AIS-188

AUTOMOTIVE INDUSTRY STANDARD

APPROVAL OF VEHICLES WITH REGARDS TO LANE DEPARTURE WARNING SYSTEM (LDWS)

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ON BEHALF OF
AUTOMOTIVE INDUSTRY STANDARDS COMMITTEE

UNDER
CENTRAL MOTOR VEHICLE RULES – TECHNICAL STANDING COMMITTEE

SET-UP BY
MINISTRY OF ROAD TRANSPORT and HIGHWAYS
GOVERNMENT OF INDIA

November 2024

INTRODUCTION

The Government of India felt the need for a permanent agency to expedite the publication of standards and development of test facilities in parallel when the work on the preparation of the standards is going on, as the development of improved safety critical parts can be undertaken only after the publication of the standard and commissioning of test facilities. To this end, the erstwhile Ministry of Surface Transport (MOST) has constituted a permanent Automotive Industry Standards Committee (AISC) vide order No. RT-11028/11/97-MVL dated September 15, 1997. The standards prepared by AISC will be approved by the permanent CMVR Technical Standing Committee (CMVR-TSC). After approval, the Automotive Research Association of India, (ARAI), Pune, being the Secretariat of the AIS Committee, will publish this standard. For better dissemination of this information ARAI may publish this document on their Website.

Based on the discussion in the 66th AISC held on 14th July, 2021 Committee agreed in principle to formulate an Automotive Industry Standard (AIS) for type approval procedure for Lane Departure Warning System (LDWS) as defined in this standard. The intention of this Standard is to establish uniform provisions for Lane Departure Warning Systems (LDWS) fitted to motor vehicles of the categories M2, M3, N2 and N3 primarily used under highway conditions.

These vehicle categories will benefit from the fitment of a LDWS, especially in the field of monotonous driving situations. The benefit of such system installation is to support a distracted or drowsy driver by warning if the vehicle is unintentionally leaving the lane.

While, in general, those vehicle categories will benefit from the fitment of a LDWS, there are subgroups where the benefit is rather uncertain because they are primarily used in other conditions than highway conditions i.e. Type I buses, off-road vehicles, construction vehicles, special purpose vehicles, etc.). Regardless from the benefit, there are other subgroups where the installation of LDWS would be technically difficult (e.g. on vehicles equipped with split windshields, asymmetrical cabs, windshield of high thickness, front hood vehicles, vehicles with front mounted equipment, etc.

The Standard cannot include all the traffic conditions and infrastructure features in the type-approval process. Actual conditions and features in the real world should not result in false warnings to the extent that they encourage the driver to switch the system off. While preparation of this standard considerable assistance is derived from UNR 130, Amendment 1.

The AISC panel and the Automotive Industry Standards Committee (AISC) responsible for preparation of this standard are given in Annexure-C and Annexure-D respectively.

CONTENTS

Approval of Vehicles with regards to Lane Departure Warning System (LDWS)

1.0 SCOPE

1.1 This Standard applies to the lane departure warning system of vehicles of categories M2, M3, N2 and N3.

Note: The requirements of this standard may be optional for the following category of vehicles, as per the choice of manufacturer;

1. Type I buses as defined under AIS 052 (Rev. 1), as amended from time to time.
2. Off road vehicles (N2G and N3G) as defined under IS 14272, as amended from time to time.

1.2 The Standard cannot include all the traffic conditions and infrastructure features in the type-approval process. Actual conditions and features in the real world should not result in false warnings to the extent that they encourage the driver to switch the system off.

2.0 REFERENCES

1. UN R 130 and Amendment 1 to UNR 130, date of entry into force 8th October 2016.
2. Indian Road Congress document on road markings IRC:35:2015

3.0 DEFINITIONS

For the purposes of this standard the following definitions shall apply.

3.1 "**Approval of a vehicle type**" means the full procedure whereby a Testing Agency certifies that a vehicle type meets the technical requirements of this Standard;

3.2 "**Vehicle type with regard to its Lane Departure Warning System**" means a category of vehicles which do not differ in such essential respects as:

(a) The manufacturer's trade name or mark;

(b) Vehicle features which significantly influence the performances of the Lane Departure Warning System;

(c) The type and design of the Lane Departure Warning System;

3.3 "**Lane Departure Warning System (LDWS)**" means a system to warn the driver of an unintentional drift of the vehicle out of its travel lane;

3.4 "**Lane**" means one of the longitudinal strips into which a roadway is divided (as shown in Annexure B);

3.5 "**Visible lane marking**" means delineators intentionally placed on the borderline of the lane that are directly visible by the driver while driving (e.g. not covered by snow, etc.);

3.6 "**Rate of departure**" means the subject vehicle's approach velocity at a right angle to the visible lane marking at the warning issue point;

3.7 "**Common space**" means an area on which two or more information functions (e.g. symbols) may be displayed, but not simultaneously.

4.0 APPLICATION FOR APPROVAL

4.1 The application for approval of a vehicle type with regard to the LDWS shall be submitted by the vehicle manufacturer or by his authorized representative.

4.2 It shall be accompanied by the documents mentioned below:

4.2.1 A description of the vehicle type with regard to the items mentioned in clause 6, together with dimensional drawings and the documentation as referred to in clauses 7.2.3.2. and 7.2.3.3. The numbers and/or symbols identifying the vehicle type shall be specified.

4.3 A vehicle representative of the vehicle type to be approved shall be submitted to the Test Agency conducting the approval tests.

5.0 APPROVAL

5.1 If the vehicle type submitted for approval pursuant to this Standard meets the requirements of clause 6.0, approval of that vehicle type shall be granted.

6.0 SPECIFICATIONS

6.1 General

6.1.1 Any vehicle fitted with a LDWS complying with the definition of clause 3.3., above shall meet the requirements contained in clauses 6.1 to 6.5. of this Standard.

6.1.2 The effectiveness of LDWS with respect to EMI/EMC shall be demonstrated by fulfilling the technical requirements of AIS-004 (Part 3), as amended from time to time.

6.2 Performance requirements

6.2.1 Whenever the system is active, as specified in clause 6.2.3., the LDWS shall warn the driver if the vehicle crosses over a visible lane marking for the lane in which it is running, on a road with a directional form that varies between straight and a curve having an inner lane marking with a minimum radius of 250 m, when there has been no purposeful demand to do so.
Specifically:

6.2.1.1 It shall provide the driver with the warning specified in clause 6.4.1., when tested in accordance with the provisions of clause 7.5. (departure warning test) and with lane markings as specified in clause 7.2.3.

6.2.1.2 The warning mentioned in clause 6.2.1. may be suppressed when there is a driver action which indicates an intention to depart from the lane.

6.2.2 The system shall also provide the driver with the warning specified in clause 6.4.2., when tested in accordance with the provisions of clause 7.6. (failure detection test). The signal shall be constant.

6.2.3 The LDWS shall be active as per the table given below for the specified vehicle categories unless manually deactivated as per clause 6.3.

For M2 and N2	at least at vehicle speeds above 60 km/h *
For M3 and N3	at least at vehicle speeds above 40 km/h

* For vehicle categories under M2 and N2 with maximum speed limit of 60 km/h as per CMV Rule No. 118 or maximum designed speed less than 65 km/h (for e.g. school bus, hazardous goods carrying vehicle etc.) LDWS activation speed shall be 40 km/h.

6.3 If a vehicle is equipped with a means to deactivate the LDWS function, the following conditions shall apply as appropriate:

6.3.1 The LDWS function shall be automatically reinstated at the initiation of each new ignition "on" (run) cycle.

6.3.2 A constant optical warning signal shall inform the driver that the LDWS function has been deactivated. The yellow warning signal specified in clause 6.4.2., may be used for this purpose.

6.4 Warning indication

6.4.1 The lane departure warning referred to in clause 6.2.1., shall be noticeable by the driver and be provided by:

(a) At least two warnings means out of optical, acoustic and haptic, or

(b) One warning means out of haptic and acoustic, with spatial indication about the direction of unintended drift of the vehicle.

6.4.1.1 Where an optical signal is used for the lane departure warning, it may use the failure warning signal as specified in clause 6.4.2., in a flashing mode.

6.4.2 The failure warning referred to in clause 6.2.2., shall be a yellow optical warning signal.

6.4.3 The LDWS optical warning signals shall be activated either when the ignition (start) switch is turned to the "on" (run) position or when the ignition (start) switch is in a position between the "on" (run) and "start" that is designated by the manufacturer as a check position (initial system (power-on)). This requirement does not apply to warning signals shown in a common space.

6.4.4 The optical warning signals shall be visible even by daylight; the satisfactory condition of the signals must be easily verifiable by the driver from the driver's seat.

