

AUTOMOTIVE INDUSTRY STANDARD

**APPROVAL OF VEHICLES
WITH REGARDS TO
EMERGENCY LANE KEEPING SYSTEM
(ELKS)**

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AUTOMOTIVE INDUSTRY STANDARDS COMMITTEE

UNDER
CENTRAL MOTOR VEHICLE RULES – TECHNICAL STANDING COMMITTEE

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

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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 meeting of AISC, held on 14th July, 2021, it was agreed in principle to formulate an Automotive Industry Standard (AIS) for type approval procedure for Emergency Lane Keeping Systems (ELKS), as defined in this standard. The intention of this Standard is to establish uniform provisions for Emergency Lane Keeping Systems (ELKS) fitted to motor vehicle of category M1, primarily used under highway conditions. ELKS controls the lateral and longitudinal movement of the vehicle for a defined period until further driver's command.

The Emergency Lane – Keeping System is a driver assisting system that provides warning to the driver and correct the trajectory only when the driver is unintentionally leaving the lane.

Note: ELKS as a standalone function falls into Level 1 automation as per SAE definition, since ELKS has only partial longitudinal control (Braking Function only) during emergency situations.

For vehicle automation level refer SAE J3016 or ECETRANSWP29/1140 dated 23rd April 2018 for detailed understanding on vehicle automation levels (Level 1-5) and related ADAS features.

The current existing technologies for the emergency lane-keeping systems are based on the detection of lane markings and the performance of these systems cannot be guaranteed in the absence of such markings. Therefore, the emergency lane-keeping systems should not be required to operate in the absence of lane markings. In accordance with national traffic legislation, drivers are allowed to cross dashed-lane markings and it is particularly difficult for current technologies to assess whether the crossing of dashed-lane markings by the driver is intentional or not. In order to avoid unnecessary interventions by the emergency lane-keeping system, which may prompt the driver to switch the system off and thus lead to loss of potential safety benefit, the emergency lane-keeping system should be required only to warn the driver and not to correct the vehicle trajectory when crossing dashed-lane markings.

While preparation of this part of the standard considerable assistance is derived from EU regulation 2021/646 on Emergency Lane Keeping System (ELKS). The Visible Lane markings are referred from Indian Road Congress IRC 35-2015 Second Revision.

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

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Approval of vehicles with regards to Emergency Lane Keeping System (ELKS)

0.0 SCOPE

0.1 This Standard applies to the type approval of vehicles of Category M1 when equipped with Emergency Lane Keeping System.

1.0 DEFINITIONS

For the purpose of this Standard, the following definitions shall apply:

1.1 **‘Vehicle type with regard to its Emergency Lane Keeping System’** means a category of vehicles which do not differ in such essential aspects as:

- (1) Vehicle features which significantly influence the performances of the Emergency Lane Keeping System;
- (2) The type and design of the Emergency Lane Keeping System;

1.2 **‘Corrective Directional Control Function (CDCF)’** means a control function within an electronic control system whereby, for a limited duration, changes to the steering angle of one or more wheels and/or braking of individual wheels may result from the automatic evaluation of signals initiated on-board the vehicle optionally enriched by data provided off-board the vehicle, in order to correct lane departure, e.g. to avoid crossing lane markings, leaving the road;

1.3 **‘Subject vehicle’** means the vehicle being tested;

1.4 **‘Distance to Lane Marking (DTLM)’** means the remaining lateral distance (perpendicular to the lane marking) between the inner side of the lane marking and most outer edge of the tyre before the subject vehicle crosses the inner side of the lane marking;

1.5 **‘Flat Road’** means a road with a slope less than 1 % in the longitudinal direction and for the lateral direction, less than 2 % for half a lane width either side of the center line and less than 3 % for the outer half of the lane;

1.6 **‘Dry Road’** means a road with a nominal peak braking coefficient of 0.9;

1.7 **‘The System’** means the electronic control system and complex electronic control systems that provide or form part of the control transmission of the emergency lane-keeping system, including the transmission links to or from other vehicle systems that act on the emergency lane-keeping system;

1.8 **‘Units’** means the smallest divisions of system components which will be considered, since these combinations of components will be treated as single entities for purposes of identification, analysis or replacement;

1.9 **‘Transmission links’** means any electric, mechanic, pneumatic or hydraulic equipment used for inter-connecting distributed units for the purpose of conveying signals, operating data or energy supply;

- 1.10 **‘Electronic Control System’** means a combination of units, designed to cooperate in the production of a vehicle control function by electronic data processing;
- 1.11 **‘Complex Electronic Vehicle Control System’** means an electronic control system in which a function controlled by an electronic system or the driver may be over-ridden by a higher-level electronic control system/function, thus becoming part of the complex system, as well as any overriding of the system, including the transmission links to and from the overriding systems/function outside of the scope of this Standard;
- 1.12 **‘Control Strategy’** means a strategy to ensure robust and safe operation of the function(s) of an electronic control system in response to a specific set of ambient and/or operating conditions (such as road surface condition, traffic intensity and other road users, adverse weather conditions, etc.), which may include the automatic deactivation of a function or temporary performance restrictions (e.g. a reduction in the maximum operating speed, etc.);
- 1.13 **‘Safety Concept’** means a description of the measures designed into the system, for instance within the electronic units, so as to address system integrity and ensure safe operation under fault and non-fault conditions, including in the event of an electrical failure. The possibility of a fallback to partial operation or even to a back-up system for vital vehicle functions may be a part of the safety concept.

2.0 GENERAL REQUIREMENTS

- 2.1 An Emergency Lane Keeping System (ELKS) shall comprise a lane Departure Warning System (LDWS) and a Corrective Directional Control Function (CDCF).
 - 2.1.1 The LDWS shall meet the requirements of clauses 3.1 to 3.4 and clause 3.5.
 - 2.1.2 The CDCF shall meet the requirements of clauses 3.1 to 3.4 and clause 3.6.
- 2.2 ELKS lane departure warnings and interventions

Subject to specific requirements below, the system shall be designed to minimize warnings and interventions for driver intended maneuvers.

3.0 SPECIFIC REQUIREMENTS

3.1 ELKS failure warning

A warning shall be provided when there is a failure in the ELKS that prevents the requirements of this Standard of being met.

- 3.1.1 The failure warning shall be a constant visual warning signal.
 - 3.1.1.1 There shall not be an appreciable time interval between each ELKS self-check (an integrated function that checks for a system failure on a continuous basis at least while the system is active), and subsequently there shall not be a delay in illuminating the warning signal, in the case of an electrically detectable failure.

3.1.1.2 Upon detection of any non-electrical failure condition (e.g. sensor misalignment), the warning signal as defined in clause 3.1.1 shall be activated.

3.1.2 If the vehicle is equipped with a means to deactivate the ELKS a warning shall be given when the system is deactivated according to clause 3.2. This shall be a constant visual warning signal. The failure warning signal specified in clause 3.1.1. may be used for this purpose.

3.2 **ELKS deactivation**

3.2.1 Manual deactivation

When a vehicle is equipped with a means to manually deactivate the ELKS function, either partially or fully, the following conditions shall apply as appropriate:

3.2.1.1 The full ELKS function shall be automatically and fully reinstated upon each activation of the vehicle master control switch.

3.2.1.2 The manual deactivation of the full ELKS shall not be possible with less than two deliberate actions, e.g. press and hold on a button, or select and confirm on menu option. It shall be possible to easily suppress acoustic warnings of the LDWS, but such action shall not at the same time deactivate the LDWS or the CDCF.

3.2.1.3 The manual deactivation capability shall be tested in accordance with the relevant vehicle test(s) specified in clause 3.

3.2.2 Automatic deactivation

If the vehicle is equipped with a means to automatically deactivate the ELKS function, either partially or fully, for instance in situations such as off-road use, being towed, a trailer being hitched to the vehicle or the Electronic Stability Control (ESC) being deactivated, the following conditions shall apply as appropriate:

Note: Partial – only CDCF deactivation (LDWS remains activated) or vice versa

Fully – Both (LDWS and CDCF) deactivated.

3.2.2.1 As part of the safety audit, the vehicle manufacturer shall provide a list of situations and corresponding criteria where the ELKS function is automatically deactivated which shall be annexed to the test report.

3.2.2.2 The ELKS function shall be automatically and fully reactivated as soon as the conditions that led to the automatic deactivation are not present anymore.

3.2.3 A constant visual warning signal shall inform the driver that the ELKS function has been deactivated. The failure warning signal specified in clause 3.1.1 above may be used for this purpose.

