Appendix B
Regional Prototype SIS in the Valley Corridor

1. STEEL INTERSTATE DEMONSTRATION- the Valley Corridor

RAIL Solution has been discussing with various governmental entities and the Norfolk Southern Corporation a proposal to undertake a feasibility study and preliminary engineering analysis of a project for a prototype demonstration of the Steel Interstate concepts. This project would provide both freight and passenger service on the same system at speeds in the 60 to 115 mph range, the exact range depending on the type of traffic, whether general freight, intermodal freight, or passenger traffic. At this point, Norfolk Southern has not endorsed this project. The project, to be known as the Valley Corridor Route Steel Interstate Prototype, would upgrade the western half of the Norfolk Southern Corporation’s Crescent Corridor to meet the required standards to operate rail service according to the requirements of the National Rail Plan¹ and the outline of specifications of the Steel Interstate System which has been proposed by RAIL Solution.²

The Steel Interstate System addresses most of the elements of the vision of the 2010 National Rail Plan. The specific ways in which it addresses the Rail Plan vision for service to cities, towns, and regions follows:

- Regional Corridors: The SIS network, as conceived by RAIL Solution, connects all sizes of communities across America. The SIS serves both freight and passenger traffic on the same systems at speeds from 60 to 115 mph. Thus, both freight and passenger traffic will be served on a national network connecting all cities because of the fact that rail freight must connect most American towns and cities. The system will interconnect with the high speed passenger rail systems. However, these will be a separate system from the SIS.

- Emerging/Feeder Routes: The SIS network will utilize much of the existing rail system to connect smaller communities and more distant areas, thus providing access of these areas and communities to the larger network.

- Community Connections: The SIS will provide a lower cost option for higher speed passenger rail, for quicker and safer travel from outlying areas to major hubs for air traffic, and compete head-to-head with airlines and automobiles for intermediate distance passengers, traveling distances between cities up to 500 miles.

The SIS Prototype Demo will show the viability and economics of the total system by demonstrating these features in the selected rail corridor, a part of the Norfolk Southern Crescent Corridor.

1.1. Valley Corridor Route

¹ National Rail Plan, September 2010, U.S. Department of Transportation, Federal Railroad Administration. This is the shortest route of the two parallel rail lines of the Crescent Corridor that one can take between the Mid-South (Memphis and Birmingham and Harrisburg, PA.

² RAIL Solution is a non-profit organization that has developed the Steel Interstate System concept. ([www.steelinterstate.org](http://www.steelinterstate.org))
The route RAIL Solution has chosen for the demonstration of the Prototype of the SIS is a part of the existing Crescent Corridor of the Norfolk Southern Corporation, which covers the territory from the Southeast to the edge of the Northeastern Mega-region. That route is depicted in Figure 1. This is an underserved rail corridor despite the fact that it has some of the highest levels of heavy truck traffic in the United States. Much of this is due to the fact that much of the rail system was laid out in the 1800s and is single-track and winds through the center of villages, towns, and cities. There are 15 grade crossings in Morristown, TN, (pop. 29,000) and five in Abingdon, VA, (pop. 8200), for example.

Figure 1. Map of the Route for the Steel Interstate Prototype System

The Valley Corridor Prototype Demonstration route southern terminus is near Memphis, Tennessee at the Norfolk Southern Memphis Regional Intermodal Terminal in Rossville, in Fayette County, Tennessee. The route links consecutively south to North the following cities:

- Huntsville, Alabama
- Chattanooga, Tennessee - links to Birmingham, Shreveport, Dallas, Nuevo Laredo, Mexico and Atlanta
- Knoxville, Tennessee - links to Lexington, KY; Cincinnati, Louisville and Ashville, NC
- Bristol, TN-VA - links to Kingsport, TN and I-26 which links to Asheville, NC
- Roanoke, Virginia- link to Heartland Corridor which runs east and west through Roanoke to the port of Norfolk and to Richmond, VA (mid-way between Bristol and Roanoke, I-77 at Wytheville, VA, links to Charlotte, Winston-Salem, Greensboro, Durham, and Raleigh to the southeast and Charleston, WV, to the north.
- Front Royal, VA- link to Manassas, VA with service to Washington, Baltimore
- Hagerstown, MD- rail and highway links to multiple directions from intermodal terminal at Greencastle, PA, serving New York City, New Jersey, Albany, and New England and Montreal, Canada, Philadelphia, Wilmington, and Trenton.
- Harrisburg, PA- similar links to Greencastle, PA, facility
The extended map showing the principal extension of the Valley Corridor is shown in Figure 2.

