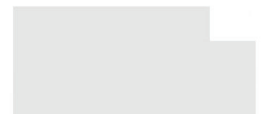
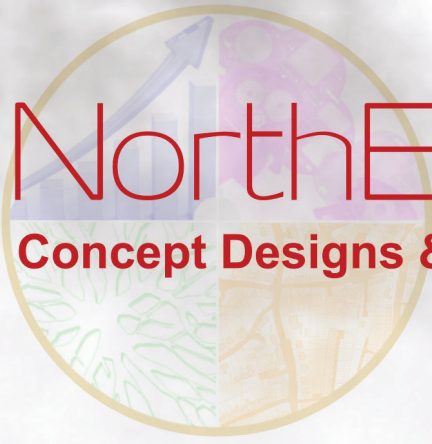


NorthEast Area Study

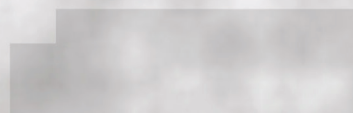
Concept Designs & Hot Spots Summary Report | January 2014



A technical report to provide short-term recommendations to improve substandard intersections and roadway locations in southern Franklin County and eastern Wake County

Capital Area Metropolitan Planning Organization

prepared by Stantec Consulting Services Inc. and AMT Consulting



CAPITAL AREA
METROPOLITAN
PLANNING ORGANIZATION

NEAS Northeast Area Study



2014

Stantec

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Table of Contents

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In addition to the participants listed here, we would like to thank all of the communities that have engaged in the success of this plan from our traveling roadshows participants to summer youth to the elderly citizens who participated, **THANK YOU.**

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Preface

CONCEPT DESIGNS OVERVIEW

This document includes a series of concept designs for four (4) corridors and twelve (12) hot spots geographically distributed throughout the study area. These concepts express the design intent developed during the study process.

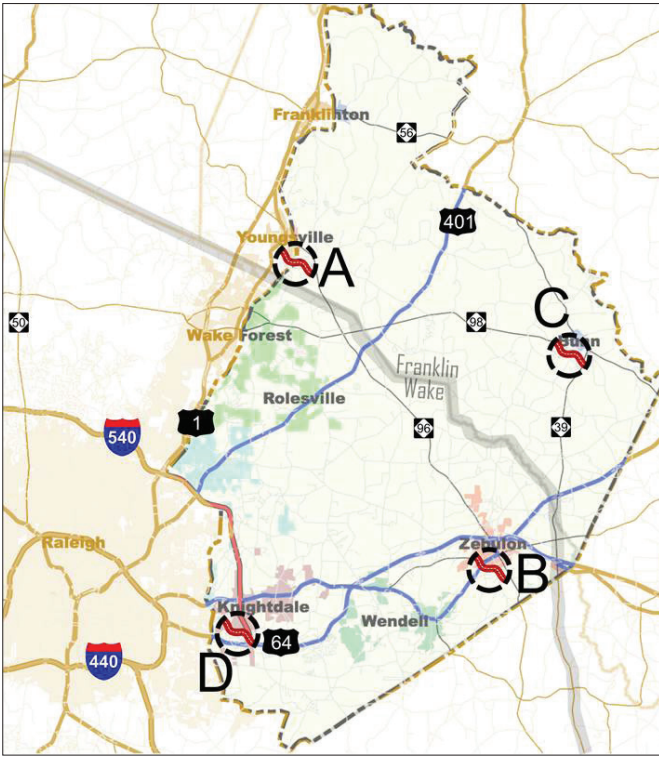
The CTT members selected several intersection and roadway locations throughout the NEAS area where problems (i.e., operational, design, and/or aesthetics) were occurring. The intent of the Concept Designs and Hot Spots are to identify priority investment strategies to alleviate or address these problems through low cost, but effective improvements.

CONCEPT DESIGN LOCATIONS:

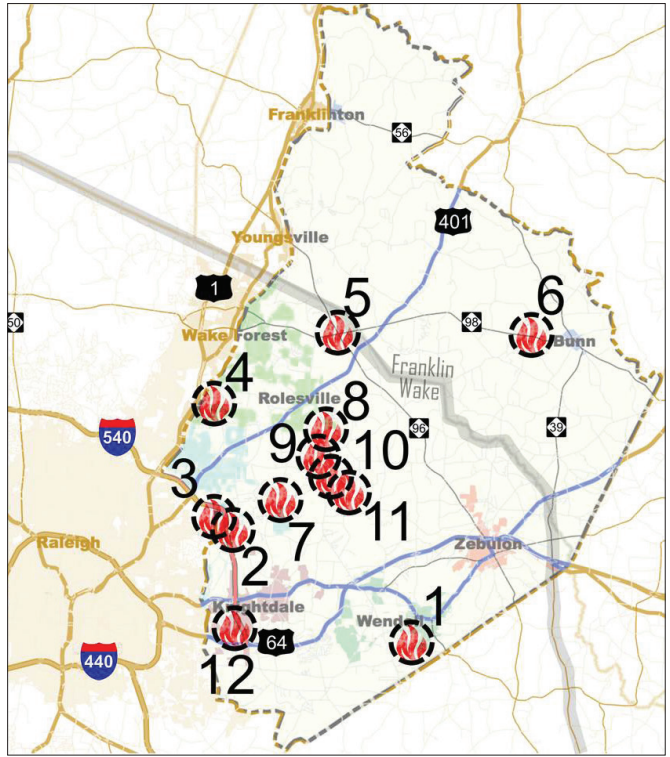
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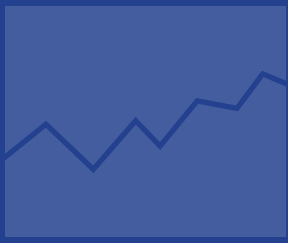


Concept Designs Vicinity Map –
 the following map depicts the general locations for the four (4) Concept Designs



Hot Spots Vicinity Map –
 the following map depicts the general locations for the twelve (12) Hot Spots





YOUNGSVILLE
NC 96 FROM US 1A
TO NORTH CROSS STREET



NC 96 from US 1A to North Cross St., Youngsville



Introduction & Problem Statement

With 20% truck traffic and 7,000 vehicles per day passing through the center of town, Youngsville is experiencing difficulty balancing the needs of bicyclists and pedestrians with vehicles traveling through their jurisdiction. The large trucks are causing safety problems and creating operational issues at key intersections. The long-term solution is the construction of a bypass around the town. However, the bypass is unfunded and nothing is planned for the interim to address the safety and congestion issues. This concept design is a combination of streetscape, gateway, Complete Streets and operational improvements that should help alleviate some of the issues of congestion and potentially help to reduce the number of trucks passing through the community. The streetscape improvements would include street trees, high visibility crosswalks, mid-block crossings, pedestrian level lighting, gateway monuments, and pocket park. The streetscape improvements would not necessarily require additional right-of-way except at the location of the proposed roundabout. The conceptual roundabout is designed (125 foot inscribed circle) to handle the turning radius of a WB-50 tractor trailer. Part of these improvements would include entry signage and wayfinding improvements from the east and west into town to improve driver awareness of bicycle and pedestrian activity. The streetscape improvements would fit well within the Youngsville Downtown Master Plan - Envision Youngsville.

Traffic Operations

Part of the Concept Design assessment included an operational evaluation (2013 peak hour) of the existing US 1A/NC 96 signal versus a proposed one-lane roundabout. The results (as seen below) of this analysis indicate an 85% reduction in delay with the proposed roundabout.

Project Length: 0.44 miles (2,300')

Opinion of Probable Cost (OPCC):

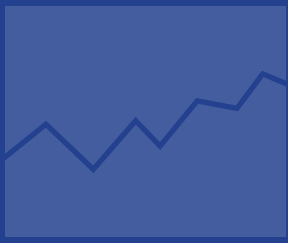
\$750,000

Traffic Operations:

Youngsville Roundabout Analysis Comparison (2013 Peak Hour)				
	With Signal		With Roundabout	
	LOS	Delay (sec)	LOS	Delay (sec)
US 1A @ NC 96 / Holden Road	F	140	C	18.4
EB Approach	B	13.2	A	9.3
NB Approach	B	19.4	B	11.1
WB Approach	F	185.9	C	24.2
SB Approach	F	178.8	C	17.6





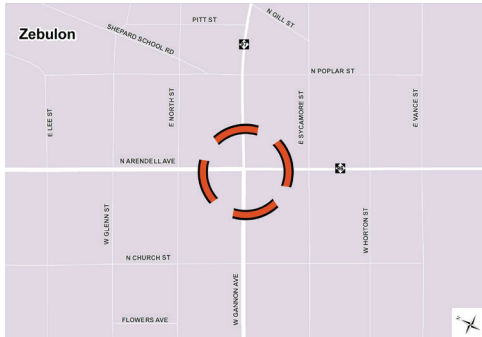


ZEBULON
NC 97/ NC 96 GATEWAY



ZEBULON

NC 97/ NC 96 Gateway, Zebulon



Introduction & Problem Statement

NC 96 and NC 97 come together at the crossroads Zebulon. With its connection to US 64 bypass to the north and Wal-Mart to the east, this intersection provides a focal point or “gateway” to the community. However, as growth and downtown revitalization has played a significant part in attracting residents and visitors to this area, this has caused significant congestion and delay to this intersection. Over 17,000 vehicles per day pass through this vital intersection on a daily basis. The issue with this intersection is the lack of adequate space for left-turning large vehicles. That is, trucks heading eastbound on NC 97 turning left require vehicles in the southbound left lane to back up to avoid being hit. As a remedy to this and other related safety and congestion problems, a roundabout is proposed. The proposed roundabout is designed (116 foot inscribed circle) to handle the turning radius of a WB-50 tractor trailer, eliminating the need for vehicles to “back up” while awaiting a left turn.

