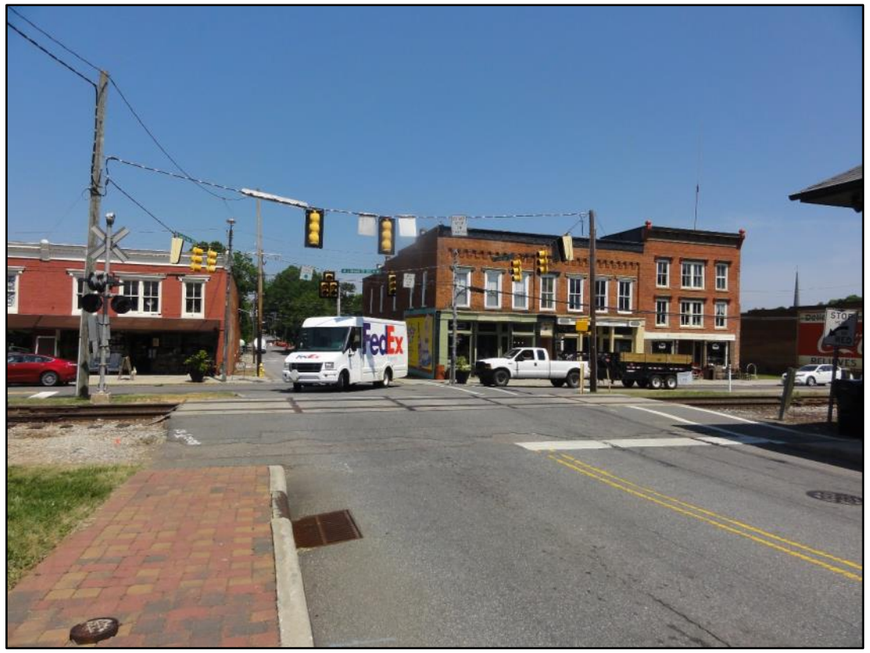

TRAFFIC SEPARATION STUDY

FOR THE

TOWN OF MOORESVILLE

August 2018

Prepared by

HDR, Inc.

Prepared for the

North Carolina Department of Transportation

Rail Division

Engineering Coordination and Safety Branch

TRAFFIC SEPARATION STUDY
for the
TOWN OF MOORESVILLE

August 2018

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Table of Contents

TABLES

NCDOT RAIL DIVISION

FIGURES

APPENDICES

EXECUTIVE SUMMARY

NCDOT RAIL DIVISION

EXECUTIVE SUMMARY

The North Carolina Department of Transportation (NCDOT) Rail Division, in cooperation with the Town of Mooresville and Norfolk Southern Railway (NS), conducted a Traffic Separation Study (TSS). The study evaluated 27 at-grade highway/railroad crossings along the NS "O" Line from Bridges Farm Road (SR 1106) to Mazeppa Road (SR 2395) in Mooresville, Iredell County (see Figure 1). The rail corridor primarily parallels NC 115 through Mooresville. NC 115 is a heavily traveled north-south highway corridor between Charlotte and North Wilkesboro. The purpose of the TSS is to determine the need for improvements and/or elimination of public at-grade crossings to improve safety and mobility for motorists, rail passengers, and train crews. The Mooresville TSS evaluated potential grade crossing closures and other improvements to support the opening of two new public grade crossings at Timber Road and between Langtree Road and Bridges Farm Road.

In 2004, NCDOT evaluated 13 grade crossings of the NS "O" Line in the Charlotte to Mooresville TSS. At the time, no further action was taken. Since the earlier evaluation many local plans and development changes have occurred, including the adaptation of the Mooresville Comprehensive Transportation Plan in 2008. This, combined with increased rail and vehicular traffic, is the reason that the study team reconsidered options for improving safety and mobility for railroad and highway traffic.

The crossings that are included in this TSS are listed in Table ES.1 below and depicted on Figure 1.

Table ES.1 – TSS Crossings

Crossing No.	Milepost	Road Name	Crossing Type	Existing Crossing Safety Protection
721 704A	23.18	Bridges Farm Road (SR 1106)	At-grade	Crossbucks
721 703T	23.41	Private road	At-grade	Stop Signs
721 702L	23.82	Private road	At-grade	Stop Signs
721 701E	24.02	Private road	At-grade	Stop Sign
721 700X	24.53	Langtree Road (SR 1102)	At-grade	Crossbucks, Flashing Lights, and Gates
721 697S	25.07	Fairview Road (SR 1246)	At-grade	Crossbucks, Flashing Lights, and Gates
721 696K	25.37	Crossrail Road (SR 1170)	At-grade	Crossbucks
721 695D	25.70	Waterlynn Road (SR 1135)	At-grade	Crossbucks, Flashing Lights, and Gates
721 692H	26.31	Foursquare Road (SR 1132)	At-grade	Crossbucks
721 691B	26.60	Timber Road (Private)	At-grade	Crossbuck and Stop Signs
721 687L	27.30	Norman Drive/ Doster Avenue	At-grade	Crossbucks
721 685X	27.50	Brawley Avenue	At-grade	Crossbucks and Flashing Lights
721 683J	27.60	Mills Avenue	At-grade	Crossbucks
721 682C	27.80	Wilson Avenue	At-grade	Crossbucks, Flashing Lights, and Gates
721 681V	28.00	Catawba Avenue	At-grade	Crossbucks
721 680N	28.16	McLelland Avenue (NC 115)	At-grade	Crossbucks, Flashing Lights, and Gates
721 679U	28.30	Center Avenue	At-grade	Crossbucks and Flashing Lights
721 678M	28.40	Moore Avenue	At-grade	Crossbucks and Flashing Lights
721 677F	28.49	Iredell Avenue (NC 3/NC 152)	At-grade	Crossbucks, Flashing Lights, and Gates
721 676Y	28.75	Oak Street	At-grade	Crossbucks, Flashing Lights, and Gates
721 675S	28.89	Walnut Street	At-grade	Crossbucks
721 674K	28.98	Patterson Avenue	At-grade	Crossbucks, Flashing Lights, and Gates
736 195A	29.20	Statesville Avenue	At-grade	Crossbucks and Flashing Lights
721 673D	29.39	Williams Street	At-grade	Crossbucks, Flashing Lights, and Gates
721 671P	29.59	Plaza Drive (NC 150)	At-grade	Crossbucks, Flashing Lights, and Gates
721 668G	30.16	Whitman Circle (SR 2396)	At-grade	Crossbucks
721 665L	30.61	Mazeppa Road (SR 2395)	At-grade	Crossbucks, Flashing Lights, and Gates

Safety and Mobility Issues

Safety and mobility issues were considered at each crossing based on roadway geometry, existing warning devices, and behavior of users across the tracks. The following conditions were observed:

- Bridges Farm Road (SR 1106) (721 704A) – This is a paved, two-lane, slightly skewed crossing that provides access to a dead end residential area of approximately 200 homes. The railroad is in a tangent section, and the sight distances are adequate. The warning devices at the crossing include crossbuck signs.
- Private road (721 703T) – This is a paved, one-lane, humped crossing with adequate sight distances on a gravel road leading to farm land and a single residence. The warning devices at the crossing include a stop sign on both sides of the railroad.
- Private road (721 702L) – This is a paved, one-lane, severely humped crossing with adequate sight distances on a gravel road leading to vacant wooded land. The warning devices at the crossing include a stop sign on both sides of the railroad.

Bridges Farm Road (721 704A)

NCDOT RAIL DIVISION

- Private road (721 701E) – This is a paved, one-lane, severely humped crossing with adequate sight distances on a dirt road leading to farm land and a single residence. The warning devices at the crossing include a stop sign on the east side of the railroad.
- Langtree Road (SR 1102) (721 700X) – This is a paved, two-lane, humped crossing with adequate sight distances on a sharp skew angle to the railroad. There is a dedicated right turn lane and a lane for thru and left turning traffic on Langtree Road on the east side of the crossing. The crossing experiences high traffic volumes – a Lowe's Corporate Headquarters access point and an I-77 interchange lie west of the crossing approximately 0.3 mile and one mile, respectively, and Mount Mourne Volunteer Fire Department is across NC 115 from the crossing. The warning devices at the crossing include crossbuck signs, flashing lights, and gates.

Fairview Road (721 697S)

- Fairview Road (SR 1246) (721 697S) – This is a paved, two-lane crossing with limited sight distances due to a horizontal curve to the south and trees and vegetation to the north. Fairview Road is approximately 65 feet wide (four to five lanes) and perpendicular to the crossing on the west side. It is 32 feet wide (two lanes) beginning at the crossing and immediately curves to the north heading towards NC 115. Lake Norman Regional Medical Center lies approximately 0.2 mile west of the crossing. The warning devices at the crossing include crossbuck signs, flashing lights, and gates.

Brawley Avenue (721 685X)

- Crossrail Road (SR 1170) (721 696K) – This is a narrow, paved, two-lane crossing located in a horizontal curve along the railroad. Trees, vegetation and the curve limit sight distances in both directions. Crossrail Road is a dead end residential road that provides access to approximately 11 residences west of the crossing. The warning devices at the crossing include crossbuck signs on both sides and a yield sign on the west side.
- Waterlynn Road (SR 1135) (721 695D) – This is a paved crossing with limited sight distance to the north due to a horizontal curve in the railroad and to the south due to trees and vegetation. Waterlynn Road is three lanes wide approaching the crossing on both sides and narrows to two lanes at the crossing. It connects NC 115 and US 21. A dense residential area lies in the northwest quadrant of the crossing. The warning devices at the crossing include crossbuck signs, flashing lights, and gates.
- Foursquare Road (SR 1132) (721 692H) – This is a paved, two-lane crossing with adequate sight distance to the north and limited to the south due to a horizontal curve in the railroad and trees. Foursquare Road is a dead end road that primarily serves a residential area; however, there is a church and a commercial nursery west of the crossing. The warning devices at the crossing include a crossbuck and yield sign on both sides.
- Timber Road (private) (721 691B) – This is a narrow, one-lane, paved crossing that is humped. It is a private crossing on a gravel road that provides access to one residence. Sight distance to the south is adequate and limited to the north due to a horizontal curve in the railroad. The warning devices at the crossing include a crossbuck sign on the east side of the crossing and stop signs on both sides.
- Norman Drive/Doster Avenue (721 687L) – This is a paved, two-lane, severely humped crossing with adequate sight distance to the north and limited to the south due to a horizontal curve in the railroad and trees. There is less than 10 feet between NC 115 and the nearest rail – leaving no room to the east of the crossing for a vehicle on Norman Drive/Doster Avenue waiting to turn onto NC 115 without being on the tracks. Norman Drive/Doster Avenue provides access to a golf course community. South Broad Street ends at Norman Drive/Doster Avenue immediately west of the crossing. The warning devices at the crossing include a crossbuck sign on the west side of the crossing.

- Brawley Avenue (721 685X) – This is a paved, two-lane, humped crossing with adequate sight distances. The crossing geometry is similar to Norman Drive/Doster Avenue in that it is very close to NC 115, leaving little room to allow a car to wait on the east side to turn without being on the tracks. Brawley Avenue ends at South Broad Street immediately to the west of the crossing. The parking driveway for a municipal baseball field is across South Broad Street from the crossing. There is frequent pedestrian activity at this crossing. The warning devices at the crossing include crossbuck signs and flashing lights. There is not enough clearance for gates.
- Mills Avenue (721 683J) – This is a paved, two-lane, humped crossing with adequate sight distances. Like the two previous urban crossings, Norman Drive/Doster Avenue and Brawley Avenue, the Mills Avenue crossing is very close to South Broad Street to the west and NC 115 to the east, leaving little room to allow a car to wait without being on the tracks. The warning devices at the crossing include a crossbuck sign on the east side of the crossing.
- Wilson Avenue (721 682C) – This is a paved, two-lane, humped crossing with a concrete surface and adequate sight distances. A high volume of traffic uses Wilson Avenue, and it is in close proximity to NC 115 and South Broad Street, similar to the crossings discussed above. The warning devices at the crossing include crossbuck signs, flashing lights, and gates.
- Catawba Avenue (721 681V) – This is a paved, two-lane, humped crossing with adequate sight distances. It is in close proximity to NC 115 and South Broad Street, similar to the crossings discussed above. There is frequent pedestrian activity at this crossing, partly due to a nearby library and a soup kitchen. The warning devices at the crossing include a crossbuck sign on the east side of the crossing.
- McLelland Avenue (NC 115) (721 680N) – This is a wide, paved, two-lane, humped crossing with a concrete surface and adequate sight distance to the south and limited to the north due to a horizontal curve in the railroad. It is in close proximity to NC 115 and South Broad Street, similar to the crossings discussed above. NC 115 crosses the railroad here. NC 115 is on the east side of the tracks south of the McLelland Avenue crossing and on the west side north of the crossing. The warning devices at the crossing include crossbuck signs, flashing lights, and gates.
- Center Avenue (721 679U) – This is a wide, paved, two-lane, humped crossing with a concrete surface and adequate sight distance to the south and limited to the north due to a horizontal curve in the railroad. NC 115 is approximately 20 feet east of the crossing, leaving little room to clear the tracks for cars waiting to turn onto NC 115 from Center Avenue. There is frequent pedestrian activity at this crossing as it is within downtown Mooresville. The warning devices at the crossing include crossbuck signs and flashing lights. There is not enough clearance for gates.
- Moore Avenue (721 678M) – This is a paved, three-lane, humped crossing with a concrete surface and adequate sight distance to the south and limited to the north due to a horizontal curve in the railroad. Like Center Avenue, there is little room for a car between the crossing and NC 115 without it being on the tracks. There is frequent pedestrian activity at this crossing as it is within downtown Mooresville (sidewalks and pedestrian crosswalks are located on both sides). The warning devices at the crossing include crossbuck signs and flashing lights.

