ITS Development and Deployment in China

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Content

- Present Situation of ITS in China
- Strategy and Plan in Next Stage
- Policy and Step - Related ITS Deployment
I. Present Situation of ITS
1.1 20-Year Look Back in China

Starting
1995-2000
ITS Strategy & ITS Architecture

2001-2005
Technology research & Demo in City/Expressway

Development & Demo

Integrated & Application
2006-2010
ITS Service in Olympic, World Expo and Asia Games
ETC in Expressway
Expressway Management System

Next Stage ITS
2011-2015
Next Stage ITS Strategy and Plan Research
New Tech. R&D:
Cooperative-ITS Communication in ITS Autonomous Car
ITS Industry
Top View of ITS in China

- The National ITS Strategy has been generated
- National ITS Architecture and National ITS Standard Framework have been established
- Many ITS technologies have been applied in China and created new industries
- National and local ITS application system promote safety, flexible, and environmentally safe movement of people and goods
- Enterprises have become the main role in the ITS development
1.2 Current Status of ITS in China

- **Traffic Information Services**
  - Become Popular
  - Smart phone, Car-navigator, Website, VMS, Broadcast, …

- **Car Navigator**
  - Cumulative sales of on-board units: 65 million

- **Market size of Car Navigation**
  - About 30 billion USD in 2015 (navigator, phone, map…)

- **ETC**
  - ETC cover the total national expressway network
  - More than 12,000 ETC lanes have been built
  - 38 million ETC users
  - ETC usage rate in Beijing: about 40-45% 

- **Network Reservation Taxi/Car Service**
  - Taxi hailing, Express, Private car service, ……
    - DiDi: more than 10 million orders per day
    - Uber: Reservation car service in 60 cities
City Traffic Control Center
- Established in 256 Cities
- Monitoring Camera: 51 thousand

Smart Public Transport and Service
- Smart Card: issued more than 430 million
- Smart Bus System: 26 cities have launched

The Use of GNSS Big Data
- Traffic Index Service via GNSS and statistical data
- Spring Festival passenger transport forecast and service

Commercial Vehicle Monitoring System
- National Platform has been built
- Online Commercial vehicle more than 2 million

Online Ticket Booking (2015)
- Air: the online penetration rate is 59.2%
- Train: the online penetration rate is 70.5%
  - Via website: 42.7%
  - Via smartphone App: 27.8%
1.3 R&D in Recent Years

(1) Cooperative ITS

- Cooperative system for Highway Ramp Safety, in Beijing-Tianjin Expressway (2012)
- Technology Development on Vehicle and Road Cooperation (2011-2015)
  - On board system, Road side system, Communication and control, Integration

(2) Automated Vehicle Research

- Theory Research and Tech development
  - Research in cognitive computing of visual and auditory information
- Car Manufacturer Development
  - CHANGAN, SAIC, BAIC, FAW……
- AV Development in Internet Companies
  - Baidu, LeEco, … …
- Automated Vehicles Test in Highways
  - Zhengzhou to Kaifeng Highway (Aug 2015)
  - Chongqing to Beijing, Automated Car (Apr 2016)
(3) Study of Communication in ITS (2012-2014)

1. Communication Architecture for ITS
   - 1-1 Study of Need for Communication in ITS
   - 1-2 Study of Communication Technology Using Scene in ITS
   - 1-3 Development of Communication Architecture for ITS

2. Communication Technology in ITS
   - 2-1 Evaluation of Key Communication Technology in ITS
   - 2-2 Demo of Communication in ITS
   - 2-3 DSRC Development

Schematic Diagram for Communication in ITS

- **User:**
  - Infor. Serv.
  - ITS Application

- **Network Layer:**
  - TCP
  - UDP
  - L2/UDP

- **Switch:**
  - MAC
  - 4G/5G
  - WAVE/GB-DSRC

- **Connect QoS:**
  - MAC
  - STD/GB/CEN

- **Security:**
  - MAC

- **QoS Interface:**
  - Infor. Serv.
  - C-ITS
  - ETC
II. Strategy and Plan in Next Stage
2.1 National ITS Development Strategy

National ITS Strategy Research  (National Research Project, 2015)

