Submitted by the expert from Japan

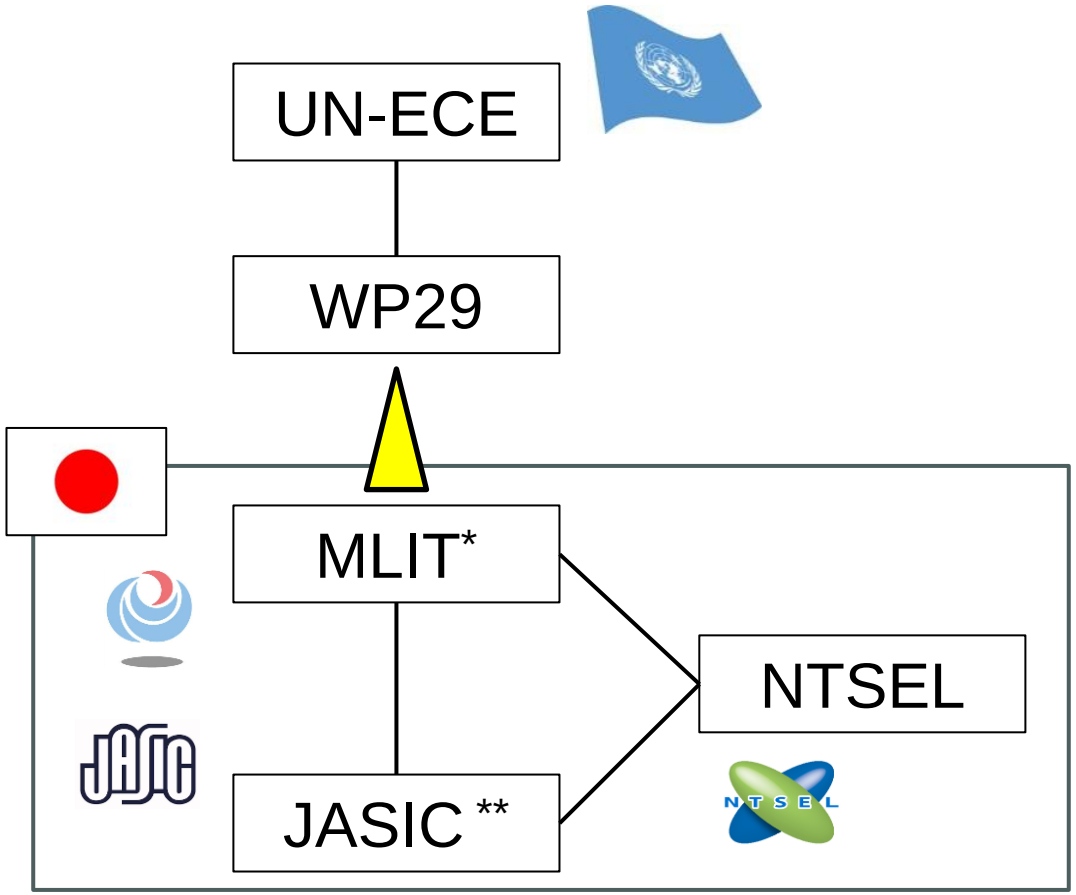
Item 11. Exchange of views on guidelines
and relevant national activities.

Informal document GRVA-18-35
18th GRVA, 22-26 January 2024
Provisional agenda item 11

Introduction of researches in JAPAN regarding AD/ADAS

NATIONAL TRAFFIC SAFETY and
ENVIRONMENT LABORATORY
(NTSEL)

Introduction of NTSEL



*MLIT: Ministry of Land, Infrastructure, Transport, and Tourism
**JASIC: Japan Automobile Standards Internationalization Center

