Road Cross-Section Elements

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References:
Road Cross-Section Elements
Urban Roads

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Rural Roads
Road Cross-Section Elements
Rural Roads

![Rural Road Image]

Road Cross-Section Elements
Rural Roads

![Rural Road Image]
Right of Way

- The right of way is the total land area acquired for the construction of the roadway.
- Its width should be enough to accommodate all the elements of the roadway cross section, any planned widening of the roadway, and any public utility facilities that will be installed along the roadway.

Road Cross-Section Elements

Two types:

- **Basic elements**
  - Width of carriageway (including no. of lanes)
  - Central reservation (or median strip)
  - Shoulders
  - Laybys
  - Camber of the carriageway (cross slope)
  - Side-slopes of cuttings and embankments
Road Cross-Section Elements

Two types:
- **Ancillary elements**
  - Safety fences
  - Crash attenuation devices
  - Anti-dazzle screen
  - Noise barriers

See figure 19-10 page 340 (O' Flaherty)
- Figure a) 2-lane street
- Figure b) urban motorway
- Figure c) 2 or 3 – lane rural highway
- Figure d) rural motorway
Urban highway crosssection
design features and terms

Road Cross-Section Elements

- Road Cross-Section Elements are those features of a roadway which forms its effective width.
Cross Section (rural highway)

Twolane rural highway cross section design features and terms.
Cross Section
(urban highway)

Cross Section
(urban highway)
Road Cross-Section Elements

Basic elements:

1. Carriageway width p. 340

Factors which influence the width of a carriageway are:
- Design volume
- Vehicle dimensions
- Design speed
- Road classification

Lane width:

In urban areas

Lane width is normally not less than 3.5m
Narrower lanes are used for economic or environmental reasons
Lane width:

*In rural roads*

recommended lane width is 3.65m to:

*reduce accidents* and *increase capacity*.

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Three-lane single carriageway is not recommended. **Why**?

Two-lane single carriageway roads constitute the predominant type.

A road of 10m width is preferred to have 2-lanes and not 3.
Definition:
Motorways are:
- Dual carriageway roads with 3 or more lanes in each direction
- With full control of access
- With grade-separated intersections and no at-grade crossings.

In urban areas:
- Width of the nearside lane is often increased to:
  - Improve conditions for cyclists
  - Allow more space for commercial vehicles.
In urban areas:

- Two-way local distributor route can be:
  - As narrow as 6.1m in carriageway width;
  - Provided that kerb (curb) parking is restricted.

In rural areas

- Standard edge treatment on normal two-lane single carriageways consists of a 1m strip of the same construction as the carriageway on both sides with a solid white line.
  - Total width becomes 9.3m
Travel Lanes

- Travel lanes facilitate the movement of vehicles. Lane widths usually vary from 3.0m to 3.6m.
- Most arterials have 3.6m travel lanes since the extra cost for constructing 3.6m lanes over 3.0m.

Basic elements

Shoulders

- Shoulders are contiguous with the travel lanes providing space along the roadway for vehicles to stop especially during emergencies.
- Shoulders also function to laterally support the pavement structure.
Shoulders (p343)

**Definition:**
A surfaced clear portion of the roadway cross-section immediately adjacent to the carriageway edge.

**Advantages:**
- Refuge for vehicles in case of emergency stops
- Recovery space for vehicles
- Temporary extra traffic lanes
- Assist in horizontal sight distance
- Structural support to the road pavement
- Decrease accident risk
Shoulder width:

- A shoulder width of 3 to 3.35m is internationally considered adequate for most high-speed high-volume roads (motorways).
- However, to reduce cost of dual carriageways and single carriageways in rural roads, only 1m wide hard strips are used in addition to 2.5m wide grass verges.

Sidewalks

- Sidewalks are usually provided on roads in urban areas, but very seldom they are provided in rural areas.
- Generally, sidewalks should be provided when pedestrian traffic is high along main or high-speed roads in either rural or urban areas.
Medians

- A median is the element of a divided roadway that separates the lanes in opposing directions.

Central reservation (or median strip) (p342)
Dual carriageways are normally divided by a central reservation of median strip.
Central reservation has a number of uses:
- Separating
- Vehicles to recover
- Safe waiting place
- Left turning
- Space for road furniture
- Storage lanes

Ideal width of central reservation

<table>
<thead>
<tr>
<th>Rural</th>
<th>Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-15m</td>
<td>5.5 – 9m</td>
</tr>
<tr>
<td>Can be 30m (USA)</td>
<td>Can be 1m but 3m preferred</td>
</tr>
</tbody>
</table>
Basic elements

Cross Slopes (Camber)

- Pavements on straight sections of two-lane and multilane roadways without medians are sloped from the middle downward to both sides of the roadway.
- This provides a cross slope, whose cross section can be either curved or plane or a combination of the two.

Cross slopes for multilane roadways
A cross section of a superelevated section of a roadway's curve

Superelevation Transition

from AASHTO's *A Policy on Geometric Design of Highways and Streets*
**Basic elements**

**Side Slopes**

- Side slopes are provided on embankments and fills to provide stability for earthworks.
- They also serve as a safety feature by providing a recovery area for out-of-control vehicles.

