NC Department of Transportation
RAIL DIVISION

WILMINGTON
TRAFFIC SEPARATION STUDY

FEBRUARY 2017

STV 100 Years

WILMINGTON TRAFFIC SEPARATION STUDY

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Gregory Sigmon, P.E.; Principal-In-Charge
STV Inc.

NORTH CAROLINA PROFESSIONAL SEAL 17692 ENGINEER GREGORY R. SIGMON
02/27/17

Kathryn Curry, AICP; Project Manager
STV Inc.

For the North Carolina Department of Transportation

Nancy Horne, P.E.; NCDOT Rail Division, Project Manager

NORTH CAROLINA PROFESSIONAL SEAL 17628 ENGINEER NANCY M. HORNE
2/27/17

For the City of Wilmington

Mike Kozlosky, Executive Director
Wilmington Metropolitan Planning Organization

APPENDICES

EXECUTIVE SUMMARY

In a joint cooperative effort with the City of Wilmington and CSX Transportation (CSXT), Wilmington Urban Area MPO, the North Carolina Department of Transportation (NCDOT) has completed the Wilmington Traffic Separation Study (TSS), focusing on 26 existing at-grade roadway-railroad crossings along a 6-mile span of the CSXT rail line which runs from the Port to Pembroke, NC. Wilmington's River to Sea Trail crosses the CSX within the study area, but was excluded from this study. The study team evaluated the CSXT rail line, as well as any planned or programmed railroad and roadway improvements within the study area. **Figure 1** defines the study area of the project.

The process involved public input and involved a series of meetings to gather information and receive public comments on proposed recommendations. These recommendations include safety improvements and possible closures at existing street/rail grade crossings in the City of Wilmington.

A Stakeholder Committee was comprised of members of CSX rail, NCDOT Rail Division and NCDOT Division 3. This committee was established to guide the development of the analysis and recommendations due to their role in providing financial assistance to the completion of the study, and possibly the implementation of approved recommendations. The Stakeholder Committee met twice over the course of the project; the first meeting was held on March 25, 2014 to introduce the project and study area; the second meeting was held on December 2, 2014 to present the draft recommendations and receive feedback on which draft recommendations should be presented to additional stakeholders and to the public.

The study team met with additional stakeholders in order to gain critical input in reaching consensus on grade crossing recommendations. These stakeholders included various city departments, local neighborhood associations, emergency response, and school district representatives met three times during the course of this study; June 10th 2014 March 25, 2015, and November 13, 2015. The Public Involvement program included two Citizens Informational Workshops (CIWs) and one neighborhood group meeting. These meetings are summarized below.

Citizens Informational Workshop #1

The first series of CIWs were held on June 9th and June 10th. 2014 Study team members were available to introduce the Wilmington Traffic Separation Study, to answer questions related to the study, and to receive comments to aid in developing recommendations for improving the 26 rail crossings.

Advertisements were placed in the Wilmington Star News, Greater Diversity Newspaper and the Wilmington Journal. There were also 1672 postcards sent out to residents located within the study area surrounding the railroad corridor. There were a total of 12 attendees at the meetings. Residents of area neighborhoods were primarily concerned with increased freight train activity, at-grade crossing safety, and investigating new freight railroad corridors. Comments included the need to close redundant crossings, concern over the frequency of train horns, and need for investigating grade separated crossings. Love Grove neighborhood (King Street crossing) expressed concern over the one neighborhood access point that requires residents and emergency response vehicles to cross the CSX Transportation corridor.

Citizens Informational Workshop #2

The second CIW was held on May 11th and 12th, 2015 at Wilmington City Hall and Sunset Park Baptist Church, respectively. The study team developed and presented preliminary study recommendations and renderings of improvements to the 26 crossings. Study team members were available to answer questions related to the study, and to receive comments on the preliminary recommendations on safety improvements and closures for the 26 rail crossings.

Advertisements were placed in the Wilmington Star News, Greater Diversity Newspaper and the Wilmington Journal. There were also 1672 postcards sent out to residents located within the study area surrounding the railroad corridor. There were a total of 45 attendees at the meetings. Residents of area neighborhoods were primarily concerned with access to homes and businesses north and south of the tracks. Some stakeholders perceived S. 8th and S. 10th Streets as local thoroughfares with substantial traffic, and felt that 7th Street and 9th Street would be better options for closures. Residents were concerned that dead-end streets in the southern section caused by the closures would be disadvantageous to the neighborhood. They shared their concern for aesthetic treatments of proposed barriers, maintenance of landscaped areas, the potential that these areas would be dumping grounds for trash, EMS accessibility to homes in the area, impediment of economic development initiatives, and the potential for increased criminal activities. At the Love Grove neighborhood, the King Street improvements were well-received but the need for a second access was also discussed.

Neighborhood Group Meeting

In an extra effort to reach residents in the area between S. 4th Street and S. 10th Street, a small group meeting was held on June 29th, 2015 at St. Andrews AME Zion Church. Concept renderings were revised based on feedback from the CIWs, and were shared with the group. Study team members were available to answer questions related to the study, and to receive comments on the recommendations.

Over 800 door hanger meeting announcements were delivered to local residents. There were a total of 48 attendees at the meeting. Residents re-iterated their concern that dead-end streets in the southern section of the study resulting from the proposed closing would disadvantageous to the neighborhood, and shared the same concerns shared at CIW #2. Additionally, they felt the closures would force vehicular traffic on roads that currently carried large volumes of traffic.

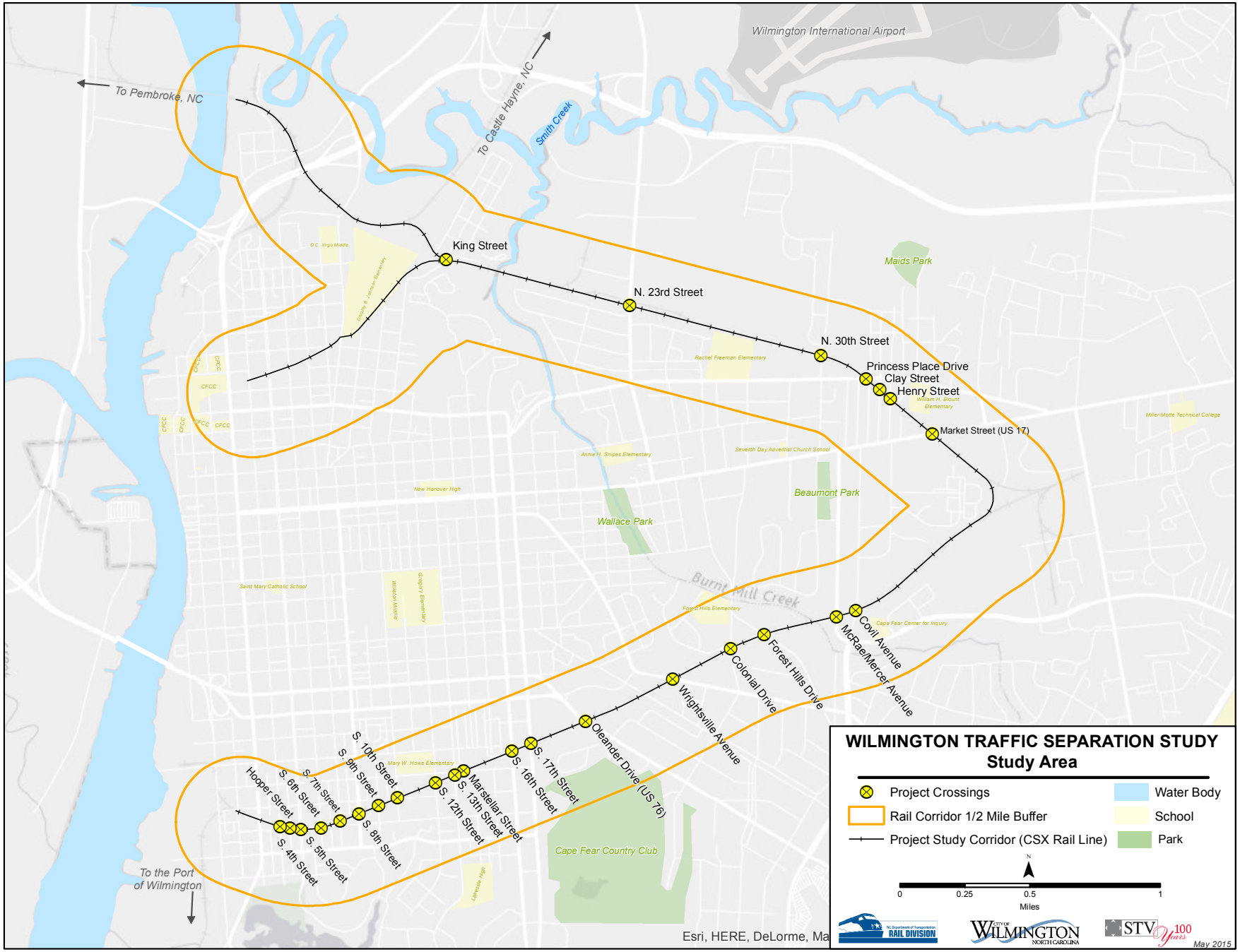


Figure 1 – Wilmington TSS Project Limits

Study Recommendations

The North Carolina Department of Transportation Rail Division recommends the following crossing improvements at this time. Additional recommendations are outlined in section G.

A. S. 4th Street (Crossing # 629 445S)

Signal and gate 4th Street and connect Hooper Street to S. 4th Street using Martin Street modifications. Martin Street's roadway classification proposed to be a driveway to provide access to adjacent parcels only.

B. Hooper Street/Martin Street (Crossing # 629 443D)

Close the at-grade crossing as well as close a portion of Martin Street from S. 4th Street to S. 5th Street. Install end of road markers, guardrail and landscaping (per CSXT standards). Define the edge of pavement to minimize parking within railroad limits on the southwest corner property of S. 5th Street and Martin Street.

C. S. 5th Street (Crossing # 629 442W)

Extend existing medians and construct concrete noses. Convert Martin Street on east side into driveway. Convert S. 5th Street into a complete street concept. Reduce the 4-lane cross section to a 2-lane cross section, incorporate bike lanes and on-street parking.

D. S. 6th Street (Crossing # 629 441P)

S. 6th Street at-grade crossing to remain open. Close Martin Street from S. 5th Street to Stroud Alley. Install curb and gutter and landscaping within Martin Street; though providing a driveway along the northern side of Martin Street between S. 5th Street and S. 6th Street to access commercial properties.

E. S. 7th Street (Crossing # 629 440H)

Continue to operate the crossing as an at-grade crossing. Martin Street would be closed west of Stroud Alley. Install flashers and gates.

F. S. 8th Street (Crossing # 629 439N)

Keep S. 8th Street open; install flashers and gates and improve crossing surface. Construct Kidder Street connector between S. 8th Street and S. 9th Street.

G. S. 9th Street (Crossing # 629 438G)

Close the at-grade crossing and install end of road markers, guardrail and landscaping (per CSXT standards). Construct Kidder Street connector between S. 8th Street and S. 9th Street.

H. S. 10th Street (Crossing # 629 437A)

Crossing to remain open with Kidder Street Roadway modifications to include installing end of road markers and guardrail, and landscaping (per CSXT standards); upgrade flashers and install gates at S. 10th Street.

I. S. 12th Street (Crossing # 629 436T)

Continue to operate the crossing as an at-grade crossing. Install flashers and gates.

J. S. 13th Street (Crossing # 629 435L)

Install gates at crossing.

K. Marstellar Street (Crossing # 629 434E)

Improve existing crossing by replacing the rail seal and ensure there is horizontal clearance for two-way traffic. In addition, investigate possible extended gate arms to increase horizontal coverage of crossing closure due to the skewed crossing.

L. S. 16th Street (Crossing # 629 433X)

Improve the crossing surface and upgrade sidewalks.

M. S. 17th Street (Crossing # 629 432R)

Improve the crossing surface and upgrade sidewalks.

N. US 76/Oleander Drive (Crossing #629 431J)

Upgrade crossing signals and install concrete medians in order to prevent vehicles from crossing the at-grade crossing, as the gates do not protect all movements.

O. Wrightsville Avenue (Crossing # 629 430C)

Improve the crossing surface and upgrade signal system.

P. Colonial Drive (Crossing # 629 429H)

Install gates at crossing.

Q. Forest Hills Drive (Crossing # 629 428B)

Install gates at crossing.

R. Mercer Avenue (Crossing # 629 427U)

Install gates at crossing.

S. Covil Avenue (Crossing # 629 426M)

Install cantilevers, improve crossing surface.

T. US 17/Market Street (Crossing # 629 290C)

Improve the crossing surface and install concrete median.

U. Henry Street (Crossing # 629 289H)

Upgrade signal system.

V. Clay Street (Crossing # 642 724T)

Close the at-grade crossing and install end of road markers, guardrail and landscaping (per CSXT standards). Construct new street connection between Henry and Clay Street.

W. Princess Place Drive (Crossing # 629 288B)

Install cantilevers, improve crossing surface, and provide pedestrian crossing.

X. N. 30th Street (Crossing # 629 287U)

Install gates, improve surface crossing.

Y. N. 23rd Street (Crossing # 629 286M)

Improve crossing surface and install concrete median.

Z. King Street (Crossing # 629 284Y)

Install flashers and gates. Slightly re-align King Street, relocate utility pole, and improve crossing surface.

