Freight 9

FREIGHT TRANSPORTATION PLANNING

In many long-range transportation plans freight transportation is overshadowed by passenger transportation. In recent years the popularity of bicycle accommodations, greenway trails and other forms of non single-occupancy motorized vehicle (SOV) transportation has occupied the spotlight of transportation planning in the United States.

While it may not have the appeal of planning for bicycles and greenways, freight transportation planning is equally important. Trucks deliver nearly 70 percent of all freight transported annually in the U.S.

Freight transportation demand can be driven by many demographic factors. For instance, as gas prices go up, people may order more products from the internet. Freight transportation also has a direct connection to globalized supply chain, just in time delivery and other interregional and international logistics and manufacturing systems. Finally, there is a public safety aspect to large vehicle planning. Fire-trucks and ladder-trucks have large wheel bases and large turning radius requirements. This presents design challenges when initiatives such as complete streets or traffic calming occur in corridors that have to also accommodate freight transportation. Designers should keep freight vehicle characteristics in mind when designing with other planning values in mind.

This chapter presents freight data summaries for the RVAMPO region using 2004 Global Transearch® data. It presents design issues common to freight transportation. It also provides a menu of quick action freight projects that were featured in the 2002-03 RVARC Regional Freight Study for financially constrained or vision list consideration and a proposal for a regional intermodal facility project just outside the MPO.

Freight Data Summary

Truck Freight Arriving in Region

Jurisdiction	Total Truck Tons	Total Value
Alleghany County	371,917.49	$379,787,454.30
Botetourt County	2,402,830.02	$4,983,794,770.05
Clifton Forge	9,241.99	$53,061.80
Covington	955,189.41	$3,835,727,917.87
Craig County	256,053.26	$216,082,306.43
Franklin County	2,624,830.12	$3,310,887,253.13
Roanoke City	4,959,179.38	$7,894,637,680.84
Roanoke County	2,038,499.85	$2,127,568,295.50
Salem	1,386,790.11	$4,129,808,894.83
Grand Total	**15,004,531.65**	**$26,878,347,634.76**

Top Commodities Arriving in Region by Weight

Rank	Commodity	Truck Tons
1	Nonmetallic minerals	6,044,483.06
2	Secondary traffic	3,039,844.42
3	Clay, concrete, glass, or stone	1,927,778.40
4	Lumber or wood products	1,684,156.98
5	Food or kindred products	444,579.46
6	Petroleum or coal products	409,069.35
7	Chemicals or allied products	352,166.90
8	Pulp, paper, or allied products	295,466.20
9	Transportation equipment	145,700.25
10	Primary metal products	107,752.96
	Total Tons of Top Commodities	**14,450,997.98**

Top Commodities Arriving in Region by Value

Rank	Commodity	Value
1	Secondary traffic	$19,842,942,724.65
2	Transportation equipment	$1,067,111,883.68
3	Electrical equipment	$934,889,877.21
4	Chemicals or allied products	$744,921,185.08
5	Lumber or wood products	$701,920,826.72
6	Machinery	$551,038,303.95
7	Pulp, paper, or allied products	$455,818,440.01
8	Food or kindred products	$376,816,905.03
9	Fabricated metal products	$298,661,551.54
10	Rubber or misc. plastics	$288,569,109.58
	Total Value of Top Commodities	**$25,262,690,807.45**

Truck Freight Originating in Region

Jurisdiction	Total Truck Tons	Total Truck Value
Alleghany County	684,925.82	$1,450,049,455.70
Botetourt County	1,696,892.61	$915,736,195.97
Clifton Forge	22.46	$145,851.50
Covington	774,501.91	$1,207,273,452.90
Craig County	252,272.63	$38,401,509.56
Franklin County	2,313,985.69	$1,145,428,418.67
Roanoke City	6,134,110.82	$15,625,412,922.74
Roanoke County	3,261,428.51	$7,402,847,256.28
Salem	2,252,914.62	$15,920,228,343.87
Grand Total	**17,371,055.06**	**$43,705,523,407.17**

Top Commodities Originating in Region by Weight

Rank	Commodity	Truck Tons
1	Nonmetallic minerals	4,990,803.70
2	Clay, concrete, glass, or stone	3,011,385.65
3	Secondary Traffic	2,764,281.44
4	Lumber or wood products	2,145,267.26
5	Pulp, paper, or allied products	1,091,868.75
6	Machinery	539,963.91
7	Chemicals or allied products	491,475.94
8	Food or kindred products	489,348.60
9	Rubber or misc. plastics	437,106.16
10	Farm products	309,012.12
	Total Tons of Top Commodities	**16,270,513.53**

Top Commodities Originating in Region by Value

Rank	Commodity	Value
1	Secondary Traffic	$18,041,567,726.72
2	Machinery	$9,773,224,266.88
3	Chemicals or allied products	$3,167,200,459.95
4	Electrical equipment	$2,053,565,119.66
5	Rubber or misc. plastics	$1,749,460,660.55
6	Apparel or related products	$1,506,969,555.79
7	Pulp, paper, or allied products	$1,420,078,487.14
8	Fabricated metal products	$1,258,146,436.61
9	Transportation equipment	$1,040,471,141.20
10	Lumber or wood products	$736,763,630.12
	Total Value of Top Commodities	**$40,747,447,484.62**

Freight Traffic

Freight, or truck, traffic data for Interstates, U.S. Highways, and State Highways in the Roanoke Valley Area Metropolitan Planning Organization region is presented on the following two pages. The data used to produce the maps was taken from 2007 Virginia Department of Transportation Daily Traffic Volume Estimates reports.

The first map, "Truck Traffic as Percentage of AADT," shows truck traffic as a percentage of the total traffic (Average Annual Daily Traffic or AADT) traveling on the roads each day. Truck traffic includes buses and the four truck categories provided on the Traffic Volume Estimates: 2 Axel, 3+ Axel, 1 Trailer, and 2 Trailers.

The second map, "Estimated Number of Trucks Per Day," shows the approximate number of trucks that travel on the roads each day. In each section of roadway, this number is the product of the AADT multiplied by the Truck Traffic Percentage discussed previously.

