UNIT – VI (B)
ROAD MARKING

Presentations by

PV Eswar

Unit 6

- **TRAFFIC SIGNS AND ROAD MARKINGS :**
  - Types of traffic signs
  - Cautionary, regulatory and informative signs
  - Specifications
  - Pavement markings
  - Types of markings
  - Lane markings and object markings
  - Standards and specifications for road markings.

ROAD MARKINGS

Overview

- The Essential Purpose of Rd Markings is to
  - Guide and Control Tfc on a HW
  - Warn the Driver about the Hazardous Locations in the Rd
- They Supplement the function of Tfc Signs.
- They are very important to ensure the Safe, Smooth and Harmonious Flow of Tfc, because they
  - serve as a Psychological Barrier and
  - signify the Delineation of Tfc Path and
  - Signify its Lateral Clearance from Tfc Hazards
- Various Types of these Markings are
  - *Longitudinal markings*
  - *Transverse markings*
  - *Object markings*
  - *Special markings*

Classification

- The Rd Markings are Defined as
  - *Lines, Patterns, Words or other Devices*, EXCEPT Tfc Signs
  - *Set into, Applied or Attached to* the Carriageway or Kerbs or to Objects within or adjacent to the Carriageway,
  - for Controlling, Warning, Guiding and Informing the Users.
- The Rd Markings are Classified as
  - *Longitudinal markings,*
  - *Transverse markings,*
  - *Object markings,*
  - *Word Messages,*
  - *marking for Parking,*
  - *marking at Hazardous Locations etc.*

Longitudinal Markings

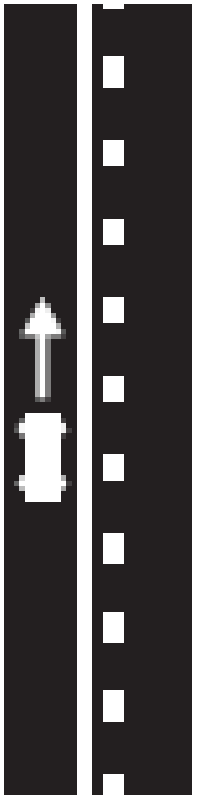
- Longitudinal markings are
  - Placed along the Direction of Tfc on the Rdway Surface
  - for the Purpose of indicating to the driver, his Proper Position on the Rdway.
- Different types of Longitudinal Markings are
  - *Center line*
  - *Tfc Lanes*
  - *No Passing Zone*
  - *Warning Lines*
  - *Border* or *Edge lines*
  - *Bus Lane markings*
  - *Cycle Lane markings.*

Longitudinal Markings

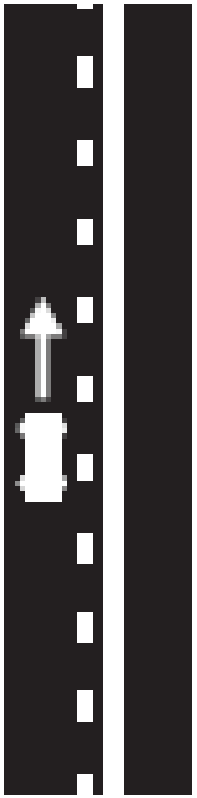
- Some of the Guiding Principles in Longitudinal Markings
  - Longitudinal markings are provided for SEPARATING *tfc flow in the Same Direction* and the
  - Predominant Color used is White.
  - Yellow color is used to
    - SEPARATE *the Tfc flow in Opposite Direction*
    - SEPARATE the *Pavement Edges.*

Longitudinal Markings

- The Lines can be either Broken, Solid or Double Solid.
  - Broken lines are Permissive in Character and ALLOWS *crossing with discretion*, if traffic situation permits.
  - Solid lines are Restrictive in Character and do not allow crossing EXCEPT
    - for Entry or Exit from a Side Rd or Premises (or)
    - to Avoid a Stationary Obstruction.
  - Double solid lines indicate Severity in Restrictions and Should NOT be Crossed EXCEPT *in case of Emergency*.
  - There can also be a Combination of Solid and Broken Lines. In such a case,
    - a *Solid line may be crossed with discretion*, IF the *broken line of the combination is* NEARER *to the direction of travel.*
    - *Vehicles from the Opposite Directions are NOT Permitted to Cross the line*.



Do not cross or straddle



May cross to overtake

Center line

- Center Line SEPARATES *Opposing Streams of Tfc* and facilitates their movements.
- Usually NO Center Line is provided for Rds having
  - Width < 5 m and
  - Width > 4 Lanes.
- Depending upon the Rd and Tfc requirements, Center Line may be marked with either
  - *Single Broken line*
  - *Single Solid line*
  - *Double Broken line or*
  - *Double Solid line.*
- On Urban Rds with < 4 lanes,
  - the Center Line may be Single Broken Line Segments of 3 m long and 150 mm wide. The Broken lines are placed with 4.5 m gaps (Figure 1).
  - On Curves and near Intersections, Gap shall be reduced to 3 meters.

Center Line marking for a ***2 Lane Rd***

On Urban Rds with < 4 lanes,

- the Center Line may be Single Broken Line Segments of 3 m long and 150 mm wide.
- Broken lines are placed with 4.5 m gaps (figure 1).
- On Curves and near Intersections, Gap shall be reduced to 3 meters

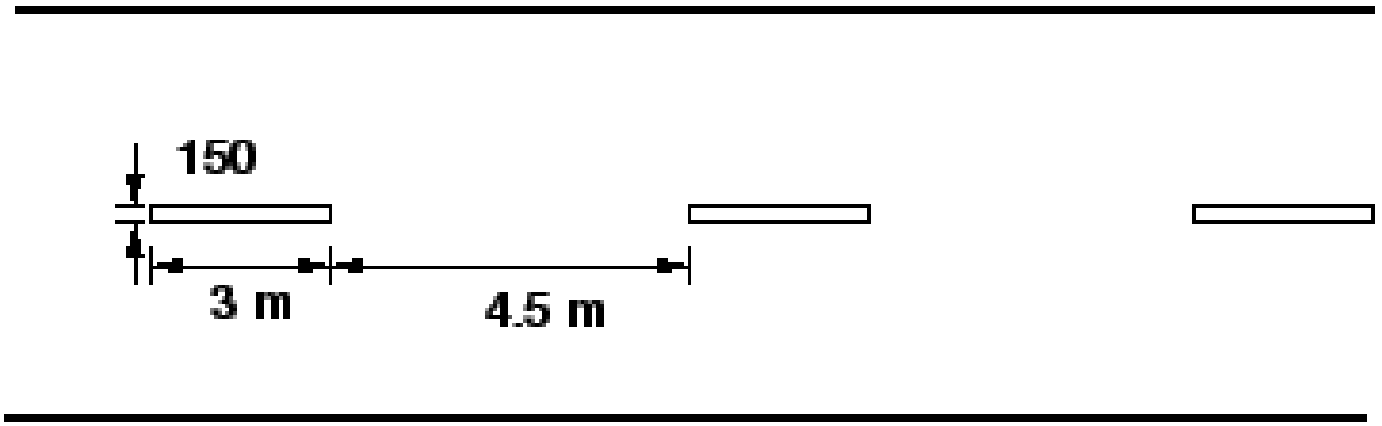


Figure 1: Center Line marking for a 2 Lane Rd

Center line (Contd)

- On *Undivided* Urban Rds with at least 2 Tfc Lanes in each direction, the Center Line Marking may be
  - Single Broken Line of 150 mm wide as in figure 2, or
  - Double Solid Line of 100 mm wide, separated by a space of 100 mm as shown in figure 3.
- The Center Barrier Line marking for 4 Lane Rd is shown in figure 4

Center Line and **Lane marking** for a **4 Lane Rd**

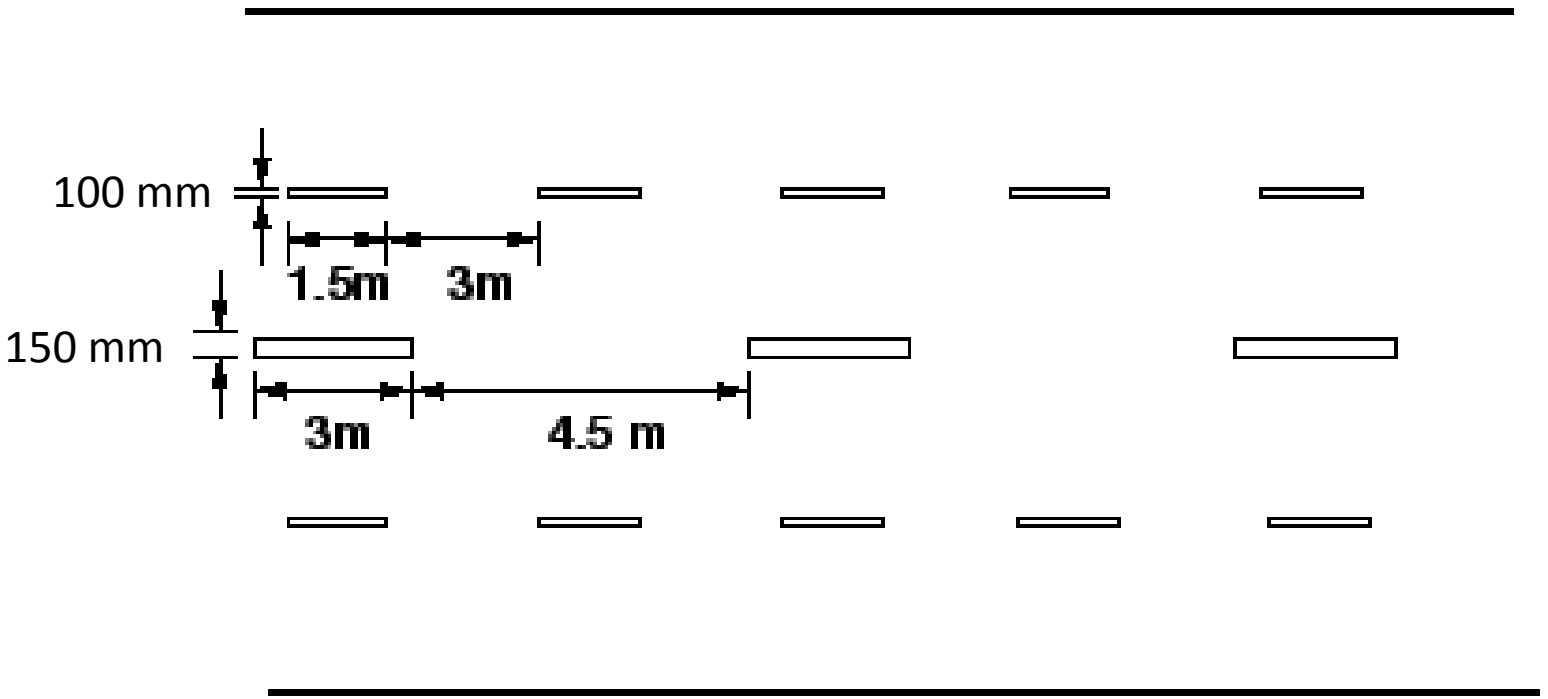
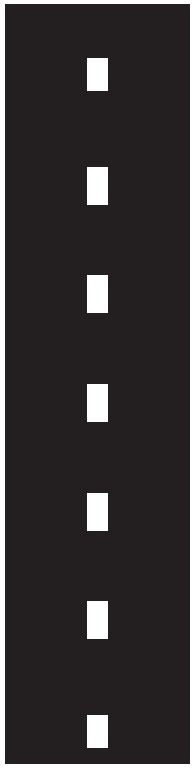


