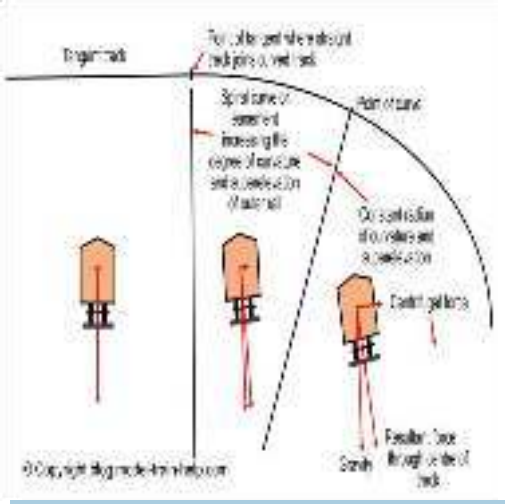
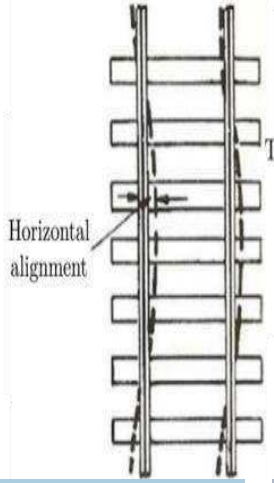
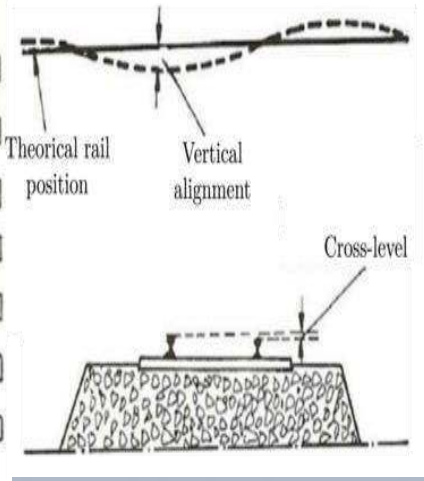
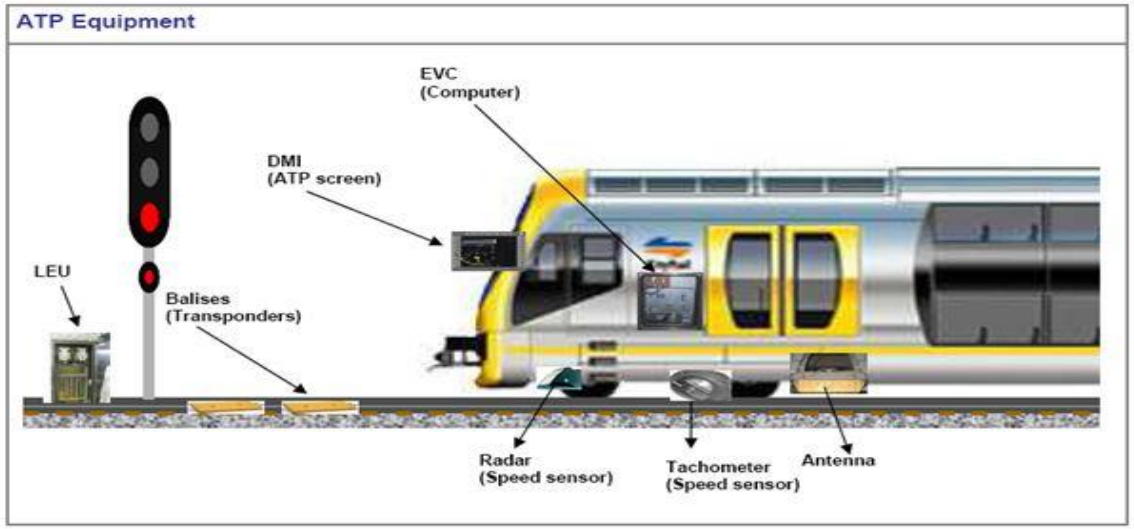
Typical tasks would include determining horizontal and vertical alignment design, station location and design, construction cost estimating, and establishment of signaling & controlling system.

