RICHMOND/ TRI-CITIES

Regional Intermodal Strategies Study

Prepared for:
Richmond Area Metropolitan Planning Organization

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May 13, 2010

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Acknowledgement

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SUMMARY

S.1 Purpose and Scope

The initial purpose for this study was the identification of infrastructural concerns and policies which hindered the efficient movement of goods throughout the region. As the study progressed towards identifying infrastructure concerns, the need to place equal effort on policy-oriented strategies became apparent. These included not only more defined issues such as designation of access routes for the ease of movement between modes, but also discussions of the driving forces behind the "why" of modal operations.

The benefits of exploring both infrastructure and policy strategies, in equal levels of effort, provide the MPOs with a foundation from which to build a relationship with the private sector, and the private sector a reciprocal rapport with the public sector. These affiliations can promote greater understanding and more productive exchanges towards the establishment of better practices in freight transportation planning within the region.

S.2 Freight in the Study Area

Freight movement in the Richmond and Tri-Cities regions utilizes a variety of modes, and several modes have multiple routes available to them. The identification of a critical freight system that accommodates the major freight flows is beneficial to identifying key corridors and prioritizing scarce financial resources to the greatest value possible. Designating such a system requires an understanding of the flows that make up the goods movement environment.

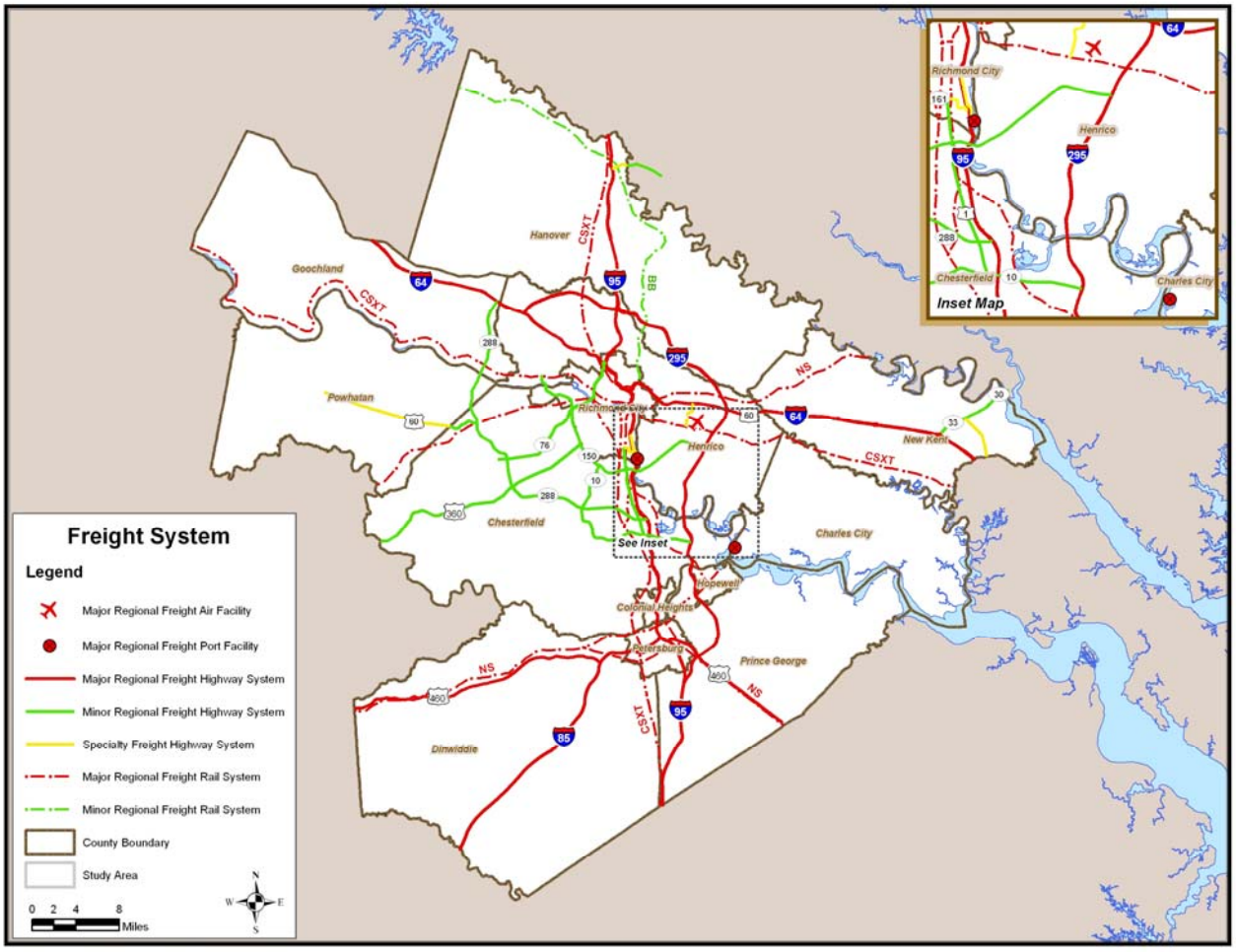
In 2004, 292 million tons of freight, valued at $712 billion, was transported in, out, within, and through the Richmond and Tri-Cities regions. Though current events influence trends, based on the 2004 baseline, 2035 will experience an increase to 656 million tons, valued at $3.5 trillion. Motor carriers are estimated to handle 67% of that total tonnage, rail transporting 26%, water just under 7% and air less than one 1%.

Identification of a freight network based on freight tons allows planners to prioritize and focus transportation investments that benefit freight movements. The system includes routes most heavily utilized (designated as Major Regional or Minor Regional), and then those segments not providing general access, but traveled to a great extent by trucks to access a particular area (designated as Specialty Connectors). The final freight network is multimodal, including rail, air, and water components as well, as reflected in **Table S-1 and Figure S-1.**

Table S-1 Richmond and Tri-Cities Regional Multimodal Freight Network

Network	Mode	Facility	From	To
Major Regional	Highway	I-64	Fluvanna County Line	James City County Line
		I-95	Caroline County Line	Sussex County Line
		I-85	Brunswick County Line	I-95 Interchange in City of Petersburg
		I-295	I-95 Interchange in Prince George County	I-64 Interchange in Henrico County
		US 460	Nottoway County Line	Sussex County Line
	Rail	CSX		
		Norfolk-Southern		
	Air	Richmond International Airport		
	Water	Port of Richmond		
		Port of Hopewell		
Minor Regional	Highway	SR 288	I-64 Interchange in Goochland County	I-95 Interchange in Chesterfield County
		SR 10	SR 150 Interchange in Chesterfield County	I-295 Interchange in Chesterfield County
		SR 76	SR 288 Interchange in Chesterfield County	I-195 Interchange in City of Richmond
		SR 150	I-95 Interchange in Chesterfield County	River Road in Henrico County
		US 360	Amelia County Line	SR 150 Interchange in Chesterfield County
		US 1/US 301	SR 288 Interchange in Chesterfield County	Chamberlayne Avenue in the City of Richmond
	Rail	Buckingham Branch RR		
	Water	E.I. DuPont Drewery's Bluff		
		Kinder Morgan Energy Partners		
		Plantation Pipeline Company		
		Vulcan Materials		
		IMTT Richmond		
		Flint Hills Resources		
		Simsmetal America		
Specialty Connectors	Highway	US 60	SR 300 Scottsville Road	Chesterfield County Line
		SR 161	I-95	US 1/US 301, Jefferson Davis Highway
		SR 30	US 1, Washington Highway	Caroline County Line
		SR 30	King William County Line	James City County Line
		Deepwater Terminal Road	Connector Road	I-95
		Airport Drive	Airport Entrance	I-64

Figure S-1 Richmond and Tri-Cities Regional Multimodal Freight Network (Map)



S.3 Local Freight-related Concerns

Data analysis is two dimensional by nature and requires another input to provide the "whys" of modal selection. Stakeholder engagement was initially approached with an online survey for those engaged in the shipping, receiving, or actual transport of goods on the freight network. This was broadened to include in-person interviews. As the study expanded with the inclusion of greater emphasis on policy-related strategies, members of both the public and private sectors were encouraged to participate in a facilitated Freight Forum meeting to collectively discuss those issues and concerns prominent within the freight community.

S.4 Potential Policy and Infrastructure Actions

Multimodal corridors designated as part of the freight transportation system did not exclude the need for future improvements. A number of future design recommendations have been presented to offer strategies to accommodate current and future truck traffic.

Design and policy actions focused on:

- Roundabout Design: This discussion provided construction techniques to accommodate trucks more effectively. These centered on truck aprons, traversable islands, decision sight distance, and education documentation.

- Signage Practices: Sign placement is outlined by the Manual for Uniform Traffic Control Devices (MUTCD). Potential interpretation may not address needs of trucks.

- Access Management Practices: Though all jurisdictions provide for access management, a common, regional approach may produce more recognizable standards for trucks.

- Truck Route Plan: Development of a designated regionally oriented truck route plan provides not only for a managed roadway plan for truck drivers, but also the ability to approach funding a roadway maintenance more effectively.

- General Road Design: AASHTO does not specify truck-related design criteria. However, AASHTO recommends a collection of build standards that favor truck flows and these should be adopted on designated truck routes.

- Non-public Sector Engagement: To develop and sustain a plan that may be adopted and maintained by all members of the freight community, it is essential to engage members of the private sector and communities.

- Future Land Use Associated Policies: Incorporation of land use management as part of the freight planning process enables the jurisdiction to address access and flow issues.

- Revenue Capture Strategies for Through Truck Traffic: Through truck movement generates little revenue for the jurisdiction responsible for the continued maintenance of these roadways.

- Container-trailer on Barge Service (COB-TOB): Utilized extensively in the European supply chain model, may provide viable diversion to mitigate truck volumes on roadways between the coastal ports and the region.

- Requirement for Freight Transportation Plans during Development: Mandatory assessment and planning for freight access to and from a proposed commercial or industrial site can be beneficial to identify and mitigate future concerns and issues.

Infrastructural actions included eleven improvement projects at specific locations to address design or build concerns directly influencing truck flow. An additional five were those identifying at-grade rail crossing issues. There projects are summarized in **Table S-2**.

Table S-2 Summary of Improvement Projects

Accessibility	Roadway/Pavement Condition	Capacity Enhancements	Signage	Roadway Geometry	At-Grade Crossings
I-895/Bells Road	Deepwater Terminal Road from Bells Road to the access road just south of the weight station	Hull Street Exit from SR 288	SR 5 between Williamsburg Avenue and Water Street	Bells Road between Commerce Road and Jefferson Davis Highway	Leigh Street At-Grade rail Crossing
	Goodes Street between Commerce Road and CSX Railroad Tracks	Capacity Improvement at the Southern I-64/I-95 Interchange			Industrial Street Hopewell Double At-Grade Rail Crossing
	Commerce Road from Hull Street to Trenton Road				Deepwater Terminal Road At-Grade Rail Crossing
	I-895 Expansion Joints at James River Bridge				Brook Road At-Grade Rail Crossing
	I-95 through the City of Richmond (I-64 overlap section)				Ashland Avenue Hopewell At-Grade Rail Crossing
	I-64 from Parham Road to the junction with I-95 and I-195				

Chapter 1: STUDY CONTEXT

1.1 Historical Perspective

The movement of goods, in the modern sense, began in Virginia with the first utilization of waterways, both ocean routes and local rivers, to support the Jamestown colony. As population centers developed in the interior of the state, water continued to play an important role. The City of Richmond and its modern neighbors first prospered with the use of water-borne transport along the James River, which initiated the concept of multimodalism, first with combined service available from horse and wagon, and then from rail. This progression continued, leading to the current and diverse system of water, rail, truck, and air cargo. No longer reliant on a single mode and having the historical precedence of multimodal goods movement, the areas around Richmond and Petersburg have the benefit of serving the region as the transportation center.

As the United States has transitioned from a largely domestic economy to one of global reliance on international movement of goods and services, the inherent dominance of the Richmond and Petersburg region is now subject to pressures by neighboring locales and regions. "Business as usual" practices may no longer keep a region well-positioned to capitalize on the benefits of freight mobility. Public awareness, leadership and potential financial support, and the cooperation of the public and private sectors are avenues to strengthen the region's position.

1.2 Purpose and Scope

The initial purpose for this study was the identification of infrastructural and policies which hindered the efficient movement of goods throughout the region. With the progress toward increased private sector involvement, the purpose was modified to identify actions that would increase freight mobility options and opportunities within the region. The region is defined by those counties and independent cities within the Richmond and Tri-Cities Metropolitan Planning Organizations (MPOs), hereafter referred to as the Richmond Region.

As the study progressed towards identifying infrastructure concerns, the need to place equal effort on policy-oriented strategies became apparent. These included not only more defined issues such as designation of access routes for the ease of movement between modes, but also discussions of the driving forces behind the "why" of modal operations. The benefits of exploring both infrastructure and policy strategies, in equal levels of effort, provide the MPOs with a foundation from which to build a relationship with the private sector, and the private sector a reciprocal rapport with the public sector. These affiliations can promote greater understanding and more productive exchanges towards the establishment of better practices in freight transportation planning within the region.

1.3 Report Format

The remainder of the document provides a logical review of the effort, input, and strategies identified during the project. Where it is advantageous to the flow of the document, detailed evidence in the form of tables and charts is placed into appendices at the end of the report.

The organization of the report will be as follows:

- Chapter 1: Study Context – Overview of the purpose of the study;
- Chapter 2: Freight in the Study Area – Strategic view of freight movement and the freight transportation system in the region;
- Chapter 3: Local Freight-related Concerns – Stakeholder engagement and identified issues;
- Chapter 4: Potential Policy and Infrastructure Actions – Policy actions and infrastructural improvements; and
- Appendices – Specific detail data and illustrations.

Chapter 2: FREIGHT IN THE STUDY AREA

2.1 Overview

Freight movement in the Richmond region utilizes a variety of modes, and several modes have multiple routes available to them. The identification of a critical freight system that accommodates the major freight flows is beneficial to identifying key corridors and prioritizing scarce financial resources to the greatest value possible. Designating such a system requires an understanding of the flows that make up the goods movement environment.

2.2 Synopsis of Freight Volumes

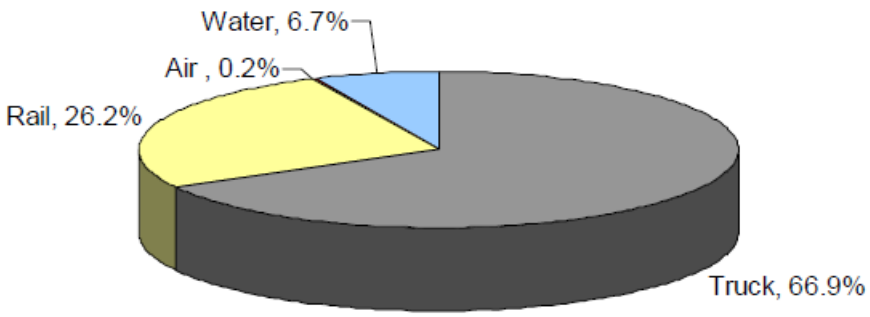
2.2.1 Source

Virginia Department of Transportation (VDOT) provides access for local MPOs to Global Insight's product database, TRANSSEARCH. This database allows accurate evaluation of goods movement by mode and by commodity type. The analysis classifies the commodity movements into four modes: motor carrier, rail, air, and water. The most recent available data is for 2004 and forecasts for 2035 were provided as well. Detailed findings are included in *Technical Memorandum #1: Existing Freight Logistics Profile*. Analysis presented in this chapter was based on this data source.

2.2.2 Findings

In 2004, 292 million tons of freight, valued at $712 billion, was transported in, out, within, and through the Richmond region. Motor carriers are estimated to handle 67% of that total tonnage, rail transporting 26% water just under 7% and air less than one 1%, as shown in **Figure 2-1**. Though current events influence trends, based on the 2004 baseline, 2035 will experience an increase to 656 million tons, valued at $3.5 trillion.

Figure 2-1 Richmond and Tri-Cities 2004 Tonnage by Mode



The four types of directional movement are:

- Inbound: Traffic traveling from a point outside of the region to a location within the region. This may be domestic or international in origin.
- Outbound: Traffic traveling from a point within the region to a location outside the region. Again, this may be moving domestically or internationally.
- Internal: a.k.a local, traffic moving from a point within the region to a location within the region.
- Through: Traffic moving from a point outside the region to a location outside the region, but traveling through the region itself.

The region is dominated by truck and, in all four modes, "through" movements, as reflected in **Table 2-1**. "Through" movements require specific strategies by a local body to mitigate the disproportionate burden of system use versus revenue generation.

Table 2-1 Richmond and Tri-Cities Tonnage of Freight by Mode and Direction

2004						
Mode	**Inbound**	**Outbound**	**Internal**	**Through**	**Total**	**Percent**
Truck	30,842,443	32,416,085	10,443,249	121,544,243	**195,246,020**	**66.9%**
Rail	8,198,650	3,484,433	100,808	64,667,457	**76,451,347**	**26.2%**
Air	33,408	25,875	-	410,274	**469,557**	**0.2%**
Water	528,479	2,185,034	38,762	16,892,055	**19,644,330**	**6.7%**
Total	**39,602,981**	**38,111,426**	**10,582,819**	**203,514,028**	**291,811,254**	
Percent	**13.6%**	**13.1%**	**3.6%**	**69.7%**		**100.0%**
2035						
Mode	**Inbound**	**Outbound**	**Internal**	**Through**	**Total**	**Percent**
Truck	73,011,888	72,207,929	22,361,127	271,756,613	**439,337,556**	**66.9%**
Rail	17,550,431	5,244,078	140,370	152,991,512	**175,926,392**	**26.8%**
Air	91,266	139,255	-	1,223,005	**1,453,527**	**0.2%**
Water	1,312,812	5,780,409	61,570	32,616,837	**39,771,628**	**6.1%**
Total	**91,966,397**	**83,371,671**	**22,563,068**	**458,587,967**	**656,489,103**	
Percent	**14.0%**	**12.7%**	**3.4%**	**69.9%**		**100.0%**

Through trucks carry approximately 62% of tonnage moved by trucks, and make heavy use of the interstate system within the region, specifically I-64, I-85, and I-95. This through truck traffic adds to congestion and offers little economic benefit for local businesses. This condition may warrant investigation of introduction or expansion of container-trailer on barge (COB-TOB) operations.

An appreciation of the commodities handled assists in planning for possible future shifts in modal selection. **Table 2-2** identifies leading commodities by the direction or type of movement. Presented as a function of dollar value (**Table 2-3**) as opposed to tonnage, the top 10 commodities change slightly.

Table 2-2 Top Commodities by Direction by Tonnage

Commodity	2004 Tons				2035 Tons			
	Inbound	Outbound	Internal	Through	Inbound	Outbound	Internal	Through
Secondary Traffic	7,026,408	6,122,077	789,080	18,899,537	27,456,725	23,555,752	3,382,012	72,852,159
Coal	5,964,177			33,260,488	12,794,143			85,414,572
Nonmetallic Minerals	4,137,157	14,616,026	7,636,741		8,758,468	22,894,737	14,214,994	
Chemicals Or Allied Products	3,986,033	3,438,398	182,509	18,267,791	6,837,821	4,505,051	343,963	25,474,298
Clay, Concrete,Glass Or Stone	2,994,824	1,849,440	739,320	9,384,352	5,896,468	7,194,958	2,803,457	20,991,075
Lumber Or Wood Products	2,635,642	1,738,601	86,782	14,752,680	3,841,646	2,381,102	93,442	21,615,902
Petroleum Or Coal Products	2,542,055			8,114,394	4,727,294			16,126,760
Food Or Kindred Products	2,225,091	1,109,456	67,563	22,733,189	4,414,815	2,465,475	126,392	39,736,238
Farm Products	1,720,729		330,846		2,550,973		378,016	
Primary Metal Products	1,524,497	805,974	178,543		2,309,029	1,302,576	314,561	
Pulp, Paper Or Allied Products		2,857,085	240,942	9,750,522		4,999,358	434,090	15,219,842
Waste Or Scrap Materials		1,386,560	95,919			5,086,925	141,531	
Transportation Equipment		760,713		5,336,692		1,392,591		15,445,518
Misc Mixed Shipments				4,731,096				17,568,885

Table 2-3 Top Commodities by Direction by Value

Commodity	2004 Value ($000's)				2035 Value ($000's)			
	Inbound	Outbound	Internal	Through	Inbound	Outbound	Internal	Through
Secondary Traffic	45,871,590	40,052,987	5,166,247	122,777,000	258,674,296	222,125,095	32,039,853	681,928,462
Electronic Equipment	3,299,747	2,635,241	31,424	34,342,363	37,236,640	47,554,166	425,047	458,576,250
Chemicals or Allied Products	5,281,168	7,907,665	582,865	29,108,622	14,654,100	15,466,379	1,731,329	69,322,022
Transportation Equipment	413,302	18,922,054		141,481,238	10,376,195	50,816,043		764,992,188
Instrument, Photo or Optical Equipment	976,229			9,360,163	6,398,635			62,694,074
Primary Metal Products	2,683,964		97,084		5,946,998		294,522	
Pulp, Paper or Allied Products	107,829	3,375,879	349,403	10,960,434	5,796,005	12,207,104	1,190,880	32,189,028
Food or Kindred Products	1,878,163			20,727,900	5,522,564			50,898,911
Machinery	1,599,664	3,542,976	149,566	33,271,410	5,328,420	14,389,946	479,399	132,192,196
Rubber or Misc Plastics	1,207,101				4,498,369			
Tobacco Products		8,802,158	1,843,143			10,347,845	1,395,655	
Misc Manufacturing Products		1,361,141		5,552,466		9,129,322		39,718,823
Fabricated metal Products		2,000,508		10,036,809		5,907,857		35,933,171
Furniture or Fixtures		1,288,805	123,398			4,770,209	311,654	
Clay, Concrete, Glass or Stone			117,064				694,248	
Farm Products			144,757				239,300	

What comes into the region in terms of tonnage are primarily secondary traffic (finished goods from distribution centers) followed by coal and non-metallic minerals. What goes out are non-metallic minerals, followed by secondary traffic and chemicals or allied products. Within the region major freight movements are related to construction materials. The major commodity moved through the region is coal. **Table 2-4** illustrates the commodity by mode tonnage volume, in both 2004 and estimated by 2035.

Table 2-4 Top Commodities by Mode by Tonnage

Commodity	2004 Tons				2035 Tons			
	Truck	Rail	Air	Water	Truck	Rail	Air	Water
Nonmetallic Minerals	23,434,590	2,201,306		754,027	41,170,249	3,960,119		737,831
Secondary Traffic	13,937,564				54,394,490			
Clay, Concrete, Glass Or Stone	5,012,968	569,824		642	14,499,597	1,393,605		1,275
Chemicals Or Allied Products	6,146,407	1,452,623	6,348	1,562	9,956,742	1,715,576	13,190	1,326
Pulp, Paper Or Allied Products	3,730,177	821,839		3,406	6,501,912	1,338,155		6,306
Lumber Or Wood Products	4,146,240	314,786			5,855,980	460,210		
Food Or Kindred Products	3,128,828	262,459		10,693	6,487,108	510,433		8,967
Petroleum Or Coal Products	2,697,842			365,343	4,812,212			380,331
Coal	1,717,380	4,257,317			3,965,634	8,851,051		
Primary Metal Products	2,184,081	324,896			3,587,606	338,444		
Waste Or Scrap Materials		1,086,105		1,500,669		3,528,895		5,819,872
Transportation Equipment		291,762	3,316			333,208	6,577	
Machinery			7,797				108,415	
Mail Or Contract Traffic			27,151				31,841	
Electrical Equipment			4,714				45,101	
Misc. Mixed Shipments			2,348				11,393	
Printed Matter			1,560				2,715	
Fabricated Metal Products			1,442				2,928	
Instrument, Photo Equip, Optical Equip			779				2,957	
Apparel Or Related Products			977				540	
Farm Products				89,637				118,806
Misc Freight Shipments				8,727				56,413
Fresh Fish Or Marine Products				17,523				23,593

Local jurisdictions will be impacted by the growth from 2004 to 2035. **Table 2-5**, indicates relative freight trends by jurisdiction.

Table 2-5 Freight Growth Trends by Jurisdiction

County/City	Inbound Tons			Outbound Tons		
	2004	2035	Change	2004	2035	Change
Charles City County	350,065	1,284,199	267%	7,938,715	12,550,582	58%
Chesterfield County	17,557,180	35,953,407	105%	6,374,396	14,656,989	130%
Colonial Heights	134,924	375,782	179%	212,142	519,228	145%
Dinwiddie County	2,265,932	7,876,515	248%	234,129	692,810	196%
Goochland County	482,303	755,998	57%	1,886,688	3,183,374	69%
Hanover County	2,651,965	6,063,822	129%	4,204,781	9,125,061	117%
Henrico County	5,867,013	16,987,669	190%	5,673,389	19,983,021	252%
Hopewell	2,714,143	8,189,800	202%	1,799,341	3,685,967	105%
New Kent County	124,500	199,822	60%	196,229	187,533	-4%
Petersburg	718,410	2,388,629	232%	1,383,185	4,156,748	201%
Powhatan County	301,871	530,315	76%	95,643	126,843	33%
Prince George County	2,882,992	6,143,698	113%	3,506,768	4,886,324	39%
Richmond	3,551,683	5,216,740	47%	4,606,022	9,617,192	109%

Chesterfield County's inbound freight is expected to double and reach 35 million tons by 2035. Outbound, Henrico County and Petersburg lead in terms of expected increases in freight tons shipped between now and 2035.

2.2.3 Identification of the Freight Transportation System

Identification of a freight network based on freight tons allows planners to prioritize and focus transportation investments that benefit freight movements. The system includes rates most heavily utilized (designated as Major Regional or Minor Regional), and then those segments not providing general access, but traveled to a great extent by trucks to access a particular area (designated as Specialty Connectors). Using VDOT Annual Average Daily Traffic (AADT) statistics for 2008, **Table 2-6** lists those that satisfy each of the three conditions. Further analysis of these roadways provided the related safety and level of service.

