

Asian Transport Outlook

Railways in Asia-Pacific

Rail Sector Snapshots through Railway Profiles

MEL EDEN
Asian Transport Outlook

Expert Group Meeting on Transport Connectivity and Logistics
Emerging opportunities and challenges for enhancing rail connectivity along the Trans-Asian Railway network

Apr 30, 2024

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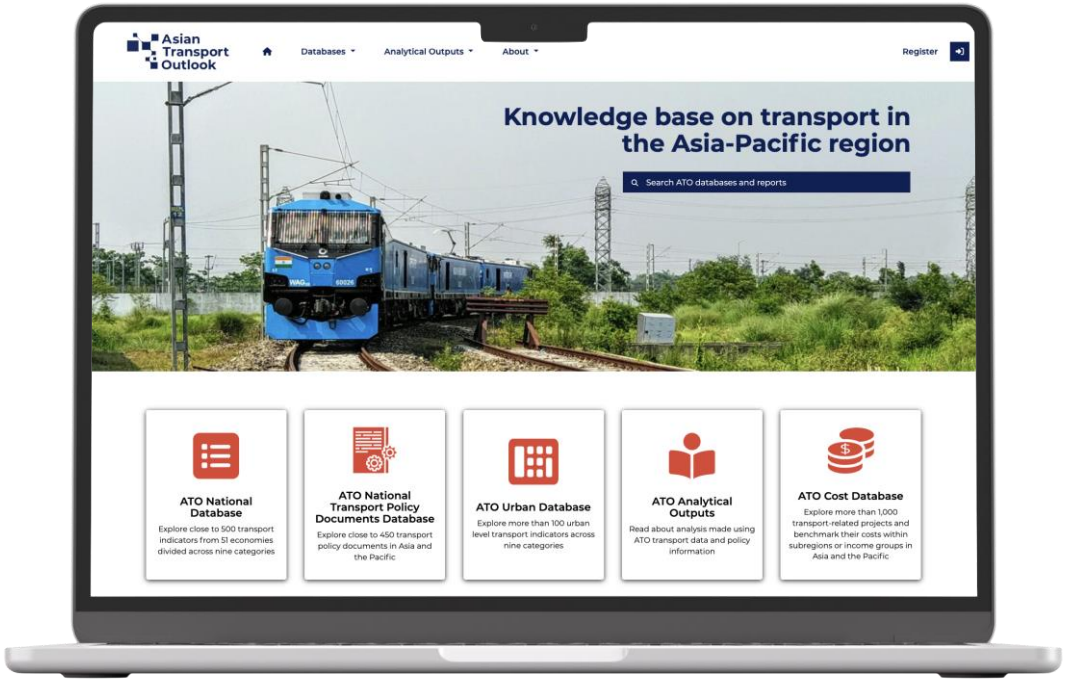

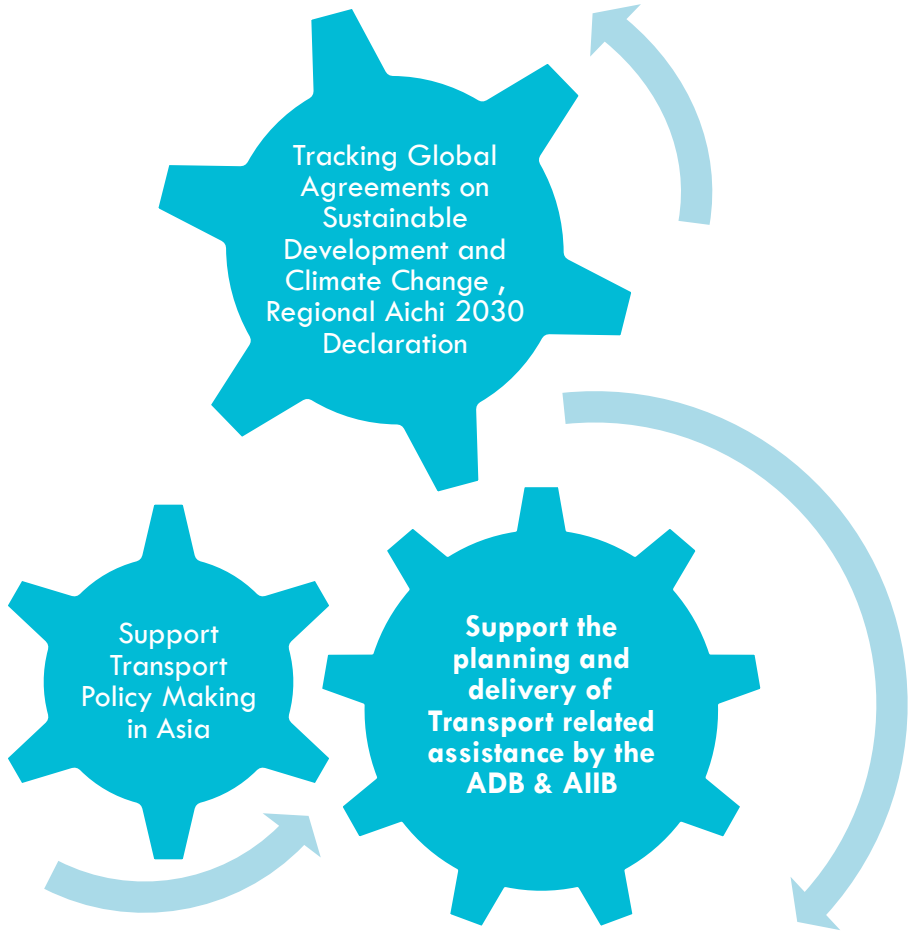

Brainstorming
2019 – 2020

Phase 1
November 2020 – May 2021

Interim Phase
June 2021 – October 2021

Phase 2
November 2021 – November 2022

Phase 3
March 2023 – November 2024

Phase 4 +

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ATO National and Urban Database Indicators





51 Economies (ADB Members + Russia and Iran)

460 Urban Centers (412 Asia-Pacific, 48 International)

46 Urban Centers with a detailed review

410 national indicators,

53% have multi-year data,
45% have 2022 data ,
10% have more than 2 sources,
30% have more than 1 source,