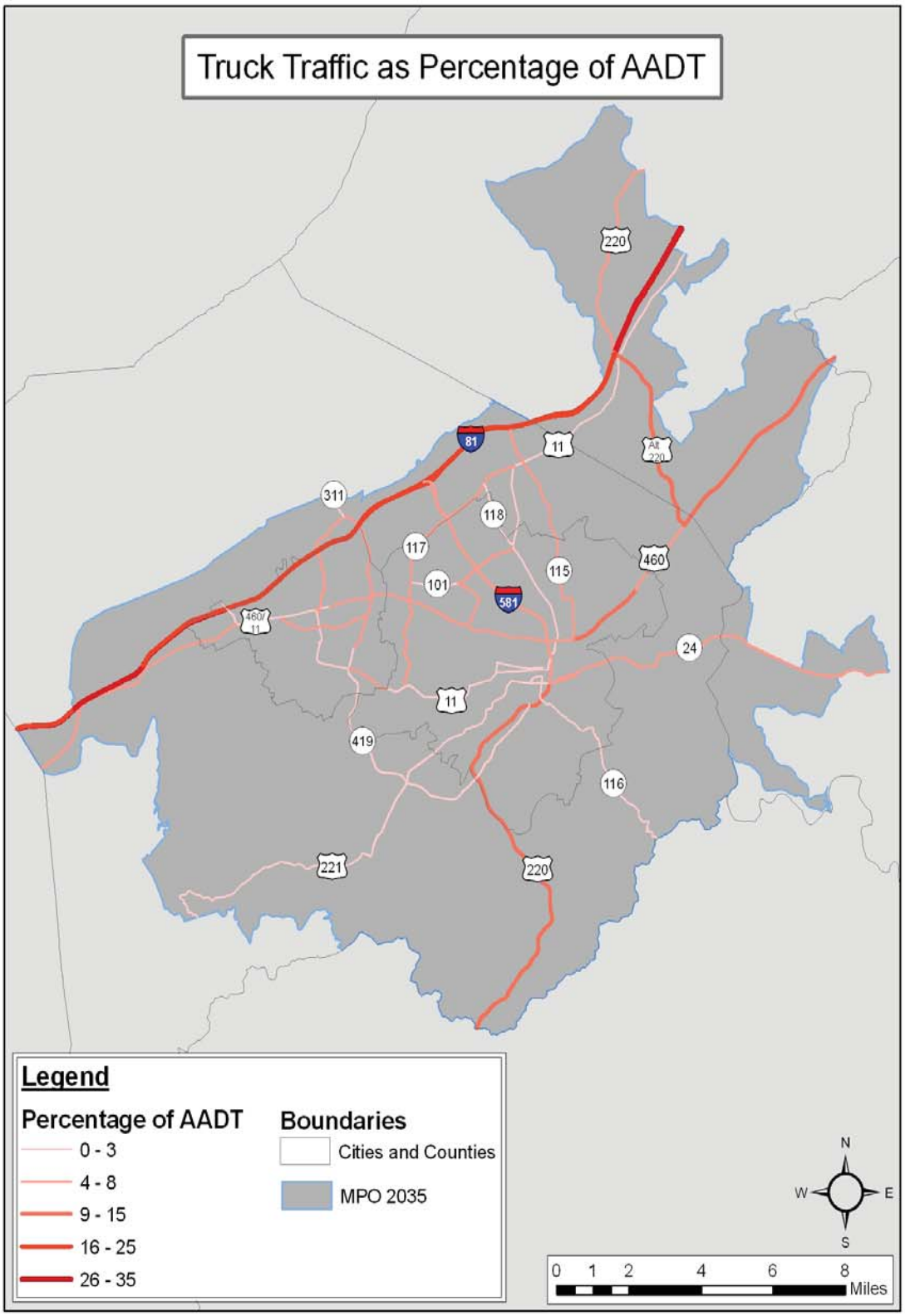
Between 5,000 and 9,000 trucks travel on each direction of I-81 each day, making it the busiest truck corridor in the region. It handles more than 15% of the total traffic in every section. In some sections in the northern part of the region, the truck traffic is responsible for 26-35% of the total traffic.