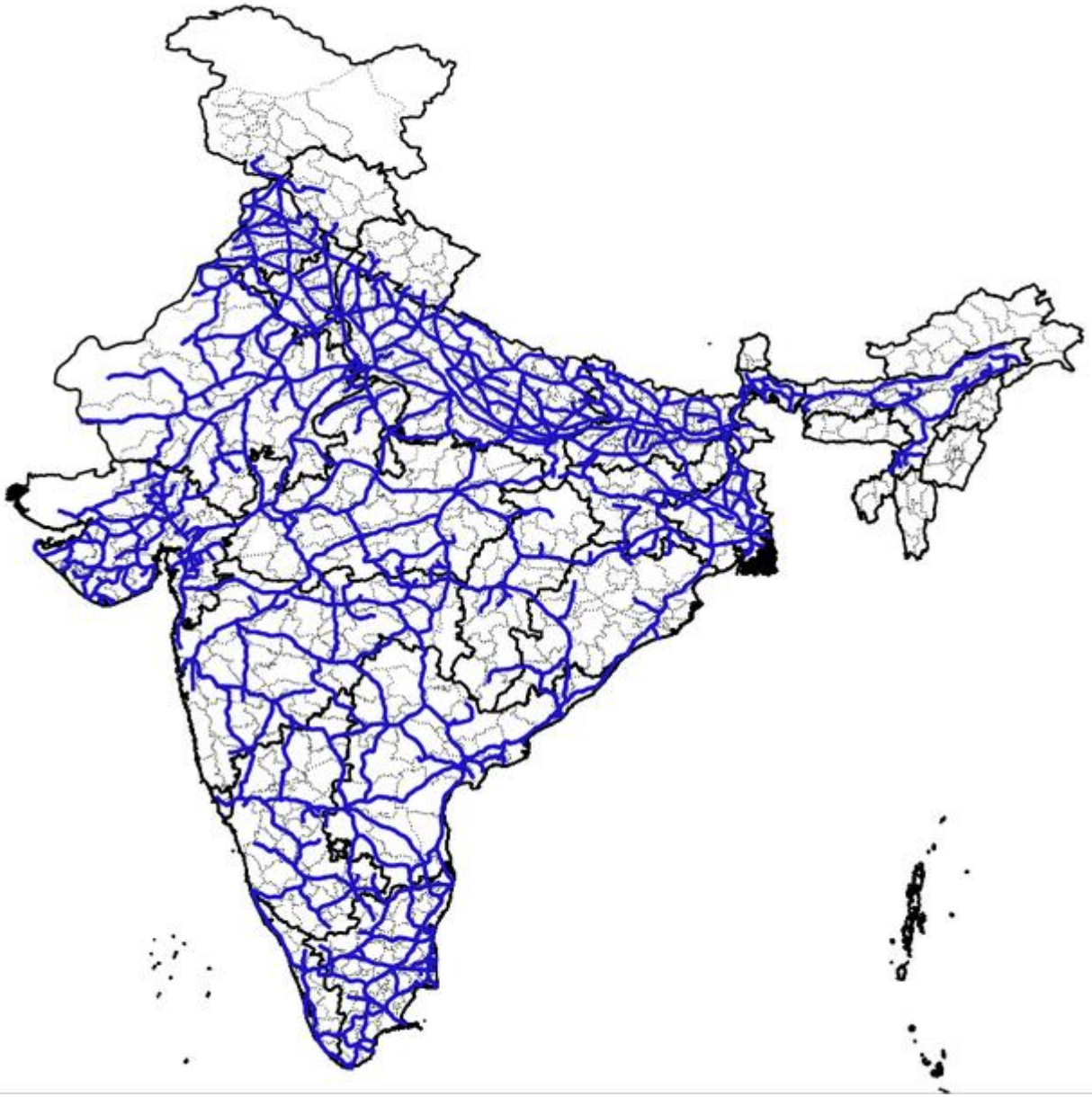






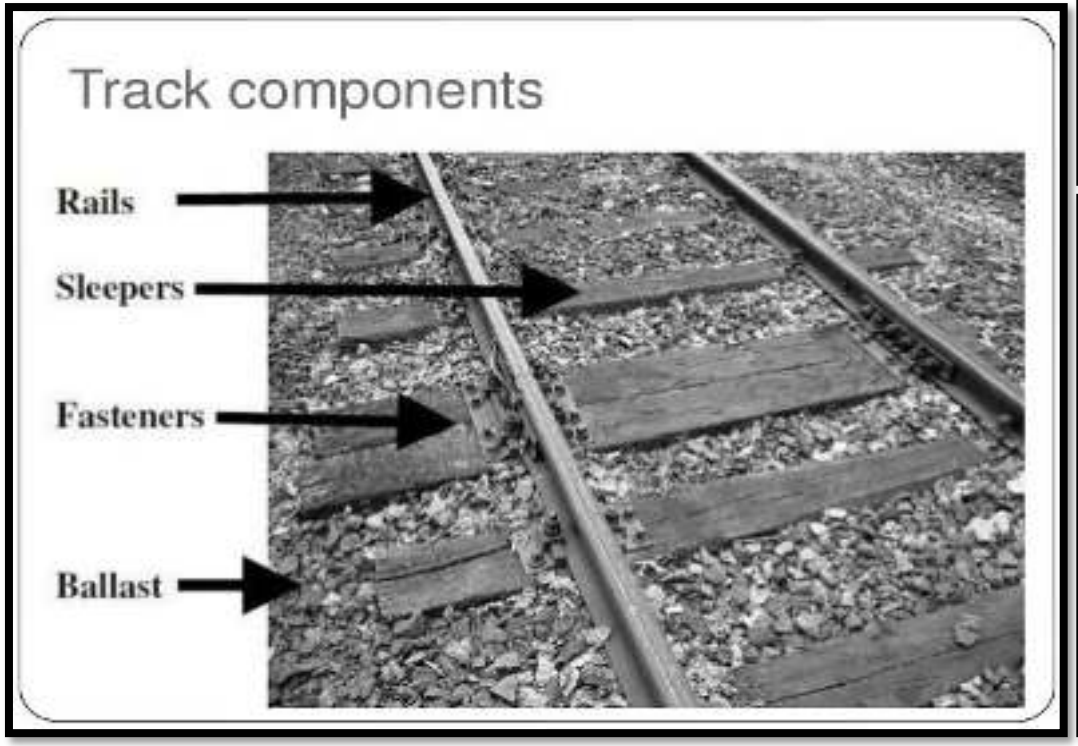


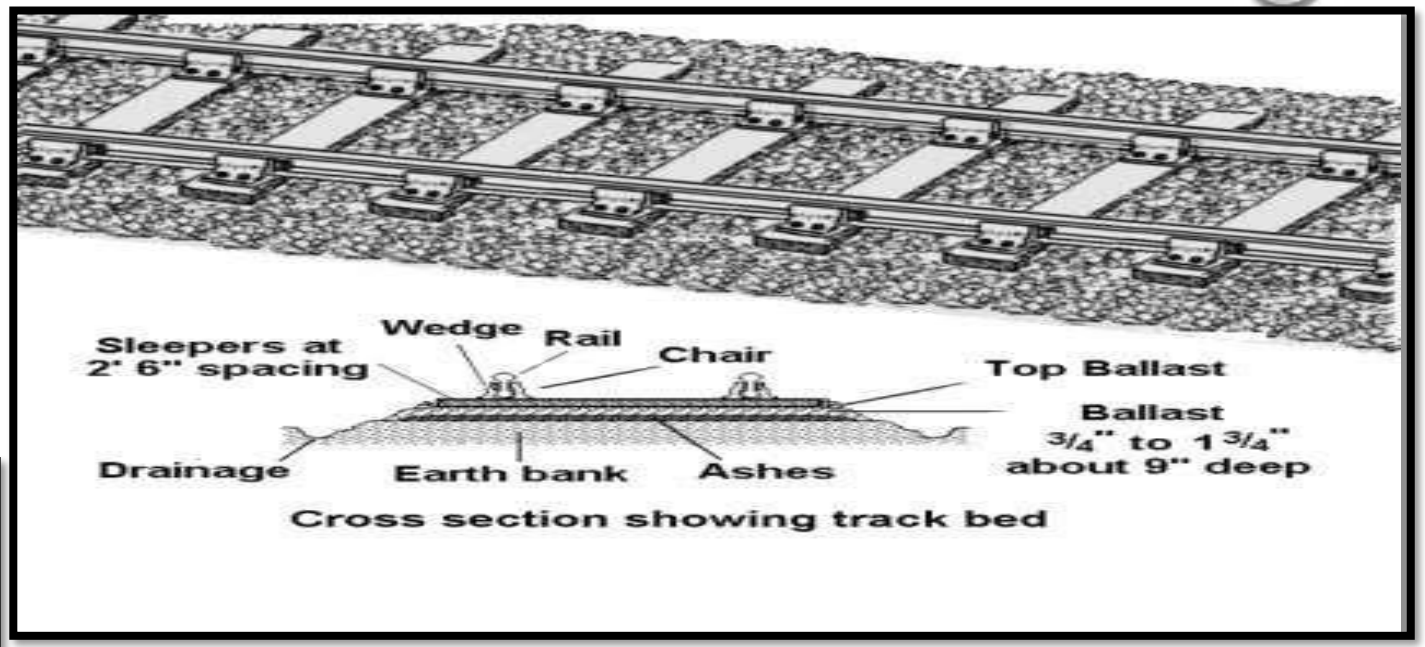
Railroad engineers can also move into the specialized field of train dispatching which focuses on train movement control. Railway engineers also work to build a cleaner and safer transportation network by reinvesting and revitalizing the rail system to meet future demands.

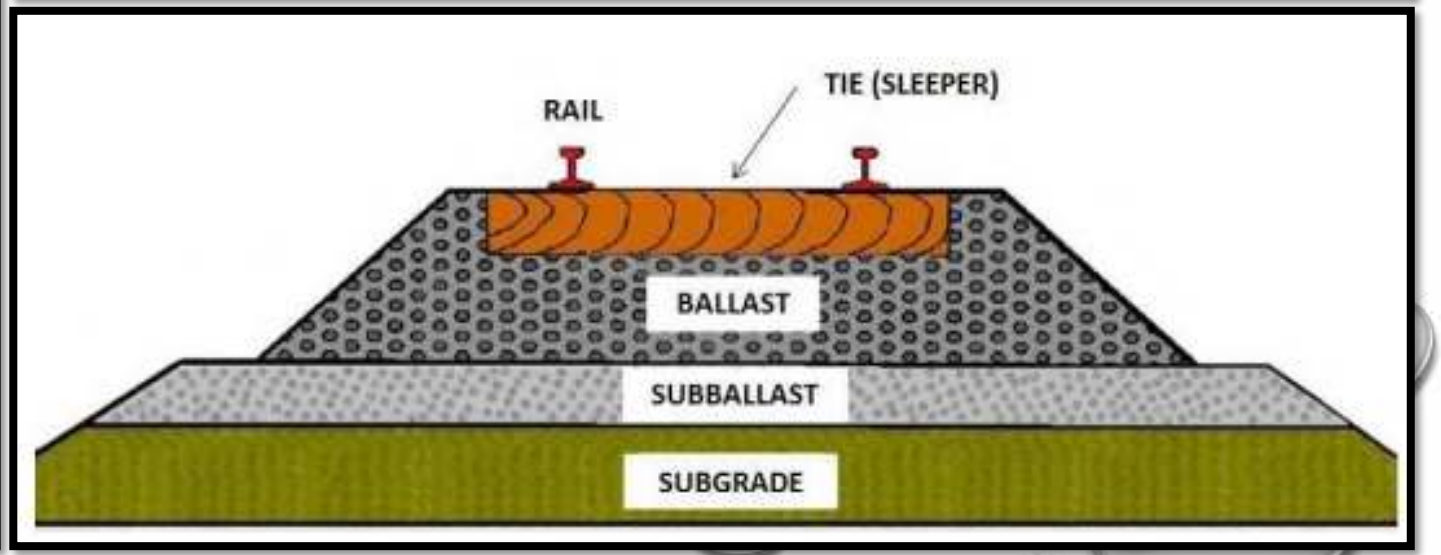


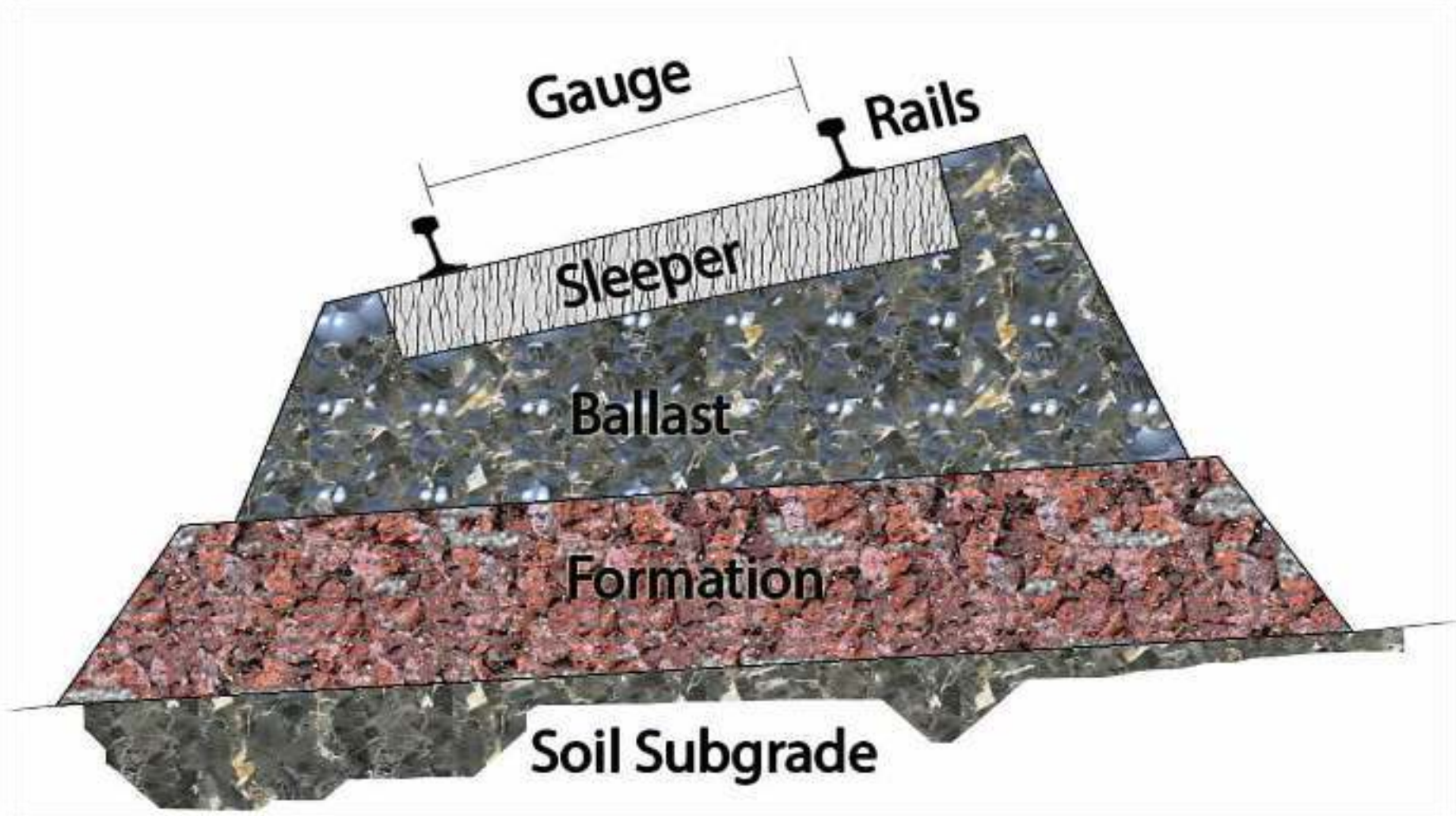
component parts of railway track

1. Formation
2. Ballast
3. Sleepers
4. Rails
5. Fastenings

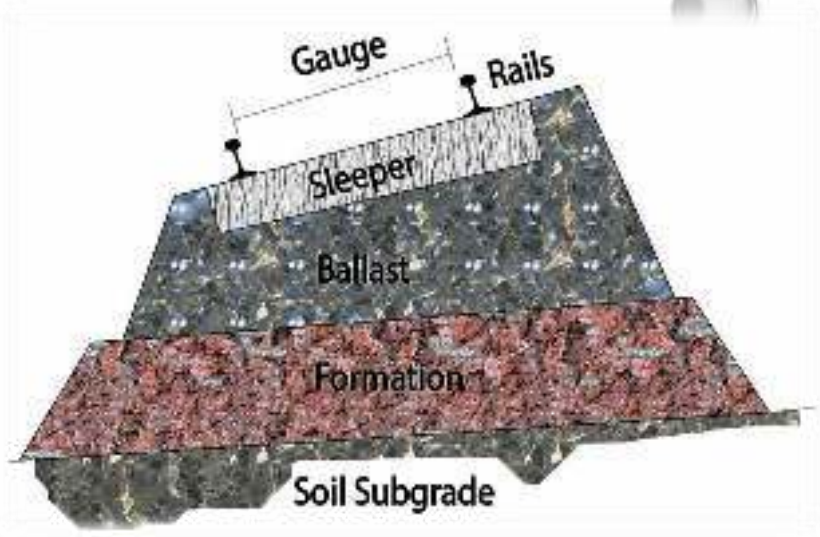







Gauge
Rails
Sleeper
Ballast
Formation
Soil Subgrade

1. FORMATION



The surface prepared to receive the ballast, sleepers, rails, etc.. for constructing the railway track is called formation or sub grade.