Traffic Operations

As a part of this assessment, an operational analysis (2013 peak hour) was included of the existing NC 96/NC 97 signal versus a proposed one-lane roundabout. The results (as seen below) of this analysis indicate a LOS C (for the existing signal) and a LOS B (for the proposed roundabout. This translates to a 60% reduction in delay with the proposed roundabout.

Project Length: 0.2 miles (400')

Opinion of Probable Cost (OPCC):

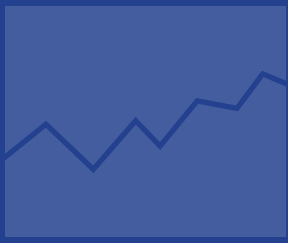
\$400,000

Traffic Operations:

Zebulon Roundabout Analysis Comparison (2013 Peak Hour)				
	With Signal		With Roundabout	
	LOS	Delay (sec)	LOS	Delay (sec)
NC 96 at NC 97	C	29.2	B	11.8
EB Approach	C	28.0	B	12.2
NB Approach	C	28.6	B	10.4
WB Approach	D	35.9	B	12.9
SB Approach	C	22.7	B	10.6







BUNN
NC 39 FROM MAIN STREET
TO E. JEWETT AVE.



NC 39 from Main Street to E. Jewett Ave., Bunn, NC



Introduction & Problem Statement

Bunn, North Carolina is a rural hamlet of Wake County with quaint shops, central Town services and country homes in close proximity to its downtown Main Street. With virtually no interconnectivity of streets, Main Street has become the focal point of all bicycle, pedestrian and vehicular activity. It also serves as the gateway for all civic (library, Town Hall, schools, fire and rescue) uses and commercial activity. NC 98 and NC 39 provide service to cross-county commuters as well as residents of Lake Royale. At 6,000 daily vehicle trips, Main Street doesn't warrant capacity improvements. However, it is becoming more difficult to take left turns (including school buses) and safe ingress/egress for destinations along this corridor, especially during peak hour commuting periods. Local residents and community leaders have expressed a concern for escalating traffic speeds as well as safe accommodations for bicycle and pedestrian users. As a result, it is recommended that a streetscape and traffic calming strategy be implemented along the 0.5 mile section of Main Street. Design elements would include sidewalks (both sides), plantable median islands, street trees, and three roundabouts at the intersections of Main Street/NC 98 (near Food Lion), Main Street/Bunn Elementary School, and Main Street/Railroad Street. The roundabouts would encourage lower speeds, act as a gateway and allow large vehicle (i.e., buses) proper turning radius.

Traffic Operations

As a part of this assessment, an operational analysis (2013 peak hour) was included at the only signal along Main Street (NC 39/NC 98), located on the eastern end of town near the Food Lion shopping center. A comparison was made between the operation of the signal versus a proposed one-lane roundabout. The results (as seen below) of this analysis indicate a slight LOS improvement (LOS B for the existing signal and LOS A for the proposed roundabout).

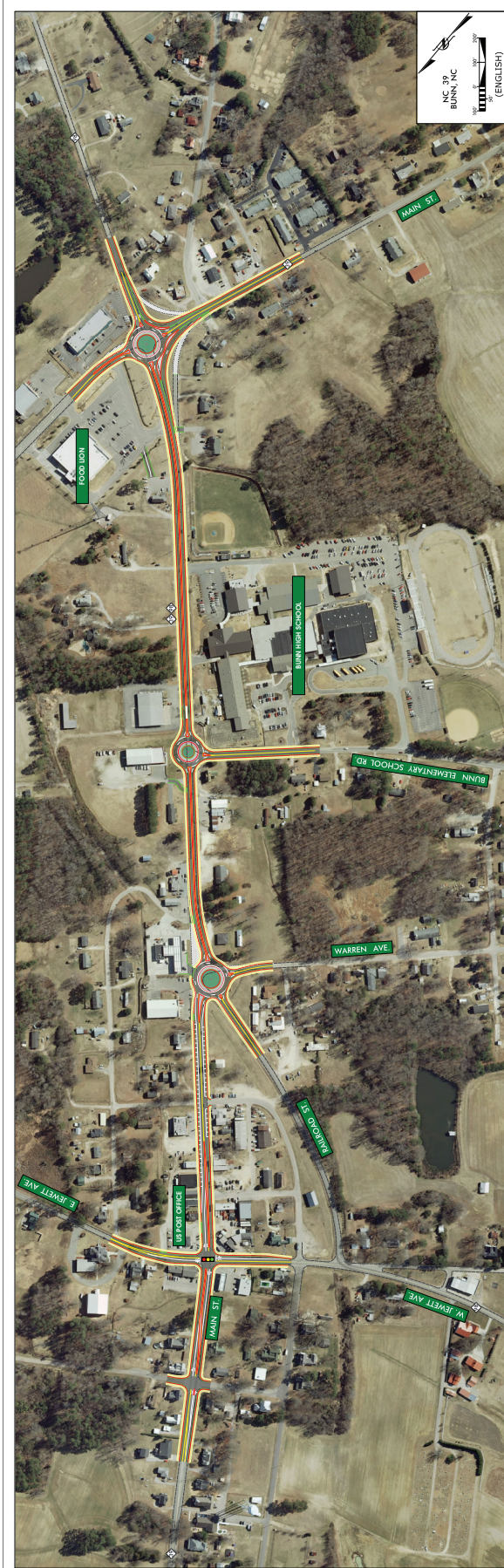
Project Length: 0.7 miles (3,400')

Opinion of Probable Cost (OPC):

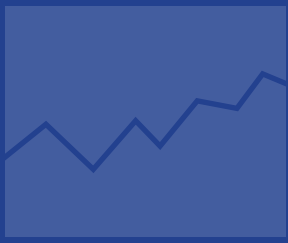
\$1.1 million

Traffic Operations:

Bunn Roundabout Analysis Comparison (2013 Peak Hour)				
	With Signal		With Roundabout	
	LOS	Delay (sec)	LOS	Delay (sec)
NC 98-39 at Main St.	B	10.2	A	6.1
EB Approach	A	8.1	A	5.4
NB Approach	B	13.8	A	6.8





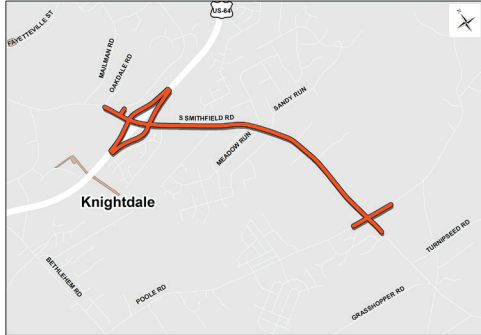


KNIGHTDALE
**SMITHFIELD ROAD FROM
US 64 TO POOLE ROAD**



KNIGHTDALE

Smithfield Road from US 64 to Poole Road, Knightdale, NC



Introduction & Problem Statement

Smithfield Road is a 2-lane farm-to-market road that provides direct access to US 64 and the Knightdale community. With the opening of the new US 64/264 Bypass, this area has experienced tremendous residential growth along this radial route creating congestion and spillback problems between Poole Road, and in particular, at its connection with US 64. With 17,000 vehicles per day, this facility is proposed to be widened to a multilane roadway as adopted in the current CAMPO Long Range Transportation Plan. There is also a need to upgrade the interchange at US 64, which is experiencing significant demand northbound heading westward towards Raleigh and Research Triangle Park (RTP) in the AM peak period and counter flow in the PM peak period. There is also an interest in designing this road in context with the surrounding environment, which includes single family residential uses and some parkland. With this in mind, it is recommended that this roadway be improved to a 4-lane divided (plantable median) facility with street trees and a meandering sidepath from US 64 to Poole Road. The design speed is recommended at 50 mph with a posted speed of 40 mph or 45 mph. The interchange at US 64 is recommended to be upgraded to a Diverging Diamond interchange.

Traffic Operations

An operational analysis (2013 peak hour) of the existing US 64 traditional diamond interchange versus a proposed diverging diamond interchange was conducted as summarized below. The results of this analysis indicate a significant improvement in the operational level of service between the traditional diamond at LOS F and the DDI at LOS A/B. With the proposed DDI interchange there is a 75% reduction in delay.

