

Interstate 81 Multimodal Corridor

Traversing the length of western Virginia from Tennessee to West Virginia, the I-81 Corridor is a critical link in the national freight transportation system and connects to it via several highway, rail, and airport facilities, including I-64, I-66, I-77, U.S. 58, and U.S. 460; Norfolk Southern rail lines; and the Roanoke Regional Airport. Manufacturing, on a relative basis, is more concentrated within the I-81 Corridor than it is in the Commonwealth overall. Nearly 78 percent of tonnage moving within the I-81 Corridor is pass-through freight.

Recommendations to improve the flow of freight through the I-81 Corridor include the completion of Norfolk Southern's Crescent Corridor project and the widening of I-81 in selected locations.

■ Geographic Definition

Functional Classification: Interstate



Hugging Virginia's western border, Interstate 81 (I-81), which extends from Tennessee to New York, is one of the top trucking routes in the United States. This is due in part to the choices that drivers make to avoid congestion along I-95 to the east. At 326 miles in length, I-81 is the longest Interstate in Virginia. It has 90 interchanges, including major connections with I-66, I-64, I-77, and I-581. The I-81 Multimodal Freight Corridor is comprised of the following jurisdictions (see Figure 1):

Cities

- Bristol
- Buena Vista
- Harrisonburg
- Lexington
- Radford
- Roanoke
- Salem
- Staunton
- Waynesboro
- Winchester

Counties

- Augusta
- Botetourt
- Clark
- Frederick
- Montgomery
- Page
- Pulaski
- Roanoke
- Rockbridge
- Rockingham
- Shenandoah
- Smyth
- Warren
- Washington
- Wythe

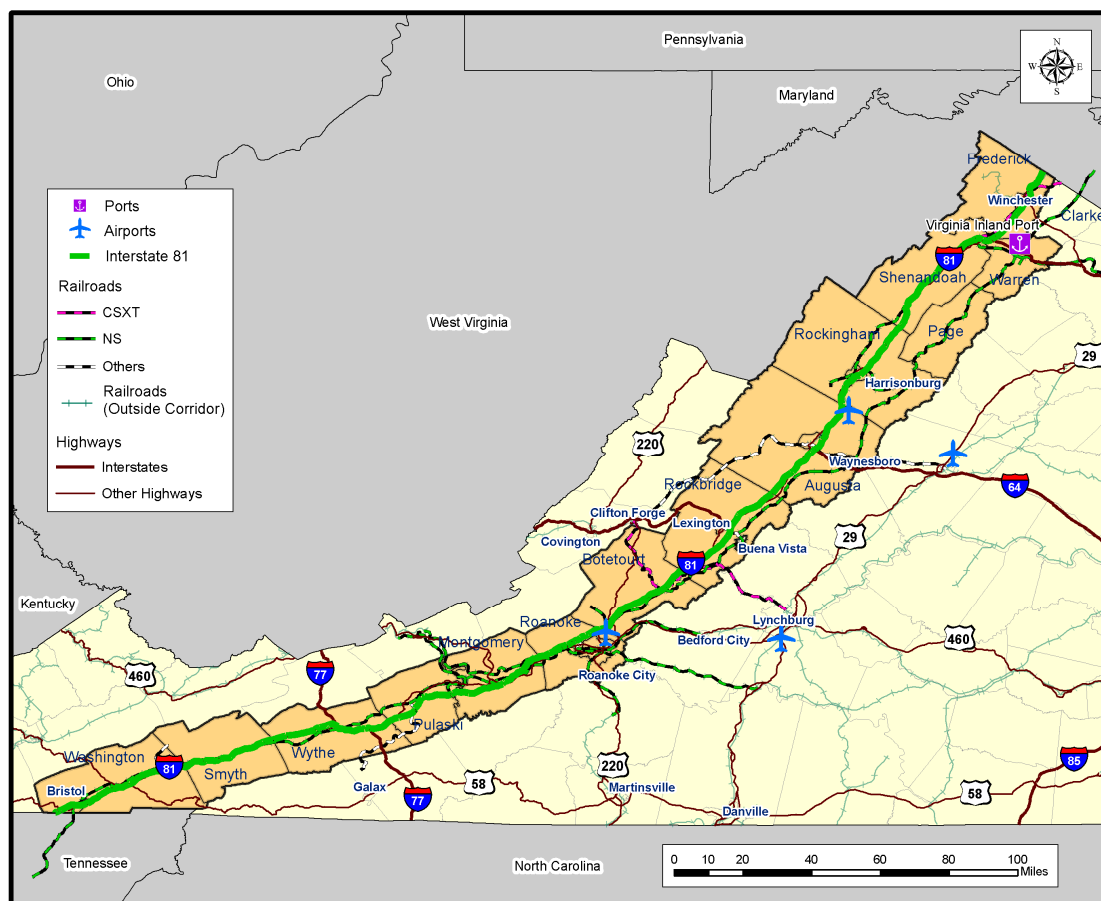
Significant rail facilities within the Corridor include the Norfolk Southern's Shenandoah line (part of the Crescent Corridor) that runs parallel to I-81 between Front Royal and

Roanoke and serves the Commonwealth's Virginia Inland Port in Front Royal. Norfolk Southern's Heartland Corridor crosses I-81 between Roanoke and Walton. The CSX, Winchester and Western, and Buckingham Branch Railroads also operate within the I-81 Corridor.

Roanoke Regional Airport is the only significant air cargo facility located within the Corridor. It is the fourth largest in Virginia and handled just under 11 million pounds of freight in 2006.

The Commonwealth's **Virginia Inland Port** is located within the Corridor near Front Royal.

Figure 1. The Interstate 81 Multimodal Corridor



■ Economic Profile

The growth of freight volumes in Virginia and the I-81 Corridor will be influenced by the interplay of a variety of factors that will have a bearing on transportation demand. These factors include population growth, changes in national and global logistics patterns, and

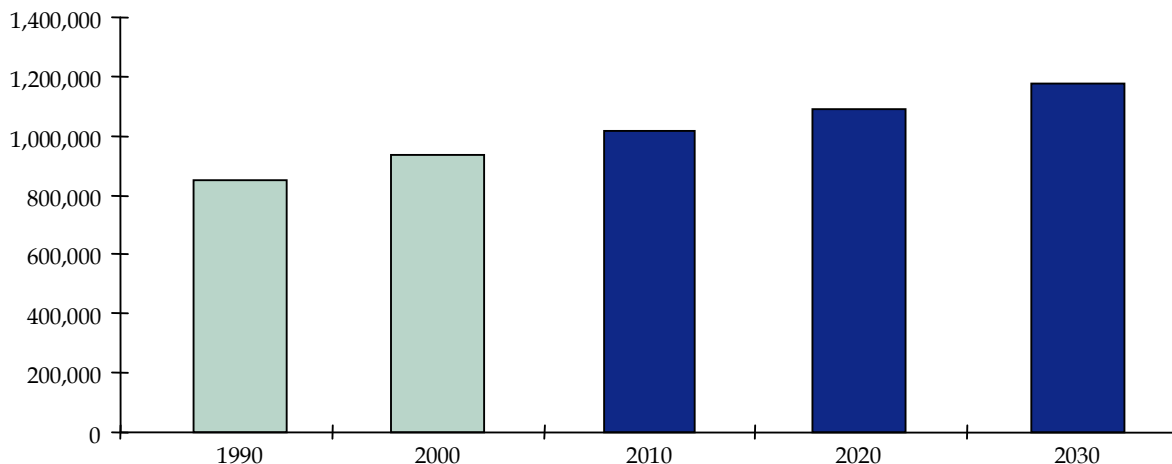
the evolution of the Corridor's industry structure. Industries, ranging from manufacturing to construction have specific freight needs, and their growth will affect freight demand on the I-81 Corridor. Already, it is clear that heavy users of freight, such as manufacturing and warehousing, have congregated on the Corridor, benefiting from convenient access to a major Interstate. On the supply side, I-81 represents a crucial component of Virginia's transportation system and its ability to carry freight efficiently will affect, positively or negatively, the overall competitiveness of the State's economy. The population growth and industry trends that will influence the freight demands placed on the I-81 Corridor are reviewed in this section.

