SIP Automated Driving System

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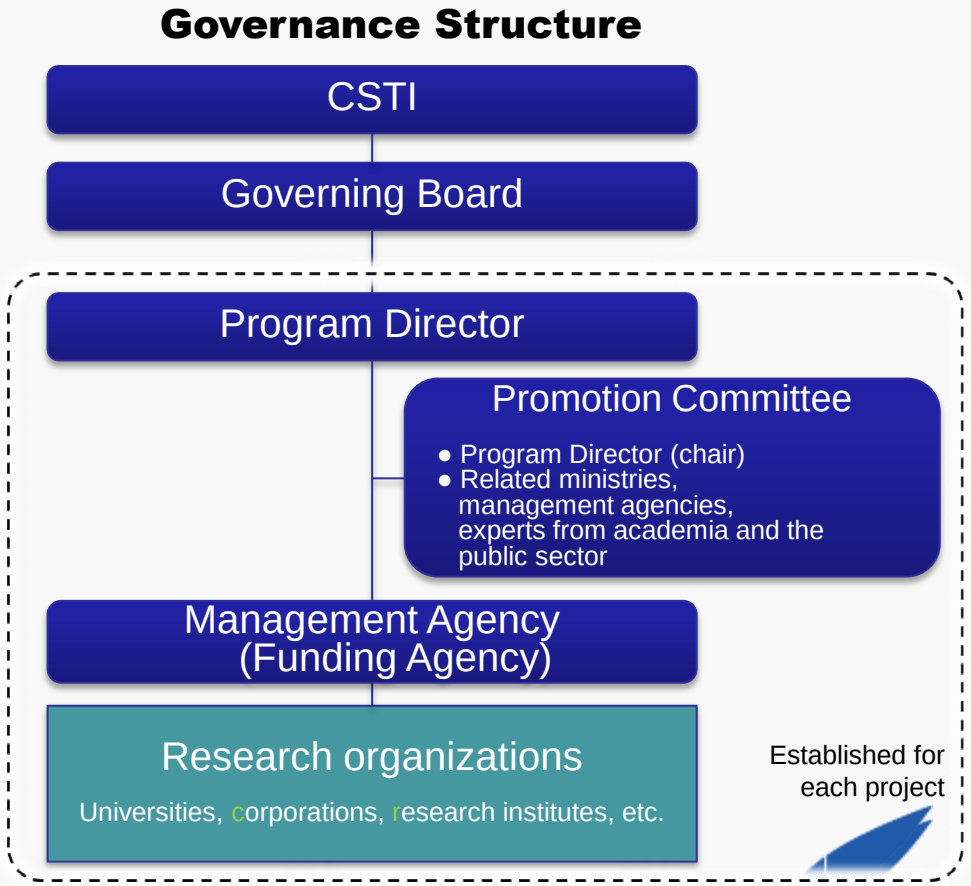
Cross-Ministerial Strategic Innovation Promotion Program

SIP (Cross-Ministerial Strategic Innovation Promotion Program)

- SIP aims to foster innovation through the promotion of R&D at all stages by enhancing cross-ministerial cooperation.
- CSTI* designates research themes based on the expected impact in solving societal issues and enhancing economic growth.
- CSTI appoints a program director for each research theme and allocates the budget.

*CSTI: Council for Science, Technology and Innovation



SIP (Cross-Ministerial Strategic Innovation Promotion Program)

Prioritized societal issues	Themes
Energy	Innovative combustion technology
	Next-generation power electronics
	Innovative structural materials
	Energy carriers
	Next-generation ocean resources development technologies
Next-generation Infrastructure	Automated driving systems
	Technologies for maintaining/upgrading/managing infrastructure
	Improvement/reinforcement of methods for preventing and mitigating disasters
Local Resources	Technologies for fostering next-generation agriculture, forestry and fisheries
	Innovative design/manufacturing technologies

Automated driving systems

Hiroyuki Watanabe
Toyota Motor Corp.

