SAKURA
Safety Assurance KUdos for Reliable Autonomous Vehicles

Overview of SAKURA Project
– a Japanese safety case approach –

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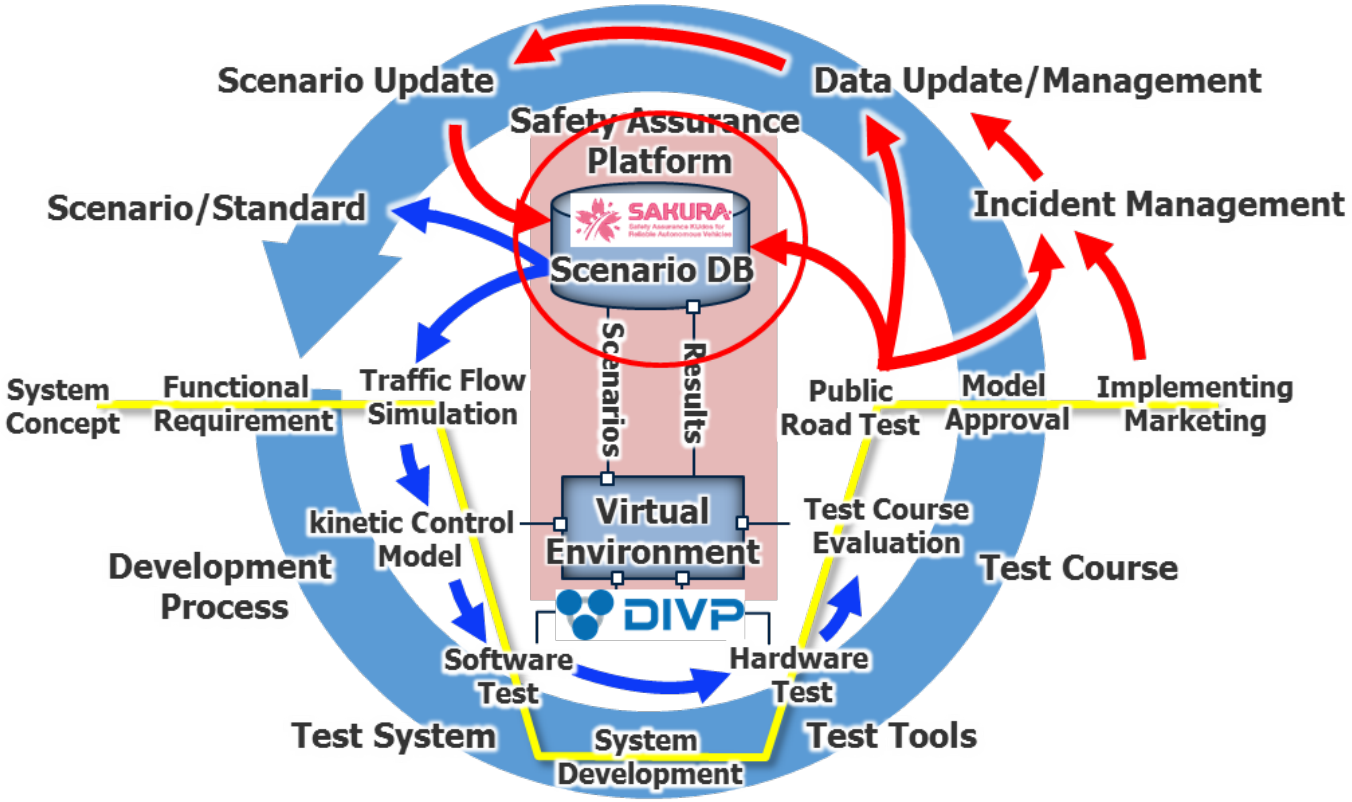
Overview of SAKURA project

Project aims

- Harmonize data collection, develop research methodologies
- Coordinate standardization activities through joint efforts with JAMA and academia
- Establish a continuous safety evaluation eco-system for safer AD development