NCDOT RAIL DIVISION

- Iredell Avenue (NC 3/NC 152) (721 677F) – This is a paved, three-lane crossing with a concrete surface and adequate sight distance to the south and limited to the north due to a horizontal curve in the railroad. Traffic volumes are relatively high at this crossing as three NC routes converge – NC 3, NC 115 and NC 152. Like the two crossings before it, there is little room for a car between the crossing and NC 115 without it being on the tracks. There is frequent pedestrian activity at this crossing as it is within downtown Mooresville (sidewalks are located on both sides). The warning devices at the crossing include crossbuck signs, flashing lights, and gates.
- Oak Street (721 676Y) – This is a paved, two-lane crossing with adequate site distances. Oak Street approaches the crossing from the east at a slightly skewed angle to the railroad, and there is little room for a car between the crossing and NC 115 without it being on the tracks. Oak Street connects NC 115 and NC 801 and serves a mostly residential area. Park View Elementary School is located approximately 0.3 mile east of the crossing. The warning devices at the crossing include crossbuck signs, flashing lights, and gates.
- Walnut Street (721 675S) – This is a narrow, paved, two-lane, humped crossing with adequate sight distances and less than 100 vehicles per day (vpd). Walnut Street approaches the crossing from the east at a significantly skewed angle to the railroad, and there is little room for a car between the crossing and NC 115 without it being on the tracks. Walnut Street is a short (0.2 mile long) residential street that connects NC 115 and Statesville Avenue. The warning devices at the crossing include crossbuck signs.
- Patterson Avenue (721 674K) – This is a paved, two-lane, humped crossing with adequate sight distance to the south and limited to the north due to a horizontal curve in the railroad. Patterson Avenue approaches the crossing from the east at a significantly skewed angle to the railroad, and there is little room for a car between the crossing and NC 115 without it being on the tracks. Patterson Avenue ends 0.1 mile east of the crossing and primarily serves a collection of commercial businesses and a warehouse. The warning devices at the crossing include crossbuck signs, flashing lights, and gates.
- Statesville Avenue (736 195A) – This is a paved, two-lane crossing with a concrete surface and limited sight distances in both directions due to a horizontal curve in the railroad. Statesville Avenue approaches the crossing from the east at a severely skewed angle to the railroad, and there is not enough room for a car between the crossing and NC 115 without it being on the tracks. Drivers turning from Statesville Avenue onto NC 115 are required to look almost behind them for oncoming traffic. The warning devices at the crossing include crossbuck signs and flashing lights. There is not enough clearance for gates.


Plaza Drive (721 671P)

- Williams Street (721 673D) – This is a paved, two-lane, humped crossing with limited sight distances in both directions due to a horizontal curve in the railroad. East of the crossing, Williams Street leads to a network of primarily residential streets with access to NC 150 to the north and NC 801 farther to the east. The warning devices at the crossing include crossbuck signs, flashing lights, and gates.
- Plaza Drive (NC 150) (721 671P) – This is a paved, three-lane, crossing with a concrete surface and limited sight distances in both directions due to horizontal curves in the railroad. Plaza Drive approaches the crossing from the east at a significantly skewed angle to the railroad. This crossing experiences the highest volume of traffic (over 10,000 vpd) compared to the other crossings being studied. NC 150 is a regional route between I-85 to the east and I-77 to the west. Locally, a densely developed commercial corridor begins at the Plaza Drive crossing and extends for approximately four miles to I-77 and beyond. The warning devices at the crossing include crossbuck signs, flashing lights, and gates.
- Whitman Circle (SR 2396) (721 668G) – This is a narrow, paved, two-lane crossing with adequate sight distance to the north but limited to the south due to a horizontal curve in the railroad. Whitman Circle serves a mostly residential area and provides indirect access via Goodwin Circle to NC 150. Driveways for a church and a commercial storage facility are located immediately east of the crossing. Due to poor sight distances and heavy traffic congestion at Goodwin Circle and NC 150, many residents choose to use Whitman Circle and the crossing to get in and out of the neighborhood. Some drivers also use Whitman Circle/Goodwin Circle to bypass the NC 115/NC 150 intersection. The warning devices at the crossing include crossbuck and yield signs on both sides of the crossing.


Mazeppa Road (721 665L)

- Mazeppa Road (SR 2395) (721 665L) – This is a paved, three-lane, two-track crossing with concrete surfaces and adequate sight distances. The NGK Ceramics plant is located in the northeast quadrant of the crossing. Trains making deliveries to the plant frequently block the Mazeppa Road crossing. Mazeppa Road experiences a high volume of traffic and serves numerous industrial/manufacturing facilities east of the crossing. Mazeppa Road turns into the recently constructed Connector Road west of NC 115, crosses over US 21 and will eventually connect to I-77 at a future interchange. The warning devices at the crossing include crossbuck signs, flashing lights, and gates.

All statements of volume intensity above are relative only to other crossings in this study.

Crash Data

Crash data from NCDOT and the Federal Railroad Administration (FRA) was analyzed for the 17-year period from 2000 to 2016. No crashes involving train/vehicle collisions were reported at the at-grade crossings in the study area. The most recent recorded crashes occurred in 1997 at Langtree Road, Oak Street, and Williams Street.

Capacity Analysis

Based on the preliminary analysis, all of the study crossings currently perform at a level of service (LOS) D or better with the exception of Plaza Drive, which operates at LOS E.

Public Involvement

A public involvement program was established as part of this study. It consisted of:

- Three stakeholder meetings
- Two public meetings
- A coordination meeting with NGK Ceramics representatives
- A public hearing

NCDOT RAIL DIVISION

- Mailings and press releases

Stakeholders who met to provide input during the course of the study included:

- Town of Mooresville
- Mooresville Graded School District
- Mooresville Fire Rescue
- Mooresville Police Department
- Mooresville Downtown Commission
- Mooresville South Iredell Economic Development Corporation (MSIEDC)
- Iredell County
- Mount Mourne Volunteer Fire Department
- NCDOT Rail Division
- NCDOT Division 12
- Norfolk Southern Railway
- NGK Ceramics
- Nest Homes
- Crosland Inc.
- Goode Properties
- HDR Inc.

Recommendations

The near-, mid-, and long-term recommendations of this study are presented from south to north below in Table ES.2 and in Figures 2 through 5. The cost estimates are for construction only and do not include right of way acquisition, utility relocation, or costs associated with construction phasing where railroad construction is required.

Table ES.2 – Mooresville TSS Recommendations

Crossing No.	Milepost	Road Name	Near-Term (< 3 years)		Mid-Term (3-7 years)		Long-Term (> 7 years)		Comments
			Recommendation	Construction Cost	Recommendation	Construction Cost	Recommendation	Construction Cost	
721 704A	23.18	Bridges Farm Road (SR 1106)			Install flashing lights and gates	$300,000			
721 703T	23.41	Private road*					Closure	$45,000	
721 702L	23.82	Private road*					Closure	$45,000	
721 701E	24.02	Private road*					Closure	$45,000	
721 700X	24.53	Langtree Road (SR 1102)	Minor resurfacing of roadway approach to flatten the roadway crossing surface	$3,000					
721 697S	25.07	Fairview Road (SR 1246)			Widen crossing to accommodate four lanes and a raised concrete median, and upgrade flashing lights and gates	$600,000	Widen roadway to four lanes between the crossing and NC 115	$1,000,000	
721 696K	25.37	Crossrail Road (SR 1170)			Install flashing lights and gates	$300,000			
721 695D	25.70	Waterlynn Road (SR 1135)	None	N/A	None	N/A	None	N/A	
721 692H	26.31	Foursquare Road (SR 1132)			Install flashing lights and gates	$300,000			
721 691B	26.60	Timber Road (Private)*					Closure	$45,000	
721 687L	27.30	Norman Drive/ Doster Avenue					Closure	$45,000	
721 685X	27.50	Brawley Avenue	Improve crossing surface and change signage so South Broad Street traffic yields to Brawley Avenue traffic	$3,000	Widen crossing to accommodate turning movements of tractor trailers and a pedestrian crosswalk; paint pedestrian crosswalks across Brawley Avenue east of NC 115 and across NC 115 and South Broad Street on the south side of the crossing; and upgrade flashing lights	$156,000			A traffic analysis should be conducted that considers traffic patterns at the Brawley Avenue crossing after the crossings at Norman Drive/Doster Avenue and Mills Avenue are closed and the new at-grade crossing at the Timber Road Extension is opened.

Table ES.2 – Mooresville TSS Recommendations

Crossing No.	Milepost	Road Name	Near-Term (< 3 years)		Mid-Term (3-7 years)		Long-Term (> 7 years)		Comments
			Recommendation	Construction Cost	Recommendation	Construction Cost	Recommendation	Construction Cost	
721 683J	27.60	Mills Avenue					Closure	$45,000	
721 682C	27.80	Wilson Avenue	Paint pedestrian crosswalks across NC 115 and South Broad Street on the south side of the crossing	$1,000					
721 681V	28.00	Catawba Avenue			Convert to a pedestrian only crossing with a Z-gate crossing	$200,000			
721 680N	28.16	McLelland Avenue (NC 115)	Paint pedestrian crosswalks across NC 115 and Main Street on the north side of the crossing	$1,000	Upgrade flashing lights and gates	$300,000			
721 679U	28.30	Center Avenue	Paint an edge line along the south side of Center Avenue from the end of the sidewalk east of the crossing to the curb at NC 115	$1,000					
721 678M	28.40	Moore Avenue			Upgrade flashing lights and install gates	$300,000			
721 677F	28.49	Iredell Avenue (NC 3/NC 152)			Upgrade flashing lights and gates	$300,000			
721 676Y	28.75	Oak Street			Upgrade flashing lights and gates	$300,000			
721 675S	28.89	Walnut Street			Closure	$45,000			
721 674K	28.98	Patterson Avenue					Closure	$45,000	
736 195A	29.20	Statesville Avenue	None	N/A	None	N/A	None	N/A	Due to the geometry of the roadway and railroad and the lack of clearance between the crossing and NC 155, roadway improvements and gates are not possible.
721 673D	29.39	Williams Street	None	N/A	None	N/A	None	N/A	
721 671P	29.59	Plaza Drive (NC 150)	Upgrade flashing lights and gates	$300,000					The near-term recommendation for the Plaza Drive crossing is to upgrade the flashing lights and gates in conjunction with the Town's Plaza Drive/NC 115 intersection improvement project (see Table B.3).

Table ES.2 – Mooresville TSS Recommendations

Crossing No.	Milepost	Road Name	Near-Term (< 3 years)		Mid-Term (3-7 years)		Long-Term (> 7 years)		Comments
			Recommendation	Construction Cost	Recommendation	Construction Cost	Recommendation	Construction Cost	
721 668G	30.16	Whitman Circle (SR 2396)			Resurface crossing and install flashing lights and gates	$302,000			
721 665L	30.61	Mazeppa Road (SR 2395)			Complete environmental and design studies for a new grade separation to replace the existing at-grade crossing	N/A	Replace the at-grade crossing by grade separating Mazeppa Road with a four-lane bridge over the railroad and NC 115 just to the south of the existing at-grade crossing	$7,700,000	The long-term recommendation will require realignment of Mazeppa Road and Connector Road. A two-way ramp between NC 115 and Connector Road will be provided to preserve the connection. Additional roadway work at McKenzie Road and in front of NGK Ceramics will be required to maintain access to the ceramics plant.

* Note: the use of private crossings is determined through an agreement between the property owner and NS Railway. If the land use changes or the property that is served by the crossing is sold, NS Railway has the right to terminate the agreement or renegotiate it with the property owner. NCDOT does not have jurisdiction over private crossings; therefore, they do not have the authority to participate in closures of private crossings.

Insert Figure 1 – Project Overview

Insert Figure 2 - Study Area Crossings: Bridges Farm Road to Langtree Road

Insert Figure 3 - Study Area Crossings: Fairview Road to Timber Road (Private)

Insert Figure 4 - Study Area Crossings: Norman Drive/Doster Avenue to Walnut Street

Insert Figure 5 - Study Area Crossings: Patterson Avenue to Mazeppa Road

SECTION A – Introduction

NCDOT RAIL DIVISION

A. INTRODUCTION

The North Carolina Department of Transportation (NCDOT) has developed the Traffic Separation Study (TSS) as an effort to pursue a more systematic approach to crossing safety. Traffic Separation Studies are a comprehensive evaluation of traffic patterns and road usage for an entire municipality or region that determines the need for improving and/or eliminating public grade crossings.