Funnction of formation

The formation has the following functions

- It provides a smooth and uniform bed on which the track is laid.
- It bears the entire load transmitted from the moving loads to it through the ballast.
- It provides drainage facilities.
- It provides stability to the track.

Design aspects

WIDTH

The width of the formation depends upon

- Numbers of tracks to be laid over it.
- Gauge of the track.
- Width of ballast layer.
- Width of drains provided.

HEIGHT

The height of the formation depends upon the topography of the alignment and the gradients adopted.

SLIDE SLOPES

The slide slopes of the formation depends upon the characteristics of the soil, as shear strength, angle of repose etc.

2. BALLAST

Ballast is a layer of broken stone, gravel, or any other suitable material placed under and around the sleepers for distributing the load from the sleepers to the formation.

Functions of Ballast

- It provides a suitable foundation for the sleepers.
- It transfer and distributes loads from the sleepers to a larger area of formation.
- it provides effective drainage to the track.
- It helps in protecting the top surface of the formation.

PHYSICAL PROPERTIES OF GOOD BALLAST

- It should be hard and tough.
- It should wear resistant and durable.
- It should be non-porous and non-absorbent of water.
- It should be cheaper and easily available.
- It should not be brittle.
- It should not allow rain water to accumulate

Types of ballast

Following materials can be used as ballast:

1. Broken stone
2. Gravel
3. Cinders or Ashes
4. Sand
5. Brick ballast
6. Kankar

3. SLEEPERS

- Sleeper is transverse support for a railway to give stiffness to it.

FUNCTIONS OF SLEEPERS

- Holds the rails to correct gauge.
- Give a firm and even support to the rails.
- Distributes the axle load over a sufficiently large area of ballast.
- To act as elastic medium between the rails and ballast to absorb vibration.
- To maintain the alignment of the track.
- To provide insulation for electrified track.

Classification of sleepers

Depending on the material used for their manufacture, the sleepers can be divided into the following categories

- Wooden sleepers.
- Steel sleepers.
- Cast iron sleepers.
- Concrete sleepers

WOODEN SLEEPERS

Wooden sleepers are the ideal type of sleeper.Hence they are universally used. The utility of timber sleepers has not diminished due to the passage of time.

STEEL SLEEPERS

Due to the increasing shortage of timber in the country and other economical factors have led to the use of steel and concrete sleepers on railways.

CONCRETE SLEEPERS

Concrete ties have become more common mainly due to greater economy and Shortage of timber.

4. RAILS

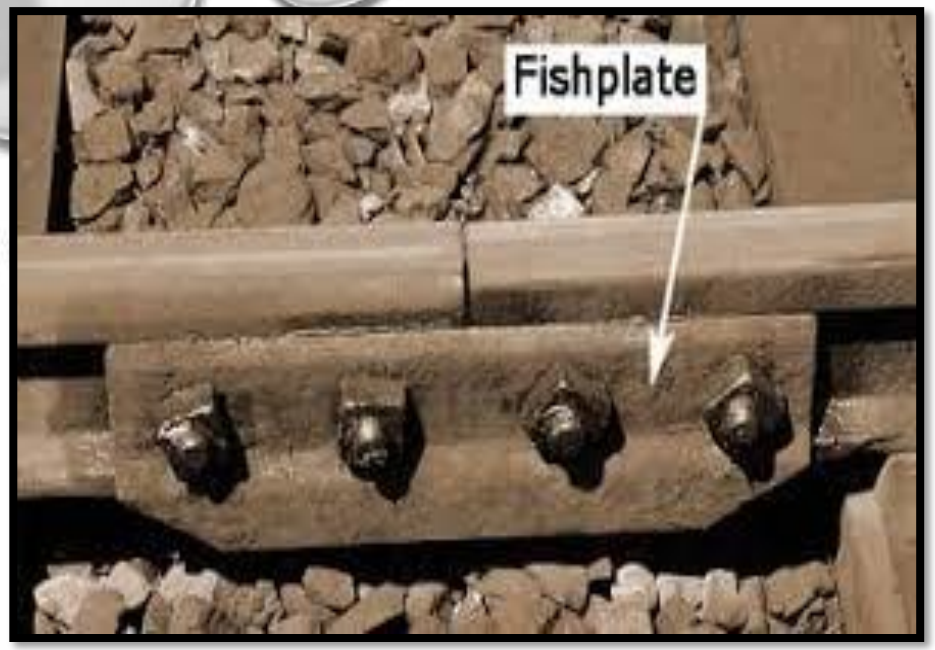
Definition and Function

- Rail is an iron beam.
- Its main function is to provide a most economical, smooth and level surface for the smooth passage of heavily loaded vehicles at great speed.
- The two rails of the track also serve as a lateral guide for the running of the wheels.

5. FASTENINGS

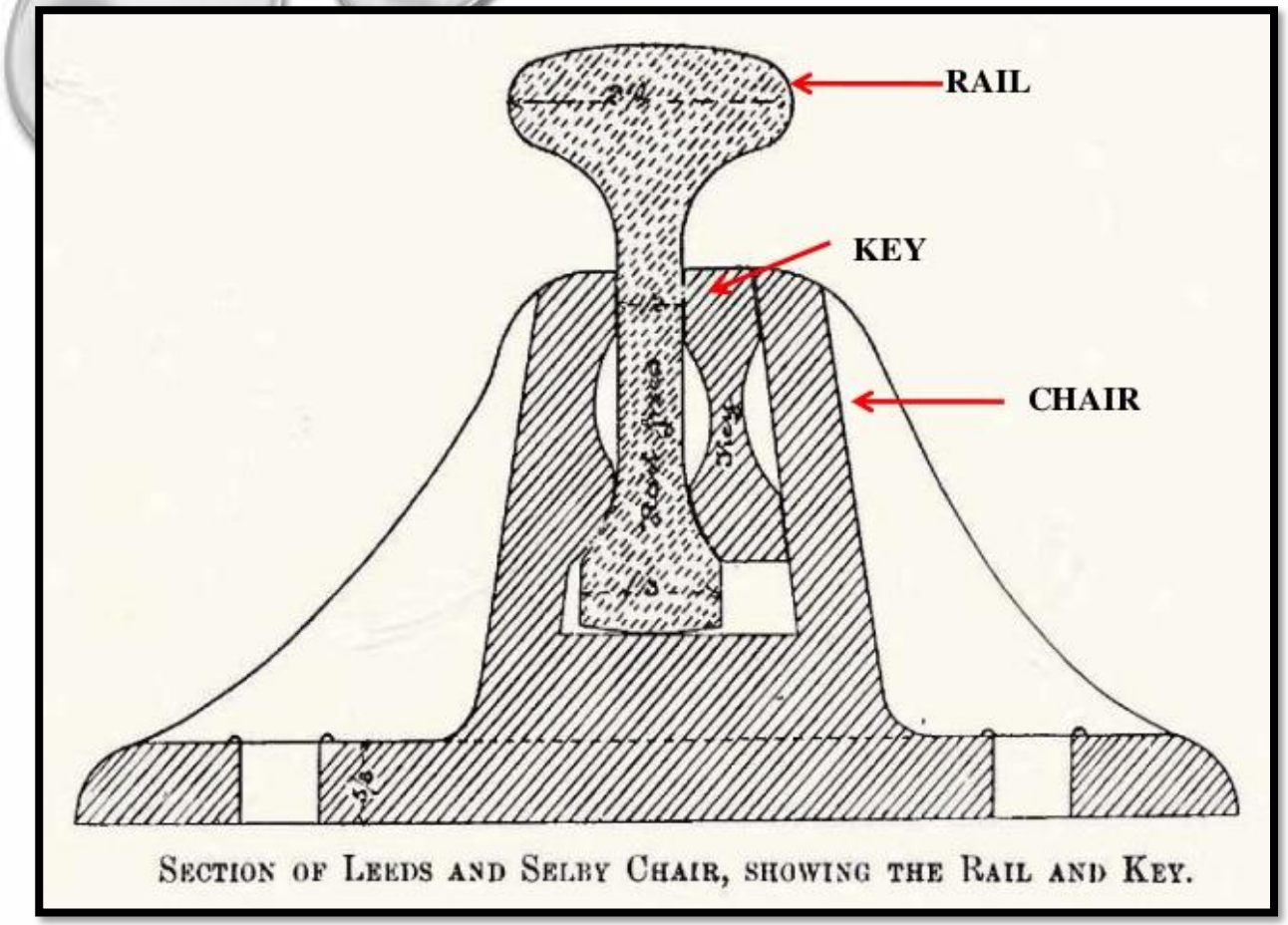
The devices used to connect rails and sleepers together to form the track are known as fastenings.
These includes:

- Fish plates
- Bolts
- Chairs
- Keys
- Bearing plates

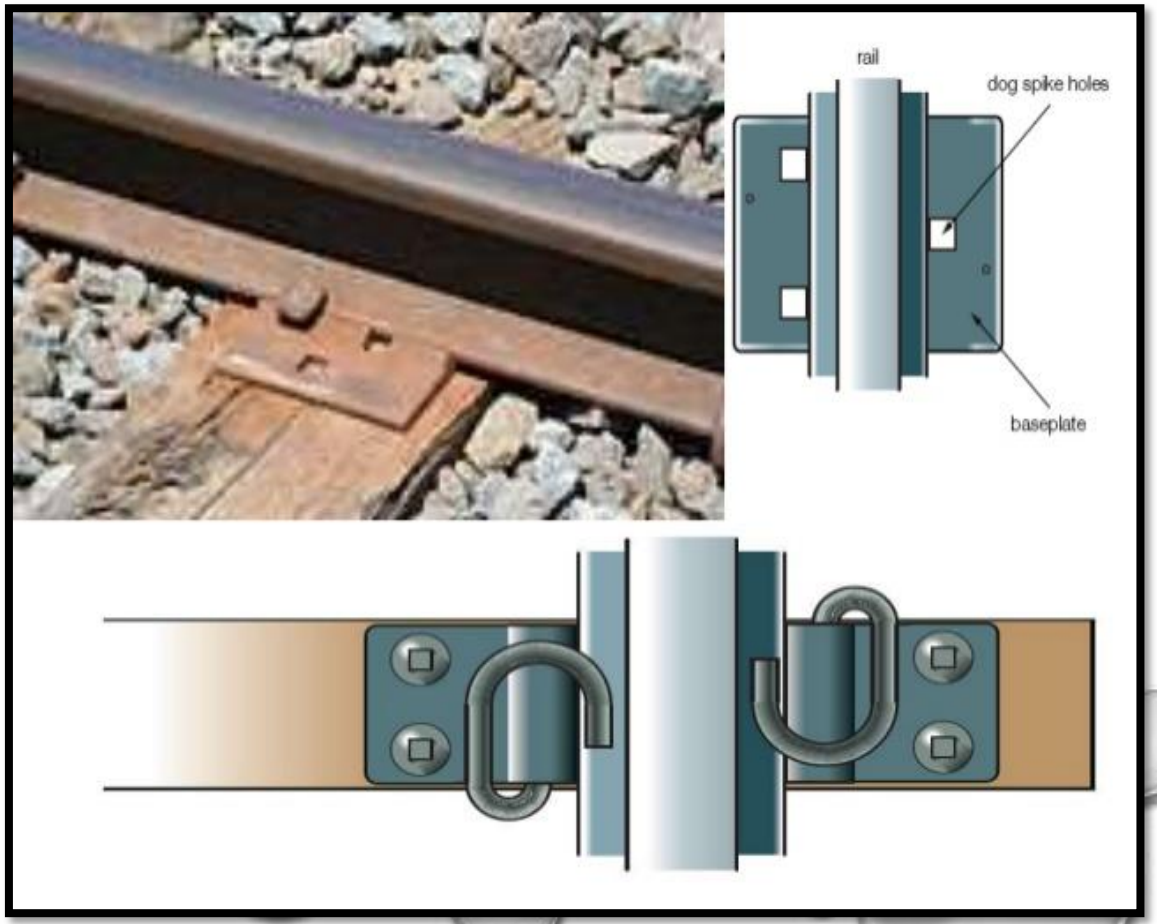

Fishplate


Bolts


CHAIRS



SECTION OF LEEDS AND SELBY CHAIR, SHOWING THE RAIL AND KEY.



FISH PLATES

- The function of a fish plate is to hold two rails together.
- At each, joint a pair of fish plates is used.

BOLTS

Various types of bolts are used in railroad fitting.

- **Fish bolts:**
- With each pair of fish plates two, four or six fish bolts are used.
- The standard practice is to use four bolts.
- They are made up of high carbon steel to with stand considerable stresses.

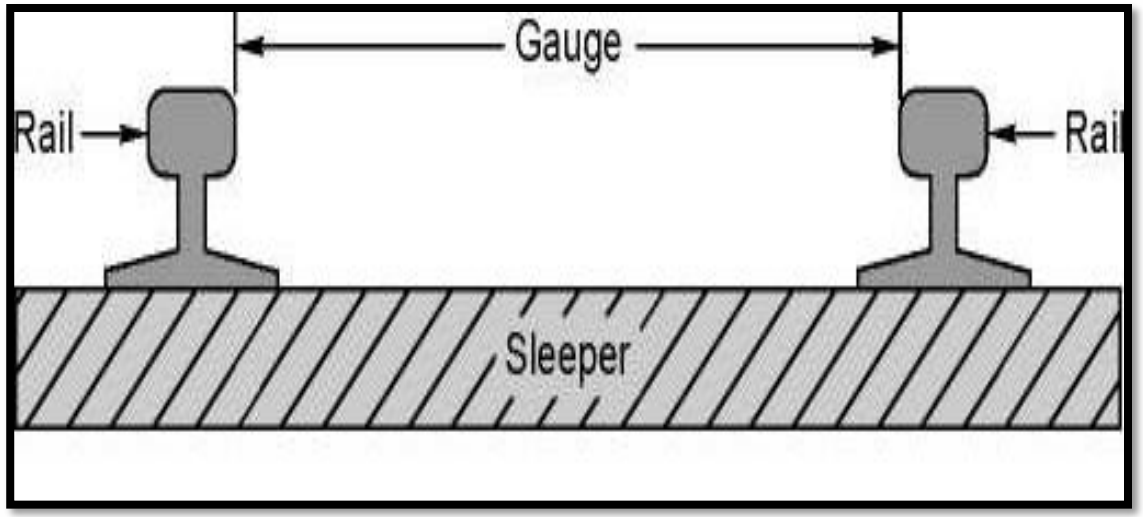
CHAIRS

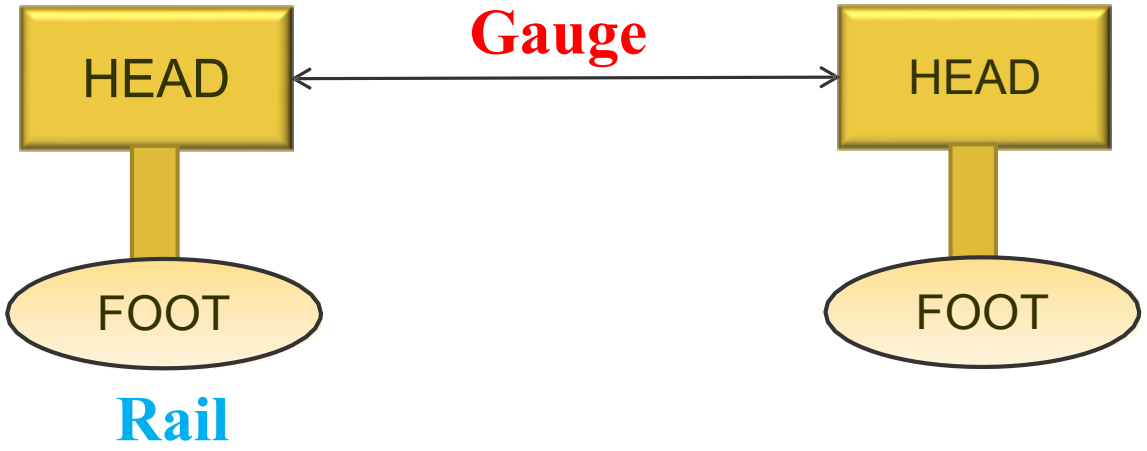
- Chairs are used to hold the double headed and bull-headed rails in position. Invariably chairs are made of cast iron and they help in distributing the load from rails to sleepers.

BEARING PLATES

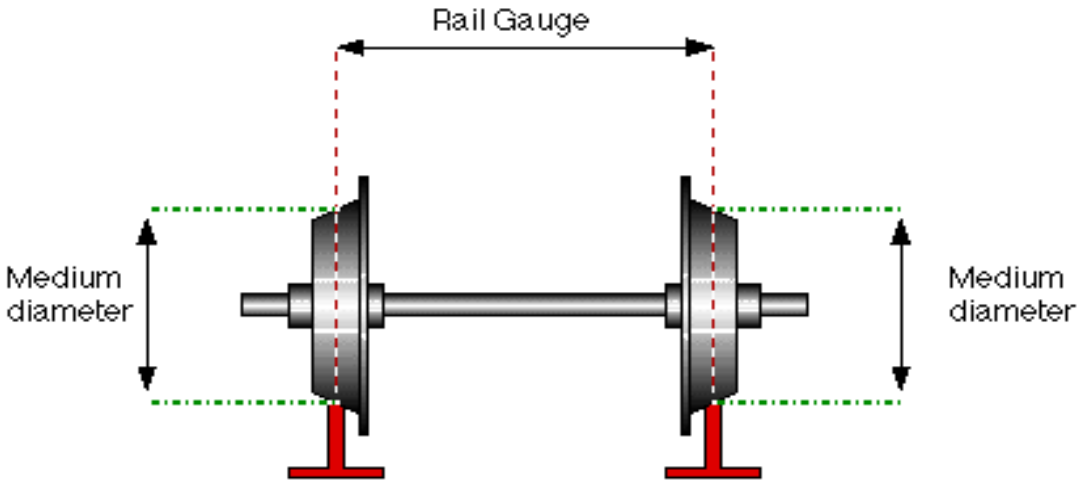
- Chair used for flat footed rails are known as bearing plates.
- They increase the bearing area on the sleeper and thus decrease the loading intensity.

