

## 2011 Village of Pinehurst Thoroughfare Plan



**Adopted 10/11/11**

# 2011 Village of Pinehurst Thoroughfare Plan

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## **Introduction**

The existing thoroughfare plan was completed twenty years ago by the North Carolina Department of Transportation for Aberdeen, Pinehurst and Southern Pines. Much of the functional classification system found in this plan is based on the original thoroughfare map.

The purpose of this thoroughfare planning document is to ensure that Pinehurst's road network will be both dynamic and strategic in its development and will be sufficient to serve both future travel and future land use demands for the Village of Pinehurst and surrounding communities of Moore County. Ultimately, the goal is for traffic to function in the most efficient manner possible. The basic principles applied in the development of Pinehurst's local thoroughfare plan establish a foundation upon which to seek and support a local consensus of the vision for Pinehurst's future transportation system. This endeavor is based upon collected data and identification of emerging needs due to growth and development.

By endorsing a local developed thoroughfare plan, the Village of Pinehurst will facilitate the implementation of roadway improvements and manage projected growth permitting travel in Pinehurst to occur safely and unrestricted by congestion.

Due to physical roadway conditions, deteriorating level of service, and increasing traffic volumes; congestion has become prevalent along specific corridors in Moore County. In addition, development partnered with land-use patterns have progressed inconsistently with the existing roadway network. To identify possible improvements, the existing roadway network should be delineated with respect to travel use, contiguous land use, and local vision.

## **Classification System**

The role of each road is to provide mobility of travel and access to property. However, the streets in our transportation system are designed to carry traffic in different ways, and it is important to delineate by category these roadways in consideration of future service and improvements. Facility classifications germane to the Village of Pinehurst are as follows:

**Major Thoroughfares** function as the primary traffic arterial and provide for traffic movements within, through, and around the area. Major arterials are the "highest order" of surface streets and typically carry high volumes of traffic. Examples of major thoroughfares in Pinehurst are mostly state routes such as Highway 211, Juniper Lake Road, Highway 15-501, Midland Road, Morganton Road, Highway 5/Beulah Hill Road and Linden Road

**Minor Thoroughfares** are designed to collect traffic from the local streets to the major thoroughfares. Minor thoroughfares serve a similar function as major thoroughfares;

however, these roads carry less traffic over shorter distances than major thoroughfares. Examples of minor thoroughfares in Pinehurst include; McKenzie Road, Murdocksville Road, Rattlesnake Trail, Gunclub Road, Spring Lake Drive, Kelly Road and Chicken Plant Road.

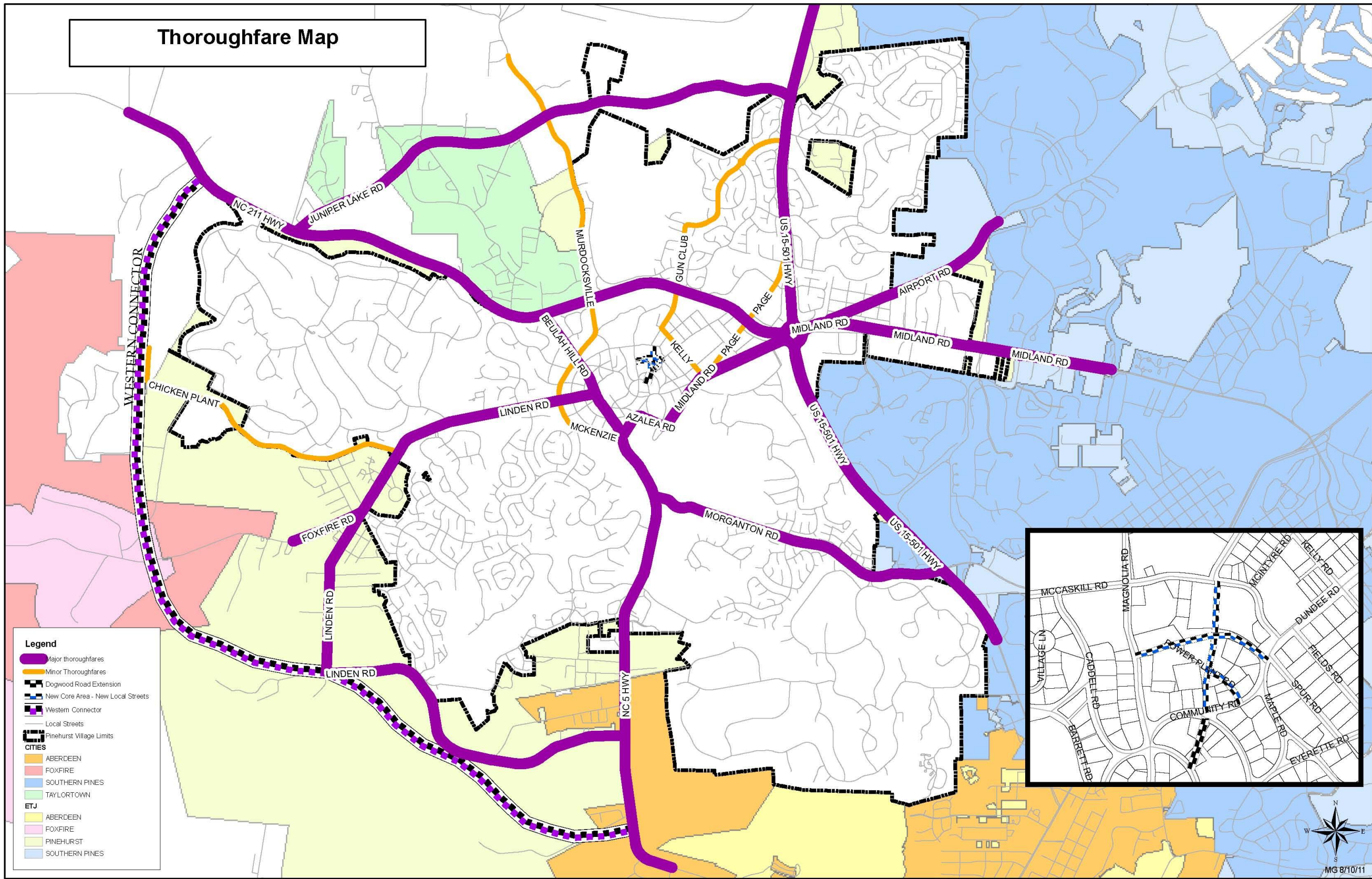
**Collector Streets** provide access to abutting properties. Local streets may be further classified as residential or commercial. Through traffic is generally discouraged on residential access streets, however, there are a few roads where these streets connect to thoroughfares. Examples would be Monticello Drive and Fields Road. There are local access streets in Pinehurst South which function as commercial access roads such as Blake Boulevard and Parker Lane.

### **Thoroughfare Map**

The Thoroughfare Map, included in this report on the next page, indicates how Pinehurst's roadways are classified for future road function, based on the categories of roads discussed above.



# Thoroughfare Map



- Legend**
- Major thoroughfares
  - Minor Thoroughfares
  - Dogwood Road Extension
  - New Core Area - New Local Streets
  - Western Connector
  - Local Streets
  - Pinehurst Village Limits
  - CITIES**
  - ABERDEEN
  - FOXFIRE
  - SOUTHERN PINES
  - TAYLORTOWN
  - ETJ**
  - ABERDEEN
  - FOXFIRE
  - PINEHURST
  - SOUTHERN PINES

## **Transportation Planning**

The Village of Pinehurst participates in the rural policy organization known as the Triangle Area Rural Policy Organization (TARPO). In the last decade the Village has worked dividing transportation planning efforts into long range and short range transportation planning.

## **Short Range Transportation Studies and Plans**

### **Community Indicator Reports**

In 2004 as a result of concerns over the quality of home development and efforts from the 2003 Village Long Range Plan, the annual Community Indicator Reports were undertaken by the planning staff. These reports focused on key /critical community indicators which included transportation. Utilizing Carl Simmons, traffic engineer and consultant, several key local improvements were made as a result of this excellent planning effort.

In the May 2006 Community Indicator report four intersections were selected for study which resulted in the intersection improvement at NC 5 and NC 2. The roundabout at Carolina Vista and NC 2 was included in this report and the 2003 Comprehensive Plan.

### **NC 5 Bi-Annual Traffic Update**

In 2005 the Village of Pinehurst completed a traffic review of the major intersections along NC 5, NC 2, and NC 211. The study provided a base condition of the existing traffic at these locations. In 2005, peak hour counts were obtained and the Level of Service at the intersections calculated. This information is important because it will be used to make future comparison, so that transportation projects can be developed for the Village. The Village has set up a two-year cycle for updating the traffic information along these transportation corridors. Studies were completed in 2005, 2007, 2009 and most recently the 2011 report.

Along NC 5, the seven intersections studied are:

- NC 5@ McDonald
- NC 5@ McKenzie
- NC 5 @ Barrett/McCaskill
- NC 5 @ NC2/McKenzie
- NC 5 @ Morganton
- NC 5 @ Monticello
- NC 5 @ Blake

Please refer to Appendix A for a summary of the approach volumes for the different intersection legs along the NC 5 corridor for the study years referenced above. Carl Simmons, PE prepared all of the referenced reports for the Village of Pinehurst in November 2005, May 2009 and May 2011. The Highway Capacity Manual standards were utilized in establishing the level of service (LOS). Several of the intersections are showing level of service changes since they were last studied in 2009. The westbound AM traffic at the intersection of NC 5 and McDonald Road is slightly improved from a level of service D changing to a level of service C.

The intersection of NC 5 at McKenzie Road is also showing an improved level of service for AM westbound traffic and PM eastbound traffic. This increase was caused by a 30% decrease in traffic on McKenzie Road. Consequently, this improved the AM westbound LOS on McKenzie Road from a LOS D to LOS C, and the eastbound PM level of service on McKenzie Road from LOS E to LOS D.

Levels of service improvements are also occurring on the Barrett/McCaskill six way intersection. The software and motion cameras used for the study could not analyze a six way intersection, so the traffic on Barrett Road and McCaskill Road was statistically combined to a four way intersection for better analysis. The AM eastbound level of service improved from LOS E to LOS C, while the AM westbound Level of Service improved from LOS F to LOS D. The PM analysis showed an improvement in the Level of Service for the eastbound traffic from LOS D to LOS C while the westbound Level of Service remained the same.

With stop signs controlling intersections, the poor levels of service can be found on the side streets along NC 5. The first signalized intersection in the study was NC 5 and NC 2 (Cherokee Road). The Simmons 2011 study found that traffic along NC 5 had increased by approximately 15% for the AM peak hour since the 2009 study. This increase has caused a decrease in the Level of Service during that peak hour from LOS B to LOS C. A slight increase in the PM peak hour did not change the level of service.

Please note at signalized intersections the Synchro software calculates the complete intersection.

At NC 5 and Morganton Road, north and southbound, AM traffic increased by 6%. This increase has caused both the northbound and southbound traffic at the intersection to decrease from LOS B to LOS C. The PM traffic at this intersection had an increase of 10% on the northbound, southbound and eastbound lanes which impacted the level of service, which decreased from LOS B to LOS D. The analysis stated this should not be cause for concern because the delay time only exceeds the level of C threshold by .7 seconds.

There were no changes to report in the level of service at the two remaining signalized intersections; NC 5 at Monticello Drive (East) and Lake Hills (West) and NC 5 at Blake Boulevard (East) and Trotter Road (West), which remained at the same level of service since the 2009 report period.

Please refer to NC 5 2011 Traffic Update in its entirety in Appendix A of this Thoroughfare Plan.

## **Long Range Transportation Planning**

### **2003 Comprehensive Long Range Plan**

It is not the intent of this Comprehensive Plan to accommodate traffic growth in Pinehurst to the exclusion of other factors. Community character is an essential element of what makes Pinehurst special and the community intends to fit transportation improvement that may be necessary into the fabric of the community rather than to the detriment of community character. This balancing act will be one of the challenges to the Plan.

