Ministry of Land,
Infrastructure and Transport

Korea Automobile Testing &
Research Institute

Safety considerations
on Emergency Manoeuver

ACSF IWG 20th meeting
November 2018, Liverpool

Korea **A**utomobile **T**esting & **R**esearch **I**nstitute

➢ **Based on ongoing discussion about emergency manoeuver requirements**

2.5.x. The activated system shall detect the risk of an imminent collision e.g. due to <u>a decelerating lead vehicle</u>, <u>a cutting in vehicle</u> or <u>a suddenly appearing obstacle after a lane change of a leading vehicle</u> and shall automatically perform an appropriate emergency manoeuver as specified in paragraph 2.10.

※ Requirements for emergency manoeuver(2.10.x)

- Detect imminent danger (e.g. collision with another road user ahead or beside the vehicle).

- In case of insufficient lead time to transition to the driver, an emergency manoeuver shall be initiated immediately.

- Full braking or evasive manoeuvre

- Other test requirements to be developed

➢ **Suggestions for the consideration of test procedure & requirement**

✓ Automated vehicle shall be able to reduce accidents caused by human weakness

✓ The test requirements for emergency manoeuver shall be in such a way that the performance is at least equal to that of a human being, as the case may be

➤ **Accident analysis from dash-cam footage**
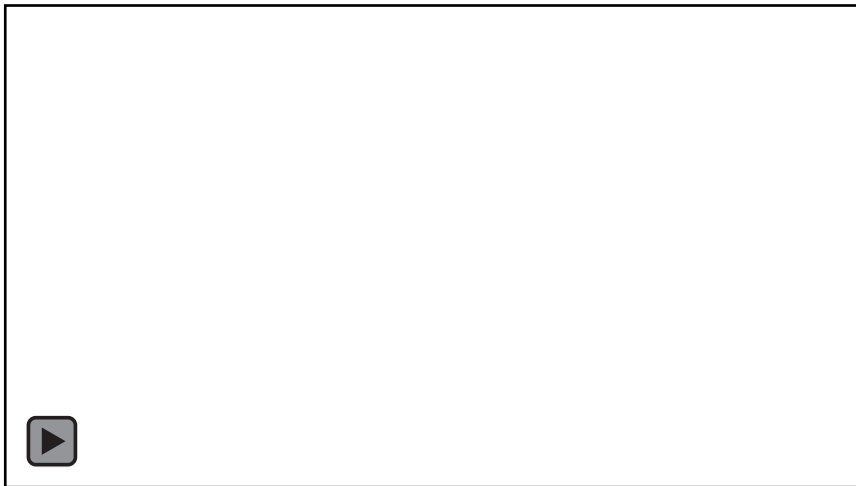
a cutting in vehicle