-Missions of NTSEL-

- ◆ Comprehensively address various motor vehicle-related issues
  - Prevent the circulation of vehicles not compliant with regulations via type approval tests
  - Faster and secure response to recalls via recall-related technical verification of motor vehicles
  - Support the government's policymaking and regulation development relating to safety and the environment via tests and studies
- ◆ Support local transportation systems
  - Provide technical support of technical evaluation and standard development for transportation systems via tests and studies
- ◆ Ensure international coordination
  - Provide technical support for the promotion of Japanese automotive technology as part of international regulations
  - Provide technical support for the promotion of Japanese railway technology as part of international standards

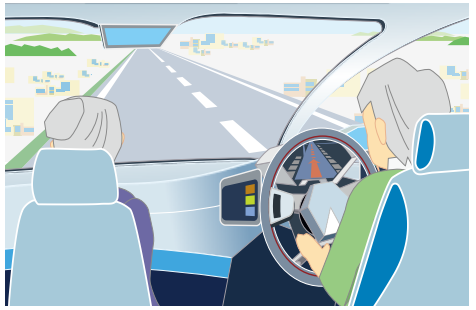




Introduction and contents

To achieve

Safe & Convenient mobility



<Research topics>

- Validation method
  - to achieve comprehensiveness with equivalence and reproducibility
  - to validate the robustness of the system
- Social acceptance
  - to be equivalent to or safer than human drivers

AD/ADAS

<Contents of this presentation>

1．Indoor VR Testing System

2．Artificial Rainfall Device

3．Negligence Requirements Based on Case Analysis

1. Indoor VR testing system

<Research question and objective>

How can comprehensiveness be ensured while guaranteeing equivalence and reproducibility?

⇒ Investigate the possibilities and challenges of indoor validation methods

w/ actual vehicle

@ proving ground / real world

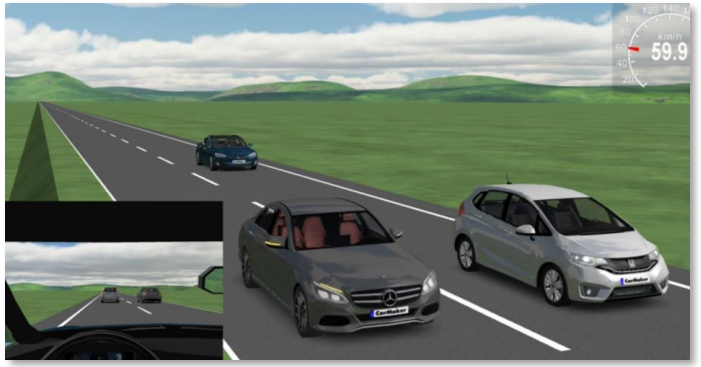
comprehensiveness and reproducibility are the issues

Proposed method

- address issues with both
- achieve efficient and reliable validation

w/o actual vehicle

(via simulation)



equivalence is the issue

Need to clarify the extent to which the validity of the simulation can be ensured