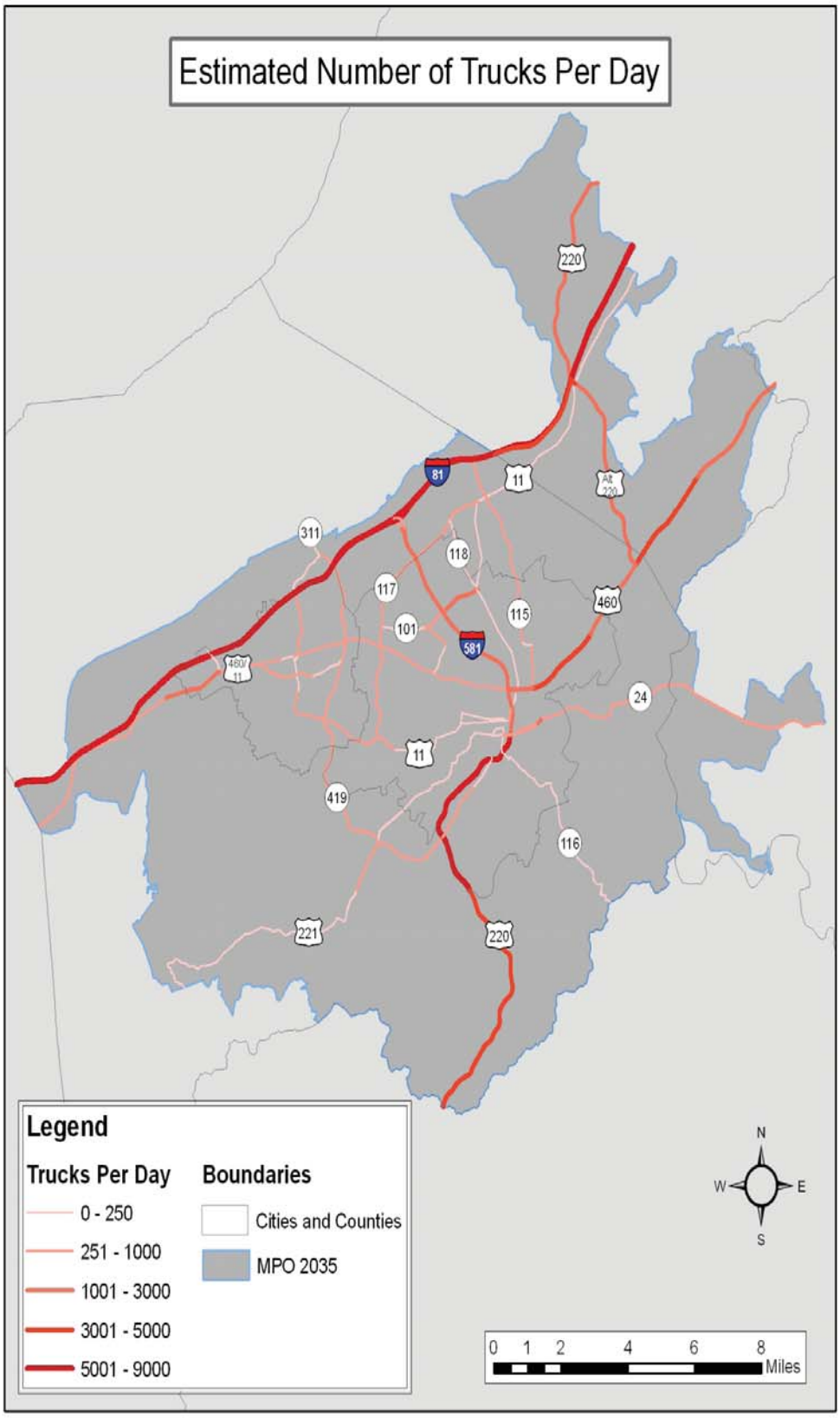
U.S. 220 Alternate, U.S. 460, U.S. 220, and I-581 are the other major truck corridors in the region. I-581 (defined by terminals at I-81 in the north and the City of Roanoke's Elm Avenue in the south) appears on the maps to have significantly less truck traffic than U.S. 220. This is true for the percentage of truck traffic. Trucks comprise 6-7% of the total traffic on I-581. In terms of the total number of trucks, however, it's a different story. The numbers shown for U.S. 220 include the number of trucks traveling both north and south along the corridor. For I-581, these numbers are divided between the directions of travel. Approximately 2,000 trucks per day travel each direction of the corridor, meaning that over 4,000 trucks travel on the corridor as a whole each day.

U.S. 460 is a major truck corridor to the east of I-581. In most sections, truck traffic constitutes 9-15% of the total traffic. Some sections receive between 3,000-5,000 trucks per day, while the rest receive 1,000-3,000 per day. West of I-581, truck traffic on U.S. 460 is still significant, but it is noticeably diminished.

U.S. 220 Alt serves as the primary connecting corridor between I-81 and U.S. 460. 1,000-3,000 trucks travel this corridor each day, which accounts for 9-15% of the total traffic.

U.S. 220 carries between 3,000-9,000 trucks per day between Franklin County and Elm Avenue in the City of Roanoke, with the numbers steadily increasing as the road approaches downtown Roanoke City. These vehicles comprise slightly under 15% of the total traffic on this section of the road. U.S. 220 then shares roadway designation with I-581 and I-81 until it reaches I-81 Exit 150 in Botetourt County. After it separates from I-81, the truck traffic diminishes greatly. These sections receive between 1,000-2,000 trucks per day.


Truck Traffic as Percentage of AADT
220
81
11
Alt 220
311
118
117
115
460
101
581
460/ 11
24
11
419
116
221
220
Legend
Percentage of AADT
0 - 3
4 - 8
9 - 15
16 - 25
26 - 35
Boundaries
Cities and Counties
MPO 2035
N
W
E
S
0 1 2 4 6 8
Miles


Estimated Number of Trucks Per Day
220
81
11
Alt 220
311
118
117
115
460
101
581
460/ 11
24
11
419
116
221
220
Legend
Trucks Per Day
0 - 250
251 - 1000
1001 - 3000
3001 - 5000
5001 - 9000
Boundaries
Cities and Counties
MPO 2035
N
W
E
S
0 1 2 4 6 8
Miles

Freight Design Deficiencies

In the 2002-03 Regional Freight Study, shippers and motor carriers in the region identified a number of traffic and roadway design deficiencies in the study area. Those that were identified as in most need of improvements were:

- Traffic signalization – timing and spacing
- Intersection Design – specifically making right turns
- Sufficient turning radii into delivery points such as shopping centers, retail establishments, restaurants, etc. along roadways
- Freight access and staging for commercial/business establishments

Traffic design issues often contribute to a less reliable freight network. By developing a defined network and understanding the specific freight roles played by the region's highways, roadway improvement strategies are likely to be more successful. There are several common areas of need for roadway design standards for truck activities:

- Intersection Design
- Cross-Section and Geometric Design
- Signalization
- Separation.

Computer illustration of right hand access lanes (i.e. "jug handle") to accommodate left hand turns - highlighted in orange

Computer illustration of right hand access lanes (i.e. "jug handle") to accommodate left hand turns - highlighted in yellow

Design Standards for Freight Transportation

Intersection Design affects accessibility through delayed right turns due to oncoming traffic. To avoid oncoming traffic, trucks may be forced to "cut corners" onto curbs, while in other instances "curb hopping" may be attributed to lane-dividing medians. In either case, when forced onto curbs or medians while negotiating a right turn, trucks run the risk of load shifts and damage to the goods they carry. Impediments, such as telephone poles, signs, or landscaping can also affect maneuverability. While the beautification of intersections has its benefits, in many instances such beautification projects fail to take into consideration the potential impact on freight mobility. Landscaping, when combined with either oncoming traffic or center medians, can place a tremendous burden on truck drivers in terms of maneuverability. Further, natural and artificial impediments, when not placed properly taking into consideration freight transport interests, can affect sight lines. Such an effect can directly impact intersection safety for freight and passenger traffic alike.