Figure 2: Center Line and Lane marking for a 4 Lane Rd



Lane line.
Line dividing
traffic lanes

Centre line.
Line dividing
two-way
traffic

Double Solid Line for a 6 Lane Rd

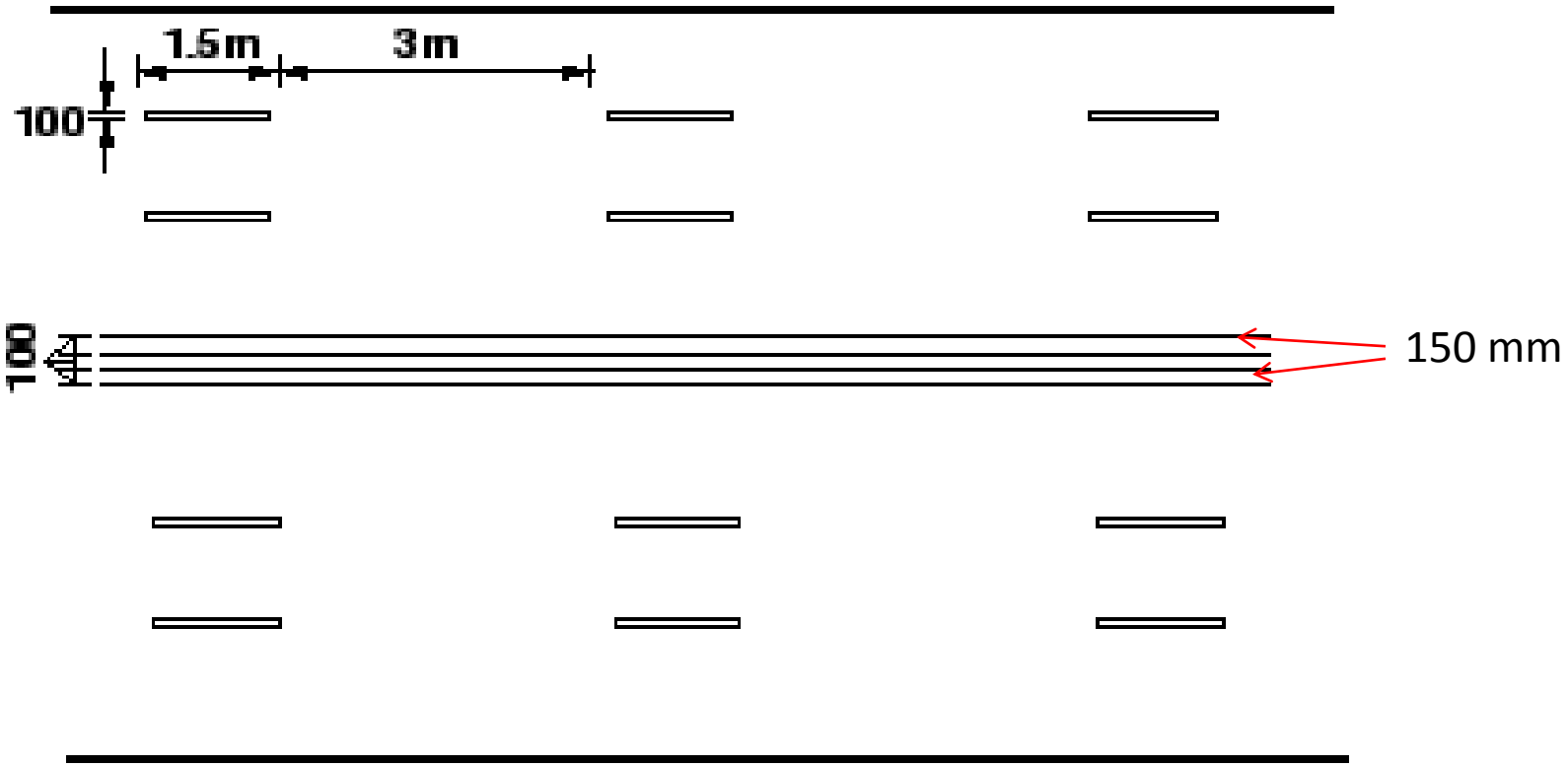


Figure 3: Double Solid Line for a 2 Lane Rd

Center Barrier Line marking for **4 Lane Rd**

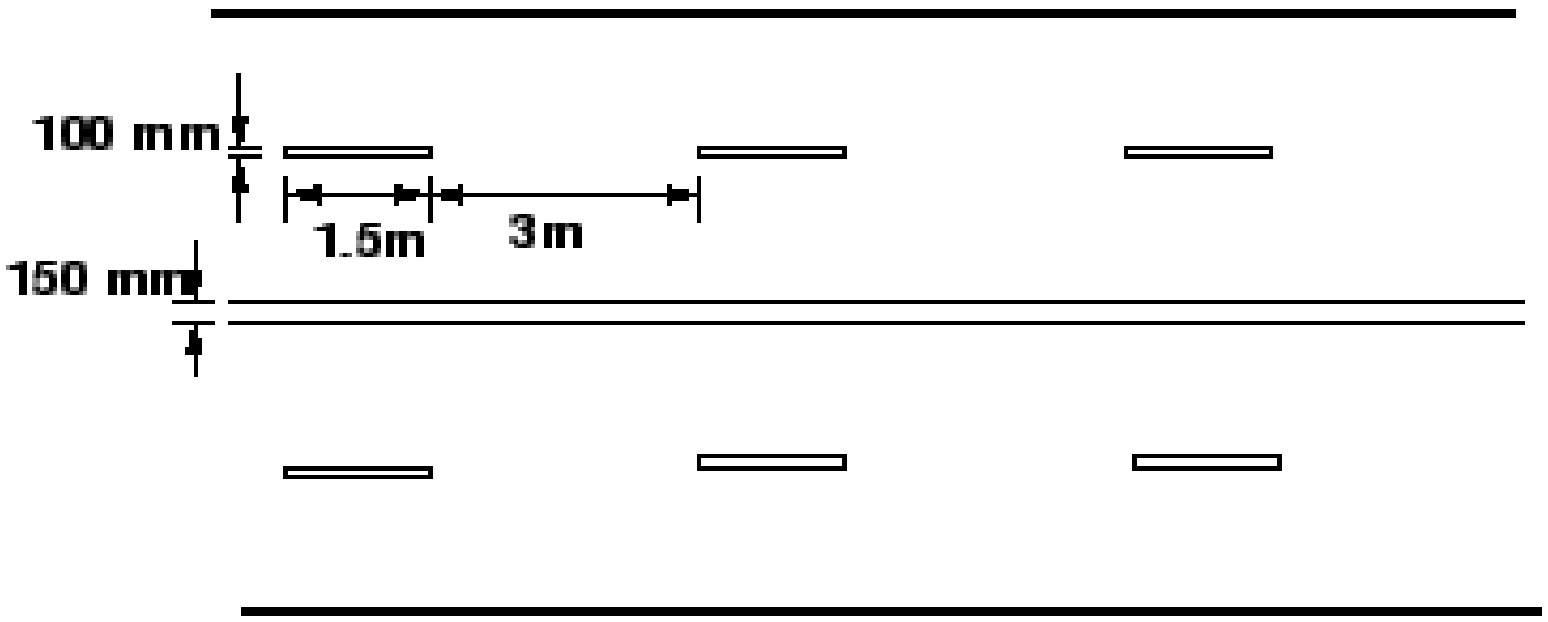
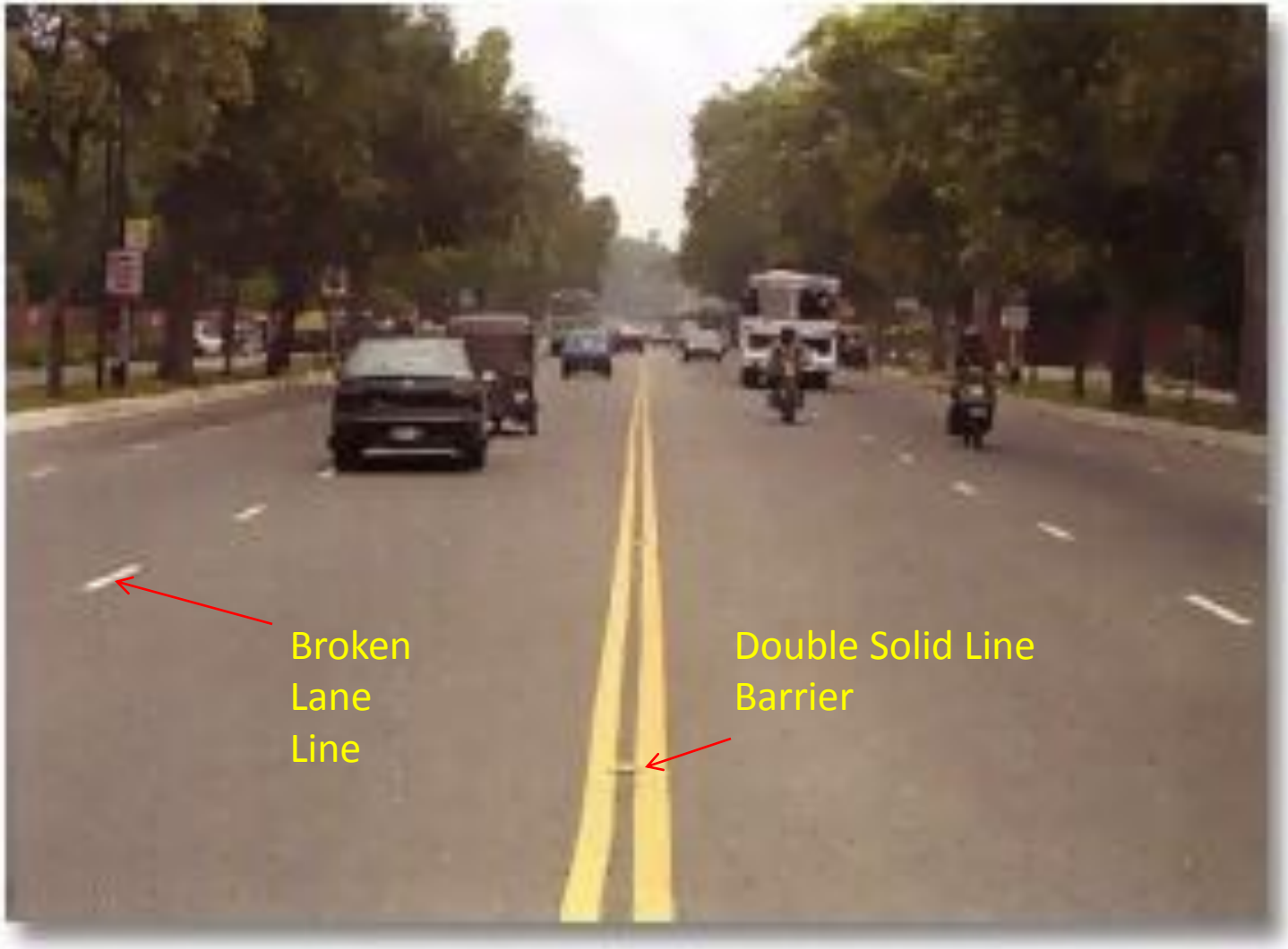


