

Truck Diversion from Interstate 81 to Rail

A report by the Roanoke Valley-Alleghany Regional Commission

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Abstract

The growth of Interstate 81 truck traffic has intensified interest in diverting freight to rail. Interstate 81 truck traffic increased by 10% from 3.4 million trucks in 2008 to 3.7 million in 2018 and may reach 7.1 million in 2035. Up to 37.7% of Interstate 81 truck traffic could be diverted to Norfolk Southern Railway's Shenandoah and Piedmont lines by targeting long-haul or short-haul trips, through-trips, and intermodal transfers. These diversions could generate 350,067 to 700,134 rail cars and could save almost \$25 million per year in pavement maintenance.

Introduction

This report, responding to a request in the 2020 Unified Planning Work Program, describes annual I-81 truck flow and the potential number of rail cars and savings to road maintenance resulting from diverting freight to rail. The report draws on data and estimates from the 2018 *I-81 Corridor Improvement Plan*¹, the 2010 *Feasibility Plan for Maximum Truck to Rail Diversion in Virginia's I-81 Corridor*², the 2015 *Western Virginia Intermodal Facility: Economic and Transportation Impacts Study*³, and other sources.

Several previous studies have explored the idea of diverting Interstate 81 truck traffic to rail over the past two decades. The 2010 *Feasibility Plan* identified strategies to “divert the maximum amount feasible of long-haul, through-truck freight traffic to intermodal rail in the Interstate Route 81 Corridor” as directed by the 2007 Appropriations Act. The 2018 *I-81 Corridor Improvement Plan* examined financing options for I-81, as directed by the Virginia General Assembly, and identified needs beyond the General Assembly's direction for the plan, including multimodal improvements. The Office of Intermodal Planning and Investment and the Department of Rail and Public Transportation are following up the 2018 *Interstate Corridor*

¹ *I-81 Corridor Improvement Plan*, adopted by the Virginia Commonwealth Transportation Board in 2018, examines financing options to improve I-81.

<https://drive.google.com/file/d/19wDQUVyJrAogLjNatCQXIfWcVVPmlbdq/view>

² *Feasibility Plan for Maximum Truck to Rail Diversion in Virginia's I-81 Corridor*

(<http://drpt.virginia.gov/media/1141/i-81-freight-rail-study-final.pdf>) included a summary of prior studies: *Desirability and Feasibility of Establishing Additional Intermodal Transfer Facilities* (2001), *The Potential for Shifting Virginia's Highway Traffic to Railroad* (2001), *The Northeast-Southeast-Midwest Corridor Marketing Study* (2003), and *The I-81 Corridor Improvement Study* (2007)

³ *Western Virginia Intermodal Facility: Economic and Transportation Impacts Study*, https://rvarc.org/wp-content/uploads/2015/09/Western-Virginia-Intermodal-Study-Final_RoanokeReport_LessAppendices-Final-Report-06-25-2015.pdf, studied the feasibility of a Western Virginia Intermodal Facility including the impacts the facility would have on I-81 truck traffic.

Improvement Plan with plans for specific multimodal improvements, including freight rail improvements.

Annual truck flow

According to Virginia Department of Transportation Annual Average Daily Traffic Estimates, in 2008, Interstate 81 carried

an average of 9,250 trucks per day in both directions, based on averages of individual segment counts, or 3.4 million trucks annually. Truck traffic increased by 10% in 2018, to 10,176 trucks per day and 3.7 million trucks annually. The 2010 *Feasibility Plan* predicts annual truck traffic to reach 7.1 million in 2035 (Figure 1). Although both the *Feasibility Plan* and the more recent *I-81 Corridor Improvement Plan* (2018) predict truck traffic to grow at a faster pace than passenger vehicle traffic, truck traffic grew more at a slower pace from 2008 to 2018 (10% increase) than all traffic (16%).

