

Highway Cross-Section Elements

The highway cross section is made up of design elements which can be classified into three broad groups:

- 1- The traveled way: pavement surface, lane widths, normal cross slopes.
- 2- Road margins: shoulders, sidewalks, curbs, guard rails & guard posts, road side slope.
- 3- Traffic separation: the median.

1. **The travelled way** (carriage way). It is the portion of the roadway used by the vehicle drivers for movement. It contains of pavement excluding road margins

- Pavement surfaces:

- For heavy traffic volumes, the pavement surface should be strong enough and also smooth to prevent high friction, and may be designed with minimum cross slope.
- Low - type rough surfaces must be crown enough to drain well.
- Low- type surfaces tend to reduce operating speeds.

Cross section elements

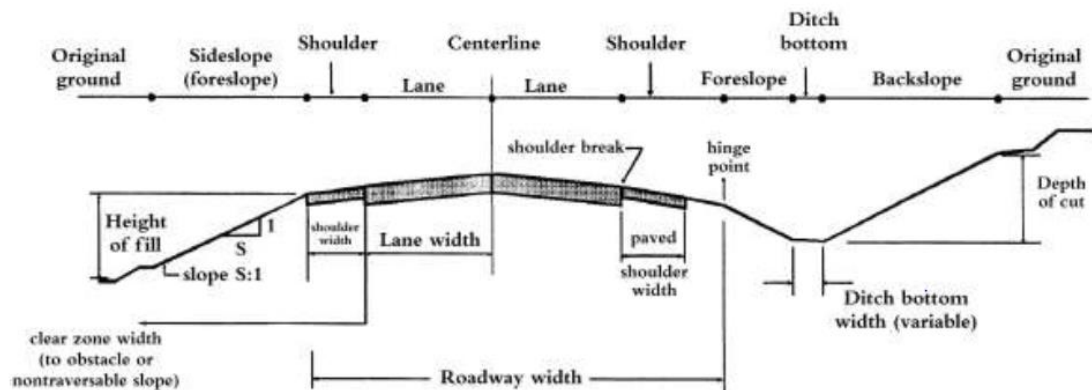
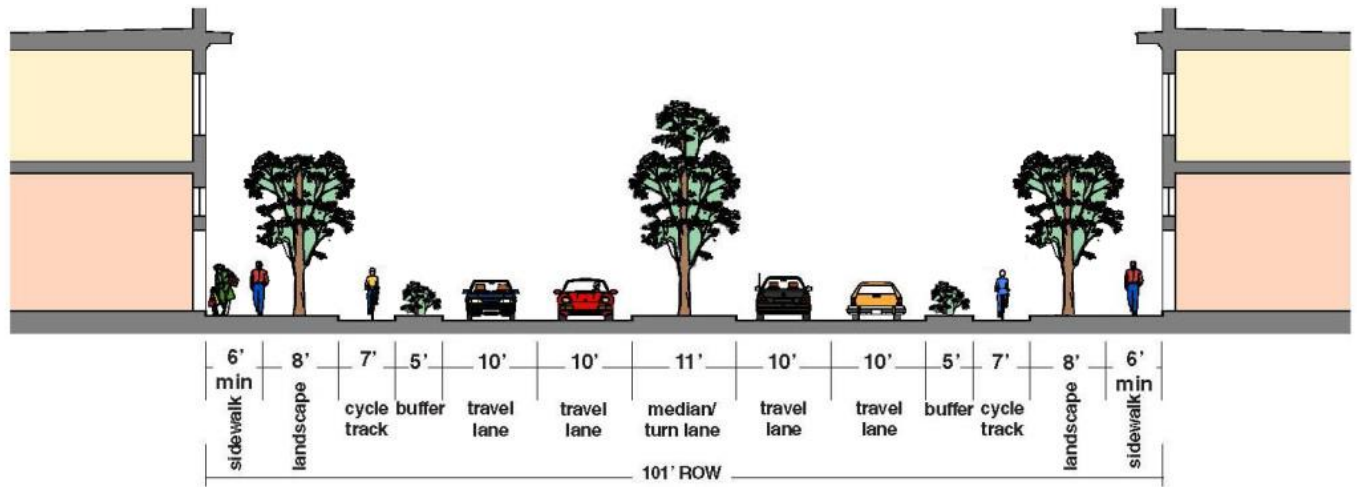


Figure 1 Typical cross section for two-lane highway



- Lane widths (in meter also). It affects the safety and should be comfortable for drivers.

