

# 3.5

# Passenger and Freight Railways



(Note: The focus of this section is on long-distance passenger and freight railways; for a discussion of urban rail systems, see Section 3.4 on Urban Passenger and Freight Transport.)

## Key findings



### Demand trends

- Global passenger rail activity grew 6% between 2016 and 2018, to 4 billion passenger-kilometres.
- The share of high-speed rail in global inter-city passenger rail activity doubled between 2010 and 2019, rising from 10% to 20%.
- Although high-speed rail accounts for only 2% of the global rail network, it transports one-quarter of all rail passengers. For distances up to 1,200 kilometres, high-speed rail competes with air transport.
- Rail freight activity increased 12% between 2010 and 2018, reaching a total of 11 trillion tonne-kilometres.



### Emission trends

- The carbon intensity of rail transport dropped to around 14 grams of carbon dioxide (CO<sub>2</sub>) equivalent per passenger-kilometre in 2019, less than one-tenth of the energy consumed by larger cars or airplanes.
- The share of electrified railways worldwide increased from 36.7% in 2015 to 40.2% in 2019. In 2020, three-quarters of passenger rail activity was on electrified systems, up from 60% in 2000.

- Nearly one-quarter of the electricity used to power electric trains is estimated to come from renewable sources, which supplied 9% of total global rail energy in 2015 (latest available data).
- Shifting from air travel to high-speed rail produces 3.4 times less pollution and uses 80-90% less energy.
- Scaling up the use of fuels such as green hydrogen can increase the efficiency of passenger and freight railways.



### Policy measures

- Ambitious national rail investment programmes are reinvigorating passenger and freight rail systems, with significant investments in emerging economies in Asia and Latin America.
- New and expanding high-speed rail services in the Global South are outpacing investments in the Global North.
- As of 2020, there were 29 railway projects under China's Belt and Road Initiative, which aims to promote infrastructure across Africa, Asia and Europe; this has catalysed an increase in cross-border rail investments to accelerate economic integration.

- A shift from air travel to high-speed rail could displace 21% of domestic and international flights in North America, 10% of domestic flights in Europe and 9% of domestic flights in Latin America.

### Impacts of the COVID-19 pandemic

- Passenger rail demand fell an estimated 8% during the first six months of 2020, while freight rail demand stayed at similar levels in all regions.
- In the first six months of 2020, the rail sector lost an estimated USD 36 billion globally due to the pandemic.
- Passenger rail demand is expected to recover steadily from COVID-19 impacts, with global average annual growth of 2.3% projected through 2025.
- Several national governments have announced plans to implement recovery measures to support and prioritise the competitiveness of railways.
- Around one-third of transport spending in recovery packages in G20 countries is allocated to green investment (USD 103 billion), with 26% of this amount for rail, exceeding investment in electric vehicles and alternative fuels (18%) and airlines and ports (13%).

## Demand trends



Global passenger rail activity grew 6% between 2016 and 2018, to 4 billion passenger-kilometres (see Figure 1).<sup>6</sup> Asia and Europe accounted for the vast majority (95%) of passenger rail activity in 2018, and passenger rail grew 33% and 9%, respectively, in these regions from 2010 to 2018.<sup>7</sup>

The state rail agency in **Bangladesh** received its highest ever allocation in the 2019-2020 fiscal year, launching new direct services from Dhaka to Benapole, Rajshahi and Siliguri.<sup>8</sup>

In **India**, the Vande Bharat Express, a semi-high-speed train operating from Delhi to Varanasi, was launched in 2019, and the Ahmedabad-Mumbai Tejas Express line was launched in 2020.<sup>9</sup>

- The first express train service in **Senegal** – a railway connection between Dakar city centre and the country's largest airport, Blaise Diagne International Airport – was launched in 2016 and was expected to start operation in 2021.<sup>10</sup> The line will provide both passenger and freight service.<sup>11</sup>
- The passenger rail operator Amtrak in the **USA** registered a 2.5% increase in ridership during the 2019 financial year, to a record 32.5 million passenger trips.<sup>12</sup>