6.4.5 When the driver is provided with an optical warning signal to indicate that the LDWS is temporarily not available, for example due to inclement weather conditions, the signal shall be constant. The failure warning signal specified in clause 6.4.2., may be used for this purpose.

6.5 Provisions for the periodic technical inspection

6.5.1 At a periodic technical inspection, it shall be possible to confirm the correct operational status of the LDWS by a visible observation of the failure warning signal status, following a "power-ON" (off–system OK, on–system fault present).

In the case of the failure warning signal being in a common space, the common space must be observed to be functional prior to the failure warning signal status check.

6.5.2 At the time of type-approval, the means to protect against simple unauthorized modification of the operation of the failure warning signal chosen by the manufacturer shall be confidentially outlined.

Alternatively, this protection requirement is fulfilled when a secondary means of checking the correct operational status of the LDWS is available.

7.0 TEST PROCEDURE

7.1 The manufacturer shall provide a brief documentation package which gives access to the basic design of the system and, if applicable, the means by which it is linked to other vehicle systems. The function of the system shall be explained and the documentation shall describe how the operational status of the system is checked, whether there is an influence on other vehicle systems, and the method(s) used in establishing the situations which will result in a failure warning signal being displayed.

7.2 Test conditions

7.2.1 The test shall be performed on a flat, dry asphalt or concrete surface.

7.2.2 The ambient temperature shall be between 0° C and 45° C or as mutually agreed between vehicle manufacturer and Test Agency.

7.2.3 Visible lane markings

7.2.3.1 The visible lane markings used in the lane departure warning tests of clause 7.5., shall be those of one of the Testing Agencies as identified in Annexure B to this Standard, with the markings being in good condition and of a material conforming to the requirements of most recent revision of Code of Practice for Lane Markings published by the Indian Road Congress. The visible lane marking layout used for the testing shall be recorded.

7.2.3.2 The vehicle manufacturer shall demonstrate, through the use of documentation, compliance with all the other lane markings identified in Annexure B to this Standard Any such documentation shall be appended to the test report.

7.2.3.3 In the case the vehicle type may be equipped with different variants of the LDWS with regional specific adjustments; the manufacturer shall demonstrate through documentation that the requirements of this Standard are fulfilled in all variants.

7.2.4 The test shall be performed under visibility conditions that allow safe driving at the required test speed.

7.3 Vehicle conditions

7.3.1 Test weight

The vehicle may be tested at any condition of load, the distribution of the mass among the axles being that stated by the vehicle manufacturer without exceeding any of the maximum permissible mass for each axle. No alteration shall be made once the test procedure has begun. The vehicle manufacturer shall demonstrate through the use of documentation that the system works at all conditions of load.

7.3.2 The vehicle shall be tested at the tyre pressures recommended by the vehicle manufacturer.

7.3.3 In the case where the LDWS is equipped with a user-adjustable warning threshold, the test as specified in clause 7.5., shall be performed with the warning threshold set at its maximum lane departure setting. No alteration shall be made once the test procedure has begun.

Note: LDWS shall be designed to meet requirements of clause 7.5., at all warning threshold settings (if provided) and worst-case setting (i.e. setting in which Lane Departure Warning occurs at maximum distance after vehicle's front wheel closest to the lane markings crosses the outside edge of the visible lane marking to which the vehicle is being drifted) shall be selected during test.

7.4 Optical warning signal verification test

With the vehicle stationary, check that the optical warning signal(s) comply with the requirements of clause 6.4.3.

7.5 Lane departure warning test

7.5.1 Drive the vehicle at a speed as specified in the table below, into the center of the test lane in a smooth manner so that the attitude of the vehicle is stable.

For M2 and N2	Vehicle speed shall be 65 ± 3 km/h *
For M3 and N3	Vehicle speed shall be 45 ± 3 km /h

* For vehicle categories under M2 and N2 with maximum speed limit of 60 km/h as per CMV Rule No. 118 or maximum designed speed less than 65 km/h (for e.g. school bus, hazardous goods carrying vehicle etc.) vehicle speed shall be 45 ± 3 km/h

Maintaining the prescribed speed, gently drift the vehicle, either to the left or the right, at a rate of departure of between 0.1 and 0.8 m/s so that the vehicle crosses the lane marking. Repeat the test at a different rate of departure within the range 0.1 and 0.8 m/s.

Repeat the above tests drifting in the opposite direction.

7.5.2 The LDWS shall provide the lane departure warning indication mentioned in clause 6.4.1., at the latest when the outside of the tyre of the vehicle's front wheel closest to the lane markings crosses a line 0.3 m beyond the outside edge of the visible lane marking to which the vehicle is being drifted.

7.6 Failure detection test

7.6.1 Simulate a LDWS failure, for example by disconnecting the power source to any LDWS component or disconnecting any electrical connection between LDWS components. The electrical connections for the failure warning signal of clause 6.4.2., and the LDWS disable control of clause 6.3., shall not be disconnected when simulating a LDWS failure.

7.6.2 The failure warning signal mentioned in clause 6.4.2., shall be activated and remain activated while the vehicle is being driven and be reactivated after a subsequent ignition "off" ignition "on" cycle as long as the simulated failure exists.

7.7 Deactivation Test

7.7.1 If the vehicle is equipped with means to deactivate the LDWS, turn the ignition (start) switch to the "on" (run) position and deactivate the LDWS. The warning signal mentioned in clause 6.3.2., shall be activated. Turn the ignition (start) switch to the "off" position. Again, turn the ignition (start) switch to the "on" (run) position and verify that the previously activated warning signal is not reactivated, thereby indicating that the LDWS has been reinstated as specified in clause 6.3.1. If the ignition system is activated by means of a "key", the above requirement shall be fulfilled without removing the key.

8.0 MODIFICATION OF VEHICLE TYPE AND EXTENSION OF APPROVAL

8.1 Every modification of the vehicle type as defined in clause 3.2. of this Standard shall be notified to the Testing Agency which approved the vehicle type. The Test Agency may then either:

8.1.1 Consider that the modifications made do not have an adverse effect on the conditions of the granting of the approval and grant an extension of approval;

8.1.2 Consider that the modifications made affect the conditions of the granting of the approval and require further tests or additional checks before granting an extension of approval.

	ANNEXURE A (RESERVED) **TECHNICAL SPECIFICATIONS TO BE SPECIFIED BY MANUFACTURER**

ANNEXURE B

VISIBLE LANE MARKING IDENTIFICATION

The visibility of lane markings shall be as per the Code of Practice for Road Markings (Second Revision) Prepared and Published by the Indian Road Congress (IRC:35-2015) as amended from time to time. The reference gist of lane markings to be referred is as given below:

A. Longitudinal Marking for Undivided Roads under Section 4 for Markings for Road Links, sub-section 4.6,

Figure 4.4 : Single / Intermediate Lane Bi-Directional Road (less than 5.5m)

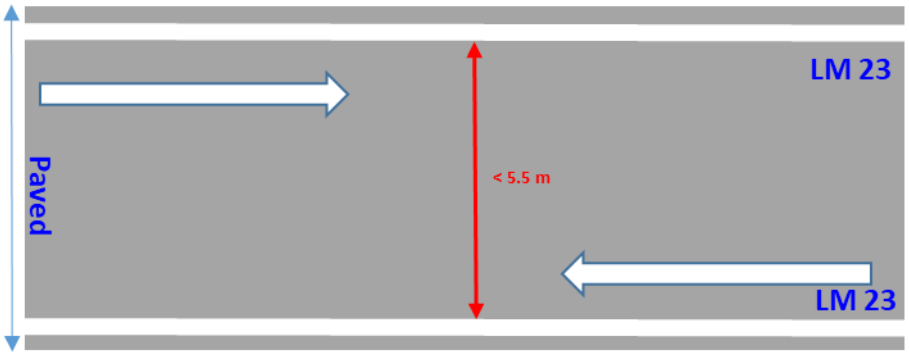
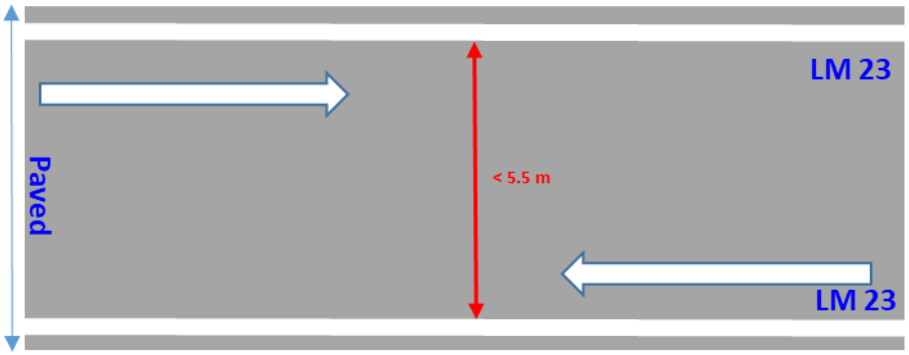
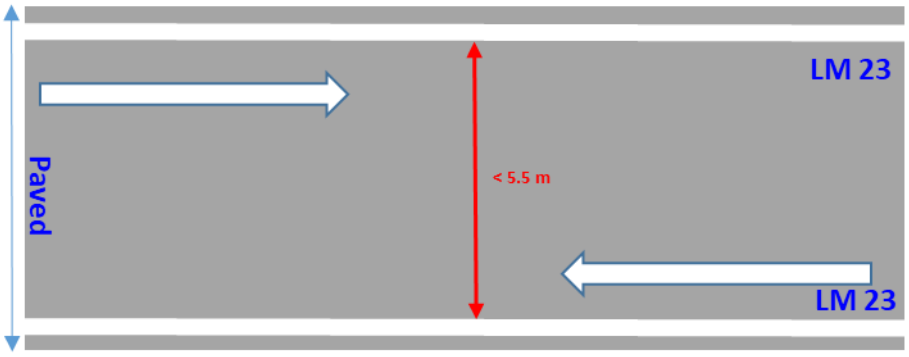
NORMAL	:	
WARNING	:	
NO - OVERTAKING	:	

