Transmitted by the expert from Japan

Informal Document No. **GRE-61-15**
(61st GRE, 30 March – 3 April 2009,
agenda item 4(a))

**Proposal for Supplement 4 to the 04 series of amendments to Regulation No.48 (based on ECE/TRANS/WP.29/GRE/2007/60)**

***Bold part was updated from the document of ECE/TRANS/WP.29/GRE/2007/60**

A. PROPOSAL

Insert a new paragraph 2.28., to read:

"2.28. "Rear-end collision alert signal **(RECAS)**" means ~~a signal to indicate to other road users to the rear of the vehicle that a rear-end collision is unavoidable.~~ **the rapid approach to the leading vehicle that cannot avoid by the ordinary driving operation to the driver in the following vehicle.**"

Paragraph 5.15., amend to read:

"5.15. The colours of the light emitted by the lamps are the following:

….

| | |
|---|---|
| emergency stop signal: | amber or red |
| rear-end collision alert signal: | ~~red or~~ **amber** |
| rear registration plate lamp: | white |

….

~~*[Emergency stop signal and rear-end collision alert signal shall display same colour.]*~~"

Insert new paragraphs 6.25. to 6.25.8., to read:

"6.25. REAR-END COLLISION ALERT SIGNAL

6.25.1. Presence

Optional

The rear-end collision alert signal shall be given by the simultaneous operation of all the ~~stop~~ **direction indicator** lamps fitted as described in paragraph 6.25.7.

6.25.2. Number

As specified in paragraph ~~6.7.2.~~ ~~[~~**6.5.2** ~~or 6.7.2]~~

6.25.3. Arrangement

As specified in paragraph ~~6.7.3.~~ ~~[~~**6.5.3** ~~or 6.7.3]~~

6.25.4. Position

As specified in paragraph ~~6.7.4.~~ ~~[~~**6.5.4** ~~or 6.7.4]~~

6.25.5. Geometric visibility
As specified in paragraph ~~6.7.5.~~ [**6.5.5** ~~or 6.7.5~~]

6.25.6. Orientation
As specified in paragraph ~~6.7.6.~~ [**6.5.6** ~~or 6.7.6~~]

6.25.7. Electrical connections

6.25.7.1. All the lamps of the rear-end collision alert signal shall flash in phase at a frequency of 4.0 ± 1.0 Hz.

6.25.7.1.1. However, if any of the lamps of the rear end collision alert signal to the rear of the vehicle use filament light sources the frequency shall be 4.0 +0.0/-1.0 Hz.

6.25.7.2. The rear-end collision alert signal shall operate independently of other lamps.

6.25.7.3. The rear-end collision alert signal shall be activated and deactivated automatically.

6.25.7.4. The rear-end collision alert signal shall not be activated during the ESS activation.

6.25.7.5. **The rear-end collision alert signal shall not be activated where;**

**(a) the relative speed between leading and following vehicle is not more than 15km/h and**

**(b) the estimated time to collision (TTC) which is the time obtained by dividing distance by relative speed between following vehicle and leading vehicle is more than 1.4 seconds,**

**but it is allowed to be activated anytime when TTC is not more than 1.4 seconds, the actual value being defined by the vehicle manufacturer.**

**6.25.7.6. The rear-end collision alert signal shall not be activated when the following vehicle passes the forward vehicle.**

**6.25.7.7. The activation period of the rear-end collision alert signal shall be not more than 3 seconds.**

6.25.8. Tell-tale
Optional"

B. JUSTIFICATION

Background:
During the fifty-fifth and fifty-sixth GRE session, Japan submitted ECE/TRANS/WP.29/GRE/2006/23 and ECE/TRANS/WP.29/GRE/2006/57 proposing conditions for automatic activation of hazard warning signal. ECE/TRANS/WP.29/GRE/2006/23 is superseded by ECE/TRANS/WP.29/GRE/2006/57.