## Overview



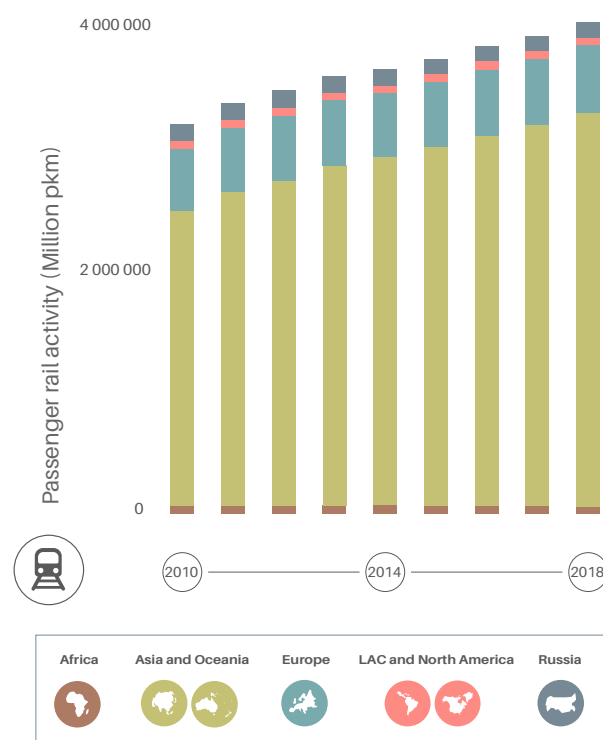
Passenger railways are a backbone of long-distance mobility networks, providing commuter, regional and inter-city services across different regions of the world. Demand for long-distance passenger rail is growing in many countries, driven by the rapid development of high-speed rail globally.<sup>1</sup> This trend is expected to increase with emerging investments in high-speed rail networks in Africa, Asia and the Middle East.

Freight railways are a key driver of global trade and regional economic activity.<sup>2</sup> Rail freight is more cost effective per tonne-kilometre than road freight and causes fewer traffic fatalities and less noise pollution.<sup>3</sup> Railways facilitate inter-modal freight, providing efficient transport for the bulk of a trip and then allowing more flexible transport modes, such as trucks and cargo bikes, to complete deliveries to a final destination.

Railways are the most energy efficient means of long-distance passenger and freight transport on land. Although railways carry 8% of the world's passengers and 8% of global freight tonnes, they account for only 3% of total transport energy demand and produce only 0.3% of global direct CO<sub>2</sub> emissions.<sup>4</sup>

The COVID-19 pandemic led to strong reductions in rail passengers and rail freight in the first six months of 2020, but recovery packages support the modernisation of railways and a shift from air travel to railways (see Box 1).<sup>5</sup>

Figure 1. Passenger rail activity by region, 2010-2018



Source: See endnote 6 for this section.

The share of high-speed rail in global inter-city passenger rail activity doubled between 2010 and 2019, rising from 10% to 20%.<sup>13</sup> This growth was driven largely by increased high-speed rail activity in China and to the introduction and expansion of high-speed rail service in several other countries (see Figure 2, and Policy Measures section below).<sup>14</sup>

Although high-speed rail accounts for only 2% of the global rail network, it transports one-quarter of all rail passengers.<sup>15</sup> For distances up to 1,200 kilometres, high-speed rail competes with air transport.

- In China, 1 billion people travel by high-speed rail each year, more than double the country's 415 million domestic aviation passengers.<sup>16</sup>
- In 2018, Morocco inaugurated the 323-kilometre Al-Boraq high-speed rail line between Casablanca and Tangier, cutting travel time by more than half.<sup>17</sup> The project is the first high-speed rail in Africa and is part of a broader plan to connect Morocco's north and south via a 1,314-kilometre high-speed line.<sup>18</sup>
- In 2018, Saudi Arabia became the first Arab country to develop high-speed rail, as part of the country's 2030 vision to boost socio-economic development and relieve roadway congestion.<sup>19</sup>