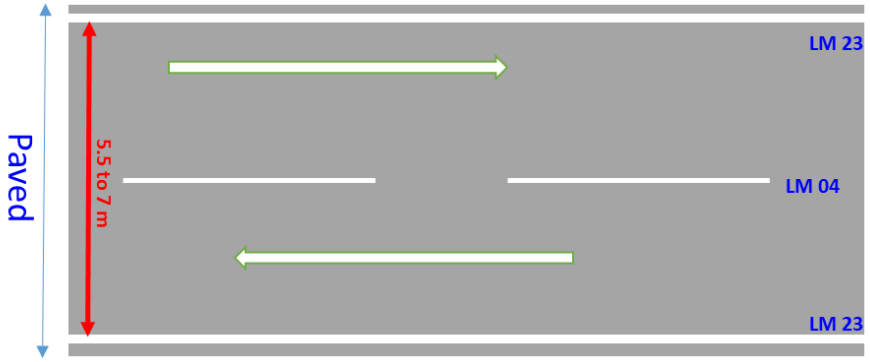
Figure 4.5 : Two Lane Bi-Directional Road		
NORMAL	:	
WARNING	:	
NO – OVERTAKING	:	

Figure 4.6 : Two Lane Bi-Directional Road with Paved Shoulder

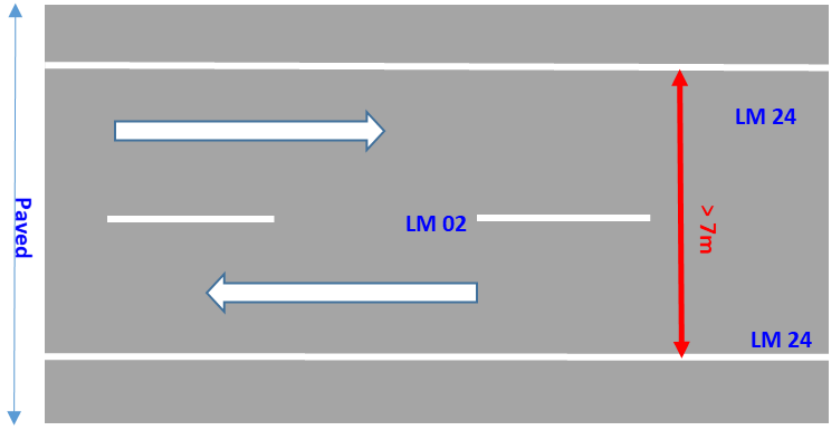
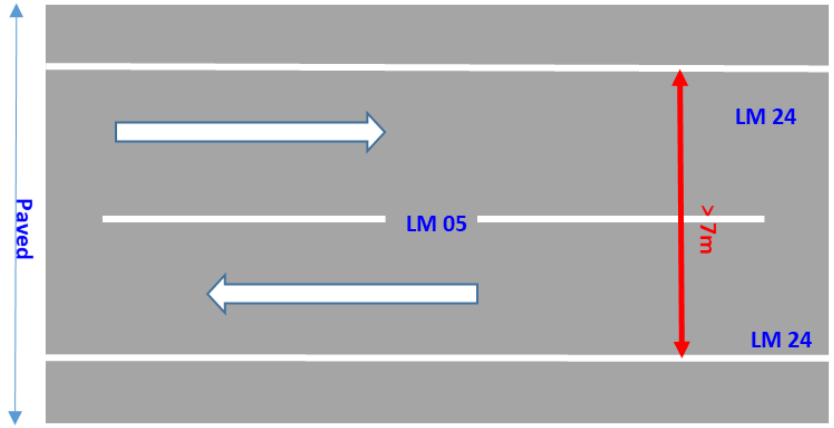
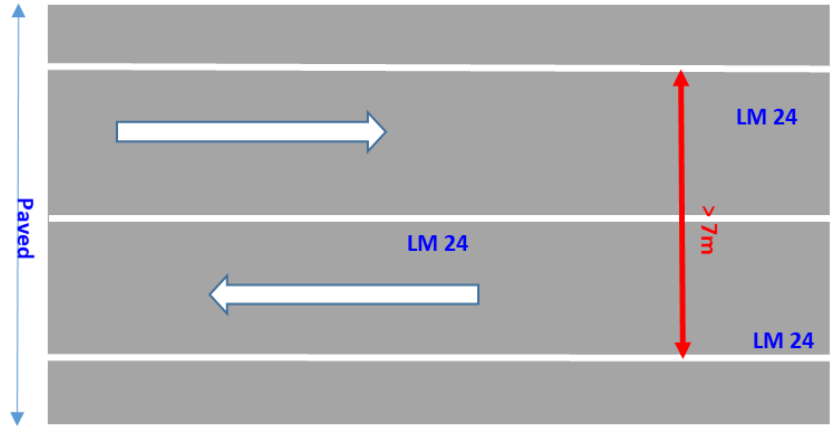
NORMAL	:	
WARNING	:	
NO - OVERTAKING	:	