GAUGE

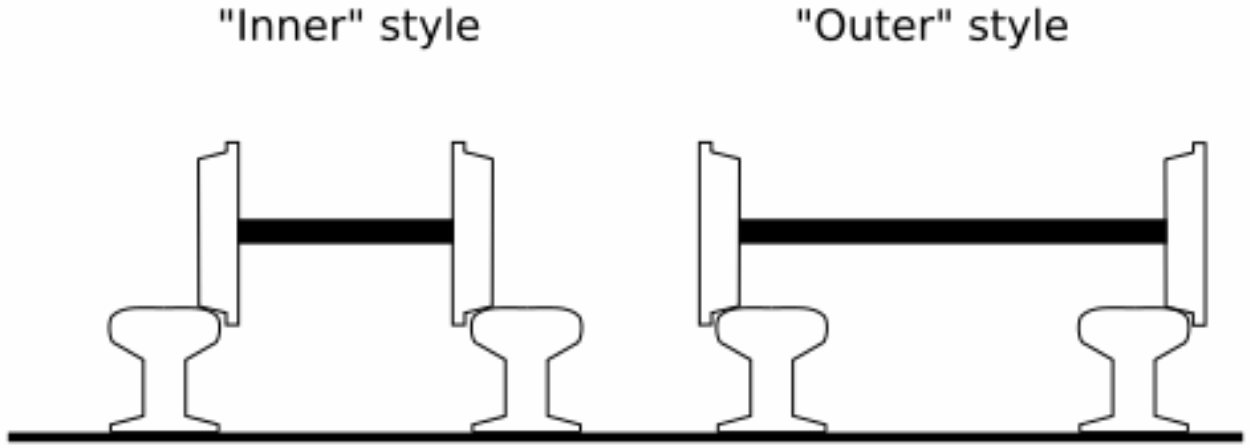


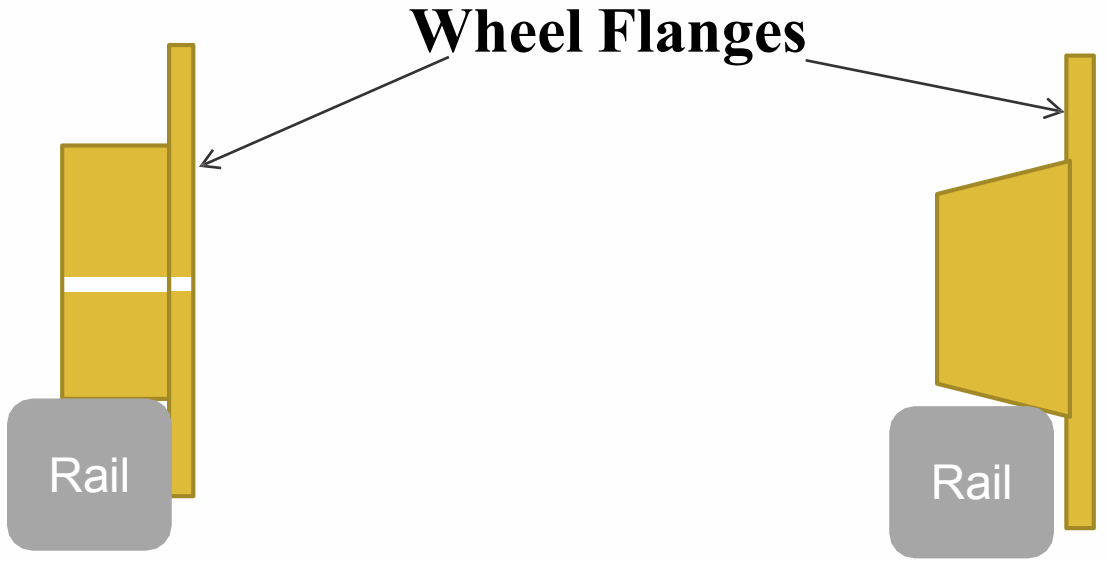

Gauge
HEAD
HEAD
FOOT
FOOT
Rail


Gauge


Rail Gauge
Medium diameter
Medium diameter

GAUGES ON WORLD RAILWAYS

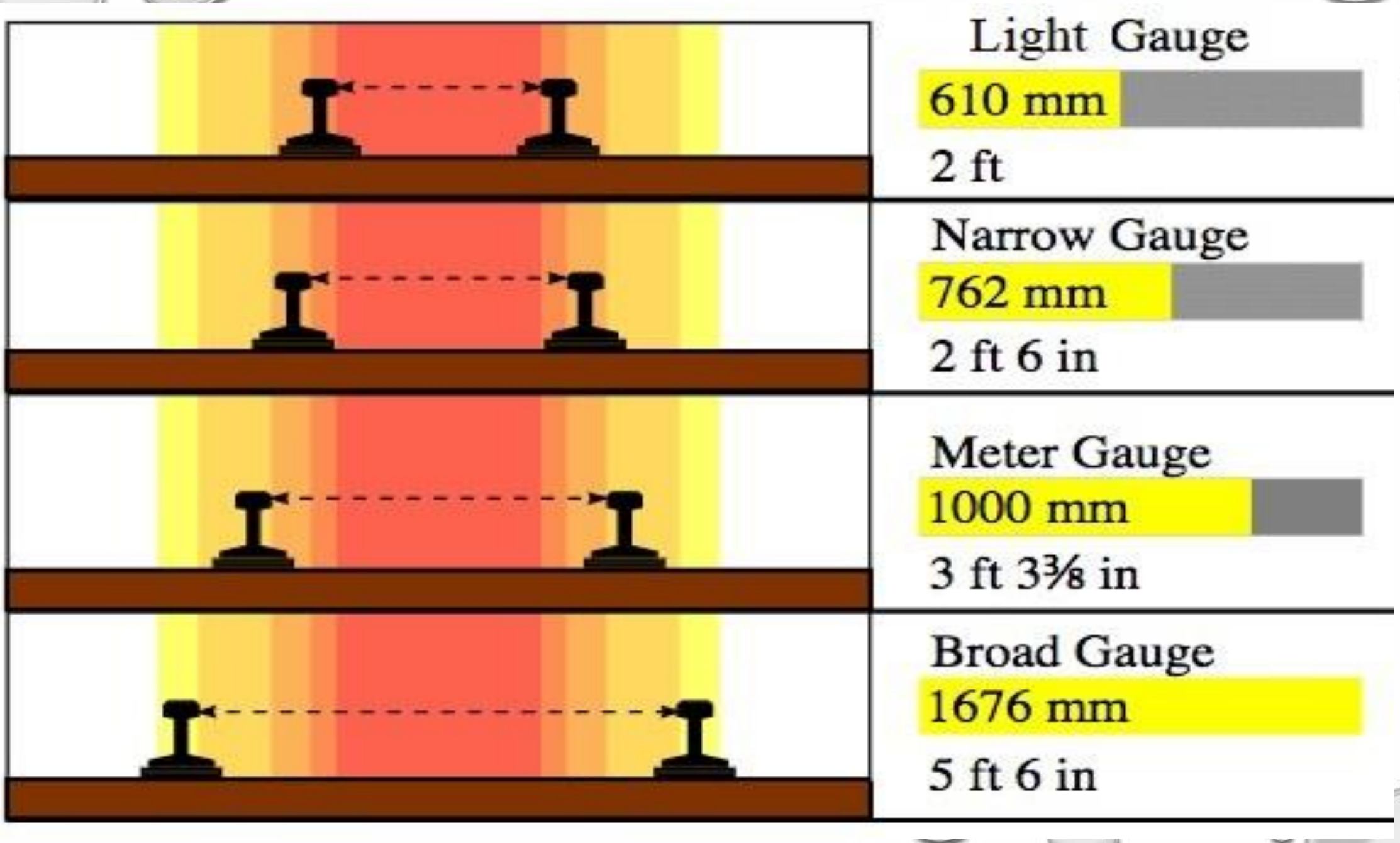




Type of gauge	Gauge (mm)	Gauge (feet)	% of total length	Countries
Standard gauge	1435	4'8.5"	62	England, USA, Canada, Turkey, Persia, and China
Broad gauge	1676	5 '6"	6	India, Pakistan, Sri Lanka, Brazil, Argentina
Broad gauge	1524	5'0"	9	Russia, Finland
Cape gauge	1067	3 '6"	8	Africa, Japan, Java, Australia, and New Zealand
Metre gauge	1000	3 '3.5"	9	India, France, Switzerland, and Argentina
23 various other gauges	Different gauges	Different gauges	6	Various countries

