Driver's Abnormal Condition Response System (Pull-over Type)

Basic Design Document

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Road Transport Bureau,

Ministry of Land, Infrastructure,

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History

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1. Introduction

1.1 Positioning of Basic Design Document

This Basic Design Document provides for technical requirements to be met, matters to be taken into consideration, etc. when designing a pull-over type system to be used for a driver's abnormal condition response system.

1.2 Functions of Pull-over Type Driver's Abnormal Condition Response Systems

If a driver cannot continue driving safely due to a sudden change in physical condition, the driver's abnormal condition response system for pulling the vehicle over shall pull the vehicle over as closely to the road shoulder or edge as possible and stop the vehicle as an emergency measure on behalf of the driver.

Explanatory Note:

The driver's abnormal condition response system should not assume vehicle operation due to human error of a normal driver, but operate as an emergency measure in the event of a sudden change in the physical condition of the driver.

The system is aimed at preventing a vehicle runaway (uncontrolled situation) in the event of a sudden change in the physical condition of the driver, thus protecting the driver, passengers and others on the road from the danger of a vehicle crash.

A system that does not stop the vehicle is outside of the scope of this Basic Design Document. That is, a system based on the pretext that the vehicle eventually collided and stopped or that a passenger stopped the vehicle by operating the brake on behalf of the driver was excluded from the Basic Design Document.

A pull-over type driver's abnormal condition response system refers to a driver's abnormal condition response system that pulls the vehicle over as much as possible to the road shoulder or edge, while paying attention to the safety of other surrounding vehicles. In order to secure the safe evacuation of the passengers and shorten the rescue time, the system should allow the vehicle to continue traveling for a certain period of time, pull it over to the road shoulder or edge and stop it, if the requirements specified in this Basic Design Document are met.

By the way, if it is difficult to pull the vehicle over to the road shoulder or edge, the system should transition to "the function of decelerating and stopping the vehicle". In this case, the vehicle will eventually stop in the travel lane of the expressway, so it is desirable, once the safety of the vehicle is confirmed by the rescuer, to immediately cancel the system and move the vehicle to a road shoulder of sufficient width, an

emergency parking area or the like.

1.3 Scope

(1) Driver's abnormal conditions to be detected

The abnormal conditions to be detected shall be sudden changes in physical condition such as sudden cerebrovascular disease, heart disease, gastrointestinal disorder, fainting or other condition that is difficult to be predicted in advance by the driver.

Physical disorders or abnormal conditions due to drinking, inadequate management of one's physical condition, fatigue, illness, drugs, etc. that can be predicted beforehand are not considered within the scope of this application. However, such physical disorders or abnormal conditions should not be excluded.

Explanatory Note:

Article 65 of the Road Traffic Act provides that "No one shall drive a vehicle or the like under the influence of alcohol." Article 66 of the same act stipulates that "In addition to the case in paragraph 1 of the preceding article, no one shall drive a vehicle or the like in a condition where normal driving may not be possible due to overwork, illness, medical effect or other reasons."

A driver is required to properly manage his/her physical condition on his/her own, and it is predicated that a driver himself/herself adjusts his/her physical condition before driving.

Since it is technically difficult to determine the difference between physical disorders or abnormal conditions that can be predicted beforehand and sudden changes in physical conditions that are difficult to be predicted in advance, the following text is added: "However, such physical disorders or abnormal conditions should not be excluded".

(2) Target vehicles

This system applies to vehicles (excluding motorcycles) that are allowed to drive on expressways.

Explanatory Note:

Expressways in this Basic Design Document refer to expressways and highways restricted to vehicular traffic (defined in Article 1.4).

(3) Target roads

This system applies to expressways.

Explanatory Note:

This Basic Design Document is a summary of technical requirements and matters to be taken into consideration for pull-over type driver's abnormal condition response systems that are expected to be put into practical use on expressways before on general roads. Therefore, the vehicles that are not permitted to travel on expressways are outside the scope of application.

Also, motorcycles (including bicycles with motors) are outside the scope of application because the system may not function effectively if the motorcycle falls over.

1.4 Definition of Terms

(1) Driver's abnormal condition

A sudden change in one's physical condition that is difficult to predict in advance. The driver's abnormal conditions do not include physical disorders or abnormal conditions that can be predicted in advance.

(2) Driver's abnormal condition response system

A system capable of detecting abnormal conditions of the driver and stopping the vehicle on behalf of the driver.

(3) Driver's abnormal condition response system of deceleration stop type

A control system that decelerates the vehicle speed and stops the vehicle if a driver's abnormal condition is detected. This includes systems equipped with a steering control function in order to prevent lane departure or deviation from the road.

Explanatory Note:

A driver's abnormal condition response system of deceleration stop type does not include steering control for the purpose of changing lanes, stopping on a road shoulder or the like. In addition, this system does not always judge whether or not it is a suitable place for stopping.

For technical requirements and matters to be taken into consideration for driver's abnormal condition response system of deceleration type, refer to the "Driver's Abnormal Condition Response System (Deceleration Stop Type) Basic Design

Document".

(4) Pull-over type driver's abnormal condition response system (hereinafter referred to as the "System")
This system decelerates the vehicle speed, pulls the vehicle over as closely as possible to the road shoulder or edge and stops the vehicle if a driver's abnormal condition is detected.

(5) Control
The act of the System automatically adjusting the movement of the vehicle by speed adjustment only, steering only or both speed adjustment and steering.

(6) Passenger
An occupant (including crews and passengers) other than the driver.

Explanatory Note:
In the System, passengers of private vehicles are not distinguished from passengers of commercial vehicles; they are simply treated as passengers.

(7) Lane change
The act of crossing the lane boundary line from the current travel lane and moving the vehicle to the adjacent left lane.

(8) Pulling over to a shoulder
The act of crossing the road outside line from the current travel lane and moving the vehicle over to a road shoulder, emergency parking area or the like.

(9) Course change
The act of crossing the lane boundary line from the current travel lane and moving the vehicle to the adjacent left lane, or the act of crossing the lane boundary line from the current travel lane and moving the vehicle over to a road shoulder, emergency parking area or the like.

(10) Lateral direction
The direction perpendicular to the lane boundary.

(11) Expressway
Expressways and highways restricted to vehicular traffic.

(12) Road edge
The left-side road shoulder, road side strip, emergency parking bay or left road edge.

(13) Passenger pushbutton type
With this type of system, the System detects driver's abnormal condition by a passenger pushing the activation switch. "Pushbutton" means all types of switches including but not limited to buttons pushed with a finger.

(14) Driver pushbutton type
With this type of system, the System detects driver's abnormal condition by the driver pushing the activation switch. "Pushbutton" means all types of switches including but not limited to the buttons pushed with a finger.

(15) Abnormal condition automatic detection type
With this type of system, driver's abnormal condition shall be detected by the System for automatically detecting the driver's abnormal conditions.

(16) System for automatically detecting the driver's abnormal conditions
A system capable of inferring the occurrence of a driver's abnormal condition using sensors, etc.

(17) Main switch
This switch that turns on and off the functioning of the System.

(18) Activation
The act of activating an alarm or control function.

(19) Activation switch
A switch that generates a trigger signal that activates an alarm or control function. The pushbutton in a passenger pushbutton type system or driver pushbutton type system equates to an activation switch.

(20) Cancellation switch
A switch for the driver to stop the alarm or control function.

(21) Alarm
Making the status of the System known to the persons affected by the control function of the System visually, audibly, by the sense of touch (vibration of the steering wheel, etc.) or by the sensation of slow speed or deceleration.

Explanatory Note:
Weak braking is experienced as slow speed or deceleration by drivers and passengers.

(22) Road users outside the vehicle
Persons around a vehicle equipped with the System, including drivers of four-wheel vehicles and motorcyclists.

Explanatory Note:
This Basic Design Document applies to expressways. Therefore, pedestrians and cyclists are not included but drivers and passengers who have evacuated to the road shoulder due to vehicle malfunction and workers who are working on road construction are included in the road users outside the vehicle.

(23) Activation start alarm
This alarm makes known to the driver and passenger who pushed the activation switch that the System has been activated and urges the driver to push the cancellation switch if the control function is not necessary.

(24) Reminder alarm
This alarm alerts the passengers and road users outside the vehicle that the control function will start after the lapse of a certain period of time.