Population Growth

Population growth has a direct impact on freight transportation demand. More people take more trips, require more services, and need more goods to sustain themselves. The I-81 Corridor is experiencing moderate population growth, 6.2 percent from 2000 to 2007, slightly slower than the Nation's (+7.2 percent). As of 2007, the I-81 Corridor was home to 994,352 residents and accounted for 12.9 percent of Virginia's population. According to state population projections, the I-81 Corridor is expected to add 183,128 people during the next 23 years (see Figure 2) and will reach a population of 1,177,480 by 2030 (this growth is the equivalent to adding the present-day populations of Roanoke County and the City of Roanoke to the Corridor). The rate of projected population growth in the I-81 Corridor through 2030 is lower than Virginia's but slightly higher than the Nation's.

The I-81 Corridor's moderate but constant growth in population puts pressure on the facility. In particular, the Corridor must accommodate the mobility, consumer, and logistics needs of an increasing number of residents, workers, and businesses, and do so reliably, safely, and efficiently. For these reasons, the decision-making process regarding the future of freight-related infrastructure and services on I-81 needs to incorporate and respond to these growth conditions.

**Figure 2. Historic and Forecast Population Growth
1990-2030**

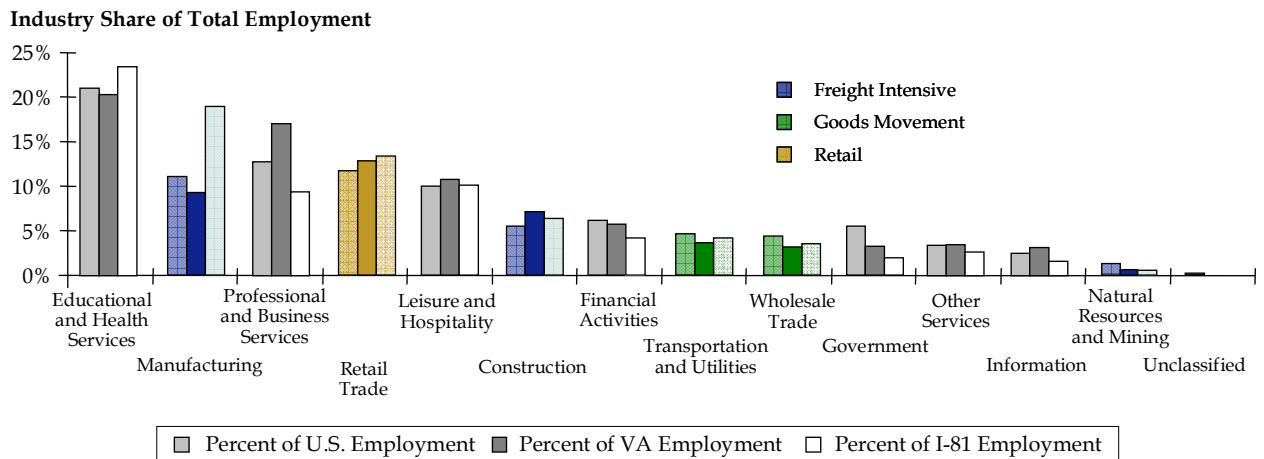


Source: Virginia Employment Commission.

Economic Structure

The I-81 Corridor’s defining economic characteristic compared to the nation and Virginia is the relative size of its manufacturing sector. In 2005, manufacturing accounted for 19 percent of the Corridor’s jobs compared to 11 percent and nine percent, respectively, for the nation and Virginia. Figure 3 illustrates the contribution of each major sector to total jobs in the I-81 Corridor and the relatively large size of the Corridor’s manufacturing sector can be easily seen. Manufacturing is more dependent on transportation than most other industry sectors and counts on the reliability and connectivity provided by the road, air, and rail networks to produce and deliver products. Manufacturers keep inventories low to reduce costs and this requires a dependable, multimodal supply chain. Reflecting the importance that manufacturing places on transportation, including proximity to Interstate highways (e.g., the large Volvo truck assembly facility in Dublin is almost directly on the highway), it is not surprising that the I-81 Corridor has become a favored location for manufacturers in Virginia.

Figure 3. Economic Structure
*Shares of Employment by Major Industry Sector,
 United States, Virginia and Corridor 81*



Source: Virginia Employment Commission and U.S. Department of Labor.

With its manufacturing sector commanding a disproportionately large part of its jobs, the I-81 Corridor's economy is generally less dependent than the U.S. and Virginia economies on service-related industries, including finance, professional, and business services. An exception, however, is the relatively large size of the healthcare and education services industry (due in part to the presence of 29 colleges and universities) within the I-81 Corridor. Growth in these service industries will have a significant impact on freight in the I-81 Corridor. Service industries tend to move more time-sensitive goods. The trucking and air industries have historically dominated these types of shipments.

Growth in service industries is driven by increasing business and consumer demand. Businesses demand increasingly efficient communication, finance, transportation, and distribution services in order to develop competitive advantages and as essential inputs into the production of goods and other services. For consumers, as personal income grows so does demand for services such as banking, telecommunications, tourism, and entertainment.

