United Nations ECE/TRANS/WP.29/2021/16

# Economic and Social Council

Distr.: General
18 December 2020

Original: English

## Economic Commission for Europe

Inland Transport Committee

### World Forum for Harmonization of Vehicle Regulations

**183rd session**
Geneva, 9-11 March 2021
Item 4.7.5 of the provisional agenda
**1958 Agreement:**
**Consideration of draft amendments to existing**
**UN Regulations submitted by GRVA**

# Proposal for Supplement 2 to the 01 series of amendments to UN Regulation No. 152 (AEBS for $M_1$ and $N_1$)

## Submitted by the Working Party on Automated/Autonomous and Connected Vehicles *

The text reproduced below was adopted by the Working Party on Automated/Autonomous and Connected Vehicles (GRVA) at its seventh session in September 2020 (ECE/TRANS/WP.29/GRVA/7, paras. 54-55). It is based on ECE/TRANS/WP.29/GRVA/2020/27. It also takes into account the decisions of the World Forum for Harmonization of Vehicle Regulations (WP.29) at its November 2020 session as well as guidance by GRVA at its December 2020 session. It is submitted to WP.29 and to the Administrative Committee (AC.1) for consideration at their March 2021 sessions.

* In accordance with the programme of work of the Inland Transport Committee for 2020 as outlined in proposed programme budget for 2020 (A/74/6 (part V sect. 20) para 20.37), the World Forum will develop, harmonize and update UN Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

*Insert a new paragraph 5.1.4.1.3., to read:*

"5.1.4.1.3. Upon detection of any non-electrical failure condition (e.g. sensor blindness or sensor misalignment), the warning signal as defined in paragraph 5.1.4.1. shall be illuminated."

*Paragraph 5.1.4.3.*, delete.

*Paragraph 5.1.6.*, amend to read:

"5.1.6. False reaction avoidance

The system shall be designed to minimise the generation of collision warning signals and to avoid advanced emergency braking in situations where there is no risk of an imminent collision. This shall be demonstrated in the assessment carried out under Annex 3, and this assessment shall include in particular scenarios listed in Appendix 2 of Annex 3."

*Paragraphs 5.2. to 5.2.1.4.*, amend to read (including missing headings in the table for $M_1$ vehicles):

"5.2. Specific Requirements

5.2.1. Car to car scenario

5.2.1.1. Collision warning

When a collision …

5.2.1.4. Speed reduction by braking demand

In absence of driver's input which would lead to interruption according to paragraph 5.3.2., the AEBS shall be able to achieve a relative impact speed that is less or equal to the maximum relative impact speed as shown in the following table:

(a) For collisions with unobstructed and constantly travelling or stationary targets;

(b) On flat, horizontal and dry roads;

(c) In maximum mass and mass in running order conditions;

(d) In situations where the vehicle longitudinal centre planes are displaced by not more than 0.2 m;

(e) In ambient illumination conditions of at least 1000 Lux without blinding of the sensors (e.g. direct blinding sunlight);

(f) In absence of weather conditions affecting the dynamic performance of the vehicle (e.g. no storm, not below 0°C);

(g) When driving straight with no curve, and not turning at an intersection.

It is recognised …

**Maximum relative Impact Speed (km/h) for $M_1$ vehicle***

| *Relative Speed (km/h)* | *Stationary/ Moving* | |
|---|---|---|
| | *Maximum mass* | *Mass in running order* |
| 10 | 0.00 | 0.00 |
| 15 | 0.00 | 0.00 |
| 20 | 0.00 | 0.00 |
| 25 | 0.00 | 0.00 |
| 30 | 0.00 | 0.00 |
| 35 | 0.00 | 0.00 |
| 40 | 0.00 | 0.00 |
| 42 | 10.00 | 0.00 |

| | | | |
|---|---|---|---|
| 45 | 15.00 | 15.00 | |
| 50 | 25.00 | 25.00 | |
| 55 | 30.00 | 30.00 | |
| 60 | 35.00 | 35.00 | All values in km/h |

***** For relative speeds …"

*Paragraphs 5.2.2. to 5.2.2.4.*, amend to read:

"5.2.2. Car to pedestrian scenario

5.2.2.1. Collision warning

When the AEBS …

…

5.2.2.4. Speed reduction by braking demand

In absence of driver's input which would lead to interruption according to paragraph 5.3.2., the AEBS shall be able to achieve an impact speed that is less or equal to the maximum relative impact speed as shown in the following table:

