Visualization Technology Development of Vehicular Traffic CO_2 Emission

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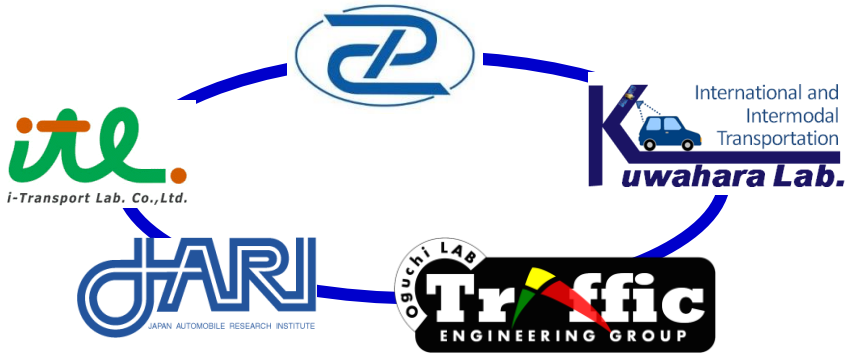
Objective of the **project**(FY2015-) supported by METI, Japan

Automated Driving Systems raise exception for contribution to reduce energy consumption and CO2 emissions from vehicular highway traffic.

CO2 emission reduction effect by improvement of traffic flow and reduction of traffic accident by Automated Driving System will be quantified and visualized.

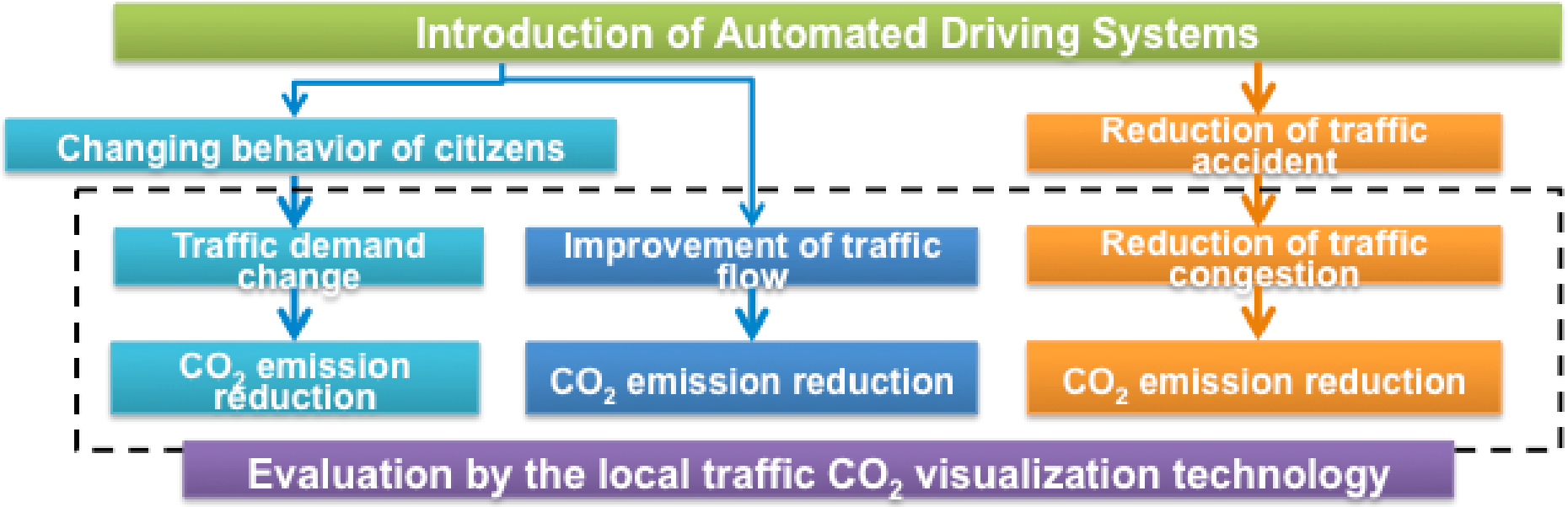
The visualization technology will consist of a traffic simulation and a CO2 emission model.



