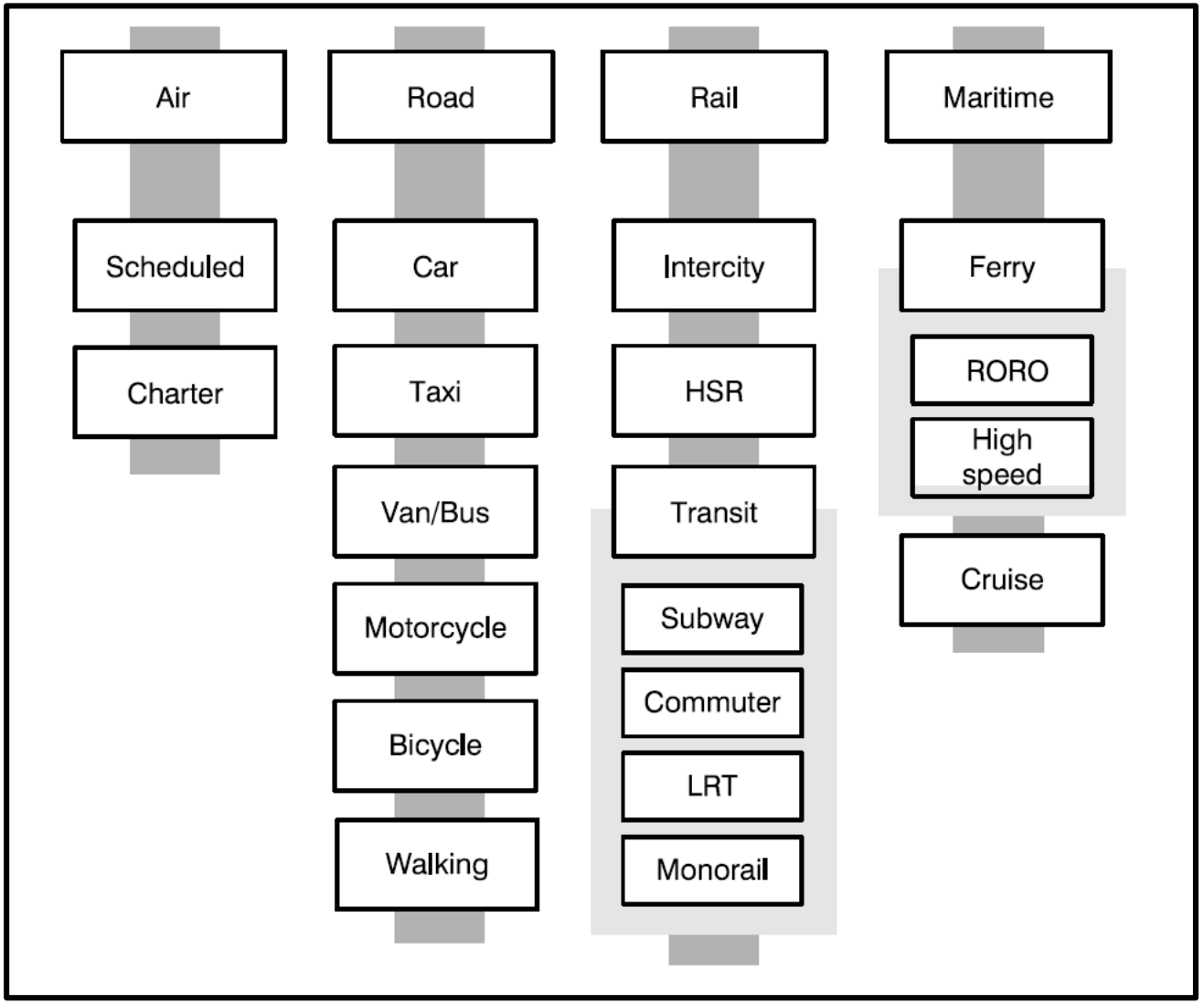
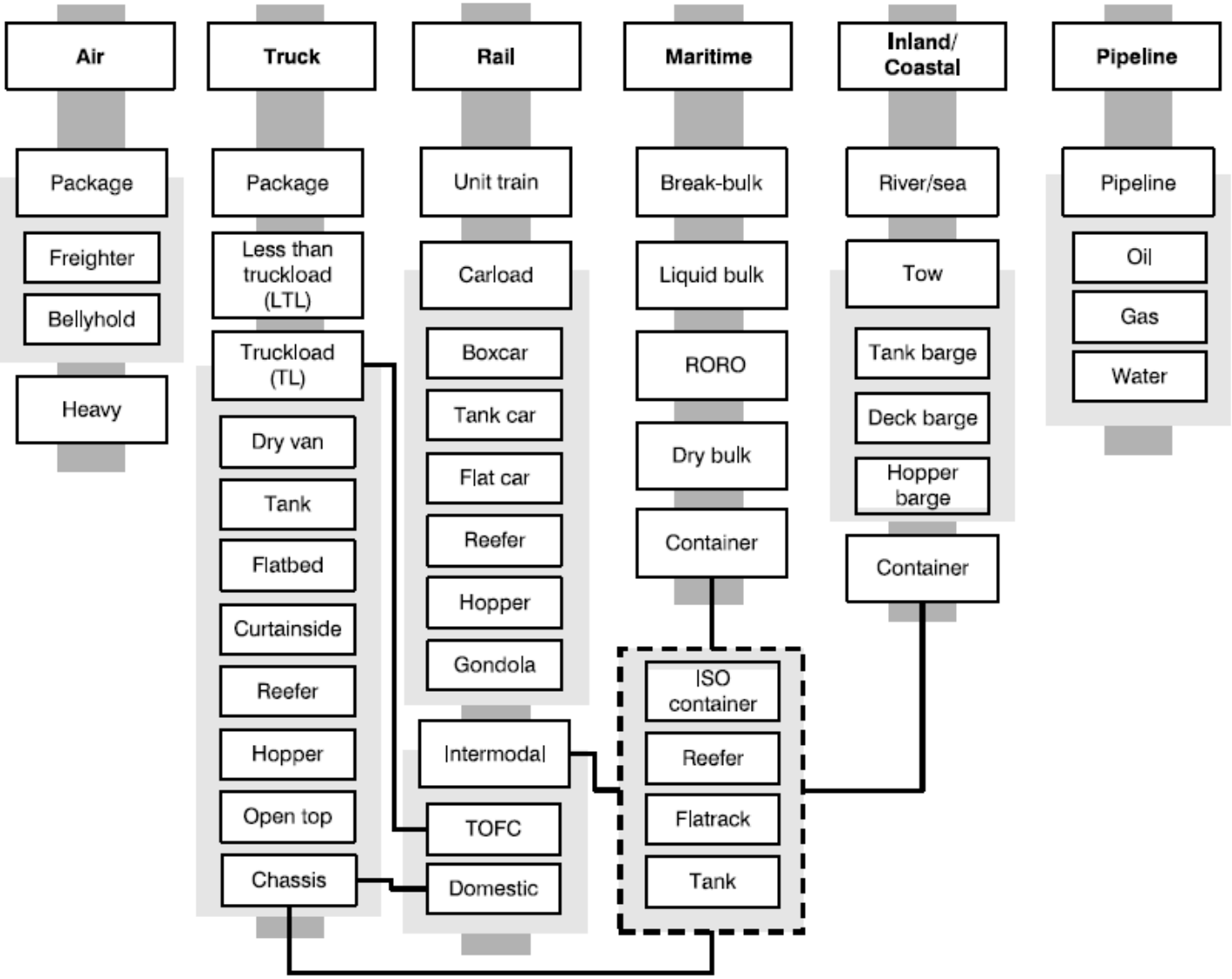
Transnational sea-routes, railways and highways with reference to India

Modes of transportation

Transport modes are the means by which people and freight achieve mobility. They fall into one of three basic types, depending on over what surface they travel – land (road, rail and pipelines), water (shipping) and air. Each mode is characterized by a set of technical, operational and commercial characteristics



Freight Modal Options



Transnational sea-routes

Waterways are the most suitable and cheapest for the international trade. International trade is carried out through ports and harbours which are connected with hinterlands through railways, roads or inland waterways. Waterways are the most suitable and cheapest for the international trade.