In 2004, NCDOT evaluated 13 grade crossings of the Norfolk Southern Railway (NS) "O" Line in the *Charlotte to Mooresville TSS*. At the time, no further action was taken. Since the earlier evaluation many local plans and development changes have occurred, including the adaptation of the Mooresville *Comprehensive Transportation Plan* in 2008. This, combined with increased rail and vehicular traffic, is the reason that the study team reconsidered options for improving safety and mobility for railroad and highway traffic.

The Town of Mooresville, NS, and NCDOT entered into a Municipal Agreement to evaluate highway/railroad grade crossings along the NS "O" line. The Mooresville TSS consists of evaluating 23 public and four private at-grade NS railroad crossings within or near the corporate limits of the Town of Mooresville, NC. These are located between Bridges Farm Road (SR 1106) and Mazeppa Road (SR 2395) (see Figure 1). The Mooresville TSS evaluated potential grade crossing closures and other improvements to support the opening of two new public grade crossings at Timber Road and between Langtree Road (SR 1102) and Bridges Farm Road. The crossings being evaluated are presented from south to north in Table A.1.

Table A.1 – Evaluated Crossings

Crossing No.	Milepost	Road Name	2014 ADT (vehicles/day)
721 704A	23.18	Bridges Farm Road (SR 1106)	1,188
721 703T	23.41	Private road	N/A
721 702L	23.82	Private road	N/A
721 701E	24.02	Private road	N/A
721 700X	24.53	Langtree Road (SR 1102)	8,966
721 697S	25.07	Fairview Road (SR 1246)	7,662
721 696K	25.37	Crossrail Road (SR 1170)	130
721 695D	25.70	Waterlynn Road (SR 1135)	5,546
721 692H	26.31	Foursquare Road (SR 1132)	321
721 691B	26.60	Timber Road (Private)	N/A
721 687L	27.30	Norman Drive/Doster Avenue	4,300
721 685X	27.50	Brawley Avenue	3,400
721 683J	27.60	Mills Avenue	870
721 682C	27.80	Wilson Avenue	6,400
721 681V	28.00	Catawba Avenue	869
721 680N	28.16	McLelland Avenue (NC 115)	5,173
721 679U	28.30	Center Avenue	1,600
721 678M	28.40	Moore Avenue	2,240
721 677F	28.49	Iredell Avenue (NC 3/NC 152)	8,700
721 676Y	28.75	Oak Street	600
721 675S	28.89	Walnut Street	66

Table A.1 – Evaluated Crossings

Crossing No.	Milepost	Road Name	2014 ADT (vehicles/day)
721 674K	28.98	Patterson Avenue	200
736 195A	29.20	Statesville Avenue	720
721 673D	29.39	Williams Street	1,800
721 671P	29.59	Plaza Drive (NC 150)	10,061
721 668G	30.16	Whitman Circle (SR 2396)	578
721 665L	30.61	Mazeppa Road (SR 2395)	8,219

The following crossings are located along the study corridor but were not evaluated as part of this TSS (see Figures 1-5):

- Quality Lane (721 699F) (private at-grade crossing) – located north of Langtree Road
- East Campus Lane (721 698Y) (private, commercial at-grade crossing) – located south of Fairview Road
- Residential driveway (721 693P) (private at-grade crossing) – located north of Waterlynn Road
- Tunnel Road (960 218T) (public grade-separated crossing) – located north of Iredell Avenue
- Commercial driveway (721 670H) (private at-grade crossing) – located north of Plaza Drive
- Residential driveway (721 669N) (private at-grade crossing) – located south of Whitman Circle
- Residential driveway (721 667A) (private at-grade crossing) – located south of Mazeppa Road

The Traffic Separation Study process has three phases:

A.1 Preliminary Phase

The NCDOT Rail Division and the Town of Mooresville agreed to study and implement improvements that will be identified by the TSS, and an engineering consultant was selected by NCDOT to develop the TSS and provide recommendations.

A.2 Study Phase

The engineering consultant evaluated the existing crossing conditions, average daily traffic (both trains and vehicles) and the socioeconomic impacts of potential closings for all public crossings within the study area and prepares recommendations for NCDOT and local officials to review. Recommendations are divided into three categories of improvements Near-term, Mid-term, and Long-term. These categories are described below:

Near-term recommendations (within three years) may include installation of flashing lights and gates, enhanced warning devices such as four-quadrant gates and longer gate arms, installation of concrete or rubber crossings, crossing closures, median barrier installation, pavement markings, roadway approach modifications and crossings realignments.

Mid-term recommendations (within three to seven years) may include installation of flashing lights and gates, enhanced warning devices such as four-quadrant gates and longer gate arms, connector roads, roadway realignments, crossing closures, relocations of existing crossings to safer locations and feasibility studies to evaluate potential grade separation locations.

Long-term recommendations (more than seven years) may include grade separations, connector roads and crossing closures. Recommendations are presented to the public for comment.

A.3 Implementation Phase

If applicable, funding sources for improvements are identified, project agreements are developed between funding partners, which identify responsibilities for project design, crossing closure coordination with railroad and state highway and local officials, and oversight of project implementation. Town staff typically assists with project development, utility relocation and right of way acquisition, if needed.

SECTION B – Data Collection

NCDOT RAIL DIVISION

B. DATA COLLECTION

B.1 Existing Conditions

The information included in Table B.1 was gathered for each grade crossing in order to evaluate the crossing conditions in terms of traffic and safety. Photographs along with data summary sheets for each crossing are included in Appendix A.

Table B.1 – Data Sources

Data Item	Source
Crossing Number	NCDOT Rail Division
Street or Route	NCDOT Rail Division
Railroad Company	NCDOT Rail Division
Railroad Milepost	NCDOT Rail Division
Existing Warning Devices	Site Inspection and Federal Railroad Administration (FRA) Inventory Forms
Vehicle Traffic	NCDOT Rail Division
24 hour Train Volumes	FRA Inventory Forms
Accident History	Accident Reports (NCDOT and FRA)
Street Classification	CRTPO/NCDOT Functional Classification Maps[1]
Truck Route	Site Inspection and NCDOT North Carolina Truck Network
Transit Route	ICATS[2]
School Bus Route (Yes/No)	FRA Inventory Reports/Mooresville Graded School District
Crossing Surface and Condition	Site Inspection
Land Use	Site Inspection
Redundant Crossing (Yes/No)	Site Inspection
Potential for Grade Separation	Exposure Index[3]
Humped Crossing	Site Inspection
Crossing Geometry	Site Inspection
Need for Enhanced Warning Devices	Site Inspection & Accident History
Feasibility of Roadway Improvements	Site Inspection & Engineering Judgment

1. CRTPO – Charlotte Regional Transportation Planning Organization
2. ICATS – Iredell County Area Transportation System
3. Exposure Index = Number of trains per day x Average Daily Traffic at highway/rail crossing (See Section C)

B.1.1 Traffic Counts

Average Daily Traffic (ADT) for the year 2014 at each public crossing was provided by the NCDOT Rail Division. Table A.1 in the previous section includes traffic volume data.

[1] For purposes of determining redundancy, traffic volumes were considered relative to other crossings in this study. In this case a low-volume crossing is defined as having an average daily traffic (ADT) less than 1,000 vpd.

B.1.2 Redundant Crossings

If a low-volume crossing has alternate access across the tracks available within a reasonable distance, it is often considered redundant.[1] Table B.2 lists the distance between redundant crossings in the study area.

Table B.2 – Redundant Crossings

Crossing No.	Milepost	Road Name	Nearest Parallel Crossing	Distance Between Redundant Crossings
721 683J	27.60	Mills Avenue	Brawley Avenue	0.17 miles
721 681V	28.00	Catawba Avenue	Wilson Avenue	0.15 miles
721 676Y	28.75	Oak Street	Walnut Street	0.14 miles
721 675S	28.89	Walnut Street	Patterson Avenue	0.09 miles
721 674K	28.98	Patterson Avenue	Walnut Street	0.09 miles
736 195A	29.20	Statesville Avenue	Williams Street	0.22 miles

B.1.3 Crash Data

Crash data from NCDOT and FRA was analyzed for the 17-year period from 2000 to 2016. No crashes involving train/vehicle collisions were reported at the crossings in the study area. The most recent recorded crashes occurred in 1997 at Langtree Road, Oak Street, and Williams Street.

B.2 Train Operations

B.2.1 Existing Train Service

The primary user of the railroad corridor through the project study area is Norfolk Southern Railway (NS) for freight operations. According to FRA crossing inventory data, two to three freight trains travel through the study area per week. The trains serve area customers including NGK Ceramics at the Mazeppa Road crossing and Bay State Milling Company north of the Iredell Avenue crossing. NS provides service to NGK Ceramics two to three times per week – spending 15 to 20 minutes each trip. The Mazeppa Road crossing is occupied by the train during those times. When this occurs, vehicles must find alternate routes to cross NC 115.

The NS "O" Line could serve as an alternate north-south route to the mainline along the North Carolina Railroad corridor should the mainline become inoperable.

B.2.2 Future Train Service

According to local economic development officials, rail access is used to market industrial areas along the Mazeppa Road corridor. Train traffic along the NS "O" Line could increase as industrial development grows in this area.

The Charlotte Area Transit System (CATS) is currently reevaluating its planned rapid transit LYNX Red Line that would utilize the NS "O" Line to link Mooresville to Charlotte. Stations may be located in Mooresville, Davidson, Cornelius, Huntersville, and several locations in Charlotte.

B.3 Other Transportation and Pedestrian Projects

The Town of Mooresville's *Comprehensive Transportation Plan* (June 2008) and *Comprehensive Transportation Plan Amendments Addendum Report* (April 2013) describe two new potential grade crossings along the corridor.

- A new grade crossing will be needed south of Mooresville where the proposed East-West Connector crosses the railroad south of Langtree Road.
- The proposed extension of Timber Road west to US 21 will require a new grade crossing near the intersection of Timber Road and NC 115.

Table B.3 lists transportation and pedestrian projects that are in the vicinity of the project corridor. Information is based on the NCDOT 2018-2027 State Transportation Improvement Program (STIP), CRTPO's 2018-2027 TIP (2017) and Metropolitan Transportation Plan (MTP) Addendum (February 2016), and various transportation planning documents from the Town of Mooresville. All projects listed in Table B.3 are located in Iredell County unless otherwise noted.

Table B.3 – Other Transportation and Pedestrian Projects

TIP No./ Project ID	Type	Description	Length (miles)	Status*
NCDOT 2018-2027 STIP				
B-5142	Bridge Replacement	Replace bridge No. 480057 on Cornelius Road (SR 1302) over Cornelius Creek	N/A	Under construction
I-5717	Interchange Improvements	Construct improvements at I-77/NC 150 interchange	N/A	Right of way in progress; Construction: 2019
I-5962**	New Interchange	Convert I-77/Cornelius Road grade separation to an interchange	N/A	Right of way: 2021; Construction: 2022
R-2307B	Road Widening	Widen NC 150 to multi-lanes from east of Greenwood Road (SR 1840) in Catawba County to US 21 in Iredell County	15	Right of way in progress; Construction: 2019
R-3833C	Road Widening	Widen Brawley School Road (SR 1100) from I-77 to US 21	0.8	Right of way: 2018; Construction: 2020
R-5100	Road Widening	Widen Williamson Road (SR 1109) from I-77 to NC 150	3.2	Right of way: 2019; Construction: 2020
U-5816	Road Widening	Widen Oates Road/Midnight Lane (SR 1305) to three lanes with an overpass over I-77 from US 21 to Bluefield Road (SR 1474)	1.5	Right of way: 2019; Construction: 2021
U-5817	New Location	Extend Fairview Road over 1-77 to connect with Alcove Road (SR 1206) and construct parallel north-south connector roads to Williamson Road	0.1	Right of way: 2019; Construction: 2021
U-5960**	Road Widening	Widen NC 150 to four lanes from NC 115 to NC 801	2.6	Right of way: 2023; Construction: 2025
U-5963**	Signal System Installation	Install close loop signal system on NC 115 from Waterlynn Road to Yellow Wood Drive	N/A	Construction: 2018
U-6037**	Road Widening	Widen US 21 to a four-lane divided facility from Plaza Drive to Medical Park Road (SR 1245)	2.7	Right of way: 2022; Construction: 2024
CRTPO 2040 MTP Addendum				
I-4750	Road Widening/Interchange Improvements	Widen I-77 from West Catawba Avenue in Mecklenburg County to NC 150 in Iredell County and improve the I-77/Griffith Street interchange in Mecklenburg County	7.8	2025
27	Road Widening	Widen NC 150 from US 21 to NC 801	3.1	2040
45	Road Widening	Widen NC 150 from I-77 to US 21	1.1	2025
Town of Mooresville				
East-West Connector	New Location	New road from Langtree Road to Faith Road (SR 1136) and from Faith Road to Shearers Road (SR 1125)	2.8	Unfunded
Timber Road Extension	New Location	Extend Timber Road west from NC 115 to US 21	0.9	Unfunded
Wilson Avenue	Road Improvements and Multi-use Path	Improve Wilson Avenue from US 21 to South Broad Street with curb and gutter and a multi-use path on the south side	1.3	Right of way: 2017; Construction: 2018
McLelland Avenue	Road and Pedestrian Improvements	Improve McLelland Avenue from just east of NC 150 to South Broad Street with curb and gutter and sidewalks on both sides.	0.9	Under construction
NC 150/NC 801	Intersection Improvements	Improve the NC 150/NC 801 intersection by adding left turn lanes to all four legs	N/A	Under construction
NC 115/NC 150	Intersection Improvements	Improve the NC 115/NC 150 intersection by adding right turn lanes to the westbound and southbound legs	N/A	Right of way: Complete; Construction: 2018
Main Street/Statesville Avenue	Intersection Improvements	Improve the Main Street/Statesville Avenue intersection by adding left turn lanes to the northbound and southbound legs	N/A	Complete
Mill Village Sidewalk	Pedestrian Improvements	New curb and gutter and sidewalks in the Mill Village area of Mooresville (east of NC 115 near the Norman Drive/Doster Avenue crossing)	N/A	Under construction
NC 115/East Campus Lane/Faith Road	Intersection Improvements	Improve the NC 115/East Campus Lane/Faith Road intersection by realigning Faith Road and adding left turn lanes to all four legs	N/A	Under construction

* NCDOT 2018-2027 STIP status given in fiscal years. CRTPO 2040 MTP Addendum status given in horizon years.
** These projects are also included in the CRTPO 2018-2027 TIP.

