

Session : Impact assessment

SIP-PROJECT :
Preliminary examination of
traffic accident simulation
to evaluate the benefits of safety systems
for the reduction of traffic accidents

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Project Goal

【National Goal】

- Reduce the number of casualty in the traffic accidents

【Project Goal】

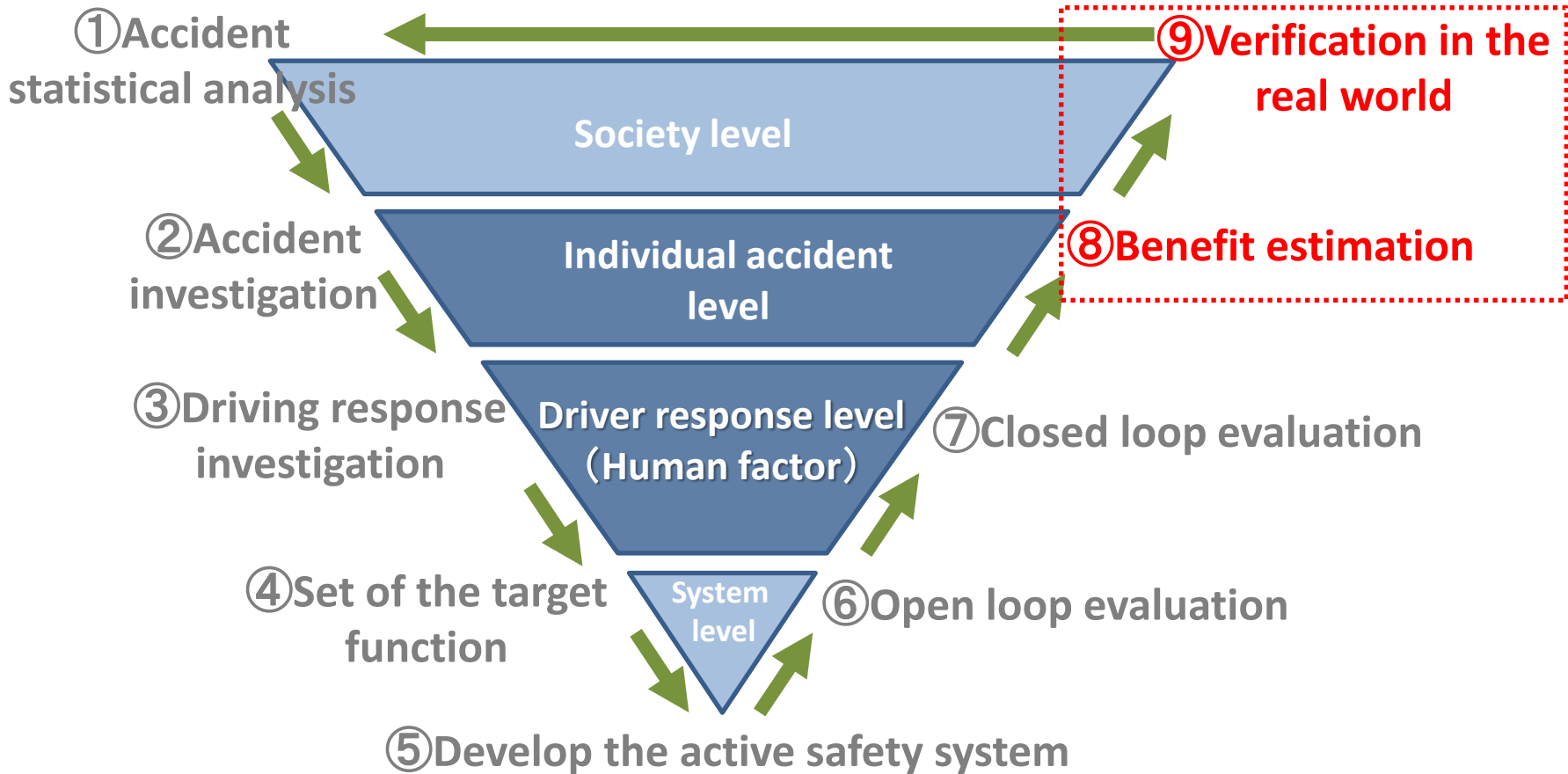
- Develop multi agent simulation tool to evaluate benefit when active safety system and automated driving system are introduced.