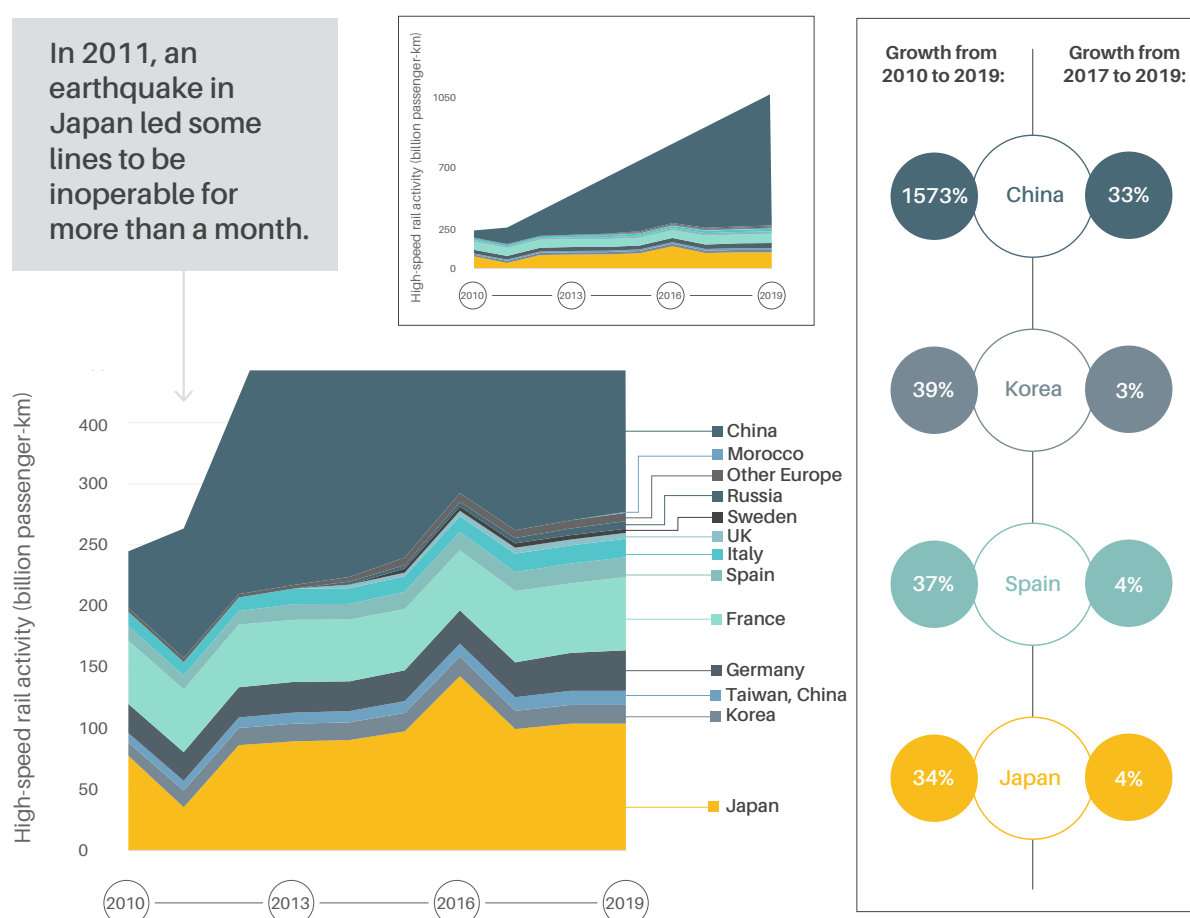
Its 449-kilometre high-speed line connects Jeddah, Mecca and Medina, with a capacity of 60 million passengers per year and a travel speed of 300 kilometres per hour.<sup>20</sup>

- Alongside its 594 kilometres of existing high-speed rail, Turkey is developing 16 new lines to connect major cities in a 1,652-kilometre network by 2023.<sup>21</sup> It is planning more than 30 new high-speed rail lines, for a total of 7,419 kilometres, and completed tests in 2020 on the 393-kilometre Ankara-Sivas line, expected to be operational in late 2021.<sup>22</sup>

Rail freight activity increased 12% between 2010 and 2018, reaching a total of 11 trillion tonne-kilometres.<sup>23</sup> Rail accounts for 60% of freight activity in the Russian Federation, 55% in the USA, and 50% in China, while in Europe the rail share of freight has stagnated at around 18%.<sup>24</sup> Regionally, rail freight activity is driven primarily by Asia and Oceania, and by Latin America and North America (see Figure 3).<sup>25</sup>

- In 2019, Brazil set a target to double the share of its freight moved by rail from 15% in 2019 to 31% in 2025.<sup>26</sup>
- India has set a target to move 70% of goods by rail along an 8,325 kilometre freight rail network being developed by the

**Figure 2.** Development of high-speed rail by country, 2010-2019

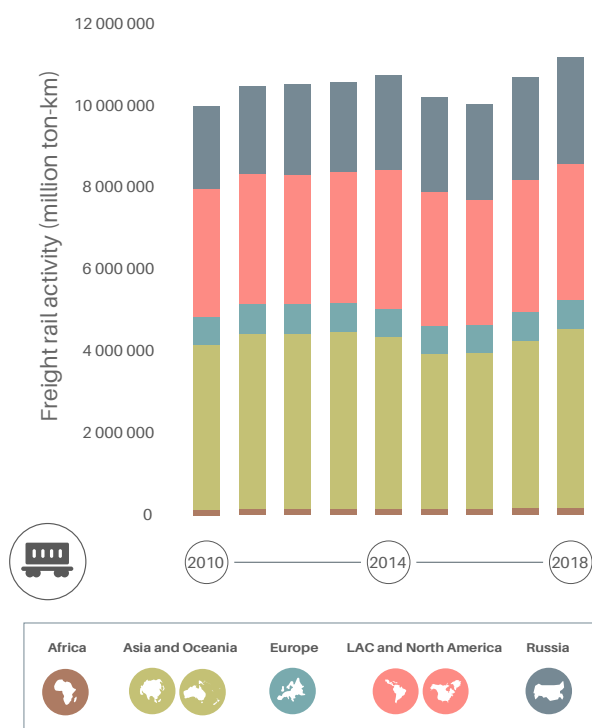


Source: See endnote 14 for this section.