1. Indoor VR testing system -System configuration-

<Vehicle on Dyno>

Torque

Gas/ Brake
Velocity

Perception information

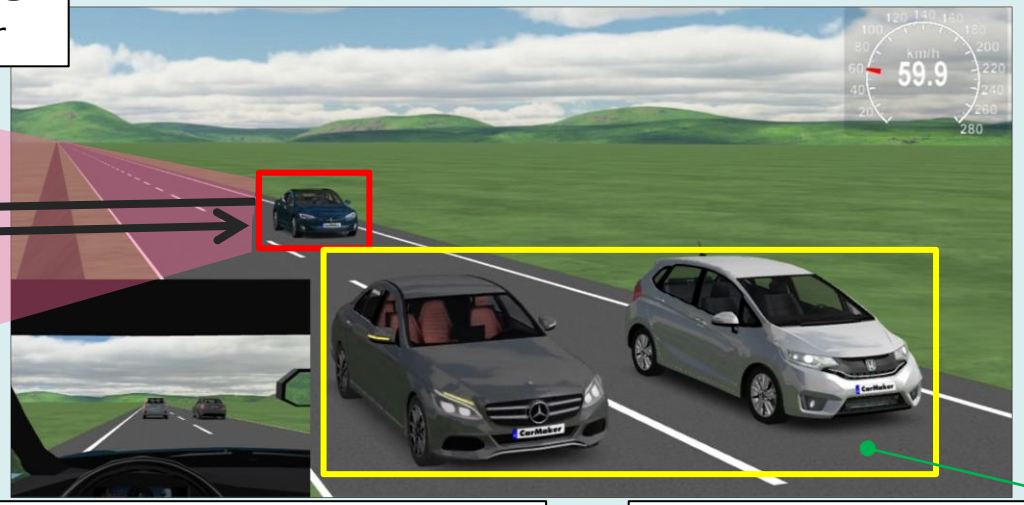
<Emulation systems>

-Camera emulator-

Emulation by display with different picture to the stereo camera

a. Vehicle model
→ estimate ego behavior

Software



<Simulation>

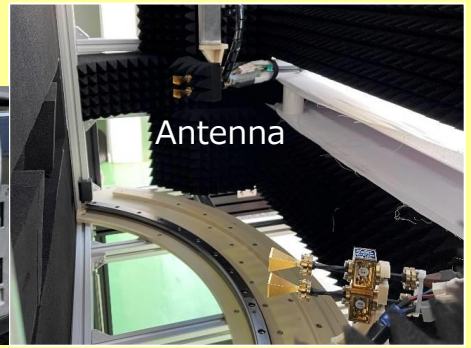
c. Sensor models
→ convert information of targets to sensor readable signals

b. Scenarios
→ control relation with targets e.g. cut out, cut in, etc.

Hardware

Signal conversion:
Ex. - Distance → Time delay
Relative velocity → Frequency shift
Size → Gain

-Radar emulator-



Emulation with simulated reflection mm-wave

2. Artificial Rainfall Device

<Rain>

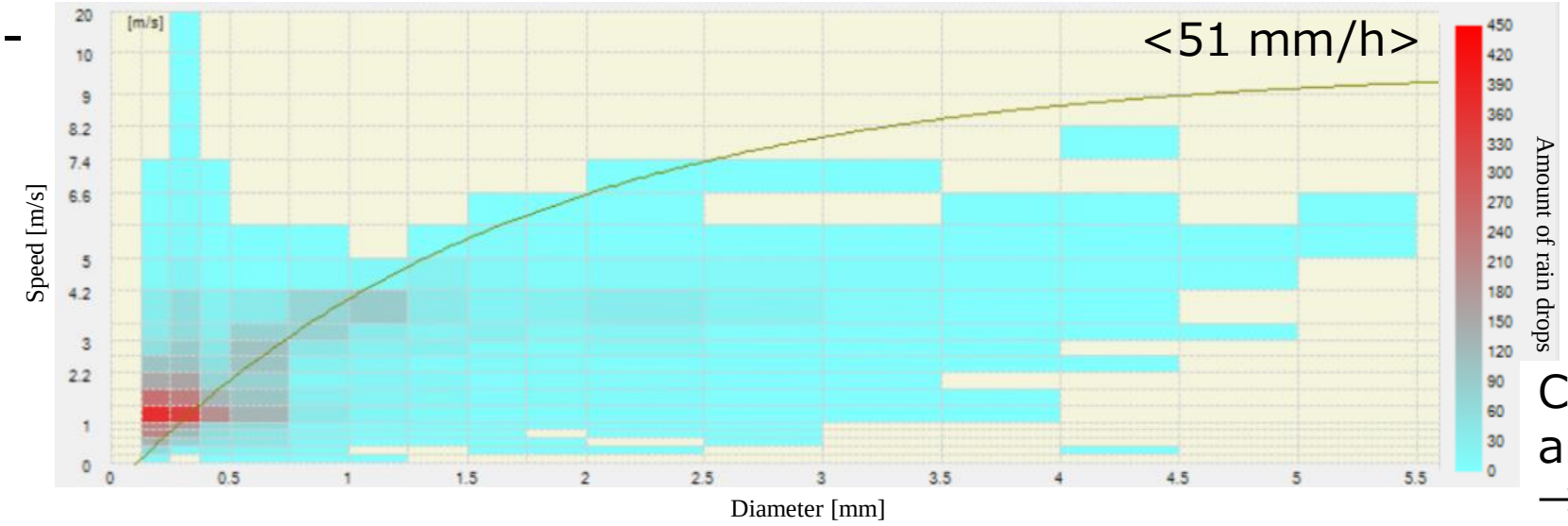
Precipitations of
20-100 mm/h
(every 20 mm/h)