【Project Goal in 2014】

- Clarify requirement of the simulation tool developed in the project.

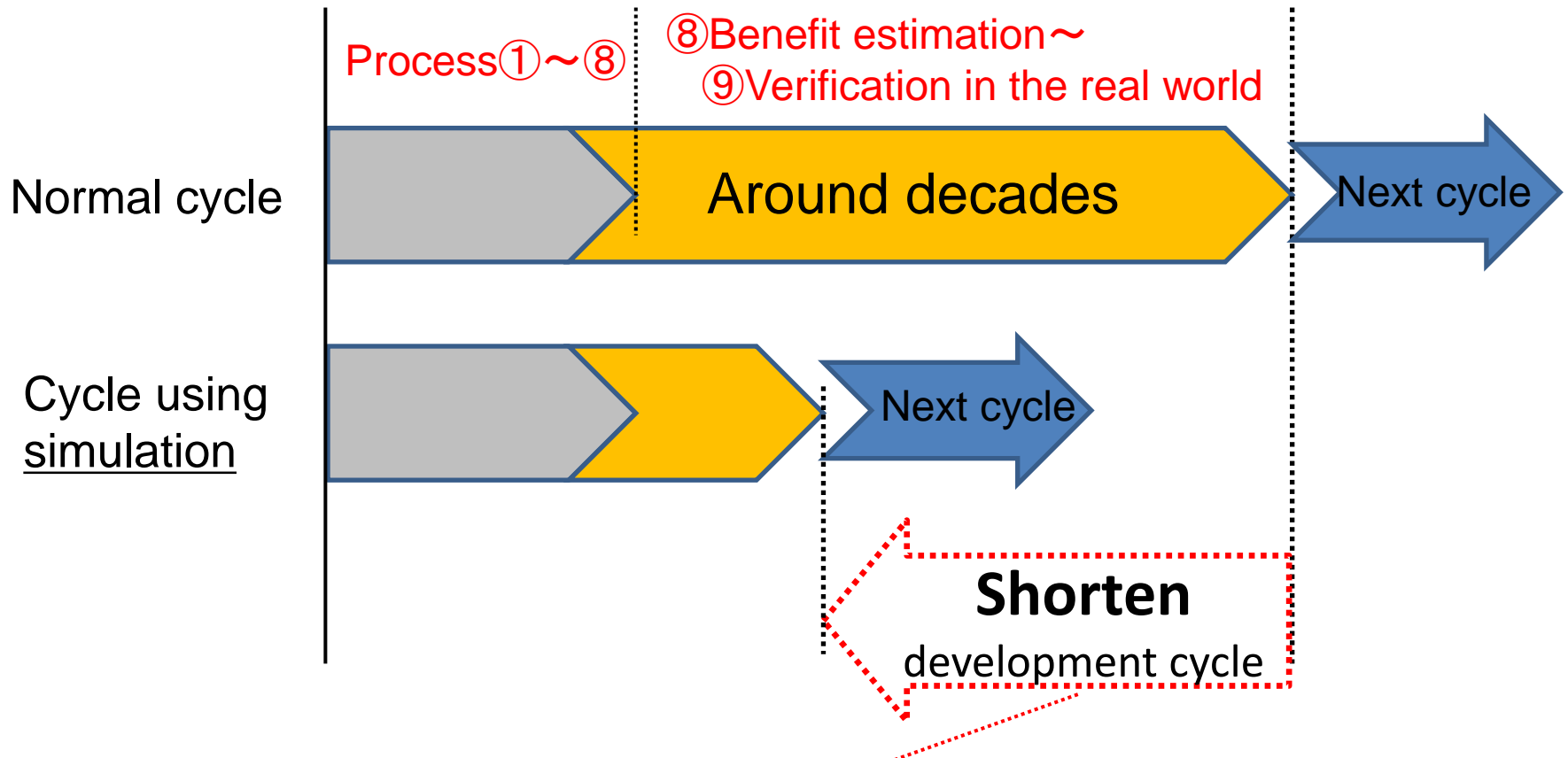
Utilization of Simulation

Basic development cycle of active safety systems



Advantage of simulation

Comparison of normal cycle with cycle using simulation
in the process of ⑧~⑨



Simulation tool leads to Efficient and Effective development.

Objective and Work Items in 2014

- Clarify requirement of new simulation tool developed in the project.