281 urban indicators,

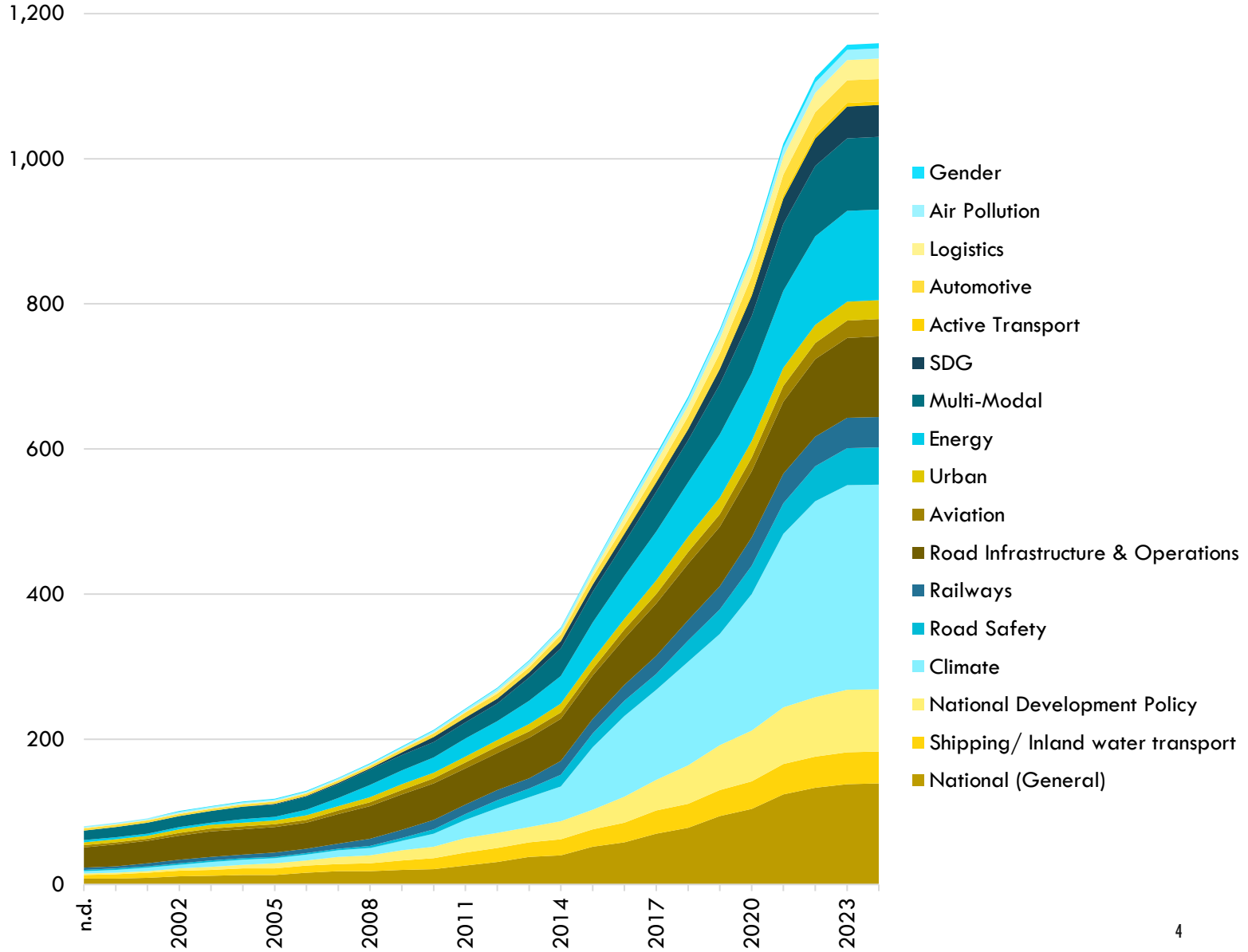
~80% have multi-year data,
~70% have more than 1 source

Asian Transport Outlook

Unpacking of policies, uncovering of insights

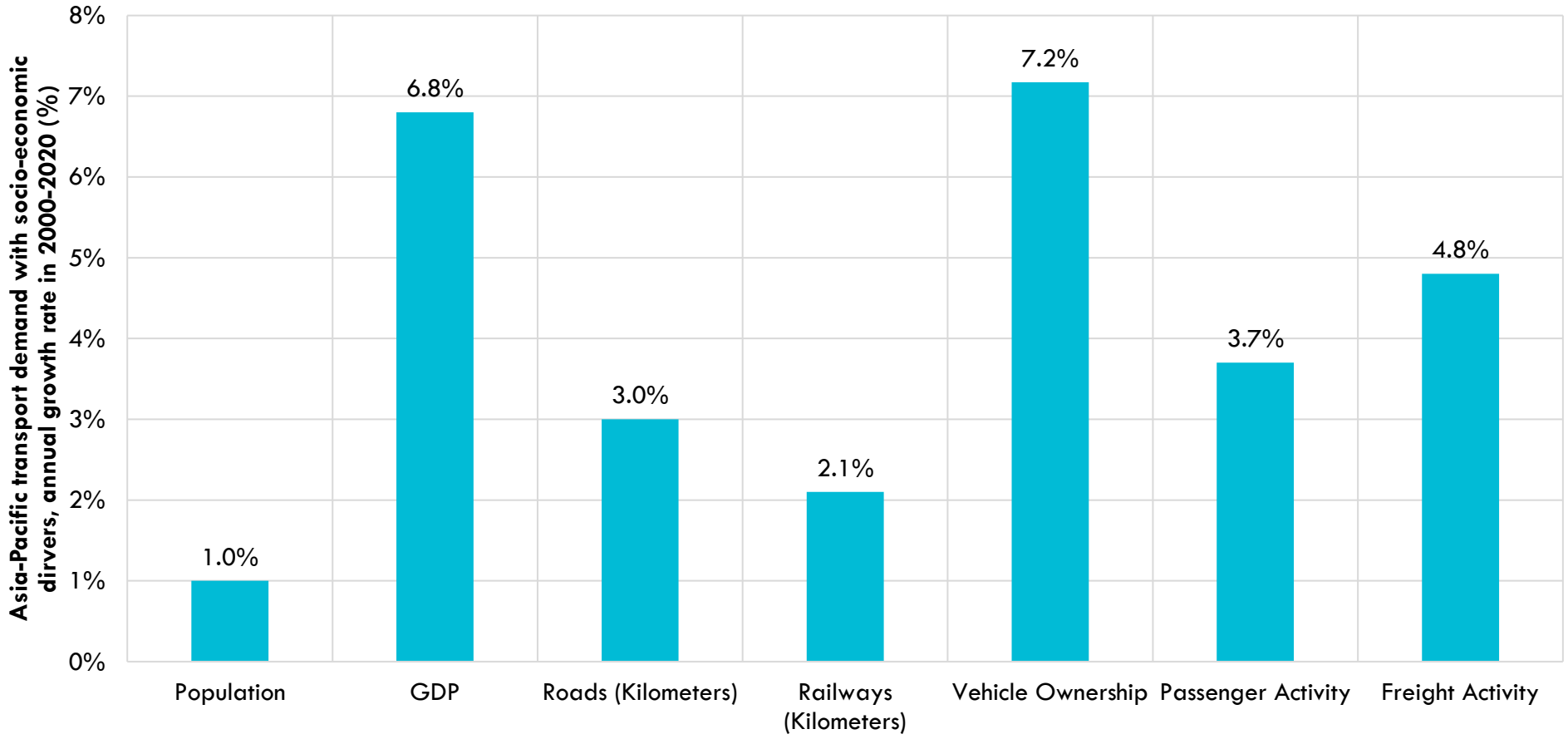
6,000+ total policy measures
Recorded from 500+ policy documents for a sample of 25 economies.

- National development policies,
- National transport policies,
- Transport sub-sector policies,
- NDC/LTS,
- Transport laws, regulations
- Other transport-related policies



Heavy Rail & HSR Growth and the Infrastructure gap

Asia - Pacific added 39% of the global rail infrastructure increase between 2000-2010 and 57% between 2010-2020



2021, Asia - Pacific has 74km rail infrastructure per million population. Europe and North America - 456, Global - 107