(a) With unobstructed perpendicularly crossing pedestrians with a lateral speed component of not more than 5 km/h;

(b) In unambiguous situations (e.g. not multiple pedestrians);

(c) On flat, horizontal and dry roads;

(d) In maximum mass and mass in running order conditions;

(e) In situations where the anticipated impact point is displaced by not more than 0.2 m compared to the vehicle longitudinal centre plane;

(f) In ambient illumination conditions of at least 2000 Lux without blinding of the sensors (e.g. direct blinding sunlight**)**.

(g) In absence of weather conditions affecting the dynamic performance of the vehicle (e.g. no storm, not below 0°C) and

(h) When driving straight with no curve, and not turning at an intersection.

It is recognised …

**Maximum Impact Speed (km/h) for $M_1$***

| *Subject vehicle speed (km/h)* | *Maximum mass* | *Mass in running order* | |
|---|---|---|---|
| 20 | 0.00 | 0.00 | |
| … | … | … | |
| 60 | 35.00 | 35.00 | All values in km/h |

***** For subject vehicle speeds between the listed values ...

**Maximum Impact Speed (km/h) for $N_1$ vehicles***

| *Subject vehicle speed (km/h)* | *Maximum mass* | *Mass in running order* | |
|---|---|---|---|
| 20 | 0.00 | 0.00 | |
| … | … | … | |
| 35 | 0.00 | 0.00 | |
| 38 | 0.00 | 0.00 | |
| 40 | 10.00 | 0.00 | |
| … | … | … | |
| 60 | 40.00 | 35.00 | All values in km/h |

***** For subject vehicle … "

*Paragraphs 5.4. to 5.4.2.*, amend to read:

"5.4. Deactivation

5.4.1. When a vehicle …

5.4.2. When the vehicle is equipped with a means to automatically deactivate the AEBS function, for instance in situations such as off-road use, being towed, being operated on a dynamometer, being operated in a washing plant, the following conditions shall apply as appropriate:"

*Insert a new paragraph 5.4.2.3.*, to read:

"5.4.2.3. Where automatic deactivation of the AEBS function is a consequence of the driver manually switching off the ESC function of the vehicle, this deactivation of the AEBS shall require at least two deliberate actions by the driver."

*Insert a new paragraph 5.4.4.*, to read:

"5.4.4. While automated driving functions are in longitudinal control of the vehicle (e.g. ALKS is active) the AEBS function may be suspended or its control strategies (i.e. braking demand, warning timing) adapted without indication to the driver, as long as it remains ensured that the vehicle provides at least the same collision avoidance capabilities as the AEBS function during manual operation."

*Paragraph 5.5.7.*, amend to read:

"5.5.7. When the driver is provided with an optical warning signal to indicate that the AEBS is temporarily not available, for example due to inclement weather conditions, the signal shall be constant. The failure warning signal specified in paragraph 5.5.4. above may be used for this purpose."

*Paragraphs 6.1. to 6.1.1.*, amend to read (including "minimum" in footnote 3):

"6.1. Test Conditions

6.1.1. The test shall …

6.1.1.1. The road test surface shall have a nominal[1] peak braking coefficient (PBC) of 0.9. unless otherwise specified. when measured using either:"

*Insert a new paragraph 6.1.6.*, to read:

"6.1.6. At the request of the manufacturer and with the agreement of the Technical Service tests may be conducted under deviating test conditions (suboptimal conditions, e.g. on a not dry surface; below the specified minimum ambient temperature), whilst the performance requirements are still to be met."

*Paragraphs 6.3. to 6.3.1.*, amend to read:

"6.3. Test Targets

6.3.1. The target used for the vehicle detection tests shall be a regular high-volume series production passenger car of Category $M_1$ AA saloon. or alternatively a "soft target" representative of such a vehicle in terms of its identification characteristics applicable to the sensor system of the AEBS under test according to ISO 19206-3:2020. The reference point for the location of the vehicle shall be the most rearward point on the centreline of the vehicle."