(1) Investigation of the multi agent simulations using driver model.

- ① Review of the existing multi agent simulations
- ② Requirement of driver models
- ③ Applicability of other areas

(2) Investigation of requirement on new simulation tool

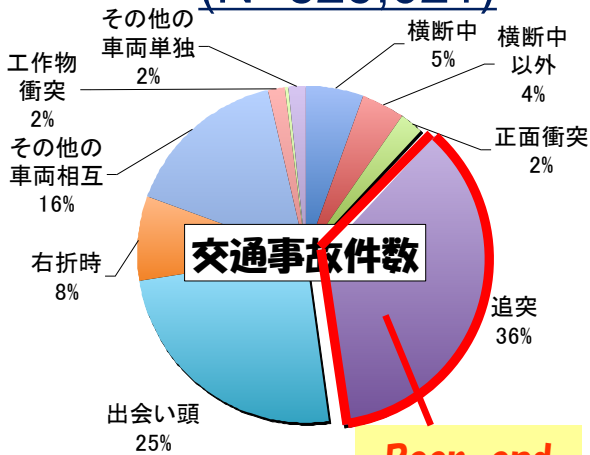
Accident Types

★What accident pattern is focused on?

From traffic accident statistics, we will focus on at least three accidents pattern.

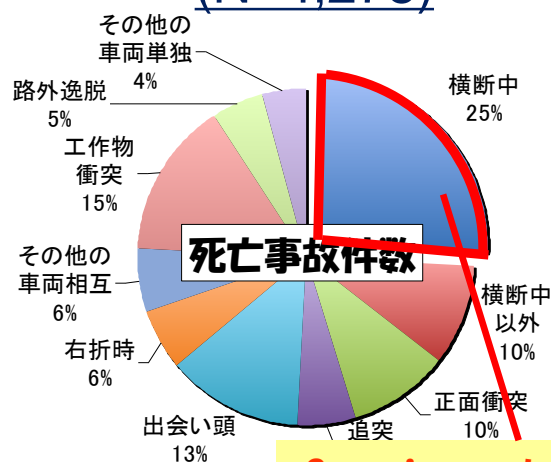
- ① "Rear-end accident"
- ② "Crossing pedestrian-car accident"
- ③ "accident causing lane departure"

Traffic accidents in 2013
(N=629,021)



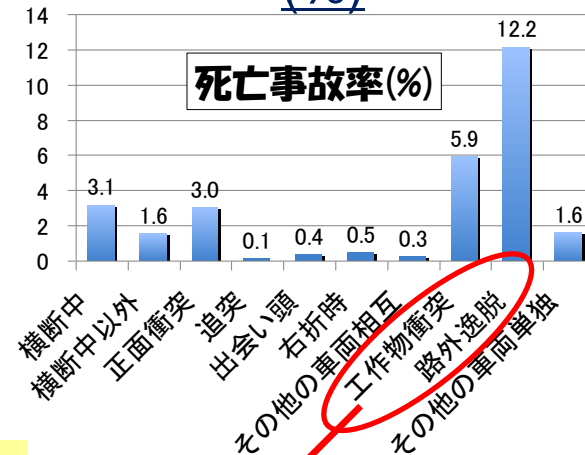
Rear-end accident
36%

Fatalities
(N=4,278)



Crossing pedestrian-car accident
25%

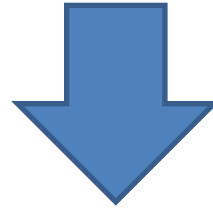
Fatality rate
(%)