- (2.75m-4.8m) (9'-16')

Design with (3.65-4) m

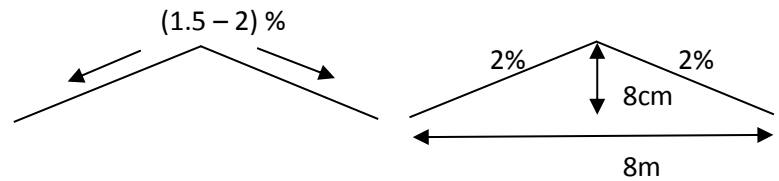
حسب المواصفة العراقية (3.75 m) و هو ثابت لكل الطرق

- Cross slope:

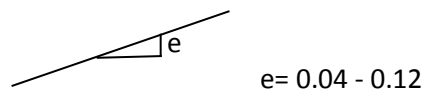
- Normal cross slopes: it is an important element used to prevent water from staying on the pavement surface and then penetrate through pavement materials causing pavement failure.

The cross slopes on divided highways are provided by either crowing the pavement in each direction, or by sloping the whole pavement in one direction.

⇒ Normal crown (Camber)

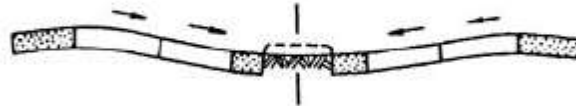


⇒ Super elevation (curve)

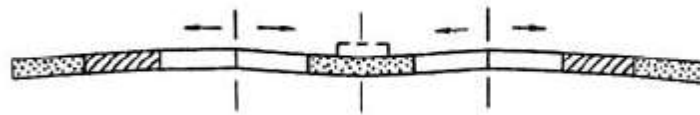




All lanes are crowned toward outer edge



All lanes are crowned toward inner edge



Each pavement slopes two way

The normal cross slope of carriageway on a straight alignment depends on the type of pavement and the total width of the paved area to be drained:

Type of Pavement	Normal Cross Slope
Gravel Roads, stabilized surfaces	3%
Bituminous surface treatment	2.5-3%
Bituminous macadam, carpets	2.5%
Stone block paving	2.5%
Asphaltic concrete	1.5-2%
Concrete road	1.5%

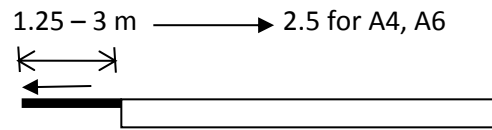
Width of drained area: 1-2 lanes.

2. Road margins

- Shoulders:

They are adjacent to the traveled way. shoulders are provided for the accommodation of stopped vehicles, for emergency use, and for lateral support of the base and surface courses.

Full width usable shoulders should be provided on highways where the DHV exceeds 100 vehicles per hour.



Shoulders → Paved → 1.5 – 2% الاصلى الطريق ميل نفس

→ Unpaved → compacted soil (6 – 8)%

→ granular material (4 – 6)%



Unpaved shoulder



Paved shoulder

- Sidewalks:

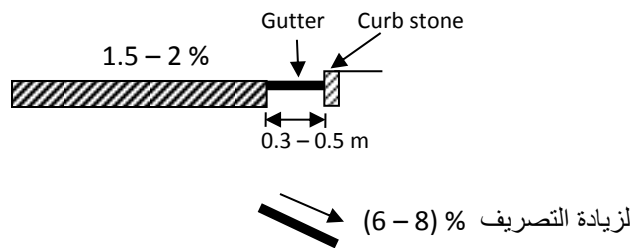
Generally sidewalks should be provided when pedestrian traffic is high along main or high-speed roads in either rural or urban areas.