Table 2-6 Richmond and Tri-Cities Regional Highway Freight Network

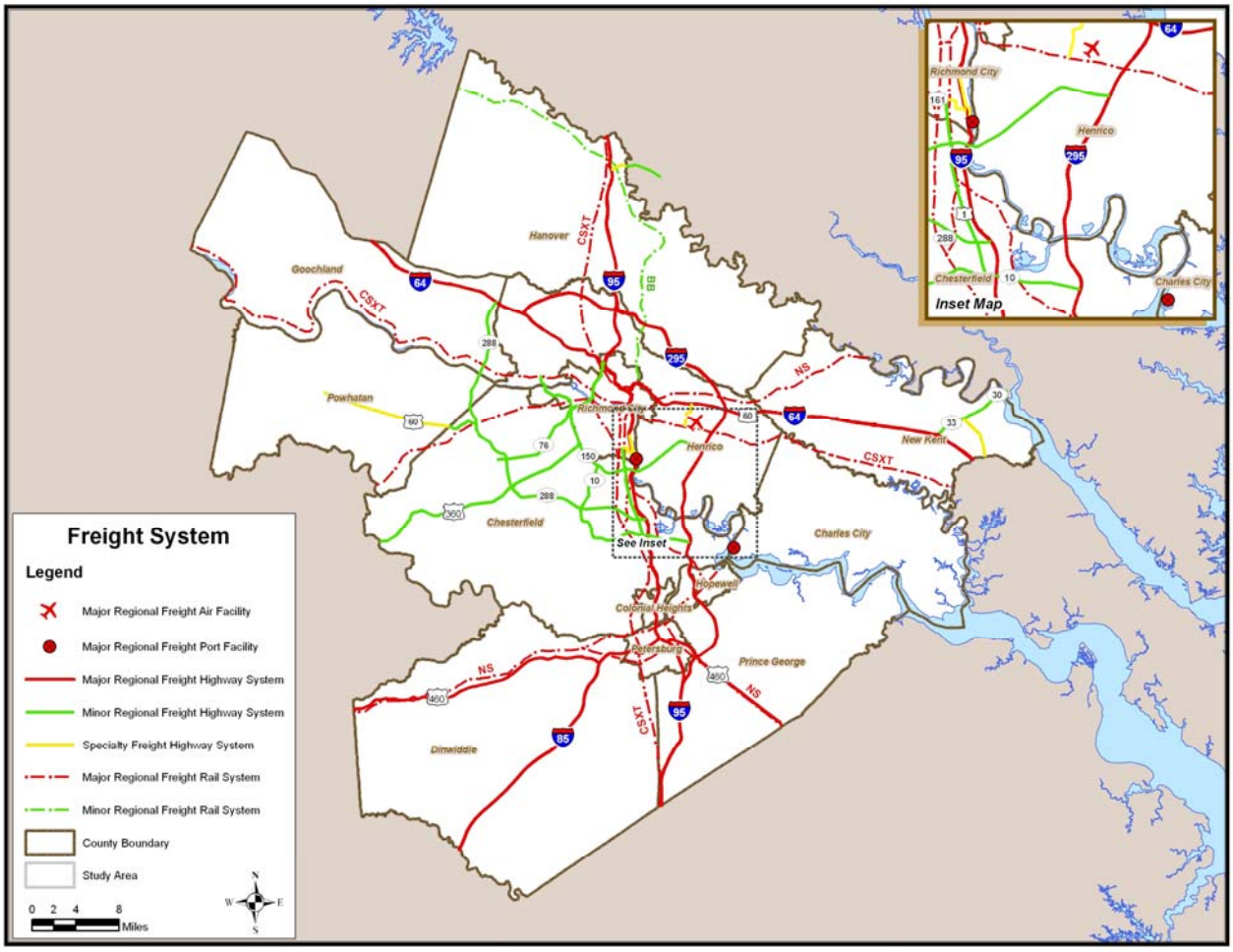
Network	Facility	2008 AADT Range	Highest Truck Volume	# of Segments at Worst		2007 Truck Accidents
				2005	2035	
Major Regional	I-64	42,000-151,000	12,100	F-4	F-4	21
	I-95	43,000-151,000	17,900	F-3	F-5	42
	I-85	26,000-61,000	11,000	C-2	E-1	10
	I-295	38,000-99,000	8,900	C-1	F-1	37
	US 460	17,000-61,000	11,000	D-1	D-1	<2
Minor Regional	SR 288	42,000-48,000	2,400	F-1	F-2	6
	SR 10	26,000-39,000	1,900	F-1	F-3	<2
	SR 76	49,000-93,000	1,000	D-2	F-2	<2
	SR 150	51,000-74,000	1,500	F-1	F-2	<2
	US 360	67,000	5,400	D-1	F-1	<2
	US 1/US 301	22,000-32,000	1,300	D-1	D-2	<2
Specialty Connectors	US 60	28,000	1,400	C-1	E-1	<2
	SR 161	19,000	2,500	A-1	B-1	3
	SR 30	11,000	1,900	C-1	D-1	<2
	Deepwater Terminal Road	na	na	na	na	na
	Airport Drive	na	na	B-1	D-1	<2

The final freight network is multimodal, including rail, air, and water components as well, as reflected in **Table 2-7 and Figure 2-2.**

Table 2-7 Richmond and Tri-Cities Regional Multimodal Freight Network

Network	Mode	Facility	From	To
Major Regional	Highway	I-64	Fluvanna County Line	James City County Line
		I-95	Caroline County Line	Sussex County Line
		I-85	Brunswick County Line	I-95 Interchange in City of Petersburg
		I-295	I-95 Interchange in Prince George County	I-64 Interchange in Henrico County
		US 460	Nottoway County Line	Sussex County Line
	Rail	CSX		
		Norfolk-Southern		
	Air	Richmond International Airport		
	Water	Port of Richmond		
		Port of Hopewell		
Minor Regional	Highway	SR 288	I-64 Interchange in Goochland County	I-95 Interchange in Chesterfield County
		SR 10	SR 150 Interchange in Chesterfield County	I-295 Interchange in Chesterfield County
		SR 76	SR 288 Interchange in Chesterfield County	I-195 Interchange in City of Richmond
		SR 150	I-95 Interchange in Chesterfield County	River Road in Henrico County
		US 360	Amelia County Line	SR 150 Interchange in Chesterfield County
		US 1/US 301	SR 288 Interchange in Chesterfield County	Chamberlayne Avenue in the City of Richmond
	Rail	Buckingham Branch RR		
	Water	E.I. DuPont Drewery's Bluff		
		Kinder Morgan Energy Partners		
		Plantation Pipeline Company		
		Vulcan Materials		
		IMTT Richmond		
		Flint Hills Resources		
		Simsmetal America		
Specialty Connectors	Highway	US 60	SR300 Scottsville Road	Chesterfield County Line
		SR 161	I-95	US 1/US 301, Jefferson Davis Highway
		SR 30	US 1, Washington Highway	Caroline County Line
		SR 30	King William County Line	James City County Line
		Deepwater Terminal Road	Connector Road	I-95
		Airport Drive	Airport Entrance	I-64

Figure 2-2 Richmond and Tri-Cities Regional Multimodal Freight Network (Map)



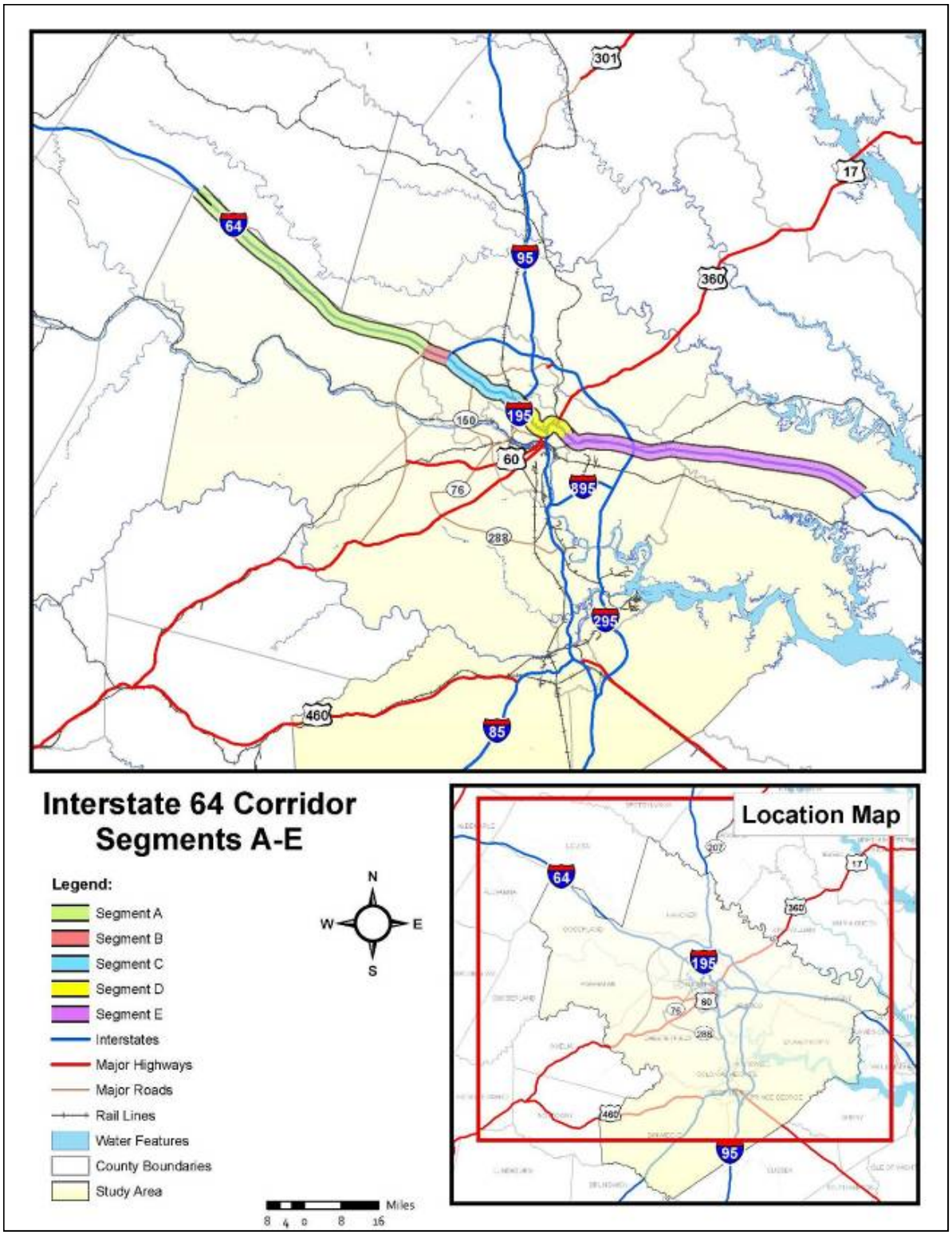
2.2.4 Corridor Profiles

Detailed corridor profiles were developed for the highway and rail elements of the multimodal freight network. Information on classification, AADT, level of service, speed limits, freight terminals and bottlenecks are included in a single corridor profile. **Figure 2-3 (A, B)** is an example of this process, with all profiles presented in **Appendix A**.

Figure 2-3A Corridor Profile, Interstate 64

Corridor:	**INTERSTATE 64**				
From:	**Fluvanna County Line**				
To:	**James City County Line**				
EXISTING OPERATIONAL PROFILE					
	Segment A	**Segment B**	**Segment C**	**Segment D**	**Segment E**
From	Fluvanna County Line	SR 288	I-295	I-95;I-195	SR 33 Nine Mile Road
To	SR 288	I-295	I-95;I-195	SR 33 Nine Mile Road	James City County Line
Freight Classification	Major Regional				
VDOT System Classification	Interstate				
Lanes	4	4	6	6	4-6
Speed Limit	65	65	65	55	65
For link on segment with highest traffic volume					
2008 AADT	42,000	61,000	130,000	151,000	67,000
Percent Trucks	12%	12%	3%	8%	10%
Level of Service 2005	F	F	F	F	B
Level of Service 2035	F	F	F	F	D
Total Truck Accidents Eastbound/Westbound					
2005	26/22				
2006	14/14				
2007	8/13				
EXISTING LAND USE PROFILE					
Intermodal Terminals Served (within 2 miles)			**Notes**		
Richmond International Airport			Air Cargo, primary provider		
ACCA Yard			CSX, Richmond		
Transflo			CSX, Richmond		
Current Bottlenecks			**Notes**		
I-64 and US 60			I-64 and N Parham Rd		
I-64 and I-295			I-64 and I-195		

Figure 2-3B Corridor Profile, Interstate 64



2.2.5 Importance of Freight Issues within Transportation Planning

Goods movement is a vital contributor to the economic well-being of any area. Any business, large or small, must have the ability to receive or ship materials and product. Without an adequate freight network, shelf items would fail to meet the demands of the consumer, and parts and material needs of production and assembly facilities could go unfilled. The need continues where the production cycle ends. Partially or finished goods require transport away from the manufacturing plant in order to become the inbound materials and goods for the consumer.

Previous planning practices associated efficient truck traffic with general automotive movement. As truck size and weights have increased, roadway design and access abilities have influenced truck traffic significantly. These require that the planner observe and develop a network where aspects of design and construction provide for greater turning radii, longer stop sight distances, wider travel lanes, and other characteristics. With the current trend of downsizing automobile sizes, the associated planning and design techniques must be cognizant of the widening differences between the automobile's and truck's needs.

The impact of general transportation planning goes beyond that of highway transport. As rail lines increase in volume and presence, the need for support facilities increases. Train volumes foster the need for the transportation to and from the railroad's loading and unloading facilities. Greater train usage, therefore, will require increased traffic from trucks. This contribution to congestion will be further felt in greater delays encountered at at-grade rail crossings with longer and more numerous trains. Water-borne traffic requires similar support from trucks and rail. These may raise congestion levels related to increased volumes of container and bulk traffic. It is these types of issues that the remainder of the study focused on.

The planning process requires regional coordination to unify local jurisdictional efforts. As goods movement is multi-jurisdictional in nature, many local jurisdictions attempting to minimize the impact of truck movement may fail to identify the need for that truck trip to support an adjacent or neighboring jurisdiction. That one jurisdiction's through truck is another jurisdiction's inbound or outbound truck requires the need for a regional approach to transportation planning, as a whole.

Chapter 3: LOCAL FREIGHT-RELATED CONCERNS

3.1 Stakeholder Engagement

3.1.1 Purpose and Methodology

Data analysis is two dimensional by nature and requires another input to provide the "whys" as to modal selection. This information comes from benefits and costs conversations for all modes. These discussions identify the weaknesses and opportunities to improve freight mobility that will guide the planning for the Richmond and Tri-Cities regions.

The initial intent of the stakeholder engagement was to identify infrastructure deficiencies. Primarily approached as an online survey for those engaged in the shipping, receiving, or actual transport of goods on the freight network, this was broadened to include in-person interviews. As the study included greater emphasis on policy-related strategies, members of both the public and private sectors were encouraged to participate in a facilitated Freight Forum meeting to collectively discuss those issues and concerns of prominence within the freight community.

3.1.2 Online Surveys

The focus of the survey was on major manufacturers since they play an important role in the supply chain and in overall freight movement by determining the product shipped, the type of shipment, the shipment size, volume, frequency, origin and destination. A total of 468 potential survey participants were identified using the following criteria:

- NAICS 31-33: All businesses in manufacturing groups (242 identified)
- NAICS 21: All businesses in mining, quarrying, and oil-gas extraction (10 identified)
- NAICS 42: All businesses in wholesale trade (141 identified)
- NAICS 48-49: All businesses in transportation and warehousing (75 identified)

Identification of valid emails, either through phone or internet search, reduced this audience to 278 invitations to participate. Response to the survey effort was met with a lack of interest by the local freight community. The recent outreach effort performed in support of the statewide freight study may have lessened response to this methodology. With sixteen incorrect email addresses, of the total 262 viable candidates:

- 4 declined to participate; and
- 19 responded with complete or partial survey information

Calls were placed with 65 non-respondents, of which only two agreed and provided complete or partially completed surveys. This lack of interest provided information that the freight community viewed the current infrastructure as acceptable to their needs. The survey was

conducted in March 2009 when many businesses were focused on the recent economic downturn where transportation needs had decreased and the focus on immediate business needs had increased. This may have contributed to the low number of responses.

3.1.3 In-person Interviews

A number of companies were contacted to request an in-person interview. Much like the survey results, many did not wish to participate. As a result, four interviews were conducted—three with less-than truckload motor carriers and one with a manufacturer of grocery store displays.

3.1.4 Survey and Interview Findings

The purpose of the surveys and interviews was to learn something more about the freight system. Detailed information is included in the Appendices. This chapter highlights the key themes that can be extracted from the survey/interview efforts. The key messages included:

- Participation was less than desired, but we believe that is due to the fact that there are no major problems with freight mobility in the area;
- The information received does correlate with the TRANSEARCH data and national trends;
- The relatively low modal share of air cargo might be explained in part due to the lack of connectivity of commercial service from Richmond to major markets (would require significant network restructuring by the involved airlines);
- Port of Richmond might be used more if there were improved intermodal connectivity with rail;
- Many of the trucking businesses are moving out of the immediate Richmond area (specifically the Jefferson Davis Highway area) to more southern locations near the junction of I-295 and I-95 (this relocation is designed to place terminals in closer proximity to a business community that is itself moving in the same directions); and
- A few specific transportation improvements were identified as necessary.

3.1.5 Freight Forum

Responding to an inherent need to foster interaction between the MPOs and the freight community, including economic development related agencies, a Freight Forum was held that included public and private sector entities. This event explored both infrastructure and policy observations and expectations. Finally, the Forum was a venue of cooperative effort whereby all participants were afforded the opportunity to explore the missions and activities of the other.

This event was well attended and each of the following areas was represented:

- Economic Development Agencies
- Motor Carriers
- Railroads
- Port Authorities

- Warehousing and Third Party Logistics providers
- Industry representatives
- Regulatory and Managing Agencies
- Chambers of Commerce
- Metropolitan Planning Organizations
- Regional Planning Commissions
- State Department of Transportation

3.2 Key Findings From Stakeholder Engagement

3.2.1 Transportation Infrastructure

As with the online survey and limited interviews, infrastructure deficiencies were limited. Highway concerns, reflective of the larger modal share in general commodities movements, dominated the discussion and the following specific areas were identified for further review:

- I-95 access for eastbound traffic near Bells Road;
- Capacity constraints on I-64 and I-95;
- Road surface issues on I-64 and I-95;
- Alternative route availability as Deepwater Terminal Road presents minimum vertical clearance concerns for oversize loads moving to the port;
- Alternative to Deepwater Terminal Road should be explored for surface improvement; and
- Alternative employment of roundabouts versus traditional signalized intersections and the effects on truck traffic

3.2.2 Transportation Policy

- Highway considerations were most affected by local policy and ordinance implementation, as motor carriers operate nearly exclusively on publicly held roadways. Changes in road design such as traffic calming techniques, if utilized, must ensure that they meet the needs of heavy truck traffic. Where traffic circle designs are implemented along significant truck routes, they must have an expanded radii design or be equipped with “truck aprons”. An appropriate design vehicle should be used.

- Access management, present in all jurisdictions as varying applications of ordinances and design standard, can be better recognized through a common source of goals and objectives across the region. The individual concepts, such as inter-parcel access or implementation of limited access design, are utilized and can be identified within ordnance reviews. The participants saw this as a developer’s issue to be handled during the early phases of site development. This belief is contrary to the local jurisdiction practices that do not necessarily require a “freight transportation plan” from a developer

during the permit phase. Other areas, such as several jurisdictions in the Atlanta area, require a "freight transportation plan" and review process prior to authorizing development. There is a consensus that access management is a factor in site selection. The ability to be barred from access to roadways or facilities, based on road design, determines the feasibility for efficient operations. This, along with public awareness of the proposed plan, is critical to future co-existence. This was illustrated in an example where site selection had been concluded, only to be discarded when faced by public concern over the volume of truck traffic needed to support the developed site.

- The discussion of "off-peak" operations and traffic reduction policies, targeting a reduction or elimination of all truck traffic during specified hours, solicited the most interaction of the forum. These mitigation strategies were identified as being more associated with the need to address not the transportation providers but the shipper and consignee participants. There was agreement that without changes in supply chain needs and operational windows at the customer level, transportation providers would continue to be forced to operate in a manner to meet the delivery and shipping "windows" or hours of operations, of those contracting the carriers.

3.2.3 Land Use Practices

- Common confrontation between residential and commercial development was voiced. The lure of residential construction near waterfront locations was identified as an adverse effect on industrial site selection that required port access. Relocation farther inland of industrial development causes an increase in truck traffic between the industrial node and the port, an issue largely overlooked by the general public.

- To provide for more "transportation" oriented land use was seen as a key to economic growth for the area. Foreign companies evaluating future sites are seeking not only a diverse transportation network, but specifically adept infrastructure to efficiently handle intermodal exchanges of cargo. The Richmond region was perceived as lacking in this capacity.

3.2.4 Interaction of Infrastructure, Policy and Land Use Practices

- The management associated with these is not governed by a single entity. Differing responsible agencies inherently place varying goals and require a more collaborative effort. This effort would need to cross traditional boundaries of inter-agency and public-private competing goals.

- There is a perceived funding inequity favoring highway over the other modal choices. This, along with varying degrees of private funding to develop and maintain components of the overall network, leads to a cost disadvantage for non-truck modes.

Chapter 4: POTENTIAL POLICY AND INFRASTRUCTURE ACTIONS

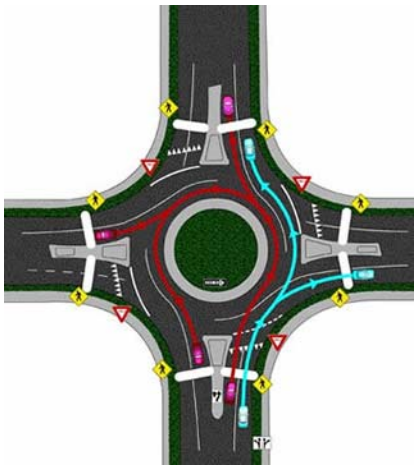
4.1 Policy Actions

4.1.1 Roadway Design Strategies

4.1.1.1 Roundabout Design

Roundabouts, such as that illustrated in **Figure 4-1**, have proven to be safe and efficient forms of traffic control and are growing in popularity across the country. This increase in utilization has significant support as a means to address congestion and resulting air quality issues resulting from idling or reduced levels of service. Local governments in the Richmond area have designed and constructed roundabouts in recent years and continue to plan for them due to their efficiency in accommodating traffic in certain situations. With regard to freight movement, roundabouts can be designed with special features to better accommodate heavy vehicles. The following paragraphs outline some of these features in greater detail.

Figure 4-1 Example illustration of Roundabout Design



Source: 02/03/2010, http://www.ci.watertown.mn.us/images/pics/roundabout_diagram_small.jpg

4.1.1.2 Truck Aprons

As vehicle length increases, the need to provide an expanded lane width during turning is necessary. Where truck traffic is expected, placement of truck aprons, road surface between the travel lanes and the landscaped interior of larger roundabouts, accommodates the "trailing" movement of the trailer. To mitigate other vehicle usage and or abuse, and to identify the road surface as such, a different surface, such as pavers, concrete, etc. is utilized, as shown in **Figure 4-2**. Striping that is recognizable by all drivers may also be used in tandem with surface changes. Without this added lane width, longer trucks will avoid the roundabout due to both

equipment and cargo damage as a result of driving over elevated curb heights. Where this damage does occur, either alternative routing should be provided to commercial vehicles or continuing maintenance dollars can be expected to be repetitively charged to reconstruct the curb and landscaping.

Figure 4-2 Truck Apron

Source: 02/03/2010, http://www.ksdot.org/roundabouts/images/truck.jpg

4.1.1.3 Traversable Islands

In extremely space restricted roundabouts, introducing islands, which may be driven over by trucks, while still directing automobile and other traffic in the traditional circular flow, is an accepted practice, as illustrated in **Figure 4-3**. Construction of this type is typically for intersections with lower truck volumes, as there is added wear on the materials used in the construction of the island. This design serves as a greater deterrent to trucks as they must reduce speeds to reduce load shift and possible resulting cargo damage.

Figure 4-3 Traversable Island Construction

Source: 02/03/2010, http://safety.fhwa.dot.gov/intersection/roundabouts/presentations/safety_aspects/long.cfm

4.1.1.4 Decision Sight Distance

The construction of multi-lane roundabout designs present issues with advance signing. Though discussed later in this report, as each lane proceeding into the roundabout is designed to accommodate a left or right turn or through traffic pattern movement, signage must be highly visible and provide the truck driver ample reaction time to select and then move to the appropriate lane, as shown in **Figure 4-4**.

4.1.1.5 Education Documentation

Where roundabout design has been pursued, there are adverse opinions on safety and concern over proper use. Two strategies to mitigate these concerns are:

- How-to Guidebooks
- Safety Awareness

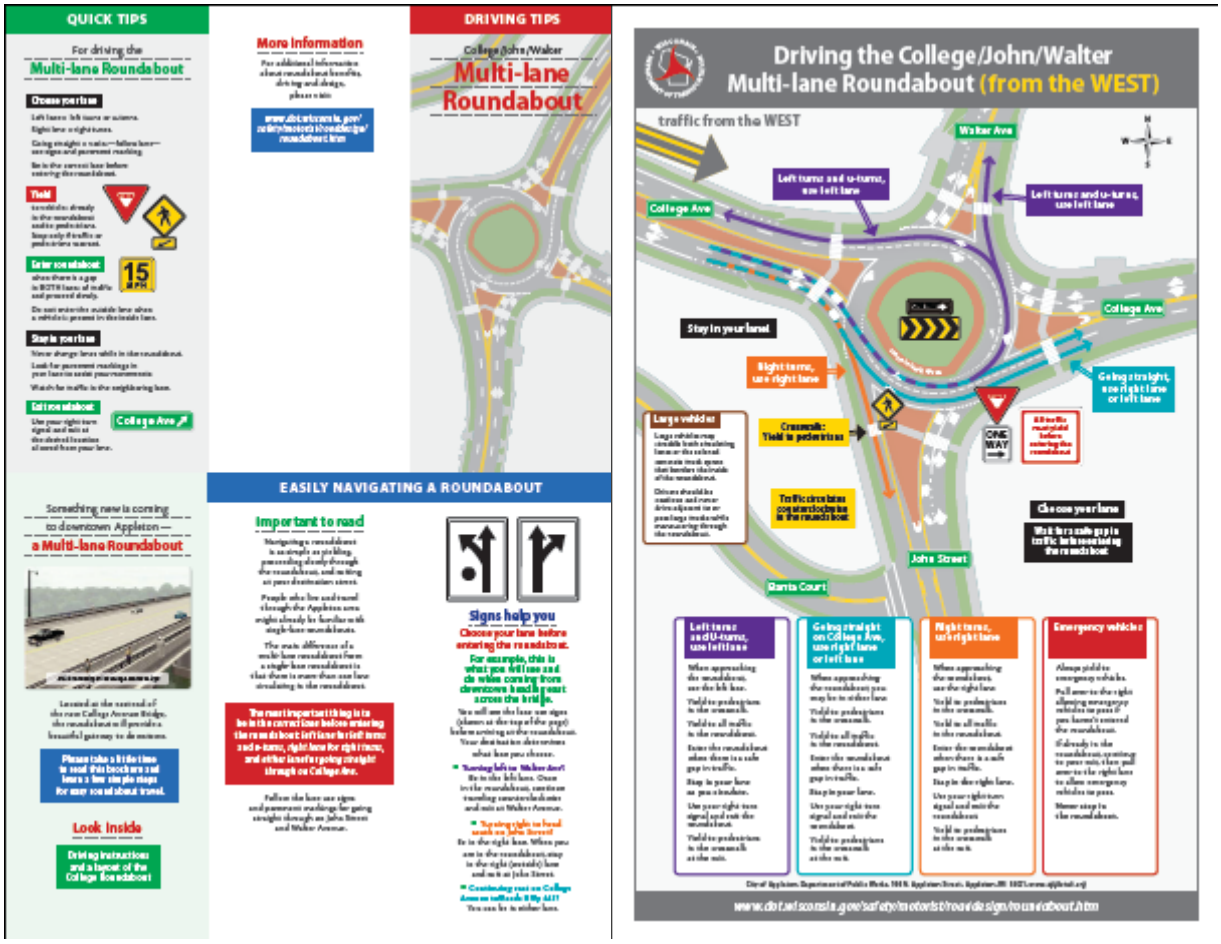
"How To" Guides - Supplying driver-friendly documentation to truck drivers at welcome centers, truck stops, and truck related facilities can assist in the successful negotiation of roundabouts. State DOTs, Wisconsin and Virginia among that group, have been instrumental in presenting written and visual education products for the driving public on the "why's" and "how's" of roundabout utilization. This process can easily be carried down to the MPO level. The City of Appleton, Wisconsin hosts location specific guides on those roundabouts present in their limits, as reflected in **Figure 4-5.** These describe and illustrate the design and specific actions necessary to navigate roundabouts. Targeting automobile traffic, notes and discussions of decision points related to truck traffic are noted as well.

Safety Related Statistics - Crash frequency rates and crash levels of severity have been proven to reduce significantly with roundabouts. Presentation within the brochures and online avenues mentioned previously can disseminate those statistics. Posting of them in a manner that truck operators are made aware of these benefits is an effective marketing tool. Truck driver communication consists of a great deal of one-on-one discussions over radios and at collection points, such as truck stops and places of work. A program relating safety, utilization methods, and efficiency metrics can more effectively reach a larger audience if done strategically.

Figure 4-4 Multi-lane Roundabout with Signage, VanDyke Blvd, Sterling Heights, MI

Source: Google Maps

Figure 4-5 Roundabout Education Brochure, Appleton WI



Source: 02/05/2010, http://www.appleton.org/departments/public/traffic/roundabouts/files/CJW%20Brochure.pdf

4.1.2 Signage Practices

The most common issue related to poor sign practices is the failure to provide adequate advance warning of special considerations adjacent to or on the roadway to allow truck operators sufficient time for decision making. Each opportunity to communicate conditions requires additional distance between the vehicle and the event for truck operators in comparison to automobile operators due to greater stop sight distance characteristics of trucks. Restricted or posted weight limits on bridges, left turn exits, prohibited routes and minimum vertical clearances are the more common scenarios faced by the driver unfamiliar with local road conditions. In each case where inadequate sign placement has reduced reaction time, once recognized, the driver is presented with either radical vehicle movement or continuing on, possibly into areas not "truck friendly" The Manual on Uniform Traffic Control Devices (MUTCD) 2009 provides guidance not only for the type and size of signage, but also on placement. To illustrate where sign placement adheres to this guidance, yet may not be adequate

for larger commercial vehicles, a less than adequate minimum vertical clearance exists where VA 5 diverges from US 60 (East Main Street), as depicted in **Figure 4-6.**

Figure 4-6 Minimum Vertical Clearance, VA 5 near US 60

Source: Google Maps

Section 2C.27 of the MUTCD discusses conditions and placement of the Low Clearance sign. Sub section 03 notes:

Section 2C.27 Low Clearance Signs (W12-2 and W12-2a)

Standard:

01 **The Low Clearance (W12-2) sign (see Figure 2C-5) shall be used to warn road users of clearances less than 12 inches above the statutory maximum vehicle height.**

Guidance:

02 *The actual clearance should be displayed on the Low Clearance sign to the nearest 1 inch not exceeding the actual clearance. However, in areas that experience changes in temperature causing frost action, a reduction, not exceeding 3 inches, should be used for this condition.*

03 *Where the clearance is less than the legal maximum vehicle height, the W12-2 sign with a supplemental distance plaque should be placed at the nearest intersecting road or wide point in the road at which a vehicle can detour or turn around.*

04 *In the case of an arch or other structure under which the clearance varies greatly, two or more signs should be used as necessary on the structure itself to give information as to the clearances over the entire roadway.*

05 *Clearances should be evaluated periodically, particularly when resurfacing operations have occurred.*

Option:

06 The Low Clearance sign may be installed on or in advance of the structure. If a sign is placed on the structure, it may be a rectangular shape (W12-2a) with the appropriate legend (see Figure 2C-5).

The sign placement itself, as seen in **Figure 4-7,** does not provide adequate visibility of the sign until a vehicle enters the intersection.

Figure 4-7 View Southeast on E. Main Street

The sign is placed at the divergence point of SR 5 and US 60 providing little time to safely divert from continuing on SR 5 toward the minimal vertical clearance location to US 60. A longer and larger vehicle, more apt to be impacted by the clearance distance, may have to suddenly change direction. The driver will either stop or rapidly change direction; either will create greater crash potential. Should the truck choose to continue until safely passing through the intersection, inadequate space is provided for turning around before reaching the clearance obstacle, leaving only hazardous backing into the intersection, as a course of action.

