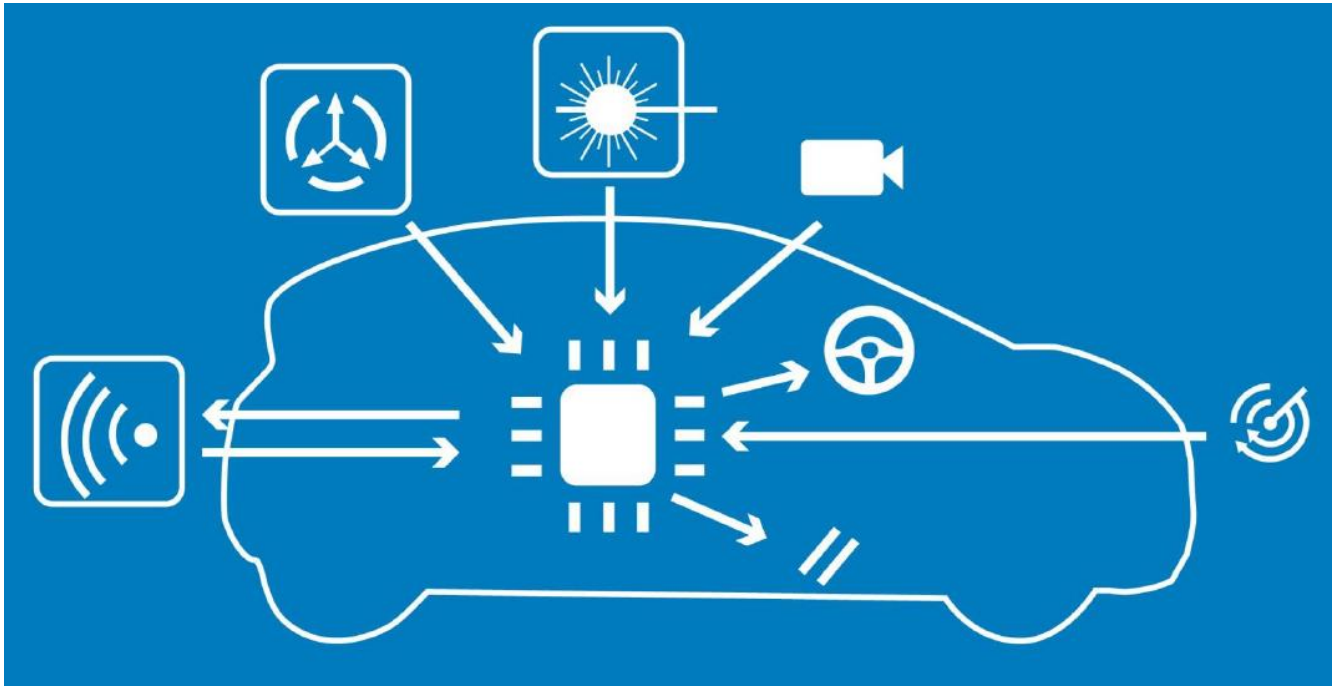
Eletrônica Automotiva

ADAS - Sistema, funções e arquitetura

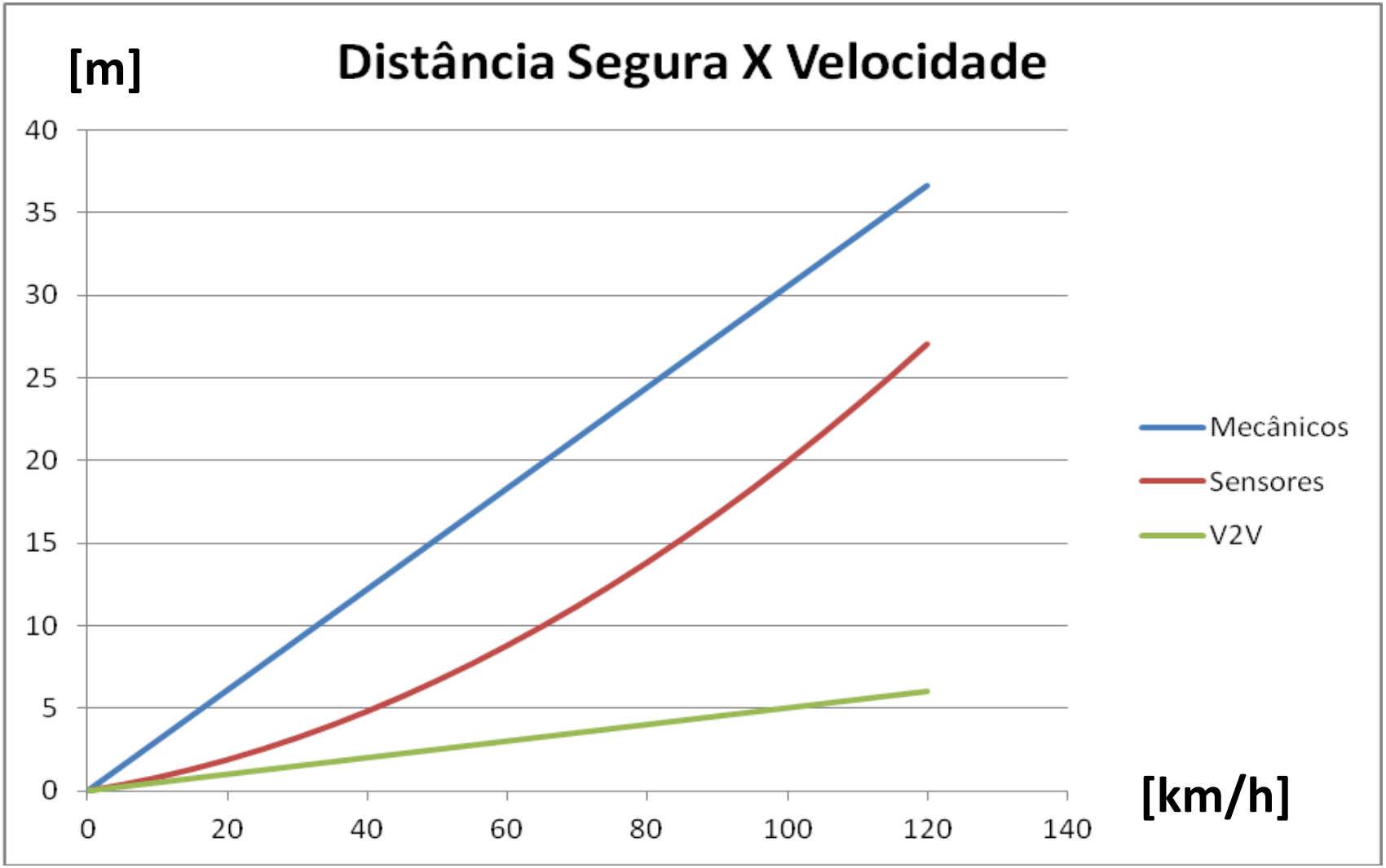


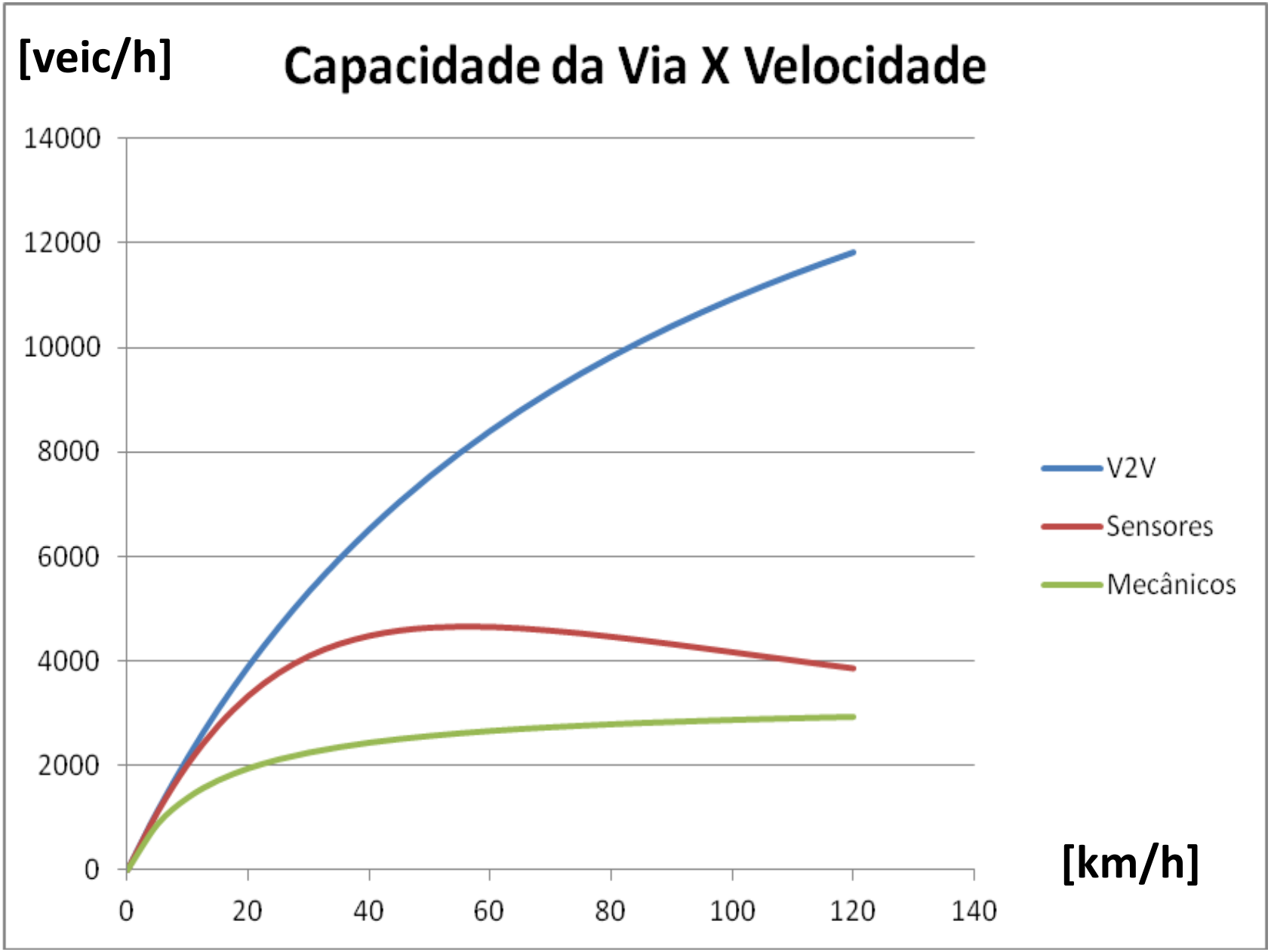
24 Maio 2018

Prof. Leopoldo Yoshioka

Cenário Atual

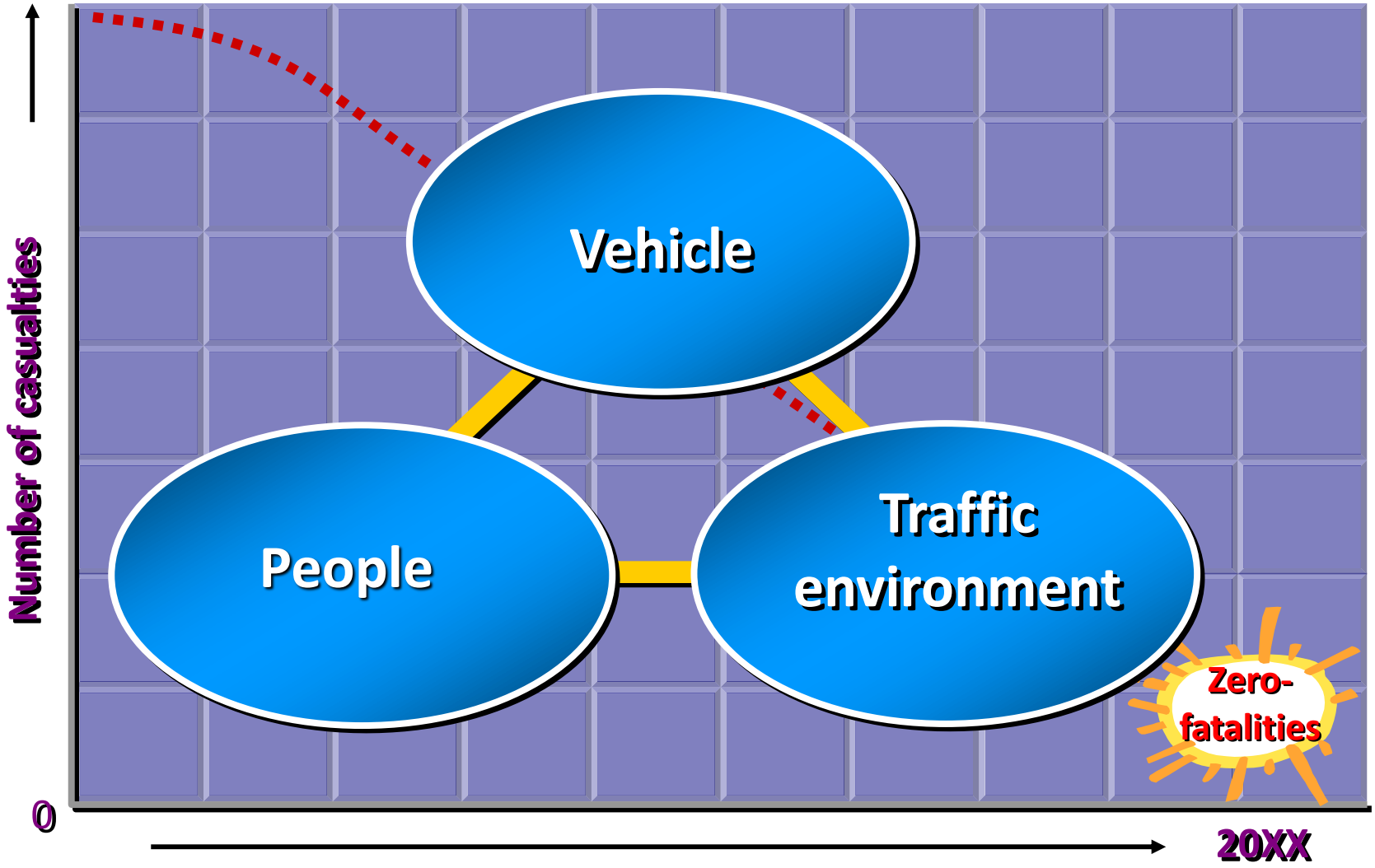
- 90% Inovações => Eletrônica / Software / Inteligência Artificial
- Está ocorrendo uma verdadeira “Revolução de Mobilidade”
- Veículos autônomos disponíveis comercialmente em 5 a 10 anos
- Smart Cities
- Empresa mais inovadora em 2015 e 2016: Tesla (Forbes)
- Oportunidades para empresas e profissionais do mundo inteiro


[m]
Distância Segura X Velocidade
40
35
30
25
20
15
10
5
0
0
20
40
60
80
100
120
140
Mecânicos
Sensores
V2V
[km/h]


[veic/h]
Capacidade da Via X Velocidade
14000
12000
10000
8000
6000
4000
2000
0
0
20
40
60
80
100
120
140
V2V
Sensores
Mecânicos
[km/h]

Acidentes de trânsito

- **1,25 milhões** pessoas morrem por ano no mundo devido a acidentes de trânsito.
- **45 mil** pessoas/ano morrem no Brasil
- **377 mil** acidentes/ano com vítimas no Brasil
- **3ª causa mortis**.