(25) Control activation alarm
This alarm makes known to the driver, passengers and road users outside the vehicle that the control function is active (including when the vehicle is kept stopped due to the control activation).

(26) Override

Override means that the driver or passenger takes over control of the braking, driving or steering from the System.

2. Overview of the Functions

2.1 Functions of the System

The System shall consist of the following functions.

・”Function of detecting a driver’s abnormal condition”
・”Function of pulling the vehicle over to a road shoulder or the like”
・”Function of issuing an alarm concerning the condition of the system”

The “function of detecting a driver’s abnormal condition” shall be of the following types.

・Abnormal condition automatic detection type
・Driver pushbutton type
・Passenger pushbutton type

In this System, these functions shall be used independently or in combination with one another.

The “function of pulling the vehicle over to a road shoulder or the like” shall encompass the following.

・Function of keeping the vehicle inside the lane
・Function of changing the lane of the vehicle
・Function of bringing the vehicle close to the road edge
・Function of decelerating and stopping the vehicle

The “function of issuing an alarm concerning the condition of the system” shall have the following alarms.

・Alarm to the driver
・Alarm to the passengers
・Alarm to the road users outside the vehicle

Explanatory Note:

If a driver suddenly becomes unfit to drive while driving in a travel lane and the control function is activated, the System should confirm the safety of the left lane and change the driving lane of the vehicle. After that, the System should keep the vehicle moving while searching for a stoppable area such as a road shoulder, and, after confirming safety, pull the vehicle over to the road shoulder or edge.

On some highways, there are sections without a road shoulder. In such a case, it is considered safer to bring the vehicle close to the left side of the road and stop there, therefore, the System should pull the vehicle over to the left side of the first travel lane.

If there is a road shoulder but it is narrower than the vehicle width, the System should stop the vehicle near the left side of the road shoulder out of similar consideration for safety.

The System is envisioned as having multiple functions that operate in conjunction with one another. For example, regarding the function of pulling the vehicle over to a road shoulder or the like in addition to the System with all of the functions shown in Fig. 1, there could be a System that, if activated while the vehicle travels in the 1st driving lane, brings the vehicle to the road shoulder and stops it using the "function of bringing the vehicle close to the road edge", but if activated while traveling in another lane, stops the vehicle in the road using the "function of decelerating and stopping the vehicle". Or, there could be a System that uses both abnormal condition automatic detection and passenger pushbutton activation for the "function of detecting a driver's abnormal condition".

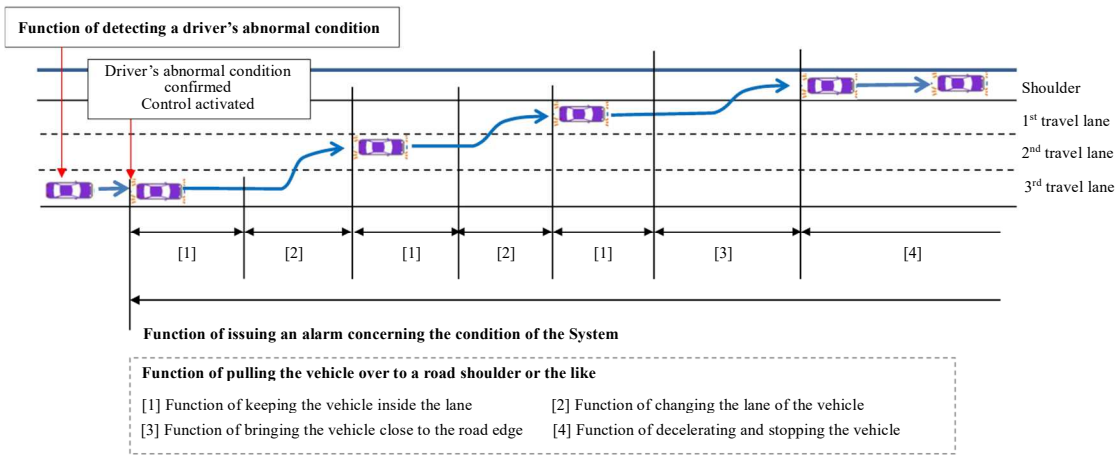

Fig. 1 Functions of a Pull-over Type Driver's Abnormal Condition Response System

Explanatory Note:

Figure 2 shows the structure of this Basic Design Document.

Fig. 2 Structure of this Basic Design Document

2.1.1 Main Switch

Manufacturers may add a main switch that drivers can use to turn on or off the functioning of the System. If a main switch is added, the System (main switch) shall turn on when the motor is started.

Explanatory Note:

The System should be designed to be turned on or off by the driver's intention, like other driving support systems.

"When the motor is started" means "when the vehicle is ready for driving", implying "when the engine is started", "when the motor system for driving an electric vehicle is started" and so on.

Consideration should be shown to the operation procedure and design of the location where the main switch is installed, to prevent it from being accidentally turned off by misoperation. Examples of the operation procedure include holding down the switch or pressing the switch twice.

2.2 Function of Detecting a Driver's Abnormal Condition

The function of detecting a driver's abnormal condition shall consist of abnormal condition automatic detection type, driver pushbutton type and passenger pushbutton type. These shall be used independently or in combination with each other.

2.2.1 Abnormal Condition Automatic Detection Type

With this type of system, the System shall automatically detect the driver's abnormal conditions. The abnormal condition can be detected by vehicle behavior, by driving behavior or by the driver's condition. An abnormal condition detected by driving behavior shall be inferred from wavering, runaway, contact, etc. An abnormal condition detected by driving behavior shall be deduced by detecting driving operation inputs that are not made under normal operation. An abnormal condition detected by the driver's condition shall be inferred from driving posture, facial expressions (coma, etc.), biological signals (heart rate, pulse, changes in body temperature, etc.), operations not being made for a certain period of time, etc.

Explanatory Note:

Technical requirements and matters to be taken into consideration for a system that infers a driver's abnormal condition from a slouched posture, closed eyes, an unoperated steering wheel or other detectable items are summarized in the "Basic Design Document: System for Automatically Detecting the Driver's Abnormal Conditions". Refer to both that document and this Basic Design Document to develop and design systems that automatically detect driver abnormalities from such detectable items.

2.2.2 Driver Pushbutton Type

With this type of system, the System detects driver's abnormal condition by the driver pushing the activation switch.

Explanatory Note:

This type of system imagines a scenario in which the driver is gradually losing consciousness and, sensing that something is physically wrong with oneself, pushes the activation switch. It should also cover the possibility of the driver being unable to operate the activation switch if he/she suddenly loses consciousness.

2.2.3 Passenger Pushbutton Type

With this type of system, the System detects driver's abnormal condition by a passenger who notices the driver's abnormal condition and pushes the activation switch.

Explanatory Note:

In a situation where the driver is unable to push the activation switch on his/her own accord, the response from this type of system is activated by a passenger who notices the driver's abnormal condition and pushes the activation switch. With the exception of motorcycles, this type of system can be applied to all types of vehicles including buses, personal cars, taxis, etc.

2.3 Function of Pulling the Vehicle over to a Road Shoulder or the Like

This is a general term for the function where the System stops the vehicle by bringing the vehicle as close as possible to the road shoulder or edge after the driver's abnormal condition is detected by the "function of detecting a driver's abnormal condition". This function shall consist of functions for "keeping the vehicle inside the lane", "changing the lane of the vehicle", "bringing the vehicle close to the road edge" and "decelerating and stopping the vehicle".

2.3.1 Control Start Timing

After an abnormal condition is detected in the driver, the control function shall activate if there is no response from the driver for a certain period of time (in principle, at least 3.2 seconds). However, this time may not be set for cases where the driver pushes the activation switch.

Explanatory Note:

As a consideration for the System incorrectly detecting the driver's condition as abnormal, it was decided that control should activate only if there is no response from the driver within a set amount of time from when his/her abnormal condition was detected, as this would verify the driver to be incapacitated. If the driver is feeling normal, he/she can cancel system activation by pushing the cancellation switch in response to the activation start alarm (see 2.4.1.1).

In principle, this set amount of time should be no less than the 3.2 seconds needed to respond to the alarm as defined in the 4th ASV Promotion Plan, and should be set in consideration of how quickly the driver can react to the alarm and push the cancellation switch under various driving scenarios. This period of time may also be changed according to driving scenario.

Moreover, this period of time may be shortened if driver training enables the driver to assuredly push the cancellation switch in less than 3.2 seconds.