A. INTRODUCTION

From 2012 to 2015, there were more than 100 crashes resulting in fatalities every year, and over 400 injury crashes nationwide in recorded incidents between vehicles and trains. According to statistics from the Federal Railroad Administration (FRA), there are 4,025 at-grade public crossings in North Carolina. Forty percent of North Carolina's at-grade railroad-highway crossings remain unprotected by mechanical warning devices.

Between 2012 and 2015, the number of street-rail incidents in North Carolina ranged from 26 to 35 per year. The number of fatal crashes ranged from one to six, and the number of nonfatal incidents ranged from 17 to 88. Safety initiatives have reduced street-rail incidents from 300 in 1975, 187 in 1985, 135 in 1995, 67 in 2005, and 35 in 2015.

Traditionally, The North Carolina Department of Transportation (NCDOT) uses a Traffic Separation Study (TSS) to systematically review crossing safety. Traffic Separation Studies comprehensively evaluate traffic patterns and road usage for an entire municipality or region, determining the need for improving and/or eliminating public grade crossings.

NCDOT entered into an agreement with the City of Wilmington and CSX to prepare this TSS, initially focusing on 26 at-grade roadway-railroad crossings in downtown Wilmington. The consultants evaluated the CSX rail line in downtown Wilmington that crosses these 26 streets, as well as any planned or programmed railroad and roadway improvements within the study area. The study area consists of the existing CSX rail line that enters Wilmington as it crosses the Cape Fear River, north of downtown Wilmington, and curves around to the southern edge of downtown Wilmington (**Figure 1**), toward the Port of Wilmington

The Traffic Separation Study process has three phases:

1. Preliminary Phase

The NCDOT and the City of Wilmington contractually agreed to make a “best” effort to approve and implement improvements identified by the study. An engineering consultant was then selected by NCDOT.

2. Study Phase

The engineering consultant evaluated the existing crossing conditions, average daily traffic (trains and vehicles) and socioeconomic impacts of potential closings for all public vehicular crossings within the study area, and prepared recommendations for NCDOT and local officials to review. Recommendations would be broken into three categories, short-term, mid-term, and long-term based on possible improvements. The possible recommended improvements and timeframes are described below.

Short-term recommendations (within two to five years): include improvements such as installation of flashing lights and gates, enhanced 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, connector roads, roadway realignments, crossing closures, relocations of existing crossings to safer locations and feasibility studies to evaluate potential grade separation locations.

Mid-term recommendations (five to eight years): include improvements such as grade separations, connector roads and crossing closures.

Long-term recommendations (more than 8 years): include improvements such as grade separations, connector roads and crossing closures that require longer-term planning/funding than mid-term projects.

Recommendations were presented to the public for comment.

3. Implementation Process

If applicable, funding sources for improvements are identified, project agreements will be 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. City staff typically assists with project development, utility relocation and right of way acquisition, if needed.

B. DATA COLLECTION

Data was gathered from various sources in order to assess crossing conditions. These sources are presented in Table B-1.

The information included in Table C-1 was gathered for each grade crossing in order to evaluate the crossing conditions in terms of traffic and safety.

The crossing inventory sheets for each crossing and the corresponding directional photographs for each crossing can be found in Figures 2 - 53.

Average Daily Traffic data from 2014 was in order to gauge the level of traffic on the surrounding streets of the crossings. The Average Annual Daily Traffic (AADT) can be found in Table C-3.

TABLE B-1

Data Item	Source
Crossing Number	NCDOT Rail
Street or Route	NCDOT Rail
Railroad Company	NCDOT Rail
Railroad Milepost	NCDOT Rail
Existing Warning Devices	Site Inspection
Vehicle Traffic	NCDOT / City of Wilmington
24 hour train volumes	Federal Rail Administration Inventory Forms
Accident History	Accident Reports (NCDOT & Federal Rail Administration)
Truck Route	N/A
Transit Route	Wilmington Transit Authority
School Bus Route (Yes/No)	New Hanover County Schools
Crossing Surface and Condition	Site Inspection
Land Use	Site Inspection
Redundant Crossing (Yes/No)	Site Inspection
Humped Crossing	Site Inspection/ Federal Rail Administration Inventory Forms
Crossing Geometry	Site Inspection
Need for Enhanced Warning devices	Site Inspection and accident history
Feasibility of Roadway Improvements	Site Inspection and engineering judgment

Figure 2 – S. 4th Street, Crossing Inventory

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
629 445S	249.66	CSX	S 4th Street	Local	MMFL	Residential

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
763	3/day; 5 days/week		No	No	n/a

Preemption	Humped Crossing	Crossing Condition Geometry	Crossing Surface Condition	Crossing Condition Sight	Redundant Crossing
☒	☐	Fair	Poor	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Need for Enhanced Warning Devices
Low	High	Low	No

Aerials *Notes: Erosion issues under rail and road*

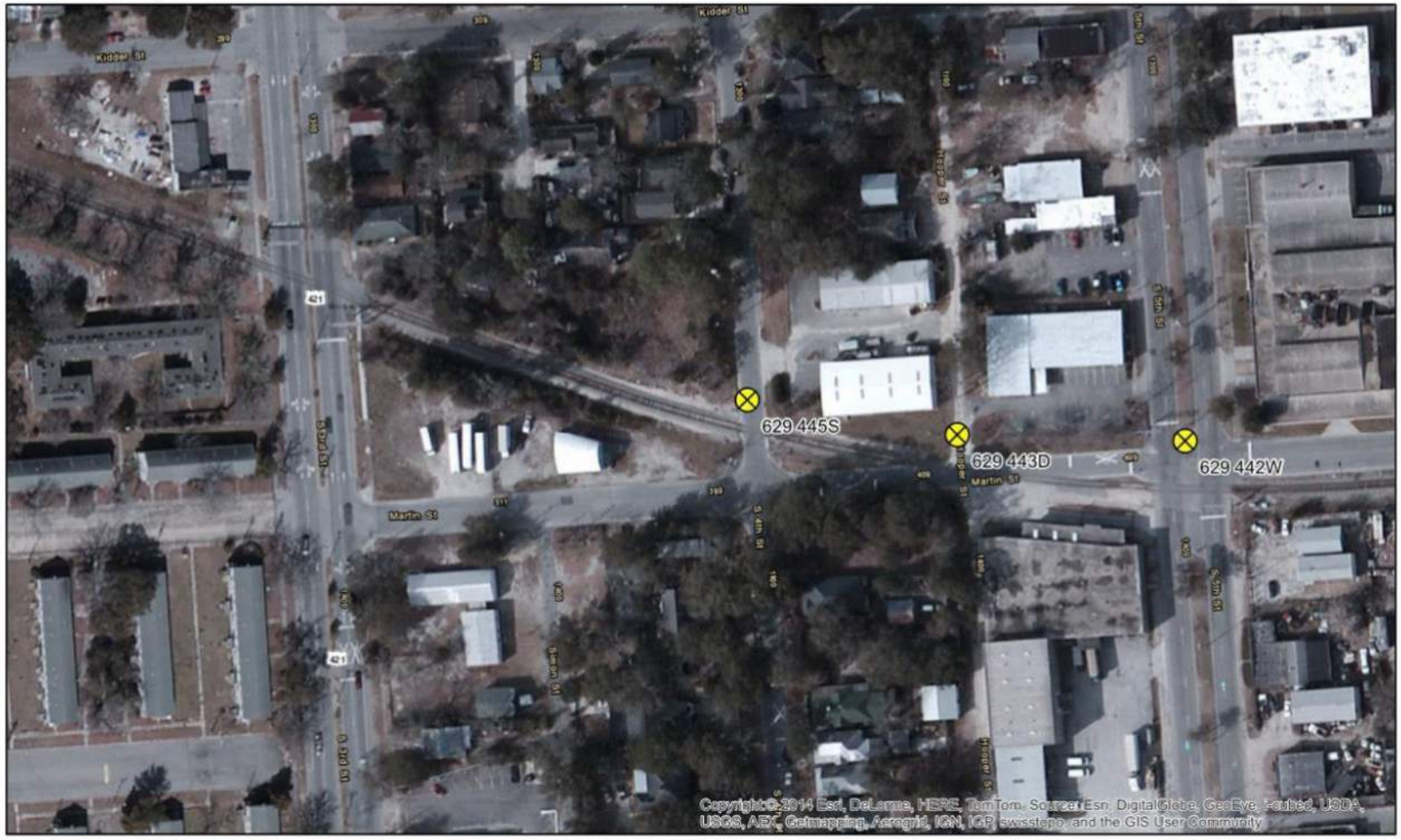


Figure 3 – S. 4th Street, Photos of Directional Views

Looking North

Looking South

Looking West

Looking East

Figure 4 – Hooper Street/S. Martin Street, Crossing Inventory

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
629 443D	246.48	CSX	Hooper Street	Local	None	Industrial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
393	3/day; 5 days/week		No	No	n/a

Preemption	Humped Crossing	Crossing Condition Geometry	Crossing Surface Condition	Crossing Condition Sight	Redundant Crossing
☒	☐	Fair	Poor	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Need for Enhanced Warning Devices
Low	High	Low	No

Aerials

Figure 5 – Hooper Street/S. Martin Street, Photos of Directional Views

Looking Northwest

Looking Southeast

Looking West

Looking East

Figure 6 – S. 5th Street, Crossing Inventory

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
629 442W	249.58	CSX	S 5th Street	Local	CFL	Industrial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
2,214	3/day; 5 days/week		Yes	No	n/a

Preemption	Humped Crossing	Crossing Condition Geometry	Crossing Surface Condition	Crossing Condition Sight	Redundant Crossing
☒	☐	Good	Good	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Need for Enhanced Warning Devices
Low	High	Low	No

Aerials

Figure 7 – S. 5th Street, Photos of Directional Views

Looking North

Looking South

Looking West

Looking East

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
629 441P	249.50	CSX	S 6th Street	Local	None	Industrial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
576	3/day; 5 days/week		No	No	n/a

Preemption	Humped Crossing	Crossing Condition Geometry	Crossing Surface Condition	Crossing Condition Sight	Redundant Crossing
☒	☐	Fair	Poor	Poor	Yes

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Need for Enhanced Warning Devices
Low	High	Low	No

Aerials *Notes: Rail crosses at both 6th Street and Martin Street at same location*

Looking North

Looking South

Looking West

Looking East

Figure 10 – S. 7th Street, Crossing Inventory

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
629 440H	249.42	CSX	S 7th Street	Local	None	Residential

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
574	3/day; 5 days/week		No	Yes - Avg.: 3/day	n/a

Preemption	Humped Crossing	Crossing Condition Geometry	Crossing Surface Condition	Crossing Condition Sight	Redundant Crossing
☒	☐	Fair	Poor	Poor	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Need for Enhanced Warning Devices
Low	High	Low	Yes

Aerials — *Notes: Rail crosses at both 6th Street and Martin Street at same location*

Figure 11 – S. 7th Street, Photos of Directional Views

Looking North

Looking South

Looking West

Looking East

Figure 12 – S. 8th Street, Crossing Inventory

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
629 439N	249.50	CSX	S 8th Street	Local	None	Residential

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
763	3/day; 5 days/week		No	Yes - Avg.: 4/day	n/a

Preemption	Humped Crossing	Crossing Condition Geometry	Crossing Surface Condition	Crossing Condition Sight	Redundant Crossing
☒	☐	Fair	Poor	Fair	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Need for Enhanced Warning Devices
Low	High	Low	Yes

Aerials

Figure 13 – S. 8th Street, Photos of Directional Views

Looking North

Looking South

Looking West

Looking East

Figure 14 – S. 9th Street, Crossing Inventory

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
629 438G	249.27	CSX	S 9th Street	Local	None	Institutional

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
570	3/day; 5 days/week		No	Yes - Avg.: 7/day	n/a

Preemption	Humped Crossing	Crossing Condition Geometry	Crossing Surface Condition	Crossing Condition Sight	Redundant Crossing
☒	☐	Fair	Poor	Fair	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Need for Enhanced Warning Devices
Low	High	Low	Yes

Aerials

Figure 15 – S. 9th Street, Photos of Directional Views

Looking North

Looking South

Looking West

Looking East

Figure 16 – S. 10th Street, Crossing Inventory

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
629 437A	249.19	CSX	S 10th Street	Local	CB; MMFL; other	Industrial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
523	3/day; 5 days/week		No	No	n/a

Preemption	Humped Crossing	Crossing Condition Geometry	Crossing Surface Condition	Crossing Condition Sight	Redundant Crossing
☒	☐	Poor	Poor	Fair	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Need for Enhanced Warning Devices
Low	High	Low	No

Aerials

Figure 17 – S. 10th Street, Photos of Directional Views

Looking North

Looking South

Looking West

Looking East

Figure 18 – S. 12th Street, Crossing Inventory

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
629 436T	249.03	CSX	S 12th Street	Local	None	Industrial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
201	3/day; 5 days/week		No	No	n/a

Preemption	Humped Crossing	Crossing Condition Geometry	Crossing Surface Condition	Crossing Condition Sight	Redundant Crossing
[X]	[X]	Poor	Fair	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Need for Enhanced Warning Devices
Low	High	Low	Yes

Aerials

Figure 19 – S. 12th Street, Photos of Directional Views

Looking North

Looking South

Looking West

Looking East

Figure 20 – S. 13th Street, Crossing Inventory

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
629 435L	248.95	CSX	S 13th Street	Collector	CFL	Industrial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
2,797	3/day; 5 days/week		No	Yes - Avg.: 22/day	n/a