To protect community character, roadway modifications will:

- Be limited to major thoroughfares to the extent possible,
- Discourage through traffic in residential neighborhoods,
- Maintain or enhance the roadway character (especially on historic and scenic roads such as Midland Road (the oldest median-divided highway in North Carolina) and Linden Road,
- Exhibit roadway designs that support and reinforce the “character” of Pinehurst.

Much of Pinehurst and the surrounding area has been developed with only a limited number of either continuous north-south or east-west roadways through the area. This has concentrated travel on a limited number of major roadways and is one of the reasons why traffic congestion is increasing in Pinehurst. The 2003 plan recommends improvement of regional connectivity through the establishment of alternative routes and roadway connections. Additional roadway connections will help distribute traffic over more routes and help reduce congestion.

As was stated in the 2003 Plan, the Pinehurst area has been developed with only a limited number of major roadways. This has concentrated travel on a few corridors which lead to and through the village. As traffic increases in the region, it ultimately increases in Pinehurst because four major highways pass through our historic village. These highways include:

- US 15-501
- NC 5
- NC 2
- NC 211

The 2003 plan strongly recommends the construction of the western bypass (also known as the western connector in later plans) to reduce traffic flow through the Village.



## **2010 Comprehensive Long Range Plan**

The Village of Pinehurst has had a roadway system for over a century, and there have been no significant changes for over forty years. The population has increased significantly over the last twenty years. Traffic congestion is of major importance, and its impact will become even more pronounced as the area continues to grow. Unfortunately, Pinehurst is incapable of solving these issues by itself because some traffic issues are the result of developments approved by adjacent communities. Meanwhile, the land area needed for such improvements falls under the jurisdiction of the North Carolina Department of Transportation (NCDOT), Moore County, or other incorporated places. Pinehurst encourages others to consider a long-term strategy in order for regional traffic needs to be met and to ensure that the overall character of Pinehurst is maintained and protected.

We need to manage the transportation system to ensure that it operates safely and with a reasonable level of service, supports community structure, and enhances community character. Pinehurst's character is an essential element of what makes it special, and transportation improvements should be designed to blend into the character of the community. It is the Village of Pinehurst's policy that traffic improvements should not have an adverse impact on ambience and character of the community. The Pinehurst area has been developed with only a limited number of major roadways, which has concentrated travel on these few corridors and is a main cause of increasing traffic congestion in Pinehurst and the surrounding areas. Since 2003 this problem has gotten worse. Additional housing has been constructed, and new developments have been approved, all without approving or constructing any new roadways. Directly, traffic volumes and congestion are increasing and are expected to increase significantly on all major roads in the area.

Pinehurst has sought to improve regional connectivity by establishing one or more alternative routes/roadway connections. Proposed projects significant to Pinehurst and the region are:

- Western Connector North - connecting Hwy 211 near Pinewild to Foxfire Road
- Western Connector South - connecting Foxfire Road to Linden Road near Lake Pinehurst and to NC Hwy5.
- Southern Connector - connecting NC Hwy 5 near Linden Road to the US 15-501 commercial area.
- Juniper Lake Road - widening and other improvements to provide relief to NC Hwy 211 and an alternate route to Carthage and points north of Pinehurst.

In addition to establishing alternative routes, Pinehurst must strive to ensure that necessary improvements be made to existing major roadways while preserving the community's character during this process. Some proposals for roadway improvements in the area include:

- **NC Hwy 211** – is presently being reconstructed as a four-lane highway by NCDOT. The village should make sure that improvements occur in a manner that is as compatible as possible with the character of Pinehurst with decorative traffic signals, tree lined center medians, pedestrian crossings and sidewalks where appropriate.
- **US 15-501** – needs a raised median, pedestrian/bicycle crossings, and realignment of Spring Lake Road at its intersections with Highway 15-501. We should advocate for these future improvements to be context sensitive and keep the tree canopy where ever possible.
- **Traffic Circle**- should be retained and preserved as it is a significant element in community character and an important entrance into the Village of Pinehurst.
- **NC Hwy 2** - should be further improved with a roundabout or other intersection improvement feature at Fields/Cherokee. It is important that traffic be guided to the village center at this location. Also additional improvements are needed at the Page Road intersection with NC 2.
- **NC Hwy 2** - (East of Traffic Circle)-should be preserved and maintained as North Carolina’s oldest median-divided highway in a manner that promotes it beauty and historic character.
- **NC Hwy 5** – needs continued intersection improvements, with traffic volumes projected to increase beyond the road’s capacity, establishing an alternate route is paramount in preserving the community historic character and quality of life. Make intersection improvements with preference for roundabouts especially at the Barrett/McCaskill intersection.
- **Morganton Rd. /Linden Rd** –we should encouraging alternative routes so as to minimize traffic growth in these areas.

In addition, Pinehurst needs to advocate and participate in local road improvements which:

- Advocate for context sensitive design in all transportation planning and design efforts
- Continue to prefer roundabouts over signalized intersection and other traffic control devices when considering intersection improvements.
- Assure appropriate landscaping as a high priority on road projects in our jurisdiction
- Preserve the tree canopy on local and regional projects to maintain our community character
- Preserve and enhance landscaping at gateway intersections
- Maintain and enhance landscape along road corridors
- Maintain strong design controls in the transportation planning review process
- Continue to investigate methods to minimize the overall costs of future pavement maintenance
- Continue to monitor traffic speeds

- Continue efforts to minimize the number of curb cuts and other possible disruptions to traffic flow, capacity, and safety on major roads.
- Continue to plan for additional sidewalks and trails to be integrated with local streets and NCDOT projects

### **Expansion of the Village Center Road Network**

Pedestrian and traffic patterns have been the subject of many studies in our Village Center and the New Core area. It is important to have a continuous level of pedestrian interest along our core Village streets. This type of expansion will maintain an active streetscape, which should lead to a strong market and an enhanced level of interest in the village center and adjacent areas.

The pedestrian connection needs to be resolved during the design of the Dogwood Road extension project. The planned roadway shown in the Thoroughfare Map for Dogwood Road extension should begin development in the near future to connect the Village Center with the proposed development in the New Core area. It is important to the success of future development and redevelopment projects; such as Magnolia Place and the Performing Arts Center.

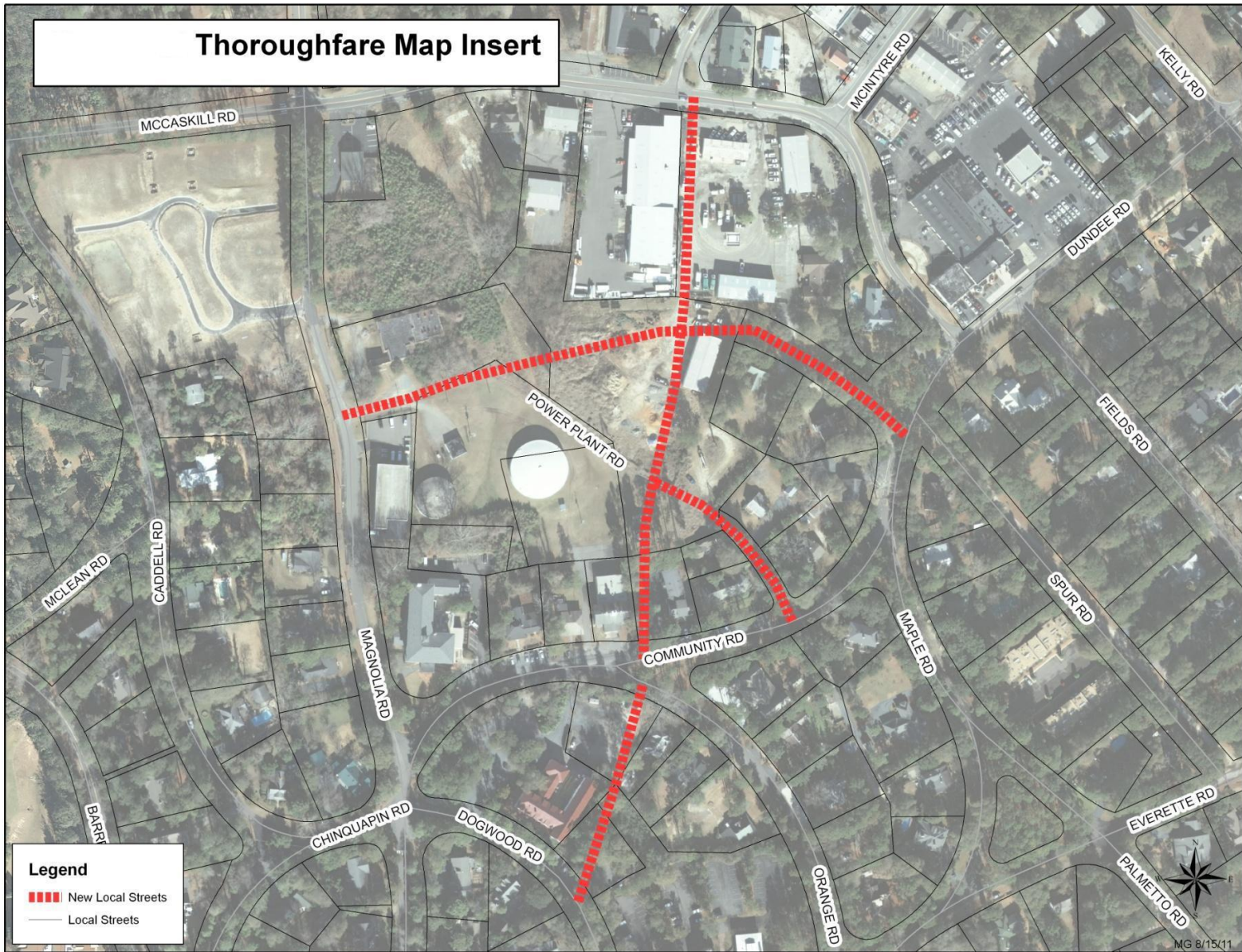
Another key issue outlined in the 2010 Comprehensive Plan is the incremental expansion of development. The continued success of existing mixed use development in the Village center is dependent on methodical incrementalism in expansion of our core village. This incremental approach to development will be controlled by zoning. Retail uses will occur in the VC zoning district which should be cautiously extended as the situation warrants.

This zoning process will clearly delineate the area where a retail streetscape is to occur. The first step is capital improvement planning for the Dogwood Road expansion project.

The adopted Implementation Element of the 2010 Comprehensive plan further supports the extension of Dogwood Road as the best method of expanding our village center business district to connect with the New Core redevelopment area.

The New Core Plan incorporates a concept in which new local access streets will be designed and constructed in order to break up the large block of land surrounded by McCaskill Road, Magnolia Road, Dundee Road and Community Road into a series of smaller development blocks consistent with the existing commercial development within the village center. The intent is to create a walkable, lively, human scale development area that will be an attraction to residents and visitors alike.

See the Dogwood Road Extension as well as the connecting blocks of roads associated with redevelopment in New Core location map on the following page.



## **Bike/Pedestrian**

A major strategy of the Strategic Element of the 2010 Comprehensive Plan is to prepare a pedestrian/Bicycle Master Plan. Due to the growing interest in walking and bicycling, this plan's goals see to standardize the overall approach to bicycle and pedestrian circulation in Pinehurst and to find ways to provide more and better facilities throughout the community.

The 2010 Comprehensive Plan Implementation Strategy calls for development of a Bicycle/Pedestrian Master Plan slated for completion in 2013. An ongoing goal is to provide for bicycles in the Village Center area. Pinehurst presently has brick sidewalks in the busiest parts and sand-clay walkways in other areas. In addition, a greenway trail system has been established which connects some of the surrounding areas to the Village Center. Since the brick sidewalks enhance the overall Village Center experience, the Plan recommends that brick sidewalks of generous width continue to be maintained in the business areas of the Village Center and expanded along major roadways to connect to major uses as opportunities present themselves. The historic sand/clay paths in the Village Center area should be retained in historic district residential areas but these are not considered appropriate for high foot-traffic and business areas since they can be messy and are often not well-maintained.