Figure 4: Center Barrier Line marking for 4 Lane Rd


Broken
Lane
Line
Double Solid Line
Barrier


Zebra Crossing
Direction Arrows
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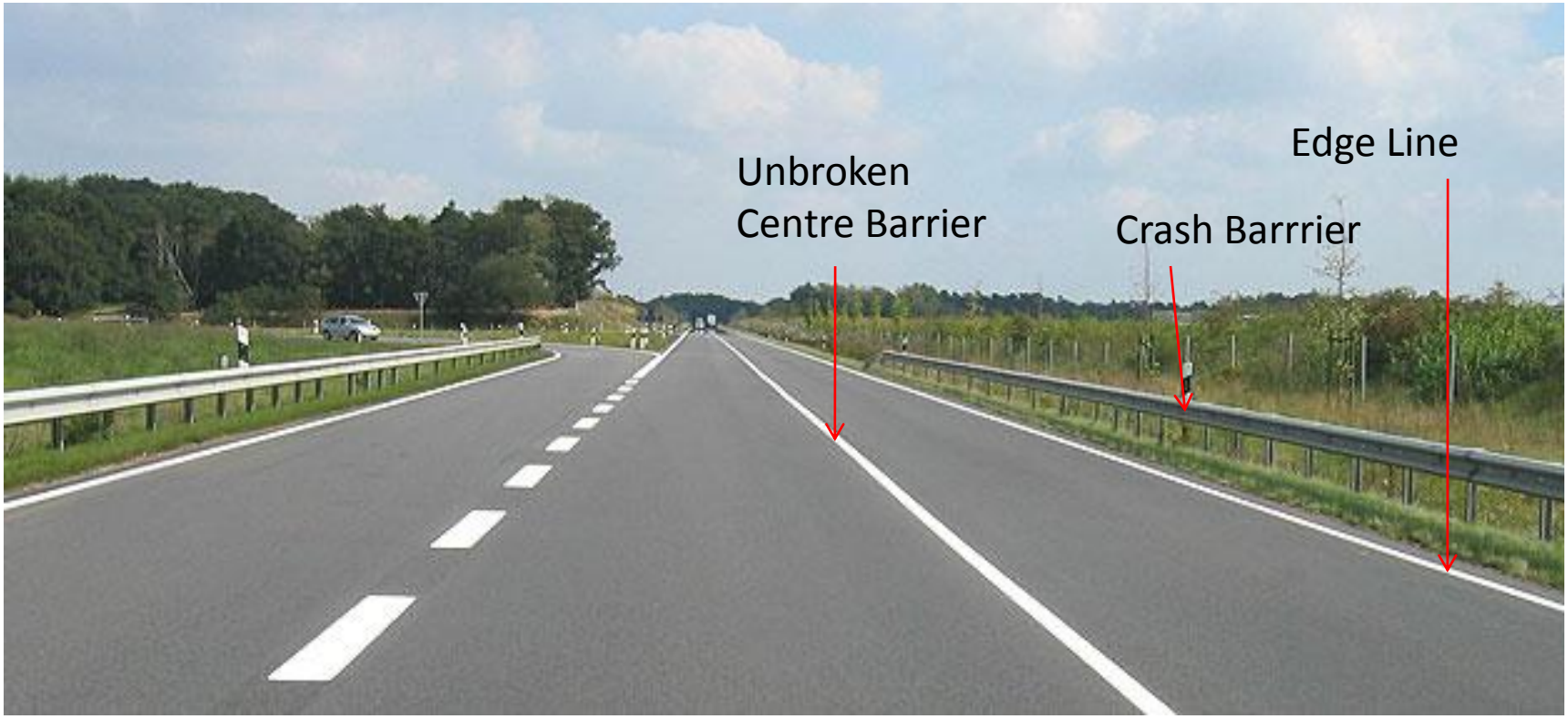
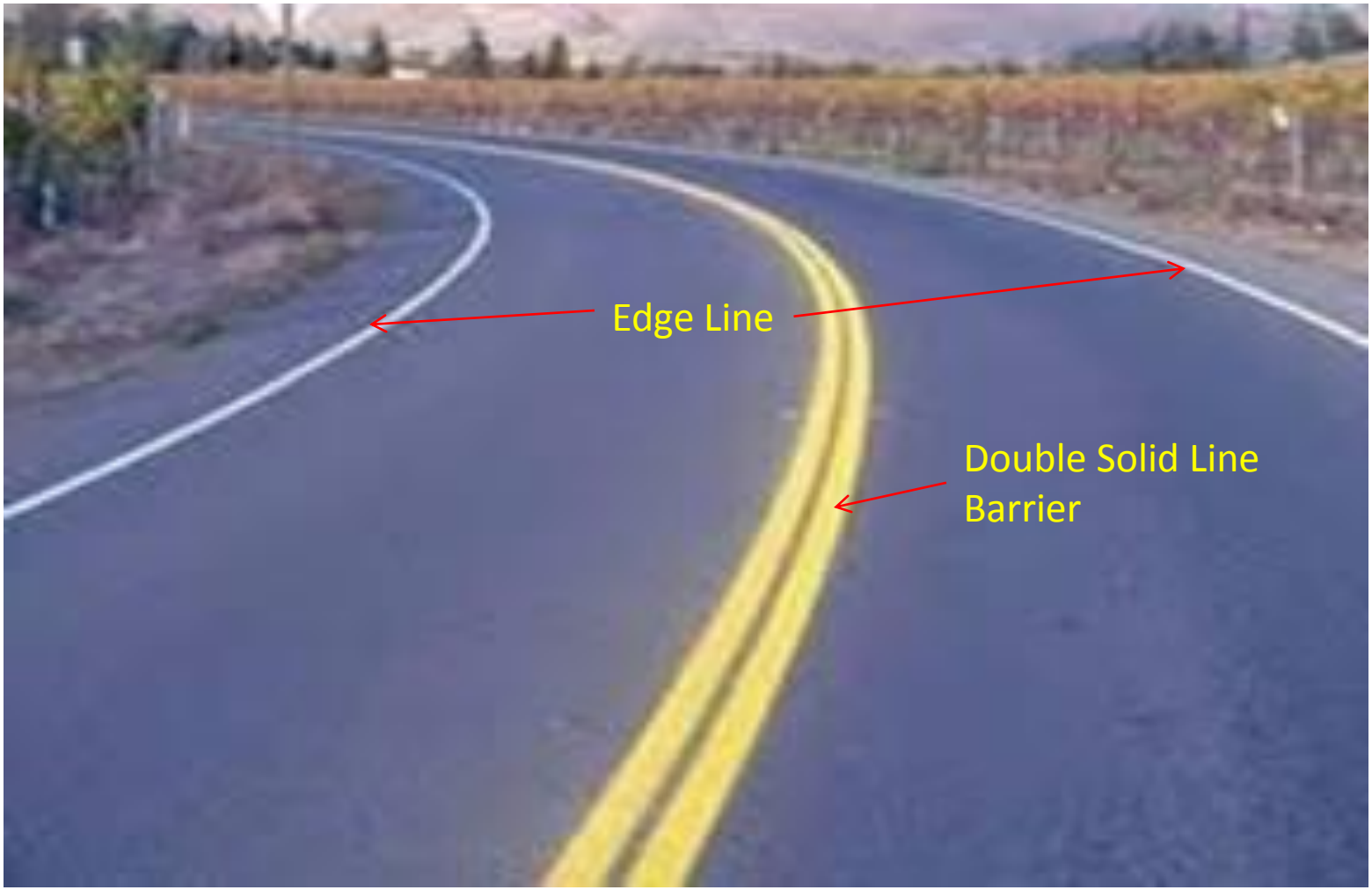
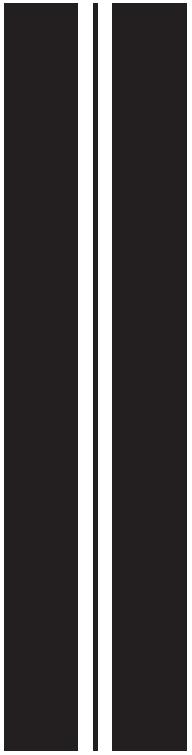
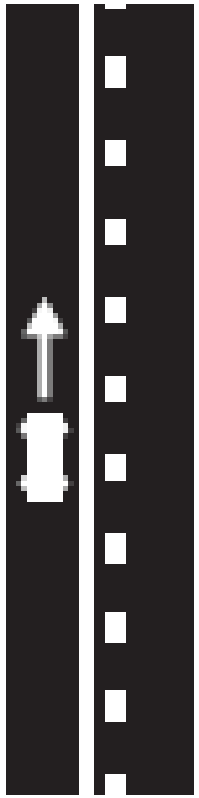

Unbroken
Centre Barrier
Crash Barrrier
Edge Line


Edge Line
Double Solid Line
Barrier

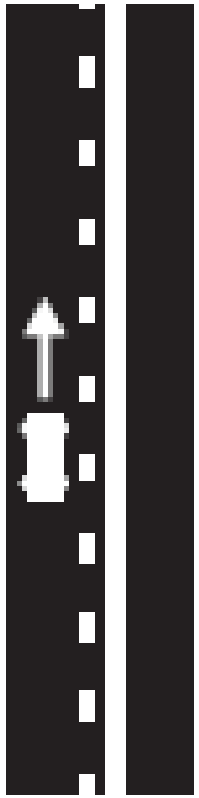


Do not cross or straddle

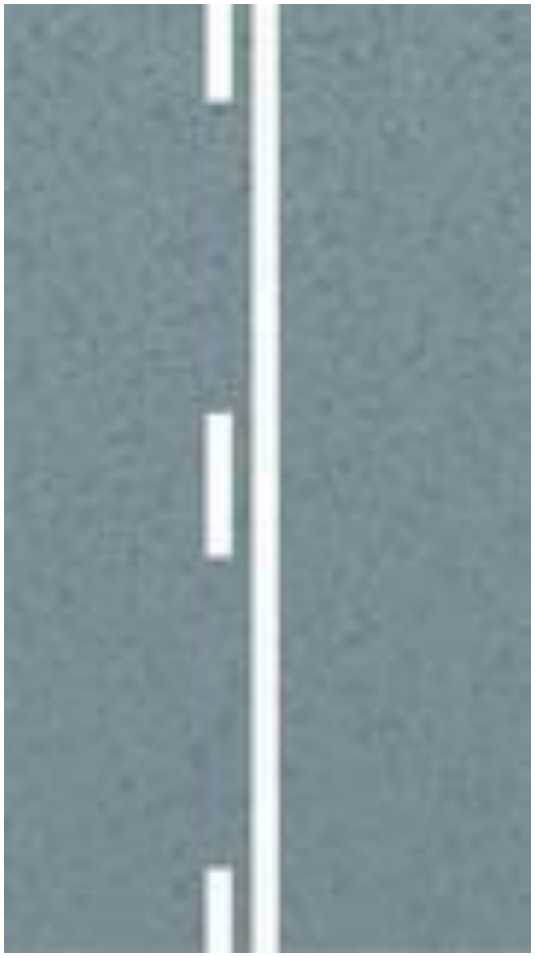
Do not cross or enter hatched are

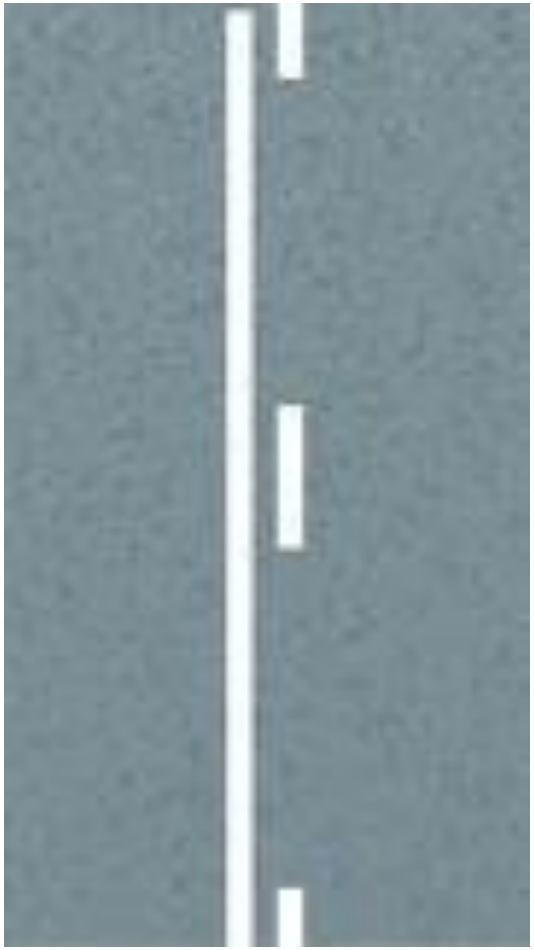


Do not cross
or straddle



May cross to
overtake





PAINTS

Thermo-Plastic Paint

Retro-reflective Paint


DAY
NIGHT
Rd Sign/ Markings with
Retro Reflex Paint

Rd Marking Machine

Traffic Lane Lines

- The Subdivision of Wide Carriageway into Separate Lanes on either side of the Carriage Way helps the Driver
  - to go straight and
  - curbs the meandering tendency
- At Intersections, these Tfc Lane lines will
  - eliminate Confusion and
  - facilitates Turning Movements.
- Thus, Tfc Lane markings Help in
  - increasing the Capacity of the Rd
  - ensuring more Safety.
- The traffic lane lines are normally single broken lines of 100 mm width. Some examples are shown in figure 5 and figure 6.