Cross-Section and Geometric Design including the turning radii, lane widths, and other cross-sectional factors should be based upon the intended use or role of the facility. Regional truck routes tend to accommodate large, as well as smaller, trucks (WB50 and WB70) and, therefore, should be designed to accommodate those vehicles without creating significant traffic impacts. Local truck routes also need to accommodate larger and smaller truck sizes, and hence would have to be designed accordingly.

Signalization has improved dramatically over the past several decades; however, the development of better timing plans is limited by the availability of good traffic data on a continuing basis. Signal timing "optimization" activity today is often performed using data collected on only one or two days and typically does not include information regarding truck volumes. Several studies have taken place recently to develop better signal plans for heavily traveled truck corridors.

The spacing of traffic signals and the individual timing patterns, while accounting for light-vehicle mobility, in many instances fails to account for the time it takes heavy truck traffic to attain a reasonable speed or to stop. Abrupt starting and stopping by large commercial freight vehicles is very fuel inefficient and indirectly increases the cost of product transport, while at the same time diminishing air quality in the region.

Truck Separation where it makes sense may be especially important in areas of high traffic density and where good alternatives are available. The most fundamental form of separation is to design roadways with sufficient lane widths, providing traffic sufficient maneuverability. Another form of separation is to restrict specific types of traffic along specific corridors.

Design Guidelines for Roadway Elements

Truck traffic, particularly heavy-truck traffic, causes a disproportionate amount of roadway wear in comparison to passenger vehicle traffic. RVAMPO roadways intended to be used as freight transport corridors should be designed to common physical standards more durable than conventional roadways. For example, freight network roadways should be designed to higher lane and curb lane widths, as well as shoulder widths. Pavement Condition Rating (PCR) values, as well as intersection radii should also be designed for a significantly higher volume of freight traffic than other roadway facilities.

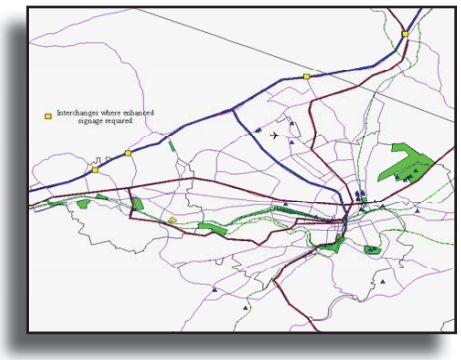
Signalization Guidelines: Special traffic signalization considerations should be made along freight network facilities. Signal timing plans along freight corridors should be adjusted to account for the larger size and slower acceleration of trucks. As metropolitan truck corridors often span multiple jurisdictions across a region, it is essential that there exist inter-jurisdictional cooperation with respect to coordination of signal timing so that the maximum benefit of this strategy may be realized.

Signage: The development of sign design and placement guidelines can facilitate the efficient movement of freight and goods. Drivers not familiar with a particular metropolitan area can be forced to backtrack if roadway signs are unclear, missing, or placed in hard to see locations. This applies to roadway identification signs, as well as directional signs along a roadway. Metropolitan areas generally do not specify guidelines as to the placement of address signs. Consequently, many businesses and residences either lack address signs altogether, or have them placed in a location hard to see from the street, making it difficult for unfamiliar delivery drivers to locate individual stops.

Fast action projects

Below are the original fast action projects recommendations from the 2002-03 Regional Freight Study. These projects will be considered as a part of the Constrained and Vision list planning processes. These project suggestions were generated through the stakeholder outreach process.

Project #1 Improve Highway Signs on I-81 and I-581

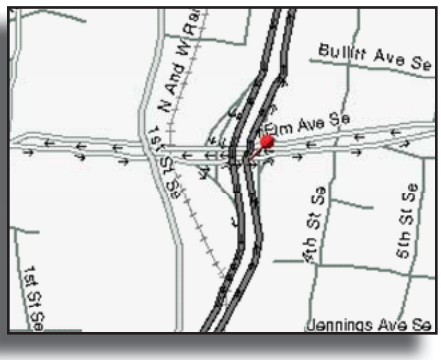


Source: Shipper Interviews
Jurisdiction: VDOT
Problem: Current traffic signs at major exits do not provide adequate information to truck drivers attempting to locate industrial centers.
Proposal: Install signs indicating exits to the City of Salem and Town of Vinton. List major industrial facilities.

Project #2 Orange Ave & I-581

Source: Motor Carrier Survey
Jurisdiction: VDOT
Problem: Inadequate acceleration/deceleration lanes at interchange
Proposal: Redesign and extend entrance/exit ramps to accommodate large trucks. (note: current TIP references ramp acceleration projects)

Project #3 Elm Avenue & I-581

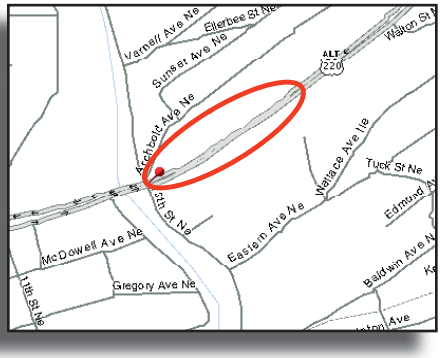


Source: Motor Carrier Survey
Jurisdiction: VDOT
Problem: Inadequate acceleration/deceleration lanes at interchange
Proposal: Redesign and extend entrance / exit ramps to accommodate large trucks. (note: current TIP references ramp acceleration projects)

Project #4 Elm Avenue & Williamson

Source: Motor Carrier Survey
Jurisdiction: City of Roanoke
Problem: Congested intersection – difficult to turn through with a truck
Proposal: Study traffic patterns to determine if an alternate route could be used by trucks, and/or conduct an operational analysis of the intersection.

Project #5 Orange Av. & 13th St. NE



Source: Motor Carrier Survey
Jurisdiction: City of Roanoke
Problem: Traffic merges from 3 to 2 lanes creating a dangerous area as people attempt to beat trucks to the merge point.
Proposal: Conduct preliminary engineering analysis for possible road widening project.