4.1.3 General Design Considerations

While there is no designated "truck" roadway design criteria, the agencies overseeing the design of roadways, American Association of State Highway and Transportation Officials (AASHTO) and appropriate Department of Transportations, in this case, Virginia DOT (VDOT), issue recommendations. Design notations are specifically made for interstate, freeway, and arterial classified roadways. Following AASHTO Green Book recommendations, VDOT, in the Road Design Manual, addresses lane and shoulder widths, dependent on the volume of truck traffic, shown in **Figure 4-8**.

Figure 4-8 Road Design Manual, VDOT, Principal Arterial Design Criteria

GEOMETRIC DESIGN STANDARDS FOR RURAL PRINCIPAL ARTERIAL SYSTEM (GS-1)

	TERRAIN	DESIGN SPEED (MPH)	MINIMUM RADIUS	(6) STOPPING SIGHT DISTANCE Min.	MIN. WIDTH OF LANE	(1) MINIMUM WIDTH OF TOTAL SHOULDERS (Graded + Paved) FILL	(1) MINIMUM WIDTH OF TOTAL SHOULDERS (Graded + Paved) CUT	(2) PAVED SHOULDER WIDTH RT.	(2) PAVED SHOULDER WIDTH LT.	(3) MINIMUM WIDTH OF DITCH FRONT SLOPE	(4) SLOPE	(5) NEW AND RECONSTRUCTED MINIMUM BRIDGE WIDTHS AND VERTICAL CLEARANCES
FREEWAYS	LEVEL	70	1821'	730'	12'	17'	14'	12'	4'	12'	CS-4B	2 THRU LANES SAME DIRECTION = 6' + PAVE. WIDTH + 14' 3 OR MORE THRU LANES SAME DIRECTION = 14' + PAVE. WIDTH + 14'
	ROLLING	60	1204'	570'								
	MOUNTAINOUS	50	760'	425'							CS-4E	
OTHER PRINCIPAL ARTERIALS	LEVEL	70	1821'	730'	12'	13'	10'	8'	4'	10'	CS-4 OR 4B	UNDIVIDED & DIVIDED 3 OR MORE THRU LANES SAME DIRECTION = 10' + PAVE. WIDTH + 10'
		60	1204'	570'								
	ROLLING	60	1204'	570'							CS-4 OR 4E	
		50	760'	425'						6'		
	MOUNTAINOUS	50	760'	425'							CS-3 OR 3B	2 THRU LANES (DIVIDED) SAME DIRECTION 6' + PAVE. WIDTH + 10'
		40	465'	305'								

GENERAL NOTES

Freeways - A design speed of 70 mph should be used for Rural Freeways. Where terrain is mountainous a design speed of 60 mph or 50 mph, which is consistent with driver expectancy, may be used. All new and major reconstructed Interstate facilities will have a 70 mph design speed unless a lower design speed is approved by the Location and Design Engineer and FHWA.

Other Principal Arterials - A design speed of 40 to 70 mph should be used depending on terrain, driver expectancy and whether the design is constructed on new location or reconstruction of an existing facility. An important safety consideration in the selection of one of the lower design speeds in each range is to have a properly posted speed limit which is enforced during off peak hours.

Incorporated towns or other built-up areas, Urban Standard GS-5 may be used for design. "Built-up" is where there is sufficient development along the roadway that justifies a need to channelize traffic into and out of properties utilizing curb and gutter.

Standard TC-5.01R (2001 AASHTO Green Book) superelevation based on 8% maximum is to be used for all Rural Principal Arterials.

Clear Zone and Recoverable Area information can be found in Appendix A, Section A-2 of the Road Design Manual.

If medians are included, see Section 2E-3 of Chapter 2E of the Road Design Manual.

For maximum grades relative to terrain and design speed, see AASHTO Green Book, Chapter 7, Exhibit 7-2, for Freeways, see Chapter 8, Exhibit 8-1.

FOOTNOTES

(1) Shoulder widths shown are for right shoulders and independently graded median shoulders with no additional width necessary for guardrail situations. On non-Interstate, an 8' graded median shoulder will be provided when the mainline is 4 lanes (both directions). For 6 or more lanes, the median shoulder provided will be the same as that shown for independent grading. On Freeways, if truck traffic is less than 250 DDHV, the minimum width of total shoulder shall be 15' for fills and 12' for cuts.

(2) When the mainline is 6 or more lanes, the left paved shoulder width should be the same as the right paved shoulder. On Freeways, if truck traffic is less than 250 DDHV, the minimum right paved shoulder width shall be 10'.

(3) Ditch slopes to be 6:1 - 10' and 12' widths and 4:1 - 6' width. A hydraulic analysis is necessary to determine actual depth requirement.

(4) Additional or modified slope criteria to apply where shown on typical sections.

(5) Vertical clearance at roadway underpasses for new and reconstructed bridges is to be 16'-6" (1' additional clearance required for non-vehicular overpasses). 14' Shoulders on bridges may be reduced to 12' minimum when truck traffic is less than 250 DDHV.

(6) For additional information on sight distance requirements on grades of 3 percent or greater, see Exhibit 3-2 of the 2004 AASHTO Green Book.

Source: 02/05/2010, http://www.extranet.vdot.state.va.us/locdes/Electronic%20Pubs/2005%20RDM/appenda.pdf

Twelve-foot travel lanes are the recommended design standard for routes currently or intended to carry high volumes of truck traffic. As lane width is reduced, the probability of truck invasion of adjacent lanes increases due to extended mirrors and possible variances between the travel line followed by the trailer versus the tractor.

Shoulder widths are also a critical element of design for any roadway accommodating significant truck traffic volumes. The wider the shoulder, the easier it is for trucks to exit without disrupting through traffic.

Design also influences the route selection a driver may make while traveling through an area. Improving roadways to meet the recommended design standards of both VDOT and AASHTO, will attract truck traffic and allow for a more focused application of funding, with or without more formal truck route designations.

4.1.4 Access Management Practices

Access management is an increasingly popular set of techniques used by state and local agencies to control access to major thoroughfares. The result is a more safe and efficient roadway network for users. Without access management, roadways could see an increase in traffic congestion, crashes, and pollution from vehicle emissions. Many states currently have access management policies that are used to regulate and control access to thoroughfares. Most, if not all, of these policies are derived from the Transportation Research Board's (TRB) *Access Management Manual*, which was published in 2003. According to TRB's website (http://www.trb.org), TRB annually engages more than 7,000 engineers, scientists, and other transportation researchers and practitioners from the public and private sectors and academia, all of whom contribute their expertise in the public interest by participating on TRB committees, panels, and task forces. TRB describes ten (10) principles of access management, which were derived from their expertise in transportation. Though directed toward management of the general driving public, each has implications on truck traffic. They include the following:

- Provide a Specialized Roadway System (SRS): Design and manage roadways according to their primary functions. One such SRS, a designated truck route system will be discussed.
- Limit Direct Access to Major Roadways: Roadways that serve higher volumes of through traffic need more access control to preserve their function. Where higher truck traffic exists, limiting junctions with major roadways will reduce the frequency of areas of slow or stopped flow, thereby increasing the throughput of the roadway.
- Promote Intersection Hierarchy: An efficient transportation network provides appropriate transitions from one functional classification to another. This results in a series of intersection types that range from the junction of two freeways or a freeway and a major arterial to a driveway connecting to a local street.
- Locate Signals to Favor Through Movements: Long, uniform spacing of intersections on major roadways enhances the ability to coordinate signals and to ensure continuous

movement of traffic at the desired speed. This pattern should also include signal timing that accounts for the slower acceleration and longer deceleration needed by trucks.

- Preserve the Functional Area of Intersections and Interchanges: The functional area of an intersection or interchange is the area that is critical to its safe and efficient operation. Access connections too close to these intersections or interchange ramps can cause serious traffic conflicts. Allowing business locations close to or immediately adjacent to these functional areas invites interruption of flow as trucks maneuver into or out of these poorly located connections.
- Limit the Number of Conflict Points: A less complex driving environment is accomplished by limiting the number and type of conflicts between vehicles, vehicles and pedestrians, and vehicles and bicyclists. This philosophy is supported by the appropriate design and construction of roundabouts.
- Separate Conflict Areas: Separating conflict areas helps to simplify driving and contributes to improved traffic operations and safety.
- Remove Turning Vehicles from Through Traffic Lanes: Turning lanes reduce the severity and duration of conflicts between turning vehicles and improves the safety and efficiency of intersections. This not only reduces the safety concerns of vehicles turning and generating "slowdowns" in the flow of truck traffic, but also assists in removing trucks from blocking regular traffic flow when assessing strategies for entering a location.
- Use Non-traversable Medians to Manage Left-Turn Movements: Non-traversable medians and other techniques that minimize left turns are effective in improving roadway safety and efficiency. These assist in limiting the areas in which trucks may "crossover" oncoming traffic flow.
- Provide a Supporting Street and Circulation System: Well-planned communities provide a supporting network of local and collector streets to accommodate development, as well as unified property access and circulation systems. Interconnected street and circulation systems support alternative modes of transportation and provide alternative routes for bicyclists, pedestrians, and drivers.

These principles have been adopted and implemented by various state DOTs including the Georgia Department of Transportation (GDOT), the Iowa Department of Transportation, the Massachusetts Highway Department (MassHighway), the Minnesota Department of Transportation (Mn/DOT), the Vermont Agency of Transportation (VTrans) and Virginia Department of Virginia (VDOT). They have also been employed by local jurisdictions, counties and municipalities, where necessary.

4.1.5 Truck Route Plan

A designated truck route system is instrumental in supporting the efficient and reliable movement of freight. This designation provides a framework for mass access management practices and other strategies that improve truck, and thus, goods movement. A system that targets truck traffic and controls its movement when traversing the region, establishes a finite set

of roadways to which funding can be applied. A basic freight network has been established based on current truck traffic usage. Freight planning and the implementation of a truck route system requires not only an analysis of existing freight movement and location of freight generators, but requires a process of identifying roadway usage, economic development, and calls for the incorporation of local jurisdictions and private sector engagement. A framework to accomplish this includes:

- Jurisdiction Review: A comprehensive interview process should be implemented, involving local county and municipality jurisdictions. These discussions are to identify the process and structure of any truck routes that have been implemented and all restrictions or prohibitions already in effect. Understanding the methodology of each, will assist in gaining a consensus for the guidelines to establish a regional truck route system.
- "Hot Spot" Identification: During the interview process, identifying existing concerns with intersections, roadway designs, active community concerns, rail crossings, and other obstacles that exist, can determine the feasibility of a proposed route to satisfy the freight movement need. These also serve to provide future projects for the regionally adopted Transportation Improvement Program (TIP) where the route could be made a useful addition to the truck route system, at a later date.
- Private Sector Involvement: As with the jurisdiction review, understanding the current expectations of the motor carriers operating in the region will assist in gaining consensus. The "why's" of driver route selection may lead to the selection or deletion of a route determined by data analysis, as it consists of a preference or performance characteristic not readily identifiable outside the private sector. This involvement should be conducted throughout the project and include post-truck route system finalization. Education provided to the company and individual driver level, where applicable and available, enhances the establishment of the routes and fosters utilization.
- Current and Future Economic Development Trends: While current determination of a successful route system may be based on present land use, incorporation of land use expectations will influence the ability of the route system to serve its purpose into the future. Though the system should reflect a dynamic approach, significant and frequent changes will generate confusion among users and reduce its effectiveness.
- Data Collection: Additional data collection is needed to evaluate roadways for inclusion in the network. These could include:
  - Functional Class
  - Actual Travel Lane Width
  - Actual Shoulder Width
  - Posted Speed
  - Bridge Conditions
  - Posted Bridge Weight Restrictions
  - Bridge Minimal Vertical Clearance
  - Bridge Sidewalk Width (continuing Functional Class design)
  - Railway At-Grade Crossings
  - Proximity to Land Use Designation (Current, Future)

  - Crash History
  - Design Speed
  - Stopping Sight Distance
  - Turning Radii
  - Clear Zone
  - Grade
  - Roadway Weight Capacity
  - Curve Off Tracking
  - Traffic Operations
  - Continuity/Connectivity/Accessibility
- Criteria Scorecard: After determining the level of influence each of the previous inputs may exert on the appropriateness and effectiveness of the network, a scorecard should be developed to assess the validity of a given roadway and as a tool to evaluate future inclusion or detractions from the network. Establishing a criteria matrix should reflect those priorities identified through public sector, private sector and community outreach. Responsible agencies, e.g. Virginia Department of Transportation (VDOT) may have previously identified evaluation methodologies that may provide a working template. Online surveys, interviews, both phone and in-person, or polling performed at formal meetings are tools to collect the various priorities exhibited by the individual counties, municipalities or stakeholder groups.

4.1.6 Non-Public Sector Engagement

Freight planning encompasses numerous disciplines and areas of experience. Understanding the business goals and operational requirements of the freight transportation network users is one critical component of the planning process. A second but no less key component is appreciation of the path of economic development an area is pursuing. The engagement of those persons or organizations active in these two areas can result in a more robust and accepted plan by incorporating the combined observations, needs and proposed solutions from these groups.

The MPO's role in these engagements can be both as a facilitator and as a participant. In many areas, the groups with a vested interest in a successful freight transportation network lack a common coordination that involves all and organizes the efforts and pertinent participants. Serving as the guiding force in freight planning, the MPO has the ability to organize involvement by type of participant and continue that effort by directing appropriate initiatives. Fundamental steps towards organizing these groups appropriately should seek:

- To identify the stakeholders within the freight community: Shippers, manufacturers, assemblers, transportation providers, facility operators.
- To identify the stakeholders within the economic development effort: Chambers of Commerce, Economic Development Agencies, real estate professionals.
- To identify the stakeholders involved in planning: state or regional planning commissions, state and local transportation departments, other affected MPOs.
- Solicit input: Adopt survey methods to ascertain areas of concern within each group.

- Organize the team: Outline the role and select a chairperson from within each stakeholder group.
- Establish meeting agendas and schedules: Assuring that agendas reflect the needs and concerns of the particular group, in addition to scheduling to maximize participation and attendance.
- Assist in short term solution implementation: "Quick wins" foster confidence in the group's ability to act and be a moving force in local decision making.
- Foster continuing participation: Serving as a central point of contact for each group, producing supportive materials and facilitating the invitation and meeting process will allow the effort to maintain or increase further participation.

One major complaint leading to disengagement by non-public sector entities is the lack of appropriate work. Where these participants are involved in matters that have no identifiable benefit or consequence diminishes the desire to interact where their contribution is vital. The MPO with its experience can assist the groups in selection of meaningful studies or projects by providing guidance in example areas of:

- Funding mechanisms
- Planning
- Environmental justice
- Interagency coordination

The MPO has a vested interest in serving as an involved participant within these groups, either as a direct member of an individual group or serving on a combined council where all groups are represented. MPO goals, methodologies and roles are not typically fully understood by non-public sector entities. Participating in discussions and solutions will ensure that the needs of the MPO are understood.

It is important that all categories of participants be engaged. Merely involving the transportation providers or the shippers, economic developers versus the chambers, or the economic development arena and not the freight transportation community will significantly skew the effort and results. Each group may be stakeholders in a single policy or action yet bring contrary observations and solutions. An illustration is the introduction of incentives to foster off-peak delivery and pick-ups. This receives attention from the public planning community in order to mitigate capacity constraints. Without the involvement of the transportation providers, it may go misunderstood that this group operates at the convenience of the shipper and an incentive targeting this participant may have no impact. Shippers may acknowledge the benefits of such programs yet some may continue to require peak service in order to satisfy the needs of consumers or to fulfill transit requirements. The effort to locate a company, and the associated employment, may be thwarted, if the off-peak requirement is implemented, as they must meet international sailing schedules and cannot do so without shipping and receiving operations conducted during peak travel times.

4.1.7 Future Land Use Associated Policies

Land use designation has been influenced by ongoing programs and policies. One to be considered is the increased importance placed on freight transportation in future decision making. The efficiency of a designated freight transportation network and corresponding truck route network is significantly influenced by the designation of commercial, industrial, and other freight intensive parcels within the region. Location of future rail and truck facilities is partially guided by the proximity to the users of those facilities. Concentrated areas of freight intensive activities, not only attract transportation providers, but increase the probability of higher levels of service and reliability. Generating greater stop density elevates the status and serviceability by the motor carrier industry, as a whole.

Where these lands cannot be located immediately adjacent to the transportation system, continuing concentration reduces the variety of logical avenues to access the area. This assists in the focus of improvement projects and funding of such projects.

This discussion goes beyond that of freight intensive designation. Assigning parcels previously freight intensive to non-freight uses, residential or recreational, impacts commercial viability of facilities such as ports or more established manufacturers and service providers. As economic cycles impact the viability of existing companies to compete in the marketplace, vacancy rates around these facilities may be reduced. As these are converted to non-freight oriented development, the ability for future tenants to take advantage of the transportation provider is diminished. This leads to either higher transportation costs for the commercial-industrial endeavor, which is passed on to consumers where possible, or to a lack of utilization of that provider.

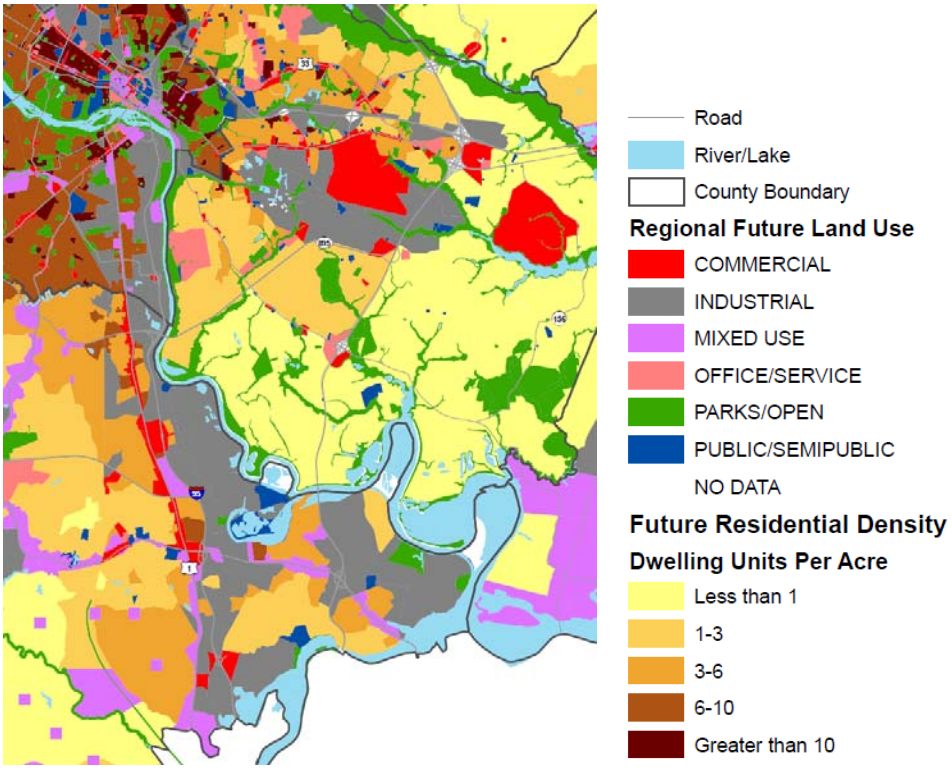
The conflict between recent residential desires to claim waterfront property for residential or recreational use and commercial-industrial access to port facilities is an illustration. Ports of all sizes are faced with the possible loss of active waterfront acreage to residential development, diminishing the usefulness of the authority and placing severe restriction on future development of the port. Identified future land use for the Richmond region presents a picture where industrial and commercial lands are already faced with residential development on all borders, illustrated in **Figure 4-9**.

This conflict is present in other ports across the country. In some, specific ordinances have been enacted to displace this conflict with constructive alternatives:

- In Baltimore, an effort to perpetuate deep waterfront acreage for industrial use resulted in the Maritime Industrial Zoning Overlay District (MIZOD). This fundamentally designated parcels as heavy industrial only, with mixed use presence only when it was directly in support of the primary purpose of the zone.
- Port of Miami has been faced with a continual private development creep: "The Port of Miami River has lost over half of its 80 acres of marine industrial zoning due to residential development since 2002, leaving just 39 acres left for operations"[1]

[1] 02/05/2010, http://www.worldtrade.org/Trade/Miami_River.htm

Figure 4-9 Port of Richmond and Private Port Facilities with Land Use Designation



4.1.8 Revenue Capture Strategies for Through Truck Movement

Through truck movement is one sided with the truck generating cost and maintenance concerns for the owner of the road, while transporting cargo that does not present revenue enhancing qualities for the jurisdiction. A variety of revenue capturing strategies may be explored:

- Dedicated Truck Lanes: Controversial with the motor carrier industry, DTL's offer an opportunity to identify and generate usage fees directly associated to truck movement
- Truck support activities: These include the encouragement of land use designation favoring commercial truck stops and other hospitality businesses oriented toward the truck driver.
- Distribution or warehouse districts: This offer the least potential without extensive interaction with freight generators and designation of these areas based on the business models for the intended tenants.

4.1.9 Container-Trailer on Barge Service (COB-TOB)

Each of these services provide for a response to increased truck traffic into and out of the region servicing goods movement to and from the Port of Hampton Roads and Norfolk. This response,

by targeting appropriate commodity types, would divert this truck movement to barge transport. This transportation method is slower than truck and delays in a single barge movement impacts numerous customers. Even with these concerns, the potential for reduced air quality concerns, elimination of a segment of road congestion, reduction in fuel usage, and other positive influences makes this mode a viable strategy for evaluation.

4.1.10 Requirement for Freight Transportation Plans during Site Development Process

The development of a new commercial or industrial site presently requires extensive planning prior to the initial land clearing action and construction efforts. The additional requirement of a freight transportation plan, identifying modal access and volumes, can assist in the:

- Evaluation of the proposed site related to the influence it will exert on neighboring communities,
- Additional burden to be placed on the infrastructure, and
- Aid in the assessment of the developer's responsibility to assist in mitigating future transportation needs of the site and area.

4.2 Infrastructure Improvements

With information collected during the various outreach programs, specific improvement projects were identified. The first 11 improvement projects are very specific locations that were identified during the study process as warranting improvements. The remaining projects were not specifically mentioned, however, at-grade railroad crossings were identified as a general concern. The study team obtained a list of rail crossings in the study area that have a high accident prediction rating. These ratings are published by VDOT and consider a number of factors including crash history, Average Annual Daily Traffic volumes (AADT), number of trains per day, number of school buses per day, type of crossing control, etc. The percentage of heavy vehicle traffic was not considered in the rating so the study team elected to take the top 25 locations from the Richmond MPO roadway network and the top 25 locations from the Tri-Cities MPO roadway network and identified the 5 crossings out of those 50 locations that had the highest number of heavy vehicles. These 5 at-grade railroad crossings were then included in this list of prioritized roadway improvements.

The actual location of each project is noted in **Figure 4-10**. **Table 4-1** is a summary of the improvements by type. There are corresponding "project work sheets" provided in **Appendix C**.

Figure 4-10 Project Locations

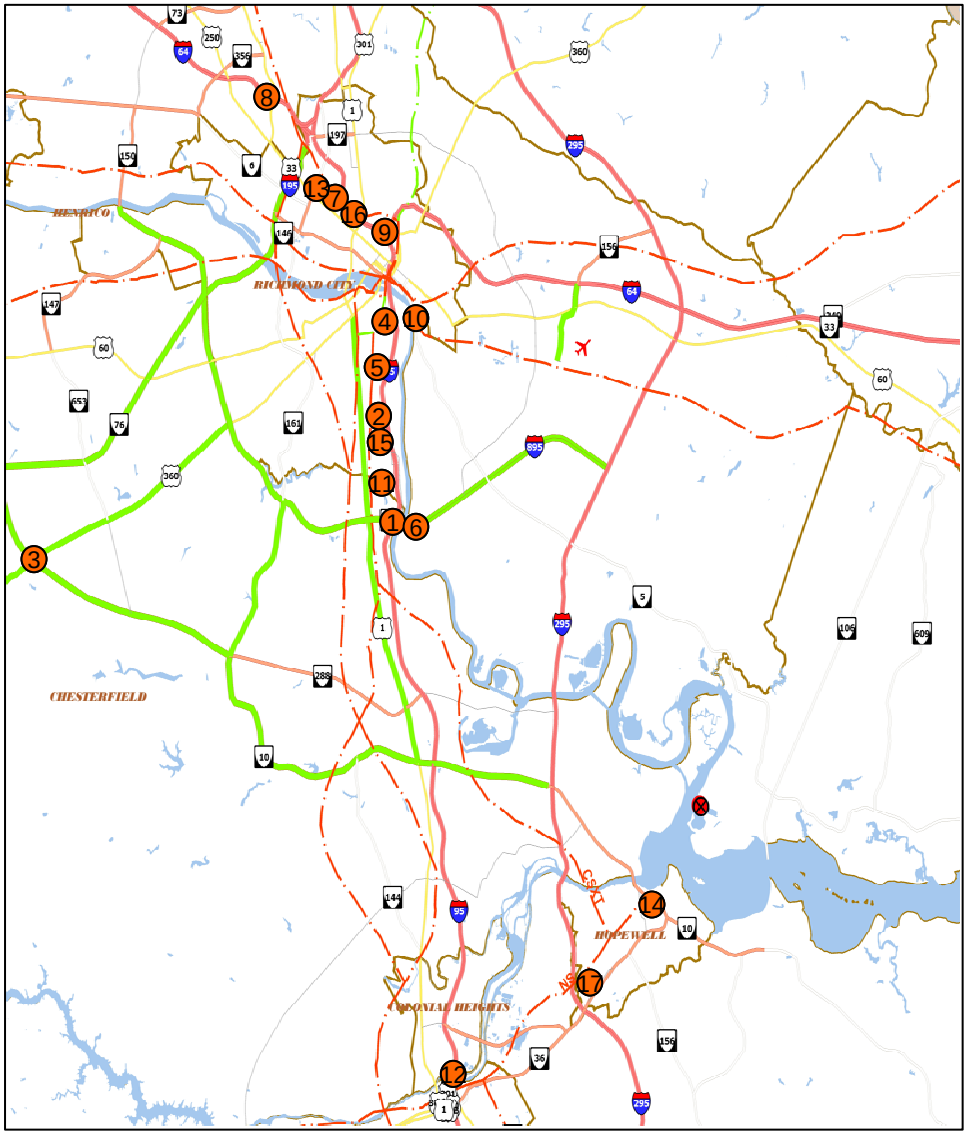


Table 4-1 Summary of Improvement Projects

Accessibility	Roadway/Pavement Condition	Capacity Enhancements	Signage	Roadway Geometry	At-Grade Crossings
I-895/Bells Road (#1)	Deepwater Terminal Road from Bells Road to the access road just south of the weight station (#2)	Hull Street Exit from SR 288 (#3)	SR 5 between Williamsburg Avenue and Water Street (#10)	Bells Road between Commerce Road and Jefferson Davis Highway (#11)	Leigh Street At-Grade rail Crossing (#13)
	Goodes Street between Commerce Road and CSX Railroad Tracks (#4)	Capacity Improvement at the Southern I-64/I-95 Interchange (#9)			Industrial Street Hopewell Double At-Grade Rail Crossing (#14)
	Commerce Road from Hull Street to Trenton Road (#5)				Deepwater Terminal Road At-Grade Rail Crossing (#15)
	I-895 Expansion Joints at James River Bridge (#6)				Brook Road At-Grade Rail Crossing (#16)
	I-95 through the City of Richmond (I-64 overlap section) (#7)				Ashland Avenue Hopewell At-Grade Rail Crossing (#17)
	I-64 from Parham Road to the junction with I-95 and I-195 (#8)				

No improvement recommended for Project #12

4.2.1 Project I-95 and SR 895 Interchange

This project would involve the construction of new ramp within the existing I-95/SR 895/SR 150 interchange to provide access from southbound I-95 to eastbound SR 895. This partial interchange was constructed as a multi-level interchange with free flowing movements between approaches, but does not currently accommodate this one vehicular movement. Vehicles desiring to make such a movement must drive north on I-95 for a distance of approximately 5 miles and then head east on I-64 which entails an approximate 7 mile drive to the airport exit or an approximate 10 mile drive to the I-295/I-64 junction.

Current Average Daily Traffic levels on SR 895 range from 6,600 near I-295 to 16,000 between Laburnum Avenue and I-95. Only 7% of the ADT is truck traffic. That low volume supports the absence of I-895 from any of the classifications of the Richmond/Tri-Cities Regional Multimodal Freight Network categories of Major Regional, Minor Regional or Specialty Connectors listed in Table 3-1 of Technical Memorandum #1.

One hypothesis for the low truck volume on SR 895 is the presence of tolls on SR 895 which could serve as a deterrent to the cost sensitive freight movement industry. These tolls would likely also serve as a deterrent to any truck traffic desiring to use a proposed connection between southbound I-95 and eastbound SR 895. Combine that likelihood with the very high price tag of constructing a ramp in an existing interchange that has right of way constraints and the construction of a ramp accommodating southbound I-95 traffic to eastbound SR 895 traffic is likely a very low regional freight priority.

A conceptual level estimate of potential cost for this project is approximately $50,000,000 due to the height of the ramp structure required to tie into the SR 895 mainline and avoiding conflicts with existing ramps.

4.2.2 Deepwater Terminal Road

This two-lane road runs parallel to I-95 and provides access to industrial properties along the James River, including the Port of Richmond. The northern part of the road is currently under design for pavement rehabilitation/reconstruction from its northern terminus to Bells Road (approximately 11,500 feet). The southern part of the road which serves the Port of Richmond is in a deteriorating state throughout its 3,000 foot length. The City of Richmond does not currently have a project programmed to address this condition on one of the region's specialty connector roads.