Concentration of Goods Movement and Freight-Intensive Industries

The relationship between freight activity and the I-81 Corridor's economy is strong and multifaceted. For example, "freight-intensive" industries, including manufacturing, mining, and agriculture rely heavily on the efficient movement of goods, both for the outbound shipments of their products to reach worldwide markets, as well as for inbound shipments of intermediate goods required for production. These freight-intensive industries contributed some 72,000 jobs to the Corridor in 2005, accounting for about 18 percent of the Virginia total (see Figure 4). In addition to freight's importance to these freight-intensive industries, efficient multimodal freight transportation systems can help to

Freight-Related Clusters

While an efficient multimodal transportation system is important to every sector of the economy, certain sectors are particularly dependent on the transportation system for freight movement. These sectors are grouped into three clusters as defined below:

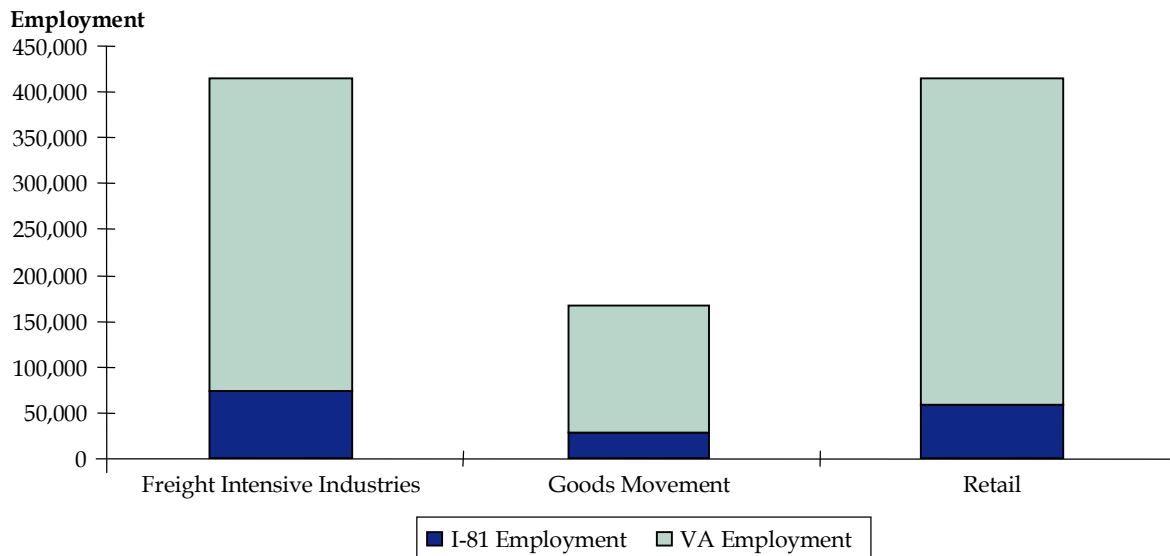
Freight-Intensive Industries includes most subsectors within natural resources and mining, all construction, and manufacturing.

Goods Movement includes the wholesale trade sector and some subsectors within transportation and utilities.

Retail Trade includes all subsectors within the retail trade sector.

minimize the cost of consumer goods, benefiting consumers and the retail industry. In 2005, the I-81 Corridor included some 58,000 retail jobs. Transportation infrastructure improvements that reduce costs by either: 1) lowering travel times; or by 2) increasing the reliability of on-time shipments translate directly into benefits for the I-81 and Virginia economies. Finally, the "goods movement" industry (e.g., trucking, distribution, airports, etc.) also provides a significant number of jobs and income to I-81 Corridor residents working for the businesses that process, ship, and deliver goods bound for destinations within Virginia, as well as to other locations within the United States and throughout the world. The goods movement industry employed over 28,000 people in the I-81 Corridor in 2005. The I-81 Corridor is lined with major distribution facilities and includes the Commonwealth's Virginia Inland Port in Fort Royal. Combined, the freight-intensive, retail, and goods movement industries account for 36 percent of total I-81 employment, significantly greater than the 31 percent average for Virginia, overall (see Figures 5 and 6).

Figure 4. Employment by Freight-Related Cluster in I-81 Corridor and Virginia



Source: Virginia Employment Commission.

Figure 5. Share of Employment by Cluster I-81 Corridor

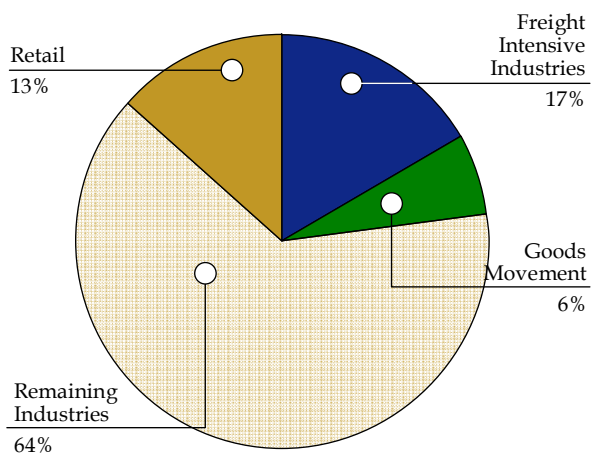
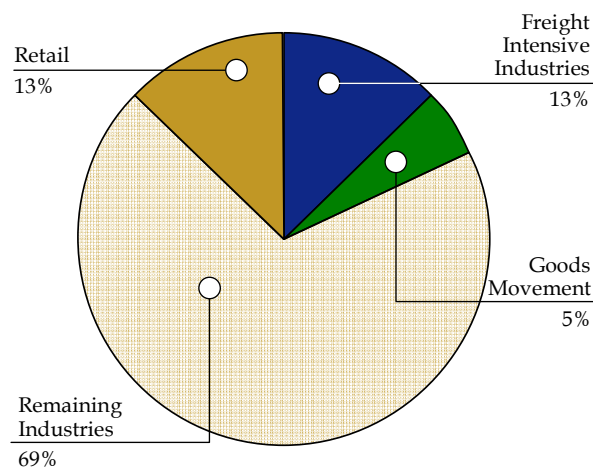


Figure 6. Share of Employment by Cluster Virginia



Source: Virginia Employment Commission.

■ Commodity Profile

The two primary measures of freight activity are tonnage and value. Value is a good indicator of economic activity associated with freight transportation, while tonnage is a good indicator of the demand that freight movement places on transportation infrastructure.

Freight also moves in different directions:

- Inbound freight is moved from somewhere outside of the I-81 Corridor to a destination within the I-81 Corridor.
- Outbound freight is moved from somewhere within the I-81 Corridor to a destination outside of the I-81 Corridor.
- Internal freight is moved from one point within the I-81 Corridor to another point within the I-81 Corridor.
- Pass-through freight is moving from an origin outside of the I-81 Corridor to a destination outside the I-81 Corridor while at some point passing through the Corridor.

Figures 7 and 8 show that about 79 percent of the total tonnage moving into, out of, within, or through the I-81 Corridor is hauled by trucks with most of the remaining hauled by rail. A large majority of the value (over 99 percent) is hauled by trucks.

