Passenger and Freight Rail Trends Mixed, High-Speed Rail Growing
Michael Renner | September 2, 2014

According to the International Union of Railways (the UIC—from its name in French, the Union Internationale des Chemins de Fer), people traveled an estimated 2,865 billion passenger-kilometers (pkm) worldwide in 2013 by intercity rail.¹ The 2013 value is virtually unchanged from 2012 and confirms a slowing down since 2008.² From 1980 to 2008, passenger rail travel rose from 1,413 billion pkm to 2,687 billion pkm—3.2 percent per year—but from 2008 to 2013 the annual pace slowed to 1.3 percent.³ (See Figure 1.)

Freight rail movements worldwide amounted to some 9,789 billion ton-kilometers (tkm) in 2013.⁴ Freight rail expanded by 4.8 percent annually between 2000 and 2008.⁵ Reflecting the impacts of the economic crisis, however, the 2013 figure is down about 4 percent from the peak value of 10,208 billion tkm reached in 2008.⁶ (See Figure 2.)

Figure 1. | World Passenger Rail Travel, 1980-2013

Source: World Bank, UIC
Even though more people and goods travel by rail, the length of the world’s railway lines has not expanded nearly as much. UIC data indicate a total length for passenger and freight lines of 909,000 kilometers in 2000. Growth during 2000–05 led the world’s rail network to peak at 1.03 million kilometers. Since then, however, the numbers have been flat.

The world’s rail vehicle stock runs to almost 3 million locomotives, railcars, and coaches—some 1.36 million in Asia (of which 750,000 are in China), 914,000 in Europe (with 125,000 in Germany and 121,000 in Russia), 667,000 in the Americas (with 442,000 in the United States), but just 46,000 in Africa. However, the vehicle count is down from more than 3.6 million units in 2001.

The capacity of freight rail vehicles has increased massively. In the United States, the number of freight cars declined from 1.4 million in 1970 to just 381,000 in 2012, yet the loads carried and especially the distances traveled increased, so that total ton-miles more than doubled from 1,231 billion to 2,756 billion during that time. The amount of energy required to haul one ton over one kilometer dropped from 1,112 Btu to 473 Btu.

Trains worldwide—whether they were transporting people or goods—traveled 12.7 billion kilometers (km) in 2013. That is up from 10.3 billion km in 1991 and 9.7 billion km in 2001. But individual trains have vastly different capacities. The number of railcars pulled by a locomotive may vary enormously. For passenger trains, seating capacity also varies considerably, especially since the introduction of double-decker cars.

Figure 2. | World Freight Rail Movements, 2000-2013

Source: UIC
In 2013, nearly 7 million employees operated and maintained rail systems. Freight trains differ substantially in length and carrying capacity. For example, although the average U.S. freight train has 70 railcars, is almost 2 kilometers long, and hauls 3,000 tons of cargo, some freight trains there as well as in China, Brazil, or Australia are made up of 300 railcars or more, pulling tens of thousands of tons of bulk cargo such as coal, iron ore, or grain. It takes a lot of people to operate and maintain rail systems, with nearly 7 million employees around the world in 2013. The largest number of these, slightly more than 2 million, work in China, followed by India (1.3 million) and Russia (896,000); the members of the European Union together have just under 1.1 million employees, while other parts of Europe (excluding Russia) have another 523,000. Asian countries, excluding China and India, employ 680,000 people. Far fewer people work in the railways sectors of the Americas (273,000) and Africa (143,000). Privatization and market liberalization policies over the last two decades brought enormous change, cutting employment from 9.36 million in 1991. In some countries, job loss has been dramatic. (See Table 1.)

Regionally, three quarters of all passenger-kilometers are traveled in Asia and Oceania, up from less than two thirds in 2000. Europe’s share has declined from 31 percent to 22 percent, while the Americas and Africa play minor roles. India and China were the dominant countries in 2013, followed by Japan, Russia, France, and Germany.

