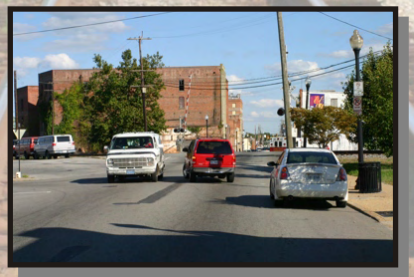
SUFFOLK RAIL IMPACT STUDY








HAMPTON ROADS
PLANNING DISTRICT COMMISSION

MAY 2007

T07-03

HAMPTON ROADS PLANNING DISTRICT COMMISSION

CHESAPEAKE
- REBECCA C. W. ADAMS
- AMAR DWARKANATH
- * CLIFTON E. HAYES, JR.
- ANNE F. ODELL
- ELLA P. WARD

FRANKLIN
- JOSEPH J. SCISLOWICZ
- * ROWLAND L. TAYLOR

GLOUCESTER COUNTY
- JOHN J. ADAMS, SR.
- * WILLIAM H. WHITLEY

HAMPTON
- * RANDALL A. GILLILAND
- ROSS A. KEARNEY, II
- JESSE T. WALLACE, JR.

ISLE OF WIGHT COUNTY
- W. DOUGLAS CASKEY
- * STAN D. CLARK

JAMES CITY COUNTY
- * BRUCE C. GOODSON
- SANFORD B. WANNER

NEWPORT NEWS
- CHARLES C. ALLEN
- * JOE S. FRANK
- RANDY W. HILDEBRANDT

NORFOLK
- ANTHONY L. BURFOOT
- * PAUL D. FRAIM
- DR. THERESA W. WHIBLEY
- REGINA V.K. WILLIAMS
- BARCLAY C. WINN

POQUOSON
- * CHARLES W. BURGESS, JR.
- GORDON C. HELSEL, JR.

PORTSMOUTH
- JAMES B. OLIVER, JR.
- * DOUGLAS L. SMITH

SOUTHAMPTON
- ANITA T. FELTS
- * MICHAEL W. JOHNSON

SUFFOLK
- LINDA T. JOHNSON
- * JAMES G. VACALIS

SURRY
- * TYRONE W. FRANKLIN
- JUDY S. LYTTLE

VIRGINIA BEACH
- HARRY E. DIEZEL
- ROBERT M. DYER
- BARBARA M. HENLEY
- * LOUIS R. JONES
- MEYERA E. OBERNDORF
- JAMES K. SPORE
- JOHN E. UHRIN

WILLIAMSBURG
- * JACKSON C. TUTTLE, II
- JEANNE ZEIDLER

YORK COUNTY
- * JAMES O. McREYNOLDS
- THOMAS G. SHEPPERD, JR.

***EXECUTIVE COMMITTEE MEMBER**

PROJECT STAFF

ARTHUR L. COLLINS	EXECUTIVE DIRECTOR/SECRETARY
DWIGHT L. FARMER	DEPUTY EXECUTIVE DIRECTOR, TRANSPORTATION
CAMELIA RAVANBAKHT	PRINCIPAL TRANSPORTATION ENGINEER
NICOLE C. FOX	TRANSPORTATION ENGINEER
ROBERT C. JACOBS	DIRECTOR OF GRAPHIC & PRINTING SERVICES
MICHAEL R. LONG	GRAPHIC ARTIST/ILLUSTRATOR TECHNICIAN II
BRIAN MILLER	GRAPHIC TECHNICIAN II
RACHAEL V. PATCHETT	REPROGRAPHIC SUPERVISOR

SUFFOLK RAIL IMPACT STUDY

This report was included in the Work Program for Fiscal Year 2006-2007, which was approved by the Commission and the Metropolitan Planning Organization at their meetings of March 15, 2006.

PREPARED BY:

MAY 2007

T07-03

REPORT DOCUMENTATION

TITLE:
Suffolk Rail Impact Study

AUTHORS:
Nicole C. Fox, P.E.
Camelia Ravanbakht, Ph.D.

REPORT DATE:
May 2007

GRANT/SPONSORING AGENCY:
FHWA/VDOT/LOCAL FUNDS

ORGANIZATION NAME, ADDRESS, & TELEPHONE
Hampton Roads Planning District Commission
723 Woodlake Drive
Chesapeake, Virginia 23320
757.420.8300
http://www.hrpdcva.gov

ABSTRACT

The City of Suffolk requested that a rail impact study be undertaken to assess the effect of increased rail traffic due to the construction of the new Maersk/APM Terminal and Craney Island Terminal port facilities in Portsmouth, the Commonwealth Railway Mainline Safety Relocation Project (Median Rail Project), and Norfolk Southern's upgraded Heartland Corridor. Commonwealth Railway, Norfolk Southern, and CSX each run through Suffolk and will experience increases in train volumes from these developments.

This study analyzes the impacts to thirty-one (31) at-grade highway-rail crossings in Suffok that will experience an increase in rail traffic due to the new port facilities. Performance measures are used to evaluate the effects of this traffic on the impact areas of mobility and safety. Based on analysis using these performance measures, the crossings are ranked and improvement priority crossings are identified for both impact areas. Each priority crossing is assessed and improvement options are identified.

ACKNOWLEDGMENTS

This report was prepared by the Hampton Roads Planning District Commission (HRPDC) in cooperation with the City of Suffolk, the Virginia Department of Transportation (VDOT), and the Federal Highway Administration (FHWA). The contents of this report reflect the views of the staff of the Hampton Roads Area Metropolitan Planning Organization (MPO). The MPO staff is responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the FHWA, VDOT, or HRPDC. This report does not constitute a standard, specification, or regulation. FHWA or VDOT acceptance of this report as evidence of fulfillment of the objectives of this planning study does not constitute endorsement/approval of the need for any recommended improvements nor does it constitute approval of their location and design or a commitment to fund any such improvements. Additional project level environmental impact assessments and/or studies of alternatives may be necessary.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF MAPS

INTRODUCTION

The City of Suffolk requested that a rail impact study be undertaken to assess the effect of increased rail traffic due to the construction of the new Maersk/APM Terminals and Craney Island port facilities in Portsmouth, the Commonwealth Railway Mainline Safety Relocation Project (Median Rail Project), and Norfolk Southern's upgraded Heartland Corridor. These projects will benefit the Hampton Roads region by providing new economic opportunities and reducing the percentage of containerized freight shipped by truck on the region's increasingly congested roadways. Currently, Commonwealth Railway, Norfolk Southern, and CSX each run through Suffolk and will experience increases in train volumes from these developments. These tracks cross many major roadways in Suffolk, including those providing access to commercial business, residences, and industry in downtown Suffolk. Significant increases in the number of trains in addition to increases in roadway congestion may affect the safety and mobility of motorists as well as the ability of the City's emergency services to provide adequate response times.


Train crossing E Washington Street

Additionally, this study will consider options to mitigate any adverse impacts to the safety and mobility of the community. These options may include improving safety protection equipment at crossings, a rail monitoring system, grade separation, or new roadway connections.


Old Myrtle Road

PURPOSE OF STUDY

The goal of the Suffolk Rail Impact Study is to analyze the effects of increasing rail traffic through Suffolk on the mobility and safety of its citizens and to consider and provide the City with options to reduce any impacts.

STUDY AREA

This study includes analysis of forty (40) highway-rail crossings along three railroad lines in the City of Suffolk. These crossings are located along

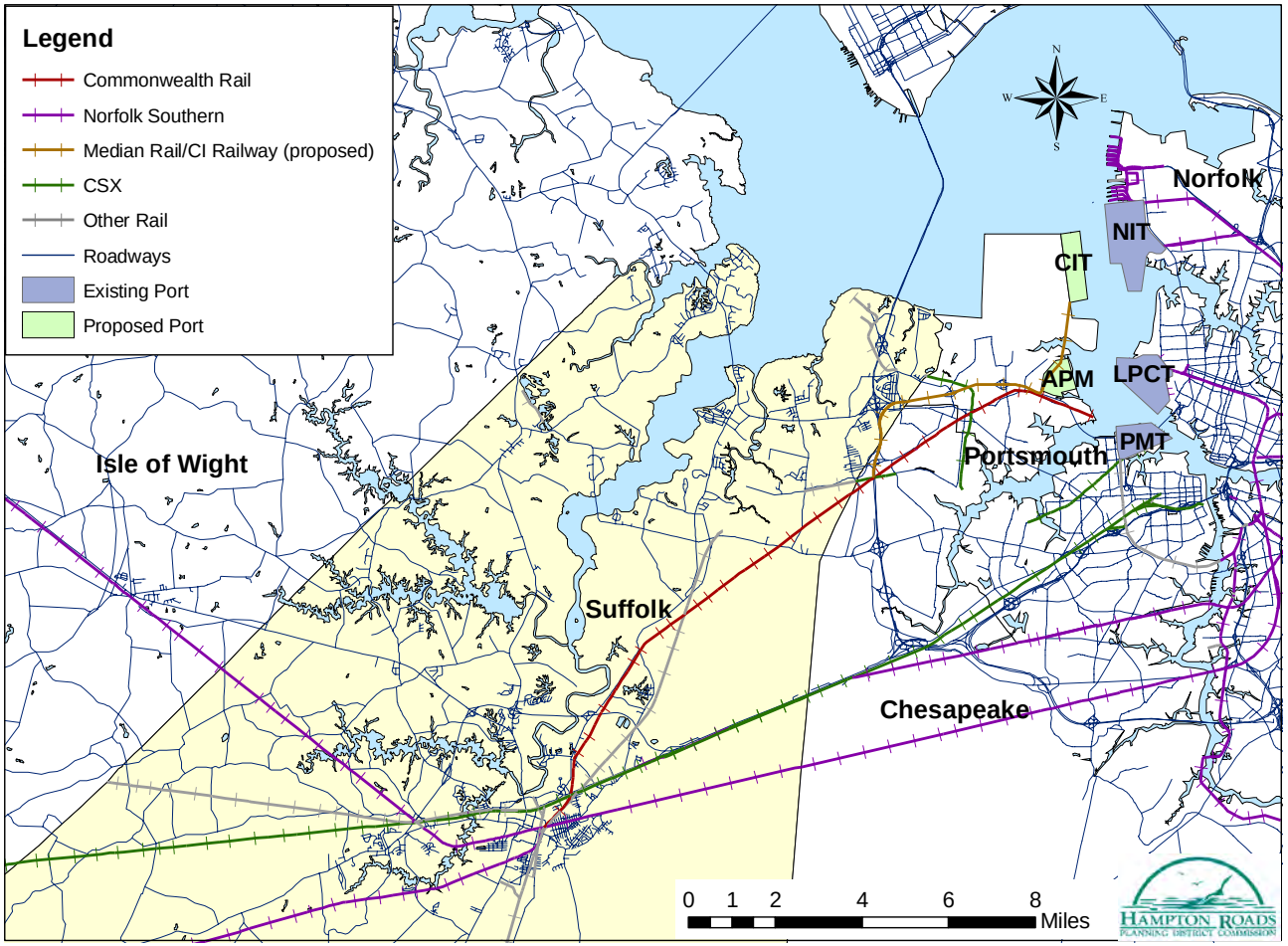
Commonwealth Railway, CSX, and Norfolk Southern lines. The additional traffic from the new port facilities will enter Suffolk on Commonwealth Railway from Chesapeake near the I-664/Pughsville Road interchange. This location will not change with the completion of the Median Rail project, as it will tie into the existing alignment just east of the Suffolk city line.

The rail traffic from the APM Terminal and Craney Island Terminal entering Suffolk on Commonwealth Railway will switch to either CSX or Norfolk Southern mainline tracks just east of downtown. From there, trains will travel west through the city and further on to their ultimate destinations. Only those crossings that will experience increased rail traffic from the new port facilities have been examined in this study. These include every Commonwealth Railway crossing and those crossings of CSX and Norfolk Southern west of their connections to Commonwealth Railway. Norfolk Southern and CSX each have connections to other existing port facilities to the east that are anticipated to generate relatively stable volumes of rail traffic.

Commonwealth Railway enters Suffolk from the east in a primarily agricultural, sparsely developed area that will likely experience significant growth in the future as the rapid development in the northern part of the city spreads south. There are already several residential neighborhoods and industry sites near this rail line.

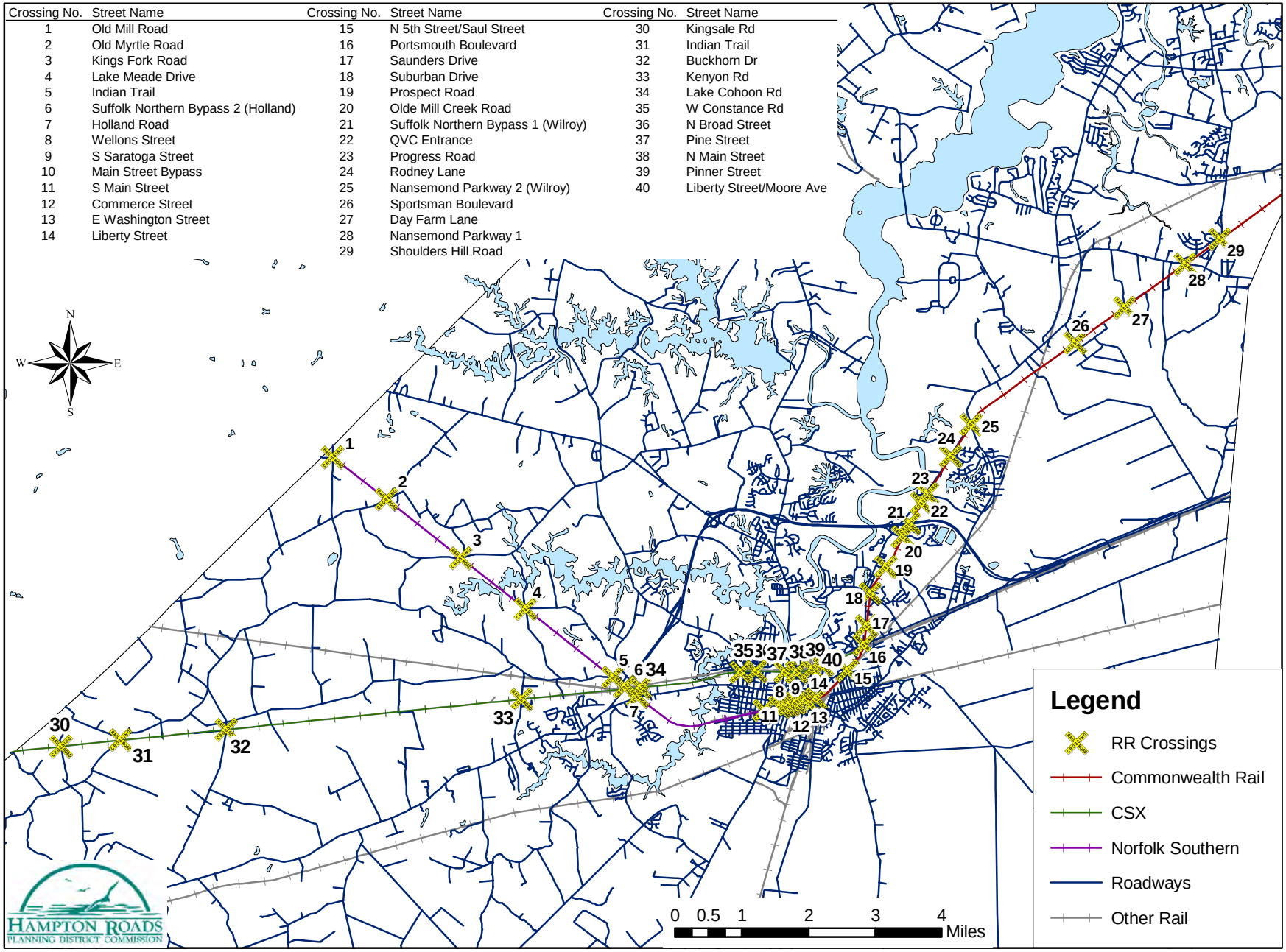
The trains will switch to CSX and Norfolk Southern lines just east of downtown. Both lines travel through the densely settled downtown area, crossing through residential, business, and mixed-use areas. Beyond downtown, the trains will travel through the rural western section of the city before crossing into Isle of Wight County.

Map 1: Existing and Proposed Southside Port Connections

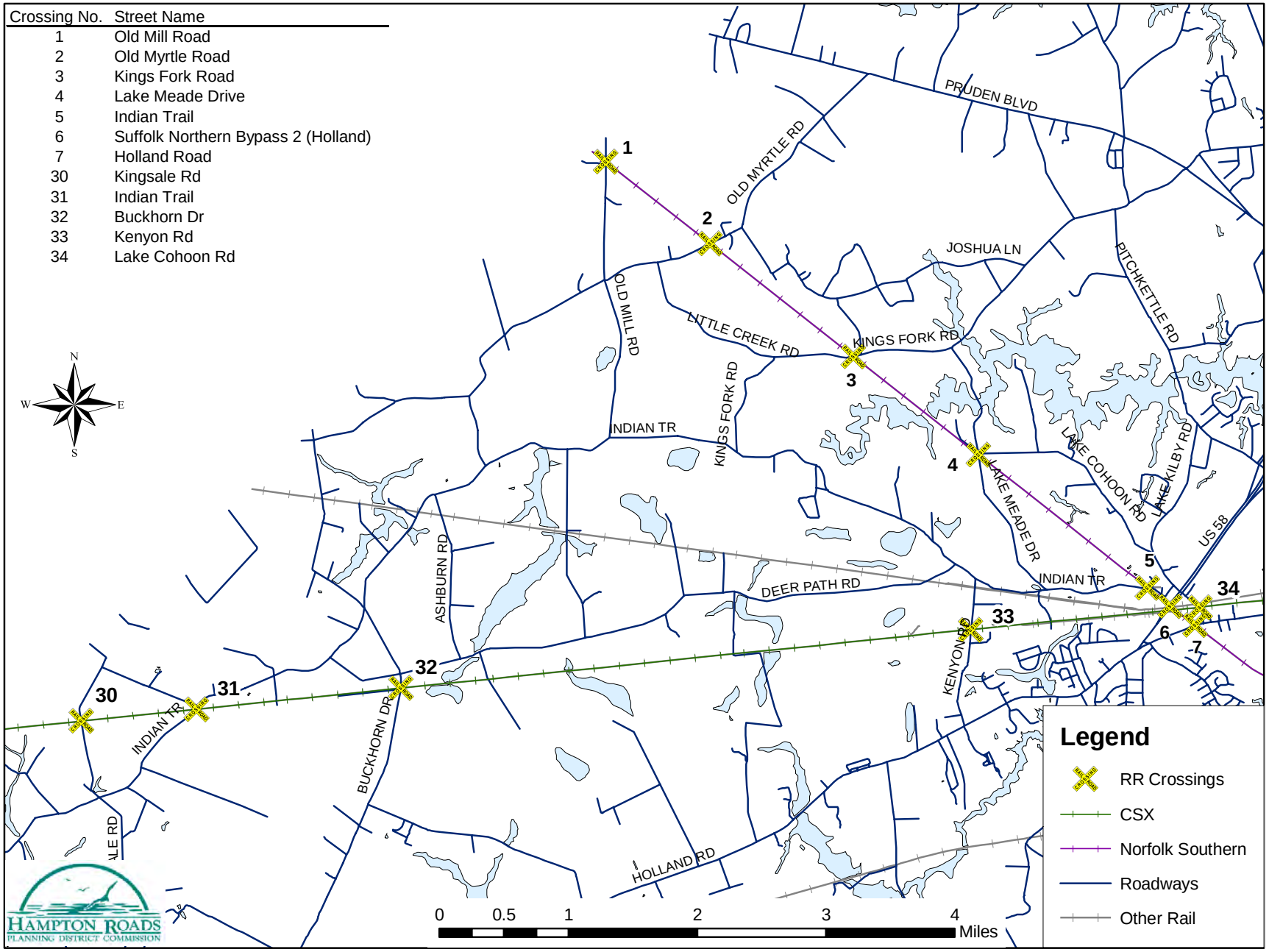


Map 2: Study-Wide Highway-Rail Crossings

Crossing No.	Street Name	Crossing No.	Street Name	Crossing No.	Street Name
1	Old Mill Road	15	N 5th Street/Saul Street	30	Kingsale Rd
2	Old Myrtle Road	16	Portsmouth Boulevard	31	Indian Trail
3	Kings Fork Road	17	Saunders Drive	32	Buckhorn Dr
4	Lake Meade Drive	18	Suburban Drive	33	Kenyon Rd
5	Indian Trail	19	Prospect Road	34	Lake Cohoon Rd
6	Suffolk Northern Bypass 2 (Holland)	20	Olde Mill Creek Road	35	W Constance Rd
7	Holland Road	21	Suffolk Northern Bypass 1 (Wilroy)	36	N Broad Street
8	Wellons Street	22	QVC Entrance	37	Pine Street
9	S Saratoga Street	23	Progress Road	38	N Main Street
10	Main Street Bypass	24	Rodney Lane	39	Pinner Street
11	S Main Street	25	Nansemond Parkway 2 (Wilroy)	40	Liberty Street/Moore Ave
12	Commerce Street	26	Sportsman Boulevard		
13	E Washington Street	27	Day Farm Lane		
14	Liberty Street	28	Nansemond Parkway 1		
		29	Shoulders Hill Road		