Preemption	Humped Crossing	Crossing Condition Geometry	Crossing Surface Condition	Crossing Condition Sight	Redundant Crossing
☒	☐	Poor	Poor	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Need for Enhanced Warning Devices
Low	High	Low	Yes

Aerials

Figure 21 – S. 13th Street, Photos of Directional Views

Looking North

Looking South

Looking West

Looking East

Figure 22 – Marstellar Street, Crossing Inventory

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
629 434E	248.92	CSX	Marstellar Street	Local	MMFL, Gates	Industrial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
1,360	3/day; 5 days/week		No	No	n/a

Preemption	Humped Crossing	Crossing Condition Geometry	Crossing Surface Condition	Crossing Condition Sight	Redundant Crossing
☒	☐	Poor	Poor	Fair	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Need for Enhanced Warning Devices
Medium	High	Low	Yes

Aerials

Figure 23 – Marstellar Street, Photos of Directional Views

Looking Northwest

Looking Southeast

Looking West

Looking East

Figure 24 – S. 16th Street, Crossing Inventory

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
629 433X	248.72	CSX	S 16th Street	Urban - other Principal	Gates, MMFL, CFL	Industrial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
17,194	3/day; 5 days/week		Yes	Yes - Avg.: 25/day	n/a

Preemption	Humped Crossing	Crossing Condition Geometry	Crossing Surface Condition	Crossing Condition Sight	Redundant Crossing
☒	☐	Fair	Poor	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Need for Enhanced Warning Devices
Medium	High	Low	No

Aerials

Figure 25 – S. 16th Street, Photos of Directional Views

Looking North

Looking South

Looking West

Looking East

Figure 26 – S. 17th Street, Crossing Inventory

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
629 432R	248.64	CSX	S 17th Street	Urban - other principal	Gates, MMFL, CFL	Commercial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
17,398	3/day; 5 days/week		No	Yes - Avg.: 20/day	n/a

Preemption	Humped Crossing	Crossing Condition Geometry	Crossing Surface Condition	Crossing Condition Sight	Redundant Crossing
☒	☐	Fair	Poor	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Need for Enhanced Warning Devices
Medium	High	Low	No

Aerials

Figure 27 – S. 17th Street, Photos of Directional Views

Looking North

Looking South

Looking West

Looking East

Figure 28 – US 76/Oleander Drive, Crossing Inventory

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
629 431J	248.41	CSX	Oleander Drive	Urban- other principal	Gates, CFL	Commercial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
26,998	3/day; 5 days/week		No	Yes - Avg.: 55/day	n/a

Preemption	Humped Crossing	Crossing Condition Geometry	Crossing Surface Condition	Crossing Condition Sight	Redundant Crossing
[X]	☐	Fair	Good	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Need for Enhanced Warning Devices
High	High	Low	No

Aerials

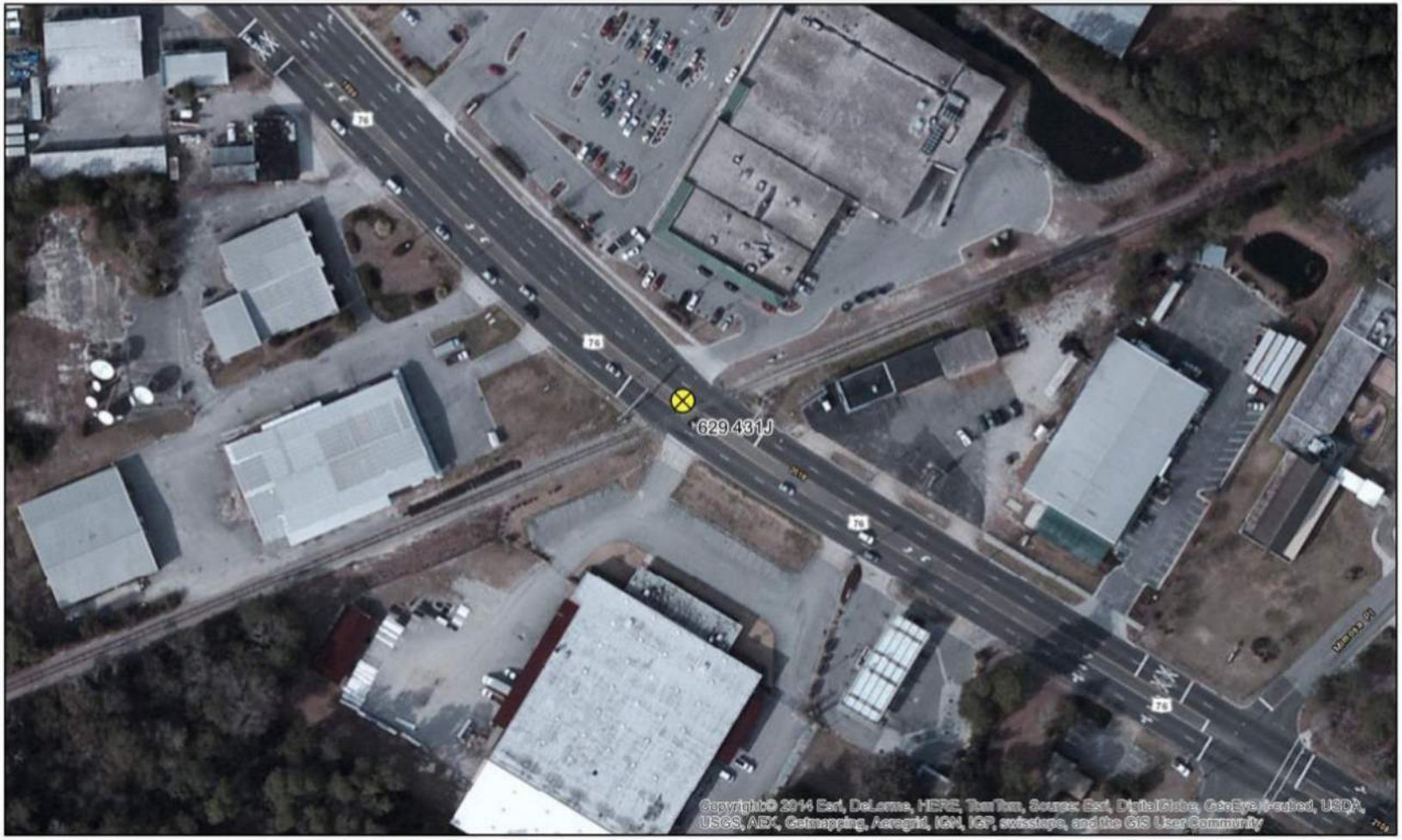


Figure 29 – US 76/Oleander Drive, Photos of Directional Views

Looking Northwest

Looking Southeast

Looking West

Looking East

Figure 30 – Wrightsville Avenue, Crossing Inventory

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
629 430C	218.04	CSX	Wrightsville Ave.	Minor Arterial	Gates, MMFL, CFL	Commercial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
18,343	3/day; 5 days/week		Yes	48	n/a

Preemption	Humped Crossing	Crossing Condition Geometry	Crossing Surface Condition	Crossing Condition Sight	Redundant Crossing
☒	☐	Fair	Fair	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Need for Enhanced Warning Devices
High	Medium	Low	No

Aerials

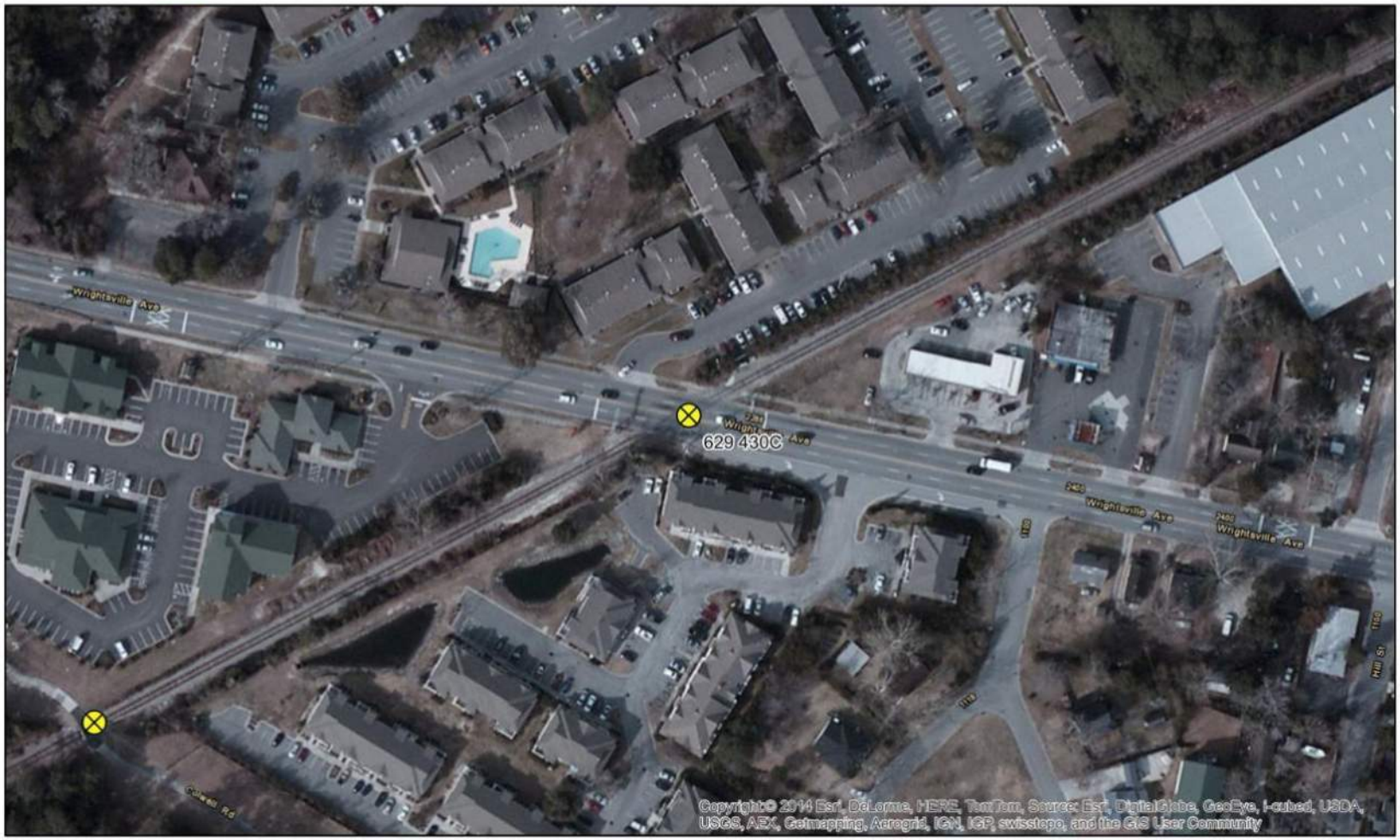


Figure 31 – Wrightsville Avenue, Photos of Directional Views

Looking Northeast

Looking Southwest

Looking West

Looking East

Figure 32 – Colonial Drive, Crossing Inventory

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
629 429H	247.79	CSX	Colonial Dr.	Minor Arterial	MMFL	Residential

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
3,837	3/day; 5 days/week		No	Yes - Avg.: 6/day	n/a

Preemption	Humped Crossing	Crossing Condition Geometry	Crossing Surface Condition	Crossing Condition Sight	Redundant Crossing
☒	☐	Fair	Fair	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Need for Enhanced Warning Devices
Low	High	Low	Yes

Aerials

Figure 33 – Colonial Drive, Photos of Directional Views

Looking North

Looking South

Looking West

Looking East

Figure 34 – Forest Hills Drive, Crossing Inventory

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
629 428B	247.65	CSX	Forest Hills Dr.	Local	MMFL	Residential

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
821	3/day; 5 days/week		No	No	n/a

Preemption	Humped Crossing	Crossing Condition Geometry	Crossing Surface Condition	Crossing Condition Sight	Redundant Crossing
☒	☒	Fair	Fair	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Need for Enhanced Warning Devices
Low	High	Low	Yes

Aerials

Figure 35 – Forest Hills Drive, Photos of Directional Views

Looking Northwest

Looking Southeast

Looking West

Looking East

Figure 36 – McRae/Mercer Avenue, Crossing Inventory

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
629 427U	247.37	CSX	Mercer Ave.	Local	CFL	Residential

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
997	3/day; 5 days/week		No	Yes - Avg.: 6/day	n/a

Preemption	Humped Crossing	Crossing Condition Geometry	Crossing Surface Condition	Crossing Condition Sight	Redundant Crossing
☒	☐	Good	Poor	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Need for Enhanced Warning Devices
Low	High	Low	Yes

Aerials

Figure 37 – McRae/Mercer Avenue, Photos of Directional Views

Looking North

Looking South

Looking West

Looking East

Figure 38 – Covil Avenue, Crossing Inventory

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
629 426M	247.28	CSX	Covil Ave.	Local	Gates, MMFL	Commercial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
17,294	3/day; 5 days/week		Yes	Yes - Avg.: 11/day	n/a

Preemption	Humped Crossing	Crossing Condition Geometry	Crossing Surface Condition	Crossing Condition Sight	Redundant Crossing
☒	☐	Fair	Good	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Need for Enhanced Warning Devices
Medium	High	Low	Yes