Figure 2. Valley Corridor Prototype Route with Rail Extensions

The rail corridor, which we call the Valley Corridor, would attract truck freight from one of the highest density truck corridors in America. The Valley Corridor can be expanded on both ends and in other locations to transform the entire region to a truly multimodal corridor. The Valley Corridor parallels I-40, I-81, and a short section of I-75 in Tennessee, and is strategically located to collect from and discharge to these highway routes: I-30, I-24, I-55, I-56, I-75, I-65, I-26, I-77, I-64, I-66, I-76, and I-80. The Valley corridor would serve major freight airports, including Memphis, Huntsville, and Dulles (via corridor extension). It would service major ports by extensions: at New York and New Jersey, Norfolk, Mobile, New Orleans, Houston, and Galveston.

The chosen route, superimposed on the interstate highway routes, is shown in Figure 3. Figure 4 shows the region overlay that includes all of geographic region served by the proposed Valley Corridor.

The rail lines will be upgraded to at least two tracks providing bi-directional train traffic, elimination of grade crossing, frequent crossovers from highways and other modes to accommodate general freight, intermodal rail, and passenger traffic at highway-competitive speeds, and positive train control to ensure safe operation. Intermodal freight terminals are being built and planned for the route, and additional loading locations will be provided for loading of trucks onto trains at closer intervals.

The operating speed design criteria will be as follows:
- Freight train speed range: 60 to 75 MPH, with target average point-to-point speed of 60 MPH
- Intermodal train speed range: 70 to 90 MPH, with target average point-to-point speed of 70 MPH
• Passenger train speed range: 79-110 MPH, with target average point-to-point speed of 90 MPH

The target average point-to-point speed includes the time for stops, changing tracks, and other operational slow-downs that decrease the overall system average speed.

Features that make the route attractive for demonstration include: its service to a region that is underserved by intermodal freight, parallel interstate highways that are crowded with truck freight, a large volume of potential truck freight that can be attracted to intermodal rail, 1000 mile length, and intersection with other feeder lines, hubs, and highways. This provides an excellent prototype demonstration route where attractiveness to both long range and mid-range trucks can be tested.

The route chosen offers the potential for passenger service both within the demonstration route and through connections from the demonstration route to large cities and hubs at reasonably short distances.

Figure 3. Valley Prototype Demonstration Route and Interstate Highway routes³.

³ Map taken from Presentation, Roger Bennett, Director or Industrial Development, Norfolk Southern Corporation, Norfolk Southern – Intermodal Future to Transportation Research Forum, Washington, DC Chapter, October 20, 2010.
Figure 4. Overlay of region of the Valley Demonstration Route

1.1.1. Features of the Valley Corridor Demonstration Route

The following are the key features of the route.

- **Density of Freight Traffic in corridor.** I-40, I-75, and I-81 all three exhibit very high volumes of truck traffic, much of which would be targeted for diversion to the SIS Prototype. Tables 1 and 2 contain estimated volumes of truck traffic existing on the SIS Prototype Demo route. Table 5 is based on Tennessee DOT projections of growth rate in Tennessee, and Table 6 is based on Virginia growth rates applied to both states. These estimates are derived from the studies of the Virginia DOT and the Tennessee DOT and are considered conservative because they are based on assumptions of stable diesel fuel price and rail service concepts that are not designed to attract the a higher proportion of the truck freight market.

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5 TDOT Final Freight Analysis, Cambridge Systematics for Tennessee Department of Transportation- June 2010
### Table 1. Estimate of Diversion of Trucks in Memphis-Knox and I-81 Corridors-TN Growth Rate for Future in Tennessee

<table>
<thead>
<tr>
<th></th>
<th>Annual Trucks</th>
<th>Low Speed (35 mph)</th>
<th>Higher Speed (60-70 Mph)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td>2008</td>
<td>2035</td>
</tr>
<tr>
<td>Memphis-Knoxville</td>
<td>Total Thru</td>
<td>1,042,000</td>
<td>1,633,000</td>
</tr>
<tr>
<td>Route</td>
<td>% Diverted</td>
<td>39</td>
<td>39</td>
</tr>
<tr>
<td>Diverted</td>
<td></td>
<td>406,000</td>
<td>636,000</td>
</tr>
<tr>
<td></td>
<td>Total Thru+</td>
<td>1,762,000</td>
<td>3,713,000</td>
</tr>
<tr>
<td>Virginia I-81</td>
<td>% Diverted</td>
<td>39</td>
<td>39</td>
</tr>
<tr>
<td>Corridor</td>
<td>Diverted</td>
<td>687,000</td>
<td>1,448,000</td>
</tr>
</tbody>
</table>

### Table 2. Estimate of Diversion of Trucks in Memphis-Knox and I-81 Corridors- Using VA Growth Rate for Future in Tennessee