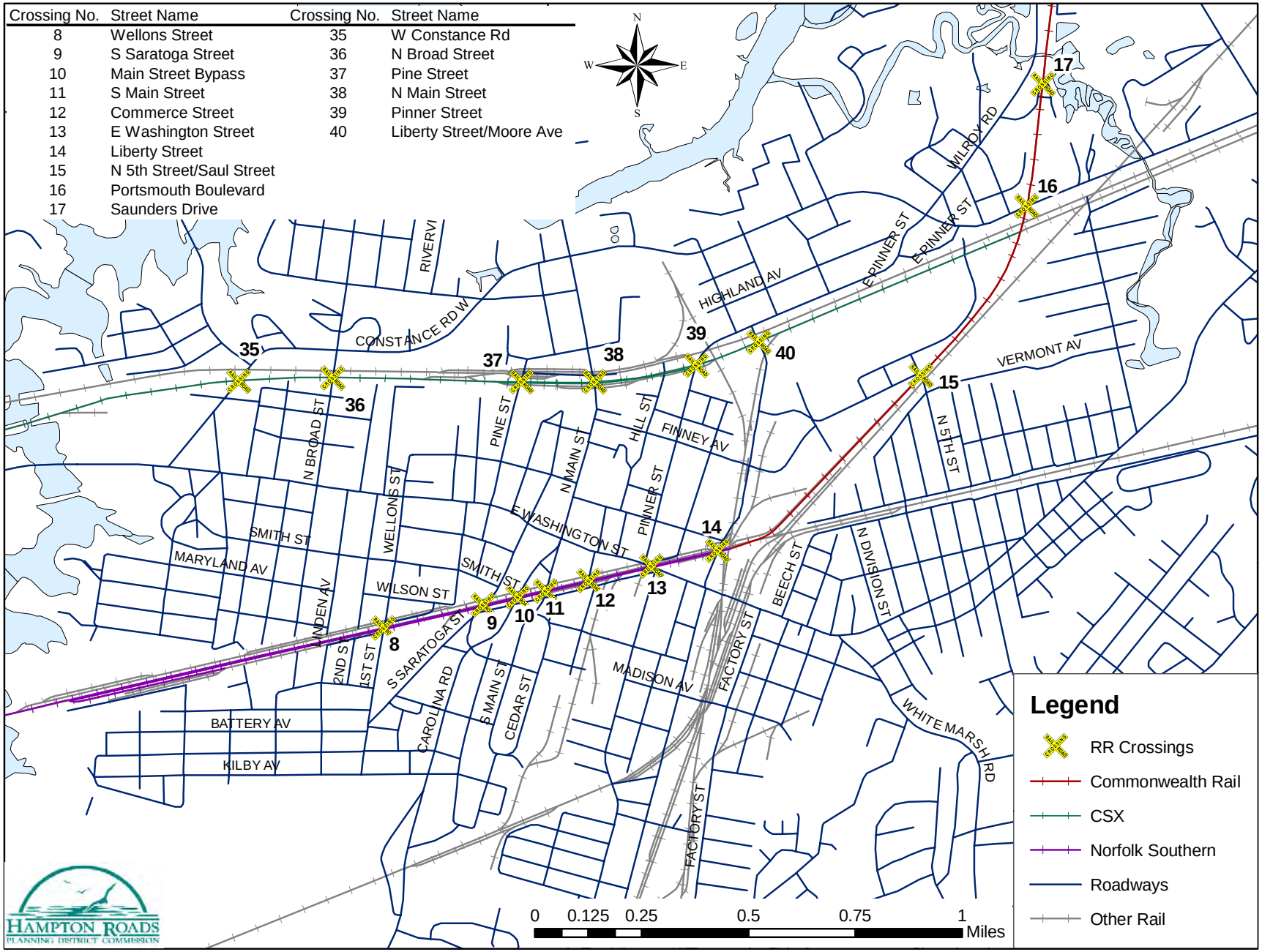


Map 3: Western Highway-Rail Crossings

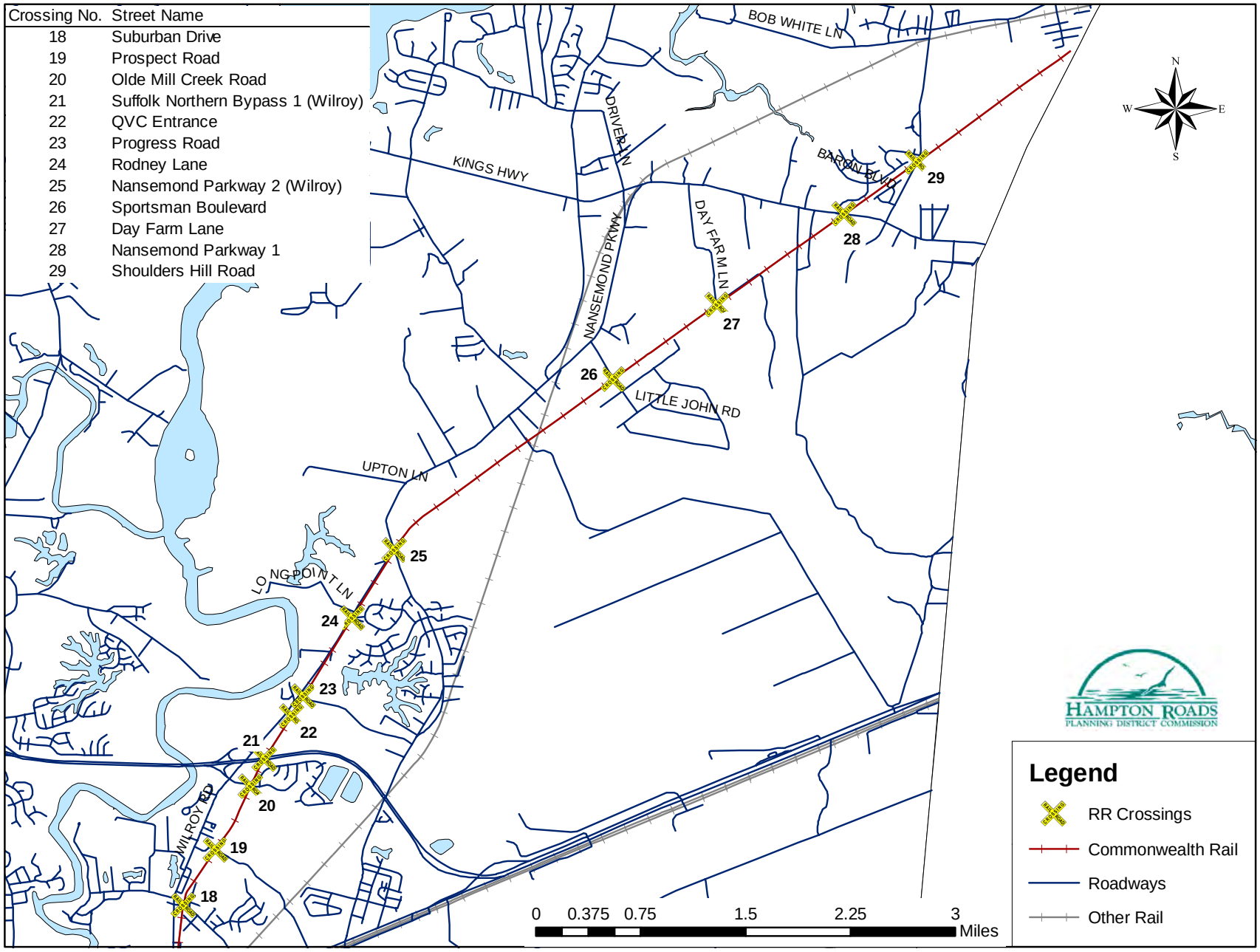


Map 4: Downtown Highway-Rail Crossings

Crossing No.	Street Name	Crossing No.	Street Name
8	Wellons Street	35	W Constance Rd
9	S Saratoga Street	36	N Broad Street
10	Main Street Bypass	37	Pine Street
11	S Main Street	38	N Main Street
12	Commerce Street	39	Pinner Street
13	E Washington Street	40	Liberty Street/Moore Ave
14	Liberty Street		
15	N 5th Street/Saul Street		
16	Portsmouth Boulevard		
17	Saunders Drive		



Map 5: Eastern Highway-Rail Crossings



BACKGROUND

COMMONWEALTH RAILWAY

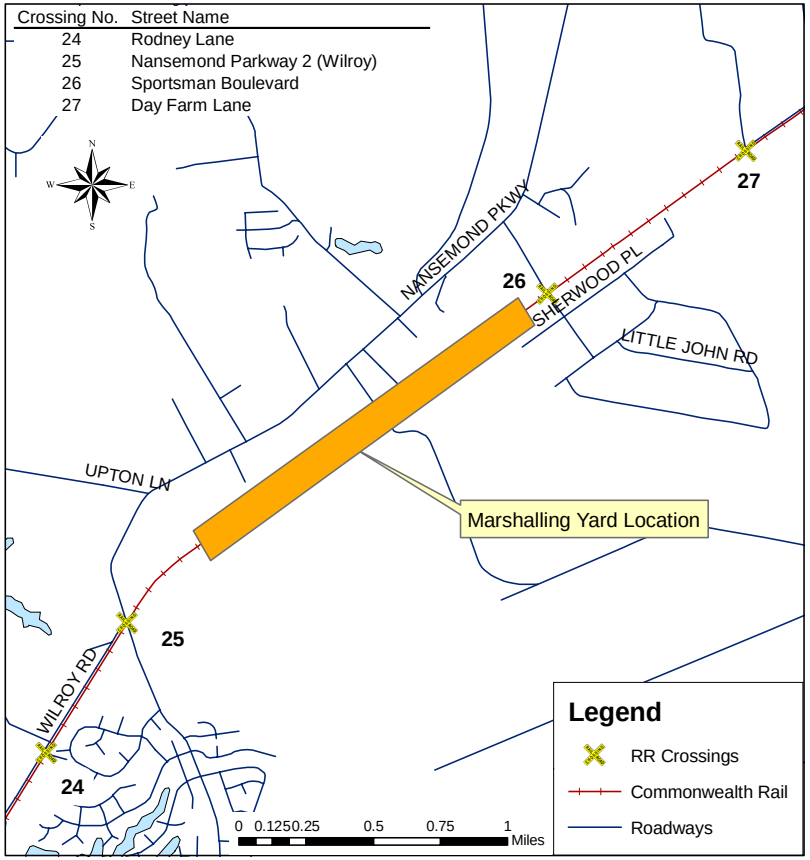
Currently Commonwealth Railway operates approximately one to two 300-foot long trains per day. These trains primarily serve the BASF plant on the Elizabeth River in Portsmouth, which will be closing in 2008. This will leave negligible baseline traffic on Commonwealth's tracks for the study years of 2010 and 2017[1].

Commonwealth Railway at Shoulders Hill Road

© William Grimes, courtesy of rrpicturearchives.net

Commonwealth Railway's tracks are currently rated for train speeds up to 10 mph only. The tracks are currently being upgraded in anticipation of the increased traffic due to the new port facilities. Following these upgrades, trains will be able to safely travel at 20 mph[2]. In addition, a marshalling yard has been constructed along Commonwealth Railway parallel to Nansemond Parkway north of Wilroy Road. This marshalling yard will be used to assemble short trains (3,500 feet long) coming from the APM facility into longer trains (up to 7,500 feet long) for long distance travel westward. The shorter trains will be used to reduce the delay caused by a single train crossing at at-grade highway rail crossings in Portsmouth, Chesapeake, and eastern Suffolk. Because the location of the marshalling yard will be east of downtown Suffolk, most of the at-grade crossings in Suffolk will not benefit from the shorter trains. The marshalling yard will be used to assemble longer trains until the completion of the Commonwealth Railway Mainline Safety Relocation Project (Median Rail Project) by the end of 2009, at which time the longer trains will be assembled at the APM port facility when its internal rail yard has been completed. The Median Rail Project will relocate

Map 6: Marshalling Yard Location



[1] Gregory Richards, "Big changes ahead on Commonwealth Railway's short line," *The Virginian-Pilot*, September 10, 2006

[2] William Jasper (Commonwealth Railway), personal communication, September 11, 2006

Commonwealth Railway's tracks to the medians of the Western Freeway (VA Route 164) and Interstate 664, removing the at-grade conflicts in Portsmouth and Chesapeake. The relocated tracks will connect to the existing alignment just east of the Chesapeake-Suffolk city line.

Using Rail Enhancement Funds, Commonwealth Railway has purchased 12 miles of track it previously leased from Norfolk Southern and will construct a switch connection to the CSX tracks that cross near downtown Suffolk[3]. This connection will make it possible for CSX to carry some of the freight from new port facilities.

NORFOLK SOUTHERN

Norfolk Southern's tracks in Suffolk carry significant existing rail traffic. The existing traffic level consists of twenty (20) daily trains with an average length of 7500 feet. These trains travel at speeds between 20 and 40 mph. Norfolk Southern anticipates adding another two trains per day in 2007 to and from Chesapeake that have been included in this study's base traffic assumptions[4].

Norfolk Southern in Suffolk

© William Grimes, courtesy of rrpicturearchives.net

Norfolk Southern is in the process of upgrading its Heartland Corridor between Portsmouth and the Midwest to allow the passage of trains double-stacked with shipping containers. The project will reduce the trip double-stacked trains travel between Hampton Roads and Chicago by more than 250 miles, or one day, over the existing route[5].

CSX

The Federal Railroad Administration indicates that five (5) trains per day pass through Suffolk on CSX tracks. The trains on CSX tracks travel at the same speed, but are shorter than Norfolk Southern trains, with an average length of 5000 feet[6].

CSX in Suffolk

© William Grimes, courtesy of rrpicturearchives.net

[3] Gregory Richards, "Big changes ahead"

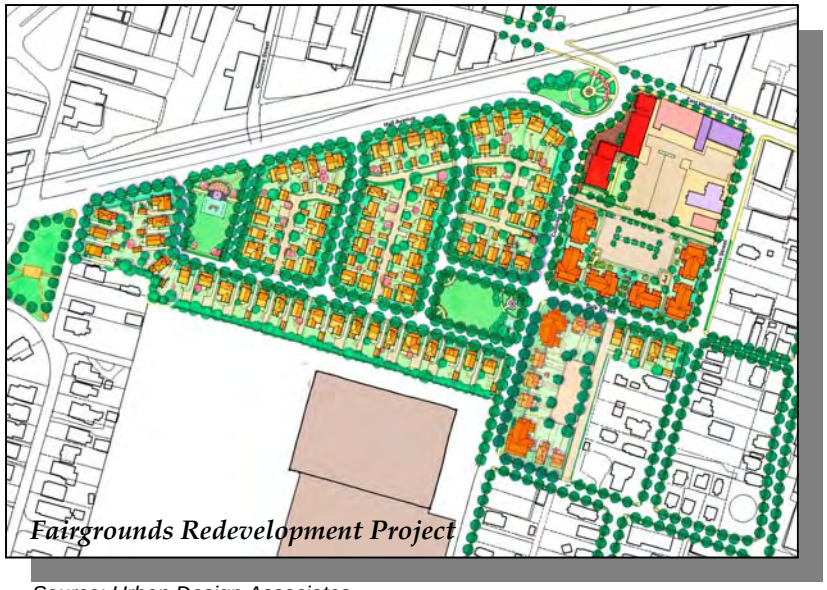
[4] Robert Siik (Norfolk Southern Corporation), email message, October 30, 2006

[5] Gregory Richards, "Rail project to cut miles to Midwest due by 2009," *The Virginian-Pilot*, February 16, 2006

It is expected that the traffic on CSX's tracks will be relatively stable in the next ten years. CSX anticipates growth in demand at a rate of 5.0% per year during the study period[7]. This anticipated growth is in addition to any increase in demand due to the new port facilities.

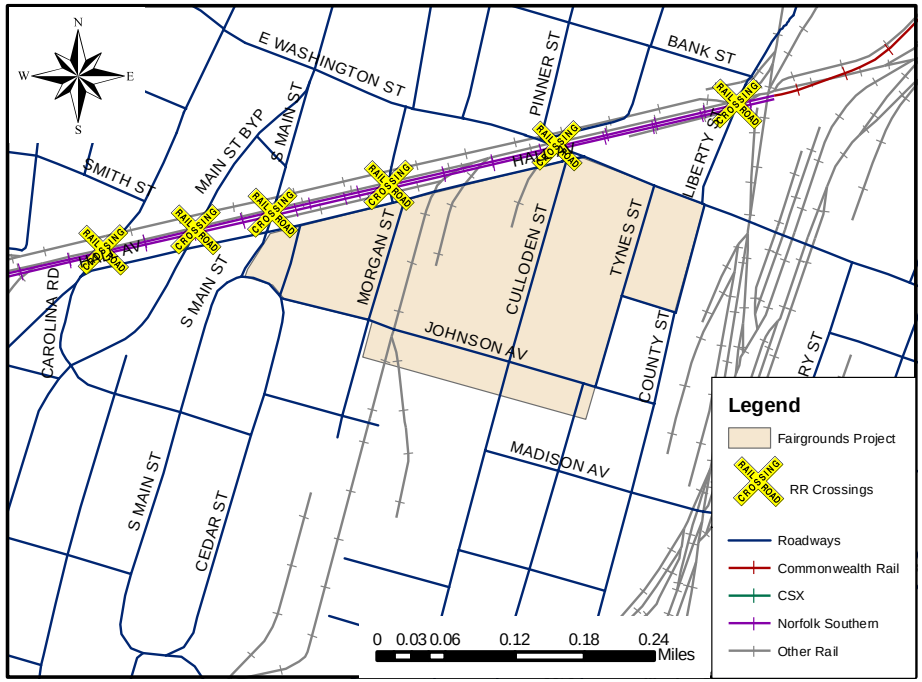
FAIRGROUNDS REDEVELOPMENT PROJECT

The City of Suffolk is completing the Fairgrounds Redevelopment Project, a significant revitalization project in downtown. The Fairgrounds project is bounded on the north by Hall Avenue and E Washington Street, to the east and west by County Street and S Main Street, and on the south by the Planters Peanuts Factory. This project will bring 170 new residential units along with additional commercial uses to an existing industrial and commercial area. The City commissioned a traffic study for this project and its results were incorporated into the traffic projections for the affected rail crossings.



