

"Safety Technology for Buses"

AUTOMOTIVE
SUMMIT 2014



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“Safety Technologies for Buses”



Large-size sightseeing bus,
“Hino Selega”



Large-size route bus, “Hino Blue
Ribbon City Hybrid”



Minibus, “Hino Poncho”



Medium-size touring coach,
“Hino Melpha”

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1. Buses in Japan

(1) Types of buses

	Primary use	Length	Width	Passenger capacity	
Articulated bus	Fixed street routes	18m	2.5m	130 people	
Large-size bus	Tourism & fixed highway routes	12m	2.5m	55 to 78 people	
	Fixed street routes	Over 9m	2.5m	77 to 79 people	
			2.3m	74 people	
Medium-size bus	Fixed street routes	7 to 9m	2.3m	56 to 59 people	
Small-size bus	Fixed street routes and community buses	7 to 9m	2.1m	29 to 33 people	
		Less than 7m	2.1m	31 to 38 people 26 to 29 people	

<Source> 2013 Japanese Bus Industry (Japan Bus Association)

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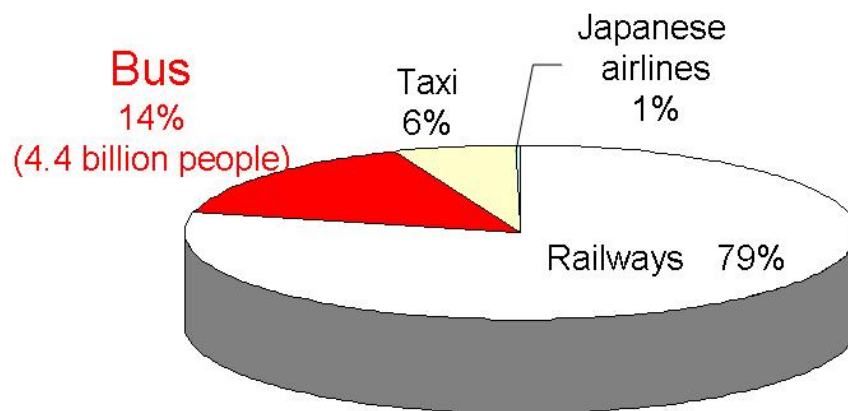
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1. Buses in Japan

(2) Current state of Japanese passenger transportation

Buses are an important means of public transportation, second only to railways



Number of passengers in Japan according to means of transportation (2012)

<Source> 2013 Japanese Bus Industry (Japan Bus Association)

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2. What is Required of the Passenger Carrier Industry

(1) The influence of accidents

The human and economic impact is very large



Society's need for safe transportation is also large

Accident caused by driver
falling asleep



ASAHI
Newspaper

May 2012. Kan-Etsu Expressway

Accident caused by a health condition



MSN NEWS

March 2014. Hokuriku Expressway

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2. What is Required of the Passenger Carrier Industry

(2) Bus industry's comprehensive safety plan 2009*

Traffic accidents involving buses in 2013

- Fatal accidents: 15
- Accidents causing injuries: 2,427



<Traffic accident reduction target>

By the year 2018,

- Fatal accidents: Zero
- Accidents causing injuries: Less than 1,800
- Drunken driving: Zero

*Japan Bus Association

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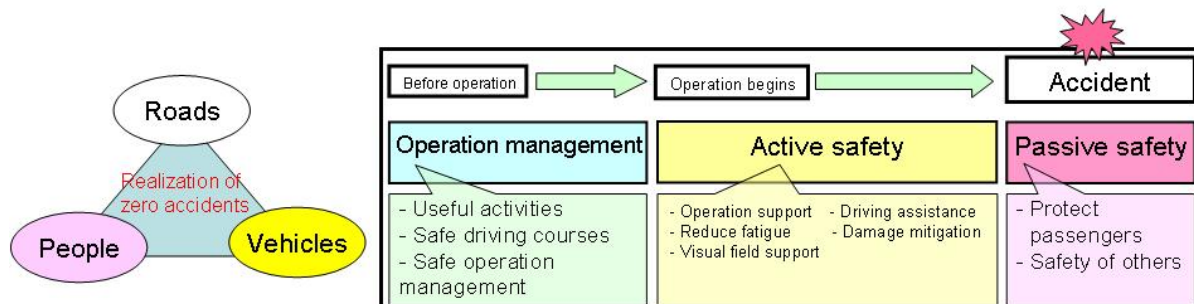
3. Enhanced Safety Measures Policies