(1) Top View of Next Generation ITS

- Interconnection and coordinated operation support integrated transportation system
- Smart sensor network and intelligent facilities are a part of traffic infrastructure - A New Infrastructure
- Low carbon and intelligent vehicles
- Open, sharing and cooperative transportation service system
- Scientific and intelligent decision making system based on big data
(2) Features of the Next Generation ITS

- The infrastructure and transport data collection should be real-time and complete
  - Full coverage of data collection with smart sensor network

- The data and information exchange between travelers, vehicles, infrastructures and operators should be real-time and high efficiency
  - V2V, V2I, V2X, 5G, ……

- Using big data and cloud computing technology, transport operation and control center, vehicles and user terminals can realize the decision, control, and service under the support of the data
  - Big data center
  - Decision-making based on data computing and knowledge base

- The each unit of ITS has the ability of artificial intelligence
  - Intelligent Vehicle, Driverless Car, Intelligent Control Center, ……
(3) Strategic Plan in the Next 10 Years

- Main ITS Service Deployment
  - Smart Traveler Service
  - Transport Management
  - Emergency Operation

- Intelligent Transport Infrastructure (ITI):
  - Traffic infrastructure construction plan including ITI
  - Enhance construction of transport data collecting and processing facilities
  - Install dedicate wireless data exchange facilities along expressway

- Standards and Technical Support
  - Speed up standards development for ITS Demo projects
  - Development leading-edge technology of ITS

- Support ITS industry and field test
  - ITS software and hardware, Intelligent Vehicle, Driverless Vehicle, ……
  - Laboratory and test field construction
2.2 National Master Plan for Next 5 Years

NDRC and MOT jointly issued in July of 2016

(1) Smart Transport Service System

- National Traveler Information Service System
- E-ticket Payment System
- Upgrading and Extending ETC Service
- Promoting the Application of Beidou Global Navigation Satellite System (Beidou GNSS)

(2) Intelligent Management and Operation System

- Upgrading City Traffic Control System and Transport Management System
- Deployment of Smart Connecting Passenger Transport System and Multimodal Freight Transport System
- Developing Intelligent Vehicle and Smart Handling Facilities
(3) Smart Decision Making System

- Decision Making System Based on Big Data
- Incident Management and emergency rescue system

(4) Intelligent Transport Infrastructure

- Smart Sensor and Monitoring System Along The Transport Infrastructure
- Next Generation Dedicate Transport Information and Communication Infrastructure
- Opening and Sharing System or Platform for Transport Information
(5) Standards and technology

- Next Generation ITS Standards
  - Traffic Data Sharing
  - Cooperative ITS
  - Intelligent Vehicle
  - E-payment Systems and Facilities
  - Logistic Information Platform

- ITS Technology Development
  - Connected Vehicles and Autonomous Driving
  - Intelligent Urban Traffic Management
  - Next Generation Air Traffic Management
  - Automatic Operation of Railway and Urban Rail Transit
  - Intelligent Vessel Position and Navigation

(6) Environment for ITS Development

- Market-driven
- Support ITS Industry
- Establishment of Trust and Credit System
- Establishment Network Security System for ITS
- Improving the Laws and Regulations of Transport
III. Policy and Steps - Related ITS Deployment
3.1 ITS in Developing Countries

(1) Different Stage, Different Problem

China Example:

- **Land/Population**: Rapid construction period: about 20 years
- **Traffic Safety**
- **Energy**: Perfect and Improve Stage
- **Environment**

Infrastructure Construction

1990 2012
We Could Find Our Own Path on ITS
(2) New Path for Developing Countries

From: Memorandum of ITS Technology, World Bank, July 22, 2004
(3) Selecting Projects According to Own or Local Needs and Market Demand

China Example:

Demand investigation: The Trend of Using ITS from 2003-2008

- Urban traffic management and plan
- Toll collection
- Traveller info. Service
- Safety and assistant drive
- Emergency Incident management
- Transport management
- Integrate transport
- Intelligent vehicle
### Market investigation: The Trend from 2003-2008