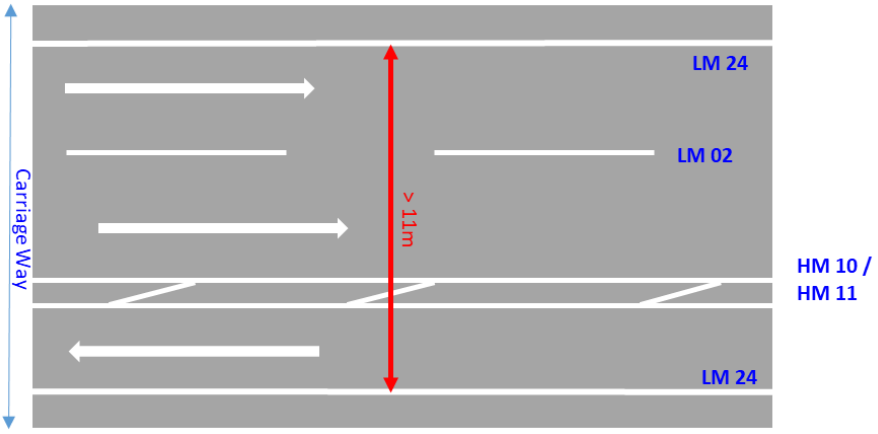
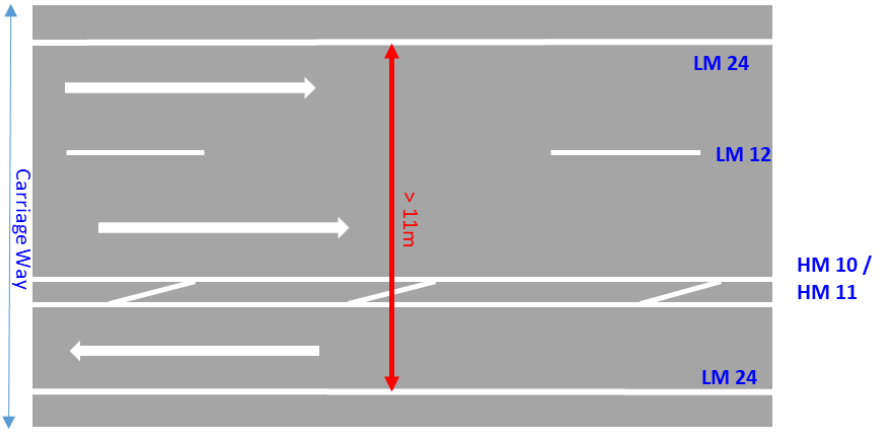
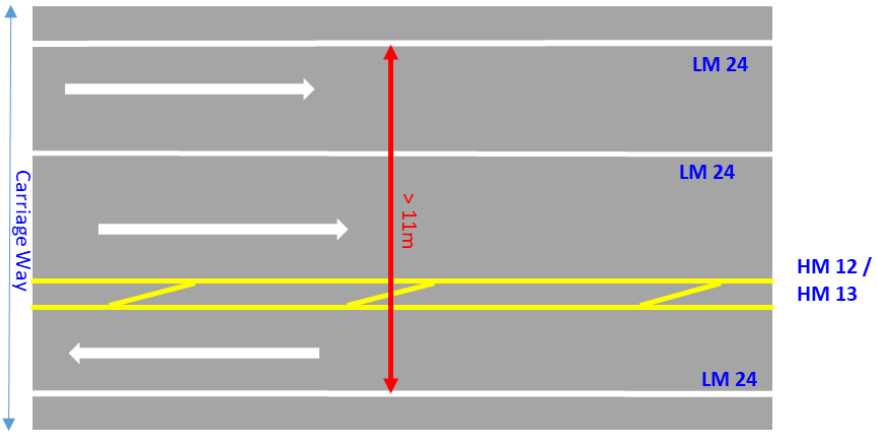
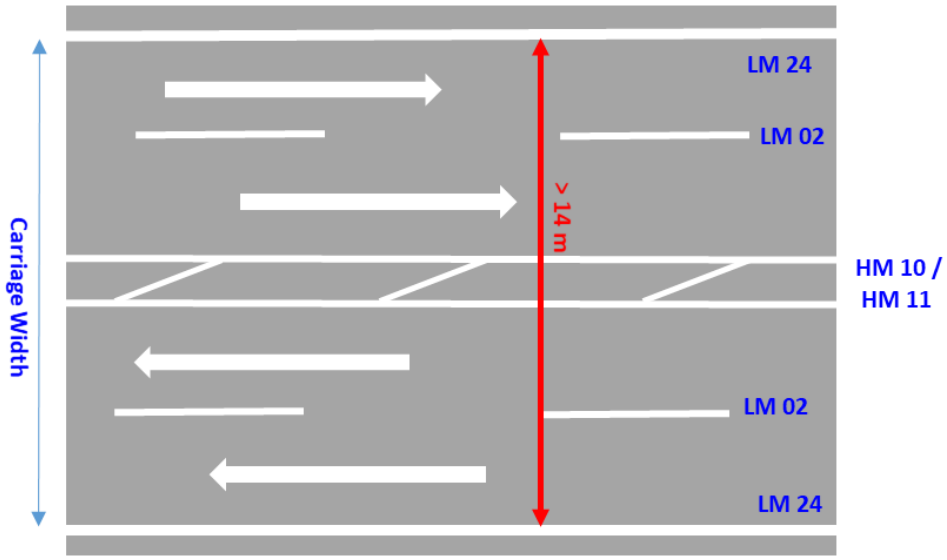
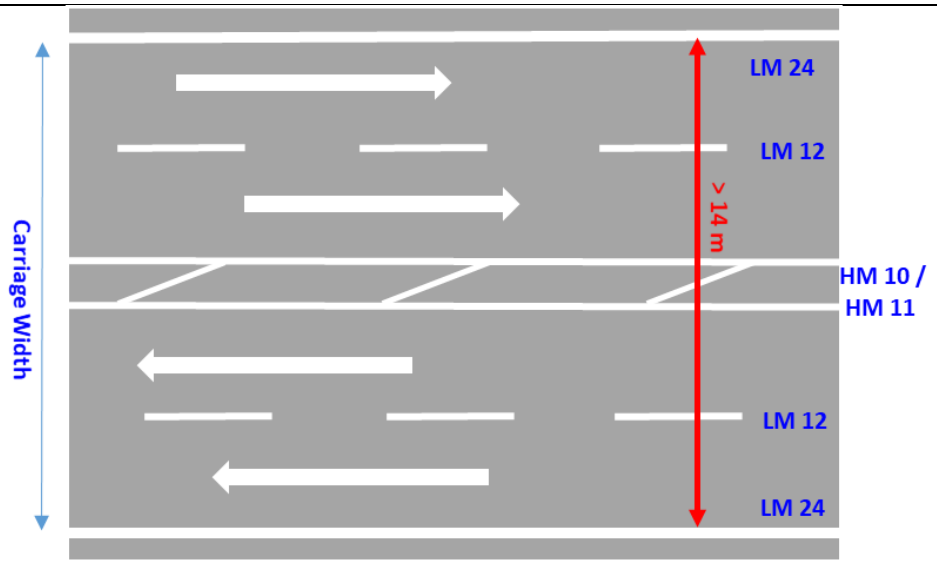
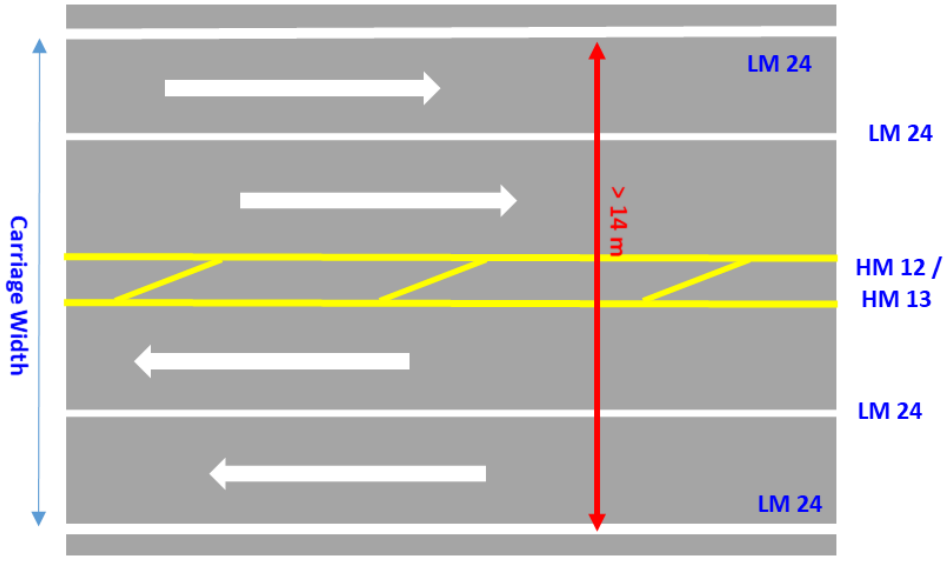
Figure 4.7 : Three Lane Bi-Directional Road		
NORMAL	:	
WARNING	:	
NO – OVERTAKING	:	

Figure 4.8 : Four Lane Bi-Directional Road

NORMAL	:	
WARNING	:	
NO – OVERTAKING	:	

B. Longitudinal Marking for Divided Carriageway under section 4, sub section 4.7

Figure 4.9 : Four Lane Divided Road (One Carriageway Width more than 7.3 m)