Facts about the projects

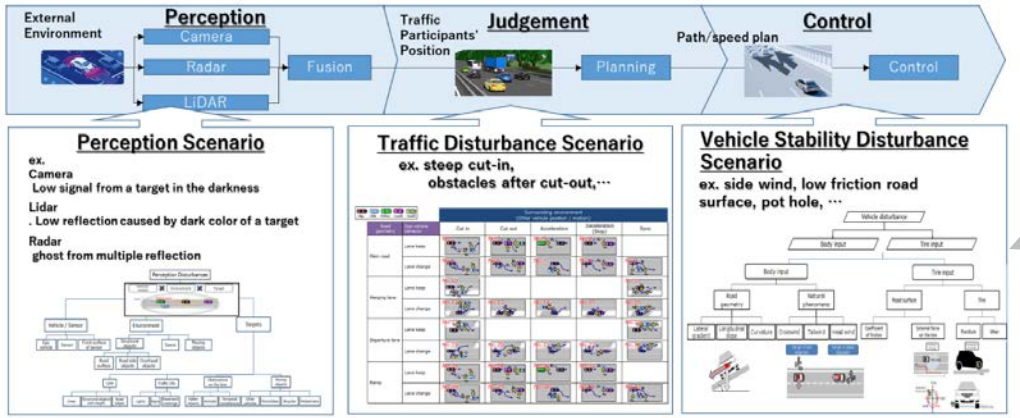
- **Funded by METI**
  - 1.26 Bio JPY(FY22)
  - 1.59 Bio JPY(FY23, incl. DIVP)
- **Duration**
  - 2018-2020(Phase1)
  - 2021-2025(Phase2)

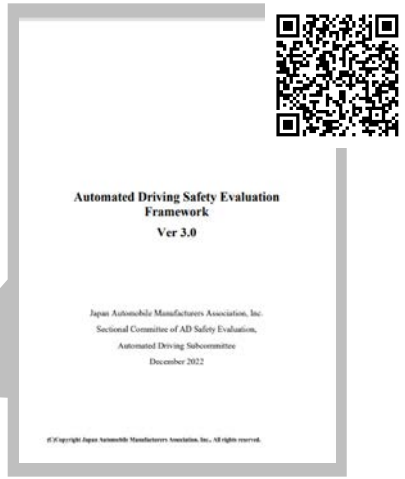


Structure of Japanese safety assurance activity

Common Foundation of ADS safety assurance

- **Methodology: converge complicated real traffic into finite number of scenarios**
  - Scenario based approach
  - Defining reasonably foreseeable and preventable boundary
  - Output as JAMA Framework and standards (ISO34502, UN R157)





- **Application: traceable evidences and practical testing tool**
  - SAKURA database
  - Integration with virtual platform (DIVP)

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Current status of FS development

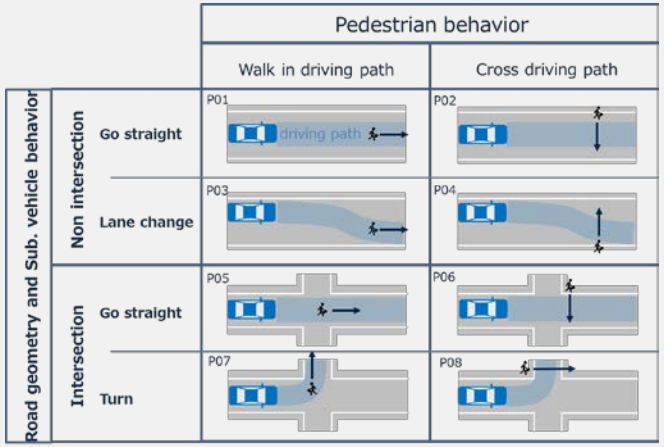
Functional

Abstract

Logical

Concrete

Urban 58 Scenarios



Pedestrian 8 scenarios

- **Car to Car Scenario**
  - Consideration of turning maneuver, oncoming vehicle and intersection
  - Converged into 58 Functional Scenarios
- **Car to Pedestrian Scenario**
  - Pedestrian behaviors are simply described
  - First draft provides 8 FS

