



NEW
THINKING.
NEW
POSSIBILITIES.



Active & passive safety systems on Hyundai vehicles; Development & strategy

Road Safety conference, Belgrade
April 27th – 29th 2011



NEW
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NEW
POSSIBILITIES.



Hyundai Auto Beograd, Since 2002

MADE IN KOREA

Chung Ju Yung and the Rise of Hyundai





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NEW
POSSIBILITIES.



HISTORY

HISTORY

1997 ~ 1967

- 1996 Completion of the Namyang new Research & Development Center
- 1994 Annual production exceeds 1 Million;
- 1967 Founding of the Hyundai Motor Company



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HISTORY

HISTORY

2005 ~ 1998

- 2005 Hyundai Motor Company enters the Top 100 Global Brands list
- 2003 HMC first automaker to announced the global environmental management
- 2002 Official Partner of the 2002 FIFA World Cup Games;
- 2000 1st fuel cell electric vehicle;
- 1998 Acquisition of Kia



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HISTORY

HISTORY

2010 ~

Hyundai Motor Company is in Global Top 5



Distributers (and Dealers) around Globe



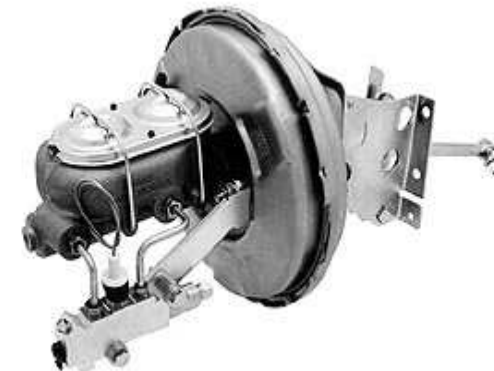
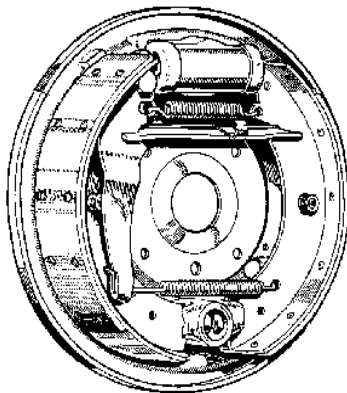
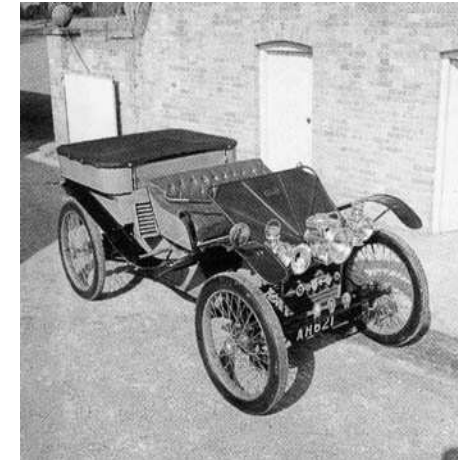
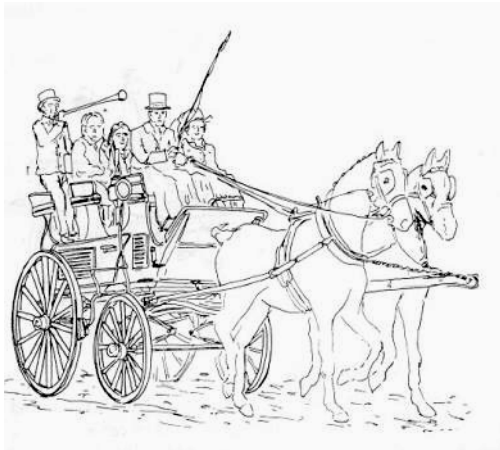
What shall we speak about in this reminder

- ✓ Active systems of safety
- ✓ Passive systems of safety
- ✓ Developments and strategy

ACTIVE SAFETY

SAFETY

History



A brake is a device which inhibits motion.

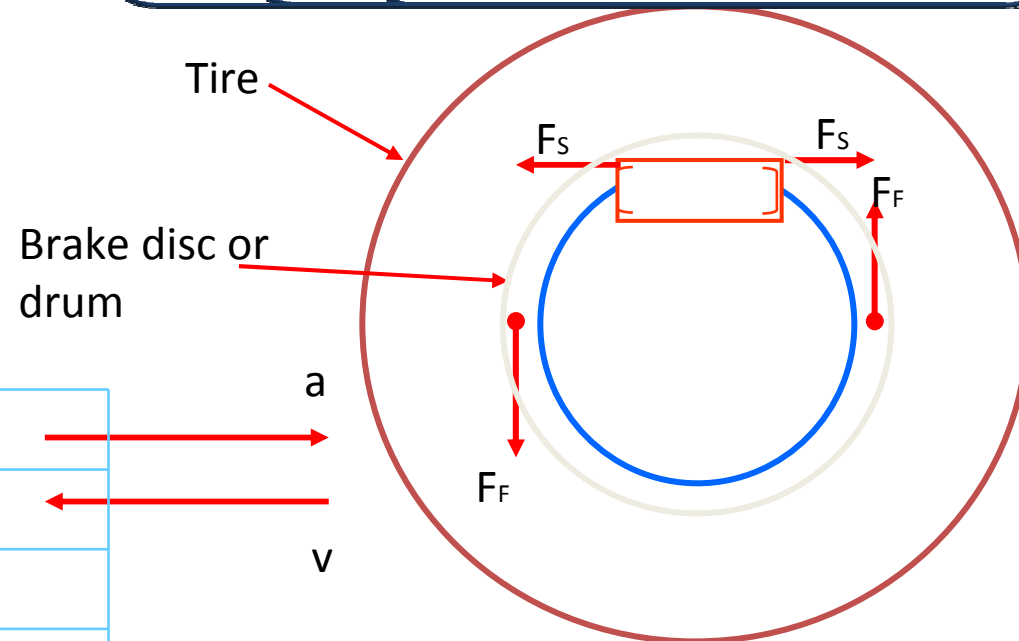
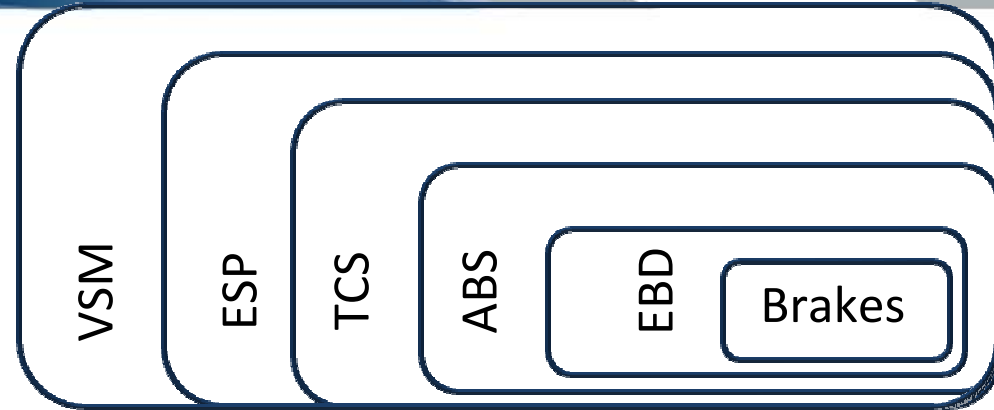
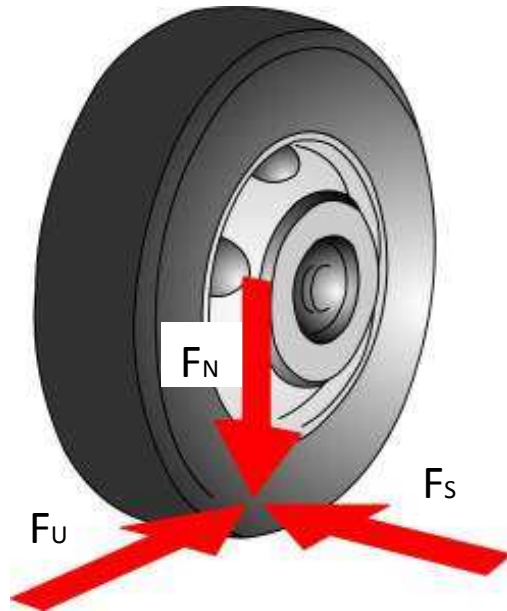


ACTIVE SAFETY

SAFETY

Forces

Tire forces and brake forces



a	Deceleration
v	Speed
FS	Apply pressure
FF	Friction Force



FRICION & slip

Forces

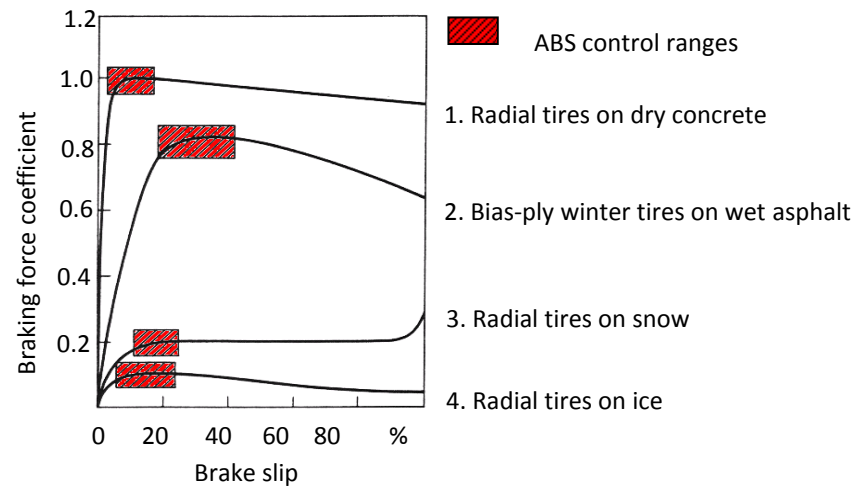
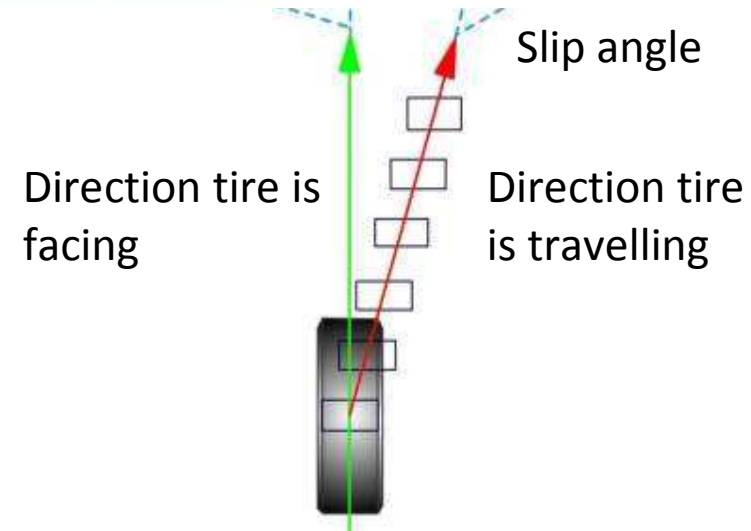
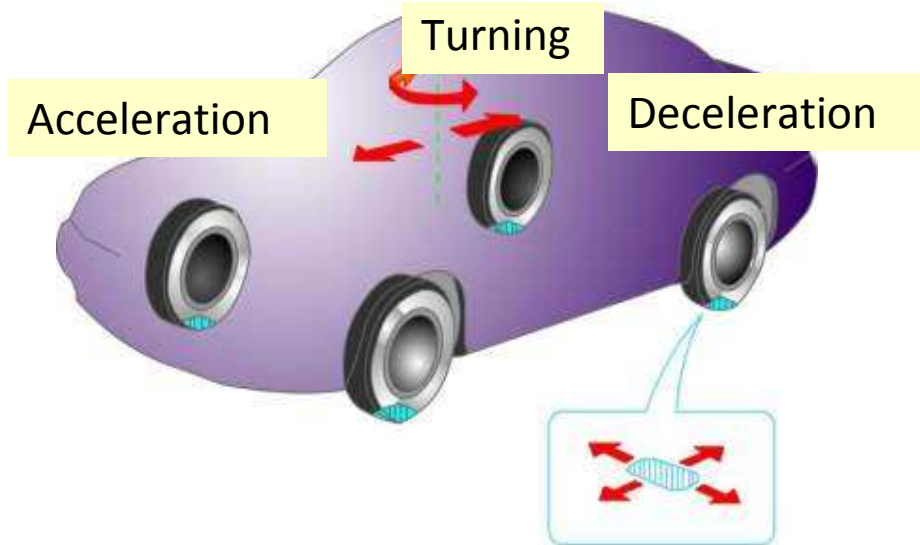