<Fog>

- Vehicle can run up to 130 km/h
- ADAS functions can activate

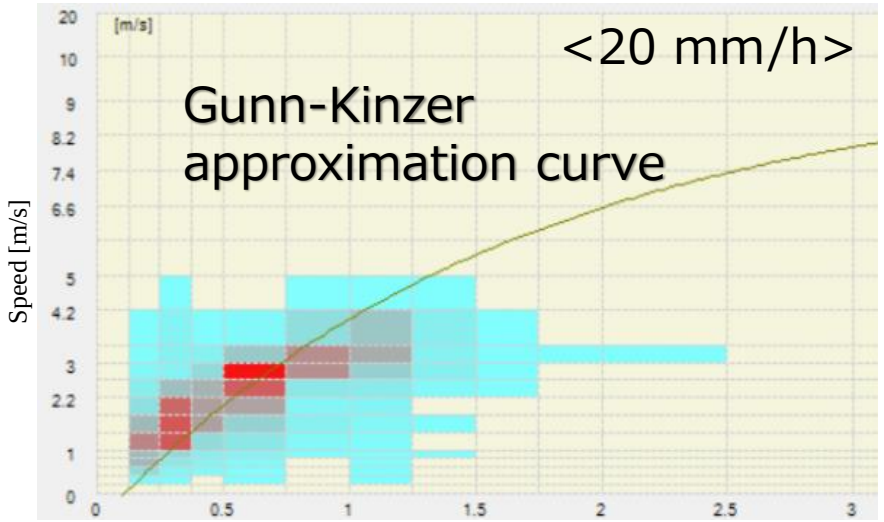
2. Artificial rainfall device -Validation of raindrops-

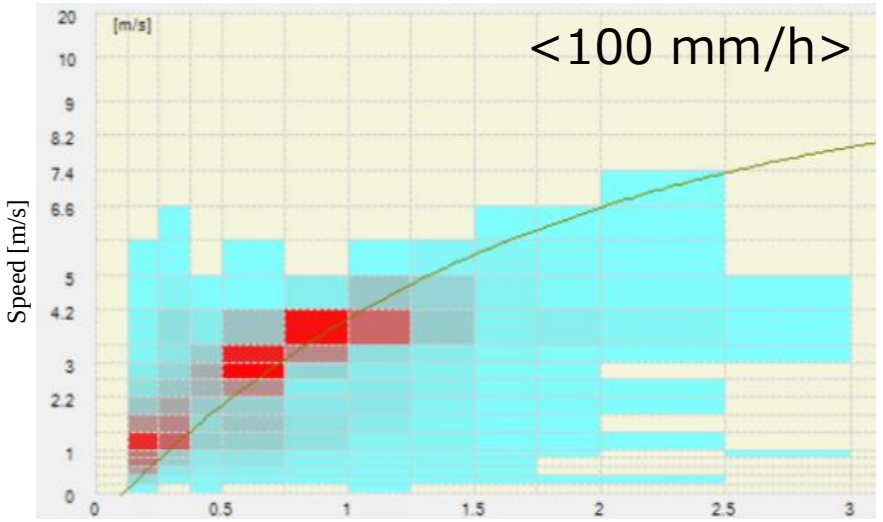
-Natural-



Concentrated areas (red) are on the theoretical line → close to natural rainfall

-Reproduced-





2. Artificial rainfall device -Validation of on-vehicle ADAS system-

- ADAS system activated and runs at almost set velocity
- Recognizing the target vehicle and both lines

- Lost the target vehicle and right-side line
- Runs slower to set velocity

→ System deactivated afterwards

3. Negligence Requirements Based on Case Analysis

<Research question and objective>

What are the requirements for human drivers to be criminally punished?