Dedicated Freight Corridor Corporation of India.<sup>27</sup> As of mid-2020, the eastern corridor of the project was 60% complete and the western corridor was 55% complete.<sup>28</sup>

- in 2019, Kenya inaugurated the second phase of the 120-kilometre Nairobi-Naivasha railway, along with a standard-gauge rail connection to the Naivasha container terminal.<sup>29</sup>

**Figure 3.** Freight rail activity by region, 2010-2018



Source: See endnote 25 for this section.

## Emission trends



The carbon intensity of rail transport dropped to around 14 grams of CO<sub>2</sub> equivalent per passenger-kilometre in 2019, less than one-tenth of the energy consumed by larger cars or airplanes.<sup>30</sup> Since 1990, rail's energy use has improved 37% per passenger-kilometre and its CO<sub>2</sub> emission intensity has improved 30% per passenger-kilometre.<sup>31</sup>

The share of electrified railways worldwide increased from 36.7% in 2015 to 40.2% in 2019.<sup>32</sup> In 2020, three-quarters of passenger rail activity was on electrified systems, up from 60% in 2000.<sup>33</sup> Railways have the highest share of electrification among all transport modes and can help to drive transport decarbonisation if rail electricity is increasingly generated from renewable sources.<sup>34</sup>

- In 2019, India's Cabinet Committee on Economic Affairs approved the complete electrification of the country's railway network, which will reduce CO<sub>2</sub> emissions and lower fossil fuel costs.<sup>35</sup>
- Latvia invested EUR 318.5 million (USD 378 million) in 2019 through the European Union Cohesion Fund, to electrify 308 kilometres of the country's main east-west railway network.<sup>36</sup>
- In 2019, Scotland (UK) committed to transitioning to a zero-emission railway network by 2035 through continued electrification of its network, using battery-powered trains and exploring the potential of hydrogen-powered trains.<sup>37</sup>
- The UK has detailed a strategy to phase out all purely diesel trains by 2040.<sup>38</sup>

Nearly one-quarter of the electricity used to power electric trains is estimated to come from renewable sources, which supplied 9% of total global rail energy in 2015 (latest available data).<sup>39</sup> From 2005 to 2015, the share of diesel in total rail energy use fell from 62% to 56%, while the share of electricity from renewable sources increased 66%.<sup>40</sup>

- China and the Russia Federation each derived 12% of their rail energy from renewables in 2015; however, the share of nuclear energy used to power railways in the Russian Federation exceeded that in China by nearly 10 times (13.3% versus 1.4%).<sup>41</sup>
- In the EU, the share of renewables in rail sector electricity more than tripled between 2005 and 2015, increasing from 6% to 21%.<sup>42</sup>
- Electricity generation from nuclear power in Japan dropped sharply after the 2011 Fukushima accident (from 25% in 2010 to 1% in 2015) and was replaced primarily by natural gas.<sup>43</sup> As a result, rail's share of transport CO<sub>2</sub> emissions in Japan rose from 4.2% in 2010 to 5.0% in 2015.<sup>44</sup>

Shifting from air travel to high-speed rail produces 3.4 times less pollution and uses 80-90% less energy.<sup>45</sup> Rail produces fewer emissions of nitrogen oxides and particulate matter than aviation.<sup>46</sup> Rail also has a lower emission impact than aviation due to its smaller infrastructure footprint and its ability to transport passengers directly to city centres, allowing shorter distances and more sustainable travel options (e.g., urban rail, walking) to reach final destinations.<sup>47</sup>

Scaling up the use of fuels such as green hydrogen can increase the efficiency of passenger and freight railways. Green hydrogen can be generated from surplus renewable energy generation to create a lower-carbon rail transport sector and contribute to economy-wide emission reduction targets. A shift to green hydrogen can also contribute to cleaner air, job creation and energy security, but it must overcome substantial cost barriers to achieve broad market penetration in the railway sector.<sup>48</sup>

- In 2019, France's rail operator SNCF ordered 15 hydrogen-powered train cars to replace diesel versions.<sup>49</sup>
- The Netherlands started operation of hydrogen fuel cell-powered passenger trains in 2019.<sup>50</sup>



## Policy measures

Ambitious national rail investment programmes are reinvigorating passenger and freight rail systems, with significant investments in emerging economies in Asia and Latin America. Railway infrastructure is underdeveloped in many emerging economies. Enhanced rail investments are being driven by greater co-ordination among regional entities and national governments, supported by public-private partnerships.<sup>51</sup>

- In 2019, **Chile** developed the largest railway investment in its history. The country aims to triple passenger rail trips to 150 million annually by 2027 and to double freight rail volumes to more than 21 million tonnes annually, through 25 rail projects and 1,000 kilometres of rail lines.<sup>52</sup>
- **Costa Rica** plans to revitalise its railway system by upgrading infrastructure, introducing electrified trains in the Metropolitan Area of San José, adding freight service to Limón and establishing new rail lines to the Pacific coast by 2023.<sup>53</sup>
- In 2018, **Sri Lanka** started a 20-year railway development strategy, with strong public support, to overcome road delays and benefit from the lower cost of rail compared to bus services.<sup>54</sup>
- **Turkey** kicked off a strategic plan in 2020 that includes planning new rail lines, rehabilitating and electrifying existing rail lines, establishing rail-served logistics centres and developing domestic supply chains.<sup>55</sup>

New and expanding high-speed rail services in the Global South are outpacing investments in the Global North. Several emerging economies in Asia, Africa and the Middle East are initiating the development of high-speed rail lines to reinforce their transport systems, mitigate traffic and reduce emissions.