Figure #1

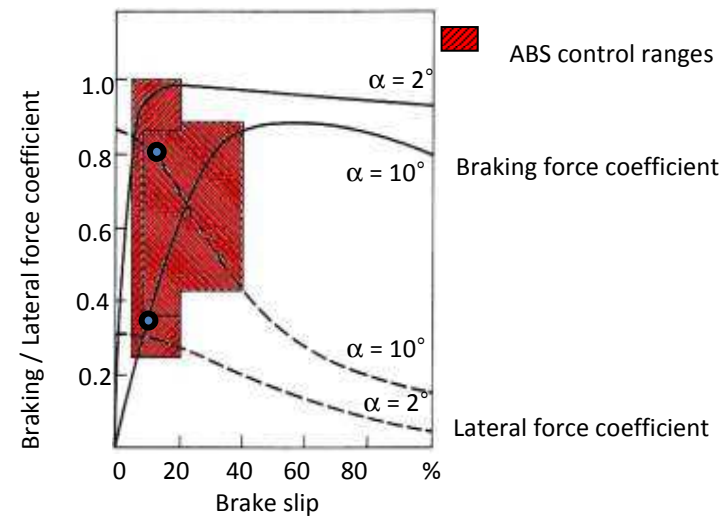
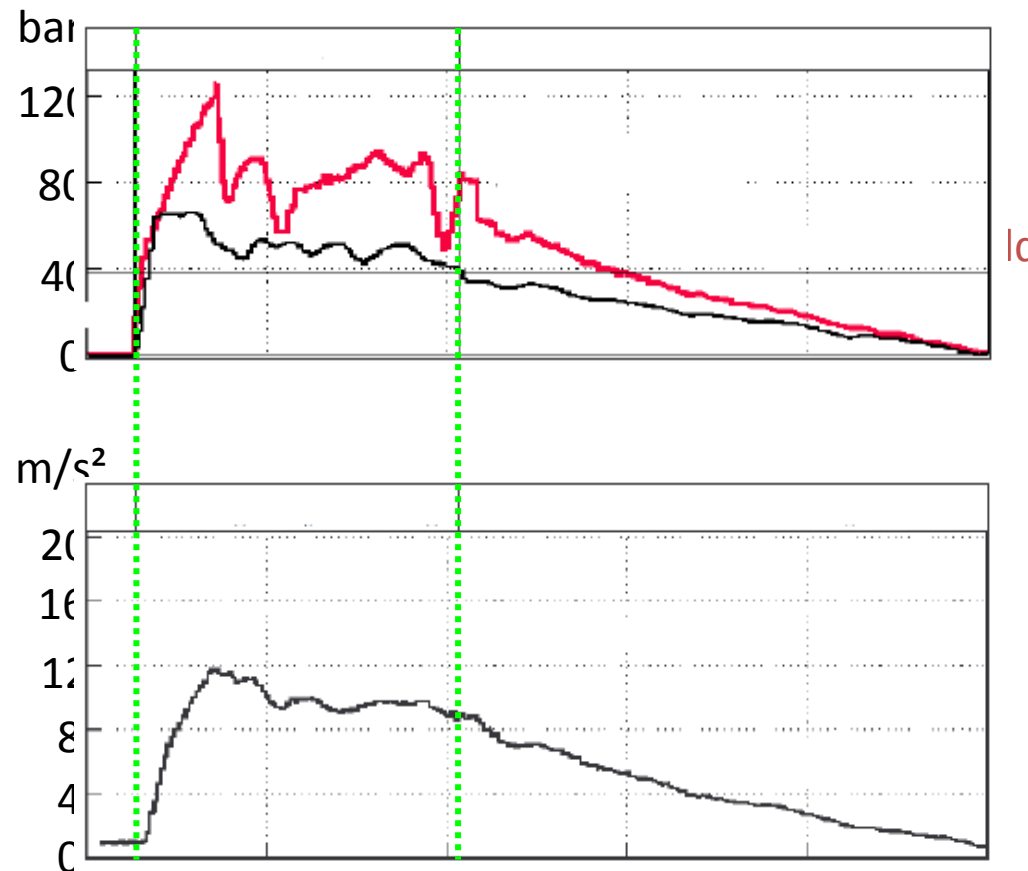


Figure #2

Phase 1: Emergency Situation, Panic braking (Maximum vehicle deceleration)

Phase 2: Reduced braking requirement (Deceleration proportional to pedal force)



Hyundai
Brake
Assistant
control



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ACTIVE SAFETY

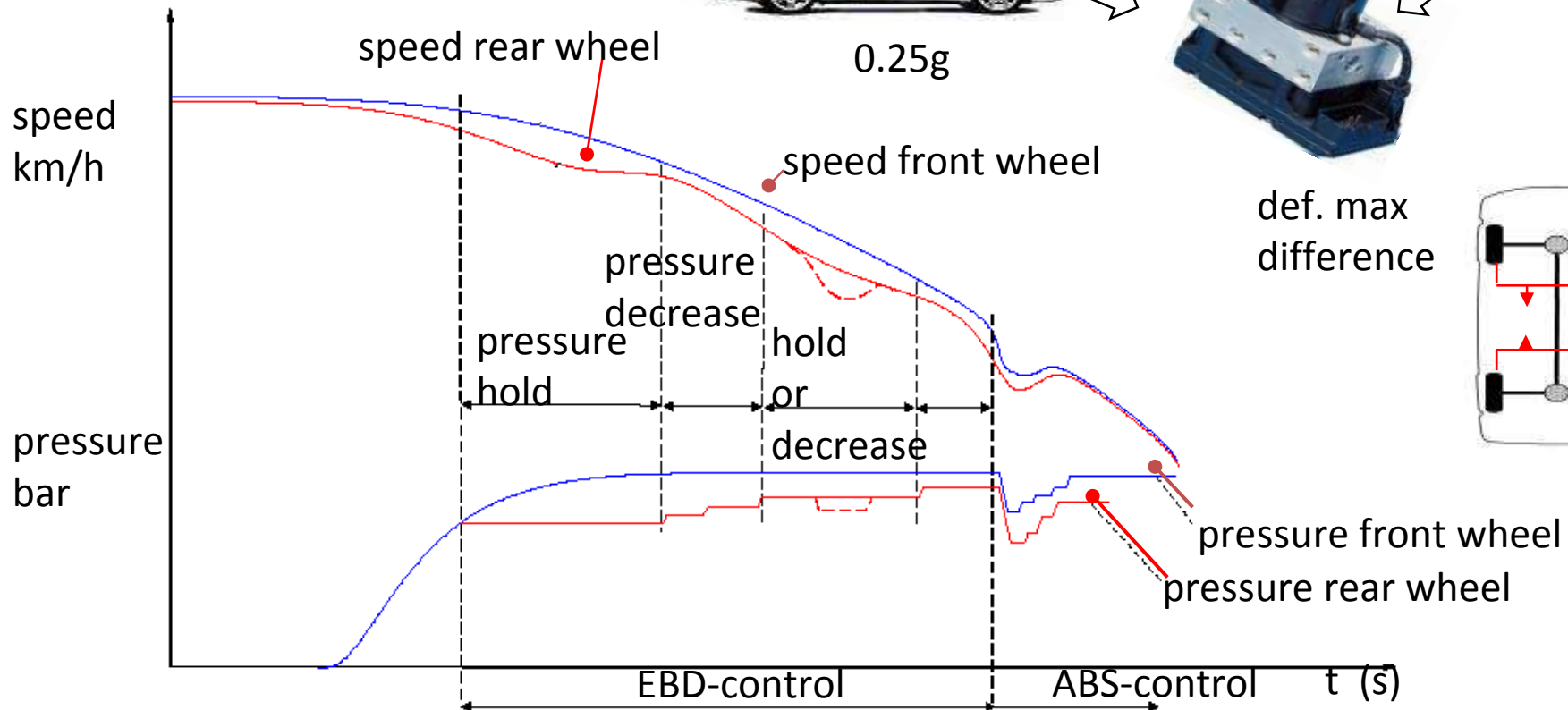
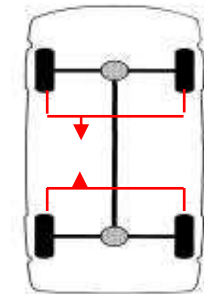
SAFETY

EBD

Electronic
Brake force
Distribution



def. max
difference





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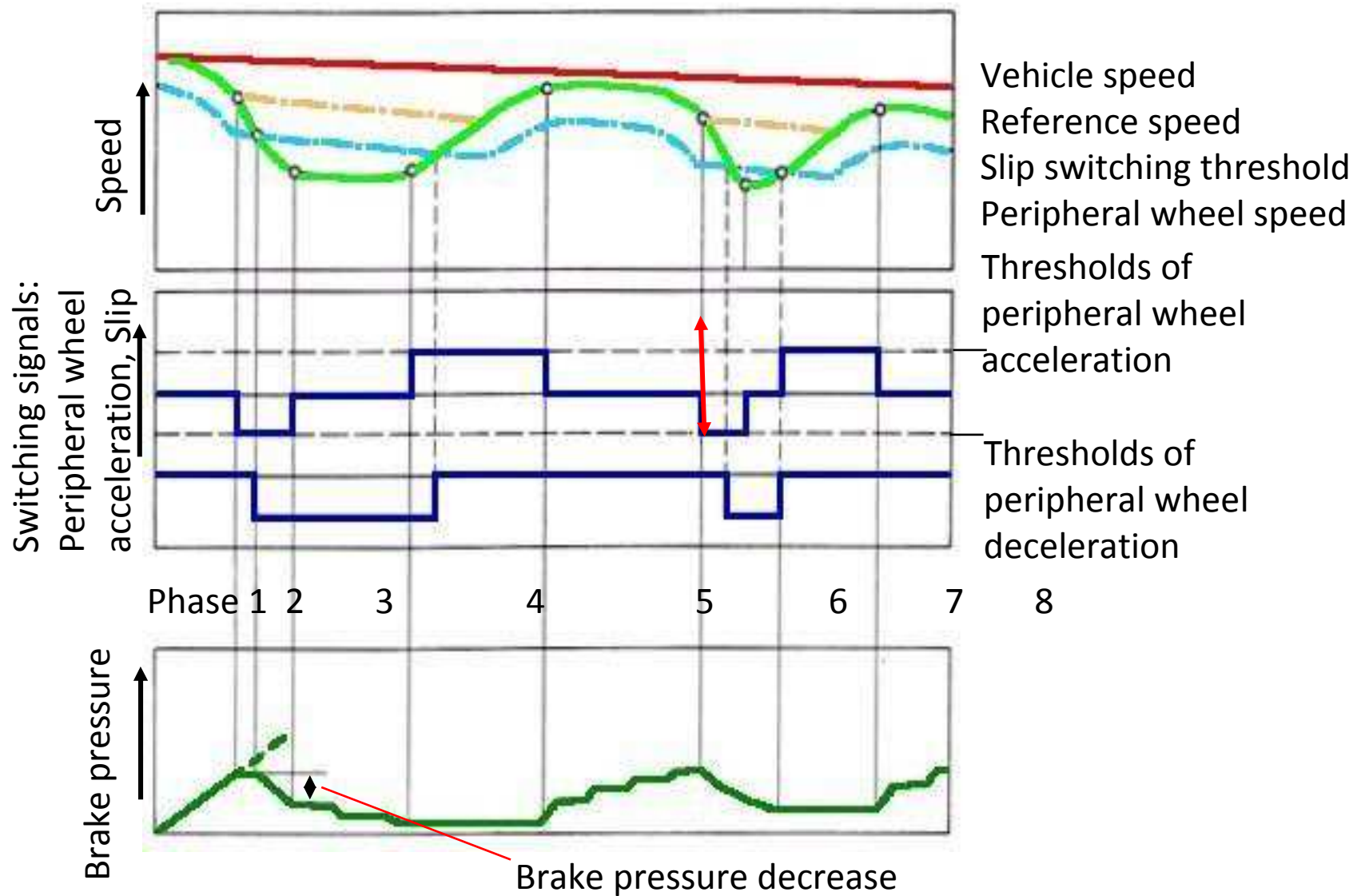