Aerials

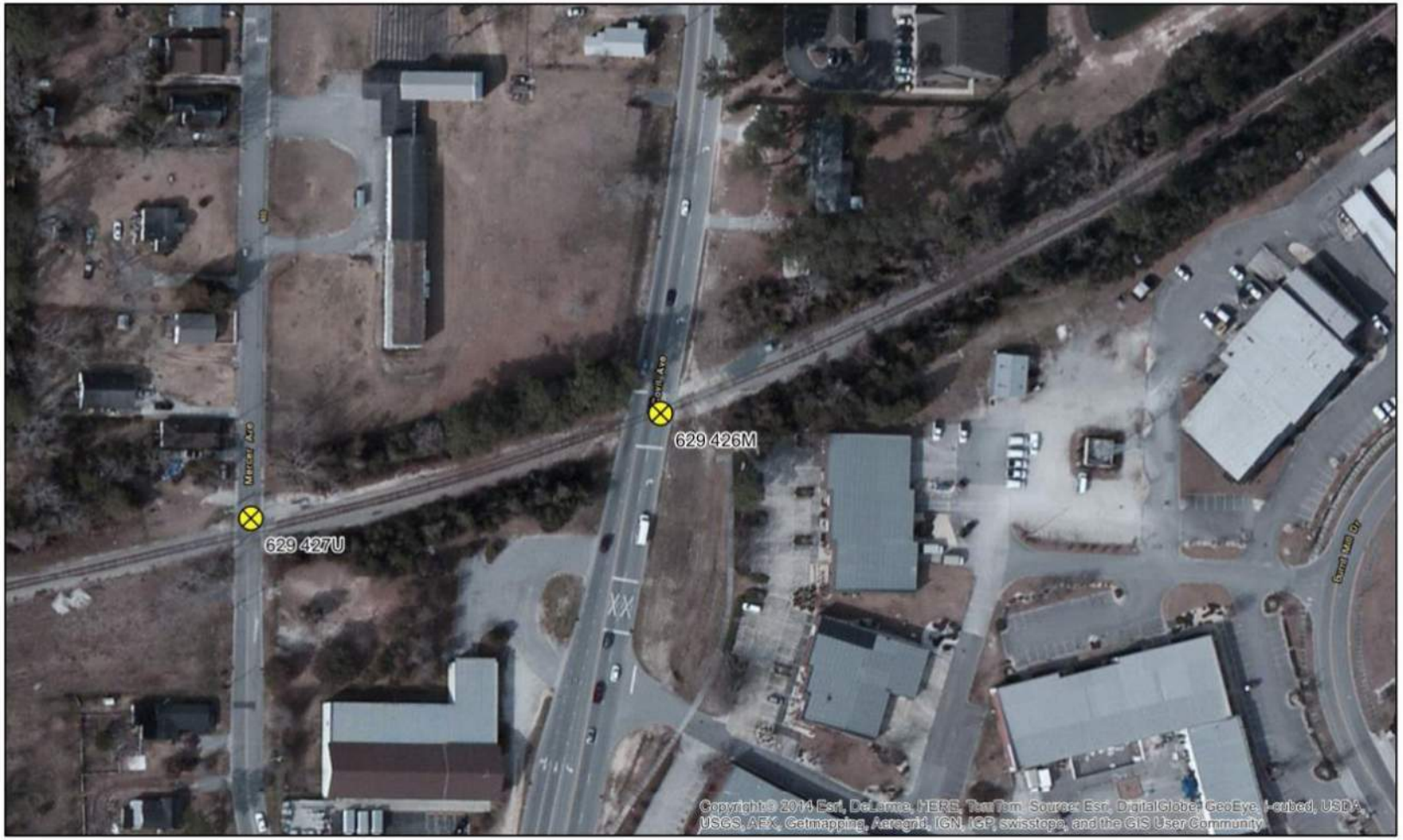


Figure 39 – Covil Avenue, Photos of Directional Views

Looking North

Looking South

Looking West

Looking East

Figure 40 – US 17/Market Street, Crossing Inventory

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
629 290C	246.24	CSX	Market St.	Urban- other principal	Gates, MMFL, CFL	Commercial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
35,920	3/day; 5 days/week		Yes	No	n/a

Preemption	Humped Crossing	Crossing Condition Geometry	Crossing Surface Condition	Crossing Condition Sight	Redundant Crossing
☒	☐	Fair	Good	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Need for Enhanced Warning Devices
High	High	Low	No

Aerials

Figure 41 – US 17/Market Street, Photos of Directional Views

Looking Northwest

Looking Southeast

Looking West

Looking East

Figure 42 – Henry Street, Crossing Inventory

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
629 289H	246.04	CSX	Henry St.	Local	Gates, MMFL	Residential

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
429	3/day; 5 days/week		No	No	n/a

Preemption	Humped Crossing	Crossing Condition Geometry	Crossing Surface Condition	Crossing Condition Sight	Redundant Crossing
☒	☐	Fair	Fair	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Need for Enhanced Warning Devices
Low	High	Low	Yes

Aerials

Figure 43 – Henry Street, Photos of Directional Views

Looking North

Looking South

Looking Northwest

Looking Southeast

Figure 44 – Clay Street, Crossing Inventory

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
629 724T	245.98	CSX	Clay St.	Local	None	Residential

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
307	3/day; 5 days/week		No	No	n/a

Preemption	Humped Crossing	Crossing Condition Geometry	Crossing Surface Condition	Crossing Condition Sight	Redundant Crossing
☒	☐	Fair	Good	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Need for Enhanced Warning Devices
Low	Medium	Low	No

Aerials

Figure 45 – Clay Street, Photos of Directional Views

Looking North

Looking South

Looking Northwest

Looking Southeast

Figure 46 – Princess Place Drive, Crossing Inventory

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
629 288B	245.91	CSX	Princess Place Dr.	Local	Gates, MMFL	Commercial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
9,155	3/day; 5 days/week		Yes	Yes - Avg.: 83/day	n/a

Preemption	Humped Crossing	Crossing Condition Geometry	Crossing Surface Condition	Crossing Condition Sight	Redundant Crossing
☒	☐	Fair	Fair	Fair	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Need for Enhanced Warning Devices
Medium	High	Low	No

Aerials

Figure 47 – Princess Place Drive, Photos of Directional Views

Looking Northwest

Looking Southeast

Looking West

Looking East

Figure 48 – N. 30th Street, Crossing Inventory

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
629 287U	245.72	CSX	W 30th Street	Local	MMFL	Residential

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
3,664	3/day; 5 days/week		Yes	No	n/a

Preemption	Humped Crossing	Crossing Condition Geometry	Crossing Surface Condition	Crossing Condition Sight	Redundant Crossing
☒	☐	Good	Good	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Need for Enhanced Warning Devices
High	High	Low	Yes

Aerials

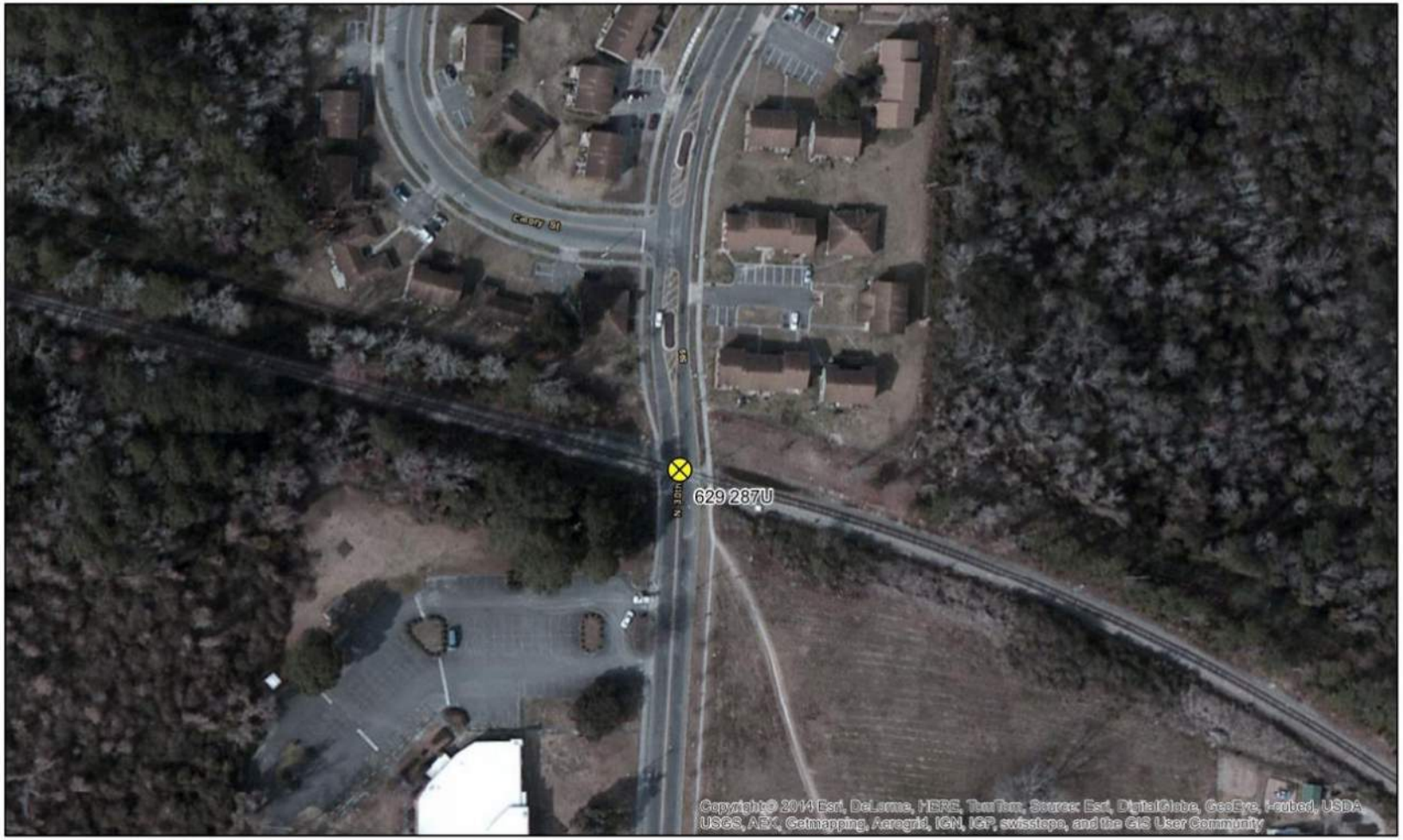


Figure 49 – N. 30th Street, Photos of Directional Views

Looking North

Looking South

Looking West

Looking East

Figure 50 – N. 23rd Street, Crossing Inventory

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
629 286M	244.97	CSX	W 23rd Street	Minor Arterial	Gates, MMFL, CFL	Commercial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
15,875	3/day; 5 days/week		Yes	Yes - Avg.: 6/day	n/a

Preemption	Humped Crossing	Crossing Condition Geometry	Crossing Surface Condition	Crossing Condition Sight	Redundant Crossing
☒	☐	Good	Fair	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Need for Enhanced Warning Devices
High	High	Low	No

Aerials

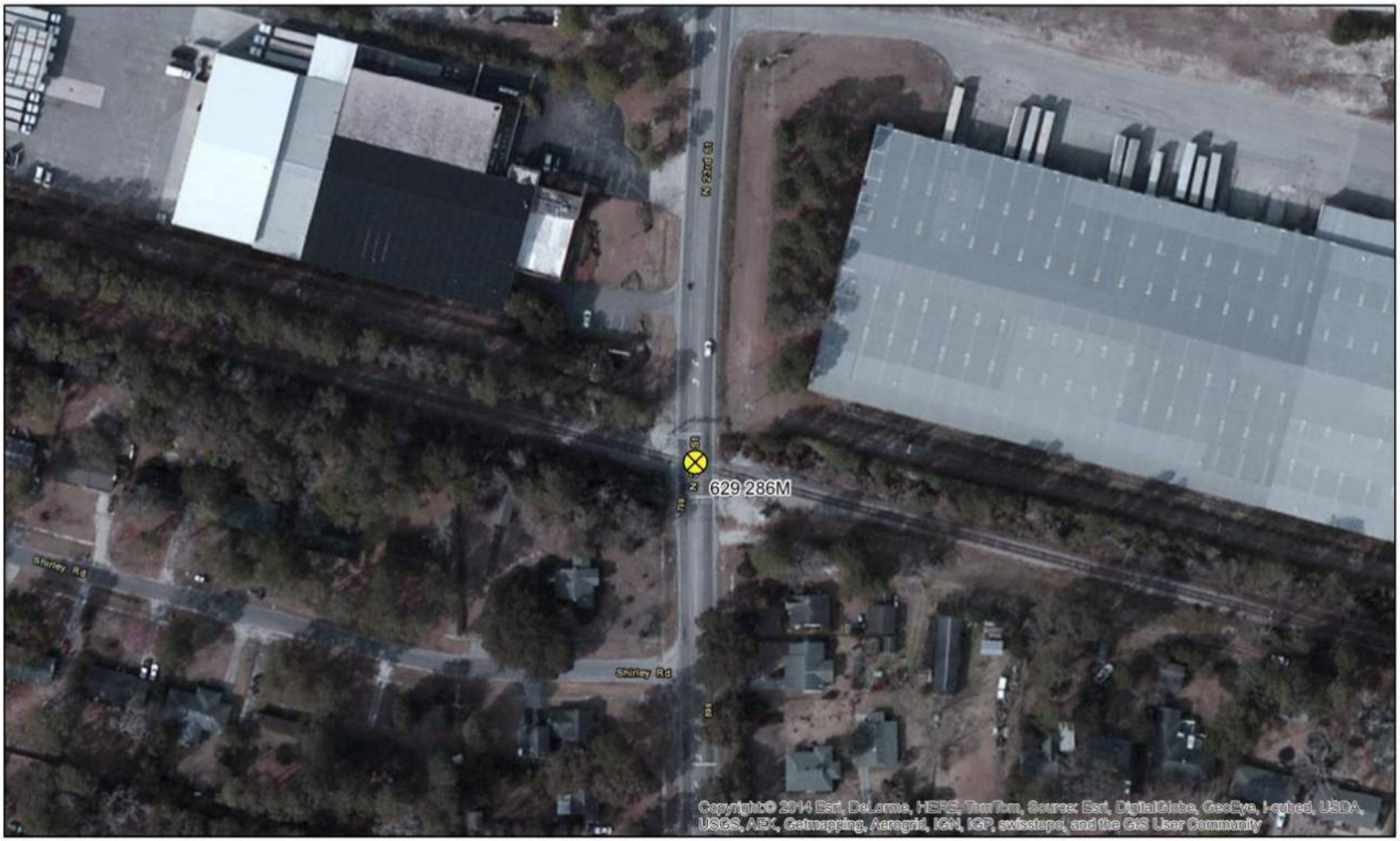


Figure 51 – N. 23rd Street, Photos of Directional Views

Looking North

Looking South

Looking West

Looking East

Figure 52 – King Street, Crossing Inventory

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
629 284Y	244.25	CSX	King St.	Collector	None	Residential