Source: Urban Design Associates

Map 7: Fairgrounds Redevelopment Project Location



[6] Jay Westbrook (CSX Corporation), personal communication, December 5, 2006

[7] Jay Westbrook, pers. comm., December 5, 2006

Table 1: Rail Crossing Inventory										
ID No.	Street Name	RR	Xing Type *	Lanes	Tracks	Area	Pvmt Markings	Signs	Lights	Gates
Norfolk Southern (Isle of Wight CL to Commonwealth Rail)										
1	Old Mill Road	NS	AG	2	2	Rur	X	X	X	X
2	Old Myrtle Road	NS	AG	2	2	Rur		X	X	X
3	Kings Fork Road	NS	AG	2	2	Rur	X	X	X	X
4	Lake Meade Drive	NS	AG	2	2	Rur	X	X	X	X
5	Indian Trail	NS	GS							
6	Suffolk Northern Bypass 2 (Holland)	NS	GS							
7	Holland Road	NS	GS							
8	Wellons Street	NS	AG	2	5	MU	X	X	X	X
9	S Saratoga Street	NS	AG	2	3	Ind	X	X	X	X
10	Main Street Bypass	NS	GS							
11	S Main Street	NS	AG	2	2	MU	X	X	X	X
12	Commerce Street	NS	AG	2	3	MU	X	X	X	X
13	E Washington Street	NS	AG	2	2	MU	X	X	X	X
14	Liberty Street	NS	AG	2	3	MU	X	X	X	X
Commonwealth Rail (Norfolk Southern to Chesapeake CL)										
15	N 5th Street/Saul Street	CWRY	AG	2	2	Res	X	X	X	X
16	Portsmouth Boulevard	CWRY	GS							
17	Saunders Drive	CWRY	AG	2	1	Res				
18	Suburban Drive	CWRY	AG	2	1	MU	X	X	X	X
19	Prospect Road	CWRY	AG	2	1					
20	Olde Mill Creek Road	CWRY	AG	2	1	Res		X	X	X
21	Suffolk Northern Bypass 1 (Wilroy)	CWRY	GS							
22	QVC Entrance	CWRY	AG	2	1	Ind			X	X
23	Progress Road	CWRY	AG	3	1	Res		X	X	X
24	Rodney Lane	CWRY	AG	2	1	Res				
25	Nansemond Parkway 2 (Wilroy)	CWRY	AG	2	1	Rur	X	X	X	X
26	Sportsman Boulevard	CWRY	AG	2	1	Res		X		
27	Day Farm Lane	CWRY	AG	2	1	Rur				
28	Nansemond Parkway 1	CWRY	AG	2	1	Res	X	X	X	X
29	Shoulders Hill Road	CWRY	AG	2	1	Res	X	X	X	X
CSX (Isle of Wight CL to Commonwealth Rail)										
30	Kingsale Rd	CSX	AG	2	1	Rur	X	X	X	
31	Indian Trail	CSX	AG	2	1	Rur	X	X	X	X
32	Buckhorn Dr	CSX	AG	2	1	Res	X	X	X	X
33	Kenyon Rd	CSX	AG	2	1	Rur	X	X	X	X
34	Lake Cohoon Rd	CSX	GS							
35	W Constance Rd	CSX	AG	2	1	Res	X	X	X	X
36	N Broad Street	CSX	GS							
37	Pine Street	CSX	AG	2	2	Res	X	X	X	
38	N Main Street	CSX	AG	4	2	MU	X	X	X	X
39	Pinner Street	CSX	GS							
40	Liberty Street	CSX	AG	2	1	Ind	X	X	X	
Prepared by: Hampton Roads Planning District Commission										

CROSSING INVENTORY

Each of the forty crossings in the study were visited and inventoried for crossing type, the number of roadway travel lanes, number of railroad tracks, neighborhood type, and crossing protection equipment. Of the forty crossings within the study area, thirty-one are at-grade crossings and nine are grade-separated crossings. Because the grade-separated crossings have no potential for conflict, they have not been examined in depth in this study. The majority of at-grade crossings in this study occur on two lane roads and provide automatic gates, flashing lights, signs, and pavement markings to alert drivers and prevent collisions. These crossings are located in widely varying neighborhoods including rural areas, residential neighborhoods, industrial areas, and mixed-use districts.

*ABBREVIATIONS

AG – At-Grade
GS – Grade-Separated
Rur – Rural
Res – Residential
Ind – Industrial
MU – Mixed Use

DATA COLLECTION

Historical Average Weekday Traffic Volumes were collected from the Virginia Department of Transportation's (VDOT's) Traffic Monitoring System database. Several count year volumes were considered because arterials and collector streets are counted every three years, but local roads are counted on a less frequent cycle. In a few cases, VDOT's database did not contain traffic counts for minor local roads. The traffic volumes for those streets were obtained from Federal Railroad Administration (FRA) data.

Existing train traffic characteristics were collected from each of the railroads potentially affected by the proposed port-generated rail traffic: Commonwealth Railway, Norfolk Southern, and CSX. The data included the number of trains per day as well as length and speed. In addition, any expected changes in this traffic not associated with the new port facilities was also collected.

The Virginia Port Authority (VPA) provided, through its consultant, the train traffic volumes anticipated to be generated by the APM Terminals and Craney Island port facilities. The data provided assumed that the APM Terminals facility will open in 2007 at 1.0 million Twenty-foot Equivalent Units (TEUs), open a second phase in 2010 with 1.3 million TEUs, and reach its full capacity of 2.1 million TEU in 2017. VPA also provided projections for Craney Island; the 2017 opening year capacity will be 0.8 million TEUs with full capacity being reached in 2032 with 2.5 million TEUs[8]. VPA has also supplied data suggesting a future expansion of Craney Island to 5.0 million TEUs at an unspecified time in the future beyond 2032[9]. The volumes of containers were converted to train traffic by making the following assumptions suggested by VPA: the intermodal split between trucks and trains is assumed to be

Table 2: Historical Average Weekday Traffic Volumes

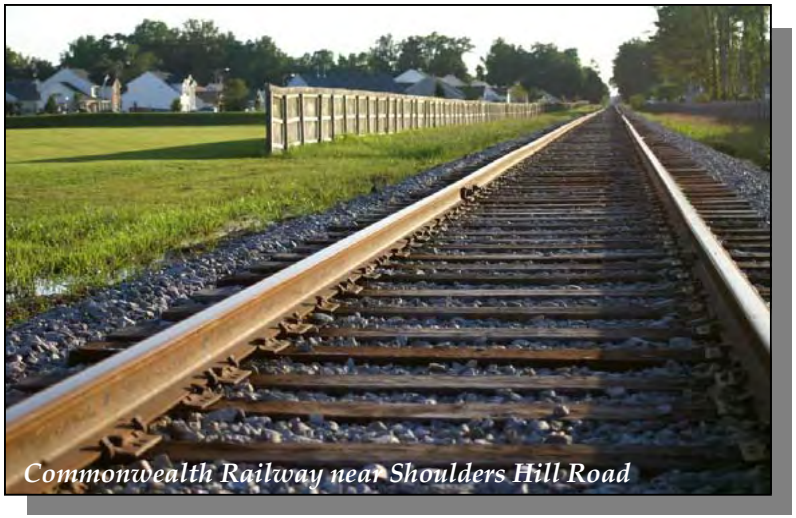
ID No.	Street Name	Average Weekday Volumes 1993-1994	1999	2002	2005
Norfolk Southern					
1	Old Mill Road	161	256	271	
2	Old Myrtle Road	417	452	461	
3	Kings Fork Road	506	487	569	461
4	Lake Meade Drive	222		403	
8	Wellons Street		1,954	2,284	2,028
9	S Saratoga Street	4,289	3,894	4,466	4,401
11	S Main Street*			3,165	
12	Commerce Street*			1,500	
13	E Washington Street	12,909	19,685	13,981	8,988
14	Liberty Street	7,232	6,057	5,663	2,935
Commonwealth Rail					
15	N 5th Street/Saul Street			2,547	
17	Saunders Drive***				
18	Suburban Drive	2,520		2,720	
19	Prospect Road			94	
20	Olde Mill Creek Road				368
22	QVC Entrance**				
23	Progress Road	2,395		3,760	
24	Rodney Lane*			0	
25	Nansemond Parkway 2 (Wilroy)			4,461	4,936
26	Sportsman Boulevard		75	68	
27	Day Farm Lane**				
28	Nansemond Parkway 1	10,664	10,819	11,171	13,119
29	Shoulders Hill Road	3,072	3,489	4,727	6,787
CSX					
30	Kingsale Rd	476	602	581	
31	Indian Trail	195	203	221	
32	Buckhorn Dr		329	457	453
33	Kenyon Rd	2,075		893	
35	W Constance Rd	10,685	9,779	9,964	9,673
37	Pine Street*			1,656	
38	N Main Street	17,002	20,943	21,500	21,154
40	Liberty Street/Moore Ave	7,232	6,057	5,663	2,935

Source: VDOT, FRA where noted with *, Private Crossing no data available where noted with **

[8] Michael Crist (Moffatt & Nichol), email message, September 20, 2006
[9] Michael Crist (Moffatt & Nichol), email message, December 1, 2006

70%/30%[10]and each train will be approximately 7500 feet long and double-stacked with containers.

Various analyses have been conducted for years 2007, 2010, and 2017, however, due to a limited ability to accurately project distant vehicular traffic volumes, it is not prudent to provide analysis for horizon years more than twenty-five years in the future. Therefore, complete analyses based on the train traffic generated by Craney Island capacities of 2.5 million in 2032 and 5.0 million TEUs at an undetermined date were not completed. It is recognized that these future volumes of containerized freight may produce more significant impacts and, for that reason, a limited analysis of the train traffic generated at full capacity and future expansion using the 2017 vehicular traffic volumes was completed. This analysis will not show the full effects of the full capacity and future expansion of the Craney Island Terminal as it is likely that vehicular traffic will also have increased significantly in the time between 2017 and those milestones.



Commonwealth Railway near Shoulders Hill Road

Commonwealth Railway near Norfolk Southern switch

© William Grimes, courtesy of rrpicturearchives.net

Highway-rail crossing accident inventory data was collected from the FRA Office of Safety Analysis website[11] for the period from 1996 through 2006. These accident reports listed any injuries or fatalities, the cause of the accident, and other data.

Several City departments provided data and input that contributed to the analysis of the highway-rail crossings in this study. The Department of Public Works provided guidance and information about both existing roadways and proposed infrastructure projects. The GIS Department provided mapping of emergency services dispatch locations and districts. The Department of Economic Development supplied information on existing and planned development affecting the economic strength of the city. The Office of the Assistant City Manager provided information regarding the Fairgrounds project including projected traffic volumes.

[10] Michael Crist (Moffatt & Nichol), email message, September 20, 2006

[11] "Highway-Rail Crossing Inventory & Accidents Page" Federal Railroad Administration Office of Safety Analysis. <http://safetydata.fra.dot.gov/OfficeofSafety/NewCrossing/>

Table 3: Projected Average Weekday Traffic Volumes				
ID No.	Street Name	Projected Weekday Volumes 2007	2010	2017
Norfolk Southern				
1	Old Mill Road	290	300	300
2	Old Myrtle Road	490	500	550
3	Kings Fork Road	500	550	600
4	Lake Meade Drive	425	450	500
8	Wellons Street	2,100	2,150	2,300
9	S Saratoga Street **	4,450	4,700	5,400
11	S Main Street*	3,200	3,400	3,600
12	Commerce Street*	1,550	1,550	1,600
13	E Washington Street	14,250	15,100	16,100
14	Liberty Street	5,700	5,700	5,700
Commonwealth Rail				
15	N 5th Street/Saul Street	2,600	2,750	2,900
17	Saunders Drive***			
18	Suburban Drive	2,800	2,950	3,100
19	Prospect Road	100	100	100
20	Olde Mill Creek Road	380	400	400
22	QVC Entrance**	100	125	150
23	Progress Road	3,800	4,100	4,300
24	Rodney Lane*	0	0	0
25	Nansemond Parkway 2 (Wilroy)	5,000	5,200	5,500
26	Sportsman Boulevard	75	75	80
27	Day Farm Lane***			
28	Nansemond Parkway 1	13,900	14,900	17,400
29	Shoulders Hill Road	7,000	7,400	8,300
CSX				
30	Kingsale Rd	600	650	700
31	Indian Trail	230	250	300
32	Buckhorn Dr	470	475	500
33	Kenyon Rd	950	1,000	1,100
35	W Constance Rd	9,710	9,800	9,900
37	Pine Street*	1,700	1,700	1,700
38	N Main Street	21,705	22,550	24,500
40	Liberty Street/Moore Ave	5,700	5,700	5,700

Source: VDOT, FRA where noted with *, City of Suffolk where noted with **, Private Crossing no data available where noted with ***

ANALYSIS

ROADWAY TRAFFIC PROJECTIONS

Future daily traffic volumes for 2007, 2010, and 2017 were projected based on the historic average daily traffic volumes. For regionally significant routes, the HRPDC 2026 Long Range Plan[12] was to obtain traffic growth rates. Where long-range plan data was unavailable, VDOT's 2025 projections were used. For local roads where neither published growth rate was available, an average annual growth rate of 1.0% was assumed. The traffic projections for S Saratoga Street and QVC were provided by the City of Suffolk.

TRAIN TRAFFIC PROJECTIONS

Each of the three railroads having crossings analyzed in this study provided train traffic data. This data consists of the existing train traffic and the changes anticipated for 2010 and 2017 that are unrelated to the new APM Terminals and Craney Island ports. Norfolk Southern anticipates stable train traffic from 2007 through 2017. Commonwealth Railway will lose its two existing trains per day by 2010 due to the closing of the BASF plant in Portsmouth. CSX expects growth of 5% per year over the existing traffic it experiences today throughout the study period. The impacts of these trains were calculated separately from the trains related to the new port facilities and are listed under the heading "Baseline". Tables containing complete calculations can be found in the appendix, included as a separate document.

Train traffic estimates for trains originating or terminating at the new APM and Craney Island ports were provided by VPA. In the detailed tables in the appendices, the effects of these trains are calculated under the heading "APM and Craney Island Generated".

[12] Hampton Roads Planning District Commission, Hampton Roads 2026 Regional Transportation Plan, June, 2004

PERFORMANCE MEASURES

Several parameters were established to compare the effects of rail traffic on the mobility and safety of vehicular traffic at railroad crossings within the study corridors. Each crossing was analyzed for each of the performance measures for the three years of consideration, 2007, 2010, and 2017, with the exception of Economic Development Priorities, Accident History, and Emergency Services Access. The Economic Development Priorities performance measure accounts for economic issues that are not easily quantified. Accident History by nature cannot be easily projected to the future, so accident records were inventoried for the ten-year period between 1996 and 2006. Emergency Services Access is a more subjective measure, where the locations of important infrastructure and alternative routes were compared and specific areas for concern were identified.

Table 4: Performance Measures

Measure	Impact Area	Function of
Exposure Index	Mobility	Daily number of trains and daily roadway traffic
Daily Minutes Crossing Blocked	Mobility	Daily number of trains, length of trains, and speed of trains
Daily Hours of Vehicle Delay	Mobility	Daily minutes crossing blocked and daily roadway traffic
Economic Development Priorities	Mobility	Economic Development Priorities
Accident History	Safety	Historical vehicle/train accident records
Hazard Index	Safety	Exposure Index and protection factor
Emergency Services Access	Safety	Emergency services locations, minutes crossing blocked, alternative access routes

The performance measures were split into the two impact areas of mobility and safety for separate analysis. Mobility and safety are both very important issues which warrant consideration independent of one another. The analyses of these impact areas will generate different results and require different types of solutions.

Nansemond Parkway at Wilroy Road

Portsmouth Boulevard

EXPOSURE INDEX

Exposure Index is a comparative measure commonly used to quantify the interaction between railroad and roadway traffic. It is not a refined measure, but the Exposure Index can be used to rank intersections with high levels of conflicting traffic and higher potential for adverse impacts related to those conflicts.

Exposure Index (EI)=(V)(T)

Where:
V – Average daily traffic on roadway
T – Daily number of trains

The Exposure Index formula multiplies the roadway vehicular traffic by the train traffic on the railroad tracks for each crossing. The Total Exposure Index for each study year was determined by calculating a baseline Exposure Index and an APM and Craney Island generated Exposure Index and summing them. The APM and Craney Island generated Exposure Index includes only those trains originating at or destined for the new port facilities and the baseline Exposure Index includes all other train traffic. At right are the Total Exposure Index values for each study crossing in each study year and, for comparison, the Exposure Index for existing conditions.

The Exposure Index values for Norfolk Southern track crossings are generally much higher than those of CSX and Commonwealth Railway because Norfolk Southern has a much higher level of baseline train traffic. As discussed in the Existing Conditions section of this report, Norfolk Southern has a total of twenty-two trains per day of base traffic compared to five for CSX and two for Commonwealth Railway. The APM and Craney Island generated train traffic will originate to the east and travel on Commonwealth Railway before switching off to either Norfolk Southern or CSX, with the majority switching to Norfolk Southern. As a result, crossings of Commonwealth Railway have the largest increases in Exposure Index, but not large enough to overcome the more significant baseline traffic of Norfolk Southern.

Table 5: Exposure Index

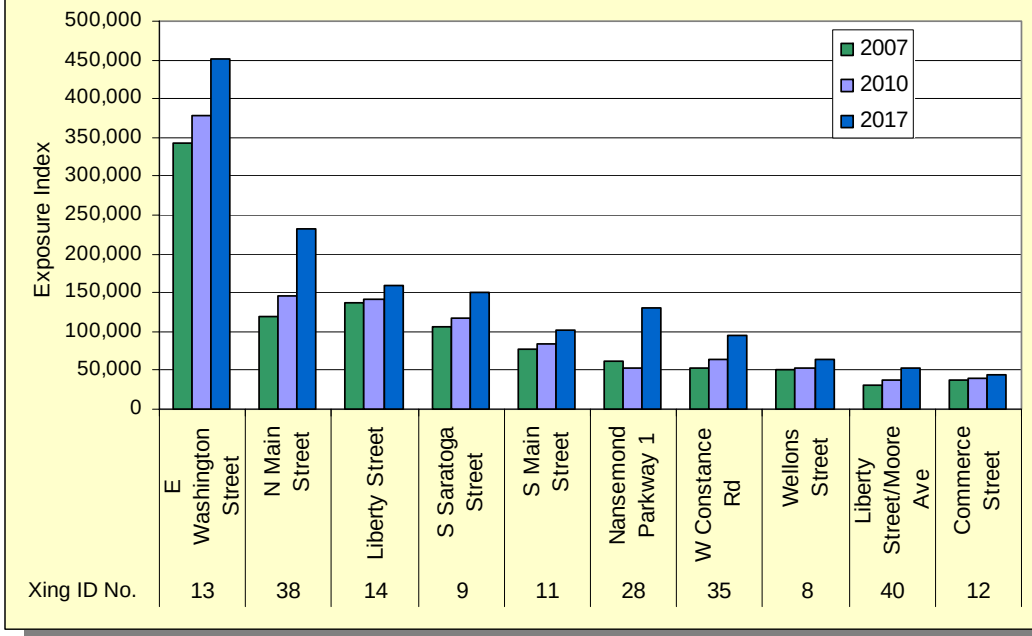
ID No.	Crossing	EI Exist	EI 2007	EI 2010	EI 2017
Norfolk Southern					
1	Old Mill Road	6,380	6,960	7,500	8,400
2	Old Myrtle Road	10,780	11,760	12,500	15,400
3	Kings Fork Road	11,000	12,000	13,750	16,800
4	Lake Meade Drive	9,350	10,200	11,250	14,000
8	Wellons Street	46,200	50,400	53,750	64,400
9	S Saratoga Street	97,900	106,800	117,500	151,200
11	S Main Street	70,400	76,800	85,000	100,800
12	Commerce Street	34,100	37,200	38,750	44,800
13	E Washington Street	313,500	342,000	377,500	450,800
14	Liberty Street	125,400	136,800	142,500	159,600
Commonwealth Rail					
15	N 5th Street/Saul Street	5,200	11,700	9,625	21,750
17	Saunders Drive	0	0	0	0
18	Suburban Drive	5,600	12,600	10,325	23,250
19	Prospect Road	200	450	350	750
20	Olde Mill Creek Road	760	1,710	1,400	3,000
22	QVC Entrance	200	450	438	1,125
23	Progress Road	7,600	17,100	14,350	32,250
24	Rodney Lane	0	0	0	0
25	Nansemond Parkway 2 (Wilroy)	10,000	22,500	18,200	41,250
26	Sportsman Boulevard	150	338	263	600
27	Day Farm Lane	0	0	0	0
28	Nansemond Parkway 1	27,800	62,550	52,150	130,500
29	Shoulders Hill Road	14,000	31,500	25,900	62,250
CSX					
30	Kingsale Rd	3,000	3,300	4,225	6,650
31	Indian Trail	1,150	1,265	1,625	2,850
32	Buckhorn Dr	2,350	2,585	3,088	4,750
33	Kenyon Rd	4,750	5,225	6,500	10,450
35	W Constance Rd	48,550	53,405	63,700	94,050
37	Pine Street	8,500	9,350	11,050	16,150
38	N Main Street	108,525	119,378	146,575	232,750
40	Liberty Street/Moore Ave	28,500	31,350	37,050	54,150

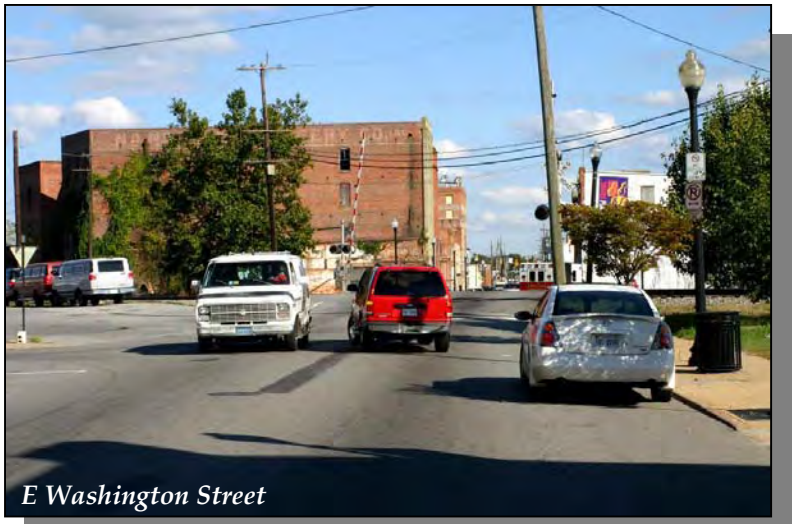
Crossings 5, 6, 7, 10, 16, 21, 34, 36, 39 are grade-separated and have been excluded from analysis

Prepared by: Hampton Roads Planning District Commission

The crossings were ranked based on this measure and the ten (10) highest crossings for the three study years are shown below.
E. Washington Street has the highest Exposure Index in each study year meaning that it has the largest potential for conflict for the duration of the study period. While this does not indicate the need for improvements specifically, it should be considered in conjunction with other performance measures.