ACTIVE SAFETY

SAFETY

ABS

Braking control on low traction surfaces



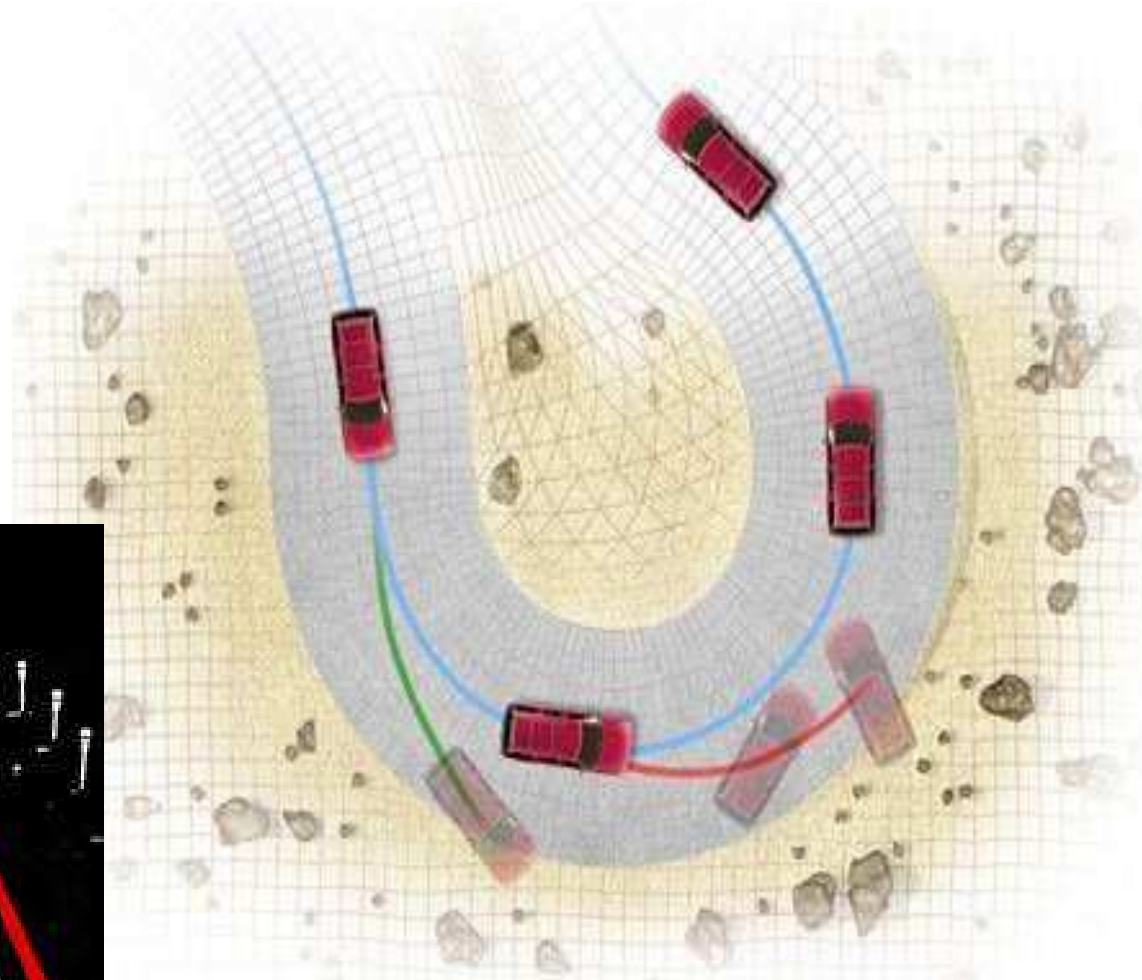
Advantages of ABS



Vehicle without ABS



Vehicle with ABS





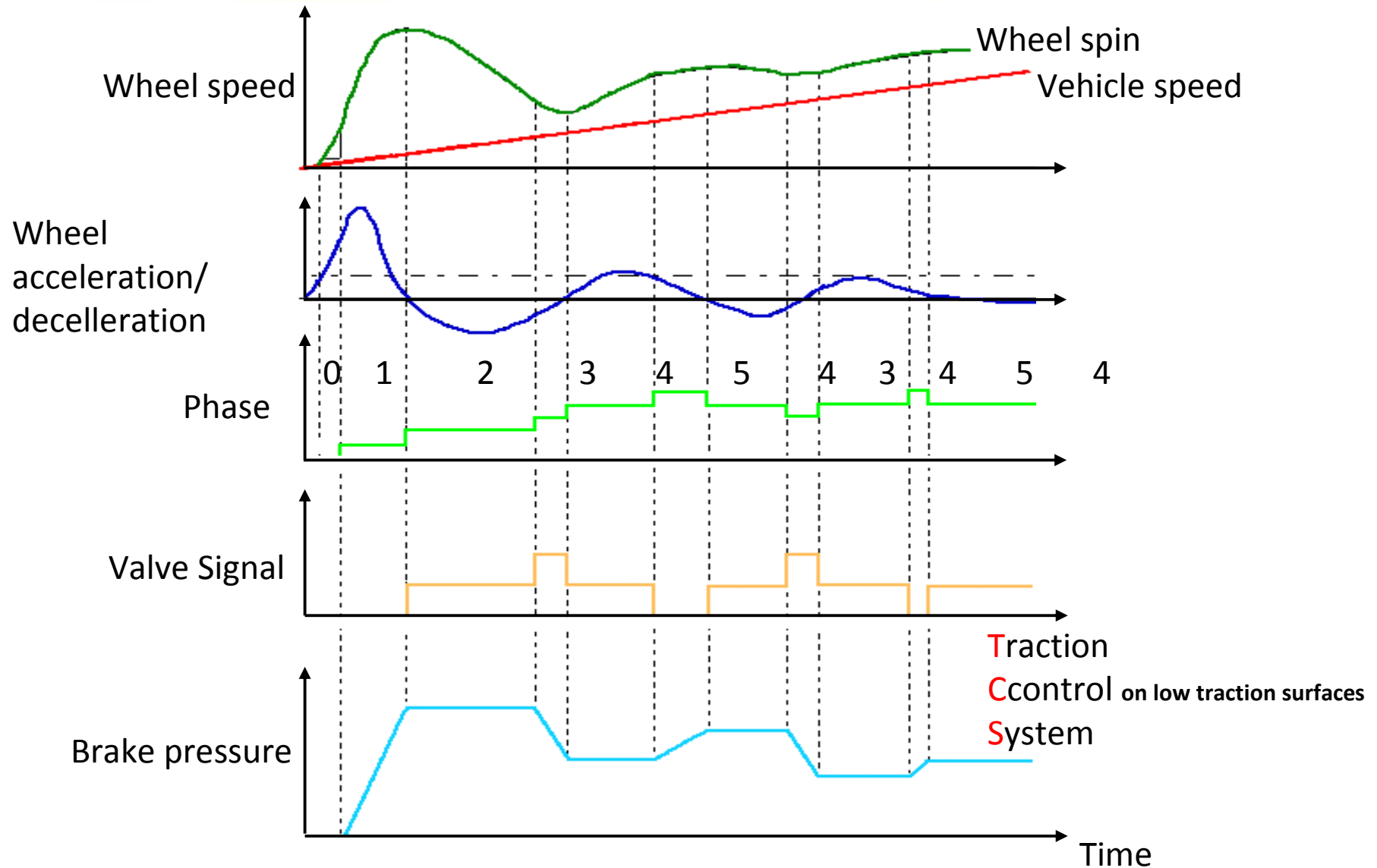
NEW THINKING.
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POSSIBILITIES.



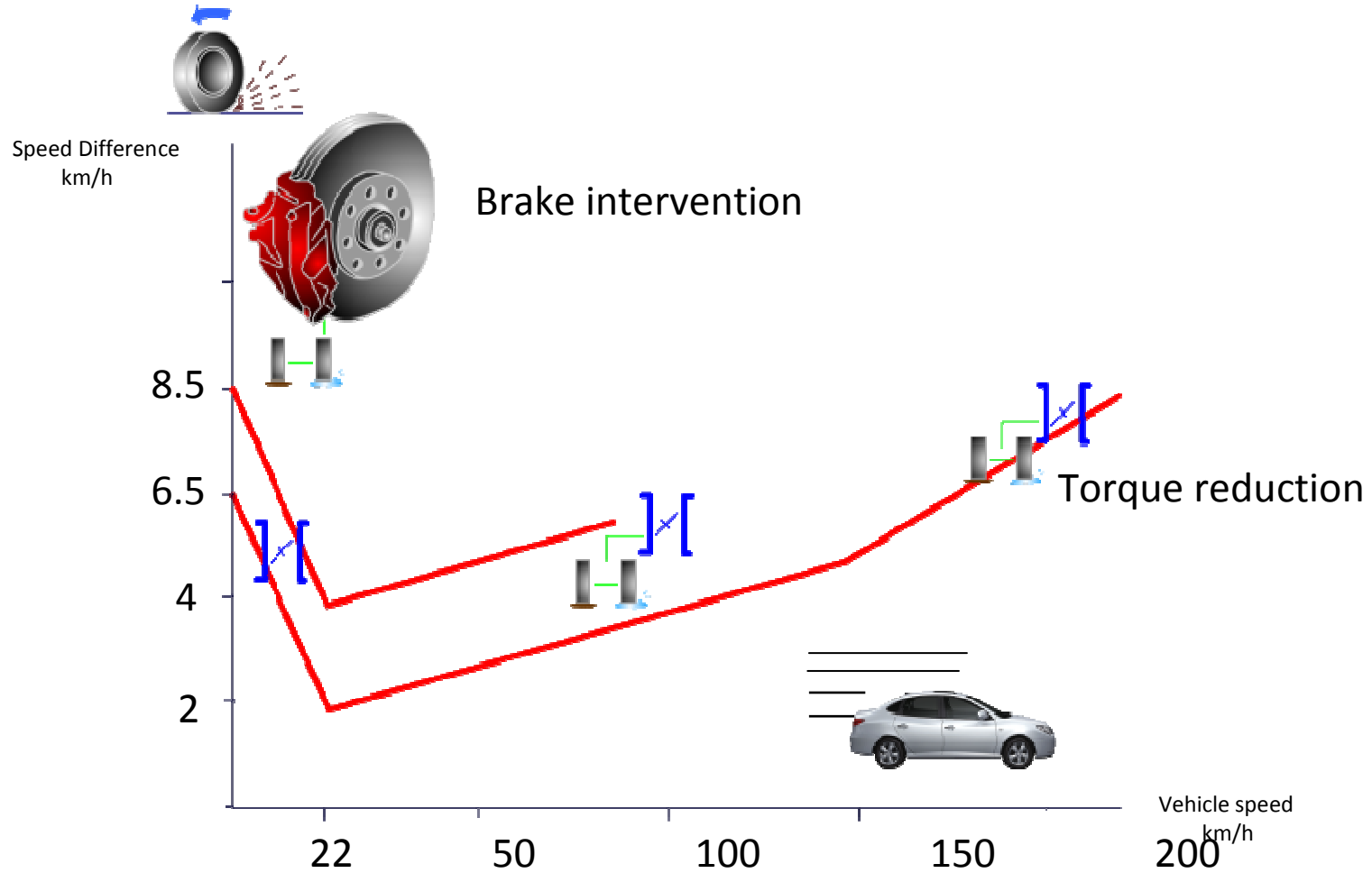
ACTIVE SAFETY

SAFETY

TCS



General TCS function

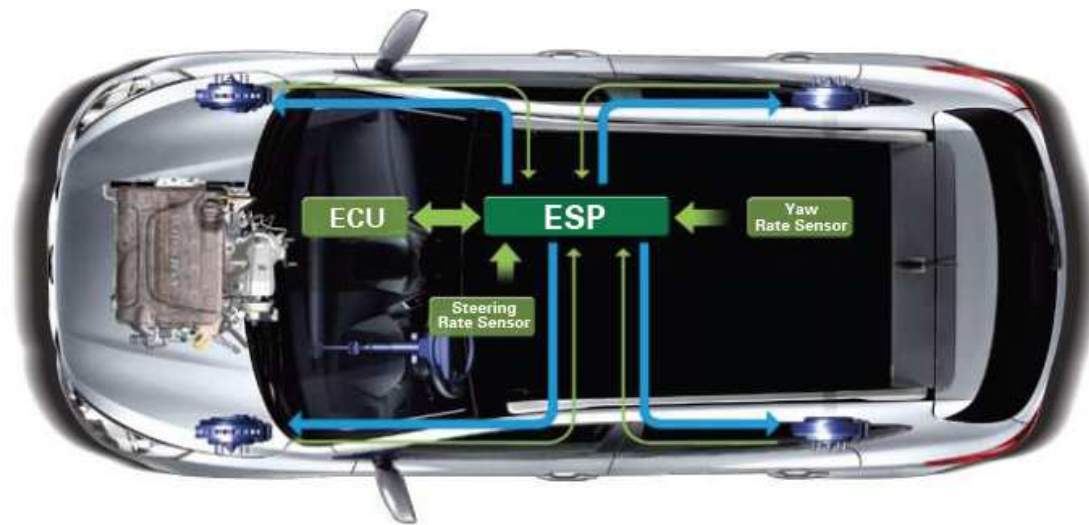


ACTIVE SAFETY

SAFETY

ESP

ESP (ELECTRONIC STABILITY PROGRAM)



■ Signal Line
■ Hydraulic Line

ESP is a high tech system that achieves driving safety by actively controlling the engine torque and braking. It senses the wheel speed, vehicle turning manner, the angle of the steering wheel and the driver pedal input when the driver cannot control the car well during the sudden braking or maneuvers.