Table 1. Rail Employment, Selected Countries and World, 1991, 2001, and 2013

<table>
<thead>
<tr>
<th></th>
<th>1991</th>
<th>2001</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>1,998</td>
<td>1,453</td>
<td>2,032</td>
</tr>
<tr>
<td>India</td>
<td>1,651</td>
<td>1,545</td>
<td>1,328</td>
</tr>
<tr>
<td>Russia</td>
<td>1,877a</td>
<td>1,240</td>
<td>896</td>
</tr>
<tr>
<td>EU, of which:</td>
<td>1,143</td>
<td>703</td>
<td>1,082</td>
</tr>
<tr>
<td>Germany</td>
<td>442</td>
<td>182b</td>
<td>294</td>
</tr>
<tr>
<td>France</td>
<td>199</td>
<td>178</td>
<td>152</td>
</tr>
<tr>
<td>Poland</td>
<td>309</td>
<td>159</td>
<td>93</td>
</tr>
<tr>
<td>UK</td>
<td>139</td>
<td>22b</td>
<td>87</td>
</tr>
<tr>
<td>Italy</td>
<td>180</td>
<td>104</td>
<td>73</td>
</tr>
<tr>
<td>Spain</td>
<td>176</td>
<td>37</td>
<td>33</td>
</tr>
<tr>
<td>Ukraine</td>
<td>665</td>
<td>376</td>
<td>339</td>
</tr>
<tr>
<td>United States</td>
<td>206b</td>
<td>186</td>
<td>178</td>
</tr>
<tr>
<td>Japan</td>
<td>193</td>
<td>157</td>
<td>128</td>
</tr>
<tr>
<td>World</td>
<td>9,363</td>
<td>7,223</td>
<td>6,956</td>
</tr>
</tbody>
</table>

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a Soviet Union. b Partial data only (not including all rail companies).

In freight rail, the regional picture is far more balanced. Asia and Oceania accounts for close to 37 percent, followed by the Americas (33 percent) and Europe (29 percent), while Africa has only 1.4 percent. Since 2000, Asia’s share of freight rail has gone up while that of the Americas has gone down. In 2013, the United States, China, and Russia were far ahead of India, Canada, Ukraine, and Kazakhstan in total ton-kilometers.

The longest rail lines are found in the Americas (37 percent in 2013) and Europe (34 percent). Asia follows with 22 percent, and Africa with 7 percent. The United States had by far the most extensive network in 2013, followed by Russia, China, India, and Canada.

Electrification of rail lines offers a number of advantages, including higher speeds, no need to carry fuel aboard, and higher energy efficiency. Worldwide, 28 percent of rail lines are electrified, but the percentage varies enormously among individual countries—from as high as all the rail lines in Switzerland to as low as 2 percent in Indonesia. (See Figure 3.)

The rail profiles of individual countries diverge considerably, depending on whether they are oriented mostly toward transporting people or goods. China, India, Germany, Russia, and Ukraine are among the top 10 countries worldwide in both categories. But the United States, second in freight rail tonnage, has only limited passenger rail traffic. Similarly, Japan—the undisputed leader in number of passengers transported—has small amounts of freight tonnage.

High-speed trains now account for 12.5 percent of all passenger rail travel, up from 7.3 percent in 2004. In Europe and East Asia, people traveled some 359 billion pkm on high-speed trains in 2013, more than double the 156 billion pkm a decade earlier. Japan and France were the top countries in high-speed rail until recently, together accounting for two thirds of the world’s high-speed travel in 2010. But China has built the world’s most extensive network of high-speed lines and grabbed the lead with a 40 percent share in 2013.

Figure 3. | Electrification of Railway Lines in Selected Countries, 2013
Although different transportation modes are difficult to compare, available estimates indicate that rail transport is generally more fuel-efficient than movement by road vehicles. In the United States, intercity rail in 2012 required 2,481 Btu per passenger mile, compared with 3,193 Btu for passenger cars and 3,561 Btu for light trucks. For freight modes, railroads required 13,800 Btu per freight-car mile in 2012, while heavy trucks used 21,525 Btu. However, the loads of railroad cars and trucks may vary and thus limit direct comparability.

While rail is likely the more environmentally friendly choice in transportation in many situations, rail transport is not without its problems. Freight trains have long played a key role in moving raw materials from countries’ interiors to export terminals, thus helping to maintain the resource-intensive global economy.

