People’s Republic of China: Transport Information System
(Financed by the Technical Assistance Special Fund)

Prepared by Research Institute of Highway
People’s Republic of China

For Ministry of Transport

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Asian Development Bank
Ministry of Transport of the People's Republic of China

Transport Information System
Volume 1

Policy Recommendation and Action Plan

TA NO.4991-PRC

Final Report

Research Institute of Highway

August 2009
Preface

This report is the study outcome of the technical assistance (TA) project financed by Asian Development Bank (ADB) and implemented by the Ministry of Transport (MOT) of the People’s Republic of China (PRC) for Traveler Information Service System (TISS).

Continuous economic growth in the People’s Republic of China (PRC) brought about the improvement of the people’s living standards, with rapid urbanization development, more private car ownership, high growth rate of motor vehicle inventory and ever-increasing road travel demand. There are more demands on quality service provided by the transport infrastructures and the transport service operators, not only in terms of safety, convenience, efficiency and effectiveness, but also environmental protection. TISS is one important component of intelligent transport system (ITS). It is an effective way to meet the demand for quality service, by the Government in its people centered transport development strategy.

This report aims to study and analyze the domestic and international experiences and lessons in TISS development and operation and to explore effective ways, for TISS development suitable to the situation in PRC. The report expounds the development strategy, TISS standard architecture framework, policy measures and action plan, based on functional requirements, logical architecture, the government function and market mechanism for sustainable TISS development.

Under the leadership of MOT and ADB, the Research Institute of Highway as leading firm undertook the TA study project joint with international consultant, GHD Pty Ltd. During the one year in-depth study, the domestic and international consultants in close cooperation with the support team carried out the field survey and overseas study, held a number of workshops, listened to the comments and advices from the representatives of the stakeholders and completed this draft final report.

The final report is composed of two volumes: “Travel Information Service System (Volume I) — Policy Recommendation and Action Plan” mainly for the transport authorities at different levels; and “Travel Information Service System (Volume II) — Guidelines for TISS Development and Operation”, mainly for TISS deployment and operation management agencies.
During the study representatives from ADB, MOT, GHD Australia, China Academy of Transportation Sciences, Transport Planning Research Institute, Beijing Municipal Committee of Communications, Chengdu Municipal Committee of Communications, Zhejiang Provincial Communications Department, Jiangsu Provincial Communications Department, Shandong Provincial Communications Department, participated the workshops and the field survey meetings with great support and valuable contribution to the TA study project.
Construction and development concept is unadvanced. Public service ability has not yet been involved in the performance assessment system. Lacking specific planning, TISS construction implementation is hard to plan as a whole in different levels. The orientation of TISS construction is unclear and faulty, which influences the construction implementation effect. The construction of TISS related infrastructure is unsustainable, which leads to the weak stamina of TISS development. Management system is intersected, which results in the distraction of resources and difficulty in integration. TISS relevant standards are lagging and information is hard to share. The industrialization faces certain risk. Lacking organic combination with market mechanism, the sustainable development capability of TISS is deficient.
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<tr>
<td>511</td>
<td>America’s Travel Information Number</td>
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<tr>
<td>3G</td>
<td>The Third Generation Mobile Communication System</td>
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<td>AASHTO</td>
<td>American Association of State Highway and Transportation Officials</td>
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<td>ACC</td>
<td>Adaptive Cruise Control</td>
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<td>ADB</td>
<td>Asian Development Bank</td>
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<td>AHS</td>
<td>Automated Highway System</td>
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<td>AMTICS</td>
<td>Advanced Mobile Travel Information and Communication System</td>
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<td>APTA</td>
<td>American Public Transportation Association</td>
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<td>APTS</td>
<td>Advanced Public Transportation System</td>
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<td>ASN.1</td>
<td>Abstract Syntax Notation One</td>
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<td>ATIS</td>
<td>Advanced Traveler Information System</td>
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<td>ATMS</td>
<td>Advanced Traffic Management System</td>
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<td>AVL</td>
<td>Automatic Vehicle Location</td>
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<td>B/S</td>
<td>Browser/Server</td>
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<td>BRT</td>
<td>Bus Rapid Transit</td>
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<td>CA</td>
<td>Civil Aviation</td>
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<td>CACS</td>
<td>Comprehensive Automobile Traffic Control System</td>
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<td>CATS</td>
<td>China Academy of Transport Sciences</td>
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<td>CCTV</td>
<td>Closed-Circuit Television</td>
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<td>CEDR</td>
<td>Conference of European Directors of Road</td>
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<td>CEN</td>
<td>European Committee for Standardization</td>
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<td>CMS</td>
<td>Changeable Message Sign</td>
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<td>CNY</td>
<td>China Yuan</td>
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<td>CO₂</td>
<td>Carbon Dioxide</td>
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<td>C/S</td>
<td>Client/Server</td>
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<td>DFT</td>
<td>Department for Transport (U.K.)</td>
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<td>DMS</td>
<td>Dynamic Message Sign</td>
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<td>DoTaRS</td>
<td>Department of Transport and Regional Service</td>
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<td>Acronym</td>
<td>Description</td>
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<tr>
<td>EDI</td>
<td>Electronic Data Interchange</td>
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<td>EOI</td>
<td>Expressions of Interest</td>
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<td>ERTICO</td>
<td>European Road Transport Telematics Implementation Coordination Organization, (ITS Europe)</td>
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<td>ETC</td>
<td>Electronic Toll Collection</td>
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<td>EU</td>
<td>European Union</td>
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<td>Federal Communication Committee</td>
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<td>Federal Highway Administration</td>
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<td>FM</td>
<td>Frequency Modulation</td>
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<td>FVD</td>
<td>Floating Vehicle Data</td>
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<td>GALILEO</td>
<td>European Satellite Navigation System</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>GHz</td>
<td>Giga Hertz</td>
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<td>GIS</td>
<td>Geographical Information System</td>
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<td>GL</td>
<td>Guideline</td>
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<td>GNSS</td>
<td>Global Navigation Satellite System (Russia)</td>
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<td>General Packet Radio Service</td>
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<td>GPS</td>
<td>Global Positioning System</td>
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<td>GSM</td>
<td>Global System for Mobile</td>
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<td>ha.</td>
<td>Hectare</td>
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<td>HAR</td>
<td>Highway Advisory Radio</td>
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<td>IATA</td>
<td>International Air Transport Association</td>
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<td>iDEN</td>
<td>Integrated Digital Enhanced Network</td>
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<td>IEEE</td>
<td>Institute of Electrical and Electronics Engineers</td>
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<td>IMMI</td>
<td>Integrated Multiple Mode Information</td>
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<td>ISO</td>
<td>International Standardization Organization</td>
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<td>ISP</td>
<td>Information Service Provider</td>
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<td>IT</td>
<td>Information Technology</td>
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<td>Abbreviation</td>
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<td>ITS</td>
<td>Intelligent Transport System</td>
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<td>ITSA</td>
<td>Intelligent Transport System of Australia</td>
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<td>IVU</td>
<td>In-Vehicle Unit</td>
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<td>KPL</td>
<td>Kilometer per Liter</td>
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<td>LAN</td>
<td>Local Area Network</td>
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<td>MATTISSE</td>
<td>Midlands Traveler Information Systems (UK)</td>
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<td>MDT</td>
<td>Mobile Data Terminal</td>
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<td>Ministry of Finance</td>
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<td>MTB</td>
<td>Municipal Transport Bureau</td>
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<td>MTI</td>
<td>Multiple Mode Traveler Information</td>
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<td>NDRC</td>
<td>National Development and Reform Commission</td>
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<td>NOIE</td>
<td>National Office of Information Economy</td>
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<td>NOx</td>
<td>Nitrogen Oxygen</td>
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<td>NTCC</td>
<td>National Traffic Control Center (U.K.)</td>
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<td>NTCIP</td>
<td>National Transportation Communications for ITS Protocol</td>
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<td>O&amp;M</td>
<td>Operation and Maintenance</td>
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<td>OBU</td>
<td>On-board Unit</td>
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<td>OCC</td>
<td>Operation Control Center</td>
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<td>PCD</td>
<td>Provincial Communications Department</td>
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<td>PDA</td>
<td>Personal Digital Assistant</td>
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<td>PPP</td>
<td>Public Private Partnership</td>
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<td>RACS</td>
<td>Road Automobile Communication System</td>
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<td>Research Institute of Highway</td>
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<td>RTIG</td>
<td>Real Time Information Group</td>
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<td>RTPI</td>
<td>Real Time Passenger Information</td>
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<td>RTTI</td>
<td>Real-time Traffic and Travel Information (Europe)</td>
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<td>Acronym</td>
<td>Full Form</td>
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<td>SAC</td>
<td>Standard Administration Commission</td>
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<td>SAE</td>
<td>Society of Automotive Engineers</td>
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<td>SIRIUS</td>
<td>Motorway Information System using VMS (France)</td>
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<td>SITA</td>
<td>Société Internationale de Télécommunications Aéronautiques</td>
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<td>SMS</td>
<td>Short Message System</td>
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<td>TA</td>
<td>Technical Assistance</td>
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<td>TDCS</td>
<td>Train Dispatching Command System</td>
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<td>TIC</td>
<td>Traffic Information Center</td>
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<td>TICS</td>
<td>Traffic Information and Control System</td>
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<td>TIH</td>
<td>Travel Information Highway</td>
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<td>TPRI</td>
<td>Transport Planning Research Institute</td>
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<td>TSTI</td>
<td>Travel</td>
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<td>TTI</td>
<td>Transport and Travel Information</td>
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<td>UK</td>
<td>United Kingdom</td>
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<td>USDOT</td>
<td>United States Department of Transportation</td>
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<tr>
<td>UTI</td>
<td>Uni-mode Traveler Information</td>
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<td>UTMC</td>
<td>Urban Traffic Management Control</td>
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<td>VASP</td>
<td>Value Added Service Provider</td>
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<td>VICS</td>
<td>Vehicle Information Communications System</td>
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<td>VMS</td>
<td>Variable Message Sign</td>
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<td>VNIS</td>
<td>Vehicle Navigation Information System</td>
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<td>WAP</td>
<td>Wireless Application Protocol</td>
</tr>
<tr>
<td>XML</td>
<td>Extensible Markup Language</td>
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1 Introduction

1.1 Project Background

Along with continuous economic growth in PRC, the people’s living standards are improving, with rapid urbanization development, more private car ownership, high growth rate of motor vehicle inventory and ever-increasing travel demand. Total motor vehicle inventory reached 64.67 million in 2008, increased by 13.5% over the previous year; and the number of private cars reached 19.47 million, increased by 28.0% over the previous year, with fast growth of travel demand and road traffic. Total passenger transport volume reached 22.07 billion passengers, 1,263.6 billion passenger-km, in 2008, with year-on-year growth rate of 7.6% and 9.8% respectively over the previous year. To meet the ever increasing road traffic demand, the Government attached great importance on the road infrastructure development in the last three decades. By the end of 2008, total road mileage reached 3.68 million km, increased by 100 thousand km compared with that of the previous year. A nationwide expressway network is shaping up with total mileage of 60,300 km in 2008. The improvement of the road system has created a good condition for people’s travel, however, the improvement of the road infrastructure only still can not meet with the ever increasing demands for safe, convenient, cost-effective and comfortable travel service. There are more expectations on high quality service, meanwhile the present travel information service is far from perfect, which has affected effective use of the existing road infrastructure and the public transport service to certain extent. Therefore more effective and efficient travel information service is needed to meet with multiple targets and diversified travel service demands.

To meet the travel service demands, the Ministry of Transport (MOT) organized and promoted local area travel information service system (TISS) development under the guidance of “people centered” transport development concept. Started from 2005 a number of demonstration pilot TISS projects were implemented in Shandong, Zhejiang provinces and Beijing and Chengdu municipalities; in 2007, more engineering projects at provincial were initiated for the development of “travel information resource integration and service”. These engineering projects were to build internet website, hotline calling, short message, paper media, expressway variable message sign, to provide for the
private drivers and the public transport users with pre-trip, en route travel information service, to make the public enjoy the convenient travel information service. At the same time, relevant departments and market entities took active part in the TISS development.

However, there are a number of constraints to the development of TISS such as the administrative organizational institutional barrier, the lack of uniform standards and technological specifications, the lack of information sharing system, which resulted in scattered resources and lack of integration, low quality of information service, limited service channel and coverage, lack of dynamic real-time information service, etc.

In addition there are more and more considerations of the environmental protection, which calls for more effective and efficient travel to minimize pollutant emissions by taking advantages of technological advancement, particularly the application of Intelligent Transport System (ITS). TISS, one of the important parts of the ITS emerged during the 1990s and included in the road and transport development program is in need of technical and institutional support to materialize its goal and objectives.

Under this circumstance, the MOT is badly in need of technical support to study and develop TISS development guidelines, the information service quality assessment system and standard architecture framework suitable to the PRC’s transport information system development, to further integrate the current TISS development for nationwide TISS and market oriented commercialized sustainable development of the transport information system.

Based on the above mentioned considerations and the consultation between the Asian Development Bank (ADB) and PRC government, an Agreement for Technical Assistance (TA) project of “Transport Information System (TA 4991-PRC) was signed between PRC government and ADB, in December 2007, with MOT as project beneficiary and Executing Agency of the PRC. The Research Institute of Highway (RIOH) was selected as the consultant to implement the Transport Information Service System Study (the Project) through its bidding proposal and the contract negotiation. An Agreement for the TA Project was signed by RIOH and ADB on April 11 2008.
1.2 Development Trend Analysis

1.2.1 Economic growth

Along with the rapid and healthy development of PRC economy and society, people's living standard has been greatly enhanced. In 2008, the per capita GDP in PRC broke USD3,300; the per capita disposable income of urban residents reached CNY15,781, with year-on-year growth of 14.5%, and actually increased by 8.4% after deducting price factor; the per capita net income of rural residents reached CNY4,761, with year-on-year (YOY) growth of 15.0% and actually increased by 8.0% after deducting price factor. For the consumer spending of urban residents and rural residents, per capita urban residents' consumer spending on transport and communication was up to CNY1,357.41 in 2007, from CNY40.51 in 1990 with annual average growth rate of 22.9%, the transport and communication share of total consumer spending increased to 13.58% in 2007 from 1.2% in 1990; per capita rural residents' consumer spending on transport and communication was up to CNY328.4 in 2007, accounting for 10.19% of the total consumer spending, increased by 8.8 percentage points compared with that in 1990.


Figure 1-1 Growth of Chinese Per Capita GDP between 1998 and 2008
 Figure 1-2  Growth of Per Capita Disposable Income of Urban Residents (1978 – 2008)

 Figure 1-3  Growth of Per Capita Net Income of Rural Residents (1978 – 2008)

 Table 1-1 Per Capita Urban Residents Consumer Spending  

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<tbody>
<tr>
<td>Per capita consumer spending</td>
<td>1,278.89</td>
<td>3,537.57</td>
<td>4,998</td>
<td>8,689.55</td>
<td>9,997.47</td>
</tr>
<tr>
<td>Including Transport &amp; Communication</td>
<td>40.51</td>
<td>183.22</td>
<td>426.95</td>
<td>1,147.12</td>
<td>1,357.41</td>
</tr>
<tr>
<td>(%)</td>
<td>1.2</td>
<td>5.18</td>
<td>8.54</td>
<td>13.19</td>
<td>13.58</td>
</tr>
</tbody>
</table>

Source: China Statistics Yearbook, 2008
Table 1-2 Per Capita Rural Residents Consumer Spending

<table>
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</thead>
<tbody>
<tr>
<td>Per capita consumer spending</td>
<td>584.63</td>
<td>1310.36</td>
<td>1670.13</td>
<td>2829.02</td>
<td>3223.85</td>
</tr>
<tr>
<td>Including</td>
<td>Transport &amp; Communication</td>
<td>8.4</td>
<td>34.1</td>
<td>93.5</td>
<td>282.9</td>
</tr>
<tr>
<td>(%)</td>
<td>1.44</td>
<td>2.58</td>
<td>5.58</td>
<td>10.21</td>
<td>10.19</td>
</tr>
</tbody>
</table>

Source: China Statistics Year-book in 2008

Along with the development of the economy, continuous increase of resident income, and more frequent social activities such as business, relative visiting, working and traveling, etc., the travel demand will rapidly increase, and passenger transport is increasing steadily, and a trend of constant increase is shown in per capita residents' trip number and trip distance. In 2008, the passenger volume of road transport reached 22.07 billion passengers and the passenger-km volume reached 1263.6 billion in PRC, with YOY growth of 7.6% and 9.8% respectively. According to the prediction in the National Expressway Network Planning, the passenger volume of road transport will reach 36.5 billion in 2020, and the passenger-km volume will reach 2500 billion, and the number of annual road trips per person will be up to 25.2 trips in 2020 from 16.6 trips in 2008. The average road passenger transport distance across the country will increase to 68 kilometers in 2020 from 57 kilometers in 2008. In the future, driven by the constant increase of travel demand, there will be more demand on travel information service.