Figure 7. Mode Share of Total Corridor Freight Tonnage 2004

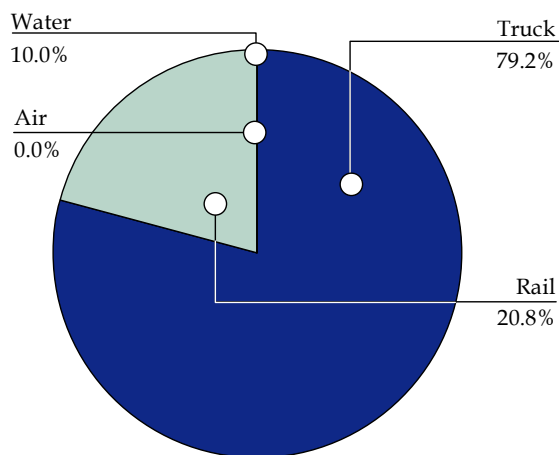
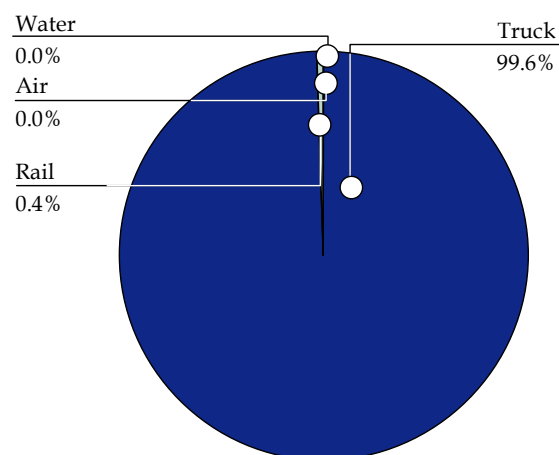


Figure 8. Mode Share of Total Corridor Freight Value 2004



Figures 9 and 10 describe the direction of travel for Virginia's domestic commodities along the I-81 Corridor, based on tonnage and on value.

Figure 9. Directional Proportion of Total Corridor Freight Tonnage 2004

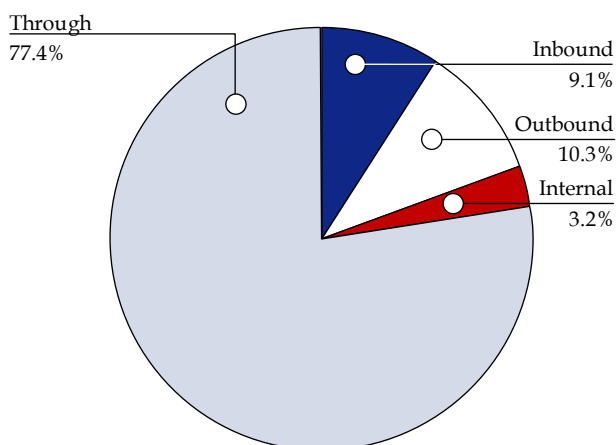
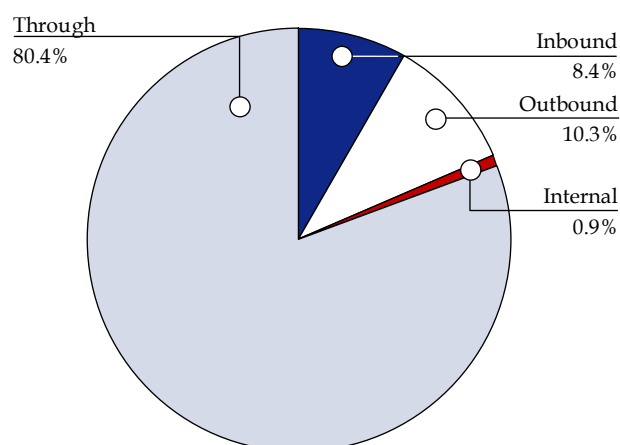


Figure 10. Directional Proportion of Total Corridor Freight Value 2004



By tonnage, the leading commodities moving domestically are nonmetallic minerals and secondary traffic (i.e., warehouse and distribution), followed by clay, concrete, glass and stone; food and kindred products; and chemicals and allied products. By value, secondary traffic is by far the leading commodity, followed by nonelectrical machinery.

Table 1. Critical Commodities Inbound, Outbound, and Internal on Interstate 81 Corridor by Tons 2004

Commodity	Tons	Percent Share
Nonmetallic Minerals	28,251,324	27%
Secondary Moves	16,891,700	16%
Clay/Concrete/Glass/Stone	13,133,305	13%
Food/Kindred	7,666,087	7%
Chemicals/Allied	6,647,215	6%
All Others	32,445,842	31%
Total	105,035,473	100%

Table 2. Critical Commodities Inbound, Outbound, and Internal on Interstate 81 Corridor by Value
2004

Commodity	Dollars	Percent Share
Secondary Moves	\$109,909,203,391	49%
Machinery Excluding Electrical	\$18,765,486,432	8%
Chemicals/ Allied	\$17,328,939,294	8%
Transportation Equipment	\$13,716,425,327	6%
Electrical Machinery/Equipment/ Supplies	\$11,092,423,899	5%
All Others	\$54,204,012,446	24%
Total	\$225,016,490,789	100%

For trade in Virginia's critical commodities - that is, inbound and outbound tonnage, excluding pass-through traffic - the leading trading partner regions are mainly within the Commonwealth followed by the southern east coast states and the Illinois/Indiana/Ohio/Michigan region.

Table 3. Trading Partners by Tonnage for the Interstate 81 Corridor
Domestic Inbound and Outbound
2004

Partner Region	Tons	Percent
Rest of Virginia	36,056,172	41%
South Atlantic	20,629,966	23%
East North Central	13,182,938	15%
East South Central	5,336,580	6%
Middle Atlantic	5,220,632	6%
New England	2,612,680	3%
West South Central	1,868,108	2%
West North Central	881,777	1%
Mountain	877,621	1%
Canada/Mexico	749,576	1%
Pacific	433,279	0.5%
Grand Total	87,849,330	100%

**Table 4. Trading Partners by Value for the Interstate 81 Corridor
Domestic Inbound and Outbound
2004**

Partner Region	Dollars	Percent
Rest of Virginia	\$80,677,513,567	38%
South Atlantic	\$38,675,661,248	18%
East North Central	\$36,078,794,489	17%
Middle Atlantic	\$14,394,543,509	7%
New England	\$12,235,556,350	6%
East South Central	\$10,230,706,507	5%
West South Central	\$7,220,678,387	3%
Canada/Mexico	\$4,946,663,643	2%
West North Central	\$4,905,352,539	2%
Mountain	\$2,762,008,728	1%
Pacific	\$2,325,569,825	1%
Grand Total	\$214,453,048,792	100%

■ Transportation System Facilities and Performance

The I-81 Corridor contains an extensive highway and freight rail network with centers of activity in Bristol, Blacksburg, Roanoke, Staunton, Harrisonburg, and Winchester. Major freight connections along I-81 include I-77 (in Wytheville), I-64 (in Lexington and Staunton), I-66 (near Front Royal), U.S. 58 (in Bristol), U.S. 460 (in Blacksburg), and U.S. 17 (in Winchester). The funded Roanoke Intermodal Terminal will provide an additional access point to the Crescent and Heartland Corridors.

Table 5. Interstate 81 Intermodal Connections

Significant Roadway Connections	Significant Airport Connections	Significant Port Connections
<ul style="list-style-type: none"> • I-77 • I-581 • I-64 • I-66 • U.S. 58 • U.S. 11 • U.S. 19 • U.S. 21 • U.S. 52 • U.S. 460 • U.S. 220 • U.S. 60 • U.S. 250 • U.S. 33 • U.S. 211 • U.S. 522 • U.S. 17 • U.S. 50 	<ul style="list-style-type: none"> • Roanoke Regional Airport • Shenandoah Valley Airport 	<ul style="list-style-type: none"> • Commonwealth’s Virginia Inland Port

Highway

I-81 is a primarily four-lane limited access Interstate highway in western Virginia. The number of lanes, along with roadway geometry, intersection spacing, etc., determines how much traffic a given roadway segment can accommodate in a given period of time and

provides a sense of the capacity of the roadway. A summary of the lane widths of I-81 is shown in Table 6.

