Economic Benefits of Additional Rail Bridge Capacity

A case study on the benefits of replacing the Merchants Bridge main spans at St. Louis

Prepared by Emma J. Nix
Under the Direction of Dr. Ray Mundy
Future of the Rail Industry

- FRA predicts total tonnage moved by rail will see a 35% increase from 2010 to 2050.
  - AAR suggests $148 billion must be invested to accommodate forecasted 2035 demand levels.
    - Without improvements, 30% of rail miles in primary corridors will be congested by 2035.
- U.S. DOT estimates that demand for freight tonnage will increase 88% from 2002 to 2035.
  - Quantity demanded will exceed quantity supplied.
Merchants Bridge, St. Louis, MO-IL

- Built in 1890.
- Operates at limited capacity due to weight restrictions.
- Improvements will restore it to a double-tracked bridge.
  - This will allow the Merchants Bridge to alleviate congestion on other routes.
- Without improvements, Merchants Bridge will close in 2034.
Merchants and MacArthur Bridge Crossing

- At an average of 72.8 trains per day, the bridges make up the most heavily trafficked Mississippi River crossing in the country.

- One of the few crossings open to all railroads.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Bridge</th>
<th>States</th>
<th>Count</th>
<th>Average TPD</th>
<th>Source</th>
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<td>1</td>
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<td>5</td>
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<td>7</td>
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<td>4954</td>
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<td>Bridge 15 UP</td>
<td>MN</td>
<td>100</td>
<td>4.0</td>
<td>UP Volume map</td>
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</table>
Benefits of Project

Benefits are gained by:

1. Avoiding diversion of freight to longer rail routes.
   - Nearest bridge accessible to all railroads takes an additional 300 miles to travel.

2. Diverting freight from truck to rail.
   - Mile-for-mile, rail is cheaper than truck.

3. Run time improvements.
   - Increase speed over bridge from 6 mph to 14 mph.
Cost Savings

Benefits can be further broken down into:

1. Transportation Cost Savings
   - Labor, Fuel, Maintenance, Congestion, etc.

2. Environmental Cost Savings
   - Emissions, Noise.

3. Inventory Cost Savings
   - Cost of delayed lading.
Summary of Project Costs

1. Construction costs.

2. Costs of closing bridge during construction.

- Use upper bound and lower bound construction cost estimates.
  - Upper bound: $212 million.
  - Lower bound: $150 million

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Cost of Construction</th>
<th>Total Cost of Transportation</th>
<th>Total Cost to Environment</th>
<th>Total Cost of Delay</th>
<th>Total Annual Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>$72.0</td>
<td>$10.3</td>
<td>$3.7</td>
<td>$4.3</td>
<td>$90.3</td>
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<tr>
<td>2018</td>
<td>$65.4</td>
<td>$9.7</td>
<td>$3.3</td>
<td>$4.1</td>
<td>$82.6</td>
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<td>2019</td>
<td>$61.1</td>
<td>$9.2</td>
<td>$3.0</td>
<td>$3.9</td>
<td>$77.2</td>
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</table>

Total Cost $250.0

- Total project cost: $191.9 million.
Summary of Project Benefits

Net Present Value of Project (Benefits – Costs)

<table>
<thead>
<tr>
<th></th>
<th>NPV</th>
<th>NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(20-year Horizon: 2017-2036)</td>
<td>(30-year Horizon: 2017-2046)</td>
</tr>
<tr>
<td>3% discount rate</td>
<td>$7.1 billion</td>
<td>$11.9 billion</td>
</tr>
<tr>
<td>7% discount rate</td>
<td>$4.7 billion</td>
<td>$6.6 billion</td>
</tr>
</tbody>
</table>

NPV (Net Present Value) is calculated using different discount rates and time horizons. The chart illustrates the benefits of various projects over two different time periods, with a 3% and 7% discount rate, showing a significant increase in NPV with longer time horizons.
TIGER Guidelines

Project benefits should be realized across 5 categories:

1. Livability
2. Economic Competitiveness
3. Safety
4. State of Good Repair
5. Sustainability
Livability

Total Hours Saved due to Project

- 7.3 million hours saved in 20-year horizon.
- 14.6 million hours saved in 30-year horizon.
Economic Competitiveness

- Approximately $3.1 billion saved in transportation costs from 2017-2036.

**Total Transportation Cost Savings by type, 7% discount rate, in millions.**

<table>
<thead>
<tr>
<th>Diverting Freight from Truck to Rail</th>
<th>Avoiding Diversion to Longer Rail Routes</th>
<th>Run Time Improvements</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>$352</td>
<td>$2,701</td>
<td>$50</td>
<td>$3,103</td>
</tr>
</tbody>
</table>

- $4.4 billion over 30-year horizon.
Safety

1. Decreased number of trucks on the highways.
   - 1.19¢ per truck ton mile; 0.25¢ per rail ton mile.
   - Total cost of miles traveled by rail compared to cost if freight, instead, traveled by truck.

2. Decreased rail miles traveled per ton of freight.
   - Cost differential of additional miles.

Transportation Cost Savings: 20-year horizon, 7% discount rate (in millions)

<table>
<thead>
<tr>
<th>Diverting Freight from Truck to Rail</th>
<th>Avoiding Diversion to Longer Rail Routes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$ 11.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$ 436.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$ 447.8</td>
</tr>
</tbody>
</table>

- $628 million over 30-year horizon.
State of Good Repair

1. Road and Rail maintenance cost savings.

2. Bridge maintenance costs.

Total Bridge Maintenance Costs: 7% discount rate (in millions)

<table>
<thead>
<tr>
<th></th>
<th>Baseline Alternative</th>
<th>Build Alternative</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>20-year Horizon</td>
<td>$ 14.7</td>
<td>$ 1.0</td>
<td>$ 13.7</td>
</tr>
<tr>
<td>2020 to 2034</td>
<td>$ 7.1</td>
<td>$ 1.0</td>
<td>$ 6.2</td>
</tr>
</tbody>
</table>

Diverting Freight from Truck to Rail
Avoiding Diversion to Longer Rail Routes

20-year Horizon 30-year Horizon

$224 $314
$105 $147
Sustainability

Total Environmental Cost Savings, by Pollutant

- $636 million over 20-year horizon
- $797 million over 30-year horizon
What does this mean?

- Improving the Merchants Bridge could generate billions in benefits over the coming decades.
  - Benefits shared by industry and public.

- Investing in other existing rail infrastructure will produce similar benefits, allowing the industry to keep up with growing demand.
  - Decrease costs associated with freight transport.
  - Decrease congestion on routes operating at or above capacity.
  - Decrease overall transport time.
Questions?