Project Length: 2.5 miles (13,200')

Opinion of Probable Cost (OPCC):

\$9.5 million

Traffic Operations:

Knightdale DDI Analysis Comparison (2013 Peak Hour)					
Intersection / Approach	Traditional Diamond		Diverging Diamond		
	LOS	Delay (sec.)	Intersection / Approach	LOS	Delay (sec.)
Smithfield Rd. @ US 64 EB Ramps	F	89.0	EBL @ NBT	A	4.8
			NBT @ SBT	B	10.0
EB Approach	C	21.8	EB Approach	D	36.0
NB Approach	F	108.0	NB Approach	B	11.4
SB Approach	A	9.9	SB Approach	D	36.4
Smithfield Rd. @ US 64 WB Ramps	E	71.7	WBL @ SBT	A	5.8
			SBT @ NBT	B	18.5
NB Approach	E	78.7	NB Approach	C	26.0
WB Approach	D	40.9	WB Approach	B	18.1
SB Approach	C	32.8	SB Approach	A	5.4



HOT SPOTS

While the Northeast Area Study is determining mobility in a big picture throughout the region, it is important to take a closer look at some specific locations where there are possible challenges today. These locations are called hot spots. The project team was responsible for the development of hot spot locations, including traffic counts, analysis, graphics, and reporting. Through meetings with CAMPO, municipal and county staff, and the public, a list of hot spot intersection locations were chosen to be analyzed. Hot spots were narrowed down to the final locations using the following criteria:

- **Safety:** high crash locations, bike/ped crashes, fatalities, multi-modal accommodations
- **Operational-performance:** vehicle delay (level of service), signalization, alternative designs
- **Geometric-Design:** sight distance, unsafe curvatures, intersection separation

Each hot spot was reviewed and analyzed in terms of the criteria. This effort included a peak hour (AM) traffic count for each subject

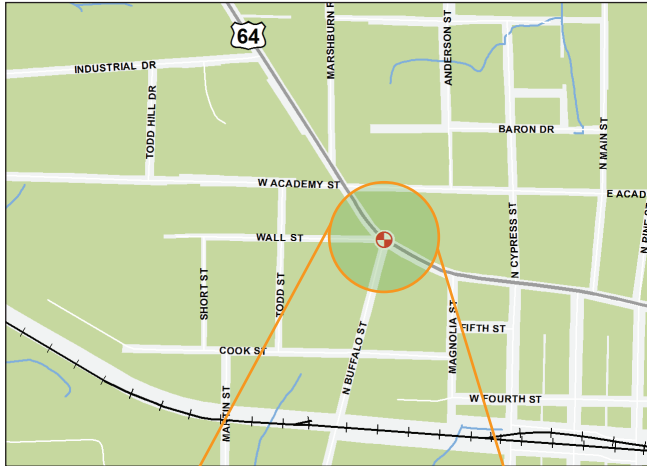
intersection. Recommendations for each intersection includes a graphic design developed to describe geometric, pavement marking/signing, and other appropriate details for improving traffic operations and safety conditions. Cost estimates for each recommendation are also included with the analyses.

Additionally, the project team did a “life analysis” for the recommendations for each hot spot. A 3% growth rate was used as an assumption for volume growth throughout the region. After applying this growth rate and projecting traffic volumes, it was then determined when each improvement would be considered “not efficient”.

Typically, a movement (at an unsignalized intersection) or a signalized intersection is considered “not efficient” when the LOS approaches E or F. The “life analysis” will give decision makers an idea of cost/benefit when determining project implementation.

The following describes the data collection, analysis, and recommendations for each location.

Wendell Boulevard (US 64 Business) & Buffalo Street / Wall Street Wendell, NC



INTRODUCTION

The intersection of Wendell Boulevard (US 64 Business) and Buffalo Street / Wall Street is currently an unsignalized intersection with Buffalo Street and Wall Street operating under “Stop” control. The study intersection is located adjacent to Wendell Elementary School in the Town of Wendell. The land use in the vicinity of the intersection is mostly single family residential with some light retail including a realtor on Wall Street and a community center on Buffalo Street. Wendell Blvd. is a two lane facility with a speed limit of 35 mph. Wendell Blvd. runs west to US 64-264 in the Town of Knightdale and east to NC 97 in the Town of Zebulon. Buffalo Street is a two lane facility with a speed limit of 35 mph. Buffalo Street runs south from the intersection to the Wendell Falls Community and then west where it changes name to Poole Road. Wall Street is a two lane facility with a speed limit of 35 mph. Wall Street is a short urban street that extends to the west from this intersection and connects to Todd Street, which runs parallel to Buffalo Street.

PROBLEM STATEMENT

This intersection has a nonstandard configuration as shown in the adjacent vicinity map. Wendell Blvd. is the main roadway to and from Downtown Wendell. The Buffalo Street northbound approach and the Wall Street eastbound approach both operate under “Stop” control conditions. Additionally, the entrance and exit for the pick-up and drop-off area for Wendell Elementary School are located on both sides of this intersection, adding to the already confusing nature of this roadway section. This nonstandard intersection configuration, with the school entrance/exit, increases the conflict area which can increase the likelihood of crashes. From 2008 to 2012, a total of 15 crashes were reported at this location.

POSSIBLE SOLUTIONS

Close Wall Street Access to Wendell Blvd.

In order to address the intersection challenges, two actions were considered. It is proposed that access from Wall Street to Wendell Blvd. be removed. Wall Street is part of a roadway grid system in the Town of Wendell and has access to all roadways via alternate routes without a direct connection to Wendell Blvd. This access closure creates a three leg T-intersection with Buffalo Street under “Stop” control. This also reduces the number of conflict points in the intersection while as reducing the size of the conflict area. A roundabout concept was not analyzed due to right of way constraints, the presence of two buildings on the corners and the school parking lot on the eastern side. Also, due to the heavy directional traffic volumes on Wendell Boulevard, a roundabout is expected to have a short design life.

TRAFFIC OPERATIONS

The operation of an unsignalized intersection is determined by the average amount of delay a vehicle is expected to experience while making a turning movement where there is opposing traffic. In this case, the delay expected for the northbound vehicles on Buffalo Street will determine the operation of the study intersection. The future growth of traffic volumes in the area are approximated by applying 3% annual growth rate applied to the existing traffic count data. By applying the growth factor and estimating the future delays, the operational “Life” of the proposed improvement is determined.

LOS D Existing

LOS E 2015

LOS F 2019

By restricting access to Wall Street, the analysis indicates that the proposed intersection is expected to operate at acceptable levels for 2 years.

Construction Cost Estimates: \$5,000 Signalized the intersection

Two years of acceptable operation is not ideal, therefore a second improvement was analyzed. In addition to closing off access to

Wall Street, it is proposed that a traffic signal be installed at this location. A traffic signal operates more efficiently for all intersection approaches. The analysis did not include the addition of any lanes on any approach.

The operation of a traffic signal is determined by the average delay per vehicle processed by the signal during the peak hour. NCDOT has determined that an overall intersection delay of 55.0 seconds or less is an acceptable level of service (LOS). The future growth of traffic volumes in the area are approximated by applying 3% annual growth rate applied to the existing traffic count data. By applying the growth factor and estimating the future delays, the operational “Life” of the proposed improvement is determined. Synchro 7.0 is the software package that was utilized to analyze the operation of the proposed signal.

LOS B Existing

LOS E 2033

LOS F 2035

The analysis indicates that the proposed signal is expected to operate at an acceptable LOS for 20 years.

Construction Cost Estimate: \$175,000

Note: An exclusive left turn lane on westbound Wendell Blvd. would be an ideal improvement in order to remove the turning vehicles from the heavy through traffic. However, there is limited right-of-way along this section of roadway. Additionally, any improvements will have to be coordinated with the MSTA (Municipal and School Transportation Assistance) Group at NCDOT. MSTA completed a study of the traffic flow at Wendell Elementary School in 2011. The MSTA recommendations are located on page 19. With this in mind, the recommended improvements from this study should work in harmony with the MSTA recommendations for the school.



NCDOT MSTA Recommendations for School Access at Wendell Elementary

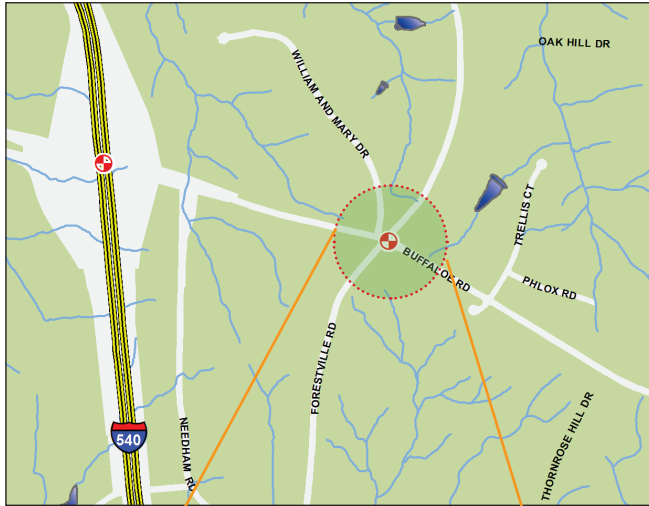




BUFFALOE ROAD &
FORESTVILLE ROAD
WAKE COUNTY, NC



Buffaloe Road & Forestville Road Wake County, NC



INTRODUCTION

The intersection of Buffaloe Road and Forestville Road is a signalized intersection with an exclusive left turn lane on each approach. The intersection is located approximately 2,700 feet to the east of the interchange of I-540 and Buffaloe Road in Northeastern Wake County on the east side of the City of Raleigh. The land use in the vicinity of the intersection is mostly residential with several large residential subdivisions to the north and east. There have been numerous larger retail developments proposed in the past around this intersection and I-540, but none of them have been constructed. Traffic patterns are heavily influenced by peak-hour commuters accessing I-540 and points west towards Downtown Raleigh. Buffaloe Road is an east-west two lane facility with a speed limit of 45 mph. Buffaloe Road accesses New Hope Road and Capital Blvd. (US 1) to the west and Old Milburnie Road and Rolesville Road to the east. Forestville Road is a north-south two lane facility with a speed limit of 45 mph. Forestville Road accesses US 401 and the Town of Wake Forest to the north and the Town of Knightdale to the south. Additionally, according to the 2040 CAMPO MTP, Buffaloe Road, from I-540 to Forestville Road, is planned to be widened from two to four lanes by 2030.

