The U.S. Freight Railroad Industry: Where We Are in 2018

Dan Keen
Wichita Ad Valorem Conference
July 31, 2018
Topics For Today

- Background
- Current issues
- The future?
- Other
U.S. Freight Railroad Fast Facts

- 7 Class I, ~593 non-Class I railroads
- ~138,000 miles
- ~30,000 locomotives
- ~1.6 million railcars
- ~4 billion gallons fuel consumed annually
- ~170,000 employees
North American Freight Railroads
Class I Railroads Account for Most U.S. Rail Traffic…

<table>
<thead>
<tr>
<th></th>
<th>BNSF</th>
<th>UP</th>
<th>CSX</th>
<th>NS</th>
<th>KCS</th>
<th>CNGT</th>
<th>SOO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue ($ bil)</td>
<td>$21.1</td>
<td>$21.2</td>
<td>$11.1</td>
<td>$10.6</td>
<td>$1.3</td>
<td>$3.2</td>
<td>$1.4</td>
</tr>
<tr>
<td>Miles operated</td>
<td>32,401</td>
<td>32,122</td>
<td>20,813</td>
<td>19,467</td>
<td>3,393</td>
<td>5,873</td>
<td>4,836</td>
</tr>
<tr>
<td>Carloads (mil)</td>
<td>10.28</td>
<td>8.59</td>
<td>6.43</td>
<td>7.61</td>
<td>1.22</td>
<td>2.59</td>
<td>1.07</td>
</tr>
<tr>
<td>States</td>
<td>28</td>
<td>25</td>
<td>24</td>
<td>24</td>
<td>10</td>
<td>13</td>
<td>11</td>
</tr>
<tr>
<td>Employees</td>
<td>41,493</td>
<td>44,146</td>
<td>22,814</td>
<td>26,717</td>
<td>2,958</td>
<td>6,641</td>
<td>2,768</td>
</tr>
<tr>
<td>Avg. haul (miles)</td>
<td>1,144</td>
<td>939</td>
<td>583</td>
<td>547</td>
<td>451</td>
<td>338</td>
<td>482</td>
</tr>
<tr>
<td>Locomotives</td>
<td>8,326</td>
<td>8,530</td>
<td>3,958</td>
<td>3,913</td>
<td>645</td>
<td>703</td>
<td>471</td>
</tr>
</tbody>
</table>

Data are 2017. Figures are for U.S. operations only. Source: R-1 reports to the STB
...But Non-Class I RRs Are Crucial Too
General Characteristics of U.S. Freight Railroads

- Privately-owned, common carriers
- Same company usually owns the track and operates trains over it; no automatic access to another’s tracks
- Little government funding
- Regulation less than once was, but still substantial
- What happens in one place affects others
- Host, but generally don’t operate, passenger trains
Why Freight Rail?

- Cost effective
- Safety
- Environmentally friendly
- Huge volumes
Railroads’ Scale Enables Efficiency Elsewhere

- One railcar coal = electricity for 21 households for a year.
- One railcar wheat = 258,000 loaves of bread.
- One railcar corn = 37,000 chickens or 480,000 bags of Fritos.
- One railcar ammonia fertilizer = 770 acres of corn.
How much did Class I railroads pay in property taxes in 2017?

A. $450 million
B. $665 million
C. $910 million
D. $1.31 billion
Railroad Property Taxes Exceed $1.3 Billion

Figures are for Class I railroads only and only include taxes based on value of real estate and personal property used in rail operations. Excludes taxes on gross receipts, franchise fees, excise taxes, and similar items. Source: Railroad R-1 reports to the STB
Class I Railroad Operating Revenue

($ billions)

Note: net income for 2017 has been adjusted to account for tax effects from the Tax Cuts and Jobs Act of 2017. Source: AAR
For the average U.S. manufacturer, capital spending is about 3% of revenue. What is it for freight RR.s?

A. 6%
B. 9%
C. 14%
D. 19%
RRs Are Far More Capital Intensive Than Other Industries

Capital Expenditures as a % of Revenue

Sources: Census Bureau, AAR
Record Recent Spending on Infrastructure & Equipment

Data are for Class I railroads. Source: AAR
“As demand increases, the railroads’ ability to generate profits from which to finance new investments will be critical. Profits are key to increasing capacity because they provide both the incentives and the means to make new investments.”