In outlying areas, the long-term goal is to provide for pedestrian circulation through establishment of sidewalks in business areas and establishment of a greenway trail system in residential neighborhoods. It may be desirable to consider the establishment of sidewalks along some of the major streets in the residential neighborhoods or seek more ways to help people get to the greenway trail system. In the 2010 Comprehensive Plan telephone survey 64 percent of respondents felt that Pinehurst needed more sidewalks on main roads in residential neighborhoods. In addition, 56 percent of those surveyed indicated they would walk more if there was an improved trail system in Pinehurst.

The Sandhills area is known regionally as an area for bicyclists, and bicycle use within Pinehurst is increasing for recreational and other reasons. In public meetings held as part of preparing the 2010 Comprehensive Long Range Plan, residents indicated they would ride a bicycle more often if there were an improved trail system in Pinehurst. If the trail system connected to adjacent communities, the appeal of bicycle riding would greatly increase.

Within the Village Center, bicycle use is easily accommodated due to the low travel speeds and a variety of routes. The Resort provides bicycles for guests to explore the Village Center and other areas. Outside of the Center, the greenway network could provide for bicycle circulation in a way that supports and enhances community character. This might include improved road shoulders, striped bike lanes, additional signage, and bicycle racks. Overall, Pinehurst should seek ways to provide for and encourage bicycle circulation and for bike lanes to be considered in future road projects.



## **Conclusion**

The Village of Pinehurst should continue to work closely with the Moore County Multi-modal Transportation Plan being prepared by the planning branch at NCDOT. Without this plan in place, we will not be eligible for future NCDOT road improvement projects.

The continued bi-yearly traffic update is essential to managing local and state partnered projects such as the intersection improvement at NC 5 and NC 2 as well as the roundabout at Carolina Vista and NC 2.

In the last decade the Village has worked diligently both in excellent capital improvement planning and exceptional comprehensive planning to assure that the Village of Pinehurst's quality is preserved and maintained for future generations.

# Appendix A

## NC 5

### 2011 TRAFFIC UPDATE

PREPARED FOR *THE VILLAGE OF PINEHURST*

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8/16/11

## **BACKGROUND**

In 2005 the Village of Pinehurst did a traffic review of the major intersections along NC 5, NC 2, and NC 211. The study provided a base condition of the existing traffic at these locations. In 2005, peak hour traffic counts were obtained and the Level of Service at the study intersections was calculated. That information is the base on which to make future comparisons so that transportation plans and projects can be developed for the Village. The Village has set up a 2 year cycle for updating the traffic information along these transportation corridors. The first update was done in 2007, the second update was performed in 2009 and the current update has recently been completed for the intersections along NC 5.

## **2011 UPDATE**

Along NC 5, seven intersections were studied and those intersections are listed below.

NC 5 @ McDonald – April 26, 2011

NC 5 @ McKenzie – April 21, 2011

NC 5 @ Barrett/McCaskill – April 20, 2011

NC 5 @ NC 2/McKenzie – April 19, 2011

NC 5 @ Morganton – April 14, 2011

NC 5 @ Monticello – April 13, 2011

NC 5 @ Blake – April 12, 2011

New AM and PM peak hour turning movement counts were taken at the above intersections during April. At the NC 5/McDonald, NC 5/Morganton and NC5/Blake/Trotter intersections, AM, Noon and PM turning movement counts were taken. The counts were performed utilizing Miovision Technologies Classic Video Collections Unit. The counts coincided with the schools being open. Figure 1 shows the peak hour volumes for the northern section of NC 5 and Figure 2 shows the peak hour volumes for the southern section of NC 5.

Table 1 is a summary of the approach volumes for the different intersection legs along the NC 5 corridor for the study years of 2005, 2007, 2009 and 2011. Approach volumes are the sum of the actual turning movement counts for that leg of the intersection. By comparing approach volumes over the different years, one can see the amount traffic change that has taken place along this roadway.

## Pinehurst 2005-2011 AM & PM Peak Hour Approach Volumes

North Section of NC 5 between McDonald and Barrett

### McDonald & NC 5

	<u>2005 AM</u>	<u>2007 AM</u>	<u>2009 AM</u>	<u>2011 AM</u>	<u>2009-2011 Difference</u>		<u>2005 PM</u>	<u>2007 PM</u>	<u>2009 PM</u>	<u>2011 PM</u>	<u>2009-2011 Difference</u>
<b><u>Southbound</u></b>											
Approach Volumes	387	366	522	561	39		434	447	507	553	46
<b><u>Westbound</u></b>											
Approach Volumes	8	7	8	6	-2		13	5	7	5	-2
<b><u>Northbound</u></b>											
Approach Volumes	302	303	352	456	104		346	464	431	458	27
<b><u>Eastbound</u></b>											
Approach Volumes	16	14	41	53	12		19	11	11	10	-1

### NC5 & McKenzie

	<u>2005 AM</u>	<u>2007 AM</u>	<u>2009 AM</u>	<u>2011 AM</u>	<u>2009-2011 Difference</u>		<u>2005 PM</u>	<u>2007 PM</u>	<u>2009 PM</u>	<u>2011 PM</u>	<u>2009-2011 Difference</u>
<b><u>Southbound</u></b>											
Approach Volumes	390	354	521	562	41		411	432	504	589	85
<b><u>Westbound</u></b>											
Approach Volumes	57	37	34	24	-10		59	62	48	33	-15
<b><u>Northbound</u></b>											
Approach Volumes	295	283	336	363	27		354	482	416	487	71
<b><u>Eastbound</u></b>											
Approach Volumes	111	83	93	144	51		53	53	43	26	-17

**NC5 & Barrett & McCaskill**

	<u>2005 AM</u>	<u>2007 AM</u>	<u>2009 AM</u>	<u>2011 AM</u>	<u>2009 - 2011 Difference</u>		<u>2005 PM</u>	<u>2007 PM</u>	<u>2009 PM</u>	<u>2011 PM</u>	<u>2009-2011 Difference</u>
<b><u>Southbound</u></b>											
Approach Volumes	389	499	497	492	-5		391	433	353	429	76
<b><u>Southwestbound</u></b>											
Approach Volumes	83	79	61	54	-7		105	87	142	82	-60
<b><u>Northwestbound</u></b>											
Approach Volumes	20	4	3	8	5		41	19	22	15	-7
<b><u>Northbound</u></b>											
Approach Volumes	338	409	385	392	7		356	445	484	480	-4
<b><u>Northeastbound</u></b>											
Approach Volumes	9	11	4	N/A	N/A		3	11	2	N/A	N/A
<b><u>Southeastbound</u></b>											
Approach Volumes	35	56	59	52	-7		31	17	100	22	-78

**TABLE 1**



## Pinehurst 2005-2011 AM & PM Peak Hour Approach Volumes

NC 5 between Cherokee Road (NC @) and Blake Boulevard

### NC 5 & Cherokee Road (NC 2)

	<u>2005 AM</u>	<u>2007 AM</u>	<u>2009 AM</u>	<u>2011 AM</u>	<u>2009-2011 Difference</u>		<u>2005 PM</u>	<u>2007 PM</u>	<u>2009 PM</u>	<u>2011 PM</u>	<u>2009-2011 Difference</u>
<b><u>Southbound</u></b>											
Approach Volumes	494	519	463	549	86		495	526	456	474	18
<b><u>Westbound</u></b>											
Approach Volumes	287	261	201	203	2		509	543	437	459	22
<b><u>Northbound</u></b>											
Approach Volumes	776	800	683	765	82		693	855	730	796	66
<b><u>Eastbound</u></b>											
Approach Volumes	443	185	355	384	29		136	185	143	154	11

### NC 5 & Morganton Road

	<u>2005 AM</u>	<u>2007 AM</u>	<u>2009 AM</u>	<u>2011 AM</u>	<u>2009-2011 Difference</u>		<u>2005 PM</u>	<u>2007 PM</u>	<u>2009 PM</u>	<u>2011 PM</u>	<u>2009-2011 Difference</u>
<b><u>Southbound</u></b>											
Approach Volumes	680	556	691	717	26		917	821	767	862	95
<b><u>Westbound</u></b>											
Approach Volumes	231	173	235	237	2		401	375	430	483	53
<b><u>Northbound</u></b>											
Approach Volumes	695	601	584	638	54		601	553	500	523	23
<b><u>Eastbound</u></b>											
Approach Volumes	5	3	5	3	-2		10	4	3	3	0

**NC5 & Monticello/Lake Hills**

	<u>2005 AM</u>	<u>2007 AM</u>	<u>2009 AM</u>	<u>2011 AM</u>	<u>2009-2011 Difference</u>		<u>2005 PM</u>	<u>2007 PM</u>	<u>2009 PM</u>	<u>2011 PM</u>	<u>2009-2011 Difference</u>
<b><u>Southbound</u></b>											
Approach Volumes	504	403	441	414	-27		650	638	586	604	18
<b><u>Westbound</u></b>											
Approach Volumes	51	54	57	42	-15		132	126	93	136	43
<b><u>Northbound</u></b>											
Approach Volumes	610	543	537	526	-11		510	572	484	500	16
<b><u>Eastbound</u></b>											
Approach Volumes	186	153	200	222	22		131	120	128	145	17

TABLE 1

**Pinehurst 2005-2011 AM & PM Peak Hour Approach Volumes**

*NC 5 between Cherokee Road (NC @) and Blake Boulevard - continued*

**NC5 & Blake/Trotter**

	<u>2005 AM</u>	<u>2007 AM</u>	<u>2009 AM</u>	<u>2011 AM</u>	<u>2009-2011 Difference</u>		<u>2005 PM</u>	<u>2007 PM</u>	<u>2009 PM</u>	<u>2011 PM</u>	<u>2009-2011 Difference</u>
<b><u>Southbound</u></b>											
Approach Volumes	450	377	432	456	24		693	474	576	600	24
<b><u>Westbound</u></b>											
Approach Volumes	67	55	79	64	-15		287	150	214	191	-23
<b><u>Northbound</u></b>											
Approach Volumes	632	516	508	607	99		553	428	552	504	-48
<b><u>Eastbound</u></b>											
Approach Volumes	47	34	33	37	4		39	25	38	33	-5

TABLE 1

The intersections were grouped into two sections along NC 5. The first section is from McDonald to Barrett/McCaskill and is called the North Section. The second section is from NC 2 to Blake and is referred to as the South Section. The North Section is composed of all stop sign controlled intersections and the South Section has the signalized intersections.

All of the intersections were analyzed with Synchro 6 software to determine the present Levels of Service. The Table 2 below compares the changes in Level of Service from 2005 to 2011 at the different study intersections.

**2011 PINEHURST NC 5 TRAFFIC UPDATE**

**LEVEL OF SERVICE COMPARISON**

INTERSECTION	AM PERIOD						PM PERIOD			
	2005	2007	2009	2011			2005	2007	2009	2011
NC 5 @ MCDONALD	C-C	C-B	D-D	D-C		C-C	C-C	C-B	C-C	
NC 5 @ MCKENZIE	D-D	D-D	E-D	E-C		C-C	D-D	E-D	D-D	
NC 5 @ BARRETT	C-C	D-E	E-F	C-D		C-D	C-C	D-D	C-D	
NC 5 @ NC 2	C	B	B	C		C	D	B	B	
NC 5 @ MORGANTON	C	B	B	C		B	B	B	D	
NC 5 @ MONTICELLO	B	B	B	B		C	B	B	B	
NC 5 @ BLAKE	A	A	A	A		B	A	A	A	

**TABLE 2**

The Highway Capacity Manual defines capacity as “the maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform section of a lane or roadway during a given time period under prevailing roadway, traffic, and control conditions”. Level of Service (LOS) is a term used to describe different driving conditions and is a qualitative measure describing the traffic conditions. LOS will go from “A” to “F” and these levels are broken out based on average control delay per vehicle. The table below shows the different levels of service and the related delays.

## HCM Level of Service and Delay Table

### Stop Sign Controlled

### Signalized Intersections

LEVEL OF SERVICE	AVERAGE CONTROL DELAY PER VEHICLE (seconds)	LEVEL OF SERVICE	AVERAGE CONTROL DELAY PER VEHICLE (seconds)
A	0 to 10	A	0 to 10
B	10 to 15	B	10 to 20
C	15 to 25	C	20 to 35
D	25 to 35	D	35 to 55
E	35 to 50	E	55 to 80
F	>50	F	>80

Based on the intersection capacity information, several of the intersections are showing a change in Level of Service when compared to the 2009 study.