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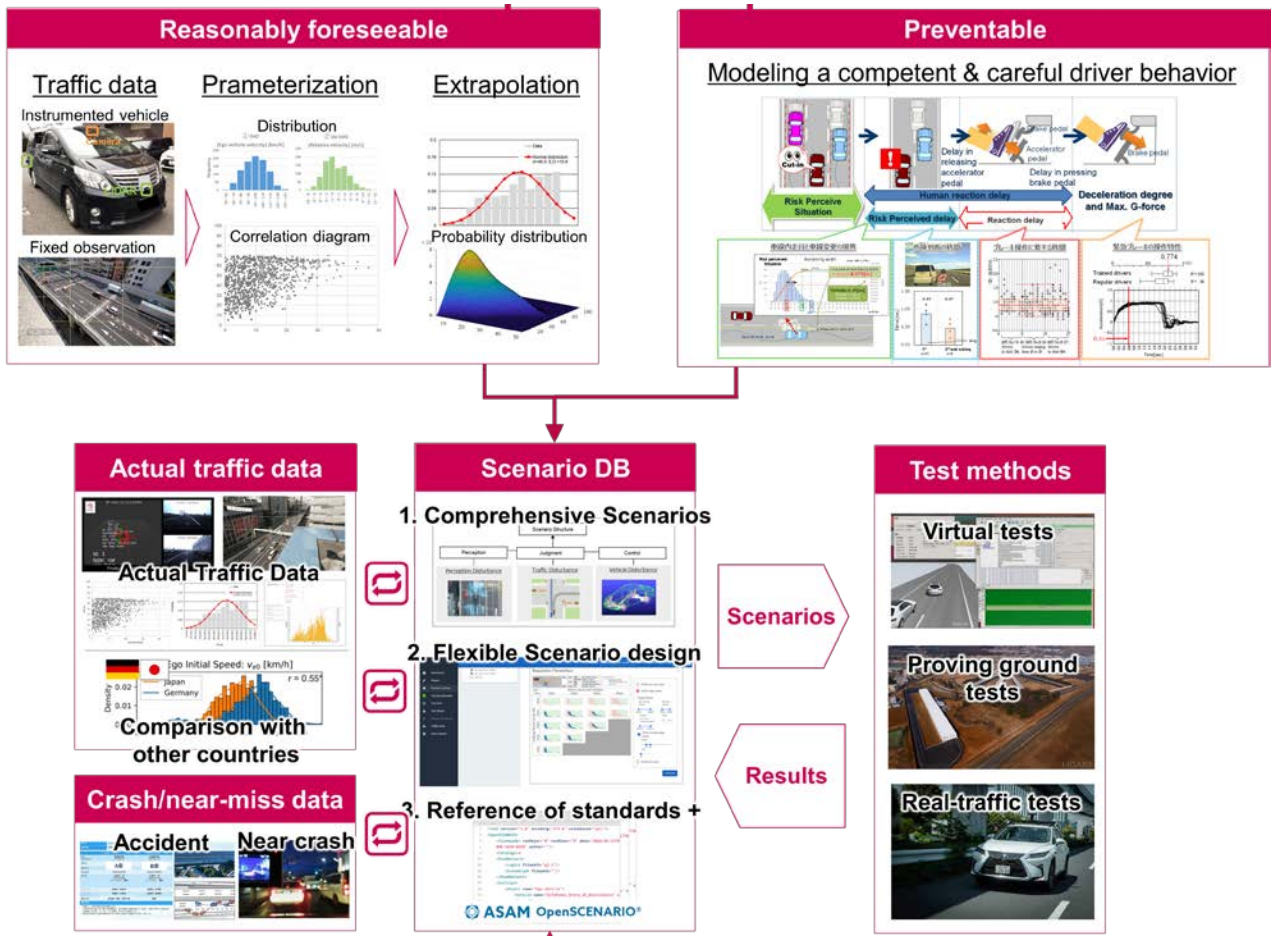
SAKURA database in the context of SA toolchain

- **Quantify foreseeable and preventable**
  - **Measurement of traffic data**
    - Validate functional scenarios
    - Estimate parameter distribution
  - **Modelling C&C driver behavior**
    - Preventable boundary