![Figure 1-4 Growth of Road Passenger Transport Volume in PRC (1998 – 2008)](image-url)
1.2.2 Transport improvement and the development of tourism

According to the National Expressway Network Planning, General Layout Planning of National Road Transport Hub Terminals, Medium-and-long Term Railway Network Planning, National Airport Layout Planning issued by the Ministry of Transport, the Ministry of Railway and the General Administration of Civil Aviation, the transport infrastructure condition in PRC will be greatly improved in future. Moreover, with great input in the rural road development and the constant increase of road network density, the improved road and transport condition will reduce travel cost and enhance travel comfort, so that great potentials of travel demand will become reality with demand on transport service including travel information service.

The National Medium-and-long Term Railway Network Planning was reviewed and approved by the State Council in 2004. The development target is: in 2020, total operating kilometers of the railway network will reach 100,000 kilometers; with separated passenger and freight railways materialized for major busy lines; the multi-track railway and electrified railway accounting for 50% of the total railway network; transport capacity meeting with the requirement of national economic and social development; and main technical equipment and rolling
stock will be up or close to the world advanced level. Total length of dedicated passenger railway will be over 12,000 kilometers, and the target speed of passenger train will be over 200 kilometers per hour.

Column 1-2: National Expressway Network Planning

According to the National Expressway Network Planning, total kilometers of the expressway network in PRC will reach 85,000 kilometers. According to General Layout Planning of National Road Transport Hub Terminals, 179 national road transport hub terminals are to be built in 197 cities (including multi-city combined hub terminal), and comprehensive passenger transport hub terminals and information service system are to be built in large scale.
According to the Layout Planning of National Civil Aviation Airport, in 2020, the total number of the airport in PRC will reach 244, forming airport groups in five regions of the North, East, Central south, Southwest and Northwest. In 2020, the total number of the airport in will reach 244, increased by 97 newly-built airports, compared with that in 2006.

PRC has rich tourism resource, including many world famous natural and cultural heritages and national major famous scenic spots. With the constant increase of household income and the improvement of living standard, the number of tourist trip and annual trip distance that reflect the resident living standard will also increase year by year. Since the holiday system in PRC is improving, the public will be able to spend more than 40% of their time on recreation and leisure, which will become an important part of daily life. The number of domestic visitors was up to 1.71 billion person-trips in 2008 from 0.744 billion person-trips in 2000, with an annual growth rate of 11.0%. Influenced by various factors such as the further development of tourism resource, during the development process of the constant improvement of the
people's living standard, the number of domestic tourist trip and foreign visitors will keep on high growth rate in the future. Meanwhile, along with the rapid development of special tourist trip such as free tour, private driving tour and backpacking tour, etc., there will be more and more demands for tourist travel information service.

1.2.3 The development of the private car ownership

When per capita GDP reaches USD3,000, private car would become popular gradually and a motorized society would be not far behind. By the end of 2008, motor vehicle population in PRC reached 168 million, and automobile population reached 64.672 million, 35 times as much as that in 1978, of which private motor vehicle ownership was 41.734 million and private passenger car was 19.47 million. In some economically developed cities such as Beijing, Shanghai, Guangzhou and Shenzhen, etc., the number of motor vehicle have exceeded 1 million. In Beijing, motor vehicle population was over 3.5 million, including 1.744 million private cars in 2007 with YOY growth rate of 19.2%.

With the rapid increase of automobile population, there will be more travel demand and more motor traffic. The development of motorization, particularly the private car, would result in some negative impact arising from road traffic congestion and the vehicle emission, as indicated by the experiences from industrialized developed countries. Therefore it is necessary for the public to understand the situation and the development trend, and to find effective and efficient solutions, which call for more effective and efficient use of the existing road capacity by use of such policy measures as transport demand management, the development of public transport and application of ITS technology.

1.2.4 The development of public transport

With the constant improvement of the road network and the improvement of public transport service, in the future, public transport will be the prevalent mode travel for urban residents, and the passenger transport of public transport will increase steadily. In 2007, the number of operating buses of public transport in PRC reached 348,000, and the total length of regular bus operating route was 140,800 kilometers, and the total passenger volume of public transport reached 55.464 billion. Owing to constant expansion of urban space and the constant development of public transport network, more information services
are needed for urban residents to understand the public transport system so as to encourage more use of the public transport. Therefore, the information service for public transport traveler will continuously increase in the future.

At present, public transport is the most important mode for travel, especially during the peak season of travel in holidays such as the golden week of the National Day and the Spring Festival. Due to the combination of various factors such as the migrant workers, students, relative visitor and tourist traveler, etc., the contribution of public transport to public travel is incomparable with any country in the world. It has a very obvious characteristic of imbalanced travel with season nature. Only the transport during the Spring Festival in 2009, the passenger volume in PRC reached 248 million, which increased by 5.6% over the previous year.

**Column 1-4: Development of public transport in Beijing**

Beijing City will further increase investment in the construction of public transport system. The proportion of public transport investment in the total investment in transport infrastructure will be up to 50% from 35% at present, so as to establish the position of public transport in daily commuting travel in Beijing. It is expected that the public transport will undertake 40% of the total travel amount in Beijing by the year of 2010. According to the statistics data provided by Beijing Municipal Committee of Communications, by the end of 2007: the public transport share of the total travel reached 34.5% and exceeded the passenger car share of 32%; the daily average passenger volume of ground public transport in Beijing reached 11.48 million with an increase of daily average passenger volume of 2 million; the average full-load ratio of each public transport route in urban area was about 70%.

In order to further improve the carrying capacity of public transport, the Government of Beijing decided to adjust the proportion of investment to public transport infrastructure in Beijing and, giving priority to the development of public transport. By 2010, the total length of rail transit route in Beijing will be up to 270 kilometers from 114 kilometers at present; the operating kilometer age of large capacity BRT in Beijing will exceed 60 kilometers, and the total length of bus priority lane will be over 300 kilometers from 140 kilometers at present.
1.2.5 Urbanization and integration of the city and the countryside

In 2007, the rate of urbanization in PRC was close to 45%, the rapid development stage of urbanization will gradually narrow the gap between the urban and the rural areas. Urbanization rate will be close to 50% in 2010 and around 55% in 2020, and urban population will exceed 700 million then. According to rough estimation, the number of annual trips per capita urban resident is 8 or 9 times that of the rural resident. With the development of social economy, the gap will narrow. Therefore, with the increase of urban population, travel and traffic volume will keep increasing.

In 2007, the rural passenger transport route in PRC reached 74,000, the number of buses was 344,000, 98.0% of towns and 83.2% administrative villages had motorized road access, primarily forming a rural passenger transport network. During the Spring Festival in 2009, the number of daily bus run for rural area reached 926,000. With the continuous development of urban and rural passenger transport in future, there will be an increase trend of greater demand for travel information service.

1.2.6 Regional economy integration and the formation of megalopolis

The development of the regional economy has resulted in the formation of Yangtze River Delta region, Pearl River Delta region, Beijing-Tianjin-Hebei region, Bohai Rim region, Chengdu-Chongqing Metropolitan Area, Changsha-Zhuzhou-Xiangtan Metropolitan Area, and Wuhan Metropolitan Area, etc. in PRC. These regions and megalopolis, especially central cities within the regions or megalopolis will be the busiest areas of social and human activities.

Regional economy integration and the formation and development of megalopolis will greatly increase the passenger and freight flow characteristic of mixed commuter and business traffic. There will be more traffic incident/accident and environmental concerns in these areas, with great demand for travel information service.

1.2.7 Efficiency of information systems

Theoretically, to build an integrated multi-mode transport system is the goal of the development of national transport system. At present in PRC, the planning of transport infrastructures for individual transport mode has been completed by relevant government departments, and construction of the infrastructures is
underway. In order to bring into full play the inherent advantages of each transport mode, the future development will stress on establishing an integrated multi-mode transport system, based on upgrading of the hardware (infrastructures) and software (management), including a high efficiency transport information system. The information system such as TISS will play an important role in realization of "zero distance transfer" and "seamless connection" between different transport modes for safer, more efficient and environmental friendly passenger and freight transport.

1.2.8 Increase the capacity of the public service

PRC governments at all levels are making great efforts in their capacity building to better perform government role and responsibility for the public service. In 2007, the MOT explicitly put forward "three services", during the process of building innovative transport industry, including "serving the people for safe and convenient travel", which is a fundamental requirement for transport administration work and a strategic emphasis of transport development. Implementation of TISS demonstration project has been taken as an important measure by MOT, PCDs and MTBs. Meanwhile, the implementation of TISS construction will facilitate the development of a convenient, safe, resource conservative and environmental friendly passenger transport service system.

The government will take the leadership in TISS development, by gradually establishing long-term sustainable TISS development and operation mechanism, based on effective policy measures promoting the stakeholders’ participation combined with taking advantage of the market mechanism.

1.2.9 Advancements of information technology

The rapid development of information technology will have profound impact on data/information collection, transmission, processing and releasing for TISS. TISS development is always supported by various technologies of hardware and software and should keep pace with relevant technological advancement. In turn, TISS development will send market signals to promote commercial activities and commercialization of TISS development and operation and the development of related product manufacturing industry.

In particular, the development of modern mobile communication technology provide important means for travelers to obtain dynamic information about road
condition, travel mode transfer information and emergency response support, etc. during travel, and will bring a revolution to the formation and development of travel information service industry to certain extent.

### Column 1-5: 3G technology and transport information service

3G is the abbreviation of 3rd Generation, which means the third generation of mobile communication technology. 3G mobile-phone is able to process multiple forms of media such as image, music and video stream, to provide multiple information services including web browsing, teleconference, electronic commerce, etc., and to support a transmission speed of at least 2Mbps indoor, 384kbps outdoor and 144 kbps during driving. PRC is a country with largest number of mobile-phone users. Through high speed wireless access, 3G technology has very wide application prospect in transport sector and is competent for the inquiry and transmission of real-time travel information. Mobile-phone will become the most important information terminal for travelers. Users can inquiry and read at any time and any place, and information linkage and data can be saved in the mobile-phone.

### Column 1-6: Two-dimensional bar code and travel information service with mobile phone

In February 2009, Shanghai Subway Operating Company applied the two-dimensional code and mobile technology of China Mobile and released a convenient information inquiring system-- Shanghai Rail Transit Roaming Guide, which is innovative. Passengers only need to log in the system platform with own mobile-phone, can they carry out self-service inquiring rail transit related information.

Markings all the stations will be included in Shanghai Rail Transit Roaming Guide. Before Shanghai World Expo in 2010, all the public transport will be included in the Guide to form a convenient and complete information service platform of the information network.

The indicating system at each of the rail transit stations in Shanghai will be
equipped with a service mark of two-dimensional code information about the station. After downloading the two-dimensional code recognition software, users can log in the web page concerning the station on the website of Shanghai Subway Roaming Guide after scanning information service mark, carrying out relevant information inquiry. The information includes: all the stops/stations along the route, the time of the first and last bus/train service; station map and surrounding map; exits of stations and near-by buildings, public transport and roads; information about the stop/station surroundings; mode transfer route/point from the origin to the destination.

In addition, users can also inquire about public transport route, train number and airline flight. Users can register and log in to set and manage own language preference, residing city and common interest point, so as to find out location, surroundings, map and route more conveniently.

The formation of the industry of travel information service will provide more timely, more comprehensive and accurate travel information for various kinds of travelers with latest technology and higher speed.

1.3 What is TISS

1.3.1 Definition

TISS is an integrated information technology system with the objectives of meeting the users’ demands for safe, convenient, cost-effective travel. This is achieved by integrating information services based on data collection, transmission and dissemination. TISS provides for the users with practical, real-time, and accurate travel information according to the user’ travel needs through appropriate and quality service.

The TISS in this report is mainly concerned with highway transport information system.

1.3.2 Classification of TISS

Based on the transport administration system and the administrative jurisdictional zonation in PRC, as well as well the travel needs of different user groups, TISS may be classified into intercity and urban TISS, with the same
technological architecture framework under different provincial communications departments' (PCDs) jurisdictions. For the user group of inter-city travelers, including private drivers and public transit users, the travel information/data source mainly comes from inter-city road and transport authorities and long distance bus operators. For the user group of intra-city or urban travelers, also including private drivers and public transit users, the travel information/data source mainly come from urban road and transport authorities and urban bus operators.

The TISS related information systems may be owned and operated by government, independent operators or other parties.

1.3.3 Relationship between TISS and ITS

TISS has a close relationship with all the eight ITS service areas under the National ITS Architecture Framework of PRC, i.e. Transport Management and Planning, ETC, Traveler Information, Vehicle Safety and Advanced Driving Assistance, Emergency Response and Security, Commercial Vehicle Operation, Integrated Transport and Automated Road System. The service areas overlap with each other one way or another, particularly in terms of data/information source and in need of coordinated data/information flow.

1.3.4 The Objectives of TISS's Development

According to the national ITS development strategies and national ITS architecture recommended in this report, a national TISS architecture
framework should be established. By integrating TISS related information resources and adopting multiple service manners, it shall meet the public's pre-trip, en-route and post-trip travel information service demands. By strengthening the system operation monitoring and the system performance assessment of TISS, public's satisfaction shall be improved and long-term operation mechanism should be established gradually. The TISS development will follow the development strategy of joint provincial and municipal TISS development, regional integration to achieve nationwide network, to promote the establishment and development of a safer, more reliable and more efficient transport information service system across the country.

By the year of 2010, each of the provinces, municipalities directly under the central government and the autonomous regions shall start the development of their own inter-city TISS under the unified development plan, standard architecture framework, and service methods. TISS shall cover all cities with population over 1,000,000 by 2015 and the user’s overage shall reach over 75% among the overall population. By 2020, the TISS providing inter-city travel information service shall be established in all the provinces and municipalities, TISS providing intra-city travel service shall be established in most cities, and the user satisfaction shall reach 90%.

1.4 Study Objectives

1.4.1 Review of existing TISS systems

Based on field survey and the literature review, comprehensive analysis is to be made on the features of the TISS practice both in PRC and aboard meanwhile the difference and gap is to be identified. Suitable solutions are to be developed to meet the demands of different users in different regions of the country.