The reason why Japan has proposed to permit the alert signal for rear end collision using automatic hazard warning signal by ECE/TRANS/WP.29/GRE/2006/23 and ECE/TRANS/WP.29/GRE/2006/57 was that the hazard warning signal has been the most suitable under the current UNECE Regulation No. 48. Japan believes this device would contribute to road safety.
Japan reconsidered the proposed text and in order to simplify to understand and, for a better understanding, proposed the additional definition of the "alert signal", i.e. a device that provides alert to the driver of the following vehicle when there is a possibility that the following vehicle will collide with the leading vehicle. (Japan **submitted** this proposal to supersede ECE/TRANS/WP.29/GRE/2006/57 **at 58th session of GRE.)**

**During 58th session of GRE, some experts concerned about this proposal due to no criteria. Therefore, Japan decided the activation and deactivation criteria are clearly defined in this proposal.**

General:
Japan believes that it is important to update UNECE Regulations in order to reflect new vehicle safety technologies available. In Japan, a large number of accidents occur when the driver of the following vehicle is preoccupied and thus fails to check the timely status of the leading vehicle (including when the leading vehicle is stopped at an intersection) resulting in a rear-end collision with the leading vehicle. There are many similar accidents in Europe, too. **If the following vehicle is operated by the driver looking ahead but not concentrating ahead, the leading vehicle detects such a following vehicle and the rear-end collision alert signal to the driver of the following vehicle is activated automatically in advance,** then the driver of the following vehicle will be less likely to fail to recognize the leading vehicle and thus the number of rear-end collisions or the degree of injury may be reduced.

**Color and frequency of the signal:**
**Although Japan investigated each effect on the color between red and amber (next page), we could not see a significant difference. Thus,** Japan has found that the color of the lamp does not contribute to make the driver of the following vehicles, who is preoccupied, recognize the danger. **On the other hand, the rear end collision alert signal can be activated automatically by the vehicle distance detection without the brake pedal application. Therefore, amber color (i.e. all the direction indicator lamps) is suitable for the current road traffic use situation and custom.**

**Regarding the frequency of flashing, as well as ESS, unexpected high frequency flashing of rear lamps is more effective than normal direction indicator (hazard) signal.**

# Vehicle test of Rear-end Collision Alert Signal

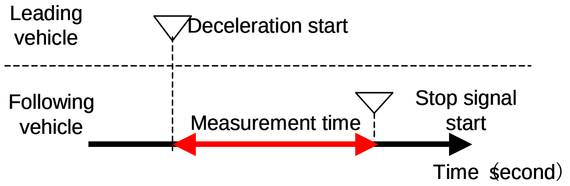
**[Test method]**

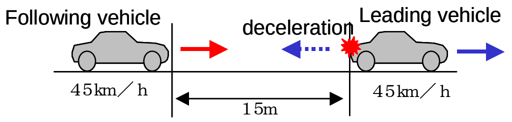
▶ Outline

Measuring the time delay between deceleration timing of leading vehicle and stop signal start time of following vehicle.

①Stop lamp ON ( In night time = tail lamp ON , In all time = stop lamp ON )

②Stop lamp OFF ( In night time = tail lamp ON )




| Test pattern |
|---|
| Deceleration by engine braking (without stop lamp lighting) |
| Deceleration by engine braking +4Hz Stop lamp |
| Deceleration by engine braking +4Hz Hazard lamp |

Driver's condition of following vehicle

▶・To simulate a drivers who are looking ahead but are not concentrated, the following vehicle's driver reads out the random number which is displayed in center cluster area.

Number of test

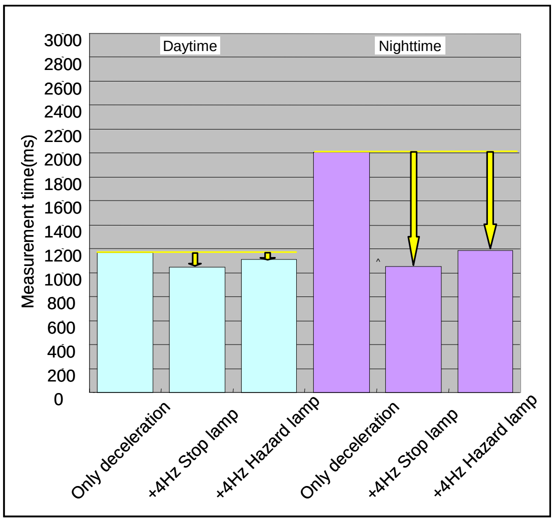
▶ 288 times=8 (persons)×3 (test pattern)×3(times/each pattern) ×2 (daytime & nighttime) ×2 (stop lamp ON and OFF)

*All test patterns were conducted in random condition to avoid the expected condition .