SECTION C – Crossing Analysis

NCDOT RAIL DIVISION

C. CROSSING ANALYSIS

C.1 Exposure Index

NCDOT uses an exposure index as one factor to determine if a grade separated crossing is warranted. The exposure index is calculated by multiplying the number of trains per day on the rail line being crossed by the number of vehicles per day at that crossing. As a general rule, grade separations should be considered in rural areas when the exposure index is 15,000 or more. In urban areas grade separations should be considered when the exposure index is 30,000 or more. The formula is shown below as:

EI = N x ADT

Where:

EI = NCDOT Rail Division's Exposure Index
N = Number of Trains per Day
ADT = Average Daily Traffic at at-grade crossing

Other factors that need to be considered in the feasibility of grade separations are accident history, topography, adjacent land use, construction impacts, and costs. As stated previously, two to three trains per week travel on this portion of the NS "O" Line. According to 2014 data, ADT volumes at all of the crossings but one are less than 10,000 vpd (Plaza Drive's ADT equals 10,061 vpd). Therefore, with less than one train per day and relatively low traffic volumes, none of the crossings warrant a grade separation based on the exposure index formula.

C.2 Economic Analysis

An economic analysis was performed for the recommendations considered at each crossing. Estimated construction costs were input into GradeDec.Net, which provided the benefit/cost information for each recommendation. GradeDec.Net is a web-based decision support tool developed by FRA that assists federal, state and local authority decision makers in evaluating the benefits and costs of highway-rail grade crossing upgrades, separations, and closures. To find the high yield crossing improvement recommendations, the analysis considers traffic flows and composition by highway and rail, growth in traffic over a specified time horizon, and the physical characteristics of the crossings and price information.

Algorithms in GradeDec.NET calculate the effects of the improvements, incorporating recent research findings relating safety to crossing improvements. The analysis includes sets of tables and graphs, included in Appendix D, that rank crossing improvements and provide quick indicators for high yield investments. The impact analysis also evaluates shifts in traffic flows in a corridor due to grade separations and closures. The analysis considers the cost as well and provides summary measures of costs and benefits. The GradeDec.Net analysis incorporated the best available information at the time it was performed in January 2018. Table C.1 summarizes the results of the GradeDec.Net analysis for all crossing recommendations.

Table C.1 – GradeDec.Net Results

Recommendations	Benefit-Cost Ratio	Base Year Collisions Per Year	Future Predicted Collisions Per Year
Near-term recommendations (within three years) include upgrading flashing lights and gates, improving crossing surfaces, pavement markings and signage, and roadway approach modifications. Mid-term recommendations (within three to seven years) include installing or upgrading flashing lights and gates, improving crossing surfaces, pavement markings, roadway approach modifications, pedestrian crossings, crossing closure, and studies to evaluate a potential grade separation. Long-term recommendations (more than seven years) include roadway approach modifications, crossing closures, and a grade separation.	0.851	0	0

SECTION D – Safety and Mobility Issues

NCDOT RAIL DIVISION

D. SAFETY AND MOBILILTY ISSUES

This section summarizes the existing warning devices at each of the at-grade crossings studied, and discusses safety and mobility issues at each crossing.

D.1 Vehicles Queuing Across Railroad Tracks

The presence of nearby traffic signals, intersections, or parallel roadways can result in queues of stopped vehicles extending onto or across a highway/rail crossing. The NS "O" Line closely parallels NC 115 along the study corridor, and there is little to no room for vehicle storage between the tracks and NC 115 at all but four study crossings – Fairview Road, Crossrail Road, Waterlynn Road, and Mazeppa Road. According to local officials and site visit observations, vehicles frequently stop on the tracks while waiting to turn onto NC 115. This is particularly true at the crossings in downtown Mooresville between Norman Drive/Doster Avenue and Plaza Drive. A local official identified Wilson Avenue and McLelland Avenue as two crossings with a notable amount of traffic where many vehicles attempt left turns but get stopped on the railroad tracks.

D.2 Humped Crossings

A "humped" crossing exists where the elevation of the railroad is significantly higher than the crossing roadway, causing vehicles to ascend on one side of the tracks and descend on the other. The severity of this condition can range from discomfort at normal speeds, to "bottoming out" of vehicles with long wheelbases or low clearances. This dragging can damage vehicles, or cause them to become stuck on the crossing, creating a serious hazard. Routine track maintenance tends to exacerbate the problem over time, as track ballast work typically adds about three inches per occurrence. Over a ten-year period, the railroad may rise as much as one foot as a result of this routine maintenance. Study crossings that are humped are presented in Table D.1.

D.3 Crossing Protection Device Upgrades

Upgrading existing warning devices is one of the most cost-effective methods of improving safety at an at-grade railroad crossing. Commonly used warning devices, include crossbuck signs, flashing lights and warning bells, and gate arms. Passive devices like crossbuck and other signs alert drivers to the presence of the crossing but do not prevent them from driving through the crossing when a train is present. Such devices are generally used when train volumes and vehicle crossing volumes are low, train speeds are low, and sight distance is not an issue.

Active devices such as gates, flashing lights, and bells warn the driver of a train approaching the crossing. These devices are generally used at higher volume crossings, where train speeds are higher, or when there is a history of train/vehicle collisions. The effectiveness of warning signs, pavement markings, traffic signals, and other traffic control devices is largely dependent upon proper installation and maintenance. The crossing protection devices by crossing are presented in Table D.1. See *Section H – Recommended Alternatives* for crossings recommended for protection equipment installation and/or upgrade.

D.4 Grade Crossing Condition

A poor grade crossing surface can result in a rough, uneven ride. This can increase wear and tear on vehicles, potentially create a traffic safety hazard, and may add to congestion by reducing travel speeds. The crossing materials used on grade crossings include asphalt, concrete slab, and rubber. Even though some materials provide a slightly improved ride and longer term maintenance, the main safety issue is the condition of the crossing. The grade crossing surface condition for each study crossing is presented in Table D.1.

Table D.1 – Existing Crossing Conditions

Crossing No.	Milepost	Road Name	Humped (Yes/No)	Existing Crossing Safety Protection		Grade Crossing Surface Condition (good/fair/poor)
				Passive	Active	
721 704A	23.18	Bridges Farm Road (SR 1106)	No	Crossbucks	None	Good
721 703T	23.41	Private road	Yes	Stop Sign	None	Poor
721 702L	23.82	Private road	Yes	Stop Sign	None	Fair
721 701E	24.02	Private road	Yes	Stop Sign	None	Poor
721 700X	24.53	Langtree Road (SR 1102)	Yes	Crossbucks	Flashing Lights and Gates	Fair
721 697S	25.07	Fairview Road (SR 1246)	No	Crossbucks	Flashing Lights and Gates	Good
721 696K	25.37	Crossrail Road (SR 1170)	Yes	Crossbucks	None	Fair
721 695D	25.70	Waterlynn Road (SR 1135)	Yes	Crossbucks	Flashing Lights and Gates	Fair
721 692H	26.31	Foursquare Road (SR 1132)	No	Crossbucks	None	Good
721 691B	26.60	Timber Road (Private)	Yes	Crossbuck and Stop Signs	None	Fair
721 687L	27.30	Norman Drive/ Doster Avenue*	Yes	Crossbuck	None	Fair
721 685X	27.50	Brawley Avenue*	Yes	Crossbucks	Flashing Lights	Poor
721 683J	27.60	Mills Avenue	Yes	Crossbuck	None	Poor
721 682C	27.80	Wilson Avenue	Yes	Crossbucks	Flashing Lights and Gates	Good
721 681V	28.00	Catawba Avenue*	Yes	Crossbuck	None	Poor
721 680N	28.16	McLelland Avenue (NC 115)	Yes	Crossbucks	Flashing Lights and Gates	Good
721 679U	28.30	Center Avenue	Yes	Crossbucks	Flashing Lights	Fair
721 678M	28.40	Moore Avenue	Yes	Crossbucks	Flashing Lights	Good
721 677F	28.49	Iredell Avenue (NC 3/NC 152)	No	Crossbucks	Flashing Lights and Gates	Good
721 676Y	28.75	Oak Street	No	Crossbucks	Flashing Lights and Gates	Fair
721 675S	28.89	Walnut Street	Yes	Crossbucks	None	Poor
721 674K	28.98	Patterson Avenue	Yes	Crossbucks	Flashing Lights and Gates	Poor
736 195A	29.20	Statesville Avenue	No	Crossbucks	Flashing Lights	Good
721 673D	29.39	Williams Street	Yes	Crossbucks	Flashing Lights and Gates	Good
721 671P	29.59	Plaza Drive (NC 150)	No	Crossbucks	Flashing Lights and Gates	Good

Table D.1 – Existing Crossing Conditions

Crossing No.	Milepost	Road Name	Humped (Yes/No)	Existing Crossing Safety Protection		Grade Crossing Surface Condition (good/fair/poor)
				Passive	Active	
721 668G	30.16	Whitman Circle (SR 2396)	Yes	Crossbucks	None	Poor
721 665L	30.61	Mazeppa Road (SR 2395)	No	Crossbucks	Flashing Lights and Gates	Good

* Based on information from local police, fire and emergency medical services (EMS) officials, these crossings present difficulties for fire trucks and tractor trailers due to the severity of the hump.

D.5 Vehicles Driving Around Automated Gates

Several situations can lead to the circumvention of automated gates by motorists:

- Gates are lowered, but no train is visible
- Gates fail, and remain in the lowered position
- Gates are lowered and a train is visible, but motorist is too impatient to wait

According to NCDOT and FRA accident reports, there have been no recorded accidents since 2000 due to vehicles driving around automated gates at the study area crossings.

D.6 Crossing Consolidation/Elimination

Vehicle and train volumes, geometry, safety, and proximity to nearby crossings are factors that are considered when identifying potential crossing closures. Good candidates for closure often have one or more of the following issues:

- Alternate crossing locations are located within a reasonable distance
- Skewed crossings
- Limited sight distance
- History of train/vehicle crashes
- Private crossing with no identifiable owner
- Complex crossings (e.g. multiple tracks, switching operations, etc.) that cannot be safely served with warning devices
- Crossings with a short distance to adjacent intersections which result in insufficient vehicular stacking distances.

See *Section H – Recommended Alternatives* for crossings recommended for consolidation/elimination.

D.7 Grade Separation

Grade-separated crossings eliminate the potential for train/vehicle collisions while maintaining vehicular and pedestrian access across the railroad tracks. However, stringent design standards and cost make changes to the railway difficult. Railroad overpasses of highways require approximately 15 feet of vertical clearance, and highway overpasses of railroad tracks require approximately 23 feet of clearance. Sight distance requirements on the overpass vertical curves generally result in long approaches, which can create adjacent property access and connectivity issues. In addition, visual and noise impacts associated with overpasses can negatively affect neighborhoods or historic areas. See *Section H – Recommended Alternatives* for crossings recommended for grade separation.

SECTION E – Community Characteristics

NCDOT RAIL DIVISION

E. COMMUNITY CHARACTERISTICS

The project study area encompasses a half-mile radius around each of the at-grade crossings. Potential impacts to community resources were considered when analyzing and ranking long term alternatives. The project study area is developed with a mix of residential, agricultural, commercial, office, institutional, and industrial land use.