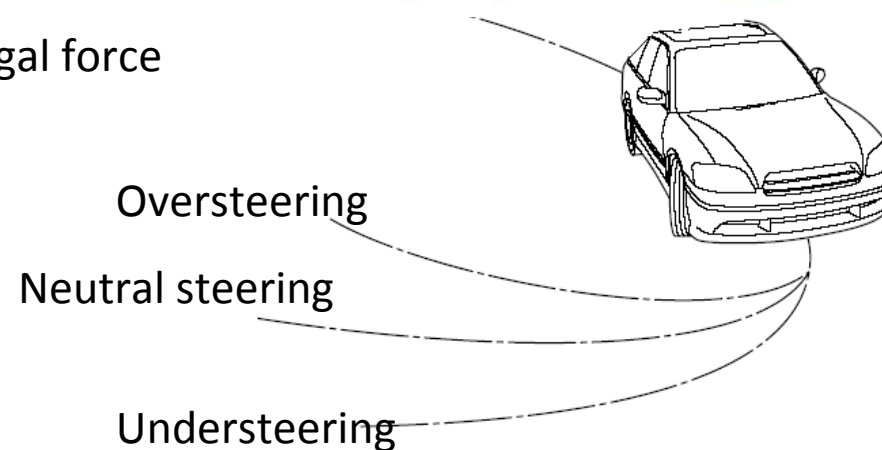
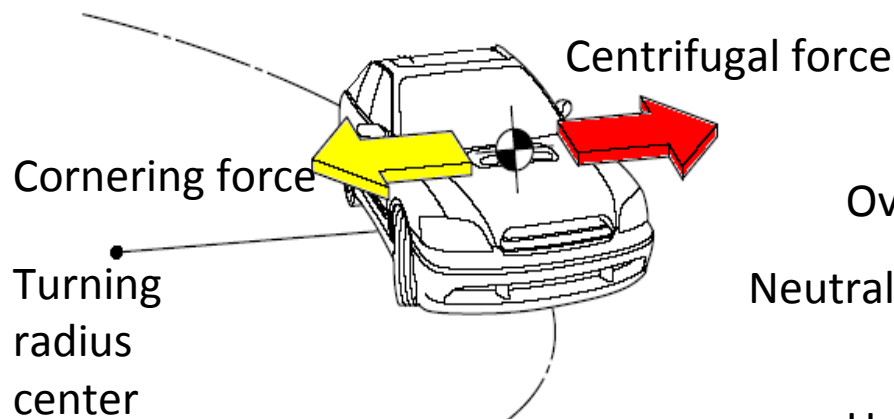
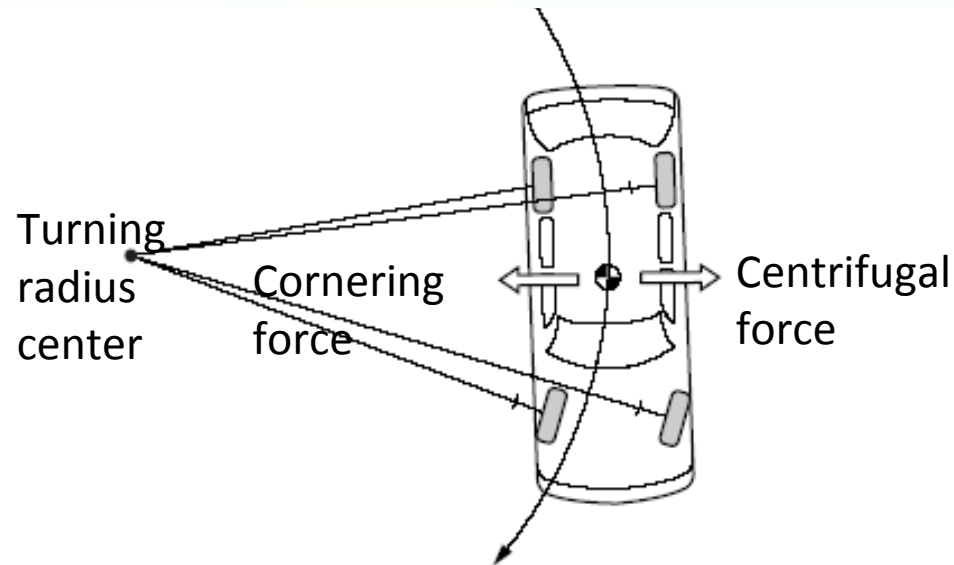


Optimum brake-force distribution under the critical situation.

ACTIVE SAFETY

SAFETY

ESP



Relationship between cornering force and centrifugal force during turns



NEW THINKING. NEW POSSIBILITIES.



ACTIVE SAFETY

SAFETY

TCS

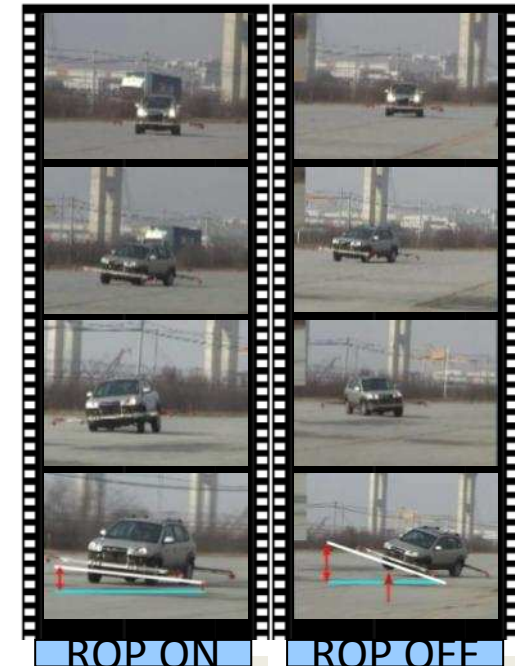
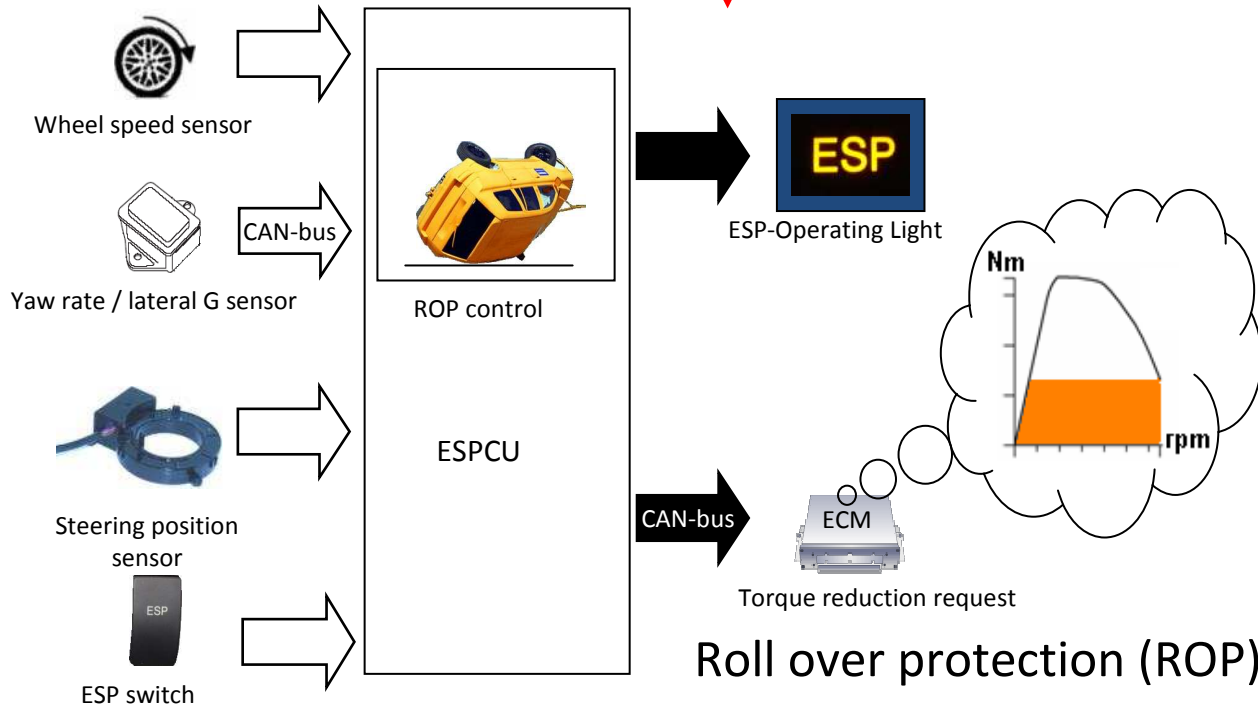


Center of gravity

Vehicle weight

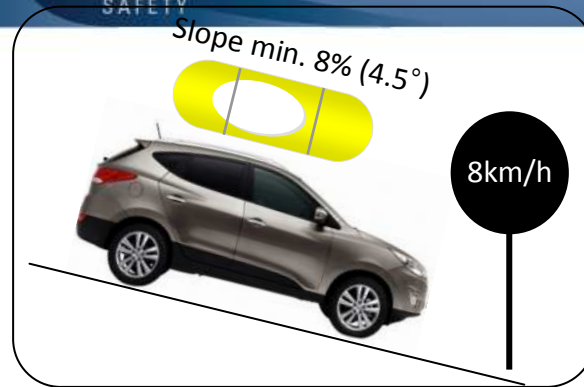


Lateral force

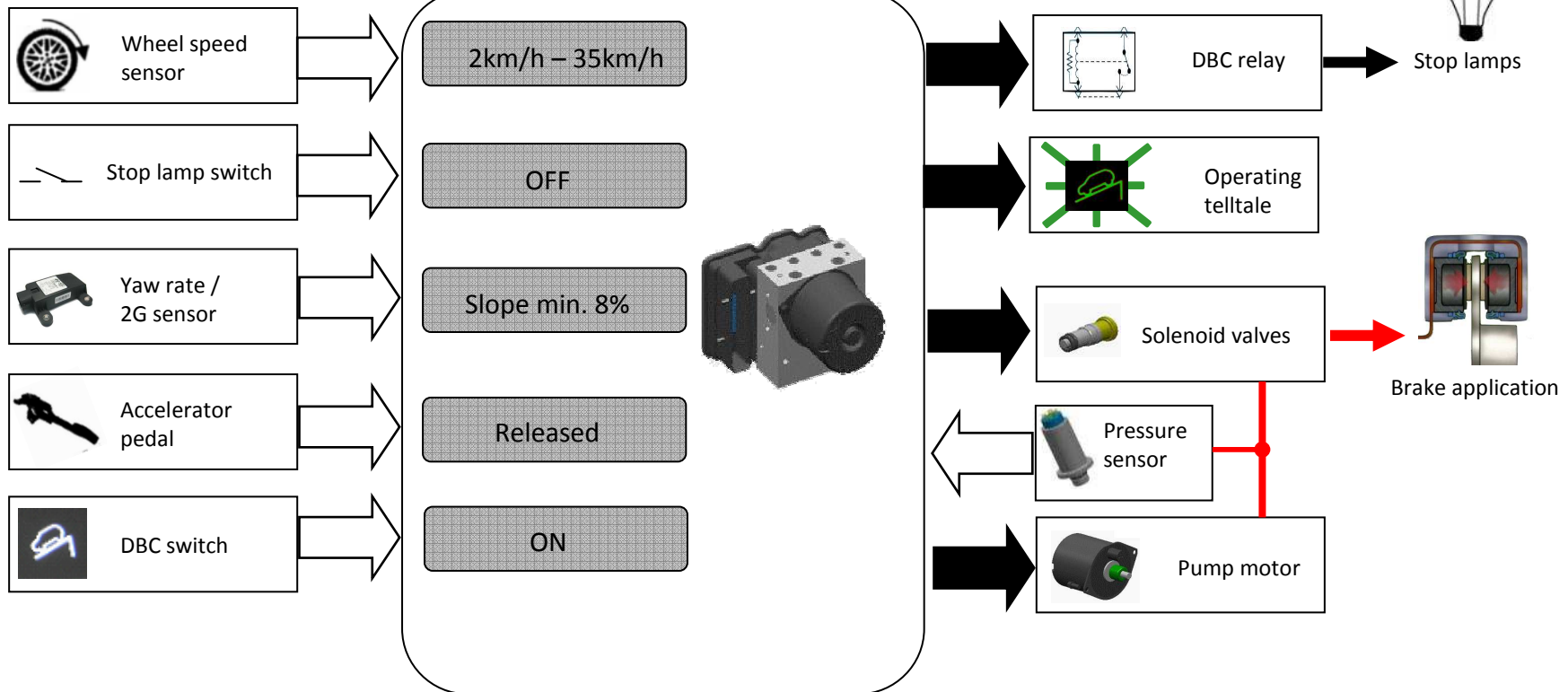


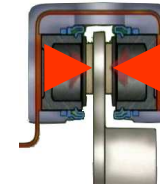
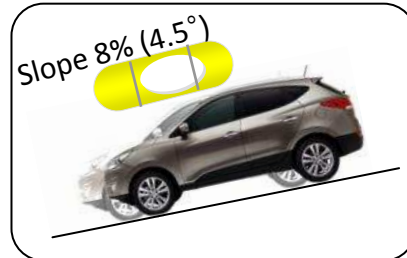
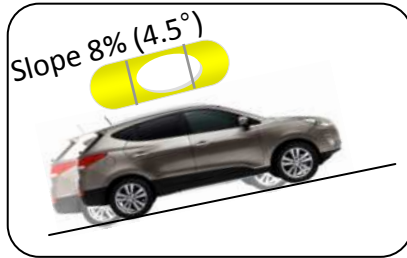
ACTIVE SAFETY