Visualization target

- Target automated driving systems
  - Green wave runs utilizing signal control information
  - Platooning
  - Advanced Rapid Transit (ART: smooth acceleration and deceleration of bus)

- Scope of the visualization



Former development of assessment methods

Energy ITS project in FY2008-FY2012

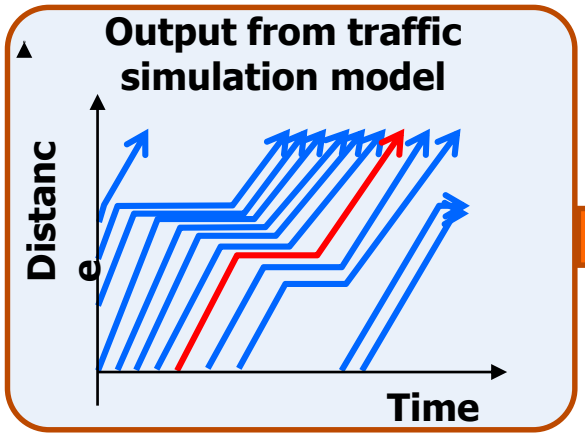
Research and development theme;

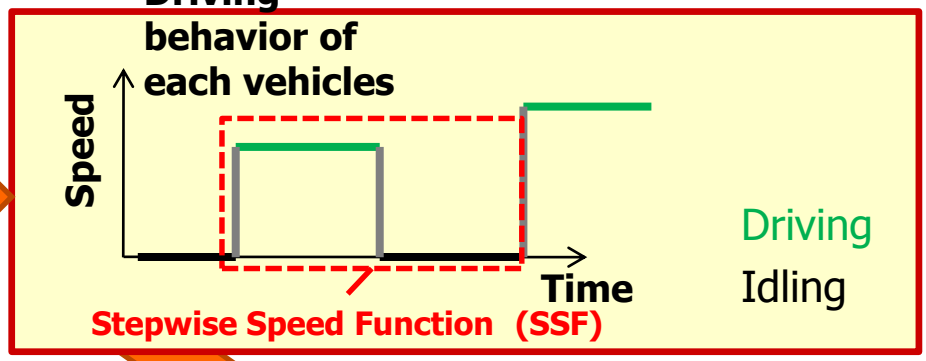
1. R&D for autonomous driving and platooning
2. Establishment of reliable international evaluation methods

lead by Prof. Masao Kuwahara

Former development of assessment methods (cont'd)

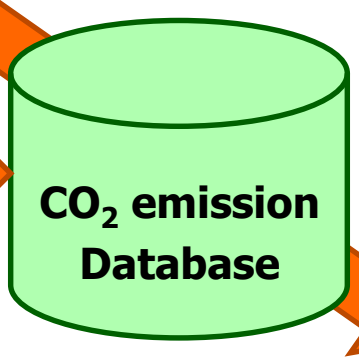
Overview of the assessment methods

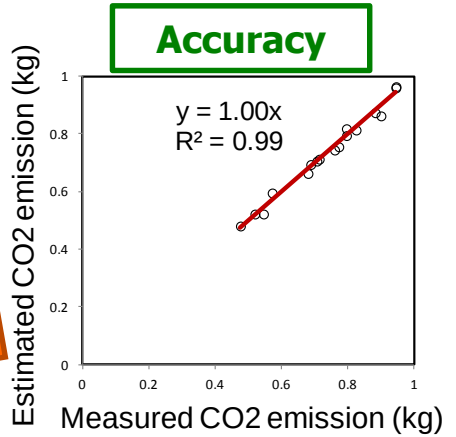




Collecting data of 8 category to represent Japanese automotive market

CO2 emission model	Motor	Categories	Traffic simulation: Small	Traffic simulation: Large
	Gasoline	Minicar	✓	
		Passenger Car	✓	
		HEV (Hybrid Electric Vehicle)	✓	
		Mini Truck	✓	
		Light and Medium Truck	✓	
	Diesel	Heavy Truck: 3.5t<GVW=<5t		✓
		Heavy Truck: 5t<GVW=<8t		✓
		Heavy Truck: 8t=<GVW		✓