⇒ Organize requirements for human drivers as the norm for AD via the analysis of traffic accident precedents in Japan

⇒Consider the boundaries of criminal penalties

<Basis of Negligence: Abuse of duty of care>

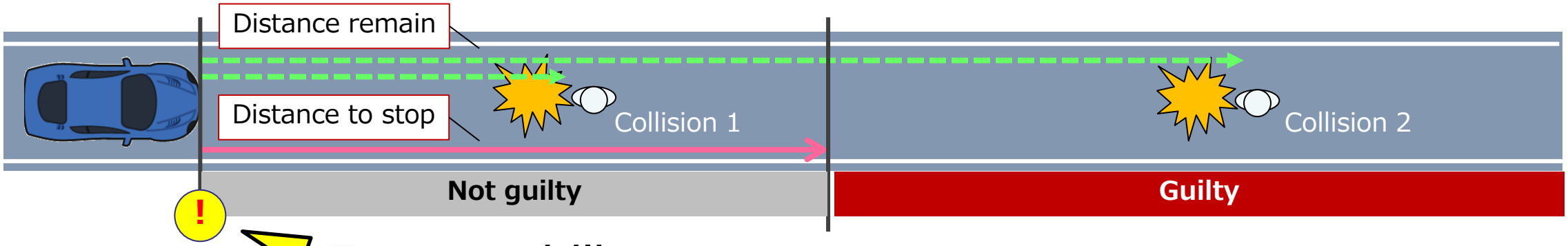
- **Foreseeability**
  - Where/when **should** human drivers recognize story triggers that lead to danger?
- **Preventability**
  - Can human drivers prevent accidents from the above trigger?

The requirement in the Framework Document

… shall not cause any traffic accidents resulting in injury or death that are reasonably *foreseeable* and *preventable*.

ECE-TRANS-WP29-2019-34-rev.1e

3. Negligence Requirements Based on Case Analysis



Foreseeability -<u>The trigger</u> to the obligation to prevent crash-

- Deeply relates to the context

<Jumping out of pedestrian>

Can see the pedestrian
→Trigger!

<Cutting in of a vehicle>

Becomes danger at certain moment…→Trigger?

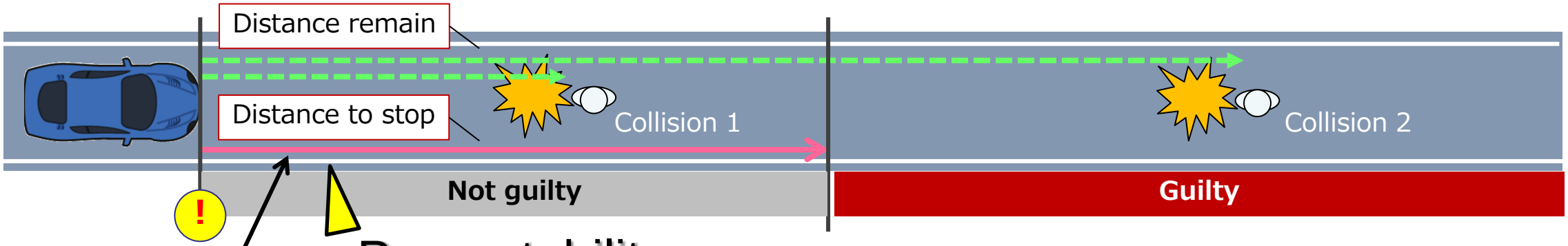
- Switching of the context

<Normal context>
No pedestrian on highway
→can drive fast

Road sign

<Switched context>
Drive with obligation to foresee the presence of pedestrians or a collision with them