Figure 1: Exposure Index - Top Ten Crossings




E Washington Street


N Main Street

DAILY MINUTES CROSSING BLOCKED

The amount of time that a roadway-rail crossing is blocked on an average day is a measure of the mobility of roadway users. It is indicative of the likelihood that a given roadway user will be stopped for a train. This measure is calculated based on the properties of the railroad traffic including the number of trains, their speeds and lengths, and warning time plus time for the train to clear the intersection.

Daily Minutes Blocked (B) = T (W+(L/S))

Where:
T – Daily Number of Trains
W – Warning/Clearance Time Per Train (see below)
L – Average Length of Trains (ft)
S – Speed of Trains (ft/min)

Warning/Clearance Time[13] (W) = X+C+R

Where:
X –advanced warning time & time to lower gates – 30s
C – time to clear intersection – (width of road + 50ft)/S
R – time to raise gates – 8s

Train speeds were assumed to be 30 mph in rural areas and 20 mph in developed areas. Until the completion of the Median Rail project in 2010, trains will only be able to travel at 10 mph on Commonwealth Railway. It was assumed that all APM generated trains in the downtown area would travel at 10 mph in 2007 because they will be

Table 6: Minutes Crossing Blocked Per Train

ID No.	Crossing	B Exist (min)	B 2007 (min)	B 2010 (min)	B 2017 (min)
Norfolk Southern					
1	Old Mill Road	3.5	3.5	3.5	3.5
2	Old Myrtle Road	3.5	3.5	3.5	3.5
3	Kings Fork Road	3.5	3.5	3.5	3.5
4	Lake Meade Drive	3.5	3.5	3.5	3.5
8	Wellons Street	4.9	9.2	4.9	4.9
9	S Saratoga Street	4.9	9.2	4.9	4.9
11	S Main Street	4.9	9.2	4.9	4.9
12	Commerce Street	4.9	9.2	4.9	4.9
13	E Washington Street	4.9	9.2	4.9	4.9
14	Liberty Street	4.9	9.2	4.9	4.9
Commonwealth Rail					
15	N 5th Street/Saul Street	1.1	9.2	4.9	4.9
17	Saunders Drive	1.1	9.2	4.9	4.9
18	Suburban Drive	1.1	9.2	4.9	4.9
19	Prospect Road	1.1	9.2	4.9	4.9
20	Olde Mill Creek Road	1.1	9.2	4.9	4.9
22	QVC Entrance	1.1	9.2	4.9	4.9
23	Progress Road	1.1	9.3	4.9	4.9
24	Rodney Lane	1.1	9.2	4.9	4.9
25	Nansemond Parkway 2 (Wilroy)	1.1	9.2	4.9	4.9
26	Sportsman Boulevard	1.1	9.2	4.9	4.9
27	Day Farm Lane	1.1	9.2	4.9	4.9
28	Nansemond Parkway 1	1.1	9.2	4.9	4.9
29	Shoulders Hill Road	1.1	9.2	4.9	4.9
CSX					
30	Kingsale Rd	2.6	3.5	3.5	3.5
31	Indian Trail	2.6	3.5	3.5	3.5
32	Buckhorn Dr	2.6	3.5	3.5	3.5
33	Kenyon Rd	2.6	3.5	3.5	3.5
35	W Constance Rd	3.5	9.2	4.9	4.9
37	Pine Street	3.5	9.2	4.9	4.9
38	N Main Street	3.5	9.3	5.0	5.0
40	Liberty Street/Moore Ave	3.5	9.2	4.9	4.9

Crossings 5, 6, 7, 10, 16, 21, 34, 36, 39 are grade-separated and have been excluded from analysis

Prepared by: Hampton Roads Planning District Commission

[13] Korve Engineering, San Gabriel Valley Grade Crossing Study, January, 1997

switching from Commonwealth Railway just beyond the marshalling yard where train speeds will be very low. Empirical data collected for the Motorist Delay at Public Highway-Rail Grade Crossings in Northeastern Illinois Study by the Illinois Commerce Commission[14] show that the value of L/S will increase by a factor of 1.65 for crossings within one-half mile of a rail yard. The only crossings within that range of the proposed marshalling yard are Nansemond Pkwy 2 (Wilroy) and Sportsman Boulevard; because the marshalling yard will only be used prior to the opening of the Median Rail Project, this effect will only exist for study year 2007.

Wellons Street

The number of minutes that a crossing is blocked each day is only dependent on the characteristics of train traffic and the width of the road being crossed and is not related to vehicular traffic flow. Because of this several crossings will be blocked for the same amount of time each day,

[14] Illinois Commerce Commission, Motorist Delay at Public Highway-Rail Grade Crossings in Northeastern Illinois, July, 2002

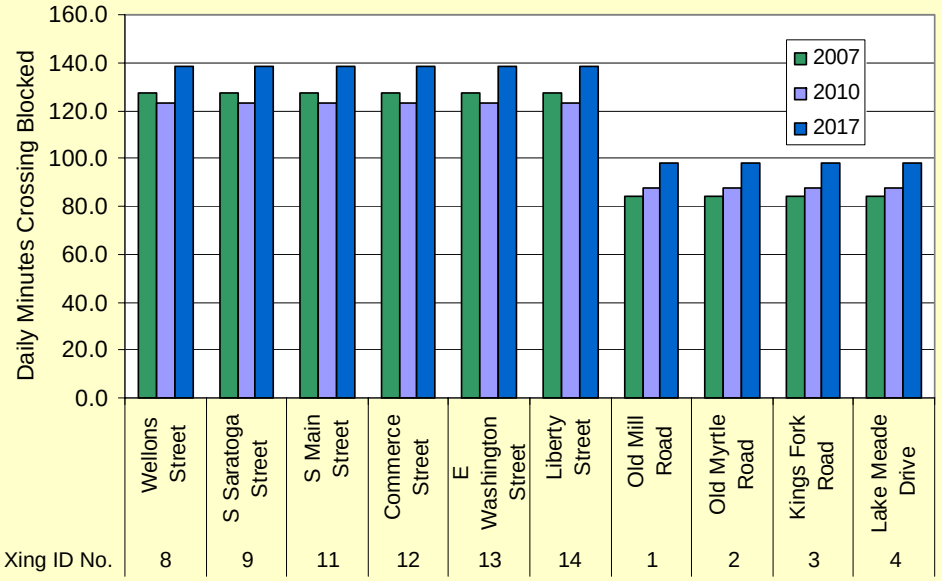
Table 7: Daily Minutes Crossing Blocked

ID No.	Crossing	B Exist (min)	B 2007 (min)	B 2010 (min)	B 2017 (min)
Norfolk Southern					
1	Old Mill Road	77.1	84.1	87.6	98.1
2	Old Myrtle Road	77.1	84.1	87.6	98.1
3	Kings Fork Road	77.1	84.1	87.6	98.1
4	Lake Meade Drive	77.1	84.1	87.6	98.1
8	Wellons Street	108.6	127.1	123.4	138.2
9	S Saratoga Street	108.6	127.1	123.4	138.2
11	S Main Street	108.6	127.1	123.4	138.2
12	Commerce Street	108.6	127.1	123.4	138.2
13	E Washington Street	108.6	127.1	123.4	138.2
14	Liberty Street	108.6	127.1	123.4	138.2
Commonwealth Rail					
15	N 5th Street/Saul Street	2.1	25.2	17.3	37.0
17	Saunders Drive	2.1	25.2	17.3	37.0
18	Suburban Drive	2.1	25.2	17.3	37.0
19	Prospect Road	2.1	25.2	17.3	37.0
20	Olde Mill Creek Road	2.1	25.2	17.3	37.0
22	QVC Entrance	2.1	25.2	17.3	37.0
23	Progress Road	2.1	25.3	17.3	37.1
24	Rodney Lane	2.1	25.2	17.3	37.0
25	Nansemond Parkway 2 (Wilroy)	2.1	40.2	17.3	37.0
26	Sportsman Boulevard	2.1	40.2	17.3	37.0
27	Day Farm Lane	2.1	25.2	17.3	37.0
28	Nansemond Parkway 1	2.1	25.2	17.3	37.0
29	Shoulders Hill Road	2.1	25.2	17.3	37.0
CSX					
30	Kingsale Rd	12.8	14.5	17.1	25.7
31	Indian Trail	12.8	14.5	17.1	25.7
32	Buckhorn Dr	12.8	14.5	17.1	25.7
33	Kenyon Rd	12.8	14.5	17.1	25.7
35	W Constance Rd	17.6	22.2	23.6	35.5
37	Pine Street	17.6	22.2	23.6	35.5
38	N Main Street	17.6	22.2	23.6	35.6
40	Liberty Street/Moore Ave	17.6	22.2	23.6	35.5

Crossings 5, 6, 7, 10, 16, 21, 34, 36, 39 are grade-separated and have been excluded from analysis

Prepared by: Hampton Roads Planning District Commission

Figure 2: Daily Minutes Crossing Blocked - Top Ten



and their speed cause the largest differences in total daily time blocked. In the chart above, note that the first six crossings will experience a decrease in blockage time from 2007 to 2010. This is largely due to an increase in train travel speeds following the completion of the Median Rail Project.

Commerce Street

S Saratoga Street

DAILY HOURS OF VEHICLE DELAY

Daily Hours of Vehicle Delay is the most comprehensive measure of mobility considered for this study because it includes both the volume of vehicles and the number of minutes the crossing is blocked. One minute of delay is calculated as one vehicle waiting for one minute, therefore, the total minutes is a cumulative value for all vehicles encountering a blocked crossing during a twenty-four hour period. The daily minutes of vehicle delay have been converted to hours for evaluation.

For calculation purposes, it was assumed that vehicular traffic arrives at a given crossing at a constant rate throughout the twenty-four hour period. While it would be possible to estimate vehicular traffic volumes at a given time of day, it is not possible to know what time of day future trains will pass through Suffolk. Due to this fact, assuming a constant rate of traffic is the best approximation available despite the fact that it underestimates the impacts of trains arriving during peak hours and overestimates the impact of trains arriving in the overnight hours. Additionally, it was assumed that because vehicles arrive at a constant rate, on average, each vehicle stopped by the passing train would wait for one-half the time for the train to cross and clear the intersection.

Daily Hours of Vehicle Delay (D) =(V_{min}*B)(0.5B)/60

Where:
V_{min} – Vehicles/Minute approaching the crossing
B – Daily Minutes Crossing Blocked

Table 8: Daily Hours of Vehicle Delay

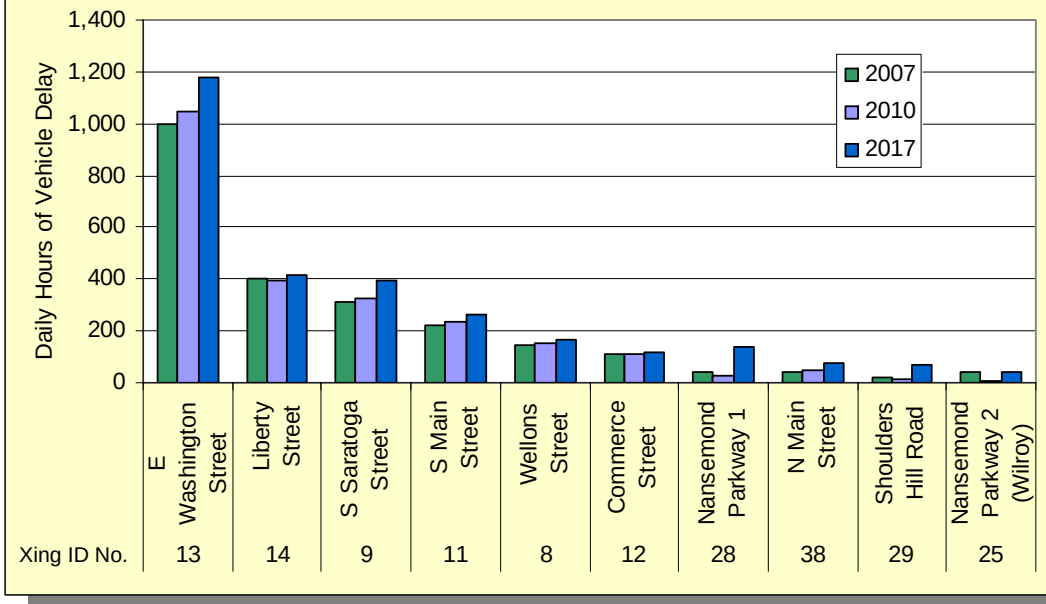
ID No.	Crossing	D Exist (hr)	D 2007 (hr)	D 2010 (hr)	D 2017 (hr)
Norfolk Southern					
1	Old Mill Road	10.0	10.0	10.5	11.1
2	Old Myrtle Road	16.8	17.0	17.5	20.3
3	Kings Fork Road	17.2	17.3	19.2	22.1
4	Lake Meade Drive	14.6	14.7	15.7	18.5
8	Wellons Street	143.4	147.5	149.5	168.7
9	S Saratoga Street	303.8	312.6	326.8	396.0
11	S Main Street	218.4	224.8	236.4	264.0
12	Commerce Street	105.8	108.9	107.8	117.3
13	E Washington Street	972.7	1,000.9	1,049.9	1,180.8
14	Liberty Street	389.1	400.4	396.3	418.0
Commonwealth Rail					
15	N 5th Street/Saul Street	0.1	8.1	4.8	23.0
17	Saunders Drive	0.0	0.0	0.0	0.0
18	Suburban Drive	0.1	8.7	5.1	24.6
19	Prospect Road	0.0	0.3	0.2	0.8
20	Olde Mill Creek Road	0.0	1.2	0.7	3.2
22	QVC Entrance	0.0	0.3	0.2	1.2
23	Progress Road	0.1	11.9	7.1	34.2
24	Rodney Lane	0.0	0.0	0.0	0.0
25	Nansemond Parkway 2 (Wilroy)	0.1	42.2	9.0	43.6
26	Sportsman Boulevard	0.0	0.6	0.1	0.6
27	Day Farm Lane	0.0	0.0	0.0	0.0
28	Nansemond Parkway 1	0.4	43.3	25.7	138.0
29	Shoulders Hill Road	0.2	21.8	12.8	65.8
CSX					
30	Kingsale Rd	0.6	0.6	0.7	1.2
31	Indian Trail	0.2	0.2	0.3	0.5
32	Buckhorn Dr	0.4	0.5	0.5	0.8
33	Kenyon Rd	0.9	0.9	1.2	1.8
35	W Constance Rd	17.4	18.6	21.4	31.5
37	Pine Street	3.0	3.3	3.7	5.4
38	N Main Street	38.8	41.5	49.2	77.9
40	Liberty Street/Moore Ave	10.2	10.9	12.4	18.1

Crossings 5, 6, 7, 10, 16, 21, 34, 36, 39 are grade-separated and have been excluded from analysis

Prepared by: Hampton Roads Planning District Commission

E Washington Street has, by far, the largest number of hours of delay for all the crossings considered in this study for each year of evaluation. In fact, the top six crossings for daily hours of delay occur at crossings of Norfolk Southern due to its high level of baseline rail traffic. In contrast, Commonwealth Railway carries all of the new port generated rail traffic, but has very little baseline traffic and there are only three crossings of Commonwealth Railway in the top ten.

Figure 3: Daily Hours of Vehicle Delay - Top Ten




E Washington Street


Liberty Street

ECONOMIC DEVELOPMENT PRIORITIES

The Suffolk Department of Economic Development provided a ranking of the rail crossings that reflects mobility priorities that it feels may not be accounted for in other measures. These rankings take into consideration existing and planned development and investments that affect the economic strength of the City. This ranking is provided below.

Table 9: Economic Development Rank

ID No.	Crossing	Rank
22	QVC Entrance	1
23	Progress Road	1
28	Nansemond Parkway 1	1
29	Shoulders Hill Road	1
33	Kenyon Rd	1
38	N Main Street	1
40	Liberty Street/Moore Ave	1
13	E Washington Street	5
25	Nansemond Parkway 2 (Wilroy)	5
35	W Constance Rd	5
37	Pine Street	5
15	N 5th Street/Saul Street	10
17	Saunders Drive	10
20	Olde Mill Creek Road	10
24	Rodney Lane	10
26	Sportsman Boulevard	10
8	Wellons Street	20
9	S Saratoga Street	20
11	S Main Street	20
12	Commerce Street	20
14	Liberty Street	20
18	Suburban Drive	20
19	Prospect Road	20
27	Day Farm Lane	20
1	Old Mill Road	25
2	Old Myrtle Road	25
3	Kings Fork Road	25
4	Lake Meade Drive	25
30	Kingsale Rd	25
31	Indian Trail	25
32	Buckhorn Dr	25

Crossings 5, 6, 7, 10, 16, 21, 34, 36, 39 are grade-separated and have been excluded from analysis

Source: City of Suffolk

QVC Entrance

Progress Road

ACCIDENT HISTORY

It is difficult to predict future accidents, so this study considered the accident history of each crossing as a measure of past safety. While new developments and projected future traffic might increase potential accidents at other crossings, accident history is a good indication of areas that may already be in need of a safety review. Fourteen (14) accidents between trains and vehicles occurred at the crossings in this study in the period from 1996 through 2006. These accidents were generally minor and resulted in only four personal injuries.

E Washington Street and Liberty Street/Moore Avenue combined had the majority of incidents and all of the personal injuries. Contributing to the number of accidents at the E Washington Street crossing is its complicated horizontal geometry with several roadways coming together on both sides of the crossing as well as its non-perpendicular crossing angle. The Liberty Street/Moore Avenue crossing is the only significant crossing in the study that does not have automated gates for protection, which likely played a part in the larger number of accidents.

Liberty Street/Moore Avenue

Table 10: Accident History 1996 - 2006

ID No.	Crossing	Summary Accidents	Summary Injuries
Norfolk Southern			
1	Old Mill Road	0	0
2	Old Myrtle Road	0	0
3	Kings Fork Road	0	0
4	Lake Meade Drive	0	0
8	Wellons Street	0	0
9	S Saratoga Street	2	0
11	S Main Street	1	0
12	Commerce Street	0	0
13	E Washington Street	0	0
14	Liberty Street	5	3
Commonwealth Rail			
15	N 5th Street/Saul Street	0	0
17	Saunders Drive	0	0
18	Suburban Drive	0	0
19	Prospect Road	0	0
20	Olde Mill Creek Road	0	0
22	QVC Entrance	0	0
23	Progress Road	0	0
24	Rodney Lane	0	0
25	Nansemond Parkway 2 (Wilroy)	0	0
26	Sportsman Boulevard	0	0
27	Day Farm Lane	0	0
28	Nansemond Parkway 1	0	0
29	Shoulders Hill Road	0	0
CSX			
30	Kingsale Rd	0	0
31	Indian Trail	0	0
32	Buckhorn Dr	0	0
33	Kenyon Rd	0	0
35	W Constance Rd	0	0
37	Pine Street	0	0
38	N Main Street	0	0
40	Liberty Street/Moore Ave	0	0
Total		**4**	**1**

Crossings 5, 6, 7, 10, 16, 21, 34, 36, 39 are grade-separated and have been excluded from analysis

No fatalities occurred at any highway-rail crossing in this study between 1996 and 2006

Source: FRA

HAZARD INDEX

The Hazard Index is a measure similar to the Exposure Index, but includes a Protection Factor based on the crossing protection equipment present at the intersection. This serves to create a more refined measure of the potential for incidents between rail and highway traffic. This study uses a formula for Hazard Index identified as the "New Hampshire Index" by the Federal Highway Administration in the Second Edition of the Railroad-Highway Grade Crossing Handbook[15].

Hazard Index (HI) = (V)(T)Pf

Where:
V – Average Daily Traffic on roadway
T – Daily number of trains
Pf – Protection Factor

Protection Factor:
0.1 – automatic gates
0.6 – flashing lights
1.0 – signs only

At right are the Hazard Index values for each study crossing for the existing conditions and each study year. The Hazard Index values for the study years 2007, 2010, and 2017 consist of the values calculated for the baseline traffic as well as the traffic generated by the new APM and Craney Island port terminals. The existing Hazard Index values are provided for comparison to the projected total values.