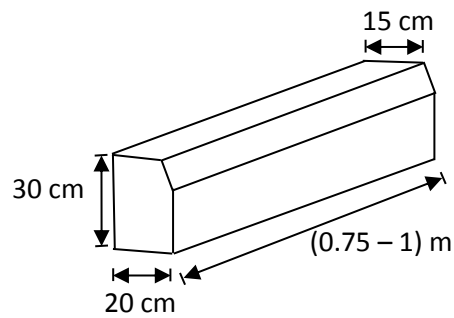
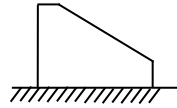
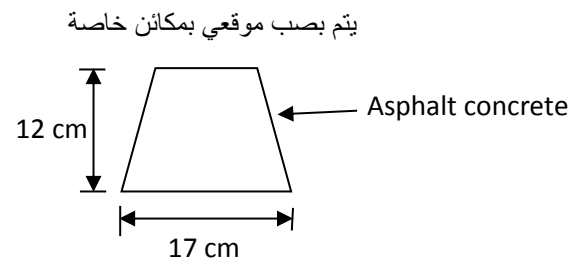
اقبل عدد 2 (عدد ممرات الاشخاص) $\longrightarrow n * 0.75m$

- Curb and Gutter:

- Curbs are raised structures used mainly on urban highways. They are used to delineate pavement edges, control drainage & improve aesthetics.
- Gutters (drainage ditches): usually located on the pavement side of a curb to provide principal drainage facility for the highways.



- Curb \longrightarrow
- (1) Barrier (0.2 - 0.3m) لا يسمح للمركبة بالعبور
 - (2) Mountable (8 cm) يسمح للمركبة بعبوره (فوق التبليط)
 - (3) Asphalt concrete

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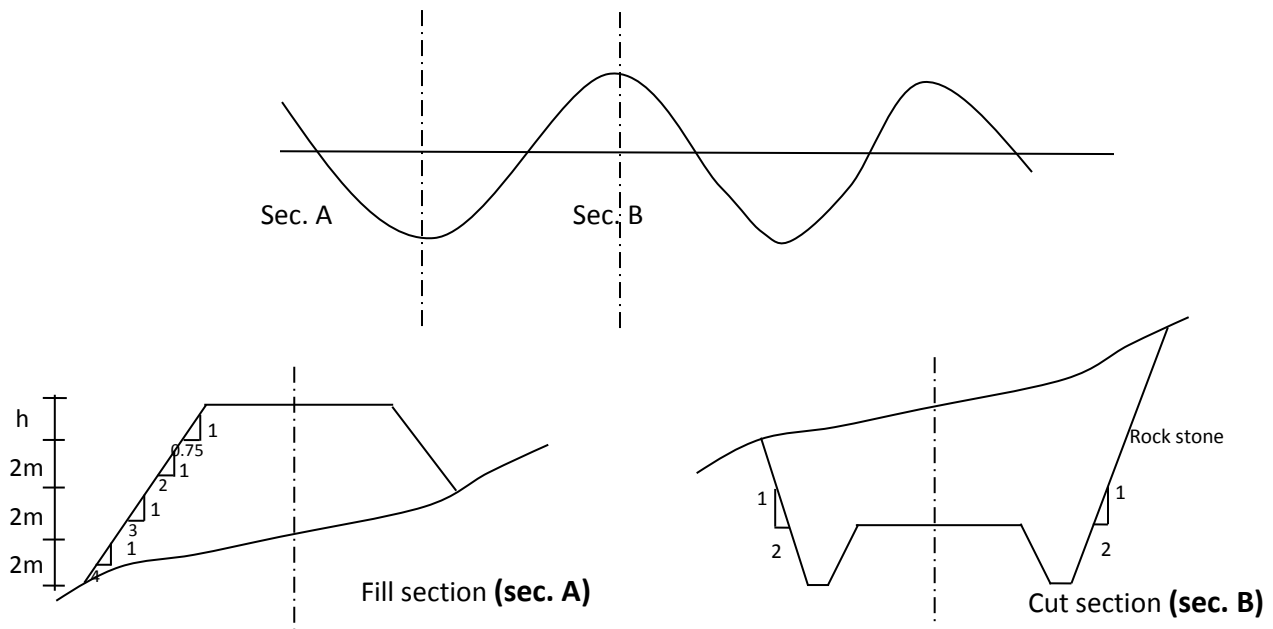
- Guard rails & Guide posts

- Guard rails are longitudinal barriers placed on the outside of sharp curves and at sections with high fills. Their main function is to prevent vehicles from leaving the road. They are installed at embankments higher than 8' and when shoulder slopes are greater than 4:1. Guide posts are generally not intended to resist impact, & they are used primarily to delineate the direction of the road, particularly at night.



