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A Safety Assurance Process for AD Systems

SAKURA
Safety Assurance KUdos for Reliable Autonomous Vehicles

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Aim of this presentation

To report on the ongoing development of an AD system safety assurance methodology in Japan

(SAE Level 3+ in motorways)

Global trend for AV social acceptance

GUIDELINES ON THE EXEMPTION PROCEDURE FOR THE EU APPROVAL OF AUTOMATED VEHICLES

Informal document **WP.29-177-19**
177th WP.29, 12-15 March 2019
Agenda items 2.3 and 17

Framework document on automated/autonomous vehicles

Safety requirements (pg.4)

When in the automated driving mode, the vehicle shall not cause any traffic accidents that are rationally foreseeable and preventable

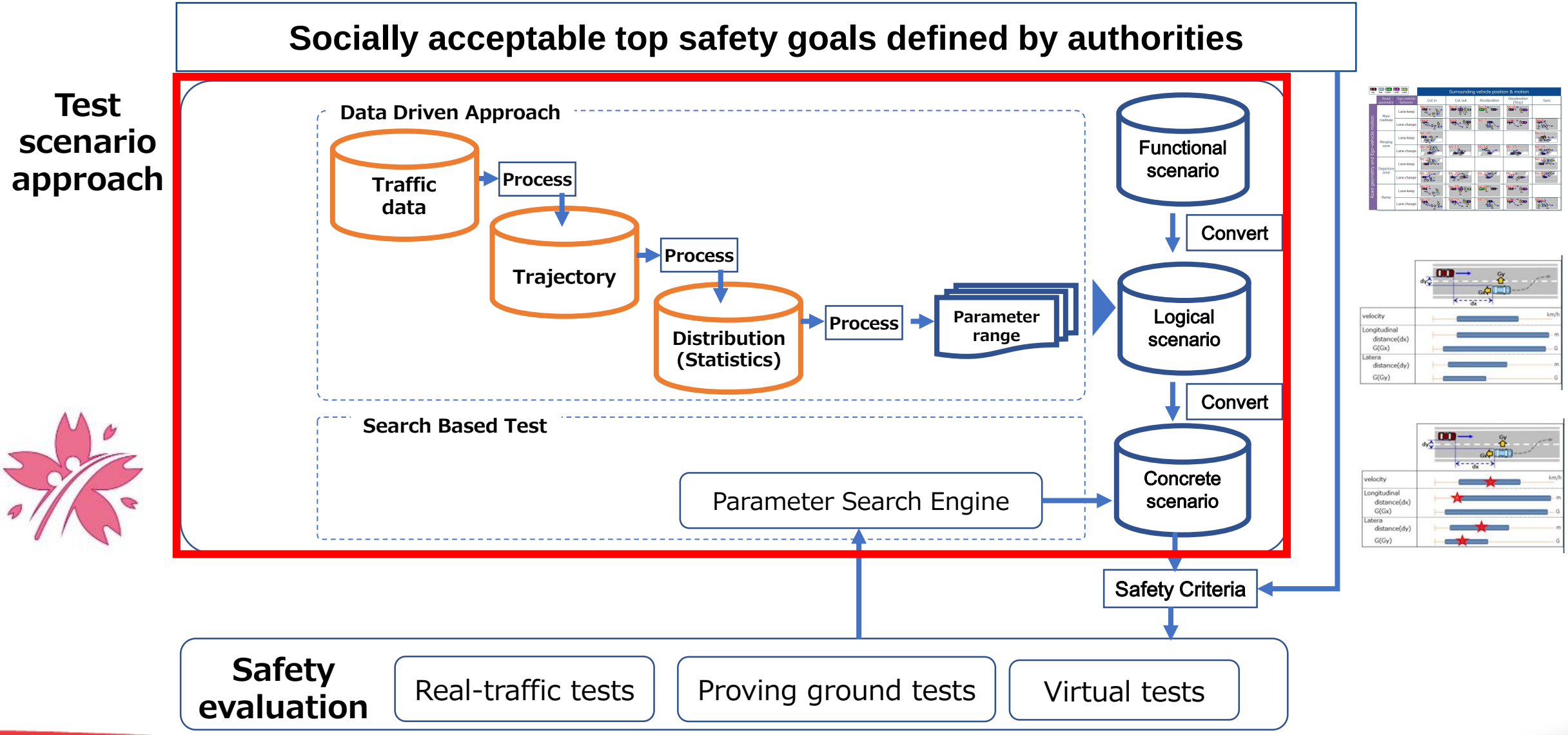
Safety vision (pg.1)