Number of casualties
0
Vehicle
People
Traffic environment
Zero-fatalities
20XX

(Toyota,2007)

Níveis de Automação

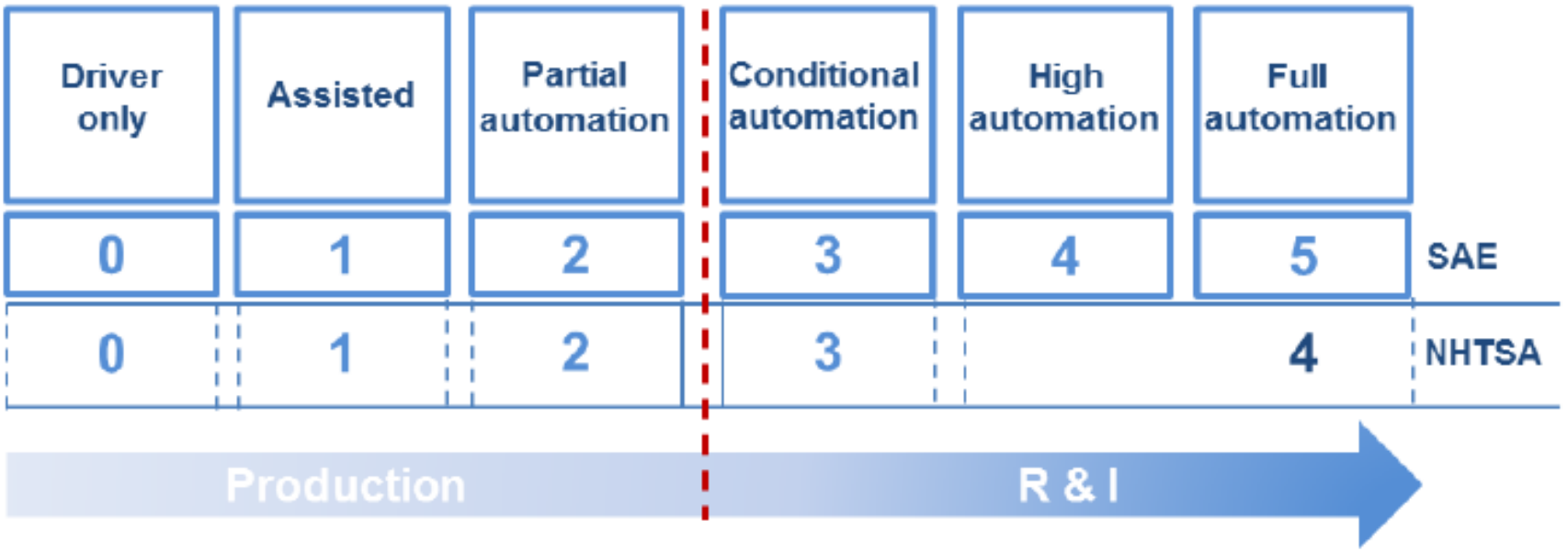
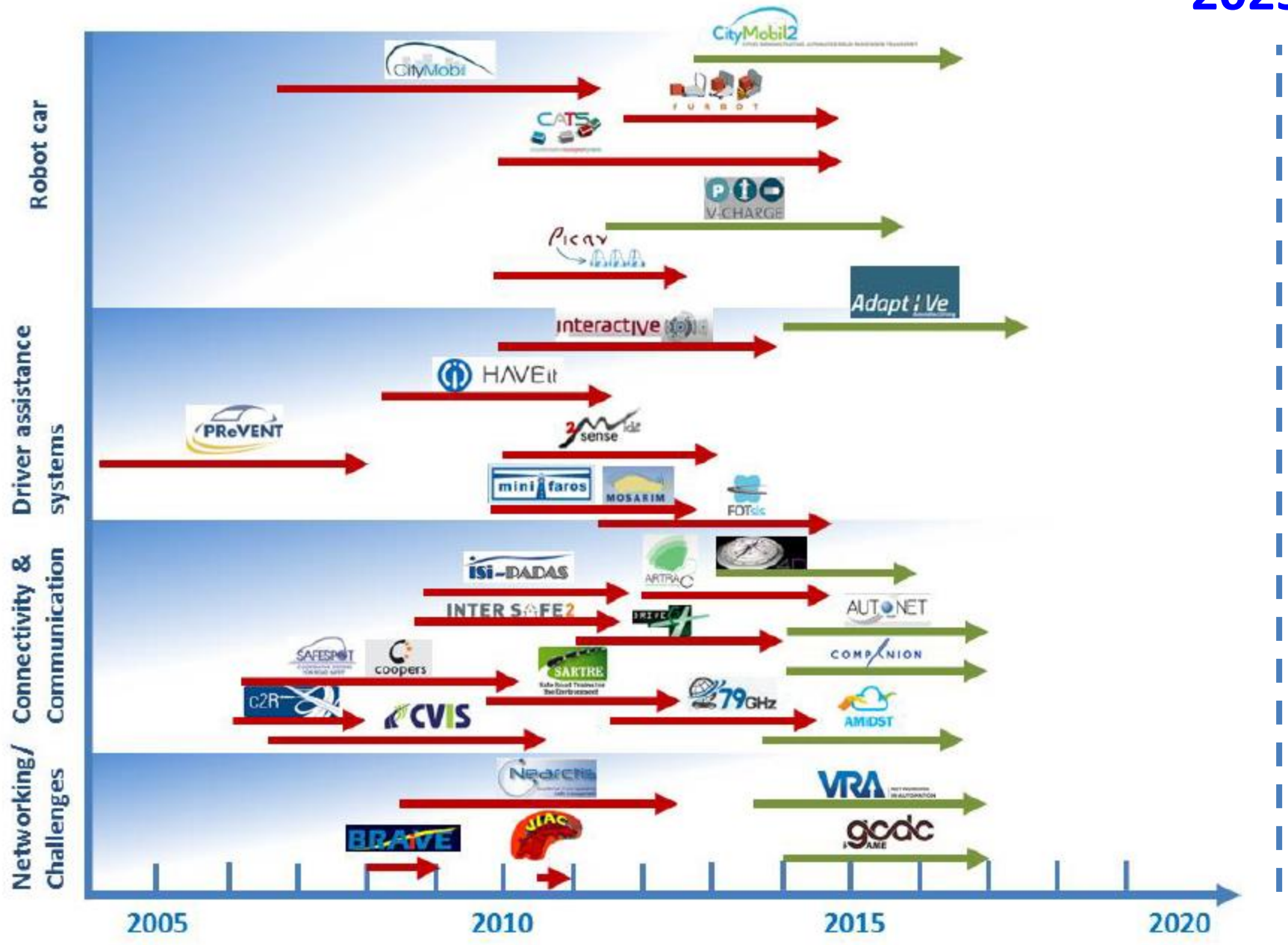


Figure 1: Levels of automated driving as defined by e.g. SAE. For comparison, definitions of automation levels of NHTSA are also given. The latter one comprises high and full automation levels towards level 4 (high automation).

Fonte: EPoSS – European Technology Platform on Smart Systems Integration (2015)


2025
Robot car
Driver assistance systems
Connectivity & Communication
Networking/ Challenges
CityMobil2
CityMobil
FURBOT
CATS
V-CHARGE
Picav
Adapt | Ve
interactive
HAVEit
PReVENT
2sense
mini faros
MOSARIM
FOTsis
isi-PADAS
ARTRAC
INTER SAFE2
AUTONET
COMPANION
SAFESPOT
coopers
SARTRE
C2R
CVIS
79GHz
AMIDST
Nearchos
VRA
BRAVE
JTAC
gcdc
2005
2010
2015
2020

Aula ITS
16.11.2015

1. Introdução → **2. ADAS** → 3. V2X → 4. Reflexão

O que é ADAS?

- **A**dvanced **D**river **A**ssistance **S**ystem
- Sistema que auxilia o motorista no processo de condução do veículo
- Busca aumentar a segurança do veículo e a segurança da rodovia

Advanced driver assistance systems are designed to increase car safety more generally road safety.

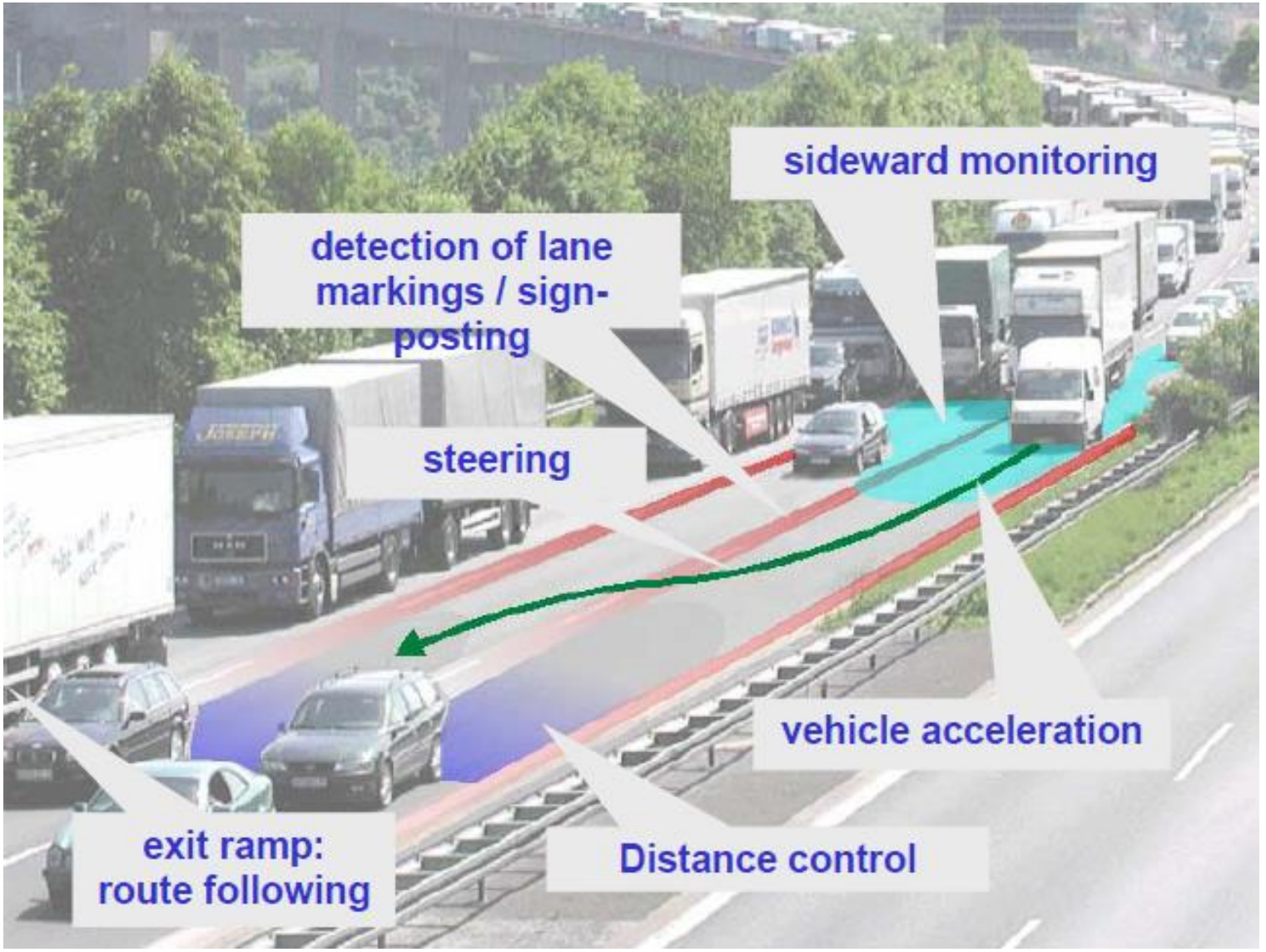
Basically Advanced driver assists(ADS) systems helps the driver in the driving process and enables safe, relaxed driving. It makes sense to get your new car with driver assist features if you find it at a reasonable price as it helps you drive easily and safely in everyday use.

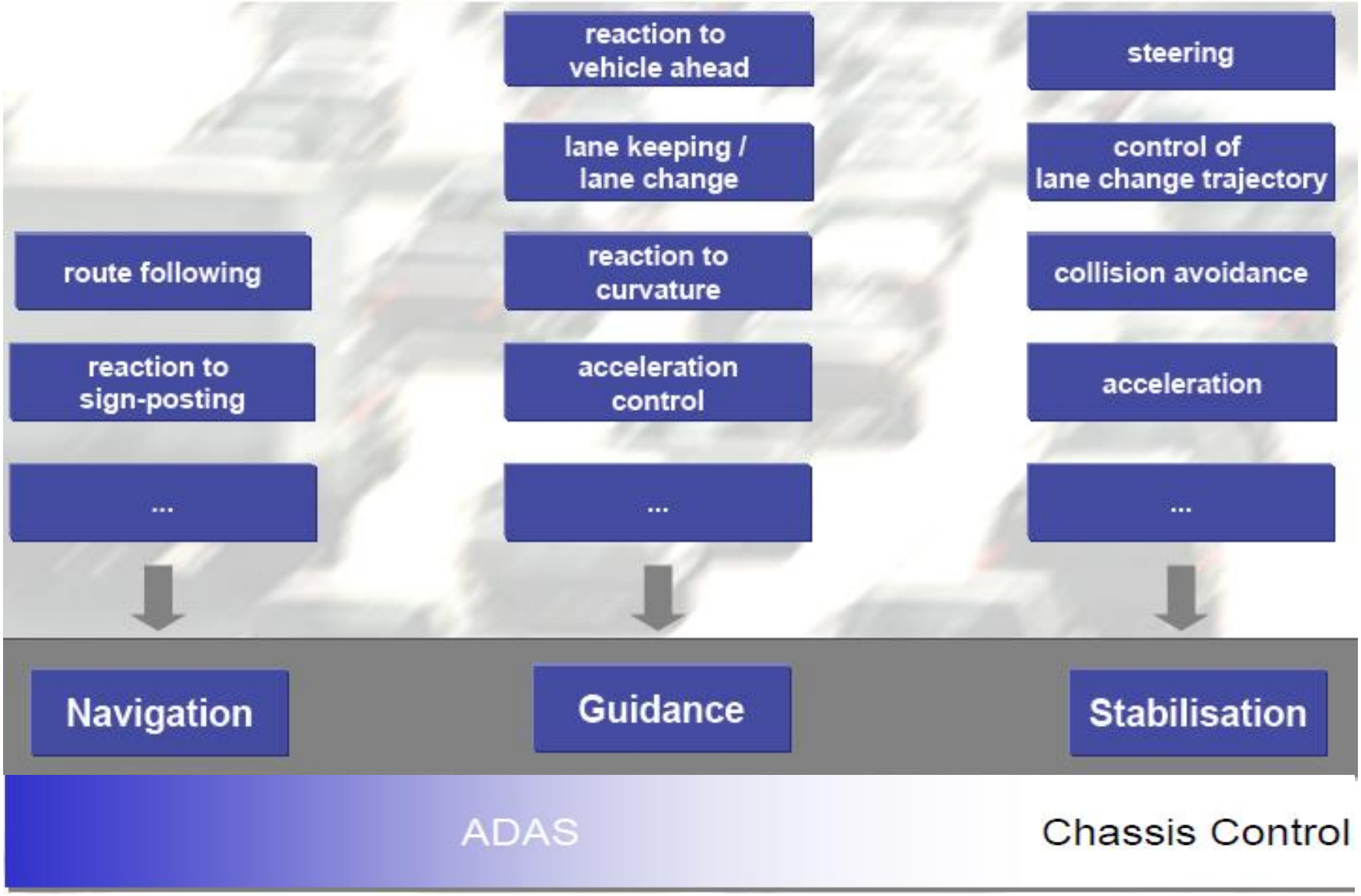
Here are different examples of driver assistance systems designed to maximise the driver safety -