- **China** continued to expand its high-speed rail network, opening more than 50 new lines between 2018 and 2020 for a total length of 35,388 kilometres, with another 5,250 kilometres under construction.<sup>56</sup>
- Recent high-speed rail developments in **India** (4,634 kilometres of lines), **South Africa** (2,390 kilometres) and **Egypt** (1,210 kilometres) are doubling existing infrastructure in these countries and making significant contributions to the global high-speed rail market.<sup>57</sup>
- Two high-speed rail lines under construction in **Iran**, connecting Tehran to Isfahan and to Mashhad, are expected to be completed in 2021 and 2022, respectively. These lines are part of a planned 3,104-kilometre network of seven lines to be developed by the end of the decade.<sup>58</sup>

As of 2020, there were 29 railway projects under China's Belt and Road Initiative, which aims to promote infrastructure across Africa,

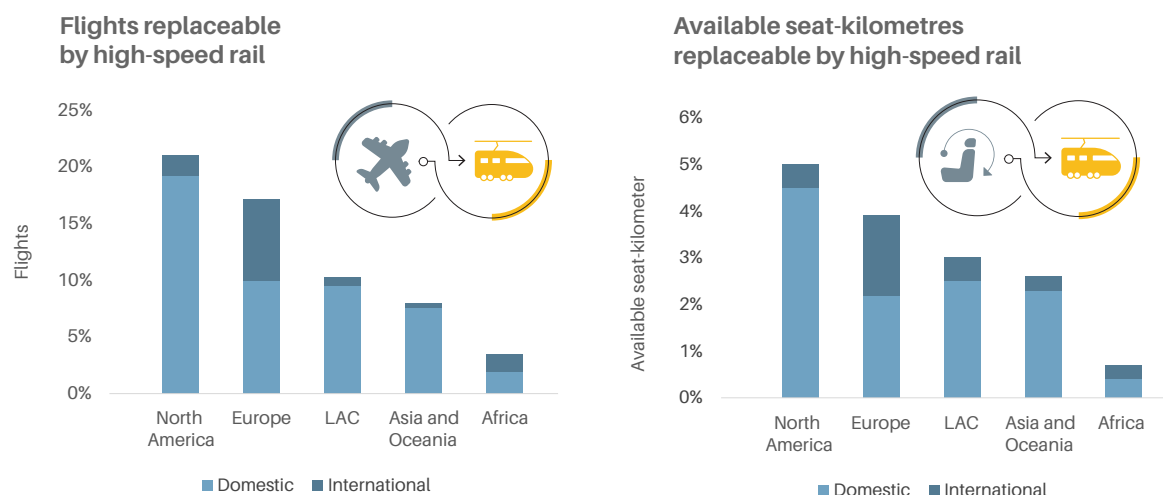
Asia and Europe; this has catalysed an increase in cross-border rail investments to accelerate economic integration.<sup>59</sup> Historically, countries have adopted different track gauge standards and electrification and traffic management systems, which create barriers to the competitiveness of passenger and freight rail against other transport modes. International co-operation within rail programmes can establish standards to increase capacity, efficiency and economic activity.

- In 2019, **Indonesia** signed a USD 4.3 billion agreement with Japan to develop a medium-speed train project to link Jakarta and Surabaya, covering 715 kilometres.<sup>60</sup>
- **Jordan** plans to develop a 1,000-kilometre railway network in four phases, resulting in railway connections with China and Europe.<sup>61</sup>
- In **Nigeria**, the 157-kilometre Lagos-to-Ibadan standard-gauge rail line entered into service in April 2020, following the government's acquisition of the service from China.<sup>62</sup>
- In 2019, **Pakistan** began construction of the Main Line-1, a flagship project and strategic initiative under the China-Pakistan Economic Corridor, at an estimated cost of USD 8.2 billion over five years.<sup>63</sup>
- The first freight train on the 8,693-kilometre **China-Turkey** corridor, part of the Belt and Road Initiative, departed on a 12-day journey in December 2020.<sup>64</sup>

A shift from air travel to high-speed rail could displace 21% of domestic and international flights in North America, 10% of domestic flights in Europe and 9% of domestic flights in Latin America (see Figure 4).<sup>65</sup> Several European countries have seen reductions in flight volumes (e.g., **Sweden**) and increases in overnight train activity (e.g., **Austria**), with the **Netherlands** observing both trends in tandem (see Section 3.9 on Aviation).<sup>66</sup>