Purpose of SIP Automated Driving Systems

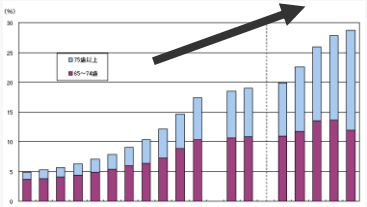
Social benefits

- Dramatic reduction in traffic fatalities
- Reduction of traffic congestion
- Enhanced mobility for the aged
- Reduction of driving workload

Traffic accidents

Congestion

Aging population



Automated Driving Systems
(built-in and connected)

Technological innovation

- Highly advanced driving assistance
- Innovative transportation systems

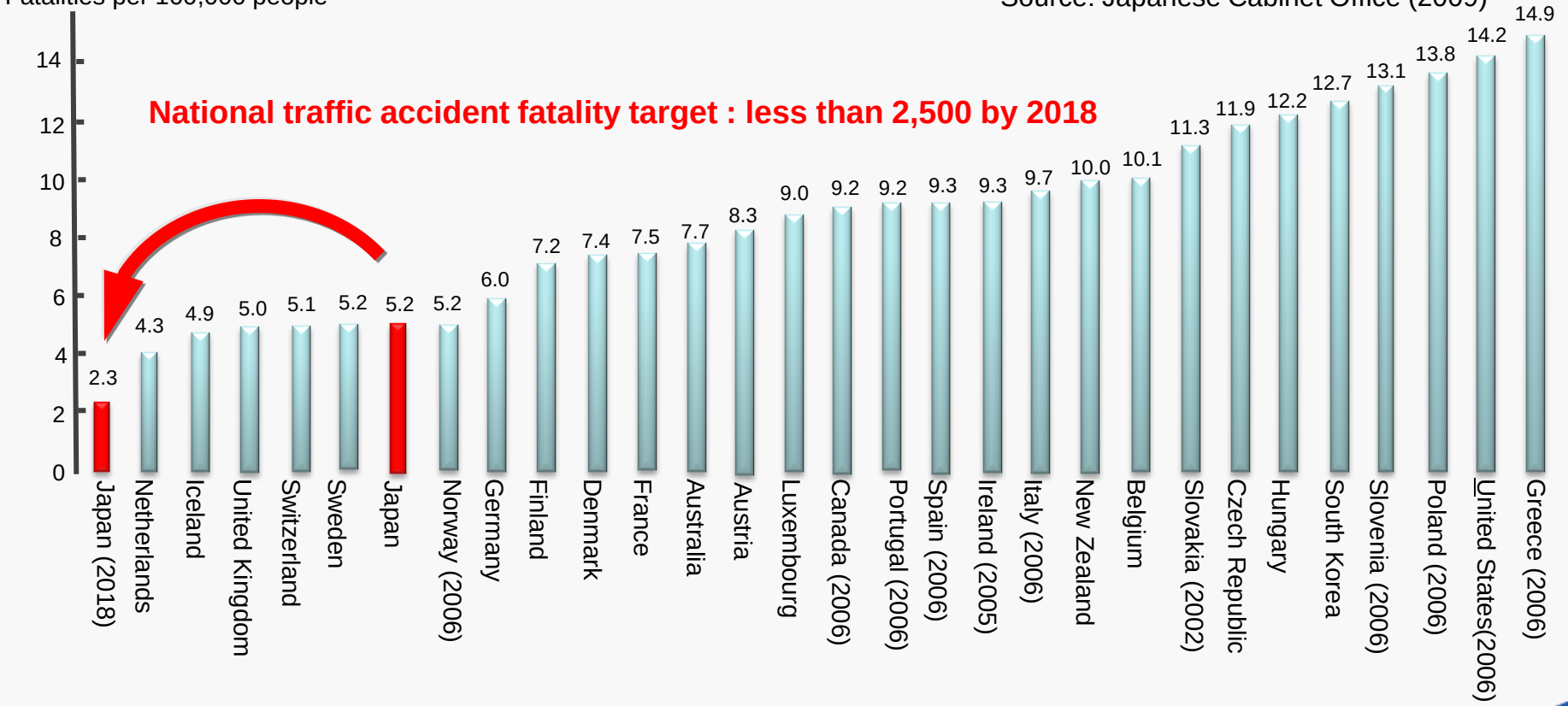
Business incubation

- Auto and electronic industries
- Creation of new industrial sectors

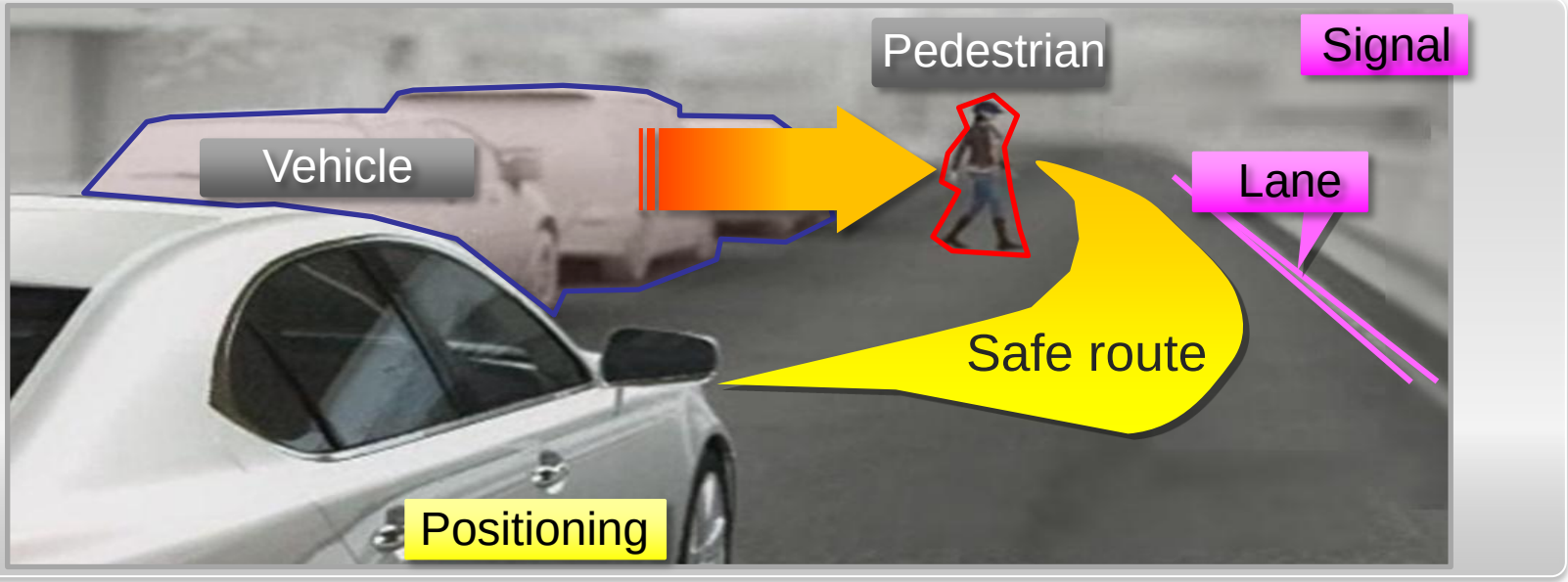
Traffic Accident Fatalities

Fatalities per 100,000 people

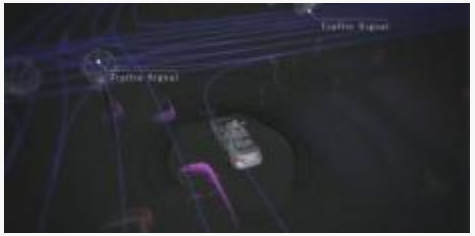
Source: Japanese Cabinet Office (2009)