3.3 Automatic suppression

3.3.1 For driver intended maneuvers

As part of the safety audit, the manufacturer shall provide a documentation package which gives access to the basic design and logic of the system for detection of likely driver intended maneuvers and automatic suppression of the ELKS. This package shall include a list of parameters detected and a basic description of the method used to decide that the system should be suppressed, including limit values where possible. For both the CDCF and LDWS, the Test Agency shall assess the documentation package to show that driver unintentional maneuvers, within the scope of the lane keep test parameters (in particular lateral departure velocity), will not result in automatic suppression of the system.

3.3.2 Automatic suppression of the ELKS is also permitted in situations when other driver assists or automated steering functions, (i.e. Automatically commanded steering function, emergency steering function or automated lane keeping), are controlling the lateral movement of the vehicle or other safety related functions (i.e. that is capable of changing the dynamic behaviour of the vehicle such as AEBS, ESC, etc.) are intervening. These situations shall be declared by the manufacturer as part of the safety audit.

3.4 RESERVED

3.5 LDWS requirements

3.5.1 Speed range

The LDWS shall be active at least within the vehicle speed range between 65 km/h and 130 km/h (or the maximum vehicle speed if it is lower than 130 km/h) and at all vehicle load conditions, unless deactivated as per clause 3.2.

3.5.2 Lane Departure Warning

When activated and operated within the prescribed speed range, the LDWS shall be able to warn the driver at the latest if the vehicle crosses over a visible lane marking for the lane in which it is running by more than a DTLM of – 0.3 m.

- (a) for lateral departure velocities in the range of the 0.1 m/s to 0.5 m/s;
- (b) on straight, flat and dry roads;
- (c) for solid line and dashed lane markings in line with one of those described in Annexure III (Visible lane marking identification) of this Standard.
- (d) with the markings being in good condition and of a material conforming to the standard for visible markings of that contracting party;
- (e) in all illumination conditions without blinding of the sensors (e.g. direct blinding due to sunlight) and with activated passing-beam (dipped-beam) headlamps if necessary;

- (f) in absence of weather conditions affecting the visibility of lane markings (e.g. no fog).

It is recognized that the performance required may not be fully achieved in other conditions than those listed above. However, the system shall not unreasonably switch the control strategy in these other conditions.

The lane departure warning capability shall be tested in accordance with the relevant vehicle test(s) specified in clause 4.

3.5.3 LDWS warning indication

3.5.3.1 The lane departure warning referred to in clause 3.5.2 shall be noticeable by the driver and be provided by:

- (a) at least two warning means out of visual, 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.

The warning mentioned above may be suppressed when there is a driver action which indicates an intention to depart from the lane;

3.5.3.1.1 Where a visual signal is used for the lane departure warning, it may use the failure warning signal as specified in clause 3.1.1 above in a flashing mode.

3.5.3.1.2 When there is a lane keep intervention by the CDCF, this shall be considered a haptic warning according to clause 3.5.3.1.

3.5.3.2 The LDWS visual warning signal shall be activated following a vehicle master control switch 'power-ON'. This requirement does not apply to warning signals shown in a common space.

3.5.3.3 The LDWS visual 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.

3.5.3.4 The visual warning signal shall be tested in accordance with the relevant vehicle test(s) specified in clause 4.

3.6 **CDCF performance requirements**

3.6.1 Speed range

The CDCF shall be active at least between 70 km/h and 130 km/h (or the maximum vehicle speed if it is below 130 km/h) and at all vehicle load conditions, unless deactivated as per clause 3.2. However, in the case that the vehicle reduces its speed from above 70 km/h to below 70 km/h, the system shall be active at least until the vehicle speed reduces below 65 km/h.

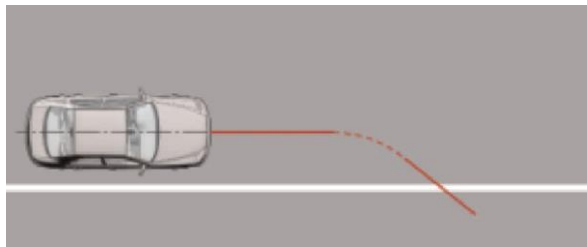
3.6.2 Lane keep

In the absence of conditions leading to deactivation or suppression of the system, the CDCF shall be able to prevent lane departure by crossing of visible lane markings in the scenarios shown in the following table by more than a DTLM of - 0.3m.

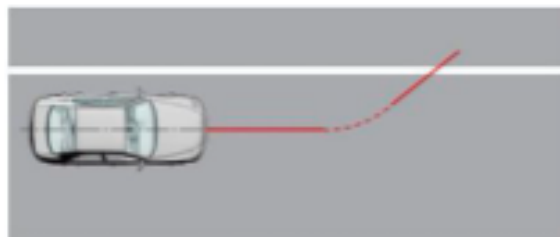
- (a) for lateral departure velocities in the range of the 0.2 m/s to 0.5 m/s for vehicle speeds up to 100 km/h and for lateral departure velocities in the range of 0.2 m/s to 0.3 m/s for vehicle speeds greater than 100 km/h and up to 130 km/h (or the maximum vehicle speed if it is below 130 km/h);
- (b) on straight, flat and dry roads;
- (c) for solid lane markings in line with one of those described in Annexure III (Visible lane marking identification) of this standard.
- (d) with the markings being in good condition and of a material conforming to the standard for visible markings of that contracting party;
- (e) in all illumination conditions without blinding of the sensors (e.g. direct blinding sunlight) and with activated passing-beam (dipped-beam) headlamps if necessary;
- (f) in absence of weather conditions affecting the dynamic performance of the vehicle (e.g. no storm, not below 5 °C) or the visibility of lane markings (e.g. no fog).

No Scenario description

- 1 Solid line – Departure to right side of the vehicle



- 2 Solid line – Departure to left side of the vehicle



It is recognized that the performances required for the scenarios in this table may not be fully achieved in other conditions than those listed above. However, the system shall not unreasonably switch the control strategy in these other conditions. This shall be demonstrated in accordance with the safety audit.

The lane keep capability shall be tested in accordance with the relevant vehicle test(s) specified in clause 5.

3.6.3 Steering override

3.6.3.1 The steering control effort necessary to override the directional control provided by the system shall not exceed 50N. Significant loss of steering support once overridden shall not happen suddenly.

3.6.3.2 For CDCF systems which do not act on the steering itself (e.g. differential braking type CDCF), the steering input shall not exceed 25 degrees.

3.6.3.3 The steering override control effort shall be tested in accordance with the relevant vehicle test(s) specified in clause 5.

3.6.4 CDCF warning indication

3.6.4.1 Every CDCF intervention shall immediately be indicated to the driver by a visual warning signal which is displayed for at least 1 second or as long as the intervention exists, whichever is longer. The visual signal may be the flashing of the failure warning signal specified in clause 3.1.1.

3.6.4.1.1 In the case of an intervention longer than 10 seconds, an acoustic warning signal shall be provided until the end of the intervention unless there is a driver action which indicates an intention to depart from the lane.

3.6.4.1.2 In the case of two or more consecutive interventions within a rolling interval of 180 seconds and in the absence of a steering input by the driver during this intervention, an acoustic warning signal shall be provided by the system during the second and any further intervention within a rolling interval of 180 seconds. Starting with the third intervention (and subsequent interventions) the acoustic warning signal shall continue for at least 10 seconds longer than the previous warning signal.

3.6.4.2 The requirements in points 3.6.4.1.1 and 3.6.4.1.2 shall be tested in accordance with the relevant vehicle test(s) specified in clause 5.

4.0 TEST REQUIREMENTS FOR LDWS

4.1 General provisions

Vehicles fitted with LDWS shall fulfil the appropriate tests requirements as specified below:

4.2 Testing conditions

The tests shall be performed:

(a) On a flat and dry asphalt or concrete road type surface, which may not contain any irregularities (e.g. large dips or cracks, manhole covers or reflective studs) within a lateral distance of 3.0 m to either side of the center of the test lane and with a longitudinal distance of 30 m ahead of the subject vehicle from the point after the test is complete.

(b) In ambient illumination conditions of at least 2000 lux without blinding of the sensors (e.g. direct blinding sunlight) and with activated low beam head lamps if necessary.

- (c) In ambient air temperatures between 5 °C and 45 °C.
- (d) In the absence of weather conditions affecting the visibility of lane markings, e.g. fog.