In the United States, growing amounts of oil are being moved by rail. According to Oil Change International, more than 800,000 barrels per day (bpd) of crude oil were transported in 2013, a 70-fold increase from 2005. The capacity to load crude oil onto trains is already at 3.5 million bpd and could grow to 5.1 million bpd by 2016, leading to additional strong growth of oil shipments by rail. The dangers are multiplying as well. The 117 spills of oil from train shipments in the United States in 2013 represented an almost 10-fold rise over 2008. In Virginia, an April 2014 derailment spilled 30,000 gallons of crude oil into a river, and in Quebec, Canada, a derailment in July 2013 led to an explosion.

<table>
<thead>
<tr>
<th>Passengers Carried (Millions)</th>
<th>Rank (#)</th>
<th>Tons of Freight Carried (Millions)</th>
<th>Rank (#)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>8,819</td>
<td>1</td>
<td>31</td>
</tr>
<tr>
<td>India</td>
<td>7,651</td>
<td>2</td>
<td>922</td>
</tr>
<tr>
<td>Germany</td>
<td>2,008</td>
<td>3</td>
<td>390</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>1,570</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>China</td>
<td>1,522</td>
<td>5</td>
<td>2,859</td>
</tr>
<tr>
<td>France</td>
<td>1,114</td>
<td>6</td>
<td>63</td>
</tr>
<tr>
<td>Russia</td>
<td>1,059</td>
<td>7</td>
<td>1,440</td>
</tr>
<tr>
<td>South Africa</td>
<td>531</td>
<td>8</td>
<td>197</td>
</tr>
<tr>
<td>Italy</td>
<td>513</td>
<td>9</td>
<td>39</td>
</tr>
<tr>
<td>Ukraine</td>
<td>485</td>
<td>10</td>
<td>457</td>
</tr>
<tr>
<td>United States</td>
<td>27</td>
<td>-</td>
<td>1,710</td>
</tr>
<tr>
<td>Brazil</td>
<td>n.a.</td>
<td>-</td>
<td>460</td>
</tr>
<tr>
<td>Canada</td>
<td>4</td>
<td>-</td>
<td>310</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>23</td>
<td>-</td>
<td>295</td>
</tr>
<tr>
<td>Australia</td>
<td>n.a.</td>
<td>-</td>
<td>242</td>
</tr>
</tbody>
</table>

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Source: UIC, Synopsis 2013
that killed 47 people. Thus, while rail may be an environmentally friendly transport mode, the full impact depends very much on what is being hauled.

Michael Renner is a senior researcher at Worldwatch Institute and co-director of State of the World 2014.

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1 International Union of Railways (UIC), “Synopsis 2013,” Paris, June 2014. Note that the UIC estimates for any year are typically composed of a range of years, since the statistics for some countries are not as up to date as for others. The passenger rail data in this Vital Sign do not include urban systems such as subways, light rail, and streetcars.


4 UIC, op. cit. note 1.

5 Calculated from ibid. and from UIC, op. cit. note 2.

6 UIC, op. cit. note 1. A time series from 1980 comparable to that for passenger rail is not available due to gaps in World Bank data, which render the resulting global numbers incompatible with UIC data.


8 UIC, op. cit. note 2.

9 Ibid.

10 UIC, op. cit. note 1.


13 Ibid.

14 UIC, op. cit. note 1.


17 UIC, op. cit. note 1.

18 Ibid.

19 Ibid.

20 Ibid.

21 UIC, op. cit. note 15.

22 Calculated from UIC, op. cit. note 1, and from UIC, op. cit. note 7.

23 Calculated from UIC, op. cit. note 1, and from UIC, op. cit. note 7. Europe’s share includes Russia.

24 UIC, op. cit. note 1.

25 Calculated from UIC, op. cit. note 1, and from UIC, op. cit. note 7.

26 Calculated from UIC, op. cit. note 1, and from UIC, op. cit. note 7.

27 UIC, op. cit. note 1.

28 Calculated from UIC, op. cit. note 1, and from UIC, op. cit. note 7.

29 Calculated from UIC, op. cit. note 1, and from UIC, op. cit. note 7.


31 Calculated from UIC, op. cit. note 1.

32 UIC, op. cit. note 1.

33 Ibid.

34 Ibid.

35 Calculated from Ibid, and from UIC, op. cit. note 2.

36 UIC, op. cit. note 1.

37 Ibid.

38 Davis et al., op. cit. note 12, Table 2-12.

39 Ibid., Table 2-15.


41 Ibid.

42 Ibid.