

# Future Safety Technologies Improved Safety with ITS

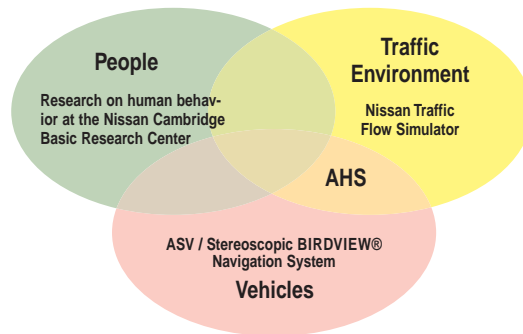
*ITS (Intelligent Transport Systems) is expected to be the mainstay of future safety technology. In its development of future automobile safety systems, Nissan views the automobile not as an individual unit, but rather as part of a larger social system. Nissan, by implementing ITS, intends to create brighter, happier automobile-oriented lifestyles for the 21st century.*

## ITS (Intelligent Transport Systems)

ITS is a completely new type of technology that uses cutting-edge electronics and information communications technology to bring people, vehicles and the traffic environment together.

Nissan is proposing and developing ITS technologies with the intention of forging an optimum harmony of people, vehicles and the traffic environment. Through the implementation of these technologies, Nissan aims to contribute to the provision of safe, comfortable and enjoyable motoring and to the formation of a new automotive society friendly to the global environment.

Nissan, focusing on the human-machine interface as a means of developing systems designed to be user-friendly, is vigorously proposing and developing safety systems based on its own original concepts while at the same time actively participating in the Advanced Safety Vehicle (ASV) project of the Ministry of Transport, the Advanced Cruise-Assist Highway System (AHS) project of the Ministry of Construction, and other government-led joint projects.



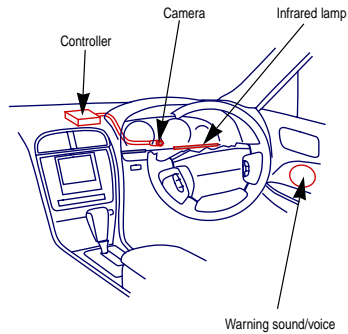
# Nissan's Safety Technologies concerning ITS

## Information Safety

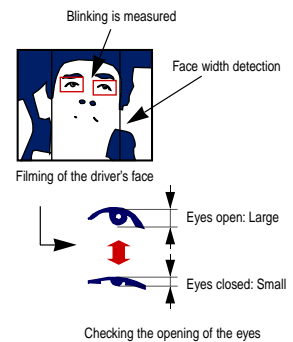
### Drowsiness Warning System and Drowsiness Relieving System

The Drowsiness Warning System uses a camera mounted to the instrument panel to monitor the blinking pattern of the driver's eyes to detect drowsiness at an early stage and issue a warning sound. When the Drowsiness Warning System detects that the driver has begun dozing off, the Drowsiness Relieving System emits a warning sound, turns on the air conditioning, and releases a stimulating mint fragrance to awaken the driver. This system can also be activated manually by pressing a switch, so that the driver can release the stimulating fragrance when he or she begins feeling drowsy.

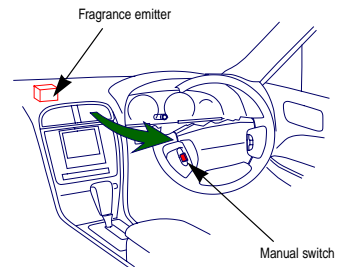
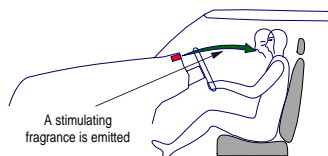
Drowsiness warning system



Drowsiness detection with image analysis



Drowsiness relieving system

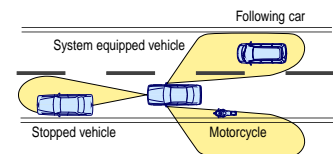


### Obstacle Warning System

This system detects objects in front of or behind the vehicle, such as a vehicle or an object on the road, and, depending on the object's proximity, emits a warning to alert the driver.

A camera mounted near the inside mirror shows the lane and vehicles ahead, while a radar device located in the front of the vehicle monitors relative speed and distance and the car's absolute speed, and sounds an alarm when there is a danger of collision.