DBC

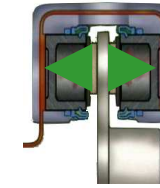


Downhill Brake Control



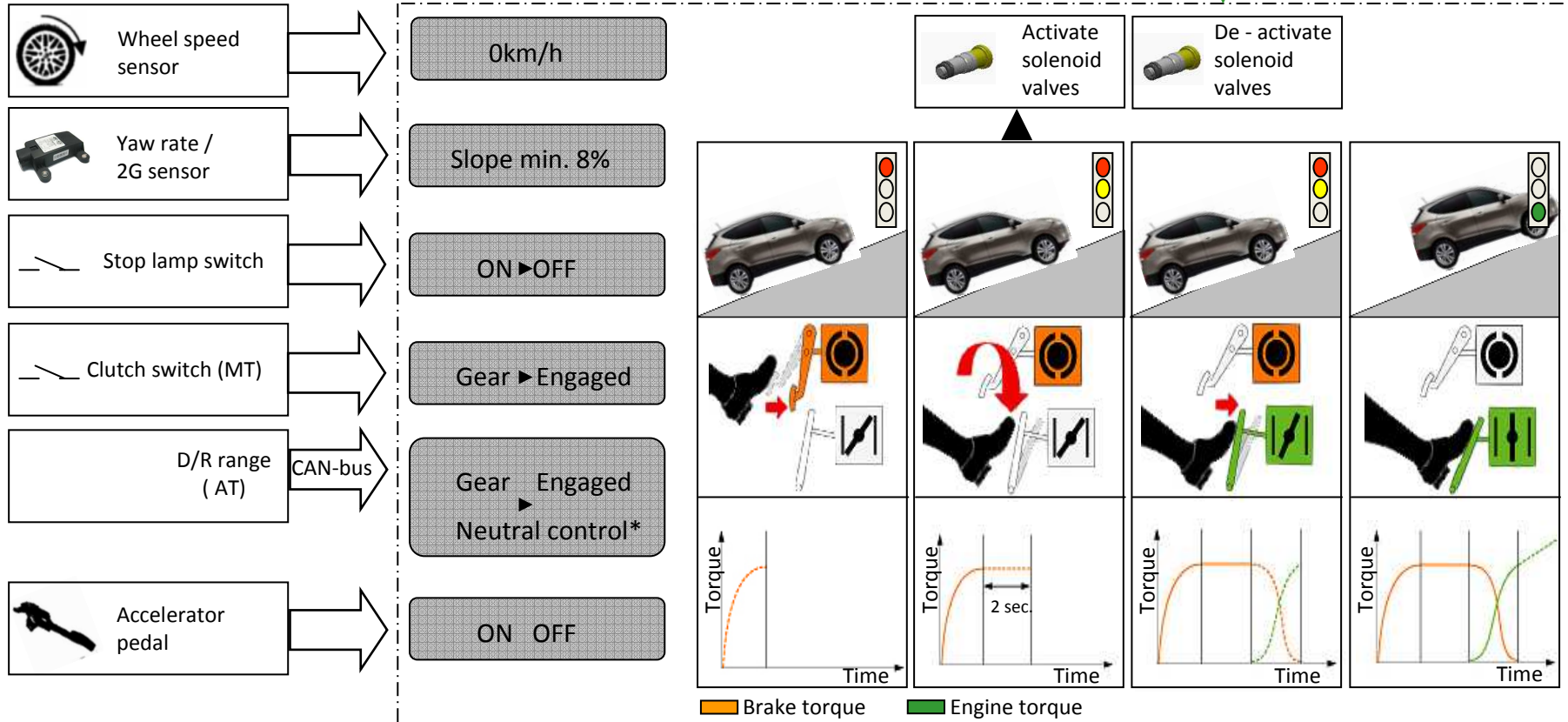


Brake engaged



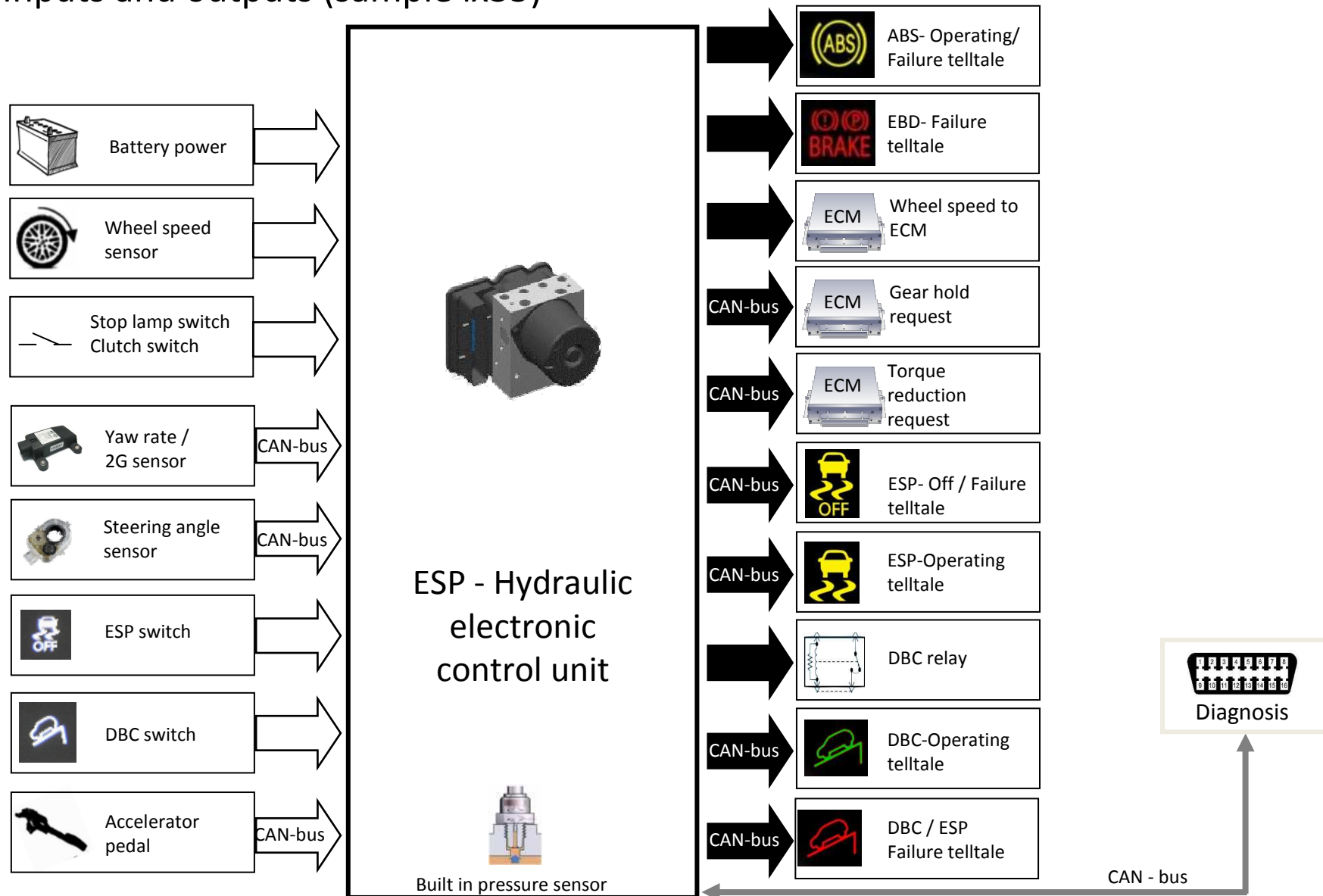
Brake released

Hill start
Assist
Control



* Diesel AT only

Inputs and outputs (sample ix35)





NEW THINKING. NEW POSSIBILITIES.



ACTIVE SAFETY

SAFETY

ESS

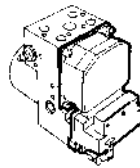
Enable condition ESS

Disable condition for ESS

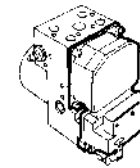


Speed above 55km/h

+



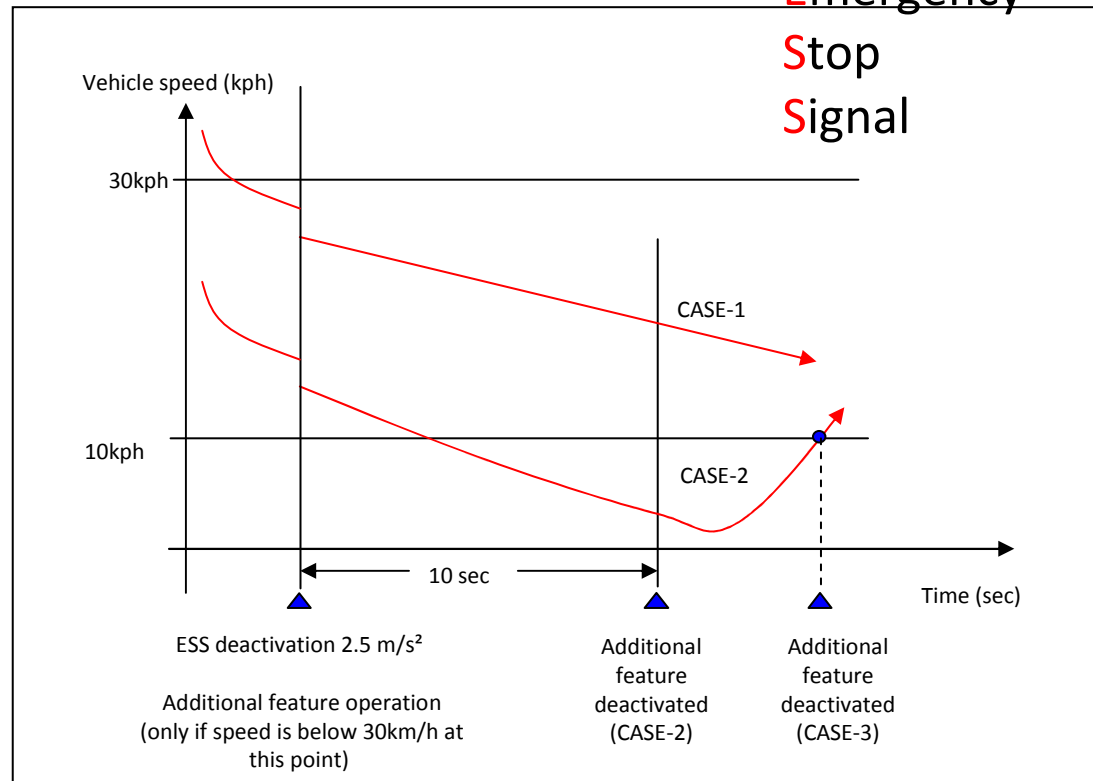
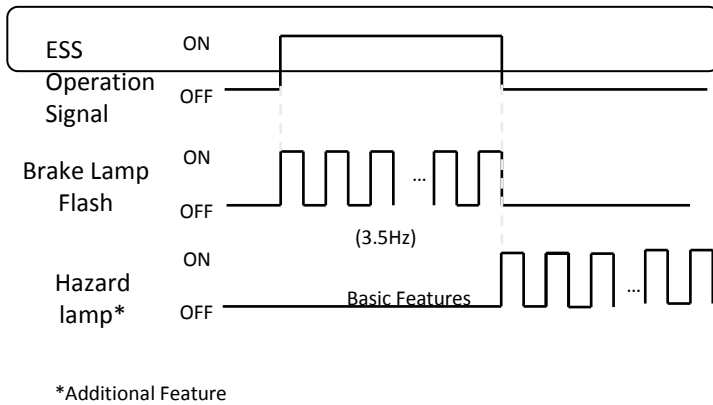
Deceleration 7m/s²