Objetivos do ADAS

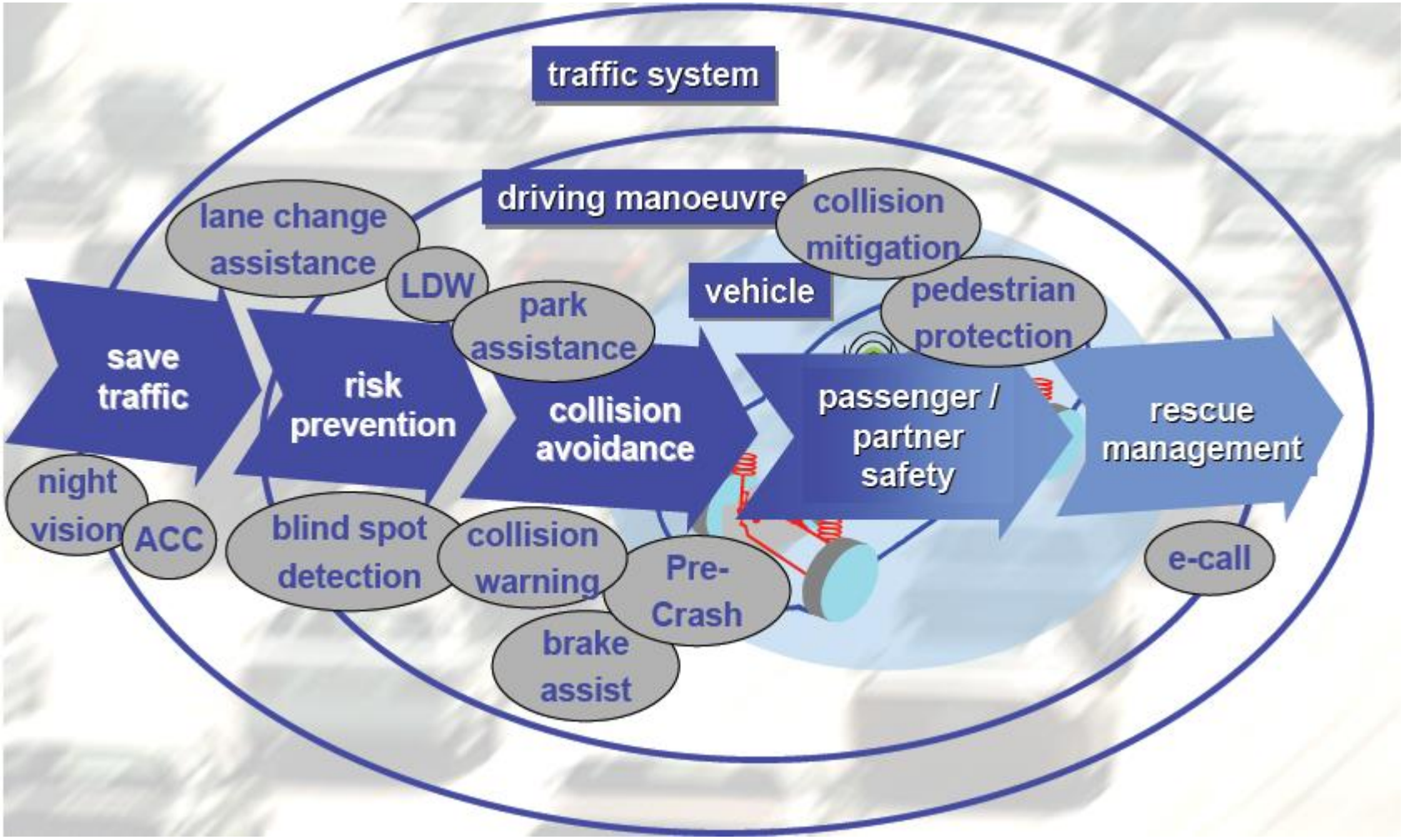
- Comfort
  - improvement of driving comfort
  - decrease of driver's work-load
- Safety
  - accident prevention
  - crashworthiness reduction
  - rescue management
- Traffic efficiency
  - Road capacity usage
  - less congestion
- environmental impact
  - less fuel consumption
  - decrease of traffic noise

Driving Tasks - Exemplo de mudança de faixa

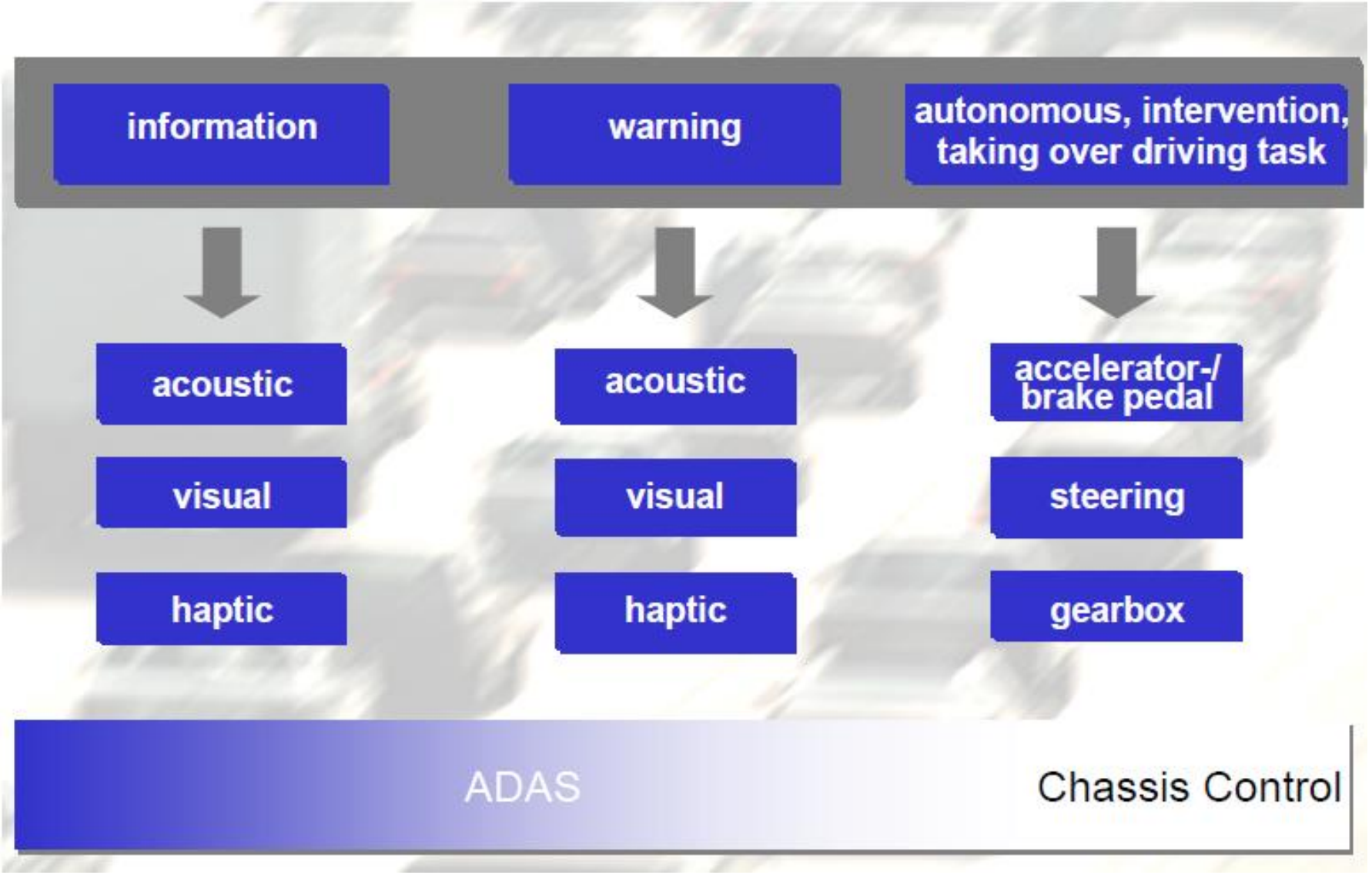



reaction to vehicle ahead
steering
lane keeping / lane change
control of lane change trajectory
route following
reaction to curvature
collision avoidance
reaction to sign-posting
acceleration control
acceleration
...
...
...
Navigation
Guidance
Stabilisation
ADAS
Chassis Control

ADAS - Sistemas de Tráfego



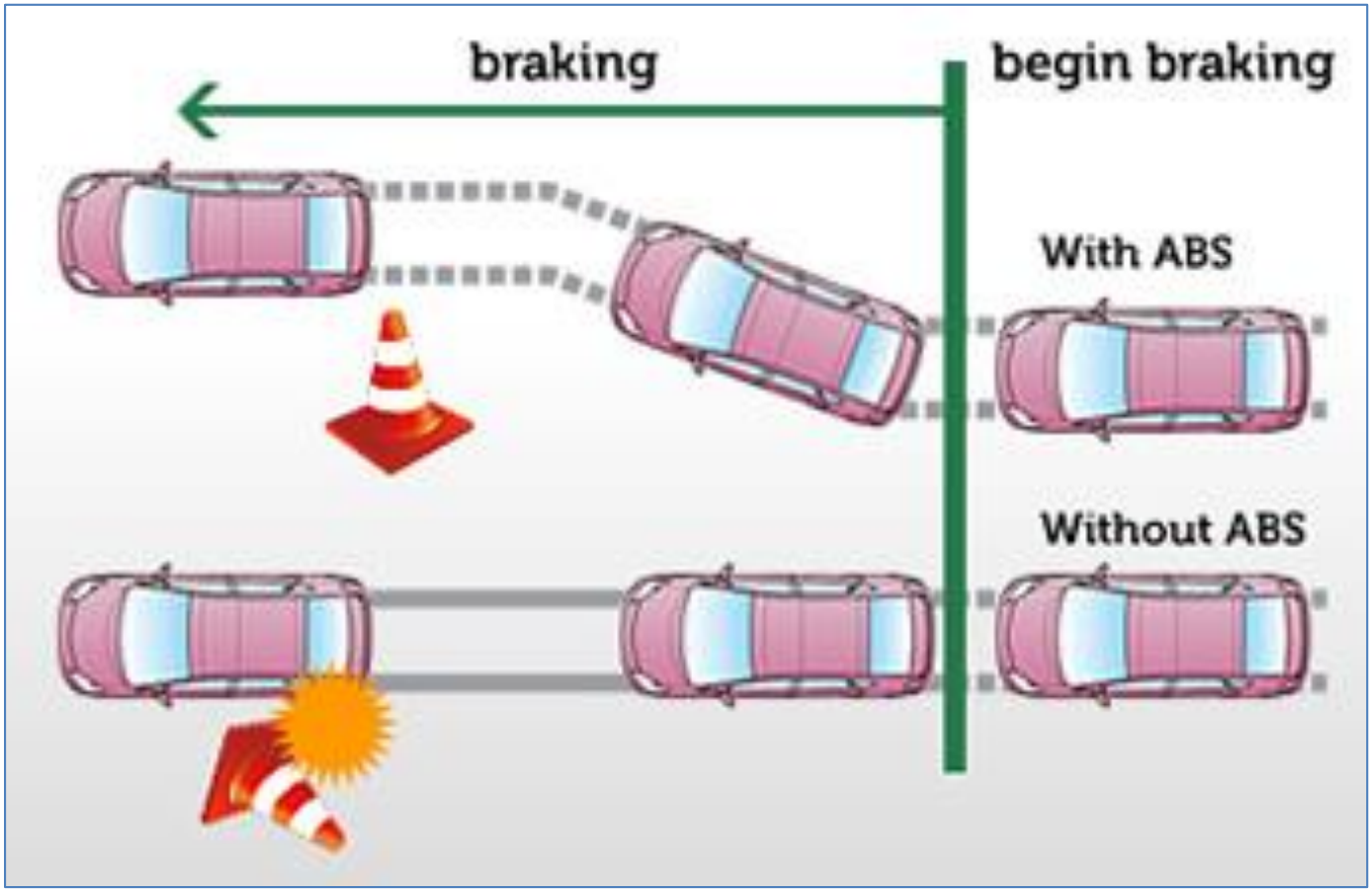
Classification of Driving Tasks



ADAS

- Adaptive cruise control
- Adaptive high beam
- Glare-free high beam
- Adaptive light control
- Automatic parking
- Navigation system
- Night vision
- Blind Spot monitor
- Precrash sytem
- Crosswind stabilization
- Driver drowsiness detection
- Driver monitoring system
- Emergence driver assistance
- Forward collision warning
- Intersection assistant
- Hill descent control
- Intelligent speed adaptation
- Lane departure warning
- Lane change assistance
- Pedestrian protection system
- Traffic sign recognition
- Turning assistant
- Vehicular communicati on systems
- Wrong way driving warning
- Car navigation system

