southern county boundary. The forecasted information was separated into four sections: population, households, retail and business employment. Projections were made to the design year 2025. The future year SE data for the Town of Troutman represented an anticipated growth of approximately 3.5 to 5.5 percent each year. It was forecasted that the majority of growth would take place between 2010 and 2015, then taper off into the year 2020. Applying the growth percentages to the 2030 design year, the future year population is expected to be approximately 27,000.

Table 7. Zonal Population and Dwelling Unit Totals

	Population	Dwelling Units (DU)
Zone 1	**518**	**212**
Zone 2	**2007**	**522**
Zone 3	**1543**	**669**
Zone 4	**1783**	**787**
Zone 5	**970**	**515**
Totals	**6821**	**2705**

Employment

An inventory of the number and types of existing businesses in the planning area was put together using US Census data. This data represents the base year employment and helped to justify travel patterns and traffic volumes on specific roads throughout the planning boundary.

BASE YEAR MODEL DEVELOPMENT

Trip Generation

The trip generation step calculates how many trips are being made in the planning area. Data used in this step includes external station volumes, dwelling unit data, and employment data. Three types of trips must be accounted for:

- External to External (E←→E) or "*through trips*": trips that begin outside of the study area, travel through the study area without making a stop, and end at a destination outside of the study area.
- External to Internal (E←→I): trips that begin outside the planning area boundary or inside the planning area, with the trip end opposite of its beginning.
- Internal to Internal (I←→I): trips that originate and end within the planning area boundary.

The base year through trip table was developed using the Synthesized Through Trip Table (SYNTH) computer program. This program performs iterations for through trips by balancing the trip percentages at the external travel stations. The SYNTH program calculates an estimated percentage of through trips at each of the external stations based on the existing AADT, functional classification and percentage of trucks on that roadway. Adjustments were made to the percentages as needed based on knowledge of the planning area. Through trips at each external station were calculated using the following formula:

Through Trips = (AADT) * (Adjusted % Through the SYNTH Program)

After the through trip table had been balanced for each station, then the E←→I trips were calculated using the following formula:

E←→I Trips = (Total AADT) – (Through Trips)

A summary of the calculated data is represented in Table 8.

Table 8. Calculations of 2002 Through Trips & External Trips

Station	Location	Trucks (%)	Total AADT	% Adjusted Through	Thru Trips	E-I Trips
1	US 21 and NC 115	7	10000	87	8700	1300
2	Wallace Spring Road	1	800	11	88	712
3	Arey Road	1	1100	11	121	979
4	Old Mountain Road	2	7000	28	1960	5040
5	E. Monbo Road	1	1500	13	195	1305
6	State Park Road	1	300	9	27	273
7	Perth/Wagner Road	3	6400	28	1792	4608
8	Fern Hill Road	2	200	11	22	178
9	I-77	29	48000	93	44640	3360
10	US 21 and NC 115	8	10000	90	9000	1000
11	Houston Road	3	800	13	104	696
12	Ostwalt Amity Road	3	3300	20	660	2640
13	Amity Hill Road	1	2700	15	405	2295
14	I-77	29	52000	91	47320	4680
15	Amity Hill Road	4	1900	18	342	1558
Total			146000		115376	30624

The amount of trips remaining within the study area includes trips generated by the dwelling units (DU Trips) and the commercial vehicles (CV Trips) within the study area, which was calculated using the following formulas:

DU Trips = (Population/Person per DU) * (Trip Rate)

CV Trips = (Percent Commercial Vehicles) * (DU Trips)

The person per dwelling unit was obtained from the US Census Bureau. The trip generation rate used for the planning area was 7.0 trips/person per day. The normal trip range for an area with a larger population is between 8.0 to 9.0 trips/person per day. Small urban areas like Troutman have a trip rate slightly below the larger population range because of the travel pattern characteristics that relate to that particular area. The percentage of commercial trips generated within the planning area was taken as 0.125 of the total dwelling unit trips. Therefore, the trips generated within the study were calculated as follows:

DU Trips *= (6900/2.6) * 7*
= 18,577 trips

CV Trips *= (0.125) * (18,577 trips)*
= 2,322 trips

Total Study Area Trips = DU Trips + CV Trips
= 18,577 trips + 2,322 trips
= 20,899 trips

The total amount of trips that are generated within a study area consists of I ←→ I trips and I ←→ E trips. A study area that is a large city has numerous attractions and would have a high percentage of I ←→ I trips, where as a bedroom community having fewer attractions would have a lower percentage of these trips. Since Troutman is a bedroom community to Statesville, Mooresville and Charlotte, it was assumed that only 80 percent of the trips remain within the planning area, which is within the normal range of 80 to 90 percent. Therefore, the total trips remaining within the study area were calculated as follows:

