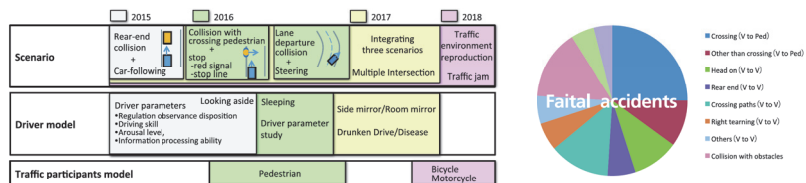# Impact assessment methods of automated driving in traffic safety and CO2 emissions

Development and substantiation of simulation technology for estimation of traffic accident reduction detailed effects
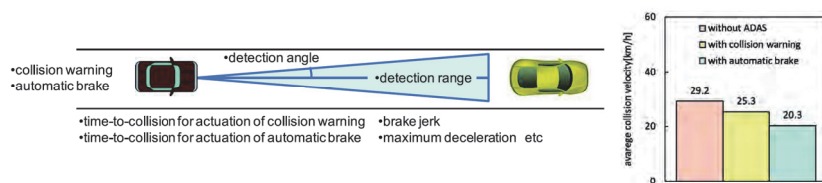
Target of a project

In order to achieve the safest automobile transportation society in the world, early practical use and promotion of the automated driving system have been expected. In this project, the simulation technology of the traffic environment reproduction to figure out the quantitative reduction effect of traffic accidents with such system is developed and contributes to the achievement of the above target.

In this project, the development of a pedestrian agent model is important because pedestrian accident is a major cause of fatal traffic accidents.
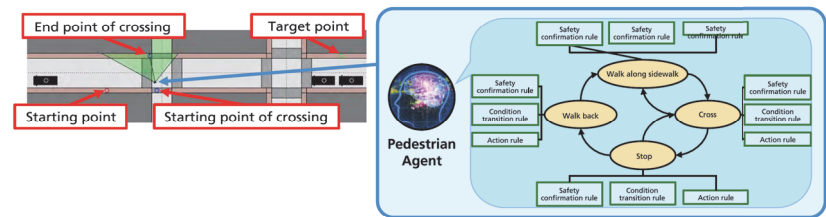

2015 Project Summary

In 2015, the common base of the traffic accident reduction detailed-effect estimation simulator and the functions of collision warning system and Autonomous Emergency brake in the situation of preceding follow and rear-end collision at the strait single-lane are implemented and evaluated, and the feasibility to estimate the quantitative accident reduction effect is confirmed.

- collision warning
- automatic brake
- detection angle
- detection range
- time-to-collision for actuation of collision warning
- time-to-collision for actuation of automatic brake
- brake jerk
- maximum deceleration etc

without ADAS 29.2 / with collision warning 25.3 / with automatic brake 20.3
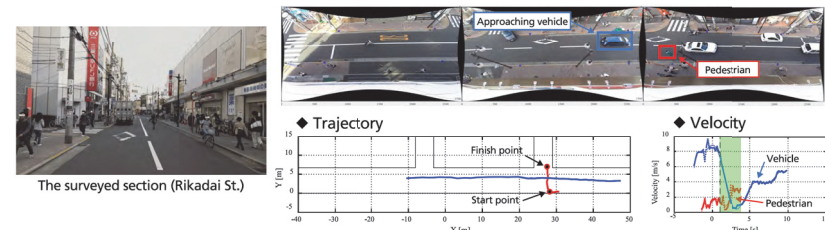
Pedestrian agent model

Develop a pedestrian agent model, which recognizes his surrounding environment, determine how to behave and act based on his decision, in order to represent pedestrian accidents.

End point of crossing / Target point / Starting point / Starting point of crossing
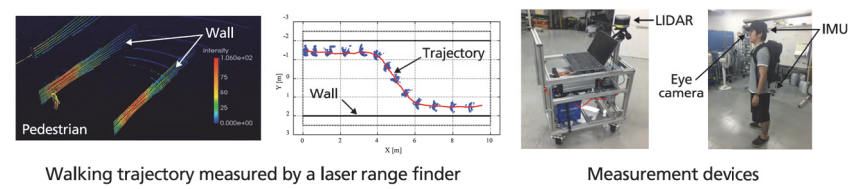
Pedestrian Agent

Investigation of pedestrian behaviors

■ Field survey

Measure and analyze actual pedestrian behavior of crossing to figure out general characteristics.

The surveyed section (Rikadai St.)

Approaching vehicle / Pedestrian

◆ Trajectory   ◆ Velocity

■ Experiment

Measure human walking trajectories and directions of heads to figure out safety confirmation behavior and criteria for judgment of crossing.

Wall / Pedestrian / Wall / Trajectory

LIDAR / IMU / Eye camera

Walking trajectory measured by a laser range finder   Measurement devices

Concept of the CO2 assessment method and target automated driving systems

The introduction of Automated Driving is expected to bring improvement of traffic flow and its impact on CO2 emissions will be quantified as part of the impact assessment under SIP-adus.

The assessment method will consist of a combination of a traffic simulation and a CO2 emission model.

Six automated driving systems that have been considered for introduction to Japan were selected for the evaluation objects.
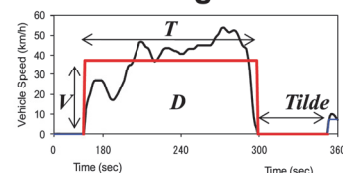
<Concept of the CO2 assessment method under development and the evaluation objects>

Traffic Simulation: TS

Automated Driving Systems

Driving data

Express driving pattern by SSF (Stepwise Speed Function)

Emission Model: EM

$$E = C_{dist} \cdot D_n + C_{V_n^2} \cdot V_n^2 + C_{V_n} \cdot V_n + \cdots$$

Estimate by Multiple regression from SSF data

$\sum$ CO$_2$ emission of target area

Target automated driving systems

- ☐ Automated driving on expressways and local roads
- ☐ Truck platooning on expressways
- ☐ Support systems for passing traffic signal (green-wave)
- ☐ Advance Rapid Transit (a route bus with precision docking and preferential passing)
- ☐ Last-1 Mile transport by automated car
- ☐ Automated valet parking