Maritime traffic is predominantly focused on freight. Before the era of intercontinental air transportation, transcontinental passenger services were assumed by liner passenger ships, mainly over the North Atlantic. Long distance passenger movements are now a marginal leisure function solely serviced by cruise shipping. Several oceanic ferry services are also in operation over short distances, namely in Western Europe (Channel; Baltic Sea), Japan and Southeast Asia (Indonesia). The systematic growth of maritime freight traffic has been fueled by:

Increase in energy and mineral cargoes derived from a growing demand from industrialized economies of North America, Europe, China and Japan. For instance, coal is mainly used for energy generation and steel- making.

Globalization that went on par with an international division of the production and trade liberalization.

Technical improvements in ship and maritime terminals have facilitated the flows of freight.

Economies of scale permitted maritime transportation to remain a low cost mode, a trend which has been strengthened by containerization.

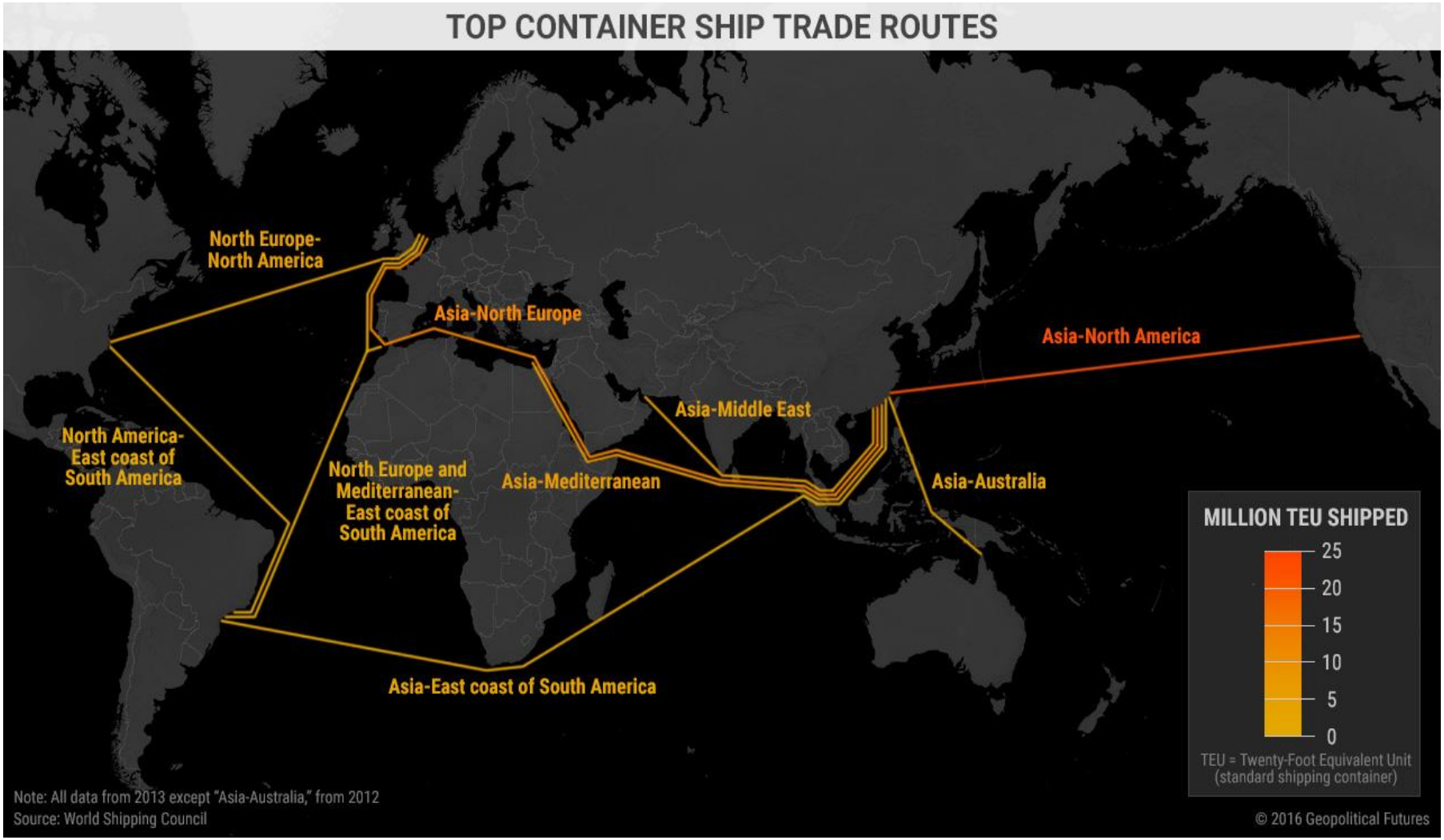
Transnational sea-routes

Maritime traffic is commonly measured in deadweight tons, which refers to the amount of cargo that can be loaded on an "empty" ship, without exceeding its operational design limits. This limit is often identified as a load line, which is the maximal draft of the ship. Maritime freight is conventionally considered in two categories: **Bulk cargo** and **Break-bulk cargo**

The global maritime shipping industry is serviced by about 79,000 commercial vessels of more than 100 tons falling into four broad types:

- **Passenger vessels** can be further divided into two categories: **passenger ferries**, where people are carried across relatively short bodies of water in a shuttle- type service, and **cruise ships**, where passengers are taken on vacation trips of various durations, usually over several days. The former tend to be smaller and faster vessels, the latter are usually very large capacity ships having a full range of amenities. In 2011, about 19 million passengers were serviced by cruise ships, underlining an industry with much growth potential since it services several seasonal markets where the fleet is redeployed to during the year.
- **Bulk carriers** are ships designed to carry specific commodities, and are differentiated into liquid bulk and dry bulk vessels. They include the largest vessels afloat. The largest tankers, the Ultra Large Crude Carriers (ULCC) are up to 500,000 deadweight tons (dwt), with the more typical size being between 250,000 and 350,000 dwt; the largest dry bulk carriers are around 400,000 dwt, while the more typical size is between 100,000 and 150,000 dwt. The emergence of liquefied natural gas technology enabled the maritime trade of natural gas with specialized ships.
- **General cargo** ships are vessels designed to carry non- bulk cargoes. The traditional ships were less than 10,000 dwt, because of extremely slow loading and offloading. Since the 1960s these vessels have been replaced by container ships because they can be loaded more rapidly and efficiently, permitting a better application of economies of scale. Like any other ship class, larger container ships require larger drafts with the current largest ships requiring a draft of 15.5 meters.
- **Roll-on-roll-off (RORO)** vessels, which are designed to allow cars, trucks and trains to be loaded directly on board. Originally appearing as ferries, these vessels are used on deep- sea trades and are much larger than the typical ferry. The largest are the car carriers that transport vehicles from assembly plants to the main markets.