At the manufacturer's discretion and with the agreement of the Test Agency the tests may be performed under conditions deviating from what is described above (e.g. at lower ambient air temperatures) and the same shall be recorded in the report.

4.2.1 Lane markings

The solid line and dashed lane markings on the road used for the tests shall be in line with one of those described in Annexure III (Visible lane marking identification) of this standard. The markings shall be in good condition and of a material conforming to the standard for visible lane markings. The lane-marking layout used for the tests shall be recorded in the test report.

The width of the lane (measured between the lane markings) shall be a minimum of 3.5 m for the purpose of the tests of this point. The vehicle manufacturer shall demonstrate, through the use of documentation, compliance with all other lane markings identified in Annexure III (Visible lane marking identification) of this standard. Any of such documentation shall be appended to the test report.

4.2.2 Subject vehicle conditions

4.2.2.1 Test mass

The subject vehicle shall be tested in a load condition agreed between the manufacturer and the Test Agency. No load 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 load conditions.

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

4.2.2.3 Where the LDWS is equipped with a user-adjustable warning threshold, the tests specified in clause 4.3 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.

4.2.2.4 Pre-test conditioning

If requested by the vehicle manufacturer the vehicle can be driven to calibrate the sensor system up to a maximum of 100 km on a mixture of urban and rural roads with other traffic and roadside furniture.

4.3 **Test procedures**

4.3.1 Visual warning signal verification test

With the vehicle stationary check that the visual warning signal(s) comply with the requirements of clause 3.5.3.2.

4.3.2 Lane departure warning test

4.3.2.1 Drive the vehicle at a speed of 70 km/h \pm 3 km/h into the center of the test lane in a smooth manner so that the attitude of the vehicle is stable.

Maintaining the prescribed speed, gently drift the vehicle, either to the left or the right, with a lateral departure velocity of between 0.1 and 0.5 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 0.5 m/s. Repeat the above tests drifting in the opposite direction

4.3.2.2 The test requirements are fulfilled, if the LDWS provides the lane departure warning indication mentioned in clause 3.5.3.1 above, at the latest when the DTLM is – 0.3 m.

4.3.2.3 In addition, the vehicle manufacturer shall demonstrate to the satisfaction of the Test Agency that the requirements for the whole speed range and lateral departure velocity range are fulfilled. This may be achieved on the basis of appropriate documentation appended to the test report.

4.3.3 Manual deactivation test

4.3.3.1 If the vehicle is equipped with means to manually deactivate the ELKS (LDWS), turn the vehicle master control switch to the ‘Power ON’ position and deactivate the ELKS (LDWS). The warning signal specified in clause 3.2.3 shall be activated.

Turn the master control switch to the ‘Power OFF’ position. Turn the vehicle master control switch to the ‘Power ON’ position and verify that the previously activated warning signal is not reactivated, thereby indicating that the ELKS (LDWS) has been reinstated as specified in clause 3.2.1.1.

5.0 TEST REQUIREMENTS FOR CDCF

5.1 General provisions

Vehicles fitted with CDCF shall fulfil the appropriate tests requirements as specified below:

5.2 Testing conditions

The tests shall be performed:

- (a) On a flat and dry asphalt or concrete road type surface, which may not contain any irregularities (e.g. large dips or cracks, manhole covers or reflective studs) within a lateral distance of 3.0 m to either side of the center of the test lane and with a longitudinal distance of 30 m ahead of the subject vehicle from the point after the test is complete.
- (b) In ambient illumination conditions of at least 2000 lux without blinding of the sensors (e.g. direct blinding sunlight) and with activated low beam head lamps if necessary.
- (c) In ambient air temperatures between 5 °C and 45 °C.

- (d) In the absence of weather conditions affecting the dynamic performance of the vehicle (e.g. no storm, not below 5 °C) or the visibility of lane markings (e.g. fog).

At the manufacturer's discretion and with the agreement of the Test Agency the tests may be performed under conditions deviating from what is described above (e.g. at lower ambient air temperatures).

5.2.1 Lane markings

The solid lane marking on the road used for the tests shall be in line with one of those described in Annexure III (Visible lane marking identification) of this standard. The marking shall be in good condition and of a material conforming to the standard for visible lane markings. The lane-marking used for the tests shall be recorded in the test report.

The solid lane marking shall be a minimum of 3.5 m distance from any other lane markings, for the purpose of the tests of this point. The vehicle manufacturer shall demonstrate, through the use of documentation, compliance with all other solid lane markings identified in Annexure III (Visible lane marking identification) of this standard. Any of such documentation shall be appended to the test report.

5.2.2 Subject vehicle conditions

5.2.2.1 Test mass

The subject vehicle shall be tested in a load condition agreed between the manufacturer and the Test Agency. No load 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 load conditions.

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

5.2.2.3 Where the CDCF is equipped with a user-adjustable timing threshold, the test specified in clause 5.3.3 shall be performed with the timing threshold set at its latest setting for system intervention. No alteration shall be made once the test procedure has begun.

5.2.2.4 Pre-test conditioning

If requested by the vehicle manufacturer the vehicle can be driven to calibrate the sensor system up to a maximum of 100 km on a mixture of urban and rural roads with other traffic and roadside furniture.

5.3 Tests procedures

5.3.1 Warning Indication test

5.3.1.1 The subject vehicle shall be driven with an activated CDCF on a road with solid lane markings on at least one side of the lane.

The test conditions and the subject vehicle test speed shall be within the

operating range of the system.

During the test, the duration of the CDCF interventions and of the visual and acoustic warning signals shall be recorded.

In the case referred to in clause 3.6.4.1.1, the subject vehicle shall be driven such that it attempts to leave the lane and causes CDCF intervention to be maintained for a period longer than 10 seconds. If such a test cannot be practically achieved due to e.g. the limitations of the test facilities, with the consent of the Test Agency, this requirement may be fulfilled through the use of documentation.

The test requirements are fulfilled if the acoustic warning is provided no later than 10 seconds after the beginning of the intervention.

In the case referred to in clause 3.6.4.1.2., the subject vehicle shall be driven in such a way that it attempts to leave the lane and causes at least three interventions of the system within a rolling interval of 180 seconds.

The test requirements are fulfilled if all the following conditions are met:

- (a) a visual warning signal is provided for each intervention, as long as the intervention exists;
- (b) an acoustic warning signal is provided at the second and third intervention;
- (c) the acoustic warning signal at the third intervention is at least 10 s longer than the one at the second intervention.

5.3.1.2 In addition, the manufacturer shall demonstrate to the satisfaction of the Test Agency that the requirements defined in points 3.6.4.1.1 and 3.6.4.1.2 are fulfilled in the whole range of CDCF operation. This may be achieved on the basis of appropriate documentation appended to the test report.

5.3.2 Steering override test

5.3.2.1 The subject vehicle shall be driven with an activated CDCF on a road with solid lane markings on each side of the lane.

The test conditions and the subject vehicle test speed shall be within the operating range of the system.

The vehicle shall be driven such that it attempts to leave the lane and causes CDCF intervention. During the intervention, the driver shall apply the steering control effort necessary to override the intervention.

The force and steering input applied by the driver on the steering control to override the intervention shall be recorded.

The test requirements are fulfilled if:

- (a) The force applied by the driver on the steering control to override the intervention does not exceed 50 N.
- (b) There is no sudden loss of significant steering support once CDCF

is overridden.

- (c) For ELKS that do not act on the steering itself (e.g. differential braking type CDCF), the steering input does not exceed 25 degrees.

5.3.2.2 In addition, the manufacturer shall demonstrate to the satisfaction of the Test Agency that the requirements defined in paragraph 3.6.4 are fulfilled in the whole range of CDCF operation. This may be achieved on the basis of appropriate documentation appended to the test report.

5.3.3 Lane keep test

5.3.3.1 The CDCF shall be tested for test scenarios No. 1 and No. 2 described in clause 3.6.2.

5.3.3.1.1 Tests for all scenarios shall be performed with lateral velocities of 0.2 m/s and 0.5 m/s.

5.3.3.1.2 A test path shall be driven which consists of an initial straight path parallel to the solid lane marking being tested, followed by a fixed radius curve to apply a known lateral velocity and yaw to the subject vehicle, followed again by a straight path without any force applied on the steering control (e.g. by removing the hands from the steering control).