Automated Driving System



Sensor

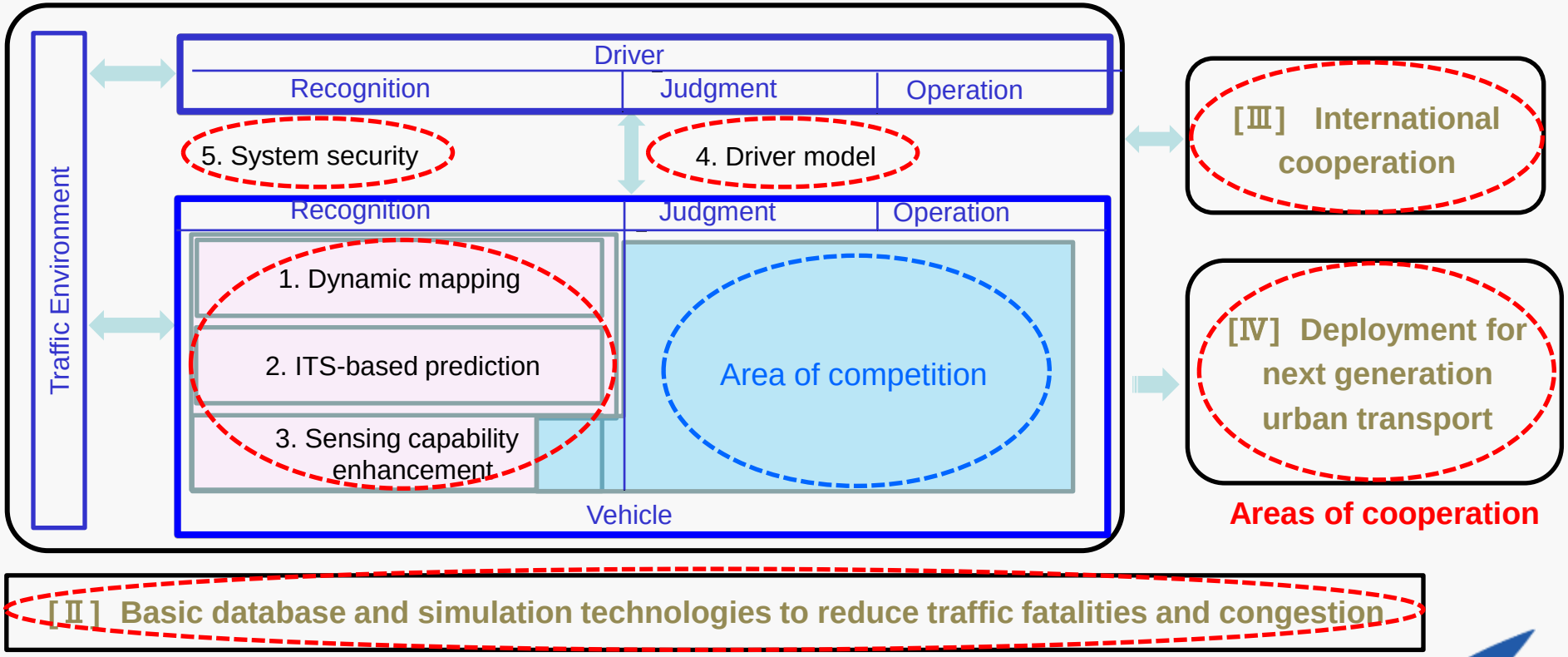


Map

ITS

Scope of Research

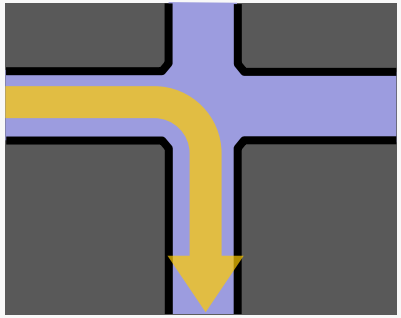
[Ⅰ] Development and implementation of automated driving systems



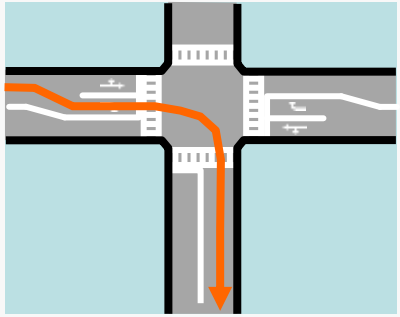
[Ⅱ] Basic database and simulation technologies to reduce traffic fatalities and congestion

Mapping for Automated Driving

- Create detailed drive routes based on precise maps and traffic control information.