Transnational sea-routes



Transnational sea-routes

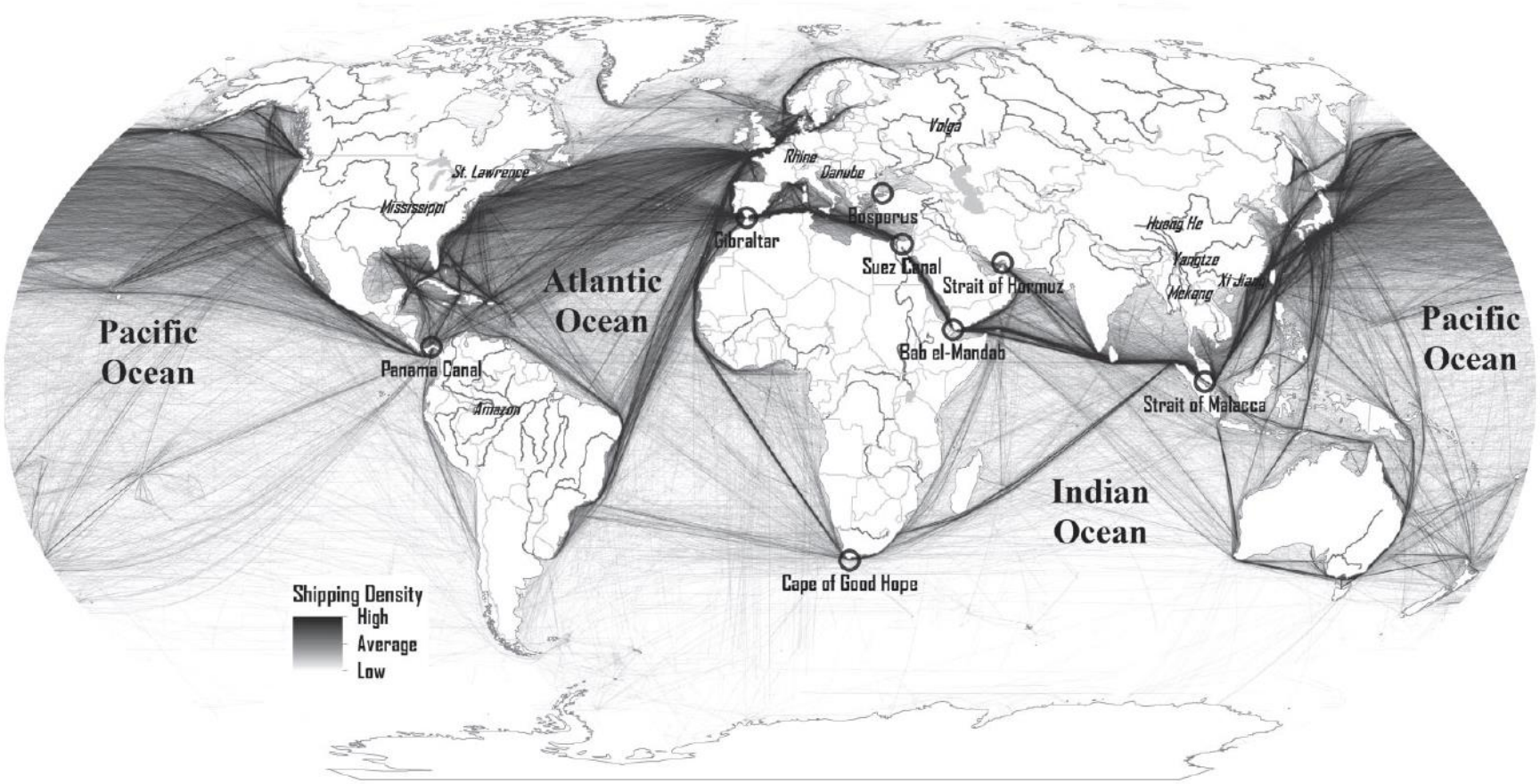
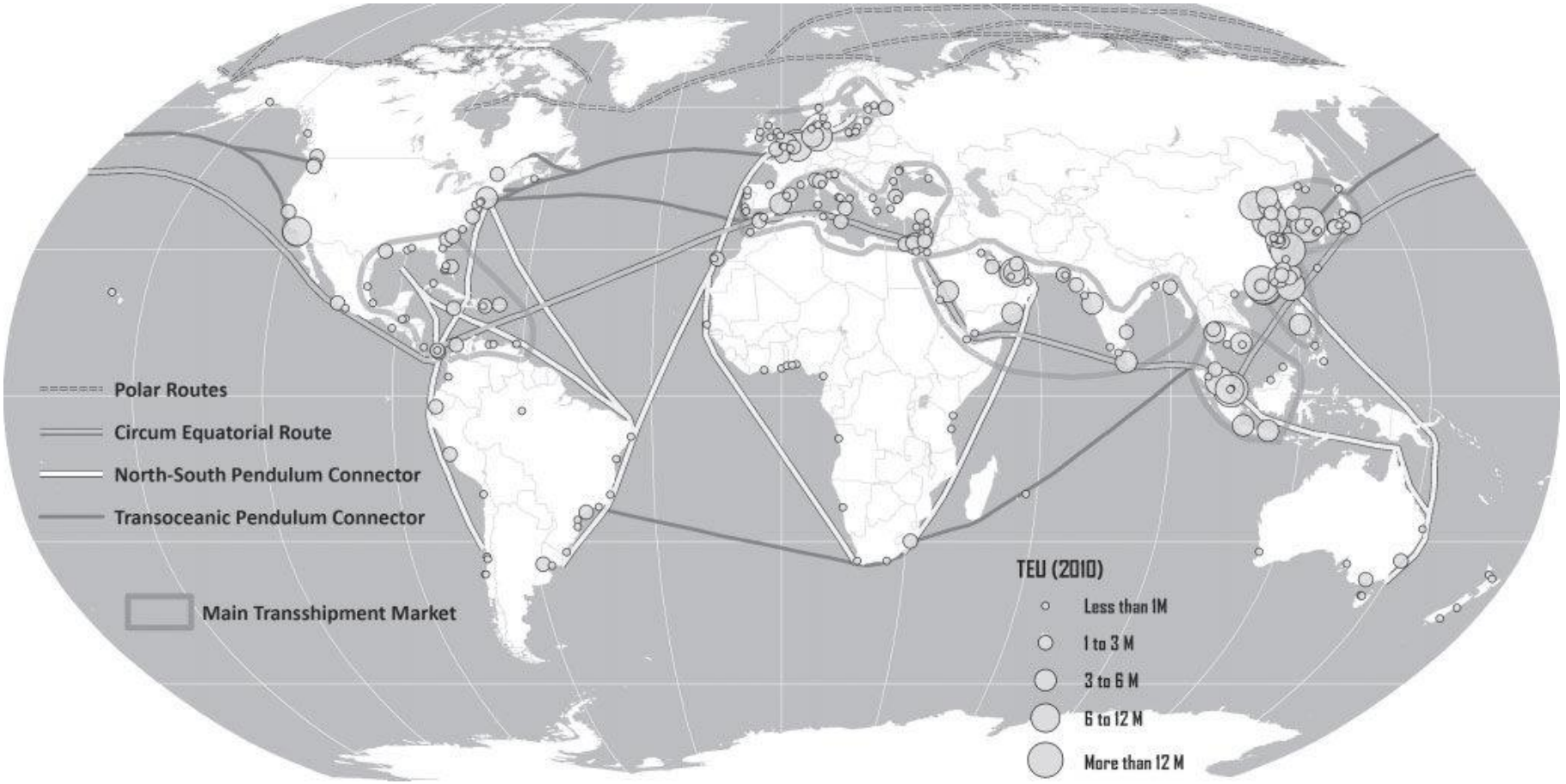


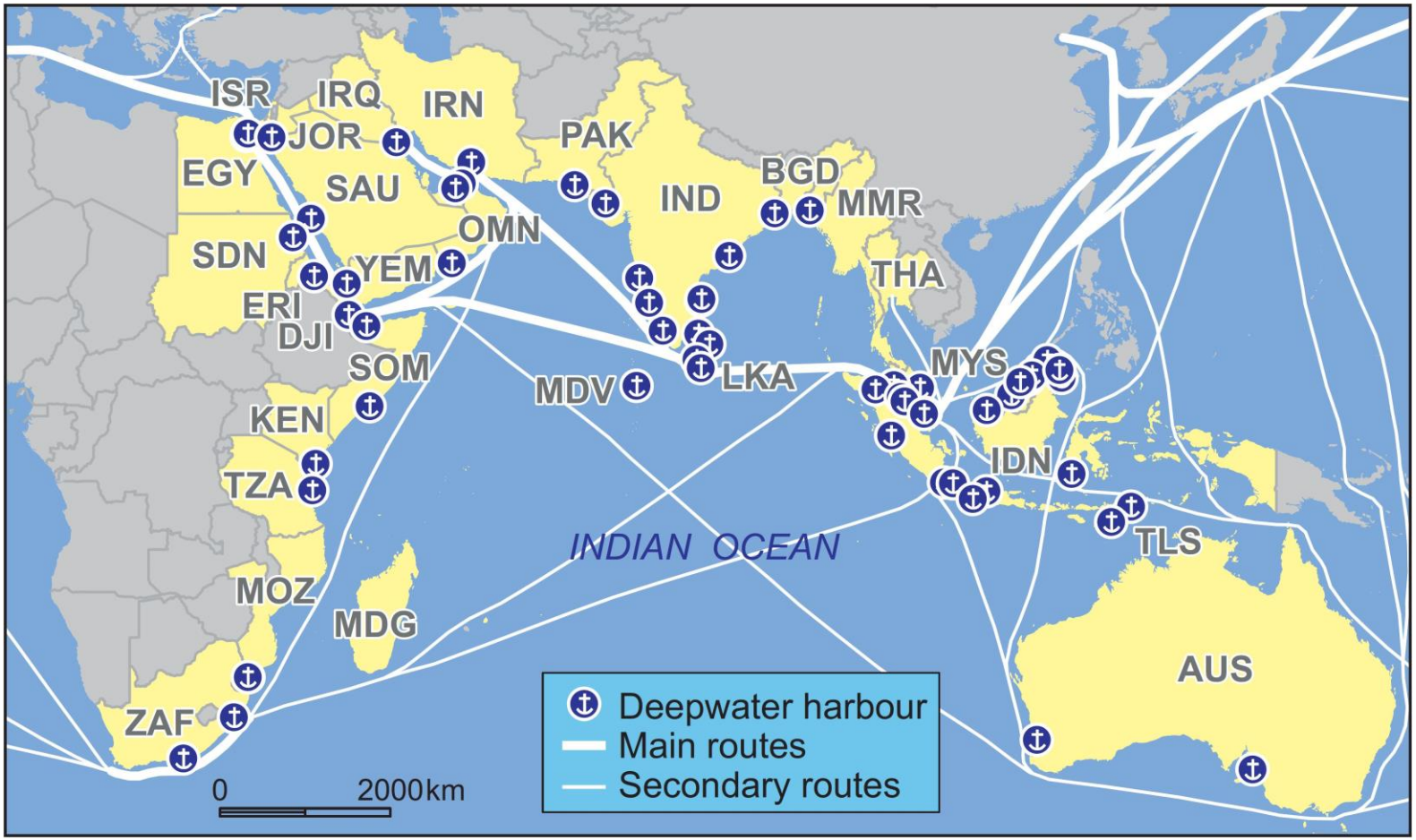
Figure 3.5 Domains of maritime circulation