a suddenly appearing obstacle
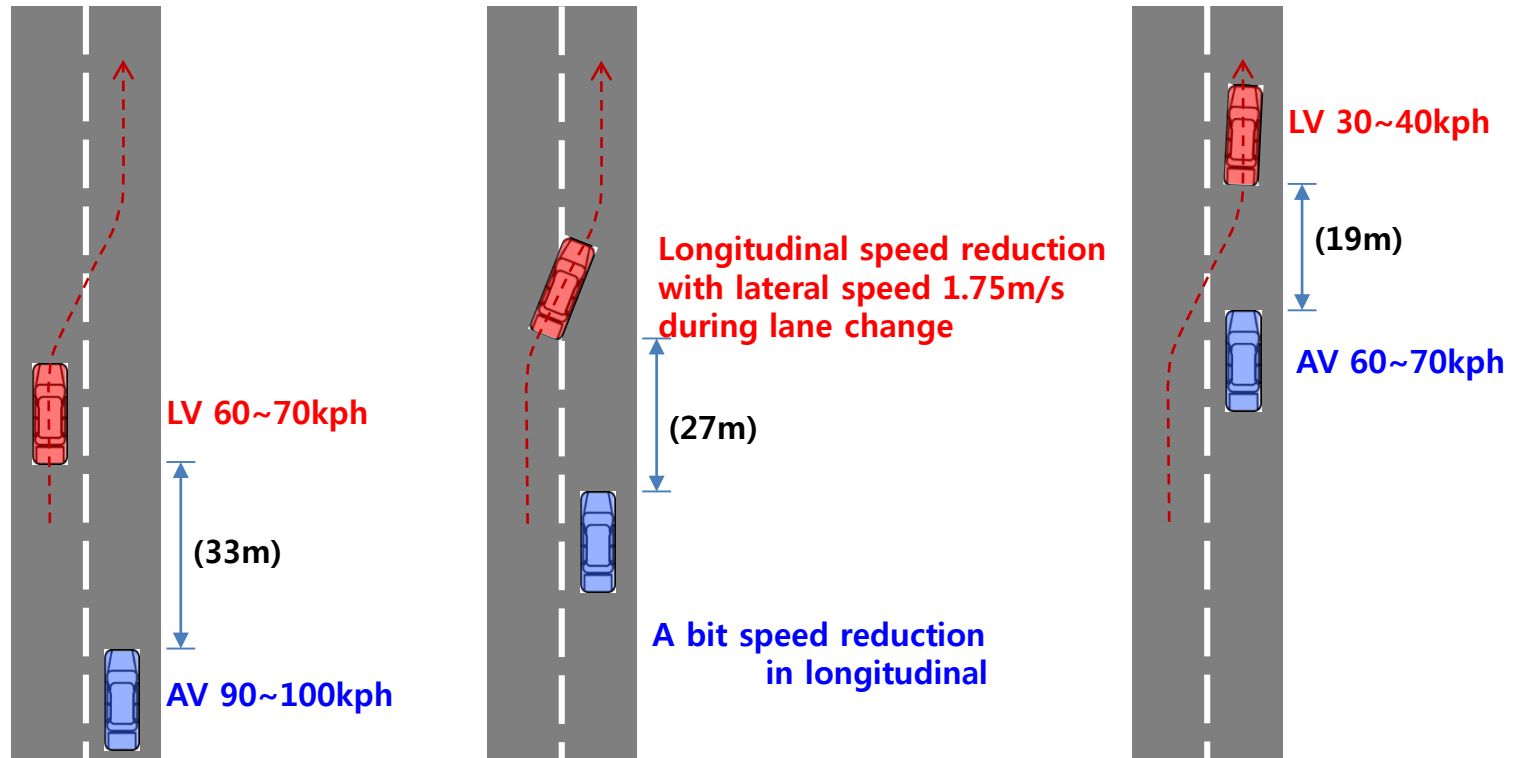(after cutting out)

✓ 650 dash-cam footages for highway accident cases in Korea

Classification	Lead vehicle deceleration	Front vehicle cutting in	Front vehicle cutting out	lane change	The others
Rate(%)	43.1	30.3	2.5	14.5	9.7

(somewhat difficult to be classified)

(source : korea insurance company, 2018 RCAR)

➢ **Front cutting in vehicle**

LV 60~70kph

(33m)

AV 90~100kph

Longitudinal speed reduction with lateral speed 1.75m/s during lane change

(27m)

A bit speed reduction in longitudinal

LV 30~40kph

(19m)