CO_2 emission

Former development of assessment methods (cont'd)

Validation Philosophy

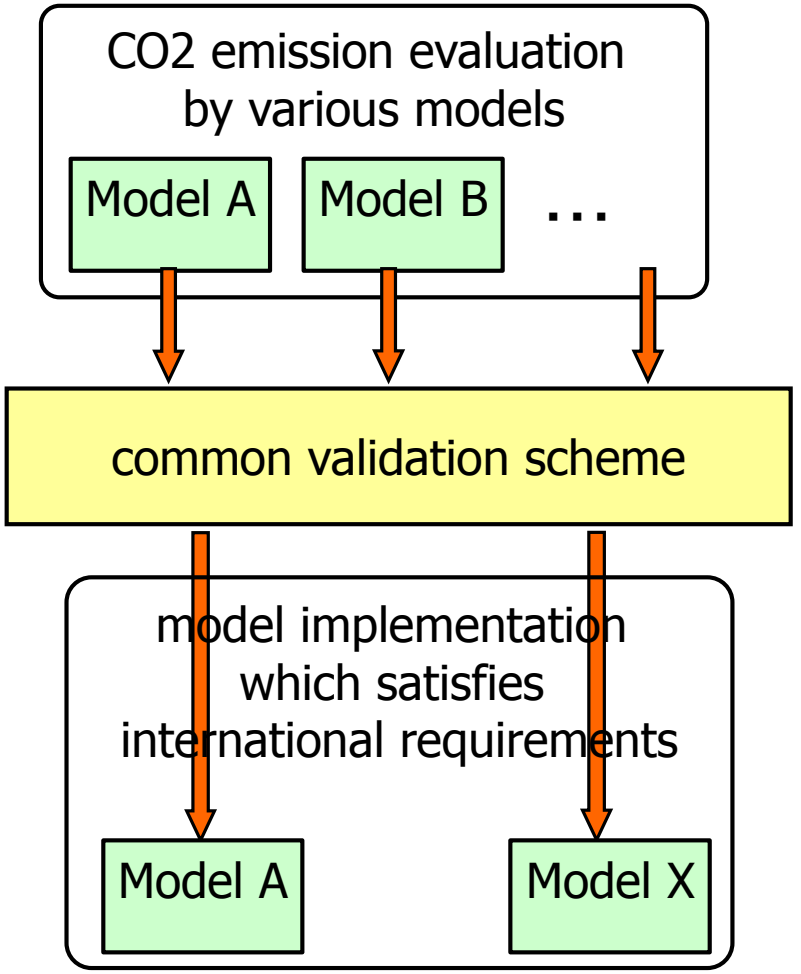
A lot of different models exist.

Preferences to use own models

Models themselves can be different.

Validation scheme should be common.

Models should be checked by the common validation process and disclose the results.



Any kinds of models can be used as long as well validated!

Former development of assessment methods (cont'd)

Validation Process

Verification

qualify tests with virtual & ideal data

to confirm the fundamental model functions.

