Measuring North Carolina Railroad Company’s Impact on North Carolina

A report prepared for the North Carolina Railroad Company
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About RTI International

RTI is a nonprofit institute with headquarters in Research Triangle Park, North Carolina, that provides research, development, and technical services to government and commercial clients worldwide. Our mission is to improve the human condition by turning knowledge into practice.

About the North Carolina Railroad Company

The North Carolina Railroad is one of North Carolina’s most unique assets — a 317-mile ribbon of steel, spanning our State from Morehead City to Charlotte. Through its capital improvement program, the North Carolina Railroad Company has invested in bridges track improvements, sidings, double tracking, safety measures and other infrastructure to attract business and industry and create jobs.
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- Background and Context
  - Summary of Findings
  - Methods and Approach
  - Results
  - Other Impacts
  - Appendix
Background and Context

- To better understand and measure their contribution to North Carolina, NCRR asked RTI to estimate the economic impact of NCRR on the State of North Carolina
- Updating 2007 economic impact study
- A one-year snapshot of the contribution of NCRR to the State’s economy, using 2013 data provided by Norfolk Southern
- A case study illustration of the value of rail to the NC economy
NCRR: an important part of a larger freight rail network
NCRR’s share of NC Rail Freight Network

- NCRR is an important part of a much larger rail network in the State

<table>
<thead>
<tr>
<th>Miles</th>
<th>NCRR Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCRR</td>
<td>317</td>
</tr>
<tr>
<td>All freight lines in NC</td>
<td>3,342</td>
</tr>
<tr>
<td>Norfolk Southern</td>
<td>1,297</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Carloads</th>
<th>NCRR Share</th>
<th>Estimated Tons</th>
<th>NCRR Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCRR (2013)</td>
<td>159,400</td>
<td>11.3 million</td>
<td></td>
</tr>
<tr>
<td>All freight lines in NC (2011)</td>
<td>835,400</td>
<td>65.2 million</td>
<td>17%</td>
</tr>
</tbody>
</table>
The larger context

- Study estimates how much additional economic activity takes place in NC due to NCRR in 2013
- Quantifies only part of NCRR’s impact – only freight, a single year
- Not considered but also a part of NCRR’s impact over time
  - Industries that would not have located in NC without rail freight access
  - Value of projects that have located along NCRR’s corridor
- Historically, NCRR enabled the growth of cities and industries along its corridor and throughout the State
Without NCRR…
Can generalize many of our findings

- We quantified only NCRR’s impacts, but our findings illustrate the value of rail in general to NC economy.
- Most NC manufacturing facilities in the state use inputs shipped by rail and/or transport their products by rail.
- Rail dependent industries employ 57,000 North Carolinians and produce $14.6 billion worth of products within the state.
Rail Dependent Industries (>1,000 employees)

NC Employment in Rail Dependent Industries

Source: RTI, IMPLAN 2012

*Jobs reflect total 2012 NC employment in each industry rather than jobs supported by NCRR.
Economic Impact
Background

- **Update and revise 2007 study**
  - Update key data inputs for the economic model
  - Specific consideration of intermodal transport

- **Scope**
  - 2013 freight data
  - Economic impact on North Carolina of lower transportation costs
  - External cost savings

- **Ongoing effort to understand and measure the railroad’s impact**
  - NCRR’s economic impact
  - The greater impact statewide
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- Background and Context
- **Summary of Findings**
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Summary of NCRR Impacts

- **Traffic on the NCRR corridor**
  - About 60 Norfolk Southern freight trains per day, about 10 Amtrak passenger trains
  - 159,000 carloads and 188,000 containers originated or terminated on the NCRR corridor in 2013
  - Equivalent to an estimated 11.4 million tons of freight

- **Direct impact on North Carolina economy**
  - Due to the cost-savings that the NCRR corridor provides compared to the alternative of truck transport, North Carolina companies generate an estimated $499 million in additional output

- **Total economic impact number**
  - The direct impact results in a total output impact of $794 million once supply chain effects and household income effects are accounted for using NC multipliers
Summary of Findings, Cont’d