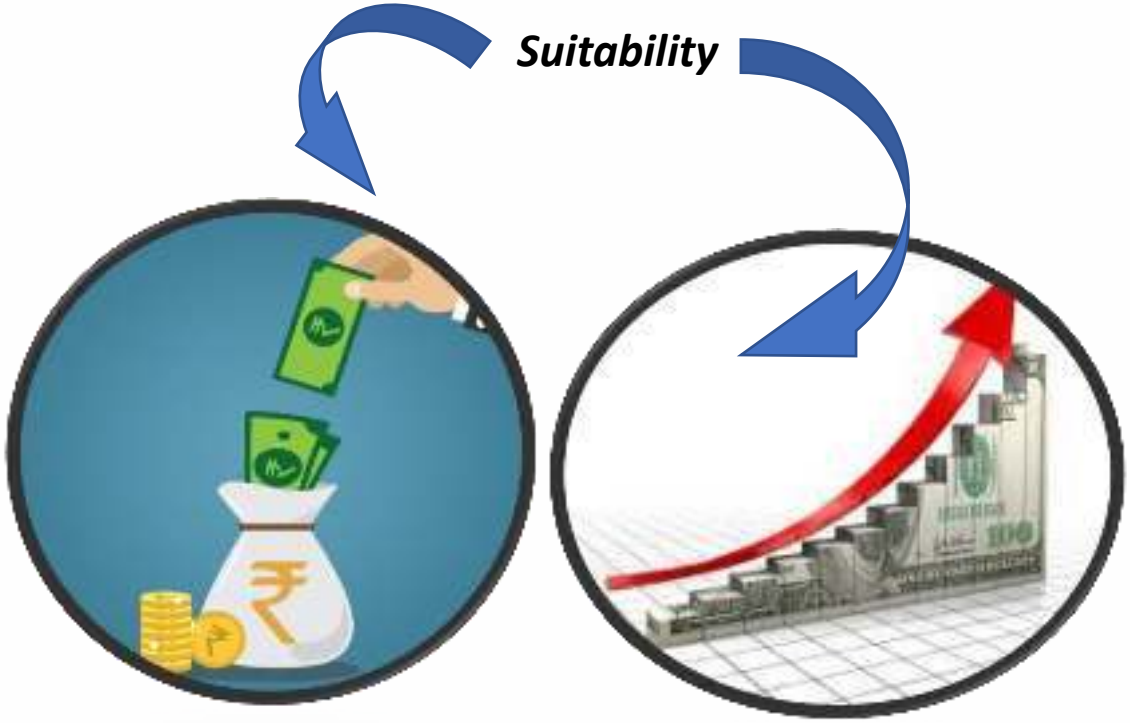
DIFFERENT GAUGES ON INDIAN RAILWAYS

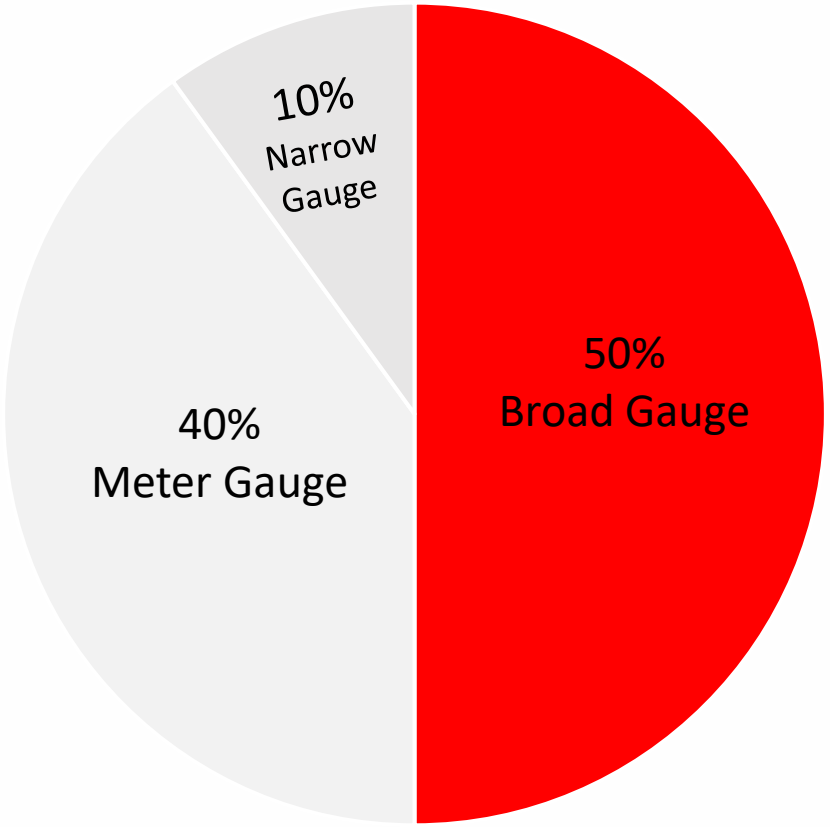
NAME OF GAUGE	WIDTH (MM)	ROUTE (KM)	% OF ROUTE (KM)
Broad gauge (BG)	1676	55,188	85.6
Metre gauge (MG)	1000	6809	10.6
Narrow gauge (NG)	762	2463	3.8
	610		
Total all gauges		64,460	100


Light Gauge
610 mm
2 ft
Narrow Gauge
762 mm
2 ft 6 in
Meter Gauge
1000 mm
3 ft 3⅜ in
Broad Gauge
1676 mm
5 ft 6 in


INDIAN RAILWAY MAP
LEGEND
INDIAN OCEAN

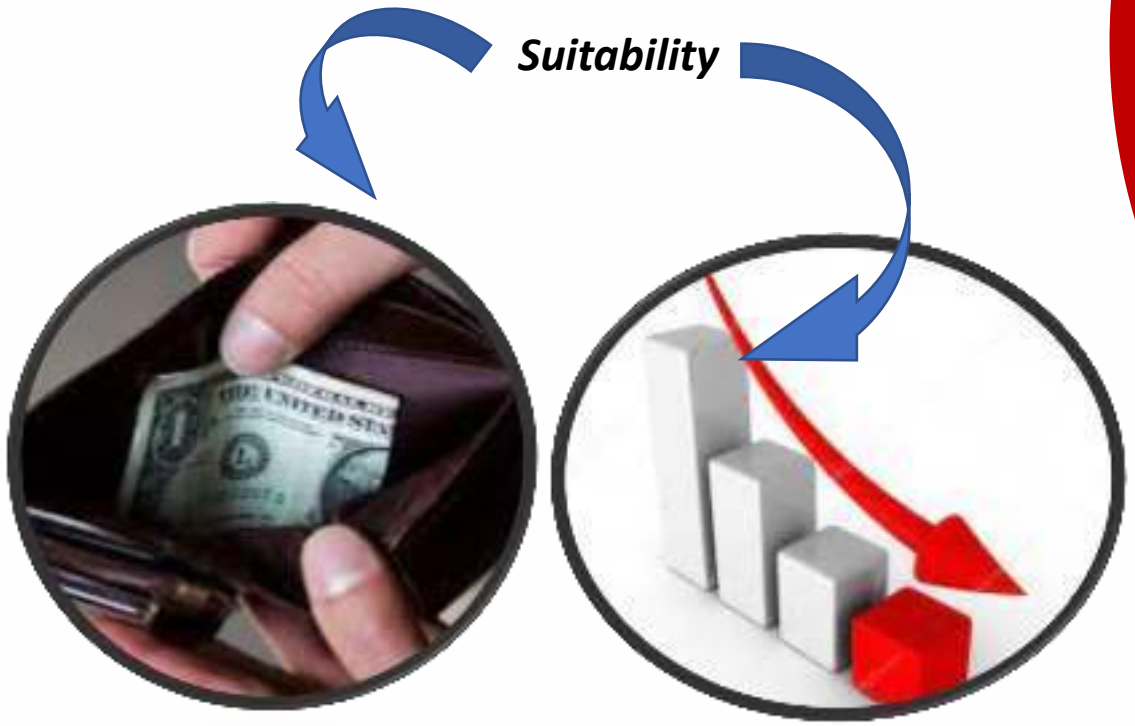
Broad gauge (BG)