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
1,120	3/day; 5 days/week		No	No	n/a

Preemption	Humped Crossing	Crossing Condition Geometry	Crossing Surface Condition	Crossing Condition Sight	Redundant Crossing
☒	☐	Fair	Fair	Fair	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Need for Enhanced Warning Devices
High	High	Low	Yes

Aerials

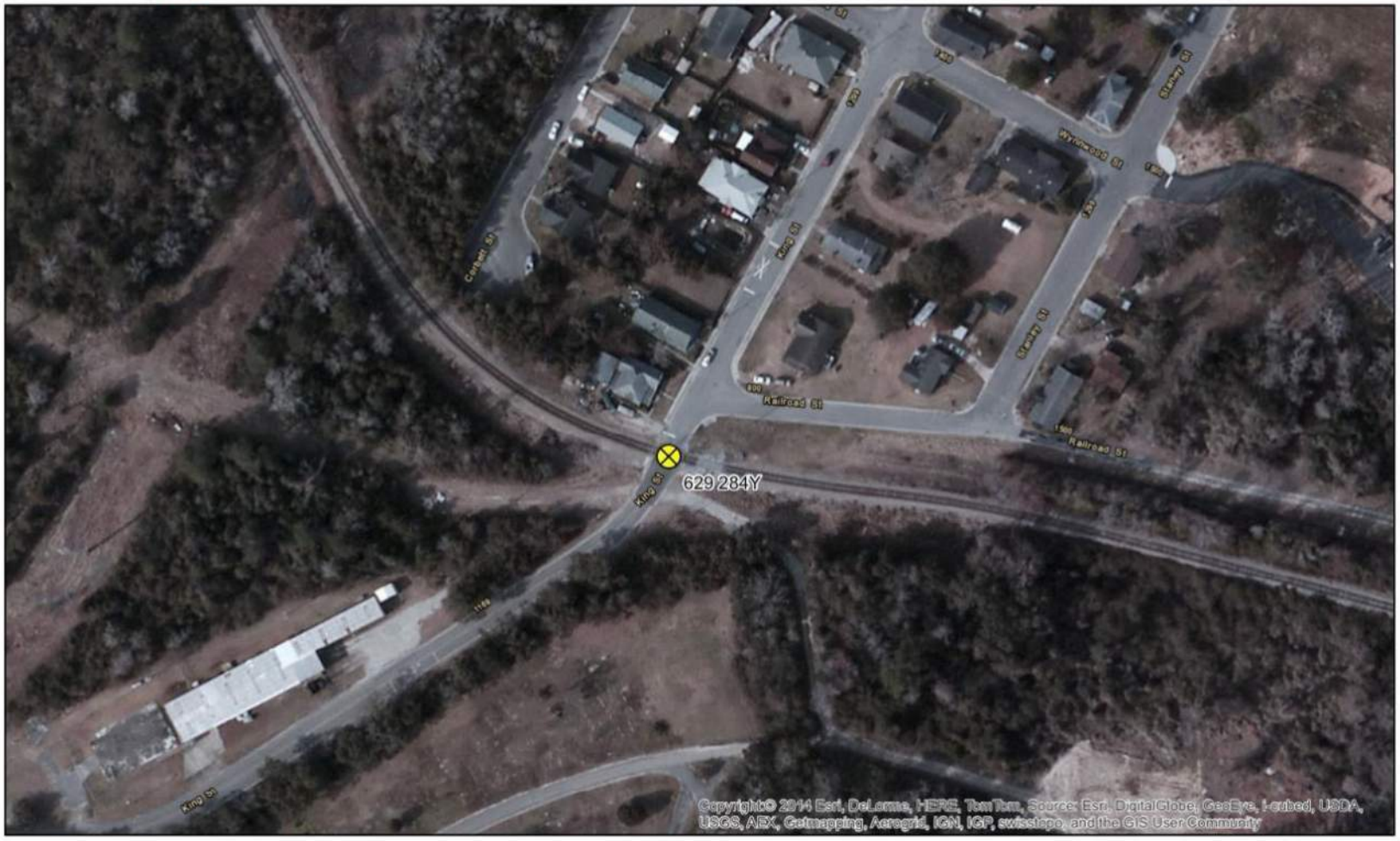


Figure 53 – King Street, Photos of Directional Views

Looking North

Looking South

Looking Northwest

Looking Southeast

C. CROSSING ANALYSIS

1. Exposure Index

NCDOT uses an exposure index as one indicator to determine if a grade separation structure is warranted at street/rail grade crossings. The exposure index is calculated by multiplying the number of trains per day by the number of vehicles per day that use the 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. Other factors that need to be considered in the feasibility of grade separations are:

- Accident history
- Topography
- Adjacent land use
- Geometric designs
- Construction impacts
- Costs

The exposure index was calculated for each of the 26 crossings (see Table C-1).

TABLE C-1 – Exposure Index

Crossing No.	Street Name	Trains per Day	2014 AADT	Exposure Index
629 445S	S. 4th Street	3	763*	2,289
629 443D	Hopper Street /Martin Street	3	393	1,179
629 442W	S. 5th Street	3	2,214	6,642
629 441P	S. 6th Street	3	576	1,728
629 440H	S. 7th Street	3	574	1,722
629 439N	S. 8th Street	3	763	2,289
629 438G	S. 9th Street	3	570	1,170
629 437A	S. 10th Street	3	523	1,569
629 436T	S. 12th Street	3	201	603
629 435L	S. 13th Street	3	2,797	8,391
629 434E	Marstellar Street	3	1,360	4,080
629 433X	S. 16th Street	3	17,194	51,582
629 432R	S. 17th Street	3	17,398	52,194
629 431J	US 76/Oleander Drive	3	26,998	80,994
629 430C	Wrightsville Avenue	3	18,343	55,029
629 429H	Colonial Drive	3	3,837	11,511
629 428B	Forest Hills Drive	3	821	2,463
629 427U	Mercer Avenue	3	997	2,991
629 426M	Covil Avenue	3	17,294	51,882
629 290C	US 17/Market Street	3	35,920	107,760
629 289H	Henry Street	3	429	1,287
642 724T	Clay Street	3	307	921
629 288B	Princess Place Drive	3	9,155	27,465
629 287U	N. 30th Street	3	3,664	10,992
629 286M	N. 23rd Street	3	15,875	47,625
629 284Y	King Street	3	1,120	3,360

*2008 AADT (FRA)

Source: Highway-Rail Crossing Inventory Data, Federal Rail Administration

The crossings that exceed the urban exposure index of 30,000 include:

- S. 16th Street
- S. 17th Street
- US 76/Oleander Drive
- Wrightsville Avenue
- Covil Avenue
- US 17/Market Street
- N. 23rd Street

2. Delay Analysis

Level of Service (LOS) is a measure of the operational efficiency of the street/rail grade crossing. It is determined using procedures from the *Highway Capacity Manual* procedures. LOS is expressed as a letter ranging from A (free flowing) to F (severely congested) and is determined using the average delay for all vehicles. Table C-2 summarizes the average delay and corresponding level of service for unsignalized intersections.

TABLE C-2 - LOS

Level of Service	Avg. Delay/Vehicle (seconds)
A	10.0
B	>10.0 to 15.0
C	>15.0 to 25.0
D	>25.0 to 35.0
E	>35.0 to 50.0
F	>50.0

The delay calculations are based on the methodology developed for the Proposed Conrail Acquisition Draft Environmental Impact Statement (DEIS) by the Surface Transportation Board's Sections of Environmental Analysis (SEA) and modified as needed for this project.

The following values were calculated for existing and future conditions.

- Blocked crossing time per train
- Event time
- Average delay per day
- Maximum vehicle queue
- Total stopped vehicle delay per day
- Average delay for all vehicles
- Traffic LOS

The LOS for each crossing was determined based on these computed values and the Highway Capacity Manual procedures. Table C-3 summarizes the delay and LOS results for the existing conditions.

TABLE C-3 – Delay and LOS

CSXT Crossings Capacity Analysis																
Crossing No.	Street Name	No. Lanes (one-way direction)	2014 AADT	Arrival Rate (Veh/Min) 2x uniform	Departure Rate	Trains per day	Train Speed (miles/hr)	Train Length (ft)	Crossing Blockage Time (min) T_c	Event (Queue) Time (min) T_e	Total Stopped Vehicle Delay Per Day (min/day) D_T	Number Vehicles Delayed/Day V_D	Max. Peak Hr. Queue (veh/lane) Q	Average Delay /Stopped Veh. (mins) D_{avg}	Avg. Delay/Veh. In Secs. (All Vehicles) D_V	LOS
629 445S	S. 4th Street	1	763*	1.06	30	3	45	9,000	2.27	2.36	4.41	4	2	1.18	0.69	A
629 443D	Hooper Street / Martin Street	1	393	0.55	30	3	45	9,000	2.27	2.31	2.19	2	1	1.16	0.67	A
629 442W	S. 5th Street	2	2,214	3.08	60	3	45	9,000	2.27	2.53	14.79	12	3	1.27	0.80	A
629 441P	S. 6th Street	1	576	0.80	30	3	45	9,000	2.27	2.33	3.27	3	1	1.17	0.68	A
629 440H	S. 7th Street	1	574	0.80	30	3	45	9,000	2.27	2.33	3.26	3	1	1.17	0.68	A
629 439N	S. 8th Street	1	763	1.06	30	3	45	9,000	2.27	2.36	4.41	4	2	1.18	0.69	A
629 438G	S. 9th Street	1	570	0.79	30	3	45	9,000	2.27	2.33	3.24	3	1	1.17	0.68	A
629 437A	S. 10th Street	1	523	0.73	30	3	45	9,000	2.27	2.33	2.96	3	1	1.16	0.68	A
629 436T	S. 12th Street	1	201	0.28	30	3	45	9,000	2.27	2.29	1.10	1	0	1.15	0.66	A
629 435L	S. 13th Street	1	2,797	3.88	30	3	45	9,000	2.27	2.61	19.86	15	6	1.31	0.85	A
629 434E	Marstellar Street	1	1,360	1.89	30	3	45	9,000	2.27	2.43	8.33	7	3	1.21	0.74	A
629 433X	S. 16th Street	3	17,194	23.88	90	3	45	9,000	2.27	11.14	2223.41	399	13	5.57	15.52	C
629 432R	S. 17th Street	3	17,398	24.16	90	3	45	9,000	2.27	11.68	2473.54	423	13	5.84	17.06	C
629 431J	US 76 / Oleander Drive	2	26,998	37.50	60	3	45	9,000	2.27	-9.09	2325.93	-512	31	-4.55	10.34	B
629 430C	Wrightsville Avenue	2	18,343	25.48	60	3	45	9,000	2.27	15.07	4340.76	576	21	7.54	28.40	D
629 429H	Colonial Drive	1	3,837	5.33	30	3	45	9,000	2.27	2.76	30.53	22	9	1.38	0.95	A
629 428B	Forest Hills Drive	1	821	1.14	30	3	45	9,000	2.27	2.36	4.77	4	2	1.18	0.70	A
629 427U	Mercer Avenue	1	997	1.38	30	3	45	9,000	2.27	2.38	5.90	5	2	1.19	0.71	A
629 426M	Covil Avenue	2	17,294	24.02	60	3	45	9,000	2.27	11.40	2341.41	411	20	5.70	16.25	C
629 290C	US 17/Market Street	2	35,920	49.89	60	3	45	9,000	2.27	-3.43	439.73	-257	41	-1.71	1.47	A

Crossing No.	Street Name	No. Lanes (one-way direction)	2014 AADT	Arrival Rate (Veh/Min) 2x uniform	Departure Rate	Trains per day	Train Speed (miles/hr)	Train Length (ft)	Crossing Blockage Time (min) T_c	Event (Queue) Time (min) T_e	Total Stopped Vehicle Delay Per Day (min/day) D_T	Number Vehicles Delayed/Day V_D	Max. Peak Hr. Queue (veh/lane) Q	Average Delay /Stopped Veh. (mins) D_{avg}	Avg. Delay/Veh. In Secs. (All Vehicles) D_V	LOS
629 289H	Henry Street	1	429	0.60	30	3	45	9,000	2.27	2.32	2.40	2	1	1.16	0.67	A
642 724T	Clay Street	1	307	0.43	30	3	45	9,000	2.27	2.31	1.70	1	1	1.15	0.66	A
629 288B	Princess Place Drive	1	9,155	12.72	30	3	45	9,000	2.27	3.94	148.39	75	21	1.7	1.95	A
629 287U	N. 30th Street	1	3,664	5.09	30	3	45	9,000	2.27	2.74	28.59	21	8	1.37	0.94	A
629 286M	N. 23rd Street	1	15,875	22.05	30	3	45	9,000	2.27	8.57	1215.89	284	36	4.29	9.19	A
629 284Y	King Street	1	1,120	1.56	30	3	45	9,000	2.27	2.40	6.70	6	3	1.20	0.72	A

*2008 AADT (FRA)

Source: Highway-Rail Crossing Inventory Data, Federal Rail Administration

3. Crash Analysis

At-Grade Crossings

Thirty-one recorded crashes have occurred in the corridor since the 1975. Only two crashes have occurred in the past ten years, and only one of those involved injuries.