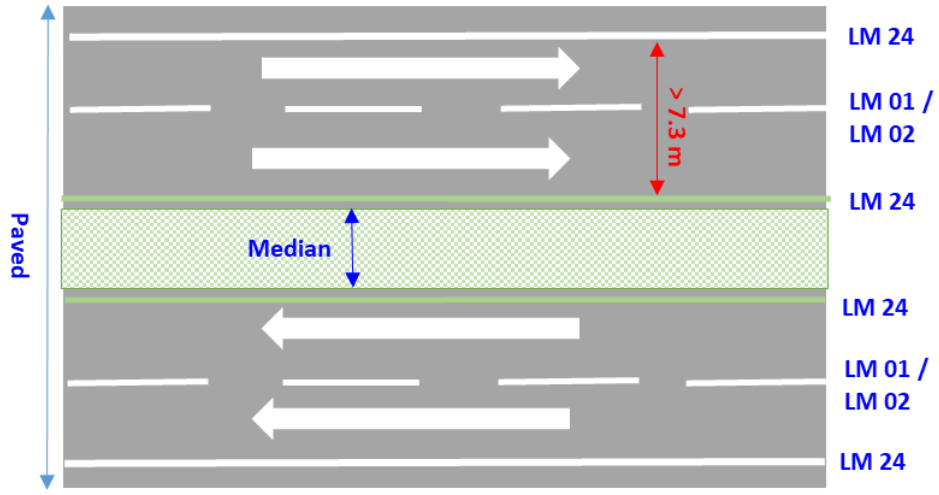
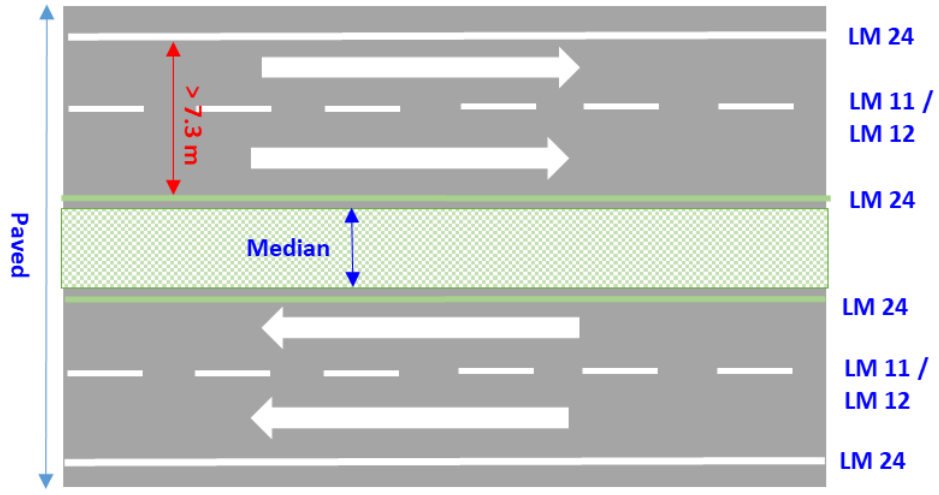
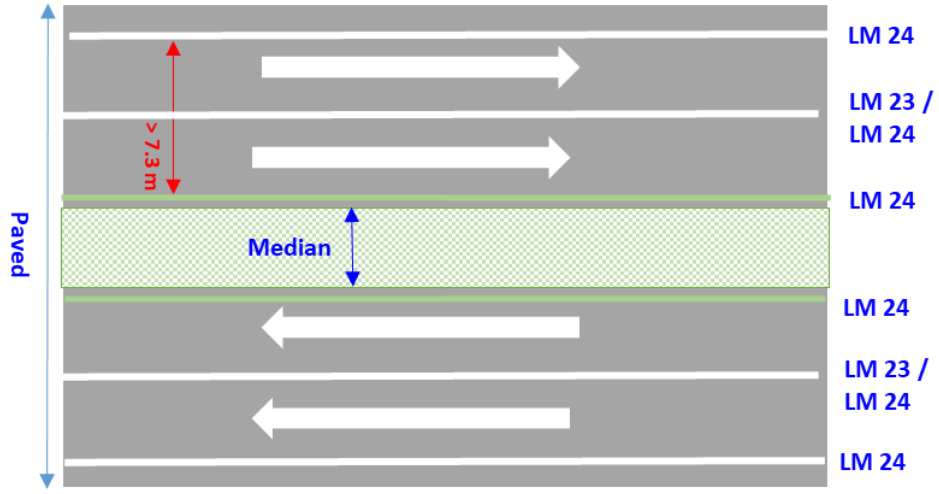
NORMAL	:	
WARNING	:	
NO - OVERTAKING	:	

Figure 4.10 : Six Lane Divided Road (One Carriageway Width more than 10.8 m)

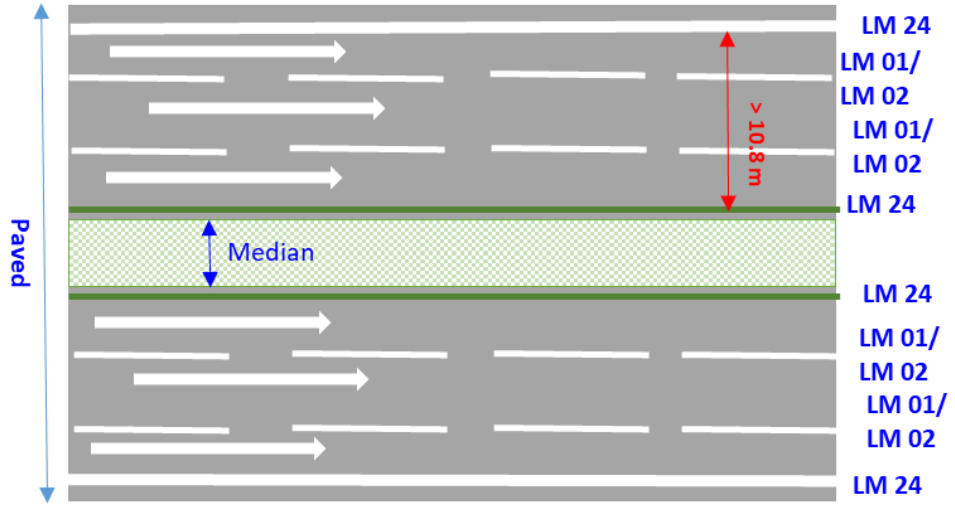
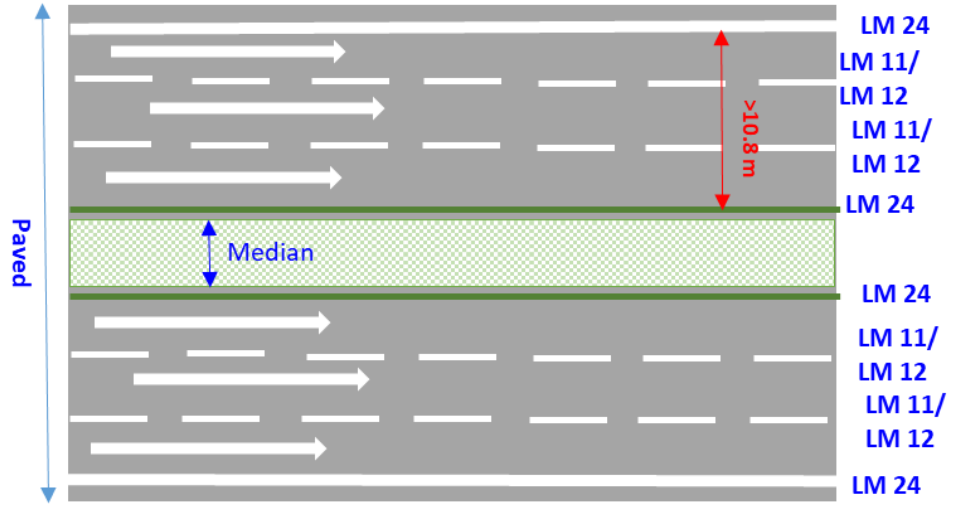
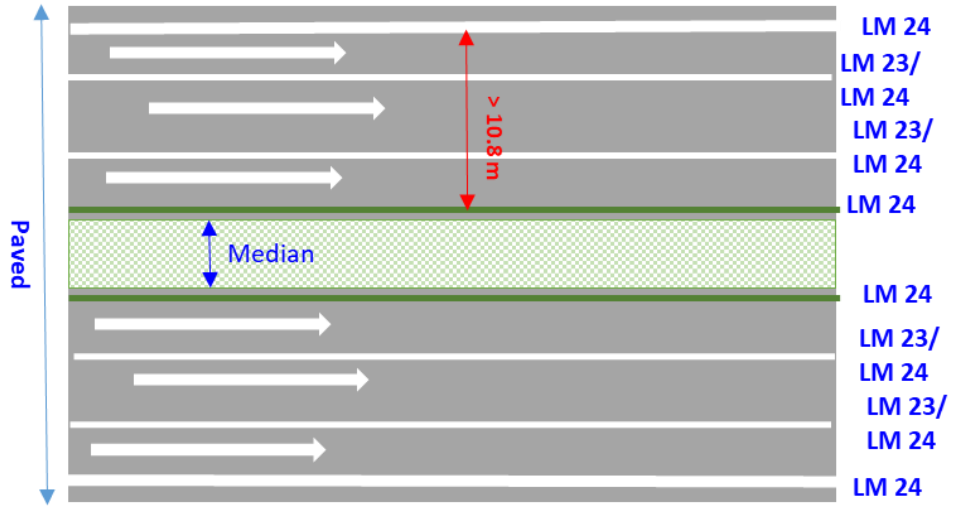
NORMAL	:	
WARNING	:	
NO - OVERTAKING	:	