- **Comparison to the 2007 study**
  - NCRR 2007 study: $338 million output impact
  - NCRR 2014 study: $794 million output impact
  - Estimate of 2013 total ton-miles is lower than ton-miles estimate from 2007 study
  - Difference in impact largely driven by higher estimated cost-savings of rail versus truck

- **External cost-savings**
  - Accounting for social costs such as congestion, accidents, and pollution, freight transported over the NCRR corridor has an external cost savings of $141 million

- **NCRR allows NC to capture a larger amount of US market share than it would in the absence of the corridor**

- **Rail dependent industries**
  - Rail supports jobs in a diverse range of “rail dependent” industries in North Carolina such as agriculture, forestry, quarrying, paper, chemicals, and electricity generation.
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Methods and Approach

- Hypothetical “what if” scenario
  - NCRR rail corridor does not exist
  - In the absence of the corridor, the next best alternative would be long-haul trucking
  - Without NCRR, businesses would face increased transportation costs

- Key data and estimates
  - Norfolk Southern freight carload and intermodal container data for shipments originating or terminating on the NCRR corridor
  - Tonnage and distance estimates to translate carloads and containers into tons and ton-miles per commodity
  - Mapping commodities originating and terminating to industry sectors
  - Costs per ton-mile of freight rail and long-haul trucking

- Estimated transportation cost savings by industry sector

1. Excludes Norfolk Southern capital expenditure and maintenance expense on NCRR.
Methods and Approach, Cont’d

- **Economic Models**
  - Lower transportation costs leads to increased production for NC industries
  - IMPLAN multipliers to determine the total impact on the North Carolina economy
    - Account for supply chain and household income effects
    - Measure the impact on output, State GDP, and jobs

- **Key model inputs and assumptions**
  - Carload and container mapping to industries
  - “Responsiveness” of 440 industries’ supply and demand to changes in cost
  - Lower trucking sector revenue partially offsets the positive effects of rail
Rail Cost-Savings Lead to Economic Impacts

Revenue per ton-mile (cents)

<table>
<thead>
<tr>
<th>Cost of rail</th>
<th>Cost of intermodal rail</th>
<th>Cost of freight trucking</th>
<th>Cost savings of rail over truck</th>
<th>Cost savings of intermodal rail over pure truck</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.8¹</td>
<td>7.0²</td>
<td>16.5¹</td>
<td>12.8</td>
<td>9.6</td>
</tr>
</tbody>
</table>

1. BTS (2011, 2007)
2. Weighted average; Dewey (2002)
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Rail Traffic on the NCRR Corridor

Total Carloads/Containers and Total Cost Savings on the NCRR Corridor

- **Number of Carloads/Containers**
  - Carloads - Terminating: 78,000
  - Carloads - Originating: 81,000
  - Containers - Terminating: 98,000
  - Containers - Originating: 89,000

- **Cost Savings (millions)**
  - Carloads - Terminating: $181
  - Carloads - Originating: $185
  - Containers - Terminating: $30
  - Containers - Originating: $27

Note: intermodal container shipments include Greensboro, Linwood, and Charlotte intermodal facilities
Top Ten Industries by Cost Savings due to NCRR

- Industry-specific cost savings depend on the Norfolk Southern freight data combined with our assumptions about trip length, tonnage, and commodity-industry linkages