PROBLEM STATEMENT

This intersection experiences excessive delay and long queues during the peak hours due to heavy directional commuter traffic. The westbound through volumes and the southbound right turn volumes are heaviest during the AM peak hour and all of the movements are funneling west towards I-540 and Raleigh. All the eastbound movements on Buffaloe Road are heavy during the PM peak hour as the traffic disperses eastbound from I-540. During the PM peak, the eastbound left-turn queue exceeds the turn bay length and interferes with through and right-turn traffic. This is causing a safety issue with a total of 23 crashes occurring at this location from 2008 to 2012 that included eight of rear-end collisions and eight turn lane switch collisions.

POSSIBLE SOLUTIONS

Roundabout: Considered, but not feasible.

To help save right-of-way and construction costs, roundabouts were initially studied at this intersection and the ramp intersections at I-540. It was determined that roundabouts would fail immediately at each intersection with high delays due to the high peak hour directional traffic.

Additional laneage on westbound Buffalo Road and turn-lanes at the intersection

The next level of study included the addition of laneage at the intersection and on Buffalo Road between Forestville Road and I-540. The analyses provided a second travel lane to the westbound approach of Buffalo Road that would terminate as an exclusive right turn lane at the ramp terminal to I-540 West. The additional pavement added to westbound Buffalo Road is approximately 2,300 feet in length west of Forestville Road. In addition, several improvements should be made to the study intersection including the installation of exclusive dual right-turn lanes on the southbound approach of Forestville Road, exclusive dual left-turn lanes on the northbound approach of Forestville Road, and a shared through-right lane on the westbound approach of Buffalo Road. Also, the existing traffic signal should be modified to allow for “overlap” phasing for right-turn movements. This intersection warrants multiple improvements to increase the efficiency at this intersection, especially during the heavier directional AM peak hour.

TRAFFIC OPERATIONS

The operation of a traffic signal is determined by the average delay per vehicle processed by the signal during the peak hour. Using the

assumed 3% growth factor and estimating the future delays, the operational “Life” of the proposed improvements is determined.

	AM	PM
EXISTING	LOS F	LOS E
LOS E	2024	2017
LOS F	2029	2024

Analysis indicates that the intersection currently operates poorly during both the AM and PM peak hour periods. With the recommended improvements in place, the study intersection is expected to operate at an acceptable LOS into the near future.

Construction Cost Estimate: \$2 million, to include roadway and signal improvements

Note: It is noted by NCDOT that there are areas of large deposits of rock near this intersection that makes construction more difficult, so the cost may increase based on further geotechnical investigations.



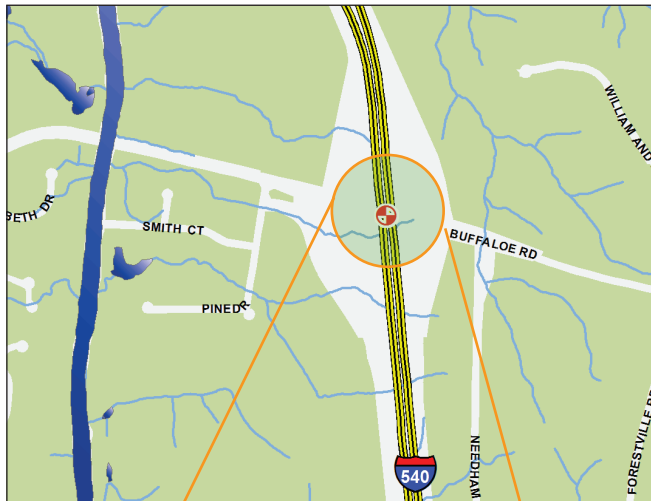


BUFFALOE ROAD &
I-540 INTERCHANGE
WAKE COUNTY, NC



Buffaloe Road & I-540 Interchange

Wake County, NC



INTRODUCTION

The interchange of Buffaloe Road and I-540 is grade-separated with a standard diamond configuration. The ramp intersections with Buffaloe Road are signalized and the bridge deck that crosses I-540 accommodates three full width travel lanes. The interchange is located in Wake County on the east side of the City of Raleigh. The land use in the vicinity of the interchange is mostly residential with several large residential subdivisions to the east and west. Traffic patterns are heavily influenced by commuters in towards the City of Raleigh during the AM peak hour and back out to the surrounding area during the PM peak hour. I-540 is a multi-lane divided facility with a speed limit of 70 mph. I-540 is a partial loop that runs through the outer limits of the City of Raleigh that terminates at US 64-264 (Knightdale Bypass) to the south and transitions to a toll facility (NC 540) near RTP at NC 147. NC 540 continues south to NC 55 (North Carolina Bypass) in the Town of Holly Springs. Buffaloe Road is a two lane facility with a speed limit of 45 mph. Buffaloe Road runs east-west with a speed limit of 45 mph. Buffaloe Road accesses New Hope Road and Capital Blvd. (US 1) to the west and Old Milburnie Road and Rolesville Road to the east.

PROBLEM STATEMENT

The study intersections experience excessive delay and long queues during both peak hours due to heavy directional commuter traffic. During the AM peak hour, the westbound through and right turn volumes (onto I-540 West) on Buffaloe Road have the highest traffic volumes causing long queues and delays on westbound Buffaloe Road as well as the left-turning movement on the eastbound Buffaloe Road at the I-540 westbound ramp. During the PM peak hour, the eastbound through traffic on Buffaloe Road and the volumes exiting I-540 East onto Buffaloe Road are heavy causing long queues and delay on the I-540 ramp to Buffaloe Road.

POSSIBLE SOLUTIONS

Create a free-flow condition for traffic also entering I-540 West from westbound Buffalo Road

Building upon the improvement to add a second lane on westbound Buffalo Road from Forestville Road to I-540, this recommendation also includes continuing the second lane onto the ramp for I-540 East creating a free-flow condition. The right turns will have their own lane separate from the vehicles turning onto the ramp from the eastbound left-turning vehicles. This will create two northbound lanes (onto I-540 West) on the ramp, which will taper down to one lane before merging with I-540 West.

TRAFFIC OPERATIONS

The operation of a traffic signal is determined by the average delay per vehicle processed by the signal during the peak hour. The future growth of traffic volumes in the area are approximated by applying 3% annual growth rate applied to the existing traffic count data. By applying the growth factor and estimating the future delays, the operational “Life” of the proposed improvement is determined.

EXISTING 2013 AM PM

I-540 WB Ramps	D	B
I-540 EB Ramps	C	F
LOS E	2017	
LOS F	2021	

Analysis indicates that with the recommended modifications to the intersection of Buffalo Road and I-540 westbound ramps, the overall intersection is expected to operate at an acceptable level of service for four years.

Construction Cost Estimate: \$1,000,000 Additional Solution: Diverging Diamond Interchange

A long term solution is to convert the current “diamond”

interchange to a Diverging Diamond Interchange (DDI). A DDI configuration creates direct left turn movements to and from I-540 while lowering conflict points. This is completed by crossing traffic at signals at both ends of the interchange to the left-hand side instead of the traditional right-hand side. The analysis of the DDI also showed that this section of Buffalo Road would need to be a four lane section for the operations to remain effective into the future.