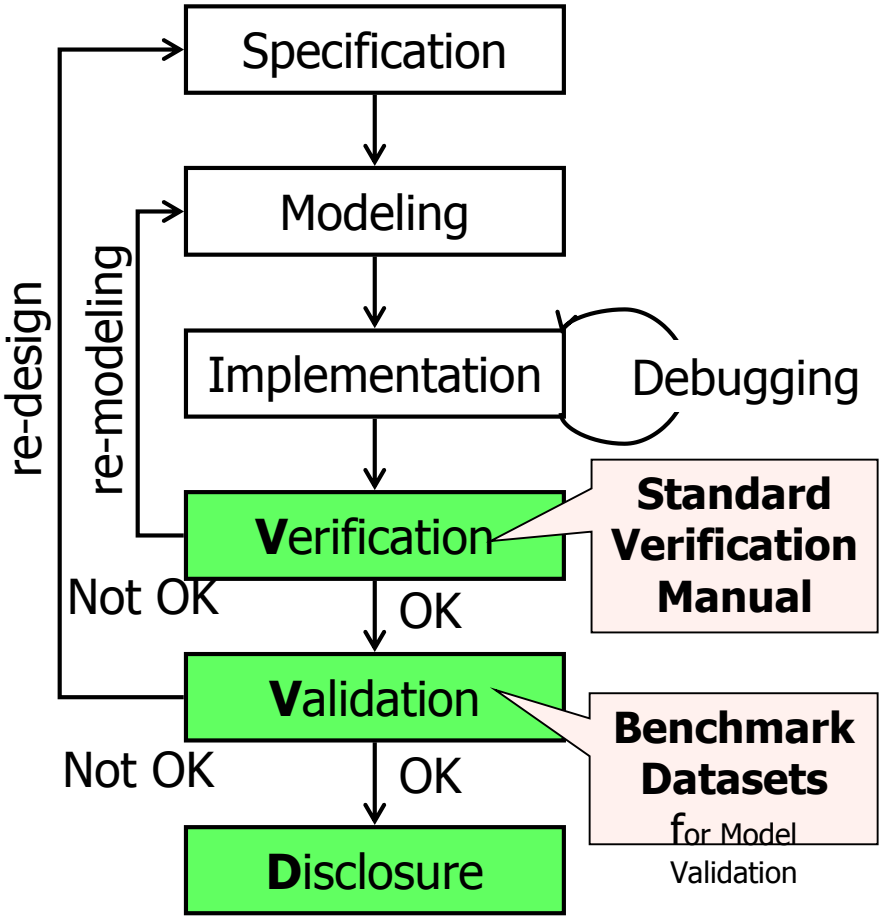
Validation

evaluation of validity using real world data

to evaluate practical applicability of the model.

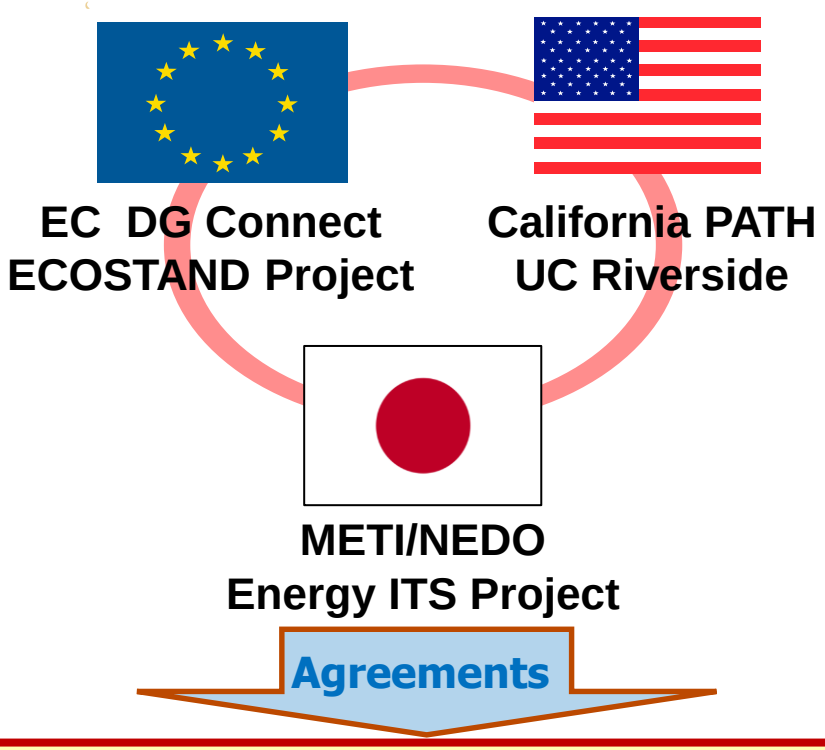
Disclosure

disclose the result of verification & validation on the Clearing House.