- **Integrate with testing methods**
  - **Provide relevant exposure**
  - **Near crash/Accident scenarios**
  - **Output concrete scenarios**



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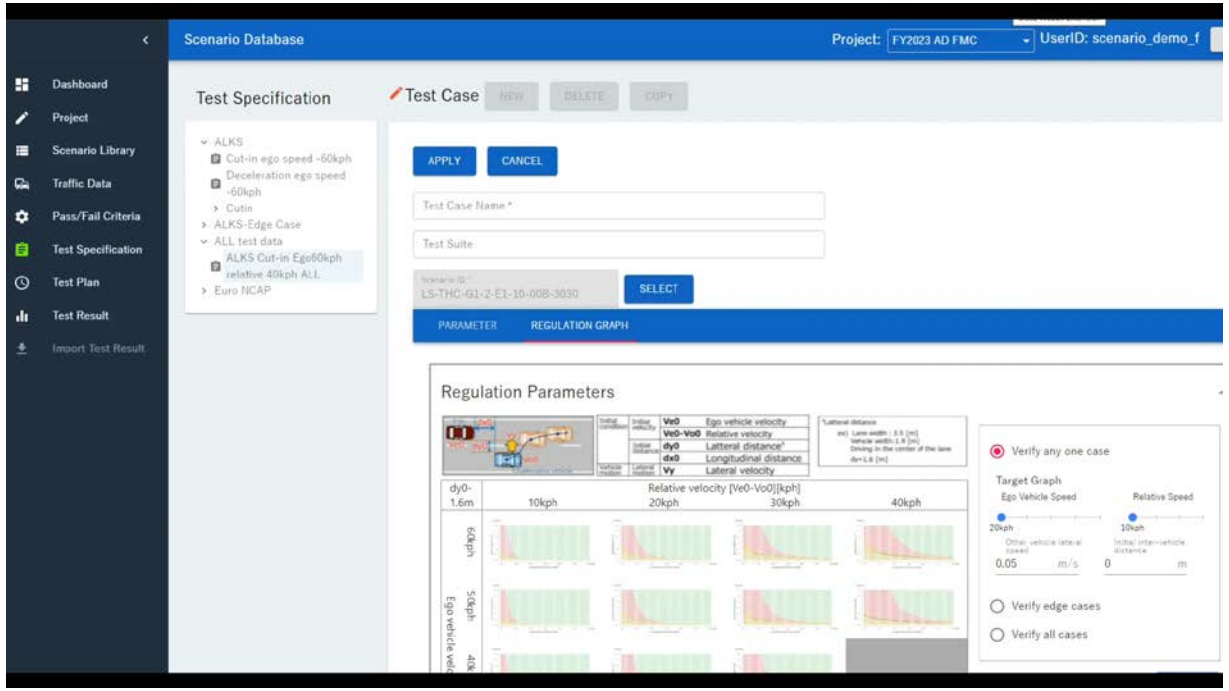
Demo of SAKURA database

- Reference for reasonably foreseeable parameter range
- Pass/Fail Criteria based on C&C driver behavior

Traffic parameter database



Traffic criteria database

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International harmonization activities in SAKURA

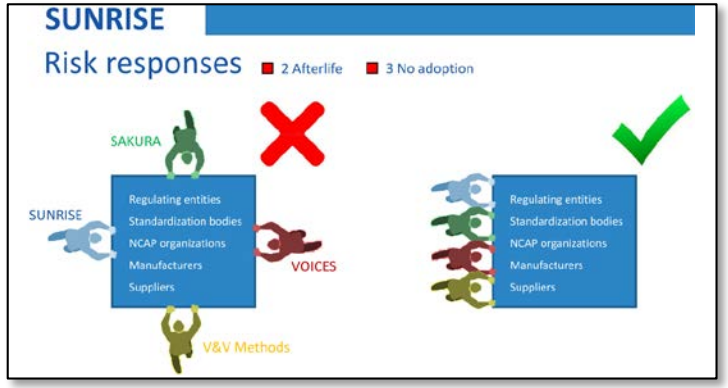
- Participating ISO TC22/SC33/WG9 as Japanese experts
- Played leading role in publishing ISO 34502
- Continuously communicating with global experts for development of safety assurance framework