<table>
<thead>
<tr>
<th></th>
<th>Annual Trucks</th>
<th>Low Speed (35 mph)</th>
<th>Higher Speed (60-70 Mph)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2008</td>
<td>2035</td>
</tr>
<tr>
<td>Memphis-Knoxville</td>
<td>Total Thru</td>
<td>1,042,000</td>
<td>2,196,000</td>
</tr>
<tr>
<td>Route</td>
<td>% Diverted</td>
<td>39</td>
<td>39</td>
</tr>
<tr>
<td>Diverted</td>
<td></td>
<td>406,000</td>
<td>856,000</td>
</tr>
<tr>
<td></td>
<td>Total Thru+</td>
<td>1,762,000</td>
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<td>Virginia I-81</td>
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<td>39</td>
</tr>
<tr>
<td>Corridor</td>
<td>Diverted</td>
<td>687,000</td>
<td>1,448,000</td>
</tr>
</tbody>
</table>

- Truck Diversion Potential Estimates by Norfolk Southern

Truck diversion potential has been estimated by Norfolk Southern, conclusions of which are shown in Figure 5. The diversion potential estimates are considerably higher than those of the state Departments of Transportation. In particular, the city pairs of the graph that are relevant to the Prototype Demonstration are Memphis-Northeast and the Birmingham-Northeast, both of which show high diversion potential.

Much of the truck traffic (possibly as much as 80 percent\(^6\)) on the interstate highway paralleling the Demonstration route is long haul or medium haul (400 to 500 miles). Medium and long haul would be targeted by the Valley Corridor Prototype.

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\(^6\) I-81 Multimodal Corridor, Virginia Statewide Multimodal Freight Study, Final Report, 2010, Part III, Cambridge Systematics, Pg 27. Page 27 states that "Over 77 percent of the total freight tonnage moving within the Corridor is through traffic." That includes truck and rail traffic.
Other truck traffic and truck diversion studies of interest

There are, of course, many studies over the past 10 years of various parts of the I-40, I-75, and I-81 corridor. One of the more interesting ones supports the fact that much of the heavy truck traffic in this corridor is long distance. This is illustrated by Figures 6 and 7, which are based on data for truck traffic from Chattanooga to the Virginia border. This would be over I-75 to Knoxville, I-40 to I-81 west of Knoxville, and I-81 to the Virginia border. Data show that over 90 percent of the trips from Chattanooga to the Virginia state line are over 1000 miles, and there are an average of 4500 daily trips to and from the Virginia line.

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7 From Presentation, Roger Bennett, Norfolk Southern Corporation, Norfolk Southern – Intermodal Future to Transportation Research Forum, Washington, DC Chapter, October 20, 2010.
8 Reference: TDOT I-75 Corridor Study- Task 3 Multi-modal Considerations (2010)
Over 90% of I-75 Trips from Chattanooga to VA State line are over 1000 miles.

Figure 6. Percent of Chattanooga-Virginia trucks that are long distance.

Reference: TDOT I-75 Corridor Study- Task 3 Multimodal Considerations (2010)
I-75 truck traffic on the order of 4500 daily on Chat. to VA border route

Figure 7. Number of trucks daily between Chattanooga and Virginia

So how much traffic can be diverted? The Tennessee studies reference this lookup table, given in Figure 8\(^9\). A convention is used to express how much truck traffic would be diverted. This convention is in fair agreement with part of Figure 5, the data of Norfolk Southern, but is not in agreement with parts of Figure 5 where intermodal rail is more competitive. The lookup table would not seem to have much validity for a parallel rail system built for serious intermodal competition with truck freight. Therefore, its use to determine policy about whether to invest in intermodal rail and not in more highways is suspect.

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\(^9\) Reference: TDOT I-75 Corridor Study- Task 3 Multi-modal Considerations (2010)
The I-75 TDOT study used a lookup table to define freight that can be diverted.

### Table 4-4: Distance-Based Freight Diversion Lookup Table

<table>
<thead>
<tr>
<th>Distance between Origin and Destination</th>
<th>% of Freight that could be Diverted</th>
</tr>
</thead>
<tbody>
<tr>
<td>500-750 miles</td>
<td>10</td>
</tr>
<tr>
<td>750-1000 miles</td>
<td>15</td>
</tr>
<tr>
<td>1000-1250 miles</td>
<td>20</td>
</tr>
<tr>
<td>1250+ miles</td>
<td>25</td>
</tr>
</tbody>
</table>

Reference: TDOT I-75 Corridor Study- Task 3 Multi-modal Considerations (2010)

**Figure 8. Lookup table for truck diversion percentages.**

- **Potential for Supporting Passenger Service**

First, it should be noted that the Valley Corridor is not served by rail passenger service except for east-west crossings, and then only in Virginia, West Virginia, and Pennsylvania. There is no service south of Staunton, Virginia until Birmingham or the Chicago-New Orleans train intersecting at Memphis.