1.4.2 Develop TISS guidelines

Systematic study is to be conducted on TISS to work out the guideline necessary for effective and efficient development of TISS in PRC on service contents, service measures, and key technologies and operation mechanism, in which a TISS standard architecture framework is included. It will work as a practical toolkit suitable for TISS implementation in different regions.
1.4.3 Recommend improvements to TISS

System operation monitoring and quality assessment system is to be established to allow the TISS administrators not only to continuously monitor the operation conditions but also to evaluate if the system can meet the user’s needs. The continuous improvement of the TISS operation performance and quality service will be materialized by effective quality assurance systems through timely communications with the stakeholders and tracking the users’ actual needs.

1.4.4 Develop standard architecture framework

The establishment of the standard architecture framework for the TISS will provide a sound basis for the standard system development. Under the guidance of the standards architecture framework, the TISS in different municipalities, provinces and regions will be compatible and will be integrated with other relevant information service systems at national level.

Additionally, the standardization will facilitate market oriented industry development and relevant standards development, which will have the effect of promoting TISS related products, value-added information service and industrial chain development so as to achieve long-term sustainable development and operation of TISS across the country.
2 Current Status of TISS Development in PRC

2.1 MOT Strategy and Policy

2.1.1 TISS development

MOT initiated TISS development during the 11th Five-year Plan period

(1) Over 2005 – 2006 the MOC provided CNY4 million for each of the pilot demonstration project to support the implementation of TISS in Beijing, Chengdu, Shandong province and Zhejiang province. From 2008, there are 14 provinces to embark on the development of TISS with financial support from the MOT.

(2) The MOC and the China Meteorological Administration (CMA) signed a Cooperation Memorandum on 27 May 2005, to jointly provide road weather information service through internet media as well as television on a daily basis combined with pre-warning weather forecast.

(3) In 2006, the MOC developed a nationwide road condition information report submission system, mainly including two kinds of information: Incident resulted from public event, which is expected to cause traffic interruption or traffic congestion more than 6 hours for expressway; or more than 12 hours for national or provincial road; Serious traffic accident with deaths and injuries or incident with very bad social impact.

Since the implementation of the road condition information report system, a total of 10,496 messages on road traffic conditions have been reported from 30 provinces and municipalities by October 27 2008, of which 9,336 are on incidents, 1,610 on scheduled events, in terms of characters of the incident; and 7,703 messages are for expressway and 2,361 for other roads. All these messages are also sent by media to the public simultaneously.

2.1.2 TISS development at provincial and municipal levels

During the 9th Five-Year Plan Period (1995 – 1999) with the improvement of the road infrastructure network condition, a few provinces initiated travel information service independently, in one way or another with limited information resources and service modality.

Since the 10th Five-year Plan period, there have been more demands for the
improvement of the government service, with travel information service listed as one of priorities for each of the transport authorities. The provincial and municipal communications departments, highway administration bureaus, as well as some of the transport service operators participated in the travel information service, by use of website and a telephone hotline. However, there is no system integration, and the users were not satisfied with the service quality.

Starting from the 11th Five-Year Plan Period, TISS was taken as part of ITS application project by the MOT with objectives of unified information and service standard across the country.

### 2.2 Main experiences of TISS development

#### 2.2.1 ITS development strategy played an important role

Intelligent Transport Systems (ITS) utilize information, communication, computer, sensor and control technologies to achieve the improvement of the performance of the transport infrastructure and service, for a safer, more efficient and environmental friendly transport system.

PRC started R&D of ITS in the 1990s and developed National ITS Architecture: Version 1.0 for 1999 – 2002 and Version 2.0 for 2002 – 2005. In 2000, the National ITS Coordinate and Lead Group was set up with main participants from the Ministry of Science and Technology (MOST), the Ministry of Communications (MOC, the predecessor of MOT), the Ministry of Public Security (MPS), and the Standardization Administration of China (SAC).

**ITS development Strategy**

Over 1996~1998 the MOC launched ITS Development Strategy Study, which formulated the ITS development program, including ITS architecture, strategic goals and objectives, standardization, major elements of the ITS and their implementation and sustainable development. And a 3-stage development strategy has been formulated.

(a) During the 11th Five-Year Plan Period (2006 – 2010), to focus on the development modality and technologies suitable to PRC situation, with objectives of the improvement of operational and management efficiency, integrated information service, dedicated short range communications (DSRC)
and relevant standards and specifications;

(b) From 2010 onwards, there will be more use of advanced electronic communication technology for the expressway system to achieve the general strategic goals of the ITS development in 20 – 30 years;

(c) In about 50 years, to materialize the goals and objectives of a safe, high efficient, environmental friendly, most competitive and integrated transport system to support sustainable social economic development and improvement of the people’s living standard.

**Organizations**

To speed up the ITS development in PRC, a number of organizations have been established at the national level, including three ITS engineering and technology research centers (for transport, road traffic and railway system respectively), the National ITS Coordination and Steering Group, the National ITS Technology Standardization Committee (ISO/TC204 China Committee).

In May 2008, ITS China was set up for ITS development planning and implementation.

**Research and development**

In the past decade, the science research institutes and universities in PRC carried out a number of R&D activities of the application of ITS in electronic toll collection (ETC), incident and hazard response system, vehicle location and navigation, automatic driving, automatic road system, transport dispatch and management system, under the national ITS architecture. The major study projects and outputs of the R&D include:

- The National ITS Architecture Framework Study, accomplished in 2001 with output of National ITS Architecture: Version 1.0, which defines the general requirements of the ITS, the national ITS architecture framework, the logic architecture and the physical architecture.

- ITS Standard System and Key Standards Study, accomplished in 2001, with the study report laying the foundation for the ITS standardization development in PRC.

Application of ITS

At present one of main areas of the application of ITS in PRC include the ETC system for networked expressway toll collection, inter-province passenger transport management, foggy road section monitoring and control, parking guidance, area public transit control, enforcement monitoring, urban traffic management, and etc. Ten cities were selected to implement ITS application demonstration projects, as shown in the following Table 2-1.

Table 2-1 Pilot Demonstration Projects of ITS in PRC

<table>
<thead>
<tr>
<th>City</th>
<th>Pilot Demonstration Project</th>
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<tbody>
<tr>
<td>Beijing</td>
<td>ITS Development Planning and Application Demonstration for Beijing</td>
</tr>
<tr>
<td></td>
<td>ITS planning for metropolitan cities is one of important theme for transport planning,</td>
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<td></td>
<td>which mainly covers three aspects, i.e. systematic study of overall planning; fundamental and essential conditions for the implementation of ITS, including traffic flow characteristics and performance parameters, road network functions and performance assessment, optimal control and simulation of traffic at signalized intersections; and pilot &amp; demonstration project. A total of 7 sub-systems of ITS were developed for optimal traffic control at signalized intersection, traffic management for Beijing Olympics, Parking guidance, Public transport dispatch, Information service platform, provide theoretical support to the ITS development for Beijing municipality.</td>
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<tr>
<td>Shanghai</td>
<td>Expressway traffic management in metropolitan area</td>
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<td></td>
<td>It is the first ITS application pilot demonstration project for advanced traffic management system implemented in metropolitan area. The traffic management system covers the Flyover Yan’an Road and 2 bridges &amp; 1 tunnel crossing over &amp; through the Huangpu river, and expressway sections, 3 separated interchanges, 26 entry/exit ramps, with daily traffic over 0.5 million; including sub-systems of data collection, traffic guidance, communications, traffic surveillance &amp; control, information sharing, etc.</td>
</tr>
<tr>
<td>Tianjin</td>
<td>ITS application in urban traffic management</td>
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<td></td>
<td>Through the pilot demonstration project, 1 center, 2 service platforms and 6 sub-systems have been developed, including CCTV intersection monitoring, traffic counting, traffic surveillance &amp; and control, Internet/WAP information service website, radio broadcasting, audio/short-message service, etc.</td>
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<tr>
<td>Chongqing</td>
<td>Safety oriented traffic management</td>
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<td></td>
<td>Including electronic traffic police system, video monitoring and control system, 122 calling system, incident &amp; accident response system connecting with traffic police, firefighting, emergency medical service, insurance company, and etc.</td>
</tr>
<tr>
<td>Jinan</td>
<td>ITS in urban transit &amp; traffic management, and traveler information service</td>
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<td></td>
<td>IT infrastructure system for ITS application in urban transport has been built, including public information sharing platform for the government departments, regional logistics management service, traveler information service website, GPS information sharing platform, inter-city bus service information and etc. A total of 1.5 million IC card for bus transit have been issued to improve the bus service efficiency and quality</td>
</tr>
<tr>
<td>Qingdao</td>
<td>ITS application in public transport dispatch and traffic control system</td>
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<td></td>
<td>A number of IT technologies have been used, including GPS, GPRS, GIS,</td>
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</table>
WAP, WEB, built-in system development technology, large scale data bank technology, for the urban traffic control center in Qingdao, for traffic surveillance and signalized control, automatic traffic data collection, incident/accident response, and etc. The first trial of the ITS application system was in January 2003 for the bus line of 501 and extended to bus line 231 in November 2003, showed the success of the pilot demonstration project. Included in the pilot project are a Comprehensive Traffic Information Management Center, signalized controlled sub-system, video traffic monitoring and automatic recording of the traffic violation case, connected with 22 traffic police stations.

Comprehensive traffic information service platform

It is an ITS application in public information sharing and service platform with functions of traffic information collection, data bank and information service system through internet, mobile-phone, or on-board terminals, etc. based on standardized format and data classification, making the travel information service available for different kinds of users.

Modern logistics information system

The System mainly includes a communication network support system, a number of management sub-systems for each of the industries and a logistics information platform, in which EDI-based logistics information platform is the core of the System, and the communication network infrastructure by use of such technology as iDEN and etc, having connected all the sub-systems with the logistics platform.

ITS application in the management of local mixed traffic

A comprehensive traffic information collection and analysis system has been established for the mixed traffic control, advanced public transit management, for the purpose of safety, more effective and efficient incident/accident response, traffic regulation enforcement, and etc, to improve the travel efficiency, public transit and tourism passenger transport service quality.

ITS for Urban traffic management, Public transport command system

All the traffic management functions have been realized through an integrated command dispatch platform based on GIS and data sharing information platform, with C/S, B/S mixed system structure, integrated with 10 sub-systems for major management and monitoring functions and with reliable hardware and software, as well as such advanced technologies as GPRS, GPS, WEB and built-in system.

Column 2-1: ITS Application Pilot Demonstration Project in City of Beijing

Parking guidance system for 8,000 parking lots in four districts, with parking information management platform

- Beijing Urban Bus Hub Station has set up bus dispatch and passenger information service system; with total investment of CNY10 million to serve for bus dispatch for 18 transit routes 600 buses.

Beijing Municipal Committee of Communications set up Information Service Website including real-time road network traffic and road work information

2.2.2 MOT Strategy provided good and policy environment

Transport development strategy priority
To apply the Scientific Outlook on Development, the MOT has explicitly included in the transport development strategy the “Three Serves” as one of objectives of the fundamental policy to develop an innovative transport industry, i.e. to serve for the development of overall national social and economic, to serve for the development of socialist brand-new rural community, and to serve for the people with a safe and convenient transport system. TISS as one of ITS application is given priority in transport development program.

**11th Five-Year IT Application Plan in Highway and Waterway Transport Development**

11th Five-Year IT Application Plan in Highway and Waterway Transport Development issued by the MOT is a fundamental document for IT application in transport sector over the years from 2006 to 2010, with objectives and main contents as follows.

**Column 2-2: 11th Five-Year IT Application Plan in Highway and Waterway Transport Development**

Development target: 40% of the provinces (municipalities), PCDs shall establish TISS to meet the travel demands of different groups;

Competent authorities for transport at provincial and municipal level should actively disseminate and apply the outcomes of the MOT pilot demonstration project of TISS to establish or improve the information service system to cover more areas and population, laying foundation for further development of TISS across the country.

**Implementation Scheme for IT Application in Highway and Waterway Transport over 2007-2008**

To carry out the 11th Five-Year IT Application Plan in Highway and Waterway Transport Development, the MOT issued a document of Implementation Scheme for IT Application in Highway and Waterway Transport over 2007-2008 with concrete tasks, which is of great significance to the development of TISS.
Provision for Road Travel Information Service

In August 2006, the MOT issued two documents of “Provisions for Road Travel Information Service” and “MOT Message Submission System Concerning Road Traffic Interruption”, for the purpose of enhancing its public service capacity in the emergency response.

Traffic observation station layout planning for national expressway network

To further improving the expressway traffic condition survey across the country, MOT organized the compilation of Traffic Observation Station Layout Planning...
for National Expressway Network in October 2008. The development strategy and relevant policy measures have created a good environment for TISS development.

**Column 2-5: Traffic Observation Station Layout Planning for National Expressway Network**

Traffic Observation Station Layout Planning for National Expressway Network set forth a 4-layer framework for the national expressway traffic survey and information service system, including Class I and Class II traffic observation stations, the expressway traffic data center, the provincial highway traffic survey and data center, the ministerial highway traffic survey and data center. The planning also includes the traffic survey indicator system, contents, the survey method, the principles and method for the layout of the traffic observation stations. According to the planning, a total of 2,148 Class I and 22,012 Class II traffic observation stations are to be established for the national expressway network.

2.2.3 Active public participation in TISS development and initiatives in its commercialization

Along with the ever-increasing demand for travel information service, the private investors have realized the potential market in TISS development. There are quite a number of TISS related products have emerged mainly engaging in the information service in static electronic map search/browsing and navigation. The market situation is just like letting a hundred flowers blossom and each of the information service providers (ISPs) trying to weed through the old to bring forth the new with more advanced and practical service. Despite the fact that the service at present is far from perfect, the users have enjoined the convenience of the information service, which has cultivated a great number of the travel information users, a foundation for commercialization of the TISS development in PRC.

**Navigation terminal unit**

In recent years, instruments for global position system (GPS) based navigation system, such as on-board units, mobile phone, personal digital assistant (PDA), were developed and available in the market. According to the market forecast made by 2007 Annual Report on China's Car Navigation Industry, the average
annual growth rate of the sales volume of on-board GPS navigation unit will be high up to 40% by the year of 2015.

According to the regulation in PRC, only those with First Grade certificate for map survey are qualified to apply for producing electronic map. At present there are only five enterprises, i.e. NavInfo, AutoNav, Changxing, RITU and LINGTU. PRC’s navigation electronic map industry has been on a fast track with each market player has its own competitive advantage, some good at map software technology and some focusing on search engine software. At the moment, there are over ten compliance manufacturers engaging in GPS navigation products. There are also overseas manufacturers trying to introduce new products sales in PRC’s market, including Pioneer from Japan and LG from Korea. Mobile phone manufacturers such as Nokia, Dopod, Samsung have declared that their mobile phone products have built-in GPS modular.

According to conservative estimation, in the year of 2007, a total of 0.4 million GPS navigation units were sold in PRC with annual growth rate over 300%. The price for GPS navigation unit may be different from a few thousand China Yuan (CNY) to CNY10 thousand, depending on quality, with total product value over CNY20 billion per year.

2.2.4 Development and Operation Mechanism

Development and operation mechanism of TISS was explored by MOT and the PCDs conducted during the implementation of the demonstration projects in
each of the pilot provinces, including fund source, the data/information system
development and operation management mechanism, with a number of
successful case studies and good experiences accumulated.

Financing

Source of fund for capital construction

- So far the fund for TISS development is mainly from provincial and
  municipal government with same subsidies from the MOC.

- At provincial level, the costs of software and hardware for TISS are
  about CNY6 million to CNY10 million, mainly for data/information
  integration and processing based on the existing data collection and
  communication network.

- There is no fund from other sources used for TISS development.

Operation and maintenance fund

- At present the fund for operation and maintenance of TISS mainly
  comes from annual financial budget of the government.

- According to the field survey, annual operation and maintenance costs
  for TISS are about 5% of that for the capital construction, and there is
  shortfall of fund compared with that from the annual financial budget.