A conceptual level estimate of potential cost for this project is approximately $1,500,000.

4.2.3 Hull Street Exit from SR 288

This southbound exit from SR 288 to westbound Hull Street (US 360) is very congested in the PM peak hour. A traffic signal is located about 1500 feet downstream from the entrance location of the SR 288 ramp on westbound US 360. During the PM peak period, queues from the traffic signal can reach all the way back to the ramp and cause congestion. This creates a potentially hazardous condition for vehicles exiting southbound SR 288 onto westbound US 360 as motorists can unexpectedly run into the back of the queue while still on the exit ramp.

VDOT is currently constructing an auxiliary lane (4^{th} through lane) that will extend from the exit ramp through the Commonwealth Centre Parkway/Old Hundred Road/ US 360 intersection, which should address this concern.

Conceptual level estimate of potential cost for the intersection capacity project is $1,000,000.

4.2.4 Goodes Street between Commerce Road and CSX Railroad Tracks

The pavement in this 1,000-foot section of Goodes Street is poor throughout and a road surface improvement is needed to prevent further degradation and to provide a smoother ride. Goodes Street accommodates heavy truck traffic associated with the quarry to the east between I-95 and

the James River, which contributes to the pavement's poor condition, but there are limited other routes that can serve this area of the region.

A conceptual level estimate of potential cost for this improvement is $300,000.

4.2.5 Commerce Road

The pavement in this section of Commerce Road from Hull Street Road to Trenton Road (near the DuPont facility in South Richmond), a distance of 4.6 miles, is in need of road surface improvement. This section of Commerce Road accommodates heavy truck traffic associated with the industrial land uses along the entire corridor and is prone to degradation given the heavy payloads that are transported over it.

The City of Richmond is in the midst of procuring a design contract to improve Commerce Road from Bellmeade Road to Bells Road, a distance of approximately two miles. A timetable for the construction of this project was unavailable.

A conceptual level estimate of potential cost for this improvement is $1,000,000.

4.2.6 I-895 Expansion Joints at James River Bridge

The expansion joints for this structure on I-895 create a very uneven road surface. This condition causes pronounced "bumps" for motorists passing over the expansion joints. The condition can jar and create shifting of payloads on heavy vehicles.

A conceptual level estimate of potential cost for this improvement is $50,000.

4.2.7 I-95 Pavement

The pavement of I-95 through the City of Richmond (I-64 overlap section), a distance of approximately 3.5 miles, is poor throughout and a road surface improvement is needed to prevent further degradation and to provide a smoother ride.

A conceptual level estimate of potential cost for this improvement is $ 25,000,000.

4.2.8 I-64 Pavement

The pavement of I-64 from Parham Road to the junction with I-95 and I-195, a distance of approximately 5.4 miles, is poor throughout and a road surface improvement is needed to prevent further degradation to provide a smoother ride.

VDOT has contracted to repave this section of I-64 with $35,000,000 of ARRA funds.

4.2.9 Capacity Improvement at the Southern I-64/I-95 Interchange

This interchange experiences frequent congestion throughout an average weekday and sometimes severe congestion during the peak hours of an average weekday. It is used as a commuting route by those living east of the City of Richmond and provides access from the north, south and west to eastbound I-64 which heads toward the Hampton Roads area of Virginia where tourism and military installations are major destinations. Of particular concern is the westbound to northbound and westbound to southbound movements in the AM peak period and the southbound to eastbound movement in the PM peak period. These ramps are all single lane ramps. Widening or reconfiguring these ramps will require the acquisition of right-of-way in physically constrained area. Merge areas between ramps and the interstate mainlines are where the majority of the congestion occurs, but some of the ramps between the two interstates exit as two lanes and merge into one before being introduced to the mainline and these ramp merge areas can cause congestion and long queues as well. The westbound to northbound ramp actually exits I-64 as a two-lane amp, but it merges with an on-ramp from 4th Street. This ramp configuration therefore creates a merge condition of 3 lanes narrowing down to a single lane on-ramp onto northbound I-95. This situation is further exacerbated by a bridge crossing with minimal horizontal clearance just downstream of the single lane ramp entrance. Replacement of that 1st Street bridge to allow an auxiliary lane between the on-ramp from I-64 to the Chamberlayne Avenue exit would help reduce congestion at this interchange as well.

There are no programmed improvements to this interchange at present. A conceptual level estimate of potential cost for this improvement is $45,000,000.

4.2.10 Lack of Advanced Notice of Low Vertical Clearance on SR 5 passing under CSX Railroad Bridge between Williamsburg Avenue and Water Street

This situation is a signing issue. High profile vehicles heading eastbound on SR 5 have limited visibility of this low clearance location as they approach it due to the horizontal alignment of SR 5. Once a sharp curve is navigated, the railroad bridge is just a short distance (about 1000 feet) downstream. Those high profile vehicle operators that suddenly encounter clearance issues turn left on Williamsburg Avenue just before the railroad crossing and can tie back into SR 5 a few thousand feet east, but not all operators are aware of this alternative route. Some supplemental signing to guide high profile operators on this alternative path in conjunction with advanced limited vertical clearance signs further upstream of the location before the sharp horizontal curve, would give operators of high profile vehicles the opportunity to divert their travel pattern.

No programmed improvements are currently planned for this location, but a SR 5 corridor study is being procured by the Richmond MPO which may identify potential solutions to this vertical clearance issue.

A conceptual estimate of potential cost for this signing improvement is approximately $10,000.

4.2.11 Bells Road Between Commerce Road and Jefferson Davis Highway (US 1)

This section of Bells Road has four lanes and is approximately 1.25 miles long with two approximate 90 degree horizontal curves in its alignment. These turns can be difficult for truck combinations of greater than 55 foot length to negotiate without their tire path impacting adjacent lanes and or curbs. It is likely that the design vehicle at the time the Bells Road was designed was WB-50. The design is proving troublesome to the newer longer truck combinations. Potential solutions include posting signs prohibiting longer truck combinations or redesigning the horizontal curves. There would appear to be some undeveloped right of way to accommodate a modified horizontal geometry for one of the curve areas, but the other area is adjacent to buildings on one side and a parking area on the other. Modified horizontal geometry at these locations would require some reconstruction of the parking area causing the loss of some spaces.

No project for this section of Bells Road is currently programmed by the City of Richmond. A conceptual estimate of potential cost for these horizontal geometric design modifications is approximately $500,000.

4.2.12 I-95 Exit 53 in Petersburg

The southbound ramps at this interchange intersect with W. Roslyn Road, which parallels I-95. At the intersection between the I-95 southbound off-ramp and W. Roslyn Road, the southbound off-ramp has the right-of-way by virtue of no traffic control for that movement in combination with two-way stop sign control on W. Roslyn Road. There were concerns over the required stops on W. Roslyn Road to allow the exiting southbound off-ramp traffic to proceed onto W. Roslyn Road. Although this traffic control condition may be a concern to some motorists, changing the right-of-way to require exiting interstate traffic to stop would likely cause far greater potential hazards. For instance, requiring the exiting traffic to stop or heed a traffic signal at the ramp's intersection with W. Roslyn Road could lead to the development of a queue of vehicles on the southbound off-ramp. The length of this queue could create increased probability of rear end collisions and potentially extend back so far back on the ramp that the queue reached the I-95 mainline. Such queuing potential would create a potentially unsafe condition and therefore changing the traffic control at the ramp intersection with W. Roslyn Road should be dropped from consideration as a potential improvement project.

4.2.13 At-Grade Rail Crossings

4.2.13.1 Leigh Street At-Grade Railroad Crossing – Richmond

This crossing is located in the city of Richmond approximately .32 miles west of DMV Drive. This four-lane crossing accommodates approximately 1,900 heavy vehicles per day. Potential crossing improvements include installation of crossing gates and warning signals.

A conceptual estimate of potential cost for this improvement is $35,000.

4.2.13.2 Industrial Street At-Grade Railroad Crossing -Hopewell

This two-lane crossing is located on the main access road running through an intensive industrial area located on the south bank of the Appomattox River. Approximately 1,100 heavy vehicles a day pass over this crossing. Potential crossing improvements include installation of crossing gates and warning signals.

A conceptual estimate of potential cost for this improvement is $35,000.

4.2.13.3 Deepwater Terminal At-Grade Railroad Crossing – Richmond

This crossing is located about 0.45 miles south of Bells Road. This two-lane crossing accommodates approximately 800 heavy vehicles per day, most of which are associated with the freight movements at the Port of Richmond. Potential crossing improvements include installation of crossing gates and warning signals.

A conceptual estimate of potential cost for this improvement is $35,000.

4.2.13.4 Brook Road At-Grade Rail Crossing - Richmond

This crossing is located just north of Belvidere Street. Brook Road has two lanes in each direction at this location at which approximately 750 heavy vehicles cross each day. Potential crossing improvements include four-quadrant gates (includes gates on the exit sides of each roadway approach).

A conceptual estimate of potential cost for this improvement is $70,000.

4.2.13.5 Ashland Avenue - Hopewell

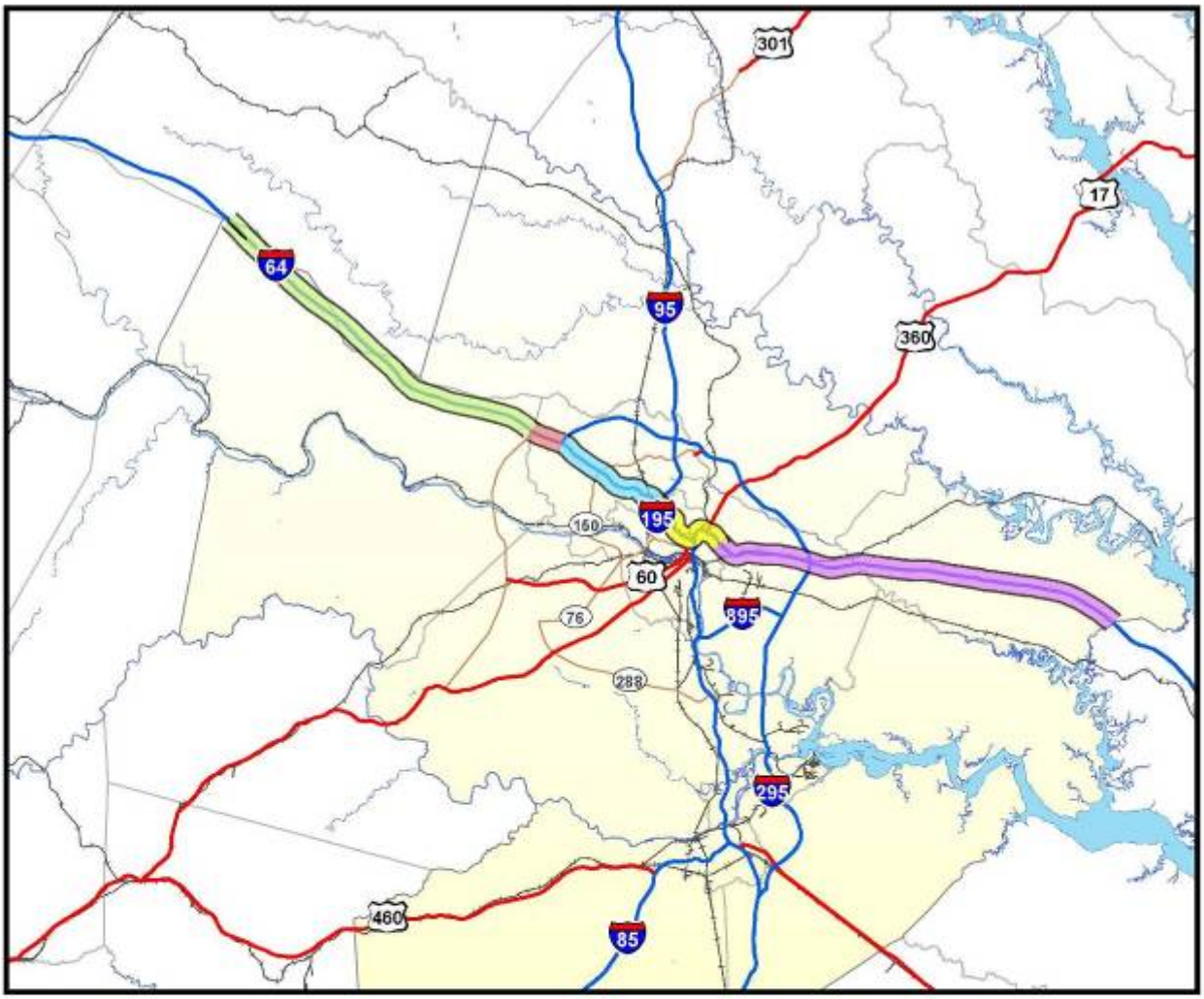
This crossing is located near the I-295/SR 36 interchange. Ashland Avenue has two lanes in each direction at this location at which approximately 700 heavy vehicles cross each day. Potential crossing improvements include four-quadrant gates (includes gates on the exit sides of each roadway approach).

A conceptual estimate of potential cost for this improvement is $70,000.

Appendix A – Corridor Profiles

A-1 I-64 Profile

Corridor:	**INTERSTATE 64**				
From:	**Fluvanna County Line**				
To:	**James City County Line**				
EXISTING OPERATIONAL PROFILE					
	Segment A	**Segment B**	**Segment C**	**Segment D**	**Segment E**
From	Fluvanna County Line	SR 288	I-295	I-95;I-195	SR 33 Nine Mile Road
To	SR 288	I-295	I-95;I-195	SR 33 Nine Mile Road	James City County Line
Freight Classification	Major Regional				
VDOT System Classification	Interstate				
Lanes	4	4	6	6	4-6
Speed Limit	65	65	65	55	65
For link on segment with highest traffic volume					
2008 AADT	42,000	61,000	130,000	151,000	67,000
Percent Trucks	12%	12%	3%	8%	10%
Level of Service 2005	F	F	F	F	B
Level of Service 2035	F	F	F	F	D
Total Truck Accidents Eastbound/Westbound					
2005	26/22				
2006	14/14				
2007	8/13				
EXISTING LAND USE PROFILE					
Intermodal Terminals Served (within 2 miles)			**Notes**		
Richmond International Airport			Air Cargo, primary provider		
ACCA Yard			CSX, Richmond		
Transflo			CSX, Richmond		
Current Bottlenecks			**Notes**		
I-64 and US 60			I-64 and N Parham Rd		
I-64 and I-295			I-64 and I-195		



Interstate 64 Corridor Segments A-E

Legend:

- Segment A
- Segment B
- Segment C
- Segment D
- Segment E
- Interstates
- Major Highways
- Major Roads
- Rail Lines
- Water Features
- County Boundaries
- Study Area

N
W E
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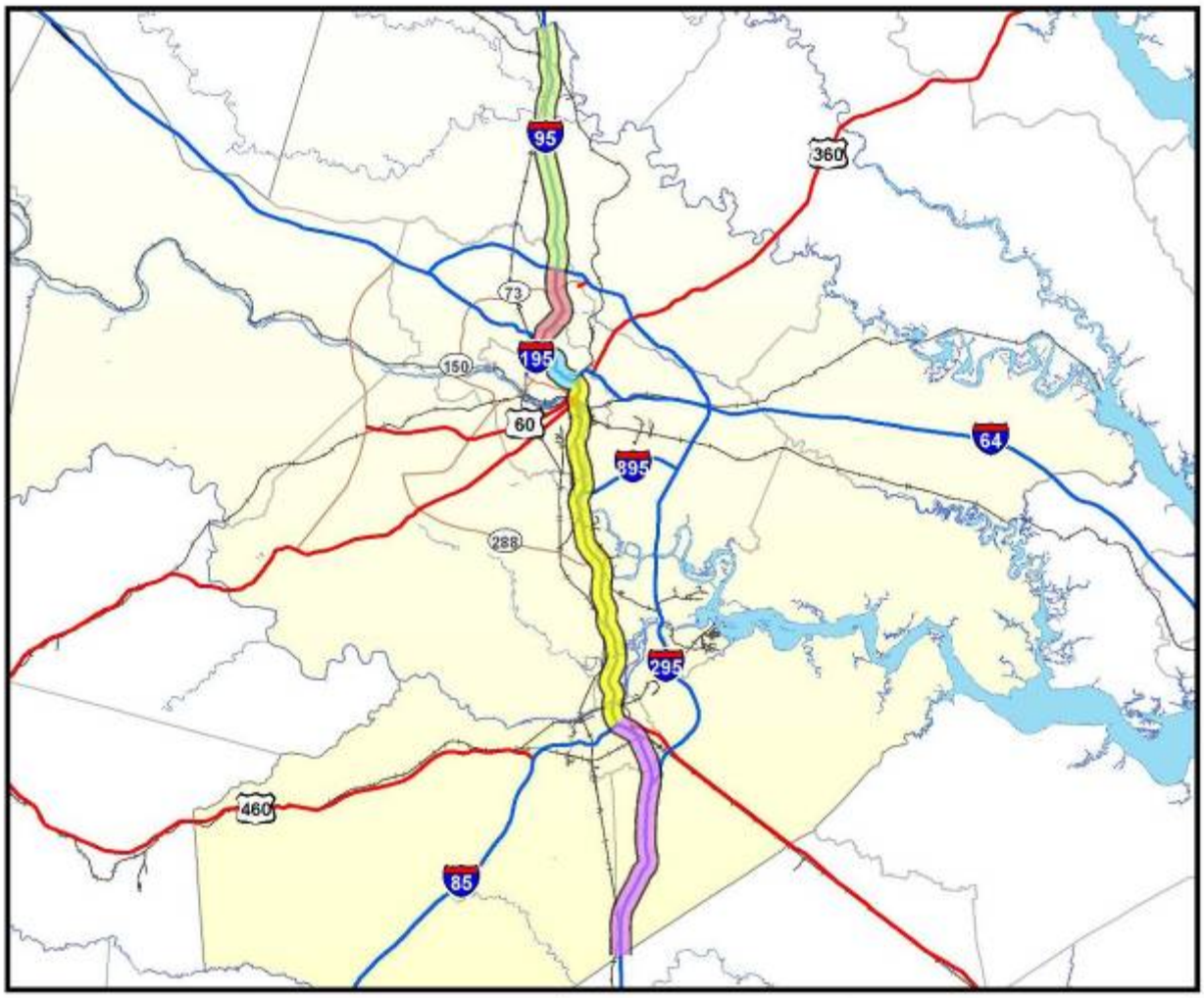
8 4 0 8 16 Miles

A-2 I-95 Profile

Corridor:	**INTERSTATE 95**				
From:	**Caroline County Line**				
To:	**Sussex County Line**				
EXISTING OPERATIONAL PROFILE					
	Segment A	**Segment B**	**Segment C**	**Segment D**	**Segment E**
From	Caroline County Line	I-295	I-64 North Interchange	I-64 South Interchange	I-85
To	I-295	I-64 North Interchange	I-64 South Interchange	I-85	Sussex County Line
Freight Classification	Major Regional				
VDOT System Classification	Interstate				
Lanes	6	6	6	6	4
Speed Limit	65	55	55	55	55
For link on segment with highest traffic volume					
2008 AADT	128,000	99,000	151,000	107,000	43,000
Percent Trucks	14%	10%	8%	10%	16%
Level of Service 2005	F	F	F	C	B
Level of Service 2035	F	F	F	F	F
Total Truck Accidents Northbound/Southbound					
2005	56/46				
2006	38/36				
2007	28/14				

EXISTING LAND USE PROFILE	
Intermodal Terminals Served (within 2 miles)	**Notes**
Buckingham Branch 8	Buckingham Branch RR, Doswell
ACCA Yard/Transflo	CSX, Richmond
W 6th St Yard	NS, Richmond
City of Richmond	Port
E.I. DuPont Drewery's Bluff	Port
Kinder Morgan Energy Partners	Port
Plantation Pipeline Company	Port
Vulcan Materials	Port
IMTT Richmond	Port
Flint Hill Resources	Port
Simsmetal America	Port
Current Bottlenecks	**Notes**
I-95 and W Patrick Henry Rd	I-95 and I-64
I-95 and I-295	



Interstate 95 Corridor Segments A-E

Legend:

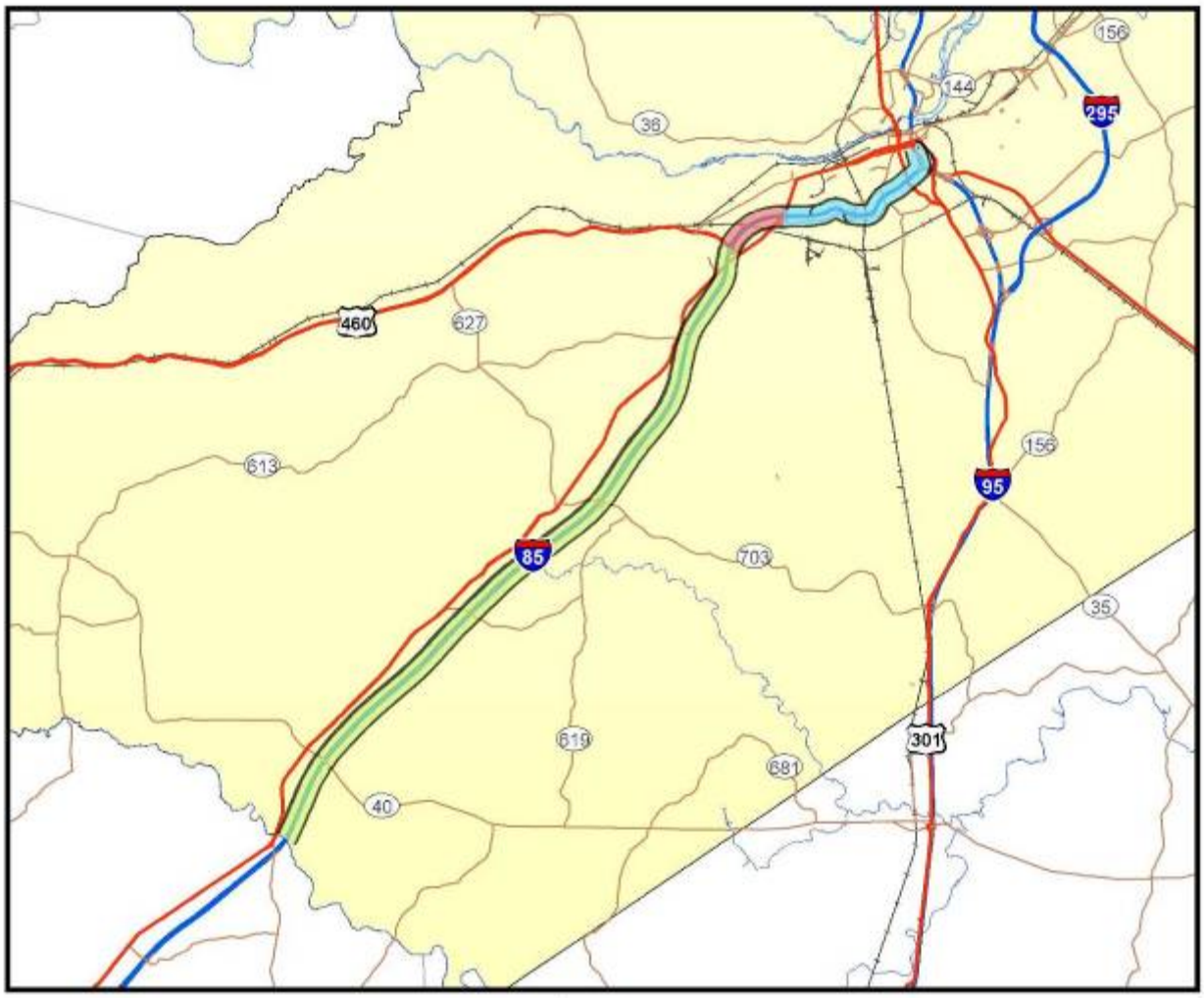
- Segment A
- Segment B
- Segment C
- Segment D
- Segment E
- Interstates
- Major Highways
- Major Roads
- Rail Lines
- Water Features
- County Boundaries
- Study Area

N
W E
S

10 5 0 10 20 Miles

A-3 I-85 Profile

Corridor:	**INTERSTATE 85**				
From:	**Brunswick County Line**				
To:	**I-95 interchange in City of Petersburg**				
EXISTING OPERATIONAL PROFILE					
	Segment A	**Segment B**	**Segment C**		
From	Brunswick County Line	US 460	US 1		
To	US 460	US 1	I 95		
Freight Classification	Major Regional				
VDOT System Classification	Interstate				
Lanes	4	4-6	6		
Speed Limit	65	65	55		
For link on segment with highest traffic volume					
2008 AADT	26,000	40,000	61,000		
Percent Trucks	18%	18%	18%		
Level of Service 2005	B	C	C		
Level of Service 2035	C	C	E		
Total Truck Accidents Northbound/Southbound					
2005	6/7				
2006	7/9				
2007	5/5				
EXISTING LAND USE PROFILE					
Intermodal Terminals Served (within 2 miles)			**Notes**		
Transflo			CSX, Petersburg		
Current Bottlenecks			**Notes**		
None Identified					



Interstate 85 Corridor Segments A-C

Legend:

- Segment A
- Segment B
- Segment C
- Interstates
- Major Highways
- Major Roads
- Rail Lines
- Water Features
- County Boundaries
- Study Area

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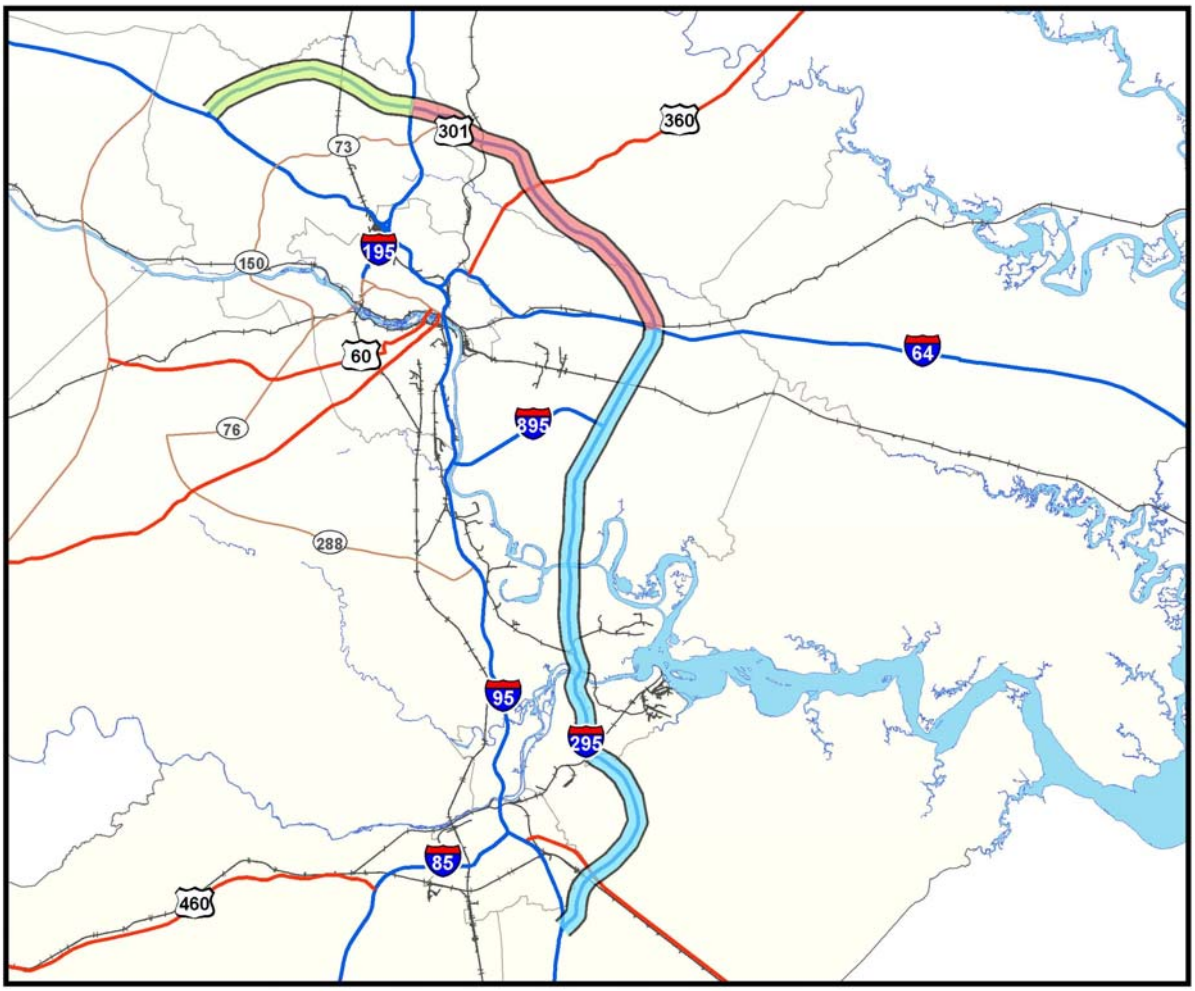
A-4 I-295 Profile