The Valley Prototype Demonstration has the potential to support SIS speed passenger traffic service to these cities within the Prototype Demonstration route:

- **Memphis - Chattanooga:**
  - Cities in Tennessee: Memphis, Germantown, Collierville, and Chattanooga.
  - City in Mississippi: Corinth.
  - Cities in Alabama: Sheffield (Florence, Muscle Shoals), Decatur, Huntsville, and Scottsboro.

- **Chattanooga - Harrisburg:**
  - Cities in Tennessee: Chattanooga, Cleveland, Athens, Sweetwater, Loudon, Lenoir City, Farragut, Knoxville, Jefferson City, Morristown, Greeneville, Johnson City (Kingsport), Bristol.
  - Cities in Virginia: Bristol, Abingdon, Marion, Wytheville, Radford, Christiansburg (Blacksburg), Roanoke, Buena Vista (Lexington), Waynesboro (Staunton), Elkton (Harrisonburg), Luray, and Berryville (Winchester).
  - City in West Virginia: Charles Town
  - City in Maryland: Hagerstown
  - Cities in Pennsylvania: Shippensburg, Chambersburg, and Harrisburg.

The potential for connection to the following highly desired destinations will exist:
• Chattanooga to Atlanta addition, making feasible Bristol and Knoxville to Atlanta service, and Memphis and Huntsville to Atlanta Service.
• Chattanooga to Birmingham addition, making feasible Bristol and Knoxville to Birmingham service.
• Connection to Virginia Rail service, making feasible service from Bristol and Roanoke to Lynchburg, Northern Virginia, and Washington.
• Connection to Amtrak service at Staunton, VA, east to Charlottesville, Washington and the NE, and west to West Virginia, Ohio, and Chicago.
• Connection to Amtrak at Martinsburg, WV east to Washington DC and the NE and west to Pittsburgh, Cleveland, Canada, and Chicago
• Connection to Amtrak at Harrisburg, PA east to Philadelphia, New York, New England, and Canada, and west to Pittsburgh, Cleveland, and Chicago

The experience with Virginia Rail indicates that there is demand for rail passenger service extension in Virginia. The three-year-old daily Northeast Corridor service between Lynchburg, VA, and Boston has exceeded by double anticipated ridership from Virginia stations. This new route is the second best financially performing Amtrak-state partnership route in the nation. In Tennessee, the demand for the service has not been studied extensively. However, it is noted that there is a proposal for very high speed rail from Chattanooga to Atlanta. Steel Interstate passenger rail would probably be adequate to assure high ridership in that market. The distance is approximately 125 miles. At an average of 90 mph, which would be achieved by SIS rail, the full trip would take about 1 hour-25 minutes. From Knoxville to Atlanta, at a distance of 220 miles would take 2 hours-30 minutes. (The flying time from Knoxville to Atlanta is 1 hour, and the cost ranges from $300 to $500, with extra travel time required between airports and downtowns.)

1.2. Correlation of Valley Corridor Prototype Route to national service requirements

The vision for the National Rail Plan will be met by the Valley Corridor Prototype Demonstration of the SIS over the chosen Memphis to Harrisburg route.

• **Meets Regional Corridors requirements.** The Prototype meets the criteria for regional corridors as required by the national plan. The Prototype connects mid-sized urban areas, as illustrated by the cities Memphis, Huntsville, Chattanooga, Knoxville, Bristol (Tri-Cities, TN/VA), Roanoke, and Harrisburg. Many smaller communities are served, including such towns and cities as Chambersburg, PA; Hagerstown, MD; Front Royal, VA; Luray, VA; Waynesboro, VA; Staunton, VA; Christiansburg-Blacksburg, VA; Wytheville, VA; Abingdon, VA; Morristown, TN; Sheffield, AL; Florence, AL; and Corinth, MS. This will be done with convenient, frequent 60-115 mph service on a mix of dedicated and shared track. Provisions exist for connection to core Express corridors at Memphis, Harrisburg, and any Chattanooga-Atlanta service.

• **Meets Emerging System requirements.** The Prototype connects to regional urban areas (Memphis and Harrisburg) and the mega regions of the Southeast and the Northeast at speeds up to in the range of 60-115 mph on shared track.

• **Meets Requirements for future community connection.** The Prototype is within the corridors required for connection to major hubs and regions thus meeting the requirement for provision for future community connections.
• **Meets Speed, Reliability, and Safety requirements.** Design and operational standards for the SIS Prototype demo will meet all requirements for fast rail. The SIS will provide greatly improved performance in these areas.

• **Meets requirements for fuel economy, less environmental impact, and less overall cost.** The use of electrified system will demonstrate lower costs, less environmental impact, and less use of petroleum products. Further, the overall cost of capital and operations cost will be less than competing solutions using conventional highway construction for increased freight capacity, petroleum based fuels, and less economical service for personal travel on air and private automobiles.