Automated vehicles shall not cause any non-tolerable risk, meaning that, under their operational domain, shall not cause any traffic accidents resulting in injury or death that are reasonably foreseeable and preventable

Comprehensive approach to safety

	Preventable	Unpreventable
Foreseeable	Prevention	Mitigation
Unforeseeable	Learning	Resilience Support

Safety assurance engineering approach



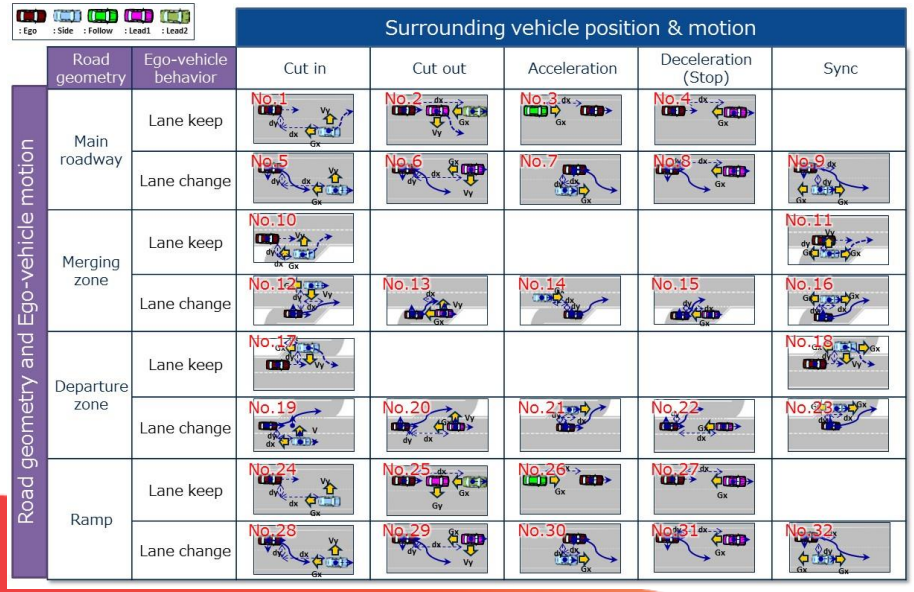
Scenario based approach based on AD system physics

Scenario Structure

- Perception
  - Perception disturbance

- Judgement
  - Traffic Disturbance

- Control
  - Vehicle Disturbance



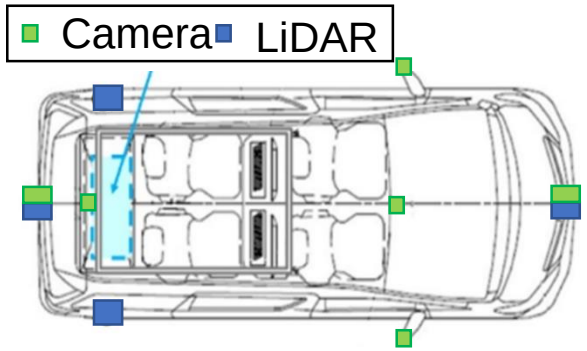
Traffic disturbance functional scenarios out from a proposed structure that incorporates road geometry, ego-vehicle behavior, and surrounding vehicles location and motion

Traffic data collection in Japan

Ongoing

Data Source	TUAT Driving Recorder (~2018~)	JAMA Driving Recorder (2008)	Driving Database (2017)	On road Recognition Database (2017)	Instrumented Vehicles (2018~)	Fixed Camera (2018~)
◎/◎ Parameter available	△	△	△	△	△	○
○ Video only	△ ○ △	○ ○ ○	○ ◎ ○	○ ◎ ○	◎ ◎ ◎	○ ○ ○
△ visible	× Ego ×	× Ego ×	○ Ego ○	△ Ego △	◎ Ego ◎	○ Ego ○
× Not recorded	× × ×	× × ×	△ ○ △	△ △ △	◎ ◎ ◎	○ ○ ○