Lane marking for a 4 Lane Rd with Solid Barrier Line

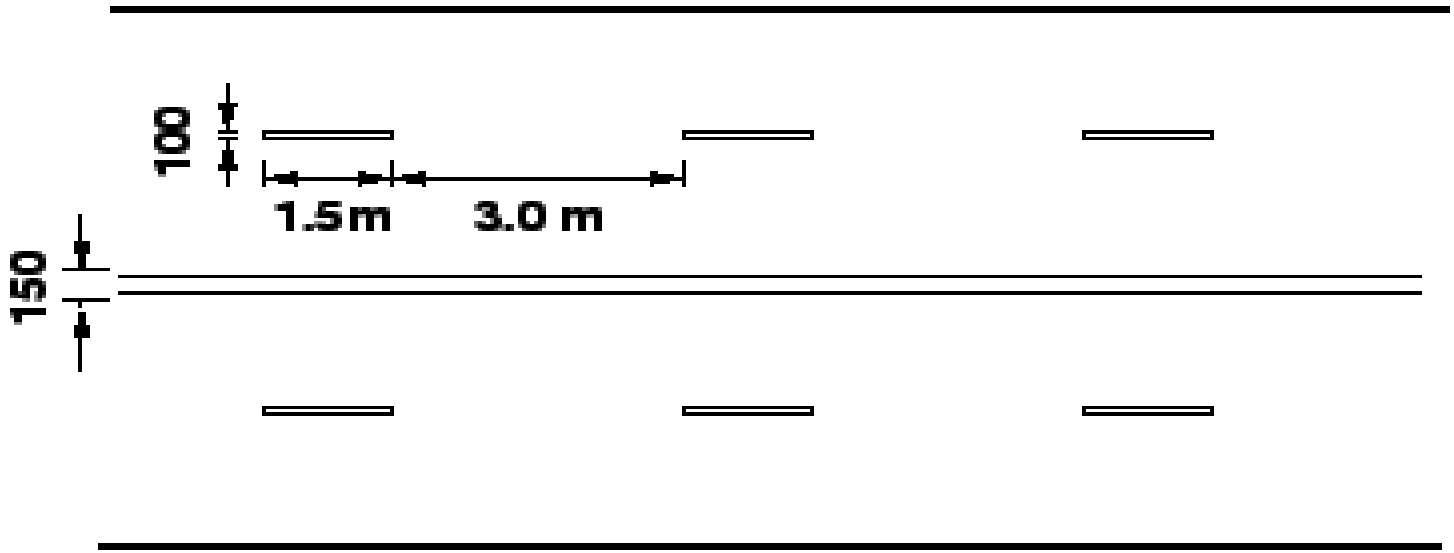


Figure 5: Lane marking for a 4 Lane Rd with Solid Barrier Line

Tfc Lane Marking for a 4 Lane Rd with Broken Center Line

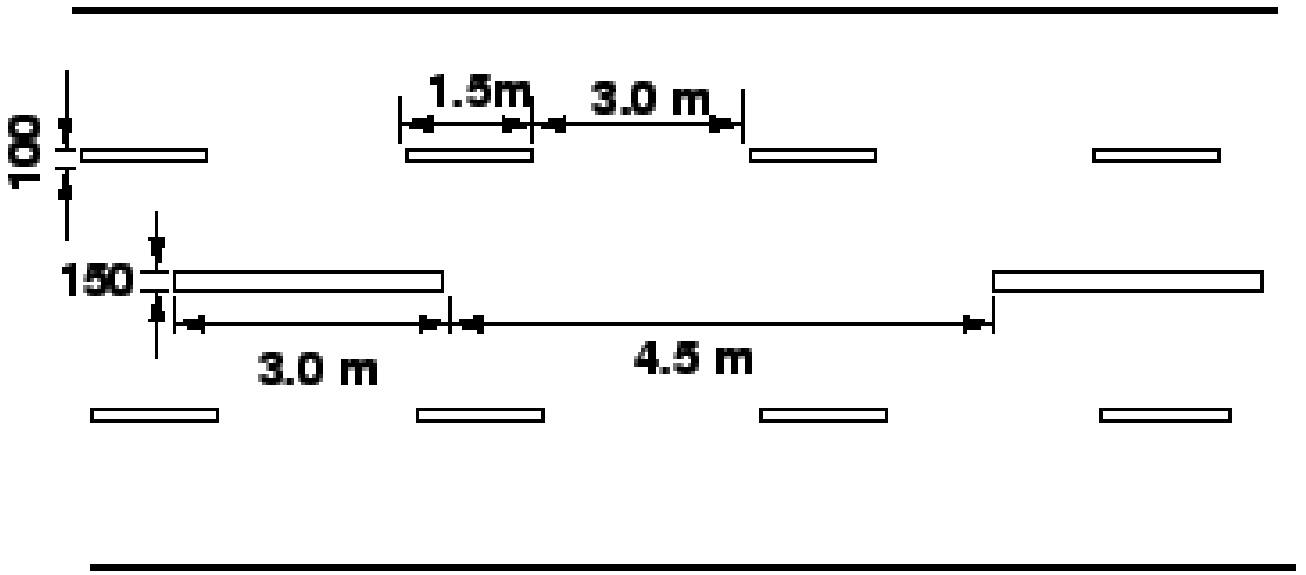


Figure 6: Tfc Lane Marking for a 4 Lane Rd with Broken Center Line

No Passing Zones

- No Passing Zones are established where Overtaking maneuvers are PROHIBITED mostly because of *Low Sight Distance*. e.g. on
  - Summit Curves
  - Horizontal Curves, and on
  - 2 Lane and 3 Lane HWs.
- It may be marked by
  - a Solid Yellow Line along the Center or
  - a Double Yellow Line. In the case of a Double Yellow Line,
    - the Left Hand Element may be a *Solid Barrier Line*, the Right Hand may be either a *Broken line (*or) *a Solid line* . These *Solid Lines* are also called Barrier Lines.
    - When a Solid line is *to the right of the broken line*, the Passing Restriction shall apply only to the *opposing traffic.* Some typical examples are shown in figure 7 and figure 8.
    - the no passing zone is STAGGERED for each direction.

Barrier line marking for a **4 Lane Rd**

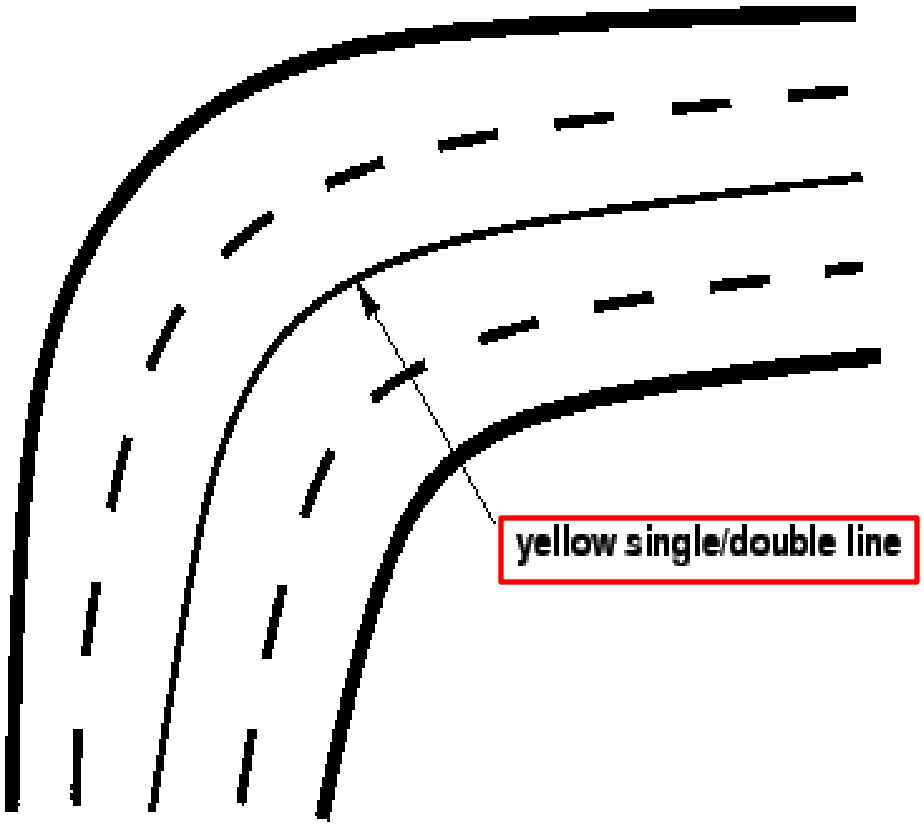
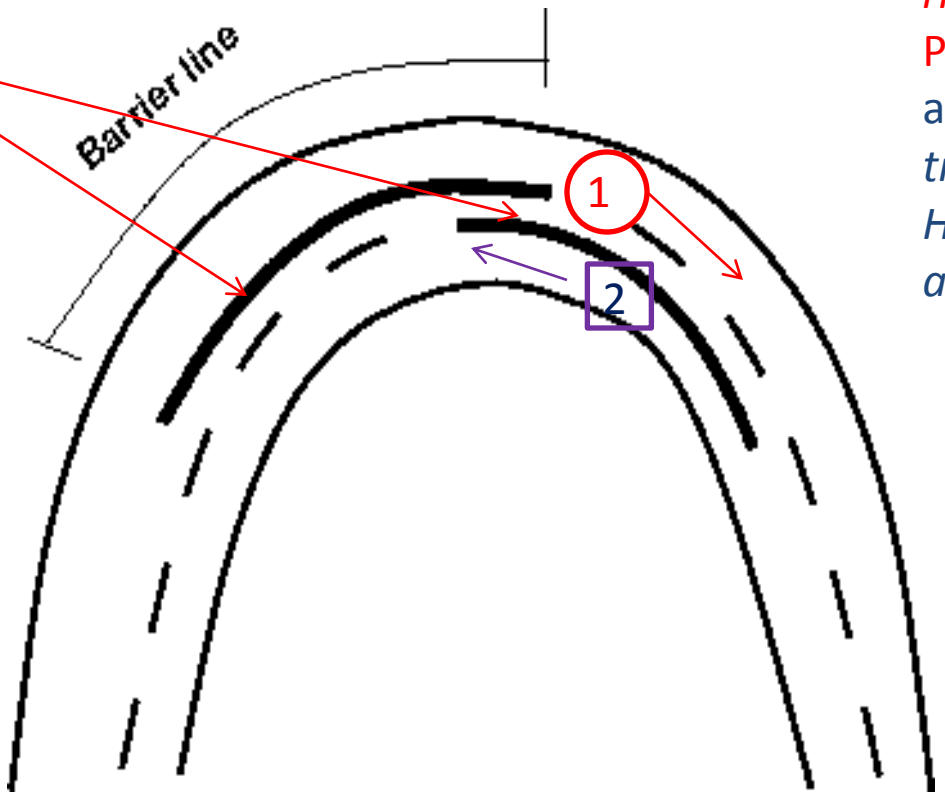


Figure 7: Barrier line marking for a 4 Lane Rd

No passing zone marking at Horizontal Curves

1. The No Passing Zone is STAGGERED for each direction.



When a Solid Line is *to the right of the broken line*, the Passing Restriction shall apply only to the *opposing traffic.*
Here,Passing restriction applies to Veh 2

Figure 8: No passing zone marking at Horizontal Curves


Solid Yellow lInes are also called
Barrier lines. They indicate
NO passing Restriction also


Solid Yellow lInes are also called
Barrier lines. They indicate
NO passing Restriction also


Solid Yellow lines are also called
Barrier lines. They indicate
NO passing Restriction also

Warning Lines

- Warning lines warn the drivers about Approaching Obstruction.
- They are marked on Horizontal and Vertical Curves where the *Visibility < Prohibitory Criteria* specified for No Overtaking Zones.
- They are *Broken Lines* with *6 m length* and *3 m gap.*
- A minimum of 7 Line Segments should be provided. A typical example is shown in figure 9