With passenger pushbutton type systems and abnormal condition automatic detection type systems, this period of time must be set so that the driver can cancel control before it activates, in the event that a passenger pushes the activation switch by mistake or the system incorrectly detects the driver's condition as abnormal.

With driver pushbutton type systems, it is completely arbitrary whether to set this period of time or not because the driver him/herself intentionally pushes the activation switch and it is unnecessary to consider incorrect detection. Nevertheless, this period of time may be set with this type of system since drivers could accidentally push the activation switch.

2.3.2 Function of Keeping the Vehicle Inside the Lane

This function shall be used to keep the vehicle in its lane in preparation for changing lanes while the System is active.

2.3.2.1 Method for Keeping the Vehicle Inside the Lane

(1) Speed

In order to minimize damage to the surroundings caused by a collision, the vehicle speed shall be adjusted to an appropriate level while keeping the vehicle inside the travel lane.

While the function that keeps the vehicle inside the lane is active, the upper limit of the speed shall be 50 km/h. If the speed when the System activates the control function exceeds 50 km/h, the speed shall be decreased

to 50 km/h.

However, this upper limit speed may be disregarded if the same degree of safety as driving inside the lane at this speed limit is ensured.

The speed stipulated in this provision can be regarded as the value instructed by the System.

Explanatory Note:

The System must keep the vehicle in its lane in place of the driver when he/she cannot drive safely. The upper limit speed in such case was set to 50 km/h for the following reasons, using as a reference therefor the minimum speed set for unmarked sections of expressways and highways where outbound and inbound lanes are structurally detached.

- To minimize damage to the surroundings in the event of a collision
- To allow nearby vehicles to take evasive maneuvers to avoid collision with a vehicle in which the System is active
- To enable the vehicle in which the System is active to change lanes

However, this 50 km/h speed limit may be disregarded if future technologies provide other solutions that adequately meet the above considerations.

Though it is required to adjust the vehicle to an appropriate speed not above 50 km/h, it is permitted for the indicated speed to momentarily exceed this upper limit speed as that could happen on downhills, wet surfaces and other road conditions.

(2) Deceleration

The deceleration while traveling within the lane due to braking by the System shall be, in principle, 2.45 m/s^2 (4.00 m/s^2 in the case of motor vehicles used exclusively for transporting passengers with a passenger capacity of less than 10 persons) or less. In the case of motor vehicles such as a bus in which there are passengers in the standing space, the deceleration shall be set in consideration that passengers may fall down.

Explanatory Note:

It is required for the vehicle to slow down while traveling within its lane based on the fundamental concept of preventing accidents and minimizing the damage effect to the greatest extent possible, espoused in the ASV policy of “safety first”. As a consideration against rear-end collision by trailing vehicles, the maximum deceleration is set to the 2.45 m/s^2 (4.00 m/s^2 for motor vehicle) approved in technical

guidelines for Adaptive Cruise Control (ACC) with brake control. For regular route buses and other vehicles in which passengers may be standing, deceleration must be set in consideration of the passengers possibly falling down.

The control method required in this provision and other requirements like the alarm stipulated for road users outside the vehicle in 2.4.3 should be socially accepted because technological measures are used to reduce the risk of secondary accidents.

2.3.2.2 Interruption of the Function That Keeps the Vehicle Inside the Lane

(1) If it becomes difficult to keep the vehicle inside the lane, the System shall transition to the "function of decelerating and stopping the vehicle".

(2) Once the vehicle stops, the provisions in 2.3.5.2 for the "function of decelerating and stopping the vehicle" shall apply and the vehicle shall not be restarted.

Explanatory Note:

Two examples of the vehicle having difficulty staying in its lane are the camera used to detect the situation in front of the vehicle not being able to detect the lane, and performance limits such as the lane keeping assist system not working on sharp curves.

2.3.3 Function of Changing the Lane of the Vehicle

This function shall move the vehicle to the adjacent left lane on behalf of the driver while the vehicle is traveling in a lane such as a passing lane that is not adjacent to the road shoulder or the like.

2.3.3.1 Method for Changing Lanes

The lateral speed during lane changes controlled by the System shall be 0.25 m/s (0.4 m/s in the case of motor vehicles used exclusively for transporting passengers with a passenger capacity of less than 10 persons) or less. However, this speed limit may be disregarded if due consideration is given so that nearby vehicles can take evasive maneuvers to avoid collision with a vehicle in which the System is active.

Also, the vehicle shall not be moved to the adjacent right lane.

Explanatory Note:

The lateral speed for changing lanes was set lower than that used in ordinary lane changes so that other vehicles, and especially motorcycles, traveling in the targeted lane or behind the vehicle with the System active can recognize that the vehicle is changing lanes and avoid a collision. For the time ordinarily required for a vehicle to change lanes, reference was made to the study by the informal working group on Automatically Commanded Steering Function (ACSF) that is working on amendments to international standards on steering control (UN R79). (For passenger cars, the lateral speed is set to 0.4 m/s, as it takes a vehicle of an assumed width of 2 m 5 seconds to fully change lanes from when the front left tire begins crossing into the new lane until all tires fully cross into the new lane. For trucks, it is set to 0.25 m/s as a 2.5 m wide truck takes 10 seconds to similarly change lanes.)

2.3.3.2 Matters to Be Taken into Consideration When Changing Lanes

The following items shall be considered in order to avoid accidents such as collisions with other vehicles that are traveling ahead, behind or next to a vehicle in which this System is active, while the subject vehicle is changing lanes.

(1) If a collision with a leading vehicle is predicted, the System shall not start changing lanes. Before initiating the lane change, the System shall confirm in the very least whether the leading vehicle is stopped (0 km/h) or decelerating rapidly at 6 m/s^2. In this case, a "leading vehicle" means a vehicle that is traveling ahead of the vehicle in which this System is active, in the lane to which the subject vehicle will change.

Explanatory Note:

This provision takes into consideration that a leading vehicle may be stopped or may suddenly decelerate due to traffic congestion or other reason that causes the Advanced Emergency Braking System (AEBS) of the subject vehicle to activate.

(2) If a collision with a trailing vehicle is predicted, the System shall not start changing lanes. Before initiating the lane change, the System shall confirm in the very least all of following behaviors of the trailing vehicle. In this case, a "trailing vehicle" means a vehicle that is traveling behind the vehicle in which this System is active, in the lane to which the subject vehicle will change.

- The speed when the turn signal starts blinking should be the

actual vehicle speed or the highest speed marked for the road by a sign or indicator, whichever is lower.

- The time from when the driver of the trailing vehicle detects the lane change operation (moving in the lateral direction with the turn signal blinking) of the vehicle with the System activated to when he/she starts decelerating should be at least 1.4 seconds. During these 1.4 seconds, the vehicle with this System activated shall run at a constant speed as indicated above.
- After the driver of the trailing vehicle detects the lane change operation of the vehicle with the System activated, he/she should start decelerating and decelerate at 3 m/s^2.

Explanatory Note:

This provision was examined on the pretext of the trailing vehicle noticing the "alarm to the road users outside the vehicle" (2.4.3) and decelerating.

The following 3 points were referenced in determining the time from when the driver of the trailing vehicle notices the vehicle with the active System changing lanes (moving laterally with the turn signal blinking) to when he/she starts decelerating. The time was then based on (2) and (3).

(1) A minimum of 3 seconds for the vehicle that is trying to change lanes to flash its turn signal (According to the Enforcement Ordinance of the Road Traffic Act, turn signals should be flashed a minimum of 3 seconds within the current travel lane before starting to move laterally.)

(2) A minimum of 1 second from when the vehicle that is trying to change lanes and flashing its turn signal started to move laterally within the current travel lane until the moment just before the front left tire starts to cross the lane boundary line (Referenced from discussions of the ACSF)

(3) 0.4 seconds from when the front left tire of the vehicle that is trying to change lanes starts to cross the lane boundary line until the driver of the trailing vehicle starts decelerating (Referenced from discussions of the ACSF)

The deceleration rate was referenced from Category C (Automatic lane changes initiated by the driver operating the turn signal) provisions of the ACSF.

The following example explains how the distance required by the System to detect a trailing vehicle and judge whether or not it can change lanes is calculated along the train of thought of the ACSF.

One thinkable scenario would be the vehicle with the System active traveling at 50 km/h under the "function of keeping the vehicle inside lane" (2.3.2) and the trailing

vehicle traveling at 100 km/h.