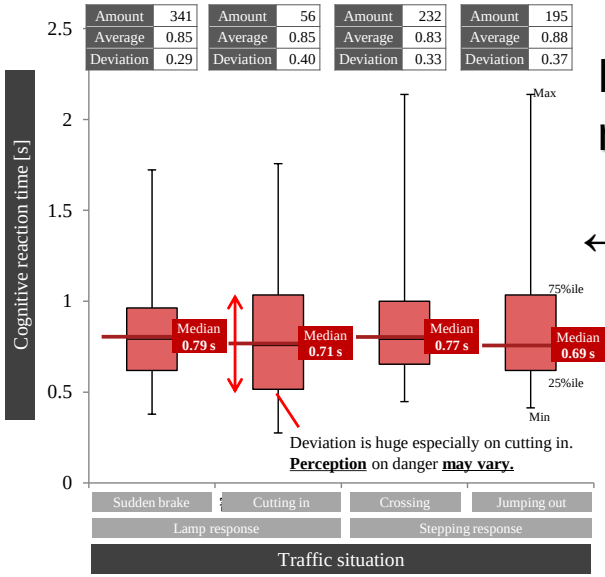
3. Negligence Requirements Based on Case Analysis



Preventability - Can prevent accidents or not from the trigger point-

➢ w/ Braking

Free run distance + Braking distance



Depends on velocity, vehicle spec, road condition, etc.

←<Cognitive reaction time>
0.75 – 0.8 s for drivers in actual traffic environment without psychological readiness

→possible to estimate preventability with braking

➢ w/ Steering

- Not obligated when it is unpreventable by brake
- Allowed as a choice of prevention
- Considered based on emergency evacuation