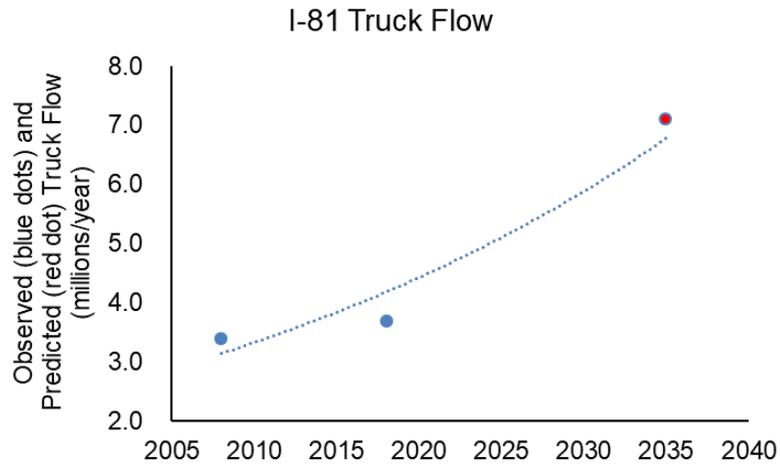


Figure 1. Observed (blue dots) and predicted (red dot) truck flow on Interstate 81

Potential number of rail cars

The number of rail cars depends on how many truck trips are diverted to rail. Whether a truck trip can be diverted to rail depends on its origin and destination which determine its route, the length of trip, and the commodity carried. Whether a truck trip that *can* be diverted *will* divert is determined by economic factors.

Potential to divert truck trips: Many I-81 truck routes have origins and destinations that are eligible to divert to rail. Norfolk Southern Railway operates the Crescent Corridor rail lines that parallel I-81 (Figure 2).

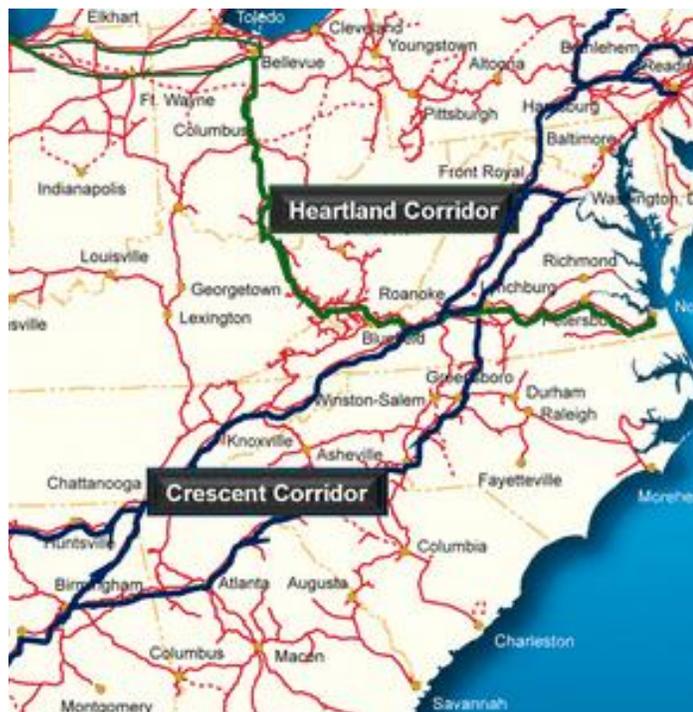


Figure 2. Rail Lines Paralleling I-81

The *Feasibility Plan* assessed the portion of trips that have routes that are compatible with diversion to rail based on origin and destination of trips. A 2007 survey of truckers at weigh-stations found that almost two-thirds of trucks on I-81 are passing through Virginia (62%), with both origin and destination in other states (Table 1). Another one-third (32%) begin or end their trip in Virginia, and 6% both begin and end the trip in Virginia.

