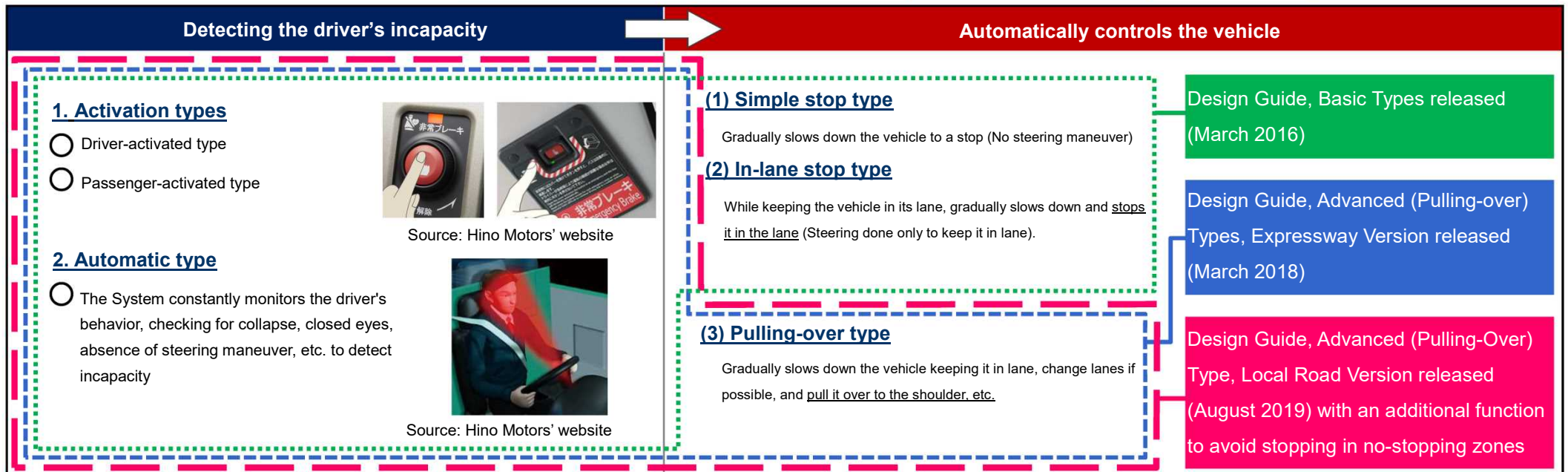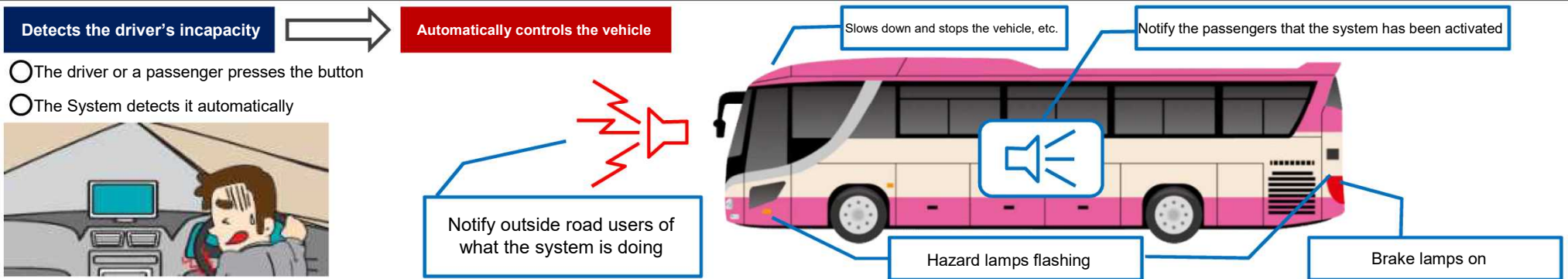# Driver Incapacity Response System

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- Every year, 200 to 300 accidents are caused by incapacitated drivers in Japan
- To promote the development, commercialization, and spread of
  Driver Incapacity Response Systems ("the Systems") that, when the driver becomes incapacitated to continue driving safely for medical reasons ("driver incapacity"), detects such driver incapacity and automatically brings the vehicle to a safe stop, the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) has developed guidelines for designing the Systems (Basic Type, Advanced Types (Expressway Version), and Advanced Type (Local Road Version) in collaboration between industry, academia, and government.
- In July 2018, a tourist coach model went on sale with a system that allows the driver or a passenger to slow down and stop the vehicle by pressing an emergency stop button.

Detects the driver's incapacity → **Automatically controls the vehicle**

○ The driver or a passenger presses the button

○ The System detects it automatically

Slows down and stops the vehicle, etc.