Warning Line marking for a 2 Lane Rd

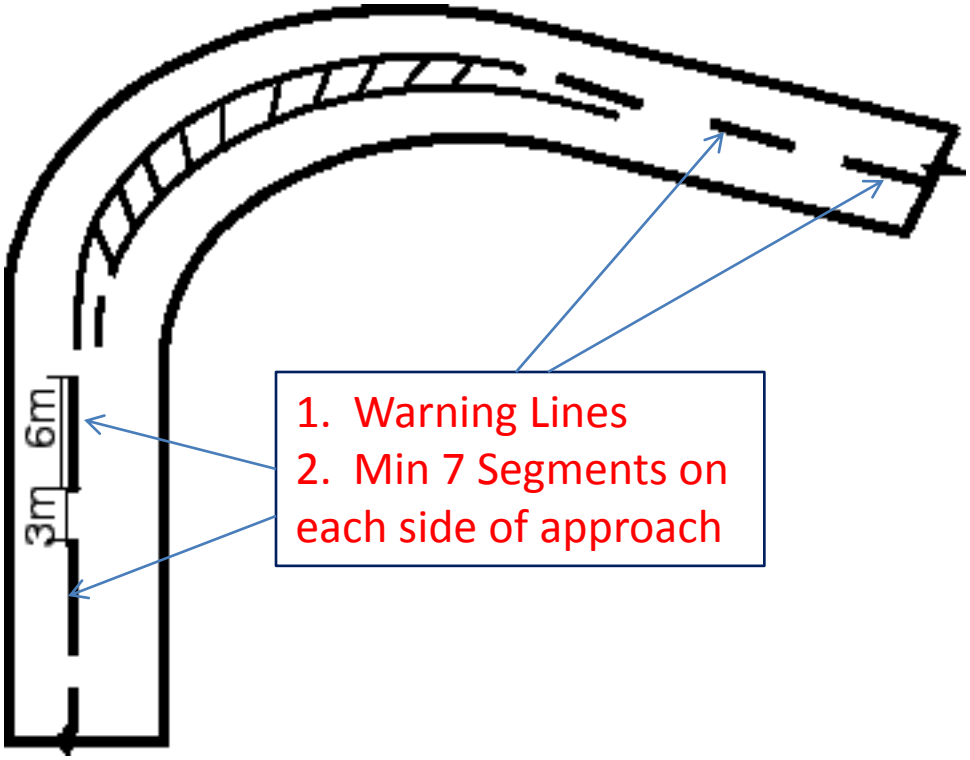
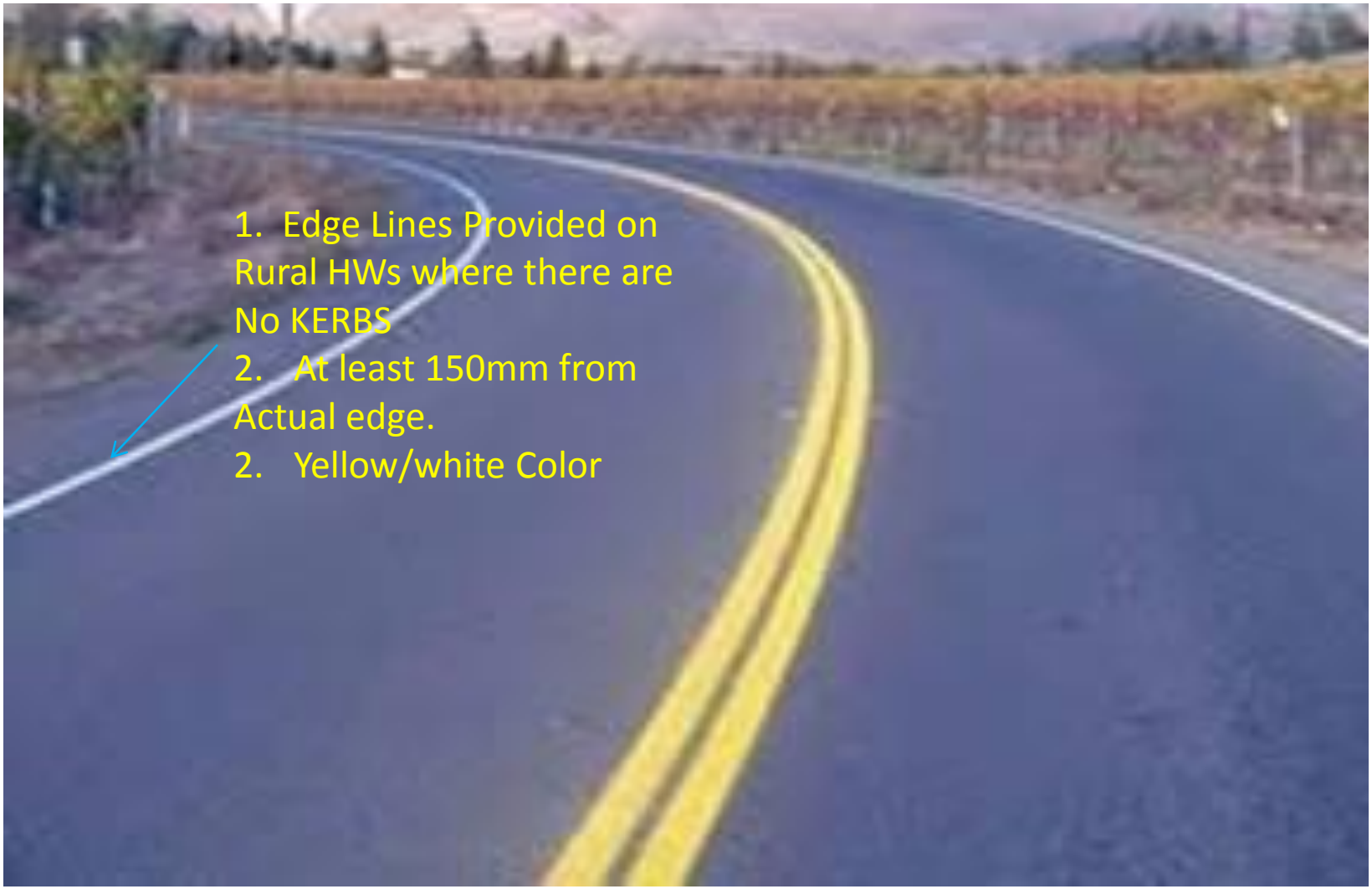


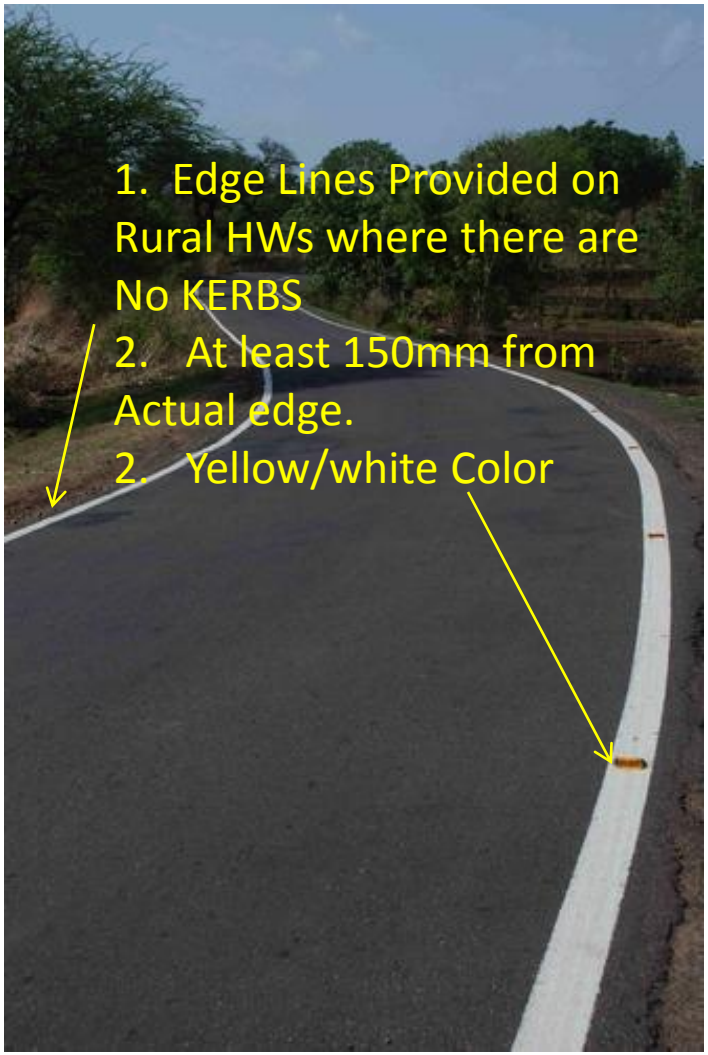
Figure 9: Warning Line marking for a 2 Lane Rd

Edge Lines

- Edge lines
  - indicate Edges of Rural Rds which have NO Kerbs
  - to Delineate the Limits up to which the Driver can safely venture.
  - They should be at least 150 mm from the Actual Edge of the pavement.
  - They are painted in Yellow or White.
- All the lines should be preferably Light Reflective, so that they will be *visible during night also.*
- Improved Night Visibility may also be obtained by the use of minute Glass Beads embedded in the pavement marking materials to produce a Retro-Reflective Surface.


1. Edge Lines Provided on Rural HWs where there are No KERBS
2. At least 150mm from Actual edge.
2. Yellow/white Color

Thermo-Plastic Paint



Transverse Markings

- Transverse markings are
  - marked ACROSS the Direction of Tfc.
  - They are marked at Intersections etc.
  - Site Conditions play a very important role.
- The Type of Rd Marking for a particular intersection depends on several Variables such as
  - *Speed*
  - *Characteristics of Tfc*
  - *Availability of Space etc*
- Some of the Markings on Approaches to Intersections are
  - *Stop Line Markings,*
  - *markings for Pedestrian Crossing,*
  - *Direction Arrows etc.*


Some of the Markings on Approaches to Intersections are
1. Stop Line Markings,
2. markings for Pedestrian Crossing,
3. Direction Arrows etc.
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Stop Line

- Indicate the Position
  - beyond which the vehicles should NOT Proceed
  - when required to STOP
    - by control devices like Signals or
    - by Tfc Police.
- They should be Placed either
  - PARALLEL to the Intersecting Rd way or
  - at RIGHT ANGLES to the Direction of Approaching Vehicles.
- An example for a stop line marking is shown in figure 10

Stop Line marking near an **Intersection**

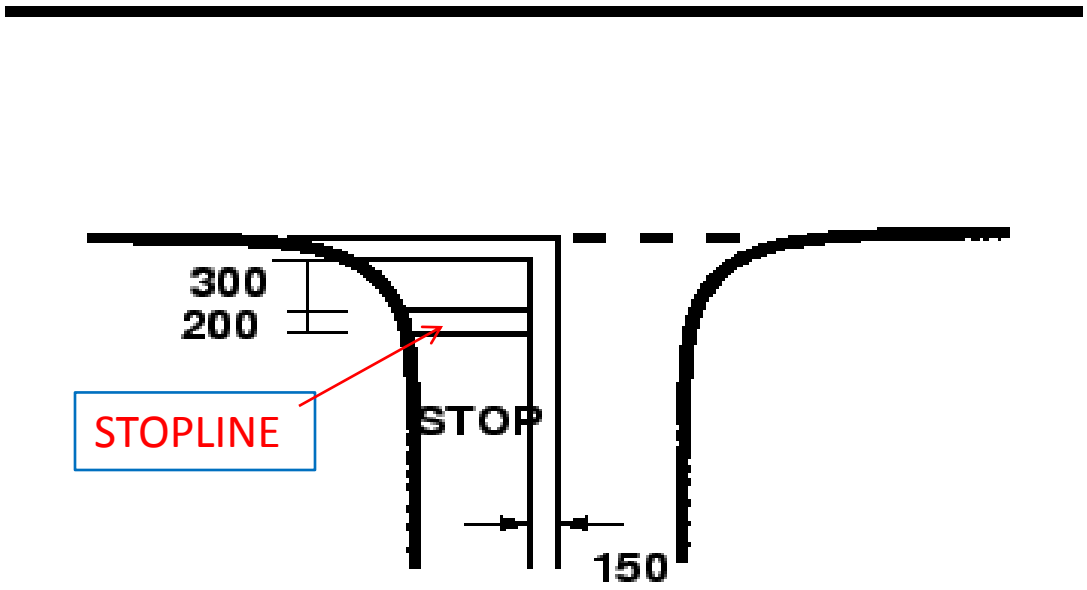

Figure 10: Stop Line marking near an Intersection


STOP LINE
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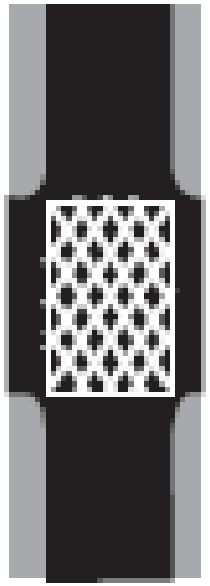
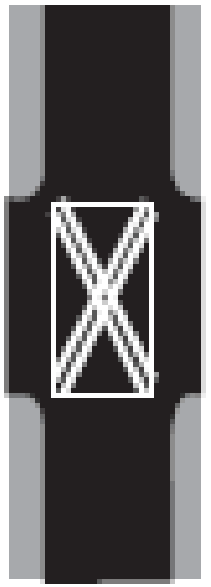


Do not enter
unless exit is clear



Do not enter
unless exit is clear

Pedestrian Crossings

- Pedestrian crossings are provided at places where the Conflict between Vehicular and Pedestrian Tfc is SEVERE
- The Site should be selected that there is
  - *LESS inconvenience to the Pedestrians and also*
  - *the Vehicles are NOT interrupted too much.*
- At intersections, the Pedestrian Crossings should be preceded by a Stop Line at a distance of
  - 2 - 3m for Un-Signalized Intersections and
  - 1m for Signalized Intersections.
- Most commonly used pattern for Pedestrian Crossing is Zebra crossing consisting of *equally spaced White strips of 500 mm wide.*
- A typical example of an intersection illustrating Pedestrian Crossings is shown in figure 11.