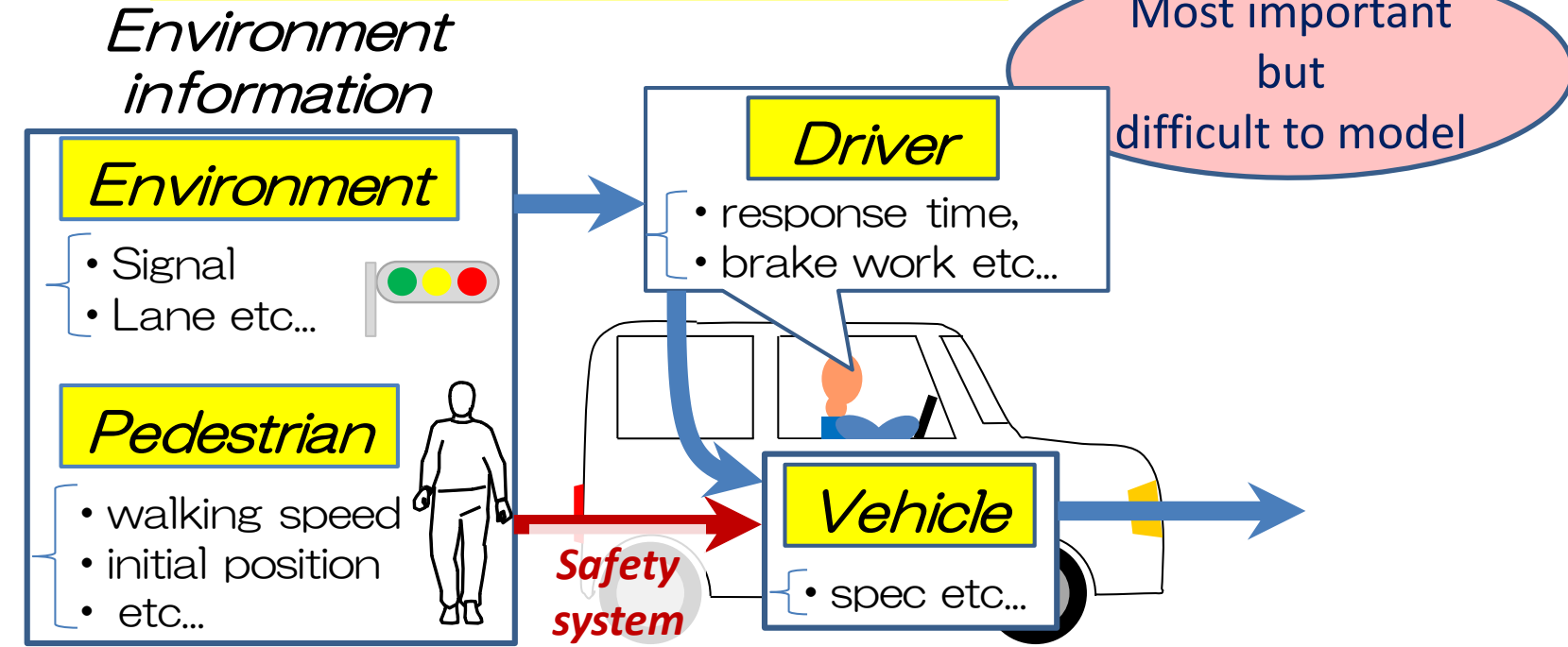
Accident causing lane departure

Composition of Models

In order to reconstruct 3 types of accidents in the simulation, it is necessary to have at least 4 components.