Table 11: Hazard Index

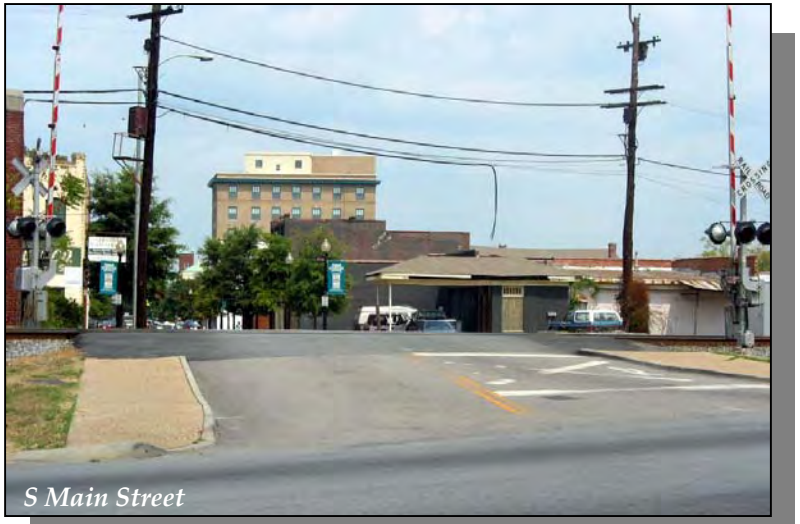
ID No.	Crossing	HI Exist	HI 2007	HI 2010	HI 2017
Norfolk Southern					
1	Old Mill Road	638	696	750	840
2	Old Myrtle Road	1,078	1,176	1,250	1,540
3	Kings Fork Road	1,100	1,200	1,375	1,680
4	Lake Meade Drive	935	1,020	1,125	1,400
8	Wellons Street	4,620	5,040	5,375	6,440
9	S Saratoga Street	9,790	10,680	11,750	15,120
11	S Main Street	7,040	7,680	8,500	10,080
12	Commerce Street	3,410	3,720	3,875	4,480
13	E Washington Street	31,350	34,200	37,750	45,080
14	Liberty Street	12,540	13,680	14,250	15,960
Commonwealth Rail					
15	N 5th Street/Saul Street	520	1,170	963	2,175
17	Saunders Drive	0	0	0	0
18	Suburban Drive	560	1,260	1,033	2,325
19	Prospect Road	0	0	0	0
20	Olde Mill Creek Road	76	171	140	300
22	QVC Entrance	20	45	44	113
23	Progress Road	760	1,710	1,435	3,225
24	Rodney Lane	0	0	0	0
25	Nansemond Parkway 2 (Wilroy)	1,000	2,250	1,820	4,125
26	Sportsman Boulevard	150	338	263	600
27	Day Farm Lane	0	0	0	0
28	Nansemond Parkway 1	2,780	6,255	5,215	13,050
29	Shoulders Hill Road	1,400	3,150	2,590	6,225
CSX					
30	Kingsale Rd	1,800	1,980	2,535	3,990
31	Indian Trail	115	127	163	285
32	Buckhorn Dr	235	259	309	475
33	Kenyon Rd	475	523	650	1,045
35	W Constance Rd	4,855	5,341	6,370	9,405
37	Pine Street	5,100	5,610	6,630	9,690
38	N Main Street	10,853	11,938	14,658	23,275
40	Liberty Street/Moore Ave	17,100	18,810	22,230	32,490

Crossings 5, 6, 7, 10, 16, 21, 34, 36, 39 are grade-separated and have been excluded from analysis

Prepared by: Hampton Roads Planning District Commission

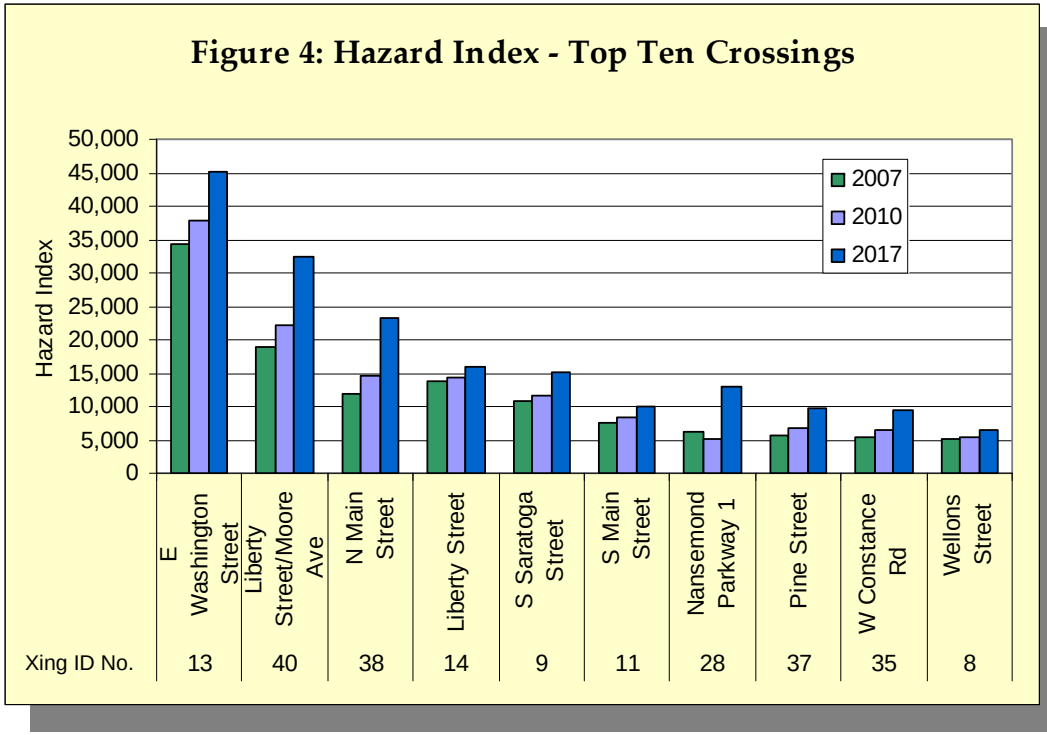
[15] Federal Highway Administration, Railroad-Highway Grade Crossing Handbook, Second Edition, September, 1986

Generally, because most crossings analyzed in this study have automatic gates for protection, crossings of Norfolk Southern tracks have higher than average Hazard Index values because of higher levels of train traffic. The Liberty Street/Moore Avenue crossing has the second highest projected value in each study year because it has only flashing lights and signs for protection and a relatively high level of vehicular traffic.


S Main Street


Nansemond Parkway 1

Figure 4: Hazard Index - Top Ten Crossings



EMERGENCY SERVICES ACCESS

The ability of first responders to reach emergencies in a timely manner is a significant issue when considering the safety effects of increased rail traffic. To estimate the relative importance of the crossings, a scoring system was developed. The scoring categories included availability of alternative routes, evacuation routes, and locations of schools. The locations of hospitals would also be an important factor, but there are no hospitals located near any of the crossings evaluated in this study. The scoring methodology is outlined below.

Emergency Services Scoring

Access
20 – highest concern, no alternative access
15 – high concern, important corridor crossing
10 – moderate concern, detour of more than 1 mi.
0 – low concern, detour of less than 1 mi.

Evacuation Routes
5 – crossing located on evacuation route
0 – crossing not located on evacuation route

Schools
5 – crossing located on primary access to school
0 – crossing not located on school access route

There are three crossings on residential streets that have no alternative access. The most significant of these is Sportsman Boulevard, which is the only access to an entire residential neighborhood. Rodney Lane and Saunders Drive only provide access to one residence each.

Table 12: Emergency Services Score

ID No.	Crossing	Composite Score
Norfolk Southern		
1	Old Mill Road	10
2	Old Myrtle Road	10
3	Kings Fork Road	10
4	Lake Meade Drive	10
8	Wellons Street	0
9	S Saratoga Street	0
11	S Main Street	0
12	Commerce Street	0
13	E Washington Street	20
14	Liberty Street	0
Commonwealth Rail		
15	N 5th Street/Saul Street	10
17	Saunders Drive	20
18	Suburban Drive	0
19	Prospect Road	0
20	Olde Mill Creek Road	10
22	QVC Entrance	10
23	Progress Road	0
24	Rodney Lane	20
25	Nansemond Parkway 2 (Wilroy)	20
26	Sportsman Boulevard	20
27	Day Farm Lane	0
28	Nansemond Parkway 1	20
29	Shoulders Hill Road	20
CSX		
30	Kingsale Rd	10
31	Indian Trail	10
32	Buckhorn Dr	10
33	Kenyon Rd	15
35	W Constance Rd	5
37	Pine Street	0
38	N Main Street	0
40	Liberty Street/Moore Ave	0

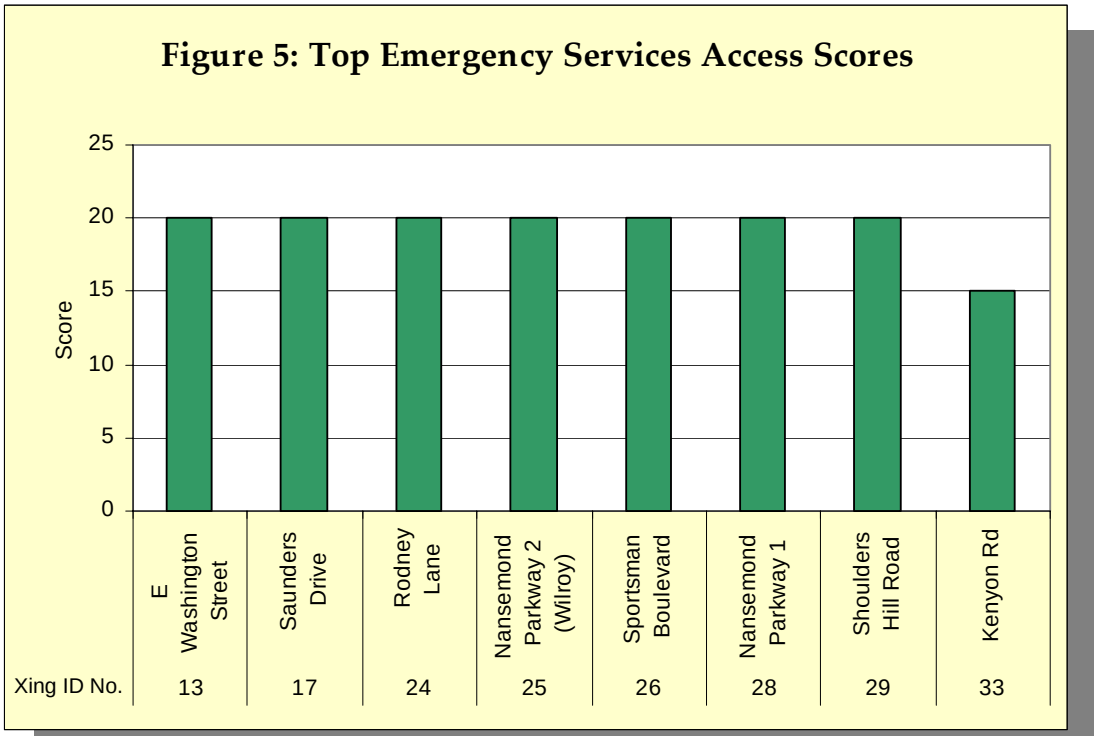
Crossings 5, 6, 7, 10, 16, 21, 34, 36, 39 are grade-separated and have been excluded from analysis
Prepared by: Hampton Roads Planning District Commission

E Washington Street, Nansemond Parkway, and Shoulders Hill Road have some alternative access, but are major roadway corridors through Suffolk and provide access to schools, causing them to score highly as well. The Kenyon Road crossing does not have a convenient alternative route and is located near a school.


Saunders Drive


Sportsman Boulevard

Figure 5: Top Emergency Services Access Scores



CRANEY ISLAND BUILD-OUT AND ULTIMATE BUILD-OUT

The Craney Island Terminal is expected to continue to grow beyond its 2017 opening-year capacity of 800,000 TEUs. It is expected to reach a build-out capacity of 2.5 million TEUs by the year 2032, with the potential for an ultimate build-out of 5.0 million TEUs at an unknown date. Clearly, the continued growth at Craney Island Terminal will further impact mobility and safety at the at-grade crossings in Suffolk, but this growth has not been included in the evaluation process. The reason for this is that roadway traffic projections are not reliable that many years in the future. Currently, VDOT's farthest projections are for 2025 and the most recent published long-range plan for Hampton Roads is for 2026. Additionally, projections for baseline rail traffic (traffic unrelated to APM and Craney Island Terminals) in this time period were not provided by any of the affected railroads.

It is worthwhile to consider what effect long-term growth of the ports will have on the crossings in this study. Despite the fact that the future growth of Craney Island Terminal has not been included in the rankings and priority identification, a preliminary analysis of this data has been conducted for informational purposes only. This analysis used 2017 roadway traffic projections and Craney Island 2032 build-out and future ultimate build-out projections for rail traffic. This method will most likely underestimate the effects of increased rail traffic because it does not consider the increase in vehicular traffic, which could be significant over the fifteen years between 2017 and 2032. The Virginia Port Authority does not have a specific year that it anticipates Craney Island Terminal will reach the ultimate build-out 5.0 million TEU capacity mark, but it could be another fifteen years or more beyond 2032.

Two performance measures have been evaluated for these future conditions: Daily Minutes Crossing Blocked and Daily Hours of Vehicle Delay. The Daily Minutes Crossing Blocked does not consider the traffic stopped by a crossing train, only the time the train blocks the crossing, so it will be fairly accurate for the future conditions. The daily total time

Table 13: Daily Minutes Crossing Blocked - Build-Out

ID No.	Crossing	B Exist (min)	B 2017 (min)	B 2032 (min)	B Ultimate (min)
Norfolk Southern					
1	Old Mill Road	77.1	98.1	133.1	185.6
2	Old Myrtle Road	77.1	98.1	133.1	185.6
3	Kings Fork Road	77.1	98.1	133.1	185.6
4	Lake Meade Drive	77.1	98.1	133.1	185.6
8	Wellons Street	108.6	138.2	187.6	261.6
9	S Saratoga Street	108.6	138.2	187.6	261.6
11	S Main Street	108.6	138.2	187.6	261.6
12	Commerce Street	108.6	138.2	187.6	261.6
13	E Washington Street	108.6	138.2	187.6	261.6
14	Liberty Street	108.6	138.2	187.6	261.6
Commonwealth Rail					
15	N 5th Street/Saul Street	2.1	37.0	64.2	93.8
17	Saunders Drive	2.1	37.0	64.2	93.8
18	Suburban Drive	2.1	37.0	64.2	93.8
19	Prospect Road	2.1	37.0	64.2	93.8
20	Olde Mill Creek Road	2.1	37.0	64.2	93.8
22	QVC Entrance	2.1	37.0	64.2	93.8
23	Progress Road	2.1	37.1	64.3	93.9
24	Rodney Lane	2.1	37.0	64.2	93.8
25	Nansemond Parkway 2 (Wilroy)	2.1	37.0	64.2	93.8
26	Sportsman Boulevard	2.1	37.0	64.2	93.8
27	Day Farm Lane	2.1	37.0	64.2	93.8
28	Nansemond Parkway 1	2.1	37.0	64.2	93.8
29	Shoulders Hill Road	2.1	37.0	64.2	93.8
CSX					
30	Kingsale Rd	12.8	25.7	36.2	50.2
31	Indian Trail	12.8	25.7	36.2	50.2
32	Buckhorn Dr	12.8	25.7	36.2	50.2
33	Kenyon Rd	12.8	25.7	36.2	50.2
35	W Constance Rd	17.6	35.5	50.3	70.1
37	Pine Street	17.6	35.5	50.3	70.1
38	N Main Street	17.6	35.6	50.4	70.2
40	Liberty Street/Moore Ave	17.6	35.5	50.3	70.1

Crossings 5, 6, 7, 10, 16, 21, 34, 36, 39 are grade-separated and have been excluded from analysis

Prepared by: Hampton Roads Planning District Commission

the crossings are anticipated to be blocked will increase significantly as Craney Island Terminal expands. For years 2007 through 2017, Norfolk Southern crossings will experience the largest blockage times, but Commonwealth Railway crossings will be blocked nearly three times more per day in the future condition over 2017. Crossings of CSX will see blockage times double in the future condition over 2017 projections.

The future projections for Daily Hours of Vehicle Delay also predict large increases over 2017 projections. Because this performance measure includes roadway traffic, these delay estimates are probably quite low for some roadways. E Washington Street is expected to see more than 1600 hours of cumulative daily delay for motorists at completion of the future expansion of Craney Island Terminal. A more than 500% increase in delay over 2017 is projected for the crossings of Commonwealth Railway.

The estimates generated by this analysis provide an indication of things to come for Suffolk, but may not necessarily supply accurate predictions of future conditions. The City will undoubtedly experience increases in roadway traffic that could not be accounted for in this analysis that will contribute to increased impacts. The effects of increased rail traffic through Suffolk will not resolve on their own and will continue to grow as the ports grow.

Table 14: Daily Hours Vehicle Delay - Build-Out

ID No.	Crossing	D Exist (hr)	D 2017 (hr)	D 2032 (hr)	D Ultimate (hr)
Norfolk Southern					
1	Old Mill Road	10.0	11.1	12.4	15.1
2	Old Myrtle Road	16.8	20.3	22.8	27.7
3	Kings Fork Road	17.2	22.1	24.9	30.2
4	Lake Meade Drive	14.6	18.5	20.7	25.2
8	Wellons Street	143.4	168.7	189.4	230.0
9	S Saratoga Street	303.8	396.0	444.8	540.0
11	S Main Street	218.4	264.0	296.5	360.0
12	Commerce Street	105.8	117.3	131.8	160.0
13	E Washington Street	972.7	1,180.8	1,326.1	1,609.9
14	Liberty Street	389.1	418.0	469.5	570.0
Commonwealth Rail					
15	N 5th Street/Saul Street	0.1	23.0	69.1	147.7
17	Saunders Drive	0.0	0.0	0.0	0.0
18	Suburban Drive	0.1	24.6	73.9	157.8
19	Prospect Road	0.0	0.8	2.4	5.1
20	Olde Mill Creek Road	0.0	3.2	9.5	20.4
22	QVC Entrance	0.0	1.2	3.6	7.6
23	Progress Road	0.1	34.2	102.8	219.5
24	Rodney Lane	0.0	0.0	0.0	0.0
25	Nansemond Parkway 2 (Wilroy)	0.1	43.6	131.1	280.0
26	Sportsman Boulevard	0.0	0.6	1.9	4.1
27	Day Farm Lane	0.0	0.0	0.0	0.0
28	Nansemond Parkway 1	0.4	138.0	414.7	885.9
29	Shoulders Hill Road	0.2	65.8	197.8	422.6
CSX					
30	Kingsale Rd	0.6	1.2	1.5	1.9
31	Indian Trail	0.2	0.5	0.6	0.8
32	Buckhorn Dr	0.4	0.8	1.1	1.3
33	Kenyon Rd	0.9	1.8	2.4	2.9
35	W Constance Rd	17.4	31.5	40.9	50.7
37	Pine Street	3.0	5.4	7.0	8.7
38	N Main Street	38.8	77.9	101.4	125.7
40	Liberty Street/Moore Ave	10.2	18.1	23.5	29.2

Crossings 5, 6, 7, 10, 16, 21, 34, 36, 39 are grade-separated and have been excluded from analysis

Prepared by: Hampton Roads Planning District Commission

COMPOSITE RANKINGS

MOBILITY RANKINGS

Composite mobility rankings were computed to determine the crossings most affected by rail traffic across all of the mobility performance measures. To determine the composite rank of a given highway-rail crossing, its ranking for each mobility performance measure was summed and then ranked among all studied crossings. For example, in 2007 E Washington Street had a ranking of one (1) for the performance measures exposure index, minutes crossing blocked, and hours of delay and a ranking of five (5) in the category of economic development priorities. Its sum of rankings is 8 (1+1+1+5) and compared to the sums of all other crossings' rankings this is the smallest sum, giving E Washington Street a composite rank of one (1).

Seven highway-rail crossings appear in the top ten for all three study years. These crossings are highlighted in the tables at right. E Washington Street is ranked first in each list indicating that mobility at this crossing will be most affected by rail traffic throughout the study period. Of the seven crossings that appear in the top ten for all three years, five are crossings of Norfolk Southern, one is a crossing of Commonwealth Railway, and one is a crossing of CSX. This is not surprising considering Norfolk Southern has a significantly higher level of baseline traffic (unrelated to APM Terminals and Craney Island) utilizing its tracks.