Table 6. Interstate 81 Summary of Lane Widths

Section	Length	Width (Total Lanes)
Washington County	25.8	4
City of Bristol	8.1	4
Smyth County	23.0	4
Wythe County	30.0	4
Pulaski County	17.4	4
City of Radford	0.1	4
Montgomery County	25.2	4
Roanoke County	11.5	4
City of Salem	5.5	4
Botetourt County	26.8	4
Rockbridge County	32.0	4
Augusta County	28.1	4
City of Staunton	4.0	4
Rockingham County	22.1	4
City of Harrisonburg	6.4	4
Shenandoah County	34.8	4
Warren County	1.4	4
Frederick County	19.3	4
City of Winchester	4.5	4

Virginia maintains a statewide vehicle count program on its major highways, including collection and/or estimation of truck counts and percentages. I-81 is a primary through truck route along the East Coast. Figure 11 shows the average Virginia AADT (all vehicle types) depicted as columns, with the corresponding average truck percentages as points.

I-81 AADT varied from around 30,000 in Smyth County to around 60,000 in Roanoke County in 2007. Truck volume is heavy on I-81 ranging between 20 and 30 percent of AADT.

Figure 11. Average AADT and Truck Percentages

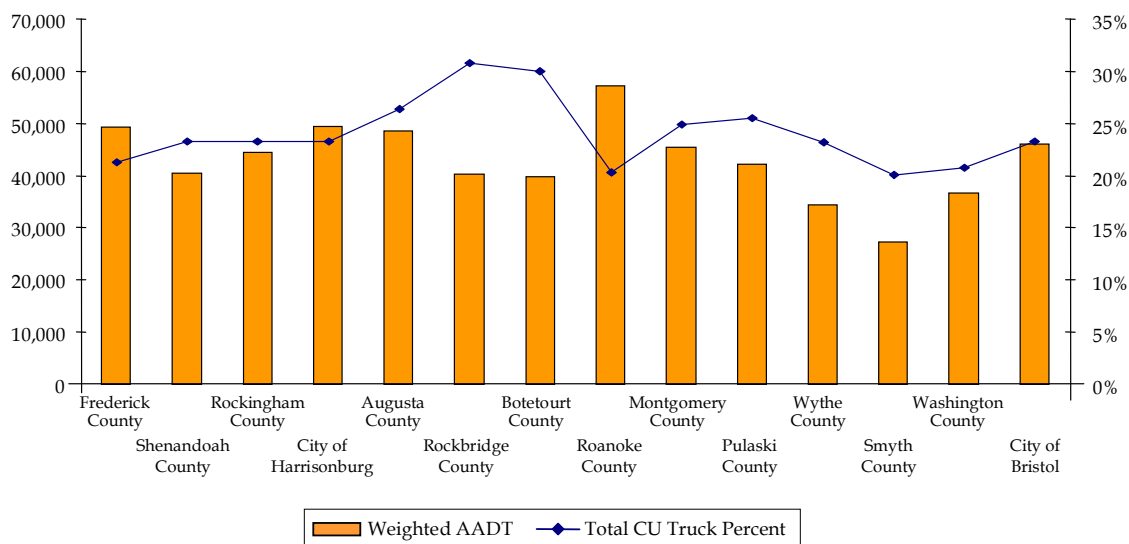


Table 7 describes average bridge and pavement condition and performance across all I-81 highway segments. The reference “IRI” stands for the International Roughness Index. IRI measures the cumulative deviation from a smooth surface in inches per mile – in other words, the sum of all the up-and-down road imperfections, from potholes to barely noticeable bumps or road roughness, which a vehicle will encounter over one mile. The ranges of values correspond to the pavement condition as follows (IRI in inches per mile): very good (0 to 85); good (86 to 110); fair (111 to 140); poor (141 to 175); very poor (more than 175). There also are road condition measures that apply to bridges; as presented in the National Bridge Inventory, “red” is the lowest of the three levels of “General Condition Ratings” that can be assigned to a bridge. Overall, the pavement quality of I-81 is in the very good category with an average rating of 68.

Table 7. Interstate 81 Road Condition by Jurisdiction

Physical Jurisdiction	2003 Weighted IRI	Percent of Bridges in “Red” Condition
Overall	68	0.74%
City of Bristol	72	0%
Washington County	66	0%
Smyth County	69	0%
Wythe County	78	0%
Pulaski County	69	0%
Montgomery County	66	13%
Roanoke County	68	0%
City of Salem	73	0%
Botetourt County	75	0%
Rockbridge County	75	0%
Augusta County	55	0%
Rockingham County	73	0%
City of Harrisonburg	72	0%
Shenandoah County	67	0%
Warren County	69	0%
City of Winchester	56	0%
Frederick County	57	0%

An important aspect of a freight system is its intermodal terminal network. These facilities provide the interface between freight rail and other transportation modes, including highway and water, and permit the transfer of goods from one mode to another. The figure below displays the rail-highway intermodal terminals along I-81, as well as additional system facilities.

Table 8. Virginia's Freight Railroads

Freight Railroad Name	Class I	Class III	Terminal/ Switching	Miles Operated in Virginia
Norfolk Southern Corporation	√			2,100
CSX Transportation	√			1,051
Buckingham Branch Railroad		√		278
Bay Coast Railroad		√		68
Chesapeake and Albemarle Railroad		√		29
Winchester and Western Railroad		√		26
Commonwealth Railway, Inc.		√		17
North Carolina and Virginia Railroad			√	4
Norfolk and Portsmouth Belt Line			√	4

The majority of Virginia's freight rail track infrastructure is in the possession of the two Class I railroads, Norfolk Southern (approximately 60 percent) and CSX (approximately 30 percent). Norfolk Southern's Shenandoah line (part of the Crescent Corridor) runs parallel to I-81 between Front Royal and Roanoke and serves the Commonwealth's Virginia Inland Port in Front Royal. Norfolk Southern's Heartland Corridor crosses I-81 between Roanoke and Walton. The CSX, Winchester and Western, and Buckingham Branch Railroads also operate within the I-81 Corridor.