Objects behind the vehicle can be observed with a camera mounted in the door mirror. There is also a radar device in the rear bumper that monitors the distance of rear vehicles, during lane changes, etc., and activates the warning system when a vehicle is too close.



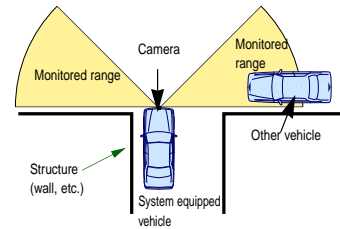
Obstacle warning system

## Information Safety

### Preview Corner Monitor System

With a camera mounted in the center of the front bumper and connected to a monitor inside the vehicle, the driver can see objects in blind spots when entering intersections with poor visibility (such as when the road is narrow and surrounded on either side by walls), or when leaving a parking lot or garage with poor visibility. By helping the driver visually check the vehicle's surroundings, this system also increases peace of mind.

The cleverly designed optical system allows a single camera to show both the left and right sides simultaneously on one monitor. And since only one camera is used, unnecessary exterior appendages are avoided and costs are kept low. In addition, the monitor can be shared by car navigation or other systems.



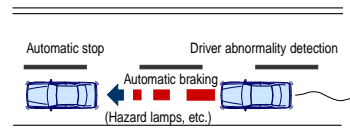
Preview corner monitor system

## Control Safety

### Emergency Braking System for Driver Impairment

When the driver fails to regain a safe level of alertness even after the warnings and precautions of the Drowsiness warning system and Drowsiness relieving system, the vehicle's decision circuit, assuming that a driver is in an abnormal condi-

tion, turns on the hazard lamps, etc., to warn other drivers, and automatically stops the vehicle to help reduce accidents. This system can also be activated manually by the driver - for example, during the sudden onset of a health problem.

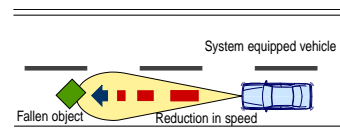


Emergency stop system

### Automatic Braking System for Reduction of Collision Speed

This system automatically applies the brakes when it determines that a collision is imminent in the event the driver fails to take evasive action after the obstacle

warning system has emitted its warnings. The objective is to reduce the collision speed as much as possible.



Collision speed reduction system

# ASV (Advanced Safety Vehicle)

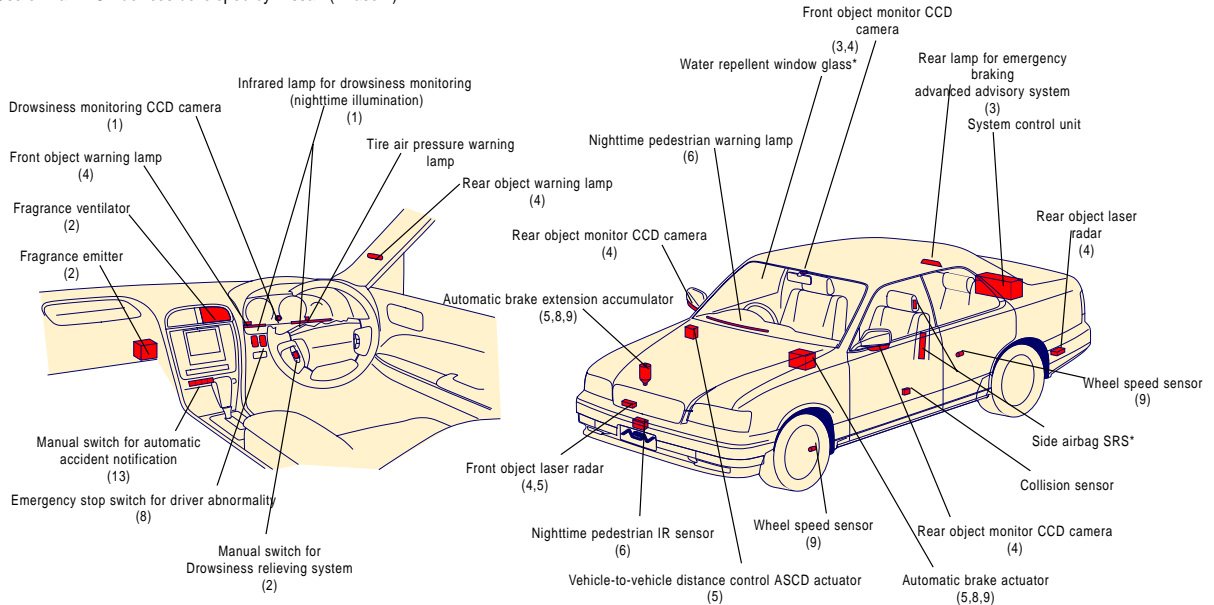
ASV (Advanced Safety Vehicle) is being promoted by the Ministry of Transport. Nissan participated in Phase 1 (1991-1995) of this project, and is now participating in Phase 2 (1996-2000). In addition to stepping up R&D efforts toward the practical implementation of