– Congressional Budget Office (Jan. 2006)
Class I Railroad Net Income

($ billions)

'08 $8.1  '09 $6.4  '10 $9.1  '11 $10.9  '12 $11.9  '13 $13.4  '14 $14.4  '15 $14.5  '16 $13.2  '17 $14.5

Note: net income for 2017 has been adjusted to account for tax effects from the Tax Cuts and Jobs Act of 2017. Source: AAR
Class I Railroad Operating Ratio*

*Operating expenses divided by operating revenue.  Source: AAR
Railroads Have Only in Recent Years Earned Their Cost of Capital

Class I RR Cost of Capital vs. Return on Investment

Note: In 2006, the Surface Transportation Board significantly changed the method by which it calculates the rail industry cost of capital. Source: STB
Higher Rail Profitability Has Led to Higher Rail Spending

*Capital spending + maintenance expenses. **Net income for 2017 has been adjusted to account for tax effects from the Tax Cuts and Jobs Act of 2017. Data are current dollars and are for Class I railroads. Source: AAR
Return on equity = net profit / shareholders' equity. Source: AAR, Fortune magazine
Total U.S. Rail Carloads

Data do not include the U.S. operations of CN and CP. Source: AAR Rail Time Indicators

(millions)
Total U.S. Rail Carloads

(average weekly originations)

Data are average weekly originations for each month, are not seasonally adjusted, do not include intermodal, and do not include the U.S. operations of CN and CP. Source: AAR Rail Time Indicators
U.S. Rail Intermodal Traffic

Data do not include the U.S. operations of CN and CP. Source: AAR Rail Time Indicators
Data are average weekly originations for each month, are not seasonally adjusted, and do not include the U.S. operations of CN and CP. Source: AAR Rail Time Indicators
U.S. Rail Carloads + Intermodal Traffic

Data are originations and do not include the U.S. operations of CN and CP.
Source: AAR Weekly Railroad Traffic
Total U.S. Rail Carloads + Intermodal Units

(average weekly originations)

Data are average weekly originations for each month, are not seasonally adjusted, do not include intermodal, and do not include the U.S. operations of CN and CP. Source: AAR Rail Time Indicators
Some of the Things That Keep Railroads Busy

- Continually changing markets that are difficult to foresee and plan for
- Positive train control
- Reregulation
- Truck size and weight
- Customer service
- The economy
Constantly Changing Markets
Part 1

Annual Rail Carloads by Commodity: 2005-2017
(index 2005 = 100)

*Combined U.S. + Canadian carloads
Source: AAR Weekly Railroad Traffic
Annual Rail Carloads by Commodity: 2005-2017 (millions)

*Combined U.S. + Canadian carloads

Source: AAR Weekly Railroad Traffic
As Markets Change, Very Hard to Plan and Manage Rail Networks

- Different train types
- Different service requirements
- Different locations
- Need for ongoing maintenance

- Resource limitations
- Need for long lead times
- Regulatory requirements
- Railroads are networks
U.S. Class I RR Gross Revenue by Commodity in 2017
($ billions)

Total = $69.5 billion

- **Coal** $10.3 (15%)
- **Grain** $5.5 (8%)
- **Food** $5.8 (8%)
- **Lumber & wood** $2.0 (3%)
- **Pulp & paper** $2.2 (3%)
- **Chemicals** $10.3 (15%)
- **Primary metal products** Cr. stone, sand, gravel $2.3 (3%)
- **Crude oil** $0.7 (1%)
- **Intermodal** $11.9 (17%)
- **Motor veh.** $5.5 (8%)
- **Other** $5.1 (8%)
- **Waste & scrap** $1.2 (2%)
- **Petr. & coal prod.** $2.9 (4%)

*Some intermodal is interspersed in other commodities. In total, intermodal is ~24% of revenue.*

Source: AAR (FCS)
U.S. Coal Production vs. Consumption

Figures are 2017.
Source: EIA
Total U.S. Electricity Generation Has Stopped Growing