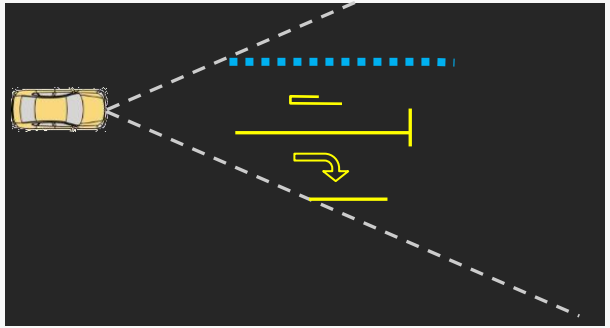


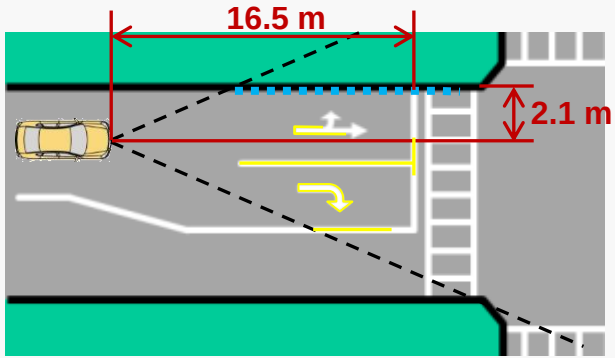
Car navigation route guide



Automated driving route

- Determine accurate vehicle position by cross-referencing GPS with map.





Dynamic Map Hierarchical Structure

- Many kinds of information should be included in dynamic maps (Dynamic ←→ Static)

Dynamic Map Hierarchical Structure

Dynamic **< 1 sec**	**Current vehicle position** **Surrounding vehicles/pedestrians…** **Traffic signal information**
Semi-dynamic **< 1 min**	**Traffic accident information** **Traffic congestion information** **Local weather information**
Semi-static **< 1 hour**	**Traffic control information** **Road works information** **Regional weather information**
Static **< 1 month**	**Traffic signal/landmark position (3D)** **Road location/traffic sign position (3D)** **Road section ID/intersection ID** **Road layout (local and main roads)**

Human Machine Interface

- Social acceptance
- Legal issues….