Table 1. 24-Hour Origin-Destination Surveys at I-81 Weigh Stations (adapted from the 2010 Feasibility Plan)

	Troutville NB	Troutville SB	Stephens City NB	Stephens City SB	Bidirectional Average
Total Trucks Counted	7,779	6,970	8,667	7,960	15,688
Through	70%	59%	61%	58%	62%
Inbound/Outbound	25%	31%	35%	38%	32%
Internal	5%	10%	5%	4%	6%

With these survey responses, the *Feasibility Plan* determined that 88.7% of I-81 trucks have divertible routings. This number may be even higher today. At the time of the *Feasibility Plan*, northwest – southeast routes were not considered compatible, but with the Heartland Corridor which is now fully operational some of these trips would be compatible. Furthermore, trips entirely within Virginia were considered too short to be effectively served by rail, but in 2018, “shortlines” carried 14,187 rail carloads⁴.

If a route is compatible with diversion to rail, the commodity being transported may not be compatible. Commodities that can’t readily be diverted to rail include:

- Freight with special handling requirements, such as certain autos
- Sensitive freight that require flexibility, such as live animals
- Freight that needs to be moved in smaller quantities

About 85% of trucks on I-81 are carrying commodities that can be diverted.

While most truck trips have divertible routings and carry commodities that can be diverted, the primary influence on diversion is economic factors.

Economic influence on diversion: The *Feasibility Plan* identified five strategies to divert truck traffic to rail based on three characteristics of a truck trip that affect how it can be diverted to rail: distance, type of move, and type of intermodal technology (Table 2). The five strategies build on top of each other, so that Strategy #1 is implemented first, followed by Strategy #2, and so on.

A trip greater than 500 miles is long-haul and less than 500 miles is short-haul. The type of move refers to whether the trip begins and/or ends within Virginia or outside of Virginia. Intermodal transfer allows a trip to be made by both truck and rail. Conventional transfer lifts containers and dry van truck bodies onto and off railcars. Liquid bulk tankers, dry bulk hoppers, and flatbeds can be diverted to rail if “roll-on/roll-off” is available, with trucks driven onto and off

⁴ 2018 I-81 Corridor Improvement Plan

the railcar platforms. This can involve splitting the rail into several segments to allow multiple points of loading and unloading, which is called “open technology”.

Table 2. Strategies to Divert Trucks to Rail (adapted from the 2010 Feasibility Plan, Table ES.2)

Strategy	Distance	Type of move	Intermodal⁵
Strategy 1	>500 miles	Through Virginia	Intermodal
<i>Expand conventional intermodal rail terminals, network capacities, and services.</i>			
Strategy 2	>500 miles	Through Virginia	Non-intermodal
<i>Introduce multistate network of open technology terminals with conventional speed services.</i>			
Strategy 3	>500 miles	Origin/Destination in Virginia	Intermodal and Non-intermodal
<i>Develop and enhance Virginia intermodal and open technology terminals.</i>			
Strategy 4	<500 miles and >500 miles	Through Virginia or Origin/Destination in Virginia	Intermodal and Non-intermodal
<i>Introduce higher-speed open technology service in the Harrisburg-Knoxville Corridor.</i>			
Strategy 5	>500 miles	Through Virginia	Intermodal and Non-intermodal
<i>Introduce very high-speed open technology “truck intercept/truck shuttle” service through Virginia.</i>			

The cost of truck vs. rail is the major factor determining whether a truck that *can* divert to rail *will* divert. The *Feasibility Plan* found that internal market estimates, cost differential analysis, and corridor-level business strategy modeling all converged on a diversion rate of 13.5% to 37.7% of total trucks, depending on which strategies are employed (Table 3). Assuming rail cars have a capacity of two or four (double stack) containers per flat car, employing all five strategies could divert 2.6 million trucks to 1.3 million (two containers / flat car) or 0.67 million (four containers / flat car) flat cars annually.

Table 3. Equivalent rail cars of feasibly divertible trucks

Strategy	Share of Trucks Diverted	Annual Feasibly Divertible Trucks	Equivalent rail cars: two containers / flat car	Equivalent rail cars: four containers / flat car
1 only	13.5%	501,422	250,711	125,356
1+2	20.3%	753,991	376,995	188,498
1+2+3	22.8%	846,847	423,423	211,712
1+2+3+4	29.9%	1,110,558	555,279	277,639
1+2+3+4+5	37.7%	1,400,268	700,134	350,067

The Strategies and the Share of Trucks Diverted are from *Feasibility Plan*. The Share of Trucks Diverted was applied to the 2018 annual truck volume of 3,714,240 (VDOT estimate) to calculate Annual Feasibly Divertible Trucks.