Figure 4.11 : Four Lane Expressway

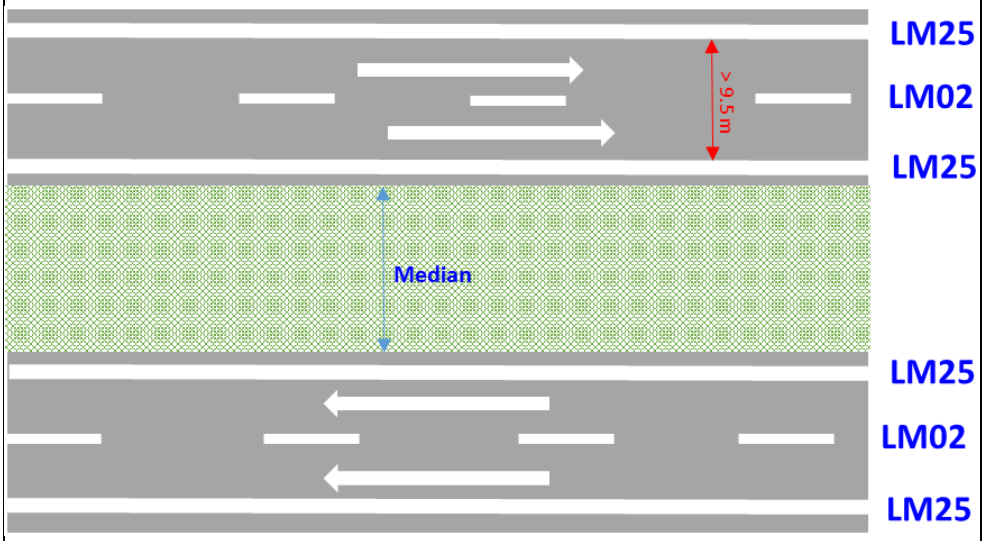
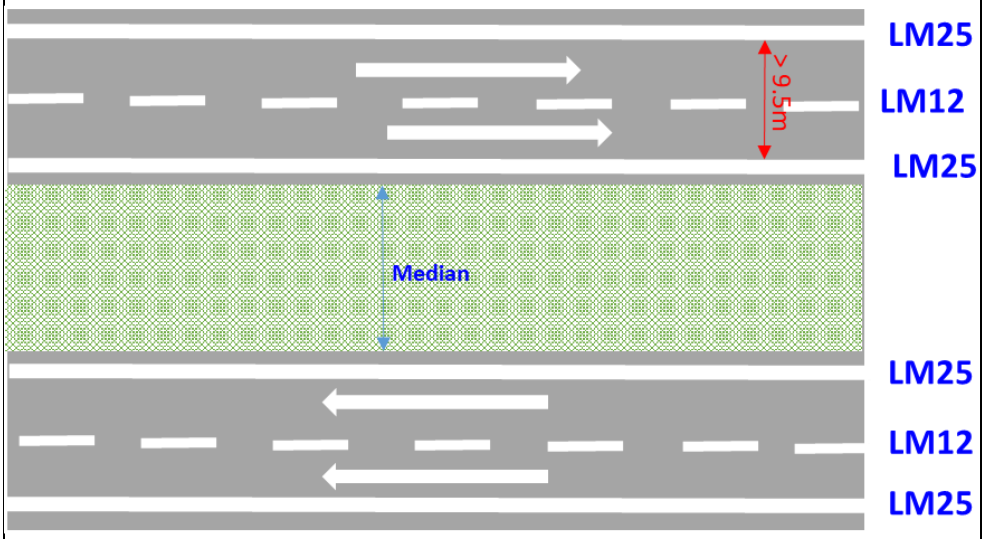
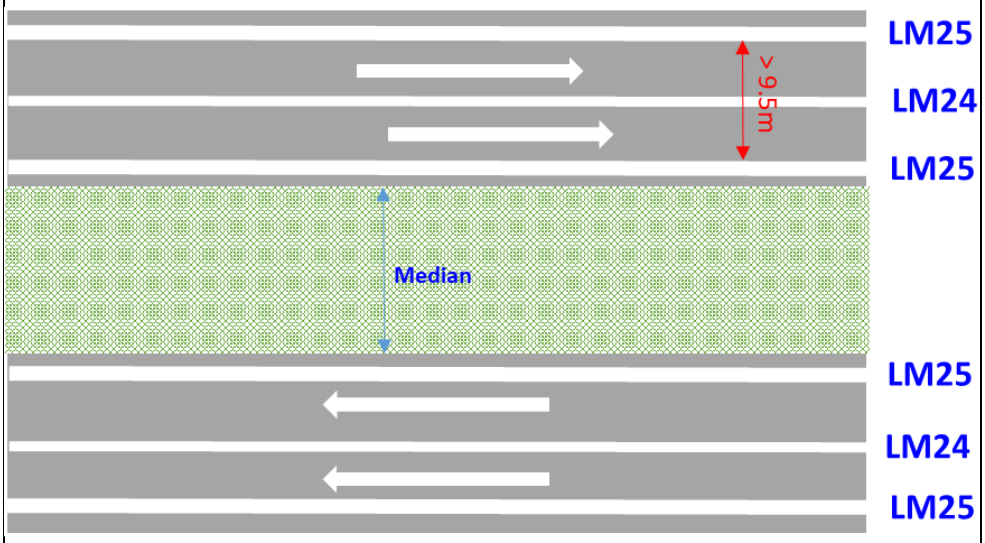
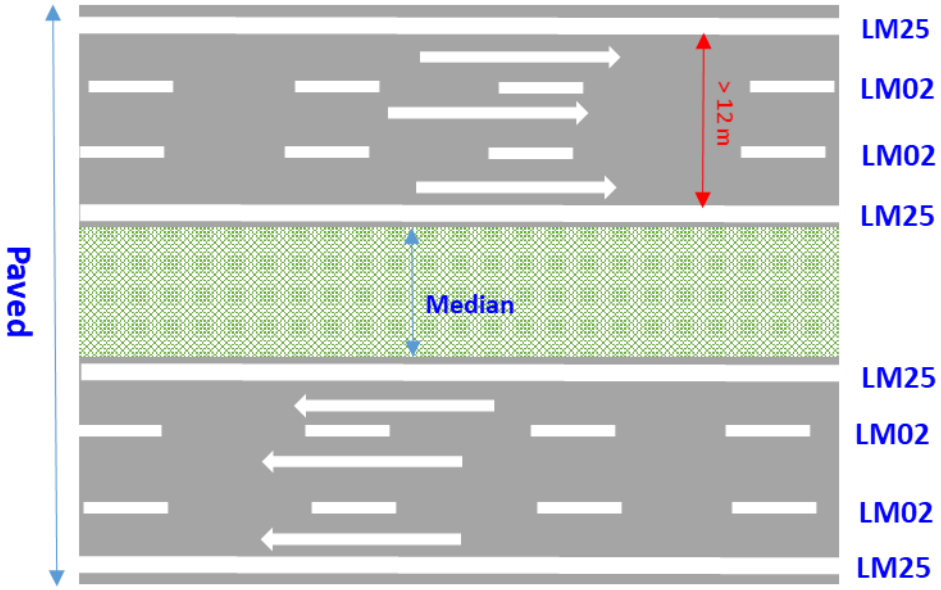
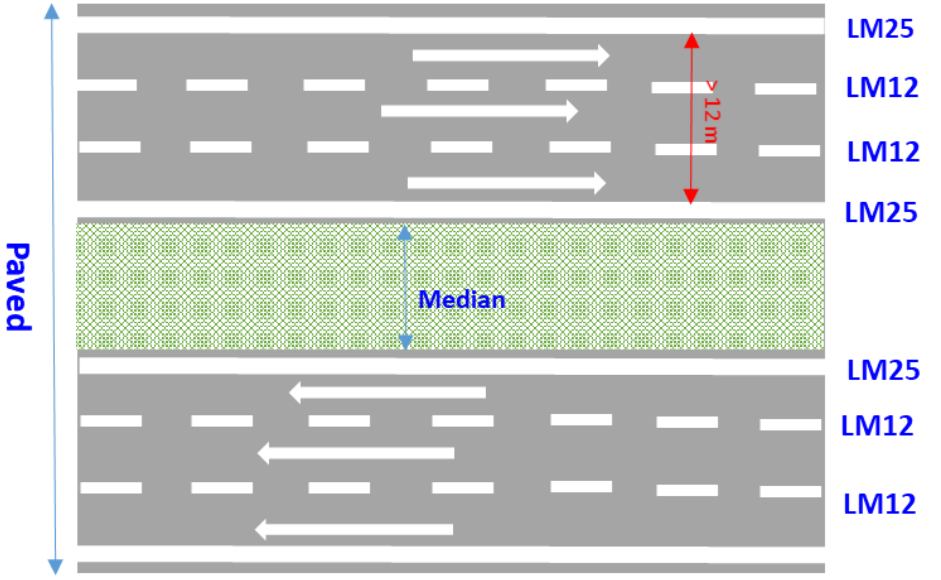
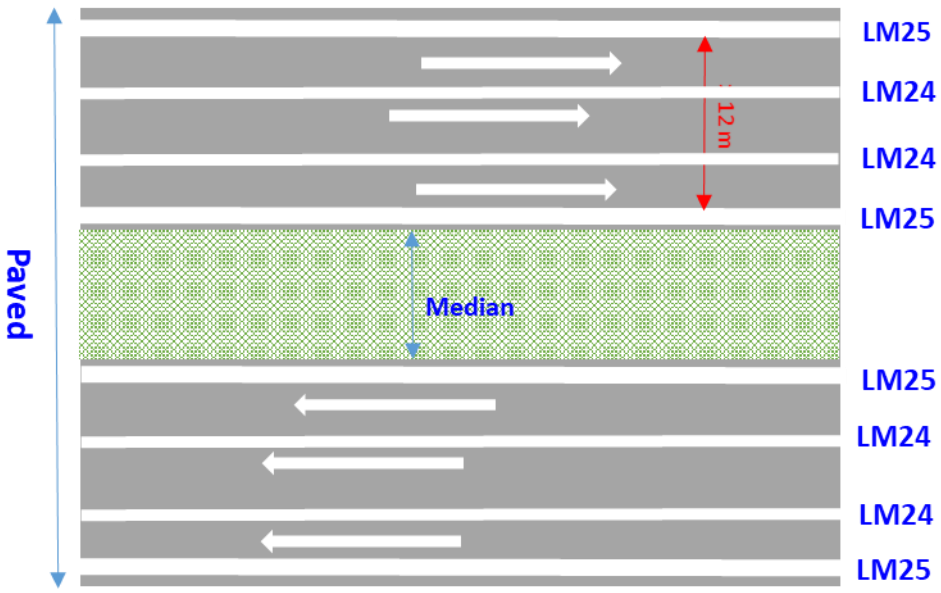
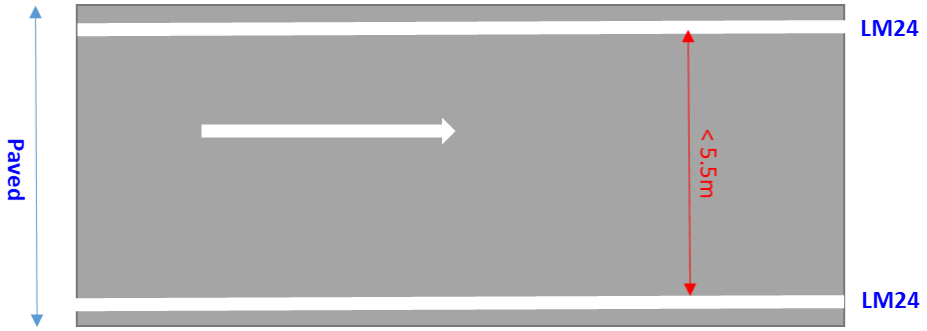
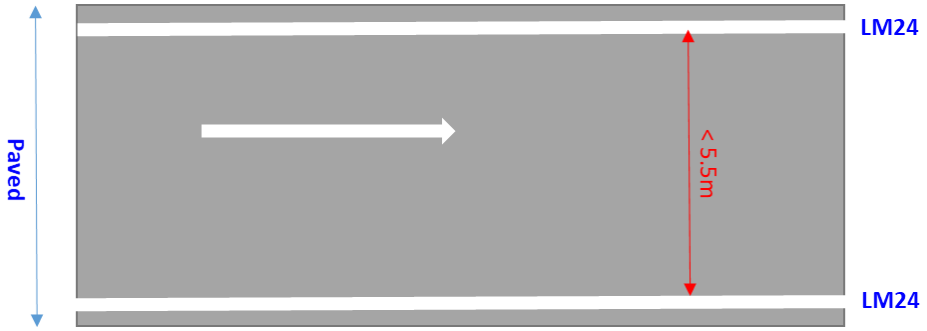
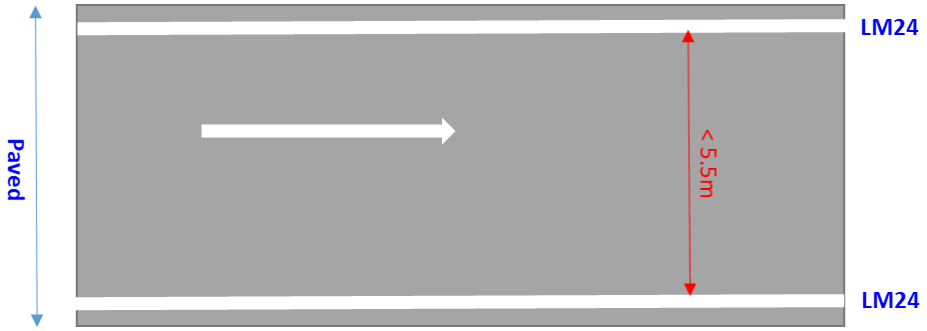
NORMAL	:	
WARNING	:	
NO – OVERTAKING	:	