Corridor:	**INTERSTATE 295**				
From:	**I-95 interchange in Prince George County**				
To:	**I-64 interchange in Henrico County**				
EXISTING OPERATIONAL PROFILE					
	Segment A	**Segment B**	**Segment C**		
From	I-64	I-95/US 1 Collector	I-64/US 60 Collector		
To	I-95/US-1 Collector	I-64/US 60 Collector	I-95		
Freight Classification	Major Regional				
VDOT System Classification	Interstate				
Lanes	6	6	6		
Speed Limit	65	65	65		
For link on segment with highest traffic volume					
2008 AADT	59,000	99,000	38,000		
Percent Trucks	5%	9%	22%		
Level of Service 2005	B	C	B		
Level of Service 2035	E	F	D		
Total Truck Accidents Northbound/Southbound					
2005	26/16				
2006	29/17				
2007	21/16				
EXISTING LAND USE PROFILE					
Intermodal Terminals Served (within 2 miles)			**Notes**		
Richmond International Airport			Air Cargo		
100 Hopewell St			NS, Hopewell		
City of Hopewell			Port		
Current Bottlenecks			**Notes**		
I-295 and I-64					



Interstate 295 Corridor Segments A-C

Legend:

- Segment A
- Segment B
- Segment C
- Interstates
- Major Highways
- Major Roads
- Rail Lines
- Water Features
- County Boundaries
- Study Area

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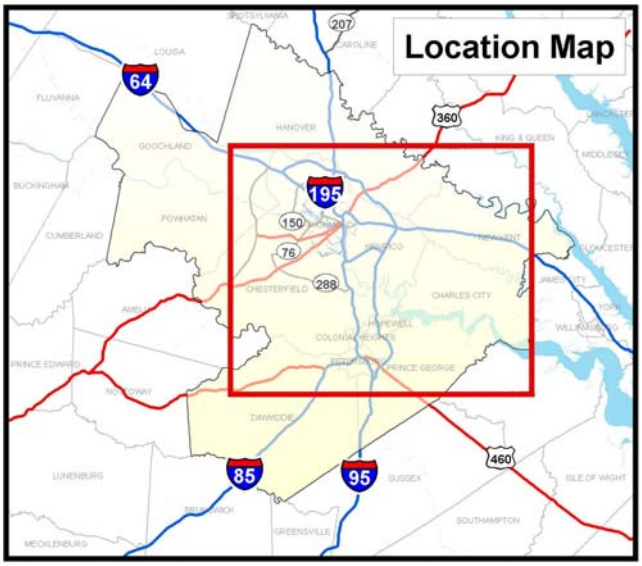
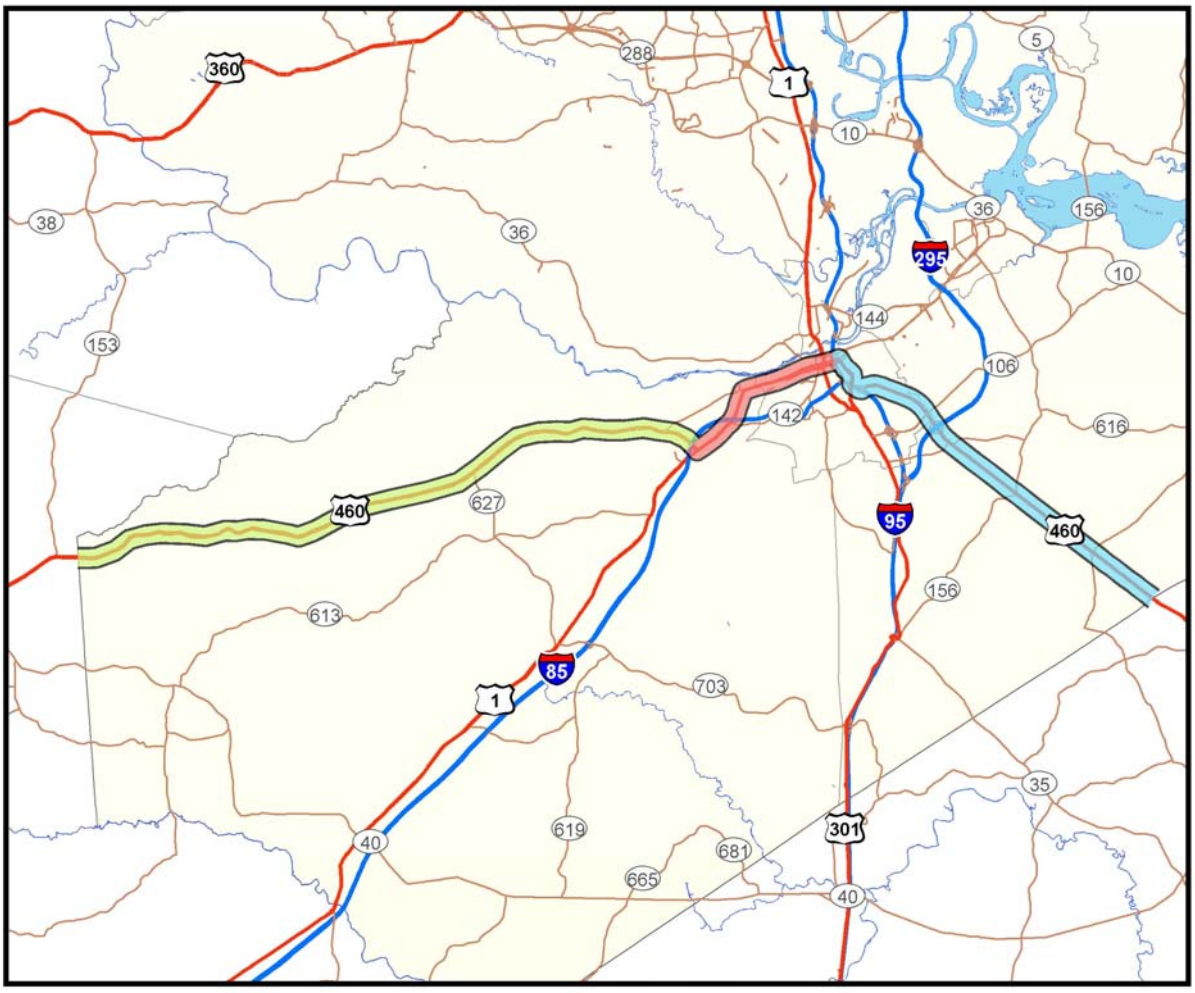


A-5 US 460 Profile

Corridor:	**US HIGHWAY 460**				
From:	**Nottoway County Line**				
To:	**Sussex County Line**				
EXISTING OPERATIONAL PROFILE					
	Segment A	**Segment B**	**Segment C**		
From	Nottoway County Line	I-85;Bus US 460	I-95		
To	I-85;Bus US 460	I-95	Sussex County Line		
Freight Classification	Major Regional				
VDOT System Classification	Primary				
Lanes	4-6	4-6	2-4		
Speed Limit	55	35	55		
For link on segment with highest traffic volume					
2008 AADT	17,000	61,000	19,000		
Percent Trucks	13%	18%	19%		
Level of Service 2005	A	D	A		
Level of Service 2035	A	D	B		
Total Truck Accidents					
2005	<2				
2006	<2				
2007	<2				
EXISTING LAND USE PROFILE					
Intermodal Terminals Served (within 2 miles)			**Notes**		
Transflo			CSX, Petersburg		
Current Bottlenecks			**Notes**		
US 460 and Duncan Rd					



US Highway 460 Corridor Segments A-C

Legend:

- Segment A
- Segment B
- Segment C
- Interstates
- Major Highways
- Major Roads
- Water Features
- County Boundaries
- Study Area

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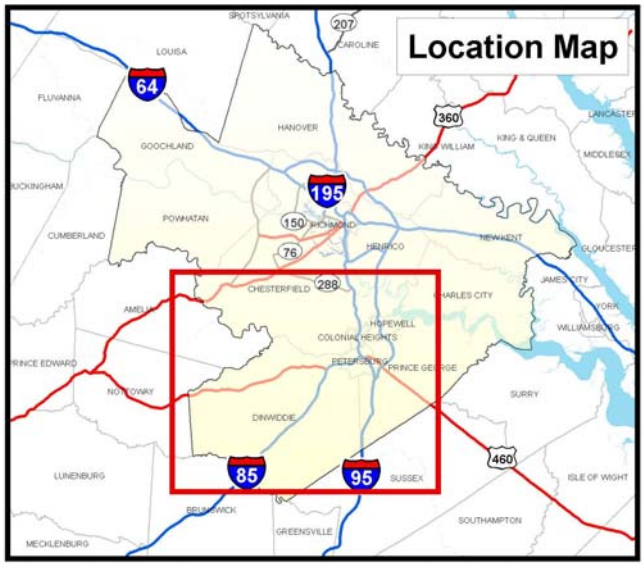
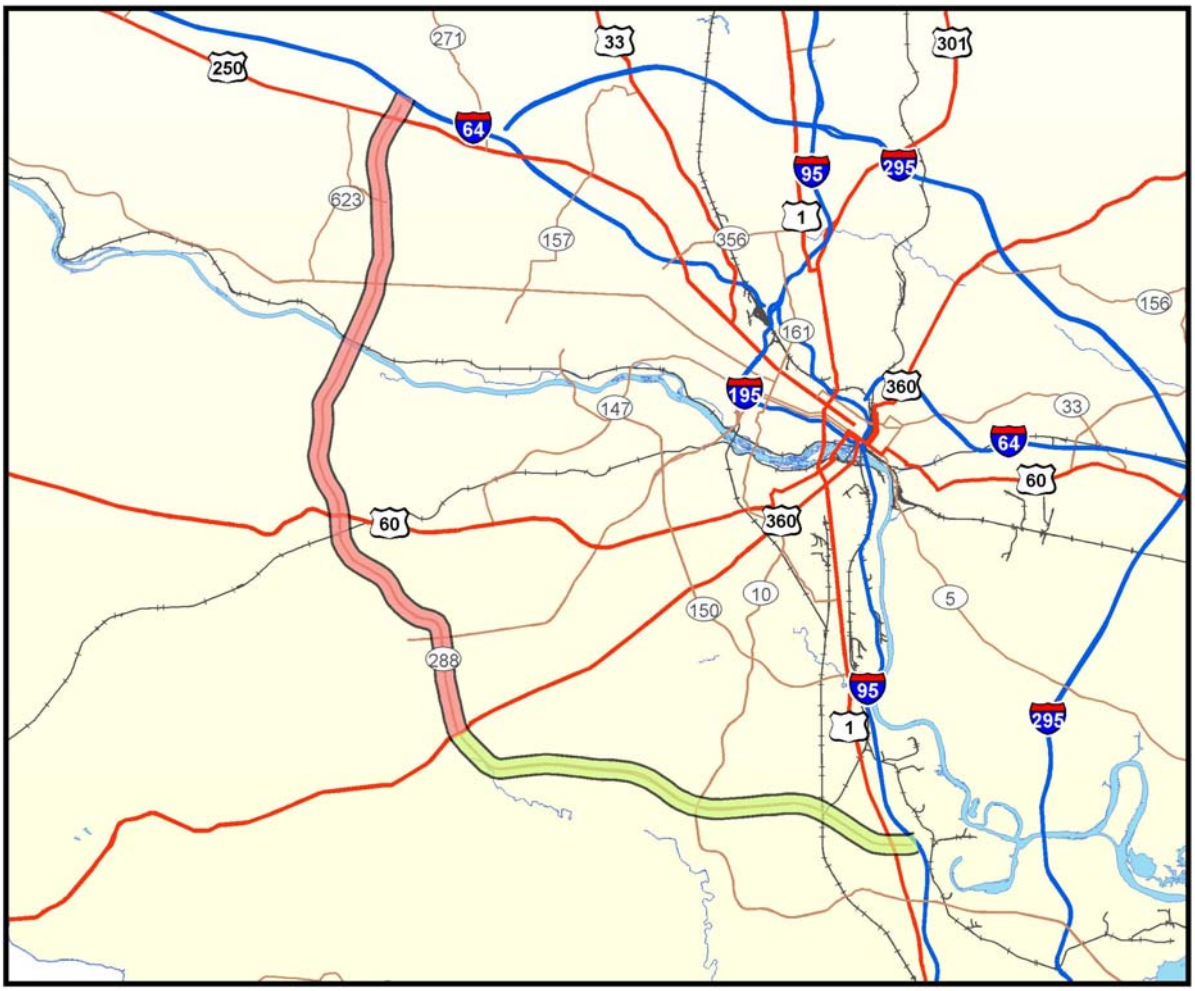


A-6 SR 288 Profile

Corridor:	**VIRGINIA STATE ROUTE 288**				
From:	**I-95**				
To:	**I-64**				
EXISTING OPERATIONAL PROFILE					
	Segment A	**Segment B**			
From	I-95	US 360; Hull Street			
To	US 360; Hull Street	I-64			
Freight Classification	Minor Regional				
VDOT System Classification	Primary				
Lanes	4	4-6			
Speed Limit	65	65			
For link on segment with highest traffic volume					
2008 AADT	48,000	42,000			
Percent Trucks	5%	5%			
Level of Service 2005	D	F			
Level of Service 2035	F	F			
Total Truck Accidents Northbound/Southbound					
2005	3/3				
2006	3/5				
2007	4/2				
EXISTING LAND USE PROFILE					
Intermodal Terminals Served (within 2 miles)			**Notes**		
None					
Current Bottlenecks			**Notes**		
SR 288 and I-64			SR 288 and US 360		
SR 288 and SR 6			SR 288 and Courthouse Rd		



Virginia State Route 288 Corridor
Segments A & B

Legend:

- Segment A
- Segment B
- Interstates
- Major Highways
- Major Roads
- Rail Lines
- Water Features
- Study Area

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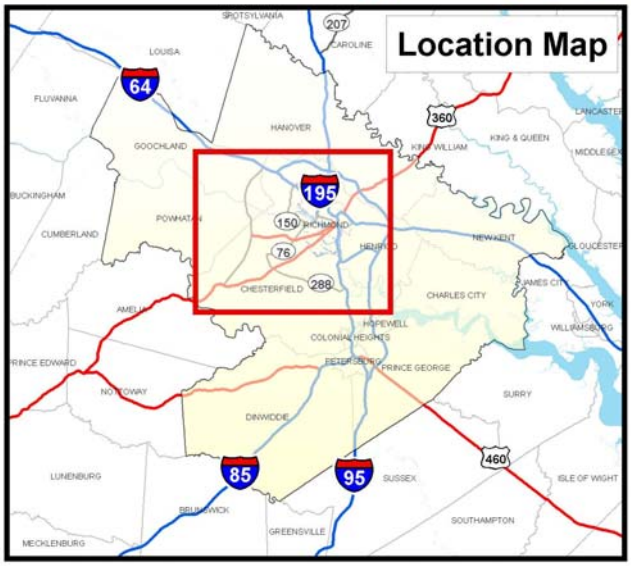
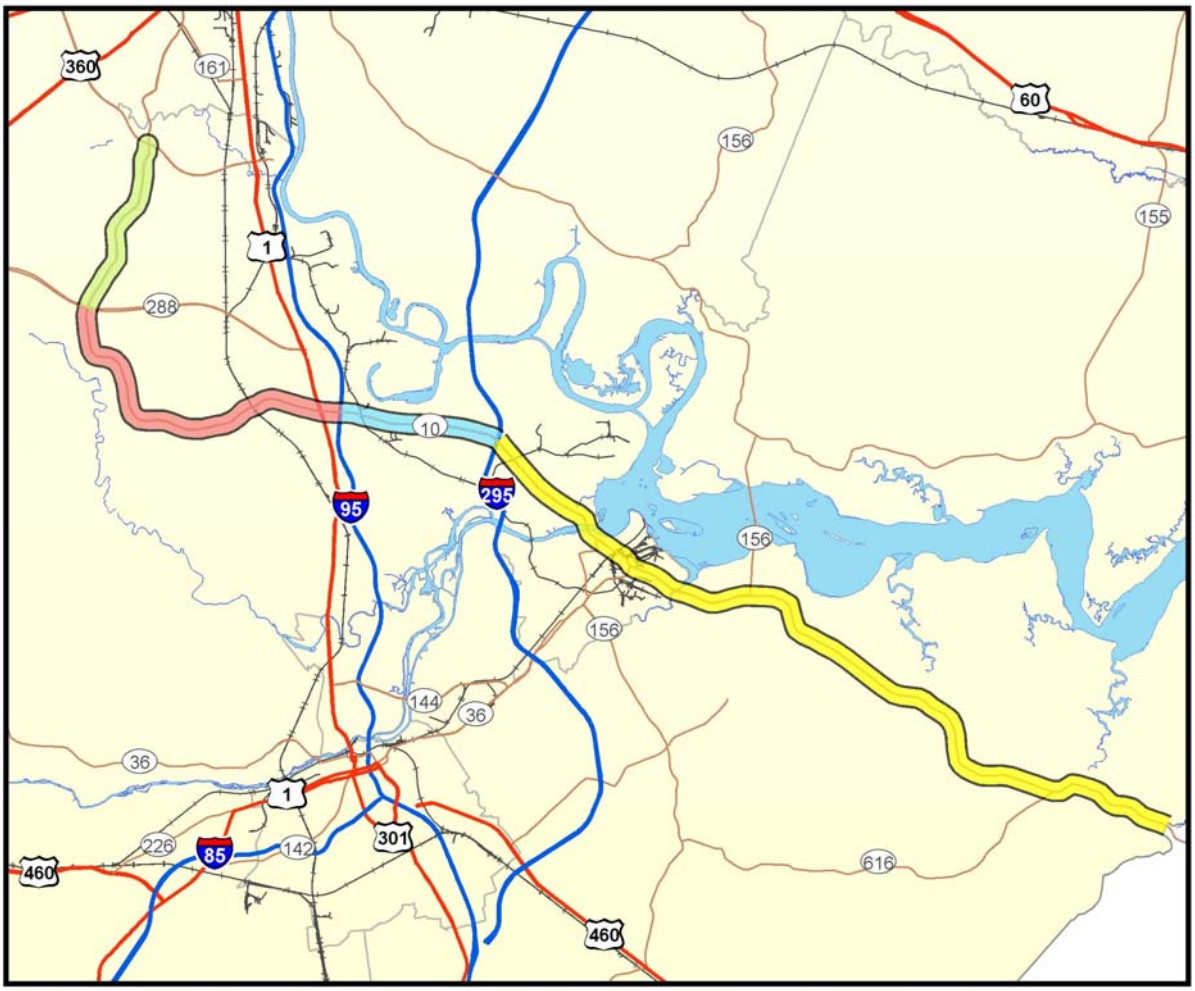


A-7 SR 10 Profile

Corridor:	**VIRGINIA STATE ROUTE 10**				
From:	**SR 150; Chippenham Parkway**				
To:	**Prince George County Line**				
EXISTING OPERATIONAL PROFILE					
	Segment A	**Segment B**	**Segment C**	**Segment D**	
From	SR 150	SR 288	I-95	I-295	
To	SR 288	I-95	I-295	Prince George County Line	
Freight Classification	Minor Regional				
VDOT System Classification	Primary				
Lanes	4	4	4-6	4	
Speed Limit	45	45	55	55	Speed Limit
For link on segment with highest traffic volume					
2008 AADT	34,000	39,000	38,000	26,000	
Percent Trucks	3%	3%	5%	5%	
Level of Service 2005	F	D	C	A	
Level of Service 2035	F	F	D	F	
Total Truck Accidents					
2005	<2				
2006	<2				
2007	<2				
EXISTING LAND USE PROFILE					
Intermodal Terminals Served (within 2 miles)			**Notes**		
None					
Current Bottlenecks			**Notes**		
SR 10 and Jessup Rd					
SR 10 and SR 288					



Virginia State Route 10 Corridor Segments A-D

Legend:

- Segment A
- Segment B
- Segment C
- Segment D
- Interstates
- Major Highways
- Major Roads
- Rail Lines
- Water Features
- County Boundaries
- Study Area

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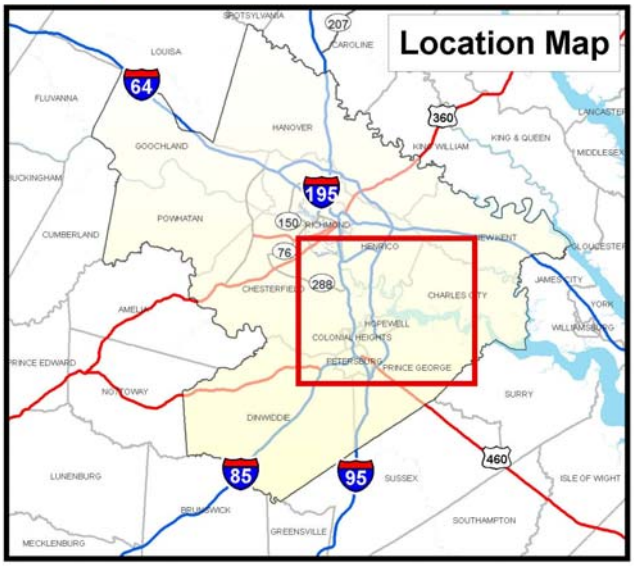
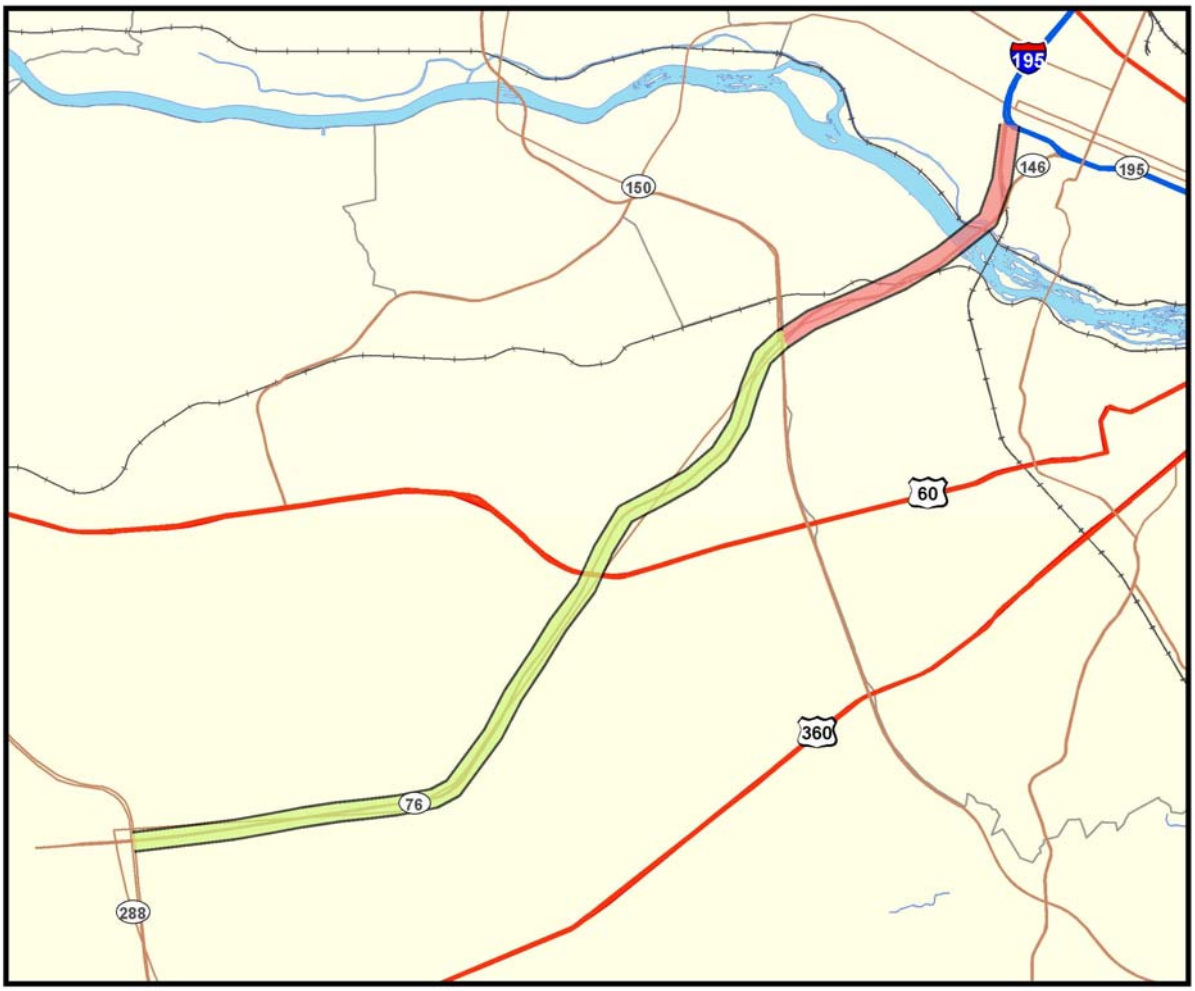


A-8 SR 76 Profile

Corridor:	**VIRGINIA STATE ROUTE 76**				
From:	**SR-288**				
To:	**I-195**				
EXISTING OPERATIONAL PROFILE					
	Segment A	**Segment B**			
From	SR 288	SR 150; Chippenham Parkway			
To	SR 150; Chippenham Parkway	I-195			
Freight Classification	Minor Regional				
VDOT System Classification	Toll				
Lanes	6-8	6-10			
Speed Limit	60	55			
For link on segment with highest traffic volume					
2008 AADT	49,000	93,000			
Percent Trucks	2%	1%			
Level of Service 2005	D	D			
Level of Service 2035	F	F			
Total Truck Accidents					
2005	<2				
2006	<2				
2007	<2				
EXISTING LAND USE PROFILE					
Intermodal Terminals Served (within 2 miles)			**Notes**		
ACCA Yard/Transflo			CSX, Richmond		
Current Bottlenecks			**Notes**		
SR 76 and SR 150					
SR 76 and I-195					



Virginia State Route 76 Corridor Segments A & B

Legend:

- Segment A
- Segment B
- Interstates
- Major Highways
- Major Roads
- Rail Lines
- Water Features
- County Boundaries
- Study Area

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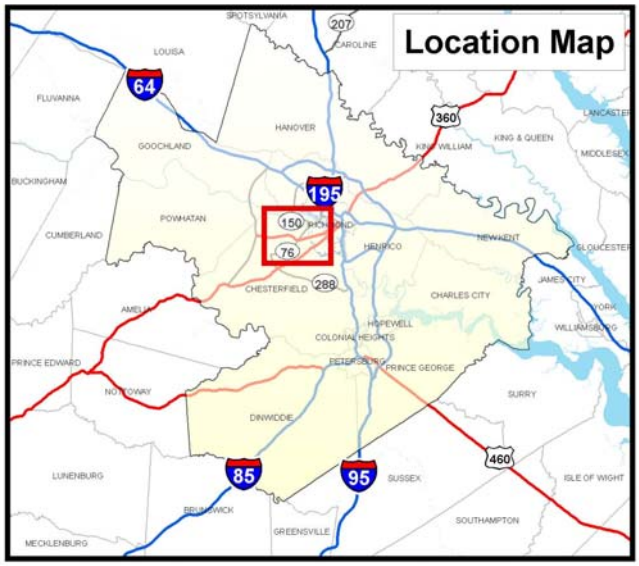
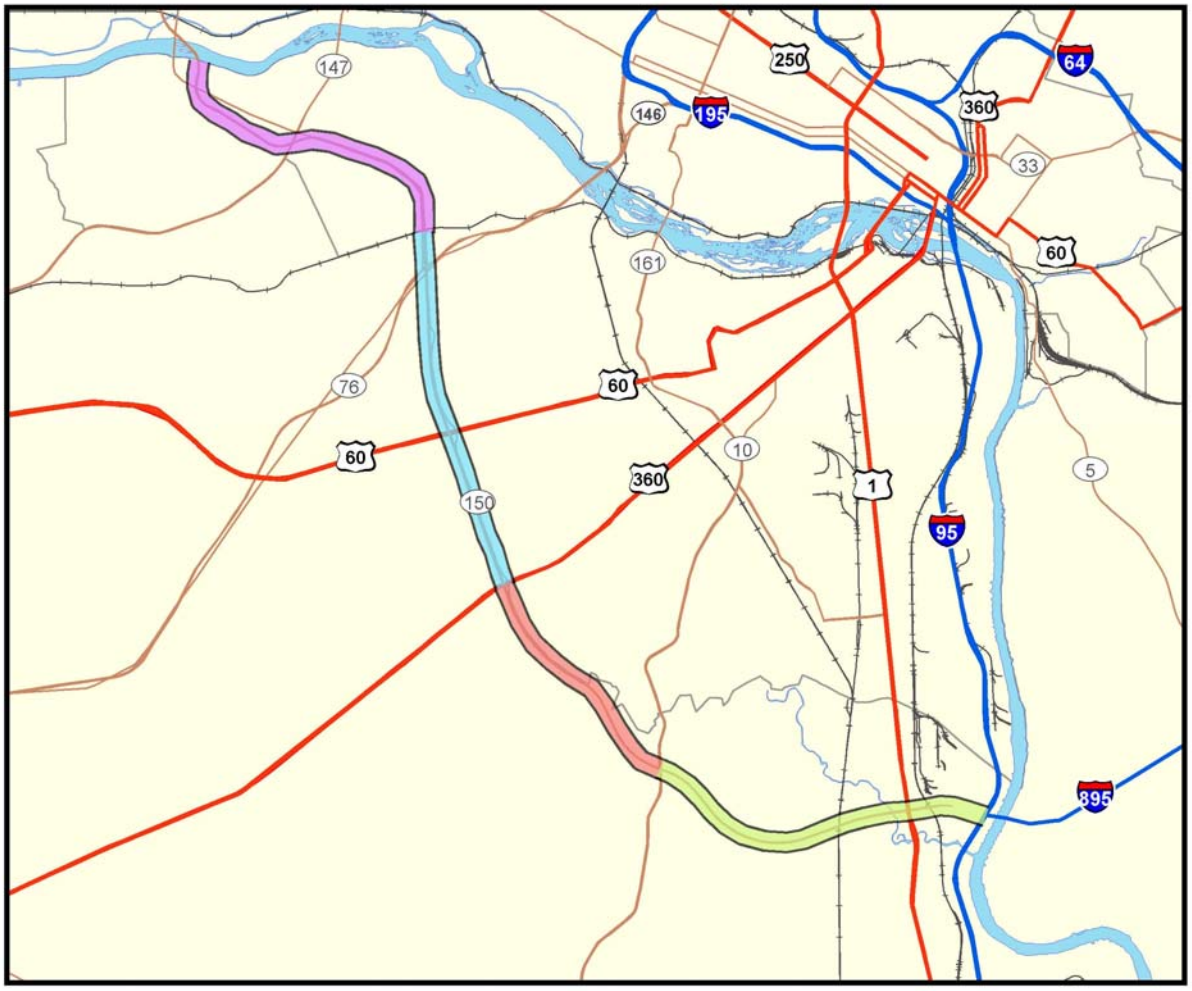