<table>
<thead>
<tr>
<th>Category</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information release</td>
<td>△△△△△△△△</td>
</tr>
<tr>
<td>Information collection and processing</td>
<td>△△△△△△△△</td>
</tr>
<tr>
<td>Car navigation</td>
<td>△△△△△△△△</td>
</tr>
<tr>
<td>ETC</td>
<td>△△△△△△△△</td>
</tr>
<tr>
<td>Traffic control equipment</td>
<td>△△△△△△△△</td>
</tr>
<tr>
<td>Network communication</td>
<td>△△△△△△△△</td>
</tr>
<tr>
<td><strong>GPS/GIS/GPRS</strong></td>
<td>△△△△△△△△</td>
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<tr>
<td>Integrated information platform</td>
<td>△△△△△△△△</td>
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<tr>
<td>Traffic detection</td>
<td>△△△△△△△△</td>
</tr>
<tr>
<td>Traffic control system and software</td>
<td>△△△△△△△△</td>
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<tr>
<td>Hand route guidance equipment</td>
<td>△△△△△△△△</td>
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<tr>
<td>Route guidance equipment</td>
<td>△△△△△△△△</td>
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<tr>
<td>Video detection</td>
<td>△△△△△△△△</td>
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<tr>
<td>Traffic monitoring</td>
<td>△△△△△△△△</td>
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<tr>
<td>Parking equipment</td>
<td>△△△△△△△△</td>
</tr>
<tr>
<td>Digital map</td>
<td>△△△△△△△△</td>
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</tbody>
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3.2 Simple ITS Technology is Effective

(1) Speed limit enforcement and warning systems

Capture camera on a special section of road

Speed warning system
### Typical provinces accident index changes before and after the installation of speeding capture

<table>
<thead>
<tr>
<th>Accident index Location</th>
<th>Before installation (year)</th>
<th>After installation (year)</th>
<th>Accident index year (increase +, decrease -)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of accidents</td>
<td>Deaths</td>
<td>Injuries</td>
</tr>
<tr>
<td>Guizhou Province</td>
<td>2005</td>
<td>2006</td>
<td>-79.33%</td>
</tr>
<tr>
<td>Guangdong Provincial Expressway</td>
<td>2004</td>
<td>2005</td>
<td>-70.8%</td>
</tr>
<tr>
<td>Kunming City, Yu Jiang Road, Tai Chi Road, Huijiang Road</td>
<td>2005.5-8</td>
<td>2006.5-8</td>
<td>-54%</td>
</tr>
<tr>
<td>Sichuan Muchuan State Road 213 and Highway 103 lines</td>
<td>2004</td>
<td>2005</td>
<td>-28%</td>
</tr>
</tbody>
</table>
(2) Flashing warning lamp

- Flashing warning lamps are mainly used in the highway and the combination of the city road and the countryside way.
- Based on the feedback of vehicle drivers, 70.7 percent of drivers considered that the device is useful.
3.3 Master Plan and Demo, Chinese Experience

(1) Building Blocks for a ITS Eco-System

Strategy & Architecture

Platforms

Deployment & Business model

ITS Strategy and Policy
National ITS Architecture
Gov. Joint Office
ITS Standard Org.
ITS Labs
Tech Development
Demo: Local & Operator
Market Driven & Operation
Evaluation
(2) Selecting A Suitable Technical System

Intelligent Transport Systems
- Toll, ETC, Warning, Emergency, Monitoring
- Weather service, Guidance, Information Service, ......

Information
- Computers
- Telecommunication
- Software

Infrastructure
(3) Demo Projects Are Very Important

- Evaluating the availability and reliability of ITS technologies
- Demonstrating the benefits of technology to the operators and public
- Get the trust and financial support from the government
- Providing the profit opportunity to the industry
- Providing opportunities for the development and validation of ITS standard
Looking Forward ….

◆ Opportunities

- ITS offers new directions and opportunities for investment
- ITS is a part of the infrastructure construction as well as new service industry
- ITS provides a huge market for new industries
- Local governments, enterprises and transport operators carry out demonstration project

◆ Challenges

- Design of Architecture is a key step of system planning
- Harmonization of systems and harmonization of operators are crucially important
- Complexities associated with widely varying procedures/practices, including contracting & funding
- Enterprise investment risk
Thank You!