Transportation Engineering II: Highway Design & Railways

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Factors Affecting Selection of an Alignment

1. Gauge of railway
2. Obligatory or control points
3. Topography
4. Geometric standards
5. Geological considerations
6. Flood and climate
7. Roads and crossings
8. Labor and material
9. Station and yards
10. Economic
11. Political

Gauge of Railway

Gauge = Clear distance between inner faces of two track rails

- Measured at a certain vertical distance below the rail table (upper surface)
  - e.g. Europe: 14mm below, Japan 16mm below

Types of Gauges

- Broad gauge:
  1.524m- 1.676m (5′ 0′′ -5′ 6″)
- Standard gauge:
  1.435m-1.451m (4′ 8.5′′ -4′ 9.125″)
- Meter gauge:
  1m- 1.067m (3′ 3.375′′ -3′ 6″)
- Narrow gauge:
  0.610m-0.762m (2′ 0′′ -2′ 6″)

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Choice of Gauge

- Cost considerations
  - Proportional increase in cost of land acquisition, earthwork, sleepers, ballast for a wider gauge
  - Marginal increase in construction cost of bridge, culvert, tunnels etc. for a wider gauge
  - No change in cost of rolling stock (for carrying same volume of traffic), stations, platforms, etc.
- Traffic considerations
  - Wider gauge ->Larger wagons->More traffic
  - Wider gauge ->Larger wheels-> Higher speed ->More traffic
- Geographical considerations
  - Mountainous terrain -> Sharper curves-> Narrow gauge
- Uniformity
  - Consistency with existing track

Reason for non-uniformity

- In most countries tracks were initially laid with only local development in mind
  - Budget limitations very often led to meter/narrow gauge
  - Inconsistency and non-uniformity when tracks were connected

Problems associated with non-uniformity

- Difficulties to passengers
- Difficulties of freight shipment
- Inefficient use of rolling stock
- Additional facilities at stations and yards
  - Yard= Facilities for maintenance of trains
- Ineffectiveness in emergency situations

Dual-gauge Tracks

A dual-gauge or mixed-gauge railway has railway track that allows trains of different gauges to use the same track. Generally dual-gauge railway consists of three rails, rather than the standard two rails. The two outer rails give the wider gauge, while one of the outer rails and the inner rail give a narrower gauge. Thus one of the three rails is common to all traffic.

Double gauge

At the Swedish-Finnish border the railway has four rails because the gauge difference is too small for three rails

Gauges in Bangladesh

- Total 2,855 route kilometres (2004-2005)
  - East Zone:
    - 1,277 route km of MG track only
  - West Zone:
    - 553 route km of MG , 660 route km of BG 365 route km of DG track

Factors Affecting Selection of an Alignment

1. Gauge of railway
   - Dictates permissible curvature
2. Obligatory or control points
   - Important cities and towns (intercity), important growth centers (urban)
   - Major bridges
   - Existing passes or saddles
   - Avoid: monuments, religious buildings
3. Topography
   - Plane
   - Valley
   - Mountain
     - Zigzag
     - Switch back
     - Spiral

Factors Affecting Selection of an Alignment

4. Geometric standards
   - Gradients and curves
5. Geological considerations
   - Stable soil
6. Flood and climate
   - Sandy/snowy: Away from wind direction
7. Roads and crossings
   - Right angle
8. Labor and material
9. Station and yards
10. Political
    - Away from borders

Factors Affecting Selection of an Alignment

11. Economic
    - Construction, Operation, Maintenance
    - Maximize annual return= (R-E)/I

      R= revenue, E=expenses, I =Investment