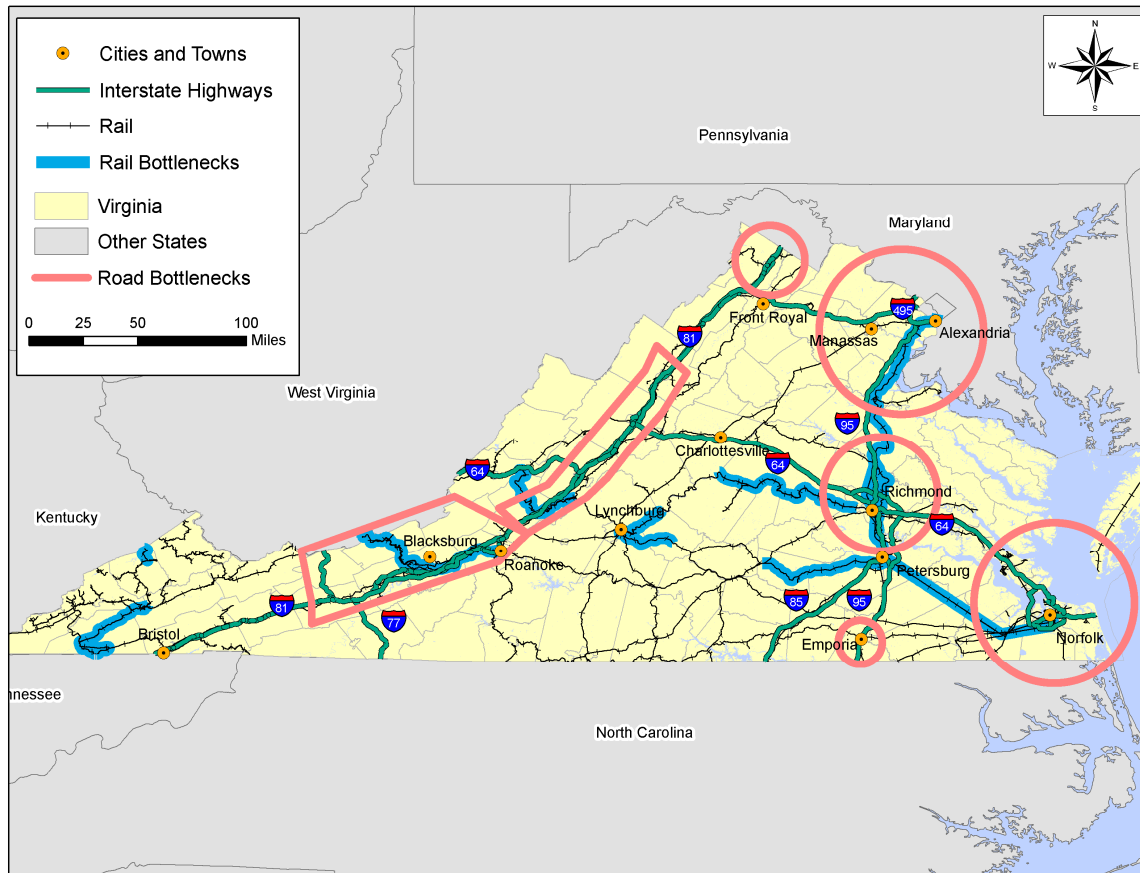
Bottlenecks

Virginia's freight transportation system contains segments that are stressed or over capacity to the point that they are defined as bottlenecks. Bottlenecks - whether existing or emerging - prohibit the efficient flow of freight through the system and across the Commonwealth. Currently, Virginia's primary freight transportation bottlenecks generally correspond to:

- Major urbanized regions with high levels of congestion;
- Intersections of major highway arteries; and
- Rail system points where infrastructure provides inadequate freight transportation capacity or dimension, especially where growing freight and passenger needs must be accommodated over shared infrastructure.

Much of the I-81 Corridor is considered a freight transportation bottleneck as shown in Figure 13.

Figure 13. I-81 and Statewide Freight Transportation Bottlenecks



Waterways and Ports

While the I-81 Corridor does not directly connect to significant port or waterway facilities, it does access the Commonwealth’s Virginia Inland Port in Front Royal. The Commonwealth’s Virginia Inland Port is an Intermodal Container Transfer Facility (ICTF) with rail service directly to Norfolk International Terminals. Containers from Hampton Roads marine terminals are conveyed to the Virginia Inland Port where they continue to their final destination via either rail or truck.

Distribution Centers

Virginia has experienced marked growth in large-scale warehousing development often associated with high-volume, or “big box” importers. These importers’ supply chains are highly dependent upon the uninterrupted flow of cargo – primarily containerized – through Virginia’s ports, and subsequently through its highways and rail connections. Fourteen major distribution centers are located along the I-81 Corridor. These are widely distributed from Bristol in the south to Winchester in the north. Target has the largest

distribution center along the route at 1.6 million square feet with Best Buy, Volvo, and Mid Mountain Foods at one million square feet each.

Table 9. Interstate 81 Warehouse and Distribution Facilities

Company	Location	Area (Square Feet)
Kohl's Corporation	Winchester	425,000
Rite Aid Corporation	Winchester	100,000
Home Depot	Winchester	842,000
Ferguson Enterprises	Front Royal	460,000
Family Dollar	Front Royal	970,000
Banta Books	Harrisonburg	260,000
Best Buy Inc.	Staunton	1,000,000
Target Stores	Waynesboro	1,600,000
Orvis Company	Roanoke	340,000
Advance Auto Parts	Roanoke	442,000
Hanover Direct	Roanoke	550,000
Home Shopping Network	Roanoke	255,000
Volvo	Radford	1,000,000
Camrett Logistics	Wytheville	345,000
Mid Mountain Foods	Bristol	1,000,000

Air Cargo

Roanoke Airport is the only major Virginia cargo airport along the I-81 Corridor. It handled over 10 million pounds of freight in 2006 as shown in Table 10.

Table 10. Cargo Airport Performance

Airports	2006 Freight Pounds	Percent Change versus 2005
Roanoke (ROA)	10,957,422	+14.2%

