

Lecture 5

University of Anbar

Civil Engineering Department

MSc- Highway Engineering

Railway and Airport Engineering

Classification of Railway Tracks

- Classification & Categories
- Design Standards
- Design Speeds

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Classification of Railway Tracks

Rail tracks are grouped under the following primary general categories:

- (i) Light rail transit tracks
- (ii) Urban rail transit tracks
- (iii) Freight and intercity passenger tracks
- (iv) High-speed railway tracks

Rail tracks are also grouped into the following secondary categories:

- (i) Main line tracks
- (ii) Secondary tracks
- (iii) Yard and nonrevenue tracks

Railway tracks can be first classified using the primary categories and then further classified using the secondary categories.

Light Rail Transit Tracks

- Light rail transit tracks carry a system of passenger vehicles that are propelled electrically by power obtained from an overhead distribution system of wires.
- The propulsion power is transmitted by means of a pantograph and returned to the electrical substations through the rails.
- Operating speeds of light rail transit systems are usually between 65 and 90 km/h.
- Light rail tracks often have horizontal curves that are as sharp as 82 ft radius. This is due mainly to the type of vehicles used, the necessity for light rail tracks to be capable of accommodating the interaction of automobile traffic and pedestrians, and the need to traverse city streets.

Light Rail Transit Tracks (Continue)

- (LRT) is a form of urban rail public transportation
- Generally, it has a lower capacity and lower speed than heavy rail and metro systems, but higher capacity and higher speed than traditional street-running tram systems.
- The difference between light and heavy rail is not weight but capacity
- Light rail track can carry up to 20000 people per hour as compared with 2000_2200 vehicles per hour for one freeway lane .

Urban Rail Transit Tracks

- Urban rail transit tracks carry urban rail transit vehicles that are usually propelled by direct current electrification at moderate voltages.
- Running speeds of trains on these tracks can be as high as 130 km/h.
- They are typically located in major corridors carrying large volumes of passengers.
- It is an all-encompassing term for various types of local rail systems providing passenger service within and around urban or suburban areas.
- The urban rail transit system, including metro, tram, and light rail except for intercity high-speed rail

Freight and Intercity Passenger Tracks

- Freight and intercity passenger tracks connect cities and generally carry line-haul rail traffic consisting of both passenger and freight movements.
- Operations on these lines generate most of the railway industry's revenue with potential operating speeds of trains on these tracks higher than 160 km/h.
- These tracks carry the U.S. national railway passenger service known as Amtrak and freight services.

High-Speed Railway Tracks

- High-speed railway tracks carry high-speed trains traveling at speeds of 145 km/h to 480 km/h, such as the “TGV” high-speed track between Paris and Lyons in France.
- Two approaches can be used in designing these high-speed tracks. The first approach assumes only passenger trains, run on the tracks, and the second allows for both passenger and freight trains.
- When these tracks are designed for passenger trains only, relatively higher grades may be allowed because of the low load/axle. However, it is now common for these tracks to be designed for both passenger and freight trains.

Secondary Categories of Rail Tracks

Main Line Tracks

- Main line tracks form the primary network of railways and connect the primary origins and destinations of the system.

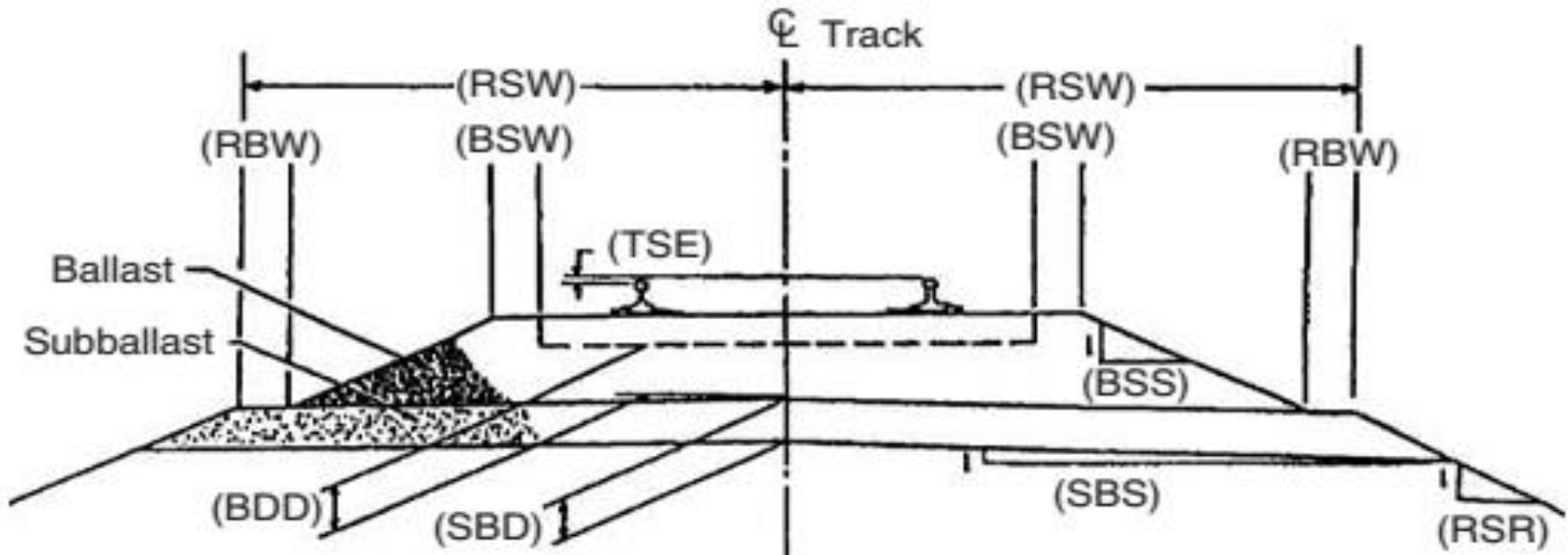
Secondary Tracks

- Secondary tracks are sometimes referred to as branch lines and include tracks that connect the mainline to a station not on the mainline, and tracks that connect the mainline with railway yards.