Actively contribute to a safer society with
“zero traffic accident fatalities and injuries”

CAPS

(Combined Active and
Passive Safety)

- (1) Promote **“total safety”**
 - “People” and “vehicles”
 - Operation management –active safety –passive safety
- (2) **Promote wide use** of safety equipment (reduce prices, etc.)



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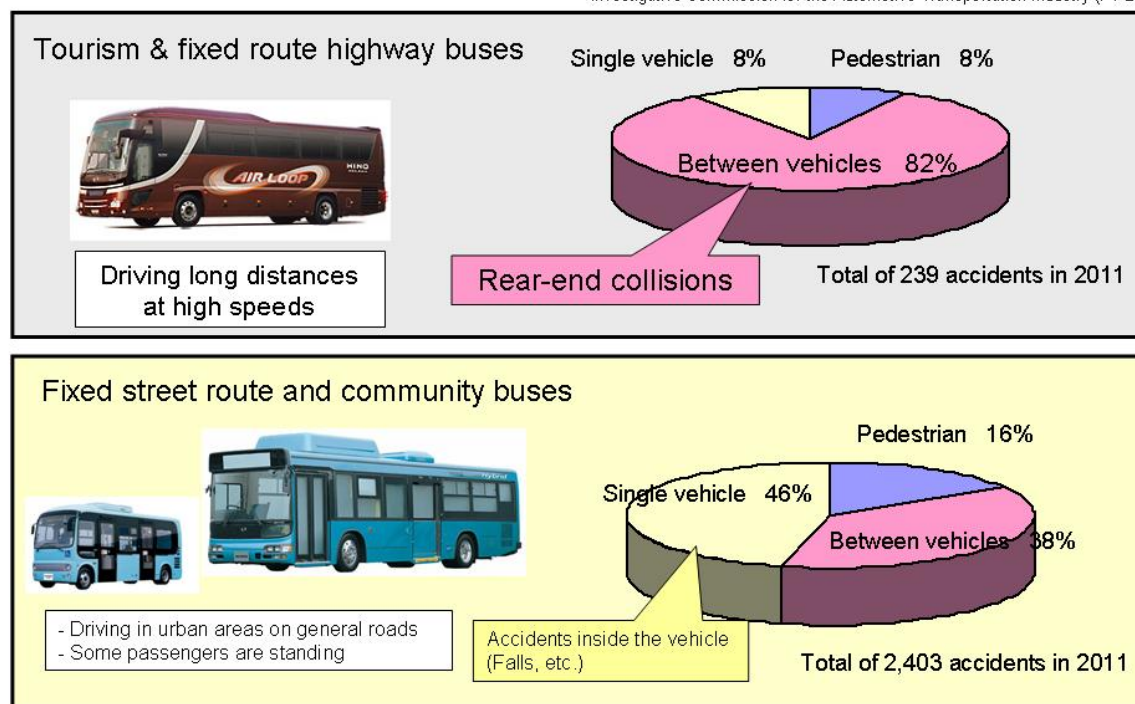
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4. Technology Development Policies

(1) Accident characteristics of each vehicle model <Accident data source> Report of the Traffic Accident Cause Analysis
Investigative Commission for the Automotive Transportation Industry (FY 2011)