- The first night train in **Austria** since 2003 started operation in 2020 by Austrian Railways OBB, travelling from Vienna to Brussels.<sup>67</sup>
- To reduce carbon emissions, **France** has banned short domestic flights that can be feasibly replaced with rail journeys.<sup>68</sup>
- In the **UK**, in the 12 months to July 2019, 29% of passengers chose to travel with Virgin Trains as opposed to flying between Glasgow and London, the country's second busiest domestic air route.<sup>69</sup>
- Carbon savings from shifting air travel to rail between **Glasgow** and **London** between 2005 and 2015 was equivalent to taking 145,000 cars off the road for a year.<sup>70</sup>

**Figure 4.** Potential of high-speed rail to displace air travel, by region



Source: See endnote 65 for this section.

## Box 1. Impacts of the COVID-19 pandemic on rail

Passenger rail demand fell an estimated 8% during the first six months of 2020, while freight rail demand stayed at similar levels in all regions. Passenger activity in the first half of 2020 dropped 55% in Spain, 52% in France, 48% in the European Union (EU), and 42% in the Russian Federation and Germany compared to the same months in 2019. Freight rail activity stayed level across regions.

In the first six months of 2020, the rail sector lost an estimated USD 36 billion globally due to the pandemic. Passenger and freight rail are projected to lose USD 125 billion in total revenue for 2020 and 2021, with passenger rail suffering a higher loss than freight rail, at USD 78 billion. For 2020, 53% of the revenue loss for passenger rail was in Asia and 44% in Europe.

Passenger rail demand is expected to recover steadily from COVID-19 impacts, with global average annual growth of 2.3% projected through 2025. A shift from air travel to train travel is anticipated in the post-COVID-19 period. In Europe, the high-speed rail sector is projected to see compound annual growth of more than 10% in the medium term.

Several national governments have announced plans to implement recovery measures to support and prioritise the competitiveness of railways. Restoring rail activity

in the post-pandemic period requires governmental economic support, and many rail agencies have expressed a preference for direct financial support. Other possible options are decreased access charges, elimination of value-added tax (VAT) and other taxes, and guarantee loans.

- In France, as part of its recovery package, the government banned short-haul domestic air travel on routes that have a journey time of 2.5 hours or less on rail.
- Germany will spend EUR 500 million (USD 610 million) to replace older passenger and freight rail systems with the newest digital interlocking technology to increasing railway capacity, punctuality and reliability.
- The USA proposes to invest USD 80 billion to improve, modernise and expand its passenger rail network, and to increase the safety, efficiency and electrification of passenger and freight rail.

Around one-third of transport spending in recovery packages in G20 countries is allocated to green investment (USD 103 billion), with 26% of this amount for rail, exceeding investment in electric vehicles and alternative fuels (18%) and airlines and ports (13%). (For more on transport investment in COVID-19 recovery packages, see Section 4 on Financing.)

Source: See endnote 5 for this section.



## Initiatives supporting railways

- The International Union of Railways (UIC) Low Carbon Sustainable Rail Transport Challenge sets ambitious targets to improve the energy efficiency of the rail sector, reduce greenhouse gas emissions and achieve a more sustainable balance among transport modes.<sup>71</sup> The Challenge is supported by UIC's 240-member railway companies based in 95 countries. In 2015, more than 70 UIC members signed a Climate Responsibility Pledge, which was updated in 2019 with more ambitious targets and had more than 30 signatories as of November 2020.<sup>72</sup>
- Shift2Rail contributes to smart and sustainable growth by fostering research and innovation in Europe's railway sector. The purpose is to achieve a Single European Railway Area, to enhance the attractiveness and competitiveness of the European railway system to ensure a shift from roads towards rail, and to sustain the leadership of the European rail industry on the global market.<sup>73</sup>
- Rail Freight Forward is a coalition of European rail freight companies that are committed to drastically reducing the negative impact of freight transport on the planet and mobility, through innovation and a more intelligent transport mix. The coalition had 18 members as of November 2020 and aims to increase the modal share of rail freight in Europe from 18% in 2020 to 30% by 2030 as the macro-economic "better solution" for European growth.<sup>74</sup>
- The European Commission established the European Year of Rail 2021 to support delivery of the EU's European Green Deal objectives in the transport field. The project includes a series of events, campaigns and initiatives in 2021 to promote rail as a sustainable, innovative and safe mode of transport, highlighting its benefits for people, the economy and the climate and focusing on the remaining challenges to create a Single European Rail Area without borders.<sup>75</sup>