Instrumented vehicles



Fixed cameras

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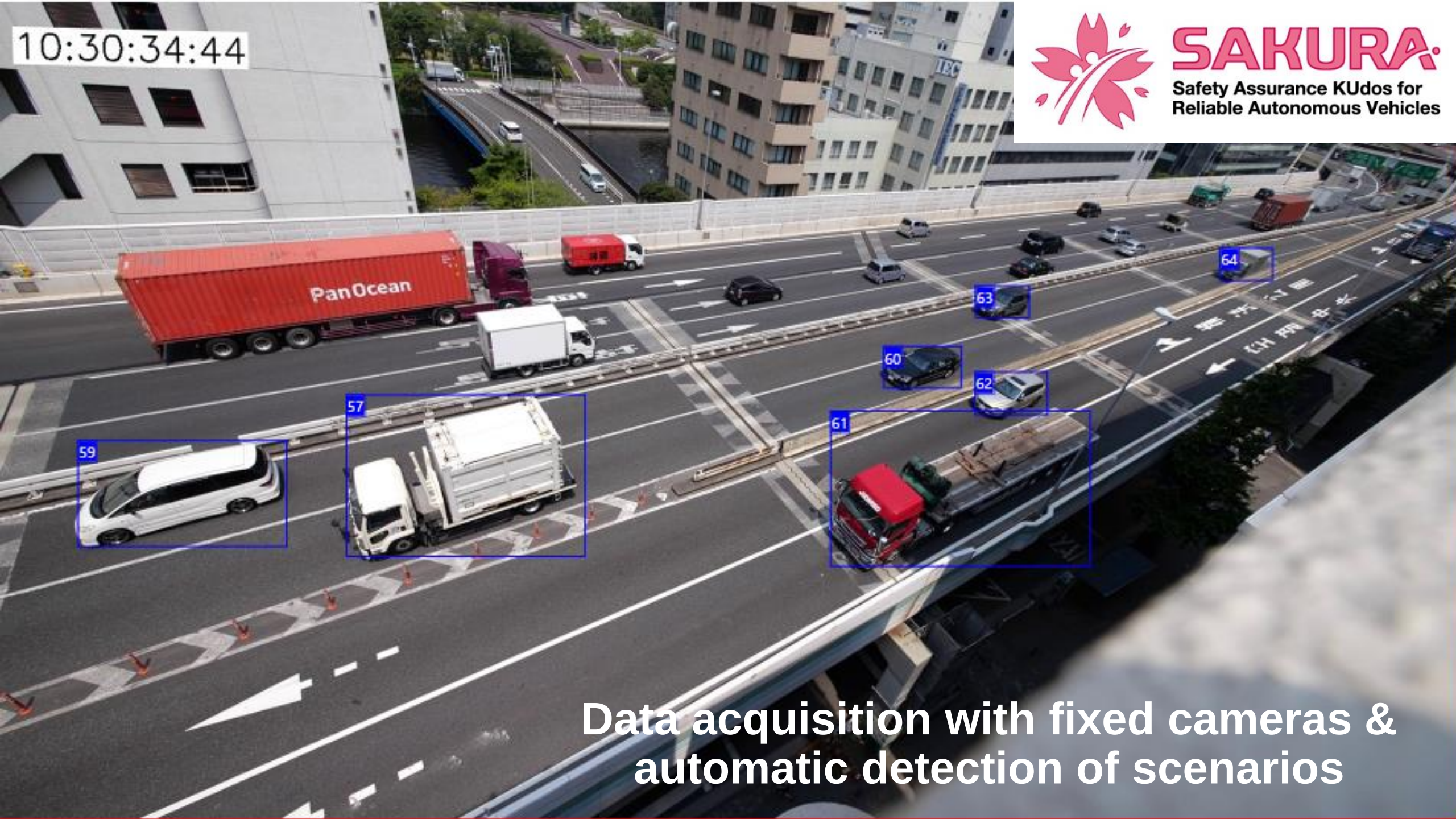
Data acquisition with instrumented vehicles & automatic detection of scenarios