E.1 Community Features

An aerial mapping review and field visit were performed to identify community facilities such as hospitals, churches, schools, fire and rescue stations, parks, and recreation areas. The following community features were observed in the project study area:

- The Cove Church
- Pine Lake Preparatory
- Caldwell Chapel AME Zion
- Mt. Mourne Fire Department
- Lowe's Home Improvement Headquarters
- Legacy Village
- Lake Norman Regional Medical Center
- Church of God of Mt. Mourne
- Mt. Mourne School
- Fair View United Methodist Church
- St. Patrick's Episcopal Church
- Centre Presbyterian Church
- Lake Norman Professional Plaza
- Abundant Life Foursquare Church
- Mooresville Golf Course
- Moor Field Baseball Park
- Southside Baptist Church
- Broad Street United Methodist Church
- Mooresville Public Library
- Mooresville Soup Kitchen
- First Baptist Church
- First Presbyterian Church
- Boy Scouts of America Troop 166
- Liberty Park
- Charles Mack Citizen Center
- Mitchell Community College
- Central United Methodist Church
- Mooresville Town Hall
- Mooresville Fire and Rescue
- Park View Elementary School
- Mooresville Police Station
- Faith United Methodist Church
- Watkins AME Zion Church and Cemetery
- NC Army Reserve Armory
- Selma Burke Community Center
- Grace Fellowship Church
- Whitman Park Baptist Church
- Magla Park
- Allison Park

During stakeholder meetings, Mooresville officials emphasized the importance of pedestrian accommodations in the downtown area. There are frequent events in this area, which draw a substantial number of pedestrians into the area that oftentimes have to cross the railroad.

E.2 Community Planning

A number of local, county, and state plans have been developed and have relevance on community planning in the project study area, including the following:

- Mooresville's *Comprehensive Transportation Plan* (June 2008) and *Comprehensive Transportation Plan Amendments Addendum Report* (April 2013)
- Mooresville's *Comprehensive Land Use Plan* (November 2012)
- Mooresville's *East-West Connector Alignment Feasibility Study* (January 2010)
- NCDOT and CATS's *Norfolk Southern "O" Line, Charlotte to Mooresville TSS* (April 2004)

A new comprehensive land use and transportation plan for Mooresville is expected to be completed in 2018.

E.3 Development Projects

Development projects in the study area that have the potential to be affected by crossings include:

- Lake Davidson, a 140-acre residential (single- and multi-family)/commercial mixed use development, is planned to be located just north of Bridges Farm Road and west of the railroad. Access to this development is planned at Bridges Farm Road and the future East-West Connector.
- A 75-acre development is planned just south of Bridges Farm Road and west of the railroad. The development will include approximately 150 single-family residential lots and will accessed from Bridges Farm Road.
- Local officials expect the approximately 1,000 acres on the east side of NC 115 south of the future East-West Connector will become available for development once the new connector is constructed.
- Residential development is occurring in the southwest quadrant of the Fairview Road railroad crossing, and local officials anticipate currently undeveloped land north and south of Fairview Road in the vicinity of the crossing will continue to develop as residential and medical offices.
- Mooresville Graded School District has purchased 80 acres for future elementary and middle schools located off Rinehardt Road (SR 1306) to the west of NC 115 and just north of Whitman Circle.
- There are approximately 450 developable acres on the north and south sides of Mazeppa Road to the east of NC 115. Future land uses in this area are planned to be industrial and recreational (soccer and baseball complexes).

SECTION F – Public Involvement

NCDOT RAIL DIVISION

F. PUBLIC INVOLVEMENT

A Public Involvement program was established as part of this study. This program involved:

- Three stakeholder meetings
- Two public meetings
- A coordination meeting with NGK Ceramics representatives
- A public hearing
- Mailings and press releases

F.1 Stakeholder Group Meetings

A stakeholder committee was formed to provide opportunities for key agencies and organizations to participate in the recommendation process. Stakeholder committee meetings were held in January, June, and October 2017. The meeting minutes for the stakeholder meetings are in Appendix B. Stakeholders included representatives from the following:

- Town of Mooresville
- Mooresville Graded School District
- Mooresville Fire Rescue
- Mooresville Police Department
- Mooresville Downtown Commission
- Mooresville South Iredell Economic Development Corporation (MSIEDC)
- Iredell County
- Mount Mourne Volunteer Fire Department
- NCDOT Rail Division
- NCDOT Division 12
- Norfolk Southern Railway
- NGK Ceramics
- Nest Homes
- Crosland Inc.
- Goode Properties
- HDR Inc.

F.2 Public Meetings

The first public meeting was held on March 27, 2017 in The Merchant Room of the Charles Mack Citizen Center (215 North Main Street in Mooresville). The meeting was held from 5:00-7:00PM. The purpose of the first meeting was to solicit input from public officials and local citizens concerning the existing conditions along the public street crossings being evaluated, travel patterns, and potential ideas for improvements. Approximately 61 local officials, residents, and business owners attended the public meeting. Nine participants submitted comment forms at the meeting, and two comments were submitted by mail subsequent to the meeting. Four comments were about the Brawley Avenue humped crossing and the congestion from the Brawley Avenue crossing on adjacent roadways. Three comments requested improved signalization at Brawley, Wilson and McLelland Avenues.

The second public meeting was held on August 2, 2017 at the same location and time as the first public meeting. The purpose of the second public meeting was to gauge public opinion on the preliminary recommendations for each rail crossing within the study area and receive feedback on the potential impacts of the recommendations.

- Seventy-three local officials, residents, and business owners attended the second public meeting.
- Forty-two comments were received on the proposed project.
- One comment was received for the Timber Road area. The commenter (on behalf of Davidson Day School) requested that the future Timber Road Extension be advanced.
- Eight comments were received for the Norman Drive/Doster Avenue, Brawley Avenue, and Mills Avenue crossings. The crossings are adjacent to one another and appear to function as a system allowing access across the tracks when another is inaccessible or congested. Five commenters requested that the Norman Drive/Doster Avenue crossing remain open; four commenters want it closed. Suggestions to improve the Norman Drive/Doster Avenue crossing include better signage and lane markings and improvements to the grade. The Brawley Avenue TSS preliminary recommendations are for safety and pedestrian improvements, not to close the crossing. These safety improvements are acceptable to the commenters as was an analysis of the traffic signalization at the crossing. A majority of comments on the Mills Avenue crossing would like for the crossing to remain open.
- Twenty-nine comments were received for the Whitman Circle crossing with the majority against closing the crossing. The primary reason for not closing the crossing was the removal of access without a safe alternative route to NC 115. Comments include: a concern for reduced access to neighborhoods, businesses, and Whitman Park Baptist Church, the alternative access route via NC 150 is not considered a safe option, and emergency vehicle access to the Whitman Circle area would be indirect and longer. One commenter requested a traffic light at Goodwin Circle and NC 150 to address traffic congestion on and access to NC 150.
- Three comments favored the grade separation proposed at Mazeppa Road.

Written comments from both public meetings are summarized in Appendix C.

F.3 NGK Ceramics Coordination Meeting

A meeting with NGK Ceramics representatives was held on August 2, 2017 at the NGK Ceramics facility on Mazeppa Road to obtain input and discuss two design concepts that grade separate Mazeppa Road over the Norfolk Southern "O" Line and NC 115. The primary difference between the two concepts is the access points to the NGK Ceramics plant. One option provides access via Mazeppa Road and the other provides access via McKenzie Road east of the facility. NGK Ceramics representatives indicated a desire to maintain the existing driveway access on Mazeppa Road directly east of the railroad crossing as tractor trailers exit the facility at this location and it is important in the facility's operational flow. See Appendix B for the meeting minutes.

F.4 Public Hearing

The Town of Mooresville Board of Commissioners advertised and held a March 19, 2018 public hearing to receive public comments on the recommendations of the Draft Traffic Separation Study Report. The Board voted to extend the public comment period until the next meeting on April 16, 2018. After evaluating the draft report and public comments, the Town of Mooresville Board of Commissioners approved the study on April 16, 2018 "subject to the ability of the Town Board to evaluate, provide input and make recommendations concerning the design, closing or impact of any crossings affecting the Town."

F.5 Mailings and Press Releases

Press releases were sent to local papers announcing both public meetings and the public hearing. Postcards announcing the meetings and hearing were mailed to stakeholders, property owners, and other interested citizens.

SECTION G – Alternatives Considered and Eliminated

NCDOT RAIL DIVISION

G. ALTERNATIVES CONSIDERED AND ELIMINATED

Through the course of the Mooresville TSS, many alternatives were considered. Based on the analysis of costs and benefits of the each alternative and input from citizens and stakeholders, several alternatives have been eliminated. Descriptions of these alternatives and the reasons for their elimination are presented below:

G.1 Langtree Road (721 700X)

Consideration was given to correcting the skew angle at the Langtree Road crossing by relocating the roadway far enough south so that the roadway could approach the railroad at a perpendicular angle. Additional right of way would be needed from a church if Langtree Road were realigned to the south and could possibly require relocating the church. The railroad is elevated several feet above, and located immediately parallel to, NC 115 in this location. These conditions would create a severe hump if the crossing were shifted south. For these reasons, this alternative was eliminated from further consideration.

G.2 Norman Drive/Doster Avenue (721 687L)

Consideration was given to correcting the severe hump at the Norman Drive/Doster Avenue crossing by matching the grades of the railroad and NC 115. To do so, either the grade of NC 115 would have to be significantly raised or the railroad grade would have to be lowered. Raising NC 115 here would result in property impacts along NC 115 in both directions due to roadway standards that limit how steep a road can be. Grade limits for railroads are even more restrictive. Lowering the railroad would result in property impacts that stretch in both directions farther than those for raising NC 115. For these reasons, this alternative was eliminated from further consideration.

G.3 Brawley Avenue (721 685X)

Consideration was given to correcting the hump and installing gates at the Brawley Avenue crossing. Correcting the hump would incur the same impacts described above at the Norman Drive/Doster Avenue crossing. Due to the close proximity of NC 115 and South Broad Street to the railroad, there is not enough clearance for gates at this crossing. For these reasons, this alternative was eliminated from further consideration.

G.4 Mills Avenue (721 683J)

Consideration was given to correcting the hump at the Mills Avenue crossing. Correcting the hump would incur the same impacts described above at the Norman Drive/Doster Avenue crossing. For these reasons, this alternative was eliminated from further consideration.

G.5 Center Avenue (721 679U)

Consideration was given to installing gates at the Center Avenue crossing. Similar to the condition described above at Brawley Avenue, there is not enough clearance between the crossing and NC 115 to the west and a building in the northeast quadrant to install gates. For this reason, this alternative was eliminated from further consideration.

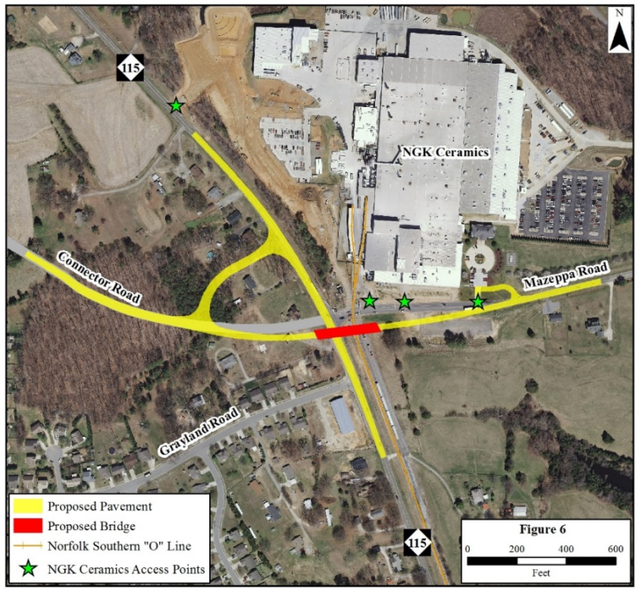
G.6 Statesville Avenue (736 195A)

Consideration was given to installing gates at the Statesville Avenue crossing. Similar to the condition described above at Brawley Avenue and Center Avenue, there is not enough room between the crossing and NC 115 to the west to install gates. Additionally, the severe skew angle of Statesville Avenue to the crossing does not provide enough clearance for gates on the east side of the crossing. For these reasons, this alternative was eliminated from further consideration.

G.7 Whitman Circle (721 668G)

Consideration was given to closing the crossing at Whitman Circle. The recommendation to close the Whitman Circle crossing was presented at the second stakeholder and public meetings. A local fire and EMS official indicated response times to residents and businesses east of the railroad would increase if the crossing were closed as emergency vehicles would be required to access the area via NC 150/Goodwin Circle. Many residents objected to the closure because it would mean their neighborhood's sole access would be at NC 150 and Goodwin Circle. Most stated this is a dangerous intersection due to poor sight distances and heavy traffic congestion. The owners of a storage facility located in the northeast quadrant of the crossing stated their business relies on close access to NC 155, and closing the Whitman Circle crossing would have negative impacts to their business. Additionally, members of Whitman Park Baptist Church, located in the southeast quadrant of the crossing, were concerned about how the closing would impact members attending church activities. For these reasons, this alternative was eliminated from further consideration.