Source: Energy Information Administration
U.S. Electricity Generation by Type of Fuel

(million megawatthours, 2008-2017)

<table>
<thead>
<tr>
<th>Type of Fuel</th>
<th>2000</th>
<th>2010</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>52%</td>
<td>45%</td>
<td>30%</td>
</tr>
<tr>
<td>Natural gas</td>
<td>16%</td>
<td>24%</td>
<td>32%</td>
</tr>
<tr>
<td>Nuclear</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>Renewables</td>
<td>2%</td>
<td>4%</td>
<td>10%</td>
</tr>
<tr>
<td>Hydro</td>
<td>7%</td>
<td>6%</td>
<td>7%</td>
</tr>
</tbody>
</table>

Source: Energy Information Administration
U.S. Natural Gas Production

(trillion cubic feet)

Source: Energy Information Administration
Average Price of Natural Gas to Utilities

(dollars per million BTU)

Source: Energy Information Administration
U.S. Coal Consumption and Production Down in Recent Years

Source: EIA

2017 production = 34% from 2008 peak
2017 consumption = 36% from 2007 peak
U.S. Rail Carloads of Coal vs. Electricity From Coal

**3-month moving average, million megawatthours.**

**3-month moving average based on weekly originations.**  
Source: EIA, AAR
U.S. Coal Volumes Are Down Sharply

(millions of tons)

U.S. coal tonnage in 2017 was 41% lower than in the peak year of 2008. Carloads were down 3.24 million over the same period, the equivalent of 27,000 120-car coal trains.

Data are originated tons for Class I railroads. Source: AAR (Freight Commodity Statistics)
Rapid Intermodal Growth

Source: AAR Weekly Railroad Traffic
U.S. Rail Intermodal Traffic

(6-week moving average originations)

2018
2016
2017 (peak year)

Data do not include the U.S. operations of CN and CP. Source: AAR Rail Time Indicators
Coal vs. Intermodal as % of U.S. Rail Revenue

Data are for BNSF, CSX, KCS, NS, and UP combined. Source: company reports
Why Has Intermodal Grown?

- Better service
- Huge RR investments
- Truck problems – fuel, driver shortages, congestion
- Switch from other freight cars
- Growing economy and trade
What is Positive Train Control (PTC)?

Designed to stop or slow a train before certain accidents caused by human error occur:

- Collisions
- Derailments caused by excessive speed
- Unauthorized incursions onto track where maintenance is taking place
- Movement of train through a track switch left in the wrong position.
Features of the PTC Mandate

- Mandated by 2008 rail safety bill
- Required for:
  - All main lines on which regularly scheduled passenger trains travel
  - All Class I main lines > 5 million annual GTM handling TIH materials.
- Installation by Dec. 31, 2018, testing until Dec. 31, 2020
What PTC Systems Must Be Able to Do

- Determine precise location and speed of trains.
- Warn train operators of potential problems (e.g., stop signal ahead).
- Take action if the train operator does not respond to a warning.
- Everything must be interoperable.
Largest Combined Effort in U.S. Transportation History

- Geo-mapping 54,000 route-miles
- Install technology on 17,200 locomotives
- Install ~28,600 wayside interface units
- Install technology on ~2,100 switches in non-signaled territory
- ~14,500 signal replacement projects
- New radio system
- Back office systems and dispatching software
- Cost? $10+ billion
## Significant Progress

### CLASS I FREIGHT RAILROAD PTC
**IN OPERATION AS OF DEC. 31, 2017**

<table>
<thead>
<tr>
<th>Miles</th>
<th>Required for PTC Operation</th>
<th>Complete %</th>
</tr>
</thead>
<tbody>
<tr>
<td>30,223</td>
<td>54,028</td>
<td>56%</td>
</tr>
</tbody>
</table>

Source: AAR compilation of figures provided by individual Class I railroads
If the U.S. is to have a viable, privately-owned freight rail system:

- Someone has to pay for it.
- The market is far superior to the government in determining who should pay.
Some Rail Customers Want to Shift Course

- Basic complaint: railroads charge too much and railroads’ use of differential pricing is unfair.
- Proposed solution: government price controls on what railroads can charge.
Price controls / restrictions on differential pricing

Revenue falls

Funds available for reinvestment fall

Rail network shrinks

Loss of scale economies

Further shrinkage & traffic diversion
• 1982: Congress decrees that trucks on Interstate Highway System can weigh no more than 80,000 pounds.