Z

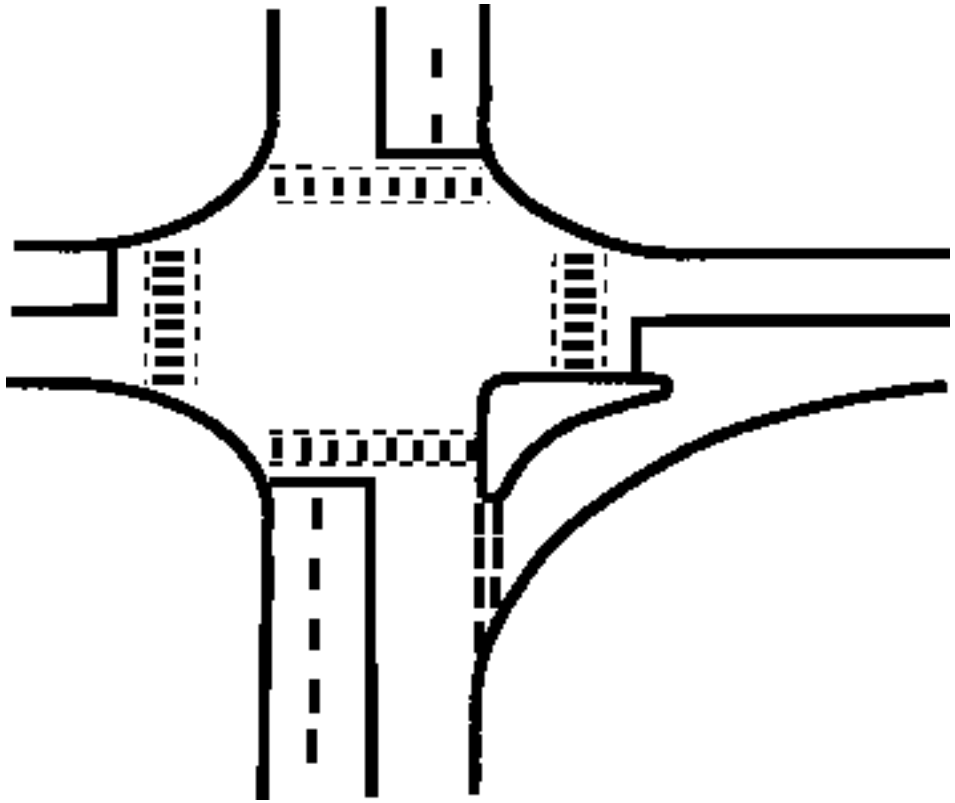
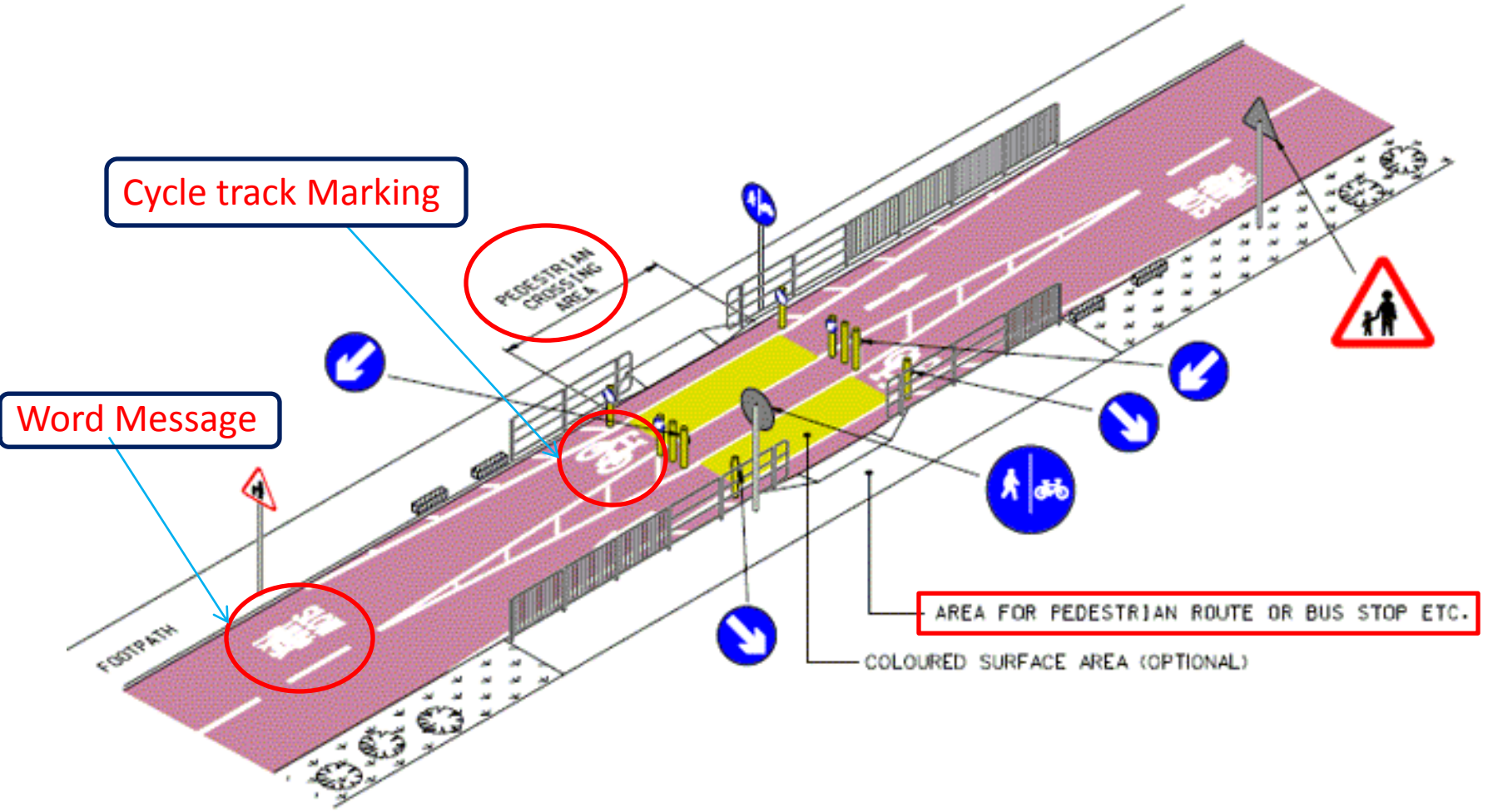
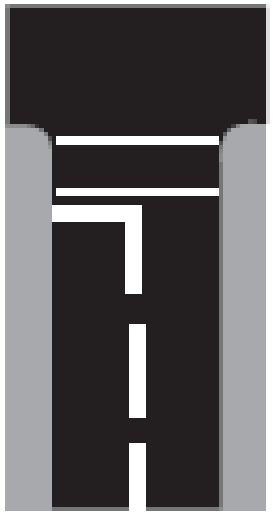


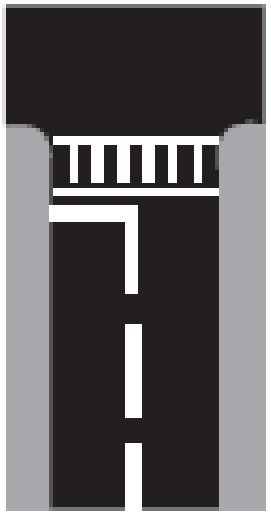
Figure 11: Pedestrian marking near an intersection

PEDESTRIAN CROSSING





Pedestrian crossing at Green man crossing or at traffic light junction



No stopping at markings showing pedestrian crossing

ZEBRA CROSSING

Directional Arrows

- In addition to the Warning Lines on Approaching Lanes; Directional Arrows should be used to Guide Drivers *in Advance* over the Correct Lane to be taken while approaching Busy Intersections.
- Because of the Low Angle at which the markings are viewed by the drivers, the arrows should be *elongated* in the direction of Tfc for adequate visibility.
- The dimensions of these arrows are also very important.
- A typical example of a directional arrow is shown in figure 12.

Directional Arrow Marking

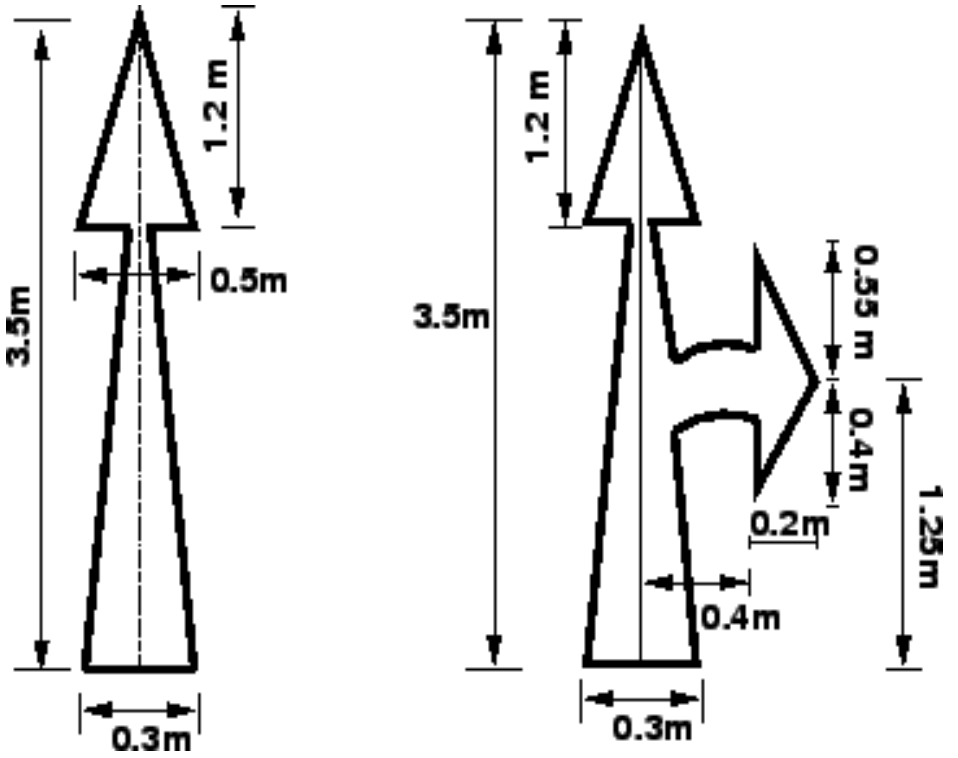
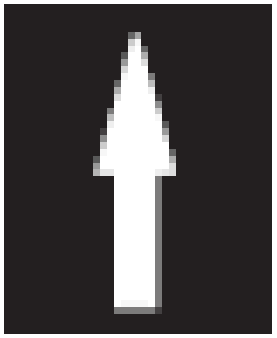
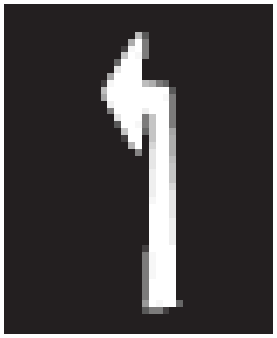


Figure 12: Directional Arrow marking

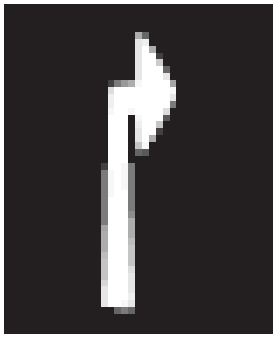
DIRECTIONAL ARROWS



Ahead only in this lane

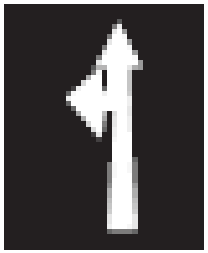


Turn left in this lane

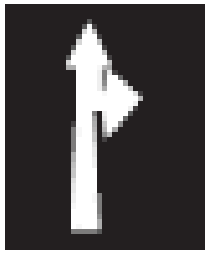


Turn ringht in this lane

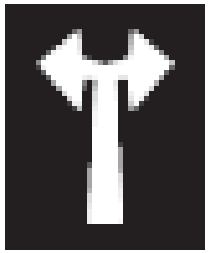
DIRECTIONAL ARROWS



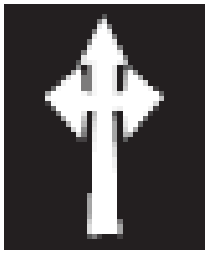
Ahead only or turn left in this lane



Ahead only or turn right in this lane



Turn left or right in this lane



Ahead, turn left or turn right in this lane

DIRECTIONAL ARROWS & LETTERING

DIRECTIONAL ARROWS

Object Marking

Object Marking

- Physical Obstructions in a Carriageway cause serious hazard to the flow of Tfc and should be adequately marked. e.g.
  - *Tfc Island or*
  - *Obstructions near Carriageway like Signal Posts, Pier* etc.
- They may be marked *on the Objects* ADJACENT to the Carriageway.

