

**NISSAN MOTOR CORPORATION**



# **Autonomous Drive in NISSAN**

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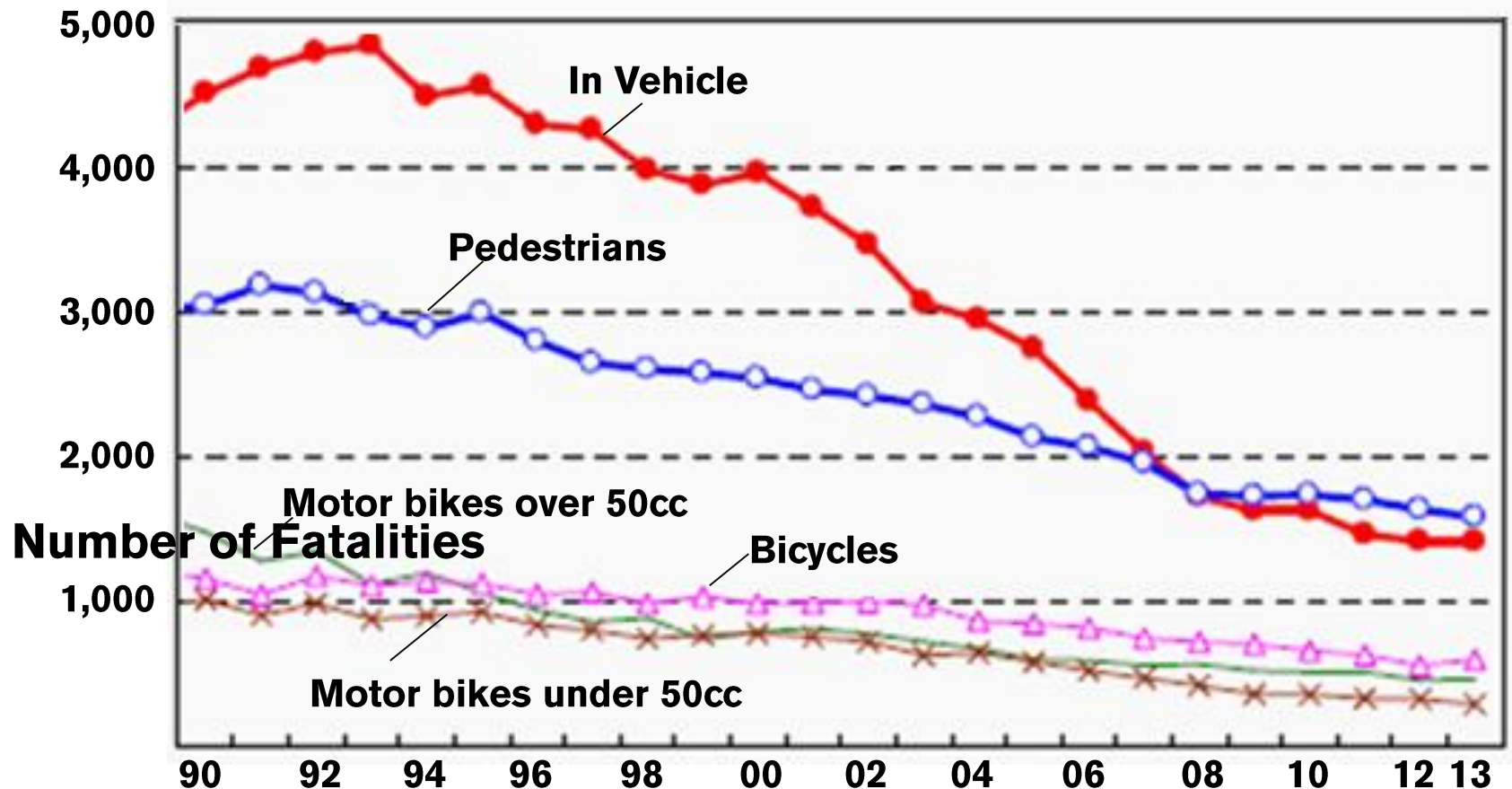
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# 1. Background