the technologies that were the focus of research and development during phase1 (side airbag SRS and a water repellent window coating system have already been implemented), Nissan is actively involved in R&D on "Autonomous Driving Technologies"

and on "Fundamental Automotive Technologies" such as the optimization of the human-machine interface. The various technologies being developed as part of Nissan ASV are guided by Nissan's Triple Safety concept.

\* Already in use

Use of main ASV devices developed by Nissan (Phase 1)



The ASV, an experimental vehicle now being developed for implementation in the 21st century, uses advanced electronics technologies -- onboard sensors, computers and other devices -- to monitor the driver, the vehicle and the surroundings, and to effectively give the vehicle functions that support driving. This new technological approach, will improve safety, help prevent accidents and reduce injuries during accidents.

## ASV Technical Issues being undertaken by Nissan

(Technologies are classified by ASV categories)

### Active Safety Technologies

(Presentation of information, warnings and injury mitigation)

- 1 **Drowsiness warning system**
- 2 **Drowsiness relieving system**
- 3 **Emergency braking advanced advisory system**  
Brake lamps are illuminated even before the driver brakes hard in an emergency, thus advising the driver of a following vehicle to take evasive action.
- 4 **Obstacle warning system**
- 5 **Adaptive cruise control system**  
If the driver approaches too closely to a preceding vehicle, the speed is automatically reduced to maintain a suitable safety distance.
- 6 **Pedestrian monitoring system**  
This system detects and alerts the driver to the presence of pedestrians at night as well as in vehicle blind spots.
- 7 **Headlamp illumination pattern control\***  
Nighttime visibility is improved by controlling the head-lamp illumination characteristics according to the driving conditions.

### Accident Avoidance Technologies

(Improvements in performance limitations and automated vehicle control)

- 8 **Emergency braking system for driver impairment**
- 9 **Automatic braking system for reduction of collision speed**
- 10 **Lane control system\***  
In the event the system detects and determines that incipient lane deviation is not the driver's intention, it issues a warning and automatically steers the vehicle, if necessary, to prevent it from leaving its lane.

### Automated Driving Technologies

(For use with existing or new infrastructures)

- 11 **Integrated safety system vehicle\***  
Integrated system control is performed to make full use of individual safety systems and thus obtain optimum safety capabilities. In addition, Nissan also intends to direct R&D efforts toward autonomous driving systems that would preclude human error and automated driving systems based on the use of the roadside infrastructure.

### Impact Safety Technologies

#### 12 **Pedestrian protection vehicle body\***

By improving the energy-absorbing capacity of the vehicle body, Nissan intends to reduce the impact applied to pedestrians in accidents involving them.

### Damage Containment Technologies

#### 13 **Automatic emergency reporting system\***

If an accident occurs, the vehicle's location is automatically reported to a traffic operations center via the vehicle's cellular phone or some other wireless link to facilitate immediate rescue action, including a request for dispatch of an ambulance.

### Fundamental Vehicle Technologies

#### 14 **Systems tailored to human-machine interfaces\***

The ways in which safety systems issue warnings and execute control operations will be optimized from the standpoint of compatibility with human-machine interfaces.

\* Indicates an issue begun in Phase 2

## AHS (Advanced Cruise-Assist Highway System)

AHS (Advanced Cruise-Assist Highway System) is a support system that links the vehicle to the road in an advanced, intelligent way - with warnings, cruise assistance, and other features that support safe cruising. The ultimate goal of this project is automatic cruising that is both safe and comfortable.