Crashes are summarized using the following classifications:

- Fatality
- Injury
- PDO – property damage only

Table C-4 summarizes the crash data.

TABLE C-4 – Crash Summary

CSXT Crossings					
Crossing No.	**Street Name**	**Total # of Crashes**	**# of Fatalities**	**# of Injuries**	**PDO**
629 445S	S. 4th Street	0	0	0	0
629 443D	Hooper Street / Martin Street	0	0	0	0
629 442W	S. 5th Street	0	0	0	0
629 441P	S. 6th Street	1	0	0	1
629 440H	S. 7th Street	0	0	0	0
629 439N	S. 8th Street	1	0	1	0
629 438G	S. 9th Street	0	0	0	0
629 437A	S. 10th Street	5	0	1	4
629 436T	S. 12th Street	0	0	0	0
629 435L	S. 13th Street	1	0	0	1
629 434E	Marstellar Street	1	0	1	0
629 433X	S. 16th Street	1	0	0	1
629 432R	S. 17th Street	1	0	0	1
629 431J	US76/Oleander Drive	0	0	0	0
629 430C	Wrightsville Avenue	1	0	0	1
629 429H	Colonial Drive	2	0	1	1
629 428B	Forest Hills Drive	0	0	0	0
629 427U	Mercer Avenue	3	0	1	2
629 426M	Covil Avenue	2	0	1	1
629 290C	US 17/Market Street	1	0	0	1
629 289H	Henry Street	2	0	1	1

(TABLE C-4 Continued)

CSXT Crossing					
Crossing No.	**Street Name**	**Total # of Crashes**	**# of Fatalities**	**# of Injuries**	**PDO**
642 724T	Clay Street	2	0	0	2
629 288B	Princess Place Drive	2	0	0	2
629 287U	N. 30th Street	5	0	1	4
629 286M	N. 23rd Street	0	0	0	0
629 284Y	King Street *	0	0	0	0

Source: FRA, Highway-Rail Grade Crossing Accident/Incident Report (Accessed December 22, 2014)

* CSX Transportation had a derailment at Crossing # 629 284Y

D. SAFETY AND MOBILITY ISSUES

There are several methods available to enhance railroad-crossing safety. This chapter discusses some of these methods in more detail.

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 street/rail crossing. During the site inspections, none of the crossings experienced queuing of vehicles across the tracks when trains were present.

2. Traffic Signal Preemption

Standard practice (based on *The Manual on Uniform Traffic Control Devices*) requires that traffic signals located within 200 feet of a street/rail at-grade crossing be coordinated with the crossing's train detection and warning system to preempt normal operations of the traffic signal. If a traffic signal is warranted at any of the other intersections, signal preemption would be required.

3. 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.

Crest vertical curves across the tracks that do not create a need for the driver to reduce speed are not considered to be a humped profile. The combination of short crest and sag vertical curves caused by a buildup of the ballast and raising of the track create a need to reduce speed across the crossing.

The following crossings have a slight humped profile:

- Forest Hills Drive
- S. 12th Street

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 these grade crossings include asphalt, concrete slab, timber 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. Several of the crossings have surfaces that are in need of improvements and rehabilitation. See **Table G-1** for more detailed information.

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 train is visible, but motorist is too impatient to wait

During the field analysis, there were no signs of vehicles circumventing the gates when a train was approaching. There were also no signs showing vehicles (tire tracks, disturbed ground) circumventing the gates.

E. SYSTEM ENHANCEMENT OPTIONS

1. Grade Separation Structures

Many factors must be considered before suggesting grade separation, including:

- Traffic volumes (both vehicle and train)
- Accident history
- Topography
- Adjacent land use
- Construction impacts
- Costs

For the analysis of these crossings, none of the above factors apply in considering grade separated crossings in this study.

2. Crossing Protection Device Upgrades

The most common, and cost-effective, way to increase the safety at a railway crossing is to upgrade existing warning devices at the crossing. Typical warning devices include signs, gate arms, flashing lights and bells. *Passive* devices, such as advanced warning signs and crossbucks, merely warn the motorist of the existence of a railroad crossing. These devices are most suitable where train and traffic volumes and speeds are low, and where sight distance is adequate. *Active* devices that warn motorists of approaching trains include flashing lights, bells, and automated gates. Such devices are usually employed at locations exhibiting higher volumes or speeds, or greater potential for accidents. The hierarchy of standard warning treatments, from least to most protected are:

Example of gates, signs and flashing lights

- Unmarked
- Railroad crossbucks
- Standard STOP signs (limited sight distance) and crossbucks
- Flashing signals and bells
- Flashing signals, bells and gates.

3. Advanced Crossing Protection Devices

These advanced crossing devices are most appropriate where high-volume multi-lane roadways cross railroad main lines, and where significant numbers of motorists are ignoring or circumventing existing warning devices. The advanced warning devices are described below.

a. Median Barriers

Median barriers consist of markers mounted on raised islands along the roadway centerline to discourage motorists from driving in opposing travel lanes to "go around" lowered gate arms. Median treatments typically extend 70 feet to 100 feet back from the gates, but may be precluded by driveways or

Example of Median Barriers

intersecting roads within this distance.

b. Four-Quadrant Gates

This crossing treatment requires an additional gate on each approach, completely "sealing" the crossing. Several measures are employed to prevent vehicles from becoming "trapped" inside the gates, including careful timing of the gates to allow traffic to clear; providing 16 feet of clearance between track center and gates; leaving adequate space between gate tips for a vehicle to "squeeze" out; and use of breakaway arms. In tests at the Sugar Creek Road crossing in Charlotte, four-quadrant gates alone reduced violations by 86%; in combination with median barriers, the reduction in violations rose to 98%.

Example of 4 Quadrant Gate

c. Long Gate Arms

Extra-long arms cover at least ¾ of the crossing width. When tested at the Orr Road crossing in Charlotte, the installation of long gate arms reduced crossing violations by 67%.

d. Articulated Gates

Articulated gates are hinged arms that unfold to cover at least ¾ of crossing width. They are typically warranted where overhead obstructions prevent the use of long gate arms. Articulated gates installed at Orr Road in Charlotte reduced crossing violations by 78%.

e. Remote Video Detection

The Crossing Law Enforcement and Research of (CLEAR) Violations program employs video cameras to monitor selected crossings. The recordings provide information on crossing operations, violations, and accidents for both enforcement and research purposes.

4. Crossing Consolidation & Elimination

Many low-volume crossings are unnecessary due to the availability of alternative access across the tracks. These alternative crossings can often be made safer, since many low-volume crossings lack adequate warning devices. Resources are not available to upgrade warning devices on all existing crossings, and grade separation would be even less feasible. Therefore, consolidation and closure of these minor crossings is an effective strategy in terms of both costs and safety benefits. Typically, a crossing is considered redundant (and therefore a candidate for elimination) if it is within a reasonable distance of another crossing connected to the same street network.

Crossing consolidations eliminate the potential for train/vehicle collisions. Crossing-related installation and maintenance costs are reduced, and by concentrating traffic at fewer, higher-volume crossings, more expensive active warning treatments and roadway improvements can be justified.

Crossings with high potential for elimination include:

- Redundant crossings near parallel crossings or grade separations, or where traffic can be safely and efficiently diverted to another crossing;

- Skewed crossings, or those where sight distance is limited by horizontal/vertical curvature, vegetation, or permanent obstructions;
- Crossings with a history of accidents;
- Crossings adjacent to a newly constructed crossing or grade separation;
- Private crossings with no identifiable owner, or where the owner is unwilling or unable to fund crossing upgrades (and where alternative access is reasonably available); since NCDOT does not currently have jurisdiction over private crossings; closing of these crossings is determined by the railroad and property owner if identified.
- Complex crossings that cannot be effectively served by warning devices due to multiple tracks, extensive switching operations, etc.

5. Roadway Improvements

Roadway improvements can reduce both accident potential and traffic delay at railroad crossings. Realignment and re-grading can improve visibility and reduce the time required to traverse a crossing. Additional lanes significantly increase capacity, reducing the residual delay following a crossing event. New roadways can provide alternative routes, allowing crossings to occur at more desirable locations, and potentially eliminate the number of crossing trips.

6. Traffic Signals

Traffic signals are not specifically intended as warning devices at railroad crossings. However, when a street/rail grade crossing is located near a signalized intersection (typically within 200 feet), special steps should be taken to insure that vehicles do not get trapped on the tracks due to queues resulting from an adjacent street intersection's red signal. The normal sequence of traffic signal indications should be preempted by the approach of a train, eliminating the possibility of entrapment due to conflicting traffic and railroad crossing signals. Ideally, the preempted signal phasing should be designed to allow non-conflicting movements to proceed during a train crossing, thereby minimizing overall traffic delay.

F. PUBLIC INVOLVEMENT

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

- Two Stakeholder Committee Meetings
- Three Additional Stakeholders Meetings
- Two Citizen Informational Workshops (CIW)
- One Neighborhood Meeting

A Stakeholder Committee was established to guide the development of the analysis and recommendations due to their role in providing financial assistance to the completion of the study, and possibly to implementation of approved recommendations. The Stakeholder Committee met two times over the course of the project; the first meeting was held on March 25, 2014 to introduce the project and study area; the second meeting was held on December 2, 2014 to present the draft recommendations and receive feedback on which draft recommendations that would be presented to additional stakeholders and to the public.

The Stakeholder Committee included the following:

- CSX Transportation
- NCDOT Division 3
- NCDOT Rail Division
- City of Wilmington.

The study team met with additional stakeholders in order to gain critical input in reaching consensus on grade crossing recommendations. These stakeholders met three times during the course of this study. These meetings were held on June 2, 2014, March 25, 2015 and November 13, 2015 with various city departments, local neighborhood associations, emergency response, and school district representatives. Stakeholder meeting summaries are included in Appendix B. These additional stakeholders include the following:

- NCDOT Rail Division
- CSX Transportation
- NCDOT Division 3
- City of Wilmington
- Wilmington City Council
- Wilmington MPO
- City of Wilmington Fire Department
- City of Wilmington Police Department
- CSX Transportation
- New Hanover County Schools
- Wilmington Downtown Incorporated
- Citizen Representatives

Additionally, the Public Involvement program included three Citizens Informational Workshops (CIWs) and one neighborhood meeting. These meetings are summarized below.

Citizens Informational Workshop #1

The first series of CIWs were held on June 9th and June 10th. Study team members were available to introduce the Wilmington Traffic Separation Study, to answer questions related to the study, and to receive comments to aid in developing recommendations for improving the twenty-six rail crossings.

Advertisements were placed in the Wilmington Star News, Greater Diversity Newspaper and the Wilmington Journal. There were also 1672 postcards sent out to residents located within the study area surrounding the railroad corridor. There were a total of 12 attendees at the meetings. Residents of area neighborhoods were primarily concerned with increased

freight train activity, at-grade crossing safety, and investigating new freight railroad corridors. Access to the Love Grove neighborhood was also a concern since there is only one access point into the neighborhood that requires residents and emergency response vehicles to cross the CSX Transportation corridor.

Citizens Informational Workshop #2

The second CIW was held on May 11th and 12th, 2015 at Wilmington City Hall and Sunset Park Baptist Church, respectively. The study team developed and presented renderings of improvements to the 26 crossings. Study team members were available to answer questions related to the study, and to receive comments on the recommendations for the 26 rail crossings.

Advertisements were placed in the Wilmington Star News, Greater Diversity Newspaper and the Wilmington Journal. There were also 1672 postcards sent out to residents located within the study area surrounding the railroad corridor. There were a total of 45 attendees at the meetings. Residents of area neighborhoods were primarily concerned with access to homes and businesses north and south of the tracks, and felt that S. 7th St and S. 9th St would be better options for closures as opposed to S. 8th St and S. 10th Street Residents were concerned that dead-end streets in the southern section of the study would be disadvantageous to the neighborhood. They shared their concern for the aesthetic quality of the closings, the potential that these areas would be dumping grounds for trash, EMS accessibility to homes in the area, and the potential for crime increase. At the Love Grove neighborhood, the King Street improvements were well-received but the need for a second access was also discussed.