# Fatalities change of each mobility

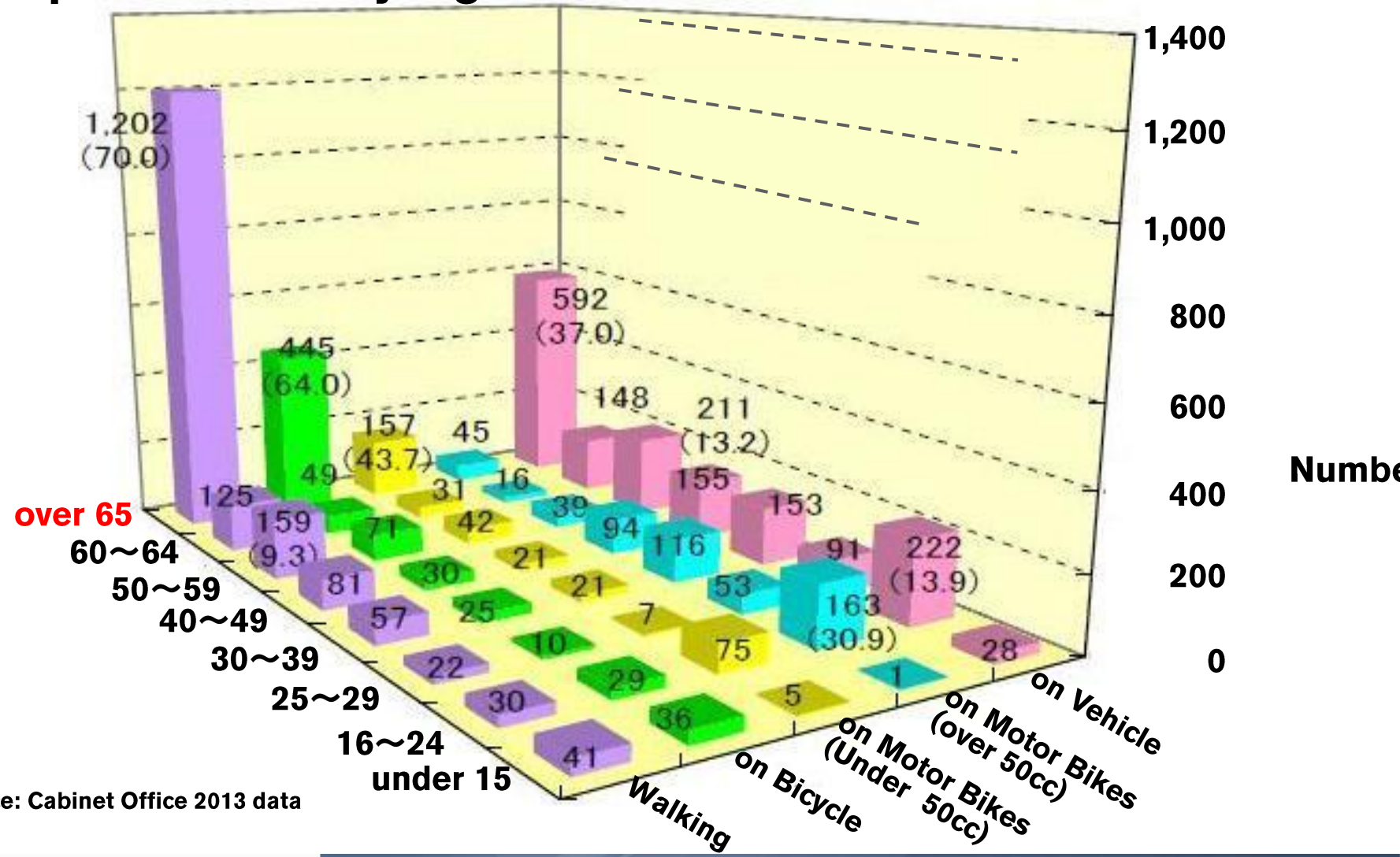
- Fatalities of pedestrian are now higher than those in vehicles.
- Fatalities reduction is levelling out.
- Fatalities especially for elderly people in vehicle have begun to increase.



Source: National Police Agency 2013 data

# Fatalities change by each generation & mobility

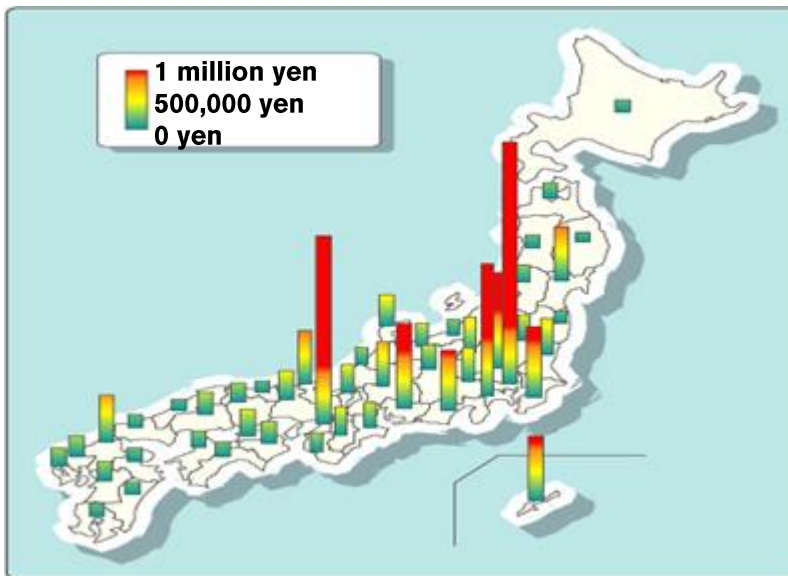
■ The fatality rate of pedestrian/bicycles/driver of elderly people is extremely high.