Deceleration below 2.5m/s²



Emergency Stop Signal

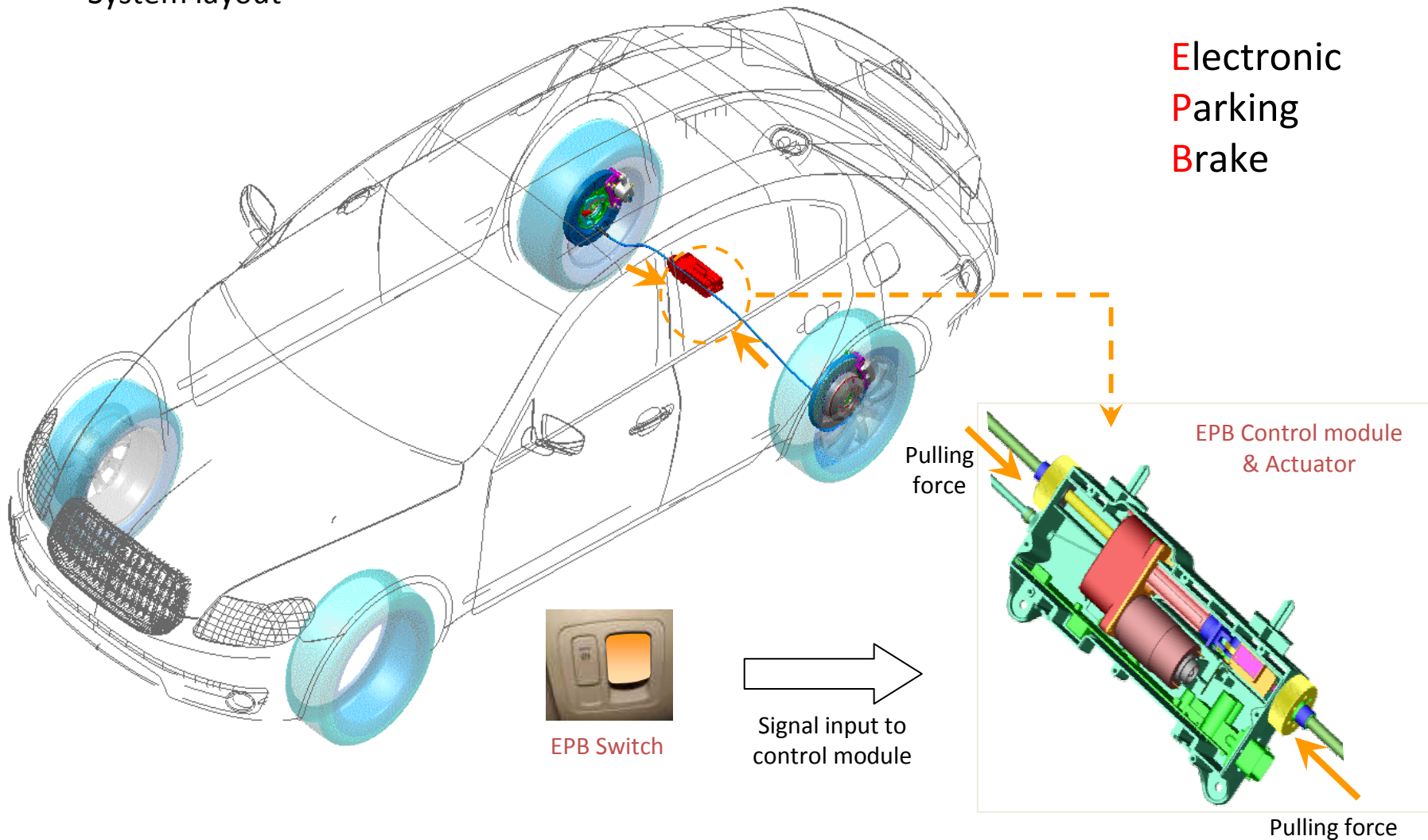


ACTIVE SAFETY

SAFETY

EPB

System layout





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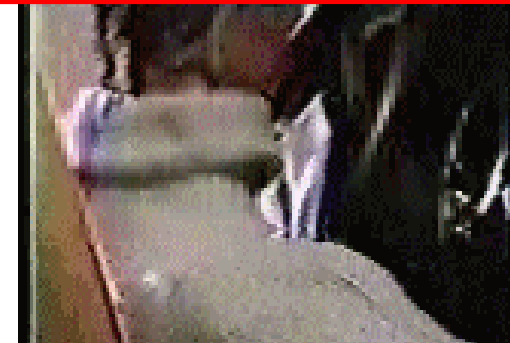
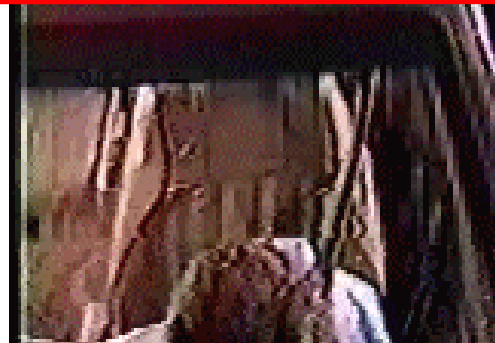
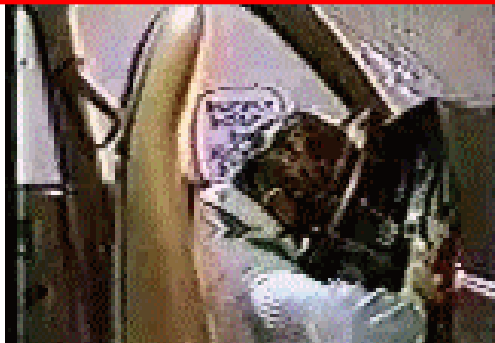
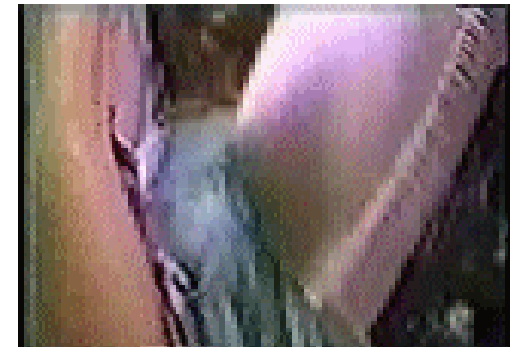


PASSIVE SAFETY

Air bags

AIR BAG

Vehicle with Airbag



Vehicle without Airbag

1. Introduction

The first part of the document discusses the importance of understanding the underlying principles of the system being analyzed.

This section provides a detailed overview of the current state of research in this field.

The following sections will explore various aspects of the system, including its components and their interactions.

It is important to note that the data presented here is preliminary and subject to further investigation.

The results of this study suggest that there is a significant correlation between the variables being studied.

Further research is needed to confirm these findings and to explore the underlying mechanisms.

The authors would like to thank the funding agency for their support in conducting this research.

This work was supported by the National Science Foundation under Grant No. 12345678.

The second part of the document focuses on the methodology used in the study.

The experimental setup was designed to measure the response of the system under various conditions.

Data collection was performed using a series of controlled experiments.

The results of these experiments are presented in the following tables and figures.

The analysis of the data shows that the system exhibits a non-linear response.

The observed behavior is consistent with the theoretical predictions.

The authors are grateful to the reviewers for their constructive comments.

The data and code for this study are available upon request.

Contact: Dr. Jane Doe, Email: jane.doe@university.edu

The third part of the document discusses the implications of the findings.

These results have important implications for the design of future systems.

The findings suggest that there is a need for more robust control strategies.

The authors believe that these results will contribute to the advancement of the field.

The research presented here is a step towards a better understanding of the system.

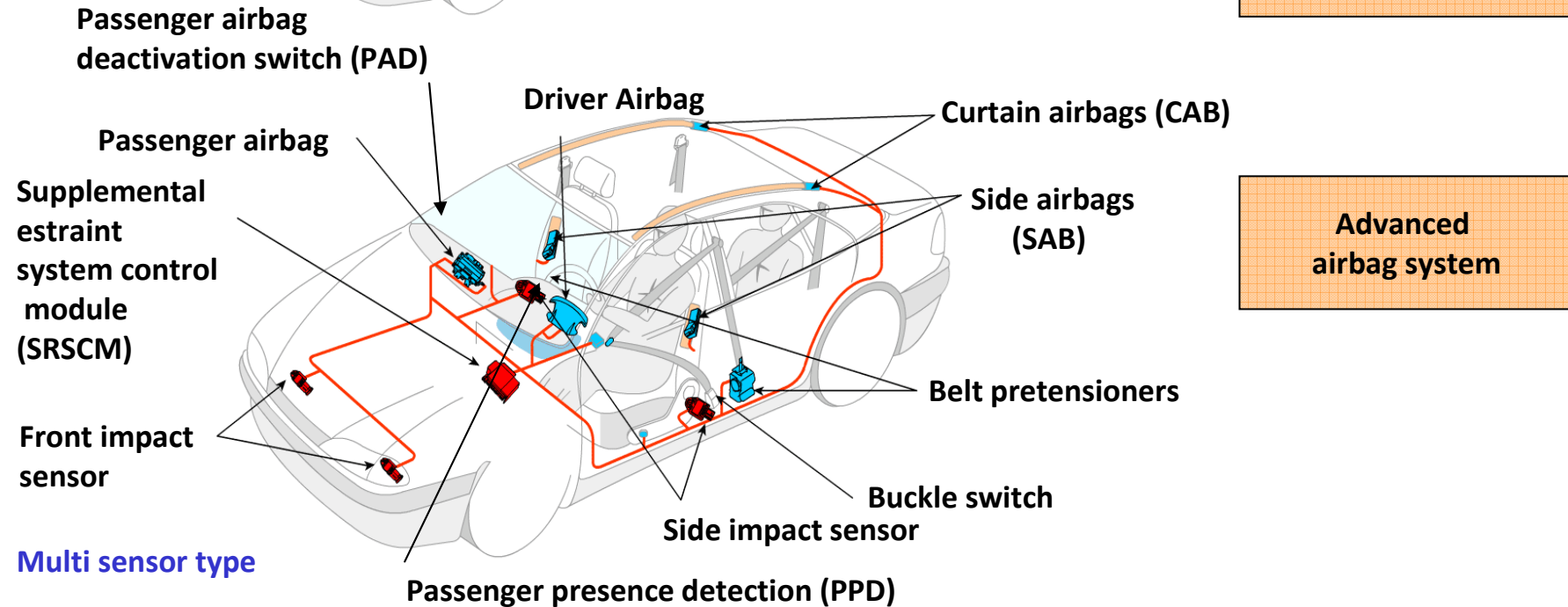
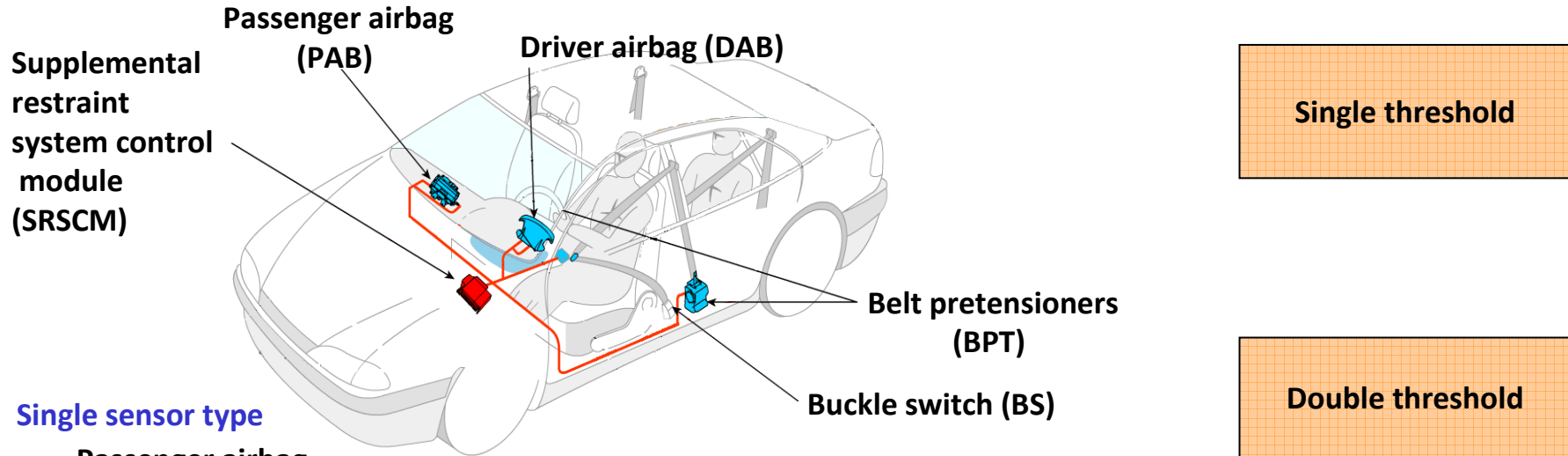
The authors look forward to future collaborations in this area.

The work was completed at the University of California, Berkeley.