## Key indicators

	2017*	2019*	% change
<b>Policy Landscape Indicators</b>			
Countries with targets for railway mode shift (# of countries)	N/A	37	–
<b>Market Development Indicators</b>			
Rail passenger activity (million passenger-kilometres)	3,864,406 (2016)	4,068,548 (2018)	+6%
High-speed rail activity (billion passenger-kilometres)	704	1,051	+39%
Rail freight activity (million tonne-kilometres)	10,046,221 (2016)	11,190,112 (2018)	+11%
Rail network length (kilometres)	1,131,101 (2016)	1,142,891 (2018)	+1%
High-speed rail length (kilometres)	59,366 (2016)	65,812	+11%
Railway electrification share	36.7% (2018)	40.2%	+10%
Passenger rail energy intensity (grams of CO <sub>2</sub> per passenger-kilometre)	17.61 (2015)	14 (2018)	-20%

(\*) Data are for the indicated year unless noted otherwise.

Source: See endnote 76 for this section.

## In Practice: Additional Policy Measures



### Policy targets set

#### Rail expansion

- A high-speed train service is envisioned to operate in Bangladesh starting in 2022, spanning 320 kilometres between Dhaka and Chittagon.<sup>77</sup>
- Several rail projects were approved in Ghana in 2019 and 2020, including construction of the 340-kilometre double-track electrified standard-gauge eastern railway connecting Accra, Koforidua, Kumasi and Tema; the Accra-Nsawam railway; and the Tema-Mpatadan railway.<sup>78</sup>
- In 2019, Nigeria awarded a USD 3.9 billion public-private partnership contract for the new Abuja-Itakpe-Lokoja rail line.<sup>79</sup>



### Policy measures implemented

#### National rail expansion

- In 2018, Ethiopia finalised the Addis-Ababa-Djibouti Railway line, an electric railway system that reduces the travel time between the port of Djibouti and the capital from 84 hours to 10 hours.<sup>80</sup>
- Pakistan launched 10 new passenger trains and 2 freight trains in 2018, between the cities of Karachi and Peshawar.<sup>81</sup>
- In Thailand, the rail link between Bangkok and Pattaya was approved in 2019.<sup>82</sup>
- In Nigeria, 44 new coaches were deployed in 2020 on the 186.5-kilometre Abuja-Kaduna rail corridor.<sup>83</sup>



# Annex: Methodological Note

## Data usage

### Time period for data:

The report strives to utilise the most recent publicly available data and information just prior to the time of publication (as of 31 May 2021). The figures in the report were developed between September and December 2020 using the most recent data available.

### Secondary data:

SLOCAT relies on secondary data and information collected and provided by SLOCAT partners and other entities and does not make use of any internal modelling tools.

### Data on sustainable mobility: A call to action

The report benefits directly from data collected by a wide range of stakeholders working in different areas of transport.

Data are important for providing a comprehensive picture of the status of sustainable, low carbon transport and are essential for both policy and investment decision making. In these times of change, it is critical to upgrade data and policy collection and interpretation capacities to better understand progress and the hurdles that must be addressed.

The data limitations mentioned below are not new. Obtaining regular, reliable and public data across regions and transport modes remains an outstanding issue. When an increasing number of stakeholders are collecting data and policy information, more and better open-access data and capacity building efforts for data interpretation are supported by many multi-stakeholder partnerships in the sustainable, low carbon movement.

If you share our passion for open-access data and knowledge towards greater impact on policy and investment decision making worldwide and/or would like to contribute data or knowledge to our collective efforts on this report, **please reach out to the research team in the SLOCAT Secretariat at [tcc-gsr@slocatpartnership.org](mailto:tcc-gsr@slocatpartnership.org)**.

### Specific data used in this report

#### Data on emissions

The data in this edition of the report point to the direct carbon emissions from transport activity; they do not cover the indirect emissions and land-use impacts associated with certain modes of transport. The report primarily utilises CO<sub>2</sub> emission data compiled in the Emissions Database for Global Atmospheric Research (EDGAR) from the Joint Research Centre of the European Commission, as this represents the most recent, comprehensive dataset on transport CO<sub>2</sub> emissions. However, this global dataset does not convey in full detail the unique situations of individual countries.

EDGAR provides estimates for fossil CO<sub>2</sub> emissions from all anthropogenic activities with the exception of land use, land-use change, forestry and the large-scale burning of biomass. The main activities covered are CO<sub>2</sub> emissions emitted by the power sector (i.e., power and heat generation plants), by other industrial combustion (i.e., combustion for industrial manufacturing and fuel production) and by buildings and other activities such as industrial process emissions, agricultural soils and waste. Transport activities covered within EDGAR include road transport, non-road transport, domestic aviation, and inland waterways on a country level, as well as international aviation and shipping.<sup>1</sup>

For the world, regions and countries, the CO<sub>2</sub> emission data (provided by EDGAR) span through 2019. In a few places in the report, CO<sub>2</sub> data for 2020 are shown to illustrate the impact of the COVID-19 pandemic; however, these data are based on a different methodology than the EDGAR dataset and should not be compared directly with the data from previous years.