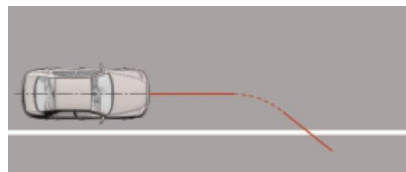


Figure a

5.3.3.1.3 The subject vehicle speed during the test up to the point of system intervention shall be 72 km/h \pm 1 km/h. The curve of fixed radius driven to apply the lateral velocity required shall have a radius 1200 m or more. The lateral velocity required shall be achieved to a tolerance of \pm 0.05 m/s.

The vehicle manufacturer shall provide information describing the radius of the curve to be driven and the location when the closed loop path and/or speed control shall be ended so as to ensure a free drifting in order not to interfere an automatic suppression according to clause 3.3.1.

5.3.3.2 The test requirements are fulfilled if the subject vehicle does not cross the lane marking by a DTLM of more than – 0.3 m..

5.3.3.3 In addition, the vehicle manufacturer shall demonstrate to the satisfaction of the Test Agency that the requirements for the whole speed range and lateral departure velocity range are fulfilled. This may be achieved on the basis of appropriate documentation appended to the test report.

SECTION I	
0.1	Make (trade name of manufacturer)
0.2	Type
0.2.1	Commercial name(s) (If available)
0.3	Means of identification of type, if marked on the vehicle
0.3.1	Location of that marking
0.4	Category of vehicle
0.5	Name and address of manufacturer
0.6	Name(s) and address(es) of assembly plant(s)
0.7	Name and address of the manufacturer's representative (if any)
SECTION II	
1	Additional information (where applicable)
2	Test Agency responsible for carrying out the tests
3	Date of test report
4	Number of test report
5	Remarks (if any)
6	Place
7	Date
8	Signature
SECTION III	
1	Additional Information
1.1	Description of the system
1.2	Means to manually deactivate the ELKS
1.3	Description of the automatic deactivation (if fitted)
1.4	Description of the automatic suppression (if fitted)
1.5	Lane Departure Warning System (LDWS)
1.5.1	Speed range of the LDWS
1.5.2	Technical description and drawing of the LDWS
1.6	Corrective Directional Control Function (CDCF)
1.6.1	Speed range of the CDCF
1.6.2	Description of the system (in particular of the system uses steering or braking)

ANNEXURE - I	
PART I	
Information document for Type-approval of vehicles with regard to their Emergency Lane Keeping Systems	
	<p>MODEL</p> <p>Information document No ... relating to the type-approval of a type of vehicle with regard to the Emergency Lane Keeping Systems.</p> <p>The following information shall be supplied in triplicate and include a list of contents. Any drawings or pictures shall be supplied in appropriate scale and in sufficient detail on size A4 or on a folder of A4 format. Photographs, if any, shall show sufficient detail.</p> <p>If the systems, referred to in this information document have electronic controls, information concerning their performance shall be supplied.</p>
0.0	GENERAL
0.1	Make (Trade name of manufacturer)
0.2	Type
0.2.1	Commercial name(s) (if available)
0.3	Means of identification of type, if marked on the vehicle component / separate technical unit;
0.3.1	Location of that marking
0.4	Category of vehicle
0.5	Company name and address of manufacturer
0.6	Name(s) and Address(es) of assembly plant(s)
0.7	Name and address of the manufacturer's representative (if any)
1.0	GENERAL CONSTRUCTION CHARACTERISTICS
1.1	Photographs and/or drawings of a representative vehicle/component/separate technical unit
1.2	Hand of drive: left/right
2.0	MASSES AND DIMENSIONS (in kg and mm) (Refer to drawing where applicable)
2.1	Mass in running order
	(i) Minimum and maximum for each variant:
	(ii) Mass of each version (a matrix must be provided):

3.0	TRANSMISSION					
3.1	Gearbox					
3.1.1	Type: Manual / Automatic / CVT (continuously variable transmission) / Fixed ratio / Atomized / Other / Wheel hub					
3.2	Maximum vehicle design speed (in km/h):					
3.3	Tyre/wheel combination(s)					
3.3.1	Axles					
3.3.1.1	Axle 1					
	3.3.1.1.1 Tyre size designation	3.3.1.1.2 Load-capacity index	3.3.1.1.3 Speed category symbol	3.3.1.1.4 Wheel rim size (s)	3.3.1.1.5 Wheel off – set (s)	3.3.1.1.6 Rolling resistance coefficient (RRC)
3.3.1.2	Axle 2					
	3.3.1.2.1 Tyre size designation	3.3.1.2.2 Load-capacity index	3.3.1.2.3 Speed category symbol	3.3.1.2.4 Wheel rim size (s)	3.3.1.2.5 Wheel off –set (s)	3.3.1.2.6 Rolling resistance coefficient (RRC)
	Etc.					
3.3.1.3	Spare Wheel, if any;					
4.0	EMERGENCY LANE-KEEPING SYSTEM (ELKS)					
4.1	Technical description and drawing of the system:					
4.2	Means to manually deactivate the ELKS:					
4.3	Description of the automatic deactivation (if fitted):					
4.4	Description of the automatic suppression (if fitted):					
4.5	Lane Departure Warning System (LDWS)					
4.5.1	Speed range of the LDWS:					
4.5.2	Technical description and drawing of the LDWS):					
4.6	Corrective Directional Control Function (CDCF)					
4.6.1	Speed range of the CDCF:					
4.6.2	Technical description and drawing of the system (in particular if the system uses steering or braking):					
	Explanatory Note:					
	This information document comprises the information relevant for the emergency lane keeping system and shall be completed in accordance with the template laid down in Annexure I.					

ANNEXURE II	
SAFETY AUDIT	
1.0	General
1.1	This Annexure defines the special requirements for documentation, fault strategy and verification with respect to the safety aspects of electronic control system(s) and complex electronic vehicle control system(s) of the Emergency Lane Keeping Systems.
1.1.1	Electronic control systems are commonly controlled by software and are built from discrete functional components such as sensors, electronic control units and actuators and connected by transmission links. They may include mechanical, electro-pneumatic or electro-hydraulic elements.
1.2	This Annexure does not specify the performance criteria for ‘The System’ covered by this Standard but covers the methodology applied to the design process and the information which must be disclosed to the Test Agency, for type approval purposes.
1.3	This information shall show that ‘The System’ respects, under non-fault and fault conditions, all the appropriate performance requirements specified in Part 2 of Annexure I and that it is designed to operate in such a way that it does not induce safety critical risks.
2.0	Documentation
2.1	Requirements
	The manufacturer shall provide a documentation package which gives access to the basic design of ‘The System’ and the means by which it is linked to other vehicle systems or by which it directly controls output variables. The function(s) of ‘The System’, including the control strategies, and the safety concept, as laid down by the manufacturer, shall be explained. Documentation shall be brief, yet provide evidence that the design and development has had the benefit of expertise from all the system fields which are involved. For periodic roadworthiness tests, the documentation shall describe how the current operational status of ‘The System’ can be checked.
	The Test Agency shall assess the documentation package to show that ‘The System’:
(a)	is designed to operate, under non-fault and fault conditions, in such a way that it does not induce safety critical risks;
(b)	respects, under non-fault and fault conditions, all the appropriate performance requirements specified elsewhere in this Standard; and
(c)	was developed according to the development process/method declared by the manufacturer and that this includes at least the steps listed in clause 2.4.4.

2.1.1	<p>Documentation shall be made available in two parts:</p> <p>(a) The formal documentation package for the approval, containing the material listed in clause 2 (with the exception of that of clause 2.4.4.) which shall be supplied to the Test Agency at the time of submission of the type approval application. This documentation package shall be used by the Test Agency as the basic reference for the verification process set out in clause 3. The Test Agency shall ensure that this documentation package remains available for a period determined in agreement with the Approval Authority. This period shall be at least 10 years counted from the time when production of the vehicle is definitely discontinued.</p> <p>(b) Additional material and analysis data of clause 2.4.4. which shall be retained by the manufacturer, but made open for inspection at the time of type approval. The manufacturer shall ensure that this material and analysis data remains available for a period of 10 years counted from the time when production of the vehicle is definitely discontinued.</p>
2.2	<p>A description shall be provided which gives a simple explanation of all the functions including control strategies of ‘The System’ and the methods employed to achieve the objectives, including a statement of the mechanism(s) by which control is exercised.</p> <p>Any described function that can be over-ridden shall be identified and a further description of the changed rationale of the function’s operation provided.</p>
2.2.1	<p>A list of all input and sensed variables shall be provided and the working range of these defined, along with a description of how each variable affects system behaviour.</p>
2.2.2	<p>A list of all output variables which are controlled by ‘The System’ shall be provided and an indication given, in each case, of whether the control is direct or via another vehicle system. The range over which ‘The System’ is likely to exercise control on each output variable shall be defined.</p>
2.2.3	<p>Limits defining the boundaries of functional operation (i.e. the external physical limits within which the system is able to maintain control) shall be stated where appropriate to system performance.</p>
2.3	<p>System layout and schematics.</p>
2.3.1	<p>Inventory of components.</p> <p>A list shall be provided, collating all the units of ‘The System’ and mentioning the other vehicle systems which are needed to achieve the control function in question.</p> <p>An outline schematic showing these units in combination, shall be provided with both the equipment distribution and the interconnections made clear.</p>