Source: Cabinet Office 2013 data

# Government's Goal for Smooth Traffic

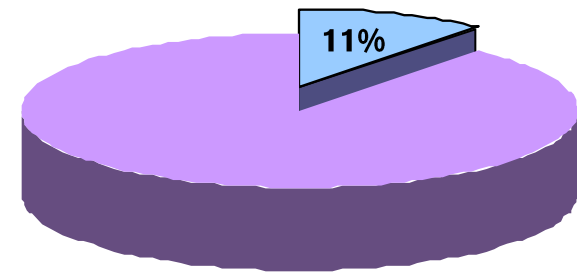
- A 50% reduction in traffic jam by 2020 compared with 2010.
- We are having huge economic loss from traffic congestion.
  - Economic loss from traffic congestion 12 trillion yen/year
  - Fuel consumption by vehicles 11% consumed in traffic congestion



**Amount of loss due to traffic congestion**

Measures to Ease Traffic in Metropolitan Areas, Ministry of Land, Infrastructure and Transport, 2003

**Percentage consumed in traffic congestion**



**Fuel consumption by vehicles**

Source: Energy Conservation Center, Japan

## **2. Nissan Systems**

# Nissan's Autonomous Drive Prototype

- Nissan full EV, LEAF, is used for autonomous drive prototype.



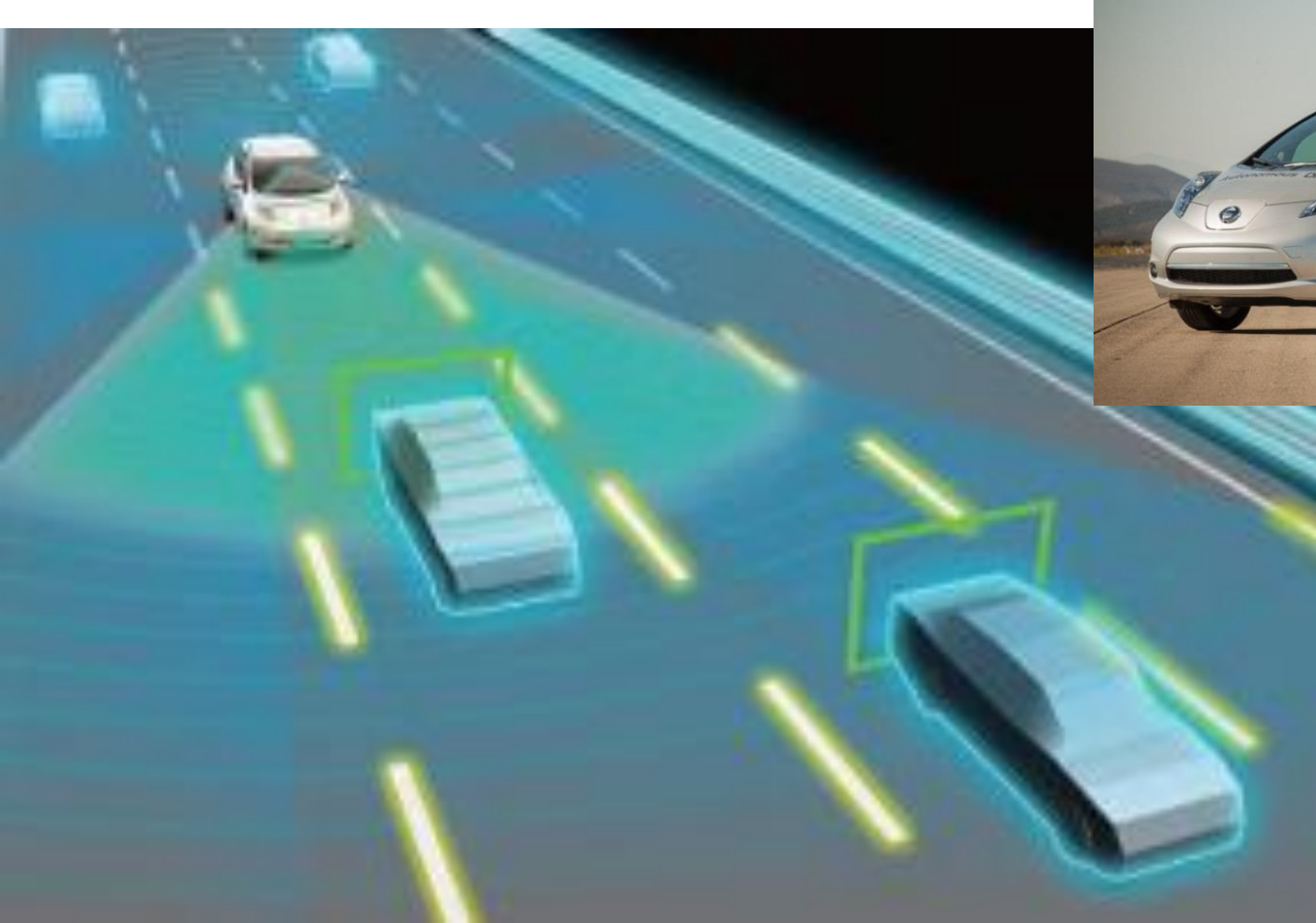
**Autonomous Driving on Highway  
and Parking**