Source: Shipping density data adapted from National Center for Ecological Analysis and Synthesis, A Global Map of Human Impacts to Marine Ecosystems.

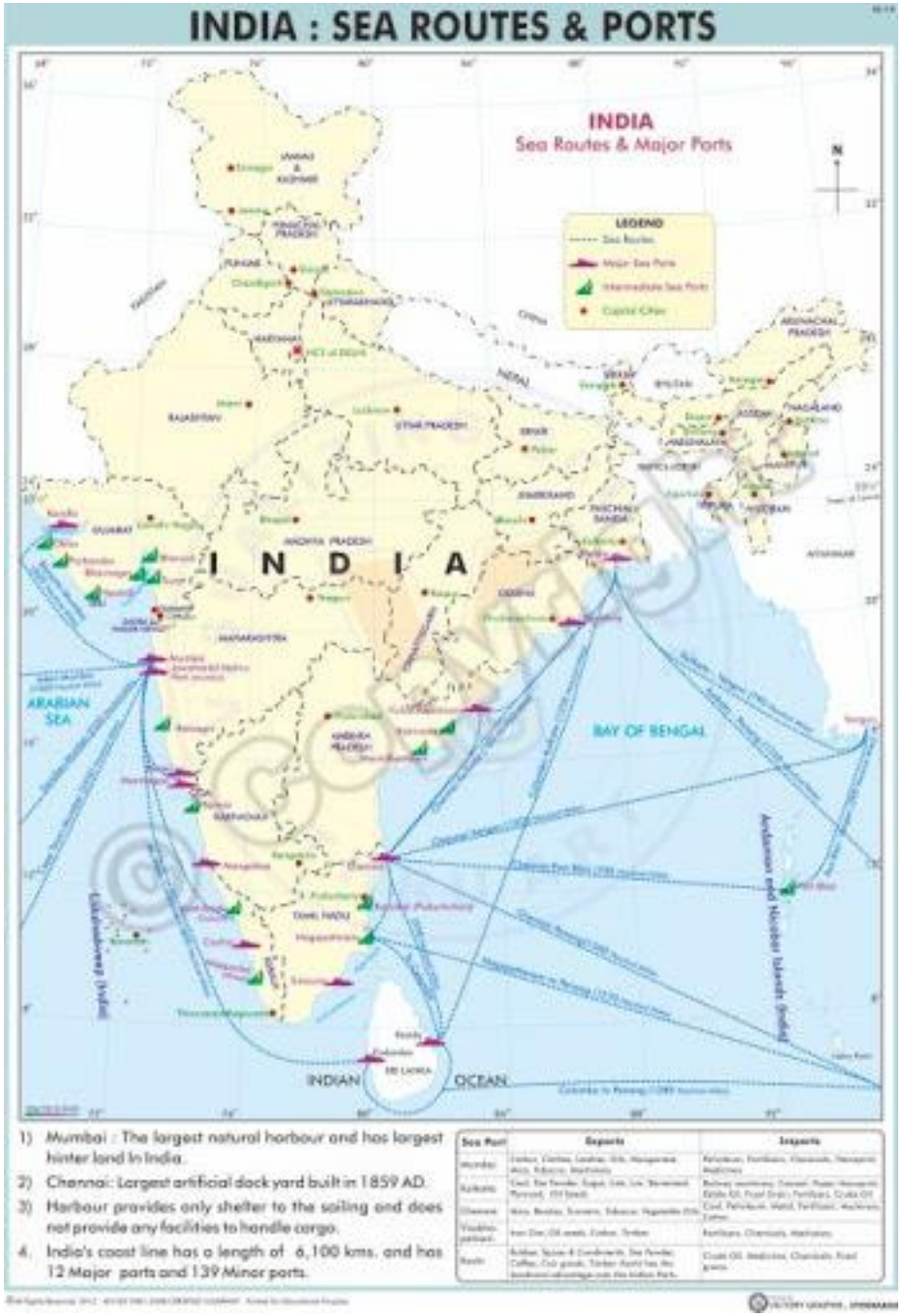
Transnational sea-routes



Indian Ocean Sea Routes



Ports in India



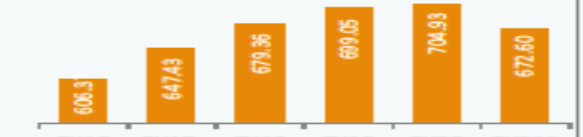
PORTS

MARKET SIZE

Cargo Capacity at Major Ports (million tonnes)

SECTOR COMPOSITION

Cargo traffic at major ports (million tonnes)

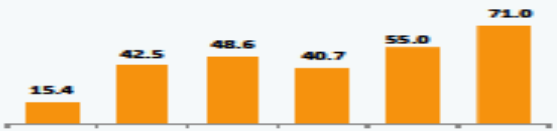


Note: *- Until March 2021

Market Share of Ports in FY20

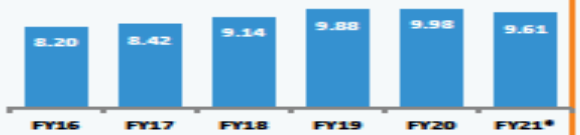
KEY TRENDS

Iron Ore traffic (million tonnes)



Note: *- Until March 2021

Container Traffic in India ('000 TEU)



GOVERNMENT INITIATIVES

- Project UNNATI
- Major Port Authorities Bill, 2020
- 100% FDI through Automatic Route

ADVANTAGE INDIA

- **Robust demand:** Ports sector in India is being driven by high growth in external trade.
- **Competitive advantage:** India has a coastline which is more than 7,517 kms long, interspersed with more than 200 ports.
- **Policy support:** In Union Budget 2021, the government announced subsidy funding worth Rs. 1,624 crore (US$ 222.74 million) to Indian shipping companies to encourage merchant ship flagging in the country.
- **Attractive opportunities:** The key ports are expected to deliver seven projects worth more than Rs. 2,000 crore (US$ 274.31 million) on a public-private partnership basis in FY22. The Finance Minister proposed to double the ship recycling capacity of ~4.5 million light displacement tonnes (LDT) by 2024; this is expected to generate an additional ~1.5 lakh employment opportunities in India.

Problems

- Few number of ports
- Not comparable with other international ports
- Poor and old Infrastructure of major ports
- Dependence for logistics
- Backdated technology
- Subsidiced policy and regulation
- Labour issue
- Privatisation

Railways

Rail transportation is composed of a traced path on which vehicles are bound. They have an average level of physical constraints linked to the types of locomotives and a low gradient is required, particularly for freight. Rail transportation is characterized by a high level of economic and territorial control since most rail companies are operating in a monopoly, as in Europe, or oligopoly, as in North America where seven large rail freight carriers control and operate large networks.