2.3.2	Functions of the units	
	The function of each unit of ‘The System’ shall be outlined and the signals linking it with other units or with other vehicle systems shall be shown. This may be provided by a labelled block diagram or other schematic, or by a description aided by such a diagram.	
2.3.3	Interconnections within ‘The System’ shall be shown by a circuit diagram for the electric transmission links, by a piping diagram for pneumatic or hydraulic transmission equipment and by a simplified diagrammatic layout for mechanical linkages. The transmission links both to and from other systems shall also be shown.	
2.3.4	There shall be a clear correspondence between transmission links and the signals carried between units. Priorities of signals on multiplexed data paths shall be stated wherever priority may be an issue affecting performance or safety.	
2.3.5	Identification of units	
	Each unit shall be clearly and unambiguously identifiable (e.g. by marking for hardware and marking or software output for software content) to provide corresponding hardware and documentation association.	
	Where functions are combined within a single unit or indeed within a single computer, but shown in multiple blocks in the block diagram for clarity and ease of explanation, only a single hardware identification marking shall be used. The manufacturer shall, by the use of this identification, affirm that the equipment supplied conforms to the corresponding document.	
2.3.5.1	The identification defines the hardware and software version and, where the latter changes such as to alter the function of the Unit as far as this Standard is concerned, this identification shall also be changed.	
2.4	Safety concept of the manufacturer	
2.4.1	The manufacturer shall provide a statement which affirms that the strategy chosen to achieve ‘The System’ objectives will not, under non-fault conditions, prejudice the safe operation of the vehicle.	
2.4.2	In respect of software employed in ‘The System’, the outline architecture shall be explained and the design methods and tools used shall be identified. The manufacturer shall show evidence of the means by which they determined the realisation of the system logic, during the design and development process.	
2.4.3	The manufacturer shall provide the Test Agency with an explanation of the design provisions built into ‘The System’ so as to generate safe operation under fault conditions. Possible design provisions for failure in ‘The System’ are for example	
	(a)	fallback to operation using a partial system;

	(b)	change-over to a separate back-up system;	
	(c)	removal of the high-level function.	
	In case of a failure, the driver shall be warned for example by warning signal or message display. When the system is not deactivated by the driver, e.g. by turning the ignition (run) switch to ‘off’, or by switching off that particular function if a special switch is provided for that purpose, the warning shall be present as long as the fault condition persists.		
2.4.3.1	If the chosen provision selects a partial performance mode of operation under certain fault conditions, then these conditions shall be stated and the resulting limits of effectiveness defined		
2.4.3.2	If the chosen provision selects a second (back-up) means to realise the vehicle control system objective, the principles of the change-over mechanism, the logic and level of redundancy and any built-in back-up checking features shall be explained and the resulting limits of back-up effectiveness defined.		
2.4.3.3	If the chosen provision selects the removal of the higher-level electronic control function, all the corresponding output control signals associated with this function shall be inhibited, and in such a manner as to limit the transition disturbance.		
2.4.4	The documentation shall be supported, by an analysis which shows, in overall terms, how the system will behave on the occurrence of any of those hazards or faults which will have a bearing on vehicle control performance or safety.		
	The chosen analytical approach(es) shall be established and maintained by the Manufacturer and shall be made open for inspection by the Test Agency at the time of the type approval.		
	The Test Agency shall perform an assessment of the application of the analytical approach(es). The assessment shall include:		
	(a)	Inspection of the safety approach at the concept (vehicle) level with confirmation that it includes consideration of:	
		(i)	interactions with other vehicle systems;
		(ii)	malfunctions of the system, within the scope of this Standard;
		(iii)	for the functions referred to in clause 2.2.:
		-	situations when a system free from faults may create safety critical risks (e.g. due to a lack of or wrong comprehension of the vehicle environment)
		-	reasonably foreseeable misuse by the driver,
	-	intentional modification of the system.	
	This approach shall be based on a hazard/risk analysis appropriate to system safety.		

	(b)	Inspection of the safety approach at the system level. This may be based on a Failure Mode and Effect Analysis (FMEA), a Fault Tree Analysis (FTA) or any similar process appropriate to system safety.
	(c)	Inspection of the validation plans and results. This shall include validation testing appropriate for validation, for example, Hardware in the Loop (HIL) testing, vehicle on-road operational testing, or any other testing appropriate for validation.
		The assessment shall consist of spot checks of selected hazards and faults to establish that argumentation supporting the safety concept is understandable and logical and validation plans are suitable and have been completed.
		The Test Agency may perform or may require to perform tests as specified in clause 3. to verify the safety concept.
2.4.4.1		This documentation shall itemize the parameters being monitored and shall set out, for each fault condition of the type defined in clause 2.4.4., the warning signal to be given to the driver and/or to service/technical inspection personnel.
2.4.4.2		This documentation shall describe the measures in place to ensure the ‘The System’ does not prejudice the safe operation of the vehicle when the performance of ‘The System’ is affected by environmental conditions e.g. climatic, temperature, dust ingress, water ingress, ice packing.
3.0		Verification and test
3.1		The functional operation of ‘The System’, as laid out in the documents required in clause 2., shall be tested as follows:
3.1.1		Verification of the function of ‘The System’
		The Test Agency shall verify ‘The System’ under non-fault conditions by testing a number of selected functions from those described by the manufacturer in clause 2.2.
		For complex electronic systems, these tests shall include scenarios whereby a declared function is overridden.
3.1.1.1		The verification results shall correspond with the description, including the control strategies, provided by the manufacturer in clause 2.2.
3.1.2		Verification of the safety concept of clause 2.4.
		The reaction of ‘The System’ shall be checked under the influence of a failure in any individual unit by applying corresponding output signals to electrical units or mechanical elements in order to simulate the effects of internal faults within the unit. The Test Agency shall conduct this check for at least one individual unit, but shall not check the reaction of ‘The System’ to multiple simultaneous failures of individual units.

	<p>The Test Agency shall verify that these tests include aspects that may have an impact on vehicle controllability and user information (HMI aspects).</p>
<p>4.0</p>	<p>Reporting by Test Agency</p>
	<p>Reporting of the assessment by the Test Agency shall be performed in such a manner that allows traceability, e.g. versions of documents inspected are coded and listed in the records of the Test Agency.</p>
	<p>An example of a possible layout for the assessment form from the Test Agency to the Type Approval Authority is given in the Appendix.</p>

APPENDIX	
Model assessment form for ELKS	
	Test Report No.
1.0	Identification.
1.1	Vehicle make:
1.2	Type
1.3	Means of identification of type if marked on the vehicle
1.4	Location of that marking
1.5	Manufacturer's name and address
1.6	If applicable, name and address of manufacturer's representative
1.7	Manufacturer's formal documentation package:
	Documentation reference No:
	Date of original issue:
	Date of latest update:
2.0	Test vehicle(s)/system(s) description
2.1	General description:
2.2	Description of all the control functions of 'The System', and methods of operation:
2.3	Description of the components and diagrams of the interconnections within 'The System':
2.4	General description:
2.5	Description of all the control functions of 'The System', and methods of operation:
2.6	Description of the components and diagrams of the interconnections within "The System
3.0	Manufacturer's safety concept
3.1	Description of signal flow and operating data and their priorities:
3.2	Manufacturer's declaration
	The manufacturer(s)affirm(s) that the strategy chosen to achieve 'The System', objectives will not, under non-fault conditions, prejudice the safe operation of the vehicle.