Neighborhood Meeting

A small group CIW was held on June 29th, 2015 at St. Andrews AME Zion Church. The study team shared new renderings of improvements to the crossings from S. 4th Street to S. 10th Street, taking previous citizen input into account. Study team members were available to answer questions related to the study, and to receive comments on the recommendations.

Over 800 door hanger meeting announcements were delivered to local residents. There were a total of 48 attendees at the meeting. Residents re-iterated their concern that dead-end streets in the southern section of the study would be disadvantageous to the neighborhood, and shared many of the same concerns as CIW # 2. Additionally, they felt the closures would force them to use other roadways that already carried large volumes of traffic.

G. RECOMMENDATIONS

With the projected increase in freight rail traffic, there is a need to focus attention on the safety of this corridor. Recommendations were identified for improvements to the at-grade crossings to provide a safer and improved mobility on and adjacent to the rail corridor to all forms of traffic.

Street/Rail Grade Crossing Recommendations

This section describes the recommendations, as well as alternatives, for the 26 at-grade crossings. The primary objective of these improvements is to provide guidance to the local and state agencies on the mechanisms that could trigger the need for further evaluation and design.

A. S. 4th Street (Crossing # 629 445S)

1. Mid-Term

   Alternative 1: Close at-grade crossing and connect Hooper Street to S. 4th Street using Martin Street modifications. Martin Street's roadway classification proposed to be a driveway to provide access to adjacent parcels only.

   Alternative 2: Signal and gate 4th Street and connect Hooper Street to S. 4th Street using Martin Street modifications. Martin Street's roadway classification proposed to be a driveway to provide access to adjacent parcels only.

   Concept design shown in **Figures 54 – 55;** conceptual renderings shown in **56 – 58**.

B. Hooper Street/Martin Street (Crossing # 629 443D)

1. Mid-Term

   Close the at-grade crossing as well as close a portion of Martin Street from S. 4th Street to S. 5th Street. Install end of road markers, guardrail and landscaping (per CSXT standards). Define the edge of pavement to minimize parking within railroad limits on the southwest corner property of S. 5th Street and Martin Street.

C. S. 5th Street (Crossing # 629 442W)

1. Mid-Term

   Extend existing medians and construct concrete noses. Convert Martin Street on east side into driveway. Convert S. 5th Street into a complete street concept. Reduce the 4-lane cross section to a 2-lane cross section, incorporate bike lanes and on-street parking

D. S. 6th Street (Crossing # 629 441P)

1. Mid-Term

   S. 6th Street at-grade crossing to remain open. Close Martin Street from S. 5th Street to Stroud Alley. Install curb and gutter and landscaping within Martin Street; though providing a driveway along the northern side of Martin Street between S. 5th Street and S. 6th Street to access those properties.

   Shown in **Figures 59** and **60**.

E. S. 7th Street (Crossing # 629 440H)

1. Mid-Term

   Alternative 1: Continue to operate as an at-grade crossing. Martin Street would be closed west of Stroud Alley. Install flashers and gates.

   Alternative 2: Close at-grade crossing and install end of road markers, guardrail and landscaping (per CSTX standards).

   Shown in **Figures 59** and **60**.

F. S. 8th Street (Crossing # 629 439N)

1. Mid-Term

   Alternative 1: Close the at-grade crossing and install end of road markers, guardrail and landscaping (per CSXT standards). Construct Kidder Street connector between S. 8th Street and S. 9th Street (with either the closure of S. 8th or S. 9th Street).

   Alternative 2: Keep S. 8th Street open; install flashers and gates and improve crossing surface. Construct Kidder Street connector between S. 8th Street and S. 9th Street (with either the closure of S. 8th or S. 9th Street).

   Shown in **Figures 61** and **62**.

Figure 54 – S. 4th Street / Hooper Street / S. 5th Street Recommendations

Figure 55 – S. 4th Street / Hooper Street Alternative Recommendations

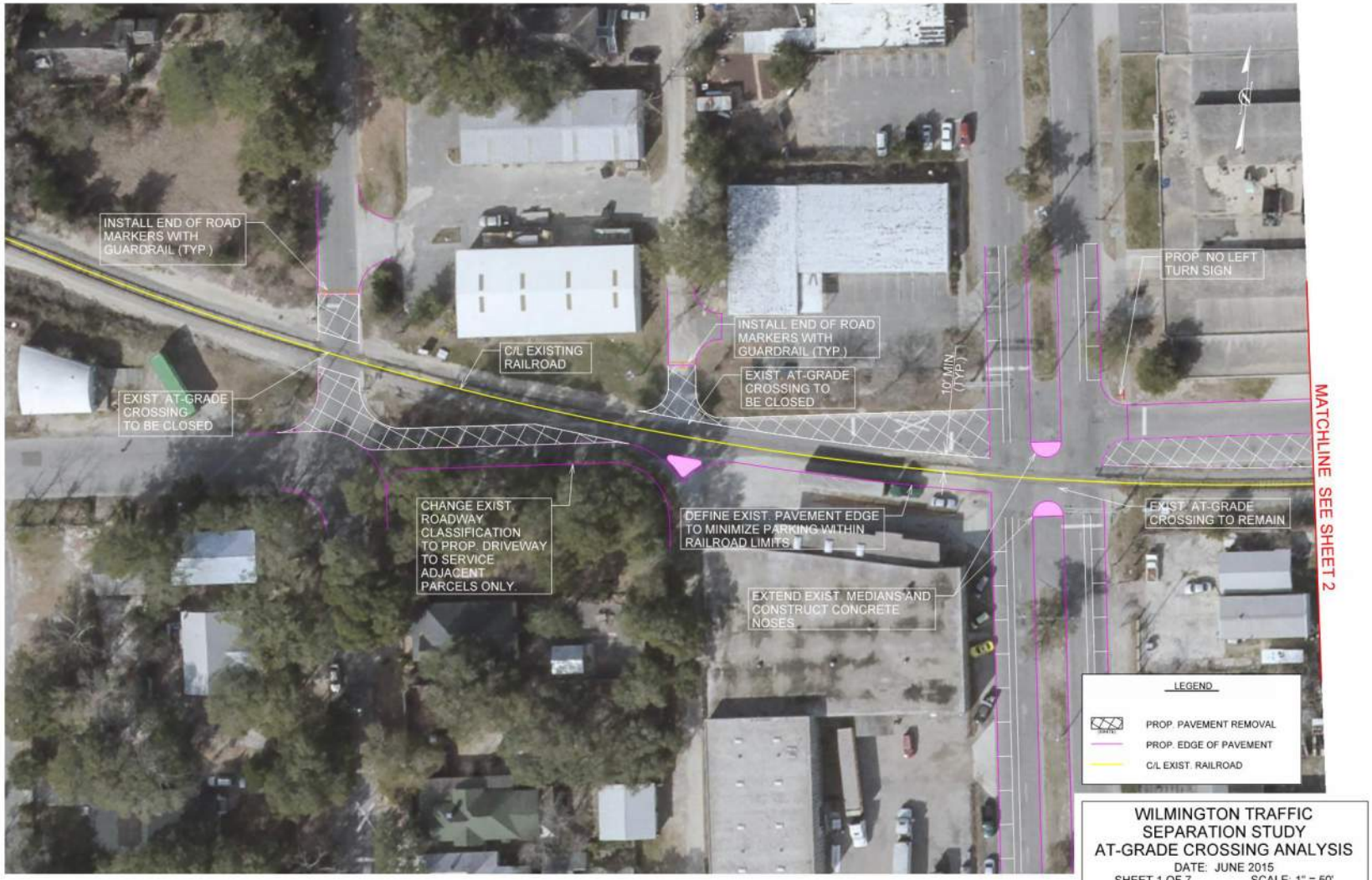


Figure 56 – S. 4th Street / Hooper Street Rendering: Existing Conditions

Figure 57 – S. 4th Street / Hooper Street Rendering: Proposed Concept for Alternative 1

Figure 58 – S. 4th Street / Hooper Street Rendering: Proposed Concept for Alternative 2