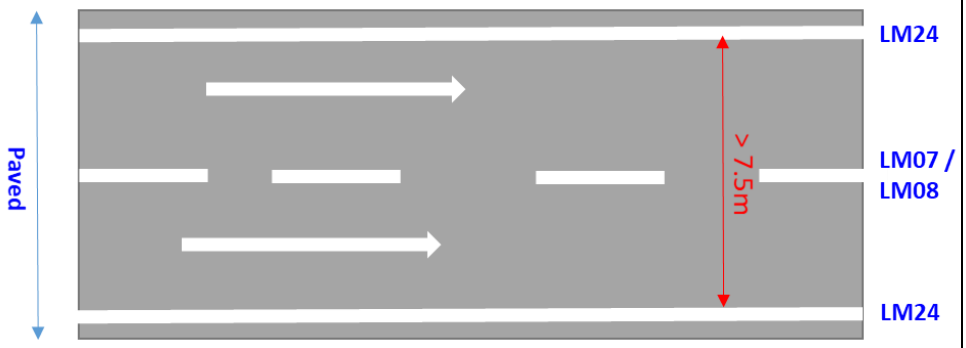
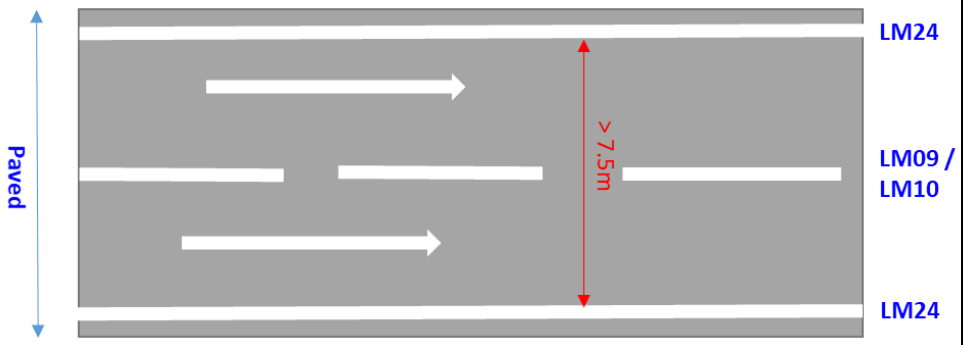
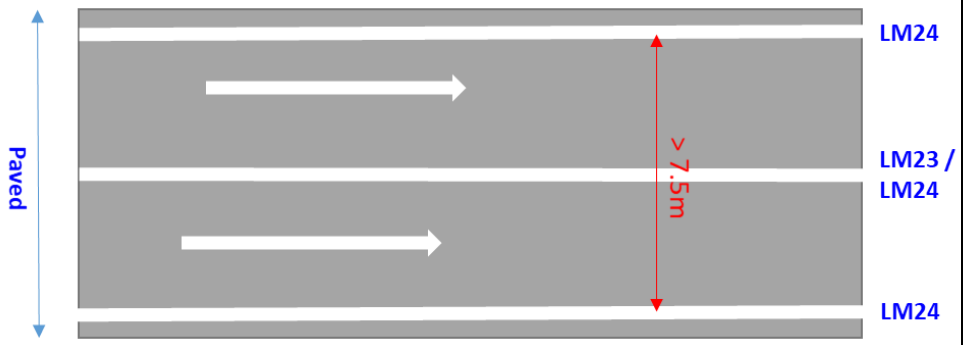
Figure 4.12 : Six Lane Expressway