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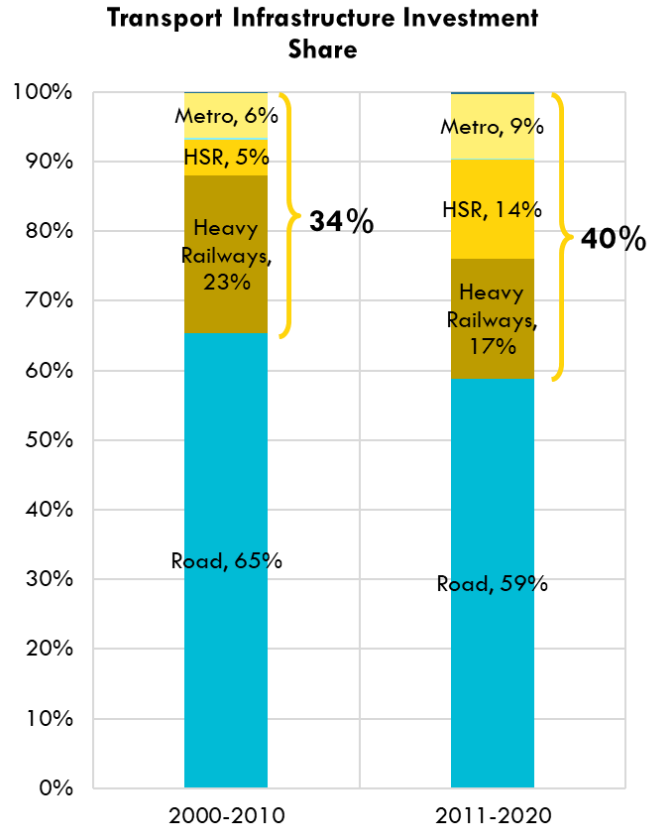
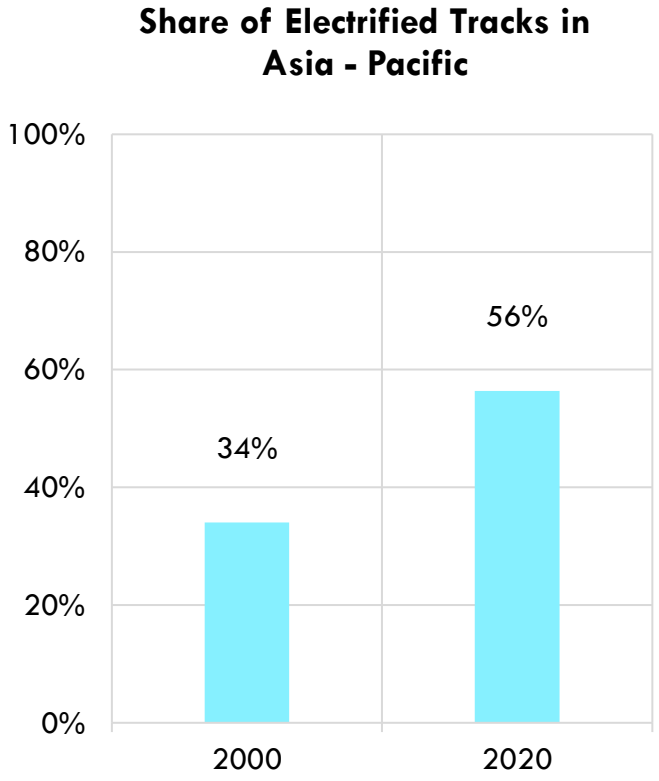
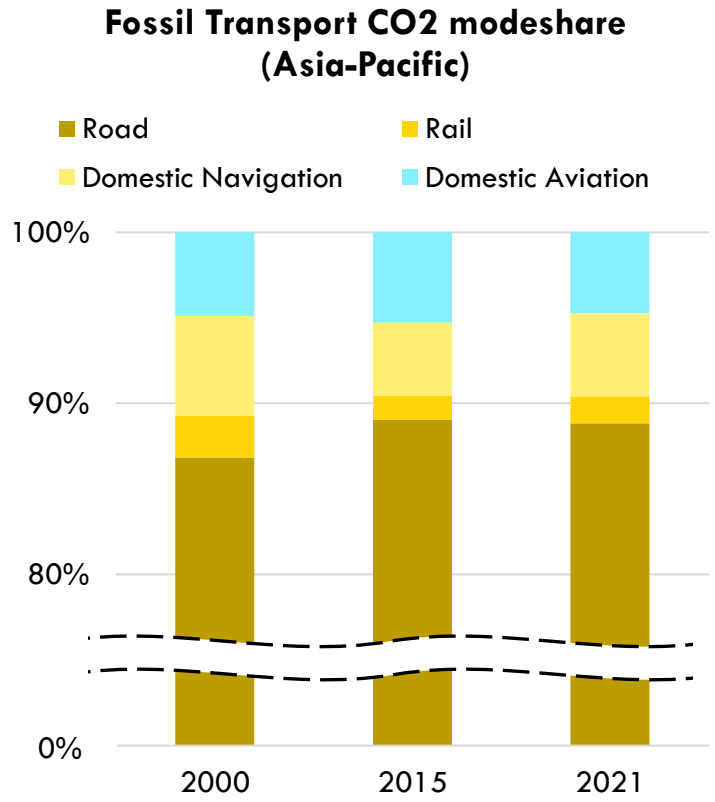
Source: ATO visualization based on UIC, UNStats, World Bank, Country statistics

Transport energy consumption, Rail electrification and CO2 emissions

*In 2018, Asian railways carried **6%** and **16%** of passenger and freight transport demand, but share only **3%** of total transport energy consumption and emitted only **2%** of fossil transport CO2 emissions*







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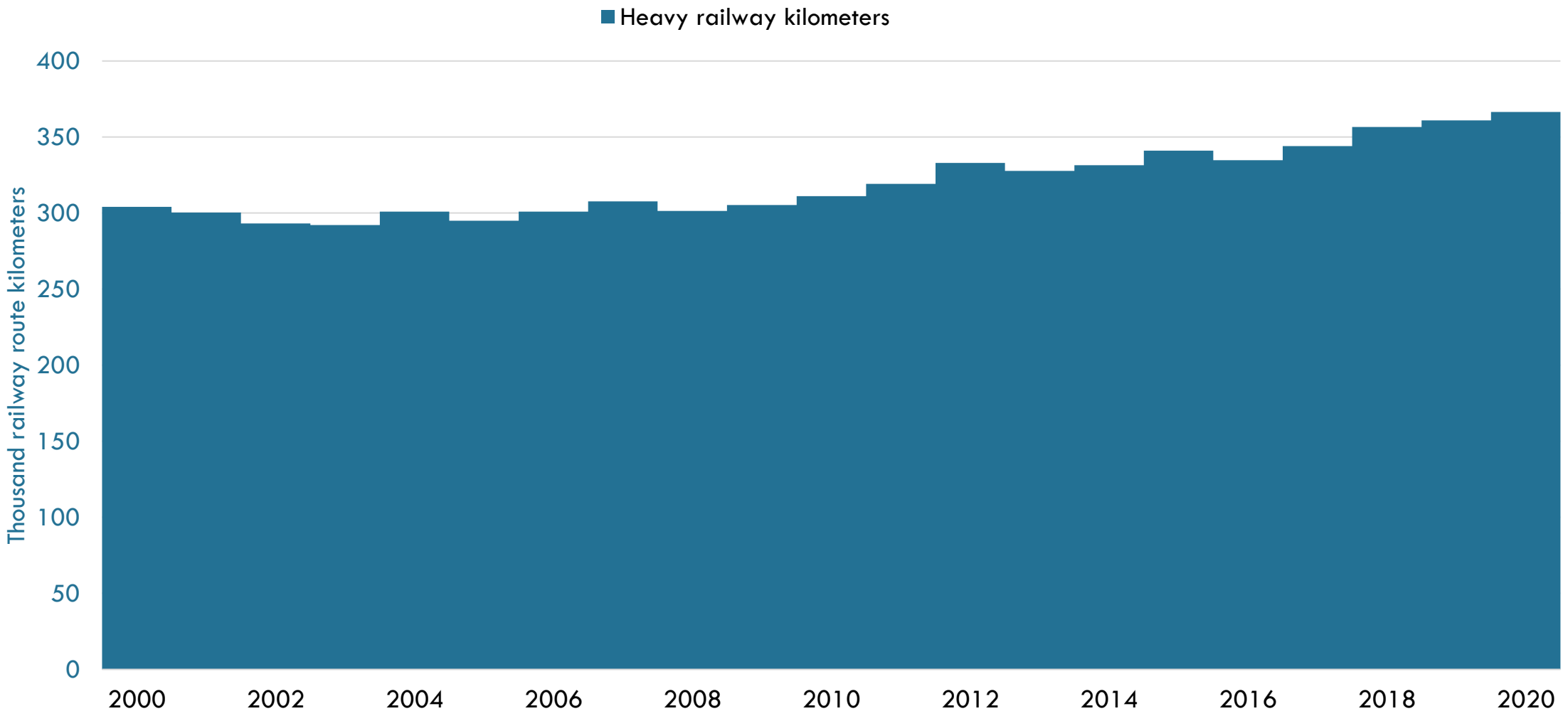
Source: ATO visualisation based on UNStats, Country Stats,World Bank, ITF Outlook, DNV Outlook