G.8 Mazeppa Road (721 665L)



Two alternatives were considered at Mazeppa Road and eliminated after further study. The first would leave it as an at-grade crossing. The other alternative involved a grade separation immediately south of the crossing's current location.

Mazeppa Road experiences a high volume of traffic and serves numerous industrial/manufacturing facilities east of the crossing. The anticipated increase in industrial growth and access to the planned interchange at I-77 and Cornelius Road (STIP I-5962, see Table B.3) is expected to bring even higher traffic volumes in the future. The NGK Ceramics plant is located in the northeast quadrant of the crossing, and trains making deliveries to the plant frequently block the Mazeppa Road crossing. Leaving the at-grade crossing would exasperate the current problems in the future. Traffic backups would be even longer as traffic volumes increase and trains continue to block the crossing. For this reason, this alternative was eliminated from further consideration.

Replacing the existing Mazeppa Road at-grade crossing with a grade separation (bridge over the railroad) immediately south of its current location would eliminate some access points to the NGK Ceramics plant (see Figure 6). Through coordination with plant representatives, it was determined the existing level of access to the plant along Mazeppa Road should be maintained. Eliminating plant access points would negatively affect operations. Mazeppa Road and the crossing are too close to the plant to allow for a bridge and still maintain existing access points. For these reasons, this alternative was eliminated from further consideration.

SECTION H – Recommendations

NCDOT RAIL DIVISION

H. Recommendations

The near- (less than three years), mid- (three to seven years), and long-term (greater than seven years) recommendations of this study are presented from south to north below in Table H.1. The cost estimates are for construction only and do not include right of way acquisition, utility relocation, or costs associated with construction phasing where railroad construction is required.

Table H.1 – Mooresville TSS Recommendations

Crossing No.	Milepost	Road Name	Near-Term (< 3 years)		Mid-Term (3-7 years)		Long-Term (> 7 years)		Comments
			Recommendation	Construction Cost	Recommendation	Construction Cost	Recommendation	Construction Cost	
721 704A	23.18	Bridges Farm Road (SR 1106)			Install flashing lights and gates	$300,000			
721 703T	23.41	Private road*					Closure	$45,000	
721 702L	23.82	Private road*					Closure	$45,000	
721 701E	24.02	Private road*					Closure	$45,000	
721 700X	24.53	Langtree Road (SR 1102)	Minor resurfacing of roadway approach to flatten the roadway crossing surface	$3,000					
721 697S	25.07	Fairview Road (SR 1246)			Widen crossing to accommodate four lanes and a raised concrete median, and upgrade flashing lights and gates	$600,000	Widen roadway to four lanes between the crossing and NC 115	$1,000,000	
721 696K	25.37	Crossrail Road (SR 1170)			Install flashing lights and gates	$300,000			
721 695D	25.70	Waterlynn Road (SR 1135)	None	N/A	None	N/A	None	N/A	
721 692H	26.31	Foursquare Road (SR 1132)			Install flashing lights and gates	$300,000			
721 691B	26.60	Timber Road (Private)*					Closure	$45,000	
721 687L	27.30	Norman Drive/ Doster Avenue					Closure	$45,000	
721 685X	27.50	Brawley Avenue	Improve crossing surface and change signage so South Broad Street traffic yields to Brawley Avenue traffic	$3,000	Widen crossing to accommodate turning movements of tractor trailers and a pedestrian crosswalk; paint pedestrian crosswalks across Brawley Avenue east of NC 115 and	$156,000			A traffic analysis should be conducted that considers traffic patterns at the Brawley Avenue crossing after the crossings at Norman Drive/Doster Avenue and Mills Avenue are closed and the new at-grade crossing at the Timber Road Extension is opened.

Table H.1 – Mooresville TSS Recommendations

Crossing No.	Milepost	Road Name	Near-Term (< 3 years)		Mid-Term (3-7 years)		Long-Term (> 7 years)		Comments
			Recommendation	Construction Cost	Recommendation	Construction Cost	Recommendation	Construction Cost	
					across NC 115 and South Broad Street on the south side of the crossing; and upgrade flashing lights				
721 683J	27.60	Mills Avenue					Closure	$45,000	
721 682C	27.80	Wilson Avenue	Paint pedestrian crosswalks across NC 115 and South Broad Street on the south side of the crossing	$1,000					
721 681V	28.00	Catawba Avenue			Convert to a pedestrian only crossing with a Z-gate crossing	$200,000			
721 680N	28.16	McLelland Avenue (NC 115)	Paint pedestrian crosswalks across NC 115 and Main Street on the north side of the crossing	$1,000	Upgrade flashing lights and gates	$300,000			
721 679U	28.30	Center Avenue	Paint an edge line along the south side of Center Avenue from the end of the sidewalk east of the crossing to the curb at NC 115	$1,000					
721 678M	28.40	Moore Avenue			Upgrade flashing lights and install gates	$300,000			
721 677F	28.49	Iredell Avenue (NC 3/NC 152)			Upgrade flashing lights and gates	$300,000			
721 676Y	28.75	Oak Street			Upgrade flashing lights and gates	$300,000			
721 675S	28.89	Walnut Street			Closure	$45,000			
721 674K	28.98	Patterson Avenue					Closure	$45,000	
736 195A	29.20	Statesville Avenue	None	N/A	None	N/A	None	N/A	Due to the geometry of the roadway and railroad and the lack of clearance between the crossing and NC 155, roadway improvements and gates are not possible.

Table H.1 – Mooresville TSS Recommendations

Crossing No.	Milepost	Road Name	Near-Term (< 3 years)		Mid-Term (3-7 years)		Long-Term (> 7 years)		Comments
			Recommendation	Construction Cost	Recommendation	Construction Cost	Recommendation	Construction Cost	
721 673D	29.39	Williams Street	None	N/A	None	N/A	None	N/A	
721 671P	29.59	Plaza Drive (NC 150)	Upgrade flashing lights and gates	$300,000					The near-term recommendation for the Plaza Drive crossing is to upgrade the flashing lights and gates in conjunction with the Town's Plaza Drive/NC 115 intersection improvement project (see Table B.3).
721 668G	30.16	Whitman Circle (SR 2396)			Resurface crossing and install flashing lights and gates	$302,000			
721 665L	30.61	Mazeppa Road (SR 2395)			Complete environmental and design studies for a new grade separation to replace the existing at-grade crossing	N/A	Replace the at-grade crossing by grade separating Mazeppa Road with a four-lane bridge over the railroad and NC 115 just to the south of the existing at-grade crossing	$7,700,000	The long-term recommendation will require realignment of Mazeppa Road and Connector Road. A two-way ramp between NC 115 and Connector Road will be provided to preserve the connection. Additional roadway work at McKenzie Road and in front of NGK Ceramics will be required to maintain access to the ceramics plant.

* Note: the use of private crossings is determined through an agreement between the property owner and NS Railway. If the land use changes or the property that is served by the crossing is sold, NS Railway has the right to terminate the agreement or renegotiate it with the property owner. NCDOT does not have jurisdiction over private crossings; therefore, they do not have the authority to participate in closures of private crossings.

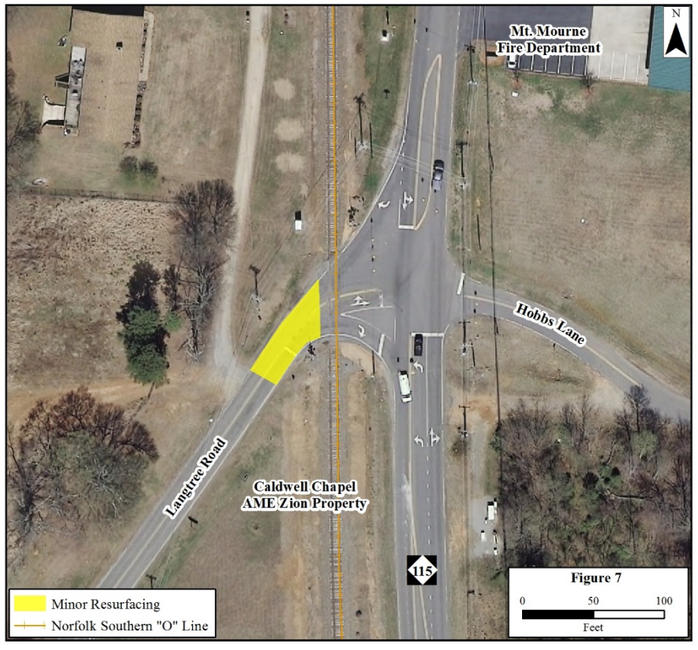
H.1 Bridges Farm Road (721 704A)

The Bridges Farm Road crossing is a paved, two-lane, slightly skewed crossing with a good crossing surface that provides access to a dead end residential area of approximately 200 homes. The railroad is in a tangent section, and the sight distances are adequate. The warning devices at the crossing include crossbuck signs. Bridges Farm Road carries nearly 1,200 vpd (2014 ADT) at the crossing. Local officials expect the area surrounding Bridges Farm Road on both sides of NC 115 will be developed – particularly in anticipation of the future East-West Connector. A 140-acre residential (single- and multi-family)/commercial mixed use development, is planned to be located just north of Bridges Farm Road and west of the railroad. A 75-acre, 150-lot single-family residential development is planned just south of Bridges Farm Road and west of the railroad. Both of these developments will have access via Bridges Farm Road. Additional active crossing safety protection is needed at this crossing.

The installation of flashing lights and gates at a construction cost of approximately $300,000 is the mid-term recommendation for the Bridges Farm Road crossing.

H.2 Three private roads (721 703T) (721 702L) (721 701E)

All three private road crossings are paved, one-lane, humped crossings with adequate sight distances, poor to fair crossing surfaces, and stop signs as the existing crossing safety protection. Private road crossing (721 703T) leads to farm land and a single residence. Private road crossing (721 702L) leads to vacant wooded land. Private road crossing (721 701E) leads to farm land and a single residence. The current property owners have a private crossing agreement with NS that dictates how the crossing can and cannot be used. Once a property owner changes or the land use changes, the private crossing contract is invalidated. NS can then close the crossing if desired or the property owner would have to renegotiate with NS for a new crossing. Local officials expect the land these three private roads serve will be developed in the future – at which point NS will have the authority to close these crossings.



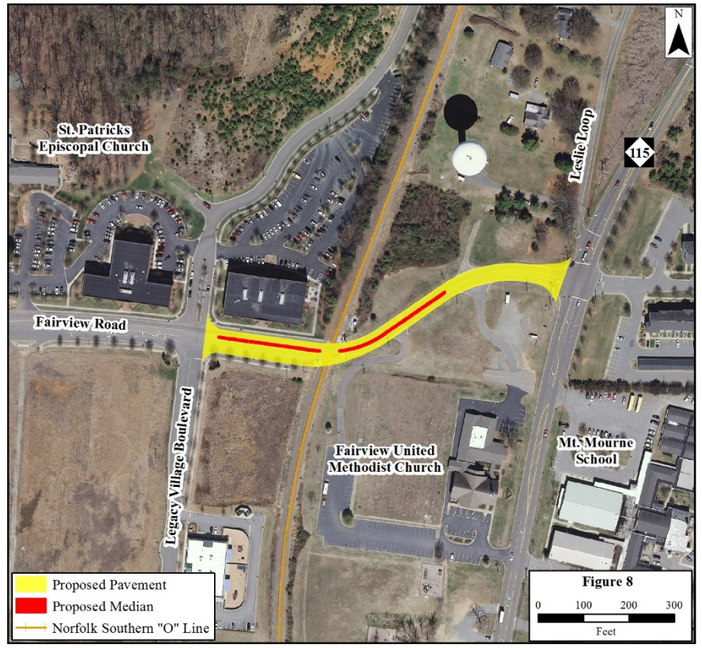
Closure with a construction cost of approximately $45,000 per crossing is the long-term recommendation for the three private road crossings located north of Bridges Farm Road.

H.3 Langtree Road (721 700X)

The Langtree Road crossing is a paved, two-lane, humped crossing with adequate sight distances and a fair crossing surface on a sharp skew angle to the railroad. There is a dedicated right turn lane and a lane for thru and left turning traffic on Langtree Road on the east side of the crossing. The crossing experiences high traffic volumes (about 9,000 vpd) – a Lowe's Corporate Headquarters access point and an I-77 interchange lie west of the crossing approximately 0.3 mile and one mile, respectively, and Mount Mourne Volunteer Fire Department is across NC 115 from the crossing. The warning devices at the crossing include crossbuck signs, flashing lights, and gates. Langtree Road begins an uphill grade immediately adjacent to the west side of the crossing. This, and the fact the crossing is humped, creates a dip in the roadway.