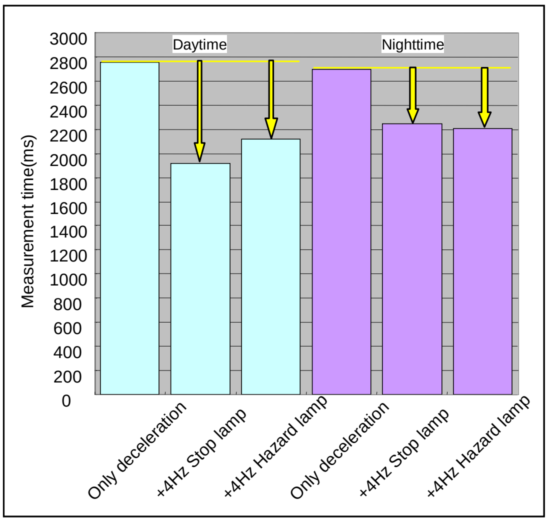
*All tests are conducted on the same day(Order:Daytime ⇒Nighttime).

## [Test Result ]

①Stop lamp On




②Stop lamp Off

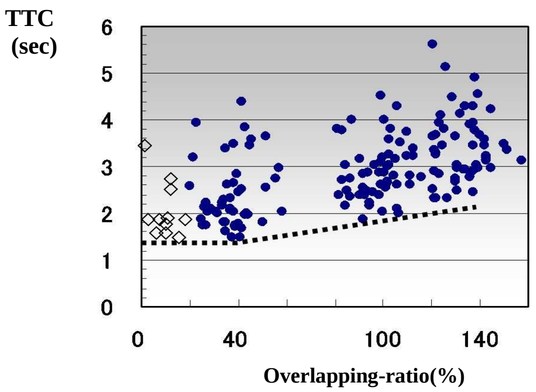


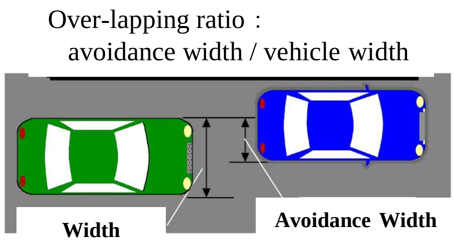

According to the test result, there is no significant difference between red and amber on the whole.

Specification:

**Para.6.25.7.5 - 6.25.7.7:**

**The intention of these requirements is the Rear-end collision alert signal would not activate at the area of ordinary driving operation. Under ordinary driving, the timing which Drivers begin steering for obstacle avoidance is as follows. (In Japan)**




#Other detail conditions: See ANNEX

**（Reference：The result of activity with regard to the 3rd ASV plan (2007.3)）**

**According to the above result, if the system is activated at TTC ≦ 1.4 s, you can find there is no influence to the ordinary driving operation, thus the rear-end collision alert signal does not make the unexpected effect to the road safety.**
**If there are frequent warning signal which are ignored by the driver of the following vehicle because they are too early to warn, the rear-end collision warning signal may lose driver's trust and it will fail to alert and/or annoy the driver of the following vehicle. This "distrust" and/or "annoyance" to the warning system needs to be reduced as much as possible, especially at the first introduction of such an "advanced signal" to the market.**
**Thus the activation of this warning signal permits within only the limited condition that there is no influence to the ordinary driving operation in consideration of the current technology.**

**Besides, this signal should not be activated under very low relative speed to avoid the annoying for driver in the following vehicle because it is more likely to be flashing under very low speed.**

**Para.6.25.8:**

**If avoidance action by braking is conducted when TTC is 1.4s, it takes around 3 seconds before the relative speed becomes 0km/h.**

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ANNEX

## 1. Method for Investigating the Timing Where Drivers Start Steering Operation to Avoid Collisions

Tests were conducted on a JARI test course, where the test vehicle was driven at a constant speed while approaching a stationary object (parked vehicle) or a moving object (vehicle travelling at low speed). The speed of the vehicle travelling at the constant speed was set at three levels of 30km/h, 60km/h, and 90km/h for approaching the stationary object and at three levels of 60km/h (relative speed of 30km/h) and 90km/h (relative speeds of 30km/h and 60km/h) for approaching the moving object. In addition, by varying the lateral position of the vehicle in front for each speed condition, three levels of offset amount (minimum amount of lateral change in position required to avoid a collision) in relation to the object in front were set.