Project #6 Salem Turnpike & Melrose Ave

Source: Motor Carrier Survey
Jurisdiction: VDOT
Problem: Dangerous intersection due to off-setting lanes, and just prior to the intersection Melrose has a narrow curve where many trucks go over the center line and encroach on east bound traffic lanes.
Proposal: Conduct an operational analysis

Project #7 Salem Turnpike & Peters Creek Road

Source: Motor Carrier Interviews
Jurisdiction: City of Roanoke
Problem: Signal functions poorly – "west bound is always green – east bound waiting to turn have to wait until next light cycle."
Proposal: Conduct an operational analysis of the intersection.

Project #8 Lynchburg Turnpike & Electric Road

Source: Motor Carrier Interviews
Jurisdiction: City of Salem
Problem: Inadequate overhead clear ance: bridge height is 13'9" and many loads require 14".
Proposal: Consider lowering the road bed 3".

Project #9 US 460 and Granby Road

Source: Motor Carrier Survey
Jurisdiction: City of Roanoke
Problem: Very difficult for trucks to make a right hand turn off US 460 (Orange Av) onto Granby Rd. to access to Statesman Industrial Center.
Proposal: Conduct an operational analysis of the intersection.

Project #10 US 460 and Challenger Ave

Source: Motor Carrier Interviews
Jurisdiction: County of Roanoke
Problem: Turn lanes constructed for the Bonsack Wal-Mart are not wide enough to store trucks side by side in the two lanes.
Proposal: Widen turn lanes.

Urban Signage Study

In fiscal year 2006, RVAMPO staff completed the *Urban Signage Study*. The following excerpt from the study includes a recommendation for signage clarification on Hershberger Road leading to Interstate 581. This section of roadway is very important for freight transportation as it connects the Roanoke Regional Airport and surrounding commercial land uses to Interstate 581 near its terminus with Interstate 81.[15]

Exit Only Lane-Hershberger Road

A common complaint amoung area residents is that the right lane in Figure 38 is an on-ramp to I-581. Local traffic often has to merge left at the last minute when they realize the lane ends. This situation could be improved by an "EXIT ONLY" sign on the overhead, or by pavement markings with a similar message.

Figure 38-Hershberger Road exit only lane to I-581 north could benefit by better marking on an overhead sign or on the pavement

5. Roanoke Urban Area Signage Study-August 2006-Page 33 http://www.rvarc.org/work/signage.pdf

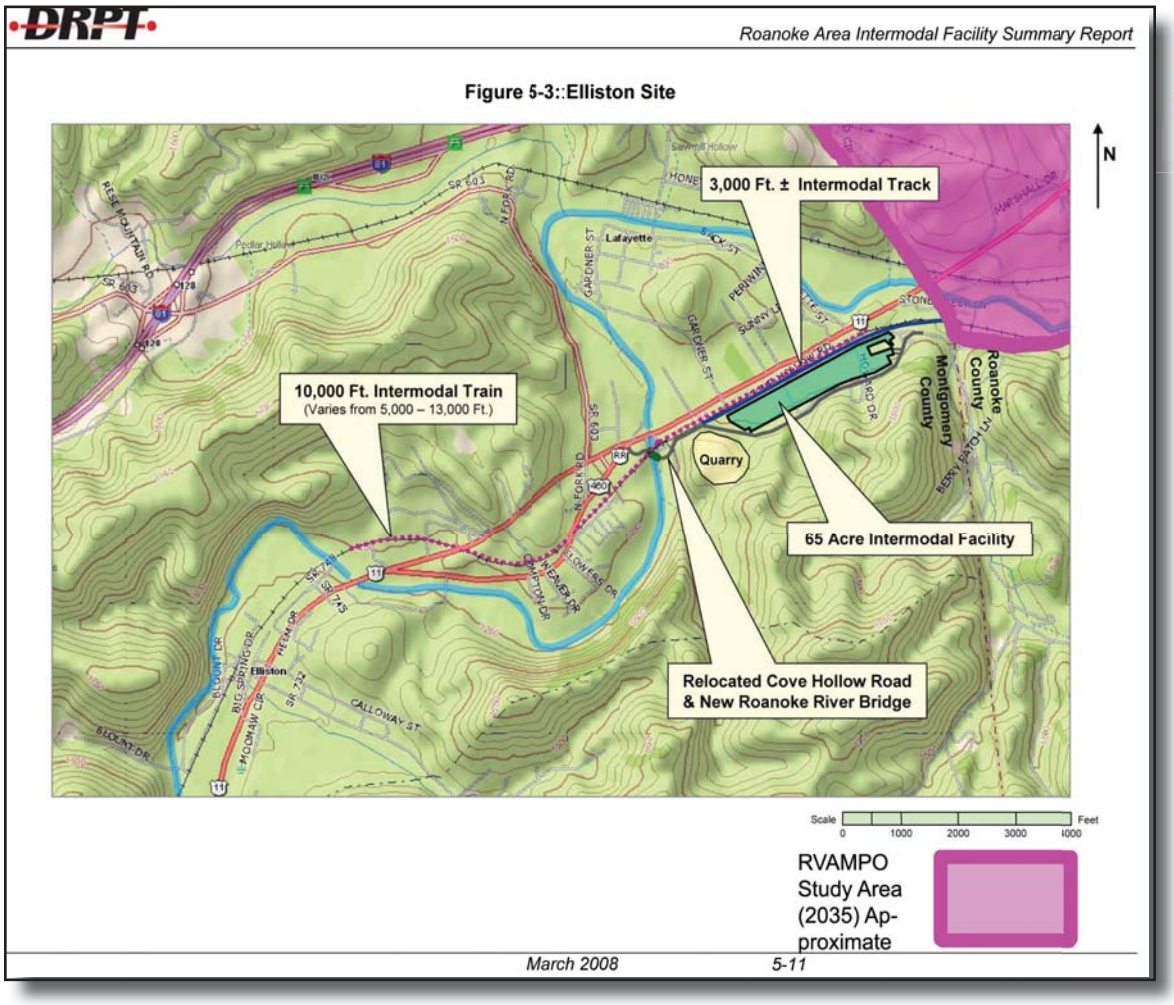
Roundabout Design

Roundabouts can be designed with truck aprons to accommodate vehicles with wheel bases of 50 to 67 feet (WB-50 or WB-67). The aprons are distinct, both visually and surface texturally, from the surrounding roundabout. However, trucks and emergency vehicles are able to drive on the aprons to negotiate the roundabout safely and without delay. The following image shows a roundabout with a properly designed truck apron.