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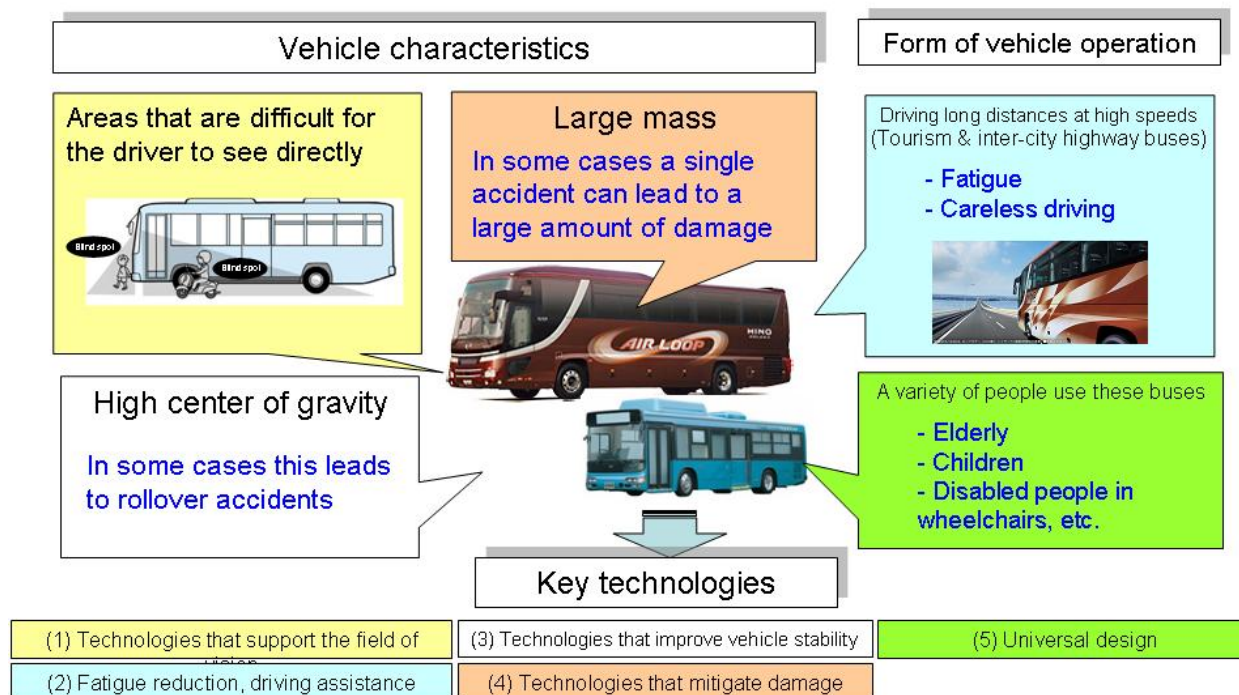
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4. Technology Development Policies

(2) Vehicle characteristics and concepts behind countermeasures



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5. Safety Systems Put into Practical Use

<Tourism & fixed route highway buses>



(1) Technologies that support the field of vision
- Left-side camera

(2) Fatigue reduction, driving assistance
★ Lane departure warning
★ Driver monitor
★ Vehicle swerving warning
- Scanning cruise

(3) Technologies that improve vehicle stability
★ VSC
(Vehicle Stability Control)

★ Explained in detail later

(4) Technologies that mitigate damage
★ PCS (collision mitigation brakes)
★ Body structure
★ SRS airbags
★ Impact absorbing steering wheel
★ 3-point seat belts
(Driver's seat, guide's seat, front row passenger seats)

<Fixed street route and community buses>



(5) Universal design

- Low floor
- Wheelchair securing devices
- Ride height adjustment (kneeling)
- Interior color scheme, etc.