*Paragraph 6.4.1.*, delete the numbering and amend to read (including the addition of two tables):

"The subject vehicle …

Tests shall be conducted with a vehicle travelling at speeds shown in tables below for respectively $M_1$ and $N_1$ Categories. If this is deemed justified, the

[1] The "nominal" value is understood as being the minimum theoretical target value."

technical service may test any other speeds listed in the tables in paragraph 5.2.1.4. and within the prescribed speed range as defined in paragraph 5.2.1.3.

**Subject vehicle test speed for $M_1$ category in stationary target scenario**

| *Maximum mass* | *Mass in running order* | *Tolerance* |
|---|---|---|
| 20 | 20 | +2/-0 |
| 40 | 42 | +0/-2 |
| 60 | 60 | +0/-2 |

All values in km/h

**Subject vehicle test speed for $N_1$ category in stationary target scenario**

| *Maximum mass* | *Mass in running order* | *Tolerance* |
|---|---|---|
| 20 | 20 | +2/-0 |
| 38 | 42 | +0/-2 |
| 60 | 60 | +0/-2 |

All values in km/h

The functional part …"

*Paragraph 6.5.*, amend to read (including the addition of two tables):

"6.5. Warning and Activation Test with a Moving Vehicle Target

The subject vehicle …

Tests shall be conducted with a vehicle travelling at speeds shown in tables below for respectively $M_1$ and $N_1$ categories and target travelling at 20 km/h (with a tolerance of +0/-2 km/h for the target vehicles). If this is deemed justified, the Technical Service may test any other speeds for subject vehicle and target vehicle within the speed range as defined in paragraph 5.2.1.3.

**Subject vehicle test speed for $M_1$ category in moving target scenario**

| *Maximum mass* | *Mass in running order* | *Tolerance* |
|---|---|---|
| 30 | 30 | +2/-0 |
| 60 | 60 | +0/-2 |

All values in km/h

**Subject vehicle test speed for $N_1$ category in moving target scenario**

| *Maximum mass* | *Mass in running order* | *Tolerance* |
|---|---|---|
| 30 | 30 | +2/-0 |
| 58 | 60 | +0/-2 |

All values in km/h

The functional part …"

*Paragraphs 6.6. to 6.6.1.*, amend to read (including the addition of two tables):

"6.6. Warning and Activation Test with a Pedestrian Target

6.6.1. The subject vehicle …

The pedestrian target shall travel in a straight line perpendicular to the subject vehicle's direction of travel at a constant speed of 5 km/h +0/-0.4 km/h, starting not before the functional part of the test has started. The pedestrian target's positioning shall ...

Tests shall be conducted with a vehicle travelling at speeds shown in tables below for respectively $M_1$ and $N_1$ categories. The technical service may test any other speeds listed in the table in paragraph 5.2.2.4. and within the prescribed speed range as defined in paragraphs 5.2.2.3.

**Subject vehicle test speed for $M_1$ category in pedestrian target scenario**

| *Maximum mass* | *Mass in running order* | *Tolerance* |
|---|---|---|
| 20 | 20 | +2/-0 |
| 40 | 42 | +0/-2 |
| 60 | 60 | +0/-2 |

All values in km/h

**Subject vehicle test speed for $N_1$ category in pedestrian target scenario**

| *Maximum mass* | *Mass in running order* | *Tolerance* |
|---|---|---|
| 20 | 20 | +2/-0 |
| 38 | 42 | +0/-2 |
| 60 | 60 | +0/-2 |

All values in km/h

From the start…"

*Annex 3, Appendix 2*

*Paragraphs 1 to 3,* delete

*Insert a new introductory paragraph*, to read:

"The following scenarios shall be used to assess the system's strategies implemented in order to minimize the generation of false reactions. For each type of scenario the vehicle manufacturer shall explain the principle strategies implemented to ensure safety.

The manufacturer shall provide evidence (e.g. simulation results, real-world test data, track test data) of the system's behaviour in the described types of scenarios. The parameters described in subparagraph 2 of each scenario shall be used as guidance if the Technical Service deems a demonstration of the scenario necessary."

(a) Definition of overlap ratio between the subject vehicle and the related vehicle

Overlap ratio between the subject vehicle and the related vehicle is calculated by the following formula.