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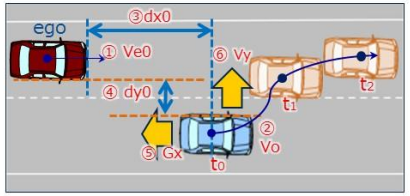
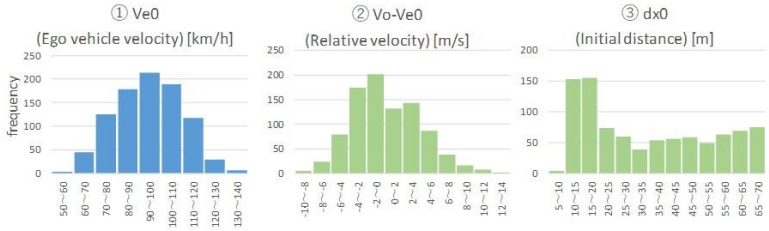
Data acquisition with fixed cameras & automatic detection of scenarios

Derivation process of functional scenarios parameter spaces

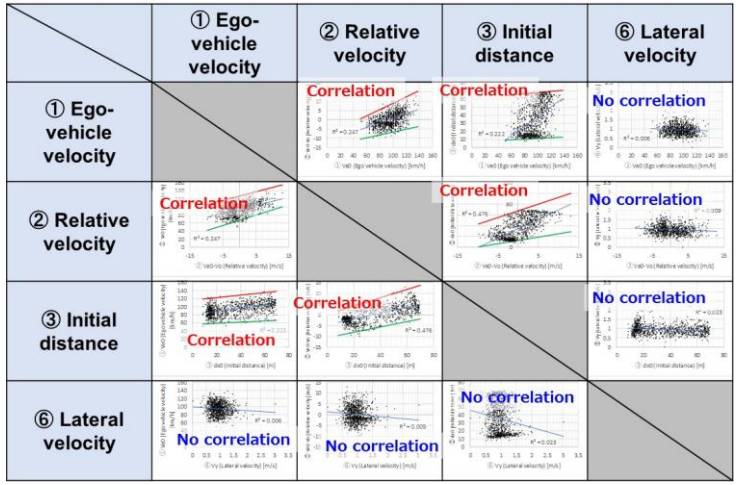
① Real-world data accumulation



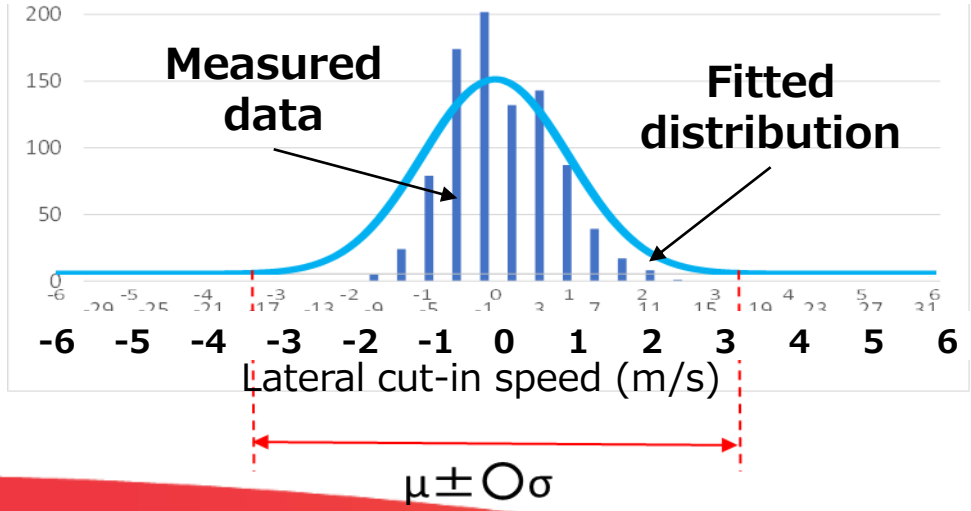
Scenario dependent parameter definition and automatic extraction