- There is a little fund comes from commercial operation as practiced in
  individual specific city, mainly limited for operation and maintenance.

Organization and management

Capital construction management

- The capital construction for TISS development project is usually
  organized by PCDs under the guidance of the MOT. The Information
  Administration under the PCD is Project owner, responsible for the
  project management, including open competitive bidding for the capital
  construction and engineering supervision for the project.

- To ensure effective and efficient implementation of the TISS project,
  special technological support team is organized by the MOT providing
technical advices for TISS project implementation in each of the provinces.

Operation management

- The IT Division of the PCD is responsible for routine operation of TISS, including financial management, operation plan, and coordination and sub-system operation management.
- Normally the system developer and integrator for the TISS are responsible for the system maintenance in a 2 – 3 year defects liability period, and once the period is over, the maintenance would be paid service.

Data maintain and update

- The TISS operator has special team for data collection, input and update.
- The system operator and the data supplier would sign bilateral agreement on the data provision, including data quantity and quality, frequency, accuracy, and update.
- The data supplier may be responsible for data maintain and update.

The system operation monitoring and service equality assessment

Only a few provinces have undertaken travel information system operation monitoring and service quality assessment, mainly including statistics of website access, user satisfaction questionnaire survey and call center number of calls.

Website access statistics

Website access number and statistics is used for the assessment based on background monitoring technology to get total access time, the time distribution, IP source, page response time, page staying time, so as to understand the system operation, user group, user preference and etc.
Column 2-6: Statistics of the number of people visiting Beijing travel information service system website

The statistics can be used to:

Analyze the intensity of use of the website;

- analyze the time of the visit and its distribution pattern

![Graph showing page view distribution](image)

**Development trend**: more visits during the weekdays, with most visits on Mondays and Fridays, the least on weekend, about half that of the weekdays.

**Analysis**: Monday and Friday is traffic peak time for commuters and business travel and those plan to travel on weekend usually have their pre-trip plan made on Thursday or Friday.

- To analyze page-view, to get the number of visits of the web pages;
- To analyze visitor’s IP;
- To analyze the hits of one visitor.

To do web site information analysis, including page-view and percentage share.

![Graph showing page view statistics](image)

**Trend**: This figure shows the distribution of page-view for different web pages,
which may be used to analyze the visits of the travel page and navigation page.

**Analysis:** The curve shows that most people are interested in and require travel information and navigation information service.

This may be used to analyze the web page visit time distribution pattern.

This may be used to analyze website access time, including the time of day, the number of visits, and percentage shares.

Statistical analysis of average time of the website access, to assess the relevance of the information provided by the website.

**Column 2-7: Beijing Municipal TISS Website performance monitoring**

**To analyze:**

The host load capacity;

Report error statistics.

![Graph of website performance monitoring](image)
Website user satisfaction survey

Although quite a number of government websites have set online survey column, the survey is not for the travel information service quality analysis. Zhejiang and Shandong provinces are among the few provinces with online survey for the quality analysis of travel information service quality.

The online survey mainly includes the most interesting column, the satisfaction, the web access frequency, the accuracy of the information provided and etc.

Column 2-8: Online survey for travel information service quality analysis made by Shandong province

<table>
<thead>
<tr>
<th>调查项</th>
<th>本省中您最感兴趣的栏目是：</th>
<th>百分比</th>
<th>投票人数</th>
</tr>
</thead>
<tbody>
<tr>
<td>路网信息</td>
<td></td>
<td>1.82%</td>
<td>97</td>
</tr>
<tr>
<td>交通信息</td>
<td></td>
<td>1.50%</td>
<td>51</td>
</tr>
<tr>
<td>路网示意图</td>
<td></td>
<td>37.16%</td>
<td>1388</td>
</tr>
<tr>
<td>安全指南</td>
<td></td>
<td>7.82%</td>
<td>293</td>
</tr>
<tr>
<td>出行指南</td>
<td></td>
<td>6.45%</td>
<td>237</td>
</tr>
<tr>
<td>等车服务</td>
<td></td>
<td>26.48%</td>
<td>1049</td>
</tr>
<tr>
<td>航空母表</td>
<td></td>
<td>16.46%</td>
<td>605</td>
</tr>
<tr>
<td>网络搜索引擎</td>
<td></td>
<td>0.82%</td>
<td>23</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>调查项</th>
<th>您认为本省网站对您出行有帮助吗？</th>
<th>百分比</th>
<th>投票人数</th>
</tr>
</thead>
<tbody>
<tr>
<td>有很大作用</td>
<td></td>
<td>37.74%</td>
<td>320</td>
</tr>
<tr>
<td>有一定作用</td>
<td></td>
<td>53.30%</td>
<td>111</td>
</tr>
<tr>
<td>不知道</td>
<td></td>
<td>2.65%</td>
<td>6</td>
</tr>
<tr>
<td>作用不大</td>
<td></td>
<td>0.13%</td>
<td>13</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>调查项</th>
<th>您是否经常访问公众出行网站？</th>
<th>百分比</th>
<th>投票人数</th>
</tr>
</thead>
<tbody>
<tr>
<td>是</td>
<td></td>
<td>56.00%</td>
<td>149</td>
</tr>
<tr>
<td>偶尔</td>
<td></td>
<td>40.00%</td>
<td>92</td>
</tr>
<tr>
<td>否</td>
<td></td>
<td>1.96%</td>
<td>4</td>
</tr>
</tbody>
</table>
Call centre (hot line service) use

There are mainly two different modalities in the call center development and operation, i.e. in-house and outsourcing. Shandong province, Beijing municipality and Jiangsu province adopted in-house mode, with statistics data analysis of the call center utilization.

Column 2-9: The hotline (96169) utilization in Shandong

The hotline at Shandong Travel Enquiry Center started operation on July 14, 2006, by the end of August 2008, it received a total of 23,163 calls, of which 20,537 calls were about road conditions of expressway, accounting for 88.66% of the total; 1,248 calls were about pre-trip enquiry, accounting for 5.54% of the total; 491 calls asking for bus runs, accounting for 2.12%; 8 asking for airline time schedule, accounting for 0.03%; 7 calls asking for weather information, accounting for 0.03%; 3 calls asking for port information, accounting for 0.01%; 121 calls asking for national and provincial road conditions accounting for 0.52%; 698 calls for other enquiry accounting for 3.01% of the total. So real time information service on road conditions of expressway is mostly needed by the road users and should be major work of the Enquiry Center.

Figure 2-2 Percentage Share of Hotline Service Types

2.2.5 Standardization initiatives for TISS development

Under the leadership of the International Standardization Organization (ISO),
over the past ten years, a series of standardization work has been done by the Standardization Administration of PRC (SAC), MOT and relevant departments in ITS standardization, which has laid foundation for TISS standardization and development.

The standardization organizational system

- In 1992, the ISO set up transport information and control system (TICS) technical committee, responsible for the development of the standards in ITS.
- During the ISO/TC204 meeting held in Hawaii in 2001, the name of the TICS was changed to ITS technical committee.
- Under the guidance of the General Administration of Quality Supervision and Quarantine of PRC, China Secretariat of ISO/TC204 was established under the MOT in 1998.
- Approved by the National Standardization Administration Committee, China National Technical Committee of Intelligent Transport Systems Standardization (ITS Standardization Committee), with code number of SAC/TC268, was established in September 2003, as a counterpart of ISO/TC204 in PRC.

The organization structure of the ITS Standardization Committee is shown in Figure 2.3 as follows. As can be seen in the Figure, TISS Working Group in yellow is one of the working groups under the Secretariat.
Figure 2-3  National ITS Standard Committee Structure

**Standard development**

There are a number of departments in PRC are involved in the travel related standards development, including the ITS Standardization Committee (SAC/TA268), MOT, Ministry of Industry and Information Technology of PRC.

**ITS related standards**

A total of 12 travel information service related national standards have been developed; with 26 standards being developed and 45 standards to be developed, with details of the standardization development program shown in the Appendix of this report.

**Other industry related standards**

The travel information service involves quite a number of information elements in different industries and business areas, such as road, passenger transport modes, urban transit, etc. The information elements included in the standards
developed by relevant industries can be used to support the TISS. Particularly the Travel Information Basic Data Element Management System issued by the MOT includes six categories of data elements and seven categories of code sets, including those for road, road transport, ship, and etc.

In addition, the standard information elements in communications, computer technology, data exchanges, can be used in the TISS, as well as those in the general standards of products and laboratories.

2.3 Existing Problems in TISS Development

2.3.1 Main problems

Since public service has been gradually highlighted in the government agenda, TISS development in PRC has been initiated from scratch and experienced certain progress from sporadic individual pilot demonstration project of local system to systematic development. However, the existing TISSs developed by the provinces are far from perfect, with many issues to be solved including the quantity and quality of the data/information service in terms of data/information collection, up-dating timeliness, accuracy, dissemination manner, effectiveness and efficiency, not convenient for the users.

**Limited information service content**

*Survey of available information*

The study team conducted the field survey on the existing traveler information service in 31 provinces, including the available information, such as traffic and road condition, toll charge criterion, pre-trip and en-route, electronic map, time schedule, route, transit transfer options, traffic and road conditions. Table 2-2 shows the summary of the survey results. There are six provinces/regions, i.e. Xizang, Ningxia, Yunnan, Gansu, Guangxi, Hainan, without any travel related information service.

<table>
<thead>
<tr>
<th>Area</th>
<th>Roadside work</th>
<th>Tolling</th>
<th>Electronic map</th>
<th>Trip plan</th>
<th>Supportive info</th>
<th>Route guidance</th>
<th>Congestion</th>
<th>Weather forecast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shanghai</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Guangdong</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Zhejiang</td>
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<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Area</td>
<td>Roadside work</td>
<td>Tolling</td>
<td>Electronic map</td>
<td>Trip plan</td>
<td>Supportive info</td>
<td>Route guidance</td>
<td>Congestion</td>
<td>Weather forecast</td>
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<tr>
<td>Shandong</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Beijing</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Jiangsu</td>
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<td>✓</td>
<td>✓</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
<td>✓</td>
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<tr>
<td>Jiangxi</td>
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<td>✓</td>
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<tr>
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<td>✓</td>
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<td>Hebei</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Fujian</td>
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<td></td>
<td>✓</td>
</tr>
<tr>
<td>Guizhou</td>
<td>✓</td>
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<td>✓</td>
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<tr>
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<tr>
<td>Shanxi</td>
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<tr>
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<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Innermongolia</td>
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<td>Anhui</td>
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<td>Henan</td>
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<tr>
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</tr>
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<td></td>
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<tr>
<td>Qinghai</td>
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<td></td>
</tr>
</tbody>
</table>

Table 2-3 Summary of TISS Website Average Daily Visit Volume and Rank

<table>
<thead>
<tr>
<th>Area</th>
<th>IP visit [week]</th>
<th>PV browsing [week]</th>
<th>International rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zhejiang</td>
<td>2760</td>
<td>5244</td>
<td>319459</td>
</tr>
<tr>
<td>Hubei</td>
<td>1380</td>
<td>8280</td>
<td>355830</td>
</tr>
<tr>
<td>Beijing</td>
<td>4200</td>
<td>4620</td>
<td>410289</td>
</tr>
<tr>
<td>Jiangsu</td>
<td>1320</td>
<td>2376</td>
<td>541233</td>
</tr>
<tr>
<td>Anhui</td>
<td>840</td>
<td>3360</td>
<td>663605</td>
</tr>
<tr>
<td>Jiangxi</td>
<td>420</td>
<td>840</td>
<td>792075</td>
</tr>
<tr>
<td>Shanghai</td>
<td>480</td>
<td>960</td>
<td>1192036</td>
</tr>
</tbody>
</table>
Pre-trip information

By the end of 2008, there are a total of 11 provinces/cities, including Beijing, Jiangsu, Zhejiang, Jiangxi, Guangdong and etc, with pre-trip information service, six of which have electronic map display service, others with written message for pre-trip proposal.

Road traffic condition

There are 5 provinces/cities, including Jiangxi, Guangdong, Zhejiang, Beijing, Shanghai, provide road condition information service.

Information about road block caused by road work or traffic incident

There are 23 provinces/Cities provide information about road block caused by road work or traffic incident, most by use of written message. Real time updated information service is available in Beijing, Shanghai, Jiangsu; daily updated information service are available in 11 provinces, such as Shandong, Hubei; and weekly updated information service are available in 8 provinces, such as Jiangxi, Liaoning and etc.

Electronic map guidance

There are 11 provinces provide electronic map information, including Beijing, Zhejiang, Jiangsu, Shanghai, Jiangxi, Guangdong, and etc.

Road weather

Road weather information is available from each PCD’s website. Only 4 provinces/Cities provide visibility, road surface temperature, information.
Interchange

There are 6 provinces/cities, Beijing, Jiangsu, Zhejiang, Shandong, Guangdong, Shanghai provide 3-dimensional geographical information of interchanges and important road sections.

Toll charge criteria

There are 14 provinces/municipalities provide toll charge criteria information, with some giving fuel consumption calculation based on the route taken by the traveler.

Help information

There are 8 provinces/cities, including Beijing, Jiangsu and etc, provide help information such as parking lot, vehicle maintenance workshop, and etc.

Long distance bus service

There are 13 provinces/cities provide long distance bus service routes and time schedule; 7 provinces/cities provide bus station/stop information; 3 provinces/cities of Jiangsu, Zhejiang, Shanghai provide bus ticket information service. Most of other provinces/cities only provide simple text table information lack of detailed useful information.

Urban transit

Beijing, Chongqing, Shanghai provide information support for public transit mode transfer. Beijing has electronic map on internet website for users to search and browsing convenient for use. Of the provinces, only Jiangsu is able to provide province-wide electronic map information service; the provinces of Guizhou, Qinghai, Heilongjiang, Anhui provide text information service for their provincial capital city's urban public transport mode transfer inquiry.
Information service manner

According to the field survey the mostly used methods for information service include internet website, call center, radio station, and short messages.

Internet website

All the provinces have set up internet website, of which 5 provinces have specialized website for travel information service, and the others have their information service in the provincial communications department website. So far only Xizang Autonomous Region has no travel information service system.

Radio station

Radio station is mostly used and a total of 30 provinces have local traffic radio stations provide users with road traffic information in urban areas, with few intercity and inter-province real time traffic information service.

Travel related short message

There are 9 provinces that have short message information service mostly for those traveling on expressway, with such messages as incident, emergency response, weather, road conditions, bus runs and routes. However most of short message service is personalized available for limited number of people.
Call center

Call center is the most convenient method to provide information service. The following Table 2-4 lists the hotline and call number adopted by each of the provinces and municipalities.