**Cross Section (rural highway)**

- **S** = Shoulder
- **T** = Traveled way
Curbs and Gutters

- Curbs are raised structures mainly made of Portland cement concrete that are used on urban roadways to delineate pavement edges and pedestrian walkways.
- Curbs are also used to control drainage, improve aesthetics, and reduce right of way.

The likelihood of pedestrian and bicycle traffic is one factor to consider when designing the cross section of a facility.
A landscaped median

Two way left turn lanes improve safety and efficiency for vehicular traffic but do not afford a safe refuge for pedestrians.
Shoulders increase safety and highway capacity and provide a place for pedestrians and bicyclists when no sidewalks are provided.

Various shoulder treatments:
(a) Gravel  (b) Paved  (c) Concrete (d) Grass with sidewalk
Use of paved shoulder, asphalt curbing, and closed drainage system along a rural minor arterial

Examples of barrier and mountable curbs
Sidewalks can be located next to a planted strip or flush with the roadside edge.

The wider the sidewalk, the more room there is for street furniture, trees, utilities, and pedestrians.
Sidewalks can be built with a variety of shapes and materials

Pedestrian barriers can provide safety by separating pedestrian and vehicular traffic
Street trees and light fixtures are carefully lined to one side of the sidewalk to provide the widest possible space for pedestrians.

A multiuse path
The shoulders on SR 313 were specifically designed to accommodate bicycle traffic.

East Capitol Street accommodates two travel lanes, onstreet parking, and a designated bike lane in each direction.
The highway landscape is an important part of its overall appearance.

Landscape treatment is most successfully integrated into a project when considered early in the design.
Trees add to the visual appeal of this urban street and can be placed in both medians and along roadway edges.

Trees make a difference. Compare the left side of this roadway with the right side, where the trees have been removed.
Weathering steel is a lowcost option for designers who are trying to "blend" a barrier into the surrounding environment.

These HO V lanes are restricted to buses, vanpools, and carpools carrying three or more occupants.
Computer visualization showing proposed design concepts of SH 23 in Rockville, MN

Existing conditions

Proposed continuous left turn lane design
Computer visualization showing proposed design concepts of SH 23 in Rockville, MN

Proposed continuous left and right turn lane design

Proposed channelized and raised median design
4. Laybys and bus bays (page 344)
   Laybys are provided instead of shoulders for economic considerations.
   For single carriageways:
   In the UK, laybys are provided with 2.5m to 3m width.
   Intervals of providing laybys for single carriageways
   at 1.5km for well trafficked roads
   and at 5.8km for light trafficked roads

For dual carriageways:
Laybys are provided at 3m width and 100m long at 1km intervals.
They should be with good visibility and tapers of 16m.

Bus stops (bays)
Usually in urban areas
3.25m wide by > or = 12m + 20m end tapers
5. **Camber of the carriageway** (page 344)

**Definition:**
- Camber is a convexity of the carriageway cross-section.
- Its purpose is to drain surface water from the road and avoid ponding in surface deformations on the carriageway.
- Shapes:
  - Parabolic or circular

**Definition:**
- Methods of application for single and dual carriageways
- In the UK 2.5% from the center of single carriageways
- And from the central reservation edge of each carriageway of dual carriageways to the outer drainage channels
- Application of camber at road intersections ....
Question:

- Describe the term camber.
- Explain the different ways of applying the camber to both single and dual carriageways.

6. Side-slopes of cuttings and embankments p(345)

- Soil mechanics is used to determine the max. slope
- Slope 1 in 2 is used
- Slope 1 in 3 is preferred

See Figure 19.11
Safety fences p (346)

- Safety fences are used to reduce the severity of accidents resulting from vehicles leaving the carriageway.
- Two main groups:
  - edge barriers (guardrails) for both vehicles and pedestrians.
  - crash barriers; located within narrow central reservations.
Materials of safety fences can be:
- Steel beam (shape: C or S)
- Rigid concrete
- Flexible cable

Read page 347 for more details and see figure 19.12 for dimension and shapes.

Guard rails are longitudinal barriers placed on the outside of sharp curves and at sections with high fills.

They are also used at the outside of rural roadway segments.

Their main function is to prevent vehicles from leaving the roadbed.
Median and Roadside Barriers

- A median barrier is defined as a longitudinal system used to prevent an errant vehicle from crossing the portion of a divided roadway separating the traveled ways for traffic in opposite directions.
7. **Anti-glare screens** p(346)
   - On unlit roads in particular
   - Anti-glare screens on the central reservation often used in conjunction with safety fences.
   - Open vision as much as possible
   - Plants can be used or metal mesh or vertical plastic vanes

9. **Noise and noise barriers** p (349)
   - In a survey in 1992 in the UK, 9% of the adult population in England was seriously bothered by traffic noise at home.
   - 16% of them were bothered when out.
   - Noise barriers could be **natural** or **manufactured**
Road Cross-Section Elements

Ancillary elements

Noise level < 68 dB(A)L10 (18h) is accepted
See p 353
To alleviate the noise nuisance:
- Insulation of buildings (closed double-glazed windows
  10cm cavity reduces noise by 25-38 dB(A))
- Constructing intervening barriers using
  - Dense timber fences
  - Concrete walls
  - Landscaped earth mounds

Height 1 – 3 m