Properly Designed Roundabout with truck/emergency vehicle apron. Roundabout location West Haven, CT designed by William Britnell, original image (without illustration and callout box) provided by VDOT central office, Richmond VA.

Intermodal Center in Elliston (Montgomery County)

In 2008, the Virginia Department of Rail and Public Transportation (VDRPT) selected a site in Elliston, Virginia for the regional Intermodal Freight Transfer facility for the multi-state Heartland Corridor Project with Norfolk Southern (NS). The Elliston location is just outside the RVAMPO 2035 study area for this plan. The graphic on the next page illustrates the proximity of the selected site to the 2035 study area (shown in purple).



Altered image depicting approximate location of RVAMPO 2035 study area boundary compared with nearby Elliston Site. Original Image "Roanoke Area Intermodal Facility Summary Report," VDRPT - March 27, 2008 - Page 41 - http://www.drpt.virginia.gov/special/files/Main Report 03-27-08.pdf

Future Expansion of RVAMPO Study Area Boundary

Since the proposed intermodal facility site is just outside the RVAMPO 2035 study area, any federal funds spent on site will not be part of the RVAMPO planning process. However, development sparked by the intermodal facility will likely expand RVAMPO study area boundaries to include Montgomery County in future Long-Range Transportation Plan updates, based on census population density results. Portions of Franklin County will also likely come into the RVAMPO planning process due to development induced by a water and sewer line extension into Franklin County along the US 220 Corridor.

Spill Back Development into RVAMPO

The Elliston intermodal site is likely to induce spill back development into western Roanoke County and the City of Salem.

A team of Virginia Tech Students investigated the concept of spill back development in a FY 2008 report. The report was a second semester follow-on to the group's third place award-winning entry in the 2008 RVAMPO Student Paper Competition. Team members included Race Kangas, Eric Hundley, Lindsey Ingalls and Shaun Lehman. The team used the projected induced employment range reported in "*An Economic Assessment of a Roanoke Region Intermodal Facility*"[61] as a control total range. The team then used a commercial type indicator from California to estimate the percentage of future employment that could be sited on the original 65 acre site. Subsequently the team used local government online GIS records to identify unused and under-utilized parcels near the intermodal site. They used the same place type indicator to allocate remaining projected employment into nearby parcels that would likely become available and were located in zoning classifications that allowed for commercial or industrial development.

Place Type Menu relates building type to estimated number of employees per acre. Provided by Sacramento Area Council of Governments www.sacog.org - Students used the place type menu to estimate commercial and industrial employment potential for properly zoned parcels close to the Ellistion intermodal site in Western Roanoke County and the City of Salem.

6. http://www.drpt.virginia.gov/special/files/Economic Assessment of Roanoke Intermodal Facility Final Report 1-07-08.pdf

The students reported that the following parcels would the most likely to develop or develop more intensely over a 20 year period.

City of Salem

Sites (TAX ID)	Zoning	Acres	Notes
163-1-1	Heavy Mfg.	12.041	Vacant Land
56-1-1	Light Mfg.	8.42	Vacant Land, located along train tracks
155-2-3	Heavy Mfg.	20.6784	Vacant Land
142-1-2	N/A	7.3	Old Tannery, could be potentially bought
116-1-2	Heavy Mfg.	13.26	Under utilized
150-3-1 and 155-2-2	Heavy Mfg.	8.47	Potential development already began

Roanoke County

Sites (TAX ID)	Zoning	Acres	Notes
055.03-01-26.00-0000	Heavy Industrial	3.06	Current owner 'Bolling Steel Co.'designated as 'not in land use'
055.03-02-01.00-0000	Heavy Industrial	10.97	Large, open parcel located next to tracks
055.03-02-08.00-0000	Heavy Industrial	3.33	Undeveloped land, may need to be cleared for future use
054.04-01-12.00-0000	Commercial	3.27	Located directly next to I-81