AV 60~70kph
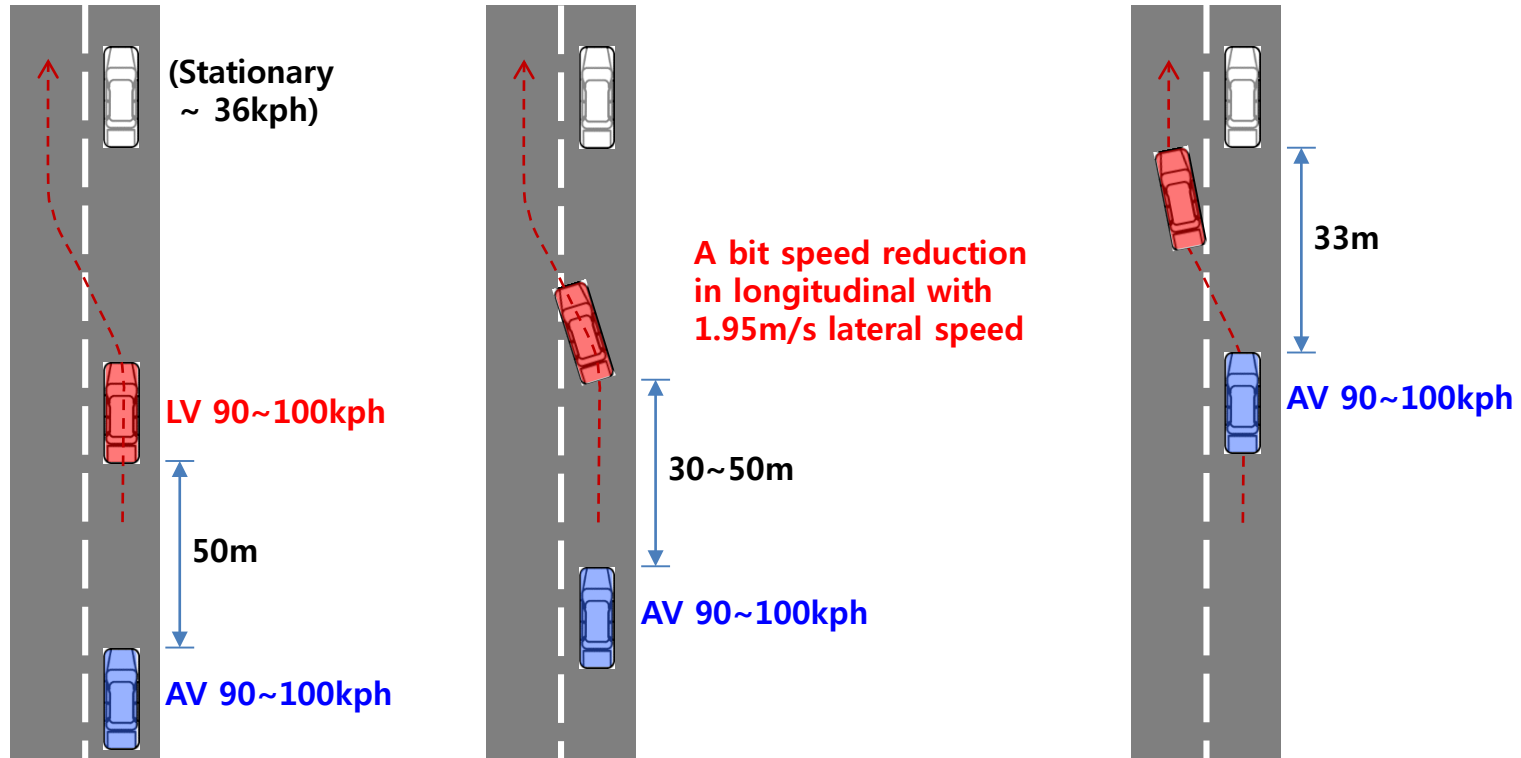
☞ **Test scenario from dash-cam footage**