$R_{overlap} = L_{overlap} / W_{vehicle} * 100$

Where:

$R_{overlap}$ : Overlap ratio [%]

$L_{overlap}$ : Amount of overlap between extended lines of the width of the subject vehicle and the related vehicle [m]

$W_{vehicle}$ : Width of the subject vehicle [m] (sensors, devices for indirect vision, door handles and connections for tyre-pressure gauges are not included when measuring the width of the vehicle)

(b) Definition of offset ratio between the subject vehicle and the stationary object

Offset ratio between the subject vehicle and the stationary object is calculated by the following formula.

$R_{offset} = L_{offset} / (0.5*W_{vehicle}) * 100$

$R_{offset}$ : Offset ratio [%]

$L_{offset}$ : Amount of offset between the centre of the subject vehicle and the centre of the stationary object, and the direction of offset to the driver's seat side is defined as plus (+) [m]

$W_{vehicle}$ : Width of the subject vehicle [m] (sensors, devices for indirect vision, door handles and connections for tyre-pressure gauges are not included when measuring the width of the vehicle)"

*Insert new Scenarios 1 to 4*, to read:

## "Scenario 1

## Left turn or Right turn at the intersection

1.1. In this scenario, the subject vehicle passes by a left turn or right turn in front of an oncoming vehicle that is stopped to make a left turn or right turn at an intersection.

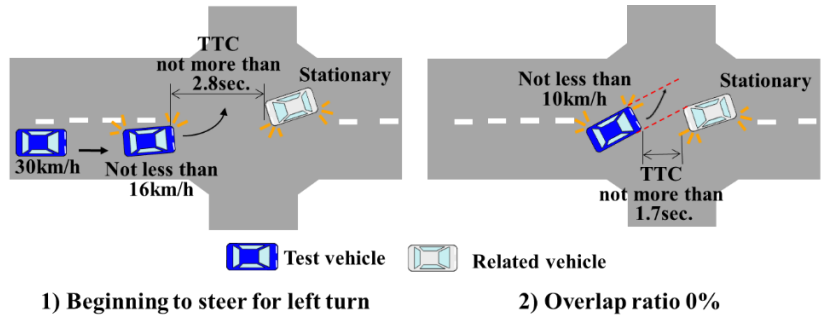
1.2. An example of the detail scenario:

The subject vehicle drives at a speed of 30 km/h (with a tolerance of +0/-2 km/h) toward the intersection, and decelerates by braking to a speed of not less than 16 km/h at a point where the subject vehicle begins to steer left / right, and the Time To Collision (TTC) to the oncoming vehicle is not more than 2.8 seconds. When the subject vehicle turns left or right in the intersection, the speed is reduced to not less than 10 km/h, and then drives at a constant speed. The TTC to the oncoming vehicle is not more than 1.7 seconds at when the overlap ratio between the subject vehicle and the oncoming vehicle becomes 0 per cent.

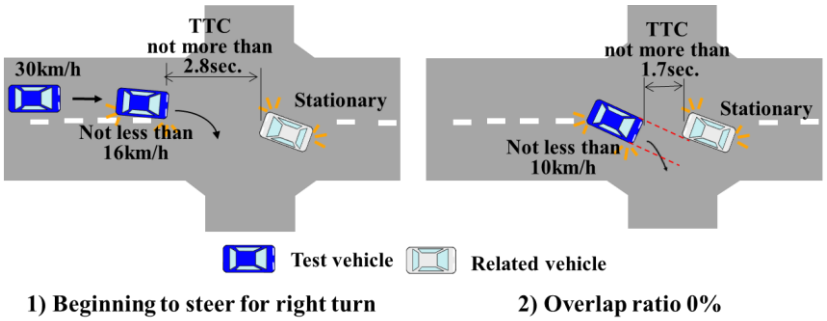
Figure 1

**Left turn or right turn at the intersection**

(A) Driving on right side of the road




(B) Driving on left side of the road



## Scenario 2

### Right turn or Left turn of a forward vehicle

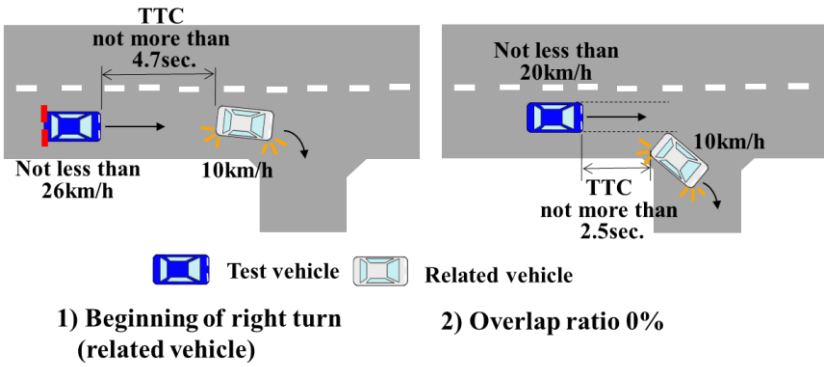
2.1. In this scenario, the subject vehicle follows a forward vehicle. After that, the forward vehicle turns right or left at a corner, and the subject vehicle goes straight.

