SIP Automated Driving System

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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)

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

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

Congestion
Traffic accidents
Aging population

Social benefits

Technological innovation

Business incubation
Traffic Accident Fatalities

National traffic accident fatality target: less than 2,500 by 2018

Source: Japanese Cabinet Office (2009)

Fatalities per 100,000 people

2.3 4.3 4.9 5.0 5.1 5.2 5.2 5.2 6.0 7.2 7.4 7.5 7.7 8.3 9.0 9.2 9.2 9.3 9.3 9.7 10.0 10.1 11.3 11.9 12.2 12.7 13.1 13.8 14.2 14.9

Automated Driving System

Vehicle

Pedestrian

Signal

Lane

Safe route

Positioning

Sensor

Map

ITS
### Scope of Research

#### [Ⅰ] Development and implementation of automated driving systems

<table>
<thead>
<tr>
<th>Traffic Environment</th>
<th>Driver</th>
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<tr>
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<td>Recognition</td>
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</table>

5. System security

<table>
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<tr>
<th>1. Dynamic mapping</th>
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<td>2. ITS-based prediction</td>
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<td>3. Sensing capability enhancement</td>
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#### [Ⅲ] International cooperation

#### [Ⅳ] Deployment for next generation urban transport

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

**Areas of cooperation**

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

Determine accurate vehicle position by cross-referencing GPS with map.
Many kinds of information should be included in dynamic maps (Dynamic ↔ Static)

### Dynamic Map Hierarchical Structure

<table>
<thead>
<tr>
<th>Type</th>
<th>Information</th>
</tr>
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</table>
| 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)
Assistance level dependent on circumstances

**Conditional Automation**

**Partial Automation**

**Transition event**

**Conditions**
- Relaxed
- Concentrated

**Timeline**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Function</th>
<th>Status</th>
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<tbody>
<tr>
<td>Task</td>
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**Perception** **Cognition** **Judgment** **Control**

Driver in control

- Sudden cut-in
- Traffic jam at exit
- Resume driving

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Accident Analysis & Simulation

**Accident Analysis**
ITARDA macro database (2013)

- Fatalities: 4,373
- Serious injuries: 44,467
- Total injuries: 781,494

**Pattern classification**

**Accident patterns**

- (Approximately 250 patterns)

**Simulation**

- Experimental data
- Experimental data
- Data from papers

**Effectiveness of traffic accident reduction by active safety systems**
International cooperation is necessary!