A) The relative speed of the vehicle with the active System is 50 km/h, as the trailing vehicle approaches. If, as given in (3) above, 0.4 seconds elapse from when the front left tire of the vehicle with the active System starts to cross the lane boundary line until the driver of the trailing vehicle starts decelerating, the trailing vehicle closes the distance by 5.6 m.

B) In the time it takes the trailing vehicle to decelerate from 100 km/h to 50 km/h at a rate of 3 m/s^2, the trailing vehicle closes the distance by 32.1 m.

C) If the trailing vehicle is 1 second away from the vehicle with the active System when it stops decelerating, the distance between the two vehicles is 13.9 m. If there are 0 seconds, the two vehicles collide.

If the sum of A, B and C above (5.6 m + 32.1 m + 13.9 m = 51.6m) yields the 1 second inter-vehicular time of C, it can be considered the minimum distance required by the System to detect the trailing vehicle and judge whether or not it can change lanes.

It is equally thinkable to design the System to not change lanes on expressways if vehicle performance does not ensure the detection distance required by the marked maximum speed. A functional limitation of the sort must be made known to drivers and others in advance.

As reference information, Category C from the ACSF stipulates a minimum detection distance of 55 m from the trailing vehicle. At current technological levels, it is adopted as the distance at which trailing vehicles, including motorcycles, can be detected.

(3) In expressway sections where MAINTAIN PRESENT LANE is indicated, the System shall not change lanes. However, it is allowed to start the lane change if an emergency vehicle approaches or it is necessary to change the lane to avoid road damage, road construction or other obstruction.

(4) If the vehicle is expected to enter a special lane closure zone due to construction, the System shall not start the lane change.

2.3.3.3 Interruption of the Function of Changing the Lane of the Vehicle

(1) If an event corresponding to the matters to be taken into consideration in the provision 2.3.3.2 occurred after the start of the lane change, the System shall transition to “the function of decelerating and

stopping the vehicle".

(2) Once the vehicle stops, the provisions in 2.3.5.2 for the "function of decelerating and stopping the vehicle" shall apply and the vehicle shall not be restarted.

2.3.4 Function of Bringing the Vehicle Close to the Road Edge

This function shall bring the vehicle from the lane adjacent to the road edge to the road shoulder or edge.

2.3.4.1 Method for Bringing the Vehicle Close to the Road Edge

(1) Speed

The System shall keep the vehicle in the lane adjacent to the road edge and reduce the speed to 10 km/h or less.

Explanatory Note:

As a preparation for the unexpected, the speed should be reduced to a level that enables the vehicle to stop in an instant.

(2) Braking method

The deceleration due to braking by the System shall be 2.45 m/s^2 (4.00 m/s^2 in the case of motor vehicles used exclusively for transporting passengers with a passenger capacity of less than 10 persons) or less. In the case of motor vehicles such as a bus in which there are passengers in the standing space, the deceleration shall be set in consideration that passengers may fall down.

Explanatory Note:

Same as (2) in 2.3.2.1.

(3) Method for bringing the vehicle close to the road edge

After reducing the speed to 10 km/h, the vehicle shall be brought close to the road shoulder or edge, but shall secure adequate space between the vehicle once stopped and any road infrastructure, such as a side wall for the passengers to evacuate.

Explanatory Note:

A specific number is not stipulated since road shoulders can vary in width or not even exist depending on where the vehicle stops, but consideration must be shown to how the vehicle is brought to the road edge and stopped because, if stopped, for example, against a side wall, passengers could have a hard time evacuating and rescuers like the police and fire department might have trouble getting inside the vehicle.

Also, to shorten the stopping distance, it is acceptable to reduce the speed while bringing the vehicle to the road edge, but the provisions in (2) apply to that as well.

2.3.4.2 Matters to Be Taken into Consideration When Bringing the Vehicle Close to the Road Edge

(1) If a collision with a vehicle (including a motorcycle) that is stopped at the road shoulder or edge or a person is predicted, the function of bringing the vehicle close to the road edge shall not start.

(2) If entering into a junction area or a construction zone is predicted, the function of bringing the vehicle close the road edge shall not start.

Explanatory Note:

"Person" in (1) means drivers and passengers who have evacuated to the road shoulder due to vehicle malfunction and workers who are working on road construction, etc.

Special considerations for vehicles approaching from behind on the road shoulder or road side strip are not needed because the Road Traffic Act does not permit driving on the road shoulder or road side strip and, during the time from when the control function activates until the vehicle is pulled over to the road edge, the System issues an alarm to road users outside the vehicle and slows the vehicle down to 10 km/h. However, consideration may be shown for vehicles approaching from behind on the road shoulder or road side strip, if the vehicles can be detected.

2.3.4.3 Transition from the Function of Bringing the Vehicle Close to the Road Edge

(1) If an event corresponding to the matters to be taken into consideration in the provision 2.3.4.2 occurs, transition to the "function of decelerating and stopping the vehicle" is allowed.

(2) Once the vehicle stops, the provisions in 2.3.5.2 for the "function of

decelerating and stopping the vehicle" shall apply and the vehicle shall not be restarted.

Explanatory Note:

The general consensus is that pulling the vehicle over to the road shoulder or edge is safer than remaining in the travel lane, but if road work is underway along a lengthy distance of the road edge, it might be safer to transition to the "function of decelerating and stopping the vehicle" than trying to pass this section of road before pulling over to the road edge. Therefore, it is permitted to transition to this function.

2.3.5 Function of Decelerating and Stopping the Vehicle

This function shall decelerate and stop the vehicle.

2.3.5.1 Braking Method

The deceleration due to braking by the System shall be 2.45 m/s^2 (4.00 m/s^2 in the case of motor vehicles used exclusively for transporting passengers with a passenger capacity of less than 10 persons) or less. In the case of motor vehicles such as a bus in which there are passengers in the standing space, the deceleration shall be set in consideration that passengers may fall down.

Explanatory Note:

Same as in (2) of 2.3.2.1.

The effectiveness of gradually applying the brakes is not shared at present as driving simulations done by the National Traffic Safety and Environment Laboratory showed the distance from trailing vehicles to sometimes shorten.

2.3.5.2 Keeping the Vehicle Stopped

The vehicle shall remain stopped until the control function of the System is canceled.

Explanatory Note:

If the vehicle stops because of traffic congestion or some other reason after the System has activated the control function, the vehicle should remain stopped until the control function is cancelled.

2.3.5.3 Steering Assistance

The System may steer the vehicle, in place of the driver, to avoid stopped vehicles that are straddling two lanes or to maintain the vehicle's course until bringing the vehicle to a stop.

Explanatory Note:

Because the System could imaginably transition to the "function of decelerating and stopping the vehicle" to preempt a course change, it is permitted for the System to also steer the vehicle around stopped vehicles that are straddling two lanes or to maintain the vehicle's course.

2.3.6 Override during Control

(1) Accelerator operation

The accelerator shall not respond to driver operation while the control function is being executed.

Explanatory Note:

Analyses * of accidents stemming from driver's abnormal condition have identified cases where accidents have thinkably been caused by the driver losing his/her posture and unconsciously pressing the accelerator, therefore accelerator operation should be disabled while the control function is active.

* "Study of Traffic Accidents Due to Seizure or Sudden Illness of Drivers of 4-Wheel Vehicles" by the Institute for Traffic Accident Research and Data Analysis

(2) Brake operation

If the braking force generated by the driver's operation of the brakes is greater than the braking force of the System, the braking operation by the driver shall be prioritized.

Explanatory Note:

It is thinkable that a driver, even while semiconscious, could try to stop the vehicle to avoid colliding with an obstacle, therefore the driver should be able to override System control with regard to braking.

(3) Steering wheel operation

Only steering wheel operations that can be judged as deliberate may be allowed to override System control.

Explanatory Note:

Steering wheel override would be effective if a semiconscious driver or a passenger acting on behalf of the driver were to deliberately steer the vehicle to avoid a collision, but it would be ineffective if the vehicle were veering off the road because the driver were slumped over the steering wheel, etc.

Possible ways for judging whether steering operations are intentional or not include detecting the driver's posture with a cab camera or detecting the steering operation as a maneuver for avoiding a known obstacle in front of the vehicle.

Nevertheless, future technological advancements with steer-by-wire systems that control steering by converting the angle of the steering wheel into electrical signals may allow the System to override the steering wheel in situations where the System accurately detects the driver to be impaired and the steer-by-wire system operates correctly.