	AM	PM
LOS E	2028	2027
LOS F	2031	2032

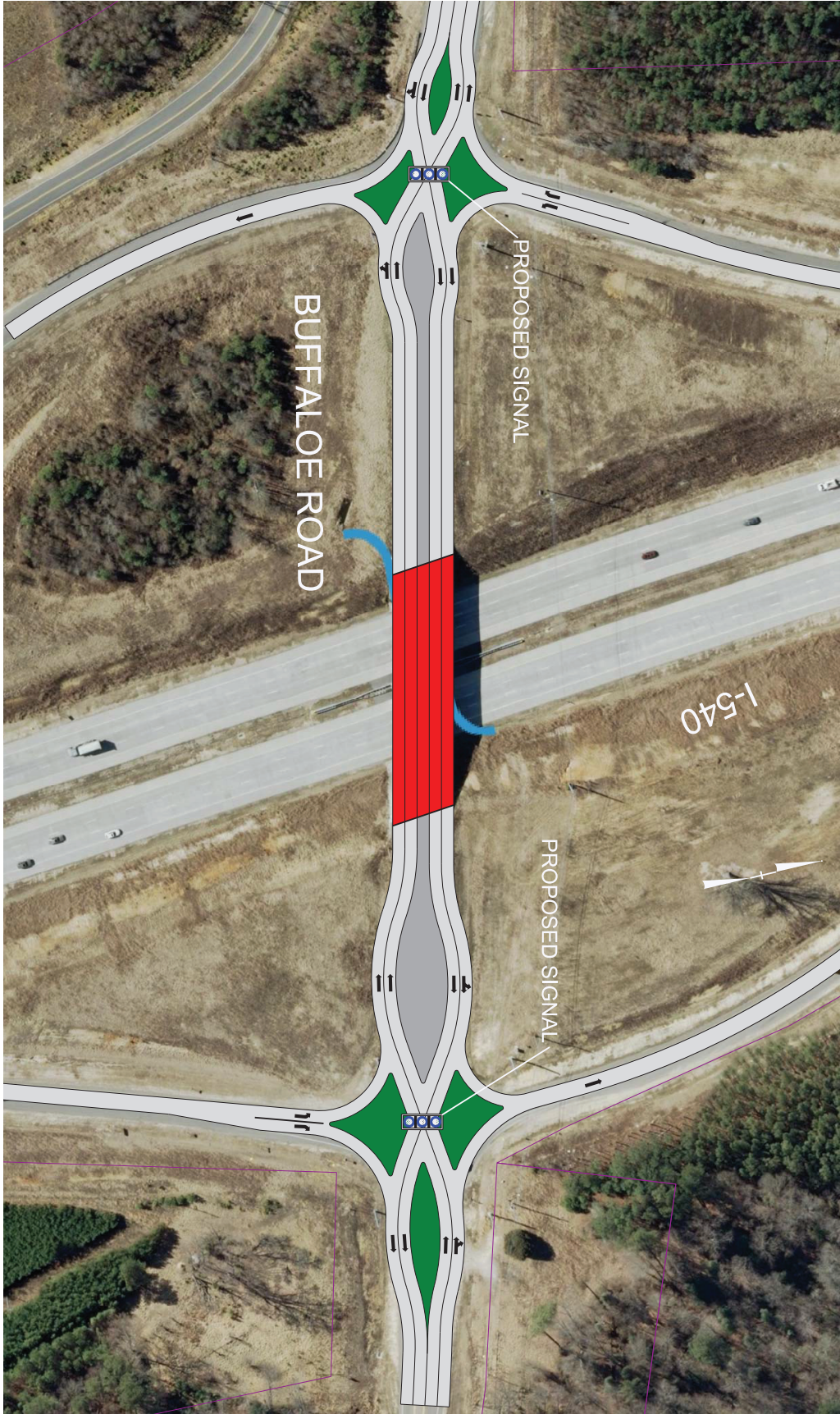
Analysis indicates that with the widening of Buffalo Road and the reconfiguration of the interchange at I-540, the interchange is expected operate at acceptable levels for 14 years.

Construction Cost Estimate: \$8,000,000

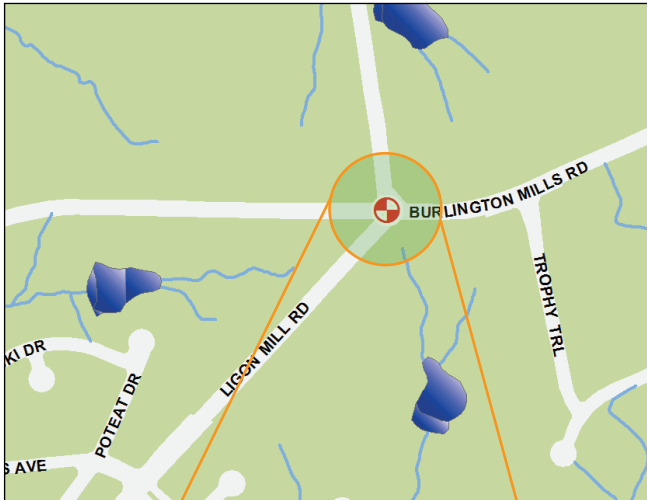


Representative illustration of a diverging diamond interchange





Burlington Mills Road & Ligon Mill Road Wake Forest, NC



INTRODUCTION

The intersection of Burlington Mills Road and Ligon Mill Road is signalized with a single lane on all approaches and is located within the limits of the Town of Wake Forest. The land use in the vicinity is mostly residential with a mixture of industrial and institutional. Burlington Mills Road is a two lane east-west roadway with a speed limit of 45 mph. Burlington Mills Road connects to US 401 (Louisburg Road) in Rolesville to the east and US 1 (Capital Blvd.) to the west. Ligon Mill Road is a two lane north-south road with a speed limit of 45 mph. Ligon Mill Road connects north to US 1-A (Main Street) and downtown Wake Forest and south to US 401 (Louisburg Road) at Mitchell Mill Road.

PROBLEM STATEMENT

This intersection currently has both operational and safety problems. Ligon Mill Road is a parallel roadway to Capital Blvd. Therefore, it is used during the peak hours as an alternate to Capital Blvd., which has heavy volumes and delays. Burlington Mills Road has high traffic volumes due to the connection from Capital Blvd. to the south side of Wake Forest. This creates two roadways that essentially have the same heavy volumes at this intersection. The safety concern is due to the number of crashes that have been reported at this location, which includes 35 crashes reported from 2008 to 2012. Most of the crashes were either “Left Turn” or “Rear End” type crashes. These occur because vehicles wanting to turn left have to slow down and stop in order to find a gap in on-coming traffic to make the turn safely. This impedes traffic and leads to rear end collisions. Additionally, left turn crashes may be exacerbated by the poor sight distance from either direction on Ligon Mill Road.

POSSIBLE SOLUTIONS

Add left-turn lanes to each approach of the intersection

The addition of an exclusive left-turn lane on each approach will aid in operational improvements. For safety purposes, the traffic signal should be updated to allow for “Protected” phases for left-turn movements. Installing an exclusive right-turn lane on the eastbound approach of Burlington Mills Road will process the heavy right-turn volumes present during the PM peak hour. The exclusive turn lanes will remove the turning vehicles from the through lanes not only creating a queue space but also separating the turning movements for a safer condition. The modified signal phasing will allow the left-turning vehicles to cross opposing traffic without having to wait for gaps and eliminating sight distance issues.

TRAFFIC OPERATIONS

The operation of a traffic signal is determined by the average delay per vehicle processed by the signal during the peak hour. By applying the 3% growth factor and estimating the future delays, the operational “Life” of the proposed improvement is determined.

	AM	PM
EXISTING	LOS D	LOS D
LOS E	2021	2027
LOS F	2026	2032

With the installation of the proposed improvements, the study intersection is expected to operate at acceptable levels for 8 years.

Construction Cost Estimate: \$500,000

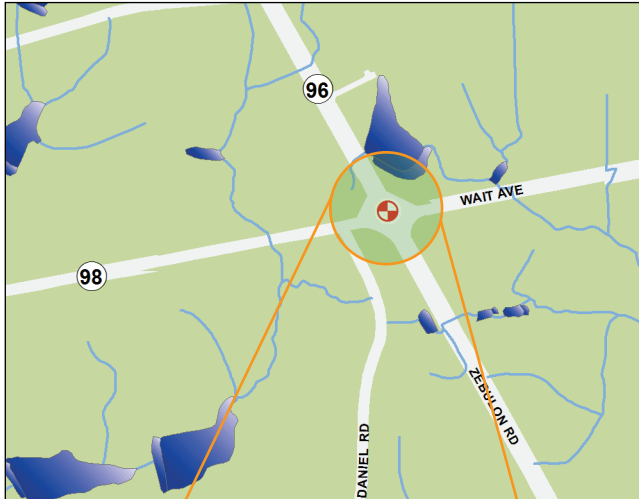




NC 98 (WAIT AVENUE) &
NC 96 (ZEBULON ROAD)
WAKE COUNTY, NC



NC 98 (Wait Avenue) & NC 96 (Zebulon Road) Wake County, NC



INTRODUCTION

The intersection of NC 98 (Wait Avenue) and NC 96 (Zebulon Road) is an unsignalized, four-leg intersection currently operating under “All-Way Stop” control. Each approach to the intersection has a free-flow right turn lane with a wide turn radius and is signed with “Yield” signs. The intersection is located east of the Town of Wake Forest in Wake County. The land use in the vicinity of the intersection is mostly undeveloped with some single family homes and commercial properties. NC 98 is a two lane east-west facility with a speed limit of 55 mph that connects to Bunn to the east and Wake Forest to the west. According to the 2040 CAMPO LRTP, NC 98, from the Wake Forest Bypass to US 401, is programmed to be widened from two to four lanes by 2040. NC 96 is a two lane north-south facility with a speed limit of 55 mph that connects to the Town of Youngsville to the north and the Town of Zebulon to the south. According to the 2040 CAMPO MTP, NC 96, from NC 98 to south of US 401, is programmed to be widened from two to four lanes by 2040.

PROBLEM STATEMENT

This intersection has significant traffic volumes on both facilities and the “All-Way Stop” control condition does not process traffic efficiently. Safety is also a concern at this intersection as highlighted by the occurrence of 38 crashes recorded from 2008 to 2012. Most of these crashes are caused by right turning vehicles failing to yield to through traffic on the other facility. This is mainly due to the lack of receiving area for the right turns at the yield. Another reason for the safety issue is the speed limit of 55 mph may be too high for an area carrying this much volume. There is also an access management problem at this intersection as some of the driveways to the local commercial developments are too close to the intersection.

POSSIBLE SOLUTIONS

Signalize the intersection

Two potential solutions were considered for this intersection: signal or roundabout. The first solution involves the installation of a two-phase traffic signal and the removal of the large radius right-turn lanes. The signal will be more efficient than an “All-Way Stop” condition as the traffic flow continues to increase into the future. With the addition of the signal, the right-turn traffic would run through the signal, which should reduce the amount of crashes caused by the current yield condition. With the addition of the signal, access management should also be improved by changing or removing some of the driveways near the intersection for better traffic flow and safer conditions.