<table>
<thead>
<tr>
<th>Terminating</th>
<th>Cost Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmaceutical preparations</td>
<td>$9 M</td>
</tr>
<tr>
<td>Maintenance /repair of nonresidential</td>
<td>$8 M</td>
</tr>
<tr>
<td>Construction of other new nonresidential</td>
<td>$8 M</td>
</tr>
<tr>
<td>Petrochemicals</td>
<td>$7 M</td>
</tr>
<tr>
<td>Construction of other new residential</td>
<td>$6 M</td>
</tr>
<tr>
<td>Personal and household goods repair and maintenance</td>
<td>$6 M</td>
</tr>
<tr>
<td>Other animal food manufacturing</td>
<td>$6 M</td>
</tr>
<tr>
<td>Poultry and egg production</td>
<td>$6 M</td>
</tr>
<tr>
<td>Food services and drinking places</td>
<td>$5 M</td>
</tr>
<tr>
<td>Plastics material and resin manufacturing</td>
<td>$5 M</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Originating</th>
<th>Cost Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other basic organic chemicals</td>
<td>$33 M</td>
</tr>
<tr>
<td>Lime and gypsum products</td>
<td>$20 M</td>
</tr>
<tr>
<td>Mining and quarrying</td>
<td>$18 M</td>
</tr>
<tr>
<td>Soybean and oilseed processing</td>
<td>$12 M</td>
</tr>
<tr>
<td>Rolling mill and other metalworking machinery manufacturing</td>
<td>$12 M</td>
</tr>
<tr>
<td>Other basic inorganic chemicals</td>
<td>$11 M</td>
</tr>
<tr>
<td>Grain farming</td>
<td>$10 M</td>
</tr>
<tr>
<td>Plastics material sand resins</td>
<td>$8 M</td>
</tr>
<tr>
<td>Paperboard Mills</td>
<td>$7 M</td>
</tr>
<tr>
<td>Petroleum and coal products</td>
<td>$7 M</td>
</tr>
</tbody>
</table>
Supply and Demand Framework Results

- Compared to the “what if” scenario (an absence of the NCRR corridor), North Carolina companies
  - save an estimated $424 million dollars versus shipping by truck
  - generate $499 million in net additional output (i.e., sales) and
  - NC industries gain US market share

- Economic impact of NCRR is partially offset by estimated revenue losses in the trucking sector
Other direct NCRR impacts

- NCRR invests in the rail network\(^1\)
  - $9.6 million invested on rail infrastructure improvements in 2013
  - Supports “rail dependent” industries by increasing efficiency, driving down transportation costs
  - Decreases external costs on society (e.g., accidents) with targeted investments

1. Excludes Norfolk Southern capital expenditure and maintenance expense on NCRR.
Economic Impact Model Results

Multiplier
A ratio of the total economic effect to the direct effect.

### Output

<table>
<thead>
<tr>
<th>Effect Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Effect</td>
<td>$499 M</td>
</tr>
<tr>
<td>Indirect Effect</td>
<td>$215 M</td>
</tr>
<tr>
<td>Induced Effect</td>
<td>$80 M</td>
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</tbody>
</table>

### GDP

<table>
<thead>
<tr>
<th>Effect Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct</td>
<td>$111 M</td>
</tr>
<tr>
<td>Indirect</td>
<td>$98 M</td>
</tr>
<tr>
<td>Induced</td>
<td>$51 M</td>
</tr>
</tbody>
</table>

### Jobs

<table>
<thead>
<tr>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,200</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>900</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>700</td>
</tr>
</tbody>
</table>
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In addition to costs experienced by shippers and passengers, transportation imposes **externals costs**

- Costs experienced by individuals who are not directly involved in the transportation sector.

**Examples of external costs**
- Congestion delays
- Accidents
- Air pollution (health costs)
- Noise pollution
The net external cost of switching to truck would be about **1.6 cents per ton-mile**.

Based on our calculations, approximately **8.7 billion ton-miles** originated or terminated in North Carolina.

Assuming conservatively that only a portion of the external costs are experienced by North Carolinians, we estimate a reduction in external cost of **$141 million**.