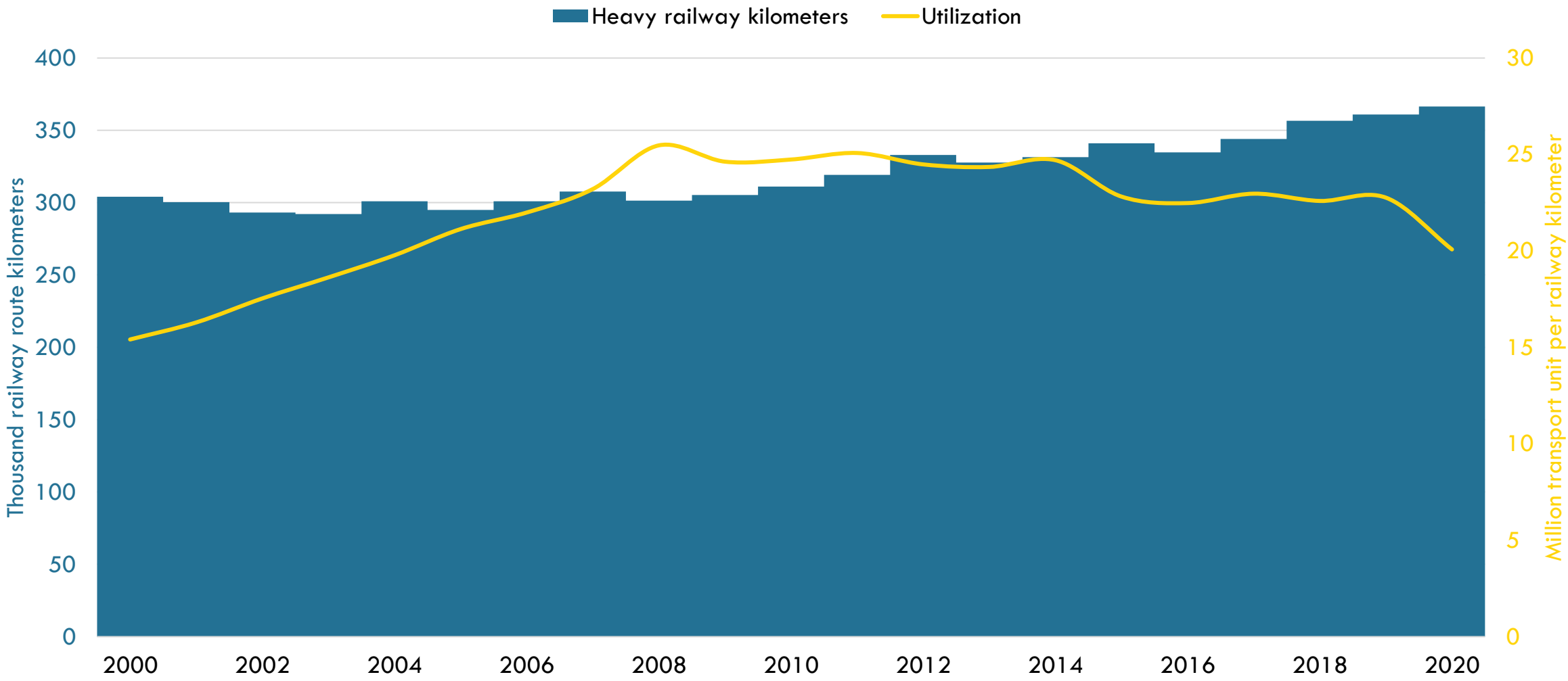
Rail utilization in Asia-Pacific



Asian Transport Outlook

Source: ATO visualisation based on UIC

Rail utilization in Asia-Pacific

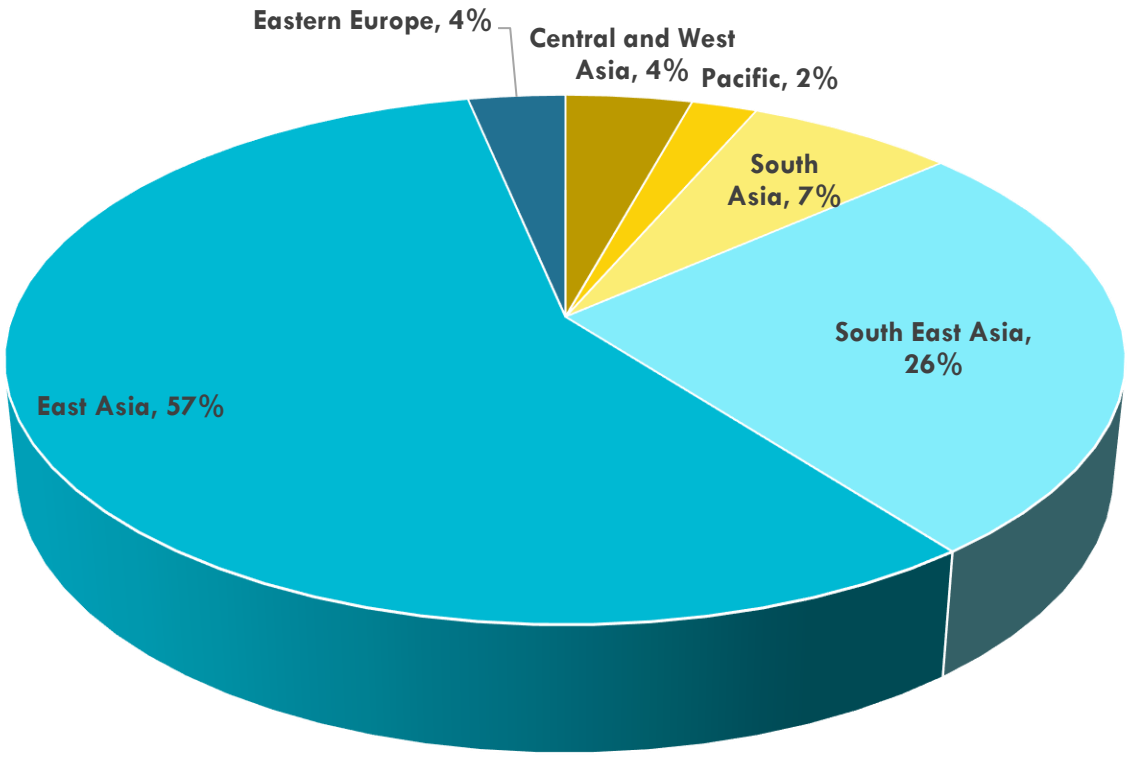


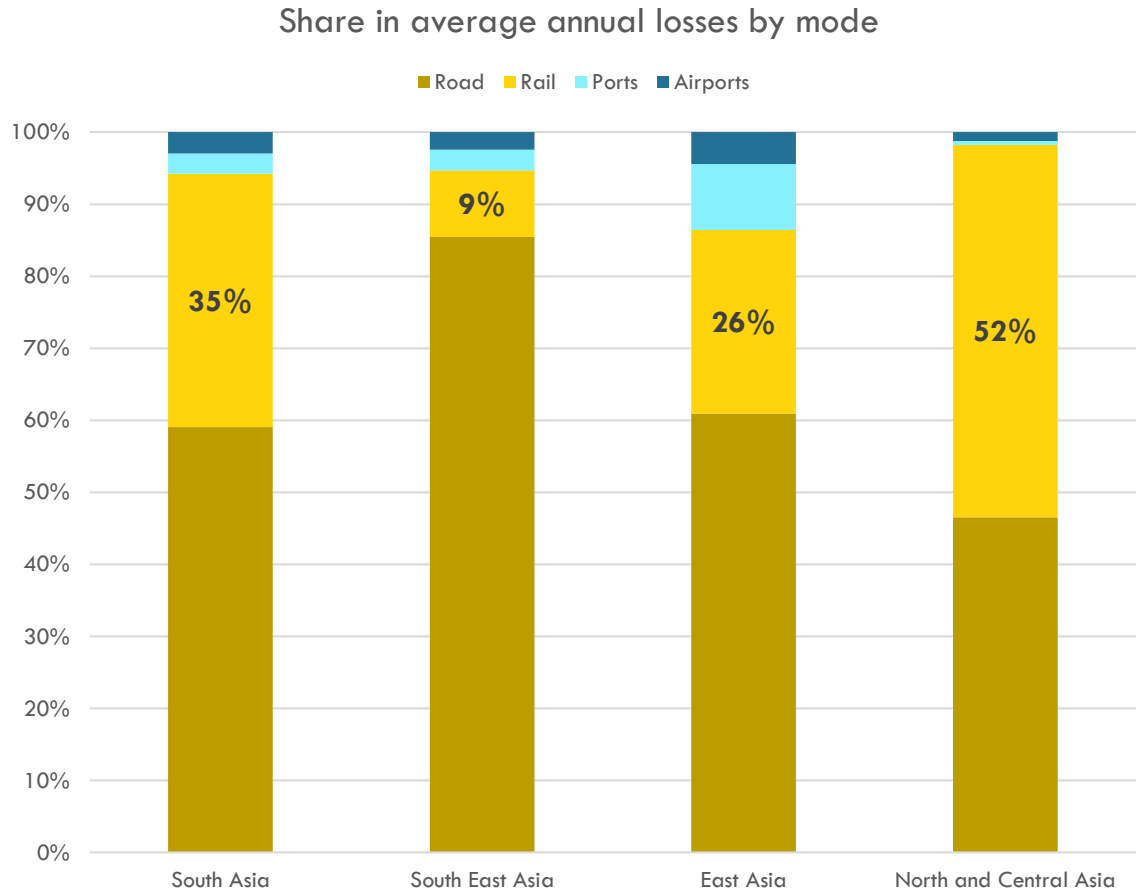
*Transport unit = passenger-kilometer + freight-kilometer

Asian Transport Outlook

Source: ATO visualisation based on UIC

Exposure of surface transport infrastructure to hazards





Expected annual damages to surface transport infrastructure in Asia is disproportionate distributed- as high as 0.1% of GDP in SEA (Myanmar) and 0.08% of GDP in NCA (Georgia)

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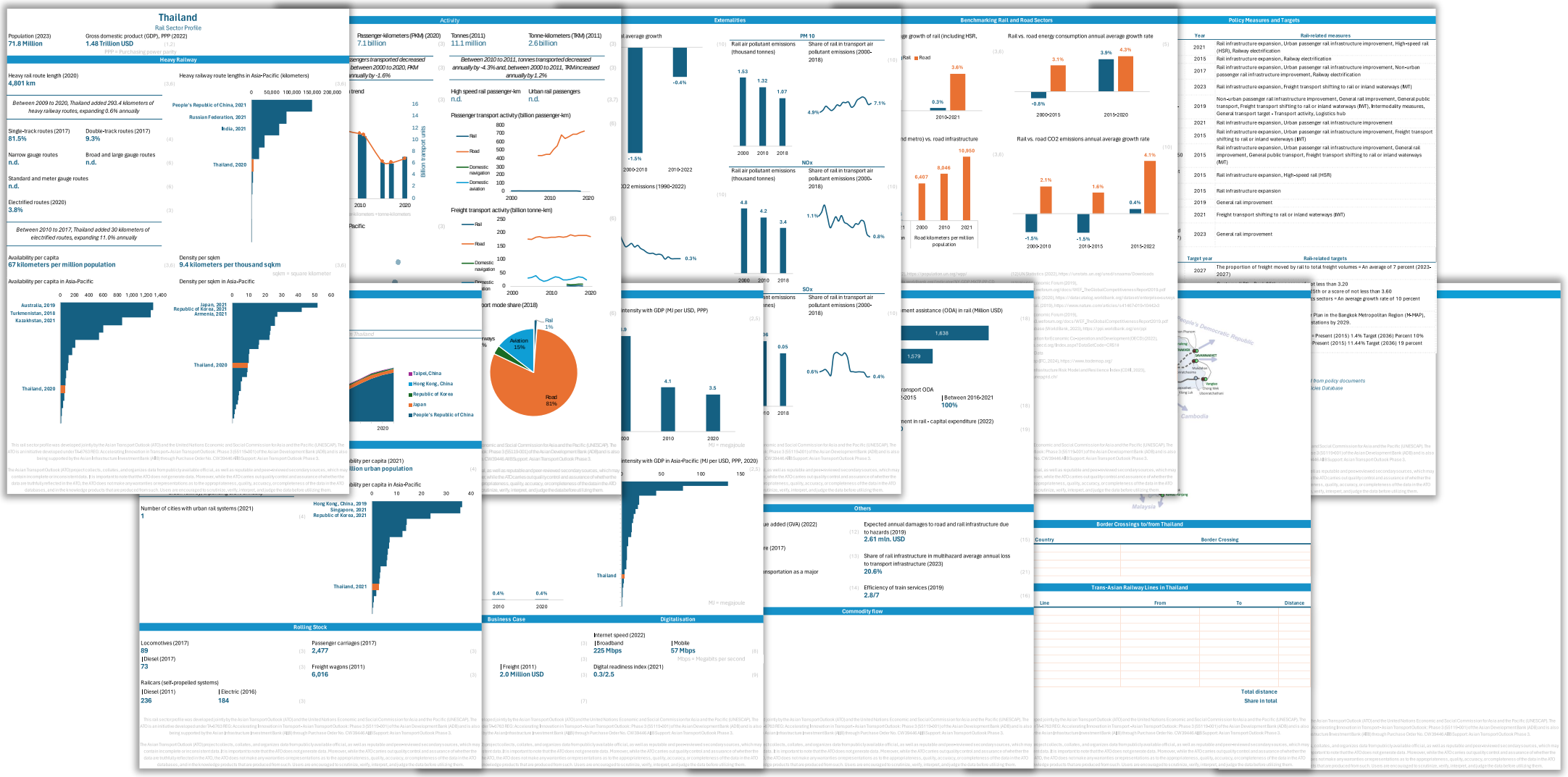
Source: ATO visualisation based on Koks, et al. (2019), Coalition for Disaster Resilient Infrastructure (CDRI)