The Level of Service for westbound AM traffic at the intersection of NC 5 and McDonald Road is showing a slight improvement from LOS D to LOS C. This is due to the slight decrease in AM traffic in the westbound direction. The westbound traffic experienced a slight decrease in LOS in the afternoon, due to the increase in traffic on NC 5. The PM LOS for the westbound traffic at this intersection decreased from LOS B to LOS C.

The intersection of NC 5 at McKenzie Road is showing an improved Level of Service for AM westbound traffic and PM eastbound traffic. Both the westbound AM traffic and the eastbound PM traffic on McKenzie Road decreased by approximately 30%. The westbound AM Level of Service improved from LOS D to LOS C, while the eastbound PM Level of Service improved from LOS E to LOS D.

At the six way intersection of NC 5 at Barrett Road and McCaskill Road, the Miovision Camera could not discern the turning movements from McCaskill Road W. These movements were combined with the southeast bound traffic on Barrett Road W. Synchro 6 software could not analyze this intersection as a six way intersection, so the traffic on Barrett and McCaskill was combined for a four way

analysis. This analysis showed an improvement in the Level of Service for both east and westbound AM traffic. The AM eastbound Level of Service improved from LOS E to LOS C, while the AM westbound Level of Service improved from LOS F to LOS D. The PM analysis showed an improvement in the Level of Service for the eastbound traffic, from LOS D to LOS C while the westbound Level of Service remained the same. These improvements are all due to the decrease in traffic along Barrett Road and McCaskill Road. However, due to the conflicting traffic movements at this intersection, it is our recommendation that Barrett Road E be closed with a cul-de-sac or a hammerhead turn around. This road has a minimal amount of traffic approaching NC 5. Two sketches of the intersection changes are in the Appendix.

With these stop sign controlled intersections, the poor Level of Service is for the side street delay. In general terms, the approach delay per vehicle is in the 30 second range. The actual calculated delay is shown on the Synchro printouts.

The first signalized intersection in our study is the intersection of NC 5 at NC 2 (Cherokee Road). Our study indicated that the traffic along NC 5 has increased by approximately 15% during the AM peak hour period. This has caused the AM Level of Service for the intersection to decrease from LOS B to LOS C. The slight increase in traffic during the PM peak hour period did not affect the Level of Service for this intersection.

At NC 5 and Morganton Road, the AM traffic, north and southbound, increased by approximately 6%. This increase has caused the AM Level of Service at the intersection to decrease from LOS B to LOS C. The PM traffic at this intersection experienced a greater increase of approximately 10% in northbound, southbound and westbound directions. The increase in traffic has caused the PM Level of Service at the intersection to decrease from LOS B to LOS D. However, the threshold for Level of Service D is 35 seconds, and the delay time for the intersection exceeds this threshold by only 0.7 seconds. Therefore, this decrease in Level of Service should not cause concern.

The remaining signalized intersections, NC 5 at Monticello Drive (E) and Lake Hills Road (W) and NC 5 at Blake Road (E) and Trotter Road (W), maintained the same Level of Service as 2009.



## **Summary**

The slight improvement in Level of Service northern section of NC 5 is due to a decrease in the east and westbound traffic on the side streets at the NC5/McDonald and NC 5/McKenzie intersections.

The southern section of NC 5 is showing a volume increase at both NC 2 and Morganton Roads, resulting in a decreased Level of Service at these intersections. However, the Level of Service at these signalized intersections remains very good.

The intersection of NC 5 at Barrett/McCaskill is operating at a level of service D for side street delay. Some alternative intersection layouts are provided for that intersection and the changes should improve its overall operation.

The turning movement counts and capacity analyses are included in the Appendix and they provide the details for this report.

## Pinehurst 2005-2011 AM & PM Peak Hour Approach Volumes

NC 5 between Cherokee Road (NC @) and Blake Boulevard - continued

### NC5 & Blake/Trotter

	<u>2005</u> <u>AM</u>	<u>2007</u> <u>AM</u>	<u>2009</u> <u>AM</u>	<u>2011</u> <u>AM</u>	<u>2009-2011</u> <u>Difference</u>		<u>2005</u> <u>PM</u>	<u>2007</u> <u>PM</u>	<u>2009</u> <u>PM</u>	<u>2011</u> <u>PM</u>	<u>2009-2011</u> <u>Difference</u>
<b><u>Southbound</u></b>											
Approach Volumes	450	377	432	456	24		693	474	576	600	24
<b><u>Westbound</u></b>											
Approach Volumes	67	55	79	64	-15		287	150	214	191	-23
<b><u>Northbound</u></b>											
Approach Volumes	632	516	508	607	99		553	428	552	504	-48
<b><u>Eastbound</u></b>											
Approach Volumes	47	34	33	37	4		39	25	38	33	-5

TABLE 1

The intersections were grouped into two sections along NC 5. The first section is from McDonald to Barrett/McCaskill and is called the North Section. The second section is from NC 2 to Blake and is referred to as the South Section. The North Section is composed of all stop sign controlled intersections and the South Section has the signalized intersections.

All of the intersections were analyzed with Synchro 6 software to determine the present Levels of Service. The Table 2 below compares the changes in Level of Service from 2005 to 2011 at the different study intersections.

**2011 PINEHURST NC 5 TRAFFIC UPDATE**

**LEVEL OF SERVICE COMPARISON**

INTERSECTION	AM PERIOD						PM PERIOD			
	2005	2007	2009	2011			2005	2007	2009	2011
NC 5 @ MCDONALD	C-C	C-B	D-D	D-C		C-C	C-C	C-B	C-C	
NC 5 @ MCKENZIE	D-D	D-D	E-D	E-C		C-C	D-D	E-D	D-D	
NC 5 @ BARRETT	C-C	D-E	E-F	C-D		C-D	C-C	D-D	C-D	
NC 5 @ NC 2	C	B	B	C		C	D	B	B	
NC 5 @ MORGANTON	C	B	B	C		B	B	B	D	
NC 5 @ MONTICELLO	B	B	B	B		C	B	B	B	
NC 5 @ BLAKE	A	A	A	A		B	A	A	A	

**TABLE 2**

The Highway Capacity Manual defines capacity as “the maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform section of a lane or roadway during a given time period under prevailing roadway, traffic, and control conditions”. Level of Service (LOS) is a term used to describe different driving conditions and is a qualitative measure describing the traffic conditions. LOS will go from “A” to “F” and these levels are broken out based on average control delay per vehicle. The table below shows the different levels of service and the related delays.

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#### Stop Sign Controlled

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Based on the intersection capacity information, several of the intersections are showing a change in Level of Service when compared to the 2009 study.

The Level of Service for westbound AM traffic at the intersection of NC 5 and McDonald Road is showing a slight improvement from LOS D to LOS C. This is due to the slight decrease in AM traffic in the westbound direction. The westbound traffic experienced a slight decrease in LOS in the afternoon, due to the increase in traffic on NC 5. The PM LOS for the westbound traffic at this intersection decreased from LOS B to LOS C.

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At the six way intersection of NC 5 at Barrett Road and McCaskill Road, the Miovision Camera could not discern the turning movements from McCaskill Road W. These movements were combined with the southeast bound traffic on Barrett Road W. Synchro 6 software could not analyze this intersection as a six way intersection, so the traffic on Barrett and McCaskill was combined for a four way analysis. This analysis showed an improvement in the Level of Service for both east and westbound AM traffic. The AM eastbound Level of Service improved from LOS E to LOS C, while the AM westbound Level of Service improved from LOS F to LOS D. The PM analysis showed an improvement in the Level of Service for the eastbound traffic, from LOS D to LOS C while the westbound Level of Service remained the same. These improvements are all due to the decrease in traffic along Barrett Road and McCaskill Road. However, due to the conflicting traffic movements at this intersection, it is our recommendation that Barrett Road E be closed with a cul-de-sac or a hammerhead turn around. This road has a minimal amount of traffic approaching NC 5. Two sketches of the intersection changes are in the Appendix.

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At NC 5 and Morganton Road, the AM traffic, north and southbound, increased by approximately 6%. This increase has caused the AM Level of Service at the intersection to decrease from LOS B to LOS C. The PM traffic at this intersection experienced a greater increase of approximately 10% in northbound, southbound and westbound directions. The increase in traffic has caused the PM Level of Service at the intersection to decrease from LOS B to LOS D. However, the threshold for Level of Service D is 35 seconds, and the delay time for the intersection exceeds this threshold by only 0.7 seconds. Therefore, this decrease in Level of Service should not cause concern.

The remaining signalized intersections, NC 5 at Monticello Drive (E) and Lake Hills Road (W) and NC 5 at Blake Road (E) and Trotter Road (W), maintained the same Level of Service as 2009.