The global rail network, which is mostly a collection of unlinked national rail systems, is an overlay of three main types of rail lines:

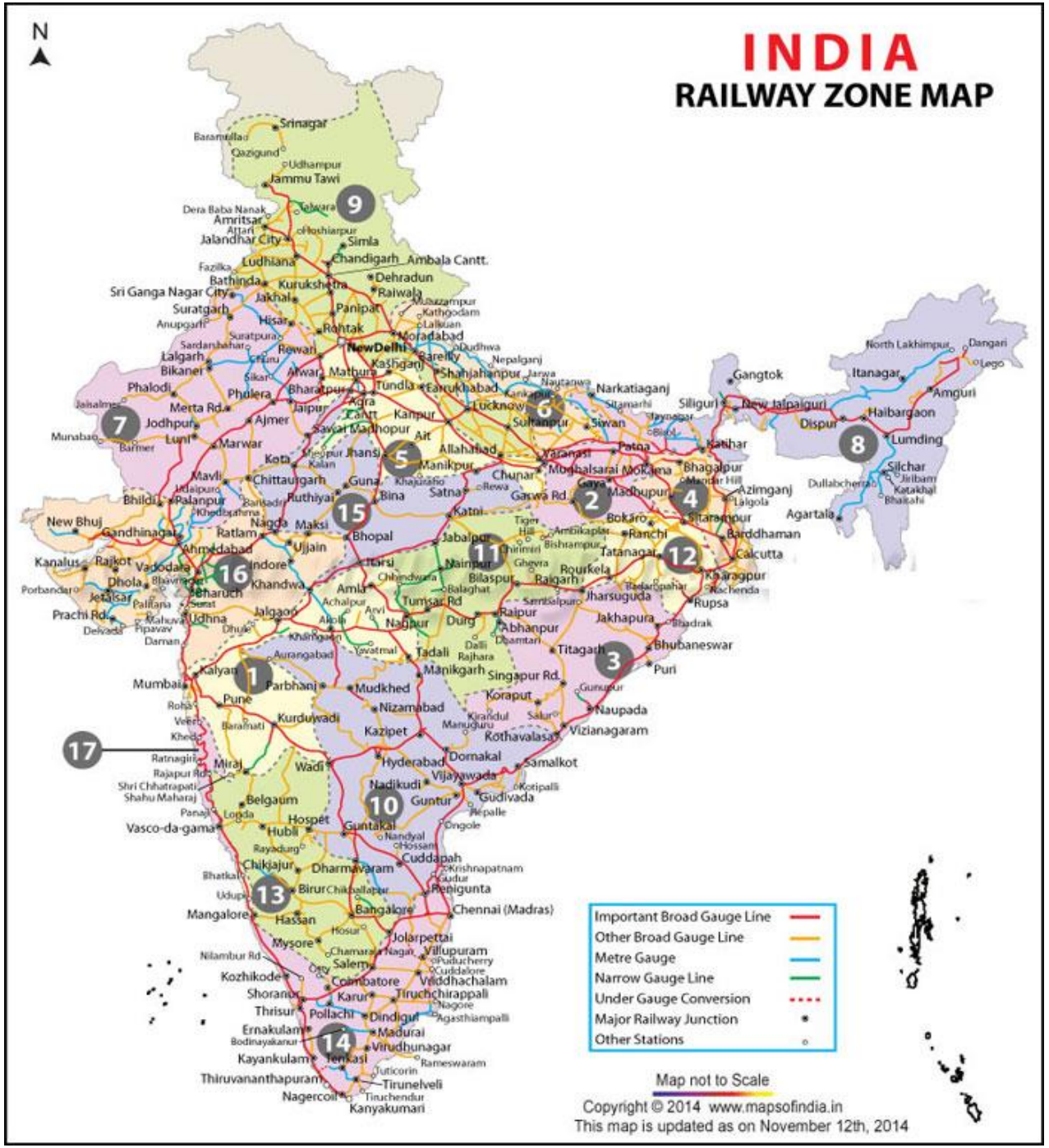
- **Penetration Lines** . Their main purpose is to link a port city with its hinterland, particularly in order to access natural resources such as minerals, agricultural products and wood products. They also represented one of the initial stages of rail development, notably in the United States, which later became regional networks linked by transcontinental lines. This type of system is today mainly found in developing countries (Africa and Latin America) and was partially the result of the colonial era. Transporting freight is the dominant function of this type of network, although passenger traffic can be significant.

Railways

- **Regional Networks** . They service high density population areas of developed countries with the goal to support massive shipment of freight and passengers. Regions with the highest rail density are Western Europe, the Northeastern part of North America, coastal China and Japan.
- **Transcontinental Lines** . These lines were mainly established for territorial conquest and the establishment of national sovereignty. The most relevant examples are in the United States, Canada, Russia and Australia, which have built rail systems of this scale. Today, transcontinental rail lines are being established, such as the North American land bridge, to attenuate the discontinuity of maritime transportation by transporting containers. They are a chain in the global intermodal transport system.
- **Other:** The standard intercity passenger services that have been active in many parts of the world for a century and a half are being expanded by the setting of high speed rail (HSR) services between high density city- pairs. Another salient form of rail services concerns urban transit systems that rely on specific applications of rail technology. Subway systems are those supporting the densest forms of mobility in large metropolitan areas. Such systems are usually supported by commuter rail linking a central station to a network of satellite cities. Light rail transit (LRT) systems are also set in lower density situations.

Indian Railway

- The first railway on Indian sub-continent ran over a stretch of 21 miles from Bombay to Thane. The idea of a railway to connect Bombay with Thane, Kalyan and with the Thal and Bhore Ghats inclines first occurred to Mr. George Clark, the Chief Engineer of the Bombay Government, during a visit to Bhandup in 1843.
- The formal inauguration ceremony was performed on 16th April 1853, when 14 railway carriages carrying about 400 guests left Bori Bunder at 3.30 pm "amidst the loud applause of a vast multitude and to the salute of 21 guns." The first passenger train steamed out of Howrah station destined for Hooghly, a distance of 24 miles, on 15th August, 1854. Thus the first section of the East Indian Railway was opened to public traffic, inaugurating the beginning of railway transport on the Eastern side of the subcontinent.
- In south the first line was opened on Ist July, 1856 by the Madras Railway Company. It ran between Vyasarpadi Jeeva Nilayam (Veyasarpandy) and Walajah Road (Arcot), a distance of 63 miles. In the North a length of 119 miles of line was laid from Allahabad to Kanpur on 3rd March 1859. The first section from Hathras Road to Mathura Cantonment was opened to traffic on 19th October, 1875.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INDIA
RAILWAY ZONE MAP
Important Broad Gauge Line
Other Broad Gauge Line
Metre Gauge
Narrow Gauge Line
Under Gauge Conversion
Major Railway Junction
Other Stations
Map not to Scale
Copyright © 2014 www.mapsofindia.in
This map is updated as on November 12th, 2014

Zones of Indian Railway

Sl. No	Name	CODE	Year of Establishment	Route KMs	Headquarters	Divisions
1	Central Railway	CR	1951	3905	Mumbai	Mumbai, Bhusawal, Pune, Solapur, Nagpur
2	East Central Railway	ECR	2001	3628	Hajipur	Danapur, Dhanbad, Mughalsarai, Samastipur, Sonpur
3	East Coast Railway	ECoR	2001	2572	Bhubaneswar	Khurda Road, Sambalpur, Visakhapatnam
4	Eastern Railway	ER	1952	2414	Kolkata	Howrah, Sealdah, Asansol, Malda
5	North Central Railway	NCR	2003	3151	Allahabad	Allahabad, Agra,Jhansi
6	North Eastern Railway	NER	1952	3667	Gorakhpur	Izzatnagar, Lucknow,Varanasi