Railway Profiles



Thailand

Rail Sector Profile

Population (2023)
71.8 Million

Gross domestic product (GDP), PPP (2022)
1.48 Trillion USD (1,2)

UN Population Database ;World Bank open data portal

Heavy Railway

Heavy rail route length (2020)
4,801 km (3,6)

Between 2009 to 2020, Thailand added 293.4 kilometers of heavy railway routes, expanding 0.6% annually

Single-track routes (2017)
81.5%

Double-track routes (2017)
9.3% (4)

Narrow gauge routes
n.d.

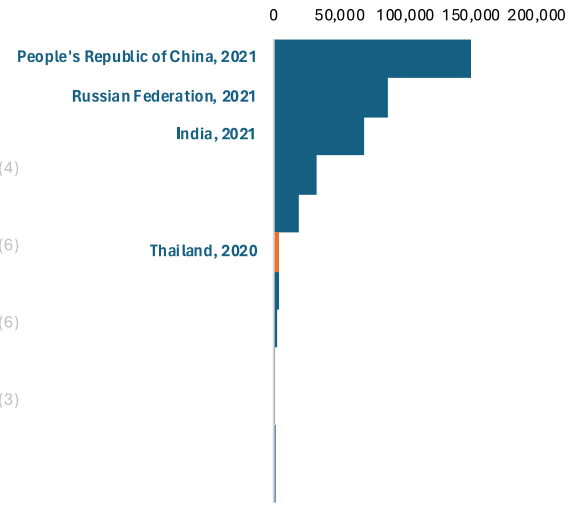
Broad and large gauge routes
n.d. (6)

Standard and meter gauge routes
n.d. (6)

Electrified routes (2020)
3.8% (3)

Between 2010 to 2017, Thailand added 30 kilometers of electrified routes, expanding 11.0% annually