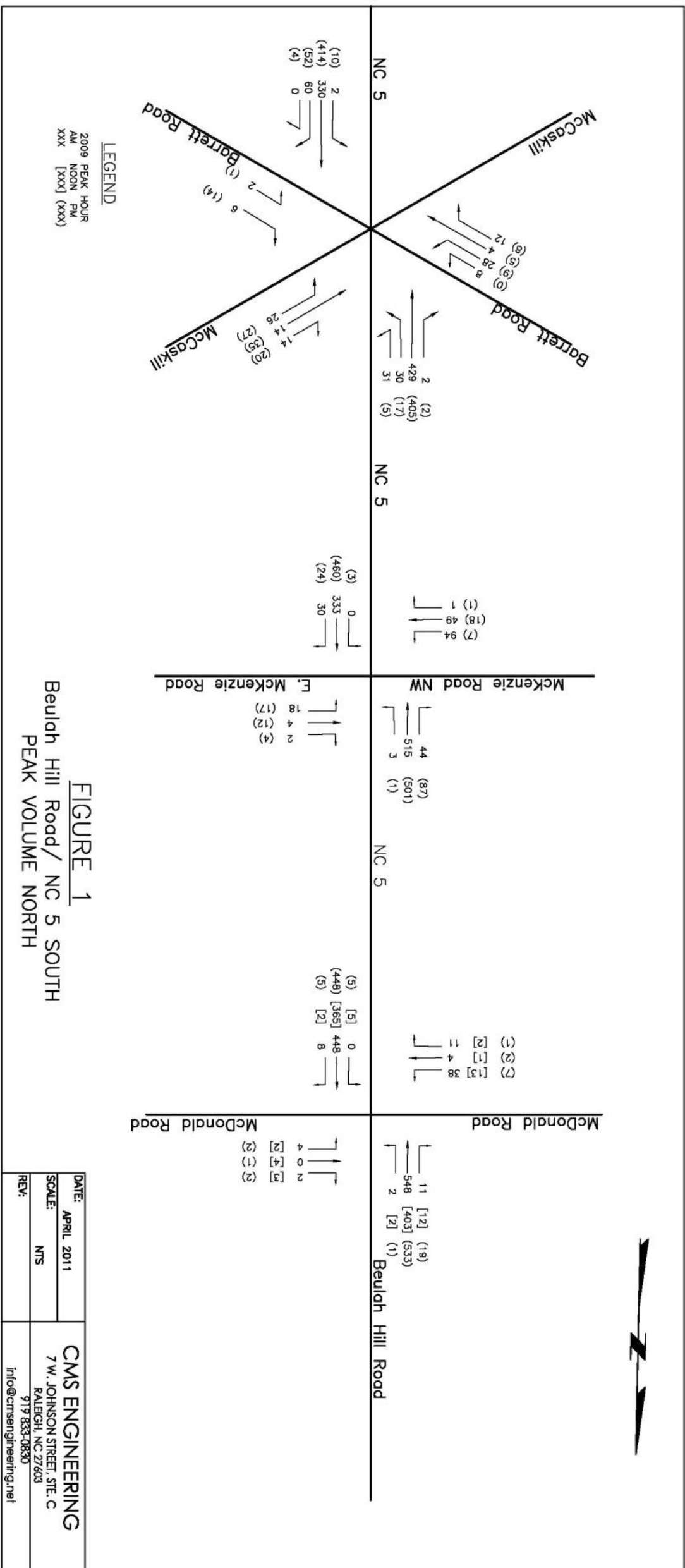
## **Summary**

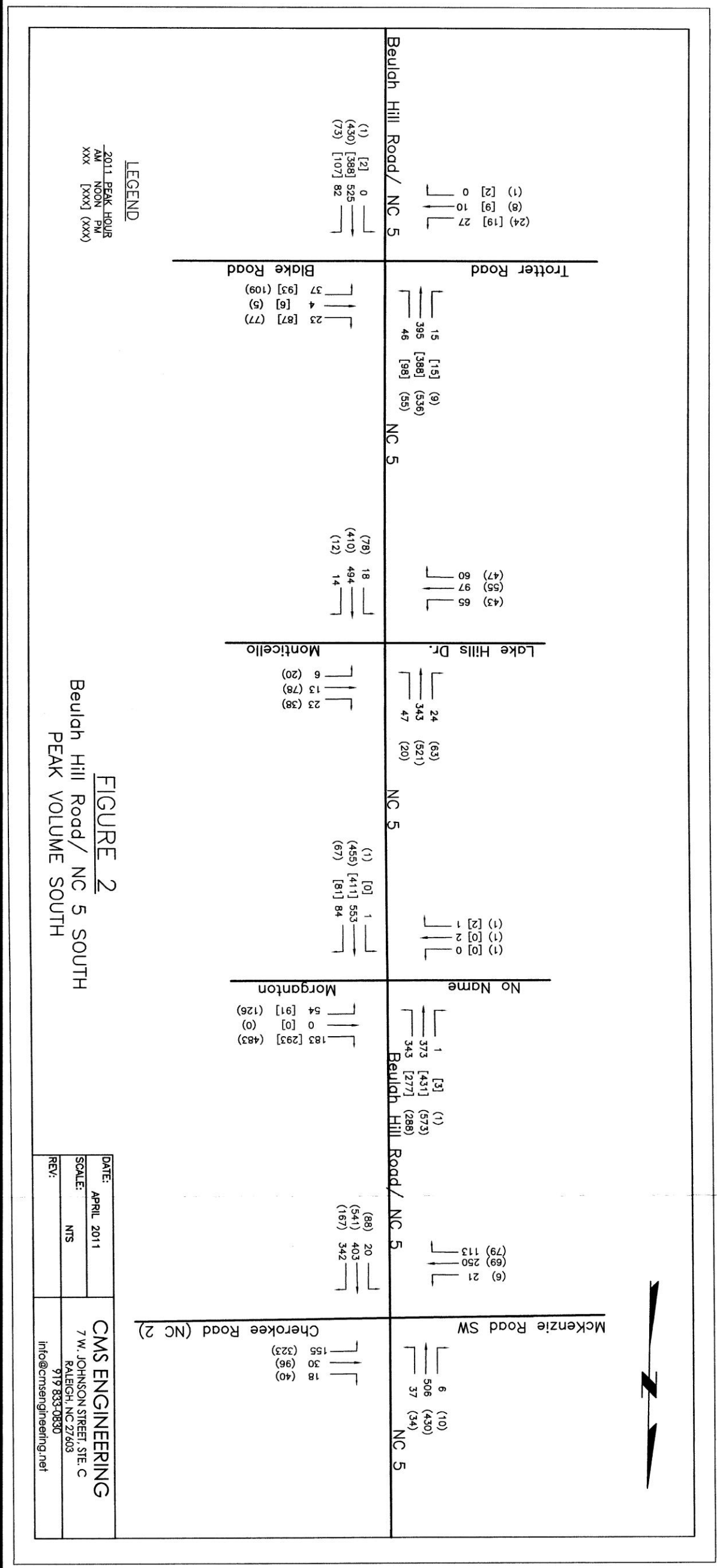
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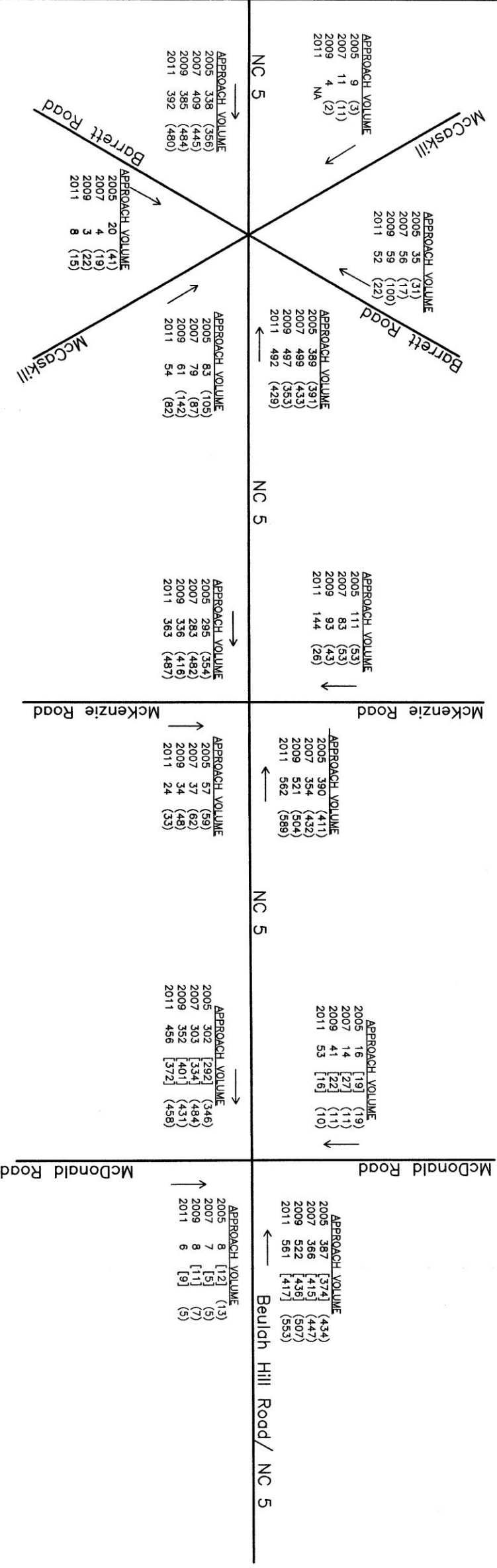




**FIGURE 2**  
Beulah Hill Road / NC 5 SOUTH  
PEAK VOLUME SOUTH

DATE:	APRIL 2011	<b>CMS ENGINEERING</b> 7 W. JOHNSON STREET, STE. C RALEIGH, NC 27603 919 833-0830 info@cmsengineering.net
SCALE:	NTS	
REV:		

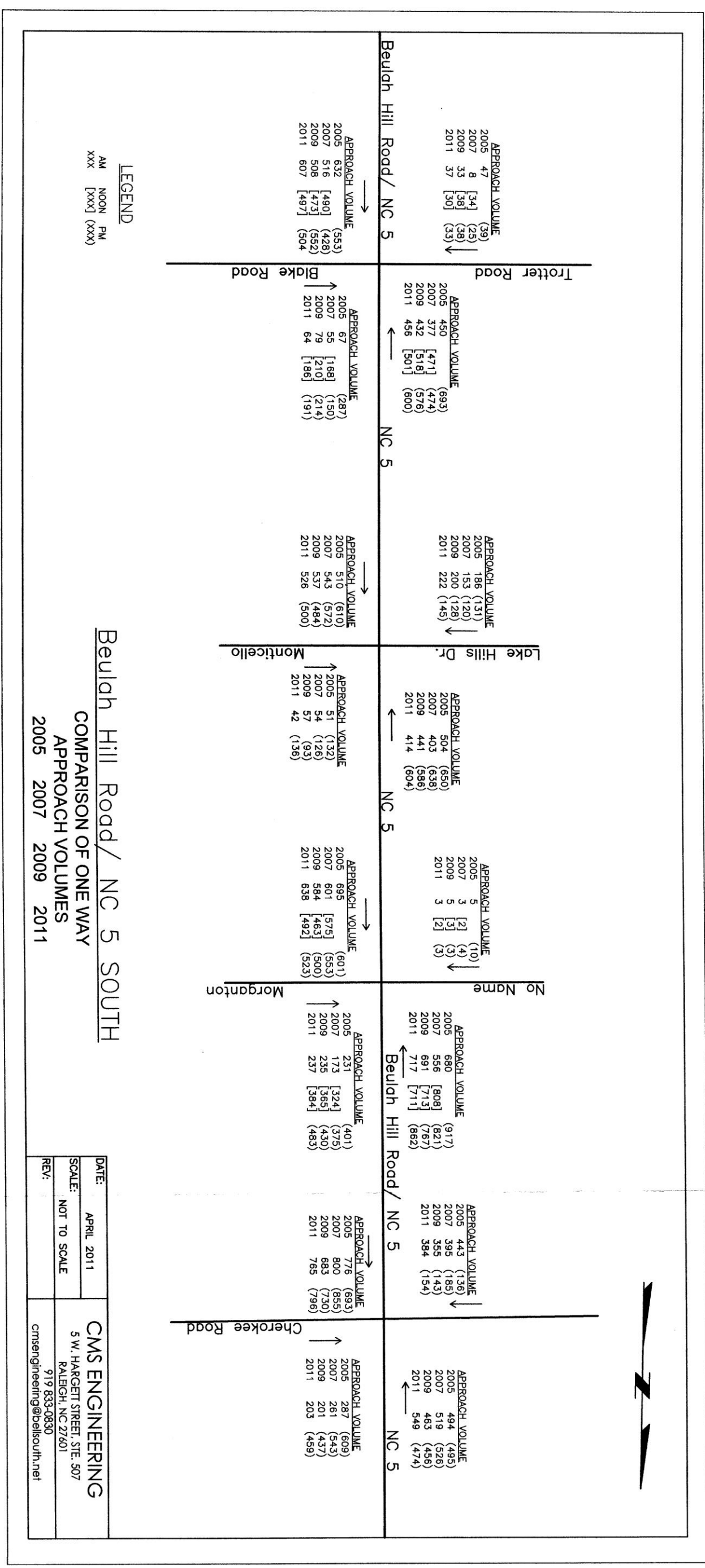




**LEGEND**  
 AM [xxx] (xxx)  
 NOON [xxx] (xxx)  
 PM [xxx] (xxx)

**Beulah Hill Road / NC 5 SOUTH**  
**COMPARISON OF ONE WAY**  
**APPROACH VOLUMES**  
 2005 2007 2009 2011

DATE:	APRIL 2011	<b>CMS ENGINEERING</b> 5 W. HARGETT STREET, STE. 507 RALEIGH, NC 27601 919 833-0830 cmsengineering@bellsouth.net
SCALE:	NOT TO SCALE	
REV:		



**Beulah Hill Road / NC 5 SOUTH**  
**COMPARISON OF ONE WAY**  
**APPROACH VOLUMES**  
 2005 2007 2009 2011

DATE:	APRIL 2011	<b>CMS ENGINEERING</b> 5 W. HARGETT STREET, STE. 507 RALEIGH, NC 27601 919 833-0830 cmsengineering@bellsouth.net
SCALE:	NOT TO SCALE	
REV:		

HCM Signalized Intersection Capacity Analysis  
 45: MONTICELLO DR & NC 5

2011 PM  
 5/19/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↖	↗		↖	↗	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Fit		0.96			0.96		1.00	1.00		1.00	0.98	
Fit Protected		0.99			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1755			1780		1770	1855		1770	1833	
Fit Permitted		0.73			0.90		0.32	1.00		0.47	1.00	
Satd. Flow (perm)		1299			1620		603	1855		883	1833	
Volume (vph)	43	55	47	20	78	38	78	410	12	20	521	63
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	47	60	51	22	85	41	85	446	13	22	566	68
RTOR Reduction (vph)	0	20	0	0	16	0	0	1	0	0	2	0
Lane Group Flow (vph)	0	138	0	0	132	0	85	458	0	22	632	0
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		13.9			13.9		79.2	73.3		73.0	70.2	
Effective Green, g (s)		15.4			15.4		81.7	74.8		75.5	71.7	
Actuated g/C Ratio		0.15			0.15		0.77	0.71		0.71	0.68	
Clearance Time (s)		5.5			5.5		5.0	5.5		5.0	5.5	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		189			235		541	1309		661	1240	
v/s Ratio Prot							c0.01	0.25		0.00	c0.34	
v/s Ratio Perm		c0.11			0.08		0.11			0.02		
v/c Ratio		0.73			0.56		0.16	0.35		0.03	0.51	
Uniform Delay, d1		43.3			42.2		4.6	6.1		4.5	8.5	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		13.6			3.0		0.1	0.7		0.0	1.5	
Delay (s)		56.9			45.2		4.7	6.8		4.5	10.0	
Level of Service		E			D		A	A		A	A	
Approach Delay (s)		56.9			45.2			6.5			9.8	
Approach LOS		E			D			A			A	