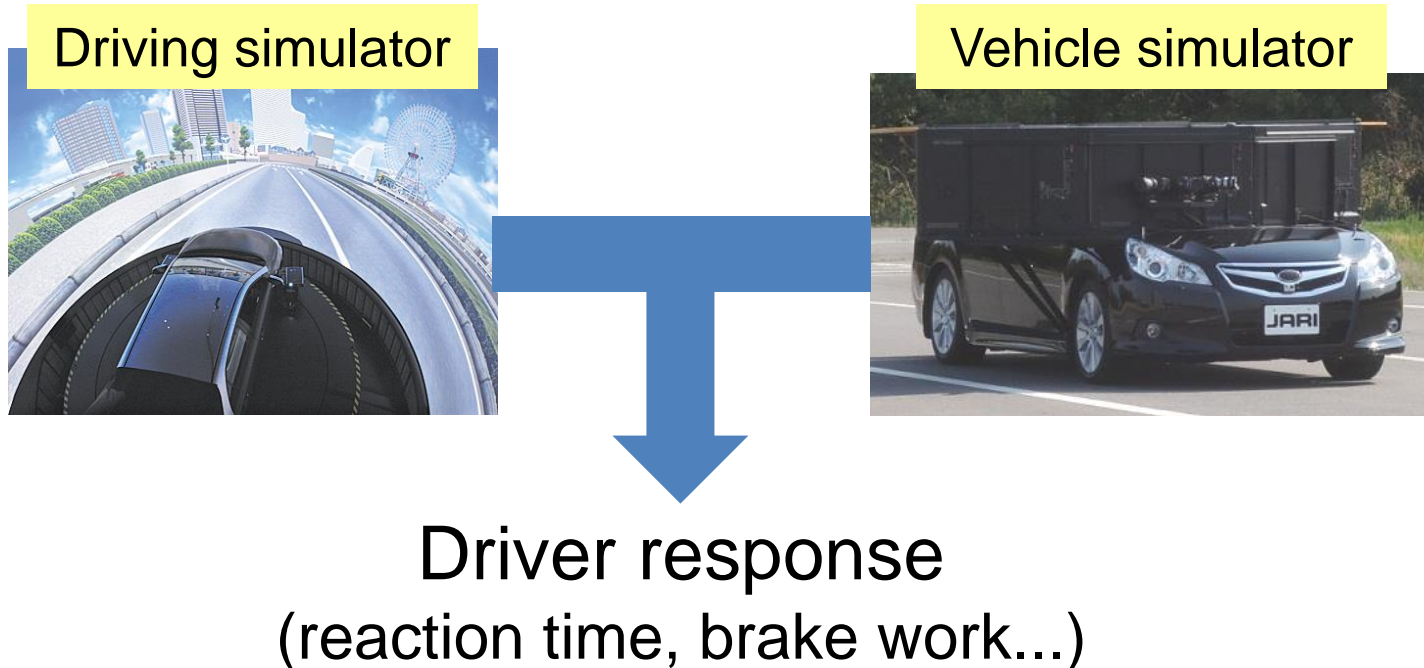
Relationship between each model



Driver Models

★What data is needed for making driver model?

- In order to develop more accurate simulation, appropriate driver model parameter is necessary(e.g. driver reaction time, brake work etc...).
- It is essential to acquire the driver response data by experiments.



Review of Existing Simulations

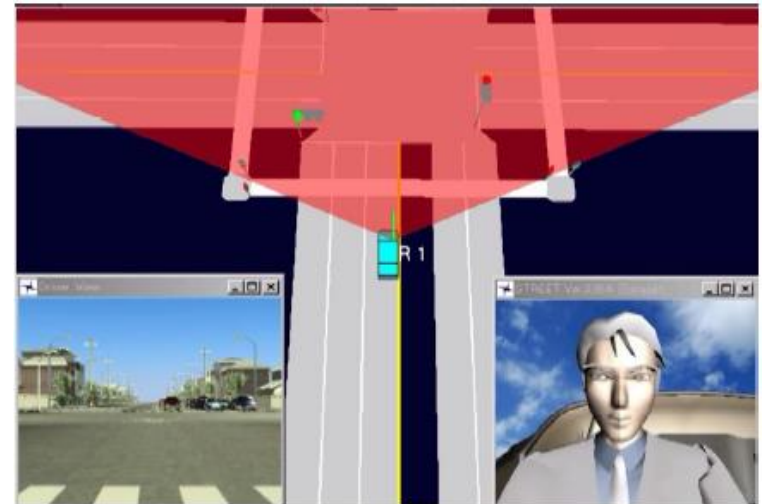
★ What simulations are reviewed?

- Investigation of the existing multi agent simulation tools, in terms of model construction, functional capability, and extendibility.

Various multi agent simulation

- **ASSTREET**(TOYOTA)
- **SIM for ACAT**(HONDA, DRI)
- **ASSESS**(NTSEL)
- **MATES**(The University of Tokyo)
- **SUMO**(DLR:Germany)
- **Prescan**(TNO / Tass International)

ASSTREET

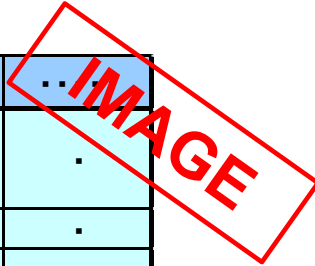


Review of Existing Simulations

★ How the prospective simulation is selected?