2.3.7 Time Constraints

The maximum amount of time that may elapse from when System control activates until the vehicle stops shall be 180 seconds. However, to avoid stopping the vehicle in a point of merging traffic, the System may exceed that limit by the amount of time needed to pass that section of road.

Explanatory Note:

The System is premised on providing an emergency response to a driver who has suddenly become impaired by an abnormal condition. Moreover, it would better serve the police, fire department and others providing assistance that the vehicle be stopped before attempting rescue, therefore a limit is placed on the amount of time that may elapse from when System control activates until the vehicle is pulled over and stopped on the road shoulder or edge.

However, points where traffic merges along expressways are not suited for evacuation because of the danger of being struck by merging vehicles. Accordingly, it is necessary to avoid stopping the vehicle in merging traffic. In this case, it is permitted to extend the time constraint by the amount of time needed to avoid that section of highway, but no more than that.

The thinking behind the 180 second time limit is explained here below.

Exit signs along expressways are often installed 2 km prior to the indicated exit. This distance is considered sufficient for a vehicle traveling in the passing lane to

change course and slow down to a suitable speed for exiting the roadway. So, 2 km should grant the System enough time from when the control function activates to change course from the passing lane and ultimately pull over and stop the vehicle on the road shoulder or edge. Moreover, given that the minimum speed on unmarked sections of expressways and highways where outbound and inbound lanes are structurally detached is 50 km/h, slowing the vehicle to the 50 km/h maximum speed of the "function of keeping the vehicle in its lane" after System control activates would be similar to decelerating the vehicle to a suitable speed for exiting the roadway within 2 km.

Based on the foregoing rational

(1) Time required for a vehicle to travel 2 km at 50 km/h: 144 seconds

(2) Time required for a vehicle to decelerate from 50 km/h to 10 km/h at a rate of 0.5 m/s^2 (approximate rate of natural deceleration by engine brake, etc.): 23 seconds

(3) Time required for a vehicle to decelerate from 10 km/h to 0 km/h at a rate of 0.5 m/s^2: 6 seconds

Nonetheless, the travel time in (1) will be shorter if the vehicle is traveling faster than 50 km/h when System control activates, which means that the speed at the moment the control function activates could be anything, so the foregoing calculations give the most amount of travel time for a vehicle traveling at a constant 50 km/h.

Together, the above (1) to (3) add up to 173 seconds, which is then rounded up one digit to 180 seconds.

On an expressway with 3 lanes running in each direction, the shortest amount of time for a car traveling in the far-right passing lane to pull over and stop on the road shoulder would be 87 seconds if it was going 110 km/h (maximum speed currently under testing in select sections of expressways) when the System activated the control function and then decelerated at 0.5 m/s^2. For a truck, it would be 102 seconds. So, in both cases, the numbers are well within the required 180 seconds.

Note that this 2 km distance was used hypothetically to calculate the time required for a vehicle to come to a complete stop from the moment System control kicks in; it is not intended to place restrictions on travel distance.

2.3.8 Transition Condition to the Function of Decelerating and Stopping the Vehicle

The System shall transition to the "function of decelerating and stopping the vehicle" if the following situations are detected.

(1) If the Advanced Emergency Braking System (AEBS) activates.

Explanatory Note:

An AEBS is designed to activate if another vehicle cuts right in front of the subject vehicle and other situations where the driver is unprepared to stop, therefore it is better not to continue traveling in this case.

(2) If it is expected to exceed the restriction placed on travel time.

(3) If steering wheel operation is detected. However, this shall not apply to cases where steering wheel operation is judged to be intentional.

(4) If the System judges it inopportune to execute or continue the functions of "keeping the vehicle inside the lane", "changing the lane of the vehicle" or "bringing the vehicle close to the road edge", in addition to the provisions stipulated in 2.3.2.2, 2.3.3.3 and 2.3.4.3.

2.3.9 Other Matters to Be Taken into Consideration Concerning the Function of Pulling a Vehicle over to a Road Shoulder or the Like

(1) Even when the System changes lanes or course based on the conditions stipulated in 2.3, unpredictable collisions are possible when pulling the vehicle over to the road shoulder or edge, therefore considerations that enable the System to avoid these collisions or minimize the damage in the event thereof are desired.

(2) It is permitted for the System to work in conjunction with emergency response and other information systems and services in order to avoid secondary damage from collisions with road users outside the vehicle, more quickly assist passengers to safety and saves the lives of drivers who cannot drive safely because of a sudden change in their physical condition.

Explanatory Note:

It is preferable for AEBS and other assist systems to be used in conjunction with the System because of the possibility of hitting drivers and passengers who have evacuated to the road shoulder due to vehicle malfunction, workers who are working on road construction, or fallen or dropped obstacles that the System has difficulty

detecting if placed on the road shoulder.

The System serves to ensure the safety of passengers and avoid secondary accidents like hitting road users outside the vehicle by providing an emergency response to a driver who has suddenly become impaired by an abnormal condition, but linking to information systems and road infrastructure is expected to enhance safety more than what can be achieved with the vehicle alone.

2.4 Function of Issuing an Alarm Concerning the Condition of the System

Alarms shall be issued to the driver, passengers and road users outside the vehicle. Alarms shall include a activation start alarm, reminder alarm and control activation alarm.

Explanatory Note:

The purpose of issuing an alarm to the driver is to avert the accidental activation of the System's control function when he/she is feeling fine.

The alarm issued to the passengers serves to alert them to an emergency and urge them to take action to protect themselves (grab a strap or railing on a bus, sit down, check one's seatbelt, etc.).

The aim of the alarm issued to road users outside the vehicle is to warn them of an emergency and prompt them to keep away from the vehicle where the System has been activated.

2.4.1 Alarm to the Driver

2.4.1.1 Activation Start Alarm

The activation start alarm shall trigger when the driver's condition is detected as abnormal, and shall end either the moment the System is cancelled or the control activation alarm triggers.

The activation start alarm shall be visually notified, as well as additionally by one or more means whether audibly, by the sense of touch or the sensation of slow speed or deceleration.

The activation start alarm is arbitrary when the driver pushes the activation switch.

Explanatory Note:

If the driver is feeling fine, he/she should be able to prevent the System from activating the control function by cancelling the System in response to the activation start alarm. (See 2.3.1 "Control Start Timing".)

It is permitted to change how the alarm is notified while it is being issued. For example, an audible alarm may be switched to the method used to issue the reminder alarm to the passengers in synch with the start of the reminder alarm for the passengers (2.4.2.2).

Here after, any reference to alarms notified by a sense of touch includes vibrating the steering wheel as a way of notification. Moreover, it is permitted to convey alarms with a sensation of slow speed or deceleration.

2.4.1.2 Control Activation Alarm

The control activation alarm shall trigger when the System activates the control function, and shall end when the System is cancelled.

The control activation alarm shall be visually notified, as well as additionally by either audible means or the sense of touch.

Explanatory Note:

It is permitted to change how an alarm is notified after the vehicle is stopped from the way it is notified before the vehicle is stopped.

2.4.2 Alarm to the Passengers

2.4.2.1 Activation Start Alarm

In a passenger pushbutton type of system, the activation start alarm may be issued to notify the passenger who pushed the activation switch that the System is activated.

The activation start alarm shall trigger when the passenger pushes the activation switch, and shall end either the moment the System is cancelled, the reminder alarm is issued or the control activation alarm triggers.

The alarm notification method is arbitrary.

Explanatory Note:

One example of how the activation start alarm could be notified to passengers would be to light the lamp of the activation switch to indicate that the System is

responding to the passenger having operated the switch.

The same method used to notify the activation start alarm to the driver may be used to notify the passengers.

2.4.2.2 Reminder Alarm

The reminder alarm shall, if provided, trigger before the control function activates.

The reminder alarm shall end either the moment the System is cancelled or the control activation alarm triggers.

The reminder alarm for passengers is arbitrary except in vehicles where passengers stand, in which case it is required. It is, however, not necessary to issue the reminder alarm in vehicles with standing space, while the vehicle is stopped. The reminder alarm must be audibly notified. Visual notification is arbitrary but advised for vehicles with standing space.

Explanatory Note:

The reminder alarm serves to call attention to the control function activating. It is required in vehicles with standing space in order to reduce the risk of standing passengers falling down. It is added to the provision that the reminder alarm does to have to be issued while the vehicle is stopped because the passengers do not need to brace themselves.