Intersection Summary			
HCM Average Control Delay	17.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	106.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	61.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis  
 28: MCDONALD RD & NC 5

2011 AM  
 5/16/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Line Configurations	↕			↕			↕			↕		
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	38	4	11	4	0	2	0	448	8	2	548	11
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	41	4	12	4	0	2	0	487	9	2	596	12
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1099	1102	602	1111	1103	491	608				496	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1099	1102	602	1111	1103	491	608				496	
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
p0 queue free %	78	98	98	98	100	100	100				100	
cM capacity (veh/h)	189	211	500	179	211	577	971				1068	

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	58	7	496	610
Volume Left	41	4	0	2
Volume Right	12	2	9	12
cSH	219	232	971	1068
Volume to Capacity	0.26	0.03	0.00	0.00
Queue Length 95th (ft)	26	2	0	0
Control Delay (s)	27.2	21.0	0.0	0.1
Lane LOS	D	C		A
Approach Delay (s)	27.2	21.0	0.0	0.1
Approach LOS	D	C		

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	41.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis  
 31: MCKENZIE RD & NC 5

2011 AM  
 5/16/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↕			↕			↕			↕		
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	94	49	1	18	4	2	0	333	30	3	515	44
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	102	53	1	20	4	2	0	362	33	3	560	48
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)												
pk, platoon unblocked												
vc, conflicting volume	973	985	584	996	992	378	608				395	
vc1, stage 1 conf vol												
vc2, stage 2 conf vol												
vcu, unblocked vol	973	985	584	996	992	378	608				395	
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
pl queue free %	55	78	100	89	98	100	100				100	
cm capacity (veh/h)	227	247	512	185	245	668	971				1164	

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	157	26	395	611
Volume Left	102	20	0	3
Volume Right	1	2	33	48
cSH	235	206	971	1164
Volume to Capacity	0.67	0.13	0.00	0.00
Queue Length 95th (ft)	105	11	0	0
Control Delay (s)	46.5	25.0	0.0	0.1
Lane LOS	E	C		A
Approach Delay (s)	46.5	25.0	0.0	0.1
Approach LOS	E	C		

Intersection Summary			
Average Delay	6.7		
Intersection Capacity Utilization	47.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis  
 34: BARRETT RD & NC 5

2011 AM  
 5/19/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Diagram												
Lane Configurations	↕			↕			↕			↕		
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	8	32	12	28	14	20	2	330	60	61	429	2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	35	13	30	15	22	2	359	65	66	466	2
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)												
pk, platoon unblocked												
vC, conflicting volume	1025	1028	467	1026	997	391	468			424		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1025	1028	467	1026	997	391	468			424		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	95	84	98	83	93	97	100			94		
cM capacity (veh/h)	187	220	596	175	229	657	1093			1135		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	57	67	426	535								
Volume Left	9	30	2	66								
Volume Right	13	22	65	2								
cSH	249	246	1093	1135								
Volume to Capacity	0.23	0.27	0.00	0.06								
Queue Length 95th (ft)	21	27	0	5								
Control Delay (s)	23.6	25.0	0.1	1.6								
Lane LOS	C	D	A	A								
Approach Delay (s)	23.6	25.0	0.1	1.6								
Approach LOS	C	D										
Intersection Summary												
Average Delay				3.6								
Intersection Capacity Utilization				65.4%	ICU Level of Service	C						
Analysis Period (min)				15								

HCM Signalized Intersection Capacity Analysis  
 39: CHEROKEE NC2 & NC 5

2011 AM  
 5/19/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↶	↷		↶	↷		↶	↷	↶	↷	↶	↷
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Flt	1.00	0.95		1.00	0.94		1.00	1.00	0.85	1.00	1.00	1.00
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1776		1770	1757		1770	1863	1583	1770	1859	1859
Flt Permitted	0.72	1.00		0.45	1.00		0.16	1.00	1.00	0.29	1.00	1.00
Satd. Flow (perm)	1346	1776		843	1757		292	1863	1583	540	1859	1859
Volume (vph)	21	250	113	155	30	18	20	403	342	37	506	6
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	23	272	123	168	33	20	22	438	372	40	550	7
RTOR Reduction (vph)	0	14	0	0	9	0	0	0	203	0	1	0
Lane Group Flow (vph)	23	381	0	168	44	0	22	438	169	40	556	0
Turn Type	Perm		Perm		Perm		Perm	Perm	Perm	Perm		Perm
Protected Phases	4		8		8		2	2	2	6		6
Permitted Phases	4		8		8		2	2	2	6		6
Actuated Green, G (s)	39.2	39.2		39.2	39.2		25.8	25.8	25.8	25.8	25.8	25.8
Effective Green, g (s)	40.9	40.9		40.9	40.9		27.3	27.3	27.3	27.3	27.3	27.3
Actuated g/C Ratio	0.54	0.54		0.54	0.54		0.36	0.36	0.36	0.36	0.36	0.36
Clearance Time (s)	5.7	5.7		5.7	5.7		5.5	5.5	5.5	5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	722	953		452	943		105	667	567	193	666	666
vs Ratio Prot	c0.21		0.02		0.02		0.24		0.11		c0.30	
vs Ratio Perm	0.02		0.20		0.20		0.08		0.11		0.07	
vc Ratio	0.03	0.40		0.37	0.05		0.21	0.66	0.30	0.21	0.83	0.83
Uniform Delay, d1	8.3	10.4		10.2	8.4		17.0	20.5	17.6	16.9	22.4	22.4
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	0.3		0.5	0.0		4.5	5.0	1.3	2.4	11.8	11.8
Delay (s)	8.3	10.7		10.7	8.4		21.5	25.5	18.9	19.4	34.1	34.1
Level of Service	A	B		B	A		C	C	B	B	C	C
Approach Delay (s)	10.6		10.2		10.2		22.5		22.5		33.2	
Approach LOS	B		B		B		C		C		C	

Intersection Summary			
HCM Average Control Delay	21.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	76.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



HCM Signalized Intersection Capacity Analysis  
42: MORGANTON & NC 5

2011 AM  
5/19/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Line Configurations		↕			↕	↕	↕	↕		↕	↕	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
F <sub>t</sub>		0.95			1.00	0.85	1.00	0.98		1.00	1.00	
F <sub>t</sub> Protected		1.00			0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1779			1770	1583	1770	1826		1770	1862	
F <sub>t</sub> Permitted		1.00			0.76	1.00	0.26	1.00		0.15	1.00	
Satd. Flow (perm)		1779			1408	1583	479	1826		284	1862	
Volume (vph)	0	2	1	54	0	183	1	553	84	343	373	1
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	2	1	59	0	199	1	601	91	373	405	1
RTOR Reduction (vph)	0	1	0	0	0	109	0	5	0	0	0	0
Lane Group Flow (vph)	0	2	0	0	59	90	1	687	0	373	406	0
Turn Type	Perm			Perm		pm+ov	pm+pt			pm+pt		
Protected Phases		4			8	1	5	2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		8.9			8.9	48.0	94.7	49.3		76.7	37.6	
Effective Green, g (s)		11.2			11.2	52.6	96.8	51.4		81.1	39.7	
Actuated g/C Ratio		0.10			0.10	0.45	0.83	0.44		0.70	0.34	
Clearance Time (s)		6.3			6.3	6.3	5.3	6.1		6.3	6.1	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		172			136	772	991	809		729	637	
v/s Ratio Prot		0.00				0.04	0.00	c0.38		c0.18	0.22	
v/s Ratio Perm					c0.04	0.02	0.00			0.18		
v/c Ratio		0.01			0.43	0.12	0.00	0.85		0.51	0.64	
Uniform Delay, d1		47.4			49.4	18.3	3.7	28.8		15.2	32.1	
Progression Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.0			2.2	0.1	0.0	10.8		0.6	4.8	
Delay (s)		47.4			51.6	18.4	3.7	39.6		15.8	36.9	
Level of Service		D			D	B	A	D		B	D	
Approach Delay (s)		47.4			26.0			39.6			26.8	
Approach LOS		D			C			D			C	

Intersection Summary		
HCM Average Control Delay	31.8	HCM Level of Service C
HCM Volume to Capacity ratio	0.67	
Actuated Cycle Length (s)	116.0	Sum of lost time (s) 12.0
Intersection Capacity Utilization	72.9%	ICU Level of Service C
Analysis Period (min)	15	
c Critical Lane Group		

HCM Signalized Intersection Capacity Analysis  
 46: MONTICELLO DR & NC 5

2011 AM  
 5/19/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↖	↗		↖	↗	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Fit		0.96			0.93		1.00	1.00		1.00	0.99	
Fit Protected		0.99			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1769			1713		1770	1855		1770	1845	
Fit Permitted		0.89			0.95		0.50	1.00		0.35	1.00	
Satd. Flow (perm)		1598			1640		930	1855		652	1845	
Volume (vph)	65	97	60	6	13	23	18	494	14	47	343	24
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	71	105	65	7	14	25	20	537	15	51	373	26
RTOR Reduction (vph)	0	14	0	0	20	0	0	1	0	0	1	0
Lane Group Flow (vph)	0	227	0	0	26	0	20	551	0	51	398	0
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		19.2			19.2		67.9	65.1		73.7	68.0	
Effective Green, g (s)		20.7			20.7		70.4	66.6		76.2	69.5	
Actuated g/C Ratio		0.20			0.20		0.66	0.63		0.72	0.66	
Clearance Time (s)		5.5			5.5		5.0	5.5		5.0	5.5	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		312			320		648	1166		539	1210	
v/s Ratio Prot							0.00	c0.30		c0.01	0.22	
v/s Ratio Perm		c0.14			0.02		0.02			0.06		
v/c Ratio		0.73			0.08		0.03	0.47		0.09	0.33	
Uniform Delay, d1		40.0			34.9		6.1	10.4		5.7	8.0	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		8.1			0.1		0.0	1.4		0.1	0.7	
Delay (s)		48.1			35.0		6.1	11.8		5.7	8.7	
Level of Service		D			C		A	B		A	A	
Approach Delay (s)		48.1			35.0			11.6			8.4	
Approach LOS		D			C			B			A	
<b>Intersection Summary</b>												
HCM Average Control Delay			18.0				HCM Level of Service				B	
HCM Volume to Capacity ratio			0.52									
Actuated Cycle Length (s)			106.0				Sum of lost time (s)			16.0		
Intersection Capacity Utilization			61.7%				ICU Level of Service			B		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
 48: BLAKE BLVD & NC 5