As the driving pattern, the test subjects were instructed to avoid the object by steering the vehicle to its right side at the moment when they judge that the distance between their own vehicle and the vehicle in front has decreased to the point where it becomes dangerous (i.e., that they would not approach any further in usual driving). Amount of steering operation by the driver and vehicle state quantities at this time were measured, and the relationship between each avoidance condition and timing for starting collision-avoidance steering operation was analyzed.

### 1.1 Vehicles Used and Test Subjects

* Vehicles used: Regular passenger cars, 4-door sedan (two vehicles: test vehicle and vehicle in front)
* Test subjects: 16 male drivers (ages 23-59)

### 1.2 Test Conditions (see Table 1)

(1) Conditions for the stationary object (three levels)
- * Travelling speed (= relative speed): 30km/h, 60km/h, 90km/h

(2) Conditions for the moving object (three levels)
- * Relative speed of 30km/h (own vehicle at 60km/h and leading vehicle at 30km/h)
- * Relative speed of 30km/h (own vehicle at 90km/h and leading vehicle at 60km/h)
- * Relative speed of 60km/h (own vehicle at 90km/h and leading vehicle at 30km/h)

(3) Required avoidance (three levels for each of the above conditions in (1) and (2))
- * Over-lapping ratio: 40%, 100%, 140%

* Over-lapping ratio (%): The value obtained by dividing the amount of offset from the object by the width of the own vehicle. Since the actual over-lapping ratio at the start of collision-avoidance steering operation varies largely depending on the driving course and angle of approach, measurement results that came within ±20% of the set ratio were taken as effective data.

### 1.3 Measurement Items

(1) Measurement targets; The following state quantities were recorded by measuring instrument or camera installed on the test vehicle:

* Amount of operation by the driver: Steering angle, accelerator position, brake pedal application force
* Vehicle state quantities: Speed of own vehicle, lateral acceleration, yaw speed
* Object in front: Forward video images captured by CCD camera

(2) Calculation targets; From the images captured by CCD camera, the following evaluation targets on the object in front were calculated:

* Distance from vehicle in front: Calculated from the angle of view characteristics of the CCD camera
* Over-lapping ratio to vehicle in front: Calculated from the positional relation with the vehicle in front on the analysis screen
* Relative speed to vehicle in front: Calculated from changes in the vehicle distance per unit of time
* Estimated time to collision (TTC): The value obtained by dividing the distance from the vehicle in front by the relative speed

Table 1: Combinations of Test Conditions and Test Sequence

| No. | Group A | Group B |
|---|---|---|
| 1 | 100% 30km/h (Stationary) | 100% 90km /h (Stationary) |
| 2 | 100% 60km/h (Stationary) | 100% 60km /h (Stationary) |
| 3 | 100% 90km/h (Stationary) | 100% 30km /h (Stationary) |
| 4 | 40% 30km/h (Stationary) | 40% 90km /h (Stationary) |
| 5 | 40% 60km/h (Stationary) | 40% 60km /h (Stationary) |
| 6 | 40% 90km/h (Stationary) | 40% 30km /h (Stationary) |
| 7 | 140% 30km/h (Stationary) | 140% 90km /h (Stationary) |
| 8 | 140% 60km/h (Stationary) | 140% 60km /h (Stationary) |
| 9 | 140% 90km/h (Stationary) | 140% 30km /h (Stationary) |
| 10 | 100% 60km/h (30km/h) | 100% 90km/h (30km/h) |
| 11 | 100% 90km/h (60km/h) | 100% 90km/h (60km/h) |
| 12 | 100% 90km/h (30km/h) | 100% 60km/h (30km/h) |
| 13 | 40% 60km/h (30km/h) | 40% 90km/h (30km/h) |
| 14 | 40% 90km/h (60km/h) | 40% 90km/h (60km/h) |
| 15 | 40% 90km/h (30km/h) | 40% 60km/h (30km/h) |
| 16 | 140% 60km/h (30km/h) | 140% 90km/h (30km/h) |
| 17 | 140% 90km/h (60km/h) | 140% 90km/h (60km/h) |
| 18 | 140% 90km/h (30km/h) | 140% 60km/h (30km/h) |

* From left to right: Over-lapping ratio, speed of own vehicle, speed of leading vehicle