The recommendation at Langtree Road is to flatten the roadway approach on the west side of the crossing in the near-term to eliminate the dip immediately adjacent to the crossing (see Figure 7). The construction cost is estimated to be $3,000 for minor roadway resurfacing.

H.4 Fairview Road (721 697S)



The Fairview Road crossing is a paved, two-lane crossing with a good crossing surface and limited sight distances due to a horizontal curve to the south and trees and vegetation to the north. Fairview Road is approximately 65 feet wide (four to five lanes) and perpendicular to the crossing on the west side. It carries about 7,700 vpd and is 32 feet wide (two lanes) beginning at the crossing and immediately curves to the north heading towards NC 115. Lake Norman Regional Medical Center lies approximately 0.2 mile west of the crossing. The warning devices at the crossing include crossbuck signs, flashing lights, and gates. There is ongoing development along Fairview Road west of the crossing, and local officials expect the area will continue to grow. This, and the planned extension of Fairview Road over I-77 to Alcove Road (STIP U-5817) will increase traffic volumes at the Fairview Road crossing in the future.

In anticipation of increase traffic volumes, the mid-term recommendation for the Fairview Road crossing is to widen it enough to accommodate four lanes and a raised concrete median and upgrade the flashing lights and gates at an estimated construction cost of $600,000 (see Figure 8). The long-term recommendation is to widen Fairview Road to four lanes from the crossing to NC 115 at an estimated construction cost of $1,000,000.

H.5 Crossrail Road (721 696K)

The Crossrail Road crossing is a narrow, paved, slightly humped, two-lane crossing with a fair crossing surface located in a horizontal curve along the railroad. Trees, vegetation and the curve limit sight distances in both directions. Crossrail Road is a dead end residential road that provides access to approximately 11 residences west of the crossing and carries less than 150 vpd. The warning devices at the crossing include crossbuck signs.

The installation of flashing lights and gates at a construction cost of approximately $300,000 is the mid-term recommendation for the Crossrail Road crossing.

H.6 Waterlynn Road (721 695D)

The Waterlynn Road crossing is a paved, humped crossing with a fair crossing surface condition and limited sight distance to the north due to a horizontal curve in the railroad and to the south due to trees and vegetation. Waterlynn Road is three lanes wide approaching the crossing on both sides and narrows to two lanes at the crossing. It connects NC 115 and US 21. A dense residential area lies in the northwest quadrant of the crossing. Approximately 5,600 vpd use the crossing. The warning devices at the crossing include crossbuck signs, flashing lights, and gates.

There are no recommendations for the Waterlynn Road crossing.

H.7 Foursquare Road (721 692H)

The Foursquare Road crossing is a paved, two-lane crossing with a good crossing surface and adequate sight distance to the north and limited to the south due to a horizontal curve in the railroad and trees. Foursquare Road is a dead end road that primarily serves a residential area; however, there is a church and a commercial nursery west of the crossing. Just over 300 vpd use the crossing. The warning devices at the crossing include a crossbuck and yield sign on both sides.

The installation of flashing lights and gates at a construction cost of approximately $300,000 is the mid-term recommendation for the Foursquare Road crossing.

H.8 Timber Road (Private) (721 691B)

The Timber Road private crossing is a narrow, one-lane, paved crossing that is humped and has a fair crossing surface. It is on a gravel road that provides access to one residence. Sight distance to the south is adequate and limited to the north due to a horizontal curve in the railroad. The warning devices at the crossing include a crossbuck sign on the east side of the crossing and stop signs on both sides. Timber Road is planned to be extended west to US 21 at an approximate construction cost of $2,000,000.[2] The extension will require a new public at-grade crossing.

Closure at a construction cost of approximately $45,000 is the long-term recommendation for the private Timber Road crossing.

H.9 Norman Drive/Doster Avenue (721 687L)

The Norman Drive/Doster Avenue crossing is a paved, two-lane, severely humped crossing with a fair crossing surface and adequate sight distance to the north and limited to the south due to a horizontal curve in the railroad and trees. Approximately 4,300 vpd use the crossing. There is less than 10 feet between NC 115 and the crossing – leaving no room to the east of the crossing for a vehicle on Norman Drive/Doster Avenue waiting to turn onto NC 115 without being on the tracks. Norman Drive/Doster Avenue provides access to a golf course community. South Broad Street ends at Norman Drive/Doster Avenue immediately west of the crossing. The warning devices at the crossing include a crossbuck sign on the west side of the crossing. Local police, fire and EMS officials indicate this crossing presents difficulties for fire trucks and tractor trailers due to the severity of the hump. The fire department avoids it when responding to calls, and larger vehicles frequently get stuck on the tracks.

[2] This construction cost estimate was calculated based on a two-lane undivided roadway of approximately one mile in length with a new at-grade railroad crossing with flashing lights and gates. It does not include right of way or utility costs.

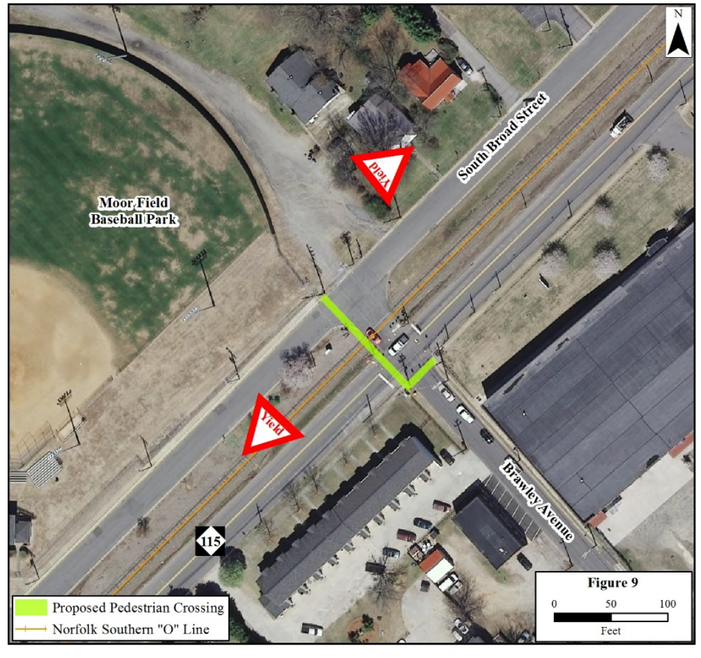
Closure at a construction cost of approximately $45,000 is the long-term recommendation for the Norman Drive/Doster Avenue crossing.

H.10 Brawley Avenue (721 685X)

The Brawley Avenue crossing is a paved, two-lane, humped crossing with a poor crossing surface and adequate sight distances that carries 3,400 vpd. The crossing geometry is similar to Norman Drive/Doster Avenue in that it is very close to NC 115, leaving little room to allow a car to wait on the east side to turn without being on the tracks. Brawley Avenue ends at South Broad Street immediately to the west of the crossing. The parking driveway for Moor Field Baseball Park is across South Broad Street from the crossing. There is frequent pedestrian activity but no crosswalks at this crossing. According to a local official, people often park on the east side of NC 115 and walk across the railroad to the baseball field. The warning devices at the crossing include crossbuck signs and flashing lights. There is not enough clearance for gates. Local police, fire and EMS officials indicate this crossing presents difficulties for tractor trailers due to the severity of the hump and the narrow crossing width. Currently, Brawley Avenue traffic must yield to South Broad Street traffic at the crossing – sometimes causing vehicles to stop on the tracks while waiting to turn.

The near-term recommendation for the Brawley Avenue crossing is to improve the crossing surface at an estimated construction cost of $3,000 and change the signage so South Broad Street traffic yields to Brawley Avenue traffic. Traffic patterns at the crossing will change with the closing of the two crossings on both sides of the Brawley Avenue crossing (Norman Drive/Doster Avenue and Mills Avenue) and the future opening of the nearby Timber Road Extension. A traffic analysis should be conducted that considers future traffic patterns as a result of the closures and new at-grade crossing.

A mid-term recommendation for the Brawley Avenue crossing is to widen it to accommodate tractor trailer turning movements and a pedestrian crosswalk at an estimated construction cost of $156,000. Crosswalks should be provided across Brawley Avenue east of NC 115 and across NC 115 and South Broad Street on the south side of the crossing (see Figure 9). The flashing lights should be upgraded in conjunction with widening the crossing.



H.11 Mills Avenue (721 683J)

The Mills Avenue crossing is a paved, two-lane, humped crossing with a poor crossing surface and adequate sight distances that carries less than 900 vpd. Like the two previous urban crossings, Norman Drive/Doster Avenue and Brawley Avenue, the Mills Avenue crossing is very close to South Broad Street to the west and NC 115 to the east, leaving little room to allow a car

Figure 10

to wait without being on the tracks. This is a redundant crossing – the Brawley Avenue crossing is less than 0.2 mile south, and the crossing at Wilson Avenue is 0.2 mile north. The warning devices at the crossing include a crossbuck sign on the east side of the crossing.

Closure at a construction cost of approximately $45,000 is the long-term recommendation for the Mills Avenue crossing.

H.12 Wilson Avenue (721 682C)

The Wilson Avenue crossing is a paved, two-lane, humped crossing with a good concrete surface and adequate sight distances. A high volume of traffic uses Wilson Avenue (approximately 6,400 vpd), and it is in close proximity to NC 115 and South Broad Street, similar to the crossings discussed above. Mooresville officials have identified Wilson Avenue as a major gateway into the downtown area. There is frequent pedestrian activity at the crossing, but there is no crosswalk. The warning devices at the crossing include crossbuck signs, flashing lights, and gates.

The near-term recommendation for the Wilson Avenue crossing is to paint pedestrian crosswalks across NC 115 and South Broad Street on the south side of the crossing at an estimated construction cost of $1,000 (see Figure 10).

H.13 Catawba Avenue (721 681V)

The Catawba Avenue crossing is a paved, two-lane, humped crossing with a poor crossing surface and adequate sight distances. Traffic volumes are relatively low at less than 900 vpd. It is in close proximity to NC 115 and South Broad Street, similar to the crossings discussed above. There is frequent pedestrian activity at this crossing, partly due to a nearby library and a soup kitchen. This is a redundant crossing – the Wilson Avenue crossing is less than 0.2 mile south, and the crossing at McLelland Avenue is 0.2 mile north. The warning devices at the crossing include a crossbuck sign on the east side of the crossing.

Figure 11

Due to its relatively low traffic volume, frequent pedestrian use and redundancy, the mid-term recommendation for the Catawba Avenue crossing is to convert it to a pedestrian only crossing by constructing a Z-gate crossing. A Z-gate crossing is designed to channel pedestrians in such a manner that they are forced to look down the tracks for oncoming trains while approaching the crossing (see Figure 11). The estimated construction cost for this recommendation is approximately $200,000.

H.14 McLelland Avenue (721 680N)

The McLelland Avenue crossing is a wide, paved, two-lane, humped crossing with a good concrete surface and adequate sight distance to the south and limited to the north due to a horizontal curve in the railroad. Approximately 5,200 vpd use the crossing. It is in close proximity to NC 115 and South Broad Street, similar to the crossings discussed above. NC 115 is on the east side of the tracks south of the McLelland Avenue crossing and crosses to the west side north of the crossing. There are existing sidewalks on both sides of McLelland Avenue east of NC 115/South Main Street and west of NC 115/South Broad Street. Sidewalks are also present along the east side of NC 115/South Main Street and the west side of NC 115/South Broad Street. There are no pedestrian crosswalks in the vicinity of the McLelland Avenue railroad crossing. The warning devices at the crossing include crossbuck signs, flashing lights, and gates.