2007 Composite Mobility Ranking		
ID No.	Crossing	Composite Ranking
13	E Washington Street	1
14	Liberty Street	2
9	S Saratoga Street	3
11	S Main Street	4
28	Nansemond Parkway 1	4
8	Wellons Street	6
12	Commerce Street	7
29	Shoulders Hill Road	7
25	Nansemond Parkway 2 (Wilroy)	9
38	N Main Street	10
23	Progress Road	11
35	W Constance Rd	12
40	Liberty Street/Moore Ave	13
3	Kings Fork Road	14
2	Old Myrtle Road	15
4	Lake Meade Drive	16
15	N 5th Street/Saul Street	17
37	Pine Street	18
1	Old Mill Road	19
18	Suburban Drive	19
20	Olde Mill Creek Road	19
22	QVC Entrance	22
26	Sportsman Boulevard	23
33	Kenyon Rd	24
17	Saunders Drive	25
24	Rodney Lane	25
19	Prospect Road	27
27	Day Farm Lane	28
30	Kingsale Rd	29
32	Buckhorn Dr	30
31	Indian Trail	31

2010 Composite Mobility Ranking		
ID No.	Crossing	Composite Ranking
13	E Washington Street	1
38	N Main Street	2
14	Liberty Street	3
9	S Saratoga Street	4
11	S Main Street	5
35	W Constance Rd	6
28	Nansemond Parkway 1	7
8	Wellons Street	8
12	Commerce Street	9
40	Liberty Street/Moore Ave	9
29	Shoulders Hill Road	11
23	Progress Road	12
25	Nansemond Parkway 2 (Wilroy)	13
37	Pine Street	14
3	Kings Fork Road	15
2	Old Myrtle Road	16
33	Kenyon Rd	16
4	Lake Meade Drive	18
15	N 5th Street/Saul Street	19
1	Old Mill Road	20
22	QVC Entrance	21
18	Suburban Drive	22
20	Olde Mill Creek Road	23
26	Sportsman Boulevard	24
17	Saunders Drive	25
24	Rodney Lane	25
30	Kingsale Rd	27
32	Buckhorn Dr	28
19	Prospect Road	29
31	Indian Trail	29
27	Day Farm Lane	31

2017 Composite Mobility Ranking		
ID No.	Crossing	Composite Ranking
13	E Washington Street	1
28	Nansemond Parkway 1	2
14	Liberty Street	3
9	S Saratoga Street	4
29	Shoulders Hill Road	5
11	S Main Street	6
8	Wellons Street	7
38	N Main Street	8
23	Progress Road	9
25	Nansemond Parkway 2 (Wilroy)	10
12	Commerce Street	11
35	W Constance Rd	12
15	N 5th Street/Saul Street	13
40	Liberty Street/Moore Ave	14
18	Suburban Drive	15
22	QVC Entrance	16
3	Kings Fork Road	17
2	Old Myrtle Road	18
20	Olde Mill Creek Road	18
37	Pine Street	18
4	Lake Meade Drive	21
33	Kenyon Rd	22
1	Old Mill Road	23
26	Sportsman Boulevard	24
17	Saunders Drive	25
24	Rodney Lane	25
19	Prospect Road	27
27	Day Farm Lane	28
30	Kingsale Rd	29
32	Buckhorn Dr	30
31	Indian Trail	31

Table 15: Composite Mobility Rankings

SAFETY RANKINGS

Like the composite mobility rankings, composite safety rankings were computed to determine the crossings most affected by rail traffic as gauged by the safety performance measures. To determine the composite rank of a given highway-rail crossing, its ranking for each safety performance measure was summed and then ranked among all studied crossings. For example, in 2007 E Washington Street had a ranking of one (1) for all three safety performance measures of Accident History, Hazard Index, and Emergency Services Access.

The sum of these rankings is 3 (1+1+1) and compared to the sums of all other crossings' rankings this is the smallest sum, giving E Washington Street a composite rank of one (1).

Ten highway-rail crossings appear in the top ten for all three study years. There are several crossings with a rank of ten (10) in 2007 and 2010. The safety composite rankings are very consistent, with the first six crossings are in the same order all three years. Because the safety performance measures are not as closely related to the traffic volumes on the roadways or railroads, the crossings in the top ten are more evenly distributed among the three railroads.

2007 Composite Safety Ranking		
ID No.	Crossing	Composite Ranking
13	E Washington Street	1
28	Nansemond Parkway 1	2
29	Shoulders Hill Road	3
25	Nansemond Parkway 2 (Wilroy)	4
40	Liberty Street/Moore Ave	5
14	Liberty Street	6
26	Sportsman Boulevard	7
9	S Saratoga Street	8
8	Wellons Street	9
17	Saunders Drive	10
24	Rodney Lane	10
30	Kingsale Rd	10
35	W Constance Rd	10
38	N Main Street	10
11	S Main Street	15
3	Kings Fork Road	16
33	Kenyon Rd	16
2	Old Myrtle Road	18
37	Pine Street	18
15	N 5th Street/Saul Street	20
4	Lake Meade Drive	21
1	Old Mill Road	22
12	Commerce Street	22
32	Buckhorn Dr	24
20	Olde Mill Creek Road	25
23	Progress Road	25
18	Suburban Drive	27
31	Indian Trail	27
22	QVC Entrance	29
19	Prospect Road	30
27	Day Farm Lane	30

2010 Composite Safety Ranking		
ID No.	Crossing	Composite Ranking
13	E Washington Street	1
28	Nansemond Parkway 1	2
29	Shoulders Hill Road	3
25	Nansemond Parkway 2 (Wilroy)	4
40	Liberty Street/Moore Ave	5
14	Liberty Street	6
9	S Saratoga Street	7
26	Sportsman Boulevard	7
8	Wellons Street	9
30	Kingsale Rd	10
35	W Constance Rd	10
38	N Main Street	10
17	Saunders Drive	13
24	Rodney Lane	13
3	Kings Fork Road	15
11	S Main Street	15
2	Old Myrtle Road	17
33	Kenyon Rd	17
37	Pine Street	17
4	Lake Meade Drive	20
15	N 5th Street/Saul Street	21
1	Old Mill Road	22
12	Commerce Street	22
32	Buckhorn Dr	24
23	Progress Road	25
31	Indian Trail	25
20	Olde Mill Creek Road	27
22	QVC Entrance	28
18	Suburban Drive	29
19	Prospect Road	30
27	Day Farm Lane	30

2017 Composite Safety Ranking		
ID No.	Crossing	Composite Ranking
13	E Washington Street	1
28	Nansemond Parkway 1	2
29	Shoulders Hill Road	3
25	Nansemond Parkway 2 (Wilroy)	4
40	Liberty Street/Moore Ave	5
14	Liberty Street	6
26	Sportsman Boulevard	7
9	S Saratoga Street	8
8	Wellons Street	9
38	N Main Street	9
17	Saunders Drive	11
24	Rodney Lane	11
30	Kingsale Rd	11
35	W Constance Rd	11
33	Kenyon Rd	15
11	S Main Street	16
15	N 5th Street/Saul Street	16
3	Kings Fork Road	18
37	Pine Street	18
2	Old Myrtle Road	20
4	Lake Meade Drive	21
1	Old Mill Road	22
12	Commerce Street	22
32	Buckhorn Dr	24
20	Olde Mill Creek Road	25
23	Progress Road	25
18	Suburban Drive	27
31	Indian Trail	27
22	QVC Entrance	29
19	Prospect Road	30
27	Day Farm Lane	30

Table 16: Composite Safety Rankings

CONCLUSIONS

MOBILITY PRIORITIES

Mobility improvement priorities were identified based on the Composite Mobility Rankings for 2007, 2010, and 2017. Seven crossings appear in the top ten for all three study years and these crossings have been included in the mobility priority list. The remaining three crossings have been selected because they appear in the top ten for two of the three study years. These priorities are meant to represent a starting point for consideration of improvements and are not a complete list of the at-grade crossings that may warrant mobility improvements. The complete mobility analyses can be found in the technical appendix.

Mobility Improvement Priorities

1. **E Washington Street**
2. **Liberty Street (14)**
3. **S Saratoga Street**
4. **Nansemond Parkway 1**
5. **S Main Street**
6. **Wellons Street**
7. **N Main Street**
8. **Shoulders Hill Road**
9. **Nansemond Parkway 2 (Wilroy)**
10. **Commerce Street**

SAFETY PRIORITIES

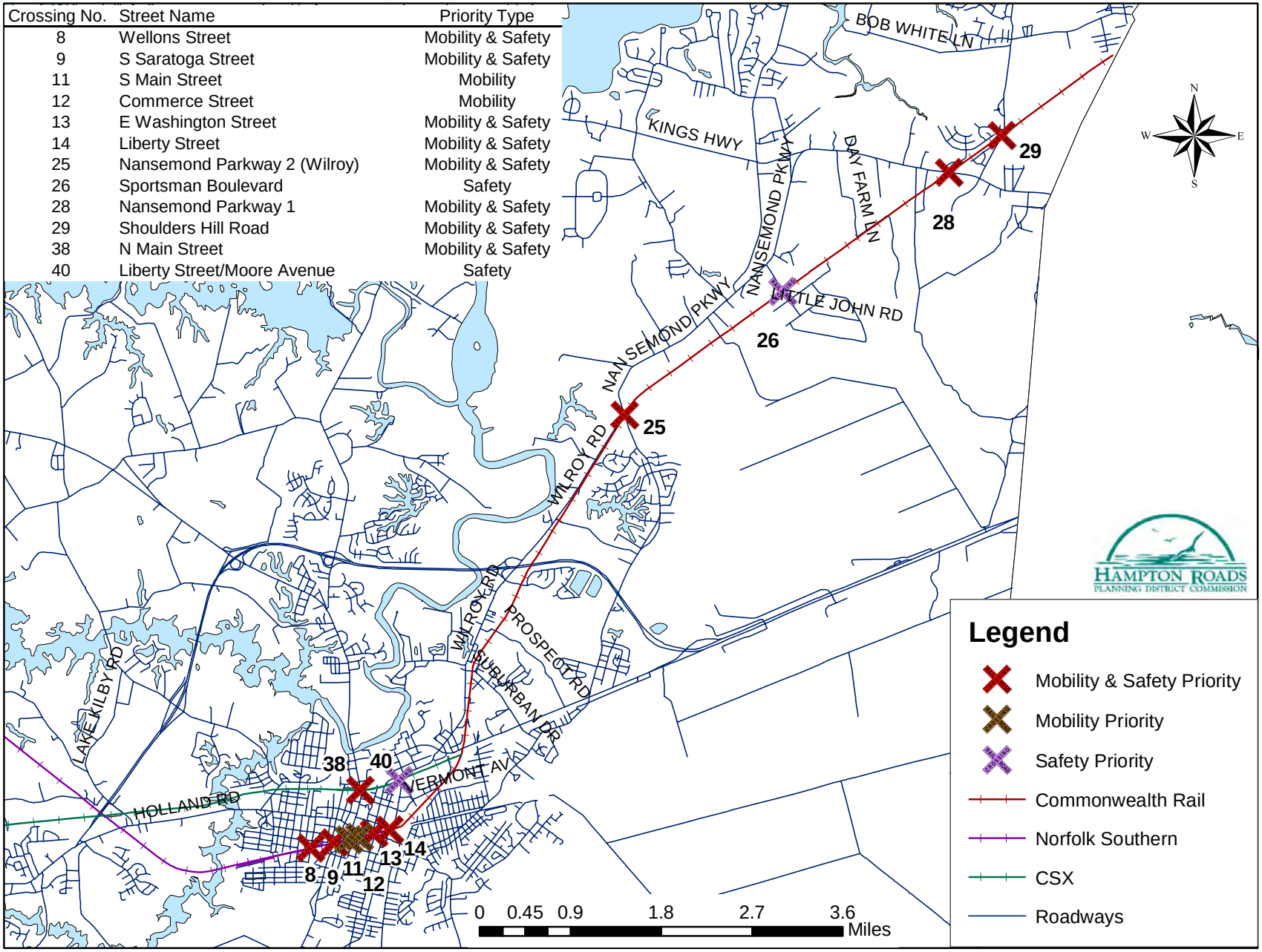
Similarly, safety improvement priorities were identified based on the Composite Safety Rankings for 2007, 2010, and 2017. The composite safety rankings experience very little change over the ten-year study period and the Safety Improvement Priorities selected were all ranked in the top ten for each study year. These priorities are meant to represent a starting point for consideration of improvements and are not a complete list of the at-grade crossings that may warrant safety improvements. The complete safety analyses can be found in the technical appendix.

Safety Improvement Priorities

1. **E Washington Street**
2. **Nansemond Parkway 1**
3. **Shoulders Hill Road**
4. **Nansemond Parkway 2 (Wilroy)**
5. **Liberty Street/Moore Ave (40)**
6. **Liberty Street (14)**
7. **Sportsman Boulevard**
8. **S Saratoga Street**
9. **Wellons Street**
10. **N Main Street**

Map 8: Mobility & Safety Priorities

Crossing No.	Street Name	Priority Type
8	Wellons Street	Mobility & Safety
9	S Saratoga Street	Mobility & Safety
11	S Main Street	Mobility
12	Commerce Street	Mobility
13	E Washington Street	Mobility & Safety
14	Liberty Street	Mobility & Safety
25	Nansemond Parkway 2 (Wilroy)	Mobility & Safety
26	Sportsman Boulevard	Safety
28	Nansemond Parkway 1	Mobility & Safety
29	Shoulders Hill Road	Mobility & Safety
38	N Main Street	Mobility & Safety
40	Liberty Street/Moore Avenue	Safety



OPTIONS

Each of the highway-rail crossings identified as an improvement priority has a unique set of conditions. These conditions both contribute to the need for improvement and provide opportunities to reduce that need. Near-term, intermediate-term, and long-term solutions have been considered to address these priorities.

Several crossings appear on both the mobility and safety improvement priority lists. In many cases, a solution to a mobility problem will resolve a safety problem or vice versa, but that is not always the case and recommendations have been made to resolve issues affecting both impact areas.

CITYWIDE IMPROVEMENTS

It is important to consider options that can create system-wide or citywide improvements in addition to options to improve individual highway-rail crossings. These improvements will not resolve the need for improvement at any individual location, but can, by degrees, improve the efficiency and overall safety of all crossings in the study area.

One simple option that could have a significant impact on mobility would be coordination between the City, ports, and railroad companies to schedule trains to avoid peak travel periods. If the majority of trains can be scheduled to travel at night, the effects of increased rail traffic on mobility could be considerably reduced.

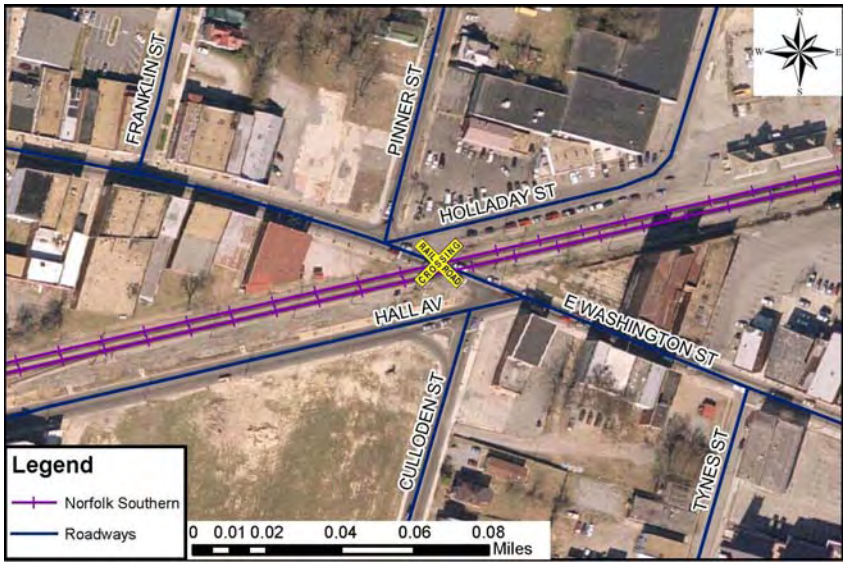
Implementation of a railroad grade crossing monitoring system would allow emergency responders to track the location and speeds of trains to avoid delay at at-grade rail crossings. Trains could be monitored at a central location and the information could be transmitted to responders in the field. There are different systems available, but the Texas Transportation Institute compared transponder and radar systems and found that systems using Doppler radar were the most accurate, did not require equipment be placed in railroad right-of-way, and were less expensive to implement[16].

Building on the concept of a train monitoring system, the information collected for first responders could be used to alert motorists of the presence of crossing trains to allow them to use an alternative route. This information could be relayed to motorists using ITS (Intelligent Transportation Systems) technologies and variable message signs. There are commercially available systems designed for this purpose.

E WASHINGTON STREET

E Washington Street is the highest priority crossing from both safety and mobility standpoints; it is also the crossing where it is most

Map 9: E Washington Street Crossing

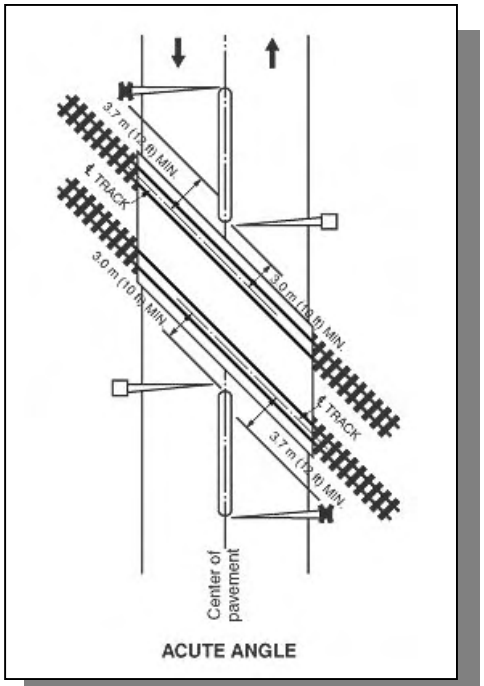


[16] Texas Transportation Institute, Railroad Grade Crossing Monitoring System, August, 2003

difficult to implement improvements. E Washington Street has several challenging aspects. Holladay Street and Pinner Street intersect E Washington Street approximately 100 feet west of the crossing and Culloden Street/Hall Avenue intersect E Washington Street about 100 feet east of the crossing. The Norfolk Southern tracks themselves cross E Washington Street at an acute angle. Additionally, this crossing is located in the downtown area where historic buildings are located very close to the street and where the City is in the process of


E Washington Street

constructing a large redevelopment project just south of this crossing. As part of this Fairgrounds Redevelopment Project, a large water main has recently been laid under E Washington Street close to this crossing. This crossing experiences daily vehicular delay well above the forty-hour threshold for consideration of grade separation outlined in the Guidance on Traffic Control at Highway-Rail Grade Crossings published by the Federal Highway Administration[17]. While this crossing certainly warrants consideration of grade-separation, because of the nearby intersections, historic buildings, and utility crossings, it would be nearly impossible and prohibitively expensive to construct either an overpass or an underpass of the railroad at this location. The City of Suffolk has a project in the early stages of development that would help ease the mobility issues anticipated at E Washington Street. This project, known as the Finney Avenue flyover, would connect Factory Street to Finney Avenue by overpassing Norfolk Southern and Commonwealth Railway tracks east of the E Washington Street crossing. This connection will provide an alternate route for travelers on E Washington Street and would be most effective in combination with a rail monitoring system and variable message signs to redirect traffic.