For cases where the driver pushes the activation switch, the reminder alarm may be set to trigger immediately or after the driver is afforded a set amount of time to cancel the System on the assumption that the driver pushes the switch by mistake.

An audible alarm for passengers, must reach all passengers (same level as internal announcements) regardless of the reminder alarm or the control activation alarm (2.4.2.3). On the other hand, visual alarms do not have to be visible from everywhere inside the vehicle.

The same method used to notify the activation start alarm to the driver may be used to notify the reminder alarm to the passengers.

2.4.2.3 Control Activation Alarm

The control activation alarm shall trigger when the System activates the control function, and shall end when the System is cancelled.

The control activation alarm must be audibly notified. Visual notification is arbitrary but advised for vehicles with standing space.

Passengers may be warned of imminent deceleration, stopping, course changes or other operation. However, particularly in the case of lane changes or course changes that pull the vehicle to the road shoulder or the like, the warning shall be issued before initiating the course change.

Explanatory Note:

The same method used to notify the control activation alarm to the driver may be used to notify the passengers.

It is permitted to change how the alarm is notified after the vehicle is stopped from the way it is notified before the vehicle is stopped.

In order to prevent passengers from intervening unnecessarily and as a consideration that standing passengers on vehicles with standing space may fall down, it is permitted to warn passengers of imminent operations (course changes, deceleration, stopping, etc.) before they are executed. Particularly with course changes, prior warning of the operating intention of the System can urge passengers to take action to protect themselves (grab a strap or railing on a bus, sit down, check one's seatbelt, etc.). Such warnings could imaginably be notified by audio announcement or visual indication inside the vehicle.

2.4.3 Alarm to the Road Users Outside the Vehicle

2.4.3.1 Reminder Alarm

The reminder alarm shall, if provided, trigger before the control function activates.

The reminder alarm shall end either the moment the System is cancelled or the control activation alarm triggers.

If provided, the reminder alarm may be notified visually by hazard warning lamps, text displays or other means, or audibly using the horn, etc.

The reminder alarm for road users outside the vehicle is arbitrary.

Explanatory Note:

The reminder alarm is nonessential because it signals the period of time from

when the driver's abnormal condition is detected until it is verified. Nonetheless, from a safety perspective, alerting road users outside the vehicle of a potential yet unverified danger should be socially welcomed as the early notice gives others that much more time to prepare for the worst, therefore the reminder alarm is arbitrary.

The aim of a reminder alarm for road users outside the vehicle is to alert them to a potentially evolving emergency and to prompt them to keep away from the vehicle, therefore notification is permitted visually by hazard warning lamps or audibly using the horn, etc.

Research was also done on the impact that the duration of a reminder alarm might have on the driving behavior of trailing vehicles in 2014. Using a driving simulator, the National Traffic Safety and Environment Laboratory (at that time) found that a long reminder alarm does not reduce the possibility of a rear-end collision from trailing vehicles. It was confirmed that, when the reminder alarm was too long, trailing vehicles initially slowed down but afterwards increased their speed again.

2.4.3.2 Control Activation Alarm

The control activation alarm shall trigger when the System activates the control function, and shall end when the System is cancelled.

The control activation alarm must be visually notified using the hazard warning lamps and audibly notified using the horn, etc., as well as using the stop lamps while braking. Visual notification by test display or other means may be used concurrently.

The control activation alarm shall be issued for no less than 3 seconds immediately after the System activates the control function and the "function of keeping the vehicle inside the lane" (2.3.2) shall be applied to the vehicle control. However, if issuing a reminder alarm that has the same level of the control activation alarm, the duration of the two alarms together may exceed 3 seconds.

Explanatory Note:

If the vehicle decelerates, the control activation alarm must be notified via the stop lamps in order to avoid a rear-end collision from the trailing vehicle. Additional visual notification by hazard warning lamps and audio notification using the horn, etc. are also required to alert road users outside the vehicle to the emergency and urge them to keep away from the vehicle.

It is permitted to change how the alarm is notified after the vehicle is stopped from the way it is notified before the vehicle is stopped.

In order to alert nearby vehicles to the active System and keep them away while the System is active, the control activation alarm must be visually notified via the hazard warning lamps and audibly using the horn, etc. for no less than 3 seconds immediately after System control activates, and using the stop lamps while braking. Additional visual notification by text display or other means may be used concurrently. The travel method of the "function of keeping the vehicle inside the lane" should be applied to vehicle control at this time in order to enable transition to the "function of changing the lane" as quickly as possible.

The use of the reminder alarm that has the same level of the control activation alarm can more quickly notify road users outside the vehicle that the System is active, in which case more than 3 seconds may be used to issue both alarms. However, in this case, the control activation alarm applies to when vehicle control is under the travel method of the "function of keeping the vehicle inside the lane".

When changing lanes or changing course to pull over to the road shoulder or the like, the alarm notification using the hazard warning lamps must be stopped and the turn signal must start blinking 3 seconds before starting any lateral motion within that same lane. Moreover, the turn signal shall continue blinking the whole time until the course change is completed.

Explanatory Note:

During the "function of keeping the vehicle inside the lane" and the "function of decelerating and stopping the vehicle", the control activation alarm should be notified using the hazard warning lamps,

During the "function of changing the lane", alarm notification using the hazard warning lamps should be stopped and replaced with a blinking turn signal.

When under the "function of bringing the vehicle close to the road edge", the control activation alarm should be notified using the hazard warning lamps while maintaining the travel lane and decelerating, and by a blinking turn signal while changing course toward the road edge.

The blinking turn signal stipulated in this provision as the notification of lane change or course change towards the road shoulder or the like should start 3 seconds before initiating any lateral motion within the current lane and continue throughout the course change until it is completed. (See the Explanatory Note in (2) of 2.3.3.2.)

Figures 3-1 through 3-3 chronologically organize how the alarms stipulated in 2.4.1 to 2.4.3 are executed over time. Figure 3-1 is an alarm timing chart for the abnormal condition automatic detection type of system, while Figs.3-2 and 3-3 are alarm timing charts for respectively driver pushbutton type and passenger pushbutton type systems.

2.4.4 Matters to be Taken into Consideration Concerning the Alarms

In issuing the activation start alarm, reminder alarm and control activation alarm, it is desired that consideration be shown so as not to interfere with audio conversations and other communications of emergency response information systems and services, etc.

Explanatory Note:

With vehicles capable of connecting with emergency response information systems and services, etc. considerations so that audible alarms of the system do not interfere with conversations between passengers or others and operators of such systems and services, such as to make it possible to adjust the volume of audible alarms, are advised.