A-9 SR 150 Profile

Corridor:	**VIRGINIA STATE ROUTE 150; CHIPPENHAM PARKWAY**				
From:	**I-95 Interchange in Chesterfield County**				
To:	**River Road in Henrico County (Richmond NCL)**				
EXISTING OPERATIONAL PROFILE					
	Segment A	**Segment B**	**Segment C**	**Segment D**	
From	I-95	SR 10; Iron Bridge Rd	US 360; Hull Street	ECL Richmond	
To	SR 10; Iron Bridge Rd	US 360; Hull Street	ECL Richmond	NCL Richmond	
Freight Classification	Minor Regional				
VDOT System Classification	Primary				
Lanes	8	8	8	6-8	
Speed Limit	60	60	60	45	
For link on segment with highest traffic volume					
2008 AADT	61,000	67,000	74,000	51,000	
Percent Trucks	2%	2%	2%	2%	
Level of Service 2005	B	C	C	F	
Level of Service 2035	E	F	D	F	
Total Truck Accidents					
2005	<2				
2006	<2				
2007	<2				
EXISTING LAND USE PROFILE					
Intermodal Terminals Served (within 2 miles)			**Notes**		
None					
Current Bottlenecks			**Notes**		
Between Sherbrook Rd and Ingalls Dr					
SR 150 and I-95					



Virginia State Route 150 Corridor Segments A-D

Legend:

- Segment A
- Segment B
- Segment C
- Segment D
- Interstate
- US Highway
- State Highway
- Rail Lines
- Water Features
- County Boundaries
- Study Area

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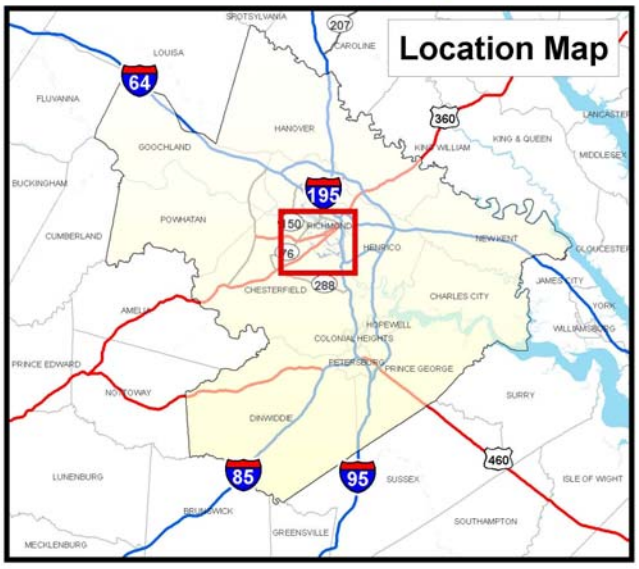
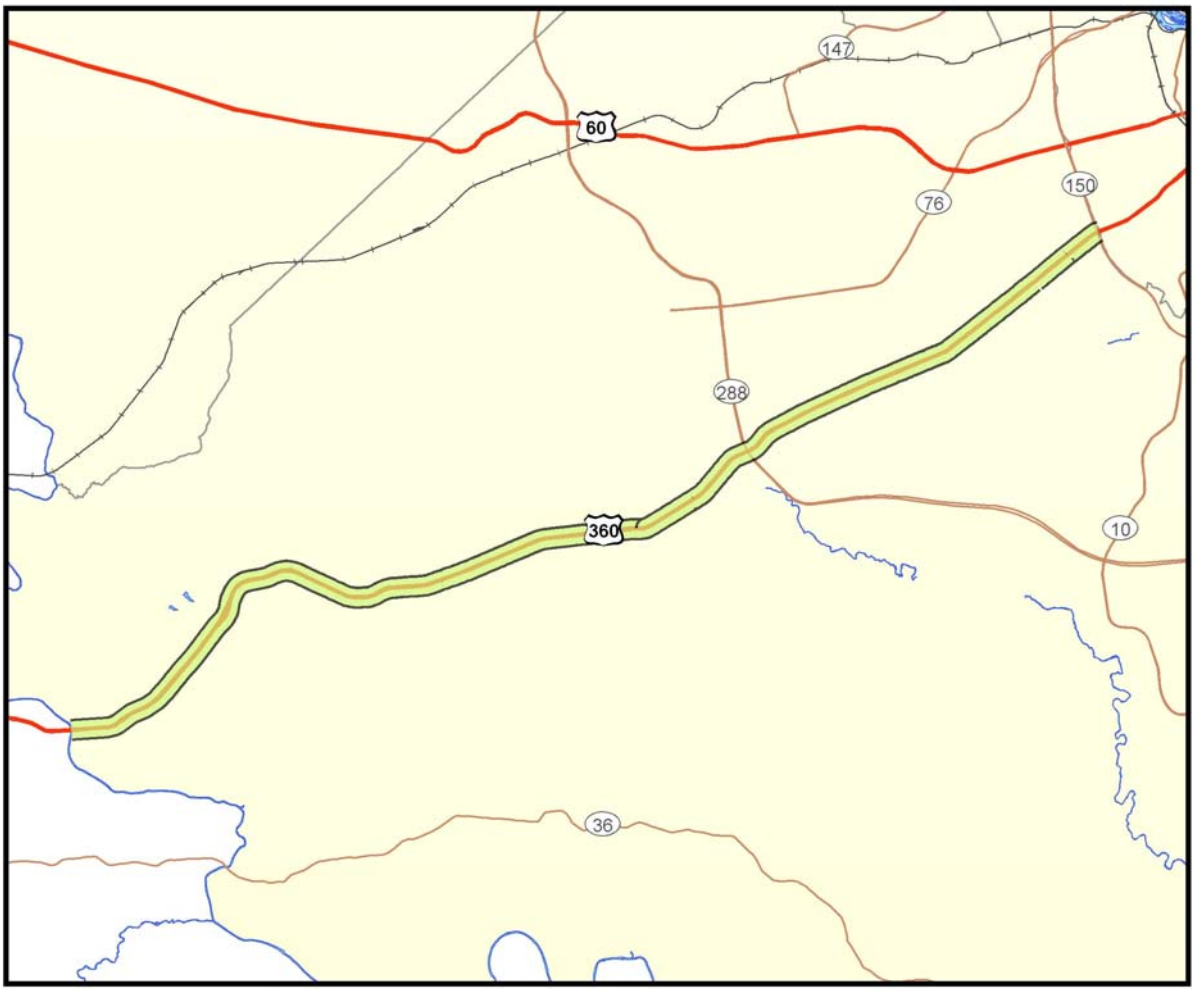


A-10 US 360 Profile

Corridor:	**US HIGHWAY 360; HULL STREET**				
From:	**Amelia County Line**				
To:	**SR 150; Chippenham Parkway**				
EXISTING OPERATIONAL PROFILE					
	Segment A				
From	Amelia County Line				
To	SR 150; Chippenham Parkway				
Freight Classification	Minor Regional				
VDOT System Classification	Primary				
Lanes	4-6				
Speed Limit	55				
For link on segment with highest traffic volume					
2008 AADT	67,000				
Percent Trucks	8%				
Level of Service 2005	D				
Level of Service 2035	F				
Total Truck Accidents					
2005	<2				
2006	<2				
2007	<2				
EXISTING LAND USE PROFILE					
Intermodal Terminals Served (within 2 miles)			**Notes**		
None					
Current Bottlenecks			**Notes**		
Between N. Springs Rd and Mockingbird Ln					



U.S. Highway 360 Corridor

Legend:

- US 360 Corridor
- Interstates
- Major Highways
- Major Roads
- Rail Lines
- Water Features
- County Boundaries
- Study Area

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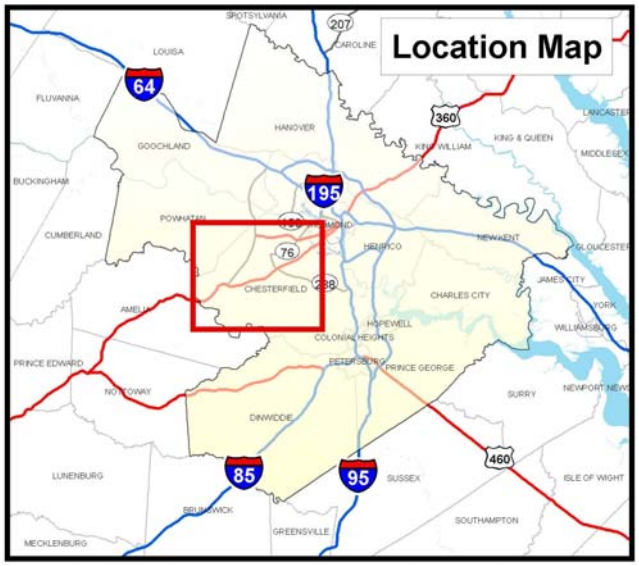
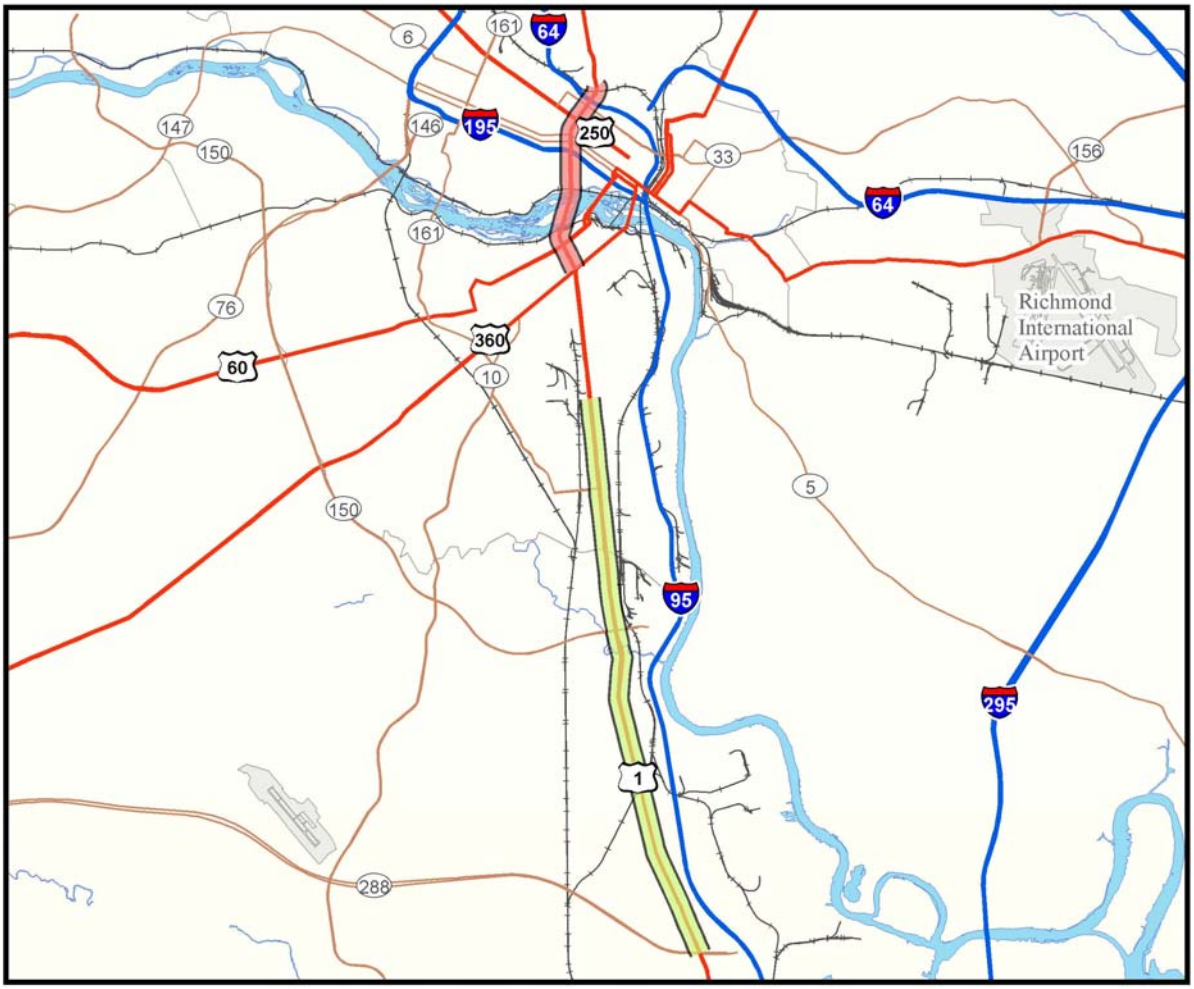


A-11 US 1 Profile

Corridor:	**US HIGHWAY 1**				
From:	**SR 288**				
To:	**Chamberlayne Ave**				
EXISTING OPERATIONAL PROFILE					
	Segment A	**Segment B**			
From	SR 288	US 360; Hull Street			
To	Bellmeade Rd	Chamber-layne Ave			
Freight Classification	Minor Regional				
VDOT System Classification	Primary				
Lanes	4	6			
Speed Limit	45	35			
For link on segment with highest traffic volume					
2008 AADT	22,000	32,000			
Percent Trucks	4%	4%			
Level of Service 2005	B	D			
Level of Service 2035	D	D			
Total Truck Accidents					
2005	<2				
2006	<2				
2007	<2				

EXISTING LAND USE PROFILE	
Intermodal Terminals Served (within 2 miles)	**Notes**
W 6th St Yard	NS, Richmond
City of Richmond	Port
E.I. DuPont Drewery's Bluff	Port
Kinder Morgan Energy Partners	Port
Plantation Pipeline Company	Port
Vulcan Materials	Port
IMTT Richmond	Port
Flint Hill Resources	Port
Simsmetal America	Port
Current Bottlenecks	**Notes**
US 1 and SR 150	US 1 and Franklin Rd
US 1 and US 60	



US Highway 1 Corridor Segments A & B

Legend:

- Segment A
- Segment B
- Interstates
- Major Highways
- Major Roads
- Rail Lines
- Airport
- Water Features
- County Boundaries
- Study Area

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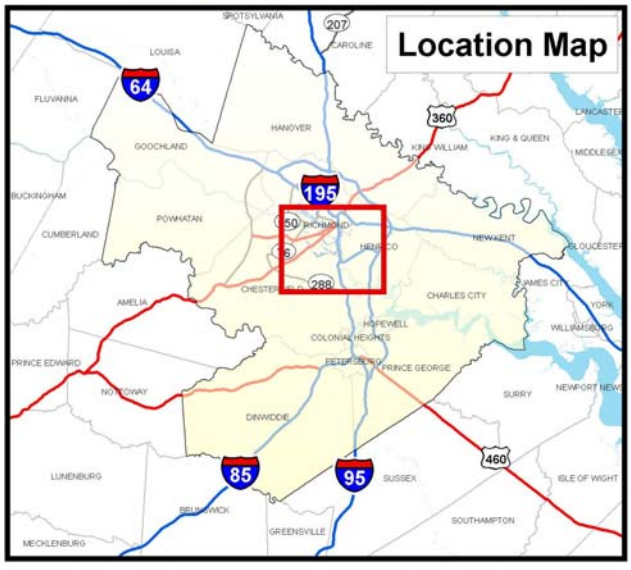
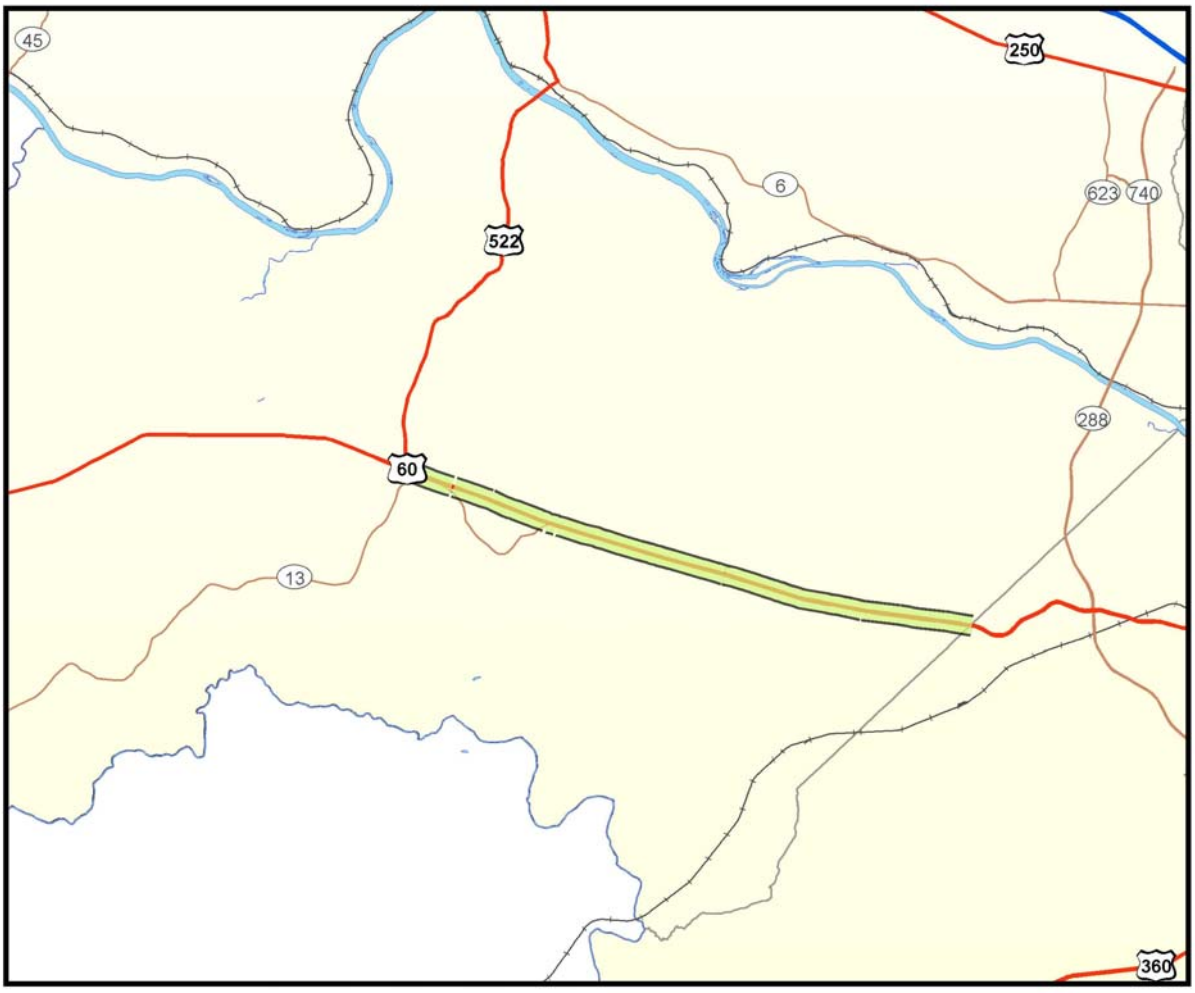


A-12 US 60 Profile

Corridor:	**US HIGHWAY 60**				
From:	**SR 300; Scottsville Rd**				
To:	**Chesterfield County Line**				
EXISTING OPERATIONAL PROFILE					
	Segment A				
From	SR 300; Scottsville Rd.				
To	Chesterfield County Line				
Freight Classification	Connector				
VDOT System Classification	Primary				
Lanes	4				
Speed Limit	35				
For link on segment with highest traffic volume					
2008 AADT	28,000				
Percent Trucks	5%				
Level of Service 2005	C				
Level of Service 2035	E				
Total Truck Accidents					
2005	<2				
2006	<2				
2007	<2				
EXISTING LAND USE PROFILE					
Intermodal Terminals Served (within 2 miles)			**Notes**		
City of Richmond			Port		
Current Bottlenecks			**Notes**		
None Identified					



U.S. Highway 60 Corridor

Legend:

- US 60 Corridor
- Interstates
- Major Highways
- Major Roads
- Rail Lines
- Water Features
- County Boundaries
- Study Area

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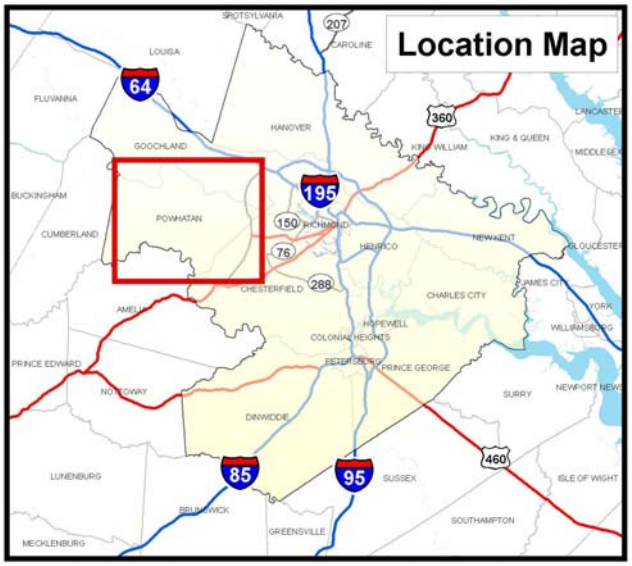
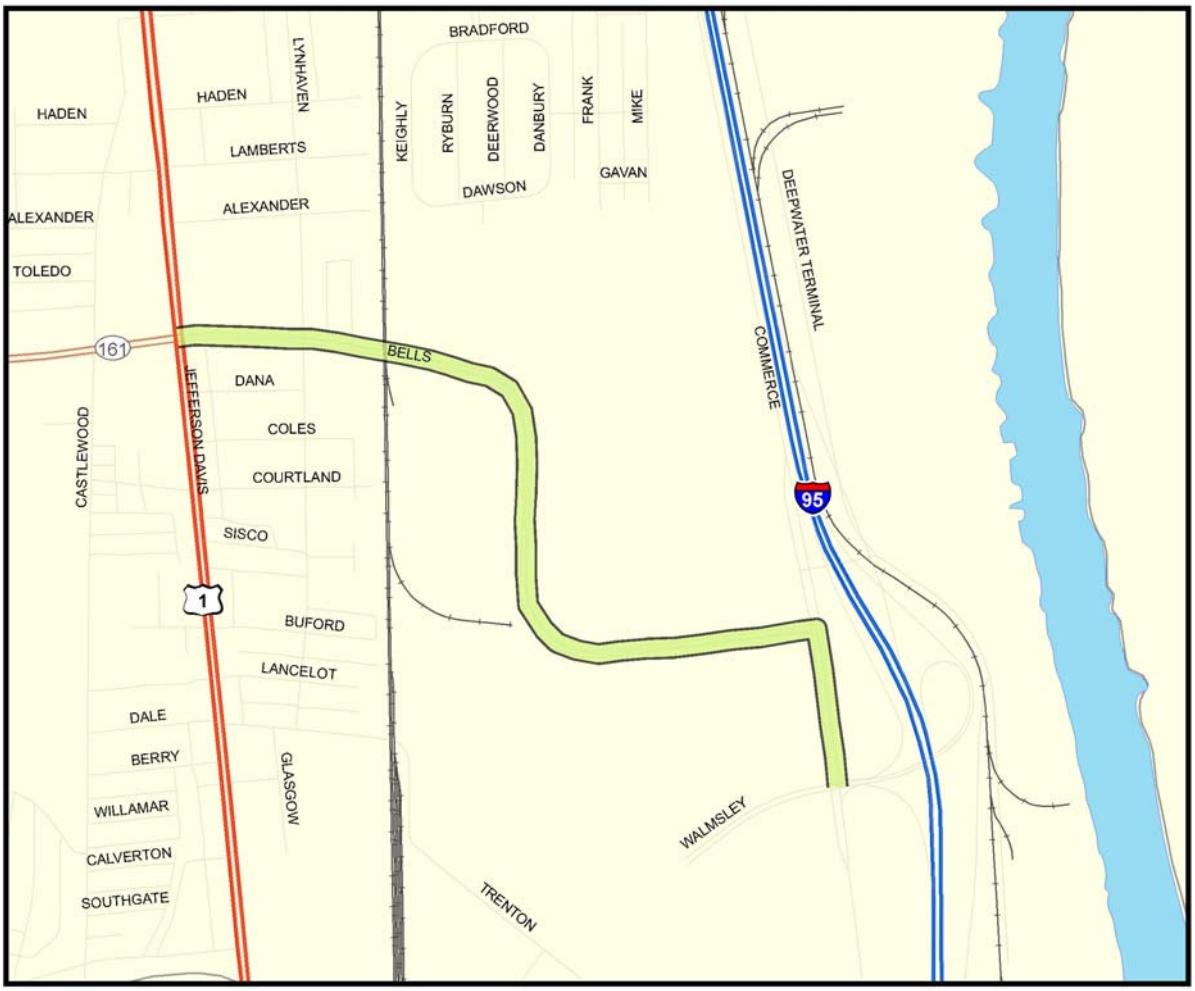


A-13 SR 161 Profile

Corridor:	**VIRGINIA STATE ROUTE 161**				
From:	**I-95**				
To:	**US 1/US 301; Jefferson Davis Highway**				
EXISTING OPERATIONAL PROFILE					
	Segment A				
From	I-95				
To	US 1/US 301; Jefferson Davis Highway				
Freight Classification	Connector				
VDOT System Classification	Primary				
Lanes	4				
Speed Limit	55				
For link on segment with highest traffic volume					
2008 AADT	19,000				
Percent Trucks	13%				
Level of Service 2005	A				
Level of Service 2035	B				
Total Truck Accidents Non-directional					
2005	2				
2006	5				
2007	3				
EXISTING LAND USE PROFILE					
Intermodal Terminals Served (within 2 miles)			**Notes**		
None					
Current Bottlenecks			**Notes**		
US 60 and SR 288					



Virginia State Route 161 Corridor

Legend:

- SR 161 Corridor
- Interstates
- Major Highways
- Major Roads
- Rail Lines
- Water Features
- County Boundaries
- Study Area

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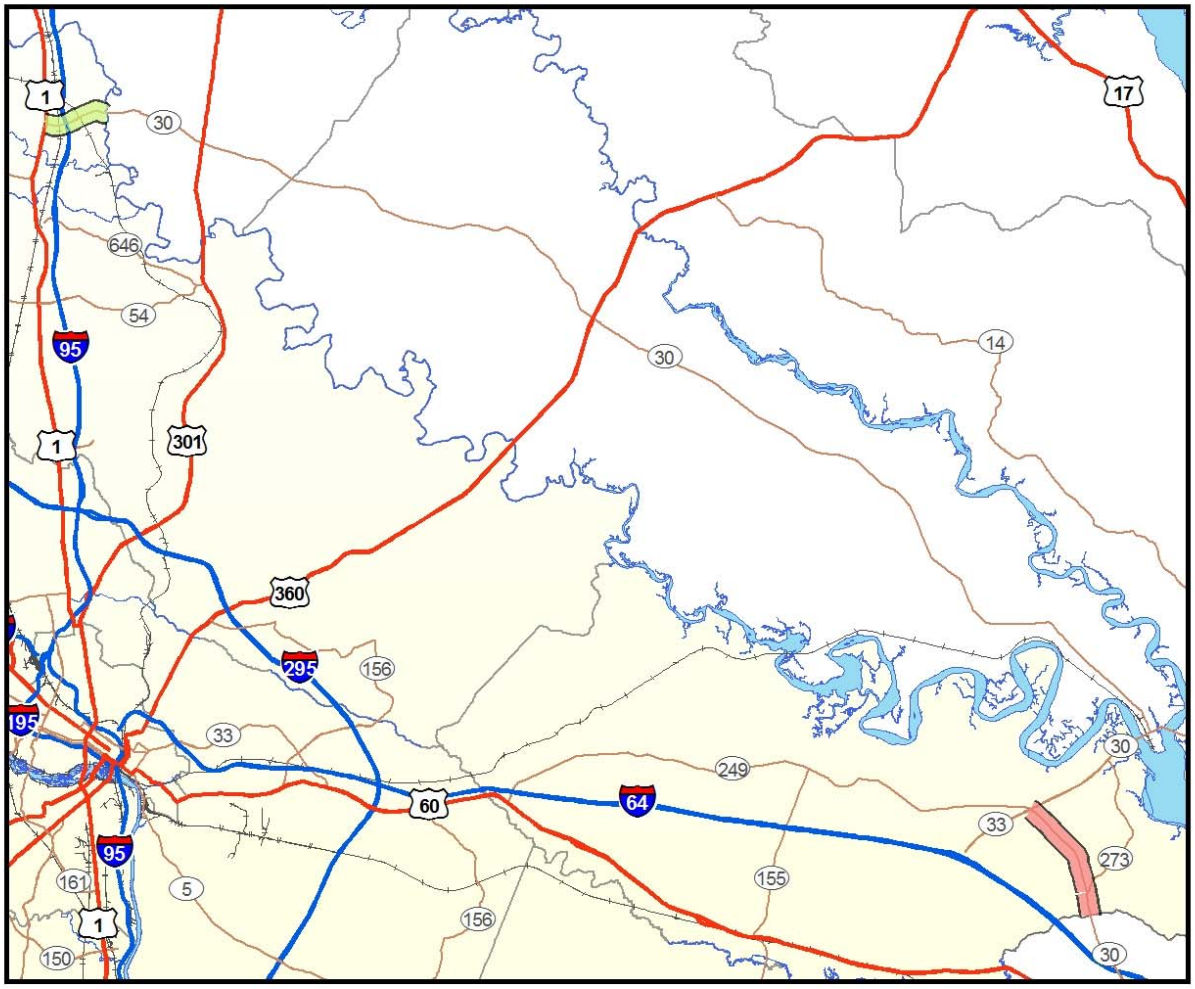
A-14 SR 30 Profile