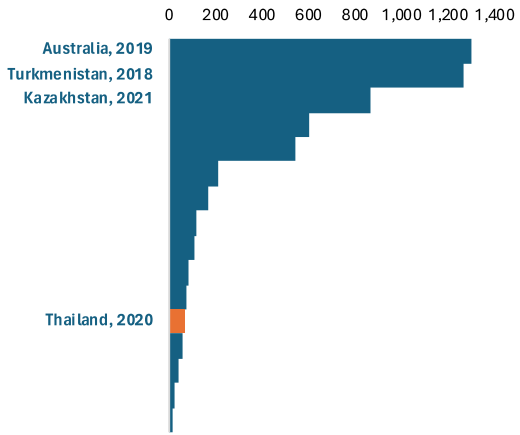
Heavy railway route lengths in Asia-Pacific (kilometers) (3,6)



International Union of Railways RAILISA portal

Availability per capita
67 kilometers per million population (3,6)

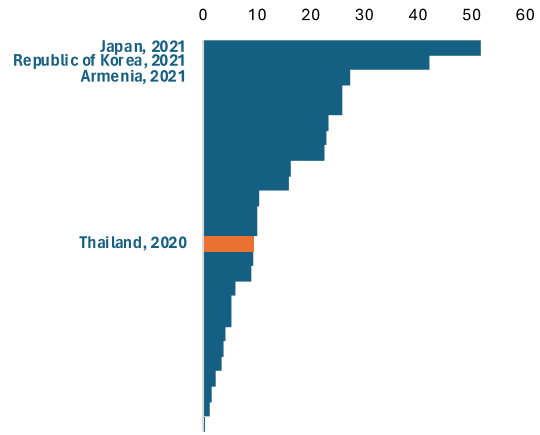
Availability per capita in Asia-Pacific



Density per sqkm
9.4 kilometers per thousand sqkm (3,6)

sqkm = square kilometer

Density per sqkm in Asia-Pacific

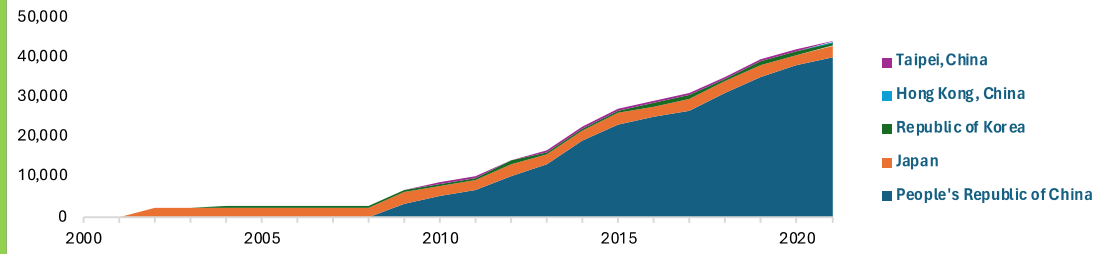


High Speed Railway

High speed railway (HSR) length (2021)
n.d. (3)

There is currently no high speed rail system in Thailand

High speed rail in Asia-Pacific (kilometers)



International Union of Railways
RAILISA portal

Urban Railway

Metro length (2021)
98 km

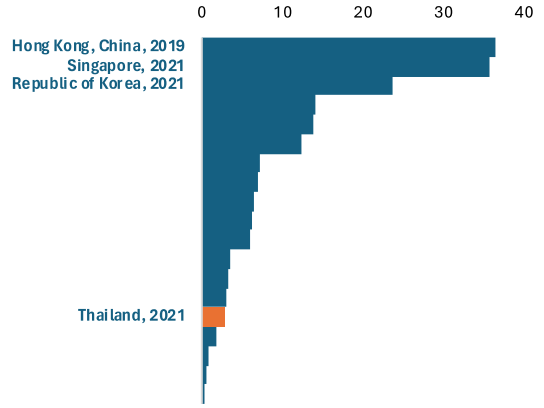
Light rail transit (LRT) length
n.d. (4)

Urban rail availability per capita (2021)
2.7 km per million urban population (4)

Between 2000 to 2021, Thailand added 73.3 kilometers of urban railway, expanding 6.8% annually

Number of cities with urban rail systems (2021)
1 (4)

Urban rail availability per capita in Asia-Pacific



ITDP Rapid Transit Ratio database

Rolling Stock

Locomotives (2017)
89 (3)

| Diesel (2017)
73 (3)

Railcars (self-propelled systems)
| Diesel (2011)
236

| Electric (2016)
184 (3)

Passenger carriages (2017)
2,477 (3)

Freight wagons (2011)
6,016 (3)

Country statistics

International Union of Railways
RAILISA portal

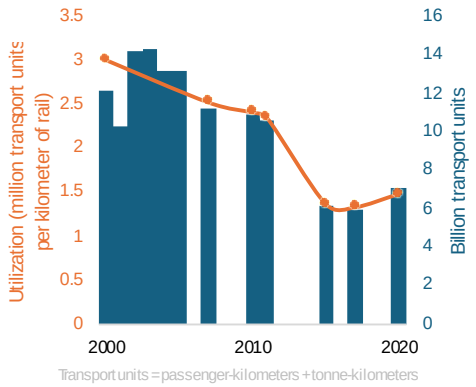
Activity

Passengers (2017)	Passenger-kilometers (PKM) (2020)		Tonnes (2011)	Tonne-kilometers (TKM) (2011)	
3.4 million	7.1 billion	(3)	11.1 million	2.6 billion	(3)

Between 2010 to 2017, passengers transported decreased annually by -30.9% and, between 2000 to 2020, PKM decreased annually by -1.6% (3)

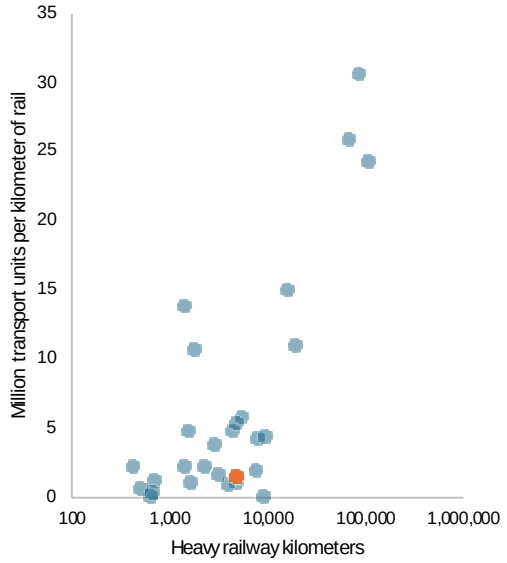
Between 2010 to 2011, tonnes transported decreased annually by -4.3% and, between 2000 to 2011, TKM increased annually by 1.2% (3)

Transport units and utilization trend (3)

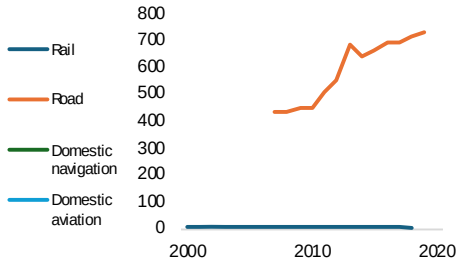


High speed rail passenger-km	Urban rail passengers	
n.d.	n.d.	(3,7)

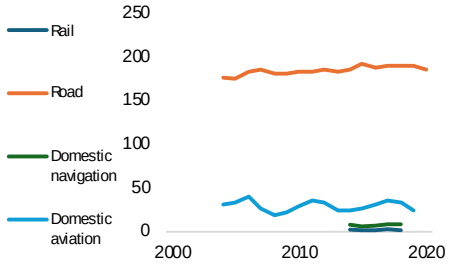
Utilization of railways in Asia-Pacific (3)



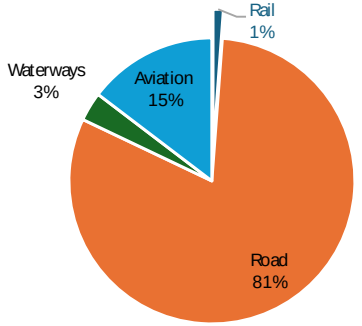
Passenger transport activity (billion passenger-km) (6)