I ←→ I Trips = (***Total Study Area Trips) * (Total % of Internal Trips)***
*= (20,899 trips) * (0.80)*
= 16,719 trips

I → E Trips = (***Total Study Area Trips) – (I ←→ I Trips)***
= (20,899 trips) – (16,719 trips)
= 4,180 trips

The remaining trips left within the planning area are those produced by non-residents traveling into the planning area. These E → I trips were calculated as follows:

E → I Trips = (AADT – Through trips) – (I→E Trips)
= (146,000 trips – 115,376 trips) – (4,180 trips)
= 26,444 trips

Trip Distribution

The trip interchanges between the zones and external stations is determined by trip distribution. The through trips were distributed between each of the external stations based on the through trip percentages calculated in the trip generation process. The balanced distribution of through trips from station to station are shown in Table 9. The attractiveness of each zone was determined using the population and number of dwelling units for each zone and is summarized in Table 10.

The distribution of I ←→ I trips between each TAZ was based on the relative attractiveness between the zones and the land use patterns within each zone. Table 11 shows the distribution of I ←→ I trips across the planning area.

E ←→ I trips were distributed between the TAZ s and the external stations based on the zonal attractiveness percentage used to distribute the I ←→ I trips. The TAZ s having more development would most likely have a higher attractiveness percentage and would produce and attract more of the E ←→ I trips. Table 12 represents the distribution of E ←→ I trips across the planning area.

Table 9. 2002 Through Trips																
Station	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
1	0	5	9	74	15	25	67	12	1810	507	20	25	19	270	0	2858
2	5	0	0	2	0	0	2	2	12	5	0	1	1	14	0	44
3	9	0	0	3	1	0	3	2	16	10	0	1	3	18	0	66
4	74	2	3	0	5	5	22	2	371	77	4	7	6	919	4	1501
5	15	0	1	5	0	15	5	2	22	15	0	1	1	25	1	108
6	25	0	0	5	15	0	0	0	30	20	0	0	0	27	0	122
7	67	2	3	22	5	0	0	0	238	69	1	6	6	384	3	806
8	12	2	2	2	2	0	0	0	3	1	0	0	0	3	0	27
9	1810	12	16	371	22	30	238	3	0	1781	53	172	70	18,749	60	23387
10	507	5	10	77	15	20	69	1	1781	0	8	27	92	1,714	18	4344
11	20	0	0	4	0	0	1	0	53	8	0	0	0	98	0	184
12	25	1	1	7	1	0	6	0	172	27	0	0	2	318	1	561
13	19	1	3	6	1	0	6	0	70	92	0	2	0	166	17	383
14	270	14	18	919	25	27	384	3	18,749	1,714	98	318	166	0	65	22770
15	0	0	0	4	1	0	3	0	60	18	0	1	17	65	0	169
Calculations	2858	44	66	1501	108	122	806	27	23387	4344	184	561	383	22770	169	57330

Table 10. 2002 Calculations of Trips per Zone				
Zone	% Zone DU s	Zone Trips	I - I Zone Trips	I - E Zone Trips
1	7.8	1600	1280	320
2	19.3	4000	3200	800
3	24.7	5200	4160	1040
4	29.1	6200	4960	1240
5	19	4000	3200	800
Totals	100	21000	16800	4200

Zone Trips = (Total Zone Trips) * (% Zone DU)
I - I Zone Trips = (Zone Trips) * (% of trips staying within the PAB (0.80))
I - E Zone Trips = (Zone Trips) - (I - I Zone Trips)

Table 11. 2002 Internal to Internal Trips					
Zone	**1**	**2**	**3**	**4**	**5**
1	230	576	749	893	576
2	282	704	915	1091	704
3	256	640	832	992	640
4	410	1024	1331	1587	1024
5	102	256	333	397	256
Totals	1280	3200	4160	4960	3200

Table 12. 2002 External to Internal Trips																
Zones	**Stations**															**Total**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	
1	770	130	180	720	230	10	860	30	220	240	80	390	350	1160	280	5650
2	940	160	210	880	280	10	1050	30	270	290	100	480	430	1420	340	6890
3	860	140	190	800	260	10	960	30	250	260	90	440	390	1290	310	6280
4	1370	230	310	1280	410	20	1530	50	390	420	140	700	620	2070	500	10040
5	340	60	80	320	100	10	380	10	100	100	30	170	150	520	130	2500
Calculations	4280	720	970	4000	1280	60	4780	150	1230	1310	440	2180	1940	6460	1560	31360

Mode Choice

The mode choice step involves dividing the trips established in trip generation and trip distribution between modes of travel to make the trips. The majority of small urban planning areas within North Carolina rely predominantly on the area roadways to make trips. Consequently, all of the trips for the planning area were committed to the roadway network for trip assignment.