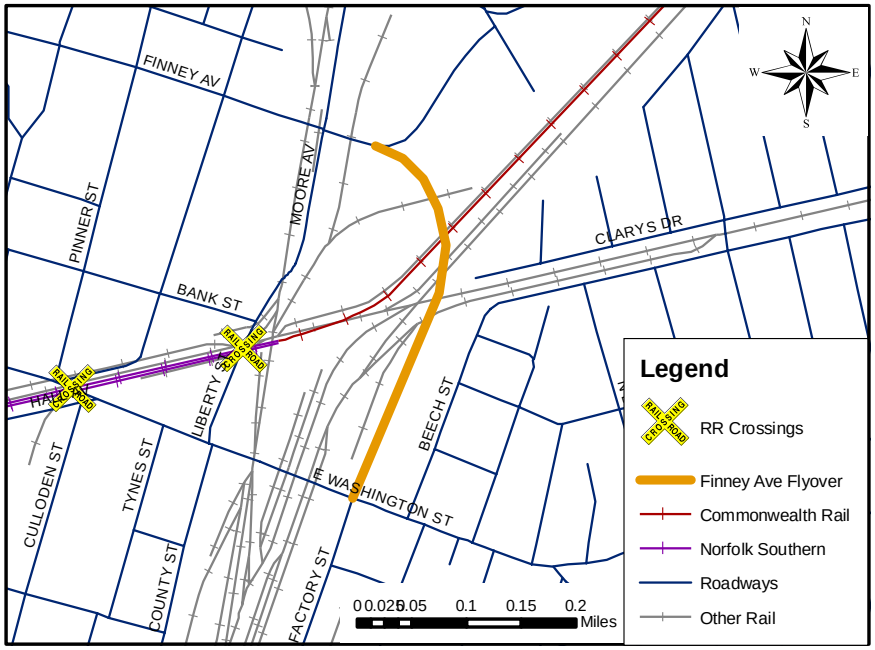
Source: MUTCD, 2003 Ed.

Figure 6: Four-Quadrant Gates – Acute Angle

While the Finney Avenue flyover will reduce the challenges to mobility at E Washington Street, there remains important safety concerns at this crossing. There were more accidents recorded at this location than at any other crossing in the study between 1996 and 2006.

[17] Highway/Rail Grade Crossing Technical Working Group (TWG), Guidance on Traffic Control at Highway-Rail Grade Crossings, Federal Highway Administration, November, 2002

Map 10: Finney Avenue Flyover Location



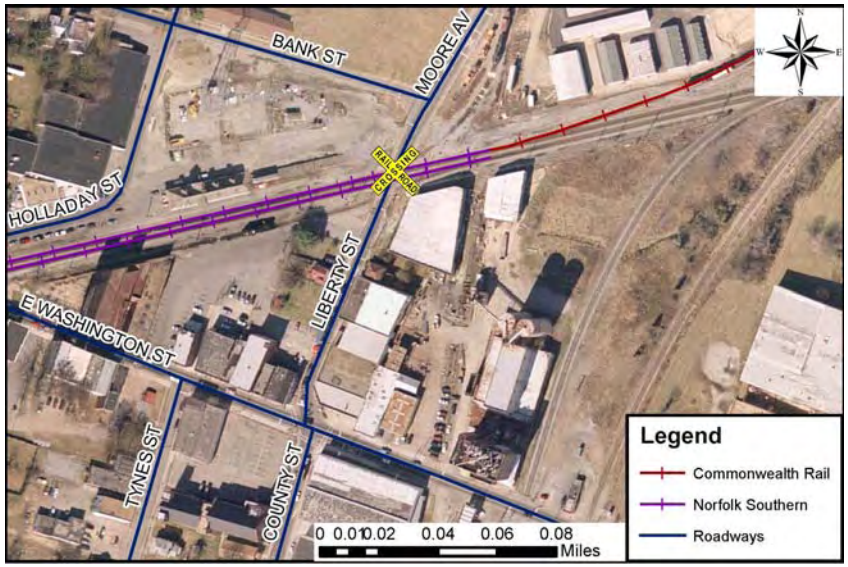
According to FRA accident reports, these accidents occurred when vehicles stopped on the tracks or drove around the gates. To address stopped vehicles, signing instructing drivers not to stop on the tracks can be installed in the near term and, if deemed necessary upon further study, traffic signals can be installed to ensure the tracks are cleared for approaching trains. Four-quadrant crossing gates can be installed in conjunction with medians to prevent motorists from driving around gates and attempting to "beat" an oncoming train. Figure 6 illustrates a configuration of four-quadrant gates and medians for a crossing with similar geometry to E Washington Street.

LIBERTY STREET (CROSSING NO. 14)

Liberty Street is the second highest mobility priority and the sixth highest safety priority in this study. Like E Washington Street, it crosses Norfolk Southern's tracks, which already have significant levels of train traffic. In fact, the existing levels of vehicular and train traffic create enough delay daily to meet FRA's threshold to consider grade-separation[18]. Also like E Washington Street, the conditions near this crossing would make grade-separation difficult. Bank Street intersects Liberty Street approximately 200 feet north of the rail crossing. There are buildings very close to the roadway roughly 200 feet south of the crossing.

The distance to the Bank Street intersection is much too short for an overpass of the railroad. The roadway would have to be elevated to allow trains double-stacked with containers, requiring vertical clearance of 21 feet, and an additional five feet for the structure of the bridge. Assuming a five percent grade on the roadway, this means that an overpass of the railroad would require at least 550 feet on either side of the tracks. An underpass of the railroad would require less clear distance from the crossing, but it would need more than the

Map 11: Liberty Street Crossing (No. 14)



[18] TWG, Guidance on Traffic Control at Highway-Grade Crossings

distance available. The height of roadway clearance is much less than that for trains, requiring only 14 feet. Additional clearance to allow for the depth of the bridge structure would be the same as for an overpass. With a roadway slope of five percent, an underpass would require at least 400 feet on either side of the tracks. The Finney Avenue flyover in conjunction with a variable message sign system would help reduce the mobility concerns at this crossing as well as at E Washington Street.

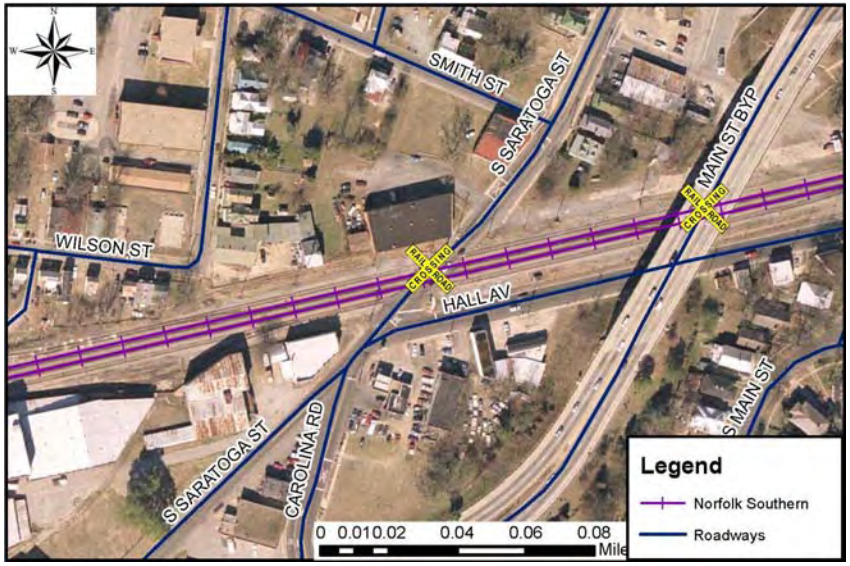
Liberty Street

The safety concerns at this crossing relate to its accident history and potential for future accidents as measured by the hazard index. FRA's accident reports indicate that both accidents occurring during the ten years considered were due to vehicles stopped on the tracks. There are no obvious indications why vehicles would stop at this location. Because Bank Street is stop-controlled, it is unlikely that traffic would back up from that intersection. Installation of signing instructing vehicles not to stop on the tracks may help raise drivers' awareness of the crossing. Additionally, moving the flashing lights from the roadside to an overhead structure will also make motorists more aware of the crossing.

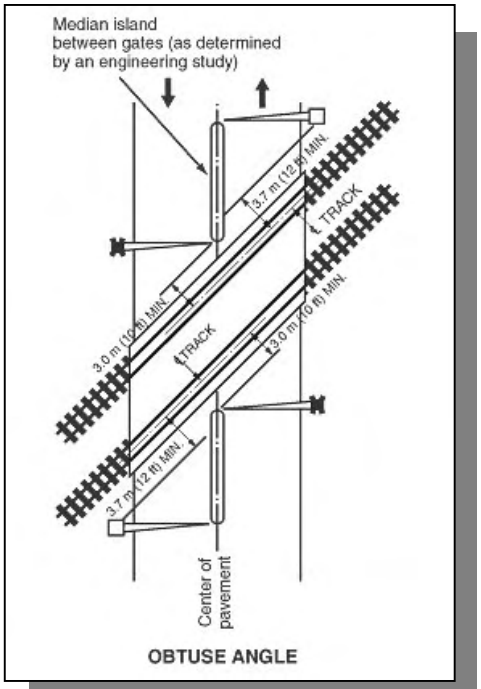
S SARATOGA STREET

S Saratoga Street is the third highest mobility priority and the eighth highest safety priority. This street, like Liberty Street and E Washington Street, crosses Norfolk Southern's tracks and experiences high enough levels of train traffic today to warrant consideration of grade-separation[19]. Also like the two previously discussed crossings, the location of the S Saratoga Street crossing realistically eliminates this possibility. Hall Avenue and Caroline Avenue intersect S Saratoga Street less than 100 feet south of the crossing and Smith Street intersects S Saratoga Street 200 feet north of the rail crossing.

Map 12: S Saratoga Street Crossing



[19] TWG, Guidance on Traffic Control at Highway-Grade Crossings



Source: MUTCD, 2003 Ed.

Figure 7: Four-Quadrant Gates – Obtuse Angle

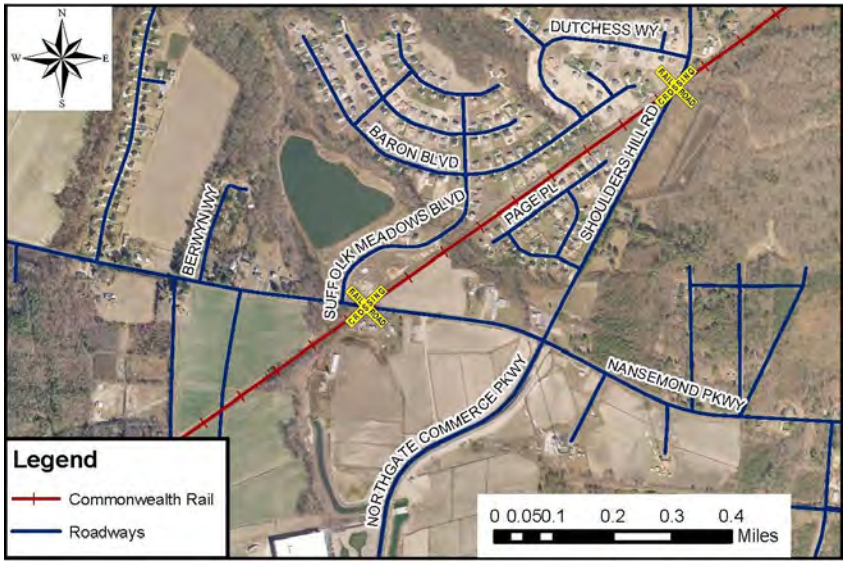
Fortunately, S Saratoga Street is one block away from the Main Street Bypass, which overpasses the railroad, and has convenient connections to the bypass. Mobility at this crossing would benefit greatly from a variable message sign system giving advance warning of an impending train crossing and directing motorists to use the bypass.

The single accident recorded in the ten years examined occurred when a driver drove around the crossing gates. The railroad tracks cross S Saratoga Street at an obtuse angle, which makes it easier for drivers to circumvent the crossing gates. Four-quadrant gates combined with median islands (see right) that effectively block the entire crossing could be installed to prevent this behavior.

NANSEMOND PARKWAY 1

The Nansemond Parkway 1 rail crossing, located near Shoulders Hill Road, is the second highest safety priority and the fourth highest mobility priority. Nansemond Parkway is crossed by Commonwealth Railway tracks, which will experience significant growth above existing train traffic from the operation of the new port facilities. Nansemond Parkway is an important corridor through Suffolk with high levels of vehicular traffic. A project to widen it from two to four lanes is the City's highest priority roadway project. In 2007 and 2017, vehicles at this crossing are expected to experience high enough levels of delay to justify consideration of grade separation[20]. The delay drops in 2010 due to the Median Rail project, but the increase in rail traffic from the Craney Island Terminal in 2017 pushes the delay well above the forty-hour mark.

Map 13: Nansemond Parkway 1 Crossing



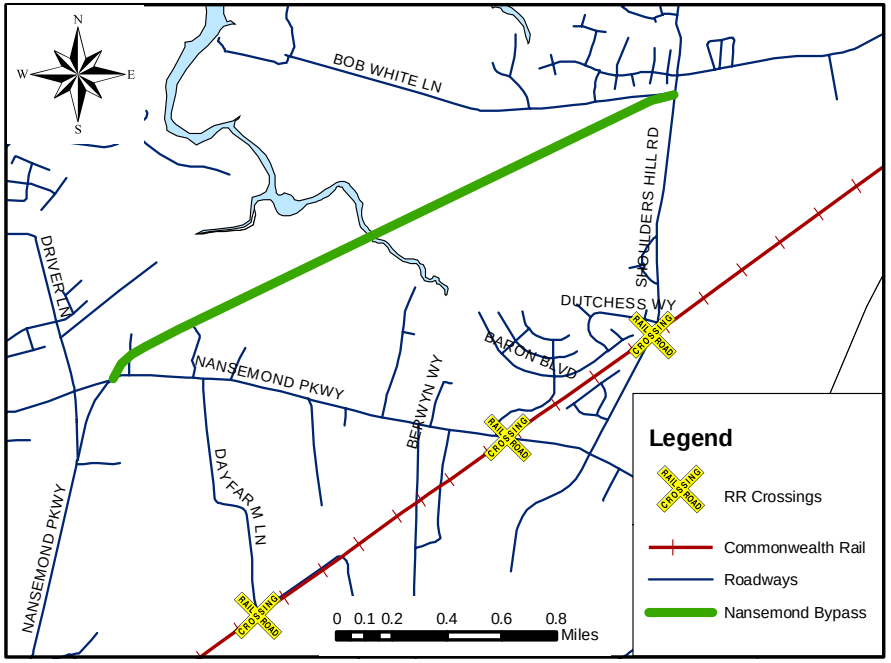
[20] TWG, Guidance on Traffic Control at Highway-Grade Crossings


Nansemond Parkway 1

There is one private driveway 200 feet east of this crossing and the intersection of Nansemond Parkway and the main entrance to a residential neighborhood, Suffolk Meadows Boulevard, is about 200 feet west of the rail crossing. This neighborhood has another entrance off of Shoulders Hill Road, although that entrance is located very close to the Shoulders Hill Road rail crossing. It would not be possible to relocate the intersection of Suffolk Meadows Boulevard far enough west to allow a grade-separated crossing without the acquisition of several residences. It would be possible, although probably unpopular, to simply dead-end this entrance. The private entrance east of the crossing also poses an obstacle to grade separation. It is impossible to determine without further engineering study whether it is feasible to relocate the entrance or whether property acquisition would be necessary.

An underpass of the railroad tracks would have fewer property impacts than an overpass, but there are several considerations that must be examined. The depth of the water table is a very important issue because low roadway crossings can be flood-prone. Nansemond Parkway is an arterial corridor with economic significance and would not be well served by removing closures due to trains and creating closures due to flooding. Further study of the advantages and disadvantages of grade-separation at this location is recommended. Another option to help alleviate some of the disruption to traffic and emergency services would be to construct an alternative route that would avoid the rail crossing. There is a possibility to build such a roadway connecting Shoulders Hill Road (north of its crossing of Commonwealth Railway) to Nansemond Parkway near the village of Driver. This route follows a discontinued railroad alignment where the City is currently planning a recreational trail. This route would not prevent through traffic on Nansemond Parkway from being delayed by crossing trains, but would help motorists traveling on Nansemond

Map 14: Nansemond Parkway Bypass Location



Parkway to or from Shoulders Hill Road. This detour connects to Nansemond Parkway approximately one mile west of the railroad crossing and to Shoulders Hill Road nearly a mile north of its rail crossing and would, therefore, work most effectively in combination with a train monitoring system and variable message signs to alert motorists to the presence of a train early enough that they may use the detour.

There is no recent history of accidents at this crossing. The crossing gates at this location appear to be effective at separating railroad and roadway traffic. Due to the large increase of train traffic over the existing condition, monitoring of motorist compliance with warning gates is recommended. This crossing is at an acute angle and if it is observed that vehicles are bypassing the gates, long-arm gates that block seventy-five percent of the roadway or four-quadrant gates should be installed to prevent that behavior.

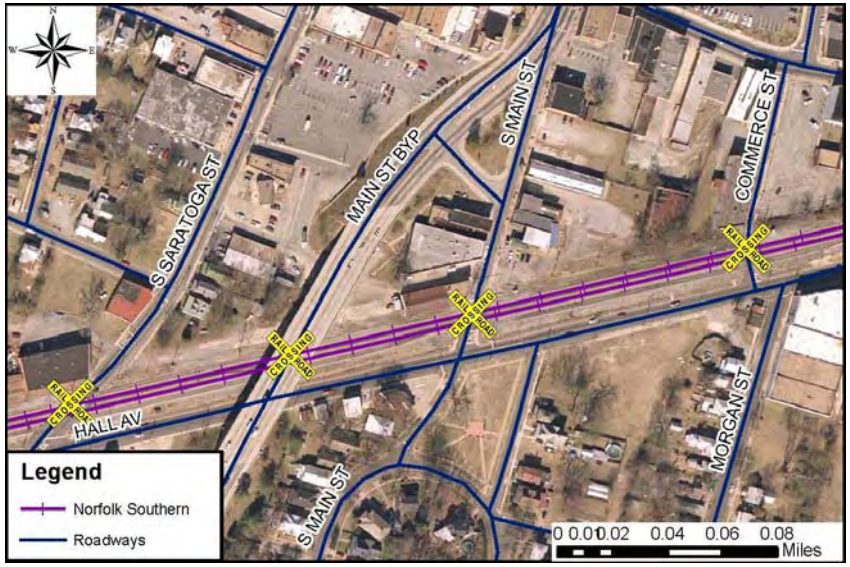
S MAIN STREET

S Main Street is the fifth highest mobility priority, but is not among the top safety priorities. This crossing of Norfolk Southern's tracks has more than sufficient traffic to consider grade-separation based on daily hours of vehicle delay[21]. Hall Avenue intersects S Main Street about 50 feet south of the crossing and there are several buildings located very close to S Main Street just north of the crossing. It is located one block east of the Main Street Bypass and has convenient connections to that grade-separated crossing. This crossing is not a good candidate for grade-separation due to the adjacent buildings, the Hall Avenue intersection, and proximity to the Main Street Bypass.

S Main Street

Mobility at this crossing would benefit greatly from implementation of a rail monitoring system and variable message sign system giving advance warning of an impending train crossing and directing motorists to the bypass.

Map 15: S Main Street Crossing

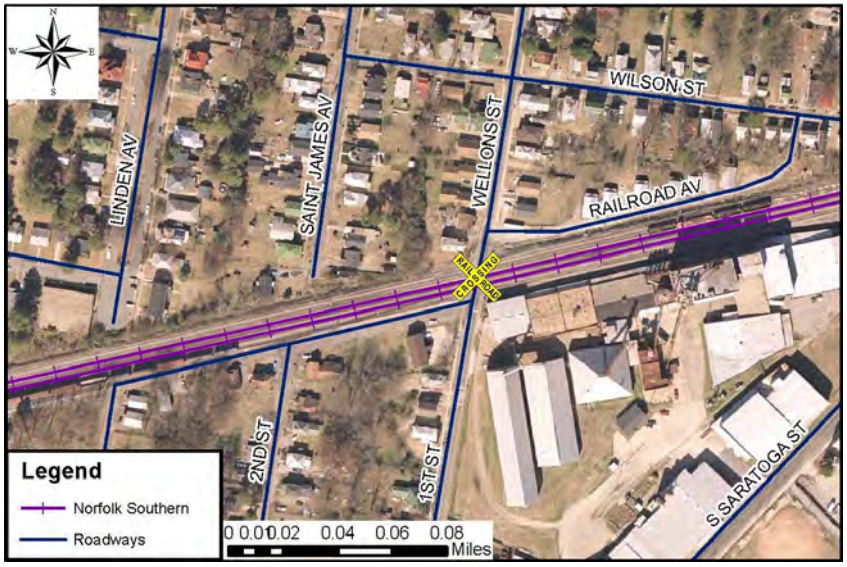


[21] TWG, Guidance on Traffic Control at Highway-Grade Crossings

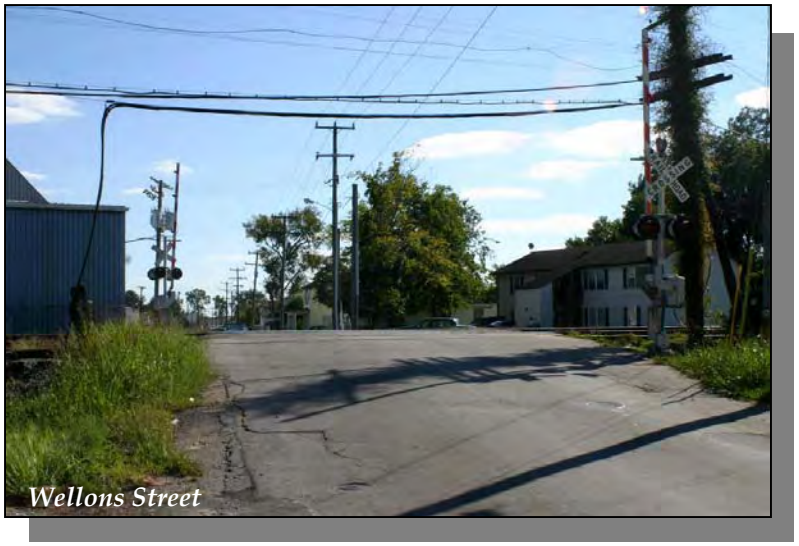
WELLONS STREET

The Wellons Street crossing is ranked as the sixth highest mobility priority and the ninth highest safety priority. Like other crossings of Norfolk Southern, Wellons Street experiences more than forty hours of vehicle delay daily in the existing condition, justifying consideration of grade separation[22]. However, also like other crossings of Norfolk Southern, the area surrounding the crossing would make that difficult. There are residences and industry located immediately adjacent to the

Map 16: Wellons Street Crossing



crossing. The industrial buildings located adjacent to the crossing are part of a much larger complex that would probably be prohibitively expensive to acquire. Fortunately, this crossing is located about a half a mile from the Main Street Bypass and has convenient connections to that grade-separated crossing. The use of a rail monitoring system in


Wellons Street

conjunction with a variable message sign system would significantly improve mobility at this crossing.