Freight transport activity (billion tonne-km) (6)



Freight transport mode share (2018) (6)



Country statistics

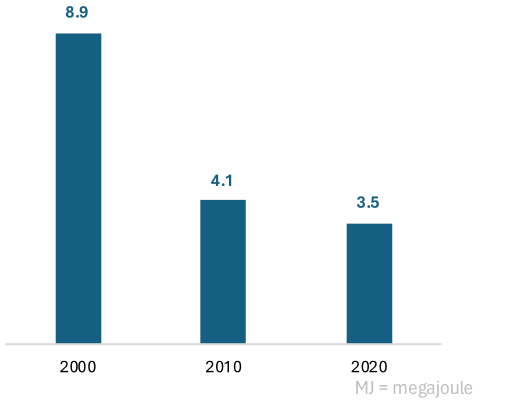
UN energy statistics database

Energy

Rail diesel consumption (2021)
69.5 thousand tonnes

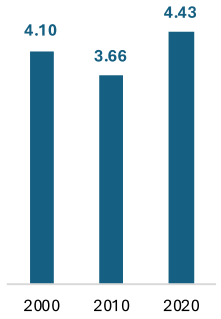
Rail electricity consumption (2021)
222 million kWh (5)
kWh = kiloWatt-hour

Rail energy intensity with GDP (MJ per USD, PPP) (2,5)



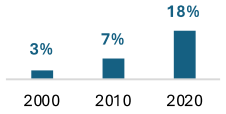
MJ = megajoule

Rail energy consumption (PJ)

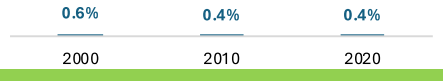


PJ = petajoule

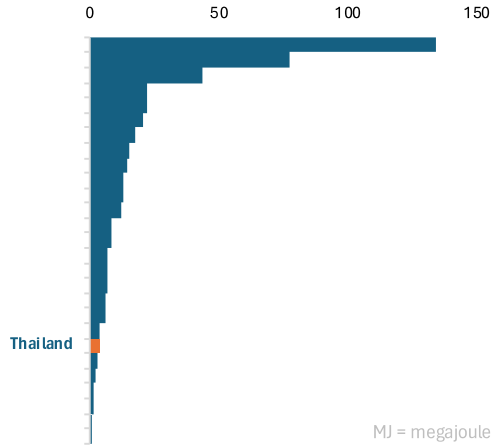
Share of electricity in rail energy consumption (5)



Share of rail in total transport energy consumption (5)



Rail energy intensity with GDP in Asia-Pacific (MJ per USD, PPP, 2020) (2,5)



MJ = megajoule

International Union of Railways RAILISA portal , Rail companies

Business Case

Operating expenses
n.d. (3)

Revenue
n.d. (3)

| Passenger (2017)
108.1 Million USD

| Freight (2011)
2.0 Million USD (3)

Employee/staffing
n.d. (7)

Digitalisation

Internet speed (2022)

| Broadband
225 Mbps

| Mobile
57 Mbps (8)

Mbps = Megabits per second

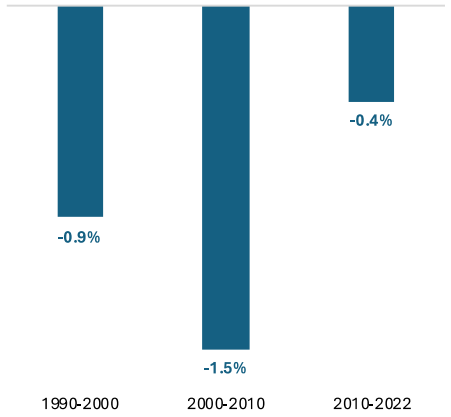
Digital readiness index (2021)
0.3/2.5 (9)

CISCO & OOKLA

JRC's EDGAR emissions database & EMBER's grid EF database

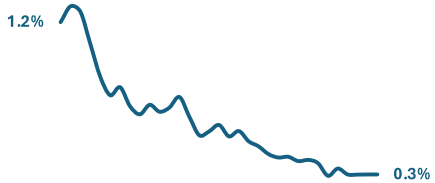
Externalities

Rail CO_2 emissions annual average growth



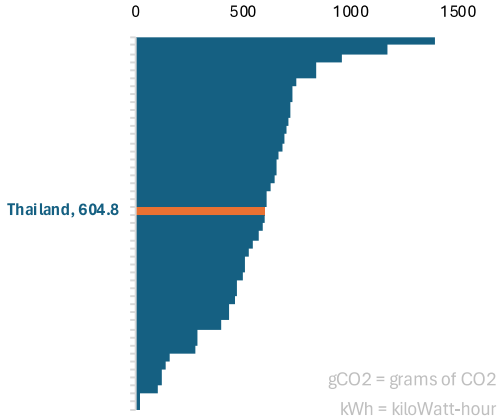
Share of rail in transport CO_2 emissions (1990-2022)

(10)



Grid emission factors (gCO_2/kWh, 2022)

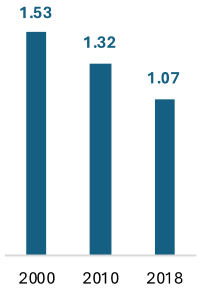
(11)



PM 10

(10)

Rail air pollutant emissions (thousand tonnes)

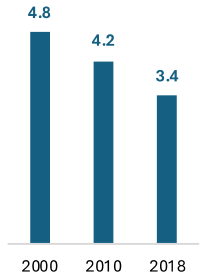


Share of rail in transport air pollutant emissions (2000-2018) (10)

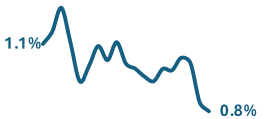


NOx

Rail air pollutant emissions (thousand tonnes)

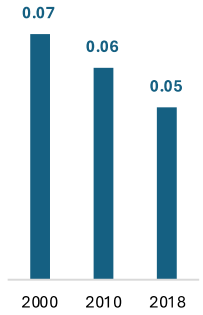


Share of rail in transport air pollutant emissions (2000-2018) (10)

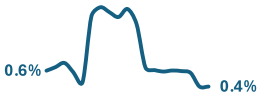


SOx

Rail air pollutant emissions (thousand tonnes)

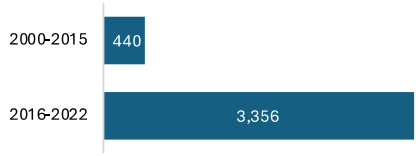


Share of rail in transport air pollutant emissions (2000-2018) (10)

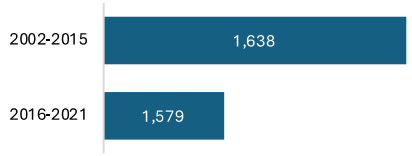


Investment

Public-private partnership (PPP) investments in rail (Million USD) (17)



Official development assistance (ODA) in rail (Million USD) (18)



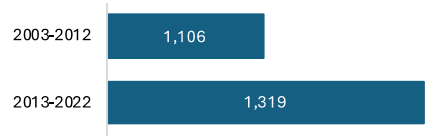
Share of rail in transport PPP (17)

Between 2000-2015	Between 2016-2022
47%	100%

Share of rail in transport ODA (18)

Between 2002-2015	Between 2016-2021
54%	100%

Import value (Million USD) (20)



Includes locomotives, railcars, passenger coaches, freight wagons, rail fixtures, rolling stock parts, and containers

National investment in rail - capital expenditure (2022) (19)

525 mln. USD

World Bank; OECD; Country data; Trademap

Others

Share of transport in gross value added (GVA) (2022) (12)

7.5%

Quality of railway infrastructure (2017) (13)

2.6/7

Percent of firms identifying transportation as a major constraint - services (2015) (14)

15.3%

Expected annual damages to road and rail infrastructure due to hazards (2019) (15)

2.61 mln. USD

Share of rail infrastructure in multihazard average annual loss to transport infrastructure (2023) (21)

20.6%

Efficiency of train services (2019) (16)

2.8/7

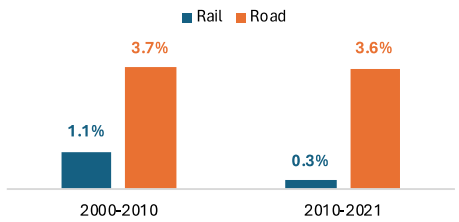
UN Statistics; WEF; World Bank; Koks, et al.