7	North Western Railway	NWR	2002	5459	Jaipur	Jaipur, Ajmer,Bikaner, Jodhpur
8	Northeast Frontier Railway	NFR	1958	3907	Guwahati	Alipurduar, Katihar, Rangia, Lumding, Tinsukia
9	Northern Railway	NR	1952	6968	Delhi	Delhi, Ambala, Firozpur, Lucknow, Moradabad
10	South Central Railway	SCR	1966	5803	Secunderabad	Secunderabad, Hyderabad, Guntakal, Guntur, Nanded, Vijayawada
11	South East Central Railway	SECR	2003	2447	Bilaspur	Bilaspur, Raipur, Nagpur
12	South Eastern Railway	SER	1955	2631	Kolkata	Adra, Chakradharpur, Kharagpur, Ranchi
13	South Western Railway	SWR	2003	3177	Hubli	Hubli, Bangalore,Mysore
14	Southern Railway	SR	1951	5098	Chennai	Chennai, Trichy, Madurai, Palakkad, Salem, Thiruvananthapuram
15	West Central Railway	WCR	2003	2965	Jabalpur	Jabalpur, Bhopal,Kota
16	Western Railway	WR	1951	6182	Mumbai	Mumbai Central, Ratlam, Ahmedabad, Rajkot, Bhavnagar,Vadodara
17	Kolkata Metro Railway	KNR	2009		Kolkata	Kolkata

Problems and Prospects

Indian Railways runs around 11,000 trains everyday, of which 7,000 are passenger trains

- **RAILWAYS' FINANCES**
- ***Railways: Sources of revenue***
- *Internal sources*
- *Budgetary support from central government*
- *Public Private Partnerships (PPPs)*
- ***Railways Expenditure***
- *Staff wages and pension*
- *Employee efficiency is low*

and expenditure on staff is high

- *Fuel and electricity*
- *Depreciation Reserve Fund (DRF)*
- *Rashtriya Rail Sanraksha Kosh*
- *Divident*

Figure 1: Railways has been losing traffic share

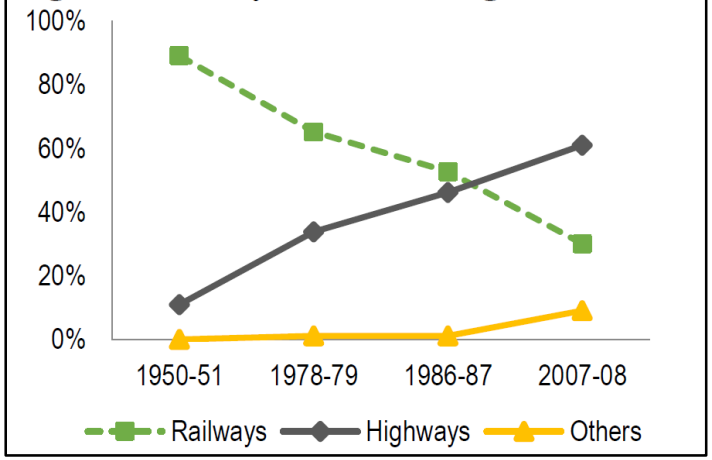
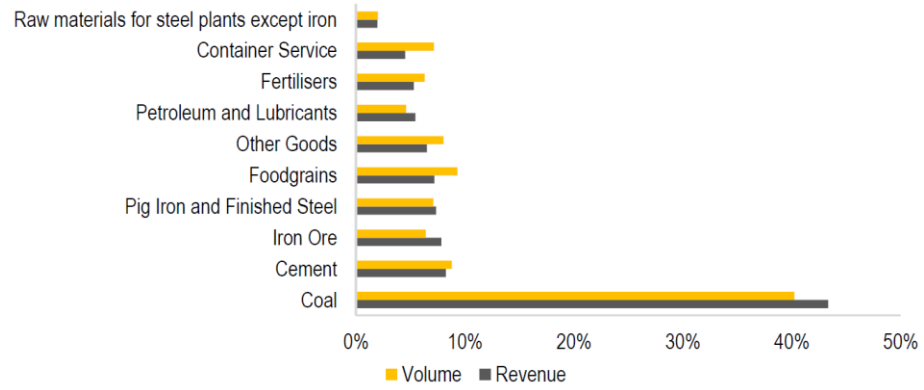


Figure 2: Share of freight volume and revenue in 2016-17 (in %)



Sources: Statement of Revenue Receipts and Expenditure 2018-19, Ministry of Railways; PRS.

Problems and Prospects

- **RAILWAYS INFRASTRUCTURE**
- ***Rail Infrastructure***
- *Capacity constraints have been increasing, affecting the quality of services*
- *Poor investment has resulted in a decline of Railways' share across all transport modes*
- *Train speeds on the Indian rail network*
- *Dedicated Freight Corridors*
- ***Safety in Indian Railways***
- *Under-investment in Railways leading to accidents*
- *Un-manned level crossings*
- ***Issues with the organisational structure***
- *Decision making in Railways is centralised, with the zones having little autonomy*
- *Railways engages in peripheral activities that are non-remunerative*
- *Need for an independent regulatory authority*

National Rail Vikas Yojana

National Rail Vikas Yojana: With a view to complete strategically important projects within a stipulated period of time, a non-budgetary investment initiative for the development of Railways has been launched.. Under the scheme all the capacity bottlenecks in the critical sections of the railway network will be removed at an investment of Rs.15,000 crore over the next five years. These projects would include:

- Strengthening of the golden Quadrilateral to run more long-distance mail/express and freight trains at a higher speed of 100 kmph.
- Strengthening of rail connectivity to ports and development of multi-modal corridors to hinterland.
- Construction of four mega bridges - two over River Ganga, one over River Brahmaputra, and one over River Kosi.
- Accelerated completion of those projects nearing completion and other important projects.

Moving Forward

- *New Steps towards Safety and Security*
- *Improving Financial Health*
- *New Trends in Passenger Amenities*
- *Indian Railway Catering and Tourism Corporation*
- *"National Train Enquiry System" has been started in order to provide upgraded passenger information and enquiries.*
- *Freight Operations Information System (FOIS)*
- *New Technologies*
- *Social obligations and care for weaker sections*
- *Tie-Up with Foreign Railways:* Indian Railways is in constant touch with Railways across the world to bring in state-of-art facilities in its system. Towards this, a Memorandum of Understanding was singed during the Eighth Session of the Indo-Austria Joint Economic Commission held in Vienna. This seeks to promote and deepen long-term infrastructure-specific cooperation between Indian and Austrian Railways to their mutual benefit.A three-day International Conference of Union of Railways was organised by Indian Railways in New Delhi in which hundreds of delegates from various industries and Railways around the world participated.

Road Transportation

Road transportation and its infrastructures are large consumers of space with the lowest level of physical constraints among transportation modes. However, physiographical constraints are significant in road construction with substantial additional costs to overcome features such as rivers or rugged terrain. While historically road transportation was developed to support non- motorized forms of transportation (walking, domestication of animals and cycling at the end of the nineteenth century), it is motorization that has shaped its development the most since the beginning of the twentieth century.

- All road transport modes have **limited potential to achieve economies of scale**. This is due to size and weight constraints imposed by governments and also by the technical and economic limits of engines. In most jurisdictions, trucks and buses have specific weight and length restrictions which are imposed for safety reasons.
- In addition, there are **serious limits on the traction capacities of cars**, buses and trucks because of the considerable growth in energy consumption that accompany increases in the vehicle weight. For these reasons the carrying capacities of individual road vehicles are limited.