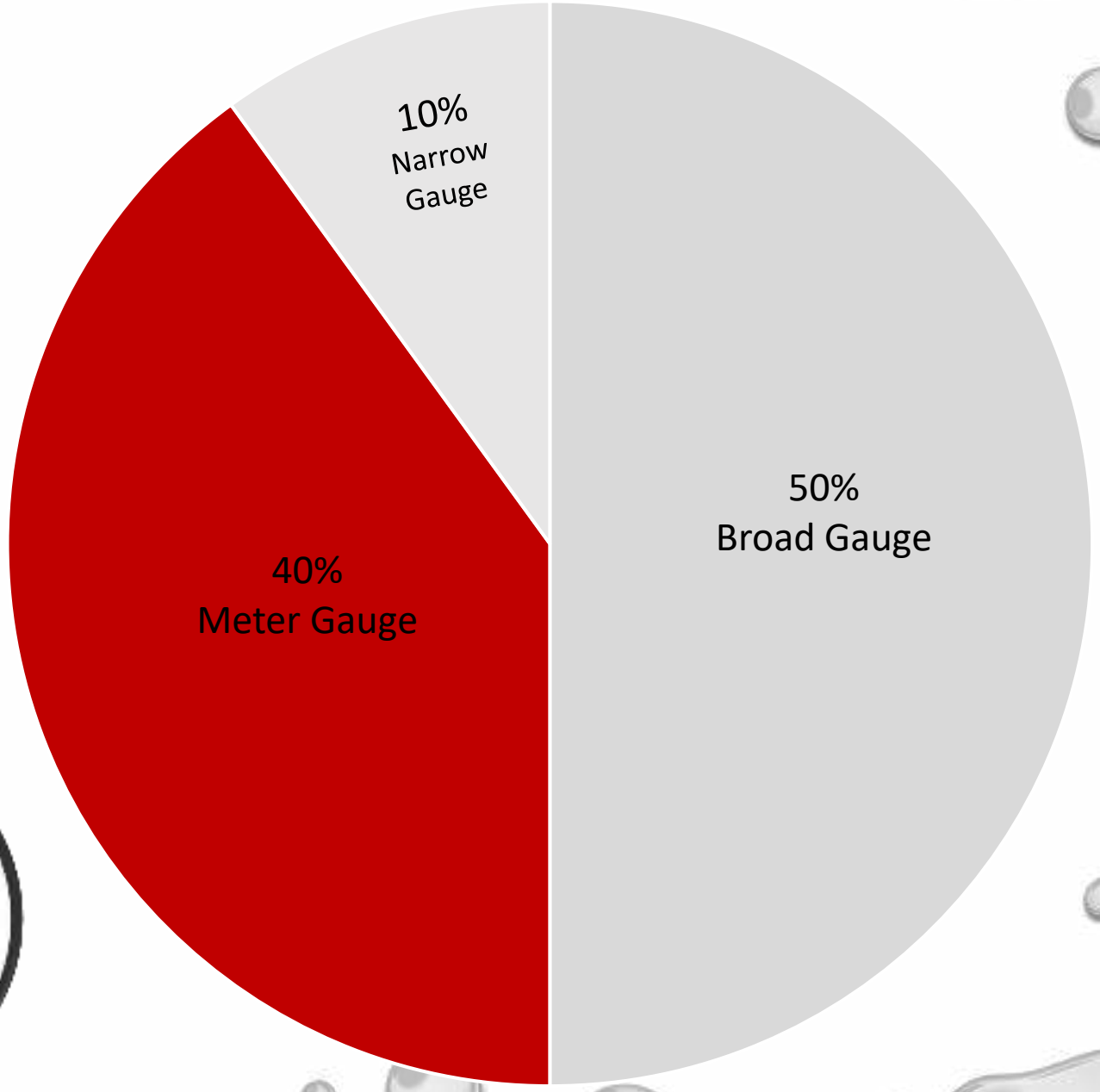





Maptitude

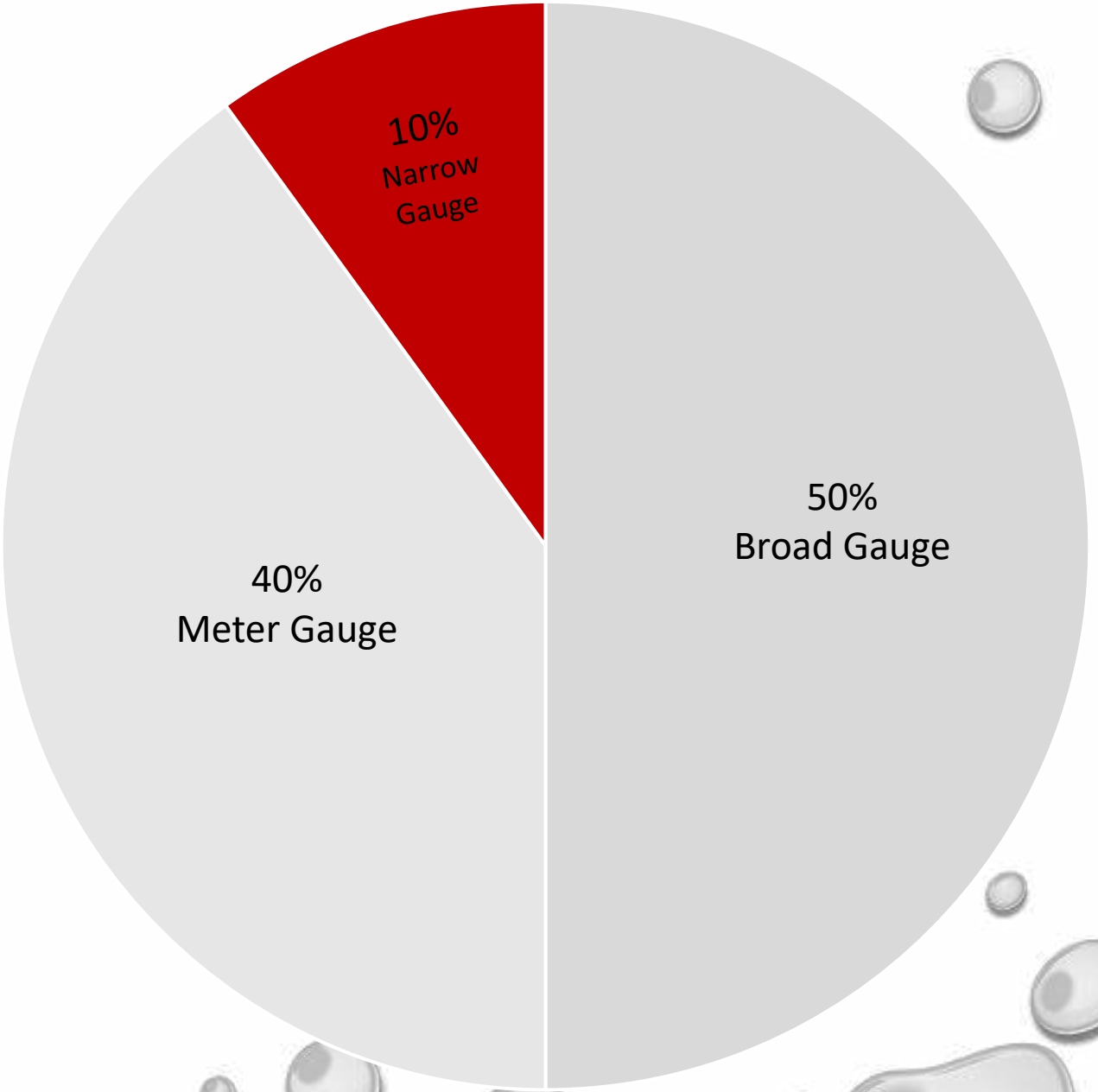
Metre Gauge






Plzeň

Narrow Gauge



Airport Engineering

Airport Engineering

Airport engineers design and construct airports. Airport engineers must account for the impacts and demands of aircraft in their design of airport facilities.

These engineers must use the analysis of predominant wind direction to determine runway orientation, determine the size of runway border and safety areas, different wing tip to wing tip clearances for all gates and must designate the clear zones in the entire port.

An airport system plan is a representation of the aviation facilities required to meet the immediate and future needs of a metropolitan area, region, state, or country.

The system plan presents the recommendations for the general location and characteristics of new airports and heliports and the nature of expansion for existing ones to meet forecasts of aggregate demand.

It identifies the aviation role of existing and recommended new airports and facilities. It includes the timing and estimated costs of development and relates airport system planning to the policy and objectives of the relevant jurisdiction.

Its overall purpose is to determine the extent type, nature, location, and timing of airport development needed to establish a viable, balanced, and integrated system of airports.

It also provides the basis for detailed airport planning such as that contained in the airport master plan. The airport system plan provides both broad and specific policies, plans, and programs required to establish a viable and integrated system of airports to meet the needs of the region.

The objectives of the system plan include:

1. The orderly and timely development of a system of airports adequate to meet present and future aviation needs and to promote the desired pattern of regional growth relative to industrial employment, social, environmental and recreational goals development aviat meet role in a balanced and multimodal transportation
2. The system to foster the overall goals of the area as reflected in the transportation system plan and comprehensive development plan.
3. The protection and enhancement of the environment through the location and expansion of aviation facilities in a manner which avoids ecological and environmental impairment.
4. The provision of the framework within which specific airport programs may be developed consistent with the short-and long-range airport system requirements.
5. The implementation of land-use and airspace plans which optimize these resources in an often constrained environment.
6. The development of long-range fiscal plans and the establishment of priorities for airport financing within the government budgeting process.

The elements in a typical airport system planning process include the following:

1. Exploration of issues that impact aviation in the study area
2. Inventory of the current system
3. Identification of air transportation needs Notes.in
4. Forecast of system demand
5. Consideration of alternative airport systems
6. Definition of airport roles and policy strategies
7. Recommendation of system changes, funding strategies, and airport development
8. Preparation of an implementation plan

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Airport Engineering

Airport Engineering encompasses the planning, design, and construction of terminals, runways, and navigation aids to provide for passenger and freight service.

Airport engineers design and construct airports. They must account for the impacts and demands of aircraft in their design of airport facilities.

These engineers must use the analysis of predominant wind direction to determine runway orientation, determine the size of runway border and safety areas, different wingtip to wing tip clearances for all gates and must designate the clear zones in the entire port.

- What is an AIRPORT?
- An airport is a facility where passengers connect from ground transportation to air transportation.
- It is a location where aircraft such as airplanes, helicopters take off and land.
- Aircraft may also be stored or maintained at an airport.
- An airport should have runway for takeoffs and landings, buildings such as hangars and terminal buildings.





- AIRFIELD is an area where an aircraft can land and take off, which may or may not be equipped with any navigational aid or markings. Many grass strips are also designated as airfields.

- AERODROMES

A defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft.

The world's first airport was built in 1928 at Croydon near London (England). It was the main airport for London till it.as closed down in1959, after the World War Il. It is now open as a visitor centre for aviation.

Airports Authority of India (AAI) manages a total of 137 Airports, which includes **103 Domestic Airports**, 24 International Airports, and 10 Customs Airports. AAI is responsible for creating, maintaining, upgrading, and managing civil aviation infrastructure in India and works under the Ministry of Civil Aviation.

- An international airport has direct service to many other airports.
- Handle scheduled commercial airlines both for passengers and cargo.
- Many international airports also serve as "HUBS", or places where non-direct flights may land and passengers switch planes.
- Typically equipped with customs and immigration facilities to handle international flights to and from other countries.
- Such airports are usually larger, and often feature longer runways and facilities to accommodate the large aircraft.

seventeen international airports in India as on date

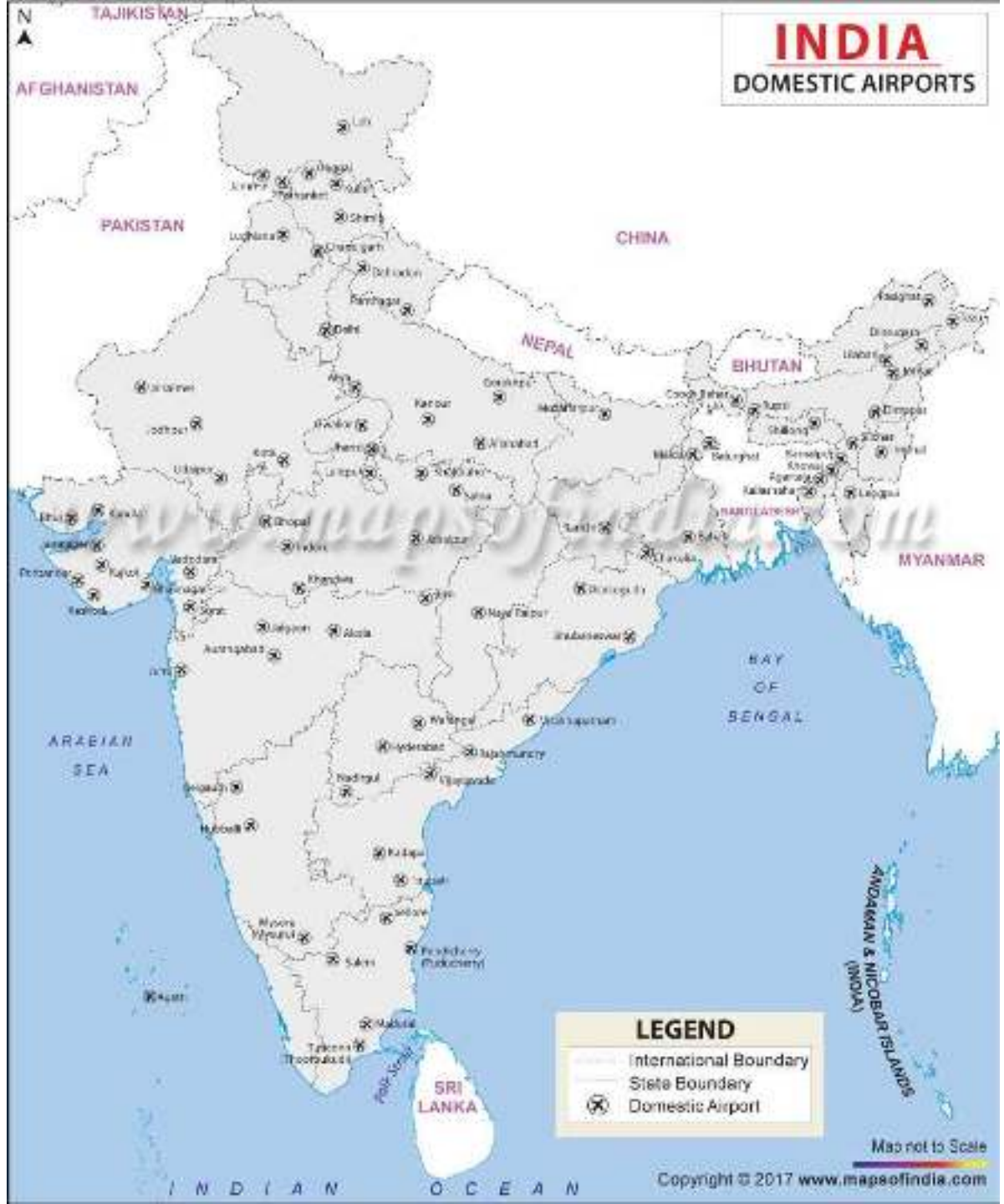
1.Netaji Subhash Chandra Bose International Airport, Kolkata
2.Chennai International Airport, Chennai
3.Thiruvananthapuram International Airport
4.Sardar Vallabh Bhai Patel International Airport, Ahmedabad
5.Guru Ram Dass Jee International Airport, Amritsar
6.Lokpriya Gopinath Bordoloi International Airport, Guwahati
7.Goa International Airport (Civil Enclave)
8.Srinagar International Airport, Srinagar (Civil Enclave)
9.Jaipur International Airport
10.Kozhikode Airport, Calicut
11.Veer Savarkar International Airport (Civil Enclave), Port Blair, A&N Islands (UT)
12.Indira Gandhi International Airport, Delhi
13.Chattrapati Shivaji International Airport, Mumbai
14.GMR Hyderabad International Airport, Hyderabad
15.Bangalore International Airport Limited, Bengaluru
16.Cochin International Airport, Kochi (Private)
17.Bharat Ratna Babasaheb Dr. B.R. Ambedkar International Airport, Nagpur (Maharashtra)