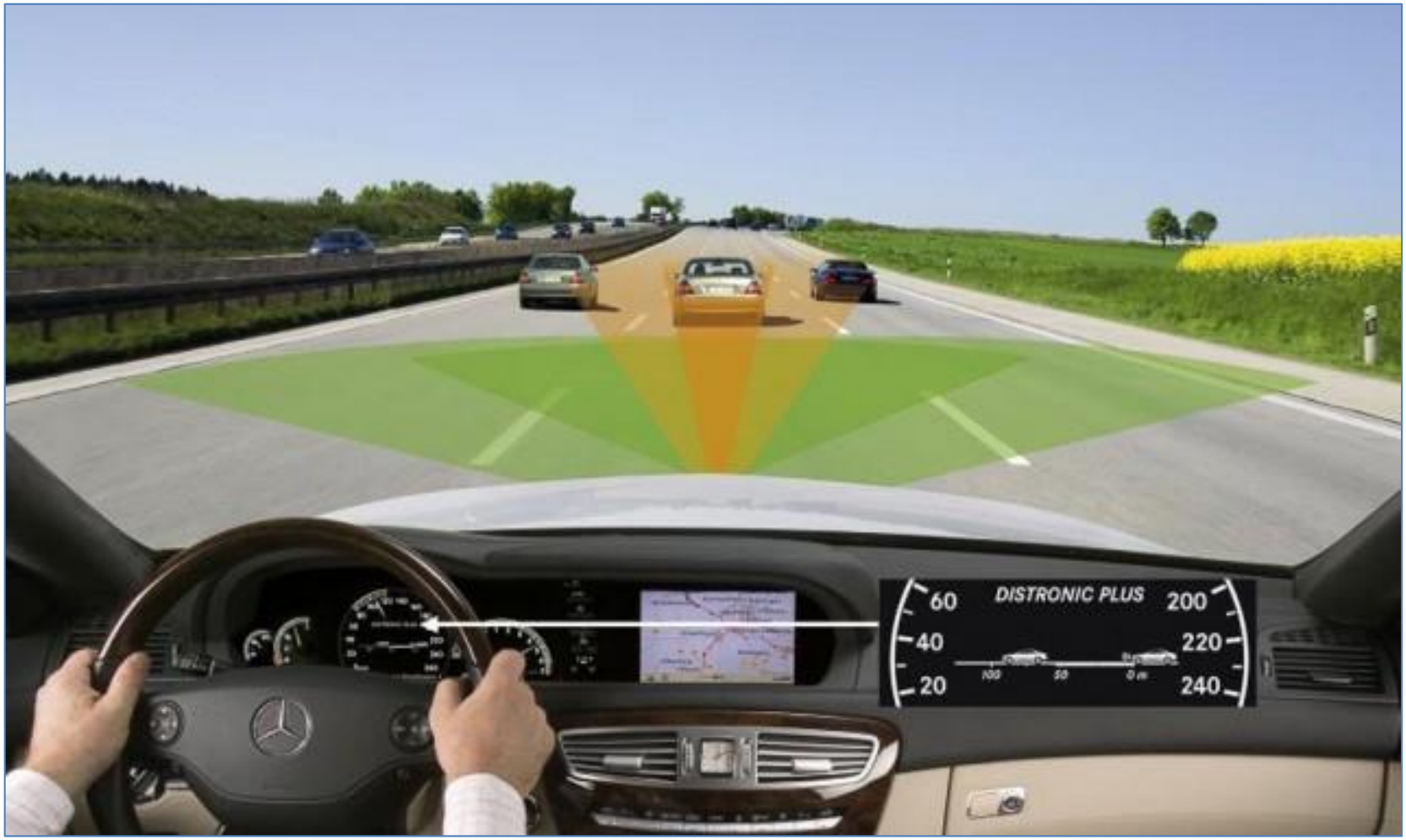
1) Antilock Braking System (ABS)



(Image courtesy – top low rider sites)

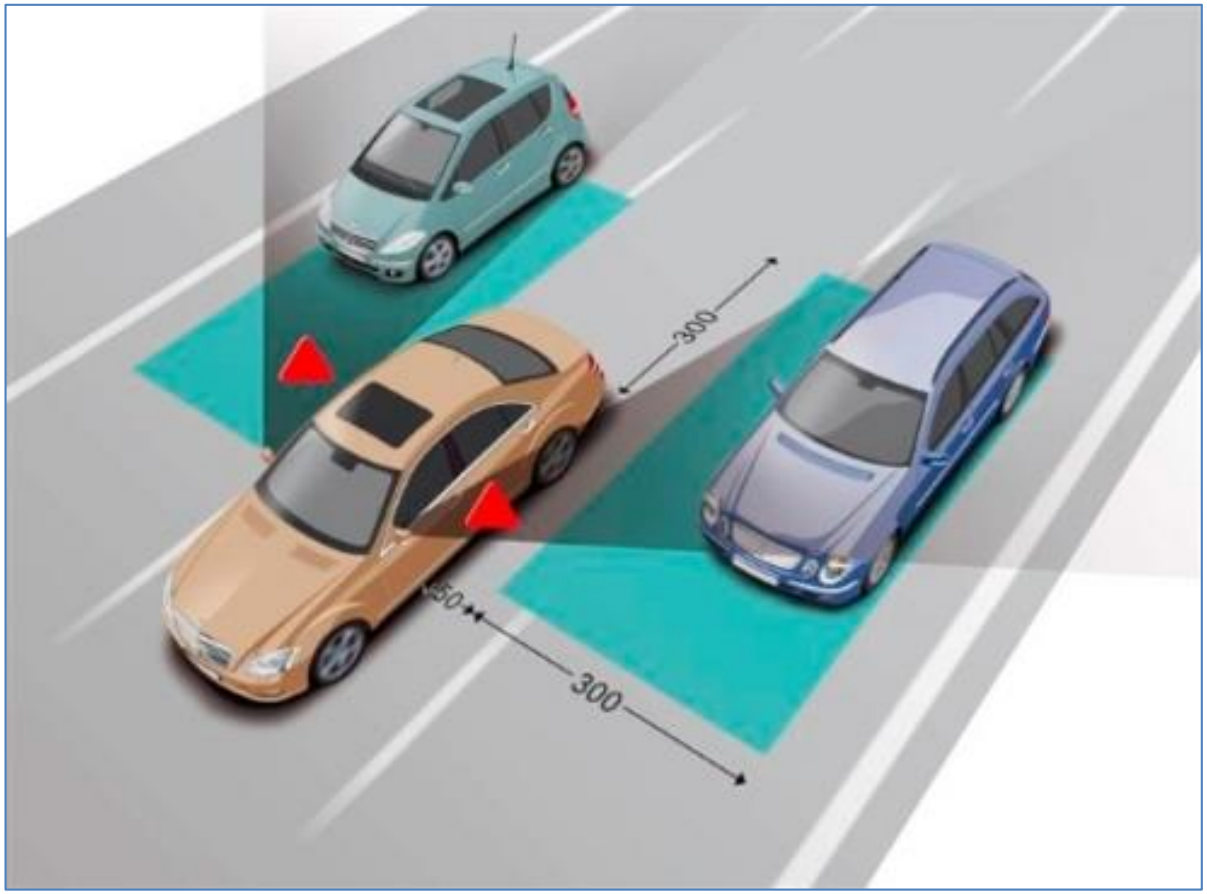
❑ Antilock braking system mainly known as ABS. Basically it allows the wheels to maintain traction control with the road surface while stop braking(emergency braking) and prevents the wheels from locking up and avoid uncontrolled skidding. ABS offers improved vehicle control and decreases stopping distances on dry and slippery roads.

2) Adaptive Cruise Control



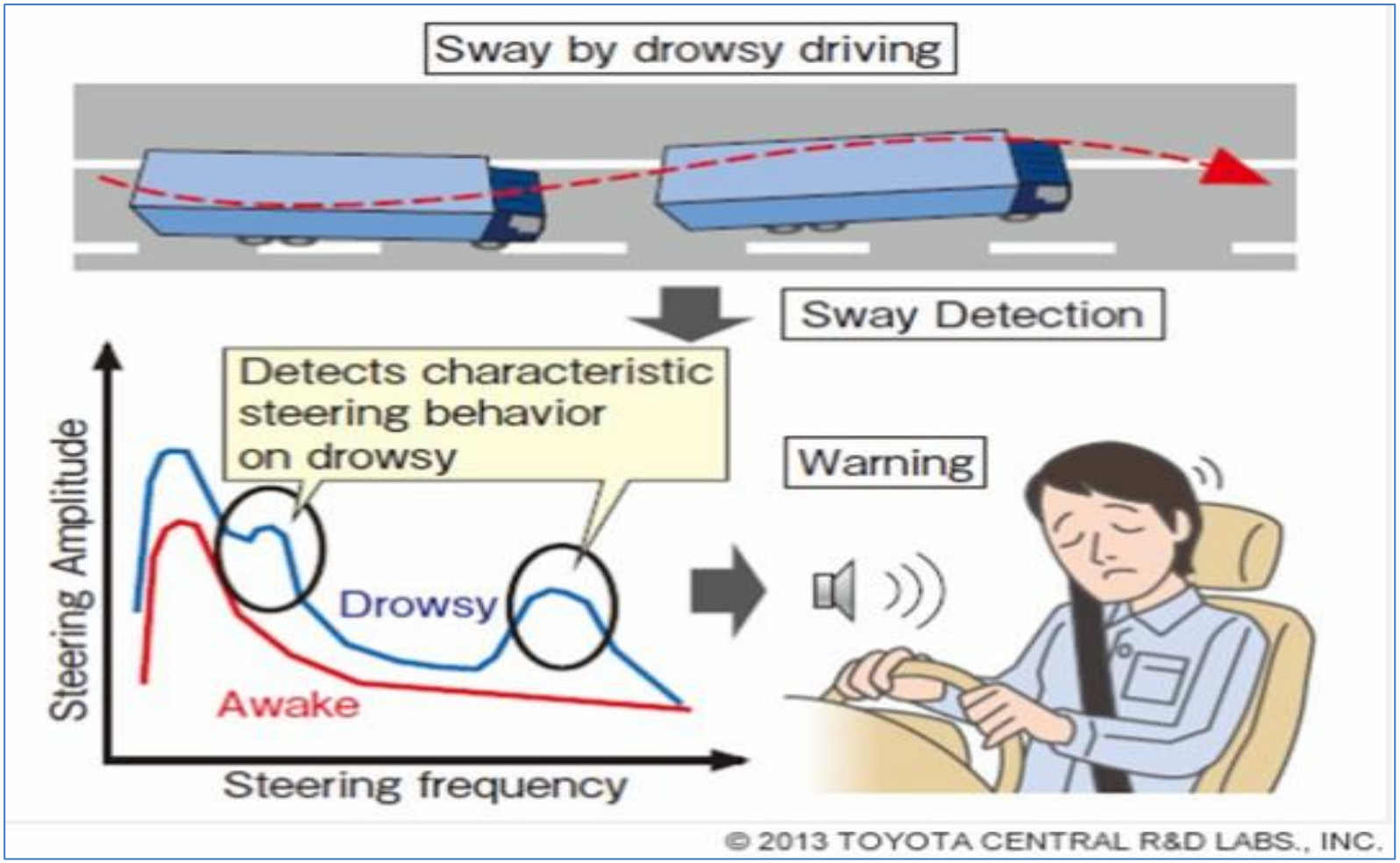
- Adaptive Cruise Control (ACC) uses forward looking radar and maintains the safe distance from the car ahead. It is designed to avoid accidents by keeping your vehicle at a safe distance from the traffic ahead.

3) Blind Spot Detection



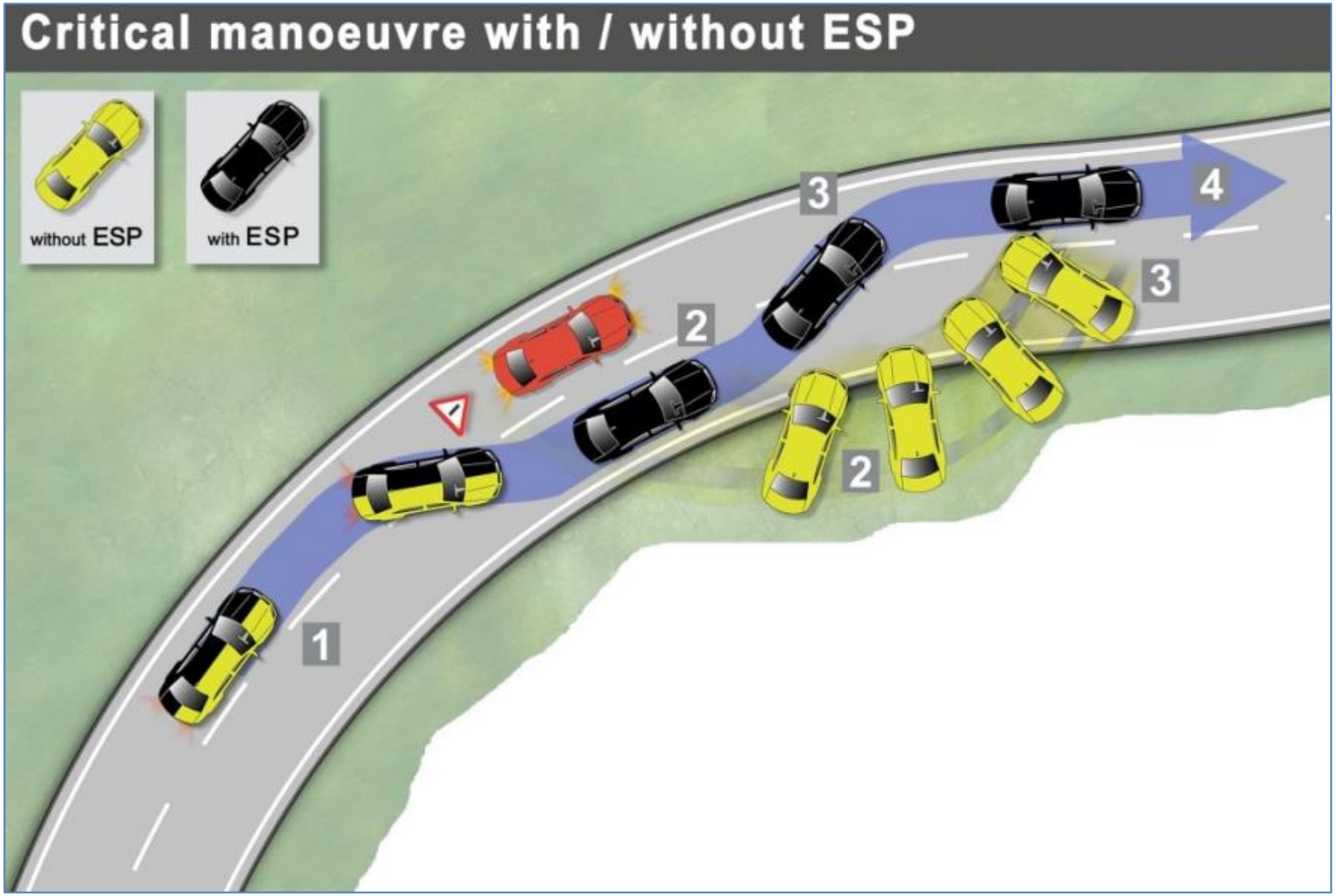
- A blind spot monitor detects other vehicles located in the blind spot areas such as side and rear, however it detects other areas as well. Blind spot areas are hard to detect when you are specially driving in the night and any bicyclist stops in your blind spot area. It gets hard to move and detect the bicyclist. Also the system provides audible and visual sign to backing out of a parking space when traffic is approaching from other sides.