Trip Assignment, Calibration & Validation

Trip assignment involves assigning all trips onto the road network based on the trip distribution results. The trips were assigned on the roadways using logical trip travel patterns and planning area knowledge.

Calibration & validation is the process in model development that applies accuracy and precision to the modeled generated traffic, helping to ensure that the traffic closely replicates the collected traffic counts. Calibration of the model involves iterations in which incremental adjustments are made either in the trip generation, the trip distribution or the road network in order to ensure that the model more accurately reflects the real world conditions it represents. The general rule of thumb is that the trips assigned on the model should fall between 90 to 110% of the actual ground counts on the network roadways. Validation of the model involves performing accuracy checks throughout the development of the model.

Some of the accuracy checks for this model were:

- verification of collected data;
- tracking specific adjustments and why they were needed;
- double-checking mathematical calculations; and
- following trips through all of the steps to ensure that none were accidentally added or subtracted from the model.

After several iterations, the assigned model volumes were found to be within acceptable limits for calibration.

FUTURE YEAR MODEL DEVELOPMENT

The purpose of developing a model of base year data is to understand how traffic is generated and dispersed throughout the planning area in order to project reasonable future traffic conditions in the study area. After the base year model was calibrated, the socioeconomic data projected for the 2030 design year was incorporated to develop a similar model for projected travel. Each of the base year variables must be appropriately modified in order to make the model replicate projected conditions. Future year development may or may not occur as projected, but an estimate must be made in order for the model to be considered relevant to that future year.

Trip Generation

The through trips for the design year calculations were achieved by using the through trip percentages from the base year model. These percentages were applied to the volumes projected at each of the external stations to determine the total number of through trips at each station. The E → I trips at each station were then calculated using the equations shown on page F-10. The design year through trips and E → I trips for each zone are represented in Table 13.

Table 13. Calculations of 2030 Through Trips & External Trips

Station #	Location	Truck (%)	Future Year AADT	% Adjusted Through	Thru Trips	E-I Trips
1	US 21 and NC 115	7	16900	57	9660	7240
2	Wallace Springs Road	1	2500	11	276	2224
3	Arey Road	1	3300	11	364	2936
4	Old Mountain Road	2	24000	28	6720	17280
5	E. Monbo Road	1	4000	13	522	3478
6	State Park Road	1	6800	9	614	6186
7	Perth/Wagner Road	3	13000	28	3640	9360
8	Fern Hill Road	2	1500	11	166	1334
9	I-77	29	90000	93	81096	8904
10	US 21 and NC 115	8	26000	90	23400	2600
11	Houston Road	3	2400	21.38	514	1886
12	Ostwalt Amity Road	3	13700	20	2740	10960
13	Amity Hill Road	1	10600	21.76	2308	8292
14	I-77	29	97000	91	88270	8730
15	Amity Hill Road	4	5700	18	1026	4674
Total			317400		221316	96,084

The remaining amount of trips traveled in the planning area, processed the same way as the base year analysis, was determined by establishing the total amount of trips generated within the planning area using the formulas shown on page F-11. The dwelling unit occupancy rate for the design year was calculated as 2.5 persons/dwelling unit, which

was established using the Southern Iredell Forecast's population and household projections within the planning area boundary for the Town of Troutman study. The trip generation rate of 7.0 trips/person per a day was consistently utilized from the base year. As a result, the total trips generated within the planning area were calculated as follows:

DU Trips *= (27,000/2.5) * 7*
= 75,600 trips

CV Trips *= (0.125) * (70,000 trips)*
= 8,750 trips

Total Study Area Trip ***= DU Trips + CV Trips***
= 75,600 trips + 8,750 trips
= 84,350 trips

The trips remaining within the planning area, which includes I ←→ I trips, I → E trips and E ←→ I trips, were calculated using the formulas shown on page F-10 as follows:

I ←→ I Trips = (***Total Study Area Trips) * (Total % of Internal Remaining Trips)***
*= (84,350 trips) * (0.80)*
= 67,480 trips

I → E Trips = (***Total Study Area Trips) – (I ←→ I Trips)***
= (84,350 trips) – (67,480 trips)
= 16,870 trips

E → I Trips ***= (AADT – Through trips) – (I→E Trips)***
= (317,400 trips – 221,316 trips) – (16,870 trips)
= 79,214 trips

Trip Distribution

The trips produced from the trip generation were distributed across the planning area using the same methodology implemented in the base year. Table 17 shows the distribution of the through trips between the external stations. The attractiveness of each zone was determined by using the projected population and number of dwelling units for each zone and is summarized in the Table 14. These percentages were again used to distribute the I ←→ I trips and the E ←→ I trips across the planning area. Table 15 and Table 16 show the resulting distribution of these trips.