**Table 2-4 List of Call Center of Each Province (Municipality)**

<table>
<thead>
<tr>
<th>No.</th>
<th>Province/City</th>
<th>Hotline service</th>
<th>Call number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Beijing</td>
<td>Travel information service</td>
<td>96166</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Booking taxi</td>
<td>96103/961001</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>Airport Expressway</td>
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<td>Jing-Jin-Tang Expressway</td>
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<td>2</td>
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<td>PCD information center</td>
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<td>3</td>
<td>Tianjin</td>
<td>Transport administration and taxation compliance enforcement</td>
<td>022-24539214/24539247</td>
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<td></td>
<td>Road condition inquiry</td>
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<tr>
<td>4</td>
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<td>Road bureau complain call</td>
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<td>Qinghai</td>
<td>User complain</td>
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<td>Ningxia</td>
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<td>Governor call</td>
<td>0451-82625282</td>
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<td>Transport administration</td>
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<td>PCD supervisor call</td>
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<td>Intra-province bus run time schedule</td>
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<td>Non</td>
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<tr>
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<td>Province/City</td>
<td>Hotline service</td>
<td>Call number</td>
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<td>Call center</td>
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<td>Jiangsu</td>
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<td>Expressway passenger service</td>
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<td></td>
<td></td>
<td>Traffic and radio broadcast network</td>
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<td>Transport administration complain call</td>
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<td></td>
<td>Real time road condition</td>
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<td>North Bus Station ticket sale center</td>
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<td>Southern station ticket sale</td>
<td>0591-83378054</td>
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<td>Southern station inquiry</td>
<td>0591-83322874</td>
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<td>Transit Co. inquiry</td>
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<td>Minyun Taxi Co. call</td>
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<td>Expressway first-aid and warning</td>
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<td>Chongqing</td>
<td>Complain and inquiry service</td>
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<td>Transport administration</td>
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<tr>
<td>31</td>
<td>Xizang</td>
<td>Non</td>
<td></td>
</tr>
</tbody>
</table>

It can be seen from the above table that:

- Most of the call centre numbers are too long not easy to remember.
- Only a few provinces provide real time road condition related information service.
- In addition, there is no uniform qualification requirement for the information service operator.
2.3.2 Analysis of the problems

Lack of Specific strategy and planning measures for TISS

Although TISS has been taken as one of the information application development program included in the national and the local level transport development planning. There is no specific development strategy and planning measures for organizational and institutional arrangement, such as financing modality, standardization, marketing, for TISS development, with insufficient resource input in the development and operation of TISS. Traditional project management system is not suitable for TISS project development and operation. A complicated information resource system composed of many sub-systems, involve a great amount of institutional and technological issues, including the system performance monitoring and assessment not only during the process of project development but also in the long term operation period.

Information service infrastructure system conditions is still weak

As an important part of ITS, TISS project is typical IT application project, which requires mutual support of relevant stakeholders from different fields to achieve coordinated development. The experience of the pilot demonstration TISS project showed that the information infrastructure system conditions of the relevant fields are important for the success of the TISS project.

At present the most important factor affecting the effect of TISS development implementation is the lack of dynamic information collection system, which need resource input for field equipment system. The present system is obviously in sufficient, in terms of the information coverage and the accuracy of the information collected.

So far there is no particular policy, technical standards and specifications for the purpose of improve the data/information collection capacity in the road sector. There is no financial input in the data collection system development, simply because that there is no direct economic benefit from this kind of input and still there is no sufficient input in TISS operation. The annual operation cost would account for 10 – 15% of the initial investment of TISS project after it put into operation.

At present the trunk optical cable under the expressway is used for the expressway networked toll collection only. Quite a number of PCDs lease the
broadband or optical cable system from the telecommunication department for their TISS development and operation. So there are in fact a number of cable systems in the TISS at the provincial level. The expressway optical cable system has not been taken into full use. The expressway optical cable systems between neighboring provinces lack of connection, which is an impediment to the inter-province data/information sharing and exchange.

The current data/information transmission network does not cover dynamic traffic conditions of ordinary road system. The transmissions of some of the wireless network systems adopted by some of the road sections are not stable. Highly separated information resource, in great number with variety format, complicated conditions, which makes it difficult for the information resources to be integrated for effective and efficient use. The information resource integration needs both institutional and technological solutions.

**Administrative and Institutional barriers still exist**

TISS development is in need of resource input from different government departments, including MOT, Ministry of Railway, Ministry of Public Security, Ministry of Housing and Urban-Rural Construction, Ministry of Industry and Information Technology, and etc. The segmentation of the system makes it difficult to integrate the information resource for TISS development and operation. Even within MOT there are barriers in the information resource integration, arising from segmentation of different provinces and regions. Therefore the resource integration and organizational coordination and cooperation are key issues for future TISS development and operation.

**Data/information Sharing and Exchange**

The segmentation of urban and inter-city transport administration system makes it difficult to share and exchange data/information.

Standard data/information sharing and exchange system has not been established among the neighboring cities and provinces.

At the national level there is no coordination mechanism and institutional arrangement for cross province data /information sharing and exchange for the travel information service system.
Standard System

TISS standard system is not a completely independent system, it is part of ITS standard system on the one hand and it is a system with close correlations with other standards of the ITS sub-system.

So far little progress has been made in the development of TISS standard system architecture owing to the lack of general practical and operable guidelines based on systematic study on relevant domestic and international standards.

Therefore the standards currently used by the provinces are not consistent, lack of a number of fundamental and general standards to support the standard system development.

The development of specialized standards could not meet the actual needs of TISS development due to longer work time schedule and improper work procedures with overlapped, duplicated work; so that more efforts are needed for the development of the TISS standard system.

There are two types of standard system in PRC, i.e. mandatory or regulatory standards and recommendation or voluntary standards. Most of the existing TISS related national standards are recommendation standards, rather than mandatory standards. Due to the lack of dissemination and outreach programs, the expected effects have not been achieved.

The standard system is also classified into two levels, i.e. the national standards and industry or trade standards. Most of the TISS related standards are industry standards, with limited application area and may be upgraded to national standards in due course.

PRC lacks systematic standards development plan for TISS directed toward standards development organizations, product developers, service providers, and public agencies at all levels, based on review of the existing standards, analysis of the benefits, risks and risk reduction measures, to assist the standards development and support TISS deployment.

Operation Monitoring and Service Quality Assessment

Just a few provinces have information service quality monitoring and assessment for their travel information service system. Although most of the provinces have realized the importance of the quality monitoring and
assessment, there are resource and knowledge constraints as how to effectively and efficiently use the available resources to carry out the service quality monitoring and assessment.

**Development and Operation Mechanism**

So far the financial input for TISS development and operation is from the government only for most of the provinces, this is insufficient to meet the actual demand, which is one of the constraints on TISS development and operation. Although there are direct and indirect benefits of TISS to the users, mobility and efficiency of the transport system and the environment, the market signal is not strong enough and it is up to the government to take initiatives and leadership at present to make market player to understand the effects of TISS and market potentials in the future.

So far there is no systematic market package for deployment of TISS in PRC, to identify near and long term development and deployment of TISS by taking advantages of market mechanism in terms of financing, standardization development and deployment, commercial operation of the information service, and etc., which should be included in the TISS development strategy and planning.

Given the fact that the information service has great demand in the market, there are market potentials during the development and operation of TISS, including various instruments and equipment used for the system development. At the moment the government is dominant in the development and operation of the TISS, lack of the involvement of market players. In the long run more resource inputs should be and can be from the market through deployment oriented market package design in the TISS architecture framework.

**2.4 Demand Analysis**

**2.4.1 Survey analysis of traveler demand in typical regions**

**Survey of traveler demand in Shanghai**

*Respondents*

In 2007, the Transport Planning and Research Institute of MOT and the Municipal Engineering Administration of Shanghai carried out a survey
concerning travelers’ demand on travel information service in Shanghai and its surrounding areas. 5,000 questionnaires were sent out, 3,623 were completed valid and returned.

**Question about the travel information content**

Travelers from Shanghai (sample size: 1032)

According to the result of the survey, almost all the people consider congestion situation, accident or road closure information and route map very important or relatively important, and most people think that the information of unoccupied parking space is also important.

![Figure 2-5 Survey of Daily Travel Information Local People Concerned with](image)

Travelers from other cities to Shanghai (sample size: 947)

According to the result of the survey, the most attention of people from other cities to Shanghai was paid to the map of the route along the way. Most people consider the road condition, accident and weather information along the way very important or relatively important. They paid relatively less attention to charging standard, and even a small part of people consider it not very important or not important at all. For the situation of target surroundings, most people consider scenic spots, hotels, catering and car parks very important or
relatively important and pay more attention to them.

Figure 2-5 Survey of Information the Visitors Concerned with

Travelers at service area/pump station

People who pass by the service areas/pump stations are on the way of journey or about to arrive their destination. The total sample size of the survey is 1,643.

According to the survey result, the travelers in service area/pump station are more concerned with the condition of the road ahead, if there is a road closure, any information about the road condition, accident, map, toll charge criteria and queuing length at toll stations. Most people consider the weather condition of
the road ahead to their destination, time needed to arrive at destination and the availability of parking space very important or relatively important, and they are relatively less concerned with the scenic spots and hotel information.

Figure 2-6 Survey of Information Travelers Concerned with at Service Area/pump Station
Conclusions of the survey: information demand

For information content, the information travelers most concerned with in Shanghai urban area is as follows:

- Traffic congestion situation along the way;
- Accident or road closure information;
- Map of route along the way;
- Information of parking space at or near the destination.

The information travelers most concerned with while traveling in Yangtze River Delta area is as follows:

- Detailed map of route to the destination;
- Information of hotel at or near the destination;
- Road and traffic condition information and accident information along the way;
- Information of scenic spot around the destination;
- Information of food and accommodation around the destination;
- Weather situation of areas along the way;
- Information of parking space at or near the destination;
- Charging criteria at toll stations along the way.

The information travelers most concerned at the service areas or pump stations is as follows:

- Information of road closure ahead;
- Road condition information and accident information of the road ahead;
- Charging criteria and queuing length at toll station ahead;
- Map of route to the destination;
- Time needed before arriving at the destination;
- Location of parking lot at or near the destination and parking space;
- Weather situation of areas ahead;
Service demand

Travelers from Shanghai (sample size: 1,032)

According to the survey result, private car travelers from Shanghai most concerned with the recommended travel plan. Besides, most people consider public transport transfer, dynamic guidance and short message warning service very important or relatively important.

Travelers from other cities to Shanghai (sample size 947)

According to the survey result, private car travelers from other cities to Shanghai demand more on the routing plan, public transport transfer plan and short message warning service. Most people consider the guidance service based on dynamic road condition very important or relatively important.
Travelers at service area/ gas station (sample size 1,643)

According to the survey result, most travelers stop at the service areas/pump stations consider it very important or relatively important for the service area to provide the travel information about the recommended routing plan from where they are to other places they are concerned with.
Conclusion of service detail survey

For comprehensive information service, travelers' service demand during traveling in Yangtze River Delta area is similar to that traveling in Shanghai, and the services they are concerned with most is in turn as follows:

- Routing plan suggestion for private car traveling;
- Short message warning service about incidents (including road closure and severe weather);
- Suggestion on public transport transfer plan;
- Guidance service based on dynamic road condition.
- Besides, most travelers who pass by service areas or pump stations consider the recommended route from where they are to the place they are concerned with very useful, and some travelers require to book taxi.

The information service methods

■ Pre- trip

Of the total 1,979 respondents, the sample size of the respondents from Shanghai is 1032 and the sample size of the respondents from other cities to Shanghai is 947. The result of the survey is shown in the following diagram.

![Figure 2-10 Service Methods Travelers Prefer Before Trip](image-url)
According to the survey result, before trip, the travelers prefer the four service methods as follows: television, website, broadcast and short message. In addition, they highly demand transport manual/map. Little demand is made on audio call, it is because that little service was provided and only a few people aware this kind of service.

- En route

Among the total amount of sample of 1,979, the sample size of the respondents from Shanghai is 1,032 and the sample size of the respondents from other cities to Shanghai is 947.

![Figure 2-11 Service Methods Travelers Prefer En Route](image)

Generally, the respondents prefer three kinds of en route information service methods are in turn as follows: broadcast, variable message sign and short message. Besides, they highly demand information from kiosk/touch screen with little demand on audio call.

- During driving

Survey of the service methods people need for help (sample size 1,643)
Figure 2-12 Service Methods Travelers Prefer to Get While Driving

Figure 2-13 Summary of Travelers Preferred Service Methods

- Charge of short message service

Of the total sample of 1,979, the sample size of respondents from Shanghai is 1,032 and the sample size of respondents from other cities to Shanghai is 947. As shown in Figure 2-11, about 50% of the respondents are willing to pay, most people willing to pay CNY1 per piece of message, and 10% willing to pay CNY2 per piece of message. Of people who are willing to pay, more are from Shanghai than people from other cities, and much more private car drivers willing to pay than common travelers.
Conclusion of the survey of preferred information service method

- Before trip, the five service methods travelers prefer most are as follows: television, website, broadcast, short message and transport manual/map. Few respondents demand audio call.

- En route, the four service methods travelers prefer most are as the following: broadcast variable message sign, short message and information kiosk/touch screen. The service mode that private car travelers prefer most while driving is broadcast, followed by variable message sign and short message.

- When at service areas or pump stations, the service methods private car travelers prefer most is to ask for help by mobile-phone, followed by use of roadside emergency telephone and short message. Some demand the information office at service area, and few respondents demand touch screen at service area.
For the short message charge, about 50% of the respondents willing to pay, most consider reasonable charge should be CNY1 per piece of message, 12% of the respondents willing to pay CNY2 per message.

Survey of traveler demand in Guangdong

During May~June 2008, Guangdong PCD sent out "Questionnaire of Public Travel Information Service". A summary of the questionnaire survey results is as follows.

Travel route planning

According to the survey, 98.5% of travelers would plan the route before going to the areas they are not familiar with. During the process of route planning, the preferred information service including map guidance (30.3%), journey time (16.9%) and real-time road condition (14.9%).

<table>
<thead>
<tr>
<th>Option</th>
<th>Proportion</th>
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<tbody>
<tr>
<td>Map guidance</td>
<td>30.3%</td>
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<tr>
<td>Journey time</td>
<td>16.9%</td>
</tr>
<tr>
<td>Real-time road condition</td>
<td>14.9%</td>
</tr>
<tr>
<td>Weather of the origin &amp; destination</td>
<td>13.5%</td>
</tr>
<tr>
<td>Toll road charge</td>
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<tr>
<td>Road work</td>
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</tr>
<tr>
<td>General knowledge for travel</td>
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<tr>
<td>Rescue call</td>
<td>6.7%</td>
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</table>

By-pass route when congestion

According to the survey, more than 50% of people need to acquire information about by-pass route in case of congestion, so it is necessary to provide by-pass information in time. Those who are familiar with the route do not need by-pass information, or they do not know the actual situation of by-pass route exactly and they are afraid that it would take longer time after by-passing than waiting at the scene.
### Table 2-6 Demand By-pass Route Information when Congestion

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<tr>
<td>Need</td>
<td>56.7%</td>
</tr>
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</table>

**Travel service manner**

Information service manners travelers prefer are mainly VMS, traffic broadcast, short message and service hotline. For the form of road condition information, they prefer the combination of text and map.

#### Table 2-7 Real-time Road Condition Information Service Method Preference

<table>
<thead>
<tr>
<th>Option</th>
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<tbody>
<tr>
<td>VMS</td>
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<tr>
<td>Traffic broadcast</td>
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</tr>
<tr>
<td>Service hotline</td>
<td>28.3%</td>
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<tr>
<td>Short message</td>
<td>26.4%</td>
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<tr>
<td>Vehicle terminal</td>
<td>19.4%</td>
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</table>

#### Table 2-8 Forms of Real-time Road Condition Information

<table>
<thead>
<tr>
<th>Option</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plain text</td>
<td>16.7%</td>
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<tr>
<td>Map</td>
<td>22.5%</td>
</tr>
<tr>
<td>Text and map</td>
<td>46.7%</td>
</tr>
</tbody>
</table>

### 2.4.2 User Demand Analysis

The users of TISS can be classified according to different travel modes adopted, including private car and public transit users (subway, bus, long distance bus, taxi, airplane, railway and ship) trip purpose and special user groups such as disabled, elders and foreigners, as shown in Figure 2-16.
Private car users

The private car users have their own vehicles and normally they have more requirements on travel time, route selection and travel costs. Their travel purposes include commuting, sightseeing, entertainment, visiting relatives and friends etc. Therefore, the information they are mainly concerned with include:

- Road condition and real time traffic information relating to the direction and distance of their trip routes, traffic congestion, traffic control, speed restriction, road construction, road class information (expressway, urban expressway, high class road, ordinary road sub-standard road or incident information and accidents;
- Weather information, such as the rain, snow, wind, fog etc.
- Relevant service en route, including expressway service area, gas station, repair and first-aid, food and accommodation, and tourism information;
- Travel cost: toll charges of the roads and bridges, fuel consumption and the cost.