1.3. **Condition of Alignment and Operating Systems**

Although the current alignment of the Prototype Demonstration route is continuous, it is now mostly single track. It has a capacity of approx 18 trains per day, which can be stretched to 30 per day with automatic train control and with correction of track alignments. The system accommodates speeds typically between 25 and 60 mph. In addition, it has a very high number of grade crossings and even some crossings of mainline tracks of other rail systems. In some areas, the alignments have small radius curves that will need to be removed. Other problems are high local grades that will need to be reduced. One of the main problems is the location of tracks that go through cities and towns. Many of these segments will need to be relocated, or railway berms or channels will be required for noise abatement and/or elimination of grade crossings. In addition, some rights-of-way may not be wide enough.

1.4. **Design basis for the Valley Corridor Prototype Demonstration**

The design basis for the SIS Prototype Demonstration will be based on the following criteria:

• **Multiple through tracks.** Main lines would have at least two through tracks, so that trains can be handled in both directions without having to stop and meet oncoming trains.

• **Electric motive power.** Electric motive power means that the SIS network will be powered by electricity, provided to electric locomotives from a system of overhead wires called catenaries.

• **Grade separated alignment of tracks.** Grade-separated means that rail lines of the SIS Prototype will not cross roads and highways at grade, but will pass over or under using bridges or underpasses.

• **SIS Prototype will be precursor to core network.** Core network means that the SIS prototype will be part of the future national backbone of SIS-caliber railroad main lines.

• **Speed criteria will be to meet the 60-115 mph range for the total prototype demonstration system speed range.** The operating speed design criteria will be as follows:
  o Freight train speed range: 60 to 75 MPH, with target average point-to-point speeds 60 MPH
  o Intermodal train speed range: 70 to 90 MPH, with target average point-to-point speeds 70 MPH
  o Passenger train speed range: 79- 115 MPH, with target average point-to-point speeds 90 MPH
The speed will be 60 mph for some parts of the system where a general freight train is operating. The maximum will be 115 mph, and that will be when a passenger train is operating at top speed on the system.

1.5. **Issues to be addressed by the Valley SIS Prototype Demonstration**

The Valley SIS Prototype would demonstrate the following relative to the ability of the Steel Interstate to meet a high standard of performance goals.

- Application of the Steel Interstate concept to a system that is underserved by intermodal freight and passenger service.
- A fast rail system operating in 60 to 110 mph range, with a target average or point-to-point speed of 90 mph for passenger, 70 mph for intermodal, and 60 mph for general freight.
- Operational control of a system with a combination of traffic, including general freight, intermodal, and passenger traffic, operating at different speed ranges.
- Diversion of a high percentage of truck freight traffic to fast speed rail.
- Successful operation of freight rail service and passenger rail service on the same system.
- Reduction of environmental impact of freight transportation systems.
- Reduction of requirements for expanded interstate highway lanes and systems to accommodate trucks.
- Improved public safety.
- Reduction in energy required for transport of freight.
- Removal of impediments to investment in fast rail.
- Determination of economic viability for fast freight rail.
- Acceptance of higher speed rail as a highly desired solution to transportation of freight and passengers by rail.

1.6. **Budgetary Estimate for the Valley Steel Interstate Prototype**

RAIL Solution has prepared an estimate of the order of magnitude of the cost of the Valley Steel Interstate Prototype System - approximately 1000 miles of multi-tracked, grade-separated, fast speed rail (top speed 115 mph). The estimate, shown in Table 7, is based on factors and costs compiled from various literature sources. The total cost is $13.375 billion.

<table>
<thead>
<tr>
<th>Description</th>
<th>$ Billions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rail Trackage</td>
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<tr>
<td>Added Railroad Right of Way</td>
<td>0.750</td>
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<tr>
<td>Buildings and Stations</td>
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<tr>
<td>Grade Crossing Elimination</td>
<td>0.875</td>
</tr>
<tr>
<td>Electrification (Optional)</td>
<td>2.875</td>
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<tr>
<td>Engineering and Project Management</td>
<td>1.75</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$13.375</strong></td>
</tr>
</tbody>
</table>

1.7. **Financing the Valley Steel Interstate Prototype System**
Financing of the Valley Steel Interstate Prototype System would need to follow the principles outlined previously in the discussion of financing the National Steel Interstate System. Financing would need to come from one or more of these sources: government guaranteed loans to Norfolk Southern, private capital, private capital from tax credits, private capital from repatriation of profits held overseas.

The distribution of costs to various entities is given in Table 8.