AHS was launched by the Ministry of Construction in 1989 with private-sector participation. In 1996, the AHS Research Association was founded with 21 participating private corporations to further intensify the quest to develop a working, practical system.



Nissan has been actively involved in AHS-related research and development since the project's start.

In September 1996, in Komoro-city, Nagano Prefecture, a demonstration of an experimental AHS vehicle was carried out on actual roads for the first time in Japan.

Below is an overview of the features of the Nissan AHS vehicles used in that demonstration.

### Information Provision Service

- Road condition warning systems: accident, road obstruction, and traffic congestion reports, etc.
- Miscellaneous warning system: safe headway, excessive speed, and lane deviation warnings, etc.

### Control Support Service

- Adaptive cruise control
- Collision prevention: Automated braking using information from on-board sensors and roadside LCX (leakage coaxial) cable

### Automated Cruise Service

- Automated driving guidance using magnets imbedded in the road surface
- Automated acceleration/deceleration guided by LCX
- Platoon driving

## Research on Human Behavior at the Nissan Cambridge Basic Research

Nissan strives to develop safe driving support systems designed to be user friendly. Special emphasis is being placed on the human-machine interface in developing these systems. In addition to Nissan's in-house research programs, joint R&D projects are also under way with a wide range of specialized research institutes both at home and abroad. The aim of these efforts is to create systems optimally tailored to driver behavior.

As part of this work, Nissan established the Cambridge Basic Research (CBR) in Cambridge, Massachusetts in the United States in 1992. With the cooperation of American universities and research institutes, CBR is engaged in research on recognition, judgment and functional comprehension during driving. Nissan makes extensive use of the results of this research in designing and engineering new vehicles and systems.

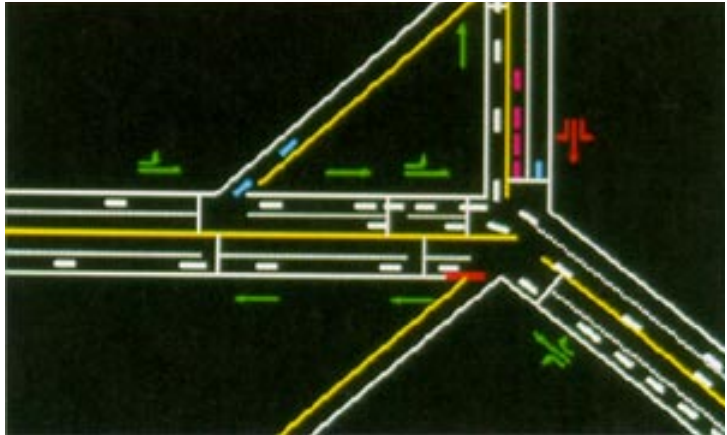
### An example of research:

Nissan studied how people remember roads. This research revealed that people can be divided into three groups with respect to how they remember roads: those who remember distinctive turns, those who remember routes in sequence, and those who can remember where they have been as clearly as if reading a map. These results suggest the need for different types of guidance for different people, and also indicates the importance of basic research.

## Nissan's Traffic Flow Simulator

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As traffic congestion tends to cause accidents, Nissan has developed a traffic flow simulation model capable of forecasting traffic conditions and suggesting ways to ease congestion. This system, which uses computers to represent actual traffic flows, can examine the cause of congestion and evaluate the congestion-easing effects of road construction and traffic signal optimization. This system is being used to analyze traffic conditions in Yokohama, Yokosuka and other cities with the cooperation of the Kanagawa Prefecture Police, etc.



## Urban Traffic System for Ultra-Small Electric Vehicles

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New types of vehicles will be required as a means of personal mobility in urban areas in the future. Such vehicles will have to be designed to minimize energy consumption, air pollution and the space they occupy.

Nissan's ultra-small electric vehicle is designed in accordance with the zone body concept and so, despite its ultra-small size, delivers the same impact safety performance as a conventional small vehicle.

In "community zones" of residential areas, systems like the Zone 30, an ITS-based roadside-to-vehicle communications system, will be used to automatically control the maximum speed of vehicles passing through those areas. This system will ensure convenient door-to-door transportation that also promotes safety and keeps noise levels low in the driver's neighborhood and the residential areas visited.