This crossing is also a safety priority. Wellons Street had two accidents recorded between 1996 and 2006; these were attributed to motorists stopping on the tracks. A visibility problem could be contributing to accidents at this crossing. The industrial building at the southeast corner of the crossing is close enough to the railroad tracks that it may block motorists' views of approaching trains. Additional advanced warning signs could reduce the likelihood of future incidents. A variable message sign system would reduce this issue as well, by providing additional, eye-catching advanced warning. Installation of long-arm gates would reduce the possibility of vehicles circumventing the shorter gates at this angled crossing.

N MAIN STREET

The at-grade crossing of N Main Street and CSX is the seventh highest mobility priority and the tenth highest safety priority. This crossing is

[22] TWG, Guidance on Traffic Control at Highway-Grade Crossings

located about 100 feet from the historic Suffolk Seaboard Station Railroad Museum, Market Park, and trailhead of a recreational path. The crossing is also approximately fifty feet south of the intersection of N Main Street and Prentis Street, and 300 feet north of the intersection

Map 17: N Main Street Crossing

of N Main Street and College Court. While there were no accidents in the ten years considered, this crossing experiences significant vehicular traffic and pedestrian traffic. Significant vehicle delay of forty hours per day or more is expected once the APM Terminal facility opens later this year, which justifies consideration of grade separation[23].

The surrounding area poses considerable challenges to the possibility of grade-separation. Pinner Street to the east and N Broad Street to the west are both grade-separated. Unfortunately, neither of these is a particularly convenient alternative for drivers. An engineering study could be conducted to determine whether building a connection

N Main Street

between Pinner Street and Prentis Street in the vicinity of the existing recreational trail would be a feasible method of improving mobility at this crossing.

Safety considerations at this crossing are complicated by the presence of pedestrian traffic. This crossing is located near residences, Market Park, where a farmers market operates weekly, and recreational opportunities. Currently this crossing has standard crossing gates for the roadway. Due to the large increase in rail traffic, it is recommended that the standard gates be replaced with long-arm gates to discourage drivers from bypassing the gates in an attempt to "beat" an oncoming train. In addition, it is recommended that pedestrian gates be installed to deter pedestrians from crossing in front of trains. Providing benches on either side of the crossing would also discourage this behavior by providing a comfortable place to wait for the train to pass.

[23] TWG, Guidance on Traffic Control at Highway-Grade Crossings

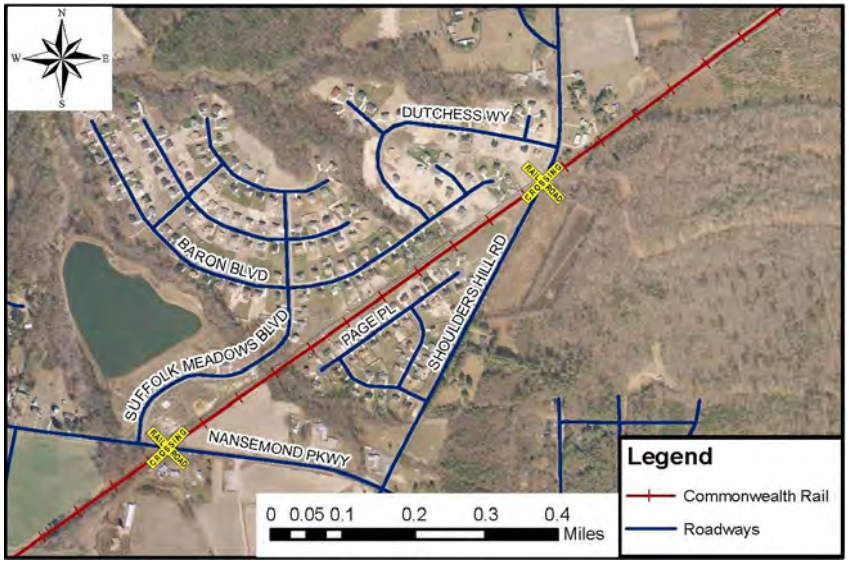
SHOULDERS HILL ROAD

The Shoulders Hill Road at-grade crossing is the third highest safety priority and the eighth highest mobility priority. Shoulders Hill Road crosses Commonwealth Railway at an obtuse angle approximately 200 feet south of its intersection with Dutchess Way. By 2017, the year Craney Island Terminal opens, there will be enough daily vehicular delay to consider grade-separation[24]. While there are no obvious constraints south of the rail crossing, the proximity of the Dutchess Way intersection north of the crossing poses a serious obstacle to grade-separation.

Shoulders Hill Road

As discussed for the Nansemond Parkway 1 crossing, there is a possible detour route connecting Shoulders Hill Road to Nansemond Parkway near the village of Driver. This route would follow a discontinued railroad alignment where the City is currently planning a recreational trail. This route would not prevent traffic on Shoulders Hill Road planning to travel east on Nansemond Parkway or south on Northgate Commerce Parkway from being delayed by crossing trains, but would help motorists traveling on Shoulders Hill Road heading to or from the west on Nansemond Parkway. This detour would connect to Shoulders Hill Road nearly a mile north of the rail crossing to Nansemond Parkway approximately one mile west of its crossing. It would, therefore, work most effectively in combination with a rail monitoring system and variable message signs to alert motorists to the presence of a train early enough that they may use the detour. A map of this detour is shown in the Nansemond Parkway 1 section (page 39).

Map 18: Shoulders Hill Road Crossing



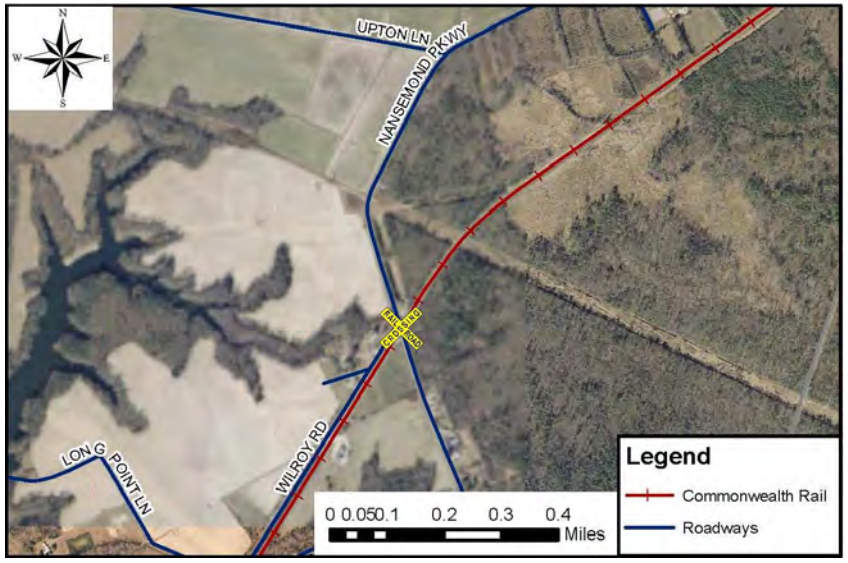
While this crossing does not have a recent history of accidents, the current traffic on Commonwealth Railway is infrequent and slow moving. Once the APM Terminal is opened and the Median Rail project is completed, the potential for an incident will be much greater. It is recommended that the standard crossing gates be replaced with four-quadrant gates and raised median islands to prevent vehicles from driving around the gates, as shown in figure 7 (page 38).

[24] TWG, Guidance on Traffic Control at Highway-Grade Crossings

NANSEMOND PARKWAY 2 (WILROY)

The Nansemond Parkway 2 crossing of Commonwealth Railway is the fourth highest safety priority and the ninth highest mobility priority. This crossing, like Nansemond Parkway 1, will have enough combined vehicular and rail traffic in 2007, following the opening of the APM Terminal, and 2017 to warrant consideration of grade-separation[25]. Wilroy Road intersects Nansemond Parkway only 25 feet from the crossing, making grade separation problematic. The traffic volume on Nansemond Parkway drops significantly south of Wilroy Road because the majority of traffic north of the crossing on Nansemond Parkway turns right onto Wilroy Road; that traffic is unaffected by the railroad crossing. Because the surrounding area is largely undeveloped, it may be possible to configure an overpass of both the railroad crossing and Wilroy Road. Ramps could be constructed to provide access to/from Wilroy Road.

Map 19: Nansemond Parkway 2 (Wilroy) Crossing



Nansemond Parkway 2 (Wilroy)

There is no opportunity to provide drivers with an alternate route once they are northbound on Nansemond Parkway, so while the rail monitoring system would be helpful to emergency responders, it would do little to help motorists avoid delays.

Due to the significant increase in rail traffic on Commonwealth Railway, drivers will have to wait far longer for trains to pass once the new port facilities open and may be tempted to avoid the crossing gates. One of the gates at this crossing is already the long-arm type and it is recommended that the other gate be replaced with a long-arm gate as well.

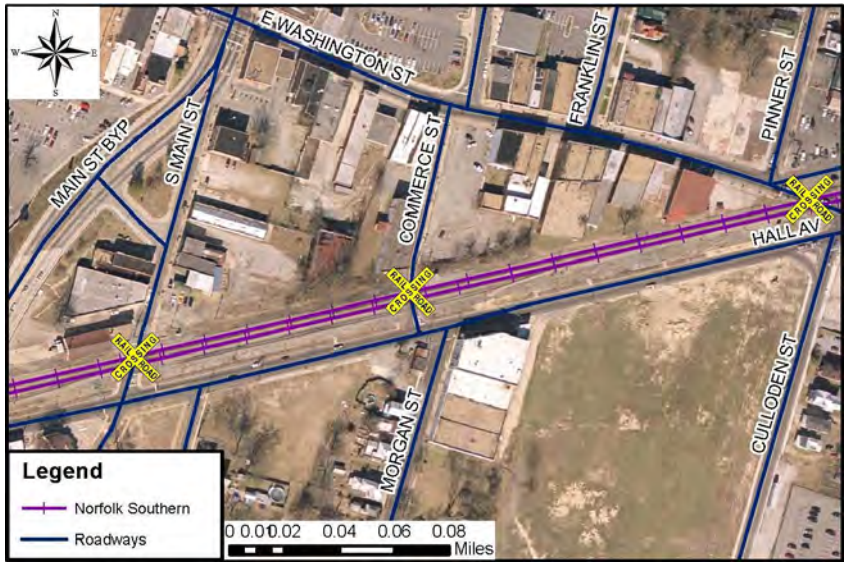
COMMERCE STREET

Commerce Street is the tenth highest mobility priority. Like the other mobility priority crossings of Norfolk Southern, motorists on Commerce Street currently experience more than forty hours of daily

[25] TWG, Guidance on Traffic Control at Highway-Grade Crossings


Commerce Street

Map 20: Commerce Street Crossing



vehicle delay, which is the threshold to consider grade separation[26]. Hall Avenue intersects Commerce Street approximately 50 feet south of the crossing, a commercial building is located very close to Commerce Street just north of the crossing, and the crossing is two blocks from the Main Street Bypass.

The location of Hall Avenue, an adjacent building, and its proximity to the Main Street Bypass cause Commerce Street to be a poor candidate for grade separation. Because this crossing is only two blocks from the Main Street Bypass, traffic could easily be diverted using variable message signs activated by a rail monitoring system to reduce delay at this crossing.

LIBERTY STREET/MOORE AVENUE (CROSSING NO. 40)

The Liberty Street/Moore Avenue crossing is the fifth highest safety priority. This crossing of CSX tracks is located about 200 feet south of


Liberty Street/Moore Avenue

[26]TWG, Guidance on Traffic Control at Highway-Grade Crossings

the Moore Avenue/Pinner Street intersection and approximately 100 feet north of the entrance to the Producers Peanut Company site. A large complex of warehouses, Commonwealth Storage Buildings, is also located about 200 feet south of the crossing.

This crossing does not experience enough combined vehicular and rail traffic to consider grade separation[27]. There were four accidents at this location, one with injuries, recorded in the period between 1996 and 2006. A likely contributing factor is the absence of crossing gates at this location. It is recommended that long-arm crossing gates be installed at this location to protect vehicles from passing trains. The installation of variable message signs used with a rail monitoring system would alert drivers to the presence of a train and allow them to use Pinner Street, which is grade-separated. This would improve safety by diverting them to a crossing with no potential for conflict with train traffic.

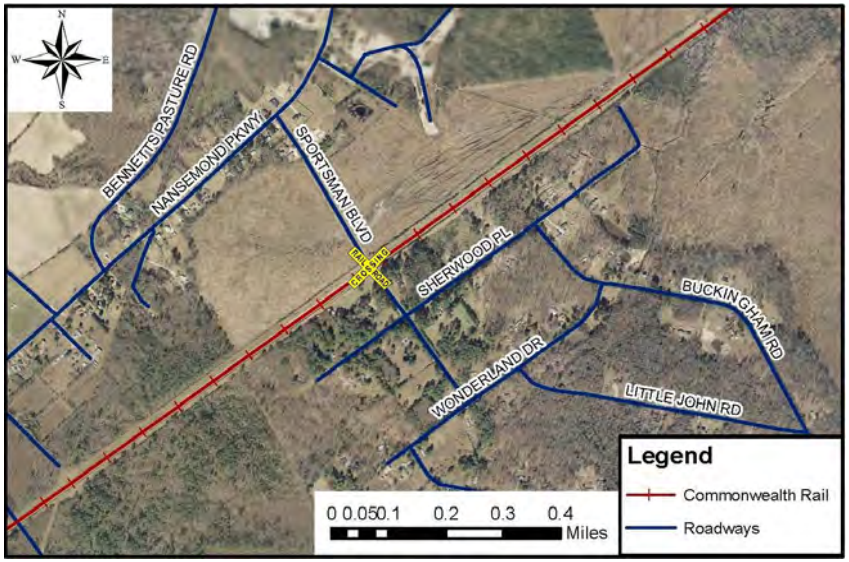
Map 21: Liberty Street/Moore Avenue Crossing (No. 40)

[27] TWG, Guidance on Traffic Control at Highway-Grade Crossings

SPORTSMAN BOULEVARD

Sportsman Boulevard is the seventh highest safety priority and the sole access point for the Wonderland Forest residential neighborhood. This crossing of Commonwealth Railway is adjacent to the marshalling yard currently under construction (see map page 7). There are driveways for two residences about 200 feet south of the rail crossing and undeveloped land north of the crossing.

Map 22: Sportsman Boulevard Crossing



There are two primary safety concerns at this highway-rail crossing. While there were no accidents recorded at this crossing in the time period examined, it remains a concern that this crossing does not have gates to separate roadway traffic from rail traffic. Considering the large increase in length and number of trains that will cross this roadway, the installation of long-arm crossing gates is recommended for protection of roadway traffic.

Additionally, there is an emergency services access issue at this crossing because Sportsman Boulevard is the only entrance into the Wonderland Forest neighborhood. A rail monitoring system would not alleviate this problem because no alternate route can be used. This neighborhood is in an isolated location and a new roadway connection would need to be more than a mile long to avoid another highway-rail crossing. Because of the residential driveways just south of the crossing, it would be difficult to grade-separate this crossing. The lot sizes of those two residences are large enough that it might be possible to relocate them far enough south that an underpass of the railroad would be possible. There are other factors to consider with an underpass, including depth of the water table, which would need to be considered in an engineering study before a conclusion can be reached.

Sportsman Boulevard

SUMMARY

Railroad traffic through the City of Suffolk will increase dramatically due to regional growth as well as the construction of the new APM and Craney Island Terminals. These new port facilities will have important positive economic effects for Hampton Roads and surrounding regions, but safety and mobility in Suffolk will be negatively impacted. Four mobility performance measures and three safety performance measures were used to evaluate the severity of those impacts. Based on that analysis, ten mobility and ten safety priority crossings were identified. Eight priority crossings appeared on both the mobility and safety lists, resulting in further assessment of a total of twelve crossings.

Each priority crossing was evaluated based on its unique characteristics and options for improvement were identified to address the particular challenges at each location. These options included near-term, intermediate-term, and long-term solutions. Many of the safety improvements recommended lend themselves to quick implementation, such as installation of gates and signing which can be completed quickly and with relatively little cost. Most of the mobility improvements recommended require extensive planning and design with potentially high right-of-way and construction costs, which cause them to be long-term solutions.

Citywide solutions were also considered to alleviate safety and mobility issues. City coordination with the railroads and ports to schedule as many trains at off-peak travel times could dramatically reduce the effects of increased rail traffic. A Doppler radar based rail monitoring system to track the presence, location, and speeds of trains is also recommended to assist emergency responders. This system can be expanded to activate variable message signs (VMS) alerting motorists to blocked crossings and suggesting alternate routes.

The study recommendations and planning-level costs are provided below for informational purposes. Decisions to implement any recommendations will be made by the City of Suffolk based on further study and the availability of funding.

Table 17 - Summary Table

ID No.	Crossing	Priority Type	Near-Term Options		Intermediate-Term Options		Long-Term Options	
			Possible Solution	Planning Cost*	Possible Solution	Planning Cost*	Possible Solution	Planning Cost*
13	E Washington Street	Mobility & Safety	Four-quadrant gates w/ medians & signing	$170,000	Rail Monitoring System w/ VMS	$3 million	Finney Avenue Flyover	$30 million
14	Liberty Street	Mobility & Safety	Signing & overhead lights	$130,000	Rail Monitoring System w/ VMS	$3 million	Finney Avenue Flyover	$30 million
9	S Saratoga Street	Mobility & Safety	Four-quadrant gates w/ medians	$170,000	Rail Monitoring System w/ VMS	$3 million		
28	Nansemond Parkway 1	Mobility & Safety	Long-arm gates	$130,000	Rail Monitoring System w/ VMS	$3 million	Bypass Road or Underpass	$20 million $50 million
11	S Main Street	Mobility			Rail Monitoring System w/ VMS	$3 million		
8	Wellons Street	Mobility & Safety	Signing & long-arm gates	$135,000	Rail Monitoring System w/ VMS	$3 million		
38	N Main Street	Mobility & Safety	Long-arm gates, pedestrian gates, & benches	$200,000	Rail Monitoring System w/ VMS	$3 million	Connection to Pinner Street	$15 million
29	Shoulders Hill Road	Mobility & Safety	Four-quadrant gates w/ medians	$170,000	Rail Monitoring System w/ VMS	$3 million	Bypass Road	$20 million
25	Nansemond Parkway 2 (Wilroy)	Mobility & Safety	Long-arm gate (1)	$70,000	Rail Monitoring System w/ VMS	$3 million	Overpass	$60 million
12	Commerce Street	Mobility			Rail Monitoring System w/ VMS	$3 million		
40	Liberty Street/Moore Ave	Safety	Long-arm gates	$130,000	Rail Monitoring System w/ VMS	$3 million		
26	Sportsman Boulevard	Safety	Long-arm gates	$130,000	Rail Monitoring System w/ VMS	$3 million	Underpass	$35 million

* Planning costs shown for each crossing represent the cost to implement the entire solution and not the share of the project related to each crossing.

Prepared by: Hampton Roads Planning District Commission