The public transport operators, including short/long-distance bus, tourist bus, chartered bus, are more concerned with the real-time traffic situation, weather,
roadwork and incident information and their impact on the bus operation schedules.

Truck drivers are more flexible to choose their trip routes and time apart from hazardous goods transport operators need to strictly follow the time and route as specified by traffic management department. Similar to the above types of travelers, the truck drivers are also concerned with traffic, weather, and roadwork and incident information. In addition, they are more interested in the information of road and bridge toll charges, the service along the way, and other traffic control such as the limits on height, load and traffic.

**Public transit users**

There are different kinds of public transport modes for the travelers to choose, which include long-distance bus, short-distance bus, touring bus etc. The factors affecting travelers’ trip plan include travel time, service, route and cost, with demands on such information as bus station and stops, time schedule, ticket price, lost and found service etc.

*Intercity bus travellers*

Intercity bus travelers are concerned with the bus operation relevant information in order to plan their trip accordingly, which include the location of station and stops, ticket-selling spots, interchange stations, bus operator information, service information such as route, time schedule, price, vehicle type, available seats information, transferring, traffic control measures for special public event and temporary service change information etc.

*Urban transit passengers*

Urban bus travelers are mainly concerned with the information relevant to bus route, including route type, origin and destination and stops, first and last bus departure time, schedule, ticket types and prices, transferring stop information, newly open route, and the route adjustment and extension, traffic control measures for special public event and temporary service change information etc.

**Railway, airplane and ship passengers**

Now passengers can access comprehensive information of railway and aviation via their independent information service system, including railway station or
airport information, train or flight ticket price, departure and arrival time, flight or mode transfer and etc... And they are also concerned with temporary change information of trains or flights, in order to make sure that they can adjust their trip plan in time.

Vulnerable and special groups

In terms of the special group, such as the elders, the weak, the sick, the disabled, the pregnant and foreigners, in addition to basic travel information, barrier-free facilities information, barrier-free route information, barrier-free bus and taxi information, wheelchair information and video, character, Braille for arrival time on the bus stop shall also be provided. The characters displayed shall be amplified and provided with Chinese-English conversion functions on the website or touch screen, etc.

2.5 Summary of the Analysis and the Key Issues

2.5.1 Summary of the analysis

At the moment the PRC is at a critical period for TISS development, with both opportunities and challenges. PRC has the largest transport network system and the most traveling public in the world. During its industrialization, urbanization and market oriented economic system reform process as well as globalization process, there will be more travel demand, which has become a great impetus to the TISS development. Still the development mindset will have to be upgraded based on the experiences and lessons learnt from domestic and international good practice, while seeking to explore its own TISS development modality suitable to PRC situation.

Computerized network combined with modern information and communication technological advancement and related industrial technology and product provide fundamental condition for TISS development. TISS related industry is preliminarily being in shape, thanks to the outcomes of R&D and pilot and demonstration project. Therefore industrialization of TISS development is promising.

However, there is a long way to go for TISS development in PRC, some basic issues mentioned above need to be dealt with seriously, including the infrastructures related development for the data/information collection, maintaining and integration of the data sources, standardization, effective policy
measures for financing, marketing, innovative solutions, etc., which call for more efforts and resource input.

2.5.2 Key issues

The key issues for TISS development should be as the following.

Architecture Framework and ITS standard Architecture

In review and assessment of the China ITS development strategy and the result of policy implementation, it will be necessary to clarify the importance and function of TISS within the whole ITS Architecture Framework. As one of the key components of ITS the construction and management of TISS should not only follow the standard architecture, it is also important that there are some specialized service needs and interfaces that have to be taken into account for the TISS to be inter-connected and integrated with other components within the ITS Architecture Framework and in need for policy and regulatory arrangements.

Stakeholders’ initiatives and synergy efforts

TISS involves the integration of data/information from a number of stakeholders’ daily work/operations according to the actual needs of the travel information service for different users. It is important to have a consistent approach to the level of information that will be made available to the general public from the stakeholders. Therefore, we strongly recommend that mobilization and organization of the stakeholders should be initiated at the very beginning of the TISS development.

Technological consideration and implementation measures

Data/information communication and integration is essential in providing ITS/TTSS services to a wide range of users, which needs effective and efficient technological solutions. These solutions include but are not limited to:

- A strategy to maximize the use of the existing (and planned future) communications infrastructure;
- Compatible hardware and software that is based on detail;
Long-term efficient maintenance and operation mechanism

Given the comprehensiveness and complexity of the TISS, factors that influence the long term sustainable development should be taken into account in the development, implementation and operation of the TISS programs. To ensure financial sustainability, public funds will be used by the public agencies to benefit all travelers equally. Private funds (and fees) will be used to supply additional “value add” services to those individuals willing to pay for those services. The TISS architecture should be designed not only to support the introduction of new technologies, but also to incorporate advances in technology to provide higher levels of system integration and performance.

Supervision and performance monitoring and evaluation system

The system operation quality and performance monitoring/evaluation and report system should be included in the TISS implementation and operation process, based on organizational and institutional arrangement, to make sure continuous improvement to accommodate increasing level of system integration.
3 International Experiences

3.1 Concept and Planning

3.1.1 TISS Architecture

Many countries have implemented TISS in different system architectures due to different main development bodies and service objectives. However, most systems mainly comprise of three common parts: Data Collection, Data Processing, and Data Dissemination.

Japanese Vehicle Information and Communication System (VICS) architecture

Since VICS's first development in Japan in 1991, it has become one of the representative Traveler Information Systems worldwide, including four sub-systems, data collection, data processing and editing, data providing, and data utilization.

![VICS Architecture Diagram]

The National Traffic Control Centre (NTCC)

NTCC based in the West Midlands is an ambitious telematics project aimed at providing free, real-time travel information. It is for road users and national agencies in England's network of motorways and trunk roads, allowing them to plan routes and avoid congested areas.
TISS of NTCC contains data collection, central data analysis and processing, and data dissemination.

Revelation for China TISS development – architecture based on data collection, processing, and dissemination

- After reviewing overseas TISS experiences, its key portions include: data collection, data processing, and data dissemination. For domestic TISS system development, it is suggested to build the framework referring to the above three key portions; and personalized architecture should be adopted according to the requirements for different regions.

- For the development of data collection subsystem, according to different geographic environment, the suitable collecting approach and communication method should be applied to guarantee the safety of information.

- For the data to be collected, the existing transport facilities should be used adequately; meanwhile, increase the scope and intensity of dynamic information collection. It is advised that take better use of data from relative organizations, fulfill the data communication, and reduce repeated investment on the system.
For the data processing part, different service requirement of each region shall be considered, and more practical information services shall be offered to the public.

For the data dissemination part, various methods shall be adopted, combining with Internet, Call center, radio broadcasting, and VMS to expend the scope of traffic data dissemination. The implementation of Call center can be a good choice for its applicability and convenient service method.

Additional services of traffic information are required to enhance investment recovery capability, reduce financial pressure of daily operation, and increase sustainability of TISS development.

3.1.2 Development Concept

After many years input on large scale infrastructures, the developed countries and some developing countries gradually realized the increase on operation efficiency brought by simple repeated input on infrastructure were slowing down.

With the change of the management concept and the technology improvement, the construction manager more and more recognized that the information technology will assist to increase the efficiency and effectiveness dramatically.

Built upon research results in a large number of ITS projects and basic data accumulated, a mature effectiveness estimation system is taking a shape.

Whatever the decision-maker (councils), public management sectors or private organizations are passionate on the development of ITS based on the understanding of the importance of ITS development. The benefits to be brought by ITS deployment just match the requirements to their responsibilities assigned. Therefore, relevant organizations have the common interest, but not too much interest of their own under the achievement estimation system. Varies of ITS projects were developed rapidly in those countries, which laid the foundation of the TISS development in those countries.

However, it is a common phenomenon that in China a lot of transport authorities are happier to see the immediate benefit brought by the road infrastructures input because this will reflect their political achievements. On the other hand, there is no benefit estimation system established for ITS project to estimate the
benefit so that the government authorities are not passionate to implement information systems inclusive of TISS.

3.1.3 Strategic Planning

In many developed countries in the world, some small scale TISS initially appeared naturally with the development of society needs and technology, which met the travel demands of that moment. However, with the gradual increase of cross regional and cross mode travel demands, shortcomings in the existing systems have been exposed, such as difficult to expand, lacking of communication between systems. In UK, Japan, USA and Australia governments have unveiled policies and strategies to support TISS implementation in their own countries. The key functions of each government in its TISS planning and development include the following main aspects:

- To create a TISS development policy
- To create TISS development and operation guidelines for the whole nation, including system framework and standard frameworks.
- To create key projects investment, financing and cooperation policies and investment in key projects.
- To create national project implementation plans

USA 511 system planning

In 2001, the American Association of State Highway and Transportation Officials (AASHTO), in conjunction with many other organizations including the American Public Transportation Association (APTA) and the Intelligent Transportation Society of America (ITS America), with the support of the United States Department of Transportation (USDOT), established a 511 Deployment Coalition Plan. The goal of the Coalition is “The timely establishment of a national 511 travel information service available to a majority of Americans by 2005 that is sustainable and provides value to users.” In order to implement this plan, USA set up a government policy committee and supporting group in an operational level, which include relevant government organizations, relevant departments from communication industries, consultants, system integrators, and information suppliers in traffic information service area.

Under the unified planning and guidance, 511 system in each State adopt unique function definition, data construction and communication protocols,
achieve data sharing, and gradually become a national TISS in USA.

**Japan travel system planning**

In July 1996, five relevant government institutes in Japan (National Traffic Office, International Trade and Industry Department, Transportation Department, Post and Telegraph Department, and Construction Department) developed the ‘Japan ITS General Strategy’; in which, 21 user services are described and several areas are related to TISS.

Under the structure of Japan Construction Department, Police Department, and Post and Telegraph Department, more than 200 corporations and organizations took part in the system planning and implementation working together to set up a detailed implementation plan. The plan includes implementation methods for key areas to be rolled out over several stages, system development function definition and technical criterion, and regulating data provider media approach for gradual expansion.

**UK travel system planning**

In 2000 Transport 10 Year Plan issued by the UK Transportation Department, one most important strategy in integrated traffic policies was mentioned—information is the key for a perfect integrated traffic system. “A suitable travel approach can be chosen from public transport and personal transport tools based on a public traffic information service; this new integrated traffic information service is called ‘Traffic Guidance System’, and everyone can use it conveniently by accessing relative websites.”

The UK’s strategies contain a detailed national TISS implementation plan. Transport Direct was selected and appointed to deliver the aims of the strategy, which provides all traffic modes travel plans and ticket booking services based on a real time information service system using a huge amount of historical data. This website was officially launched in December 2004. The Government’s main contractor is tasked with setting up the implementation approach and direction, and to provide standard support and road facilities.

**Revelation for China TISS development – Planning and promotion strategies**

**Strategy planning**

Overseas’ experiences show that governments play an essential role in TISS development. In PRC, government has already realized the importance of
establishing a national scale TISS construction documents (such as System Framework, Standard Framework, and Estimation System etc.).

*Promotion strategies*

The common of each nation is to set up phased implementation plan and invest step by step. This is extremely true for a nation like PRC. The pilot demonstration projects shall be set in some cities and regions with urgent requirement of TISS, then surrounding areas can be developed and fulfill the integration among regions; eventually extend to a national TISS network management and operation.

### 3.2 Coordination and Execution Organization

TISS development and operation shall involve a number of public and private sectors. In order to solve the problems of inefficient coordination among different governments departments, different areas and different levels, a coordination organization need to be established to coordinate the relationship among different parties. Further more, an execution organization which directly belong to it need to be established which will be in charge of the management of system development and operation.

Designated on 21st July 2000, 511 is currently the largest TISS system in the United States. In order to promote the development of 511 system in wider areas in the country, the American Association of State Highway and Transportation Officials (AASHTO), in conjunction with many other organizations including the American Public Transportation Association and the Intelligent Transportation Society of America, with the support of the USDOT, established a 511 Deployment Coalition. A policy guidance committee established in the management level was in charge of the compiling work of development guidance, under which a work group took the responsibilities of guiding the system development as an execution organization.

The VICS Center, a non-profit organization is responsible for the operation of VICS, which is managed by VICS transport committee established by five relevant government departments in Japan (National Traffic Office, International Trade and Industry Department, Transportation Department, Post and Telegraph Department, and Construction Department) and some relevant private sectors.
Midlands Advanced Transportation and Telematics Information System and Strategies in Europe (MATTISSE) is a unique system, originally conceived and developed by a consortium of eight Midlands Local Authorities and private service operators. It integrates systems belonging to operators such as Police Control Centers, The Highways Agency’s Regional Control Centers, the National Traffic Control Centre (NTCC), Urban Traffic Control (UTC) Centers, LA’s and Public Transport Operators, to provide fully integrated traffic and travel information.

SIRIUS is a highway system to provide guidance information and manage the traffic for Paris highway network managed by SIER which is formed by a number of relevant departments appointed by French Ministry of Transportation and Communications.

3.3 Investment and Development

3.3.1 Multiple investment and financing channels

TISS is normally considered as a non-profit service with social and public benefits such as improved traffic situation, social benefits and environmental benefits. Therefore, from an international view, TISS project investment mainly depends upon government funds. Especially in the first stage of development, central government funding and local government financing are broadly adopted.

Central government investment

Nearly all national governments increase their investment on TISS development. For instance, Australian government has increased investment on ITS field. AusLink is a national TISS project funded by the Australian Government. Transport Direct is a national TISS project planned by UK Transportation Department with investment from London Traffic Office.

Local government financing and private investment

Although TISS is a non-profit service, information is a valuable product in the commercial mode. Therefore, many governments in developed countries create attractive financing policies to introduce private fund, technology, and management into TISS development stage. This is not only to solve the capital issue, but also motivate the initiative of corporations, accelerate adoption of new technologies and improve the overall system technical skill and travel
service level.

**USA 511 system investment and financing mode**

The 511 system is a traffic information service project planned by USA Transportation Department. It is subsidized by non-federal government with non-compulsory regulation from the federal government. Detailed formulation is totally established by the State and local related institutions or operation businesses. The costs of 511 system mainly include manpower, equipment and data update, communication and marketing expenses. Each State develops its service independently by adopting suitable financing channels, and private organizations are encouraged to provide appreciation services. Advertisements and patronage are accepted as well.

**Japan VICS investment and financing method**

Japan has chosen an approach that combines government and private enterprises. On the operational manner of VICS, enterprises are provided with incentives that accelerate Japanese ITS study, development and implementation. In 1995, nearly 2000 billion Japanese Yen was invested into automobile navigation hardware and VICS infrastructure, and accounted for 5000 billion Japanese Yen in 2005. The VICS Centre (corporate body) is a public institution service body based on a service provider system combining government and non-government, and responsible for VICS implementation, management and operation. The development cost comes from government and related enterprises, including VICS on-board equipment manufacture and sales companies and system infrastructure.

### 3.3.2 Develop Step by Step and Gradually Integrate

The TISS development experiences of overseas developed countries, such as the USA and UK, are that they all basically experienced a process of pilot project, regional development, integration between regions, to a network system covering the whole nation. This progressive strategy helps to summarize experiences, solve the exposed problems, adjust strategy accordingly, and guarantee the successful implementation of project.

Based on this progressive strategy, the most essential issue is to set a unified development plan beforehand. Under this bottom-up development method, a unified standard must be set since the efficiency of regional resource
introduction is based on maturity of fundamental condition.