4) Driver Drowsiness Detection



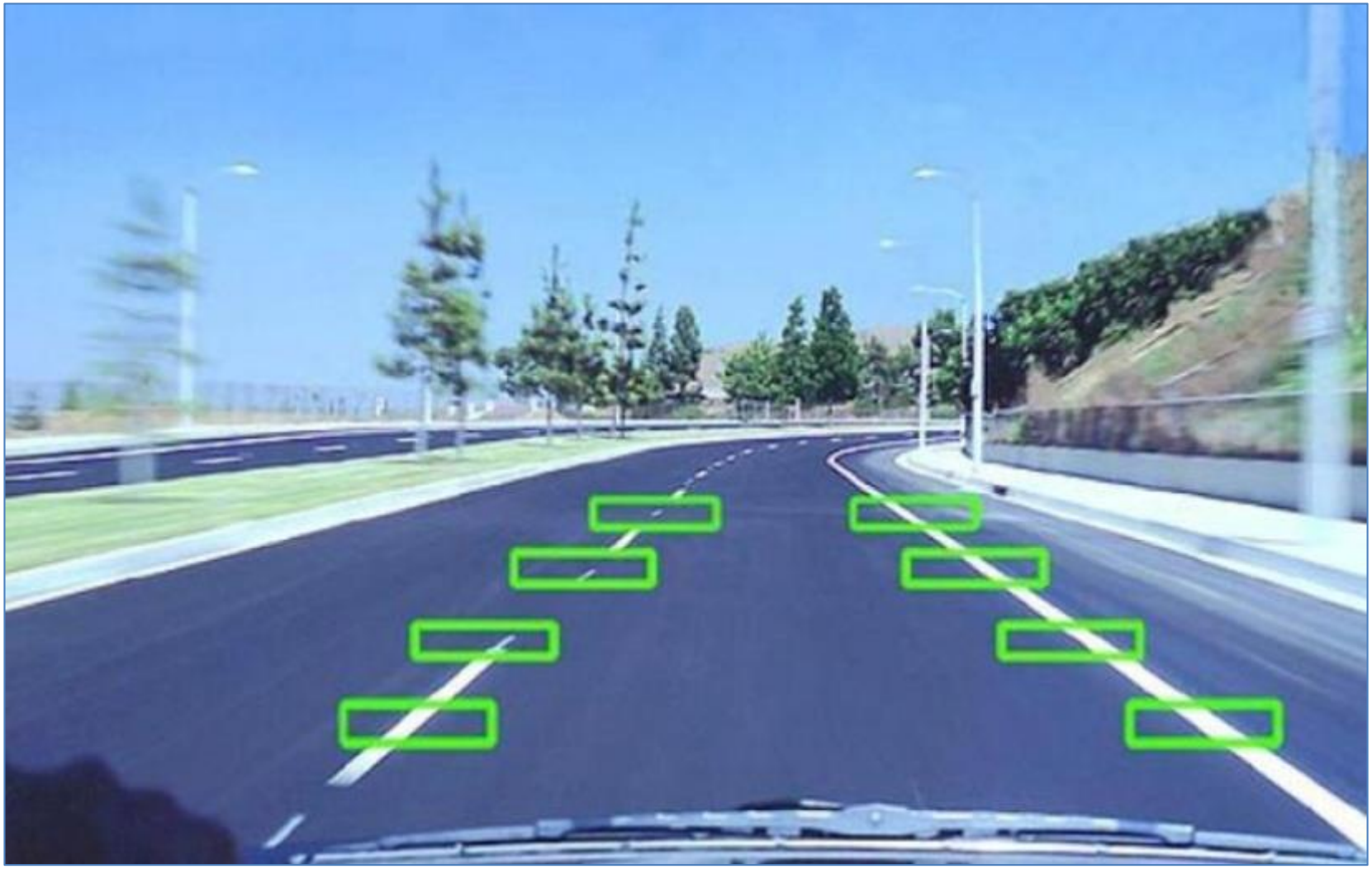
- Driver drowsiness detection is another car safety technology that designed to prevent accidents when the driver is getting drowsy and often fails to recognise early enough according to the experts.

5) Electronic Stability Control



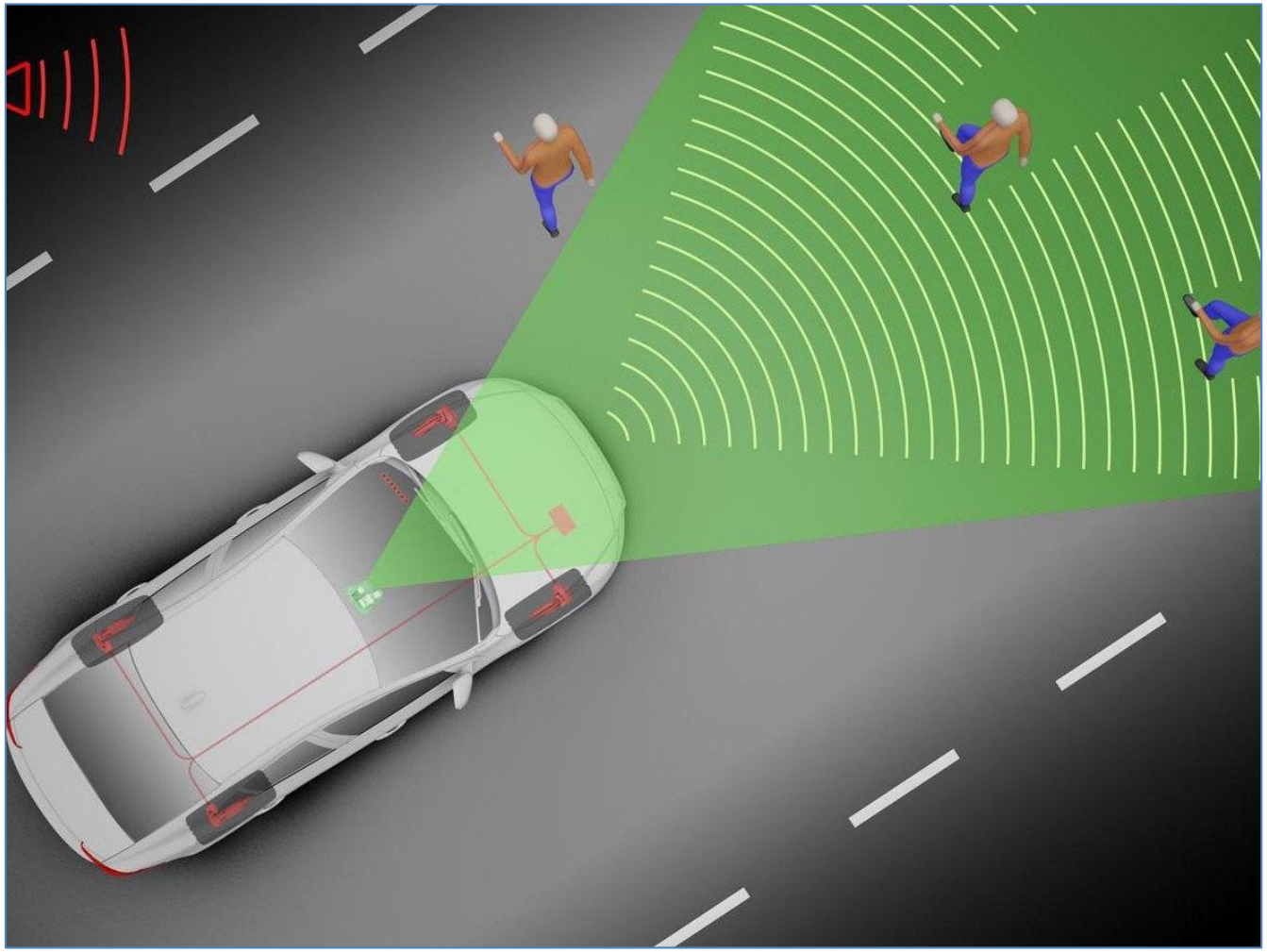
❑ Electronic stability control (known as ESC) is a computer technology improves a vehicle stability control by reducing loss of traction or skidding. When ESC detects loss of steering control, automatically applies the brakes to help steer the vehicle.

6) Lane Departure Warning/Lane Assist systems



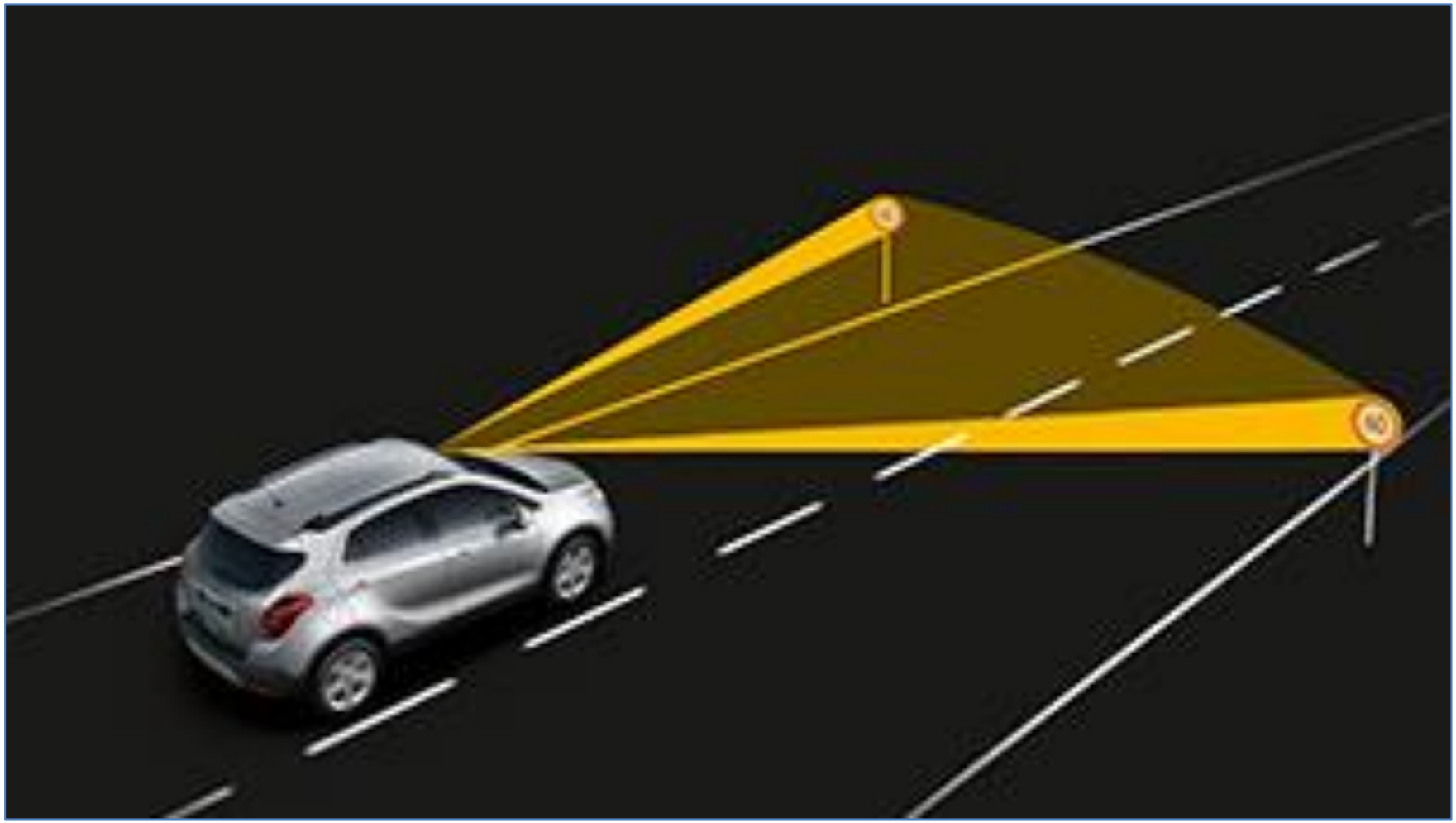
- Lane departure warning system is designed to warn a driver when the vehicle begins to move out of its lane especially on 70mph motorways. Some advanced system warns the driver and automatically brings the vehicle to safe position if no action taken by the driver.

7) Pedestrian Detection



- The predictive pedestrian protection system helps to prevent collisions and designed to minimise accident cruelty. If the pedestrian and car are in the same lane then the car warns driver or automatically start braking to avoid collision and minimise the accident.

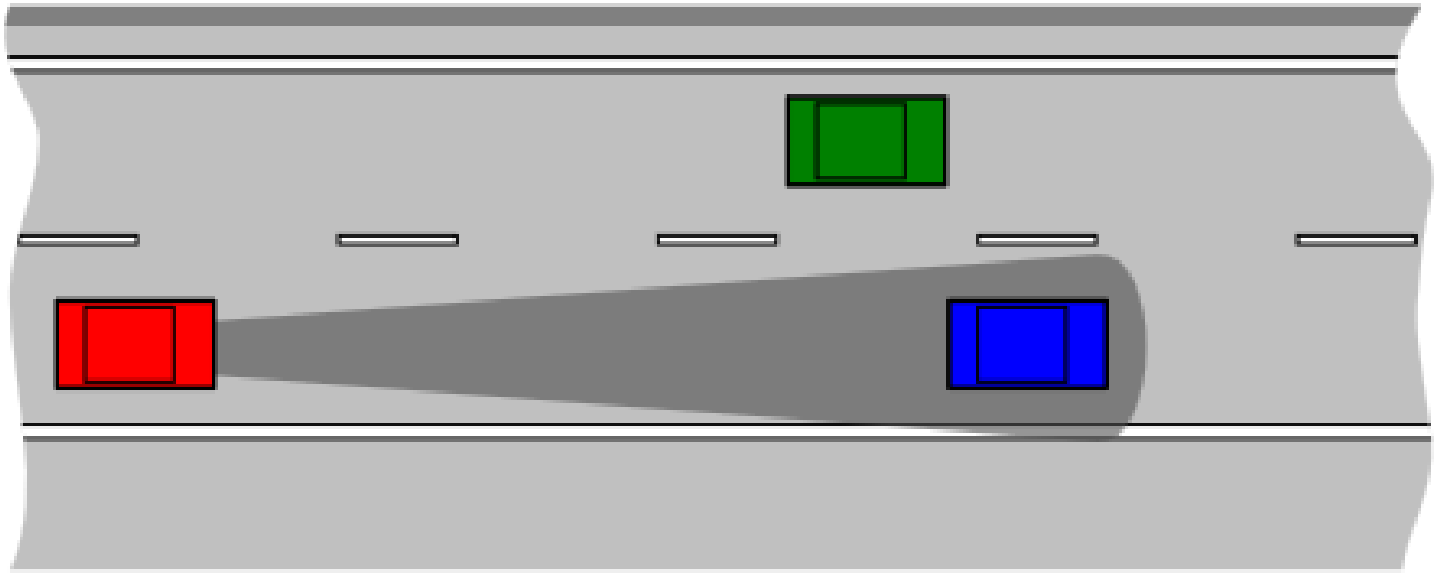
8) Traffic Sign Recognition



❑ Traffic sign recognition(TSR) system detects the road signs such as school, turn ahead, speed limit etc.. and notify or warn the driver by displaying them on a colour screen.