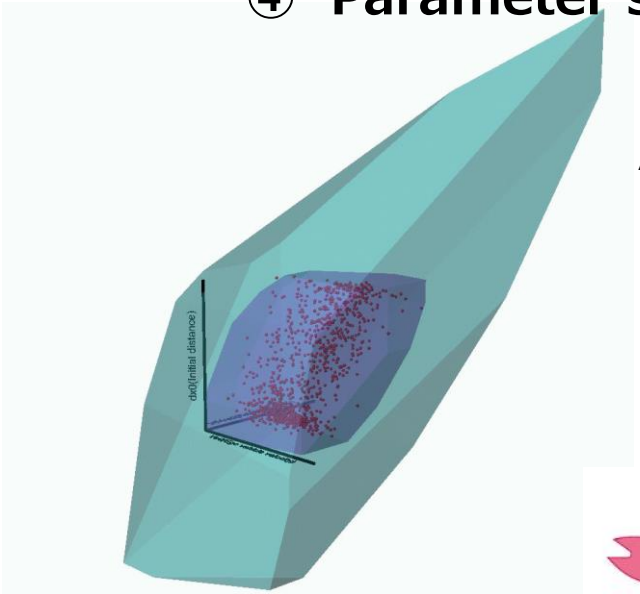
② Parameter correlation analysis



③ Parameter extrapolation



④ Parameter spaces



Account for:

- Real-world data
- Parameter correlation
- Theoretically foreseeable

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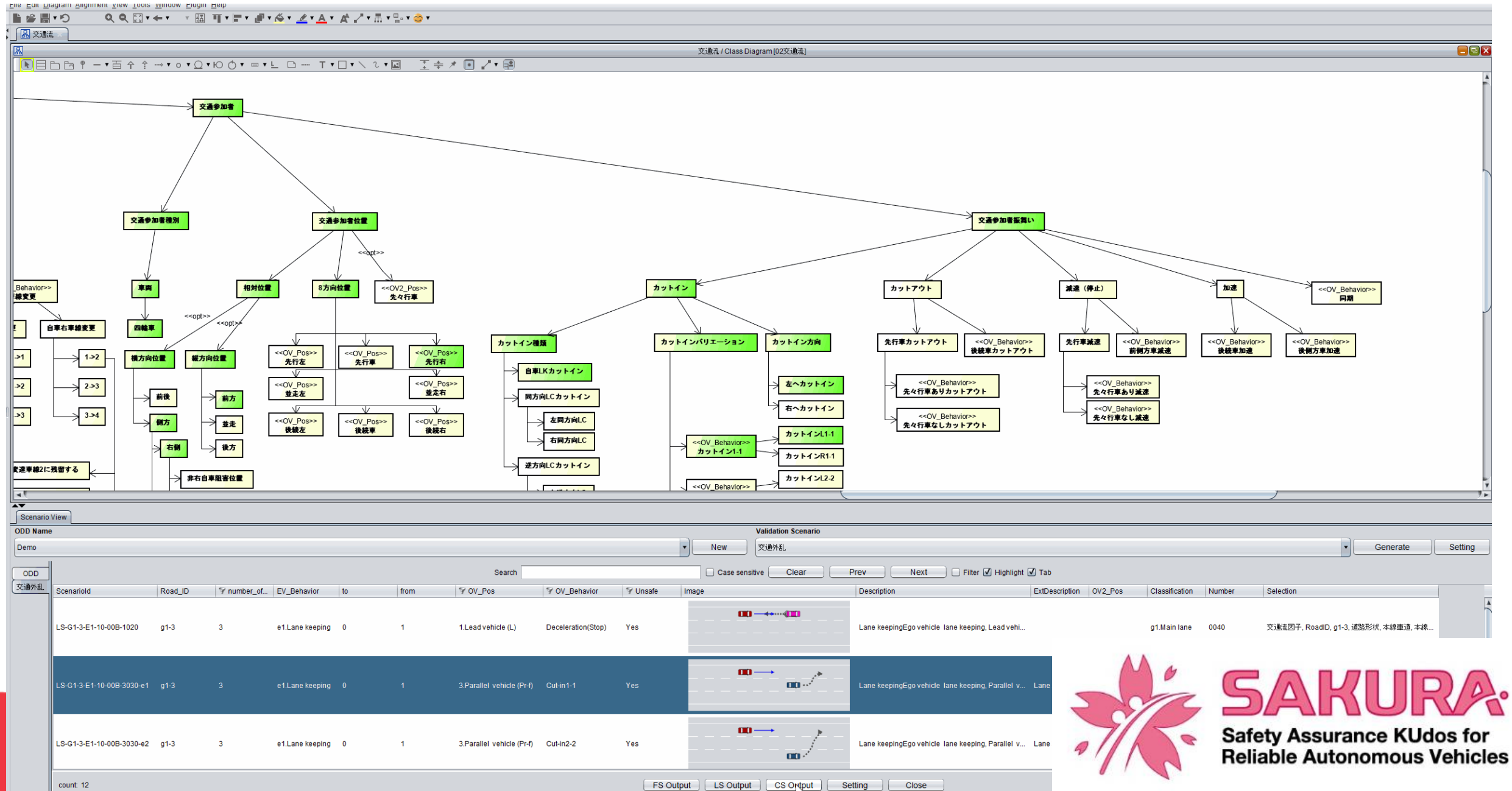
Process automation from functional to concrete scenarios