Corridor:	**VIRGINIA STATE ROUTE 30**				
From:	**US 1**				
To:	**James County Line**				
EXISTING OPERATIONAL PROFILE					
	Segment A	**Segment B**			
From	US 1	King William County Line			
To	Caroline County Line	James City County Line			
Freight Classification	Connector				
VDOT System Classification	Primary				
Lanes	2-4	4			
Speed Limit	55	45			
For link on segment with highest traffic volume					
2008 AADT	11,000	11 ,000			
Percent Trucks	17%	13%			
Level of Service 2005	C	B			
Level of Service 2035	D	C			
Total Truck Accidents					
2005	<2				
2006	<2				
2007	<2				
EXISTING LAND USE PROFILE					
Intermodal Terminals Served (within 2 miles)			**Notes**		
None					
Current Bottlenecks			**Notes**		
SR 30 and I-95					
SR 30 and Walkerton Road					



Virginia State Route 30 Corridor Segments A & B

Legend:

- Segment A
- Segment B
- Interstates
- Major Highways
- Major Roads
- Rail Lines
- Water Features
- County Boundaries
- Study Area

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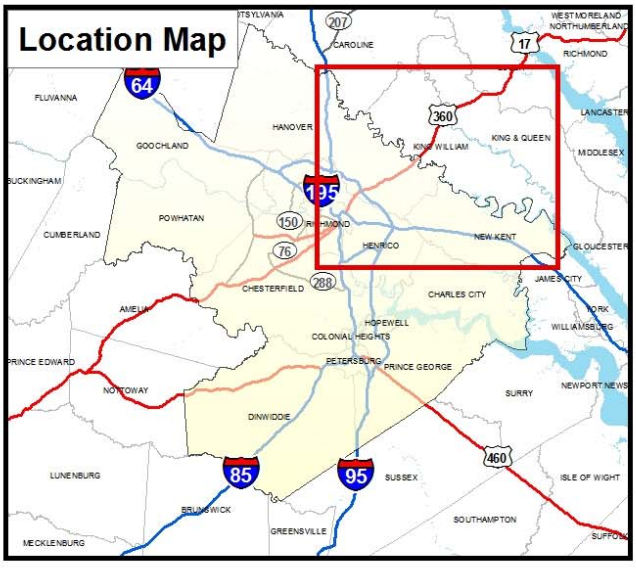
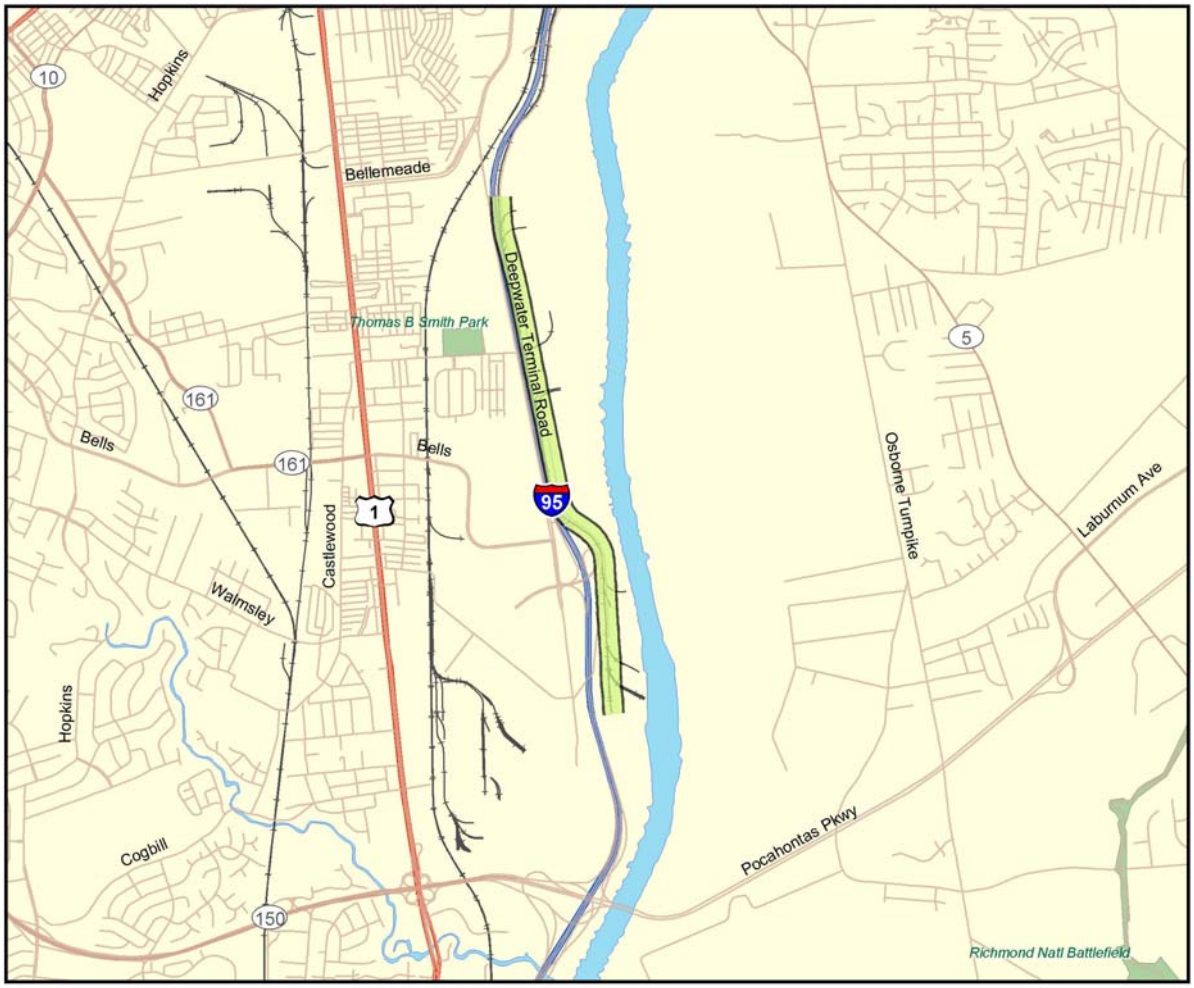


A-15 Deepwater Terminal Road Profile

Corridor:	**DEEPWATER TERMINAL ROAD**				
From:	**Connector Road**				
To:	**I-95**				
EXISTING OPERATIONAL PROFILE					
	Segment A				
From	Connector Road				
To	I-95				
Freight Classification	Connector				
VDOT System Classification	Secondary				
Lanes	2				
Speed Limit	45				
For link on segment with highest traffic volume					
2008 AADT					
Percent Trucks					
Level of Service 2005					
Level of Service 2035					
Total Truck Accidents					
2005	<2				
2006	<2				
2007	<2				
EXISTING LAND USE PROFILE					
Intermodal Terminals Served (within 2 miles)			**Notes**		
City of Richmond			Port		
E.I. DuPont Drewery's Bluff			Port		
Kinder Morgan Energy Partners			Port		
Plantation Pipeline Company			Port		
Vulcan Materials			Port		
IMTT Richmond			Port		
Flint Hill Resources			Port		
Simsmetal America			Port		
Current Bottlenecks			**Notes**		
None Identified					



Deepwater Terminal Road Corridor

Legend:

- Deepwater Terminal Corridor
- Interstates
- Major Highways
- Major Roads
- Rail Lines
- Parks
- Water Features
- County Boundaries
- Study Area

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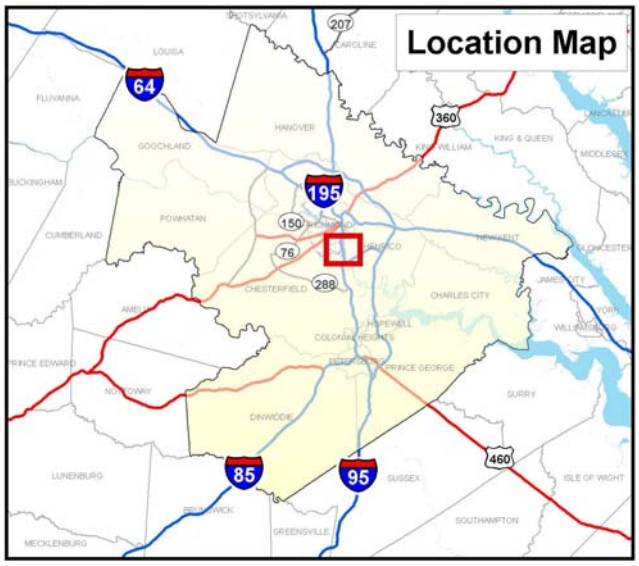
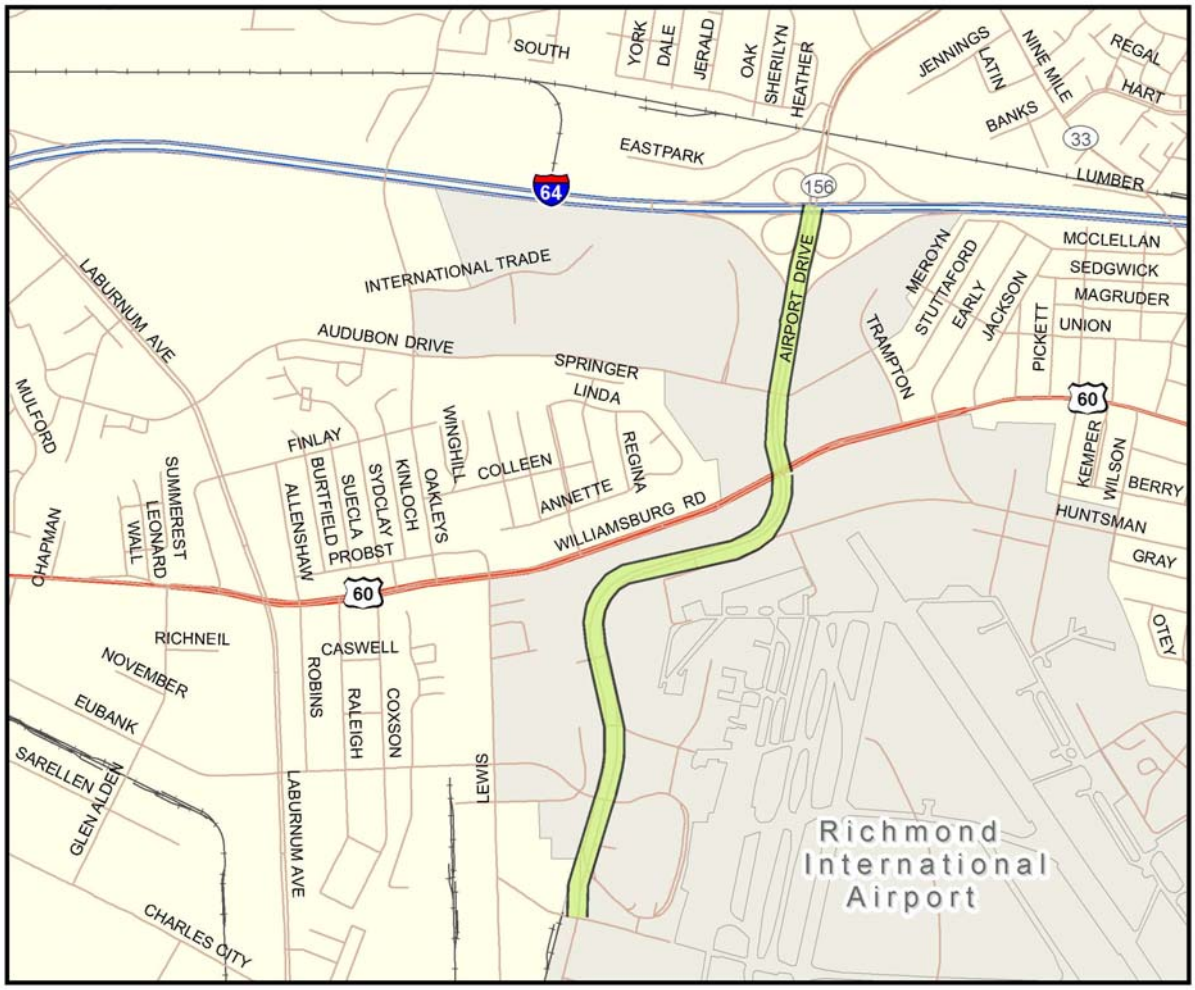


A-16 Airport Drive Profile

Corridor:	**AIRPORT DRIVE**				
From:	**Airport Entrance**				
To:	**I-64**				
EXISTING OPERATIONAL PROFILE					
	Segment A				
From	Airport Entrance				
To	I-64				
Freight Classification	Connector				
VDOT System Classification	Secondary				
Lanes	4				
Speed Limit	45				
For link on segment with highest traffic volume					
2008 AADT					
Percent Trucks					
Level of Service 2005	B				
Level of Service 2035	D				
Total Truck Accidents					
2005	<2				
2006	<2				
2007	<2				
EXISTING LAND USE PROFILE					
Intermodal Terminals Served (within 2 miles)			**Notes**		
Richmond International Airport			Air Cargo		
Current Bottlenecks			**Notes**		
Airport Drive and I-64					



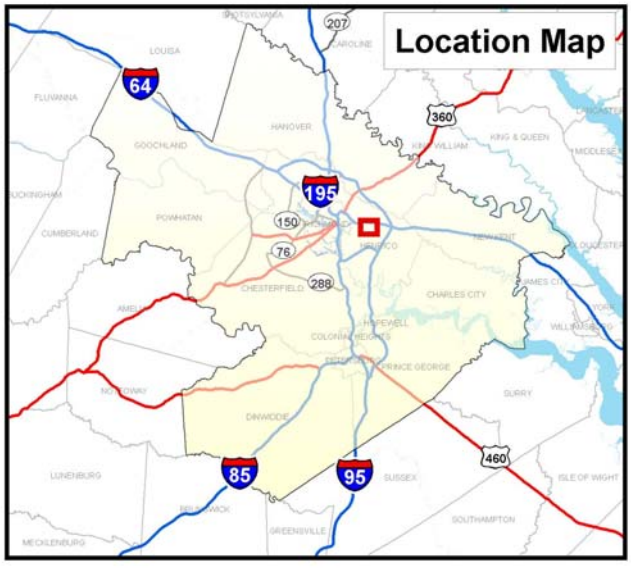
Airport Drive Corridor

Legend:

- Airport Drive Corridor
- Interstates
- Major Highways
- Major Roads
- Rail Lines
- Airport
- Water Features
- County Boundaries
- Study Area

N
W E
S

Miles
10 5 0 10 20



Appendix B – Survey Form

Richmond and Tri-Cities Inter-Regional Freight Movement Survey

1. Please tell us about yourself

This information is CONFIDENTIAL and collected solely for Wilbur Smith Associates' internal use. No one will have access to your company/contact information, in connection, with your responses.

1. Please provide the following information. This information will only be utilized should we require further clarification of your responses.

Name:

Company:

Address:

Address 2:

City/Town:

State:

ZIP/Postal Code:

Email Address:

Phone Number:

2. To complete our verification process, please identify the employment classification division must associated with your location:

- ☐ Mining, Quarrying, and Oil and Gas Extraction
- ☐ Manufacturing
- ☐ Wholesale Trade
- ☐ Transportation and Warehousing
- ☐ Other
- ☐ Do not know

2. Your observations of the available freight network

Here, we will ask you to provide your observations of the road network and overall transportation environment in and around the Richmond/Tri-Cities area.

1. OBSERVATION #1 - Provide your observations of a specific bottleneck, area of congestion, or safety issue associated with the transportation network in the area. (You will have the opportunity to provide up to five responses).

Type of Issue, is it congestion, safety, other?

Specific Location (Intersection, Address, Landmark)

Day of the Week

Time(s) of Day (by hour)

Is this a recurring event you can plan for?

If so, what is the frequency of the event?

If not, what is the likelihood that this event would be repeated?

2. OBSERVATION #1 - How would you rate the level to which the above location concern, identified in the previous question, impacts the timely receipt and shipment of your goods?

3. OBSERVATION #2 - Provide your observations of a specific bottleneck, area of congestion, or safety issue associated with the transportation network in the area. (You will have the opportunity to provide up to five responses).

Type of Issue, is it congestion, safety, other?

Specific Location (Intersection, Address, Landmark)

Day of the Week

Time(s) of Day (by hour)

Is this a recurring event you can plan for?

If so, what is the frequency of the event?

If not, what is the likelihood that this event would be repeated?

4. OBSERVATION #2 - How would you rate the level to which the

above location concern, identified in the previous question, impacts the timely receipt and shipment of your goods?

5. OBSERVATION #3 - Provide your observations of a specific bottleneck, area of congestion, or safety issue associated with the transportation network in the area. (You will have the opportunity to provide up to five responses).

Type of Issue, is it congestion, safety, other?

Specific Location (Intersection, Address, Landmark)

Day of the Week

Time(s) of Day (by hour)

Is this a recurring event you can plan for?

If so, what is the frequency of the event?

If not, what is the likelihood that this event would be repeated?

6. OBSERVATION #3 - How would you rate the level to which the above location concern, identified in the previous question, impacts the timely receipt and shipment of your goods?

7. OBSERVATION #4 - Provide your observations of a specific bottleneck, area of congestion, or safety issue associated with the transportation network in the area. (You will have the opportunity to provide up to five responses).

Type of Issue, is it congestion, safety, other?

Specific Location (Intersection, Address, Landmark)

Day of the Week

Time(s) of Day (by hour)

Is this a recurring event you can plan for?

If so, what is the frequency of the event?

If not, what is the likelihood that this event would be repeated?

8. OBSERVATION #4 - How would you rate the level to which the

above location concern, identified in the previous question, impacts the timely receipt and shipment of your goods?

9. OBSERVATION #5 - Provide your observations of a specific bottleneck, area of congestion, or safety issue associated with the transportation network in the area. (You will have the opportunity to provide up to five responses).

Type of Issue, is it congestion, safety, other?

Specific Location (Intersection, Address, Landmark)

Day of the Week

Time(s) of Day (by hour)

Is this a recurring event you can plan for?

If so, what is the frequency of the event?

If not, what is the likelihood that this event would be repeated?

10. OBSERVATION #5 - How would you rate the level to which the above location concern, identified in the previous question, impacts the timely receipt and shipment of your goods?

11. Do any of the following issues generate delays during the transit of your goods? If so, please provide specific locations.

Limited access routes for trucks

Hindered access to intermodal facilities

At-grade railroad crossings

Lack of access to/from nearby primary roads

Signalization:

- Too many located on

- Timing on

Signage:

- Inadequately marked

- Poor placement

Road design:

- Road lane widths on

- Intersections at

- On-off ramp at

12. What would motivate you to initiate or increase your utilization of the rail?

13. What would motivate you to initiate or increase utilization of the Port of Richmond to meet your shipping needs?

14. If you had the opportunity to assign monies to improve the infrastructure or affect policy decisions regarding the transportation network, what would be your top three choices to influence?

Choice #1

Choice #2

Choice #3

15. May we contact you at a later date, convenient to you, should we encounter a desire to either clarify your responses or have you participate in an in-person interview?

☐ Yes

☐ No

3. Please tell us about your operation

The following questions will provide information regarding your inbound and outbound freight.

1. What type of commodities or freight do you typically handle in the following operations? Please provide the the STCG (Standard Transportation Commodity Group), if you are aware of that designation.

Shipping - Outbound

Receiving - Inbound

2. INBOUND - The following are in regard to those shipments received into your location. Please reference information prior to the economic downturn. If you are unaware or unwilling to provide exact information, please provide a representative answer.

Average shipment size (weight)

Average number of shipments (daily)

3. INBOUND - Has the recent economic downturn led you to make a change in your modal choices on shipments being received?

☐ No, Same as before

☐ Yes, Temporary until volumes improve

☐ Yes, Expected to be permanent

4. INBOUND - Still referencing prior to the economic downturn, for those shipments received into your location, what mode(s) of transport are utilized? Please provide the percentage of use, as a part of your total modal choices?

	>75%	>74-50%	49-25%	24-01%	0%
Truck/Motor Freight	☐	☐	☐	☐	☐
Railroad Carload	☐	☐	☐	☐	☐
Railroad Intermodal	☐	☐	☐	☐	☐
Water	☐	☐	☐	☐	☐
Air	☐	☐	☐	☐	☐

5. INBOUND - Still referencing prior to the economic downturn, what

are the main factors influencing your choice of mode?

	Shipment Volume Size	Availability	Transit Time	Reliability	Price	Other
Truck/Motor Freight	☐	☐	☐	☐	☐	☐
Railroad Carload	☐	☐	☐	☐	☐	☐
Railroad Intermodal	☐	☐	☐	☐	☐	☐
Water	☐	☐	☐	☐	☐	☐
Air	☐	☐	☐	☐	☐	☐

6. INBOUND - If you receive goods via motor carriers (truck), please identify the percentage of your total weekly shipments received by each type:

Private Fleet

Courier (A C Express, local only, etc)

Parcel, Small Package (UPS, FedEx, USPS, etc)

LTL, less than truckload (Conway, YRC, etc)

TL, truckload (Schneider, USF Glen Moore, etc)

Bulk, dry or liquid (Trimac, OTL-UPT, etc)

Heavy Haul, Specialty, Other, Special Permit Required

7. OUTBOUND - The following are in regard to those shipments shipped from your location. Please reference information prior to the economic downturn. If you are unaware or unwilling to provide exact information, please provide a representative answer.

Average shipment size (weight)

Average number of shipments (daily)

8. OUTBOUND - Has the recent economic downturn led you to make a change in your modal choices, on shipments being shipped?

☐ No, Same as before

☐ Yes, Temporary until volumes improve

☐ Yes, Expected to be permanent

9. OUTBOUND - Still referencing prior to the economic downturn, for

those shipments shipped from your location, what mode(s) of transport are utilized? Please provide the percentage of use, as a part of your total modal choices?

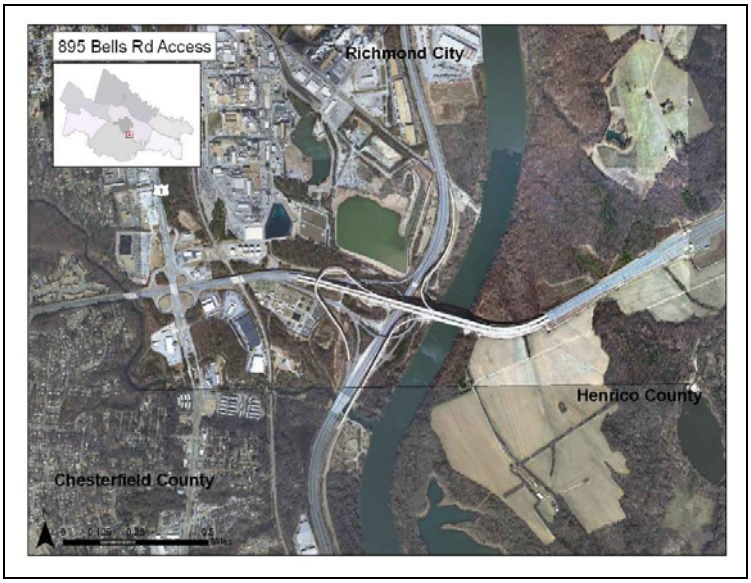
	>75%	>74-50%	49-25%	24-01%	0%
Truck/Motor Freight	☐	☐	☐	☐	☐
Railroad Carload	☐	☐	☐	☐	☐
Railroad Intermodal	☐	☐	☐	☐	☐
Water	☐	☐	☐	☐	☐
Air	☐	☐	☐	☐	☐

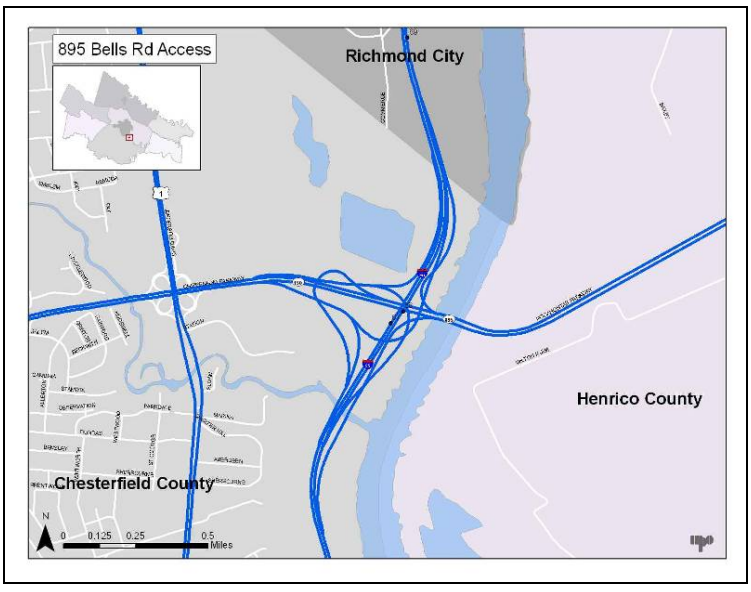
10. OUTBOUND - Still referencing prior to the economic downturn, what are the main factors influencing your choice of mode?