TRAFFIC OPERATIONS

The operation of a traffic signal is determined by the average delay per vehicle processed by the signal during the peak hour. By applying the 3% growth factor and estimating the future delays, the operational “Life” of the proposed improvement is determined.

LOS E	2030
LOS F	2033

The analysis indicates that the proposed signal is expected to operate at an acceptable LOS for 17 years.

Construction Cost Estimate: \$500,000

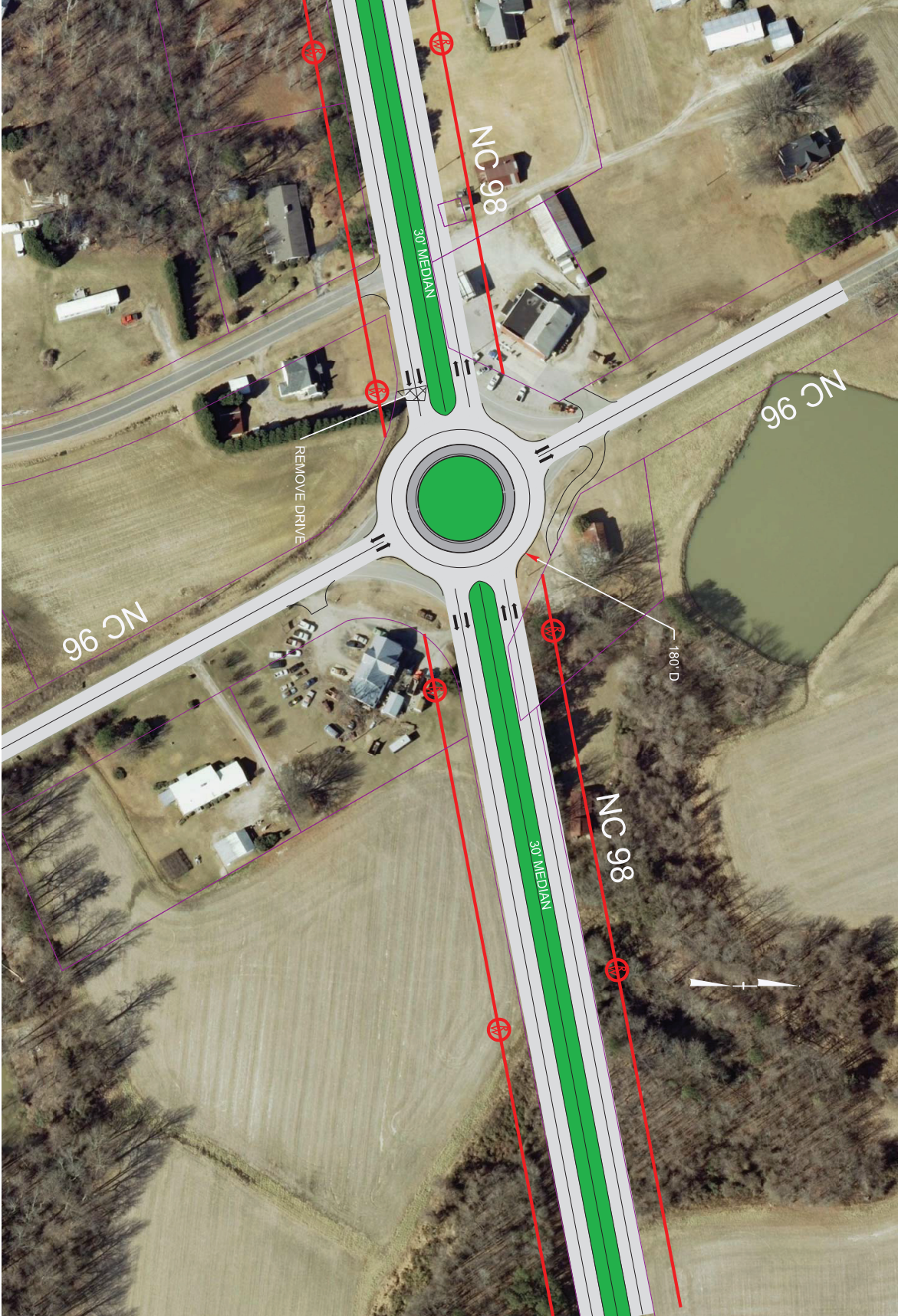
Roundabout

The second proposed solution for the safety and operational issues is the installation of a roundabout. A roundabout will be more efficient than the current configuration and will improve the safety level in the area by reducing the number of conflict points at the study intersection. The other advantage of a roundabout is size. The current footprint of the intersection indicates that a roundabout would be ideal and there would be minimal right-of-way takings to construct the roundabout. If future study indicates that there needs to be slip lanes for the right turning movements, those are already built into the intersection. Since NC 98 is scheduled to be widened to four lanes in the future, a two lane roundabout may need to be constructed with an interim condition of using one of those lanes while traffic increases in the area.

The operation of a roundabout is determined by the volume to capacity ratio (v/c) of the worst approach to the intersection. NCDOT has determined that a v/c ratio of 0.85 or less represents an acceptable level of service. By applying the 3% growth factor and estimating the future delays, the operational “Life” of the proposed improvement is determined. SIDRA is the software package that was utilized to analyze the operation of the roundabout.

The analysis indicates that the proposed roundabout with one circulating lane is expected to operate at an acceptable LOS until the year 2018. The proposed roundabout with two circulating lanes is expected to operate at an acceptable LOS until the year 2032.

Construction Cost Estimate: \$600,000

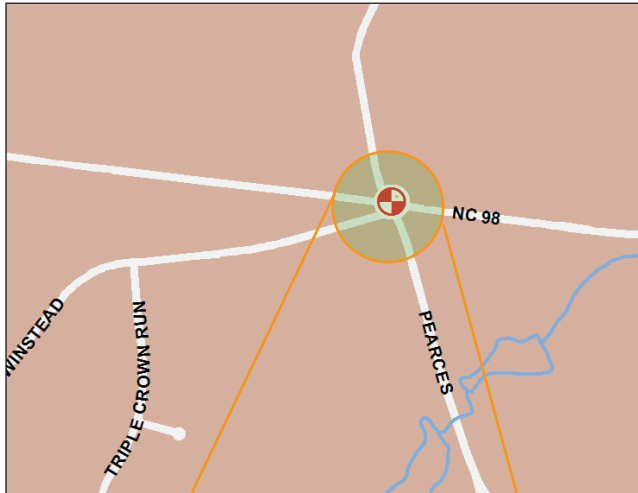




NC 98 & PEARCES ROAD /
JOHN WINSTEAD ROAD
FRANKLIN COUNTY, NC



NC 98 & Pearces Road / John Winstead Road Franklin County, NC



INTRODUCTION

The intersection of NC 98 and Pearces Road / John Winstead Road is a five-leg unsignalized intersection. The intersection is located to the west of the Town of Bunn in Franklin County. The land use in the vicinity of the intersection is mostly undeveloped with some single family homes. NC 98 is a two lane east-west facility with a speed limit of 55 mph and connects to Bunn to the east and Wake Forest to the west. Pearces Road is a north-south two lane facility with a speed limit of 55 mph and connects to NC 39 to the north US 64-264 to the south. John Winstead Road is a two lane facility with a speed limit of 45 mph that connects to Old Halifax Road to the southwest.

PROBLEM STATEMENT

A multi-leg intersection, like this one with five legs versus the normal four legged intersection, has an increased number of conflict points where vehicles can cross paths while traversing the intersection. An increased number of conflict points results in a higher likelihood of vehicular crash to occur. From 2008 to 2012, a total of 32 crashes were reported at this location. Twenty six of these crashes are “Angle” type crashes which is typical of this kind of intersection. Additionally, this intersection has sight distance issues along NC 98 as a result of the rolling terrain. NCDOT installed a flashing yellow signal to let drivers know about the intersection as they approach from all directions. The sight distance problem is evident on NC 98 West and the northbound Pearces Road approach.

POSSIBLE SOLUTIONS

Realignment of John Winstead Road

Two potential solutions were considered with the first one being the relocation and realignment of John Winstead Road. In this scenario, the existing connection to the intersection is removed and the roadway is relocated to form a new unsignalized T-intersection to NC 98 located west of Pearces Road. The location of this intersection will be determined by design standards and the grade along NC 98 as well as right-of-way concerns. The remaining intersection would be a conventional four-leg intersection with the northern and southern legs of Pearces Road under “Stop” control. Safety is the utmost concern at this intersection. Removing the fifth leg from the intersection will cut down on multiple conflict points and should reduce crashes at the intersection. This will also create a clear left turn from those traveling from NC 98 West to John Winstead Road.

TRAFFIC OPERATIONS

The operation of an unsignalized intersection is determined by the average amount of delay a vehicle is expected to experience while making a turning movement where there is opposing traffic. In this case, the delay expected for the northbound vehicles will determine operation of the study intersections. The future growth of traffic volumes in the area are approximated by applying 3% annual growth rate applied to the existing traffic count data. By applying the growth factor and estimating the future delays, the operational “Life” of the proposed improvement is determined.

LOS E	2023
LOS F	2026

With the installation of the proposed improvements, the analysis indicates that the proposed study intersections are expected to operate at acceptable levels for 10 years.