City of Roanoke

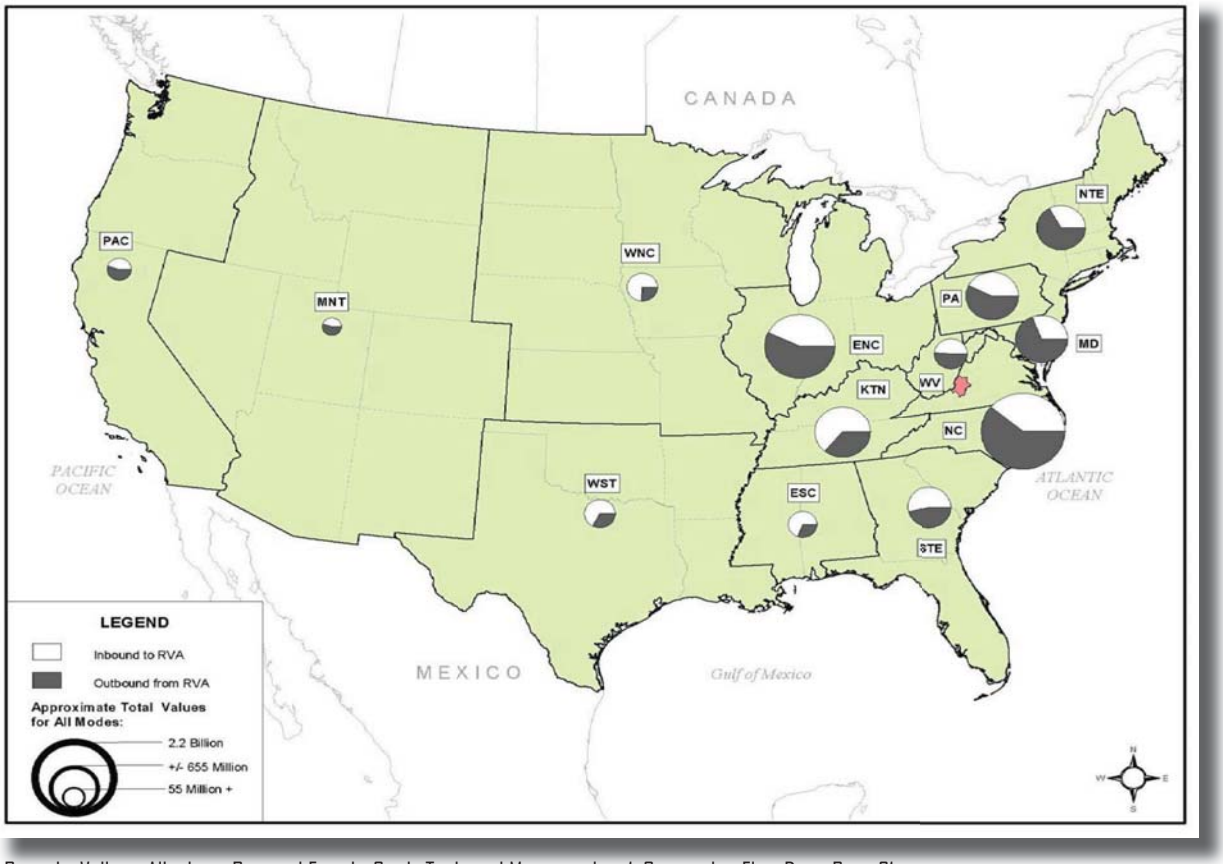
Sites (TAX ID)	Zoning	Acres	Notes
5090201	400-Commercial/Industrial	5.69	Owned by SW Improvements; older plaza that could be used for multiple businesses
5090207	400-Commercial/Industrial	1.89	Owned by SW Improvements; older plaza that could be used for multiple businesses
5210103	400-Commercial/Industrial	3.1304	Building owned by investment co.; appears vacant; next to tracks
5210711	400-Commercial/Industrial	3.9963	Appear to be older buildings, photos show storage units, located near tracks

Preliminary plans for the Elliston Intermodal Center include a connection to Interstate 81 located outside of the RVAMPO 2035 study area. However, the spill back/infill development induced by the Intermodal Center will likely put increased truck traffic on Route 11/460 as containers are drayed between manufacturing and warehousing facilities and the intermodal center itself. Any expansion or redesign of the affected sections of Route 11/460 should keep the following in mind:

- Designs should be compatible with large wheel base vehicles
- Designs should consider traffic signal timing and variable message sign placement
- Designs should consider "jug handles" or other designs to limit left turn conflicts
- Designs should designate corridor as "no idling" zone to limit air pollution

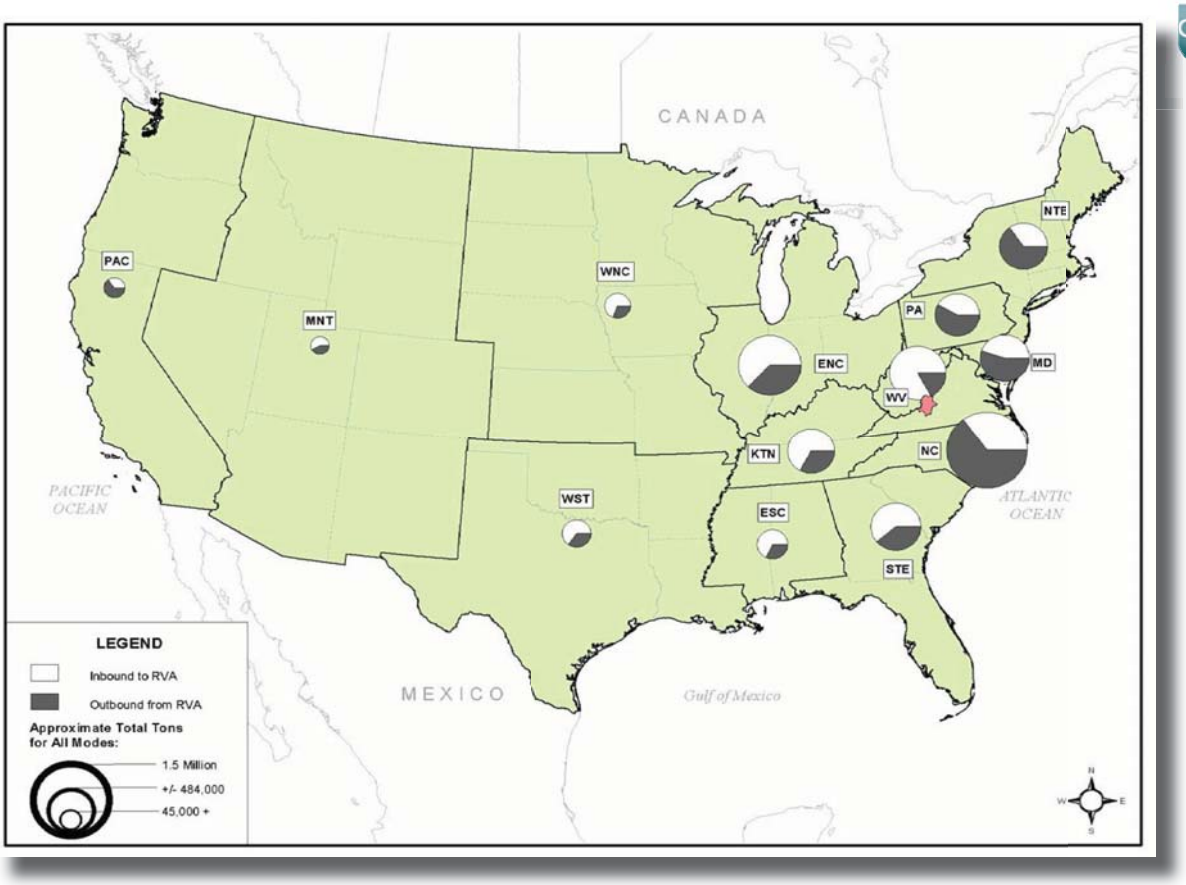
2002-03 Freight Study

The 2002-03 Regional Freight study was completed with the assistance of Wilbur Smith Associates, a Virginia engineering consulting firm. That study used 1998 Reebie Associate's Transearch Freight Data, which was the predecessor of the 2004 Global Transearch Freight Data. Below is a representation of total flows into and out of the region by value.