Objects within the carriageway

- The obstructions within the carriageway such as
  - *Tfc Islands*
  - *Raised medians,* etc.
- They may be marked
  - by > 5 Alternate Black and Yellow Stripes.
  - The stripes should Slope Forward at 45 deg wrt the direction of Tfc.
  - These Stripes shall be Uniform and should > 100 m wide so as to provide sufficient Visibility.

Objects adjacent to Carriageway

Objects Adjacent to Carriageway

- Sometimes objects adjacent to the Carriageway may pose some obstructions to the flow of Tfc. e.g.
  - *Subway Piers and Abutments*
  - *Culvert Head Walls etc.*
- They should be marked with alternate Black and White Stripes at a Forward Angle of 45 deg wrt the Direction of Tfc.
- Poles *close to the carriageway* should be painted in alternate Black and White up to a ht of 1.25 m *above the Rd level.*
- Other objects such as Guard Stones, Drums, Guard Rails etc. where chances of vehicles hitting them are only when vehicle runs off the carriageway should be painted in Solid White.
- Kerbs *of* all Islands located in the line of traffic flow shall be Painted with
  - either ALTERNATING Black and White Stripes of 500 mm wide (OR)
  - Chequered Black and White Stripes of same width.
- The object marking for Central Pier and Side Walls of an Underpass is illustrated in figure 13.

Marking for Objects adjacent to the Rd Way

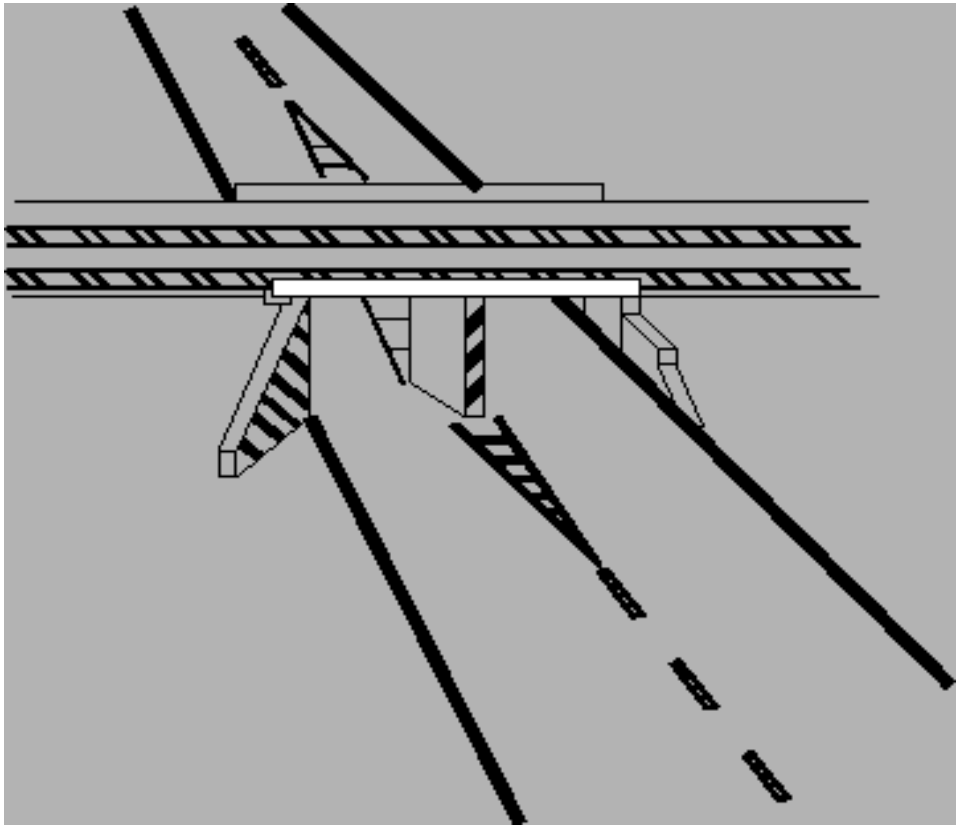


Figure 13: Marking for Objects adjacent to the Rd Way

Word Messages

- Information to *Guide, Regulate, or Warn* the Rd User may also be conveyed by inscription of word message on Rd surface.
  - Characters for word messages are usually Capital Letters.
  - The Legends should be as brief as possible and shall NOT consist of > 3 words for any message.
  - Word messages require more and important Time to Read and Comprehend than other Rd markings. Therefore, only few and important ones are usually adopted. Some of the examples of word messages are STOP, SLOW, SCHOOL, RIGHT TURN ONLY etc.
  - The Character of a Rd Message is also ELONGATED so that driver *looking at the RD Surface at a low angle* can also read them easily.
  - The dimensioning of a typical Alphabet is shown in figure 14.

Typical dimension of the Character ‘T’ used in Rd Marking

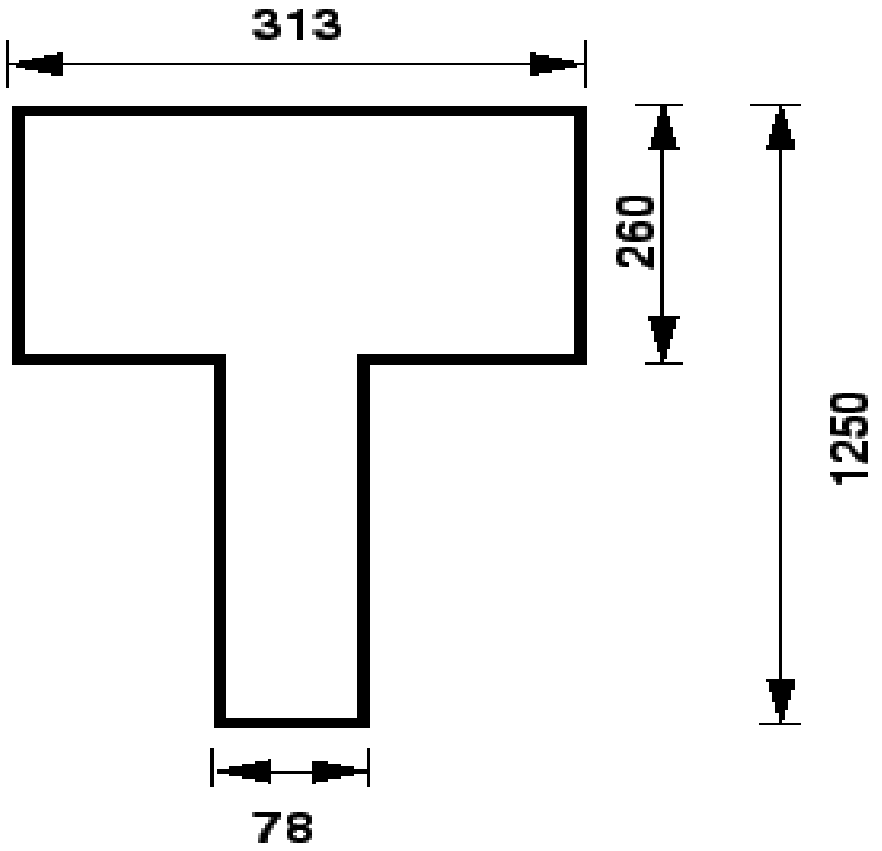
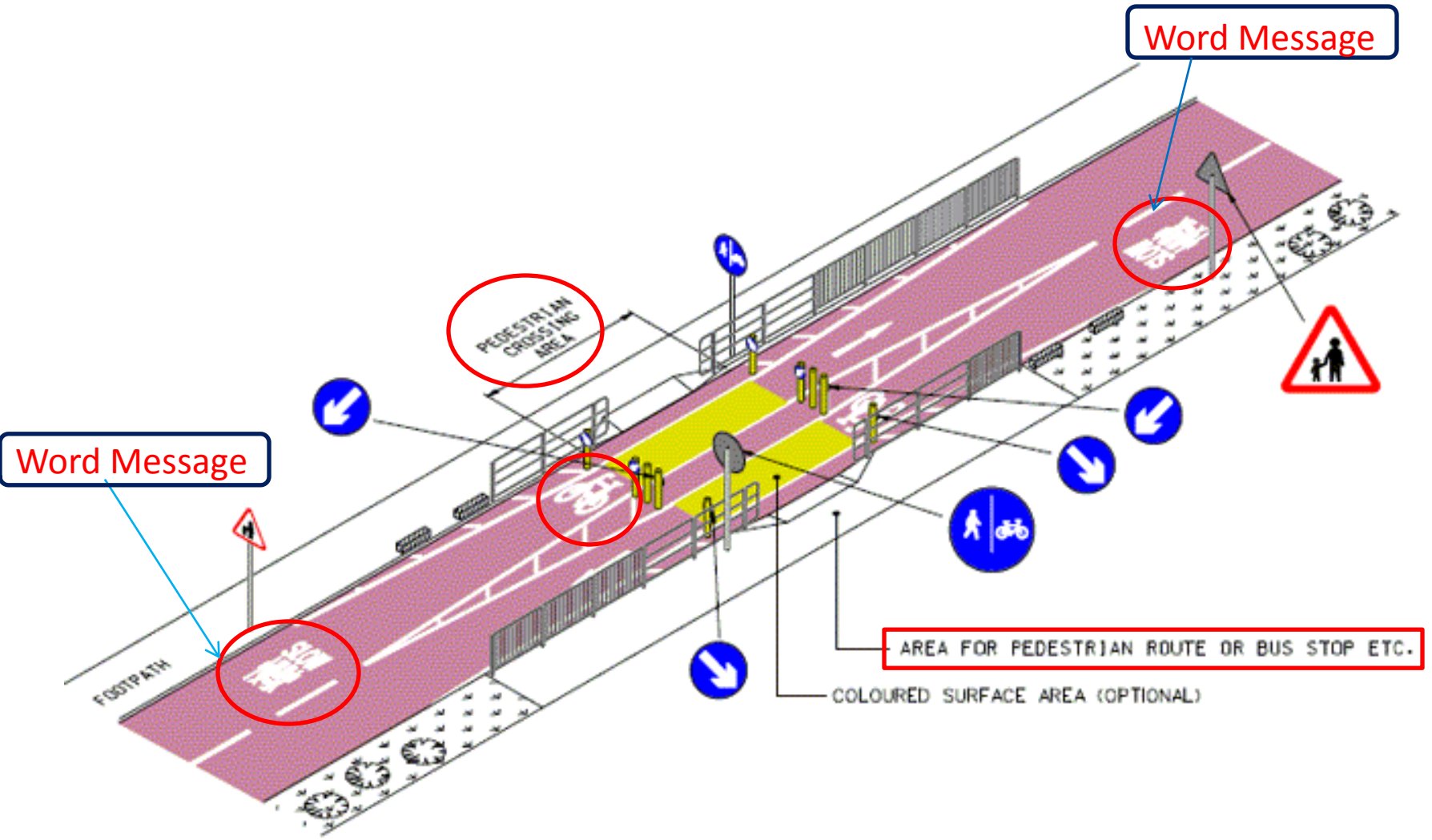


Figure 14: Typical dimension of the character ‘T’ used in Rd Marking

PEDESTRIAN CROSSING



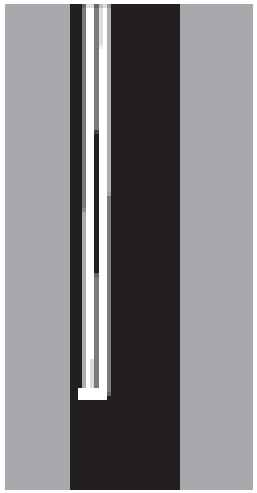
Parking

- The marking of the Parking Space Limits on Urban Rds
  - promotes more Efficient Use of the Parking Spaces and
  - tends to Prevent Encroachment on places where *Parking is undesirable* like
    - *Bus Stops*
    - *Fire Hydrant Zones* etc..
- Such parking space limitations should be indicated with markings that are Solid White Lines 100 mm wide.
- Words TAXI, CARS, SCOOTERS etc. may also be written if the parking area is specific for any particular type of vehicle.
- To indicate Parking Restriction…..
  - Kerb or Carriage Way marking of Continuous Yellow line 100 mm wide
  - covering the top of Kerb or Carriageway close to it may be used.