⁵ Intermodal transfer allows a trip to be made by both truck and rail.

Savings to road maintenance

The potential savings in pavement maintenance is \$8.9 million per year if Strategy #1 is employed and \$24.9 million per year if Strategies #1-#5 are employed (Table 4).

Table 4. Potential Savings in Pavement Maintenance

		Strategy #1	Strategy #1- #5
1	Annual Trucks Diverted	501,422	1,400,268
2	I-81 Miles in Virginia	326	
3	Maximum Possible Diverted Miles (line 1 X line 2)	163,463,702	456,487,524
4	I-81 Rural Miles⁶	73%	
5	I-81 Urban Miles	27%	
6	Diverted Miles – Rural (line 3 X line 4)	120,096,973	335,381,918
7	Diverted Miles – Urban (line 3 X line 5)	43,366,729	121,105,606
8	Rural Pavement Maintenance Savings (\$/truck-mile)⁷	\$0.035091285	
9	Urban Pavement Maintenance Savings (\$/truck-mile)	\$0.108782983	
10	Annual Pavement Maintenance Savings – Rural (line 6 X line 8)	\$4,223,629	\$11,794,874
11	Annual Pavement Maintenance Savings – Urban (line 7 X line 9)	\$4,727,941	\$13,203,212
12	Pavement Maintenance Savings (Urban + Rural) (line 10 + line 11)	\$8,951,570	\$24,998,087

The estimated savings in pavement maintenance may be overestimated because of trip length assumptions and induced demand.

Trip length assumptions: The *Feasibility Plan* did not assess the length of potentially diverted trips beyond whether they were greater or less than 500 miles. For the pavement maintenance savings, every trip was assumed to be 326 miles (the length of I-81 in Virginia), even though some trips might be shorter.

Induced demand: Induced demand can throw off estimates of savings in pavement maintenance. Induced demand refers to trips taken or routed along a newly improved area which then becomes congested again. If truck trips are successfully diverted to rail, truck trips and non-truck trips could be attracted to I-81 that currently are deployed on other routes or not

⁶ The Department of Rail and Public Transportation (DRPT) categorizes 73% of I-81 as rural and 27% as urban in the 2016 *Rail Enhancement Fund Benefit-Cost Analysis Model*.

⁷ The 2016 *Rail Enhancement Fund Benefit-Cost Analysis Model* estimates savings in pavement maintenance per truck-mile traveled for rural highway (\$0.035 per truck-mile) and for urban highway (\$0.108 per truck-mile).

deployed at all. This additional traffic would offset the pavement maintenance savings of diverting trucks to rail.

A Western Virginia Intermodal Facility alone is estimated to save between \$1.29 million to \$5.67 million in pavement maintenance⁸. This savings is not specific to I-81. The proposed intermodal facility would reduce long-haul truck trips but increase short-haul truck trips. An intermodal facility is one element of the five strategies identified in the *Feasibility Plan*.

Conclusions

A limitation of this report is that estimates rely on data from surveys conducted in 2007 and other sources that have not been updated recently.

The growth in I-81 truck traffic by 10% from 2008 to 2018 has caused concerns about the current state of I-81 and its future. The *Feasibility Plan* identified five strategies to divert trucks from I-81 to the Shenandoah and Piedmont rail lines. These strategies, targeting long-haul or short-haul trips, through-trips, and intermodal transfers, could divert up to 37.7% of I-81 truck traffic to rail. These diversions could generate 350,067 to 700,134 rail cars and could save almost \$25 million per year in pavement maintenance. However, induced demand could offset the benefits to I-81 of diverting a substantial number of trucks to rail.

⁸ *Western Virginia Intermodal Facility: Economic and Transportation Impacts Study*