2011 AM  
 5/19/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗		↖	↗	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00		1.00	1.00	
Fit	1.00	1.00		1.00	0.87			0.98		1.00	0.99	
Fit Protected	0.95	1.00		0.95	1.00			1.00		0.95	1.00	
Satd. Flow (prot)	1770	1863		1770	1622			1825		1770	1853	
Fit Permitted	0.74	1.00		0.75	1.00			1.00		0.39	1.00	
Satd. Flow (perm)	1375	1863		1398	1622			1825		719	1853	
Volume (vph)	27	10	0	37	4	23	0	525	82	46	395	15
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	29	11	0	40	4	25	0	571	89	50	429	16
RTOR Reduction (vph)	0	0	0	0	23	0	0	3	0	0	1	0
Lane Group Flow (vph)	29	11	0	40	6	0	0	657	0	50	444	0
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	4		8		8		2		2		6	
Permitted Phases	4		8		8		2		2		6	
Actuated Green, G (s)	4.8	4.8		4.8	4.8			65.2		65.2	65.2	
Effective Green, g (s)	6.8	6.8		6.8	6.8			67.9		67.9	67.9	
Actuated g/C Ratio	0.08	0.08		0.08	0.08			0.82		0.82	0.82	
Clearance Time (s)	6.0	6.0		6.0	6.0			6.7		6.7	6.7	
Vehicle Extension (s)	1.0	1.0		2.0	2.0			2.0		2.0	2.0	
Lane Grp Cap (vph)	113	153		115	133			1498		590	1521	
vs Ratio Prot	0.01		0.00		0.36		0.24		0.07		0.24	
vs Ratio Perm	0.02		0.03		0.44		0.07		0.08		0.29	
vc Ratio	0.26	0.07		0.35	0.05			0.44		0.08	0.29	
Uniform Delay, d1	35.6	35.0		35.9	35.0			2.1		1.4	1.7	
Progression Factor	1.00	1.00		1.00	1.00			1.00		1.00	1.00	
Incremental Delay, d2	0.4	0.1		0.7	0.1			0.9		0.3	0.5	
Delay (s)	36.0	35.1		36.5	35.0			3.0		1.7	2.2	
Level of Service	D		D		D		A		A		A	
Approach Delay (s)	35.8		35.9		3.0		2.2		2.2		2.2	
Approach LOS	D		D		A		A		A		A	
<b>Intersection Summary</b>												
HCM Average Control Delay	5.5		HCM Level of Service		A							
HCM Volume to Capacity ratio	0.43		Sum of lost time (s)		8.0							
Actuated Cycle Length (s)	82.7		ICU Level of Service		A							
Intersection Capacity Utilization	53.6%											
Analysis Period (min)	15											
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis  
 28: MCDONALD RD & NC 5

2011 NOON  
 5/19/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	13	1	2	2	4	3	5	365	2	2	403	12
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	14	1	2	2	4	3	5	397	2	2	438	13
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
PK, platoon unblocked												
vC, conflicting volume	863	859	445	860	864	398	451			399		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	863	859	445	860	864	398	451			399		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
trf (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
pD queue free %	95	100	100	99	99	99	100			100		
cM capacity (veh/h)	269	292	613	273	290	652	1109			1160		
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>								
Volume Total	17	10	404	453								
Volume Left	14	2	5	2								
Volume Right	2	3	2	13								
cSH	291	350	1109	1160								
Volume to Capacity	0.06	0.03	0.00	0.00								
Queue Length 95th (ft)	5	2	0	0								
Control Delay (s)	18.2	15.6	0.2	0.1								
Lane LOS	C	C	A	A								
Approach Delay (s)	18.2	15.6	0.2	0.1								
Approach LOS	C	C										
<b>Intersection Summary</b>												
Average Delay			0.6									
Intersection Capacity Utilization			33.1%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis  
42: MORGANTON & NC 5

2011 NOON  
5/19/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔	↔	↔	↔		↔	↔	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00	1.00		1.00		1.00	1.00	
F <sub>it</sub>		0.86			1.00	0.85		0.98		1.00	1.00	
F <sub>it Protected</sub>		1.00			0.95	1.00		1.00		0.95	1.00	
Satd. Flow (prot)		1611			1770	1583		1817		1770	1861	
F <sub>it Permitted</sub>		1.00			0.76	1.00		1.00		0.46	1.00	
Satd. Flow (perm)		1611			1409	1583		1817		866	1861	
Volume (vph)	0	0	2	91	0	293	0	411	81	277	431	3
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	2	99	0	318	0	447	88	301	468	3
RTOR Reduction (vph)	0	2	0	0	0	230	0	4	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	99	88	0	531	0	301	471	0
Turn Type	Perm			Perm		pm+ov	pm+pt			pm+pt		
Protected Phases		4			8	1	5	2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		13.2			13.2	27.6		69.7		53.3	38.9	
Effective Green, g (s)		15.5			15.5	32.2		71.8		57.7	41.0	
Actuated g/C Ratio		0.13			0.13	0.28		0.62		0.50	0.35	
Clearance Time (s)		6.3			6.3	6.3		6.1		6.3	6.1	
Vehicle Extension (s)		3.0			3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)		215			188	494		1125		561	658	
v/s Ratio Prot		0.00				0.03		c0.29		c0.08	c0.25	
v/s Ratio Perm					c0.07	0.03				0.19		
v/c Ratio		0.00			0.53	0.18		0.47		0.54	0.72	
Uniform Delay, d1		43.5			46.8	31.8		11.9		22.5	32.5	
Progression Factor		1.00			1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2		0.0			2.7	0.2		1.4		1.0	6.6	
Delay (s)		43.5			49.5	32.0		13.3		23.4	39.0	
Level of Service		D			D	C		B		C	D	
Approach Delay (s)		43.5			36.2			13.3			32.9	
Approach LOS		D			D			B			C	

Intersection Summary			
HCM Average Control Delay	27.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	116.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	63.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

5/19/2011

Synchro 6 Light Report  
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CMS Engineering

HCM Signalized Intersection Capacity Analysis  
 48: BLAKE BLVD & NC 5

2011 NOON  
 5/19/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↶	↷		↶	↷		↶	↷		↶	↷	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
F <sub>it</sub>	1.00	0.97		1.00	0.86		1.00	0.97		1.00	0.99	
F <sub>it</sub> Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1816		1770	1603		1770	1803		1770	1853	
F <sub>it</sub> Permitted	0.67	1.00		0.75	1.00		0.49	1.00		0.43	1.00	
Satd. Flow (perm)	1249	1816		1397	1603		917	1803		809	1853	
Volume (vph)	19	9	2	93	6	87	2	388	107	98	388	15
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	21	10	2	101	7	95	2	422	116	107	422	16
RTOR Reduction (vph)	0	2	0	0	83	0	0	6	0	0	1	0
Lane Group Flow (vph)	21	10	0	101	19	0	2	532	0	107	437	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	8.8	8.8		8.8	8.8		61.2	61.2		61.2	61.2	
Effective Green, g (s)	10.8	10.8		10.8	10.8		63.9	63.9		63.9	63.9	
Actuated g/C Ratio	0.13	0.13		0.13	0.13		0.77	0.77		0.77	0.77	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.7	6.7		6.7	6.7	
Vehicle Extension (s)	1.0	1.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lane Grp Cap (vph)	163	237		182	209		709	1393		625	1432	
vs Ratio Prot		0.01			0.01			c0.29			0.24	
vs Ratio Perm	0.02			c0.07			0.00			0.13		
vc Ratio	0.13	0.04		0.55	0.09		0.00	0.38		0.17	0.31	
Uniform Delay, d1	31.8	31.4		33.7	31.6		2.1	3.0		2.5	2.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.0		2.1	0.1		0.0	0.8		0.6	0.6	
Delay (s)	31.9	31.5		35.8	31.7		2.1	3.8		3.1	3.3	
Level of Service	C	C		D	C		A	A		A	A	
Approach Delay (s)		31.8			33.7			3.8			3.3	
Approach LOS		C			C			A			A	
<b>Intersection Summary</b>												
HCM Average Control Delay			8.9			HCM Level of Service			A			
HCM Volume to Capacity ratio			0.41									
Actuated Cycle Length (s)			82.7			Sum of lost time (s)		8.0				
Intersection Capacity Utilization			58.7%			ICU Level of Service			B			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis  
 28: MCDONALD RD & NC 5

2011 PM  
 5/16/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↕			↕			↕			↕		
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	7	2	1	2	1	2	5	448	5	1	533	19
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	8	2	1	2	1	2	5	487	5	1	579	21
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)												
pK, platoon unblocked												
vC, conflicting volume	1095	1095	590	1095	1103	490	600				492	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1095	1095	590	1095	1103	490	600				492	
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1				4.1	
tC, 2 stage (s)												
tff (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
pD queue free %	96	99	100	99	99	100	99				100	
cM capacity (veh/h)	189	212	508	188	210	579	977				1071	

Movement	EBL	WBL	NBL	SBL
Volume Total	11	5	498	601
Volume Left	8	2	5	1
Volume Right	1	2	5	21
cSH	206	265	977	1071
Volume to Capacity	0.05	0.02	0.01	0.00
Queue Length 95th (ft)	4	2	0	0
Control Delay (s)	23.4	18.8	0.2	0.0
Lane LOS	C	C	A	A
Approach Delay (s)	23.4	18.8	0.2	0.0
Approach LOS	C	C		

Approach Summary			
Average Delay	0.4		
Intersection Capacity Utilization	39.8%	ICU Level of Service	A
Analysis Period (min)	15		



HCM Unsignalized Intersection Capacity Analysis  
 31: MCKENZIE RD & NC 5

2011 PM  
 5/16/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↕			↕			↕			↕		
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	7	18	1	17	12	4	3	460	24	1	501	87
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	8	20	1	18	13	4	3	500	26	1	545	95
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)												
pK, platoon unblocked												
vC, conflicting volume	1124	1127	592	1124	1161	513	639				526	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1124	1127	592	1124	1161	513	639				526	
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
p0 queue free %	96	90	100	89	93	99	100				100	
cM capacity (veh/h)	171	204	506	168	194	561	945				1041	

Approach	EB	WB	NB	SB
Volume Total	28	36	529	640
Volume Left	8	18	3	1
Volume Right	1	4	26	95
cSH	198	194	945	1041
Volume to Capacity	0.14	0.18	0.00	0.00
Queue Length 95th (ft)	12	16	0	0
Control Delay (s)	26.2	27.7	0.1	0.0
Lane LOS	D	D	A	A
Approach Delay (s)	26.2	27.7	0.1	0.0
Approach LOS	D	D		

Average Delay	1.5			
Intersection Capacity Utilization	42.3%		ICU Level of Service	A
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis  
 34: BARRETT RD & NC 5

2011 PM  
 5/19/2011

Movement	EBL	EBT	EBR	WB	WB	WBR	NBL	NBT	NBR	SB	SB	SB
Line Configurations	↕			↕			↕			↕		
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Volume (veh/h)	0	14	8	28	35	34	10	414	56	22	405	2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	15	9	30	38	37	11	450	61	24	440	2
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)												
pL, platoon unblocked												
vC, conflicting volume	1047	1022	441	1008	992	480	442				511	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1047	1022	441	1008	992	480	442				511	
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
pL queue free %	100	93	99	85	84	94	99				98	
cM capacity (veh/h)	165	228	616	200	238	586	1118				1054	
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	24	105	522	466								
Volume Left	0	30	11	24								
Volume Right	9	37	61	2								
cSH	296	281	1118	1054								
Volume to Capacity	0.08	0.38	0.01	0.02								
Queue Length 95th (ft)	7	42	1	2								
Control Delay (s)	18.2	25.3	0.3	0.7								
Lane LOS	C	D	A	A								
Approach Delay (s)	18.2	25.3	0.3	0.7								
Approach LOS	C	D										
Intersection Summary												
Average Delay				3.2								
Intersection Capacity Utilization				51.5%	ICU Level of Service				A			
Analysis Period (min)				15								