<table>
<thead>
<tr>
<th>Table 8. Allocation of Cost to Partnership Entities</th>
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<tbody>
<tr>
<td>(Government Guaranteed Financing)</td>
</tr>
<tr>
<td>Percent</td>
</tr>
<tr>
<td>Grants from Federal Government</td>
</tr>
<tr>
<td>Loans Guaranteed by Federal Government</td>
</tr>
<tr>
<td>State Governments (90% Federal, 10% State)</td>
</tr>
<tr>
<td>Local Governments (80% Federal, 20% State-Local)</td>
</tr>
<tr>
<td>Railroad Company Resources</td>
</tr>
<tr>
<td>Private Capital (bonds)</td>
</tr>
<tr>
<td>Private Capital - direct invest</td>
</tr>
</tbody>
</table>

**Total for Steel Interstate System** $13,375

Private corporations (Norfolk Southern) would pay for 88 percent of the cost, and 12 percent of the costs would be borne by governments, primarily the Federal Government. The origin of funds for local government participation (for station and terminal infrastructure) would depend on the financial sharing of each respective state. Most of the funds, however, would be funds allocated from Federal government resources.

In another document\(^1^0\), we discuss the possibility of funding the national Steel Interstate System from various new revenue obtained from tax credits, import tariff, and/or investment of profits held in offshore accounts. If one or more of the methods of raising additional revenue is implemented, the need for government guaranteed loans will be less or non-existent.

### 1.7.1. Ability to finance the Valley Corridor Steel Interstate Prototype from current revenue of the Norfolk Southern

The question does arise, as follows: shouldn’t Norfolk Southern pay for the Valley Corridor Steel Interstate Prototype System from current revenue, and the answer is "No, Norfolk Southern cannot afford such an expense." Why? The current planned capital expenditure of the Norfolk Southern for 2013 was approximately $2 Billion\(^{11}\). Of this, approximately $600 million is for infrastructure improvement. But, the system has 20,000 route miles in 22 states\(^1^2\). The Valley Corridor represents just 5 percent of the system. Assuming that the construction of the Valley Corridor Steel Interstate project is 10 years in length and that the project would have higher

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\(^{10}\) Section 4.2.2, Government corporate tax incentive program for the Steel Interstate System, Appendix B, Steel Interstate Concept for 21st Century Railroad System in the United States, Rail Solution, March 2014


priority in the NS system, there might be available from NS resources 20 percent of the available infrastructure budget, a demonstrably high figure for NS that would total $120 million per year or $1.2 billion total. That represents the railroad company resources in the financing Table 8, an amount of $1.043 Billion in the table. Thus, other sources must be provided.

Norfolk Southern capital spending is planned for $2.2 Billion in 2014, a 10 percent boost over 2013.\(^{13}\)

1.7.2. Ability of the Valley Corridor Steel Interstate Prototype System to repay debt.

Will the Valley Steel Interstate Prototype System be able to pay the amount of debt incurred and give a rate of return on investment to justify the capital outlay? While we do not have access to the internal costs and analyses of Norfolk Southern, we have analyzed this issue from the standpoint of incremental differences in cost saving and increased traffic.

The basic parameters for the Valley Corridor Prototype of interest are: 1) amount of traffic increase due to the investment, 2) fuel savings from conversion to electric motive power, and 3) effect of implementing passenger traffic on the route.

- Traffic Increase

For the Valley Prototype, the primary traffic increase would be from intermodal service by diversion of a larger percentage of trucks from the parallel and feeder interstates. We used the data of Tennessee and Virginia for truck volume, and interpolated the data to project truck volume from 2023 to 2035, with 60% diversion of medium (500 miles) and long (1000 miles or more) distance trucks. The year 2023 would be the first year of full operation of the Valley Corridor Prototype System.

The ability to pay back indebtedness is based on the incremental increases on the route using the recent historical operating cost and earnings data of the Norfolk Southern.\(^{14}\) Revenue for passenger service was based on the Lynchburg Northeast Corridor train implementation experience.\(^{15}\)

The number of trains is based on conversion of trucks diverted to trains, using about one-half the maximum capability of intermodal trains, but equivalent to the size of average freight hauling trains on the Norfolk Southern. The number of trains assumed is given in Table 9. The estimate of trucks is based upon the average of Tennessee and Virginia through-trucks, and assumes that 50 percent of such trucks are diverted. RAIL Solution believes that higher speeds should divert a higher percentage. Also, the open intermodal system should attractive more trucks, especially opening the system for owner-operated trucks, trucks traveling medium distances, crane-lift incompatible trailers and tankers, not dry vans, and not destined for super-sized terminals at the ends of corridors.