Foreseeability of new hazards due to steering is important

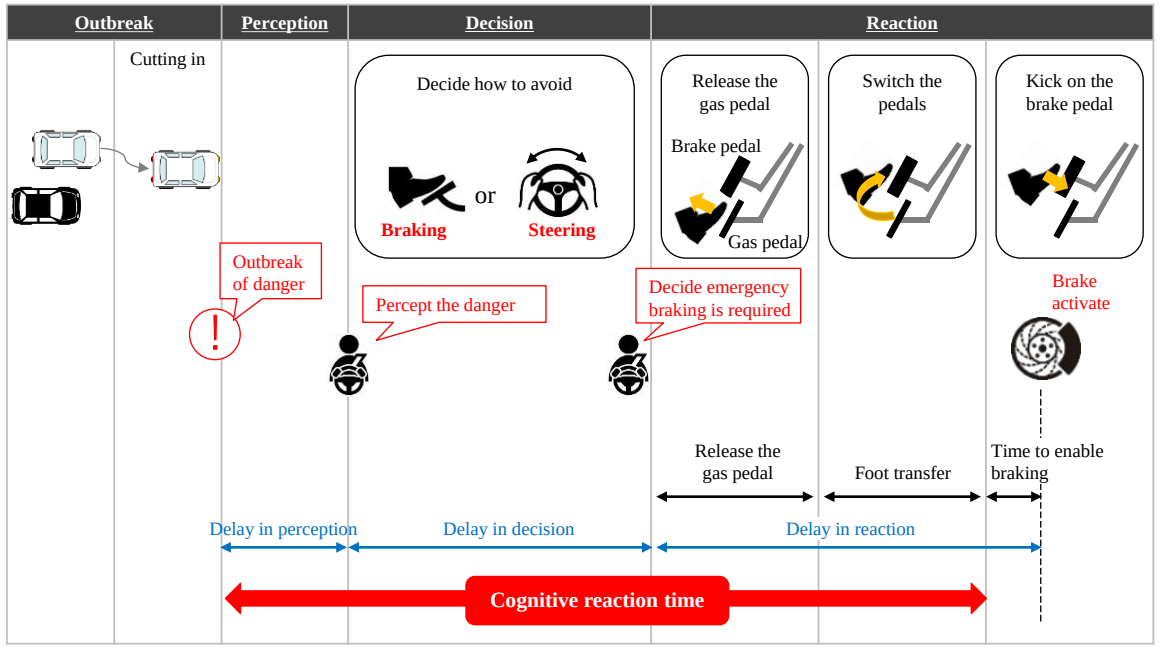
+ Behavior gets complicated

→difficult to estimate preventability with steering in general

3. Negligence Requirements Based on Case Analysis

-Cognitive reaction time under real traffic situation-

■Definition



■Ex.

Equipment		
for Front	for Footage	■ Model CS-41FH (CELLSTAR) ■ Frame rate 30fps
 (2 Mpixel)	 (1 Mpixe w/IR LED)	

- More than 300 vehicles joined
- Duration of 7 months for data acquisition

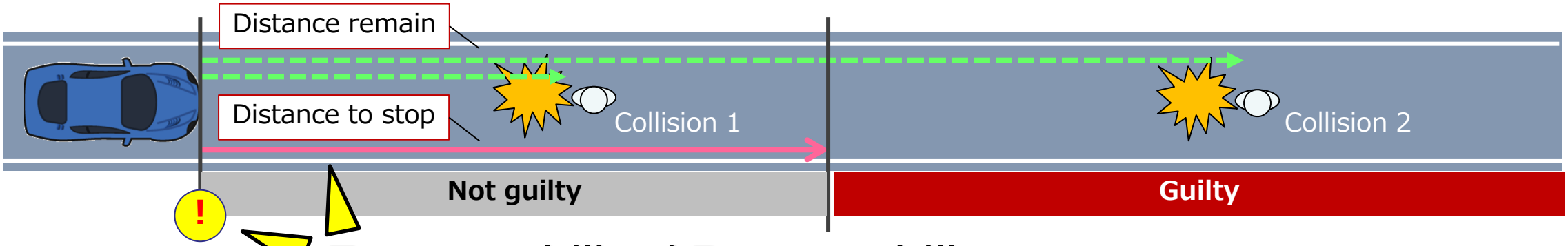
→**More than 1000 valid data** were acquired

<Major findings>

0.75 – 0.8 s (on average) for drivers in actual traffic environment without psychological readiness

*These data were **incidentally captured** by a driving recorder with brake trigger, **under actual traffic conditions**. The situation and its factor were not be created or manipulated on purpose.

3. Negligence Requirements Based on Case Analysis



Foreseeability / Preventability

- Standard of negligence as evaluation criteria
  - **General person**
    - The context is common or not
    - Generally preventable or not
  - **The said person**
    - Did he/she get to know the context?
    - Is it preventable for him/her?

Ex. Professional taxi driver:
Because he passes through that drinking district at the same time every day, he should foresee that it is not surprising to find drunk people sleeping on the street late at night on Friday.

- C&C human driver? (Research topic beyond)
  → Define the trigger point and preventability as competent and careful levels.

<Driver behavior observation>
Measured driving behavior on public road with eye tracking device

View Tracker Ⅲ

-Major findings-
- Competent implies excellent driving ability
- Careful implies that the ability to recognize contextual triggers is competent (hypothesis)

Areas of concern and potential directions for future research

1．Indoor VR Testing System

- Premature application as an official validation method in the context of type approval

2．Artificial Rainfall Device

- Reproduction of more precise rain, e.g. travel wind, splash, etc.
- Reproduction of stable fog

3．Negligence Requirements Based on Case Analysis

- Clarification and organization of trigger points as foreseeability
- Considering the foreseeability of new hazards due to steering

Thank you very much
for your kind attention.