Hong Kong International Airport – Chek Lap Kok, Hong Kong


Incheon International Airport

Domestic Airport

A domestic airport is an airport which handles only domestic flights or flights within the same country.
Domestic airports don't have customs and immigration facilities and are therefore incapable of handling flights to or from a foreign airport.
These airports normally have short runways which are sufficient to handle short/medium haul aircraft.

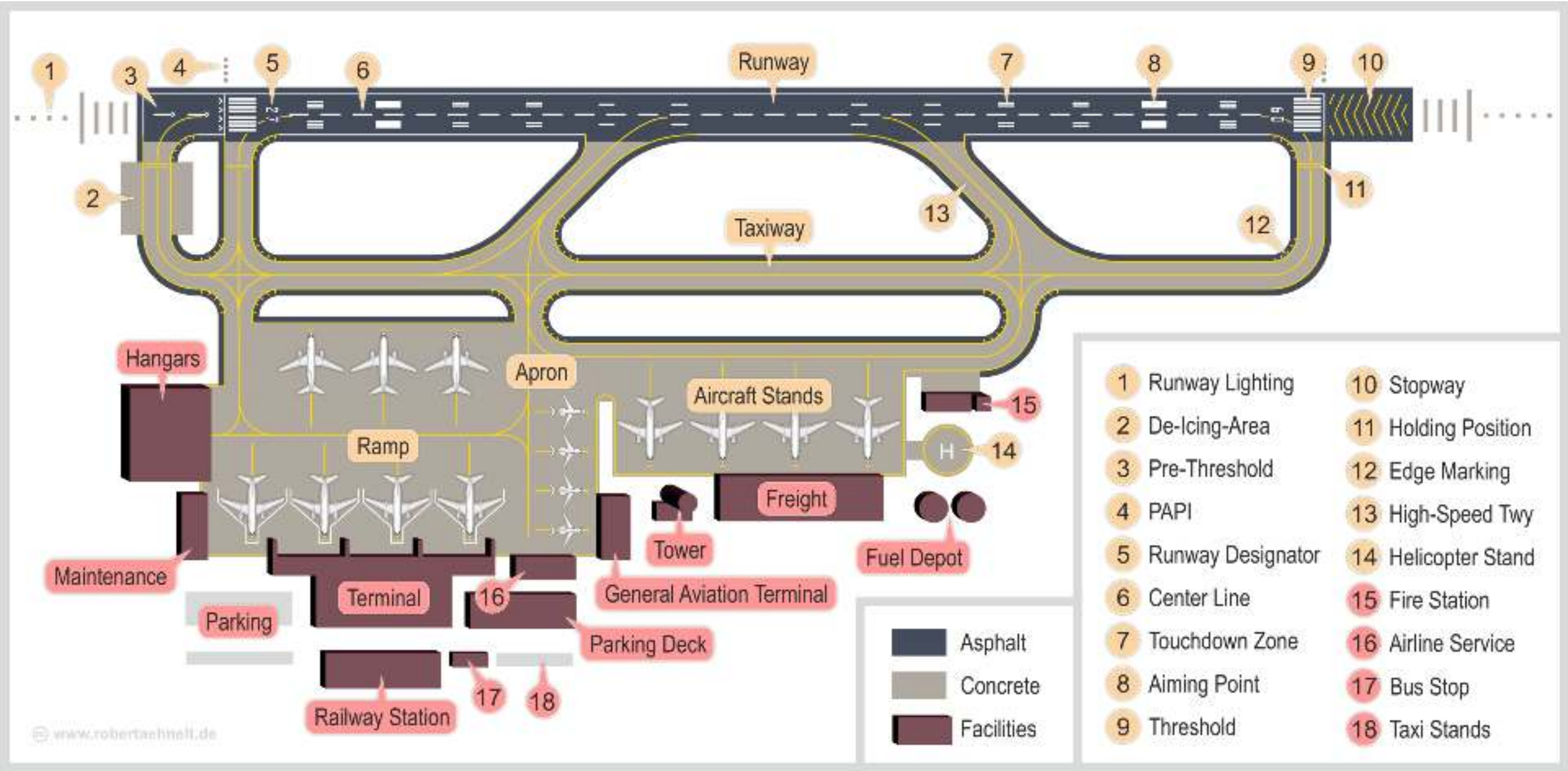

INDIA
DOMESTIC AIRPORTS
N
TAJIKISTAN
AFGHANISTAN
PAKISTAN
CHINA
NEPAL
BHUTAN
MYANMAR
BAY OF BENGAL
ARABIAN SEA
INDIAN OCEAN
SRI LANKA
ANDAMAN & NICOBAR ISLANDS (INDIA)
LEGEND
International Boundary
State Boundary
Domestic Airport
Map not to Scale
Copyright © 2017 www.mapsofindia.com

Regional Airport

A regional airport is an airport serving traffic within a relatively small or lightly populated geographical area.
A regional airport usually does not have customs and immigration facilities to process traffic between countries.
Aircraft using these airports tend to be smaller business jets or private aircraft (general aviation).


Louisiana Regional Airport, US

LAYOUT OF AIRPORT



Important Components of An Airport Layout

1. Runway
2. Terminal Building
3. Apron
4. Taxiway
5. Aircraft Stand
6. Hanger
7. Control Tower
8. Parking

RUNWAY

A runway is the area where an aircraft lands or takes off. It can be grass, or packed dirt, or a hard surface such as asphalt or concrete. Runways have special markings on them to help a pilot in the air to tell that it is a runway (and not a road) and to help them when they are landing or taking off. Runway markings are white.

Most runways have numbers on the end. The number is the runway's compass direction. Some airports have more than one runway going in the same direction, so they add letters to the end of the number R for right, C for center, and L for left.


36

TERMINAL BUILDING

Also known as airport terminal, these buildings are the spaces where passengers board or alight from flights. These buildings house all the necessary facilities for passengers to check-in their luggage, clear the customs and have lounges to wait before disembarking. The terminals can house cafes, lounges and bars to serve as waiting areas for passengers.

Ticket counters, luggage check-in or transfer, security checks and customs are the basics of all airport terminals. Large airports can have more than one terminal that are connected to one another through link ways such as walkways, sky-bridges or trams. Smaller airports usually have only one terminal that houses all the required facilities.

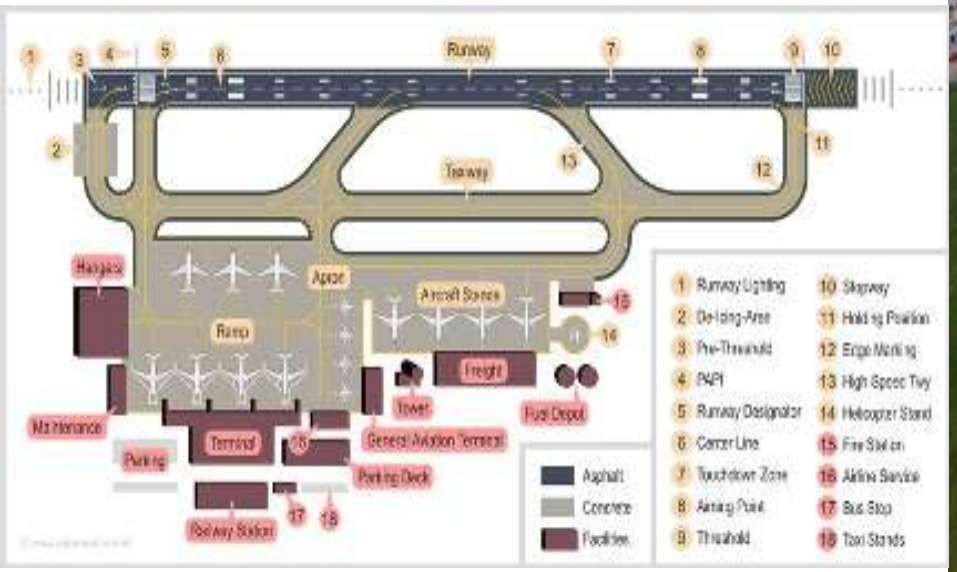
Aprons

Aircraft aprons are the areas where the aircraft park. Aprons are also sometimes called ramps. They vary in size, from areas that may hold five or ten small planes, to the very large areas that the major airports have.`

No Planes, Buildings or Vehicles Included

4. Taxiway

A taxiway is a path on an airport connecting runways with ramps, hangars, terminals and other facilities. They mostly have hard surface such as asphalt or concrete, although smaller airports sometimes use gravel or grass.



5. Aircraft Stand

A portion of an apron designated as a taxiway and intended to provide access to aircraft stands only.

7. Control Tower

A tower at an airfield from which air traffic is controlled by radio and observed physically and by radar.

8. Parking

Parking is a specific area of airport at which vehicles park.