Construction Cost Estimate: \$400,000

Roundabout

The second proposed solution for the safety and operational issues at this intersection is to install a roundabout with one circulating

lane. A roundabout will more efficiently move traffic than the current configuration and will improve the safety level in the area by reducing the number of conflict points at the intersection. The only drawback to the roundabout is the travel speeds along NC 98. Since the speed limit is 55 mph, there will need to be a speed transition from 55 mph down to 35 mph when approaching the roundabout. The safety and operation savings of the roundabout outweighs vehicle speed as metrics for this intersection.

The operation of a roundabout is determined by the volume to capacity ratio (v/c) of the worst approach to the intersection. NCDOT has determined that a v/c ratio of 0.85 or less represents an acceptable level of service. By applying the 3% growth factor and estimating the future delays, the operational “Life” of the proposed improvement is determined. SIDRA is the software package that was utilized to analyze the operation of the roundabout.

The analysis indicates that the proposed roundabout is expected to operate at an acceptable LOS until the year 2044.

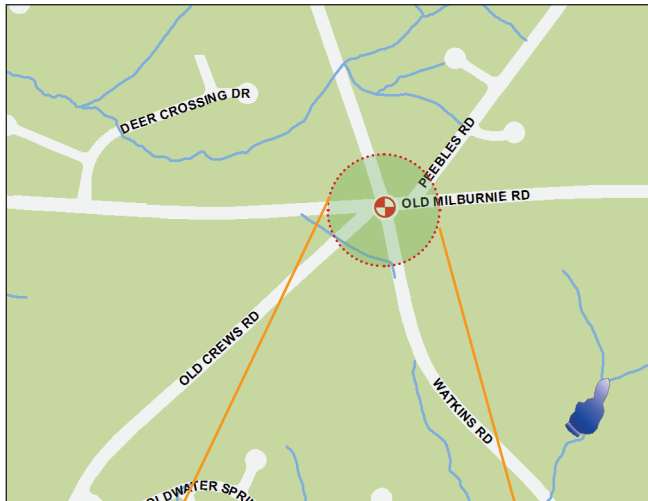
Construction Cost Estimate: \$600,000

Right of way impacts between the two solutions: The roundabout will affect right-of-way at multiple properties at the intersection which includes a business and some homes for a proposed total of 9,500 square feet. The realignment of John Winstead Road will affect one property for a total of 18,700 square feet.





Old Milburnie Road & Watkins Road / Old Crews Road / Peebles Road Wake County, NC



INTRODUCTION

This intersection located in eastern Wake County near Wendell/Zebulon is comprised of six approaches. The main roadways are Old Milburnie Road and Watkins Road which form a four-way stop. Just to the west of the main intersection is where Old Crews Road intersects Old Milburnie Road. Approximately 100 feet to the east of the main intersection is where Peebles Road intersects Old Milburnie Road. The land use in the vicinity of the intersection is mostly undeveloped with some single family homes, a convenience market in the northwest quadrant, and a fire station approximately 400 feet south along Watkins Road. Old Milburnie Road is an east-west two lane facility with a speed limit of 45 mph that connects to Forestville Road and US 64 Business to the west and Rolesville Road to the east. Watkins Road is a north-south two lane facility with a speed limit of 45 mph that connects to Mitchell Mill Road to the north and to Rolesville Road to the south. Old Crews Road is a two lane facility with a speed limit of 45 mph that connects southward to Forestville Road in the Town of Knightdale. Peebles Road is a two lane facility with a speed limit of 45 mph that connects to Mitchell Mill Road and transitions to Jonesville Road northward to US 401 in the Town of Rolesville.

PROBLEM STATEMENT

Since this intersection essentially has six approaches, it has an increased number of conflict points where vehicles can cross paths while traversing the intersection. While an “All-Way Stop” control intersection may work from an operational standpoint, there may be a solution that balances the operations and safety at this intersection. The traffic volumes at this intersection are low (2,000 vehicle per day on each approach), but the impending growth will cause an increase in traffic as more residential and commercial property is developed.

POSSIBLE SOLUTIONS

Roundabout with a realigned intersection at Old Milburnie Road and Peebles Road

A roundabout with one circulating lane is proposed to be installed at the intersection of Old Milburnie Road and Watkins Road/Old Crews Road. The approach of Peebles Road should be realigned to intersect Old Milburnie Road at a 90 degree angle. A roundabout and intersection realignment combination will more efficiently move traffic than an “All-Way Stop” by improving the visibility and safety level in the area.

TRAFFIC OPERATIONS

The operation of a roundabout is determined by the volume to capacity ratio (v/c) of the worst approach to the intersection. NCDOT has determined that a v/c ratio of 0.85 or less represents an acceptable level of service. The future growth of traffic volumes in the area are approximated by applying 3% annual growth rate applied to the existing traffic count data. By applying the growth factor and estimating the future delays, the operational “Life” of the proposed improvement is determined. SIDRA is the software package that was utilized to analyze the operation of the roundabout.

The analysis indicates that the proposed roundabout with one circulating lane is expected to operate at an acceptable LOS until the year 2049.

Construction Cost Estimate: \$750,000

Rolesville Road - Eastern Wake County

INTRODUCTION

Rolesville Road is a thoroughfare in eastern Wake County that connects municipalities in eastern Wake County such as Knightdale, Wendell, and Zebulon to the south and Wake Forest and Rolesville to the north. As this section of Wake County develops into the future, this roadway will become a major carrier of traffic. According to the 2040 CAMPO MTP, this section of Rolesville Road between Mitchell Mill Road and Riley Hill road is scheduled to be widened from two lanes to four lanes by 2040. Due to both the 2040 traffic projections and the future possible growth in the area, all four intersections along Rolesville Road within the proposed widening area are part of the hot spot intersections in this study.



ROLESVILLE ROAD &
MITCHELL MILL ROAD
WAKE COUNTY, NC



Rolesville Road & Mitchell Mill Road Wake County, NC



INTRODUCTION

The intersection of Rolesville Road and Mitchell Mill Road is located in Wake County between the Town of Rolesville to the north and the Town of Knightdale to the south. The land use in the vicinity of the intersection is mostly undeveloped farmland and single-family homes. Rolesville Road is a two-lane north-south facility with a speed limit of 45 mph. Rolesville Road connects to US 401 (Louisburg Road) to the north and US 64/US 264 to the south. Mitchell Mill Road is a two-lane facility with a speed limit of 45 mph that connects to US 401 (Louisburg Road) to the west and to NC 96 (Zebulon Road) to the north. Mitchell Mill Road, along with Old Milburnie Road and Buffalo Road, are major thoroughfares in eastern Wake County that carry heavy directional vehicular traffic during the peak hour to and from Raleigh.

PROBLEM STATEMENT

This intersection currently has a skewed angle which creates a large conflict area for vehicles traversing the intersection and makes it more difficult for drivers to predict the movements of other vehicles. The large conflict area and increased driver indecision creates a safety concern illustrated by the number and type of crashes observed at this intersection. In a three year period from 2008 to 2011, there were seven "Angle," one "Sideswipe," one "Left Turn," and one "head On" type crashes at this location. Additionally, the operations at this intersection are continuing to deteriorate. There has been an increase in traffic due to the increase in residential development and the addition of the new Rolesville High School (approximately 1.7 miles north of this intersection).

POSSIBLE SOLUTIONS

Realign to offset T-intersections

Due to the skewed intersection and associated safety problems, it is proposed that the intersection be realigned to an “Offset T-Intersection” configuration. The proposed configuration would create two separate three leg intersections with a separation of approximately 600 feet along Rolesville Road. The two T-intersections are proposed to be unsignalized with Mitchell Mill Road and to operate under “Stop” control. By separating the existing skewed intersection into two separate T-intersections, the conflict area is eliminated and drivers can identify turning movements of other drivers.

TRAFFIC OPERATIONS

The operation of an unsignalized intersection is determined by the average amount of delay a vehicle is expected to experience while making a turning movement where there is opposing traffic. In this case, the delay expected for the westbound vehicles on Mitchell Mill Road (northern T-intersection) will determine the operation of the realigned intersection during the AM peak hour and the delay expected for the eastbound vehicles on Mitchell Mill Road (southern T-intersection) during the PM peak hour. The future growth of traffic volumes in the area are approximated by applying 3% annual growth rate applied to the existing traffic count data. By applying the growth factor and estimating the future delays, the operational “Life” of the proposed improvement is determined.

	AM	PM
EXISTING	LOS C	LOS C
LOS E	2021	2023
LOS F	2023	2025

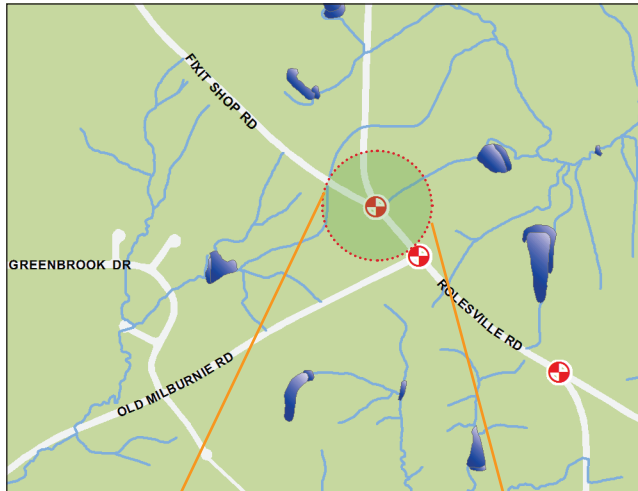
In addition to the improved safety conditions with the installation of the proposed improvement, the analysis indicates that the proposed intersection is expected to operate at acceptable levels for 8 years.