**Autonomous Driving in City**

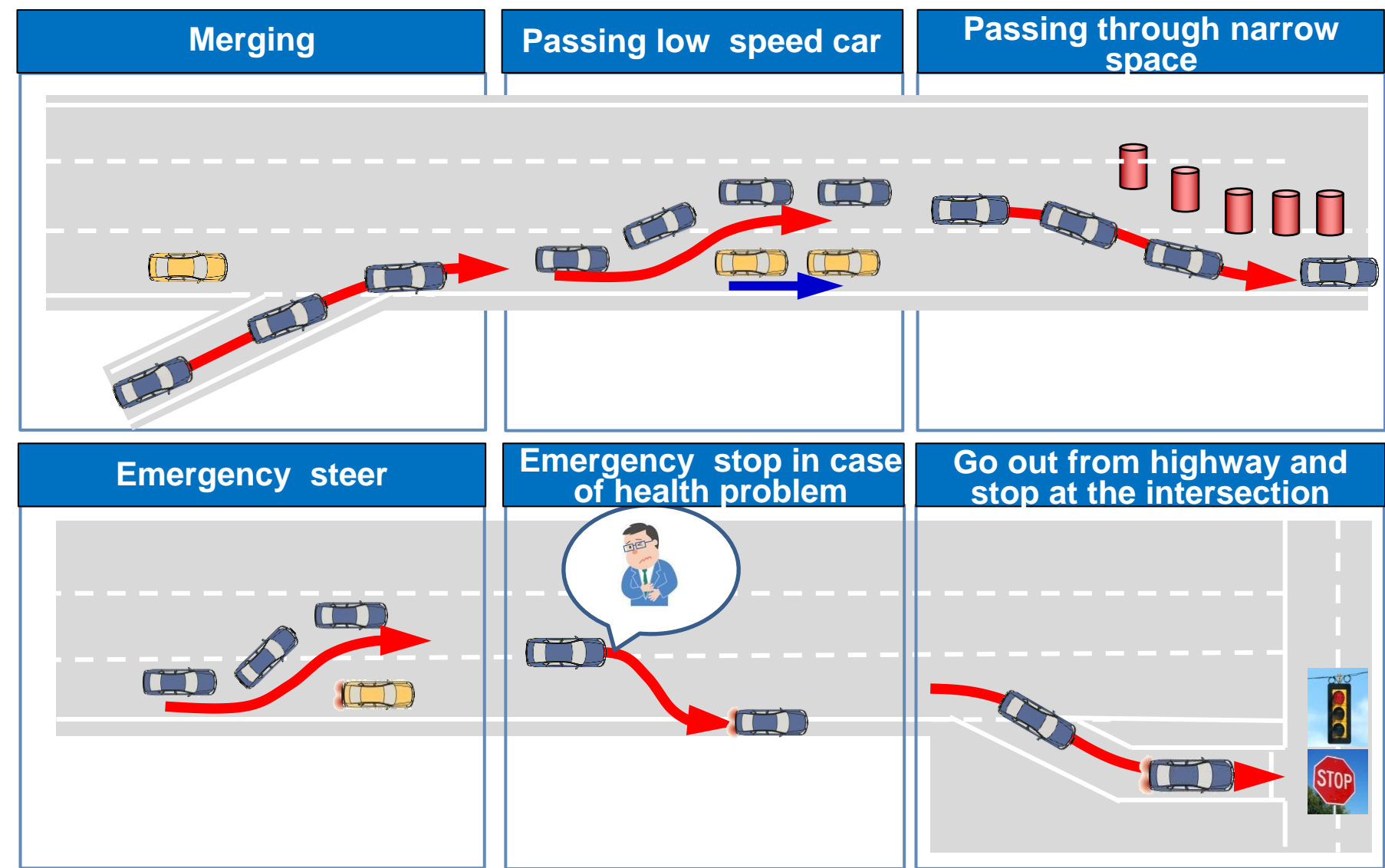
# Autonomous Drive on Highway

- The system recognize lane, traffic condition around the vehicle, traffic sign and traffic signal.  
Vehicle runs autonomously by calculating suitable route.