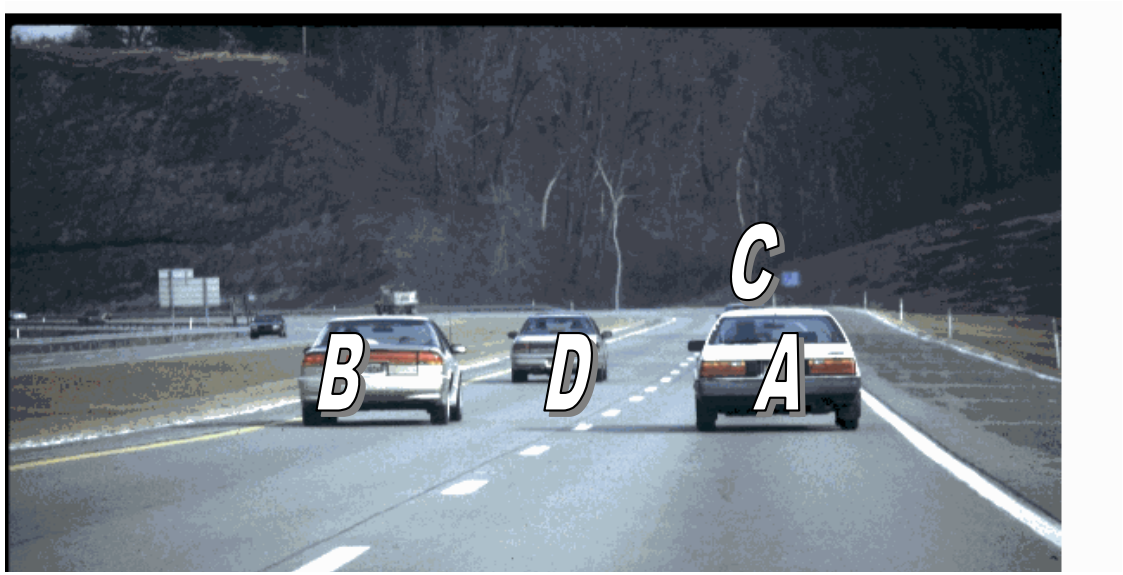
Adaptive cruise control

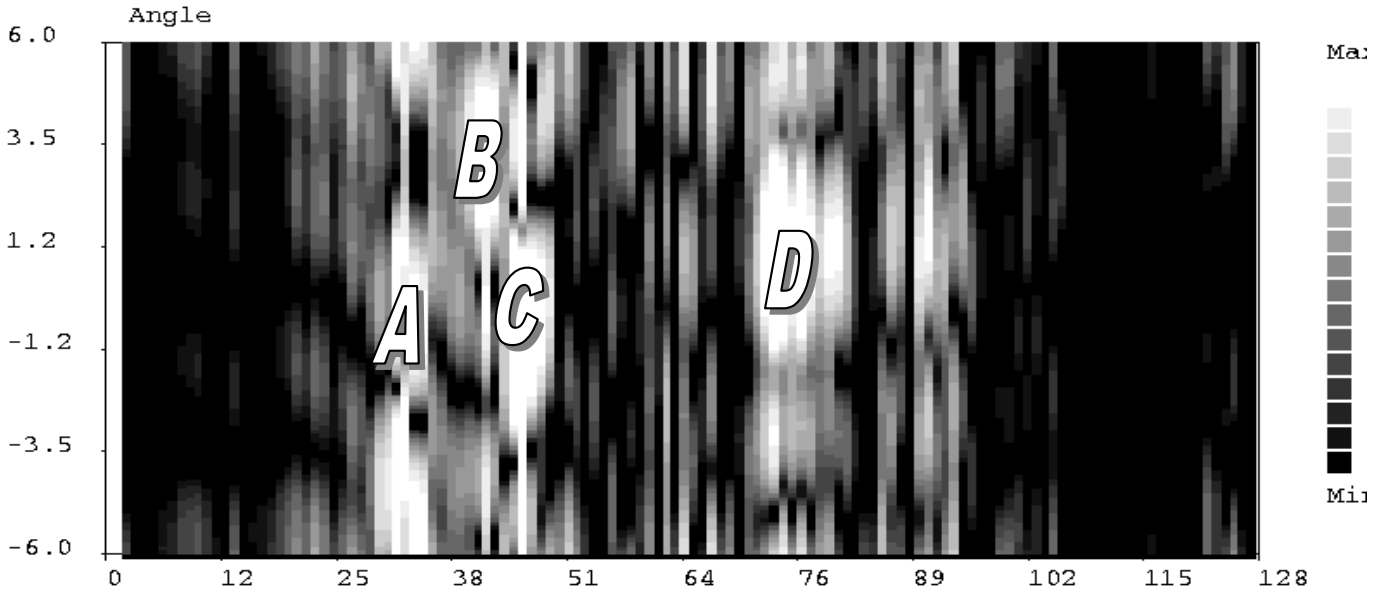
- **Radar**
- **Laser**
- **Camera**
- **GPS**



O **veículo vermelho** automaticamente segue o **carro azul**.

Radar Data

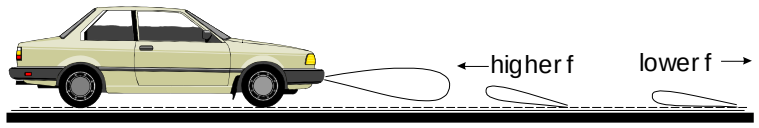




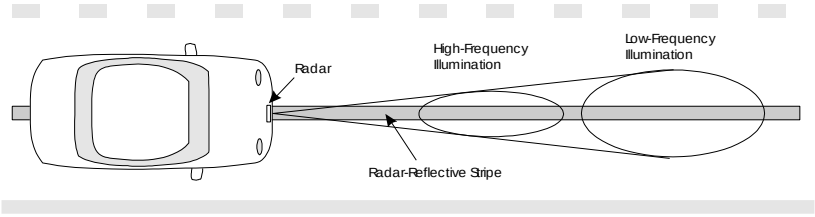
Data from a scanning radar. Top image is video of the scene, bottom is radar data, with corresponding locations marked. The radar d range (horizontal) and bearing angle (vertical; up is left, down is right). Brightness indicates strength of return. Car A is close and he center of the radar return (the video image does not extend as far to the right as the radar); B is further and left; C is further yet and barely visible above the roof of A; D is much further and has a bearing between A and B.

Radar reflective surfaces

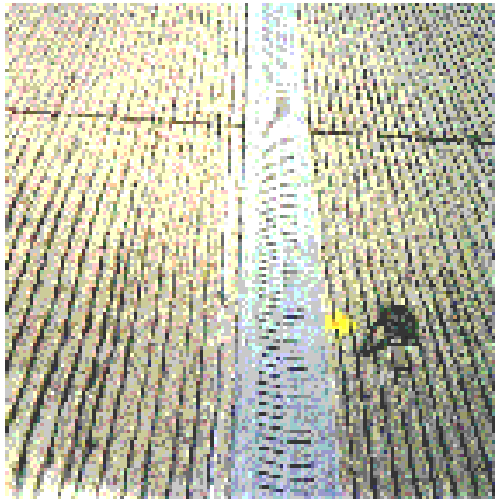
- **Collision avoidance radar can be used for lateral control with modified lane-marking tape.**
- **Frequency-dependent tape properties can provide distance and other information**



(a)



(b)



- **Conventional lane marking tape (3M Corp.) punched with specific hole pattern to provide frequency-selective retro-reflection**

Aula ITS
16.11.2015

1. Introdução → 2. ADAS → **3. V2X** → 4. Reflexão

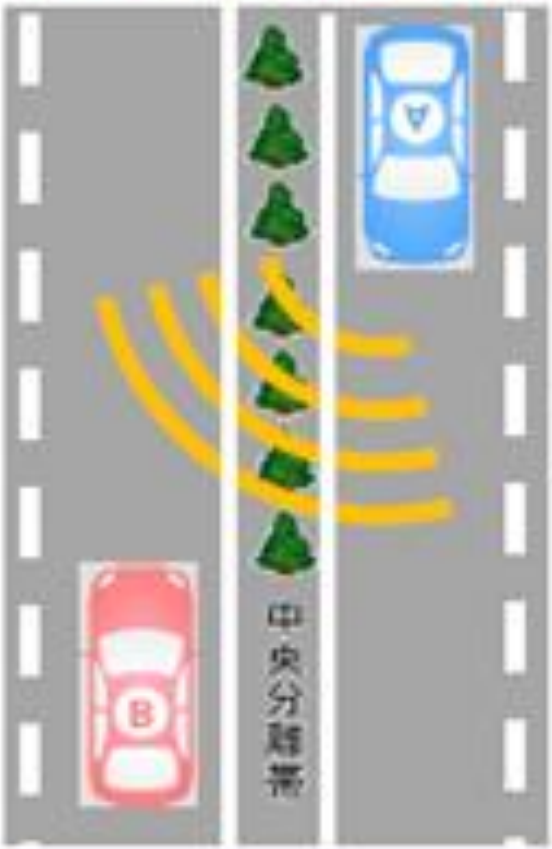
Foreseeing traffic from road info.

Obtain road ahead info unavailable in autonomus system for smooth driving

※2014 Aug. Auto-pilot system examination meeting document

Info collection & delivery via cars

A Info. re-deliverer
B Automated car



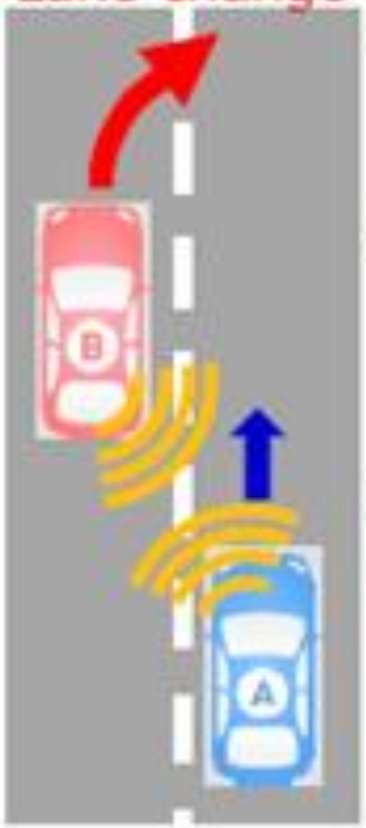
1. Automated car sensor picks up road obstacles like hazard info and return to road system. (supplement to road side sensors)

2. Road info. obtained from other on-coming traffic is re-delivered as prediction. mainly to supplement emergency road service

At merging/lane change

A Coming from rear

B Lane change



①Send lane change request to rear coming traffic upon changing lane.

②Rear coming car replies and control car to car interval to allocate.

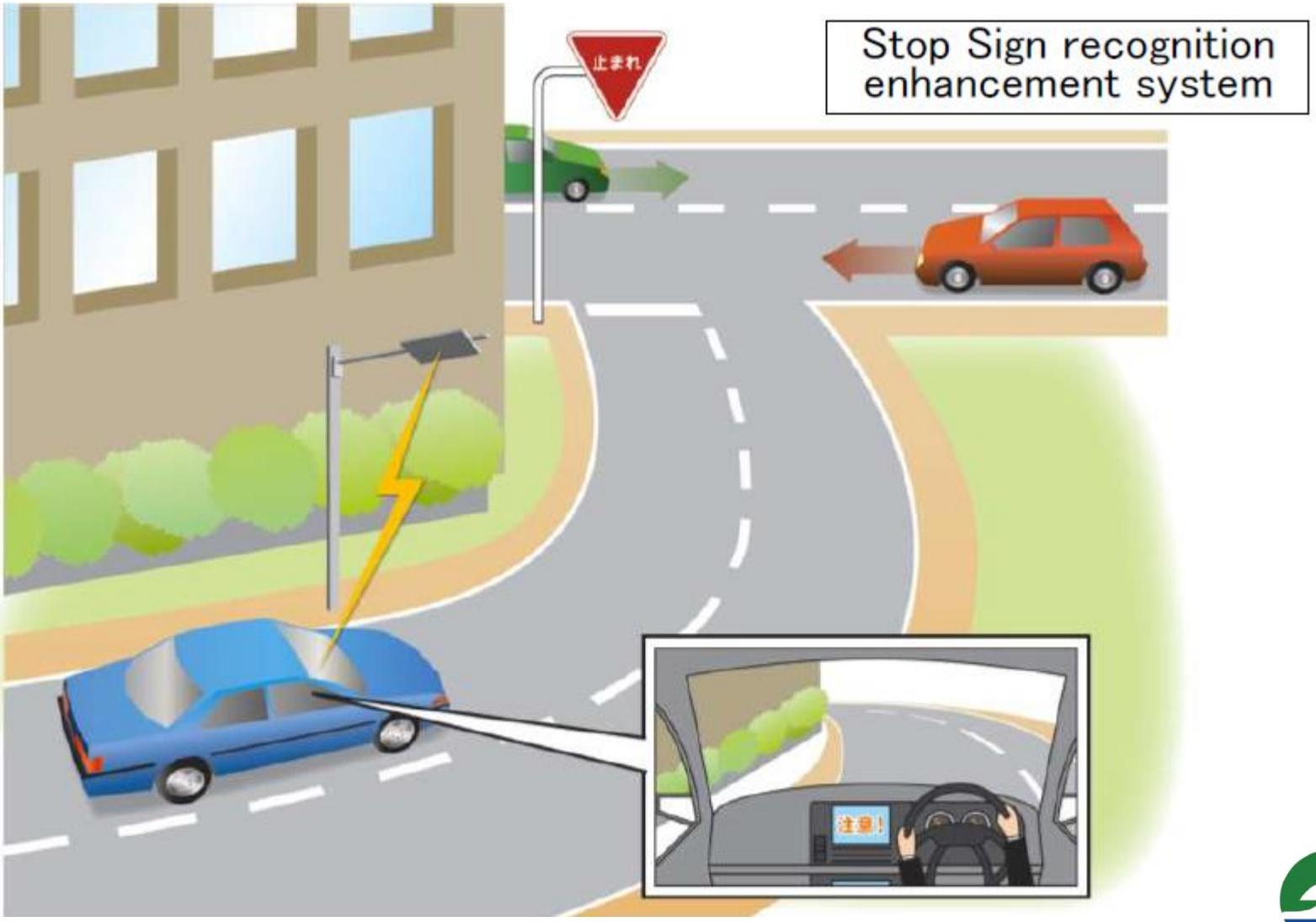
③Car of changing the lane confirms safety space from onboard sensor and control to change the lane.

Realize safe and smooth merge/lane change.