- Advantage and disadvantage for each simulation tool are evaluated as simulation requirements. Then, the most prospective simulation is selected.

| Requirement for the simulation | | Tool A | Tool B | Tool C | .. |
|--|--|--------|--------|--------|----|
| Driver model | Algorithm of perception*recognition, decision making and control | ◎ | ◎ | ○ | . |
| | Normal driving situation | ◎ | ◎ | △ | . |
| | Accident avoidance situation | ◎ | △ | ◎ | . |
| | Driver error | ○ | ○ | × | . |
| | Implementation of individual difference | ◎ | ○ | △ | . |
| | . | . | . | . | |
| Degree of freedom for vehicle dynamics | | ◎ | ◎ | ◎ | . |



- The simulation in this project will be developed based on the prospective simulation.

| | | | | | |
|-------------------|--|---|---|---|---|
| Environment model | lane...) | ◎ | ○ | △ | . |
| | Time zone (day-and-night...) | × | △ | × | . |
| | Weather (wet-and-dry...) | ○ | △ | ○ | . |
| | | . | . | . | . |
| Pedestrian model | Algorithm of perception*recognition, decision making and control | △ | △ | × | . |
| | Implementation of individual difference | ○ | △ | × | . |
| | | . | . | . | . |
| Total Evaluation | | ◎ | ○ | △ | . |

Requirements of Simulation

★What function of the simulation tool should have?

Requirements of the simulation tool

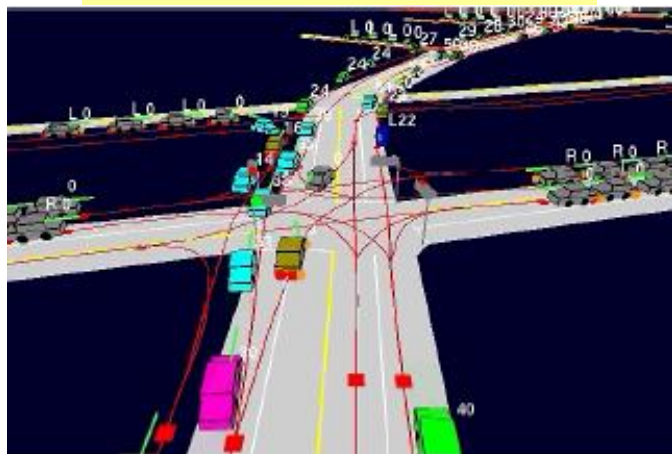
- **Driver model** : Perception • Recognition, Decision making and Control model
Driver error(oversight, Decision making • Control miss) etc.
- **Vehicle model** : Degree of freedom, Automated driving, Active safety system
- **Environment model** : Road shape, Traffic lane, Facilities and Other conditions (e.g. Weather, Road surface, Day-and-night)
- **Pedestrian model** : Perception • Recognition, Decision making and Action model (Walking speed and walking route) etc...

IMAGE

Applicability to Other Areas

- Multi agent simulation tools have applicability to not only estimation of traffic accidents but also other area by adding functions (e.g. traffic jam, environment burden).
- In this project, extendibility and versatility to other areas are also investigated.

Estimation of traffic accidents



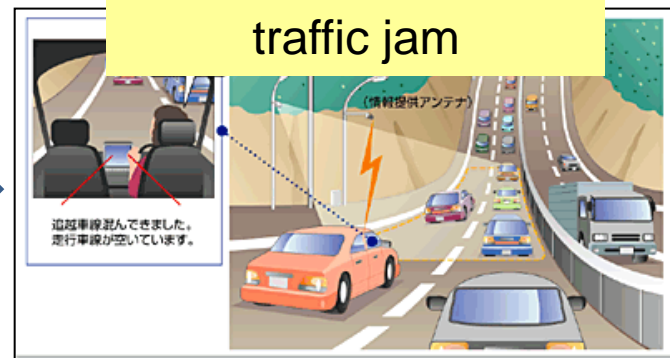
+ Driver response to

- Traffic sign
- ITS system

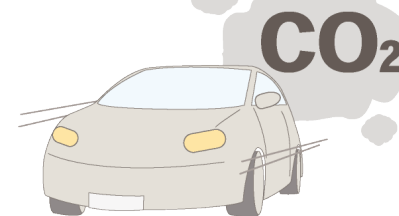
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- Gas pedal work
- Engine output
- Gas consumption

Estimation of traffic jam



Estimation of environment burden



Summary

- **We aim at developing the simulation which can carry out exactly benefit estimation of active safety system and automated driving system efficiently through this project.**
- **In promotion of development and spread for active safety technology and automated driving technology, we are sure that a simulation contributes.**
- **Taking advantage of a pioneer's knowledge, it will become a better simulation.**

Thank you for your attention