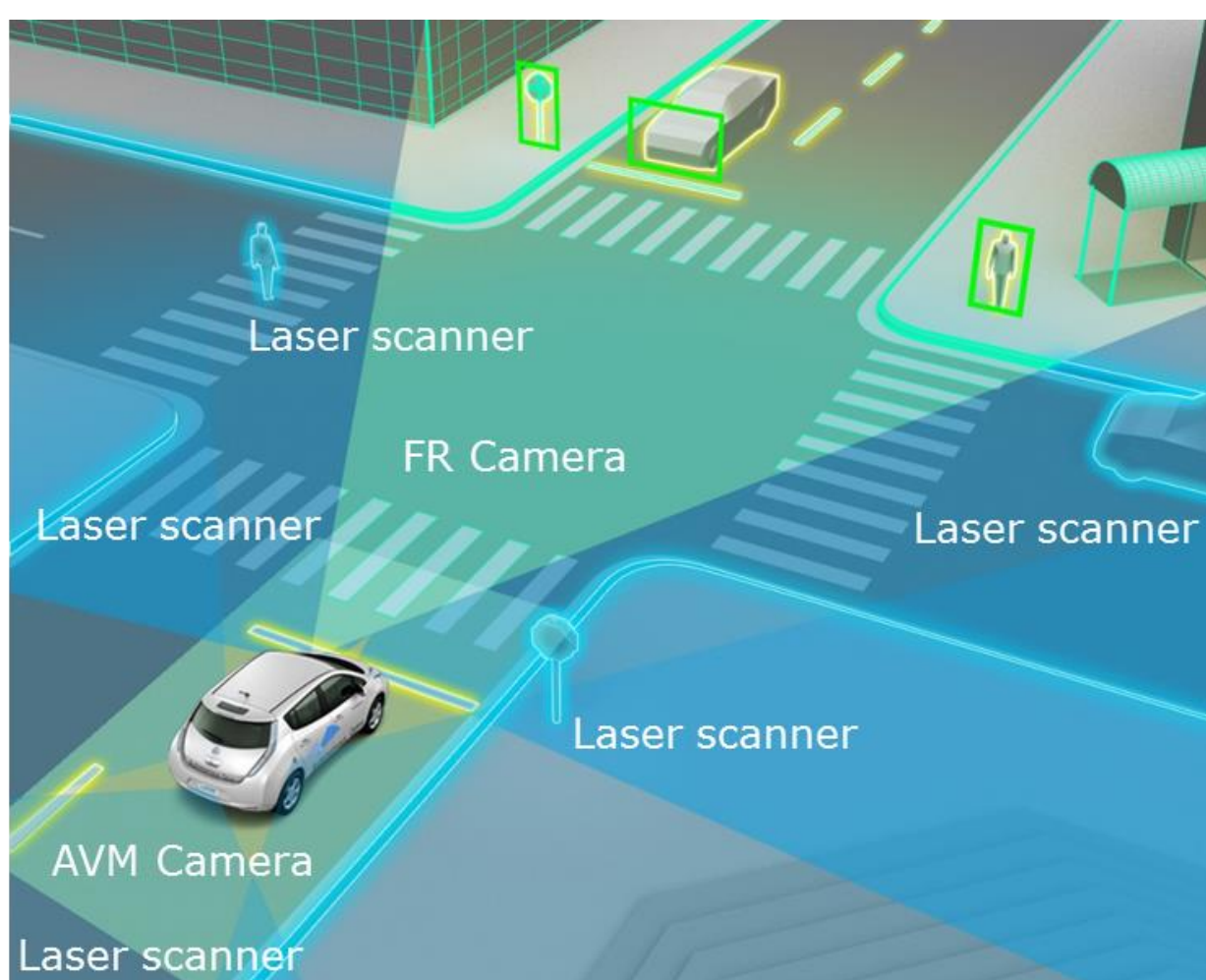
# Autonomous Drive on Highway

■ System provides a support at 6 stressful driving scenes.



# Autonomous Drive in City

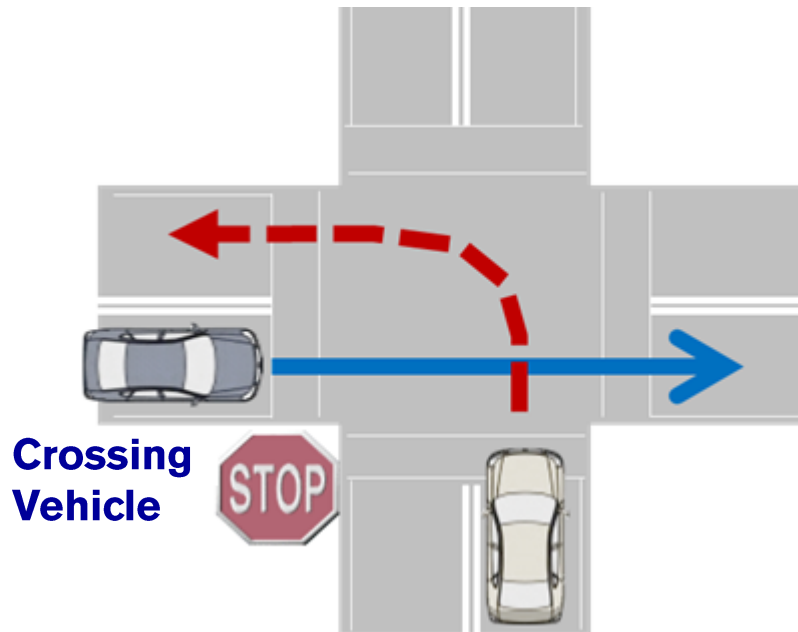
- System has been developed for the city scenes such as intersection, stop signs, parked cars, on-coming cars, etc..