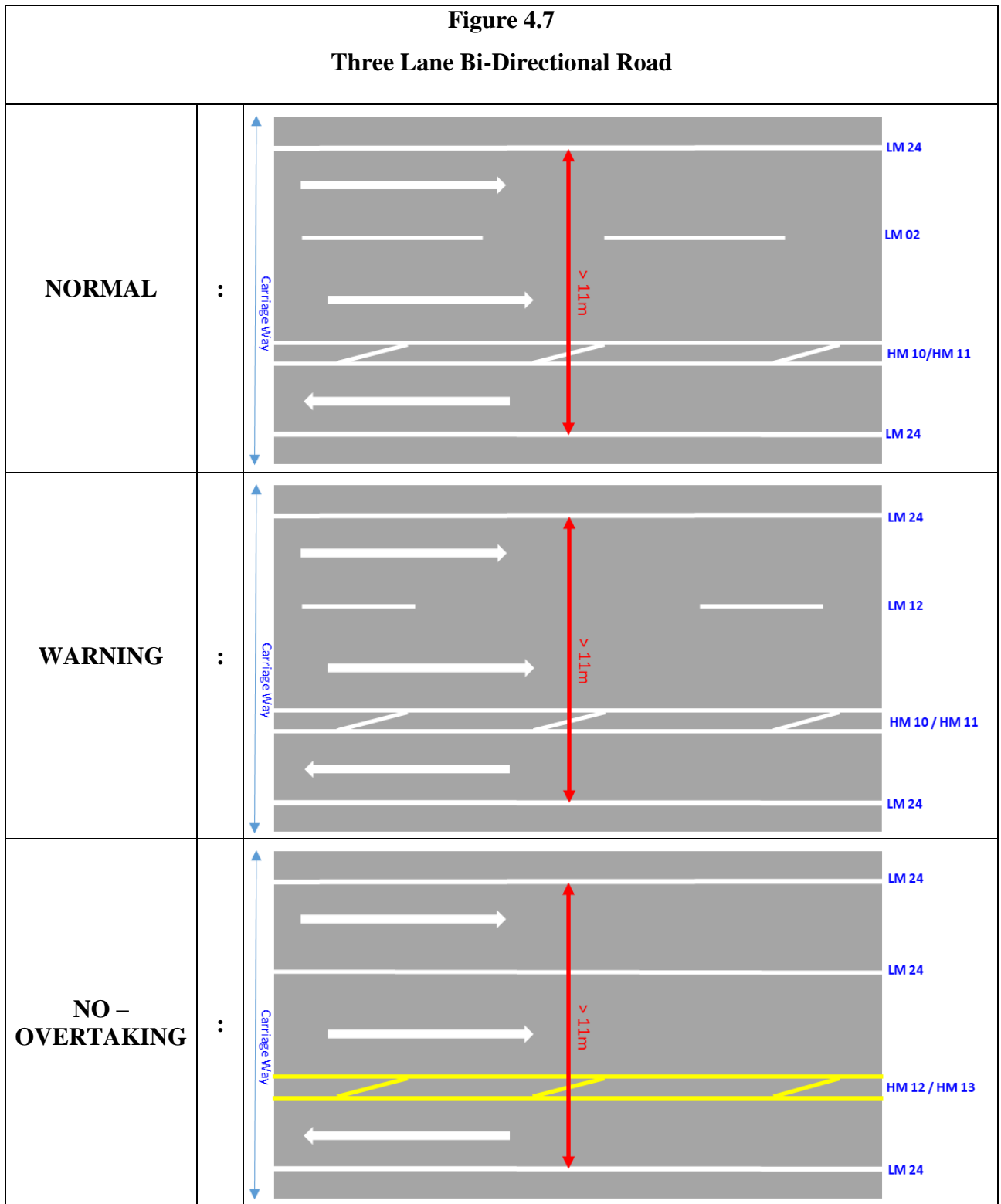
3.3	Software outline architecture and the design methods and tools used:
3.4	Explanation of design provisions built into 'The System' under fault conditions:
3.5	Documented analyses of the behaviour of 'The System' under individual hazard or fault conditions:
3.6	Description of the measures in place for environmental conditions:
3.7	Provisions for the periodic roadworthiness test of 'The System':
3.8	Results of 'The System' verification test, referred to in clause 3.1.1. of Annexure II
3.9	Results of safety concept verification test, referred to in clause 3.1.2. of Annexure II
3.10	Date of test:
3.11	This test has been carried out and the results reported in accordance with this standard
	Test Agency carrying out the test
	Signed: Date:
3.12	Comments

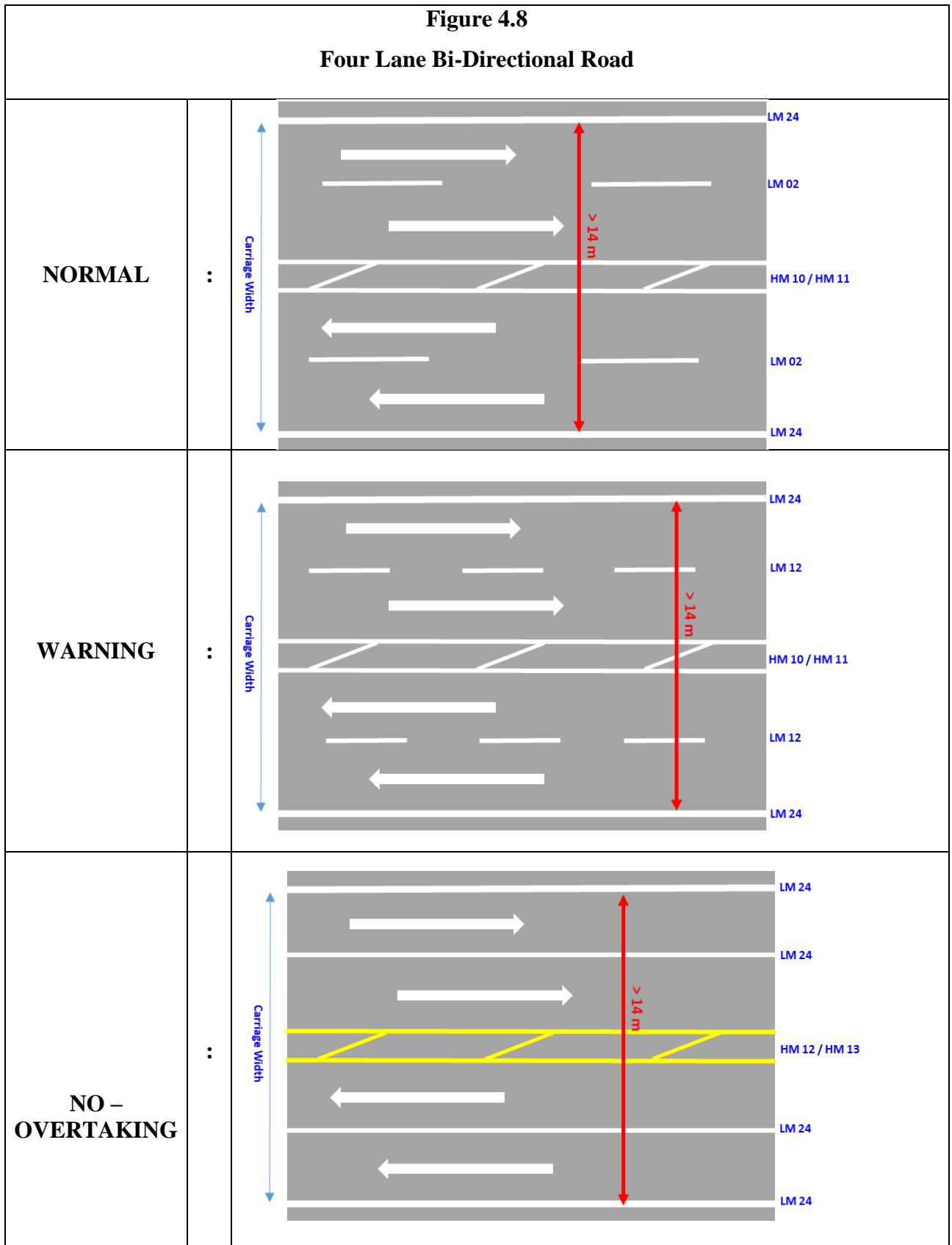
ANNEXURE III	
VISIBLE LANE MARKING IDENTIFICATION	
<p>The visibility of lane markings shall be as per the Code of Practice for Road Markings (Second Revision) prepared and published by the Indian Road Congress (IRC:35-2015), as amended from time to time. The reference gist of lane markings to be referred is as given below:</p>	
<p>A. Longitudinal Marking for Undivided Roads under Section 4 for Markings for Road Links, sub-section 4.6,</p>	
<p>Figure 4.4 Single / Intermediate Lane Bi-Directional Road (less than 5.5 m)</p>	
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