2.2. An example of the detail scenario:

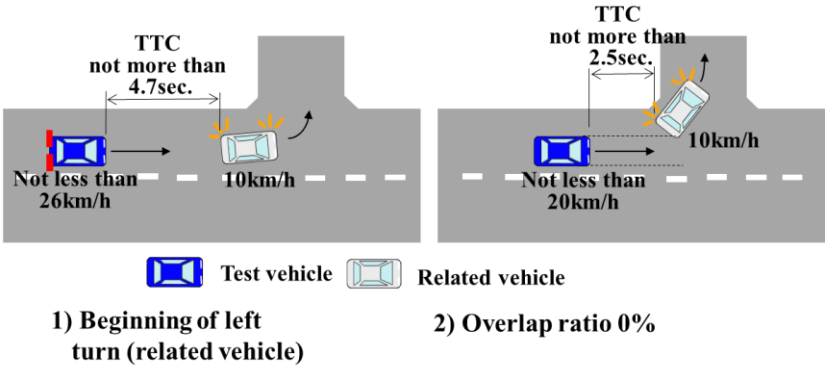
Both the forward vehicle and the subject vehicle drive at a speed of 40 km/h (with a tolerance of +0/-2 km/h) on the straight road. The forward vehicle decelerates by braking to a speed of 10 km/h (with a tolerance of +0/-2 km/h) in order to turn right or left at the corner, and the subject vehicle also decelerates by braking to keep appropriate distance with the forward vehicle. At when the forward vehicle begins to turn right or left, the speed of the subject vehicle is not less than 26 km/h and the TTC to the frontal vehicle is not more than 4.7 seconds. After that, the subject vehicle decelerates to a speed of not less than 20 km/h, and then drives at a constant speed. The TTC to the forward vehicle is not more than 2.5 seconds at when the overlap ratio between the subject vehicle and the forward vehicle becomes 0 per cent.

Figure 2
**Right turn or left turn of a forward vehicle**

(A) Driving on right side of the road




(B) Driving on left side of the road



## Scenario 3

### Curved road with guard pipes and a stationary object

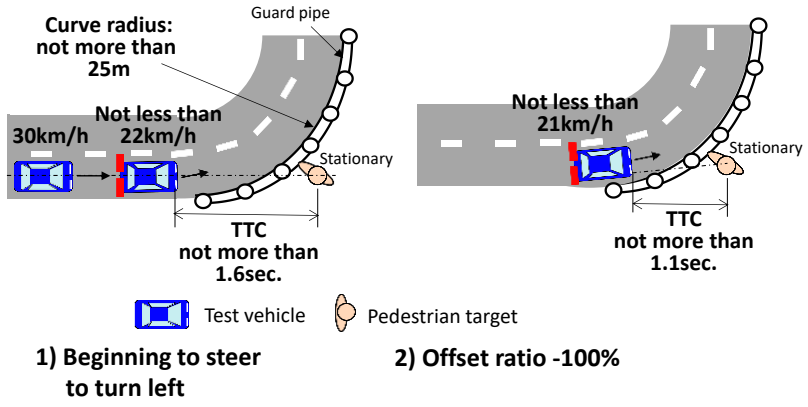
3.1. In this scenario, the subject vehicle drives a small radius curved road of which the guard pipes are constructed to the outer side, and a stationary vehicle ($M_1$ category), a stationary pedestrian target or a stationary bicycle target is positioned just outside of the guard pipes and where on the extension of the centre of the lane.