① Initial speed : AV(95kph), LV(65kph)
② Initial distance : 33m between AV & LV
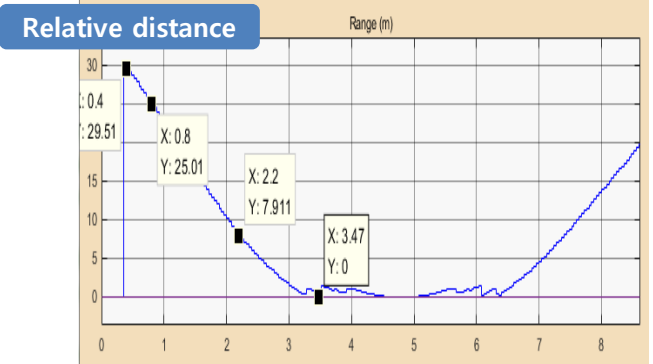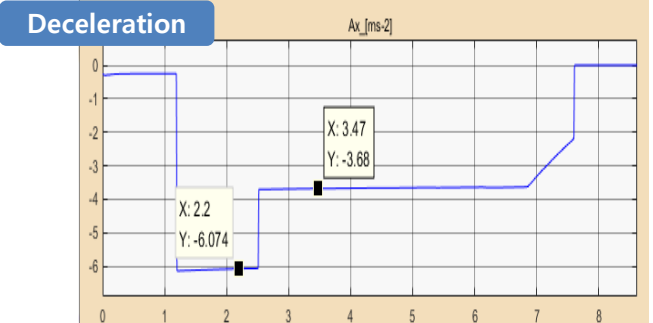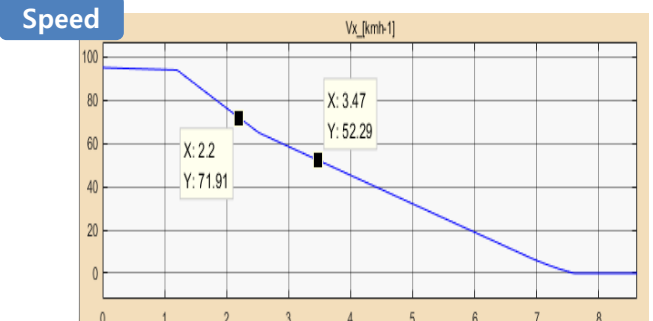③ Cutting in manoeuver : Lateral speed 1.75m/s and longitudinal speed reduction to 35kph during lane change
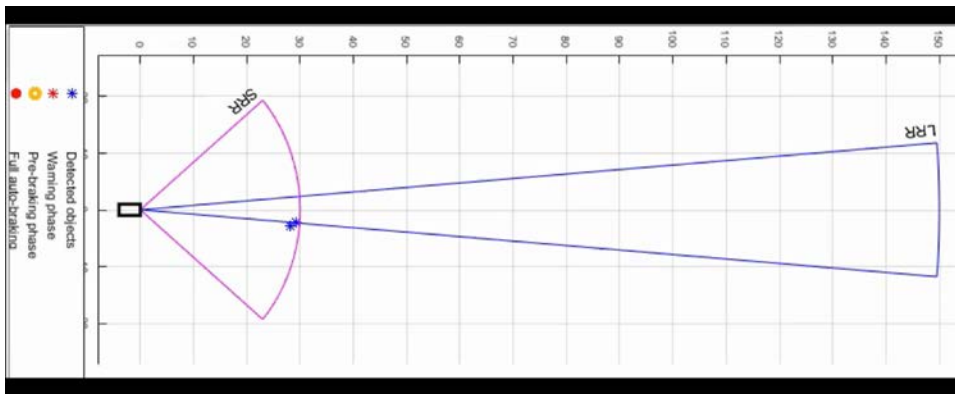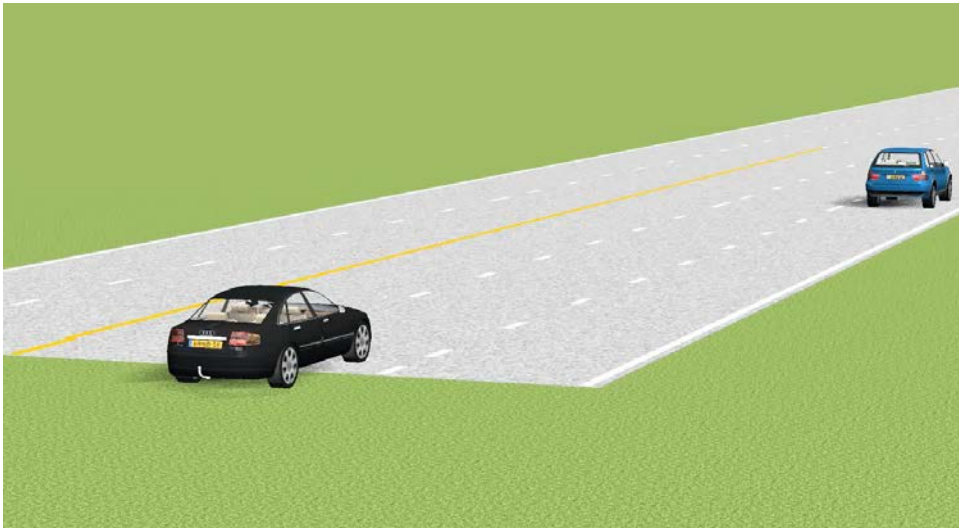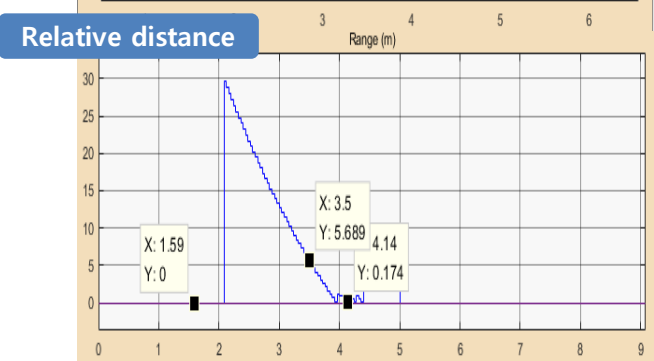
4

➢ Leading vehicle cutting out of driving lane

(Stationary ~ 36kph)