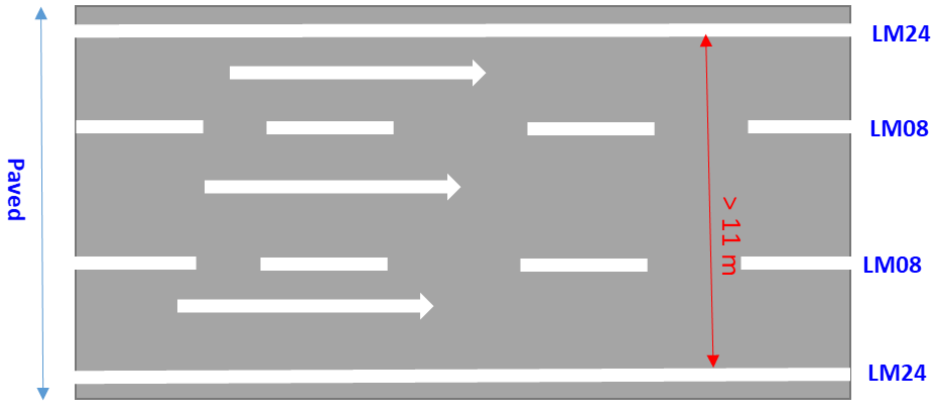
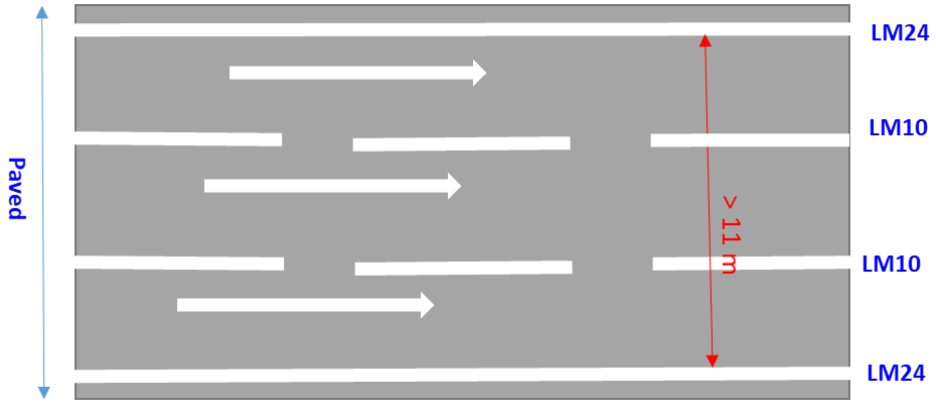
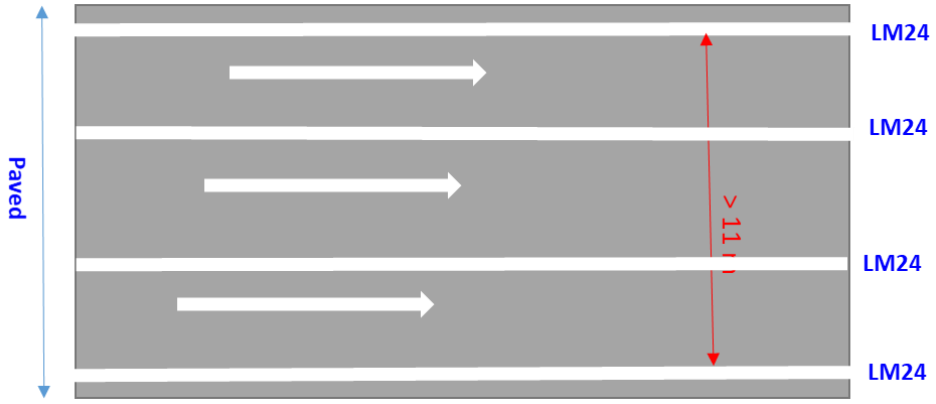
NORMAL	:	
WARNING	:	
NO – OVERTAKING	:	

C. Longitudinal Marking for Ramp/Slip Roads/One Way Streets under section, sub- section 4.8

Figure 4.13 : Single / Intermediate Lane Ramp/ Slip Road/ One Way Street (Paved Width up to 5.5m)

NORMAL	:	
WARNING	:	
NO – OVERTAKING	:	

Two Lane Ramp/Slip Road/One Way Street (Paved Width more than 7.5 m)		
Figure 4.14 : Two Lane Ramp/ Slip Road / One Way Street (Paved Width more than 7.5m)		
NORMAL	:	
WARNING	:	
NO – OVERTAKING	:	

Three Lane Ramp/Slip Road/One Way Street (Paved Width more than 11 m)		
Figure 4.15 : Three Lane Ramp/ Slip Road / One Way Street (Paved Width more than 11m)		
NORMAL	:	
WARNING	:	
NO – OVERTAKING	:	

D. Day Visibility of Road Markings, referred under Section 15

Figure 15.3 Day Visibility of Road Marking

E. Night visibility of Road Markings under Section 15

Figure 15.4 Night Visibility of Road Marking

Note:

1. The Luminance and Intensity of Retro-reflectivenss measurements are described in detail in Annexure D and Annexure E of IRC 35:2015
2. The IRC document has registered copyrights and hence cross reference of the respective clauses are mentioned instead of exact facts and figures as mentioned the aforesaid document.
3. Second revision of IRC:35-2015 is being referrred for formation of this Annexure, as amended from time to time.

ANNEXURE C

(See Introduction)

COMPOSITION OF AISC PANEL ON LANE DEPARTURE WARNING SYSTEM (LDWS)

Convener	
Mr. Sachin Deshmukh	ZF Group
MEMBERS	**REPRESENTING**
Mr. A. A. Badusha	The Automotive Research Association of India
Mr. Kamalesh Patil	The Automotive Research Association of India
Ms. Sneha Pawar	The Automotive Research Association of India
Mr. Konaki Ramu	The Automotive Research Association of India
Mr. Pratik Nayak	The Automotive Research Association of India
Ms. Vijayanta Ahuja	International Centre for Automotive Technology
Mr. Akshat Gupta	International Centre for Automotive Technology
Mr. N. Muthukumar	SIAM (Ashok Leyland Ltd.)
Mr. V. Faustino	SIAM (Ashok Leyland Ltd.)
Ms. Pushpanjali Pathak	SIAM (Mahindra & Mahindra Ltd.)
Mr. Abhijit Dhotre	SIAM (Mahindra & Mahindra Ltd)
Mr. Avnish Gosain	SIAM (Maruti Suzuki India Ltd.)
Mr. Das Subham Kant	SIAM (Maruti Suzuki India Ltd.)
Mr. Uday Salunkhe	SIAM (Tata Motors Ltd.)
Mr. Atul Date	SIAM (Tata Motors Ltd)
Mr. Sanjay Tank	Automotive Component Manufacturers Association of India (ACMA)
Ms. Sudha Ramani	ACMA (Brakes India Ltd.)
Mr. B Rubandevaprasath	ACMA (Brakes India Ltd.)
Mr. Vivekananda Nayak	ACMA (Continental Automotive Components)
Mr. Noel Alexander Peters	ACMA (Denso)
Mr. Pankaj Doshi	ACMA (Minda Group)

Mr. Surender Bhatti	ACMA (Minda Group)
Ms. Vinita Shaw	ACMA (Sandhar Group)
Mr. Ashutosh Telang	ACMA (Spark Minda)
Mr. Arvind Waghmode	ACMA (ZF group)
Dr. Rajlakshmi	IIT Hyderabad

* At the time of approval of this Automotive Industry Standard (AIS)

ANNEXURE D
(See Introduction)

COMMITTEE COMPOSITION *
Automotive Industry Standards Committee

Chairperson	
Dr. Reji Mathai	Director, The Automotive Research Association of India
Members	**Representing**
Representative from	Ministry of Road Transport and Highways
Representative from	Ministry of Heavy Industries
Representative from	Office of the Development Commissioner, MSME, Ministry of Micro, Small and Medium Enterprises
Shri Shrikant R. Marathe	Former Chairman, AISC
Head-TED	Bureau of Indian Standards
Director	Central Institute of Road Transport
Director	Global Automotive Research Centre
Director	International Centre for Automotive Technology
Director	Indian Institute of Petroleum
Director	Vehicles Research and Development Establishment
Director	Indian Rubber Manufacturers Research Association
Representatives from	Society of Indian Automobile Manufacturers
Representatives from	Tractor and Mechanization Association
Representatives from	Automotive Components Manufacturers Association of India
Representative from	Indian Construction Equipment Manufactures' Association
Member Secretary	
Shri Vikram Tandon	The Automotive Research Association of India

* At the time of approval of this Automotive Industry Standard (AIS)