SC33 "Vehicle dynamics and chassis components"

WG9 "Test scenarios of automated driving systems"

ISO3450X: Road vehicles
— Test scenarios for automated driving systems —

ISO No	Title	Current Status	Leader (Sub)
ISO34501	Vocabulary	IS published ('22 Oct.)	China
ISO34502	**Scenario based safety evaluation framework**	**IS published ('22 Nov.)**	**Japan (Germany)**
ISO34503	Taxonomy for operational design domain	IS published ('23 Aug.)	UK (Japan)
ISO34504	Scenario categorization	FDIS	Netherlands (Germany)
ISO34505	Scenario evaluation and test case generation	WD	Germany China



Harmonization image by Stefan de Vries

SUNRISE–VVM–SAKURA
'22 Oct. @Kyoto
'23 May @Lisbon
'23 Jul. @San Francisco

VTTI–JAMA–SAKURA
'22 Dec. @Tokyo
'23 Jan. @ Washington DC
'23 Jul. @ San Francisco …

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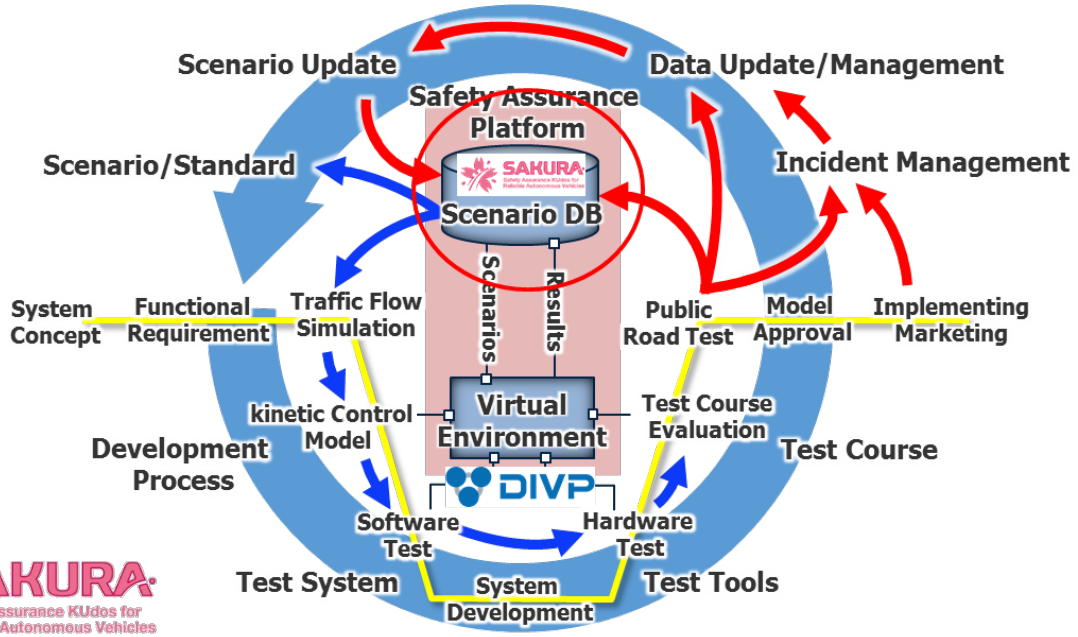
Concluding remarks

- **Summary**
  - We have developed highway scenarios aligned with ISO34502
  - Currently working on urban scenarios (58 functional scenarios)
  - SAKURA database is developed for practical utilization
- **Future tasks**
  - Integrate SAKURA database with ADS development procedure
  - Parametrization of urban scenarios (including VRU)
  - Supporting deployment (such as ADS MaaS)

Please check!

More details
on SAKURA website




Shuttles and buses on limited access roads

Trucks platooning

V2X technology

MLIT is aiming ADS deployment
in 50 places by 2025

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