LV 90~100kph

50m

AV 90~100kph

A bit speed reduction in longitudinal with 1.95m/s lateral speed
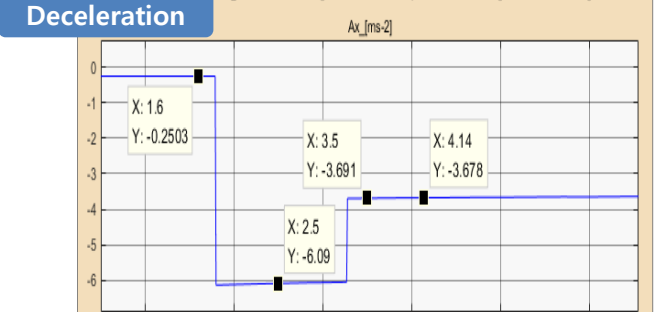
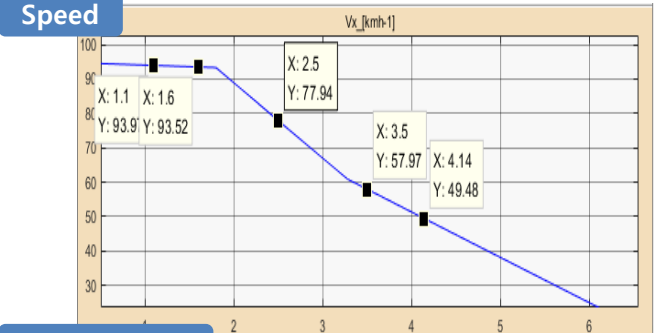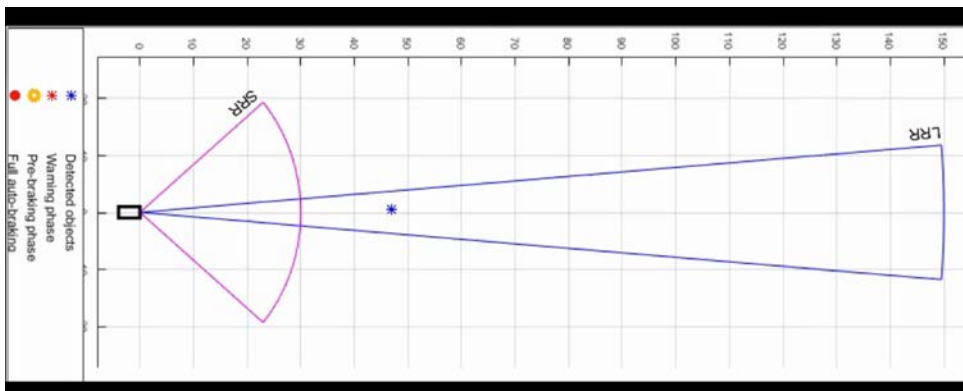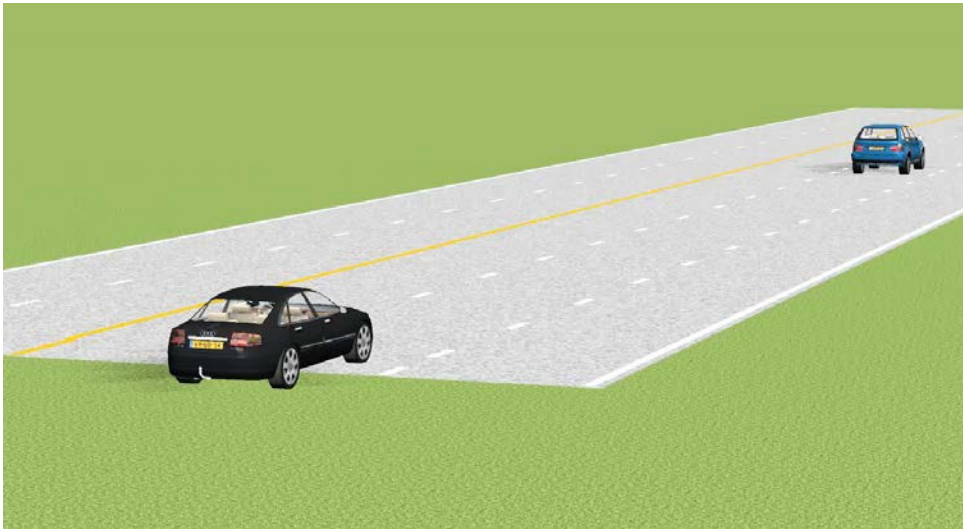**30~50m**