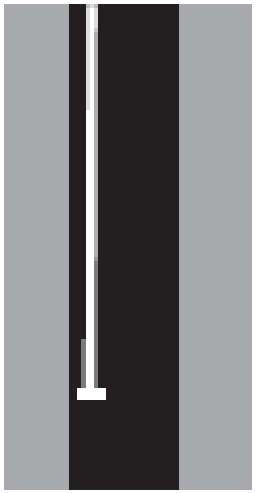
To indicate Parking Restriction…..

Kerb or Carriage Way marking of

- Continuous Yellow line 100 mm wide
- covering the top of Kerb or Carriageway close to it



No Stopping at any time



No Stopping at time shown on 'Time plate'

No parking at any time

Hazardous Location

- Wherever there is a
  - *change in the Width of the Rd (*or)
  - *any Hazardous Location in the Rd,*
- Rd Markings showing the *Width Transition* in the Carriageway should be of →100 mm width.
- Converging lines shall be
  - 150 mm wide and shall have a
  - Taper Length of > 20 times the Off-Set distance.
- Typical Carriageway Markings showing Transition from Wider to Narrower sections and vice-versa is shown in figure 15. In the figure, the Driver is Warned about the Position of the Pier through proper Rd Markings.

Hazard
warning line
Lane or centre
line near hazard

Hazard
warning area
Do not enter

Approach Marking for **Obstructions** on the Rd way

In the figure, the Driver is warned about
the Position of the Pier through proper Rd Markings.

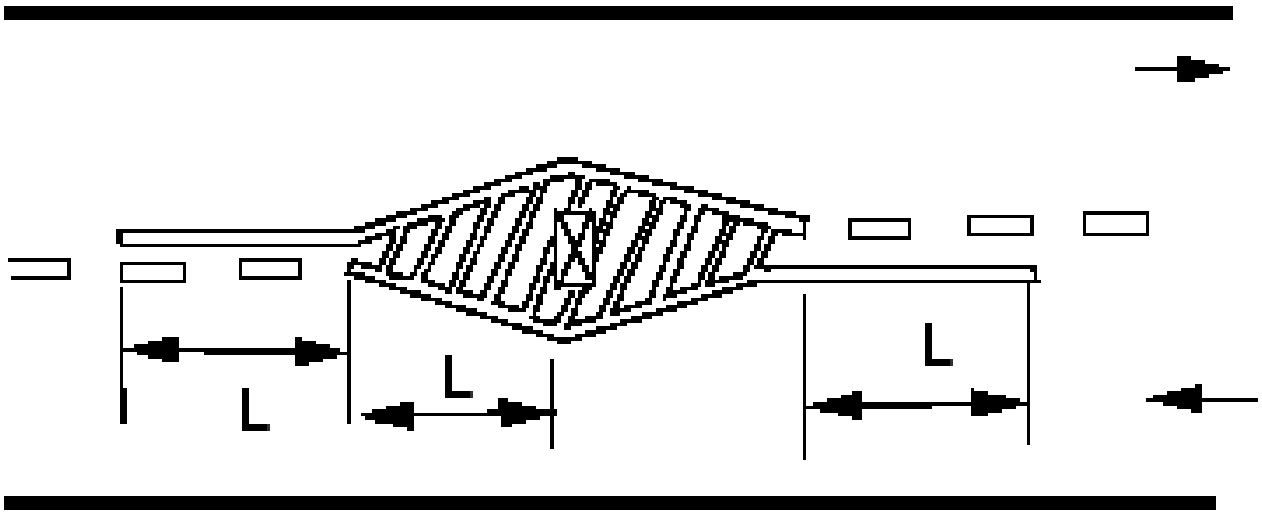
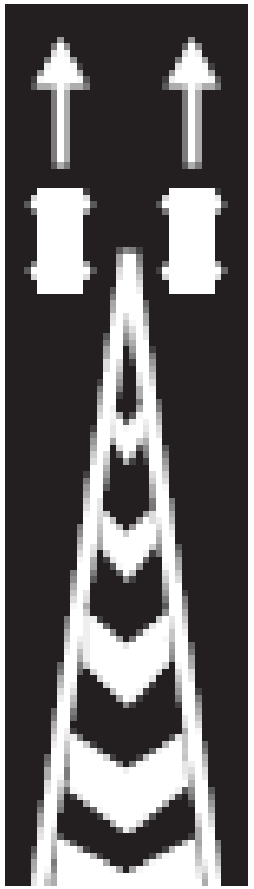
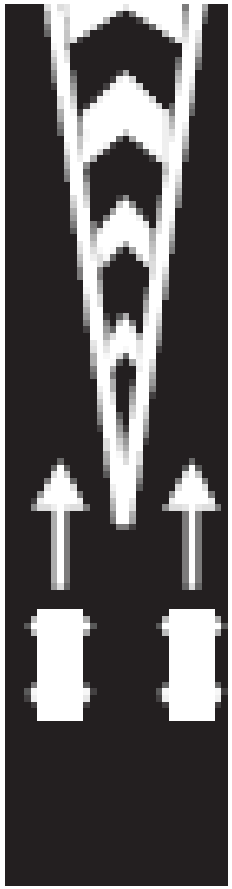


Figure 15: Approach Marking for **Obstructions** on the Rd Way



Merging



Divergir

Summary

- Road Markings are *Aids to Control Tfc* by exercising Psychological Control over the Rd Users.
- They HELP in Safe Driving by
  - *delineating the Carriage Way as well as*
  - *Marking Obstructions.*
- They also Assist Safe Pedestrian Crossing.
- Longitudinal Markings which are provided along the Length of the Rd and its various Classifications were discussed.
- Transverse Markings are provided along the Width of the Rd.
- Rd Markings also contain Word messages, but there are only very few of them, since
  - it is Time Consuming to Understand Compared to other Markings
- Markings are also used to Warn the Driver about the Hazardous Locations ahead.
- Thus Rd Markings ENSURE
  - *Smooth flow of Tfc*
  - *Also, Safety to other Rd Users.*

ROAD MARKINGS

Road marking

Road or traffic markings are made of lines, patterns, words, symbols or reflectors on the pavement, kerb, sides of islands or on the fixed objects within or near the roadway. Traffic markings may be called special signs intended to control, warn, guide or regulate the traffic. The markings are made using paints in contrast with colour and brightness of the pavement or other back ground. Light reflecting paints are also commonly used for traffic marking. In order to ensure that the markings are seen by the road users, the longitudinal lines should be atleast 10 cm thick and the transverse lines should be made in such a way that they are visible at sufficient distance in advance to give road users adequate time to respond.

The various types of markings may be classified as,

(a) Pavement markings

(b) Kerb markings

(c) Object markings and

(d) Reflector unit markings

PAVEMENT MARKINGS

PAVEMENT MARKINGS

Pavement Markings

Pavement or carriageway markings may generally be of white paint. Yellow colour markings are used to indicate parking restrictions and for the continuous centre line and barrier line markings. Longitudinal solid lines are used as guiding or regulating lines and are not meant to be crossed by the driver. Transverse solid lines indicate the position of stop lines for vehicular traffic.

PAVEMENT MARKINGS *(Contd)*

Some of the common types of pavement markings are given below :

(a) *Centre Lines* : These are meant to separate the opposing streams of traffic on undivided two-way roads. On rural highway with two or three lanes, single broken lines of width 0.1 m and length 4.5 segments and 7.5 m gaps may be painted on straight stretches of NH and SH, these may be decreased to 3.0 and 6.0 m at horizontal curves and approaches to intersection. On other roads at straights the segments are 3.0 m in length and gaps 6.0 m (which are reduced to 3.0 m at curves and approaches to intersection). On four or six lane undivided roads two solid continuous parallel lines of 0.1 m width with 0.05 to 0.10 m space in between are painted.

On urban roads with less than four traffic lanes the centre line consists of white broken lines of width 0.10 to 0.15 m, length of segment 3.0 m and length of gaps 4.5 m to be reduced to 3.0 m at curves and approaches to intersections. On undivided roads with atleast two traffic lanes for each direction of traffic flow, the centre line marking shall consist of two solid continuous lines.

PAVEMENT MARKINGS *(Contd)*

(b) *Lane Line*: Lines are drawn to designate traffic lanes. These are used to guide the traffic and to properly utilize the carriageway.

(c) *No Passing Zone Markings*: These are marked to indicate that overtaking is not permitted.

(d) *Turn Markings*: These are useful near intersection to designate proper lateral placement of vehicles before turning to the different directions.

(e) *Stop Lines*: These are meant for vehicles to stop near the pedestrian crossing, signalized intersection etc. where the vehicles have to stop and proceed.

PAVEMENT MARKINGS *(Contd)*

(f) *Cross Walk Lines* : The particular places where pedestrian are to cross the pavement are properly marked by the pavement markings. The width of pedestrian crossing may be between 2.0 and 4.0 m depending on local requirements.

(g) *Approach to Obstructions*: These may be indicated by appropriate pavement markings.

(h) *Parking Space Limits*: For proper utilization of parking facility, markings are made.

(i) Border or edge lines indicate carriageway edges of rural roads which have no kerb stones along the edges.

(j) Route direction arrows are marked by one or more arrows to guide effectively the traffic into correct lanes.

(k) Parking space limits on urban roads are marked to promote efficient use of parking spaces in a systematic manner.

(*l*) Bus Stops : The length of kerb which is reserved for buses to stop are marked by continuous yellow line on the kerb indicating 'parking prohibited'. The pavement space meant for bus stop is also marked by the word 'BUS'.

KERB/OBJECT/ RU MARKINGS
PAVEMENT MARKINGS*(Contd)*

Kerb Markings

These may indicate certain regulations like parking regulations. Also the markings on the kerb and edges of islands with alternate black and white line increase the visibility from a long distance.

Object Markings

Physical obstruction on or near the roadway are hazardous and hence should be properly marked. Typical obstructions are supports for bridge, signs and signals, level crossing gates, traffic islands, narrow bridges, culver head walls etc.

Reflector Unit Markings

Reflector markers are used as hazard markers and guide markers for safe driving during night. Hazard markers reflecting yellow light should be visible from a long distance of about 150 m.

ROAD DELINEATORS

Road Delineators

Road delineators are devices or treatment to outline the roadway or a portion there-of to provide visual assistance to drivers about the alignment of a road ahead, especially at night. Three types of delineators that may be used are Roadway Indicators, Hazard Markers and Object Markers.

Roadway indicators are in the form of guide posts, 0.8 to 1.0 m high and painted by black and white strips with or without reflectors and are intended to delineate the edges of the roadway so as to guide the drivers about the alignment ahead. Hazard markers are approximately 1.2 m high plates on posts, either with three red reflectors or markers with black and yellow strips at 45° towards the side of obstruction, meant to define obstructions or objects close to road. Object markers are circular red reflectors arranged on triangular or rectangular panels and are used to indicate hazard and obstructions within the path of vehicles, like the channelizing island placed close to the intersections.

CONTROL OF ACCESS ON HIGHWAYS

If effective access control is not affected along a highway facility, ribbon development and encroachments follow, resulting in increase in the number of accidents and considerable reduction in level of service for vehicle operation. The control of access can either be full or partial. Full control of access on highways means that the authority to control the access is exercised to give preference to through traffic by providing access connections with selected public roads only and by prohibiting crossings at grade or direct private drive way connection. When there may be some private drive way connections and some crossings at grade, this is called partial control of access.

Express ways are divided arterial highways for motor traffic with full or partial control of access and generally provided with grade separation at intersection. Arterial highways are primarily meant for through traffic, usually on a continuous route and have partial control of access.

Major corridors of inter-city traffic are increasing in importance and are to be protected from unregulated road side development by exercising limited access control.

Grade separation across highways may be provided at intersections of divided rural highways, if the AADT of fast vehicles only on the cross road within next five years exceeds 5000. Grade separation should be provided across existing railway level crossings, if the product of AADT of fast road vehicles and the number of trains per day exceeds 50,000 within the next five years; in the case of new construction like bye passes, even if this figure exceeds 25,000 the grade separation may be justified.

CYCLE TRACK & MARKING

PEDESTRIAN CROSSING