**USA 511 system development mode and exposed problems**

Take the USA 511 system for a case study, in the first stage of planning, the FCC ruling nearly all implementation issues and schedules to State and local agencies and telecommunications carriers. Each State gradually realized the benefits of providing travel information, and started to implement 511 System. Until now, 33 States and 2 special Districts have built 511 System. The 511 Deployment Coalition recognizes that 511 services will be developed in a bottom-up fashion by State and local transportation agencies – with the close collaboration of the private sector – establishing services in areas and timeframes determined by them.

With the development of 511 system, the extent of differences between each State’s 511 systems is obvious due to the lack of an unified regulation requirement. These differences are reflected in the types of service supply, quality of service, and cost of system development. When traveling cross region, traveler can not obtain the same standards and quality of services; therefore, complaining about 511 system increased. Under this situation, consistent with the national designation of 511, the FCC expects that the transportation industry will provide the traveling public with a quality service that has a degree of uniformity across the country.

**Revelation for PRC TISS development - investment and development Organization**

From the overseas' experiences, it is reckoned that under the domination of government, a committee or executive institution including all levels of government institutions, academic institutions, consultant, integrators, and service suppliers shall be built to achieve a network operational management from city, province, to whole nation; the establishment of regional operation center enhances cooperation between regions and different traffic approaches. Setting up detailed implementation plan, organizing the study of relative technical problems, establishing instructive documents, authorizing relative standards, cooperating with relative system suppliers, and setting up investment and financing strategies not only motivate relevant enterprises, but also promote the development of TISS in PRC.

**Investment**
From the overseas experiences, investment on building national TISS is huge; not even one country has invested whole scope of fund by government. For investment type, the experiences shall be learned from overseas as well; the government provides appropriate founds at initial stage, and multiple funds are introduced gradually to support later operational management and upgrade, such as media advertisement, system suppliers, operation companies, terminal manufactories and sales companies etc.

3.4 Available Information and Service Methods

3.4.1 Data collection

The contents and methods of TISS data collection are various; they differ depending on different system service objects. Mainly, they are divided into the following types:

Traffic information

Since the services scope of TISS covers highway, urban road, public transport, maritime transportation, and civil aviation, the contents and methods of data collection are not the same.

Relevant traffic information

In addition to system traffic information, traffic data of the whole city such as surrounding road networks and relevant systems are required for development of a TISS system. The collection methods are mainly through sharing information with appropriate departments (such as the Police Bureau, Road Bureau, and Transportation Office) or public databases.

Other relevant information

Weather condition is an important issue that affects traffic, which has been incorporated into traffic data collection in international TISS systems.

3.4.2 Available information

Amount of attention has been paid to public transportation services worldwide, and many countries have developed relevant studies and practices. There are various service types for traffic information services.

Public traffic information

Urban public traffic information, relevant public transport operators’ conditions
and contact telephone numbers are included, and provide ticket information, ticket sales, service information board, parking information, vulnerable and particular groups’ travel information hotline, lost and found, and ferry time schedule etc.

**Weather information**

The system provides weather information through telephone and Internet, which include each section and area’s current and forecast weather situation, wind speed, temperature, severe weather, and dry/wet condition. The forecast information can be provided up to several hours before.

**Warning information**

Traffic event information includes description, location, direction and scope, lasting time, distribution suggestion. All users that dial into the system can hear this kind of orange warning information before accessing to other services. On the website homepage, this information is normally delivered as a clicking voice or flickering cursor.

**Travel information**

The system can transfer clients’ telephone numbers to transport operators to provide relative tour information and even to connect to travel agencies. Some States also provide National Park tour activities, university sports games, concert theatres, local festival programs, conferences, and other activity information. Meanwhile, the system connects to air and railway companies’ service hot lines.

**Infrastructure information**

Including area information, city information, traffic infrastructure information, traffic auxiliary facility information, and local traffic service information.

**Traffic condition information**

Including traffic condition information, road construction information.

**Personal travel information services**

In addition, the system provides personal traffic information services, including parking guidance and instruction, inner-region information, driving direction, public transit travel plan, multi-mode route and travel plan, muster service, and traveler aid information etc.
3.4.3 Service methods

There are various service methods to disseminate the travel information, mainly including:

**Internet website**

The Internet is increasingly popular. The utilization of the Internet to provide traffic information services has been accepted by many nations. When travelers wish to obtain relevant services through telephone, Internet, and other means, those popular websites can always provide answers to frequently asked questions.

Existing websites provide road condition reports, travel plan services, weather information, traffic condition monitoring images, special site information, and links to public transport websites. On the website, maps can be enlarged and road situations are shown with color sign, as well as using special sign for road construction situations and popup word descriptions for explanation. Websites can provide regional maps for clients to choose travel start and stop points, and then the system can calculate the travel time for the journey. The website provides highway traffic flow image and the city’s traffic flow map.

**Call center**

It is extremely important for service systems to combine wire and wireless communication. Existing local telephone offices are utilized to provide communication services with a reasonable fee. Note that some large companies have attempted to negotiate for necessary labor and equipment expenses to build a call center.

**VMS**

VMS is suitable for providing dynamic information during a trip. Dynamic traffic condition, traffic accident, disaster weather, road closure information due to rain and snow etc. are distributed in real time through VMS. Traffic information dynamic dissemination system provides different information according to different type of vehicles.

**Broadcast**

The benefit of broadcast dissemination information systems is to extend the scope of information communication, increase the coverage level of traffic information dissemination, and improve the traffic guidance and instructions
efficiency. The public can easily obtain real time road condition information just by turning on the radio, which solves the problem of VMS setting location and density limitation.

**Column 3-13: Revelation for China TISS development – service scope**

It is absolutely an ideal goal for the national scale TISS development to provide integrated traffic information of all kinds of transport mode (including highway, civil aviation, railway, taxi, public transport etc.) nationwide scope, and allow clients to compare and select from those mode. However, overseas experiences show that, they all go through from simple to complex processes, which is decided by system investing scale, social recognition, and development complexity.

### 3.5 Operation and Management

#### 3.5.1 Government cooperation

Government-enterprise cooperation model is the mainstreaming in the overseas TISS development experiences. The governments of the developed countries invest the public financial funds into the construction of information infrastructures and the development of standard system. The information service including public information service and profitable services are operated by competent enterprises, which are decided by competitive selection. The government present information to those operators for free, and tax rate is zero or very low for the service operation in the early stage to assist the development of the system. In the late stage, the governments charge for higher tax to increase the economic income, and invest part of the profit into the information infrastructure expansion.

Travel Information Highway (TIH) is a multimodal travel information exchange platform developed and promoted by the UK Government for the exchange of travel data using a common framework over the Internet or over private networks. The Department of Transportation, UK assigned the design, development and ten year operation contract to TiS, the consortium comprising TCC Co, Serco Limited and Serco Limited’s sub-contractors. The government authorized TiS to collect traffic data of highway network to provide public travel information service, and promised to support the system operation on the policy level before 2011.
TRAFFICMASTER is a traffic information service provider who provides high-quality navigation, traffic information and vehicle tracking services in UK. The TRAFFICMASTER is the most successful profitable TISS project in Europe by the close cooperation among the government departments and enterprises. The public and private organizations which are involved in this project include Department for Transport (DFT), Highway Agency (HA), Transportation Research Institute, information technology enterprises, telecommunication companies, and vehicle manufactures.

For the VICS of Japan, the government are responsible of the data standardization, and the private enterprises develop and sell the on board intelligent unit.

The Big Server Plan in France integrates the data of all the database servers of traffic authorities in Paris into a central database. The private service providers can use the data under the authorization issued by the management authority of the Big server, according to a protocol on tax, data format, data accuracy and access conditions etc. In return, the public management authority are able to use the Commercial data of the private service providers for free on the public traffic management.

In China, most of TISS are developed and operated by the government at present. Under this mode, it’s hard to improve the service quality for lack of input of the market resources.

3.5.2 Data-sharing mechanism

Regional interoperability is both an interstate and intrastate issue, of which a data sharing mechanism is one key issue when building a countrywide TISS. Data sharing overseas faces similar problem as we do; in one hand, pre-plan and key standards are reinforced, in another hand, the role of data sharing cooperation is identified for they are in the highest level of TISS implementation. Therefore, they have the following suggestions:

- The inclusion of the travel information on a system outside of the local area is one that the receiving agency should weigh on its own.
- Based on data analysis, consider how to include their information for callers to the State system either through data sharing or call transfer.
Implementation institutions are responsible for cooperation between surrounding areas’ TISS implementation, and who shall be engaged to deal with the data exchanging issue in a two-way, or in some cases, multi-way dialogue.

In terms of special or essential information, such as early warning information, shall be distributed to whole nation through high-level executive body.

3.5.3 Operational mechanisms

The TISS operational mechanisms in Japan, UK, USA, and all developed countries have the following features:

- The aim of the operational mechanism is to guarantee and improve service quality;
- Professional executive institution is established or assigned to manage TISS;
- Variety of operation fund sources, such as government, private organizations, service beneficiaries, media support, and additional services incomes.

3.6 Relevant International Standards

3.6.1 TC204

In 1992, ISO set up Technical Committee 204: Intelligent Transport Systems (TC204), formerly known as Traffic Information and Control System, which is responsible for the international standardization of the Intelligent Transport System. In terms of the form of organization, ISO/TC204 sets a Secretariat, 16 Working Groups and member countries. With the development of the demand of ITS standardization, 4 Working Groups were regrouped. The Working Groups are described as below:
The above Working Groups studied two levels of ITS standards: common standards and sub-system standards. WG1 (System Architecture), WG2 (Quality and Reliability Requirements), WG3 (Database Technology), WG15 (Dedicated Short-Range Communications), WG16 (Wide Area Communications/Protocol and Interfaces) studied common standards that can be applied to sub-systems including Traveler Information System. WG10 (Traveler Information Systems) focused on Traveler Information System and establishment standards.

3.6.2 CEN/TC278

European Committee for Standardization: CEN/TC278

In 1991, CEN set up TC278 (Technical Committee 278: Road Transport and Traffic Radio Communications) in Europe to promote the establishment of standards similar to ISO/TC278.

CEN/TC278 also set up 15 working groups. WG13 (Architecture and Terminology), and WG15 (safety) studied the standards on the common level. WG4 (Traffic and Traveler Information) established detailed standards on Traveler Information Systems. ISO/TC204 and CEN/TC278 stand to the consistency of their standards under the Vienna Treaty. With regards to
Traveler Information System, the latter takes the lead in the establishment of relevant standards. In addition to the ISO standards mentioned above, CEN/TC278 established standards on Traveler Information Systems (see the Appendix).

3.7 Quality Evaluation

3.7.1 Evaluation methods

Any evaluation of a program shall include one or more of the following three components:

- Program activities and resulting measures;
- Outputs of the process or program;
- Outcomes or impacts of the process or program.

These three components shall be linked in a causal fashion. All program activities shall be directed towards achieving the program outputs. In turn, all program outputs shall be directed at achieving the desired outcomes or impacts. These components may not be mutually exclusive as evaluative measures may reflect both outputs and outcomes to varying degrees.

The following figure demonstrates the user satisfaction evaluation model:

![Figure 3-4 User Satisfaction Evaluation Model](image-url)

- **TISS**
  1. Data Collection
  2. Data Fusion/Developing Advisories
  3. Information Dissemination
  4. Marketing
  5. Management and Coordination
  6. System Deployment
  7. Record Keeping
  8. Evaluation Support

- **Outputs**
  1. Telephone Service
  2. Website Hits
  3. Email Service
  4. User Intentions
  5. User Characteristics
  6. Impact of Advisories on Demand Management

- **Outcomes**
  1. Info Accurate
  2. Info Useful
  3. Info Saved Time
  4. Easy Access
  5. Polite Response
  6. Complaints
  7. Impact on Incident Management
  8. Cost Effectiveness Analysis
3.7.2 Evaluation Indicators

In different evaluations, the following indicators are often used:

<table>
<thead>
<tr>
<th>No.</th>
<th>First grade indicator</th>
<th>Second grade indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Production</td>
<td>Visitor quantity</td>
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<tr>
<td></td>
<td></td>
<td>Income telephone quantity</td>
</tr>
<tr>
<td>2.</td>
<td>Flexibility</td>
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</tr>
<tr>
<td>3.</td>
<td>Efficiency</td>
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</tr>
<tr>
<td>4.</td>
<td>Utility rate</td>
<td>Number of incoming calls</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Number of website accessing</td>
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<tr>
<td></td>
<td></td>
<td>Use of specific services</td>
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<tr>
<td>5.</td>
<td>Accuracy</td>
<td>Reported vs. actual driving times</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reported vs. actual incidents and slowdowns</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Accuracy of entered incidents vs. CHP reported incidents</td>
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<tr>
<td></td>
<td></td>
<td>Timeliness of incident reporting</td>
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<tr>
<td></td>
<td></td>
<td>SOP compliance during major incidents (post-incident audit)</td>
</tr>
<tr>
<td>6.</td>
<td>Reliability</td>
<td>System up-time</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Website responsiveness</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Downtime per year, meantime between failure</td>
</tr>
</tbody>
</table>

3.7.3 Evaluation methods

Generally, several main methods shall be applied to realize the whole evaluation process: Focus group, Web survey, Phone survey and Awareness survey etc. One or more methods shall be adopted during evaluation process.

After survey, a data analysis process shall be used to recommend a system operation based on the analysis results.

Phone survey

Phone survey is to determine if the phone system is achieving acceptable customer satisfaction levels, as well as what effects the service has on user behaviors.

Sampling Strategy

It is essential for Phone survey methods to choose a proper sampling.
Generally, three methods are widely deployed in Phone survey: Real-time Participation Survey, Random Number Selection, and Telephone Invitation Survey.

- Real-time Participation Survey: Normally, callers are required to choose whether or not they are satisfied with the service.

- Random Number Selection: A random number list is generated from all telephone numbers in a given sampling area. The main limitation with this strategy lay in the fact that some are caller ID blocked and substantial privacy concerns.

- Telephone Invitation Survey: Deployed through automated message informing users of the survey and the monetary incentive the caller would receive to participate. If callers are interested in participating in the survey, they leave their name and phone number. Then the phone survey team members call the participants back and conducted the survey.

**Sampling Frame**

Before taking the sample, the sample size shall be determined. Based upon a 95% confidence interval, maximum variability and a + or – 5% error rate for a large population; a minimum sample size shall be produced according to the factors of population amount, gender structure, age structure, occupational characteristics, revenue characteristics, and incoming response rate etc. Meanwhile, the duration of sample choosing shall be clarified.

**Web survey**

Web survey is to identify whether or not the website meets users’ demands and achieve users’ satisfaction.

Normally, non-probability sampling is adopted in the Web survey, that is to continually distribute an open, unlimited, optional web survey, and all website visitors are invited to participate. In the survey, respondents are required to answer questionnaire within 5 minutes.

**Focus group**

The primary purpose of a Focus group is to gather information that can be used to enhance and refine the Phone survey. Information gathered focuses on what information travelers desire and what sources they use to obtain it, as well
as decision-making factors during travel, cell phone usage and awareness of the system. The main questions covered in the focus groups are:

- What types of information do travelers use pre-trip and en-route?
- What sources do travelers use to get this travel information?
- How does this information affect their travel decisions?
- How many people travel with cell phones, and how do they use them while traveling?
- Are travelers aware of TISS?
- What information do travelers want available on 511?
4 TISS Architecture

4.1 General Architecture

Network platform layer is fundamental for data communication and exchange. TISS should take advantage of the existing information network and available communication means to ensure the data collection, transmission, exchange and dissemination in an efficient and steady way.