• 1991: Congress limits routes on which trucks with two or more trailers (longer combination vehicles, or LCVs) can travel.

• Limits imposed largely due to concerns about safety and the uncompensated highway damage trucks cause.
Why Say No to Longer and Heavier Trucks?

- Available data don’t support heavier trucks (June 2015 DOT study).
- Huge existing truck under-payments would increase.
- Would divert freight to trucks that don’t pay their own way from railroads that do.
- More bridge damage and need for design upgrades.
- Sixth axle not a cure-all.
Railroad Customer Service

- Everyone agrees it has to improve
- Bar is continuously being raised
- Service improvements are expensive
- Railroads face conflicting pressures
Even In Best of Times, Planning & Managing Rail Network is Difficult

- Railroads are networks – what happens in one area can impact operations hundreds of miles away
- Different train types have different characteristics and service needs (e.g., coal vs. UPS packages; freight vs. passenger, etc.)
- Traffic volumes not always foreseen; traffic mix changes
- Long lead times (2 years for a locomotive, 6-12 months for a trained engineer, up to several years for a new siding, etc.)
- Ongoing maintenance takes away track time
- Regulatory requirements
Average Train Speed: Aug. 2017 - July 2018
(miles per hour, 3-week moving average)

Source: www.railroadpm.org
What Have Railroads Been Doing To Improve Service?

- Process changes
- Improved information technology
- People
- Locomotives and freight cars
- Physical plant
Class I Railroad Employment

Source: STB
Recent GDP Growth

(\% change over previous period)

Source: BEA
Consumer Confidence Has Surged

Source: Conference Board

(1985 = 100)
Total Industrial and Manufacturing Output

(2012 = 100)

*Includes utilities and resource extraction in addition to manufacturing. Source: Federal Reserve
Very Low Official Unemployment Rate

Source: Bureau of Labor Statistics
Weak Correlation: Services-Related GDP* vs. Total Rail Traffic**

*Imports, exports, and personal consumption of services; intellectual property; and government consumption expenditures. **Total originated U.S. carloads and intermodal units. Rail traffic excludes the U.S. operations of Canadian railroads. Source: BEA, AAR
Better Correlation: Goods-Related GDP* vs. Total Rail Traffic**

Better correlation: Goods-Related GDP* vs. Total Rail Traffic**

<table>
<thead>
<tr>
<th>Year</th>
<th>Goods-related GDP*</th>
<th>Total rail traffic**</th>
</tr>
</thead>
<tbody>
<tr>
<td>'01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>'03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>'05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>'07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>'09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>'11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>'13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>'15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>'17</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Imports, exports, and personal consumption of goods; fixed residential investment; business investment in equipment & structures; government gross investment; and change in inventories.

**Total originated U.S. carloads and intermodal units. Rail traffic excludes the U.S. operations of Canadian railroads.

Source: BEA, AAR

correlation = 90%
As of July 2018, the current recovery is more than 9 years old.

Length of U.S. Economic Expansions Since 1949
(years)

Y-axis is year recovery began. Source: National Bureau of Economic Research
U.S. Economic Expansions Since 1949: Average Annual Growth

<table>
<thead>
<tr>
<th>Period</th>
<th>Average Annual Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q4 '49 - Q2 '53</td>
<td>7.6%</td>
</tr>
<tr>
<td>Q2 '54 - Q3 '57</td>
<td>4.0%</td>
</tr>
<tr>
<td>Q2 '58 - Q2 '60</td>
<td>5.4%</td>
</tr>
<tr>
<td>Q1 '61 - Q4 '69</td>
<td>5.1%</td>
</tr>
<tr>
<td>Q4 '70 - Q4 '73</td>
<td>5.3%</td>
</tr>
<tr>
<td>Q1 '75 - Q1 '80</td>
<td>4.0%</td>
</tr>
<tr>
<td>Q3 '80 - Q3 '81</td>
<td>4.4%</td>
</tr>
<tr>
<td>Q4 '82 - Q3 '90</td>
<td>4.1%</td>
</tr>
<tr>
<td>Q1 '91 - Q1 '01</td>
<td>3.8%</td>
</tr>
<tr>
<td>Q4 '01 - Q4 '07</td>
<td>2.8%</td>
</tr>
<tr>
<td>Q3 '09 - Q2 '18</td>
<td>2.3%</td>
</tr>
</tbody>
</table>