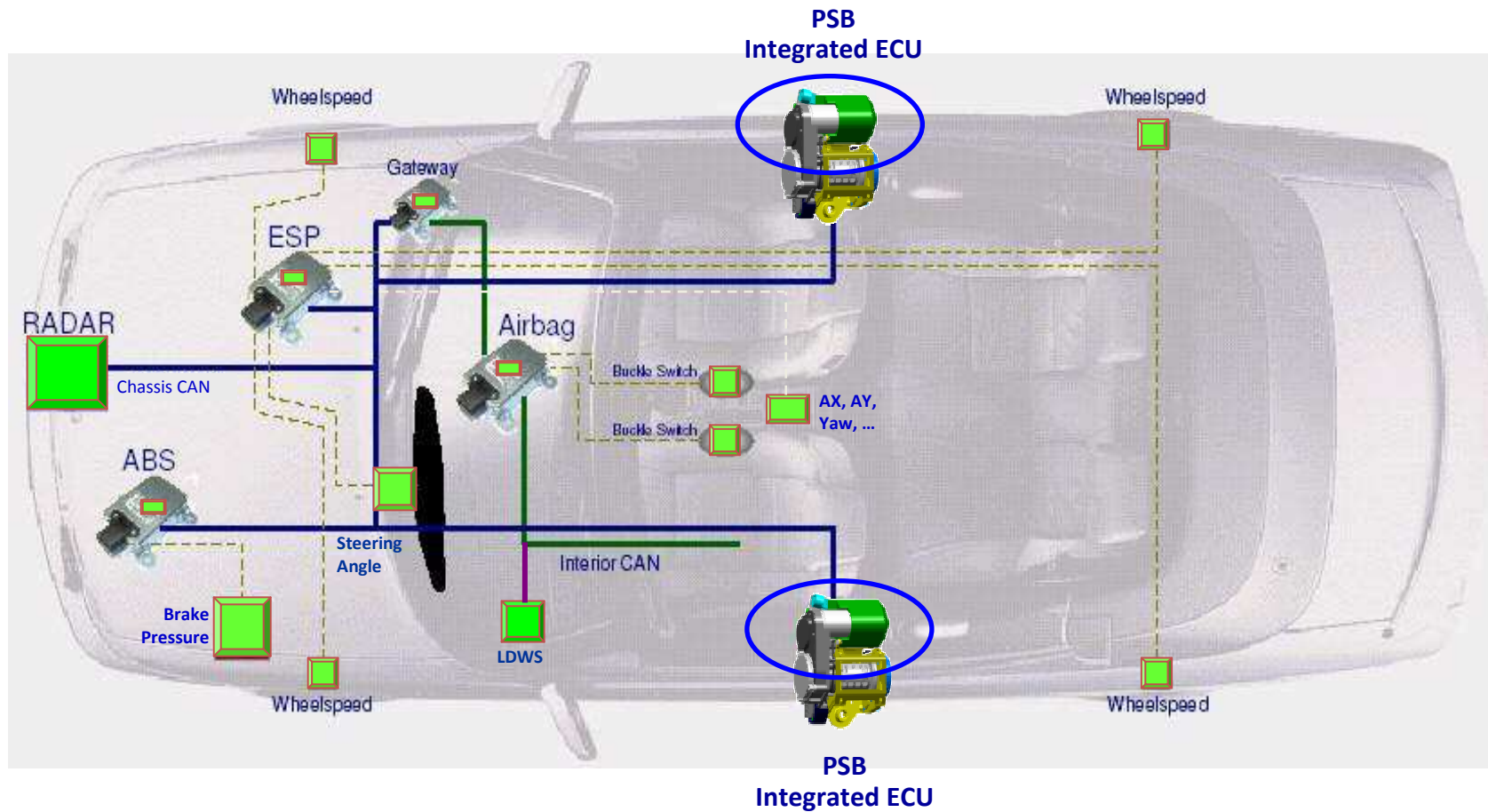
The authors would like to thank their colleagues for their support.

This work was supported by the National Science Foundation under Grant No. 12345678.

Airbag system classification, layout

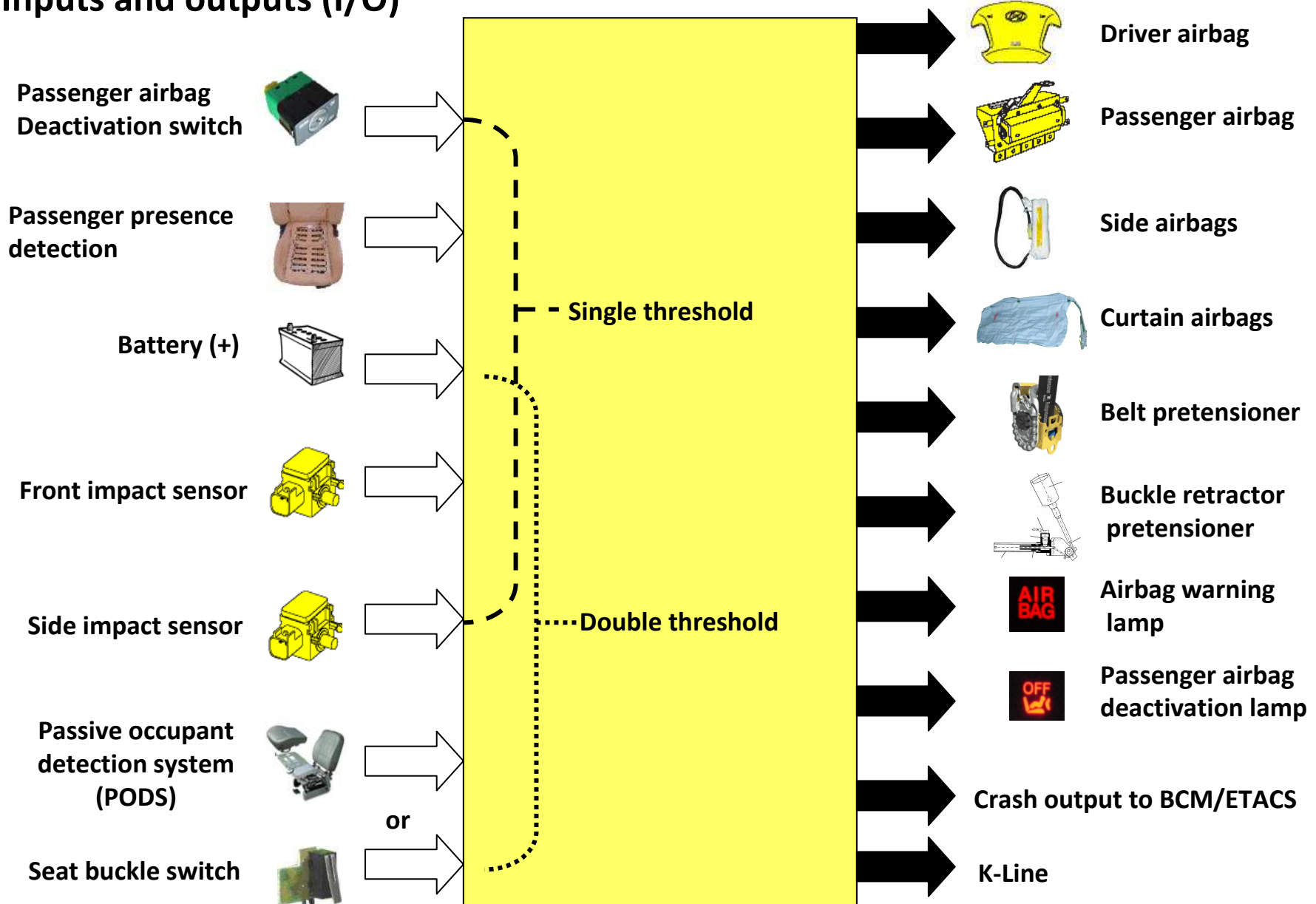


System Layout



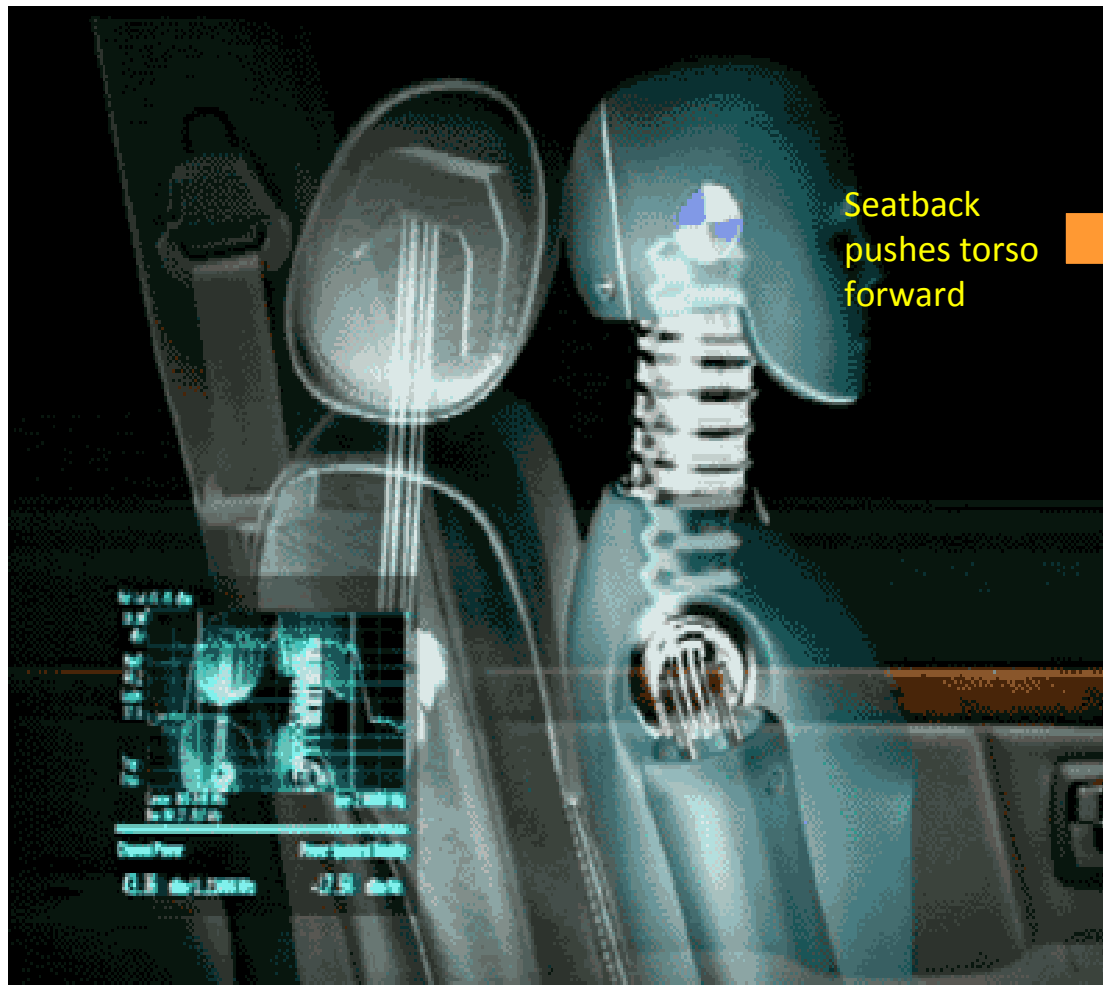
Basic Sensors & Systems

Inputs and outputs (I/O)

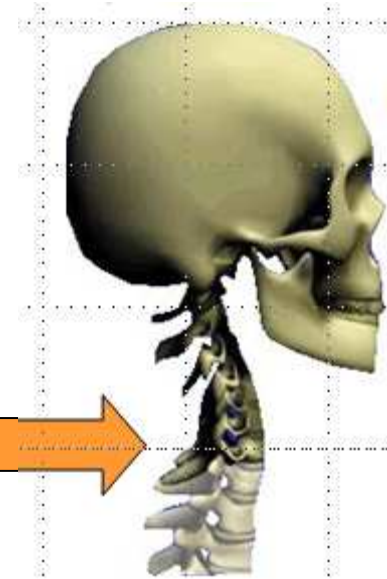


Active head rest

Head remains stationary
due to inertia



Seatback
pushes torso
forward



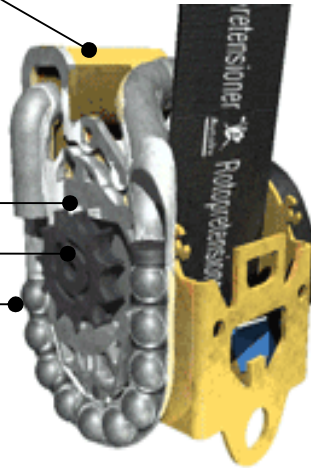
Belt pretensioner, buckle retractor, Isofix seat for kids