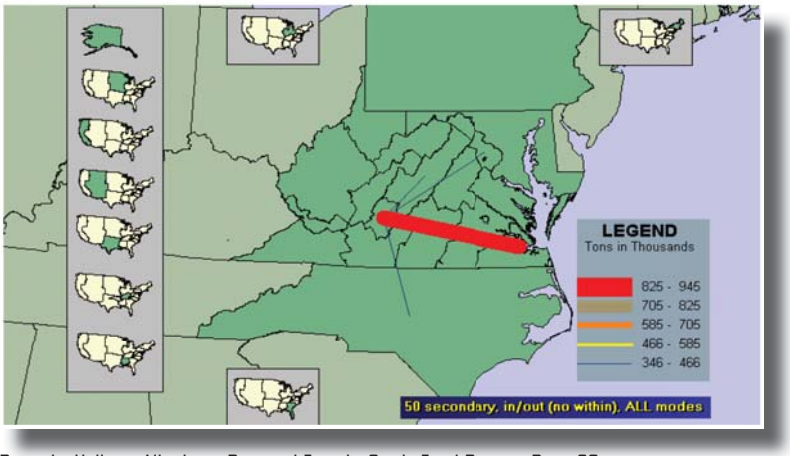
Roanoke Valley - Alleghany Regional Freight Study Technical Memorandum I: Commodity Flow Data, Page 21

The following is a similar representation of inbound and outbound freight flows (all modes) expressed in tons.



Roanoke Valley - Alleghany Regional Freight Study Technical Memorandum I: Commodity Flow Data, Page 28

These maps show relatively large inbound and outbound freight movements from the Roanoke region to and from the Port of Virginia terminals in the Hampton Roads area. The following depicts the flows of secondary traffic between the Roanoke Region and the Port of Virginia. Secondary traffic includes items that are staged, warehoused, or in general intermodal.



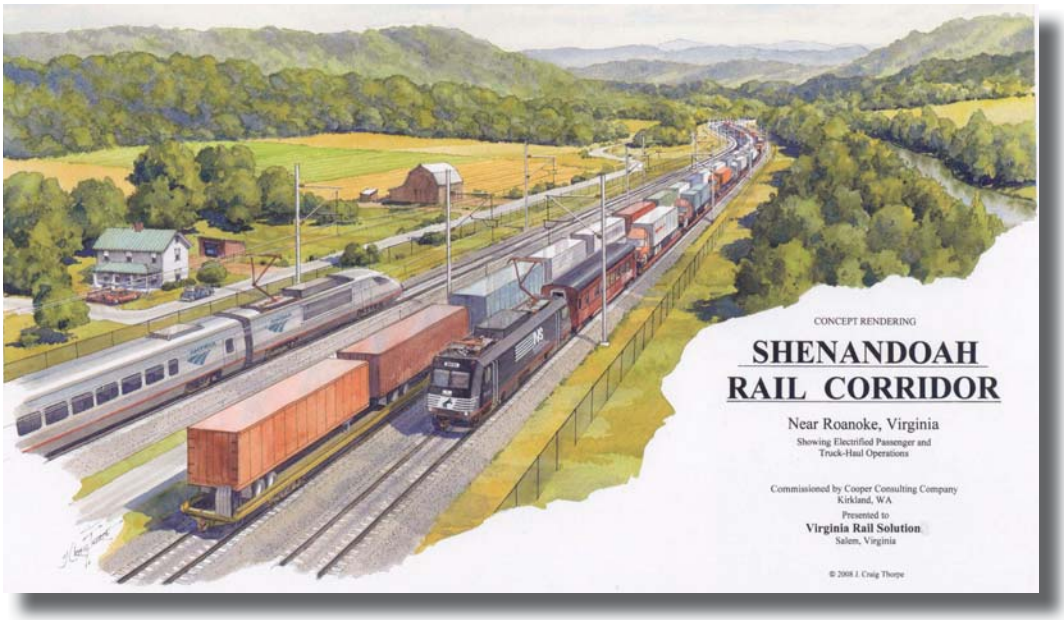
Roanoke Valley - Alleghany Regional Freight Study Final Report, Page 23

These East-West freight movements are the primary targets of the future Heartland Corridor Intermodal Center in Elliston, Virginia. The Heartland Corridor is designed to connect the Ports of Virginia to Chicago, Illinois through West Virginia and Ohio primarily using "double stacked" intermodal containers transferred to and from trucks at intermodal centers.

The Heartland Corridor may even address some East - West freight movements that are masquerading as North-South movements along Interstate 81. During stakeholder interviews for the 2002-03 Regional Freight Study Wilbur Smith Associates found the following:

> Virginia Route 460 – Overall, shippers who operated their own fleets and had frequent shipments to and from the Hampton Roads / Newport News area said that Route 460 was "not good" as it was seen as rough and slow. Most shippers send their drivers on the more circuitous route of I-81 north to I-64 to access the ports. Several shippers commented that improvements to Route 460, and construction of the proposed I-73 corridor, would take much of the congestion off I-81.[17]

There is citizen interest in diverting some of the interstate freight away from the I-81 corridor. RAIL Solution (www.railsolution.org), a grass roots citizens organization, advocates for a rail freight component to North-South freight movements. The rail would run parallel to the Interstate 81 corridor, which is often labeled a NAFTA corridor. An artist's conception of the RAIL Solution proposal is featured below (image used with permission).



Inclusion of the RAIL Solution concept and image does not imply RVAMPO endorsement of the technology advocated by RAIL Solution. RAIL Solution's roll-on-roll-off intermodal technology, conventional container double stack technology, or another intermodal freight technology may prove to be best for the rail lines in the Interstate 81 corridor.

7. Roanoke Valley - Alleghany Regional Freight Study - Technical Memorandum #2, Page 21.