Yard and Nonrevenue Tracks

- Yard and nonrevenue tracks enter railway yards where cars are sorted and maintenance and repairs to cars and locomotive engines are carried out.

Transverse Cross-sections of A Single Superelevated Track



Ballast:

BDD = Depth of ballast

BSW = Ballast shoulder width

BSS = Ballast side slope run

Subballast:

SBD = Subballast depth

SBS = Subballast side slope run

Roadbed:

RSW = Roadbed shoulder width

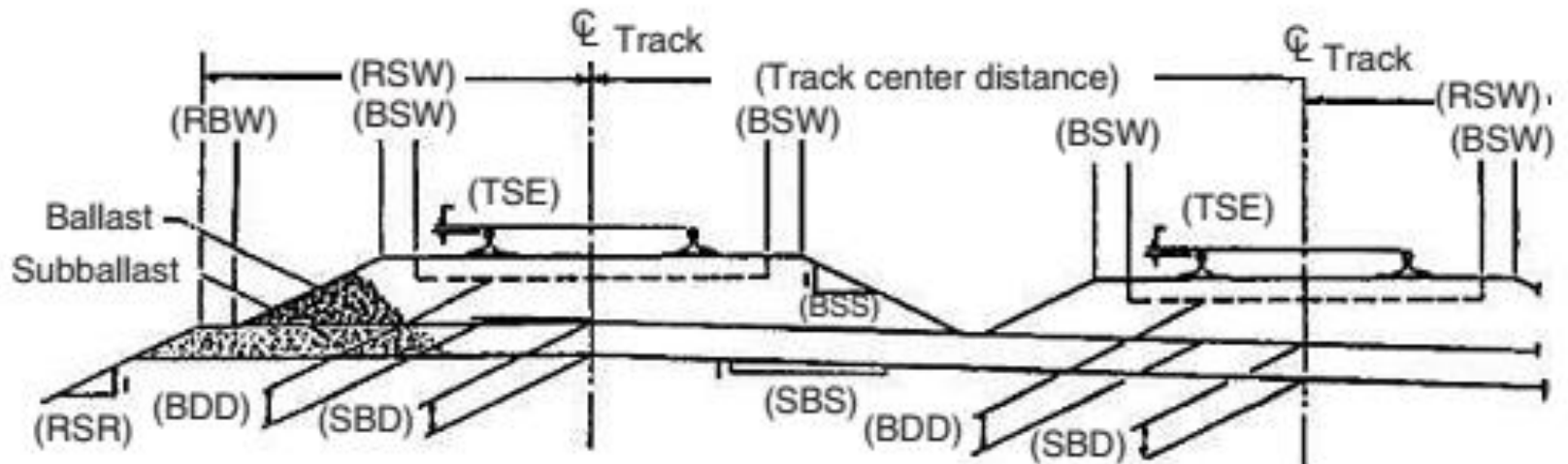
RSR = Roadbed side slope run

RBW = Roadbed berm width

Track superstructure:

TSE = Track superelevation

Cross-section of A Dual Superelevated Rail Track



Ballast:

BDD = Depth of ballast

BSW = Ballast shoulder width

BSS = Ballast side slope run

Subballast:

SBD = Subballast depth

SBS = Subballast side slope run

Roadbed:

RSW = Roadbed shoulder width

RSR = Roadbed side slope run

RBW = Roadbed berm width

Track superstructure:

TSE = Track super-elevation

Railway Track Design Standards

Longitudinal Gradient

- Recommended maximum longitudinal grades for light rail transit and other commuter rails carrying only passenger traffic are similar to those for highways.
- Those for tracks that also carry freight traffic are much lower than those for highways but are similar to those for airport runways.
- Maximum grades are specified for different categories of tracks.

Design Standards: Light Rail Main Line Tracks

- Maximum sustained grade (unlimited length), 4%.
- Maximum sustained grade (up to 750 m between points of vertical intersections (PVIs) of vertical curves), 6%.
- Maximum short sustained grade (up to 150 m between PVIs of vertical curves), 7%.
- Minimum grade for drainage, 0.2%.
- No minimum grade is specified for passenger stations on light rail main line tracks. Adequate drainage of the track is, however, required.

Design Standards

Urban Rail Transit Main Line Tracks

- Maximum grades of up to 4% have been used, although lower grades are preferred.

Freight and Intercity Main Line Tracks

- Grades on these tracks are usually not greater than 1.5%, although grades of up to 3% have been used.
- It is recommended by the American Railway Engineering and Maintenance-of-Way Association (AREMA) that the rate of change in grade on high-speed main tracks should not be greater than 3 cm/station of 30 m on crest vertical curves and not greater than 1.5 cm/station of 30 m on sag vertical curves.

Design Standards: Secondary Tracks

- Light rail secondary tracks connecting the main line and the rail yard should be designed to prevent rail vehicles from rolling out of the yard to the main line.
- It is also recommended that, in order to achieve adequate drainage, grades on these tracks be between 0.35 and 1%.
- An additional requirement for freight and intercity secondary tracks is that the rate of change in grade should not be greater than 6 cm/station of 30 m on crest vertical curves and 3 cm/station of 30 m on sag vertical curves.