Former development of assessment methods (cont'd)

- **Validation** Scheme; established with tri-lateral discussion



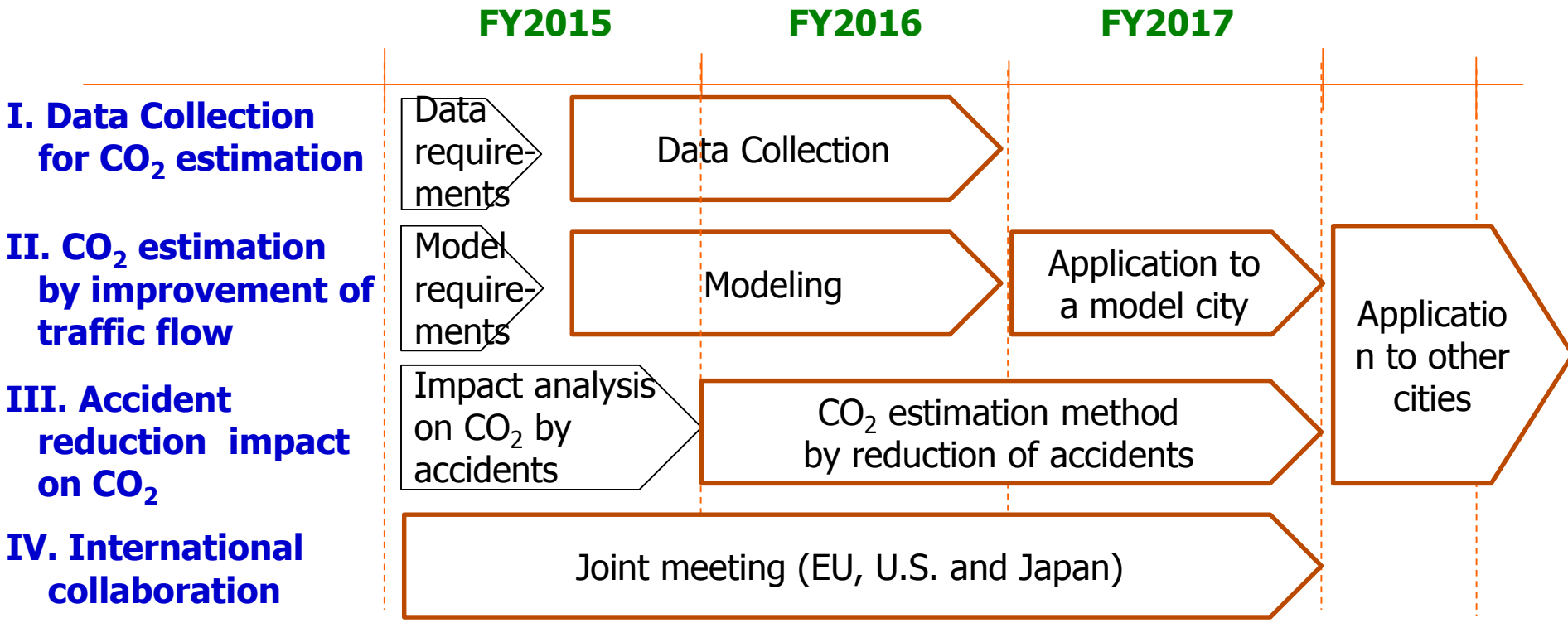
International Joint Report
"Guidelines for assessing the effects of ITS on CO2 emissions"

(available at)

http://www.nedo.go.jp/content/100521807.pdf

The **project plan**(FY2015-) supported by METI, Japan

- Project **items** & **Schedule**



The **project plan**(FY2015-) supported by METI, Japan

I. Data collection for CO_2 estimation

- For the modeling purpose…
  - Changes on the driving behaviors by the green-wave runs and platooning technologies.
  - Changes on the travel mode preferences by using ART.

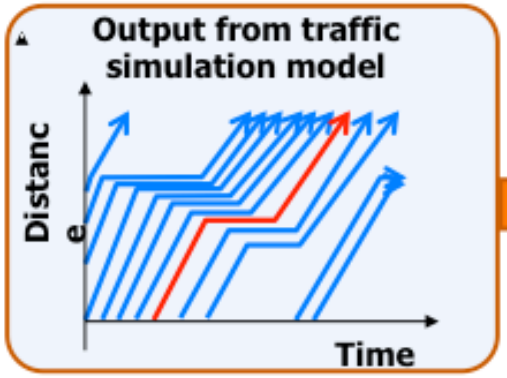
- For the simulation studies…
  - Road networks, O-D travel demands, etc.