Table 14. 2030 Calculations of Trips per Zone				
Zone	% Zone DU s	Zone Trips	I - I Zone Trips	I - E Zone Trips
1	4	3160	2528	632
2	19	15,010	12,008	3002
3	27	21,330	17,064	4266
4	42	33,180	26,544	6636
5	8	6320	5056	1264
Totals	100	79000	63200	15800

Zone Trips = (Total Zone Trips) * (% Zone DU)
I - I Zone Trips = (Zone Trips) * (% of trips staying within the PAB (0.80))
I - E Zone Trips = (Zone Trips) - (I - I Zone Trips)

Table 15. 2030 Internal to Internal Trips					
Zone	1	2	3	4	5
1	455	2161	3072	4778	910
2	303	1441	2048	3185	607
3	404	1921	2730	4247	809
4	657	3122	4437	6901	1315
5	708	3362	4778	7432	1416
Totals	2527	12007	17065	26543	5057

Table 16. 2030 External to Internal Trips															
Zones	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7	Station 8	Station 9	Station 10	Station 11	Station 12	Station 13	Station 14	Station 15
1	1300	400	530	3110	630	1120	1690	240	1600	470	340	1970	1490	1570	840
2	870	270	350	2070	420	740	1120	160	1070	310	230	1320	990	1050	560
3	1160	360	470	2770	560	990	1500	210	1420	410	300	1750	1330	1400	750
4	1880	580	770	4490	900	1610	2430	350	2320	680	490	2850	2160	2270	1210
5	2030	620	820	4840	970	1730	2620	380	2490	730	530	3070	2320	2440	1310
Calculations	7240	2230	2940	17280	3480	6190	9360	1340	8900	2600	1890	10960	8290	8730	4670

Table 17. 2030 Through Trips																
Station	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**Total**
1	**0**	**10**	**14**	**212**	**24**	**42**	**111**	**18**	**3048**	**787**	**34**	**42**	**34**	**454**	**0**	**4830**
2	**10**	**0**	**0**	**7**	**0**	**0**	**7**	**7**	**39**	**18**	**0**	**3**	**3**	**46**	**0**	**138**
3	**14**	**0**	**0**	**7**	**3**	**0**	**3**	**6**	**60**	**12**	**0**	**3**	**8**	**67**	**0**	**182**
4	**212**	**7**	**7**	**0**	**11**	**11**	**49**	**5**	**927**	**170**	**9**	**16**	**14**	**1915**	**9**	**3360**
5	**24**	**0**	**3**	**11**	**0**	**36**	**12**	**5**	**60**	**36**	**0**	**3**	**3**	**66**	**3**	**261**
6	**42**	**0**	**0**	**11**	**36**	**0**	**0**	**0**	**88**	**50**	**0**	**0**	**0**	**80**	**0**	**307**
7	**111**	**7**	**3**	**49**	**12**	**0**	**0**	**0**	**545**	**186**	**3**	**14**	**14**	**871**	**7**	**1820**
8	**18**	**7**	**6**	**5**	**5**	**0**	**0**	**0**	**18**	**7**	**0**	**0**	**0**	**18**	**0**	**83**
9	**3048**	**39**	**60**	**927**	**60**	**88**	**545**	**18**	**0**	**2813**	**107**	**310**	**415**	**31,923**	**196**	**40548**
10	**787**	**18**	**12**	**170**	**36**	**50**	**186**	**7**	**2813**	**0**	**21**	**94**	**263**	**7,195**	**48**	**11700**
11	**34**	**0**	**0**	**9**	**0**	**0**	**3**	**0**	**107**	**21**	**0**	**0**	**0**	**83**	**0**	**257**
12	**42**	**3**	**3**	**16**	**3**	**0**	**14**	**0**	**310**	**94**	**0**	**0**	**5**	**878**	**3**	**1370**
13	**34**	**3**	**8**	**14**	**3**	**0**	**14**	**0**	**415**	**263**	**0**	**5**	**0**	**345**	**52**	**1154**
14	**454**	**46**	**67**	**1915**	**66**	**80**	**871**	**18**	**31,923**	**7,195**	**83**	**878**	**345**	**0**	**196**	**44135**
15	**0**	**0**	**0**	**9**	**3**	**0**	**7**	**0**	**196**	**48**	**0**	**3**	**52**	**196**	**0**	**513**
Calculation	**4830**	**138**	**182**	**3360**	**261**	**307**	**1820**	**83**	**40548**	**11700**	**257**	**1370**	**1154**	**44135**	**513**	**110654**