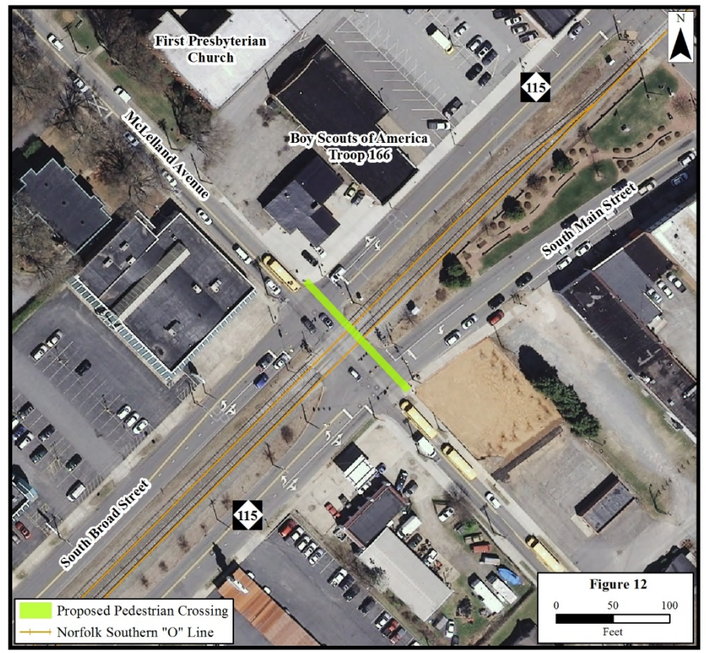


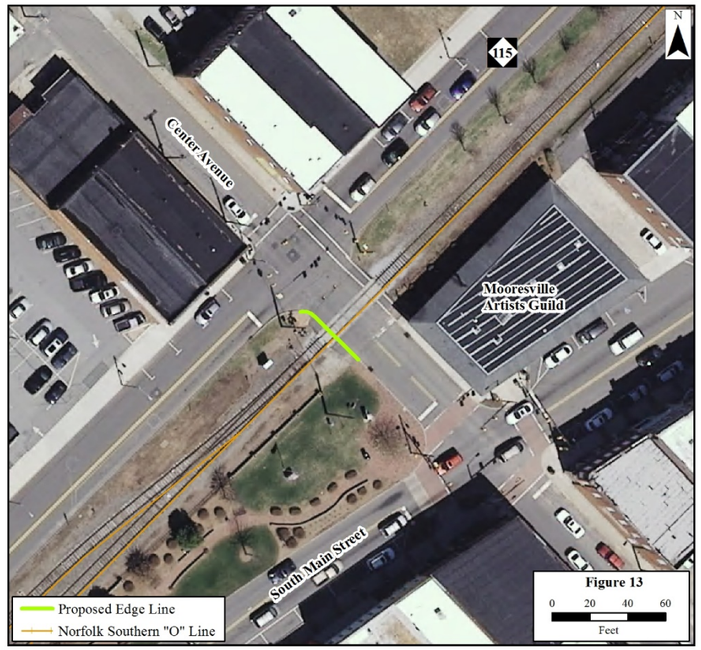
Figure 12

The near-term recommendation for the McLelland Avenue crossing calls for a pedestrian crosswalk across NC 115 and South Main Street on the north side of the crossing at an estimated construction cost of $1,000 (see Figure 12). Upgrading the flashing lights and gates at a construction cost of $300,000 is the mid-term recommendation.

NCDOT RAIL DIVISION

H.15 Center Avenue (721 679U)

The Center Avenue crossing is a wide, paved, two-lane, humped crossing with a fair concrete surface and adequate sight distance to the south and limited to the north due to a horizontal curve in the railroad. Traffic volumes at the crossing equal 1,600 vpd. NC 115 is approximately 20 feet east of the crossing, leaving little room to clear the tracks for cars waiting to turn onto NC 115 from Center Avenue. There is frequent pedestrian activity at this crossing as it is within downtown Mooresville. Sidewalks exist along NC 115, Main Street and Center Avenue with a pedestrian crosswalk across NC 115 and both side of the crossing on the north side. A sidewalk on the south side of Center Avenue stops at the east side of the crossing. The warning devices at the crossing include crossbuck signs and flashing lights. There is not enough clearance for gates.



Since the sidewalk ends at the crossing and there is no sidewalk on the opposite side of the tracks, the near-term recommendation is to paint an edge line from the curb line at the end of the sidewalk to the curb line along NC 115 on the opposite side (see Figure 13). The estimated construction cost is approximately $1,000.

H.16 Moore Avenue (721 678M)

The Moore Avenue crossing is a paved, three-lane, humped crossing with a good concrete surface and adequate sight distance to the south and limited to the north due to a horizontal curve in the railroad. Traffic volumes at the crossing equal approximately 2,300 vpd. Like Center Avenue, there is little room for a car between the crossing and NC 115 without it being on the tracks. There is frequent pedestrian activity at this crossing as it is within downtown Mooresville (sidewalks and pedestrian crosswalks are located on both sides). The warning devices at the crossing include crossbuck signs and flashing lights.

Upgrading the flashing lights and gates at a construction cost of approximately $300,000 is the mid-term recommendation for the Moore Avenue crossing.

H.17 Iredell Avenue (721 677F)

The Iredell Avenue crossing is a paved, three-lane crossing with a good concrete surface and adequate sight distance to the south and limited to the north due to a horizontal curve in the railroad. Traffic volumes are relatively high at this crossing (8,700 vpd) as three NC routes converge – NC 3, NC 115 and NC 152. Like the two crossings before it, there is little room for a car between the crossing and NC 115 without it being on the tracks. There is frequent pedestrian activity at this crossing as it is within downtown Mooresville (sidewalks are located on both sides). The warning devices at the crossing include crossbuck signs, flashing lights, and gates.

Upgrading the flashing lights and gates at a construction cost of approximately $300,000 is the mid-term recommendation for the Iredell Avenue crossing.

H.18 Oak Street (721 676Y)

The Oak Street crossing is a paved, two-lane crossing with a fair crossing surface and adequate site distances. Traffic volumes at this crossing are relatively low at 600 vpd. Oak Street approaches the crossing from the east at a slightly skewed angle to the railroad, and there is little room for a car between the crossing and NC 115 without it being on the tracks. Oak Street connects NC 115 and NC 801 and serves a mostly residential area. Park View Elementary School is located approximately 0.3 mile east of the crossing. The warning devices at the crossing include crossbuck signs, flashing lights, and gates.

Upgrading the flashing lights and gates at a construction cost of approximately $300,000 is the mid-term recommendation for the Oak Street crossing.

H.19 Walnut Street (721 675S)

The Walnut Street crossing is a narrow, paved, two-lane, humped crossing with a poor crossing surface and adequate sight distances. Traffic volumes at this crossing are less than 100 vpd. Walnut Street approaches the crossing from the east at a significantly skewed angle to the railroad, and there is little room for a car between the crossing and NC 115 without it being on the tracks. Walnut Street is a short (0.2 mile long) residential street that connects NC 115 and Statesville Avenue. This is a redundant crossing – the Oak Street crossing and Patterson Avenue crossings are approximately 0.1 mile south and north, respectively. The warning devices at the crossing include crossbuck signs.

Closure at a construction cost of approximately $45,000 is the mid-term recommendation for the Walnut Street crossing.

H.20 Patterson Avenue (721 674K)

The Patterson Avenue crossing is a paved, two-lane, humped crossing with a poor crossing surface and adequate sight distance to the south and limited to the north due to a horizontal curve in the railroad. Traffic volumes at this crossing are approximately 200 vpd. Patterson Avenue approaches the crossing from the east at a significantly skewed angle to the railroad, and there is little room for a car between the crossing and NC 115 without it being on the tracks. Patterson Avenue ends 0.1 mile east of the crossing and primarily serves a collection of commercial businesses and a warehouse. This is a redundant crossing as the Walnut Street crossing is approximately 0.1 mile south. The warning devices at the crossing include crossbuck signs, flashing lights, and gates.

Closure at a construction cost of approximately $45,000 is the long-term recommendation for the Patterson Avenue crossing.

H.21 Statesville Avenue (736 195A)

The Statesville Avenue crossing is a paved, two-lane crossing with a good concrete surface and limited sight distances in both directions due to a horizontal curve in the railroad. Traffic volumes at this crossing are approximately 700 vpd. Statesville Avenue approaches the crossing from the east at a severely skewed angle to the railroad, and there is not enough room for a car between the crossing and NC 115 without it being on the tracks. Drivers turning from Statesville Avenue

onto NC 115 are required to look almost behind them for oncoming traffic. The warning devices at the crossing include crossbuck signs and flashing lights. Due to the geometry of the roadway and railroad and the lack of clearance between the crossing and NC 155, roadway improvements and gates are not possible.

There are no recommendations for the Statesville Avenue crossing.

H.22 Williams Street (721 673D)

The Williams Street crossing is a paved, two-lane, humped crossing with a good crossing surface and limited sight distances in both directions due to a horizontal curve in the railroad. Traffic volumes at this crossing are approximately 1,800 vpd. East of the crossing, Williams Street leads to a network of primarily residential streets with access to NC 150 to the north and NC 801 farther to the east. The warning devices at the crossing include crossbuck signs, flashing lights, and gates.

There are no recommendations for the Williams Street crossing.

H.23 Plaza Drive (721 671P)

The Plaza Drive is a paved, three-lane, crossing with a good concrete surface and limited sight distances in both directions due to horizontal curves in the railroad. Plaza Drive approaches the crossing from the east at a significantly skewed angle to the railroad. This crossing experiences the highest volume of traffic (over 10,000 vpd) compared to the other crossings being studied. NC 150 is a regional route between I-85 to the east and I-77 to the west. Locally, a densely developed commercial corridor begins at the Plaza Drive crossing and extends for approximately four miles to I-77 and beyond. The warning devices at the crossing include crossbuck signs, flashing lights, and gates.

The near-term recommendation for the Plaza Drive crossing is to upgrade the flashing lights and gates in conjunction with the Town's Plaza Drive/NC 115 intersection improvement project (see Table B.3). The estimated construction cost of the upgrade is approximately $300,000.

H.24 Whitman Circle (721 668G)

The Whitman Circle crossing is a narrow, paved, two-lane, humped crossing with a poor crossing surface and adequate sight distance to the north but limited to the south due to a horizontal curve in the railroad. Traffic volumes at this crossing are approximately 600 vpd. Whitman Circle serves a mostly residential area and provides indirect access via Goodwin Circle to NC 150. Driveways for a church and a commercial storage facility are located immediately east of the crossing. Due to poor sight distances and heavy traffic congestion at Goodwin Circle and NC 150, many residents choose to use Whitman Circle and the crossing to get in and out of the neighborhood. Some drivers also use Whitman Circle/Goodwin Circle to bypass the NC 115/NC 150 intersection. The warning devices at the crossing include crossbuck and yield signs on both sides of the crossing.

The mid-term recommendation for the Whitman Circle crossing is to improve the crossing surface by resurfacing it and install flashing lights and gates at an estimated construction cost of $302,000.

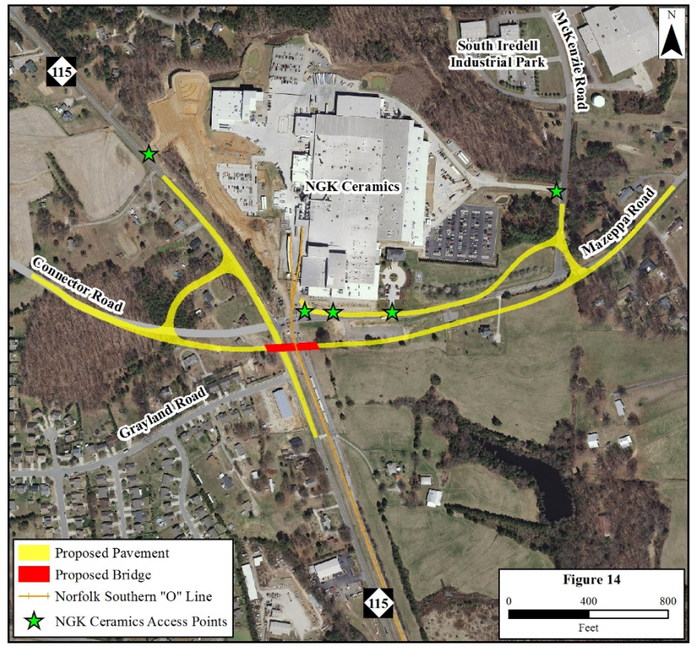
H.25 Mazeppa Road (721 665L)

The Mazeppa Road crossing is a paved, three-lane, two-track crossing with good concrete surfaces and adequate sight distances. The NGK Ceramics plant is located in the northeast quadrant of the crossing. Trains making deliveries to the plant frequently block the Mazeppa Road crossing.

Mazeppa Road experiences a relatively high volume of traffic (8,200 vpd) and serves numerous industrial/manufacturing facilities east of the crossing. Mazeppa Road turns into the recently constructed Connector Road west of NC 115, crosses over US 21 and will eventually connect to I-77 at a future interchange (STIP I-5962). Mooresville is actively marketing the Mazeppa Road area for industrial development and expects this type of growth will occur. The warning devices at the crossing include crossbuck signs, flashing lights, and gates.

Because trains often block the Mazeppa Road crossing and the area is expected to experience an increase in industrial development, the long-term recommendation is to replace the existing at-grade crossing with a four-lane roadway bridge over the railroad and NC 115 south of the existing crossing location. Mazeppa Road and Connector Road will need to be realigned far enough to the south to maintain the current level of access to the NGK Ceramic plant. A two-way ramp between NC 115 and Connector Road will be provided to preserve the connection. Additional roadway work at McKenzie Road and in front of NGK Ceramics will be required to maintain access to the ceramics plant (see Figure 14). The estimated construction cost of the upgrade is approximately $7,700,000.

The mid-term recommendation for the Mazeppa Road crossing is to conduct environmental and design studies for the new grade separation.



NCDOT RAIL DIVISION

APPENDIX A – Crossing Inventory Sheets

NCDOT RAIL DIVISION

APPENDIX B – Stakeholder Meeting Summaries

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APPENDIX C – Public Meeting Summaries

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APPENDIX D – Economic Analysis (GradeDec.Net Data)

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