<p>NORMAL</p>	<p>:</p>		<p>LM 24 LM 02 LM 24</p>
<p>WARNING</p>	<p>:</p>		<p>LM 24 LM 05 LM 24</p>
<p>NO - OVERTAKING</p>	<p>:</p>		<p>LM 24 LM 24 LM 24</p>





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)

<p>NORMAL</p>	<p>:</p>	
<p>WARNING</p>	<p>:</p>	
<p>NO - VERTAKING</p>	<p>::</p>	

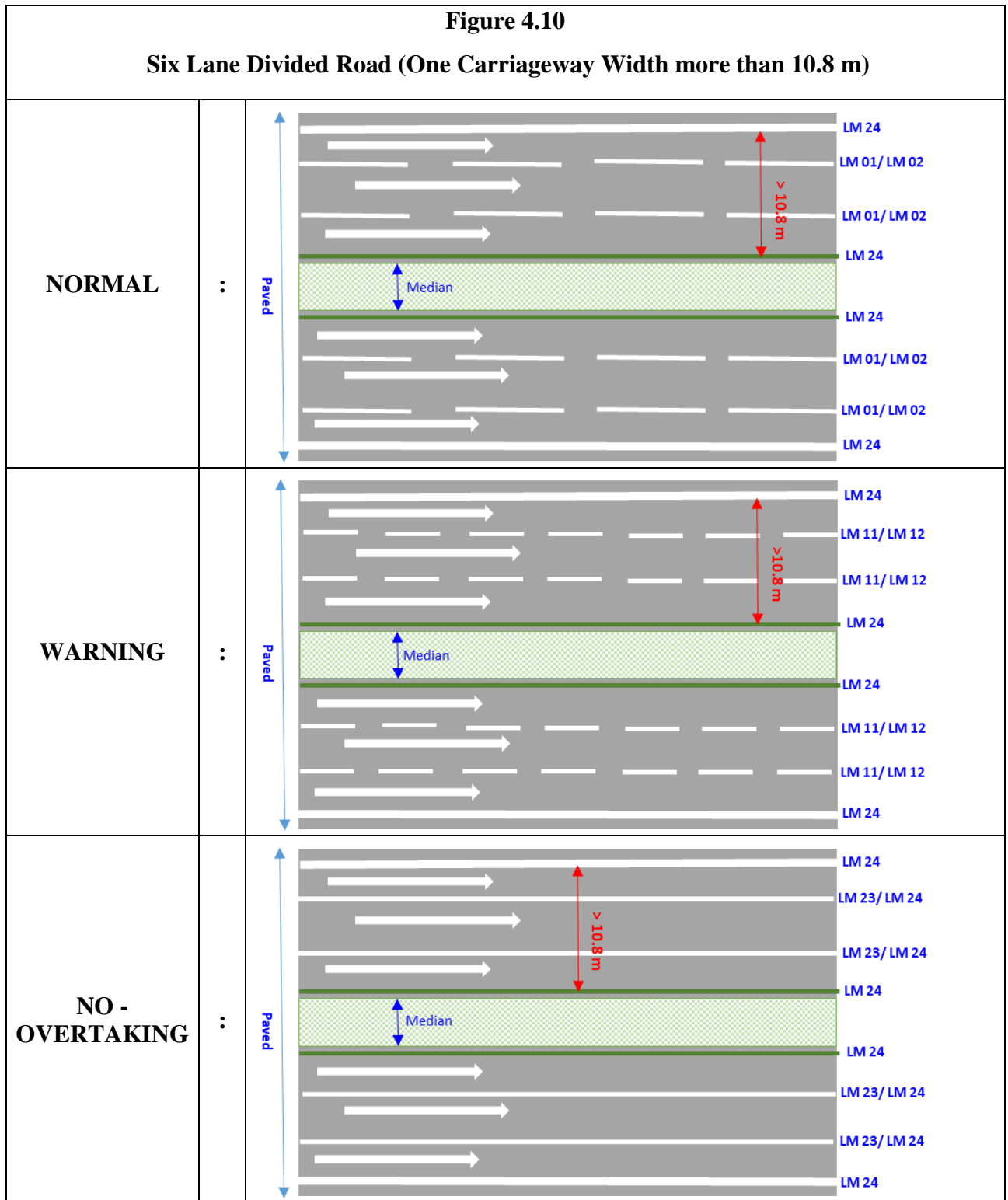


Figure 4.11
Four Lane Expressway

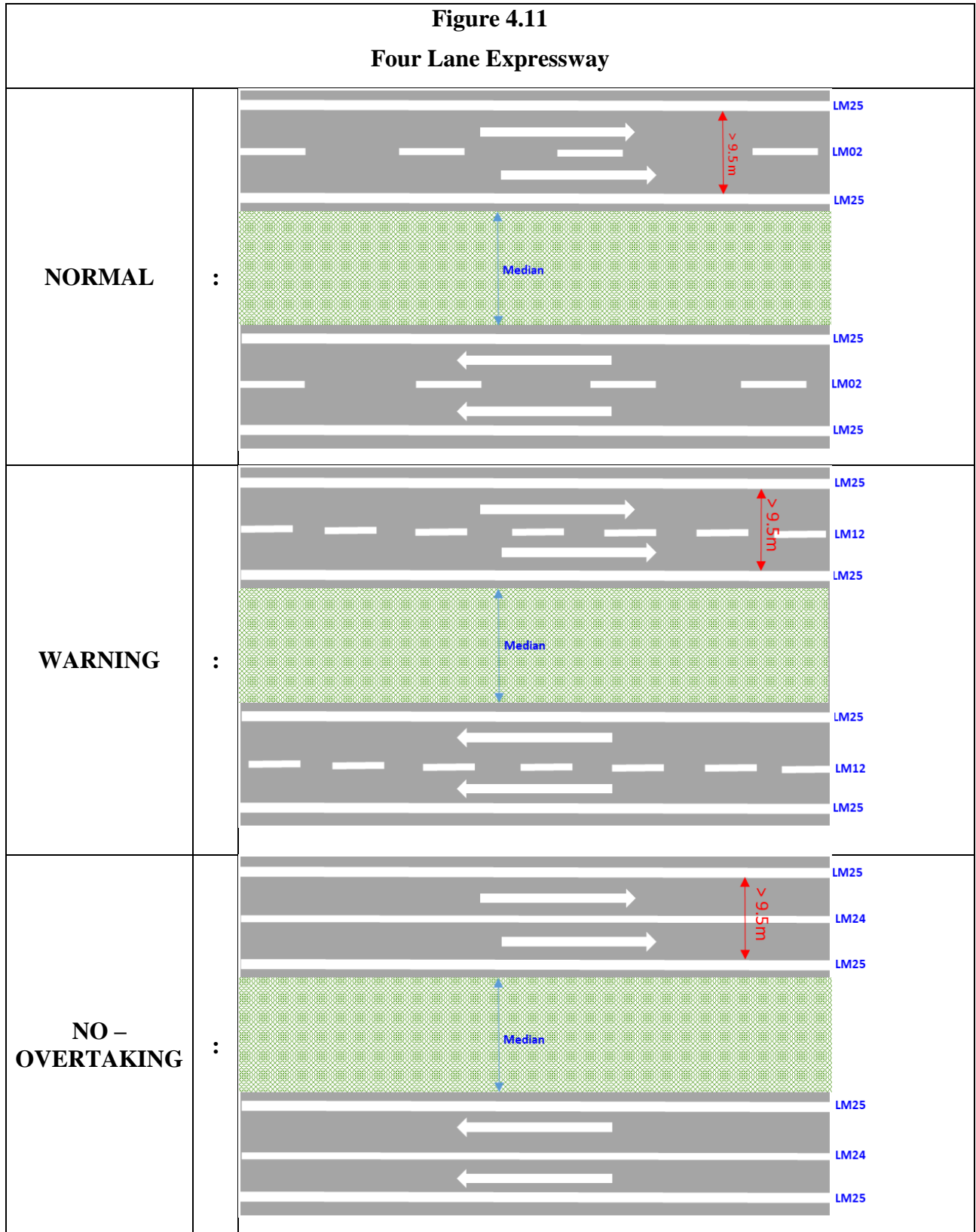


Figure 4.12
Six Lane Expressway

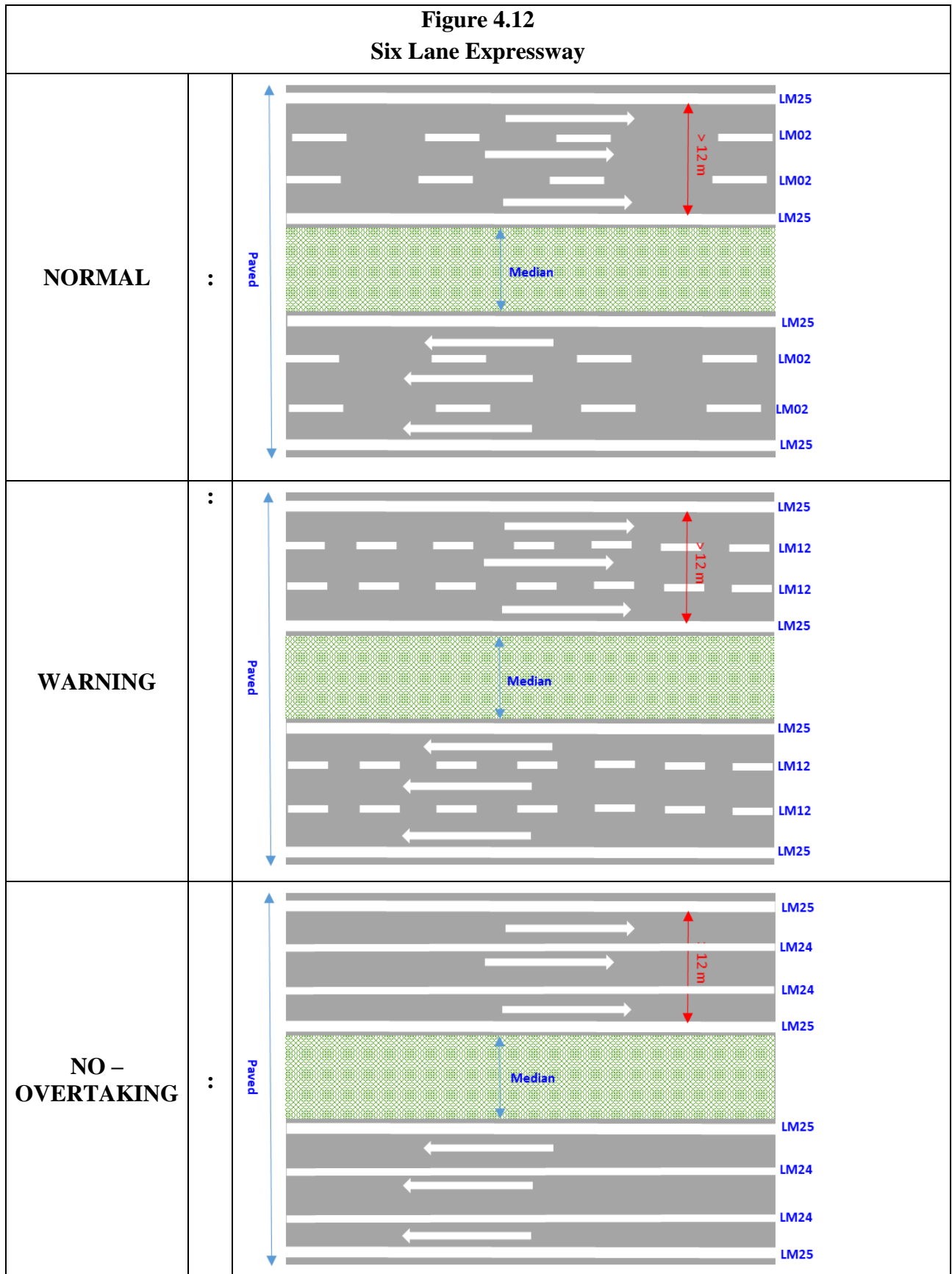


Figure 4.13

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

<p>NORMAL</p>	<p>:</p>	
<p>WARNING</p>	<p>:</p>	
<p>NO – OVERTAKING</p>	<p>:</p>	

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)

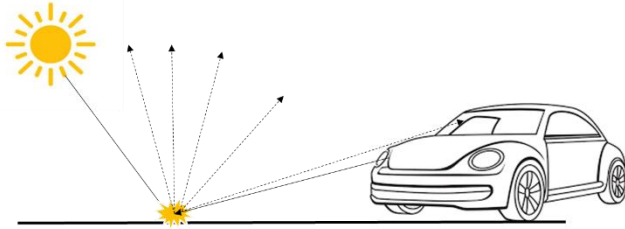
<p>NORMAL</p>	<p>:</p>	
<p>WARNING</p>	<p>:</p>	
<p>NO – OVERTAKING</p>	<p>:</p>	

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	<p>The diagram shows a three-lane road with a paved width greater than 11m. It features a central lane with a dashed center line and two outer lanes with solid edge lines. White arrows indicate traffic flow in both directions. Markings include LM24 at the top and bottom edges, and LM08 at the center line. A blue double-headed arrow on the left is labeled 'Paved', and a red double-headed arrow on the right is labeled '> 11 m'.</p>
WARNING	<p>The diagram shows a three-lane road with a paved width greater than 11m. It features a central lane with a dashed center line and two outer lanes with solid edge lines. White arrows indicate traffic flow in both directions. Markings include LM24 at the top and bottom edges, and LM10 at the center line. A blue double-headed arrow on the left is labeled 'Paved', and a red double-headed arrow on the right is labeled '> 11 m'.</p>
NO – OVERTAKING	<p>The diagram shows a three-lane road with a paved width greater than 11m. It features a central lane with a dashed center line and two outer lanes with solid edge lines. White arrows indicate traffic flow in both directions. Markings include LM24 at the top and bottom edges. A blue double-headed arrow on the left is labeled 'Paved', and a red double-headed arrow on the right is labeled '> 11 m'.</p>