<table>
<thead>
<tr>
<th>External Cost Category</th>
<th>Trucking cost/ton-mile</th>
<th>Railroad cost/ton-mile</th>
<th>Net External Cost of Switching to Truck</th>
<th>Discount Factor</th>
<th>NC External cost/ton-mile burden</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congestion delay</td>
<td>$0.00410</td>
<td>$0.00030</td>
<td>-$0.00380</td>
<td></td>
<td>-$0.00380</td>
</tr>
<tr>
<td>Accident</td>
<td>$0.01130</td>
<td>$0.00240</td>
<td>-$0.00890</td>
<td></td>
<td>-$0.00890</td>
</tr>
<tr>
<td>Air pollution (Health)</td>
<td>$0.00890</td>
<td>$0.00195</td>
<td>-$0.00695</td>
<td>0.5</td>
<td>-$0.00348</td>
</tr>
<tr>
<td>Noise</td>
<td>$0.00050</td>
<td>$0.00050</td>
<td>$0.00000</td>
<td></td>
<td>$0.00000</td>
</tr>
<tr>
<td>Total</td>
<td>$0.03970</td>
<td>$0.00775</td>
<td>-$0.03195</td>
<td></td>
<td>-0.01618</td>
</tr>
</tbody>
</table>

Source: RTI, GAO 2011

$0.016 \times 8.7 \text{ billion ton-miles} = 141 \text{ million external cost savings}$
Summary

- The NCRR makes businesses in NC more competitive by decreasing transportation costs for rail users
  - NCRR’s supports additional output, GDP, and jobs in NC
- NCRR decreases the external costs of transporting goods
- Our approach is limited to 2013 impacts of the NCRR
  - Since it’s creation in 1848, NCRR has helped shape the State’s economic geography
- NCRR’s impact is a case study of the impact of the statewide rail network
  - 10% of railroad miles operated in NC
  - 17% of carloads and containers originating and terminating in NC
  - 19% of tonnage originating and terminating in NC
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## Data Sources

<table>
<thead>
<tr>
<th>Data Source</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norfolk Southern</td>
<td>Freight carload and container data by STCC* (2013)</td>
</tr>
<tr>
<td>Association of American Railroads</td>
<td>Average cost per ton-mile, rail (2010-2012)</td>
</tr>
<tr>
<td>US DOT, Bureau of Transportation Statistics, National Transportation Statistics</td>
<td>Average revenue per ton-mile by mode of transportation (1960-2011)</td>
</tr>
<tr>
<td>US DOT, Surface Transportation Board, Carload Waybill Sample Reference Guide</td>
<td>US origin carloads and tonnage from waybill samples by STCC (2010-2012)</td>
</tr>
<tr>
<td>US DOT, Federal Highway Administration, Freight Analysis Framework Technical Documentation</td>
<td>STCC-to-SCTG crosswalk</td>
</tr>
<tr>
<td>US Census Bureau, Economic Census; EPA Elasticity Databank; literature</td>
<td>Economic data used to calibrate supply elasticities in the model</td>
</tr>
<tr>
<td>EPA Elasticity Databank; literature</td>
<td>Demand elasticities</td>
</tr>
<tr>
<td>IMPLAN, North Carolina Model</td>
<td>NAICS-to-IMPLAN crosswalk, economic impact multipliers, freight transportation demand, trade flows with other states, and economic indicators such as output, value added, and jobs (2012)</td>
</tr>
<tr>
<td>Government Accountability Office</td>
<td>External costs per ton-mile (2011)</td>
</tr>
<tr>
<td>BTS, America’s Container Ports (US Dept. of Commerce)</td>
<td>Intermodal information: container-to-carload ratio, commodity mix</td>
</tr>
<tr>
<td>IMPLAN and NS data</td>
<td>Intermodal industry mix</td>
</tr>
</tbody>
</table>

*STCC = Standard Transportation Commodity Code  
**SCTG = Standard Classification of Transported Goods


IMPLAN Group, LLC, IMPLAN System (2012 North Carolina), 16740 Birkdale Commons Parkway, Suite 206, Huntersville, NC 28078


Comparison with 2007 Results

- Larger cost differential per ton-mile between rail and truck than in 2007 study
- Difference in total ton-miles
  - 2013: 8.7 billion ton-miles
  - 2007: 9.9 billion ton-miles
- Different underlying commodity and industry mix based on carload data
- IMPLAN differences
  - Industry scheme and updated multipliers
- Other minor differences in methods and input data