\(^{15}\) http://www.newsadvance.com/news/local/article_755493f6-8272-11e2-bd8a-001a4bcf6878.html
Table 9. Number of trains assumed for the Valley Steel Interstate Prototype System

<table>
<thead>
<tr>
<th></th>
<th>Start</th>
<th>Intermediate</th>
<th>Max</th>
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<tbody>
<tr>
<td>Freight</td>
<td>14</td>
<td>16</td>
<td>18</td>
</tr>
<tr>
<td>Intermodal</td>
<td>28</td>
<td>44</td>
<td>62</td>
</tr>
<tr>
<td>Passenger</td>
<td>8</td>
<td>14</td>
<td>20</td>
</tr>
</tbody>
</table>

Estimate of Trucks per day diverted to rail: 3920, 6300, 8680

The operating expense ratio for Norfolk Southern of 75.4 percent in 2009 was used as the basis for the availability of funds to pay off loans. Thus, 24.6 percent of the operating revenues were assumed to be available to pay off the loans guaranteed by the government. The revenue for passenger rail was based on the margin of revenue above costs for the Lynchburg train experience. The experience was extrapolated on a per mile basis to the length and number of miles of the Valley Corridor Steel Interstate Prototype. Actually, more funds than this estimate may be available as Norfolk Southern has undoubtedly built in a margin above operating expenses for the Lynchburg train.

Concerning cash flow, the margin above operating expense for the first 10 years progresses from $350 million the first year to $750 million in the 10th year. In addition, when electric systems are substituted for diesel, the fuel savings on the system progresses from $115 million the first year to $250 million in the 10th year, because of the relative efficiency of the electric motive power systems over diesel (2.75 Btu Diesel output=1 Btu output for electric system). Thus, in the first year, as much as $465 million is available to pay off indebtedness, and in the 10th year, $1 billion. The break even point on paying off indebtedness (where cumulative margin exceeds cumulative payments on debt) is 8 years for the non-electrified Valley Steel Interstate Prototype and just 2 years for the electrified system.

The overall profitability of the investment for Norfolk Southern is quite large. Using the $1 billion actual out-of-corporate treasury investment of the NS initially, the present value of that investment, after 10 years, is projected as $2.5 billion. So, the figures, as rough as they are, indicate that the Valley Corridor Steel Interstate would certainly pay for itself and could start operating with a margin above operating expenses very quickly.

1.8. **Regional Benefits of the Valley Corridor Steel Interstate Prototype**

The benefits parallel the benefits discussed for the National Steel Interstate System under Section 3. We want to discuss here some of the particulars of these benefits to the Valley Corridor Steel Interstate Prototype region.

The Valley Corridor Steel Interstate Prototype will directly serve about 15 percent of the population of the United States. Here are the components of the direct service:

Appalachian Regional population: 25 Million in 2010

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Service directly outside of the ARC region: a part of state populations with a total population of about 130 Million, about 40 percent of the population of the U.S. It is estimated that the Valley Corridor Steel Interstate Prototype will serve a total of about 40 million people (those within the 150 mile distance of the system) directly, which is about 13 percent of the U.S. population. It will be carrying freight between large regions of population, including Texas and Mexico on one end and New York, New Jersey, and New England states on the other end.

See the extended map (Figure 9) of the Crescent Corridor by Norfolk Southern\textsuperscript{17}.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{crescent_corridor_map.jpg}
\caption{Extended Map of the Crescent Corridor showing extensions to Texas and Mexico.}
\end{figure}

Another map (Figure 10) of the Norfolk Southern shows the extension of the Crescent Corridor to New Jersey and south to New Orleans.

\textsuperscript{17} \url{http://www.nscorp.com/nscintermodal/Intermodal/}
1.8.1. Cost of Transportation

The cost of transportation should hold at lower values than would be the case for transportation that continues almost exclusively to depend upon the provision of expanded and new highways. Lower cost should be experienced because more genuinely competitive modes will operate in parallel, and alternative transportation, such as passenger rail will be increasingly available. A train ticket will cost less than travel by car and/or plane up to medium distances.

1.8.2. Economic Impact of the Valley Corridor Steel Interstate Prototype

The effect on business development in the region would be significant. Of course, there is the direct benefit of construction and building activity throughout the Valley Corridor that would occur if the prototype is implemented. One of the reasons for increase of business and regional development will be the access to distant markets provided by more closely spaced terminals along the corridor.

Figure 11 presents a layout of the proposed terminals for the Valley Corridor.
More access to rail is needed in the region.

![Map of the Valley Corridor Steel Interstate Prototype](image)

**Figure 11. Plan for open intermodal terminals of the Valley Corridor Steel Interstate Prototype.**

This proposal for closer spaced terminals along the Valley Corridor facilitates greater utilization of SIS services by the various cities throughout the region. Employing open intermodal services at these terminals greatly broadens potential customer base to include non-crane lift compatible classes of trucks and small operators who cannot afford to lose control of their loads and instead use their rest time to keep moving along with their trucks on the rails.

At the present time, the only terminals are at Memphis (and at Huntsville and Birmingham) and Greencastle in Pennsylvania. Front Royal in Virginia is on the Piedmont leg of the Crescent Corridor, not the Valley Corridor.

The economic impact can be seen from Figure 12 showing the geographical reach where the potential for economic activity could be generated by proximity to services offered by this state-of-the-art intermodal corridor.
The Valley Route should serve Appalachia.