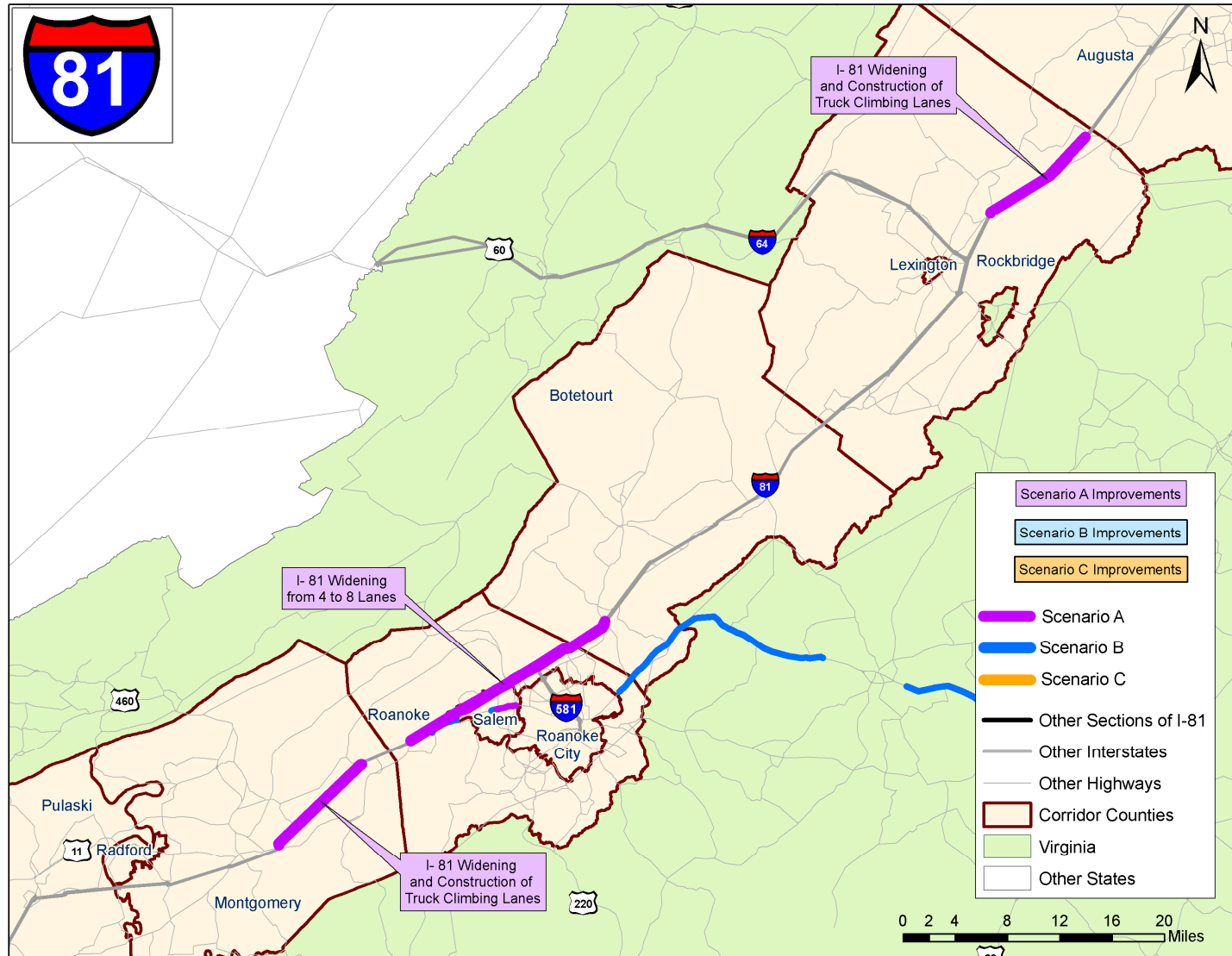
■ Alternative Scenarios

The Virginia Statewide Model (VSM) was run several times to estimate future freight transportation activities through Virginia. Each run used the same algorithm to process a different set of input parameters. These runs included a “base case” which estimated freight transportation activity in 2035 assuming no improvements in the highway or rail network. The output from this run provides a baseline to which the results of the remaining runs are compared. The final three runs, Scenarios A, B, and C, each represent different sets of roadway, rail, and marine improvements as well as travel pattern adjustments. Scenario A generally reflects the situation in the year 2035 given that only certain projects identified in the six-year improvement program are implemented. Scenario B includes everything from Scenario A plus key improvements from the Virginia 2025 State Highway Plan and a draft version of the 2035 State Highway Plan. Scenario C included everything from Scenario B plus implementation of other important freight transportation-related projects and policies. Public-Private Transportation Act (PPTA) projects are included in the scenarios as well. A description of the types of improvements included in each scenario is provided below.

Scenario A	Scenario B	Scenario C
<ul style="list-style-type: none"> • Highway – Improvements identified in the Virginia Six-Year Plan dated February 2009 that: <ol style="list-style-type: none"> (1) <i>Add significant capacity (generally those that add at least one-lane mile to the facility); and</i> (2) <i>Are located on any of the 11 freight corridors. No distinction was made between projects funded for preliminary engineering, right-of-way, or construction.</i> • Rail – Improvements to: <ol style="list-style-type: none"> (1) <i>Completion of Heartland Corridor project.</i> (2) <i>Relocate Commonwealth Railway mainline tracks to the medians of I-664 and the Western Freeway (Route 164); and</i> (3) <i>Other Virginia Port Authority CIP projects.</i> • Port – Miscellaneous improvements by the Virginia Port Authority to support anticipated growth. • Airport – None. 	<ul style="list-style-type: none"> • Highway – All highway improvements in Scenario A plus selected improvements from the VDOT 2025 State Highway Plan and from a preliminary draft version of the VDOT 2035 State Highway Plan that: <ol style="list-style-type: none"> (1) <i>Add significant capacity (generally those that add at least one-lane mile to the facility); and</i> (2) <i>Are located on any of the 11 freight corridors.</i> • Rail – All rail improvements from Scenario A. • Port – All port improvements from Scenario A. • Airport – None. 	<ul style="list-style-type: none"> • Highway – All highway improvements in Scenarios A and B plus the following: <ol style="list-style-type: none"> (1) <i>Hampton Roads Third Crossing;</i> (2) <i>U.S. 460 Expressway between U.S. 58 Bypass and I-295;</i> (3) <i>Capacity improvements on U.S. 17 and U.S. 29 near Warrenton;</i> (4) <i>U.S. 58 “Hillsville Bypass”;</i> and (5) <i>Tolling/pricing actions to shift time-of-day and/or mode choice decisions (also impacts rail mode).</i> • Rail – All rail improvements in Scenarios A and B plus the following: <ol style="list-style-type: none"> (1) <i>Crescent Corridor and National Gateway projects;</i> (2) <i>Short-haul rail projects to relieve Hampton Roads congestion;</i> (3) <i>Highway tolling/pricing actions to shift mode choice decisions; and</i> (4) <i>Craney Island on-dock rail and connection projects (also impacts port mode).</i> • Port – All port improvements in Scenarios A and B plus the following: <ol style="list-style-type: none"> (1) <i>Short-haul barge projects to relieve Hampton Roads congestion; and</i> (2) <i>Craney Island on-dock rail and connection projects (also impacts rail mode).</i> • Airport – Full build-out of the airports’ master plans and implementation of the Virginia Air Transportation System Plan recommendations.

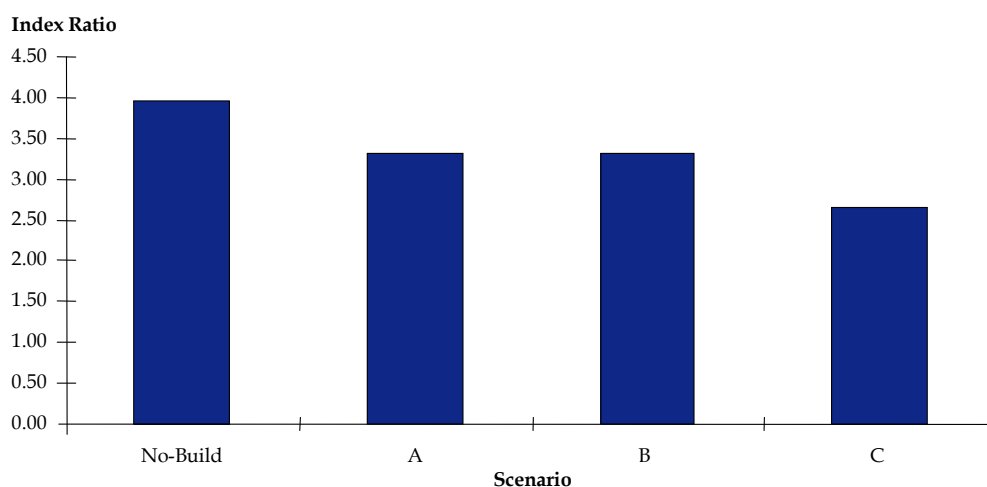
The projects included in Scenarios A, B, and C are highlighted in Figure 14.