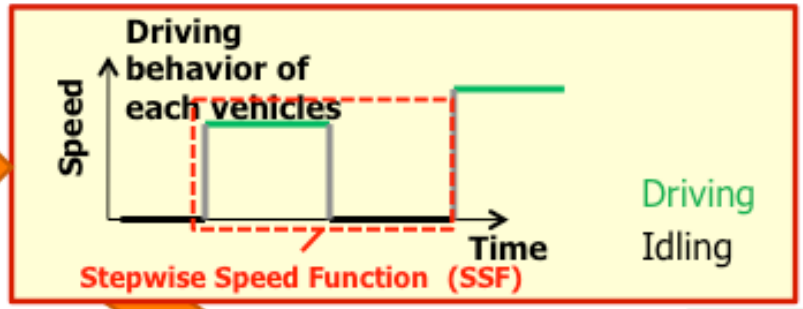
- For the scaling-up purpose…
  - Traffic census, person trip survey, etc.
  - Probe vehicle data, traffic sensor data, etc.
  - Accident statistics.

The **project plan**(FY2015-) supported by METI, Japan

I. Data collection for CO_2 estimation

- CO2 emission data of 8 model categories has been collected to represent the Japanese automotive market. To identify the effect of ART, CO2 emission data of "Route Bus" is planned to be collected.





Collecting data of 8 category to represent Japanese automotive market

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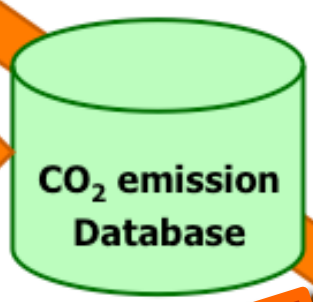

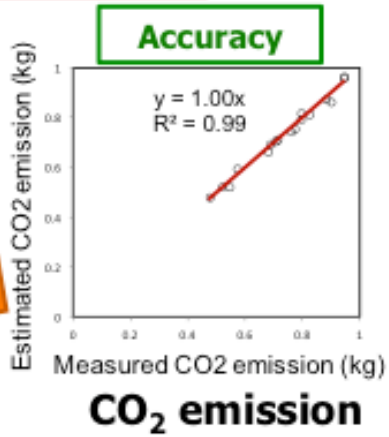

Lack of Route Bus

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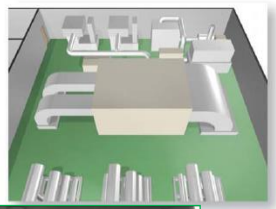
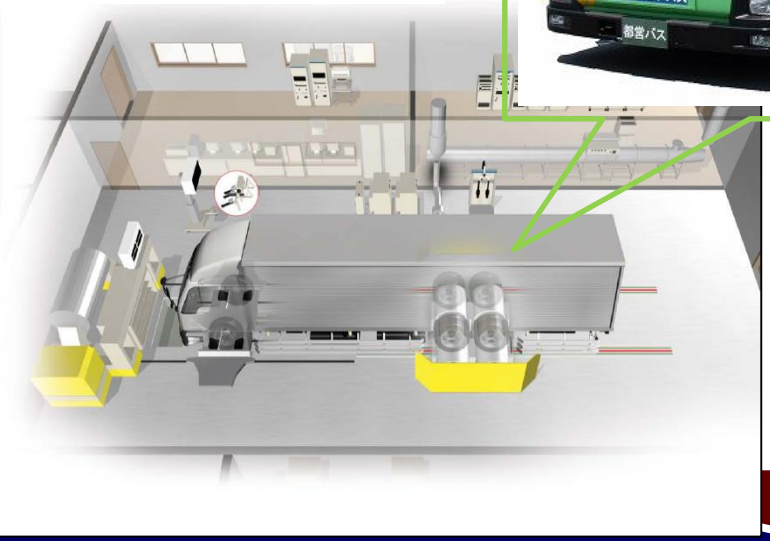
I. Data collection for CO_2 estimation

- Its data is planned to be collected with the chassis dynamometer for large buses and trucks owned by JARI (Japan Automobile Research Institute). With this data, mesoscopic CO2 emission model for "Route Bus" is going to be developed.