	Shipment Volume Size	Availability	Transit Time	Reliability	Price	Other
Truck/Motor Freight	☐	☐	☐	☐	☐	☐
Railroad Carload	☐	☐	☐	☐	☐	☐
Railroad Intermodal	☐	☐	☐	☐	☐	☐
Water	☐	☐	☐	☐	☐	☐
Air	☐	☐	☐	☐	☐	☐

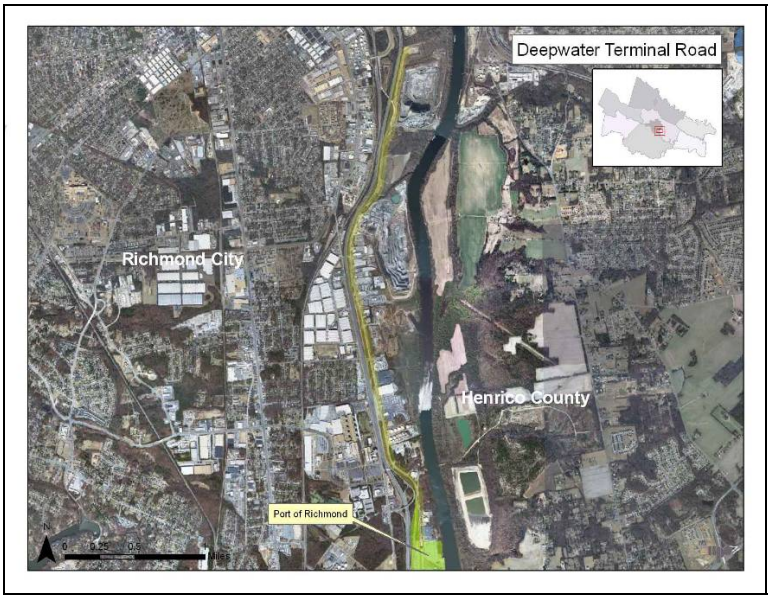
Appendix C – Project Worksheets

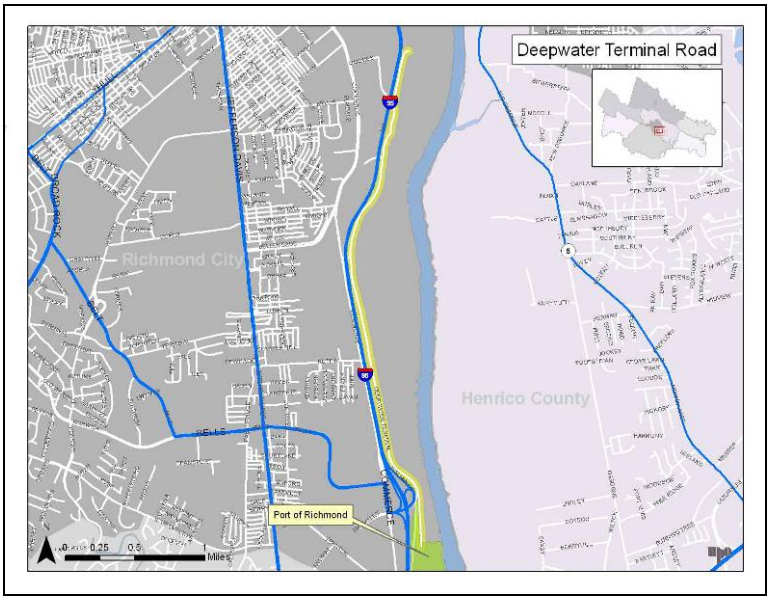
Project # 1	SR 895/Bells Road Access
Source	Forum, Interview
Jurisdiction	VDOT
Problem	No current access is provided in the I-95/SR 150/SR 895 interchange for southbound I-95 to eastbound SR 895 movements
Proposed Actions	Interim Solution: None Long-term Solution: Build an additional ramp in the interchange Construction Est.: $50,000,000





Project # 2	Deepwater Terminal Road from Bells Road to the access road just south of the weigh station
Source	Interview, Forum
Jurisdiction	City of Richmond
Problem	Poor pavement condition
Proposed Actions	Interim Solution: Repaving project Long-term Solution: None needed Construction Est.: $1,500,000

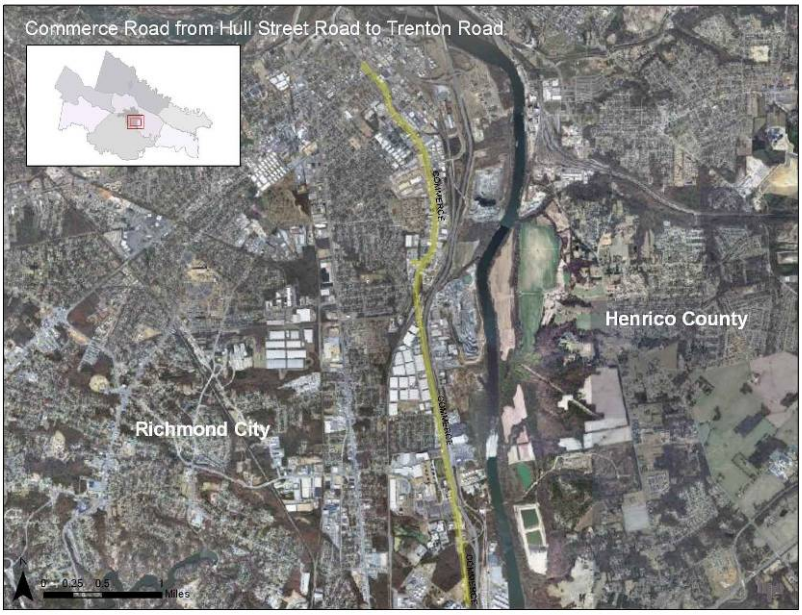


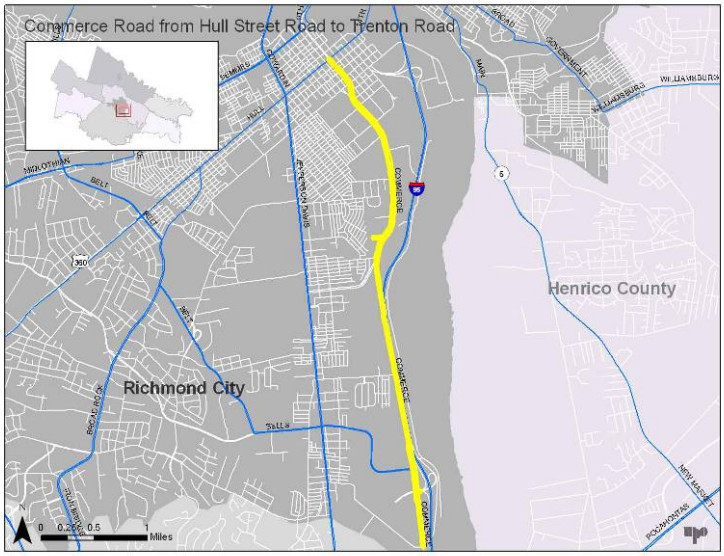


Project # 3	Hull Street Exit from SR 288
Source	Interview
Jurisdiction	VDOT
Problem	Congestion on ramp due to congestion at downstream traffic signal at Commonwealth Centre Parkway/Old Hundred Road/US 360
Proposed Actions	Interim Solution: VDOT currently constructing capacity improvement project Long-term Solution: None required Construction Est.: $1,000,000

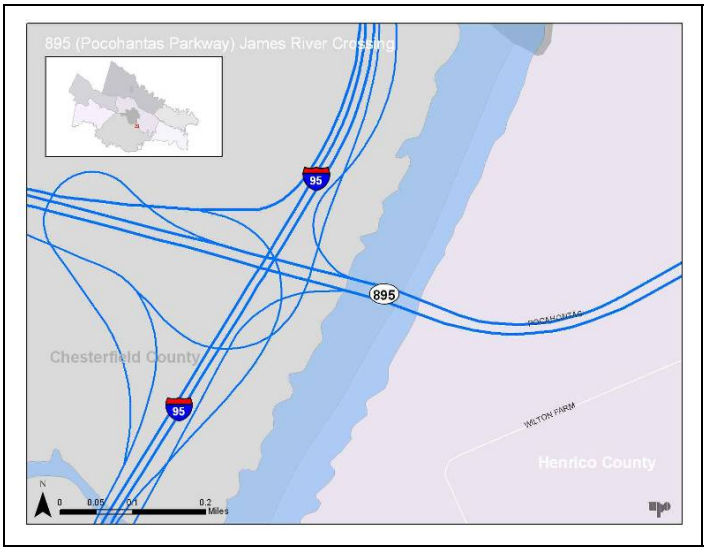
Project # 4	Goodes Street between Commerce Road and CSX Railroad Tracks
Source	Interview
Jurisdiction	City of Richmond
Problem	Poor pavement condition
Proposed Actions	Interim Solution: Resurface existing pavement Long-term Solution: None needed Construction Est.: $300,000

Project # 5	Commerce Road from Hull Street Road to Trenton Road
Source	Interview
Jurisdiction	City of Richmond
Problem	Poor pavement condition
Proposed Actions	Interim Solution: Resurface existing pavement Long-term Solution: None needed Construction Est.: $1,000,000

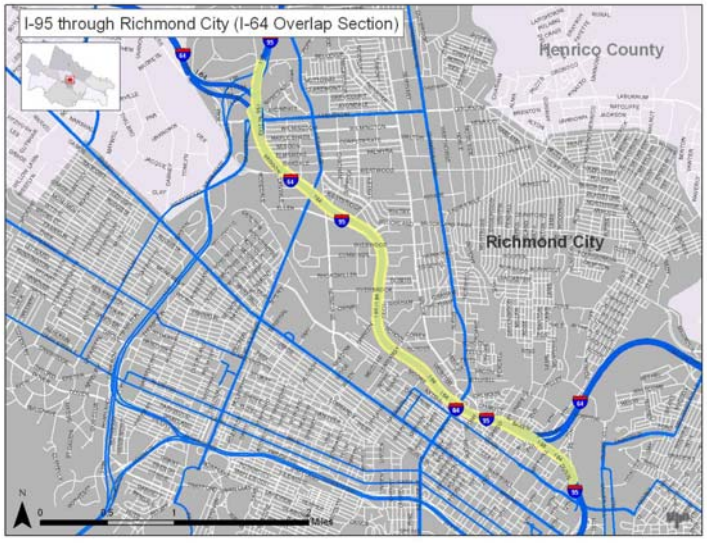




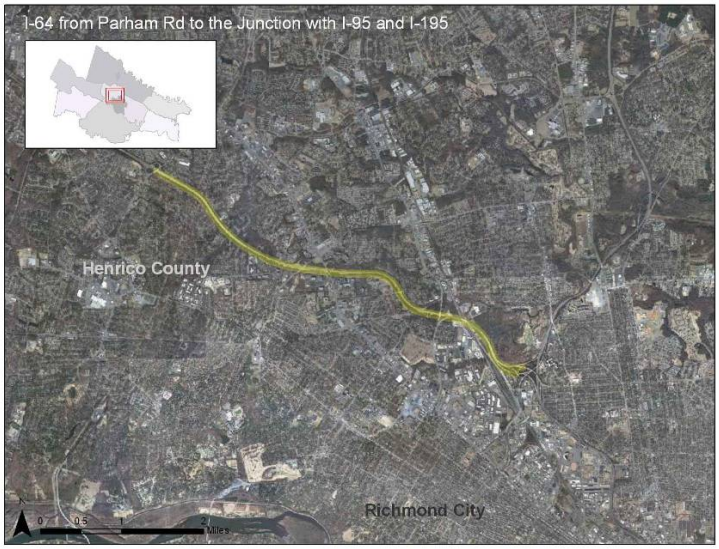
Project # 6	I-895 Expansion Joints at James River Bridge
Source	Interview
Jurisdiction	VDOT/TransUrban
Problem	Uneven expansion joints are creating rough riding surfaces
Proposed Actions	Interim Solution: Replace expansion joints Long-term Solution: Possibly investigate settlement issues Construction Est.: $50,000

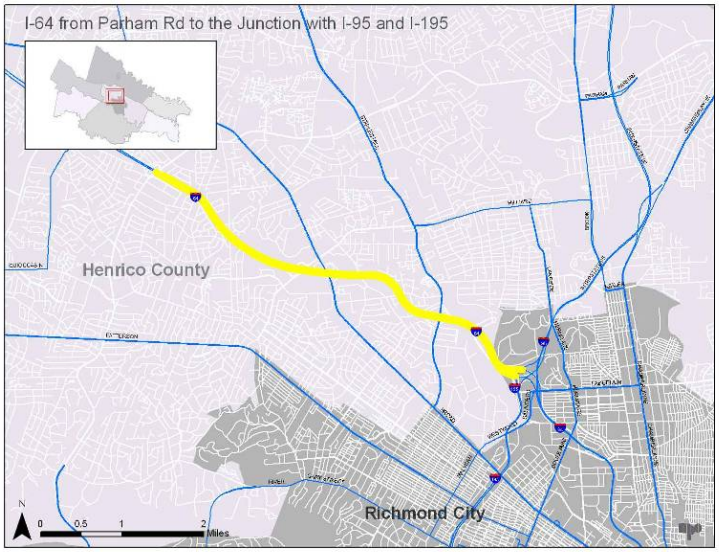


Project # 7	I-95 through the City of Richmond (I-64 overlap section)
Source	Survey
Jurisdiction	VDOT
Problem	Poor pavement condition
Proposed Actions	Interim Solution: Resurface existing pavement Long-term Solution: None required Construction Est.: $25,000,000

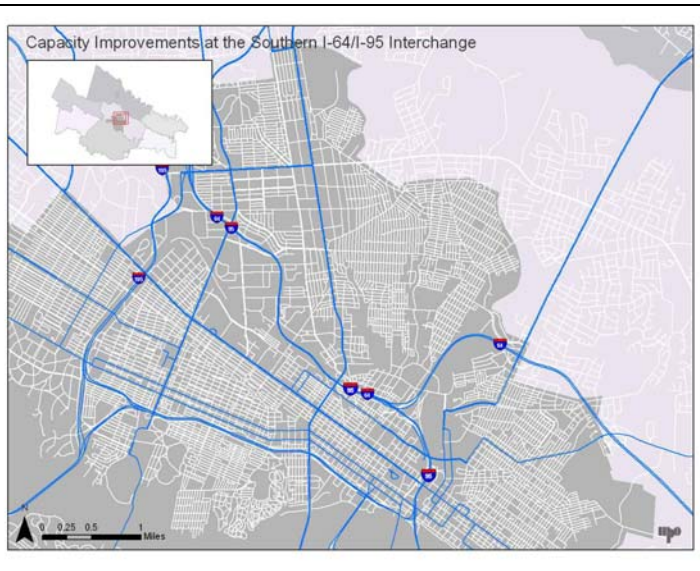


Project # 8	I-64 from Parham Road to the junction with I-95 and I-195
Source	Survey
Jurisdiction	VDOT
Problem	Poor pavement condition
Proposed Actions	Interim Solution: Resurface existing pavement. Long-term Solution: None required Construction Est.: $35,000,000

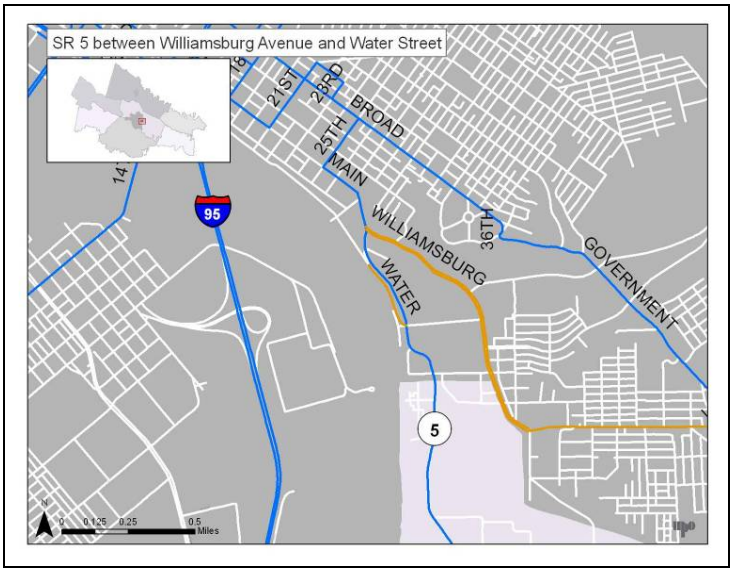




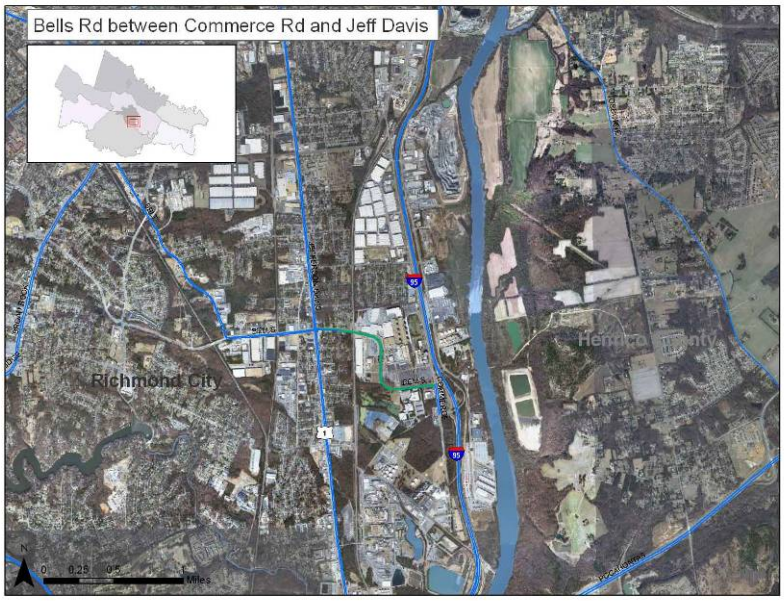
Project # 9	Capacity Improvement at the Southern I-64/I-95 Interchange
Source	Forum, Interview, Survey
Jurisdiction	VDOT
Problem	Congestion
Proposed Actions	Interim Solution: None Long-term Solution: Add capacity to and/or reconfigure interchange Construction Est.: $45,000,000

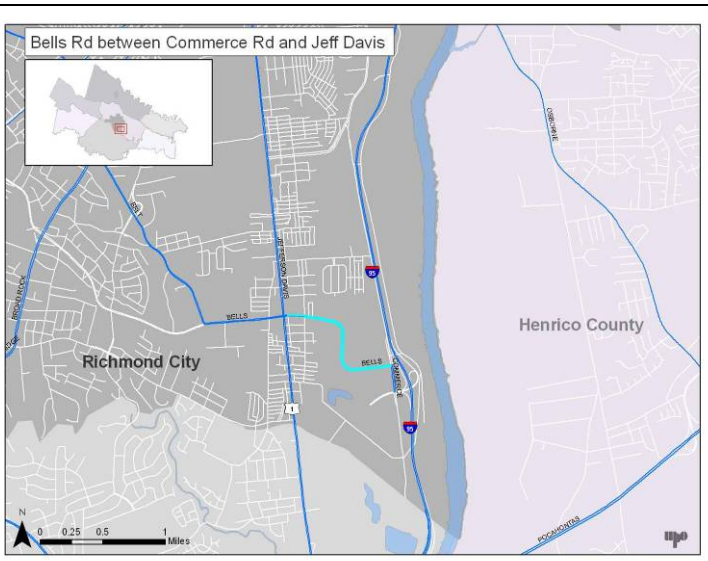


Project # 10	SR 5 between Williamsburg Avenue and Water Street
Source	Interview
Jurisdiction	VDOT
Problem	Lack of Advanced Notice of Low Vertical Clearance on SR 5 passing under CSX Railroad Bridge between Williamsburg Road and Water Street
Proposed Actions	Interim Solution: Install more advanced signing to alert motorists of low vertical clearance Long-term Solution: Reconstruct railroad bridge/roadway to provide greater vertical clearance Construction Est.: $10,000

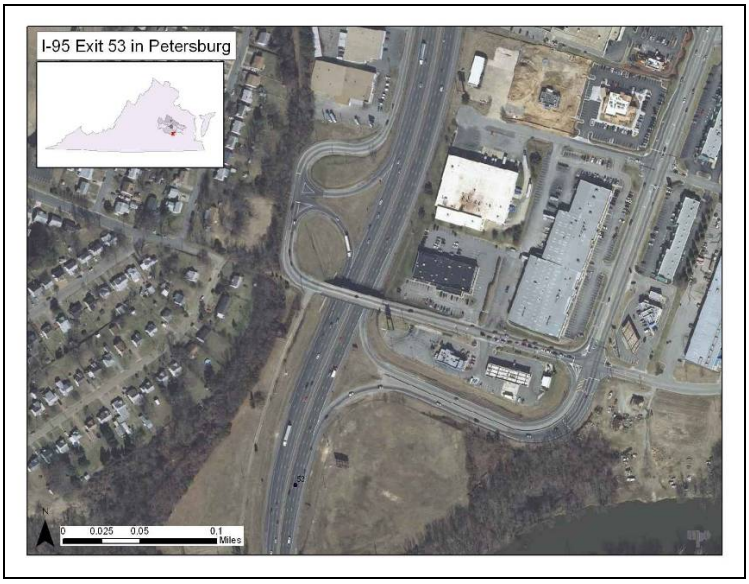


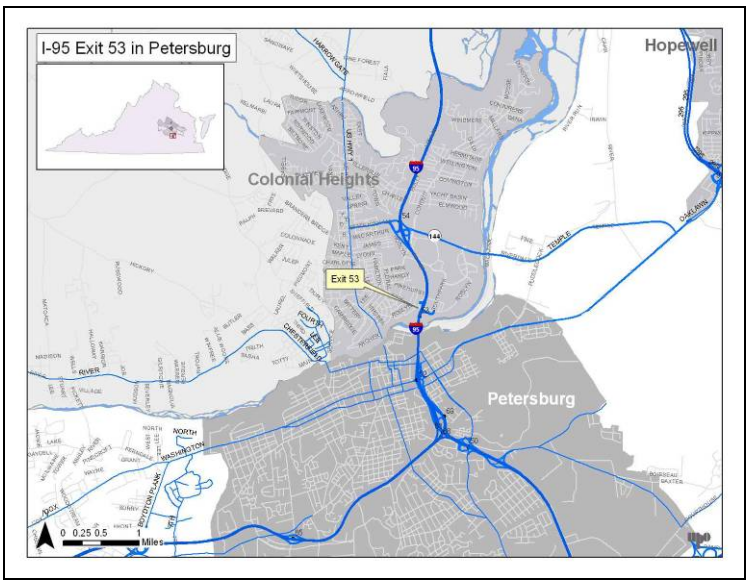
Project # 11	Bells Road between Commerce Road and Jefferson Davis Highway (US Rte 1)
Source	Interview
Jurisdiction	City of Richmond
Problem	Difficulty of roadway to accommodate truck combinations over 55 feet long
Proposed Actions	Interim Solution: None needed Long-term Solution: Rebuild horizontal curves to more adequately accommodate longer vehicles Construction Est.: $500,000



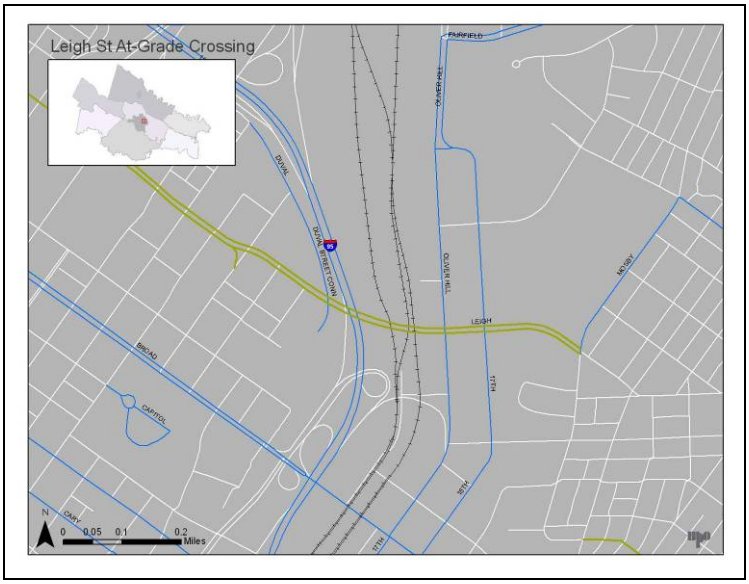


Project # 12	I-95 Exit 53 in Petersburg
Source	Interview
Jurisdiction	VDOT
Problem	Perceived right-of-way priority issue
Proposed Actions	Interim Solution: Perceived problems are safer than alternative improvements. No solution is necessary Long-term Solution: None required Construction Est.: $0

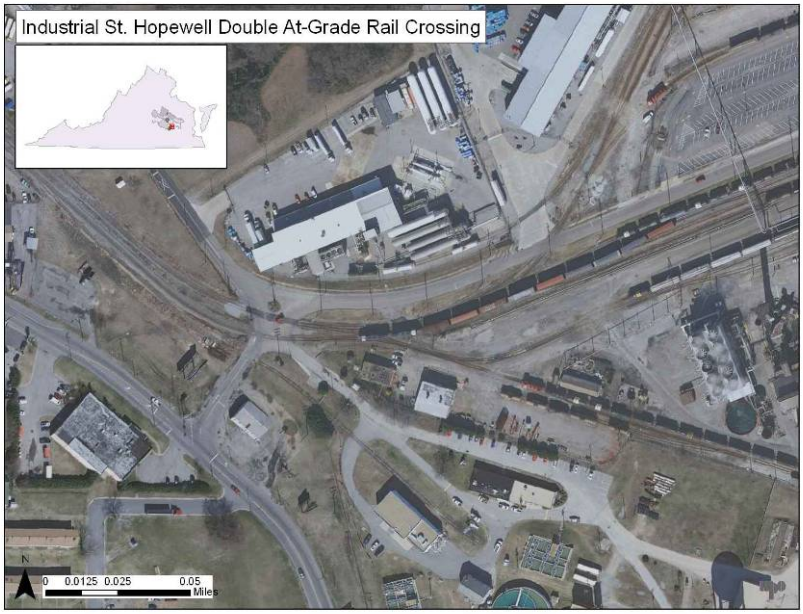




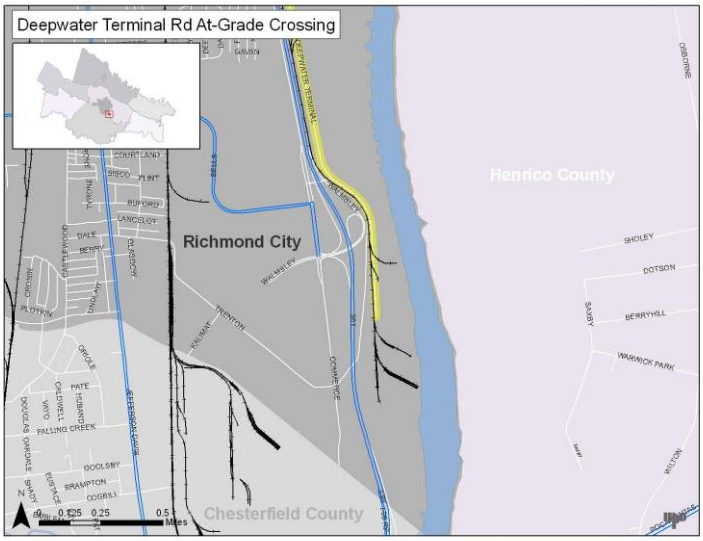
Project # 13	Leigh St. At-Grade Rail Crossing
Source	Forum
Jurisdiction	VDOT
Problem	High accident prediction rating
Proposed Actions	Potential installation of crossing gates and warning signals Construction Est.: $35,000



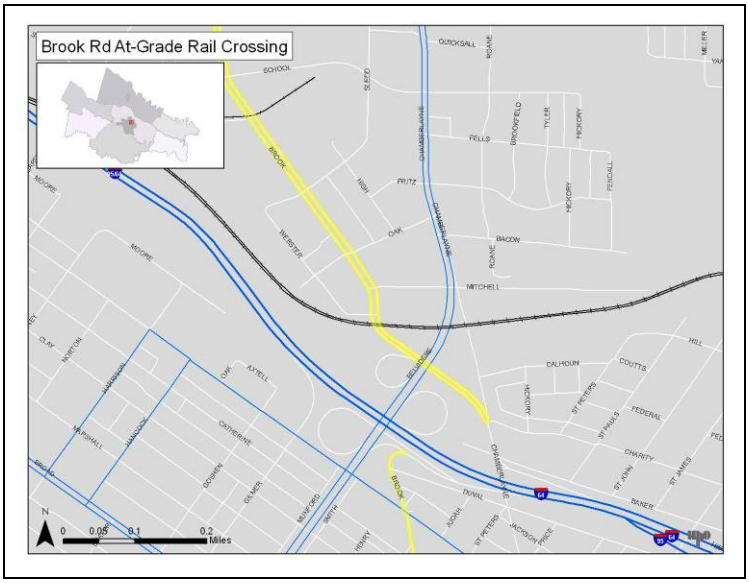
Project # 14	Industrial St. Hopewell Double At-Grade Rail Crossing
Source	Forum
Jurisdiction	VDOT
Problem	High accident prediction rating
Proposed Actions	Potential installation of crossing gates and warning signals Construction Est.: $35,000



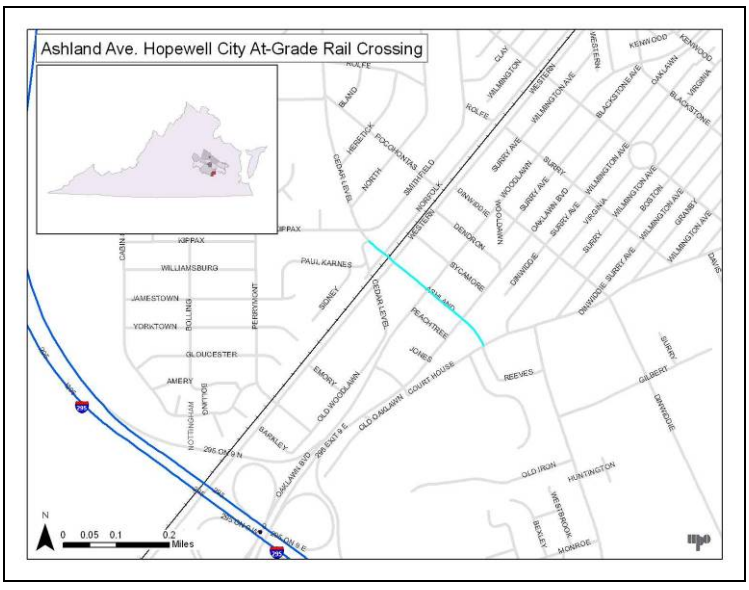
Project # 15	Deepwater Terminal Rd. At-Grade Rail Crossing
Source	Forum
Jurisdiction	VDOT
Problem	High accident prediction rating
Proposed Actions	Potential installation of crossing gates and warning signals Construction Est.: $35,000



Project # 16	Brook Rd. At-Grade Rail Crossing
Source	Forum
Jurisdiction	VDOT
Problem	High accident prediction rating
Proposed Actions	Potential installation of four-quadrant gates Construction Est.: $70,000



Project # 17	Ashland Ave. Hopewell City At-Grade Rail Crossing
Source	Stakeholder survey
Jurisdiction	VDOT
Problem	High accident prediction rating
Proposed Actions	Potential installation of four-quadrant gates Construction Est.: $70,000



APPENDIX D: RICHMOND AREA MPO MEMBERSHIP

April 29, 2010

RICHMOND AREA
METROPOLITAN PLANNING ORGANIZATION (MPO)
MEMBERSHIP

VOTING MEMBERS

Town of Ashland

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Henrico County

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NOTE:
* Denotes elected official

APPENDIX E: INTERMODAL RESOLUTION

Richmond Regional Planning District Commission

Metropolitan Planning Organization

Town of
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Counties of
Charles City
Chesterfield
Goochland
Hanover
Henrico
New Kent
Powhatan
City of
Richmond

Executive Director
Robert A. Crum, Jr.

MPO AGENDA 5/13/10; ITEM III.F

RICHMOND/TRI-CITIES REGIONAL INTERMODAL STRATEGIES STUDY

Richmond Area Metropolitan Planning Organization

On motion of Joseph B. Walton, seconded by Timothy W. Cotman, the Richmond Area Metropolitan Planning Organization unanimously approved the following resolution:

RESOLVED, that the Richmond Area Metropolitan Planning Organization (MPO) accepts as work received the *Richmond/Tri-Cities Regional Intermodal Strategies Study.*

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This is to certify that the Richmond Area Metropolitan Planning Organization (MPO) approved the above resolution at its meeting held May 13, 2010.

WITNESS:

Sharon E. Robeson
Administrative Secretary
Richmond Regional Planning
District Commission

BY:

Daniel N. Lysy
MPO Secretary

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