Figure 14. Future Improvements to the Interstate 81 Corridor



The relative effectiveness of these scenarios in meeting the I-81 Corridor's freight transportation needs is summarized in the figure below. The Freight Congestion Index (FCI) is a measure of available capacity and use by trucks. It is a function of truck volume, link length, and number of lanes (i.e., capacity). A value of 1.00 represents the average state for the no-build scenario across all 11 corridors.

Figure 15. Freight Congestion Index for the I-81 Corridor



■ Key Project Recommendations

Key recommendations for projects located within the I-81 Corridor include:

- High-Priority Projects:
 - **Complete Norfolk Southern's Crescent Corridor project.** This project will allow for the diversion of truck traffic to rail from numerous interstates, including Virginia's I-81, I-95, I-77, and I-85.
 - **Widen I-81 from four to eight lanes between VA 641 south of Salem to U.S. 220 north of Roanoke.** This portion of I-81 experiences a high volume of truck traffic and high combination-unit truck percentages. This, combined with the background traffic associated with its proximity to the cities of Roanoke and Salem, causes high levels of congestion. Expanding I-81 from four to eight lanes here will alleviate this freight transportation bottleneck.
 - **Add southbound truck climbing lanes in Montgomery County approaching Christiansburg and northbound climbing lanes in Rockbridge County north of Lexington.** These portions of I-81 have steep grades and would benefit from the addition of truck climbing lanes. Traffic volumes on these sections range from

43,000 to 49,000 AADT with combination-unit truck percentages in the 25 to 35 percent range. Widening this roadway will reduce congestion and improve safety.

- **Implement the Heartland Corridor project.** This project will improve freight flow across the I-81 Corridor and through the Commonwealth as a whole.

A more detailed description of the freight projects identified for the I-81 Multimodal Corridor is provided in Table 11.

Table 11. I-81 Multimodal Corridor Project List

Route	Project Description	From	To	Distance (Miles)	Impact on Freight Transportation Activity ^a	Scenario	Included in Freight Plan?
I-81	Widen from 4 to 8 Lanes	0.047 Mile North of Route 641 MP 135.9	0.200 Mile North of Route 635 MP 138.6	2.566	High	A	Yes
I-81	Widen from 4 to 8 Lanes	0.200 Mile North of Route 635 MP 138.6	0.75 Mile North of Route 311 MP 140.9	2.500	High	A	Yes
I-81	Widen from 4 to 8 Lanes	0.75 Mile North of Route 311 MP 140.9	0.786 Mile South of I-581 MP 143.1	2.200	High	A	Yes
I-81	Widen from 4 to 8 Lanes	0.786 Mile South of I-581 MP 143.1	0.881 Mile North of I-581 MP 144.5	1.667	High	A	Yes
I-81	Widen from 4 to 8 Lanes	0.881 Mile North of I-581 MP 144.5	0.280 Mile South of Route 648 MP 147.45	3.000	High	A	Yes
I-81	Widen from 4 to 8 Lanes	0.280 Mile South of Route 648 MP 147.45	0.79 Mile North of Route 779E 220 - MP 152.4	4.900	High	A	Yes
I-81	Add Northbound Truck Climbing Lanes	Southbound MP 119	Southbound MP 128	9.000	High	A	Yes
I-81	Add Southbound Truck Climbing Lanes	0.43 Mile North Route 11	2.08 Mile North Route 710	6.970	High	A	Yes
U.S. 58	Rural 4 Lane with Median	Scott CL	WCL Bristol	6.240	Low	B	
U.S. 58	Parallel Lane	0.320 KM East Route 11 (Abingdon)	0.237 KM East Route 638 East	2.950	Low	A	
U.S. 58	Rural 4 Lane with Median	Route 11	Route 1201	9.570	Low	B	
U.S. 58	Parallel Lane	0.080 KM East Route 677 (Rhea Valley)	0.224 KM East Route 638 East	0.191	Low	A	

U.S. 58	Parallel Lane - Corridor Development Program	0.3 KM East Route 638 East	0.61 KM East Route 708 (Rhea Valley)	2.550	Low	A	
U.S. 58	Parallel Lane - Corridor Development Program	0.61 KM East Route 708	0.2 KM West WCL Damascus	3.100	Low	A	
U.S. 460	Widen to 3 Lanes with Curb and S/W	Route 311 (Thompson Memorial Boulevard)	0.05 M E Intersect Kessler Mill Road	1.230	Low	A	
U.S. 460	Urban 4 Lane with Median	Route 612	WCL Salem	1.970	Low	B	
U.S. 460	Urban 6 Lane with Median	ECL Roanoke	Botetourt CL	1.970	Medium	B	
I-77	Truck Climbing Lanes in Select Locations	Route 58	West Virginia SL	52.500	High	B	Yes
	Crescent Corridor				High	C	Yes
	Heartland Corridor				High	A	Yes
	Virginia Inland Port Projects				High	C	Yes

a: The impact on freight transportation activity column indicates the relative impact a given project has on freight mobility as compared to the relative impact it has on mobility in general. It consists of three categories:

- High** - these projects provide a greater relative impact to the important activity of moving freight than other projects considered.
- Medium** - these projects benefit both freight and non-freight transportation activity to an important degree.
- Low** - while valuable to both freight and non-freight transportation activity, these projects have a lower relative impact on freight activity than those in the medium- or high-level categories.

■ Conclusions

The primary conclusions of the I-81 Corridor freight profile are:

- Every freight-transportation infrastructure recommendation on I-81 is high-priority. They include the widening of I-81 from four to eight lanes in the Roanoke area and the addition of truck climbing lanes in portions of Montgomery and Rockbridge Counties (see recommendations section for details).
- The Roanoke Region Intermodal facility should be completed in phases to provide intermodal terminal services to the Heartland Corridor and Crescent Corridor.
- I-81 is a freight transportation bottleneck throughout much of its length between Radford and the West Virginia border.
- The Norfolk Southern Virginia east-west mainline is a bottleneck west of Salem and the CSX Virginia east-west mainline is a bottleneck west of I-81.
- Combined, the freight-intensive, retail, and goods movement industries account for 36 percent of total I-81 employment, significantly greater than the 31 percent average for Virginia as a whole.
- Nearly 80 percent of the total freight tonnage (inbound, outbound, internal, and through) moving within the Corridor is hauled by truck with about 21 percent hauled by rail. Over 77 percent of the total freight tonnage moving within the Corridor is through traffic.
- The overall pavement condition of I-81 in Virginia is very good.
- Roanoke Regional Airport is the only significant air cargo facility located within the Corridor. It is the fourth largest in Virginia and handled just under 11 million pounds of freight in 2006.
- While there are no marine facilities in the I-81 Corridor, the Commonwealth's Virginia Inland Port is located within the Corridor near Front Royal.