Figure 59 – S. 6th Street / S. 7th Street Recommendations

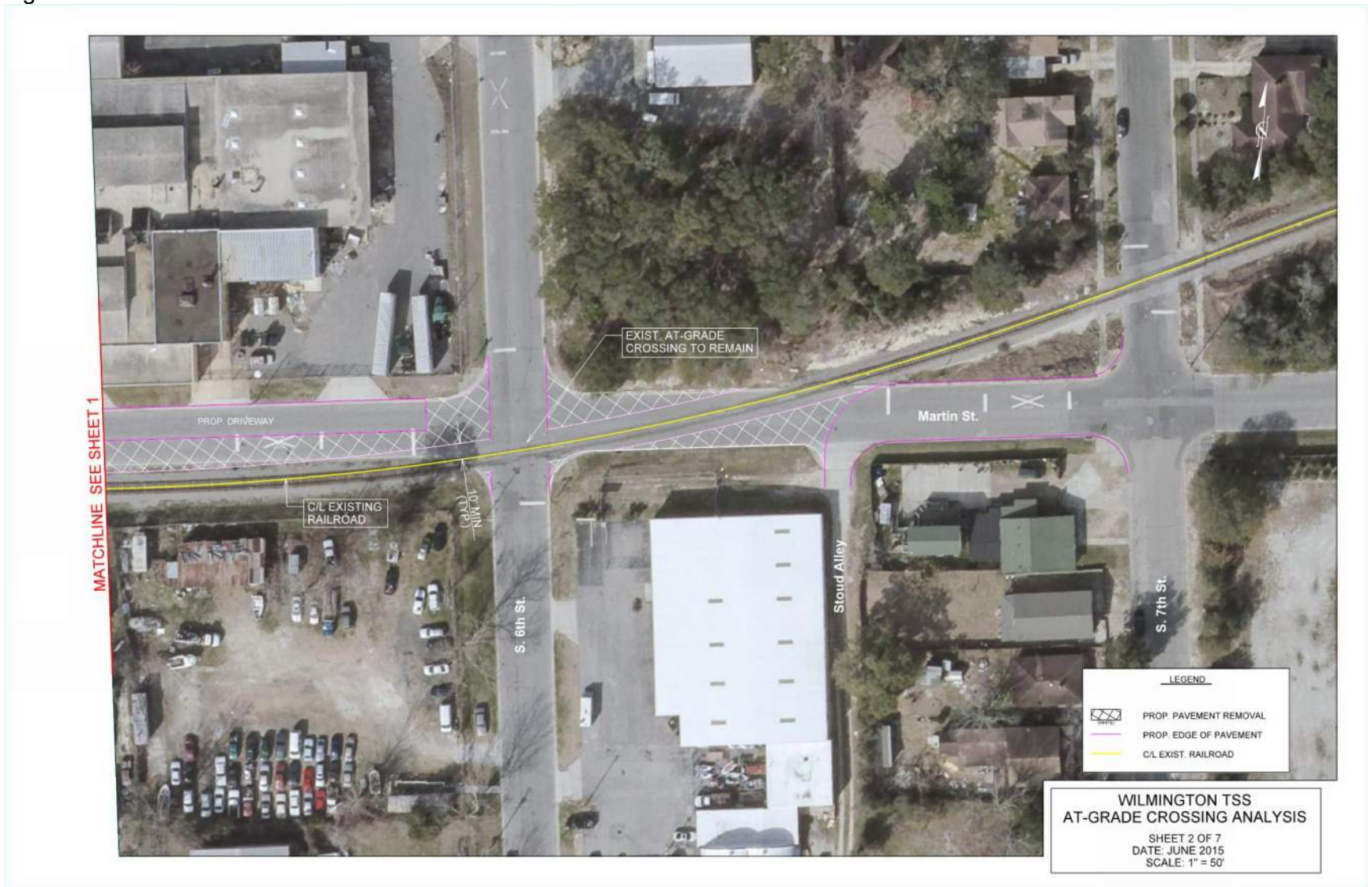


Figure 60 – S. 6th Street / S. 7th Street Alternative Recommendations

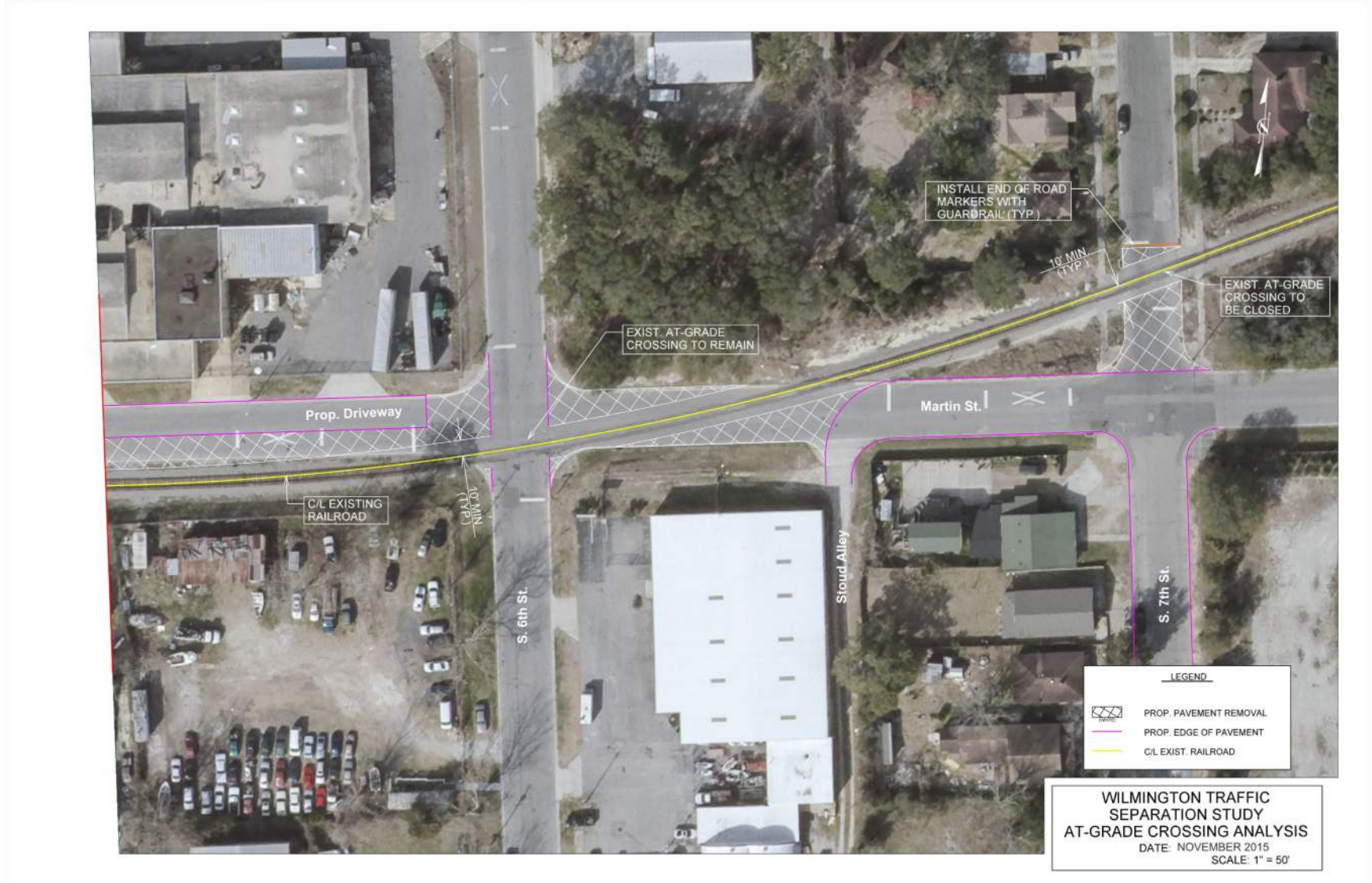


Figure 61 – S. 8th Street / S. 9th Street Recommendations

Figure 62 – S. 8th Street / S. 9th Street Alternative Recommendations

G. S. 9th Street (Crossing # 629 438G)

1. Mid-Term

   Alternative 1: Continue to operate the crossing as an at-grade crossing. Install flashers and gates. Construct Kidder Street connector between S. 8th Street and S. 9th Street (with either the closure of S. 8th or S. 9th Street).

   Alternative 2: Close the at-grade crossing and install end of road markers, guardrail and landscaping (per CSXT standards). Construct Kidder Street connector between S. 8th Street and S. 9th Street (with either the closure of S. 8th or S. 9th Street).

   Concept design shown in **Figures 61 – 62;** conceptual renderings shown in **Figures 63 – 64.**

H. S. 10th Street (Crossing # 629 437A)

1. Mid-Term

   Alternative 1: Close at-grade crossing and install end of road markers, guardrail and landscaping (per CSXT standards). Roadway modifications are proposed for the corner of Kidder Street and S. 10th Street.

   Alternative 2: Crossing to remain open with Kidder Street modifications to include installing end of road markers and guardrail and landscaping (per CSXT standards); upgrade flashers and install gates at S. 10th Street.

   Shown in **Figures 65** and **66**.

I. S. 12th Street (Crossing # 629 436T)

1. Mid-Term

   Continue to operate the crossing as an at-grade crossing. Install flashers and gates.

J. S. 13th Street (Crossing # 629 435L)

1. Mid-Term

   Install gates at crossing.

Figure 63 – S. 9th Street / Kidder Street Rendering: Existing Conditions

Figure 64 – S. 9th Street / Kidder Street Rendering: Proposed Concept

Figure 65 – S. 10th Street Recommendations

Figure 66 – S. 10th Street Alternative Recommendations

K. Marstellar Street (Crossing # 629 434E)

1. Mid-Term

   Improve existing crossing by replacing the rail seal (crossing surface) and ensure there is horizontal clearance for two-way traffic. In addition, investigate possible longer gate arms to increase horizontal coverage of crossing closure due to the skewed crossing.

L. S. 16th Street (Crossing # 629 433X)

1. Mid-Term

   Resurface the crossing, including sidewalks.

M. S. 17th Street (Crossing # 629 432R)

1. Mid-Term

   Resurface the crossing including sidewalks.

N. US 76/Oleander Drive (Crossing #629 431J)

1. Mid-Term

   Upgrade crossing signals.

O. Wrightsville Avenue (Crossing # 629 430C)

1. Mid-Term

   Improve the crossing surface and upgrade signal system.

P. Colonial Drive (Crossing # 629 429H)

1. Mid-Term

   Install gates at crossing.

Q. Forest Hills Drive (Crossing # 629 428B)

1. Mid-Term

   Install gates at crossing.

R. Mercer Avenue (Crossing # 629 427U)

1. Mid-Term

   Install gates at crossing.

S. Covil Avenue (Crossing # 629 426M)

1. Mid-Term

   Install cantilevers, improve crossing surface.

T. US 17/Market Street (Crossing # 629 290C)

1. Mid-Term

   Improve crossing surface and install concrete median.

U. Henry Street (Crossing # 629 289H)

1. Mid-Term

   Upgrade signal system.

   Shown in **Figure 67.**

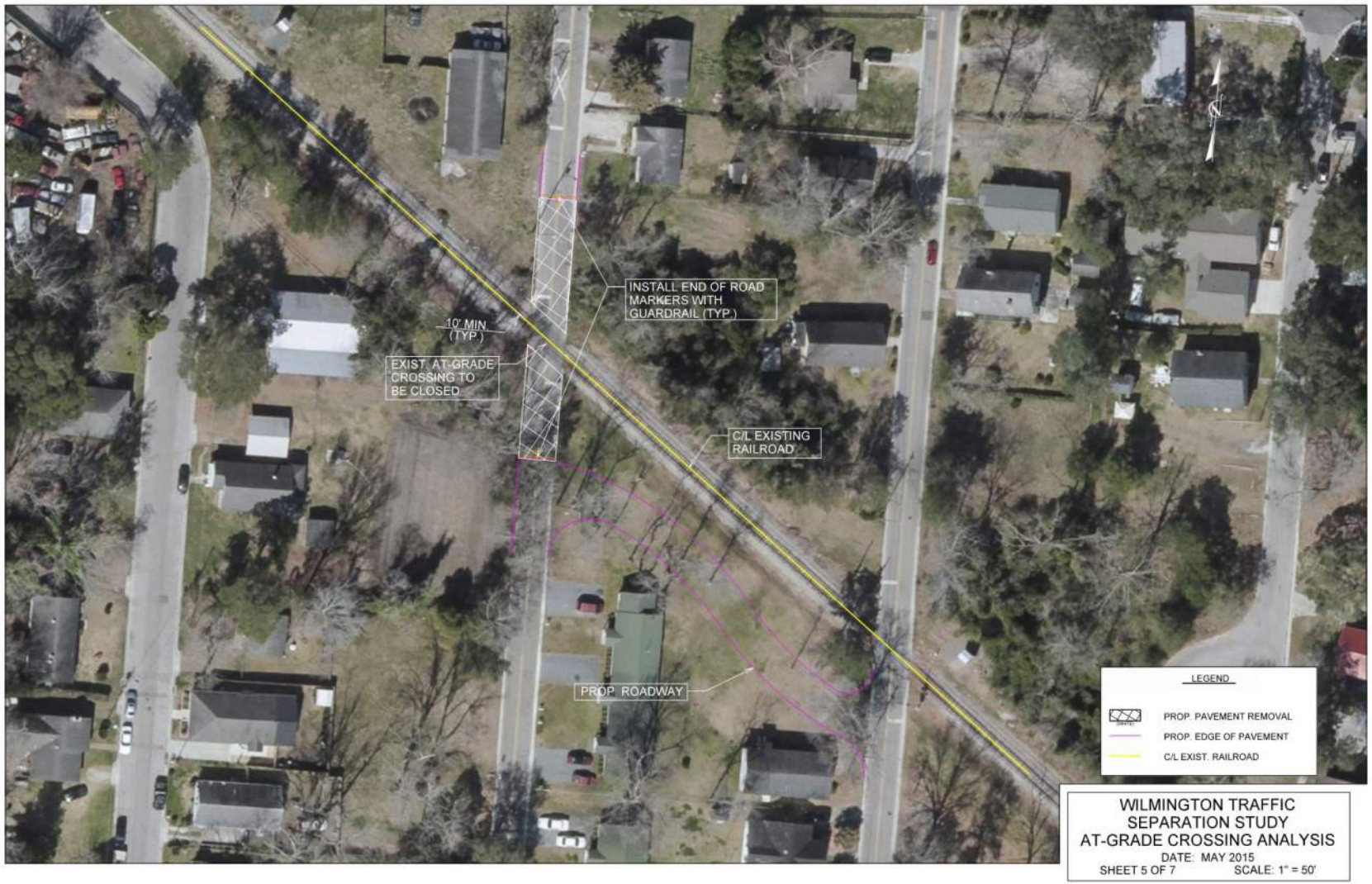
V. Clay Street (Crossing # 642 724T)

1. Mid-Term

   Close the at-grade crossing and install end of road markers, guardrail and landscaping (per CSXT standards). Construct new street connection between Henry and Clay Street.

   Shown in **Figure 67.**

Figure 67 – Henry and Clay Street Recommendations



W. Princess Place Drive (Crossing # 629 288B)

1. Mid-Term

   Install cantilevers, improve crossing surface, and provide pedestrian crossing.

X. N. 30th Street (Crossing # 629 287U)

1. Mid-Term

   Install gates, improve surface crossing

Y. N. 23rd Street (Crossing # 629 286M)

1. Mid-Term

   Improve crossing surface and install concrete median.

Z. King Street (Crossing # 629 284Y)

1. Mid-Term

   Install flashers and gates. Slightly re-align King Street, relocate utility pole, and improve crossing surface.

   Shown in **Figure 68.**

Figure 68 – King Street Recommendations

TABLE G-1 – Recommendations

Crossing #	Street Name	Recommendation
629 445S	S. 4th Street	Alternative 1: Close at-grade crossing and connect Hooper Street to S. 4th Street using Martin Street modifications
		Alternative 2: Signal and gate S. 4th Street and connect Hooper Street to S. 4th Street using Martin Street modifications
629 443D	Hooper Street / Martin Street	Close at-grade crossing with roadway modifications
629 442W	S. 5th Street	Extend concrete median towards crossing, convert Martin Street into a driveway on east side; mid-term: convert 5th Street into a complete street concept with on-street parking, bike lanes and one-lane in each direction
629 441P	S. 6th Street	Crossing to remain open; close Martin Street portion of at-grade crossing with roadway modifications
629 440H	S. 7th Street	Alternative 1: Install flashers and gates
		Alternative 2: Close at-grade crossing
629 439N	S. 8th Street	Alternative 1: Close at-grade crossing; construct Kidder Street connection between 8th and 9th streets
		Alternative 2: Keep 8th Street open, install flashers and gates, improve crossing surface, construct Kidder Street connection between 8th and 9th streets
629 438G	S. 9th Street	Alternative 1: Install flashers and gates
		Alternative 2: close at-grade crossing; construct Kidder Street connection between 8th and 9th streets
629 437A	S. 10th Street	Alternative 1: Close at-grade crossing with roadway modifications
		Alternative 2: Keep 10th Street crossing open with Kidder Street modifications; upgrade flashers and install gates
629 436T	S. 12th Street	Install flashers and gates
629 435L	S. 13th Street	Install gates
629 434E	Marstellar Street	Improve crossing surface with rail seal, extend gate arms to ensure horizontal coverage
629 433X	S. 16th Street	Improve crossing surface and upgrade sidewalks at crossing
629 432R	S. 17th Street	Improve crossing surface and upgrade sidewalks at crossing
629 431J	US 76 / Oleander Drive	Upgrade signal system
629 430C	Wrightsville Avenue	Improve crossing surface with rail seal, upgrade signal system
629 429H	Colonial Drive	Install gates
629 428B	Forest Hills Drive	Install gates

Crossing #	Street Name	Recommendation
629 427U	Mercer Avenue	Install gates
629 426M	Covil Avenue	Install cantilevers, improve crossing surface
629 290C	US 17 / Market Street	Improve crossing surface and install concrete median
629 289H	Henry Street	Upgrade signal system
642 724T	Clay Street	Close at-grade crossing; construct new street connection between Henry and Clay Streets
629 288B	Princess Place Drive	Install cantilevers, improve crossing surface and upgrade sidewalks at crossing
629 287U	N. 30th Street	Install gates; improve crossing surface
629 286M	N. 23rd Street	Improve crossing surface and install concrete median
629 284Y	King Street	Install flashers and gates; re-align King Street and improve crossing surface with rail seal