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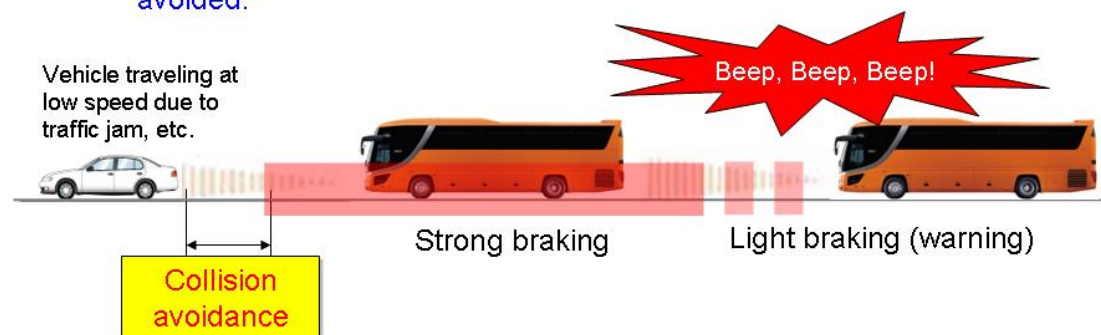
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(1) New PCS (AEBS)

- (1) Millimeter-wave radar detects obstacles and the driver is warned when the risk of a collision grows.
- (2) If the driver does not initiate an accident avoidance maneuver in response to the alarm, the system will apply the brakes to reduce the speed and mitigate the damage of a collision.
- NEW** (3) If the speed of the vehicle in front is 10 km/h or more and the relative speed difference between the two vehicles is within 50 km/h, the collision is avoided.*



*Complies with the technical standards that will be applied starting in November 2014 ("Agreement Rule (No.131) concerning collision damage mitigation brake systems (AEBS)" that were announced and went into force on November 12, 2013). There are cases where the collision cannot be avoided depending on the conditions. Brake operation will be performed as usual in response to a stopped obstacle (damage mitigation).

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Video (New PCS)



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(2) New Driver Monitor

The camera is always detecting the state of the driver's eyes (closed or open) and the direction that the driver's head is facing. If the computer determines that the driver's condition is one that requires a warning, a warning is then given to the driver. In the case where there is another vehicle in front of the bus, the operation of the PCS is sped up.

NEW

The infrared LEDs are controlled appropriately to improve the robustness of the camera against ambient light and even make it possible to detect the driver's eyes when they are wearing sunglasses.

Eye and head-facing detection function

Camera viewing range

Infrared LEDs

New driver monitor camera

While wearing sunglasses

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Video (**New** Driver Monitor)

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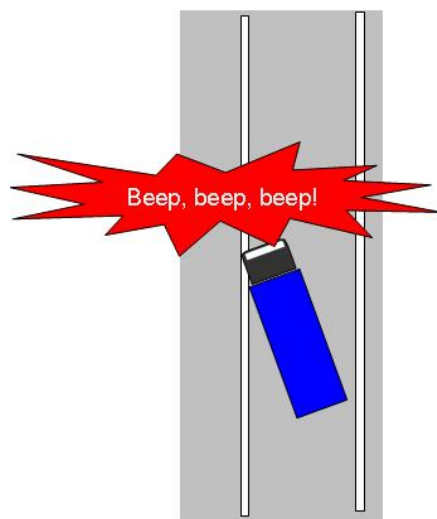
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(3) New Lane Departure Warning System

NEW

The vehicle lane is recognized using a camera and a warning is given to the driver when it detects the bus departing from the lane.

The camera performance was increased so that warnings can be given after only a small amount of lane departure (conventionally within 1 meter, can be set to be within 0.3 meters*).



New model camera (high resolution)



Vehicle lane being recognized by the camera



<Multi-information display>
Warnings via sound and indicators

*Complies with the technical standards that will be applied starting in August 2015 ("Agreement Rule (No.130) concerning lane departure warning system (LDWS)" that were announced and went into force on November 12, 2013). There are cases where the collision cannot be avoided depending on the conditions. Brakes operation will be performed as usual in response to a stopped obstacle (damage mitigation).