- Side slopes:

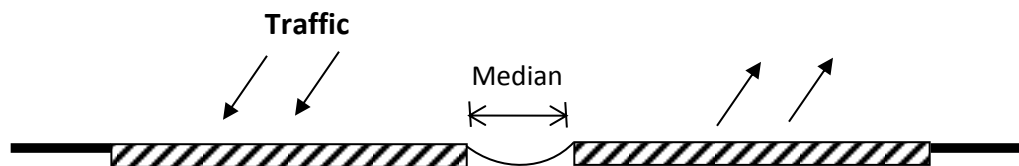
- Side slopes are provided on embankments & fill to provide stability for earth-works. They also serve as a safety feature by providing recovery area for out of control vehicles. Slopes of 3 to 1 or flatter are generally used for high embankments.



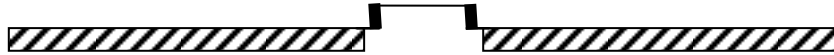
3. Traffic separation

- Median:

- Median is the section of a divided highway that separates the lanes in opposing direction. The width is the distance between the edges of the inside lanes including the median shoulders.



Rural area



Urban area

Function of a median:-

- 1- Providing a recovery area for out of control vehicles.
- 2- Separating opposing traffic.
- 3- Providing stopping area during emergency.
- 4- Storage areas for left turning & U-turning vehicles.
- 5- Providing refuge for pedestrians.
- 6- Reducing the effect of head light glare.

Median → 1.2 – 5 m (paved)

→ > 5 m (unpaved)

1.2m (min) تستعمل في الجسور لتقليل العرض



Vertical clearance:

—————> (Road – bridge)



الرقم التصميمي 5.2 >

—————> (Bridge – river)

- Group I (Tigris & Euphrates)

= 6.25 m

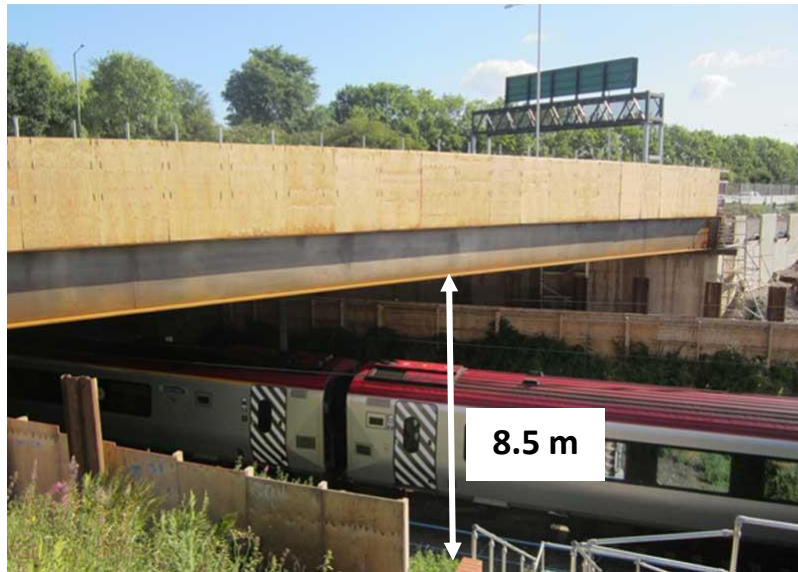
- Group II = 2.5 m

- Group III = 1.5 m

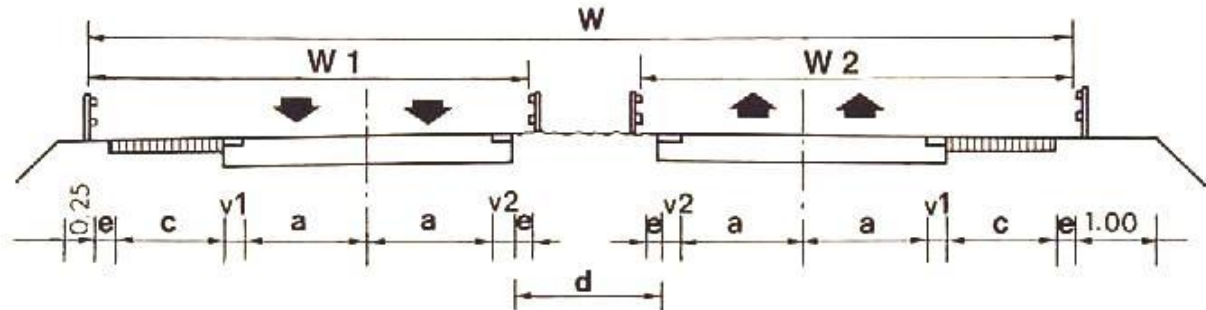


Water level

—————> (Rail Road – Bridge)