Intermodal Terminals
Memphis
Huntsville
Knoxville-North*
Roanoke-South*
Greencastle
Harrisburg
* Planned

Note: Smaller more frequent intermodal systems are proposed by Rail Solution.

Appalachian Regional Commission is a potential partner.

Figure 12. Geographic coverage of the Valley Corridor Steel Interstate Prototype

This figure only lists the presently planned terminals. It does not show additional terminals proposed in the previous figure. The service band of 150 miles (3 hours travel time) on either side of the Valley route shows a large geographic footprint covering most of the Appalachian Regional Commission region, which is underdeveloped economically. The Steel Interstate will attract manufacturing and logistics industry, just as the very large mega-terminals have attracted such industry in such cities as Memphis, Atlanta, and Harrisburg. RAIL Solution has been in negotiations with transportation staff at the Appalachian Regional Commission (ARC). We anticipate that the ARC would want to be a player in helping to implement such innovative transportation services in a region characterized by being by-passed when innovative transportation technology is being implemented.

Also, the passenger service would bring this option to a region that has no North-South passenger service and East-West service only in its northern communities. The region has been almost completely neglected in planning of passenger trains for America. The services this would bring are detailed previously.

1.8.3. Social Benefits

- Health and Safety
The health and safety benefits parallel those of the national system, but these benefits are even more imperative for the region to be served by the Valley Steel Interstate Prototype. Knoxville, for example, is ranked in the top 20 for atmospheric pollution, frequently trapped in valleys by surrounding ridgelines. Much of the smog-generating nitrous oxides come from growth in vehicular traffic, and particulate from more diesel-powered trucks. Growing vehicular movement, as shown in Figure 13, accounts for most of the growth in the state’s carbon dioxide emissions.

Sector Contributions to Gross Emissions Growth in Tennessee

![Graph showing sector contributions to gross emissions growth in Tennessee](image)

**Figure 13. Growth in carbon emissions across Tennessee industrial sectors, Tennessee Department of Transportation I-40/I-81 Corridor Study.**

While the preponderance of airborne pollution in Tennessee is emitted from coal-fired power plants, those sources are declining rather than growing.¹⁸ There will be fewer deaths from respiratory diseases in Tennessee and across the region if the Valley Corridor Steel Interstate reduces growth in interstate truck miles traveled. Also the Steel Interstate will reduce accidents and fatalities by elimination of grade crossing and reduction in number of trucks on the highways.¹⁹

- **Environment**

If the system is electrified, the reduction of oil use will amount to 20 Million barrels per year averaged over the first ten years. There will be a proportional decrease in greenhouse gases, simply by diverting hundreds of thousands of trucks to rail – even when the locomotive operates on diesel power. Converting locomotives to electric power will further reduce emissions, even employing the mix of fossil fuels generating power today. If the additional electricity required to run the Valley Corridor is generated by renewable or nuclear power sources, greenhouse gas emissions will drop even more dramatically.

There will be less road building, and the footprint of widening the rail lines because of additional tracks will not have the impact of roads. Runoff of polluted water into streams and the threat of toxic spills would be reduced because rail transportation of hazardous chemicals is considerably safer than truck. Railroads and trucks carry roughly equal hazmat ton-mileage, but trucks have 16 times more hazmat releases than railroads. Statistically, railroads are the safer form of transportation for hazardous materials.  

- **Transportation choices**

If the terminals are distributed and there is an open intermodal system, businesses and individuals throughout the Valley Corridor will have a choice of intermodal rail or long-distance trucking. This system will provide very quick access to the international air shipping terminals at Huntsville and Memphis. Additional freight service could be provided to Dulles and Baltimore-Washington International airports from the Valley route.

The passenger service capability of the Steel Interstate would bring this option to most of the communities of the region.

1.9. **Proposed Feasibility Study**

Rail Solution has been discussing with state and local government officials and Norfolk Southern officials undertaking a feasibility study for the Valley Corridor Freight Transportation System, which would include all modes of transportation, including the Steel Interstate Prototype. The multimodal feasibility study of the Valley Corridor is estimated to cost $10 million, and it is proposed that the work be financed 80 percent by the Federal Government and 20 percent by private sources. The Rail Solution proposal for a multimodal feasibility study of the valley corridor together with proposed organization and criteria is available online by downloading it from this page: [http://railsolution.org/resources/presentations-federal-government/](http://railsolution.org/resources/presentations-federal-government/). Click on the download button for this document: “The Steel Interstate System – a 21st Century Railroad Network for the United States” Appendix A. Proposed Multimodal Feasibility Study of the Valley Corridor, Organization and Criteria.*

2. **ACKNOWLEDGEMENTS**

This work is the result of efforts of RAIL Solution, a not-for-profit, 501(c)(3) organization, that studies and advocates modernization of the North American Rail systems, primarily by

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