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

Figure 15.3

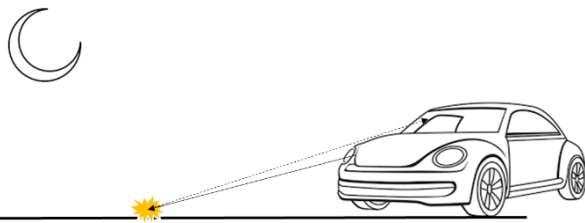
Day Visibility of Road Marking



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-reflectiveness 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 referred for formation of this Annexure, as amended from time to time.

ANNEXURE IV (See Introduction) COMPOSITION OF AISC PANEL ON EMERGENCY LANE KEEPING SYSTEM (ELKS)	
Convener	
Mr. Vivekananda Nayak	Continental Automotive Components (India) Pvt. Ltd
MEMBERS	REPRESENTING
Mr. A. A. Badusha	The Automotive Research Association of India
Mr. Manish Karle	The Automotive Research Association of India
Ms. Jyoti Kale	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
Mr. Ninad Pachhapurkar	The Automotive Research Association of India
Mr. Gavendra Singh	International Centre for Automotive Technology
Mr. Satyanarayana Gupta	SIAM (Hyundai Motors India)
Mr. Abhijit Dhotre	SIAM (Mahindra & Mahindra Ltd)
Ms. Pushpanjali Pathak	SIAM (Mahindra & Mahindra Ltd)
Mr. Shailesh Kulkarni	SIAM (Mahindra & Mahindra Ltd)
Mr. Gururaj Ravi	SIAM (Maruti Suzuki India Ltd.,)
Mr. Rajendra Khile	SIAM (Renault Nissan Technology and Business Centre)
Mr. Vijay Dinakaran	SIAM (Renault Nissan Technology and Business Centre)
Mr. Jebin P. Jowhar	SIAM (Renault Nissan Technology and Business Centre)
Ms. Aditi Deshpande	SIAM (Skoda Auto Volkswagen India Pvt. Ltd.,)
Mr. Uday Salunkhe	SIAM (Tata Motors Ltd.,)
Mr. Ajit Dubal	SIAM (Tata Motors Ltd.,)
Mr. S. Sreeram	ACMA (Bosch)
Mr. Ajaykumar T. S.	ACMA (Continental Automotive Components)

AIS-191 (Part 1)

Mr. Lokesha Darshan	ACMA (Continental Automotive Components)
Mr. Gurudatta Purandare	ACMA (Spark Minda)
Mr. Vijay Patil	ACMA (Spark Minda)
Mr. Gitesh Mutha	AMCA (Uno Minda Ltd.)
Mr. R. Manikandan	Ola Electric
* At the time of approval of this Automotive Industry Standard (AIS)	

ANNEXURE V (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
Representative from	Tractor and Mechanization Association
Representative 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)