HCM Signalized Intersection Capacity Analysis  
 39: CHEROKEE NC2 & NC 5

2011 PM  
 5/19/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Line Configurations	↖	↗		↖	↗		↖	↗	↖	↗	↖	↗
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Line Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
F <sub>t</sub>	1.00	0.92		1.00	0.96		1.00	1.00	0.85	1.00	1.00	1.00
F <sub>t</sub> Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1713		1770	1781		1770	1863	1583	1770	1856	1856
F <sub>t</sub> Permitted	0.66	1.00		0.66	1.00		0.31	1.00	1.00	0.20	1.00	1.00
Satd. Flow (perm)	1236	1713		1220	1781		573	1863	1583	378	1856	1856
Volume (vph)	6	69	79	323	96	40	88	541	167	34	430	10
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	7	75	86	351	104	43	96	588	182	37	467	11
RTOR Reduction (vph)	0	40	0	0	14	0	0	0	105	0	2	0
Lane Group Flow (vph)	7	121	0	351	133	0	96	588	77	37	476	0
Turn Type	Perm			Perm			Perm		Perm	Perm		
Protected Phases		4			8			2		2		6
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)	34.4	34.4		34.4	34.4		30.6	30.6	30.6	30.6	30.6	30.6
Effective Green, g (s)	36.1	36.1		36.1	36.1		32.1	32.1	32.1	32.1	32.1	32.1
Actuated g/C Ratio	0.47	0.47		0.47	0.47		0.42	0.42	0.42	0.42	0.42	0.42
Clearance Time (s)	5.7	5.7		5.7	5.7		5.5	5.5	5.5	5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	586	812		578	844		241	785	667	159	782	
v/s Ratio Prot		0.07			0.07			c0.32			0.26	
v/s Ratio Perm	0.01			c0.29			0.17		0.05	0.10		
v/c Ratio	0.01	0.15		0.61	0.16		0.40	0.75	0.11	0.23	0.61	
Uniform Delay, d1	10.6	11.4		14.8	11.4		15.3	18.6	13.4	14.1	17.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	0.1		1.8	0.1		4.9	6.5	0.4	3.4	3.5	
Delay (s)	10.6	11.4		16.6	11.5		20.2	25.1	13.8	17.5	20.7	
Level of Service	B	B		B	B		C	C	B	B	C	
Approach Delay (s)		11.4			15.1			22.2			20.5	
Approach LOS		B			B			C			C	
<b>Intersection Summary</b>												
HCM Average Control Delay			19.1			HCM Level of Service			B			
HCM Volume to Capacity ratio			0.67									
Actuated Cycle Length (s)			76.2			Sum of lost time (s)		8.0				
Intersection Capacity Utilization			76.5%			ICU Level of Service		D				
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
42: MORGANTON & NC 5

2011 PM  
5/19/2011

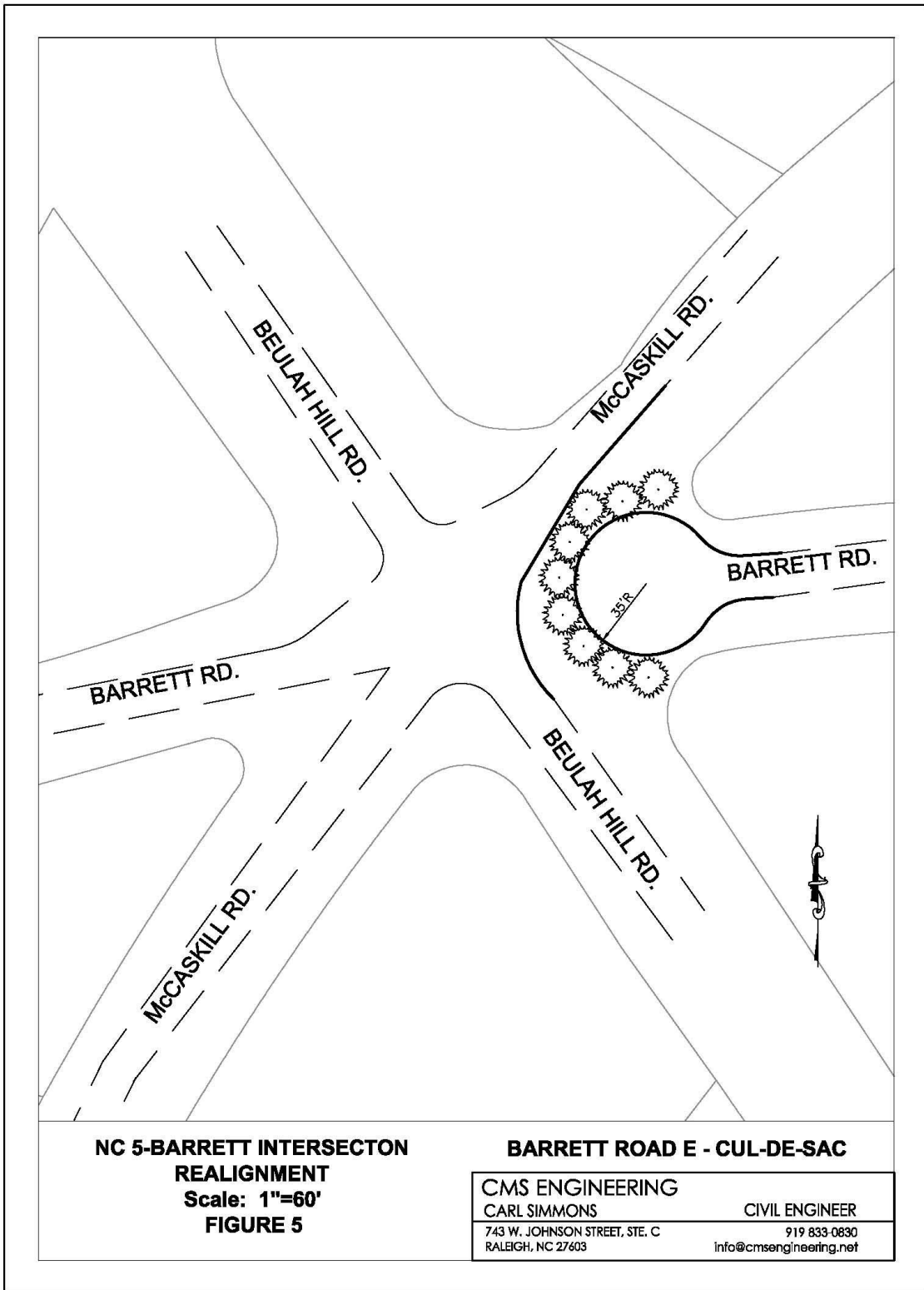
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔	↔	↔	↔		↔	↔	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0	4.0	4.0		4.0	4.0	
Line Util. Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
F <sub>it</sub>		0.95			1.00	0.85	1.00	0.98		1.00	1.00	
F <sub>it</sub> Protected		0.98			0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1750			1770	1583	1770	1827		1770	1862	
F <sub>it</sub> Permitted		0.93			0.76	1.00	0.09	1.00		0.45	1.00	
Satd. Flow (perm)		1650			1408	1583	166	1827		840	1862	
Volume (vph)	1	1	1	126	0	483	1	455	67	288	573	1
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	1	1	137	0	525	1	495	73	313	623	1
RTOR Reduction (vph)	0	1	0	0	0	329	0	3	0	0	0	0
Lane Group Flow (vph)	0	2	0	0	137	196	1	565	0	313	624	0
Turn Type	Perm			Perm		pm+ov	pm+pt			pm+pt		
Protected Phases		4			8	1	5	2		1	6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		15.3			15.3	34.1	88.3	63.2		57.7	38.9	
Effective Green, g (s)		17.6			17.6	38.7	90.4	65.3		62.1	41.0	
Actuated g/C Ratio		0.15			0.15	0.33	0.78	0.56		0.54	0.35	
Clearance Time (s)		6.3			6.3	6.3	5.3	6.1		6.3	6.1	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		250			214	583	757	1028		619	658	
v/s Ratio Prot						0.06	0.00	c0.31		c0.09	c0.34	
v/s Ratio Perm		0.00			c0.10	0.06	0.00			0.18		
v/c Ratio		0.01			0.64	0.34	0.00	0.55		0.51	0.95	
Uniform Delay, d1		41.8			46.2	29.0	9.7	16.0		20.0	36.5	
Progression Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.0			6.4	0.3	0.0	2.1		0.7	24.5	
Delay (s)		41.8			52.6	29.3	9.7	18.1		20.6	60.9	
Level of Service		D			D	C	A	B		C	E	
Approach Delay (s)		41.8			34.2			18.1			47.5	
Approach LOS		D			C			B			D	

Intersection Summary			
HCM Average Control Delay	35.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	116.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	73.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

5/19/2011

Synchro 6 Light Report  
Page 1

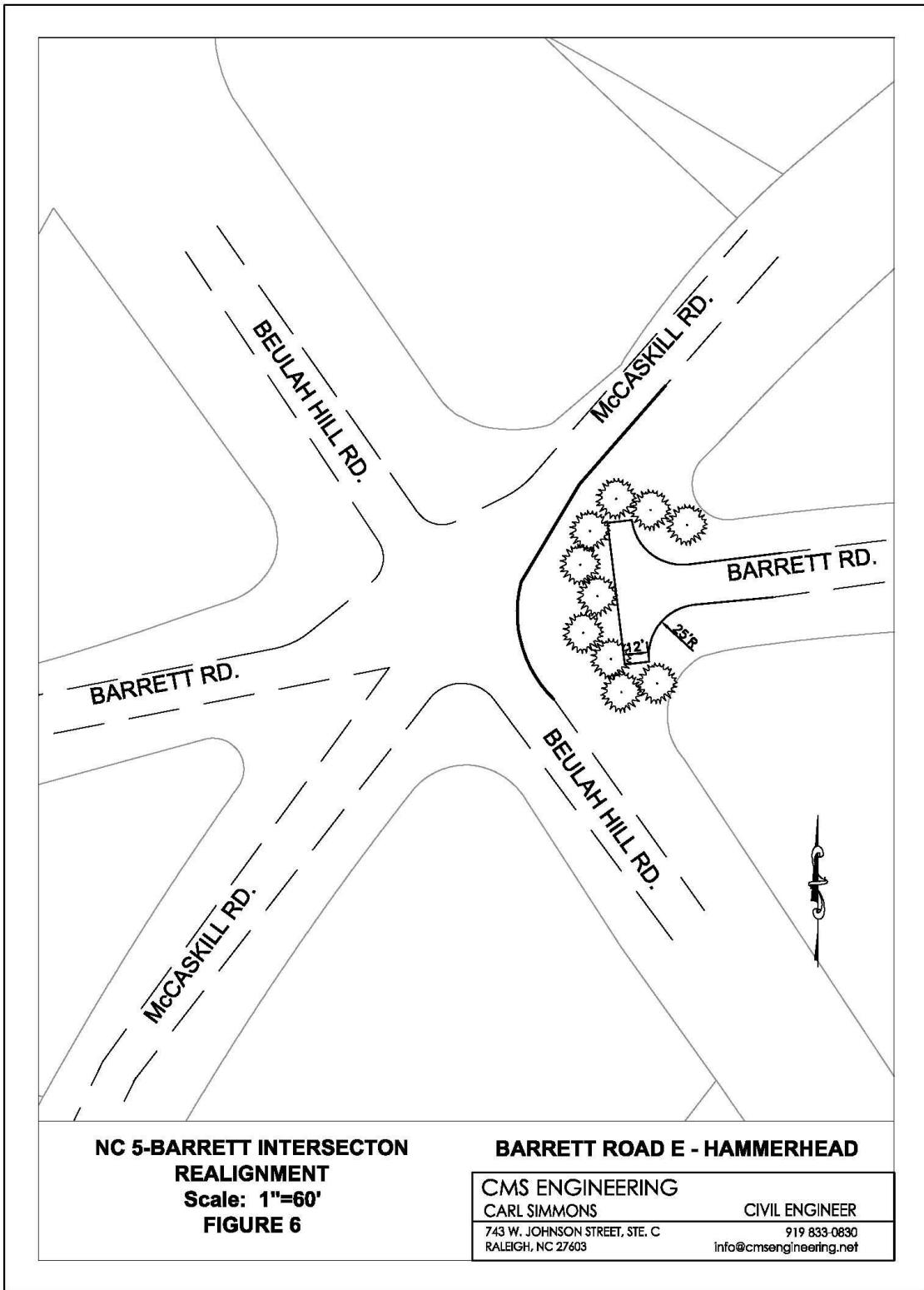
OMS Engineering



**NC 5-BARRETT INTERSECTON  
REALIGNMENT  
Scale: 1"=60'  
FIGURE 5**

**BARRETT ROAD E - CUL-DE-SAC**

<b>CMS ENGINEERING</b>	
CARL SIMMONS	CIVIL ENGINEER
743 W. JOHNSON STREET, STE. C RALEIGH, NC 27603	919 833-0830 info@cmsengineering.net



**NC 5-BARRETT INTERSECTION  
REALIGNMENT  
Scale: 1"=60'  
FIGURE 6**

**BARRETT ROAD E - HAMMERHEAD**

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