AV 90~100kph

33m

AV 90~100kph

☞ **Test scenario from dash-cam footage**

① Initial speed : AV(95kph), LV(95kph)

② Initial distance : 50m between AV & LV, 78m between AV & crash target

③ Cutting out manoeuver : Lateral speed 1.95m/s and longitudinal speed reduction to 85kph during lane change

➤ **ACC+AEB simulation for front cutting in vehicle**


Speed

Vx_[kmh-1]

X: 3.47
Y: 52.29

X: 2.2
Y: 71.91

Deceleration

Ax_[ms-2]

X: 3.47
Y: -3.68

X: 2.2
Y: -6.074

Relative distance

Range (m)

: 0.4
: 29.51

X: 0.8
Y: 25.01

X: 2.2
Y: 7.911

X: 3.47
Y: 0

6

➤ ACC+AEB simulation for leading vehicle cutting out

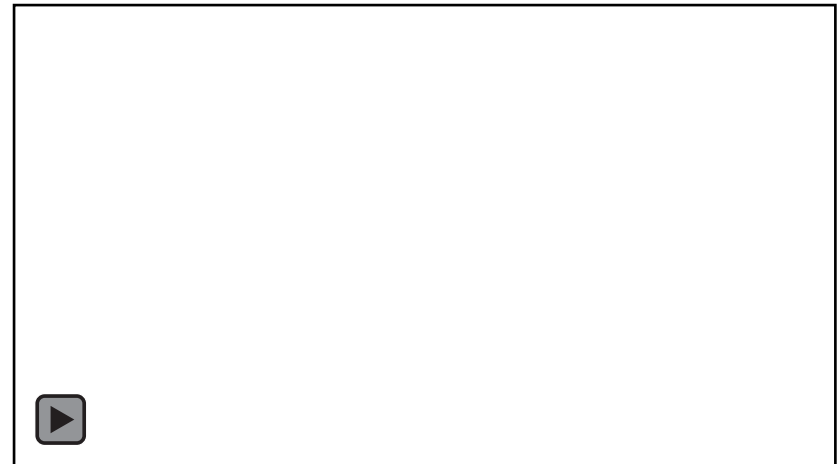**Speed**

Deceleration

Relative distance

➢ **Track test by human driver**

✓ Leading vehicle : SUV controlled by robot system(steering, braking and accelerating)

✓ Driver : test driver in attentive
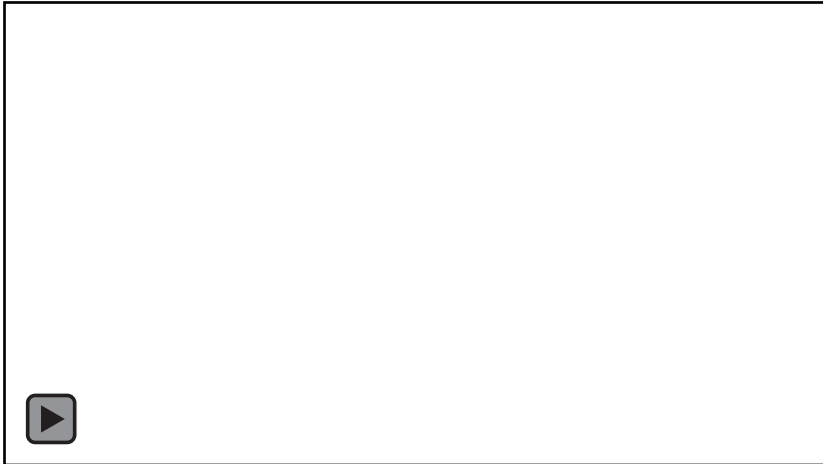
Front cutting in vehicle

Leading vehicle cutting out

➤ **Conclusions**

✓ The emergency situation that the system has to cope with is no easy with existing ADAS technology

✓ Automated vehicle shall be able to reduce accidents caused by human weakness

✓ If the AD system does not cope with a emergency situation that human driver can do, it will lose public confidence

✓ The test requirements for emergency manoeuver shall be in such a way that the performance of AD is at least equal to that of a human being, as the case may be

✓ Our suggestion is intended to give guidelines on how test procedure & requirements for emergency manoeuver should be reviewed