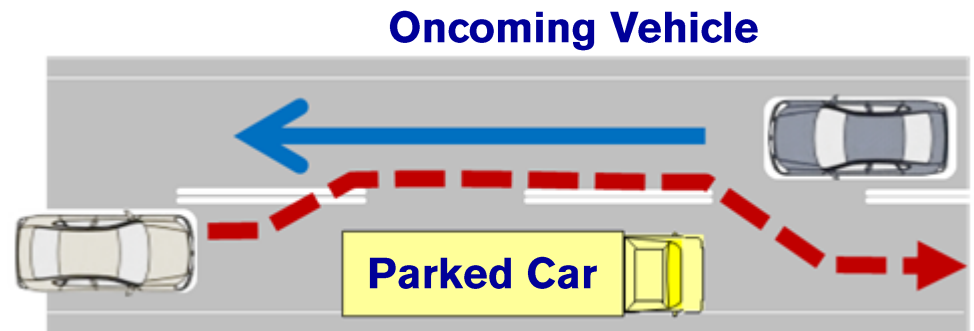
# Autonomous Drive in City

- Advanced AI logic reads the movement of the obstacles on the road especially in 2 difficult scenes below.

## Driving through Intersection



## Overtaking a Parked Car



# Video



**Autonomous Driving on Highway  
and Parking**



**Autonomous Driving in City**



# Perception

- Camera may have better perception than human eyes in some cases.



**The camera can recognize small changes at high speed like slow-motion**

# Judgment

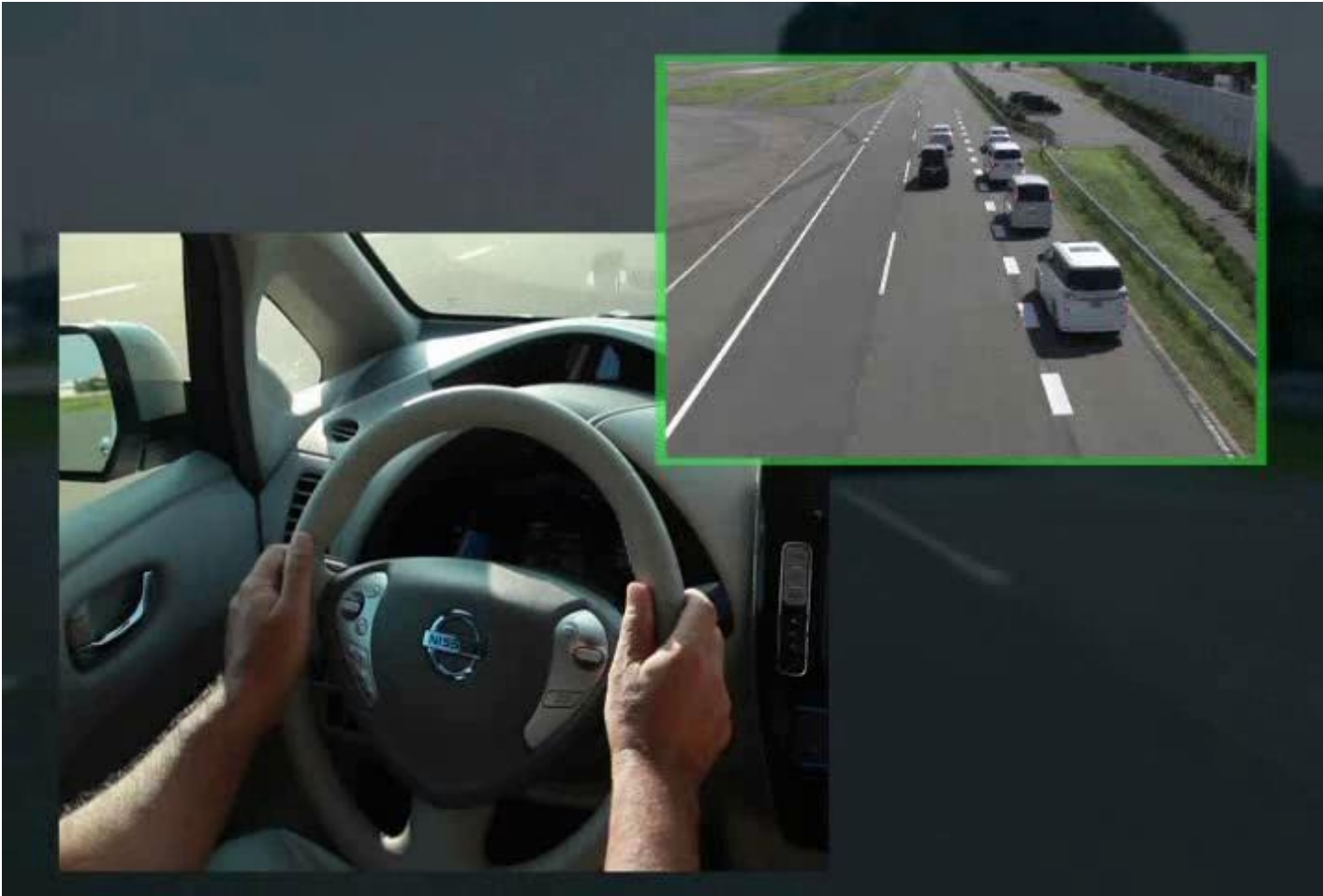
- In order to recognize objects, camera may make a better judgment than human eyes in some cases.