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Summary

- Complete AD safety assurance methodology under development in Japan
- Applicable to continue developing the systems and to evaluate their safety

<u>Need for international consensus</u>:
1) Definitions of 'foreseeable' and 'preventable' in the context of social acceptance
2) Qualification of real-world traffic data
3) Applicability to different countries/regions
4) Harmonized automated processes towards common database

Global strategy

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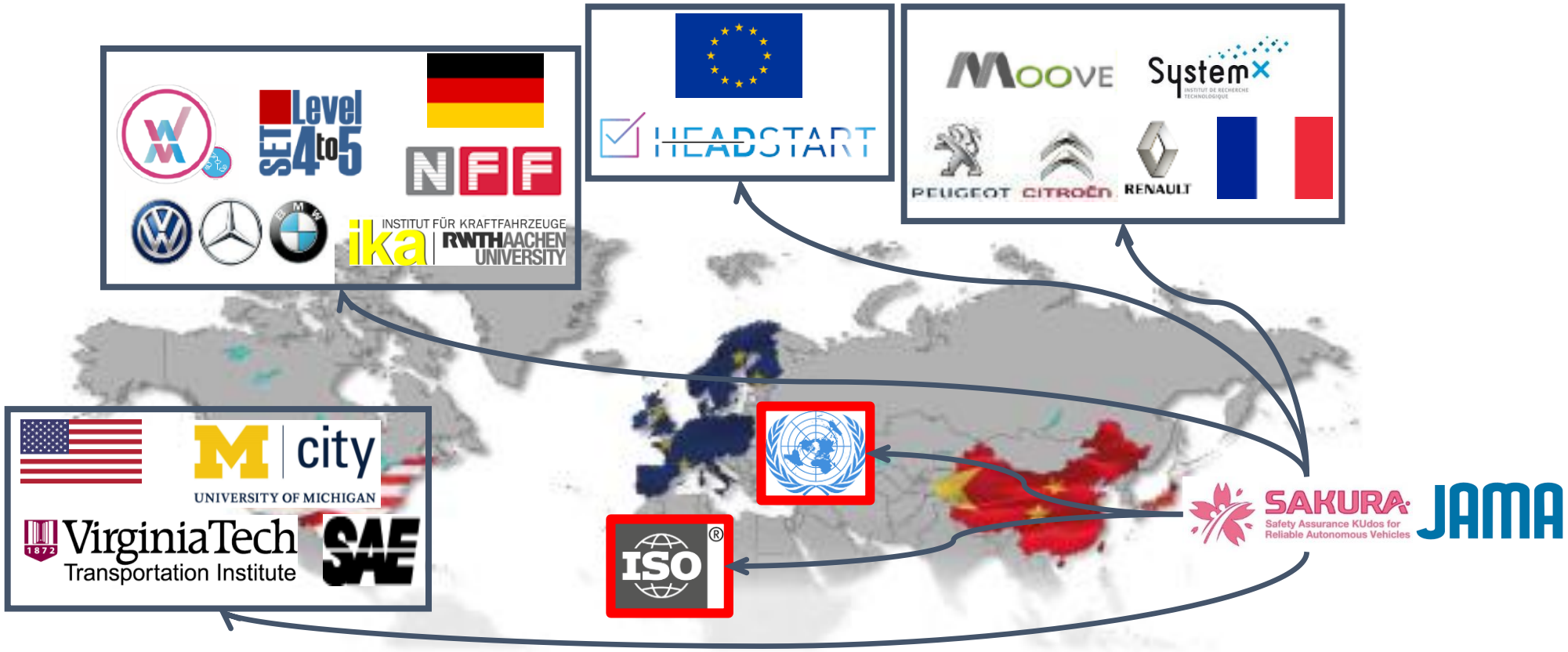
JAMA

https://www.sakura-prj.jp/



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