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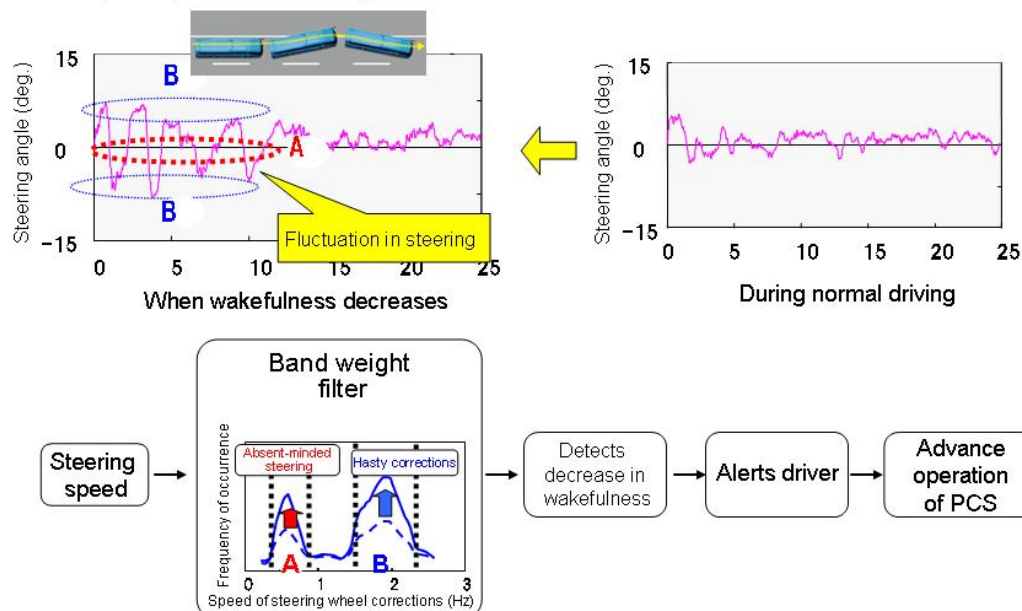
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(4) Vehicle Swerving Warning

A warning is issued when an increase in the degree of swerving in the steering wheel is detected. The driver is encouraged to take a rest. The operation of the PCS is sped up if the warning continues.



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Video (**New** Lane Departure Warning & Vehicle Swerving Warning)

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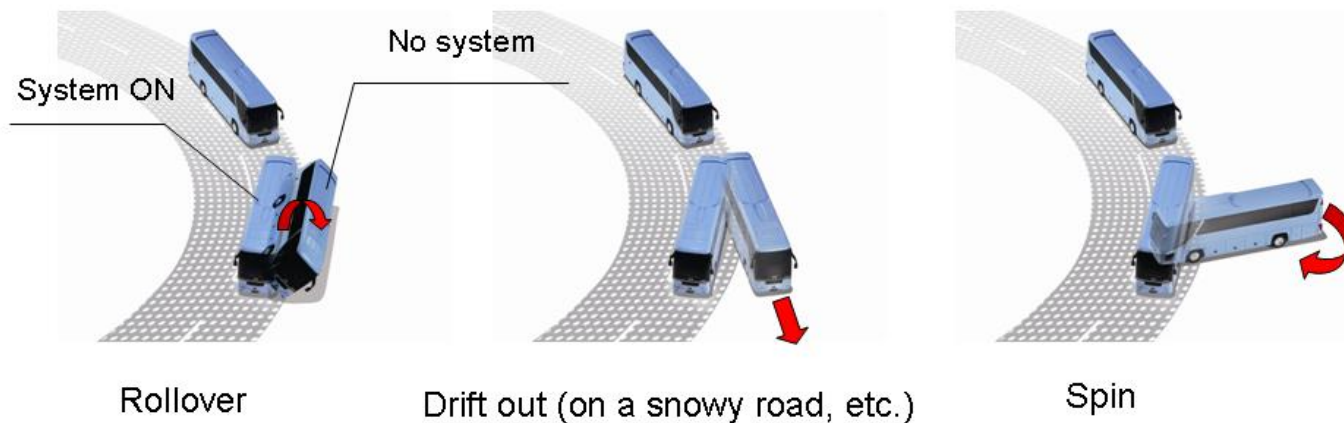
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(5) VSC

(Vehicle Stability Control System)

This system supports evasive maneuvers by the driver through warning alarms, restricting engine output, and operating the brakes to help prevent problems on curves, such as the bus departing from the vehicle lane and rollovers.