JARI
JAPAN AUTOMOBILE RESEARCH INSTITUTE

Chassis Dynamometer for Large Buses and Trucks in JARI





Route Bus
(GVW: 8 ton Class)

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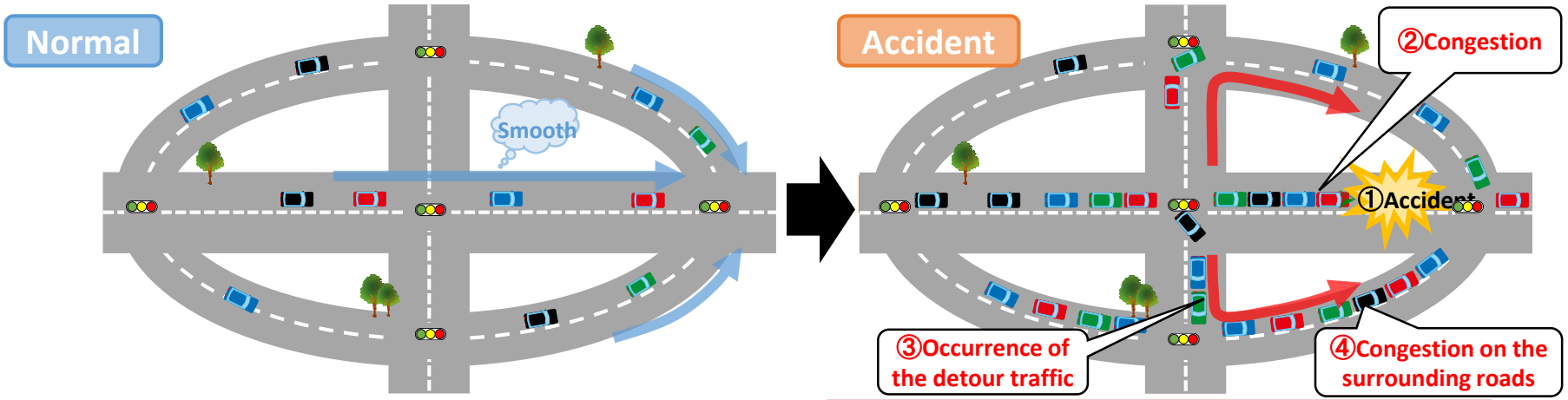
II. CO_2 estimation by improvement of traffic flow

- Green-wave runs
  - Moderate acceleration, cruise speed suppression, etc.
  - Foresighted deceleration to the red signal in front.
- Platooning
  - Adaptive headway and speed control.
  - Platoon formation on route.
- Advanced Rapid Transit (ART)
  - Route designation and stopping at service stations.
  - Lane use policies (e.g. exclusive lanes).
  - Priority signal control.

III. Accident reduction impact on CO2

- Grasp impact of an accident to the traffic flow by comparison of travel speed in accident with usual travel speed according to road types or accident types.
  - Matching accident data and probe data
- Evaluate CO2 emission reduction effect with reduction of traffic accident by Automated Driving System in cooperation with traffic fatality reduction effect estimation method which will be developed by other research organization under SIP program.



CO2 emission from the flow of traffic increases by the outbreak of a traffic jam by the accident.

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IV. International collaboration

- Purpose of International collaboration
  - •Global warming issues is a global problem, and the CO2 emission reduction is the theme that should be worked on under the international cooperation.
  - •Because development of Automated Driving Systems is progressed in the world, its impact to CO2 emissions should be shared between countries.
- International meeting
  - •We plan to hold the international meeting in Europe and in the U.S. once a year.
  - •We would like to invite comments to the progress of the project.
  - •Is there a project that it can become a counterpart in promoting the international cooperation of this project? Is there a suitable occasion to hold the international meeting?（ITS World Congress、TRB･･･）