Source: National Bureau of Economic Research
What’s going on?

Economists.

One said 3.2% and the other said 3.6% and wouldn’t back down.

www.mooselakecartoons.com
People Drive the Economy
The Economy’s People Problem: Part 1

2020, 2025, and 2030 are projections.  Source: Census Bureau
The Economy’s People Problem: Part 2

% Change in Size of the Labor Force

Source: Bureau of Labor Statistics
The Economy’s People
Problem: Part 3

% of Working Age Population With a Job

Source: Bureau of Labor Statistics
The Economy’s People Problem: Part 4

(5-year rolling average of annual productivity growth*)

*output per year. Source: Bureau of Labor Statistics
“Economists are often asked to predict what the economy is going to do. But economic predictions require predicting what politicians are going to do — and nothing is more unpredictable.”

-Thomas Sowell

Photo courtesy of the Hoover Institution
RRs and Foreign Trade: Summary Statistics

International Trade as a Share of Rail Traffic in 2014

<table>
<thead>
<tr>
<th></th>
<th>Rail Total</th>
<th>Trade Share</th>
<th>Trade % of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue ($ bil)</td>
<td>$75.1</td>
<td>$26.4</td>
<td>35.2%</td>
</tr>
<tr>
<td>Tons (millions)</td>
<td>1,879.4</td>
<td>511.0</td>
<td>27.2%</td>
</tr>
<tr>
<td>Units (millions)*</td>
<td>32.2</td>
<td>13.4</td>
<td>41.6%</td>
</tr>
</tbody>
</table>

*carloads and intermodal containers and trailers

Source: AAR analysis of government and other data

~50,000 rail jobs — worth over $5.5 billion in annual wages and benefits — depend directly on international trade
### U.S. Grain Exports (million tons)

<table>
<thead>
<tr>
<th>Year</th>
<th>Corn</th>
<th>Wheat</th>
<th>Soybeans</th>
<th>Sorghum</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>China</td>
<td>Total</td>
<td>China</td>
<td>Total</td>
</tr>
<tr>
<td>2013</td>
<td>4.0</td>
<td>26.3</td>
<td>15%</td>
<td>4.7</td>
</tr>
<tr>
<td>2014</td>
<td>0.3</td>
<td>54.5</td>
<td>1%</td>
<td>0.6</td>
</tr>
<tr>
<td>2015</td>
<td>0.8</td>
<td>49.0</td>
<td>2%</td>
<td>0.6</td>
</tr>
<tr>
<td>2016</td>
<td>0.3</td>
<td>61.5</td>
<td>0%</td>
<td>1.0</td>
</tr>
<tr>
<td>2017</td>
<td>0.9</td>
<td>58.1</td>
<td>2%</td>
<td>1.6</td>
</tr>
</tbody>
</table>

% = China's share of total  
Source: USDA
Long-Term Demand for Freight Transportation Will Grow

Billions of Tons of Freight Transported in the U.S.

<table>
<thead>
<tr>
<th>Year</th>
<th>Tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015e</td>
<td>18.1</td>
</tr>
<tr>
<td>2020p</td>
<td>20.2</td>
</tr>
<tr>
<td>2030p</td>
<td>22.9</td>
</tr>
<tr>
<td>2040p</td>
<td>25.5</td>
</tr>
</tbody>
</table>

The U.S. DOT forecasts total U.S. freight movements to rise from around 18.1 billion tons in 2015 to 25.5 billion tons in 2040 – a 41% increase.

e – estimated  p – projected  Source: FHWA - Freight Analysis Framework, version 4.4