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Video (VSC)



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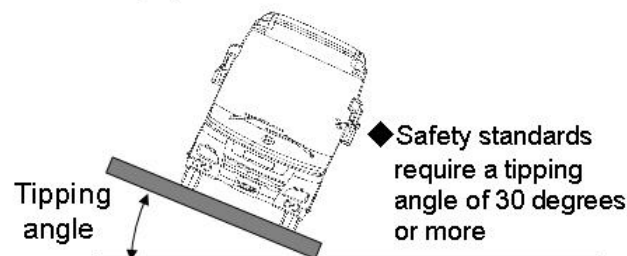
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(6) Body structure

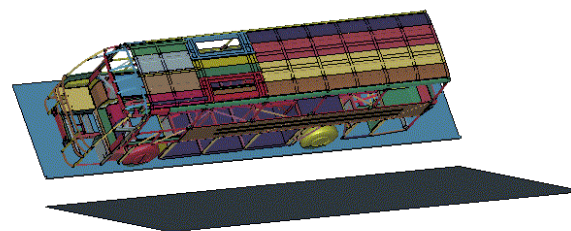
(1) Frontal collision



(2) Rollover



◆ ECE-R66



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(7) SRS airbags, impact absorbing steering wheels, and 3-point seat belts

Protect the driver



SRS airbag



Impact absorbing steering wheel

Protect the passengers



3-point seat belts with ELR (front row seats)

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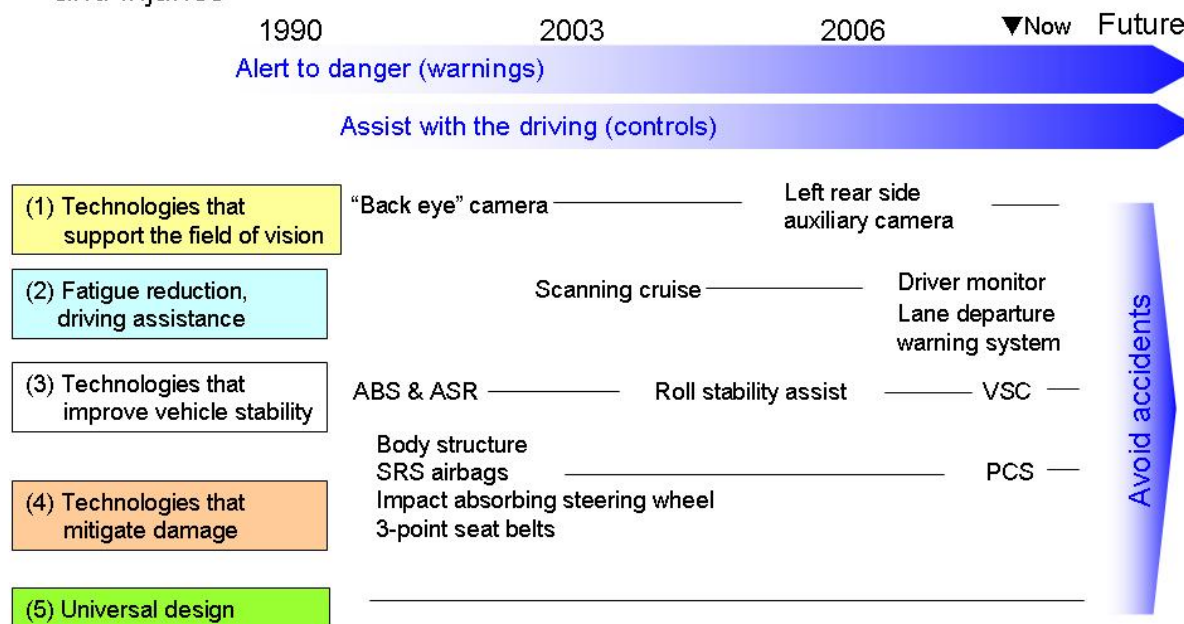
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6. Future Initiatives

Strengthen initiatives to develop new technologies and promote them widely in an effort to achieve “zero traffic accident fatalities and injuries”



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