Ball chamber

Gear

Shaft

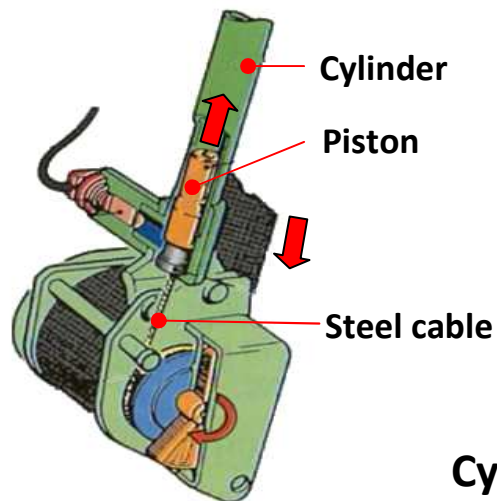
Steel balls



Ball type



Isofix child seat

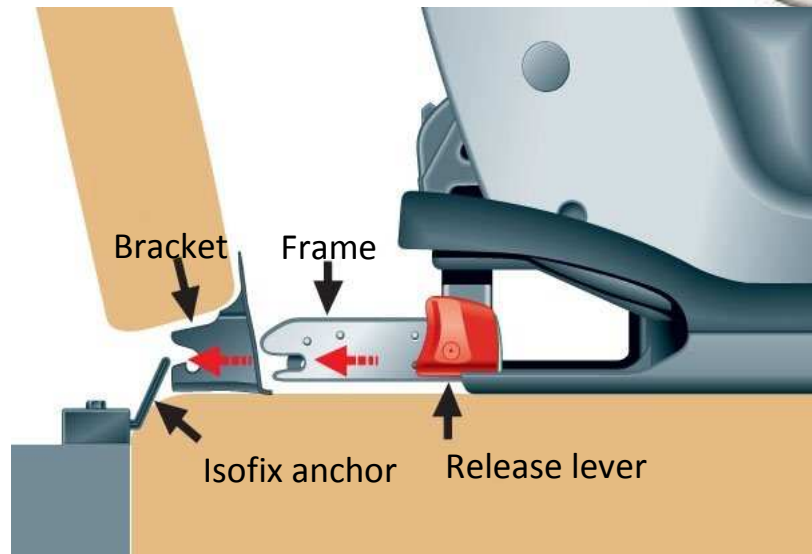


Cylinder type

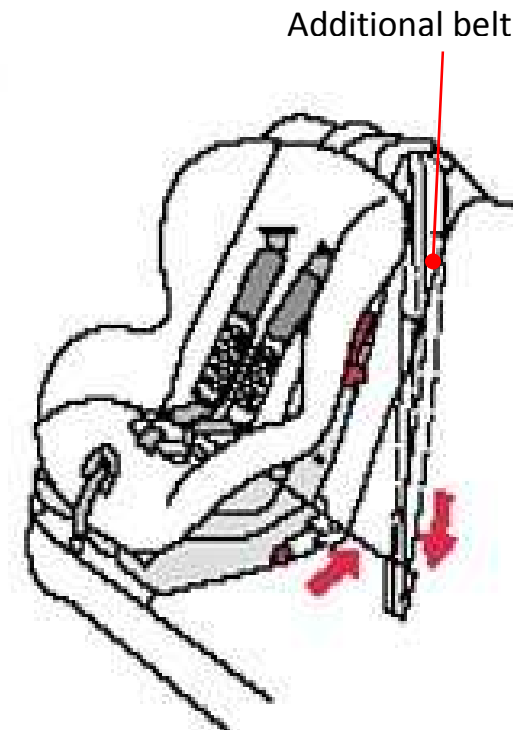


Buckle retractor pretensioner

Isofix

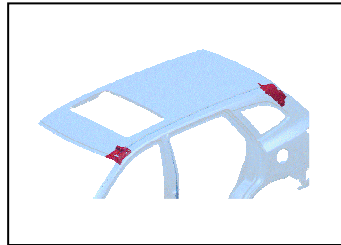


Lower anchorage type

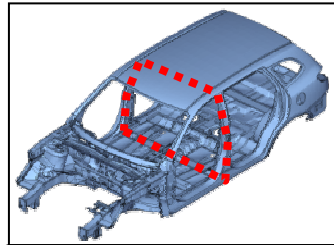


Top tether type

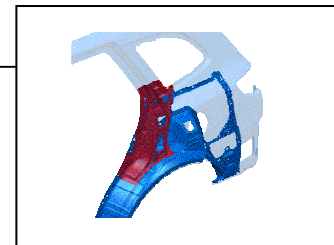
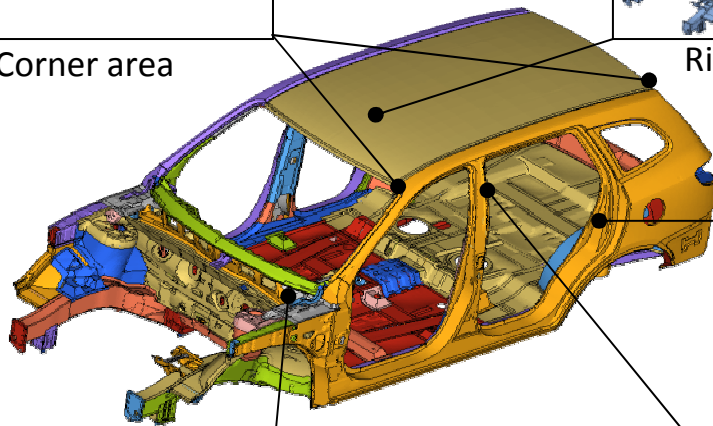
Crumple zones



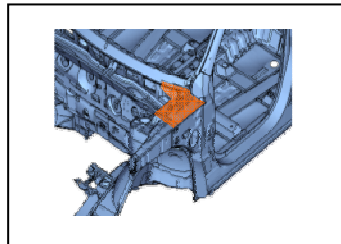
Corner area



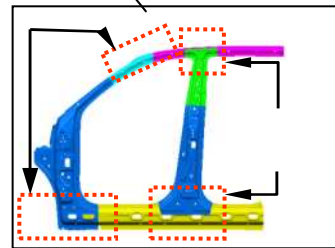
Ring frame



C-pillar area

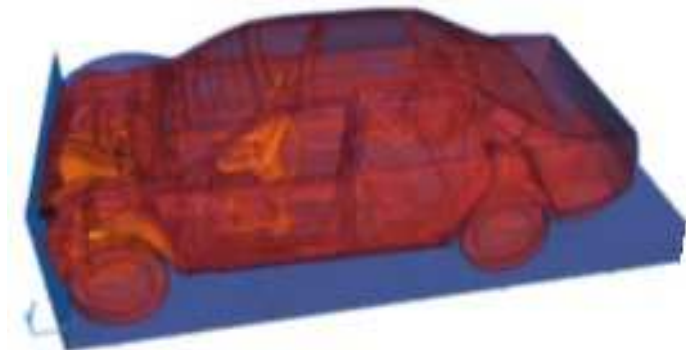


Cowl area



Material strength

Strength improved





NEW THINKING. NEW POSSIBILITIES.



NCAP Test & marks



ADULT OCCUPANT PROTECTION

We crash test 30 models a year to help you drive safely.



CHILD OCCUPANT PROTECTION

How seriously do you take your child's protection?



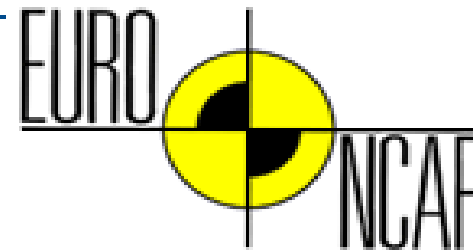
PEDESTRIAN PROTECTION

Protecting pedestrians is a priority for Euro NCAP. Is it for you?



SAFETY ASSIST

How do the latest technologies really assist you on the road?



<http://www.euroncap.com/home.aspx>

New Car Assessment Program

- ★★★★★ = 10% or less poss. Heavy injuries
- ★★★★ = 11% to 20% ~
- ★★★ = 21% to 35% ~
- ★★ = 36% to 45% ~
- ★ = 46% or higher ~



NEW
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NTHSC tests & marks



Buckles, seat belts



Air bags



All kind of accidents, roll over



Tires



Child safety



<http://www.safercar.gov>

National
Highway
Traffic
Safety
Administration

Government of the USA



NEW
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PHILOSOPHY

CORPORATIVE PHILOSOPHY

VISION

Corporate Philosophy

We have developed and implemented our corporate philosophy including management philosophy, policy, and strategy to grow together with stakeholders and contribute to improving the quality of life around the world.



We announced "**Innovation for Customers**" as our mid-to long-term vision with five core strategies: **global orientation, respect for human values, customer satisfaction, technology innovation, and cultural creation.** We desire to create an automobile culture of putting customer first via developing human-centered and environment-friendly technological innovation.

PHILOSOPHY

CORPORATIVE PHILOSOPHY

VISION





NEW
THINKING.
NEW
POSSIBILITIES.



PHILOSOPHY

CORPORATIVE PHILOSOPHY

VISION

Hyundai Design - Design Process



Designing the future of automobiles!
Perfecting design with cutting-edge technology!



NEW
THINKING.
NEW
POSSIBILITIES.



PHILOSOPHY

CORPORATIVE PHILOSOPHY

VISION

Hyundai Technology



1.DIS 2.SCC 3.SPAS 4.LDWS



5.HMI 6.UVO 7.Biometric smart key system

Making smarter vehicles!

Expanded application of automotive electronics

Infotainment system

Advanced Safety Vehicle (ASV) system



NEW
THINKING.
NEW
POSSIBILITIES.



PHILOSOPHY

CORPORATIVE PHILOSOPHY

VISION



New technologies for driver safety and convenience

PHILOSOPHY

CORPORATIVE PHILOSOPHY

VISION



DSM



Self-healing scratch shield

PHILOSOPHY

CORPORATIVE PHILOSOPHY

VISION



Solar cell sunroof

Pre-crash headrest



NEW
THINKING.
NEW
POSSIBILITIES.



PHILOSOPHY

CORPORATIVE PHILOSOPHY

VISION



Nano technology glass, wiper less



NEW
THINKING.
NEW
POSSIBILITIES.



PHILOSOPHY

CORPORATIVE PHILOSOPHY

VISION



Honeycomb tire



Smart window

Hyundai Technology - Safety



Securing the highest safety ratings



NEW
THINKING.
NEW
POSSIBILITIES.



PHILOSOPHY

CORPORATIVE PHILOSOPHY

VISION

Hyundai Technology – Pre crash Safety



Vehicle Stability Management



NEW
THINKING.
NEW
POSSIBILITIES.



PHILOSOPHY

CORPORATIVE PHILOSOPHY

VISION

Hyundai Technology – Pre crash Safety



LKAS



LKAS

Lane Keeping Assist

PHILOSOPHY

CORPORATIVE PHILOSOPHY

VISION

Hyundai Technology – Pre crash Safety




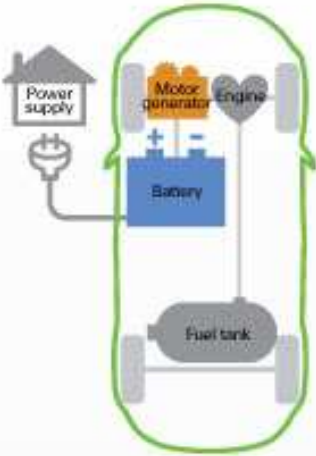
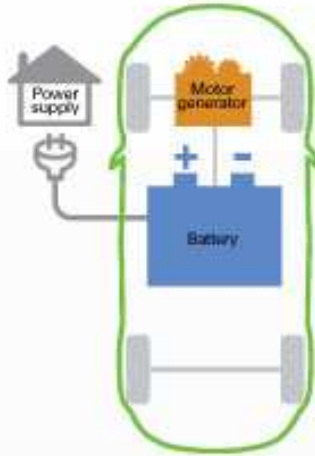
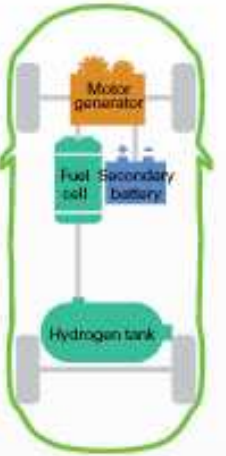
Computer aided and simulations crashes

PHILOSOPHY

CORPORATIVE PHILOSOPHY

VISION

Hyundai Technology – Environmentally friendly

	HEV	Plug-in HEV	EV	FCEV
Structure/ Characteristics	<p>Structure/Characteristics Engine+motor (secondary power source)</p>  <p>Battery 0.9~1.8 kwh</p>	<p>Engine+motor (can drive on motor)</p>  <p>Battery 4~16 kwh</p>	<p>Drives on motor alone</p>  <p>Battery 10~30 kwh</p>	<p>Creates electricity through hydrogen/oxygen</p>  <p>Battery 0.9~8 kwh</p>
Develop- ment task	<ul style="list-style-type: none"> Minimize higher price markup compared to regular vehicles 	<ul style="list-style-type: none"> Build electric charging infrastructure and develop quick charging technology Improve battery performance (Increase energy density, lower price) 	<ul style="list-style-type: none"> Build Hydrogen charging infrastructure Lower price of high-priced parts 	

Vehicle for the future - now



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Thank you kindly

Yours Hyundai Auto Beograd
Miodrag B. Stojanovic