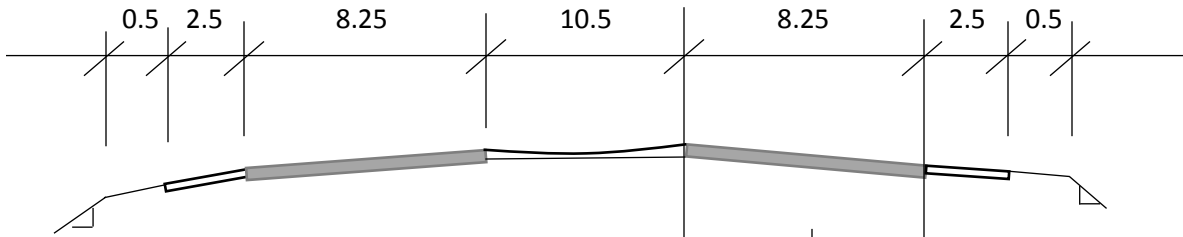
Cross Section:



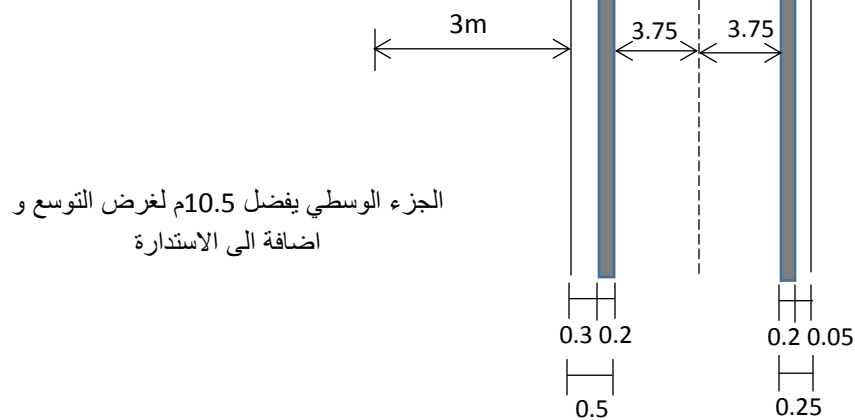
- W** – total width of highway
- W1 W2** – overall highway width in one direction
- a** – width of traffic lane
- c** – width of paved shoulder
- e** – width of unpaved shoulder
- d** – width of median
- v1** – width of outer marginal strip
- v2** – width of inner marginal strip

Cross Section Elements for Multi-Lane Highway

A4/33



A4/25



MCQ

- The value of Stop Sight Distance in urban area with design speed 120km/hr, maximum downgrade 2% and coefficient of brake fraction 0.35 is?

a. 192.53	b. 253.35	c. 221.837	d. 250.33
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- The relationship of braking distance is?

$d_b = \frac{S^2}{8 * M}$	$d_b = \frac{S^2}{15 * M}$	$d_b = \frac{(v_1^2 - v_2^2)}{254 (Fb \pm G)}$	$d_b = \frac{v^2}{254 (Fb \pm G)}$
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- The value of brake Distance in rural area with design speed 120km/hr, maximum downgrade 2% and coefficient of brake fraction 0.35 is?

a. 192.53	b. 253.35	c. 171.797	d. 250.33
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- The value of perception time for urban area with speed 130km/hr is?

a. 192.53	b. 253.35	c. 171.797	d. 54.21
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- The value of perception time for rural area with speed 130km/hr is?

a. 90.53	b. 253.35	c. 171.797	d. 54.21
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- There are two types of alignment

a. Vertical alignment	b. Horizontal alignment	c. Structure pavement	d. A and B
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