Construction Cost Estimate: \$1,000,000

(Right-of-way adds to the cost as this will need to be looked at closely during planning and design)



Rolesville Road & Fixit Shop Road Wake County, NC



INTRODUCTION

The intersection of Rolesville Road and Fixit Shop Road is located in Wake County between the Town of Rolesville to the north and the Town of Knightdale to the south. The land use in the vicinity of the intersection is mostly undeveloped farm land and single family homes. This intersection is approximately 3,600 feet south of the intersection of Rolesville Road and Mitchell Mill Road. Fixit Shop Road is a two-lane facility with a speed limit of 45 mph that serves as an alternate route between Rolesville Road to the south and Mitchell Road to the north.

PROBLEM STATEMENT

This intersection does not fully accommodate the northbound left-turning vehicles from Rolesville Road onto Fixit Shop Road. A significant percentage of the northbound vehicles on Rolesville Road turn left onto Fixit Shop Road as this is used as a cut-through to get to Mitchell Mill Road and points to the west. These vehicles slow down and stop to negotiate the turn causing delay and queuing for vehicles continuing north on Rolesville Road.

POSSIBLE SOLUTIONS

Exclusive northbound left-turn lane

An exclusive left-turn lane is proposed to be installed on the northbound approach of Rolesville Road. The exclusive turn lane will help to remove the turning vehicles from the main road and will improve the operation of the intersection.

TRAFFIC OPERATIONS

The operation of an unsignalized intersection is determined by the average amount of delay a vehicle is expected to experience while making a turning movement where there is opposing traffic. In this case, the delay expected for the eastbound vehicles (minor movement from Fixit Shop Road) will determine the operation of the study intersection. The future growth of traffic volumes in the area are approximated by applying 3% annual compound growth rate applied to the existing traffic count data. By applying the growth factor and estimating the future delays, the operational “Life” of the proposed improvement is determined.

EXISTING	LOS B
LOS E	2053
LOS F	2056

With the installation of the proposed improvement, the analysis indicates that the proposed intersection is expected to operate at acceptable levels for 40 years.

Construction Cost Estimate: \$350,000

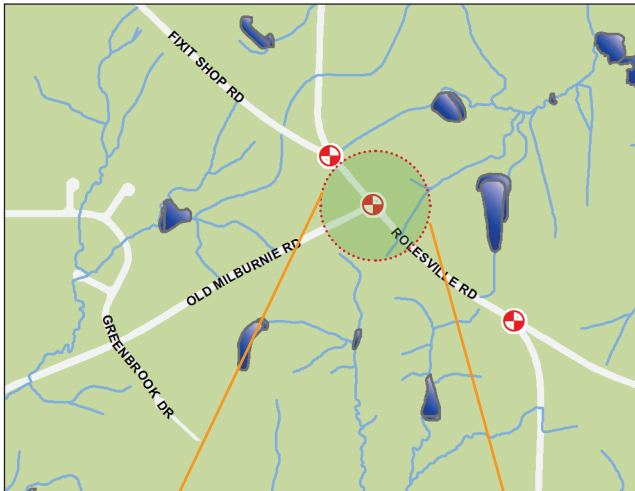




ROLESVILLE ROAD &
OLD MILBURNIE ROAD
WAKE COUNTY, NC



Rolesville Road & Old Milburnie Road Wake County, NC



INTRODUCTION

The intersection of Rolesville Road and Old Milburnie Road is located in Wake County between the Town of Rolesville to the north and the Town of Knightdale to the south. The land use in the vicinity of the intersection is mostly undeveloped farm land and single family homes. This intersection is approximately 550 feet south of the Rolesville Road/Fixit Shop Road intersection. Old Milburnie Road is a two lane east-west facility with a speed limit of 45 mph and dead ends at Rolesville Road. Old Milburnie Road connects to Forestville Road and US 64 Business (New Bern Road) to the west near the east side of the City of Raleigh.

PROBLEM STATEMENT

This intersection does not fully accommodate the southbound right turning vehicles from Rolesville Road onto Old Milburnie Road. A significant percentage (approximately 25%) of the total of southbound vehicles on Rolesville Road turns right onto Old Milburnie Road. These vehicles slow down to negotiate the turn causing delay and queuing for the vehicles continuing south on Rolesville Road.

POSSIBLE SOLUTIONS

Exclusive southbound right-turn lane

In order to address this issue an exclusive right turn lane is proposed to be installed on the southbound approach of Rolesville Road. The exclusive turn lane will help to remove the turning vehicles from the main road and will improve the operation of the entire facility.

TRAFFIC OPERATIONS

The operation of an unsignalized intersection is determined by the average amount of delay a vehicle is expected to experience while making a turning movement where there is opposing traffic. In this case, the delay expected for the eastbound vehicles (from Old Milburnie Road) will determine operation of the study intersection. The future growth of traffic volumes in the area are approximated by applying 3% annual growth rate applied to the existing traffic count data. By applying the growth factor and estimating the future delays, the operational “Life” of the proposed improvement is determined.

EXISTING	LOS B
LOS E	2044
LOS F	2047

With the installation of the proposed improvement, the analysis indicates that the proposed intersection is expected to operate at acceptable levels for 31 years.

Construction Cost Estimate: \$250,000

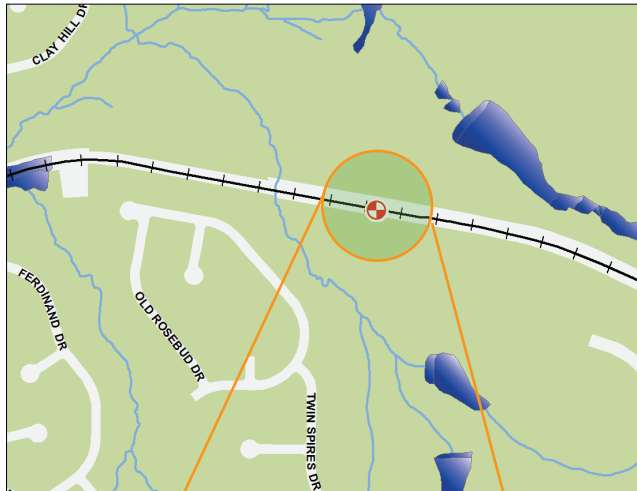




KNIGHTDALE RAILROAD CROSSINGS



Knightdale Railroad Crossings



INTRODUCTION

Not all hot spots are predicated on operations and/or safety. This hot spot location was chosen because of the lack of north-south access and the barrier caused by the railroad and Mingo Creek for vehicular and pedestrian mobility. The Town of Knightdale has connectivity issues for the neighborhoods surrounding the railroad line that runs east-west and I-540 that runs north-south. These neighborhoods are accessible from US 64 Business, Hodge Road, and Bethlehem Road, but they are not interconnected by any mode of transportation. Additionally, there are destinations on the opposing side of the railroad and creek including Hodge Road Elementary School to the south and major retail to the north.

PROBLEM STATEMENT

In discussions with the Town, it was expressed that there is a great need for another north-south crossing of the railroad between Hodge Road and Bethlehem Road. There is a large population area that is on either side of the railroad/creek corridor that justifies the need for better, safe connections. The major issues are crossing both the railroad and the creek. Any new connections should be considered multi-modal.

POSSIBLE SOLUTIONS

Vehicular Connection – Widewaters Parkway to Woodfield Lane

These natural and manmade constraints make it difficult to locate the vehicular crossing. Beyond the railroad, there is a large number of wetlands surrounding the Mingo Creek Corridor and permitting this crossing would be a challenge. The location that was selected minimized the wetland disturbance as well as connected two existing stub-out roadways: Widewaters Parkway on the north side of the railroad/creek and Woodfield Lane on the south side of the railroad/creek. While this is not a direct connection between neighborhoods, it will make emergency access easier as well as lower the travel time from the north side to Hodge Road Elementary School via Old Faison Road. The final design would need to include horizontal curvature to ensure that the connection made a perpendicular crossing of the railroad to enhance safety and sight distance.

Construction Cost Estimate: Roadway Connection: approximately 3,500 feet, \$1.5 million

Pedestrian Connection – From Mingo Creek

Greenway to Churchill Nature Trail

The Town has completed its first greenway along Mingo Creek that connects to the west to Neuse River Trail and to the east to Mingo Creek Park. The greenway runs along the north side of the creek and connects neighborhoods such as Planters Walk, Widewaters, and Timber Ridge. The Churchill Nature Trail is part of the Churchill neighborhood on the south side of the railroad. The search for a logical pedestrian connection was limited by the wetland areas and topography. It would be ideal to select a location where there could be a possible future grade separation for maximum safety crossing the railroad. With this in mind, two possible solutions were determined:

1. The location closest to I-540 (just east of I-540) was selected because the topography is best for an at-grade crossing as well as minimizing wetland impacts. This location will also include a pedestrian connection from the Mingo Creek neighborhood, which will include a trail section between the railroad and the bridge abutments under I-540.
2. The second location (further away from I-540) is in an area where a grade separated crossing may be more likely due to the existing topography.

Greenway Connection Cost Estimate: total of approximately 2,000 feet, \$375,000