The latest CO<sub>2</sub> emission data for individual transport modes are for 2018 and have been compiled only at the global level. For passenger and freight transport, the data on global CO<sub>2</sub> emissions are for 2017, as this is the latest year with robust data. Data on passenger activity (passenger-kilometres) and freight activity (tonne-kilometres) – provided mainly in the country fact sheets – are based on the latest available year, as indicated in the report analysis.

Information on greenhouse gas emissions – provided in CO<sub>2</sub> equivalent (CO<sub>2eq</sub>) – include not only CO<sub>2</sub> but also methane, nitrous oxide, and industrial gases such as hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride and nitrogen trifluoride.<sup>2</sup> These data are less up-to-date. As of 31 May 2021, data on greenhouse gas emissions were not readily available for the period 2019-2020. In some cases, additional data sources were used to provide detailed information about other climate pollutants besides CO<sub>2</sub>.

All data on CO<sub>2</sub> and other greenhouse gas emissions, as well as CO<sub>2eq</sub> are provided in metric tonnes.

### Data on car ownership

Information on car ownership rates is based on a global dataset from the International Organization of Motor Vehicle Manufacturers (OICA), with the latest release (as of 31 May 2021) dating from 2015.<sup>3</sup> Although newer information is available for some individual countries, using these data would hinder accurate global comparisons. Data on passenger and commercial vehicle sales were available only up to 2019.

### Policy landscape data

The policy-related information presented in this report is not intended to be comprehensive. The data for the policy landscape indicators provided in Section 3 were gathered through desk research unless otherwise indicated. Barriers to accessing such information include language and limited availability of information through online media (e.g., websites, press releases and news articles).

### Data in country fact sheets

Information in the fact sheets is based on desk research and on contributions from the national focal points. The data were collected to the best of the authors' knowledge and based on data availability, and thus may not be complete or show the most recent status. When no information was available for a given indicator, the term "Not available" is used.

### Data gaps

Major data gaps exist in areas where there is no globally accepted data collection methodology. For example, the mapping of cycling and walking infrastructure is not currently done in all regions. Also, the modal share can be surveyed through different methods, leading to inconsistencies in available data. In addition, data on paratransit (informal transport), a predominant form of transport in many parts of the world, are largely lacking. This results in an incomplete picture of the impact of transport on climate change and sustainable development.

## Methodological approach

### Countries and regions

The report follows the M49 Standard of the United Nations Statistics Division.<sup>4</sup> In total, 196 countries have official United Nations membership and are also party to the United Nations Framework Convention on Climate Change. The available data have been put in a common structure for the United Nations member countries, regions and income groups to enable a consistent assessment. Income groups are based on the World Bank's classification of 2019.<sup>5</sup>

### Economic calculations

The per capita and gross domestic product (GDP) calculations are based on the United Nations World Population Prospects 2019 and on World Bank GDP data using constant 2010 USD.<sup>6</sup>

### Spatial and temporal scales

The geographic scale (global, national, city-level, etc.) as well as time scale (annual, monthly, daily) used in this report depends largely on the available dataset, as noted in the relevant figures and text. The detailed data forming the basis of the calculations and analysis are provided in the SLOCAT Transport Knowledge Base.<sup>7</sup>

### Criteria for selection

The report covers policies, targets, emission reductions (achieved or envisioned) and market measures. To merit inclusion in the analysis, the policies, projects and trends must have been announced or completed between 2018 and 2020. Significant developments from January through May 2021 were included when deemed relevant, with the understanding that the next edition of the *Transport and Climate Change Global Status Report* will cover a period starting in 2021.

### Pre- and post-COVID-19 pandemic trends

The year 2020 was pivotal for the world, and the COVID-19 pandemic has had substantial impacts on many of the transport trends monitored in this report. This edition attempts to differentiate between long-term trends and impacts due to the pandemic. To the extent possible, the analysis notes "pre-pandemic" (up to the end of 2019 or latest by February 2020) and "during pandemic" trends (starting in March 2020 until the end of 2020), as in some cases the pandemic led to reversals in long-term trends, at least for a specific period of time. In each section, a box describes the impacts that the pandemic has had on specific regions and sub-sectors.

## Assembling the report

### Global Strategy Team

This edition of the report was guided by a global strategy team consisting of 20 experts in the field who provided inputs over the span of six meetings between September 2019 and October 2020. Additionally, small group consultations were organised in February 2021, following the peer review process.

### Authors and contributors

The report was collaboratively drafted by 22 authors and contributors from 16 organisations, led by the SLOCAT Secretariat. This includes additions and high-level inputs from the copy editor and from the special advisor who also co-authored the Executive Summary. Authors researched and compiled relevant facts and figures for the five sections of the report, including the Focus Features, with supporting review and inputs from several other organisations.

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## Annex: Methodological Note

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