The camera can recognize multiple moving objects at the same time

# Response and Operation

- System can react more precisely and quickly than human eyes.



**Precise and  
quick  
reaction.**

# Announcement

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## **By the end of 2016**

**Nissan will make available the next two technologies under its autonomous drive strategy.**

- (1) a traffic-jam pilot, a technology enabling cars to drive autonomously and safely on congested highways.**
- (2) fully-automated parking systems available across a wide range of vehicles.**

## **In 2018**

**Multiple-lane controls, allowing cars to autonomously negotiate hazards and change lanes.**

## **By the end of 2020**

**Intersection-autonomy, enabling vehicles to negotiate city cross-roads without driver intervention.”**

### **3. V2X support for Autonomous Drive**

# V2X for Autonomous Drive

- V2I is expected for autonomous driving.

**Stand alone basically.**

**V2I is also expected at the following driving scenes, if possible.**

**Merging vehicle info.,**

**Road surface condition ahead, Traffic jam and accident,  
so on**



Source: Ministry of Land, Infrastructure, Transportation and Tourism AUTO PILOT Committee 2013

# Dynamic Map for Autonomous Drive

## ■ Proposal of DM ( Dynamic Map) for Autonomous Drive

### <Drive Route>

Create detailed drive route based on precise map information and traffic regulation information

### <Position Accuracy>

Recognize accurate vehicle position by comparing GPS with DM

### <Vehicle Surrounding Condition>

Grasp vehicle surrounding condition by combination of map and traffic / road information

by Public & Private sectors collaboration.

# DM Hierarchical Structure

- Many kinds of information should be included in DM  
(Dynamic  $\leftrightarrow$  Static)

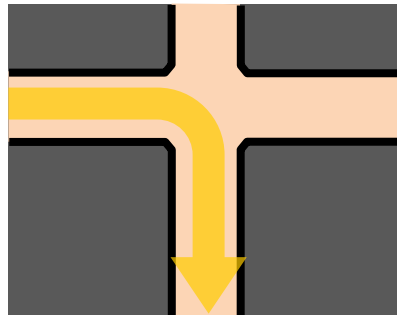
## DM Hierarchical Structure

<b>Dynamic</b> < 1 sec	<b>Vehicle current position</b> <b>Surrounding vehicles / pedestrians...</b> <b>Traffic signal info.</b>
<b>Semi Dynamic</b> < 1 min	<b>Traffic accident info.</b> <b>Traffic congestion info.</b> <b>Local weather info.</b>
<b>Semi Static</b> < 1 hour	<b>Traffic regulation info.</b> <b>Road works info.</b> <b>Wide area weather info.</b>
<b>Static</b> < 1 month	<b>Traffic signal / Landmark position (3D)</b> <b>Road location / traffic sign position (3D)</b> <b>Road section ID / Intersection ID</b> <b>Road shape ( Local roads)</b> <b>Road shape ( Main roads)</b>

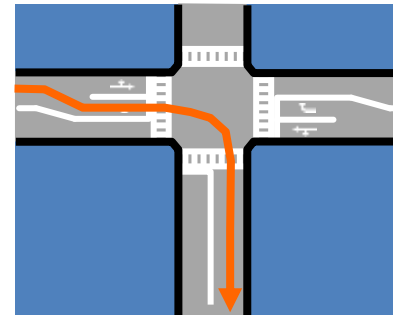


# DM Usage Example 1

- Create detailed drive route based on precise map information and traffic regulation information.