Encouraging social acceptance

OEMs/Suppliers

- Functions, effects
- Definition of the role of drivers

Customers ||

- Expectations
- Understanding of the role of drivers

Minimization of new risks due to automation

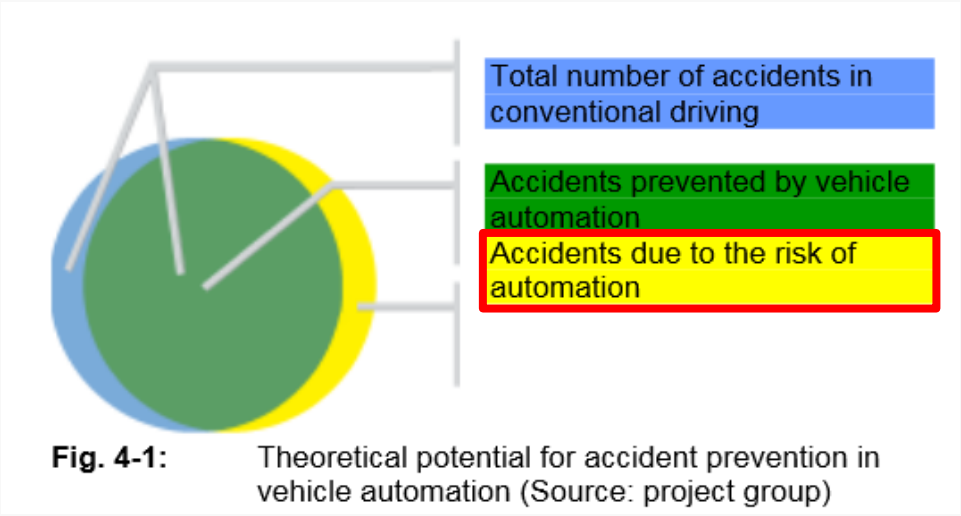


Fig. 4-1: Theoretical potential for accident prevention in vehicle automation (Source: project group)

(BASt study)

Humans & Systems

Assistance level dependent on circumstances

Conditional Automation

Transition event

Driver in control

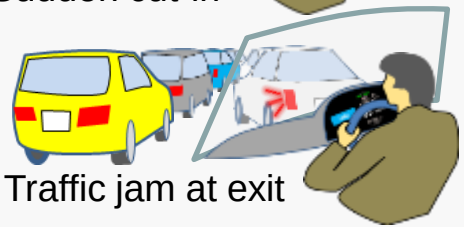
Partial Automation

Conditions

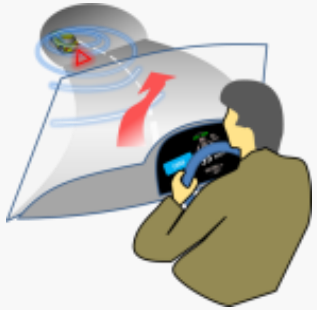
Relaxed

Concentrated

Sudden cut-in



Traffic jam at exit

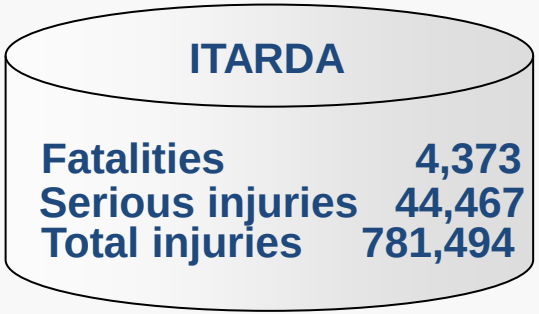


Resume driving

Timeline

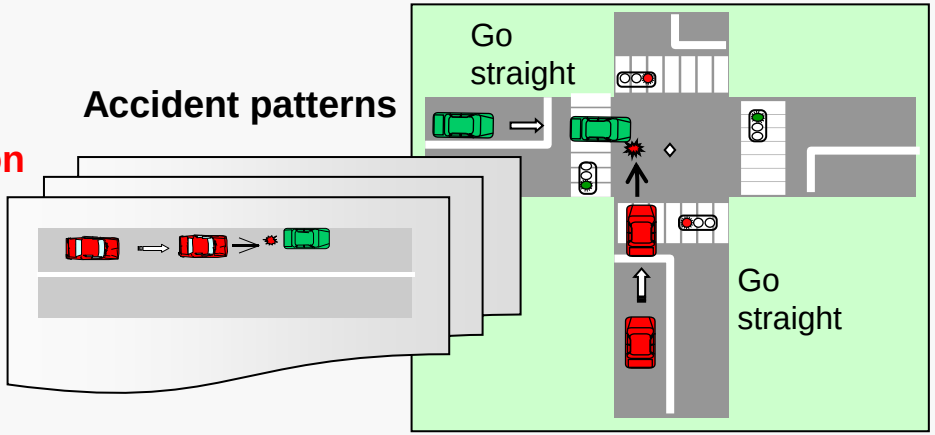
Accident Analysis

ITARDA macro database (2013)



Pattern classification

Accident patterns



(Approximately 250 patterns)

Experimental data

Experimental data

Data from papers

Simulation

Effectiveness of traffic accident reduction by active safety systems

International cooperation is necessary!