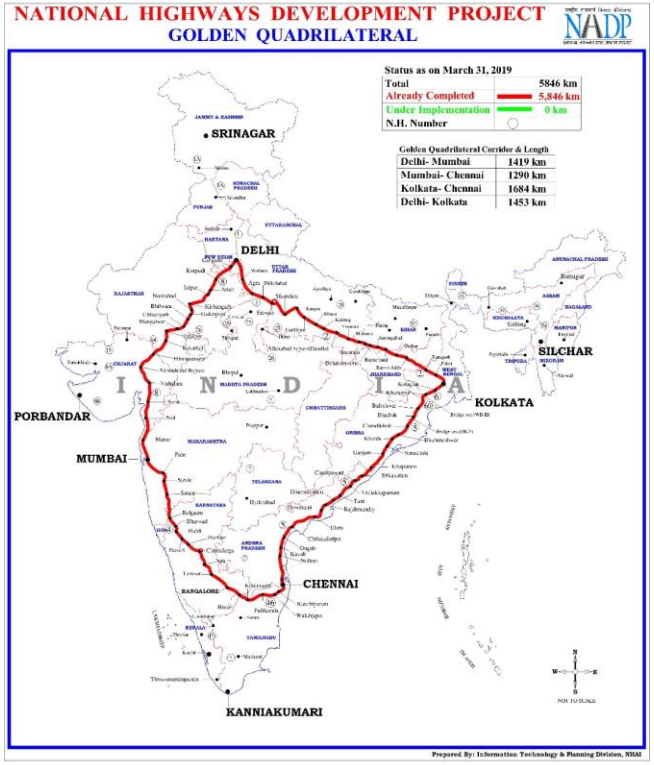
Road Transportation

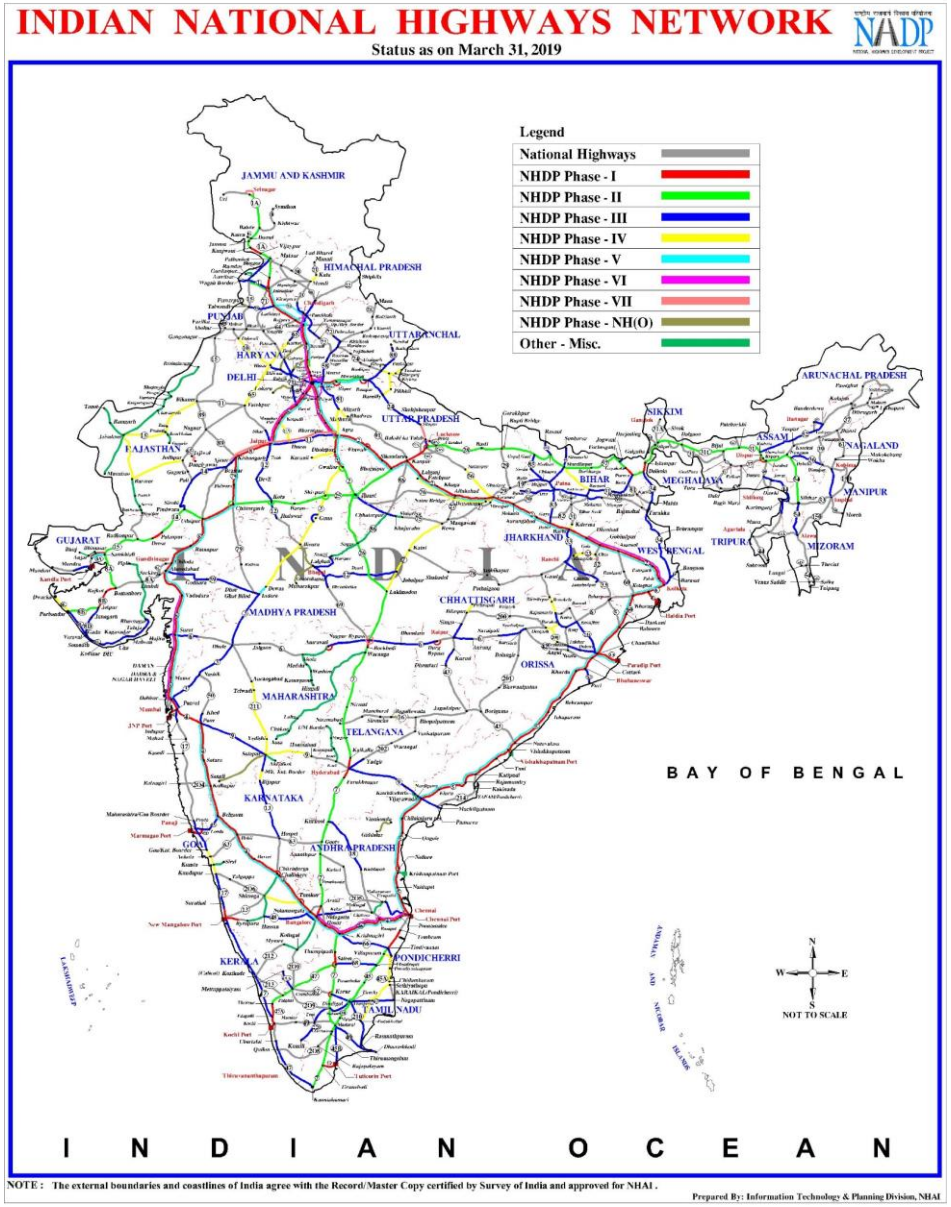
Road transport, however, possesses significant advantages over other modes:

- The **capital cost** of vehicles is relatively small, which makes it comparatively easy for new users to gain entry. This helps ensure that the trucking industry, for example, is highly competitive. Low capital costs also ensure that innovations and new technologies can diffuse quickly through the industry.
- The **high relative speed** of vehicles, the major constraint being government-imposed speed limits.
- **Flexibility of route choice** , once a network of roads is provided. Road transport has the unique opportunity of providing door-to-door service for both passengers and freight.

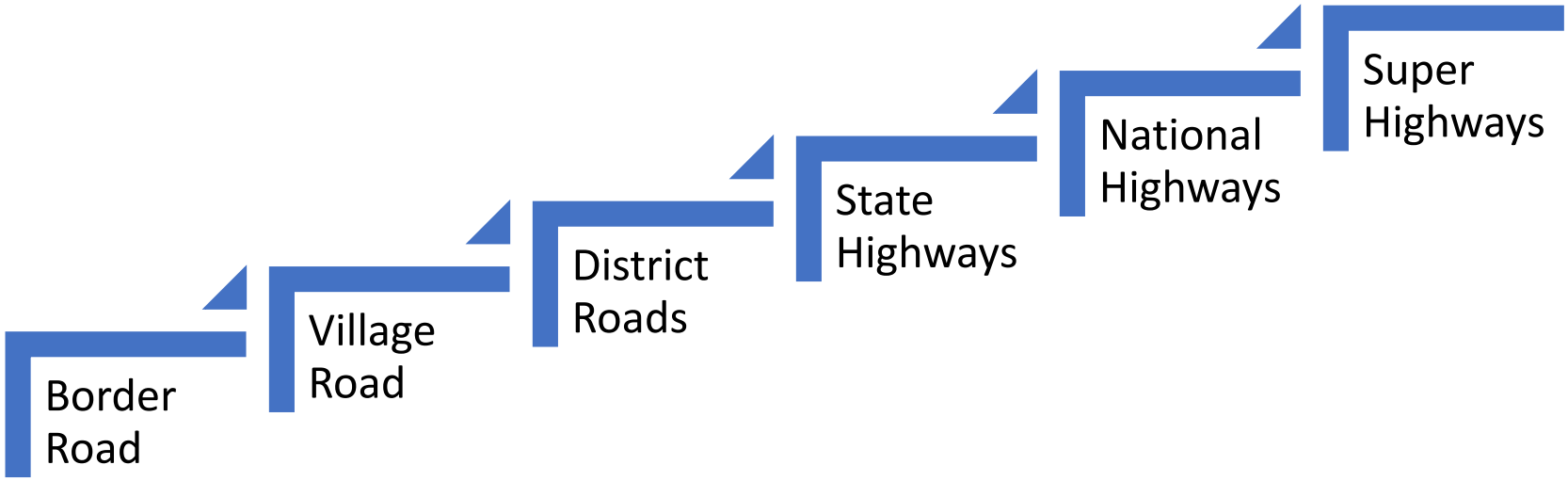
National Highways Authority of India was set up by an act of the Parliament, NHAI Act, 1988 “An Act to provide for the constitution of an Authority for the development, maintenance and management of national highways and for matter connected therewith or incidental thereto”.

The total length of NH (including expressways) in the country at present is 1,32,499 kms. **While Highways/Expressways constitute only about 1.7% of the length of all roads, they carry about 40% of the road traffic.**





Road Network in India



ROADS

MARKET SIZE

Highway Construction in India (kilometres)

SECTOR COMPOSITION

Total PPP Projects in India (as of December 2019)

Source: Department of Economic Affairs

KEY TRENDS

Outlay for Roads under the respective Union Budget (US$ billion)

Projects Awarded by NHAI (in kilometres)

Note: NHAI - National Highways Authority of India

GOVERNMENT INITIATIVES

National Investment and Infrastructure Fund (NIIF)

Central Road Fund (CRF)

Pradhan Mantri Gram Sadak Yojana

ADVANTAGE INDIA

- **Robust demand:** Production of commercial vehicles increased to 752,022 in FY20, commanding a stronger road network in India.
- **Higher Investments:** Transfer to National Investment Fund (NIF) was estimated at Rs. 6,070 crore (US$ 868.51 million) for 2019-20. Under the Union Budget 2021-22, the Government of India has allocated Rs. 108,230 crore (US$ 14.85 billion) to the Ministry of Road Transport and Highways.
- **Policy support:** 100% FDI is allowed under the automatic route subject to applicable laws and regulations. The Finance Bill 2019 made certain changes in the Central Roads and Infrastructure Fund Act. The central Government will now be responsible for formulating criteria for any state road project.
- **Attractive opportunities:** The Government aims to construct 65,000 km of national highways at a cost of Rs. 5.35 lakh crore (US$ 741.51 billion) by 2022.