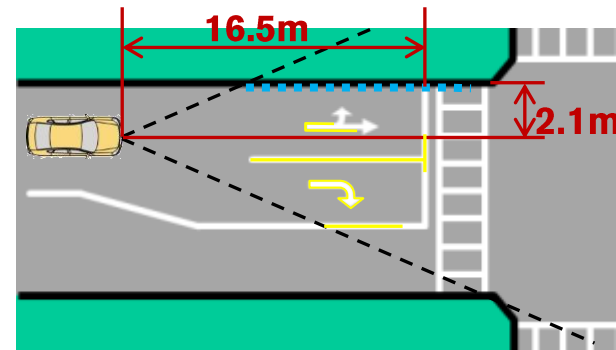
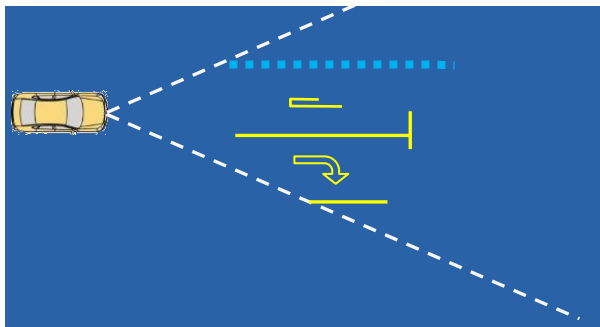


**Car Navigation  
Route Guide**



**Autonomous vehicle  
Drive Route**

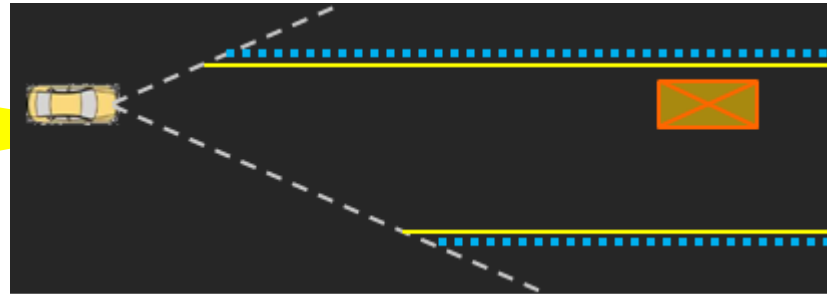
- Recognize accurate vehicle position by comparing GPS with DM.



# DM Usage Example 2

- Grasp vehicle surrounding condition by combination of map and traffic / road information.

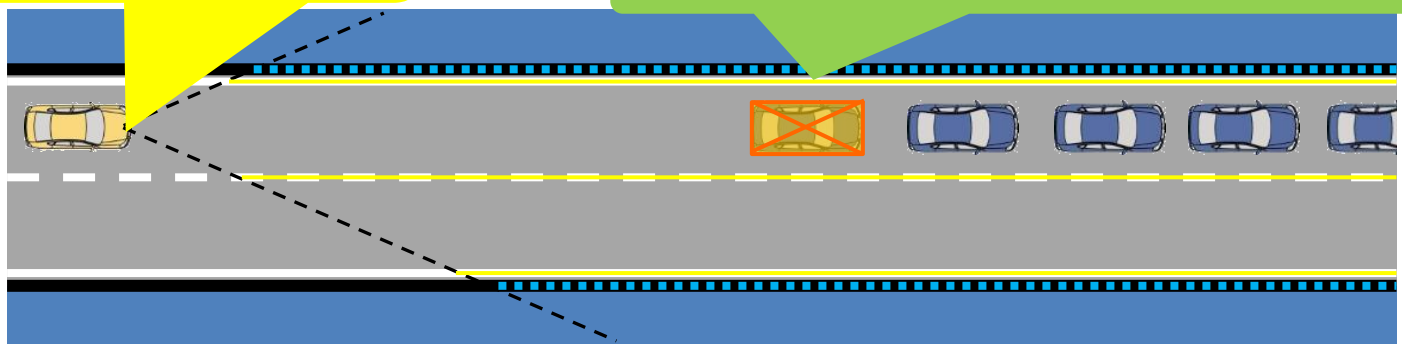
**System cannot know a vehicle ahead is parking or in the end of queue**



**System understand a vehicle ahead is in the end of queue. Never overtake this car.**



***Traffic Jam! End of queue is here!***



# Enhancement of Outside Condition Sensing

- Get more reliable outside information by double source, map and on-board sensors.

		By DM Including V2X	By on-board sensors
Dynamic < 1 sec	Vehicle current position Surrounding vehicles / pedestrians... Traffic signal info.	( ✓ ) ✓ ✓	✓ ✓ ✓
Semi Dynamic < 1 min	Traffic accident info. Traffic congestion info. Local weather info.	✓ ✓ ✓	( ✓ ) ( ✓ )
Semi Static < 1 hour	Traffic regulation info. Road works info. Wide area weather info.	✓ ✓ ✓	
Static < 1 month	Traffic signal / Landmark position (3D) Road location / traffic sign position (3D) Road section ID / Intersection ID Road shape ( Local roads) Road shape ( Main roads)	( ✓ ) ( ✓ ) ✓ ( ✓ ) ✓	✓ ✓  ✓ ✓

## 4. Summary

# Summary

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- **Nissan will launch vehicles which have advanced autonomous drive technologies.**
- **Developed technology will be used not only for realizing autonomous drive but also for enhancing the existing driver assistance systems in order to help solve problems as a result of motorization.**

***Thank you for your attention***

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