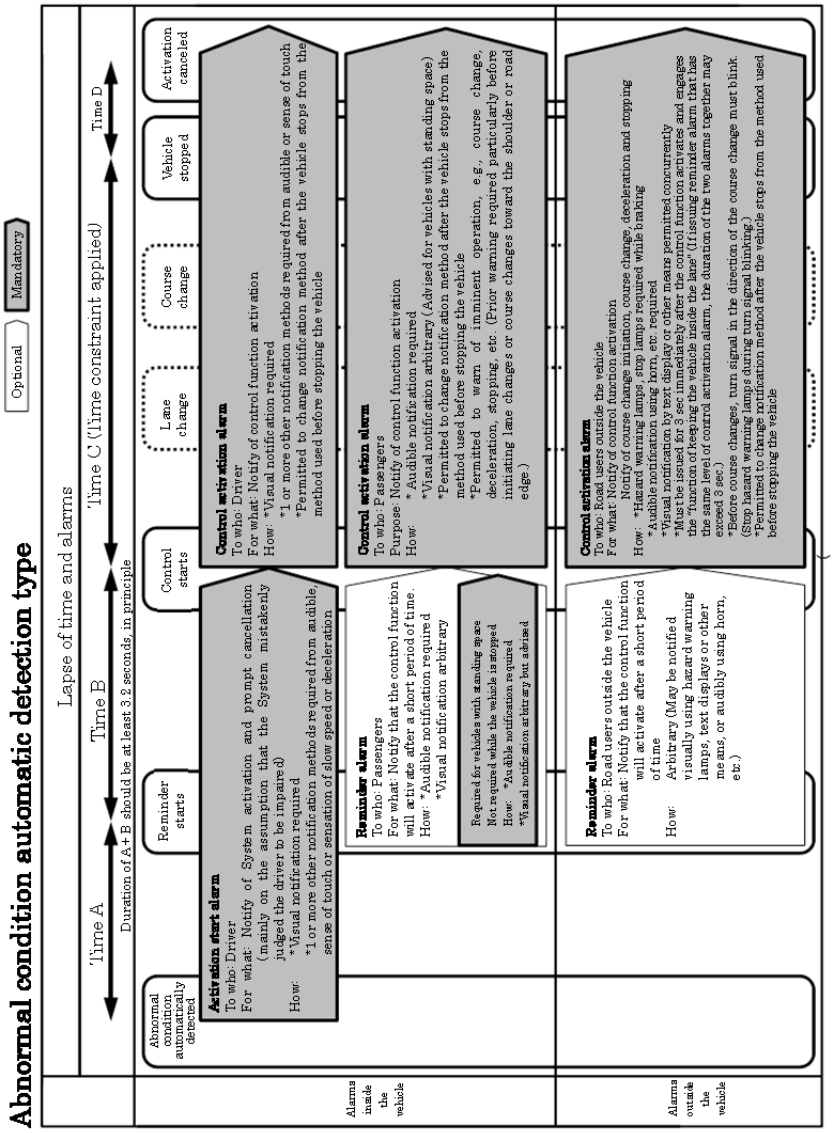

Figure 3-1 Alarm Timing Chart for the Abnormal Condition Automatic Detection Type

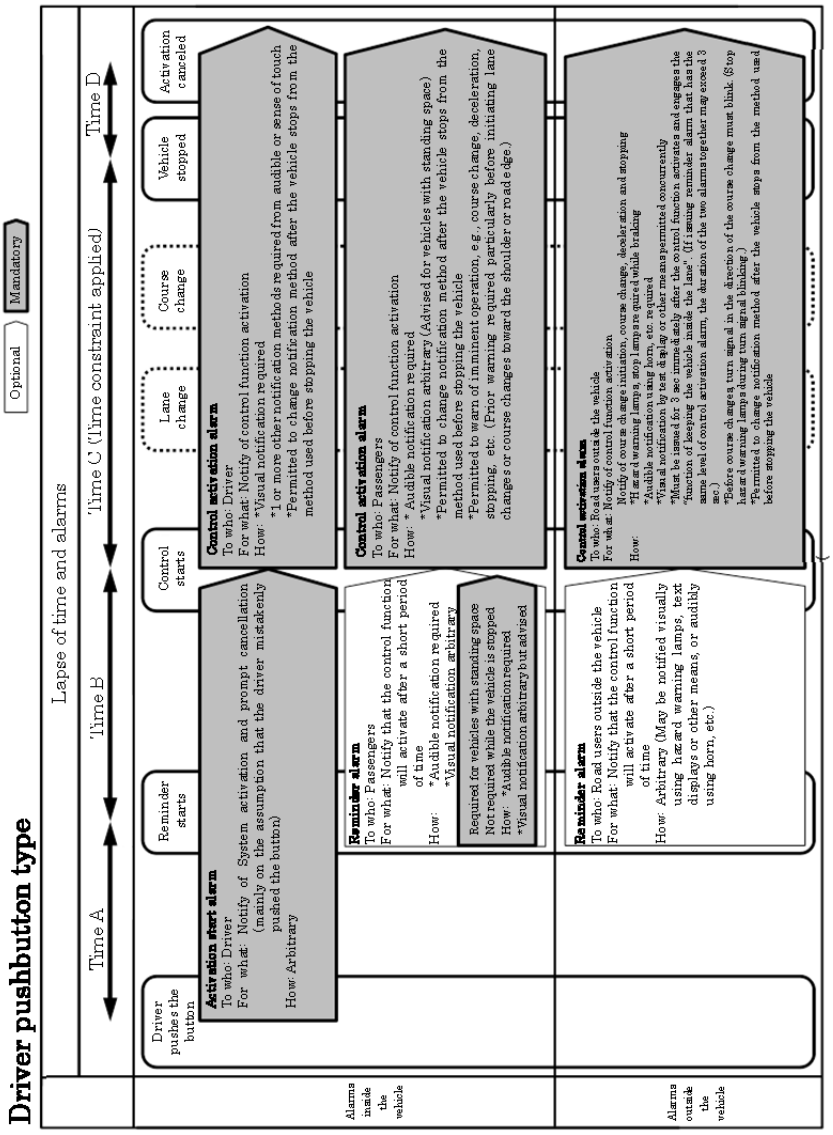

Figure 3-2 Alarm Timing Chart for the Driver Pushbutton Type

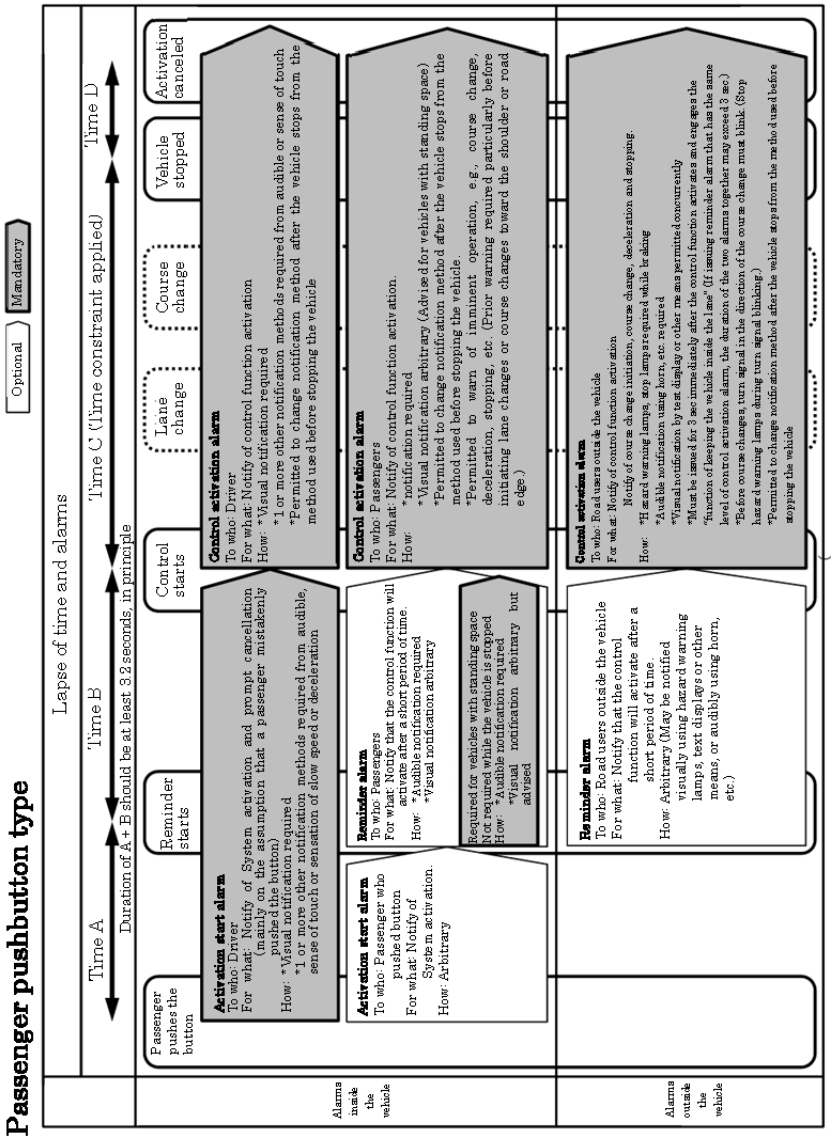

Figure 3-3 Alarm Timing Chart for the Passenger Pushbutton Type

2.5 Cancellation of Activation

A cancellation switch that enables the System to be cancelled shall be provided.

Explanatory Note:

The following considerations should be shown with the cancellation switch, on the assumption that it will be operated by an otherwise well and fit driver or a rescuer.

1) That it is readily recognizable and can be operated without interfering with

driving operations

2) That impaired drivers or passengers cannot easily cancel the system

3) That rescuers can recognize that it is a cancellation switch

The cancellation switch may double as the main switch.

In some configurations of the System, the vehicle can be started and moved by cancelling the System.

The System shall not stop until the cancellation switch is pushed or an operation that identifies the driver to be well and fit is executed.