Commodity flow

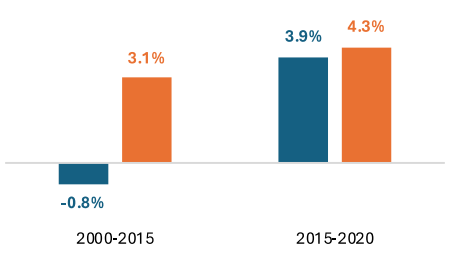
ATO estimates based on UIC, Country statistics

Benchmarking Rail and Road Sectors

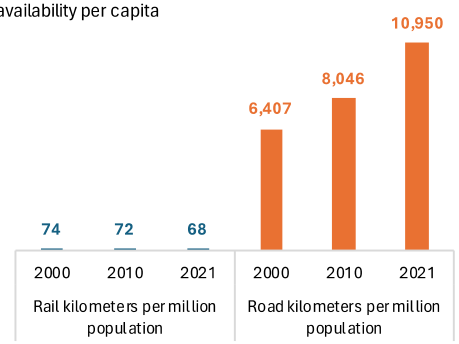
Infrastructure annual average growth of rail (including HSR, LRT, and metro) vs. road (3,6)



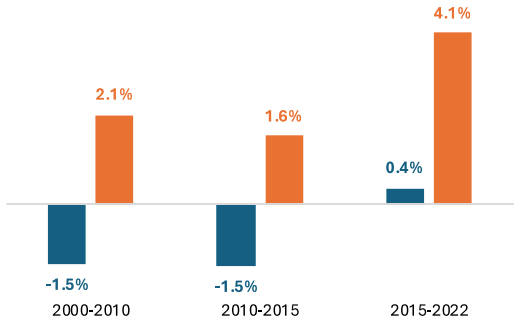
Rail vs. road energy consumption annual average growth rate (5)



Rail (including HSR, LRT, and metro) vs. road infrastructure availability per capita (3,6)



Rail vs. road CO2 emissions annual average growth rate (10)



UN Statistics & JRC's EDGAR

Sources

(1) UN Population Database (2022), https://population.un.org/wpp/

(2) World Bank (2022), https://data.worldbank.org/indicator/NY.GDP.MKTP.PP.CD

(3) International Union of Railways (2021), https://uic-stats.uic.org/

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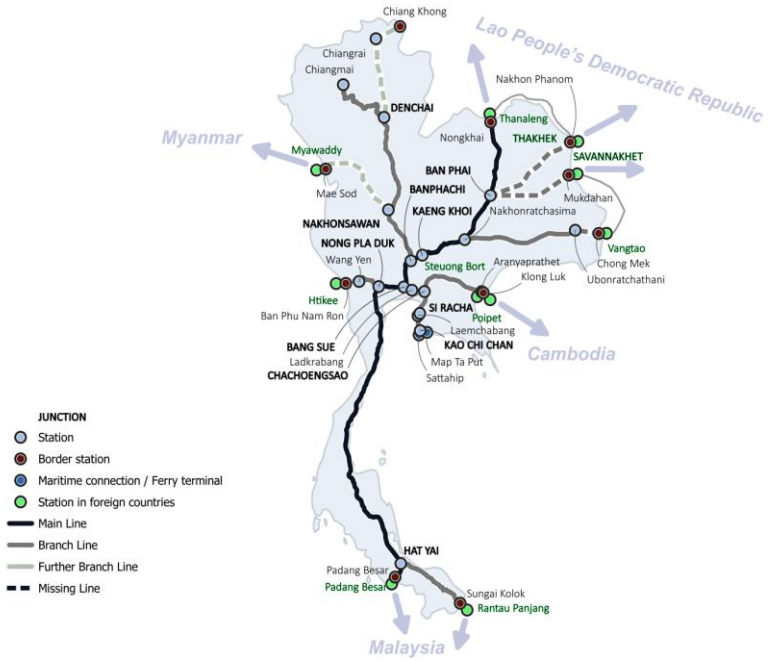
Thailand Rail Network



Border Crossings to/from Thailand

Country	Border Crossing

Trans-Asian Railway Lines in Thailand

Line	From	To	Distance
		Total distance	
		Share in total	

Based on the analysis of ATO of official policy documents

Policy Measures and Targets

Policy document	Year	Rail-related measures
Thailand Greenhouse Gas Reduction Action Plan for Transport Sector	2021	Rail infrastructure expansion, Urban passenger rail infrastructure improvement, High-speed rail (HSR), Railway electrification
Oil Plan 2015-2036	2015	Rail infrastructure expansion, Railway electrification
Strategic Plan of the Ministry of Transport 2017-2021	2017	Rail infrastructure expansion, Urban passenger rail infrastructure improvement, Non-urban passenger rail infrastructure improvement, Railway electrification
Action Plan on Thailand Logistics Development 2023-2027	2023	Rail infrastructure expansion, Freight transport shifting to rail or inland waterways (IWT)
Strategies for the Development of Thailand's Transport System for a 20-Year Period (2018-2036)	2019	Non-urban passenger rail infrastructure improvement, General rail improvement, General public transport, Freight transport shifting to rail or inland waterways (IWT), Intermodality measures, General transport target - Transport activity, Logistics hub
Voluntary National Review 2021	2021	Rail infrastructure expansion, Urban passenger rail infrastructure improvement
Intended Nationally Determined Contribution (INDC)	2015	Rail infrastructure expansion, Urban passenger rail infrastructure improvement, Freight transport shifting to rail or inland waterways (IWT)
Climate change Master Plan 2015-2050	2015	Rail infrastructure expansion, Urban passenger rail infrastructure improvement, General rail improvement, General public transport, Freight transport shifting to rail or inland waterways (IWT)
Transport Infrastructure Development Strategy 2015-2022	2015	Rail infrastructure expansion, High-speed rail (HSR)
Thailand Energy Efficiency Development Plan 2015-2036	2015	Rail infrastructure expansion
National Strategy 2018-2037	2019	General rail improvement
Updated Nationally Determined Contribution	2021	Freight transport shifting to rail or inland waterways (IWT)
The Thirteenth National Economic and Social Development Plan (2023-2027)	2023	General rail improvement

Policy document	Target year	Rail-related targets
Action Plan on Thailand Logistics Development 2023-2027	2027	The proportion of freight moved by rail to total freight volumes = An average of 7 percent (2023-2027)
Action Plan on Thailand Logistics Development 2023-2027	2027	Customs (LPI) = Rank 25th or a score of not less than 3.20 Logistics Quality and Competence = Rank 25th or a score of not less than 3.60 E-commerce value of transport and logistics sectors = An average growth rate of 10 percent (2023-2027)
Voluntary National Review 2021	2029	According to the Mass Rapid Transit Master Plan in the Bangkok Metropolitan Region (M-MAP), the Government aims to finish 103 metro stations by 2029.
Strategies for the Development of Thailand's Transport System for a 20-Year Period (2018-2036)	2036	Proportion of the volume of freight by rail = Present (2015) 1.4% Target (2036) Percent 10% Proportion of volume of water transport = Present (2015) 11.44% Target (2036) 19 percent

Policy measures and targets were extracted from policy documents as listed in the ATO National Transport Policies Database https://bit.ly/ATOpolicyrepository

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Asian Transport Outlook

ADB ASIAN DEVELOPMENT BANK

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