Notify the passengers that the system has been activated

Notify outside road users of what the system is doing

Hazard lamps flashing

Brake lamps on

Detecting the driver's incapacity → **Automatically controls the vehicle**

1. Activation types

○ Driver-activated type

○ Passenger-activated type

非常ブレーキ Emergency Brake

Source: Hino Motors' website

2. Automatic type

○ The System constantly monitors the driver's behavior, checking for collapse, closed eyes, absence of steering maneuver, etc. to detect incapacity

Source: Hino Motors' website

(1) Simple stop type

Gradually slows down the vehicle to a stop (No steering maneuver)

(2) In-lane stop type

While keeping the vehicle in its lane, gradually slows down and stops it in the lane (Steering done only to keep it in lane).

(3) Pulling-over type

Gradually slows down the vehicle keeping it in lane, change lanes if possible, and pull it over to the shoulder, etc.

Design Guide, Basic Types released (March 2016)

Design Guide, Advanced (Pulling-over) Types, Expressway Version released (March 2018)

Design Guide, Advanced (Pulling-Over) Type, Local Road Version released (August 2019) with an additional function to avoid stopping in no-stopping zones

Overview of the Guideline for Driver Incapacity Response System, Advanced (Pulling-Over) Type, Local Road Version

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Targets:

Roads: Local roads

Vehicles: Motor vehicles (Excluding motorcycles)

Note: The underlined part is the functions in the Design Guide, Advanced (Pulling-over) Type, Expressway Version (released in March 2018) added to those of the function of the Design Guide, Basic Type (released in March 2016).

The part in red is the function in the Design Guide, Advanced (Pulling-Over) Type, Local Road Version (released in August 2019) added to those of the Design Guide, Advanced (Pulling-Over) Type, Expressway Version.
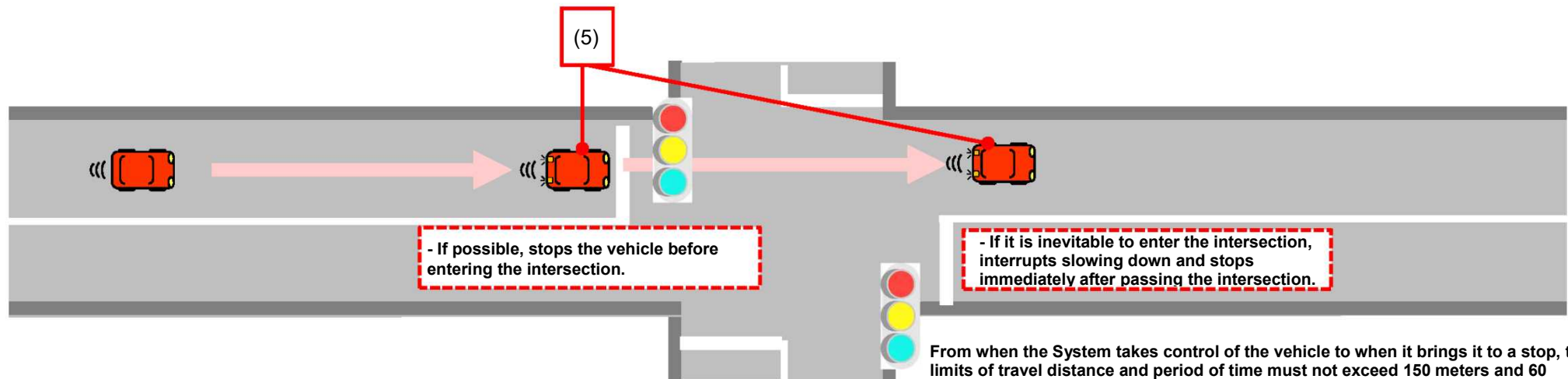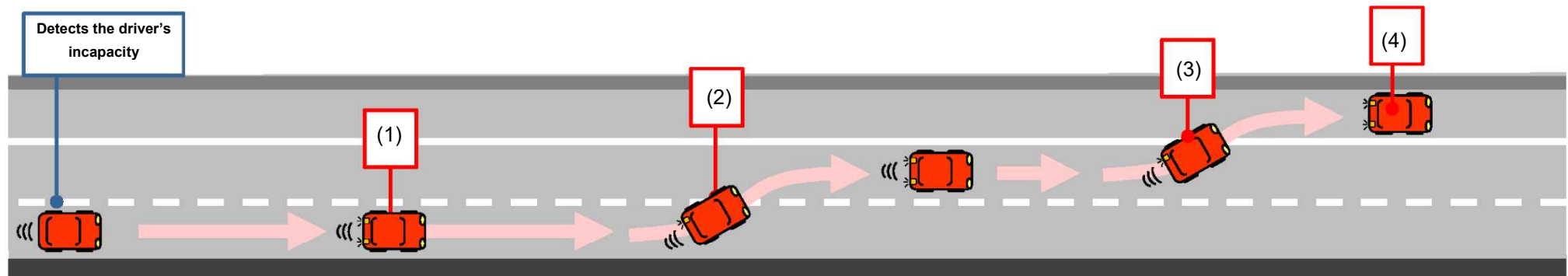
Functions to evacuate the vehicle to the shoulder, etc. (roadside)