In-Line connected driving

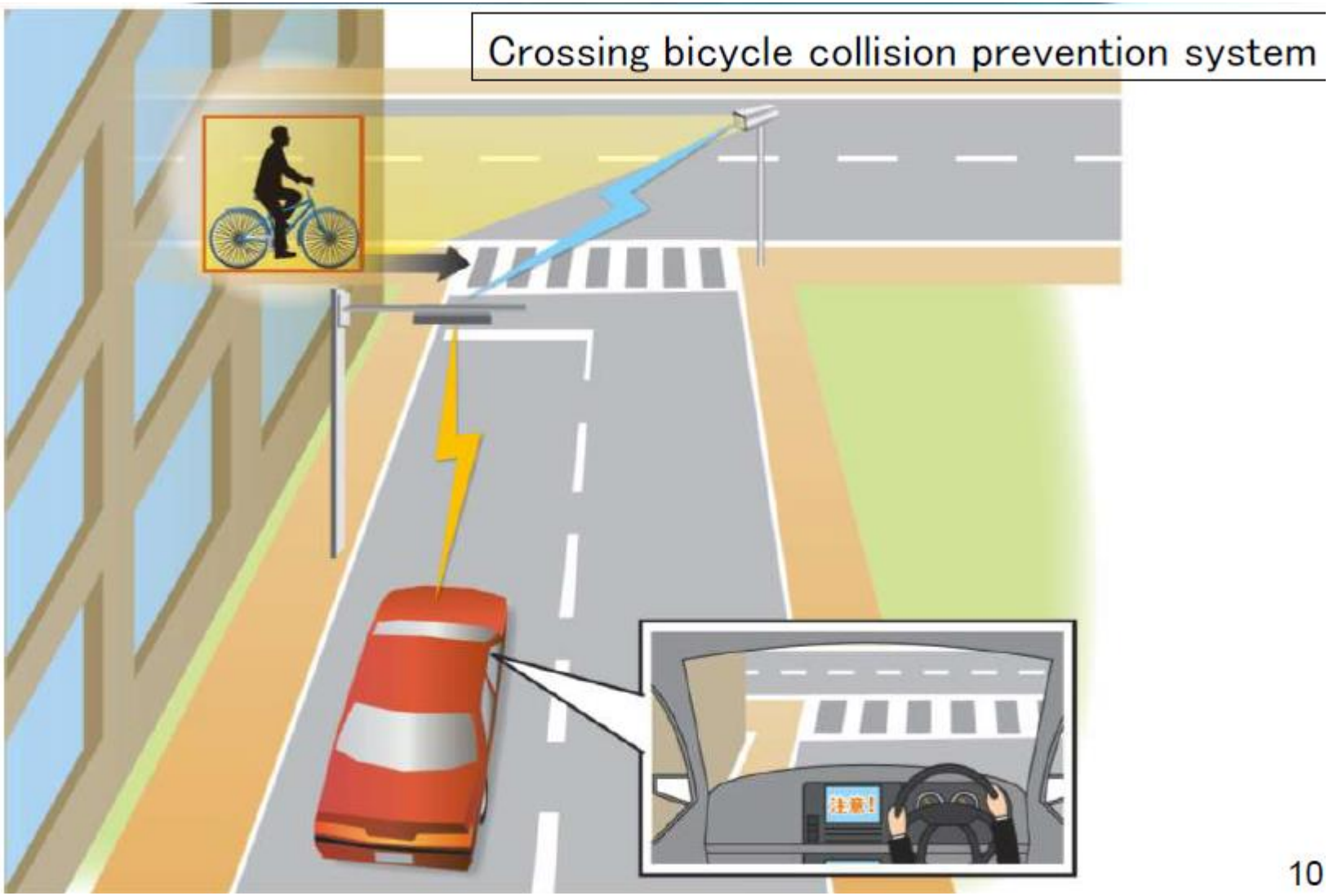
In-line connected driving is realized by exchanging automated control info. between car to car of lining.