Issues

	Project development stage	Construction stage	O&M stage
 Financing issues	• Higher land acquisition cost • Project implementation mode choice	• Limited funding option • Fading interest of PPP developers • Lender's averseness • Increased project cost	• Debt servicing and investment returns for private developers • O&M expense
 Operational issues	• Sub-optimal alignment leading to higher cost • Land acquisition delays	• Delayed approvals and clearances • Local/ enforcement issues • Cost overrun due to delay • Construction material shortage	• O&M requirements due to adverse weather conditions • Toll collection pilferage • Safety issues • Road user facility deficit
 Other issues	• State Support Agreement • Other pre-project related delays	• Disputes and claims due to delayed construction • Cost overrun	• Disputes and claims due to O&M issues and lesser than projected revenue generation

Financial Issues

Following is a brief description of various financing issues observed throughout the project development life-cycle:

a. Project-development stage	b. Construction stage	c. O&M stage
Land acquisition cost has increased more than 30 per cent since 2017[2] primarily due to enhanced compensation payment requirements as per 'The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act'. In addition to this, current project implementation modes like EPC and HAM put high stress on government resources, thus limiting the number of projects that can be taken up at one go.	There is a lower appetite for private developers to absorb construction risk as well as traffic risk based on legacies – e.g. languishing projects and projects needing premium payment deferment. Road sector projects are increasingly facing financial closure issues. Reasons include wariness of banks to lend, high share of NPAs, asset liability mismatch and banks reaching infrastructure lending caps.	There is uncertainty on equity returns in existing operational PPP projects along with difficulties faced in servicing debt. This is due to uncertainty of toll revenue collection and variation of collected toll revenue compared to projected levels. This discourages private sector interest. The increase in O&M costs are also affecting the project returns.

Operational Issues

Following is a brief description of various financing issues observed throughout the project development life cycle:

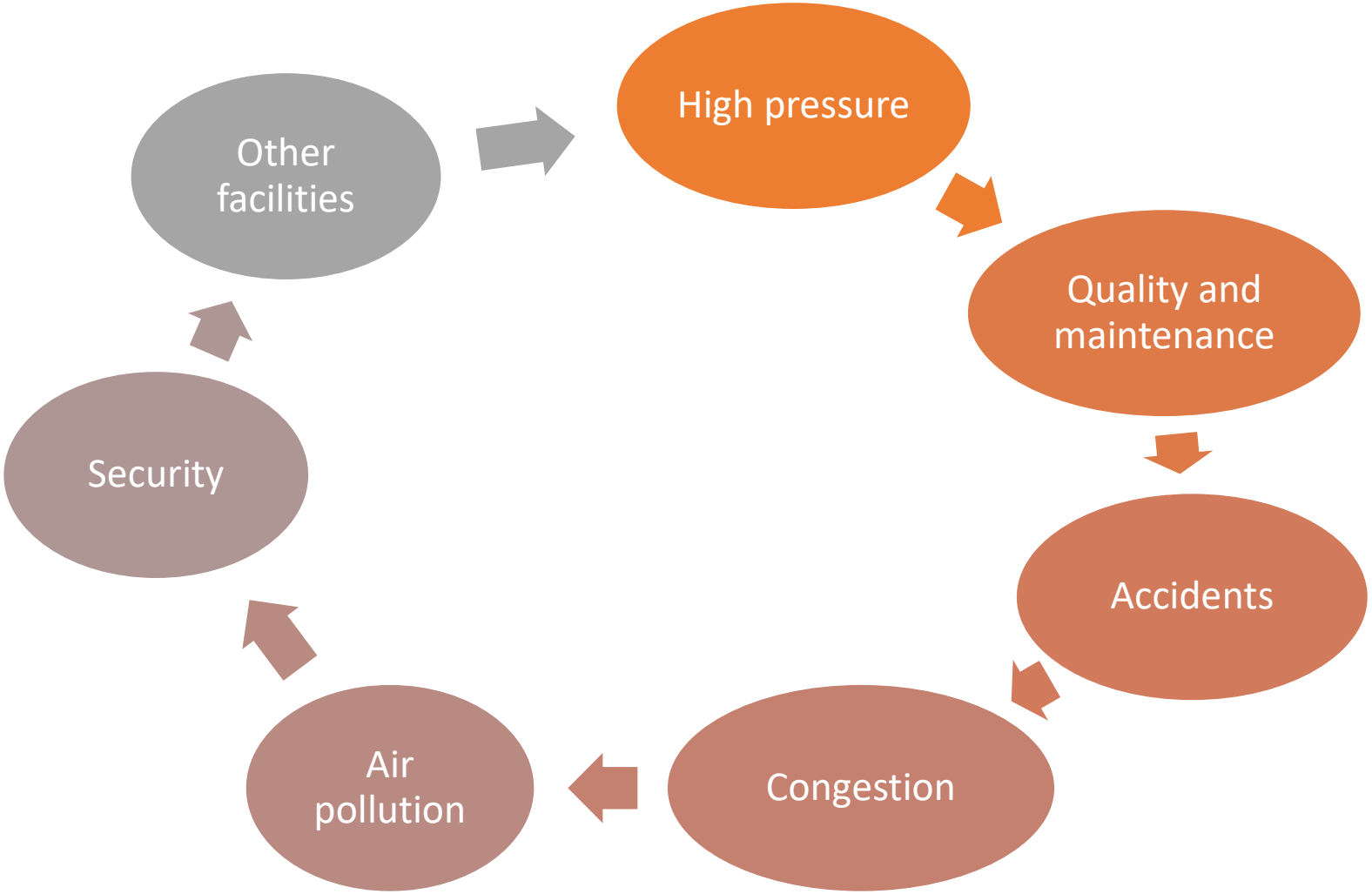
a. Project-development stage	b. Construction stage	c. O&M stage
Delays in pre-construction activities (such as land acquisition, relocation) is affecting project timelines. These processes consume considerable time. Land acquisition for road projects involve various stages. Each stage involves a number of stakeholders and regulatory bodies. The completion depends on other factors like geographical location and hence, the process is challenging. Inadequate technical due diligence at the time of preparation of Detailed Project Report (DPR) can also lead to high project costs due to aspects like sub-optimal alignments leading to enhancement in construction cost.	Road development process requires a number of approvals such as environmental clearance, forest clearance, railways clearance, etc. Each of these activities take considerable time and non-adherence to timelines result in cost overruns due to delays. In addition, other factors like enforcement issues and lack of construction material also result in delays. Managing problems of sub-contractors and holding them accountable is also a major issue faced. Sub-contractors also face payment issues.	Often unforeseen weather conditions require unplanned O&M, over and above the routine and periodic maintenance activities. This results in enhanced O&M expenses. In addition to this, there is a general lack of road user facilities. Safety related issues are also observed on many road stretches such as high accident response times, etc.

Other Issues

Following is a brief description of various project related issues observed in the roads and highways sector:

a. Project-development stage	b. Construction stage	c. O&M stage
All state government authorised projects are not backed by a state support agreement, which results in low interest in such projects.	Claims arising out of disputes between the concessionaire/ contractor and the government authorities is also a significant cost which can lead to large liabilities.	The returns on projects is not upto expectations because of improper DPR and traffic reports in the feasibility stage. Actual traffic is much less than the anticipated traffic, and so the lower returns deeply affects the financials of the project. Arbitration issues also result in project delays, which cause cost and time overruns.

Problems


High pressure
Quality and maintenance
Accidents
Congestion
Air pollution
Security
Other facilities

Reference

- https://www.ibef.org/industry.aspx
- https://indianrailways.gov.in/railwayboard/view_section.jsp?lang=0&id=0,1
- https://nhai.gov.in/#/