3.2. An example of the detail scenario:

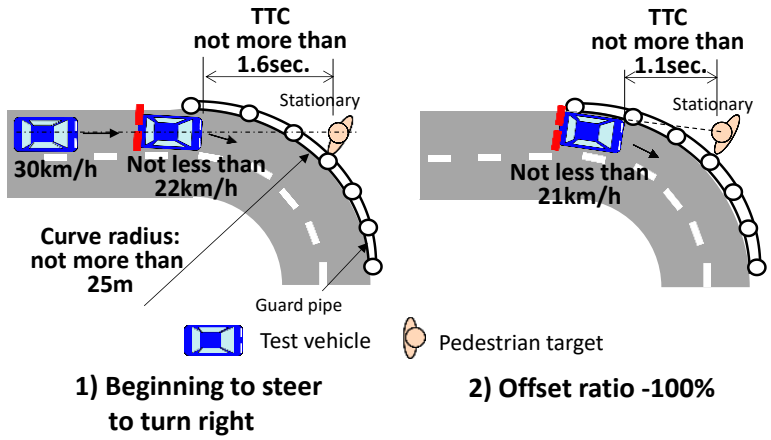
The subject vehicle drives at a speed of 30 (with a tolerance of +0/-2 km/h) km/h toward the curve of which the radius is not more than 25 m at the outer side of the road, and decelerates by braking to a speed of not less than 22 km/h at a point where the subject vehicle enters the curve. The TTC to the stationary object is not more than 1.6 seconds at when the subject vehicle begins to turn in the curve. In the curve, the subject vehicle drives outer lane than the centre of the road. After that, the subject vehicle continue to turn in the curve at a constant speed of not less than 21 km/h. The TTC to the stationary object is not more than 1.1 second at when the overlap ratio between the subject vehicle and the stationary vehicle becomes 0 per cent, or at when the offset ratio between the subject vehicle and the centre of the stationary pedestrian target or the stationary bicycle target becomes -100 per cent.

Figure 3
**Curved road with guard pipes and a stationary object**

(A) Driving on right side of the road




(B) Driving on left side of the road



## Scenario 4

### Lane change due to road construction

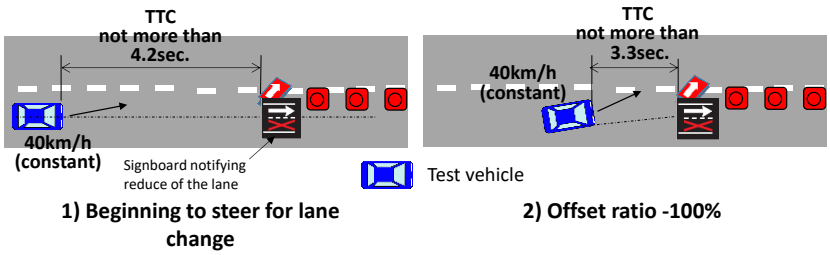
4.1. In this scenario, the subject vehicle changes the lane in front of the signboard which is positioned in the centre of the lane and notifies the driver that the lane is reduced.

4.2. An example of the detail scenario:

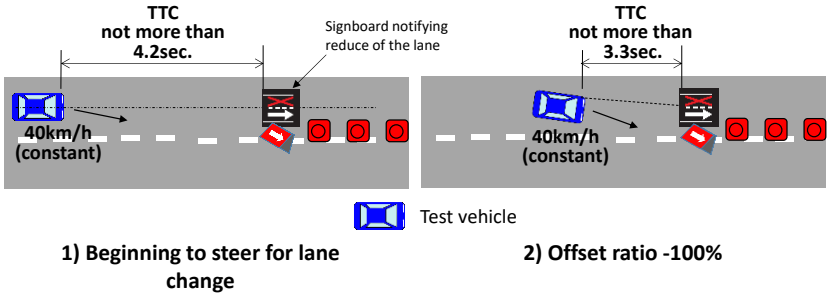
The subject vehicle drives a straight road at a speed of 40 km/h (with a tolerance of +0/-2 km/h) and begins to steer in order to change the lane in front of the signboard which notifies reducing the lane. No other vehicles approach the subject vehicle. The TTC to the signboard is not more than 4.2 seconds at when the subject vehicle begins to steer. During changing the lane, the speed of the subject vehicle is constant, and the TTC to the signboard is not more than 3.3 seconds at when the offset ratio between the subject vehicle and the centre of the signboard becomes -100 per cent.

Figure 4
**Lane change due to road construction**

(A) Driving on right side of the road




(B) Driving on left side of the road




"