Comunicação V2I

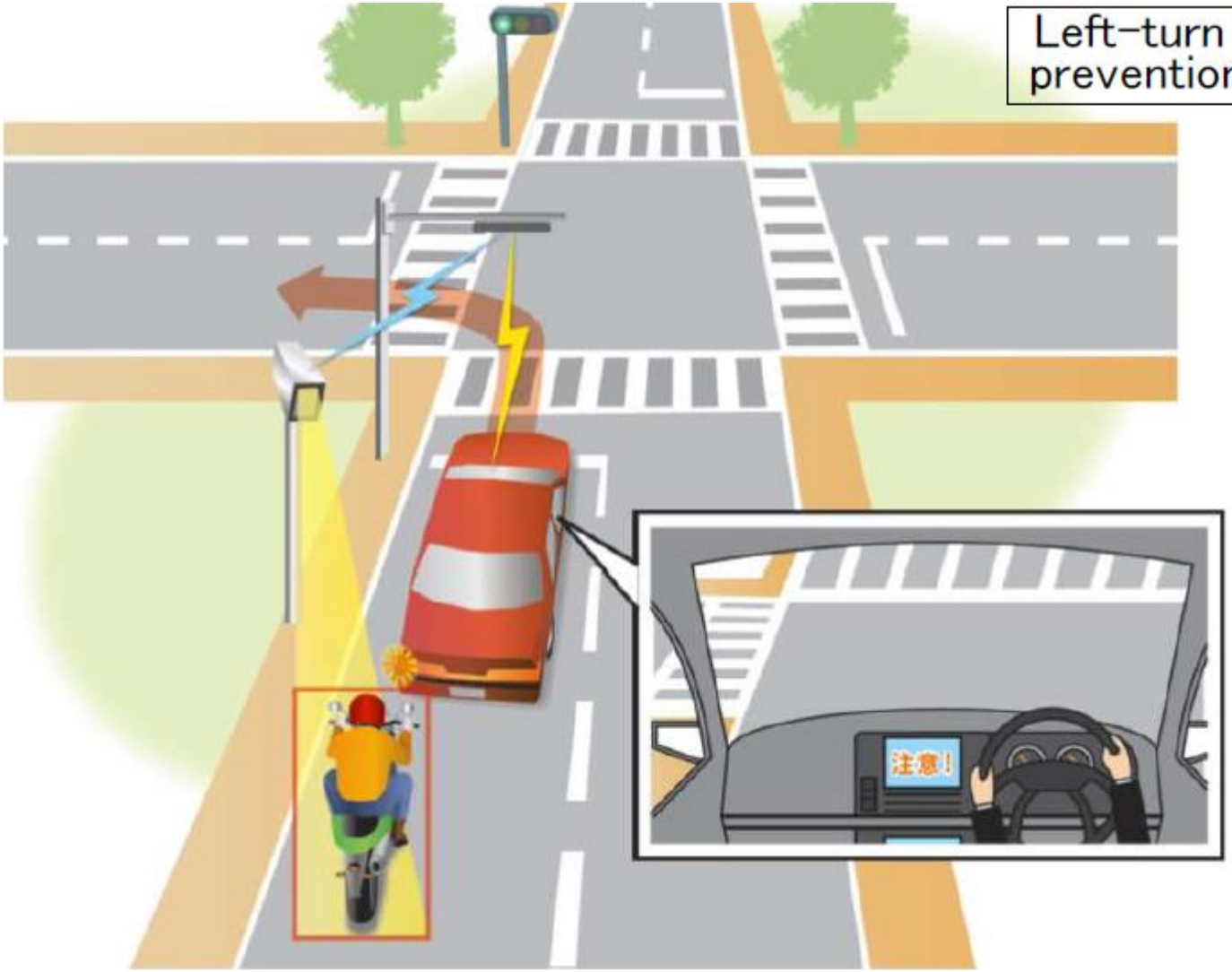


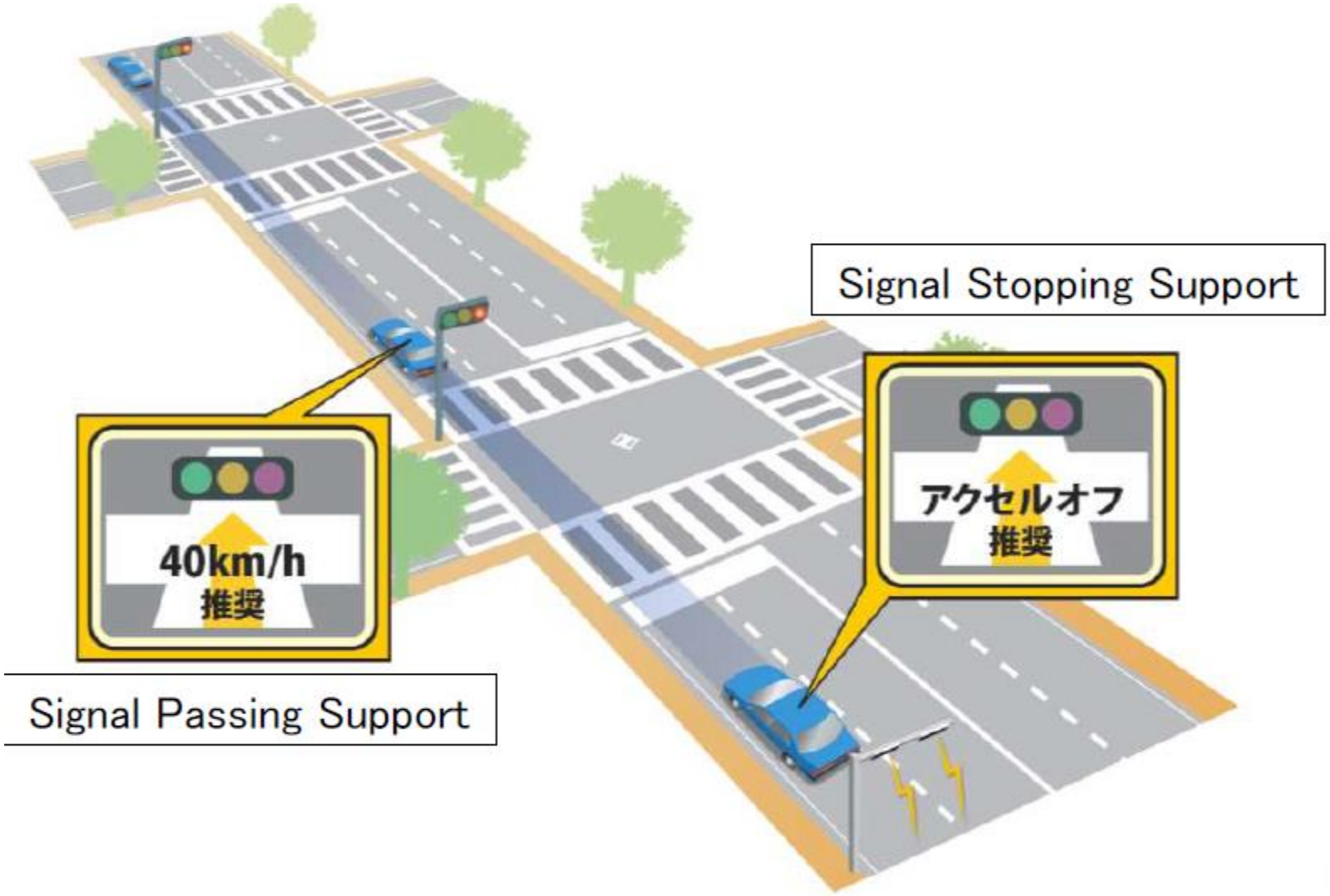
ITS GREEN SAFETY

Crossing bicycle collision prevention system

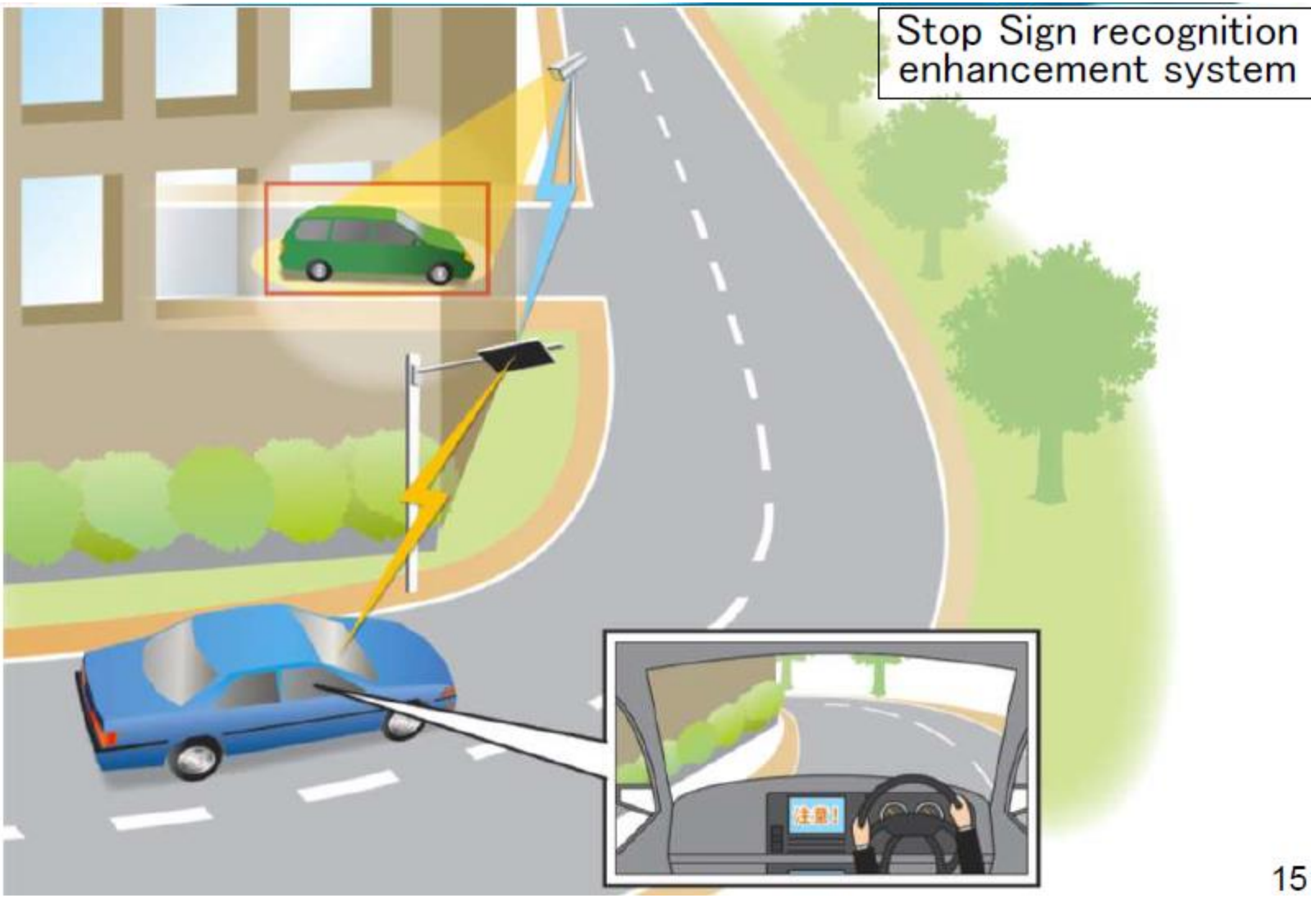


Left-turn collision prevention system

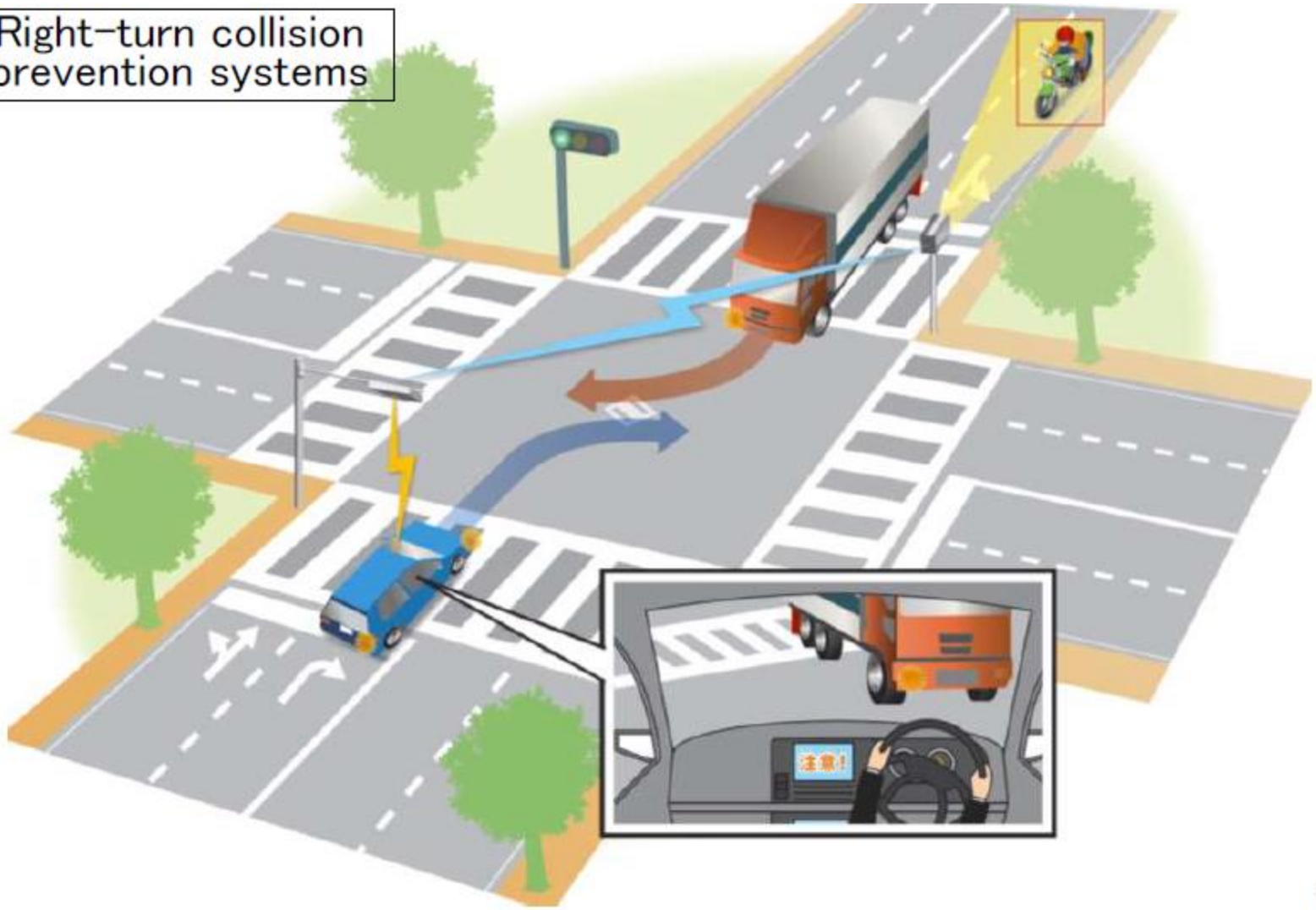



Signal Stopping Support
アクセルオフ
推奨
40km/h
推奨
Signal Passing Support

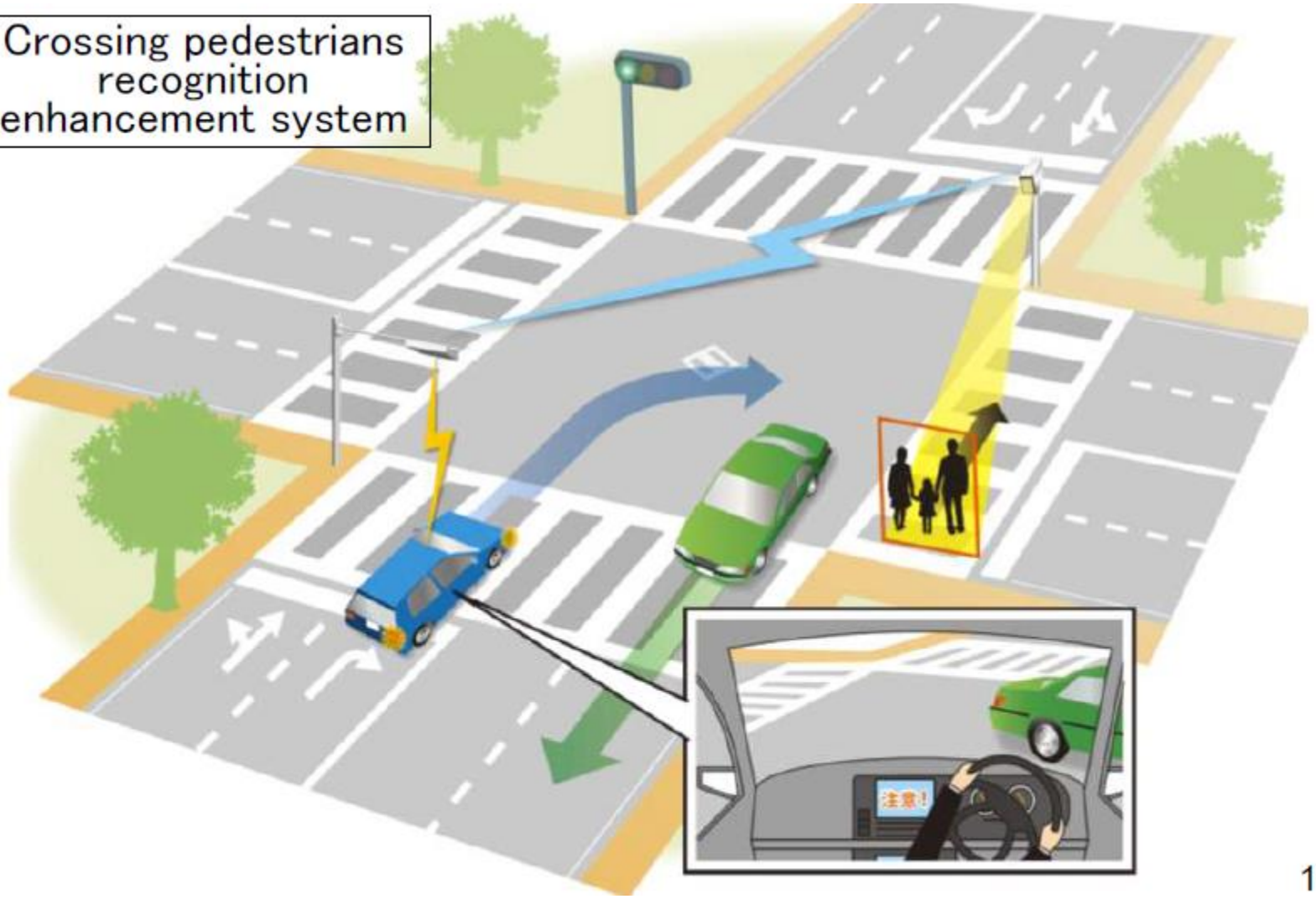
Stop Sign recognition enhancement system



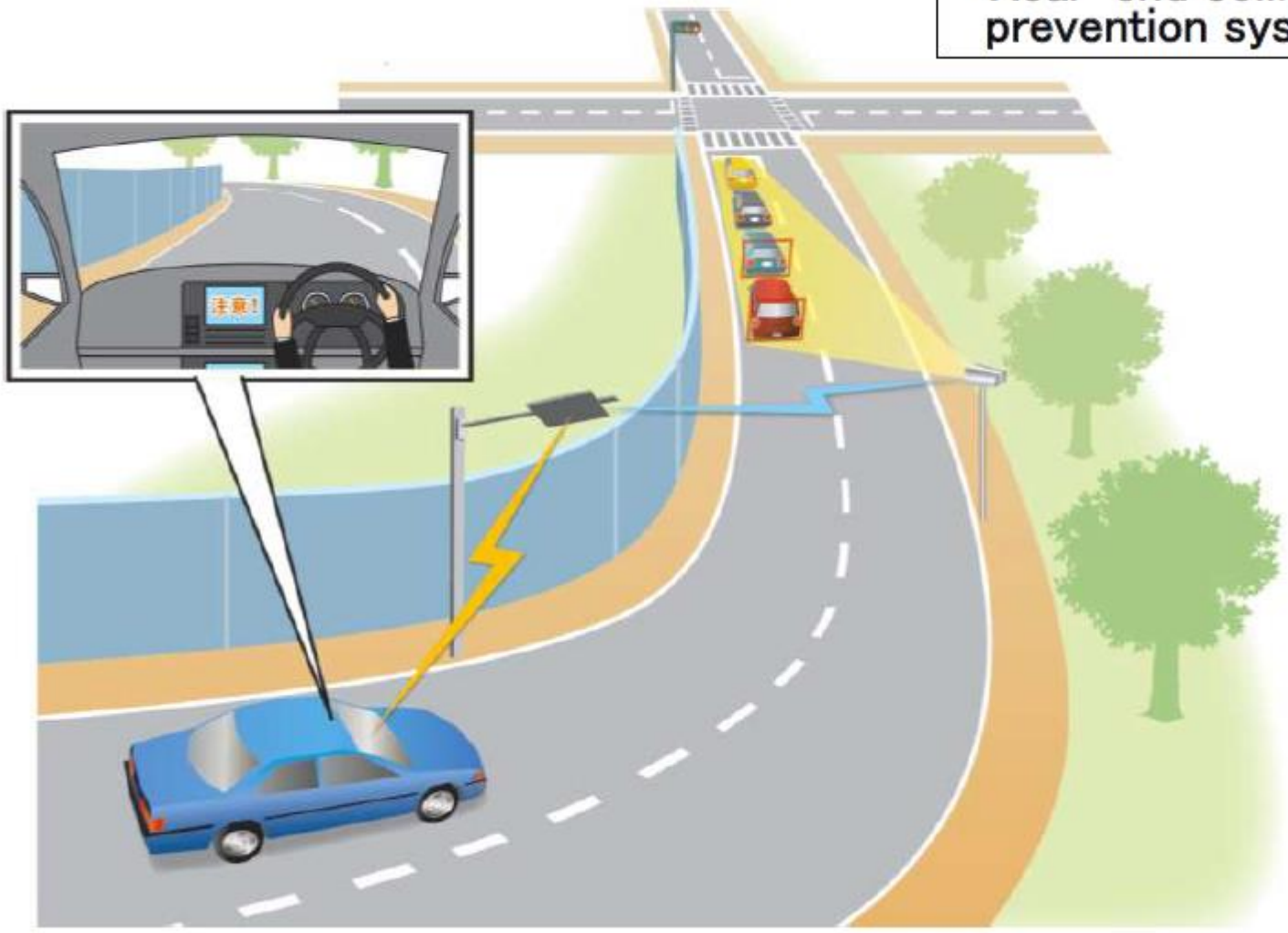
Right-turn collision prevention systems

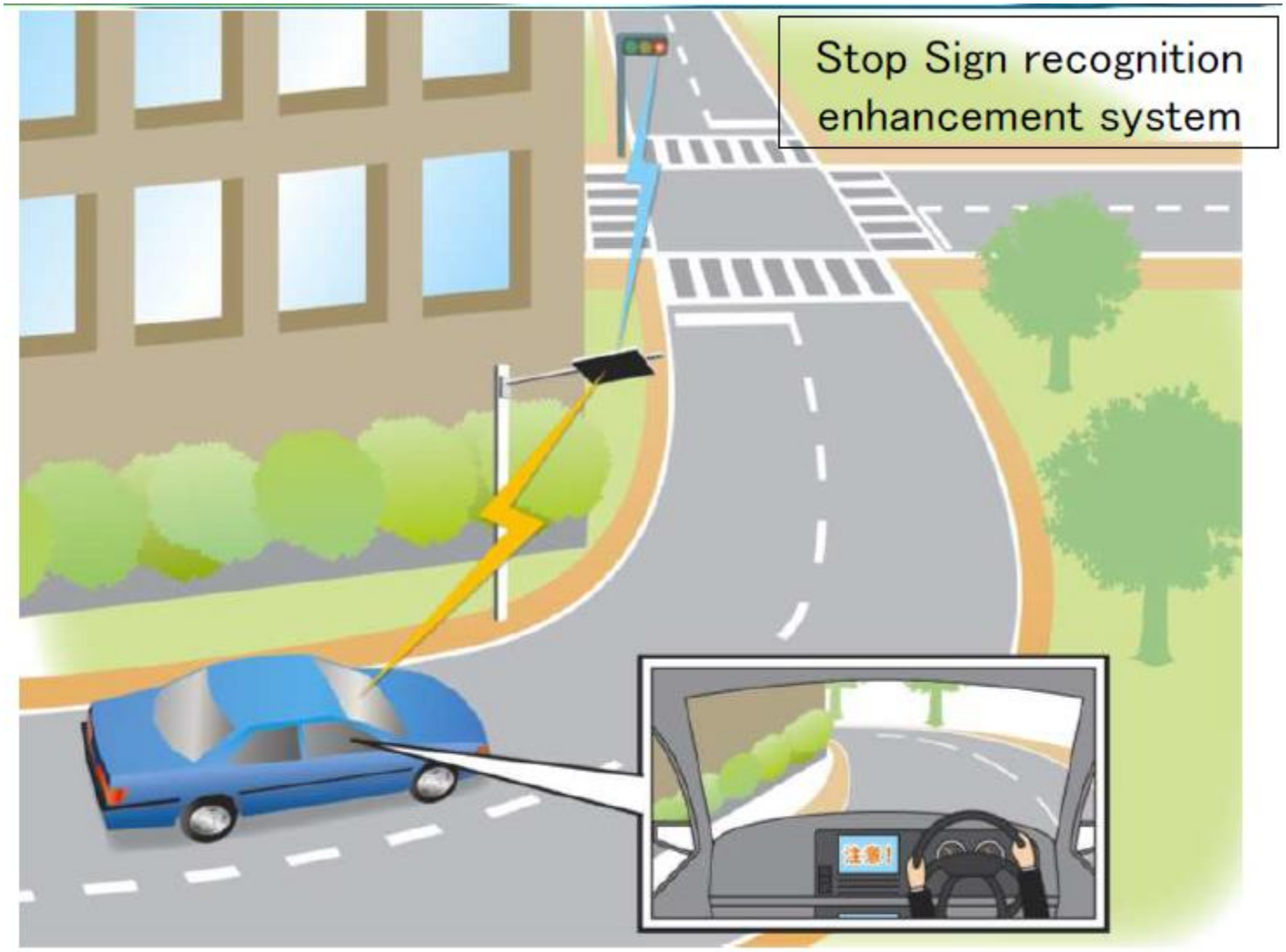


Crossing pedestrians recognition enhancement system



Rear-end collision prevention system




Stop Sign recognition
enhancement system

Cooperative Advanced Safety Vehicles

- Experience a series of Driving Safety Support Systems functioned by V2V and V2p communication technologies (V2V : 5 scenes, V2P : 1 scene)