(1) Function to have the vehicle drive in lane

(2) Function to have the vehicle change lanes

(3) Function to pull the vehicle over to the roadside
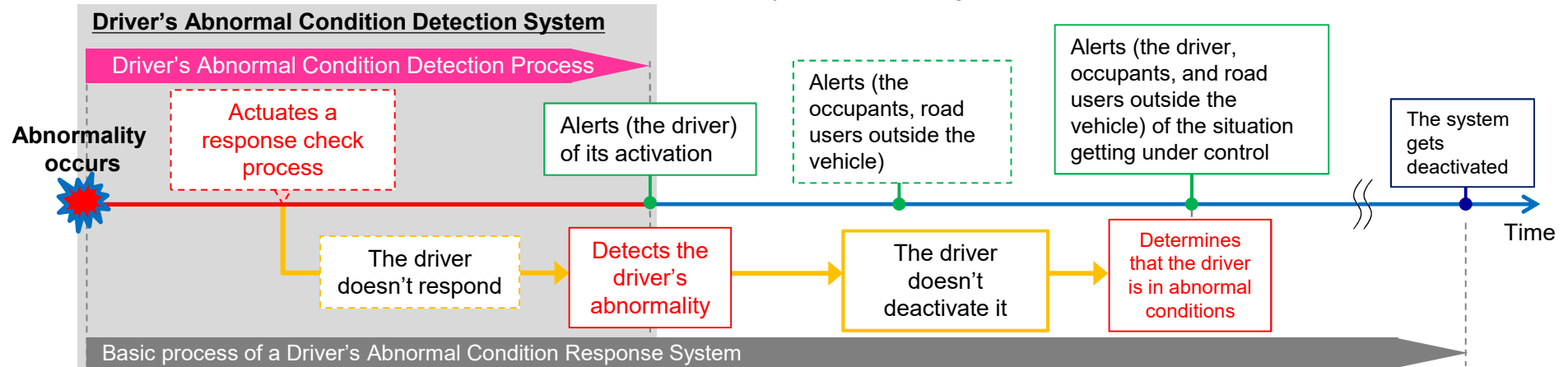
(4) Function to slow down and stop the vehicle

(5) Function to avoid the vehicle from stopping in no-stopping zones (inside an intersection, etc.)

Detects the driver's incapacity

(1)   (2)   (3)   (4)

(5)

- If possible, stops the vehicle before entering the intersection.

- If it is inevitable to enter the intersection, interrupts slowing down and stops immediately after passing the intersection.

From when the System takes control of the vehicle to when it brings it to a stop, the limits of travel distance and period of time must not exceed 150 meters and 60 seconds, respectively.

Outline of the system

- Detects the occurrence of the driver abnormality when the physical amount (index) of monitored behaviors (posture collapse, etc.) reached the threshold.
- To improve the accuracy of detection, the system actuates as necessary the driver's response check process by asking them for some kind of response and, based on the result, determines whether they can keep driving or not

Driver's Abnormal Condition Detection System

Driver's Abnormal Condition Detection Process

Abnormality occurs

Actuates a response check process

Alerts (the driver) of its activation

Alerts (the occupants, road users outside the vehicle)

Alerts (the driver, occupants, and road users outside the vehicle) of the situation getting under control

The system gets deactivated

Time

The driver doesn't respond → Detects the driver's abnormality → The driver doesn't deactivate it → Determines that the driver is in abnormal conditions

Basic process of a Driver's Abnormal Condition Response System

Detection items   * To be added as appropriate with the progress of technology

(i) Posture collapse
Detects abnormality by how much and how long the posture changes

Detection items: Posture collapse in seven patterns: Collapsing, head down, bent back, totally bent back, head angled, collapsed sideway, leaning sideway

Indicator: Displacement of the head from the reference position and its duration

Threshold: Determined in reference to the amount and duration of displacement by pattern of posture collapse

Actuate a response check process?: Optional

Over 100 mm
Over 20°
Over -20°

Examples of "head down"   Examples of "bent back"
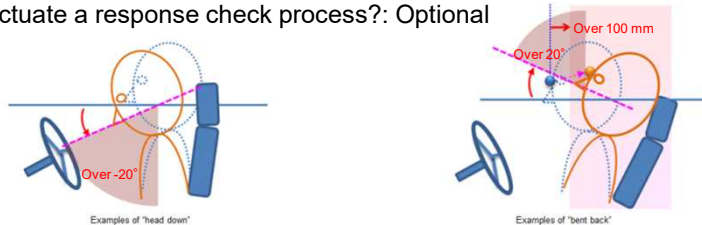
(ii) Closed eyes
Detects abnormality by how long the eyes remain closed

Detection items: Closed eyes

Indicator: How long the eyes remain closed

Threshold: When the eyes remain closed for two seconds or more

Actuate a response check process?: Optional

(iii) Absence of steering maneuvers
Detects abnormality by how long steering maneuver is absent

Detection item: Absence of steering maneuvers

Indicator: How long steering maneuver is absent

Threshold: No specific values specified

Actuate a response check process?: Required