Explanatory Note:

The above provision does not apply to situations where the System cannot continue to operate because of vehicle damage incurred from a collision, situations where the System cannot safely control the vehicle, insufficient fuel, dead battery, power to the ignition being off, etc.

Two ways to keep the vehicle stopped even after the System has stopped automatically are to automatically engage the handbrake or automatically park the vehicle.

If the system activates because the driver's condition was detected as abnormal by an automatic detection system and, after it activates, the driver operates the vehicle in a way that can be interested as normal and intentional, the driver may be judged fit to drive.

2.6 Design When More Than One Detection Method for the Driver's Abnormal Condition Is Used

If a vehicle is equipped with multiple means for detecting the driver's condition as abnormal (automatic detection, driver pushbutton and passenger pushbutton), it is thinkable that his/her abnormal condition might be detected by multiple means at the same time. In this case, based on the predetermined control start timing of each of these means, the alarms and control function of the fastest means for transitioning to control activation shall be executed.

Explanatory Note:

If a vehicle is equipped with all of the means for detecting a driver unfit to drive (automatic detection, driver pushbutton and passenger pushbutton), it could happen that, in the moment the System itself detects the driver's impaired condition, that a

passenger also notices it and presses the activation switch and the driver him/herself realizes something is wrong and presses the activation switch under his/her own power, too. In this case, since the vehicle should be stopped as quickly as possible, the alarms and control function of the means that transition to the control start timing the fastest should be executed.

2.7 Measures to Be Taken If the System Fails

(1) The System shall have the means that, in the event it detects a failure, the driver can recognize that the failure has occurred.

(2) Considerations shall be shown so that System failures do not affect the original function of the vehicle.

(3) If a failure occurs in the System while active due to a driver's abnormal condition, it is desirable to engage the "function of decelerating and stopping the vehicle" provided the situation allows that function to engage.

(4) If a failure occurs in one of the means for detecting the driver's condition as abnormal in a vehicle equipped with multiple means of detection, the System shall continue to function using the detection means unaffected by the malfunction.

Explanatory Note:

Given the technological difficulties, the System does not require self-diagnostic failure detection.

In order to avoid a situation where trouble prevents the System from fulfilling its purpose when the driver suddenly becomes unfit to drive, it is necessary to prompt the driver to have the System trouble serviced by way of an indicator or the like, and/or have regular maintenance performed on the System.

In order for the original functions of a vehicle separate of the System (braking, driving and steering) to work in the event of the System failure, it would effective to enhance vehicle reliability with redundant braking, driving and steering systems that would be unimpacted by other systems. However, redundancy could complicate not just the System but also all vehicle systems, therefore redundancy is not required.

One thinkable case of a vehicle equipped with multiple means for detecting driver

abnormality is a vehicle with all three trigger systems: automatic detection, driver pushbutton and passenger pushbutton. In such a vehicle, if a failure occurs in the automatic detection system, the systems triggered from the driver and passenger pushbuttons should remain functional.

2.8 Order of Priorities When Competing with Other Driving Assistance Control Systems

The following order of priorities shall apply in the event of competing alarms and control functions caused by this System and other driving assistance control systems activating at the same time.

2.8.1 Control System That Stabilizes Vehicle Behavior

Systems that stabilize vehicle behavior such as anti-lock brake systems and electronic stability control systems shall operate regardless whether the System is active or not.

Explanatory Note:

Functions that stabilize vehicle behavior should be operational even while the control function of the System is active. For example, if the System is controlling the vehicle on a snow-covered or otherwise slippery road, stable braking by the System should be expected owing to the anti-lock brake system.

2.8.2 Control System for the Purpose of Avoiding or Mitigating a Collision

The alarms and control functions of Advanced Emergency Braking Systems (AEBS) shall have priority over the System. The System shall be prioritized after AEBS operation ends.

Explanatory Note:

Control systems that assess the imminence of a collision should be executed before the System, which does not. An AEBS is a control system that detects and reacts to an impending collision. The system detects abnormalities in the driver's condition; it does not assess the imminence of a collision from the travel environment of the vehicle.

On this same train of thought, future steering systems for avoiding collisions, if ever practical, should be executed before the System, but that will have to be examined after such steering systems become a reality.

2.8.3 Control System Not for the Purpose of Avoiding or Mitigating a Collision

Once the System is active and has issued the control activation alarm, speed control and steering by the System shall be prioritized over control systems that do not serve to avoid or mitigate collisions.

Explanatory Note:

The System operates as an emergency system in the event that a sudden change in the driver's physical condition compromises his/her ability to safely operate the vehicle. In order for the System to better operate on the side of safety, the speed control and steering of the System should be prioritized over driving assistance control systems intended to alleviate the operating burden of physically fit drivers (Cruise Control [CC], Adaptive Cruise Control [ACC], etc.), once the control activation alarm has been issued.

Nothing, however, is stipulated about speed control by the System prior to the control activation alarm, or, in other words, during the activation start alarm and reminder alarm. Nevertheless, because the driver could become impaired beyond the capacity to safely operate vehicle during this period, if the braking by the ACC or other driving assistance control system is working, it is permitted to keep it working in order to prevent encroaching on a leading vehicle and transition the situation towards safety.

Steering by other driving assistance control systems for the purpose of keeping the vehicle within its lane or protecting the vehicle against its deviation should preferably continue during the system activation alarm and reminder alarm.

Various driving assistance control systems are likely to become practical and available in the future, so as they do, the order of priorities with the System will have to be weighed in terms of purpose, conditions and so forth, and revised if necessary.

3. Special Instructions

This section presents nontechnical matters to consider.

Explanatory Note:

A comprehensive multilateral approach to preventing accidents due to abnormalities in the driver's physical condition is desired in regards to the matters presented in this section.

3.1 Items to Be Known to the Society (Campaigns, etc.)

Consideration shall be shown to making the following matters known and understood by all road users.

(1) Purpose of the driver's abnormal condition response system
(2) How to identify a vehicle in which the System is active
(3) How to respond when seeing a vehicle with the System active

Explanatory Note:

There are various ways of educating the general public, both young and old, about the System, including awareness activities using flyers and the like, teaching about the system in schools, etc.

It should also be possible to learn about the System without riding in a vehicle equipped with it, by providing opportunities for the average person to read about the System through advertisements, websites and other advertising activities.

3.2 Items to Be Known to the Driver

The following shall properly be made known to drivers via user manuals, indications, etc.

(1) Purpose, types and benefits of the System
(2) System activation conditions and troubleshooting
(3) Audible, visual and other indications of the System and their meanings
(4) Functional limitations of the System
(5) Responsibilities associated with System operation
(6) Other precautions in use

Explanatory Note:

The above information is necessary for drivers to correctly understand and use the System. Carefully documenting what drivers, vehicle operators and others should know serves, in a certain sense, as proof that the obligation to explain the System has been fulfilled.

The above "types of the System" means the various functions of the System, such as the "abnormal condition automatic detection" and "pushbutton" triggers, functioning that "pulls the vehicle over to the road edge only if traveling in the far-left lane", etc., can be combined into a wide range of systems.

3.3 Items to Be Known to Passengers

Considerations shall be shown with indications, etc., so that passengers can understand the following.

(1) Purpose, types and benefits of the System
(2) How to use the System
(3) Audible, visual and other indications of the System and their meanings
(4) Functional limitations of the System
(5) Responsibilities associated with System operation
(6) Other precautions in use

Explanatory Note:

Labels and other informative indications should be posted in easy-to-see locations inside the vehicle. For example, they could be placed in front of the passenger seat or, on regular route buses, the advertising space or internal displays could be used. On long-distance buses, tutorial videos like those shown on planes before take-off might be effective educative platforms.

The content could be something like the following.

(1) "This system allows passengers to stop the vehicle if the driver is impaired, by pushing a button."
(2) "Push This Button If the Driver Is Impaired"
(3) Meaning of audible and visual indications and what to do if issued
(4) Explanations, such as that the vehicle does not begin braking the moment that the passenger pushes the activation switch and that the system cannot prevent all accidents, should be provided as needed.
(5) Warnings so that the button is not pushed mischievously, etc.

It should be noted that, when used properly, the person who pushed the

button is not responsible for how the System operates. According to Article 698 of the Civil Code (Urgent Management of Business), the act of a passenger pushing the button because he/she feels his/her life in danger because the driver is impaired can be interpreted as not his/her responsibility. Permission is not required from other passengers to push the button.