4.1.2 Software and hardware supporting layer

Software and hardware supporting layer comprises hardware equipment and
system software. Consideration should be given to make full use of existing hardware and software, select high quality application server and database server, storage equipments etc, with good performance and large capacity, suitable for future development needs, combined with supporting software, middle ware, data analysis software and GIS software used to establish application support environment.

4.1.3 Application system layer

This layer is composed of a set of application software system. TISS shall be developed based on uniform software architecture and uniform information coding system, to enhance multiple-use function of the software components in order to improve the development efficiency and reduce the develop cost.

4.1.4 Data exchange platform layer

As one of the most important component of TISS data center, data exchange layer provides a data integration, exchange and sharing service platform for each of the local, regional and departmental agencies with uniform data access as well as data synchronization, exchange and integration. It is also capable of materializing the data exchange for heterogeneous data sources, and providing support to the data collection, integration and transformation.

4.1.5 Data resource layer

Data resources layer is another important component of the data center, comprising database and data warehouse. TISS database are composed of basic information database, subject database, model database, knowledge database and evaluation database etc. The main functions of TISS data warehouse are extracting relevant data, to materialize mass data storage and management.

4.1.6 Application presentation layer

Application presentation layer is unified and integrated portal of TISS, which comprises multiple interfaces for end users, including website, call center, SMS platform and information display terminals (Kiosks) etc.

4.1.7 Security layer

Security layer comprises information security system, standard and
specification system, development and operation security system. Information security system is to ensure information safety through appropriate technologies and administration means. Standard and specification system is to specify TISS design, development and implementation in compliance with the relevant national and industry standards. Development and operation security system is to guarantee the TISS development and operation under reasonable management system and long-term operation mechanism, with adequate human resource and financial support.

4.2 Functional Architecture

4.2.1 Pre-trip information service

Inter-city pre-trip information services include transport infrastructure information service, ticket booking/sale, traffic condition information service, weather forecasts, traffic management and control information, trip route planning and so on.

Pre-trip information services for intra-urban area travel include urban transport
infrastructure information service, urban public transit information service, traffic condition information service, trip route planning, ticketing information service and other travel information services.

4.2.2 En-route information service

This includes real-time road condition information, weather information, travel guidance service, emergency service, and en-route information reporting.

4.2.3 Post-trip information

This includes complaints and advices, lost and found, and travel information forum.

4.3 Technical Architecture

Data collection, data transmission, data processing, data dissemination methods and information security are described in TISS Technical Architecture. Please refer to Volume 2, Development and Operation Guide for more detailed information.
Figure 4-3 Typical TISS Technical Architecture
Figure 4-4  Typical TISS Network Topology Diagram
4.4 TISS Standard System

4.4.1 Significance of the TISS standard architecture

The development of TISS standard system architecture is a pre-requisite of the materialization of the TISS data exchange, the information sharing between and among each of the relevant departments nationwide; a fundamental basis for the realization of the TISS information resource development and utilization; and an effective way to improve inter-operability of relevant TISS systems, to avoid duplicated work and to ensure quality work of TISS development and operation. The TISS standard system architecture might facilitate China TISS industry to follow international practice by following and use of suitable international standards.

4.4.2 Target of the TISS standard system development

To develop a systematic, practical, and open TISS standard system suitable to the ITS development in China

Based on the review and full understanding of the existing standards of ITS both at home and abroad, to develop a science and rational TISS standard system characteristic of having clear aims, hierarchy and integrity, co-relevant, adaptability, and openness, covering each of the TISS development and operation process and components, including the data/information collection, exchange, information sharing, information service, to integrate each of the areas, the information technology and the standards hierarchy.

To set forth a number of key standards of most needed, practical general and specialized standards

By following the national ITS standards architecture and implementing the existing national and industrial standards, to develop a number of key standards of most needed, practical general and specialized standards through innovative work in the TISS development projects so as to make the standard development to accommodate the TISS development needs, to radically change the current situation in 3 - 5 years.

To strengthen the organization and coordination of the TISS standards development

To strength the leadership and coordination of the TISS standard development
based on the ITS Standardization Committee with the support from relevant departments, with clear responsibility and accountability in the management of the total process the TISS standards development, including the R&D of the standardization, the standard formulation and implementation; and to establish coordination and monitoring mechanism for the standards development and implementation.

4.4.3 Relations between the TISS standard needs and the ITS architecture

The TISS standards are fundamental for interoperability between and among each of the hierarchies and sub-systems of the TISS system, but also for the effective and efficient information communication and sharing between the TISS and each of the relevant ITS components.

The TISS standards development will be on the basis of ITS architecture. The Government attached great importance to the relevant work associated with the ITS architecture development taking the ITS architecture as one of the keys and technological documents in the ITS development program. Since 1999, the Government has organized the domestic institutes and experts in ITS field, working on the ITS architecture development, its improvement, the relevant methodology study, the development tools and instruments, as well as its application and implementation. The China ITS System Architecture (Edition 1) was issued in 2001, followed by the improvement of their compilation method and the support system software for the ITS architecture; and under the software environment, comprehensive improvement was made of the China ITS System Architecture (Edition1) and the China ITS System Architecture (Edition 2) was issued in 2004.

The China ITS System Architecture mainly includes the user service system, logic architecture, physical architecture. The data flow of the physical architecture describes the ITS components, the data needs between and among each of the sub-systems, which is the basis for the ITS standards development.

Therefore, the development of the TISS standards system will be based on the China ITS System Architecture (Edition 2), the data flow of the ITS physical architecture, the analysis of the standards the data flow having to follow, the analysis of the internal needs of the TISS but also the TISS standard needs
associated with each of the ITS components.

4.4.4 Hierarchical division of TISS standard

The establishment and implementation of TISS standards is an important basis to guarantee the information exchange and sharing between different layers of TISS systems and to promote industrial development. In order to establish a well-arranged TISS standard framework, the national standard of GB/T13016-1991, Principals and Requirements for Standard System Establishment is taken as a reference, and TISS standard framework is shown in Figure 4-5 based on the existing standards and TISS functional demand analysis.

In TISS standard framework there are four types of standards: basic standards, professional common standards, professional dedicated standards and relevant standards, etc., in which:

(a) Basic standards, referring to the common standards in the field of ITS, such as ITS terminology. These will not be listed in the report.

(b) Professional common standards, referring to the common standards in the field of TISS, including the data set, information classification and coding applied in travel information service will be divided according to the content of different service information, including road network attribute, road traffic condition, long-distance passenger transport, urban road network, urban public transport, taxi, multi-mode transport, parking, dynamic road condition, emergencies, roadwork, weather, etc..

(c) Relevant standards, referring to standards of other industries applicable to TISS, such as communications standards, computer standards, road industry standards, which will not be listed in our standard system structure, as shown in dashed line in the following Figure 4-5.
Figure 4-5 TISS Standard System Framework
4.4.5 Existing national and industrial standards

Up to June 2008, National Standards related to Traveler Information Service System that have been officially published are shown in Table 4-1. These 12 standards are established by ITS Standard Association of China (SAC/TC268).

<table>
<thead>
<tr>
<th>No.</th>
<th>Standard</th>
<th>Standard Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Intelligent Transport System: General Terminology</td>
<td>GB/T20839-2007</td>
</tr>
<tr>
<td>3</td>
<td>Intelligent Transport System: Data Management Mechanism Requirement for Central Data Register</td>
<td>GB/T20611-2006</td>
</tr>
<tr>
<td>5</td>
<td>Road Traffic Information Collection: Information Classification and Coding</td>
<td>GB/T 20133-2006</td>
</tr>
<tr>
<td>6</td>
<td>Road Traffic Information Collection: Incident Information Set</td>
<td>GB/T 20134-2006</td>
</tr>
<tr>
<td>7</td>
<td>Traffic Management Information Attribute Classification and Coding: Urban Road</td>
<td>GB/T21379-2008</td>
</tr>
<tr>
<td>8</td>
<td>Traffic Management Geographic Information Entity Identification Coding Rules: Urban Road</td>
<td>GB/T21381-2008</td>
</tr>
<tr>
<td>10</td>
<td>Traffic and Traveler Information (TTI), Transport Message Coded TTI Message, Part II: Radio Data System – Transport Message Channel (RDS-TMC) Incident and Information Coding</td>
<td>GB/T20612.2-2006</td>
</tr>
<tr>
<td>11</td>
<td>Traffic and Traveler Information (TTI), Transport Message Coded TTI Message, Part III: ALERT-C Locating Reference</td>
<td>GB/T20612.3-2006</td>
</tr>
<tr>
<td>12</td>
<td>Road Traffic Information Service: Information Classification and Coding</td>
<td>GB/T21394-2008</td>
</tr>
</tbody>
</table>
4.4.6 List of China TISS Standard

A list of TISS Standard is provided according to the hierarchical division of the Standard Framework. The TISS Standard List is based on the modification of the existing standards according to new demands.

(a) Professional common standards include 17 standards, mainly referring to TISS General Framework, TISS Terminology and Definition, TISS Basic Information Classification and Coding, Central Data Register Standard, TISS Operation Management and Service Quality Assessment Method Standard and TISS Data Dictionary, etc. They are the commonly used standards during TISS system construction. Traveler Information Service: General Framework and Traveler Information Service: Operation Management and Service Quality Assessment Method Standard are the guideline and assessment standard of our TISS construction in the current situation. Traveler Information Service: Data Dictionary and Traveler Information Service: Central Data Register Standard are the base for realizing data exchange between different systems and different organizations/divisions, in which, Central Data Register Standard could be referred to relative existing standards in ITS field.

(b) The core components of the TISS standards system are classified into three series of standards, i.e. those for the TISS data input and exchange, the TISS data process, and the TISS information publication, with those for the in-vehicle navigation system as one specialized standard, which make a total of 4 series of standards, including a total of 39 standards, 11 of which are for in-vehicle navigation system.

(c) To accommodate the development of the TISS technology, two specialized standards are to be developed, i.e. the field data input standards of "the traffic information service, floating car data input standard" and "the traffic information service, the mobile phone data input data standard".

(d) According to the definition of the TISS interface, the data input center of the TISS will have data input from each of the stakeholders' data input centers. Therefore, there are a total of 9 standards to be developed for the data exchange between the said data input centers, including "the traffic information service, the road data input/exchange standard (with the road data center)", "the traffic information service, the incident/accident data exchange standard (with the emergency response data center)", "the traffic information service, the
weather information exchange standard (with the weather information center)”, and etc.

(e) For the storage and classification of each of the data series, additional standard for the data processing is to be developed, i.e. "the traffic information service, multiple data processing specifications"; and to unify the specifications for determination and description of the traffic conditions, additional standard of "the traffic information service, road network traffic condition classification and description specifications" is to be developed.

**Table 4-2 List of TISS Standard System (Modified)**

<table>
<thead>
<tr>
<th>No.</th>
<th>Standard</th>
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<tbody>
<tr>
<td>1</td>
<td>Terminology and Definitions</td>
</tr>
<tr>
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<td>Travel Information Service: Terminology</td>
</tr>
<tr>
<td>1.2</td>
<td>Travel Information Service: Data Dictionary</td>
</tr>
<tr>
<td>1.3</td>
<td>Travel Information Service: Schedule/Route (SCH)</td>
</tr>
<tr>
<td>1.4</td>
<td>Travel Information Service: Spacial Expression</td>
</tr>
<tr>
<td>1.5</td>
<td>Travel Information Service: Passenger Information</td>
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<tr>
<td>1.6</td>
<td>Travel Information Service: Service Quality Requirement</td>
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<tr>
<td>1.7</td>
<td>Travel Information Service: Man-Machine Interface Requirement</td>
</tr>
<tr>
<td>1.8</td>
<td>Travel Information Service: Personal Visit Information Set</td>
</tr>
<tr>
<td>1.9</td>
<td>Traveler Information Service: Multimodal Transport Information Set</td>
</tr>
<tr>
<td>1.10</td>
<td>Traveler Information Service: Vehicle Guidance Information Set</td>
</tr>
<tr>
<td>1.11</td>
<td>Traveler Information Service: Emergency Information Set</td>
</tr>
<tr>
<td>1.12</td>
<td>Traveler Information Service: Taxi Information Set</td>
</tr>
<tr>
<td>2</td>
<td>Traveler Information Service: Basic Information Classification and Coding</td>
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<tr>
<td>3</td>
<td>Traveler Information Service System General Framework</td>
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<tr>
<td>4</td>
<td>TISS Operation Management and Service Quality Assessment Standard</td>
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<tr>
<td>No.</td>
<td>Standard</td>
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<tr>
<td>5</td>
<td>Traveler Information Service: Data Dictionary</td>
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<tr>
<td>6</td>
<td>Traveler Information Service: Central Data Register Standard</td>
</tr>
<tr>
<td>7</td>
<td>Data Access Standard (Including Data Content, Data Format, Data Transmission Frequency, etc.)</td>
</tr>
<tr>
<td>7.1</td>
<td>Traveler Information Service: Floating Car Data Access Standard</td>
</tr>
<tr>
<td>7.2</td>
<td>Traveler Information Service: Mobile Phone Data Access Standard</td>
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<td>7.3</td>
<td>Traveler Information Service: Road Industry Data Access Standard (with Road Data Center)</td>
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<tr>
<td>7.4</td>
<td>Traveler Information Service: Long Distance Passenger Transport Industry Data Access Standard (with Long Distance Passenger Data Center)</td>
</tr>
<tr>
<td>7.5</td>
<td>Traveler Information Service: Traffic Management Data Access Standard (with Traffic Management Center)</td>
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<tr>
<td>7.6</td>
<td>Traveler Information Service: Urban Public Transport Data Access Standard (with Public Transport Center)</td>
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<td>7.7</td>
<td>Traveler Information Service: Railway Data Access Standard (with Railway Data Center)</td>
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<td>7.8</td>
<td>Traveler Information Service: Civil Aviation Data Access Standard (with Civil Aviation Data Center)</td>
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<td>7.9</td>
<td>Traveler Information Service: Waterway Data Access Standard (with Waterway Data Center)</td>
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<td>7.10</td>
<td>Traveler Information Service: Emergency Data Access Standard (with Processing Center)</td>
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<td>7.11</td>
<td>Traveler Information Service: Weather Data Access Standard (with Weather Forecast Center)</td>
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<tr>
<td>7.12</td>
<td>Traffic Information Service: Vehicle Location Reference</td>
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<tr>
<td>8</td>
<td>TISS Data Center Standards</td>
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<td>8.1</td>
<td>Traveler Information Service: Multiple Data Processing Standard</td>
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<td>Traveler Information Service: Road Network Condition Classification and Expression Standard</td>
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<td>8.3</td>
<td>Traveler Information Service: Dissemination Information Format Standard</td>
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<td>Traveler Information Service: Parking Guidance Information Set</td>
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<td>Traveler Information Service: Roadside VMS Traffic Information Set</td>
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<td>Traveler Information Service: Digital Radio Traffic Information Set</td>
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<td>8.3.7</td>
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<td>9</td>
<td>Information Dissemination Standard</td>
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<td>9.1</td>
<td>Traveler Information Service: Variable Message Sign Equipment Standard</td>
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<td>Traveler Information Service: Roadside Kiosk Equipment Standard</td>
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<td>9.3</td>
<td>Transport and Traveler Information (TTI): Traffic Information Encoded TTI Message</td>
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<td>9.4</td>
<td>Transport and Traveler Information (TTI): Cellular Network Transmitted TTI Message</td>
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<td>9.5</td>
<td>Transport and Traveler Information (TTI): DSRC Transmitted TTI Message</td>
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<td>9.6</td>
<td>Transport and Traveler Information (TTI): TPEG Transmitted TTI Message</td>
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<td>9.7</td>
<td>Transport and Traveler Information (TTI): TPEG Extensible Markup Language TTI Message</td>
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<td>10.2</td>
<td>On-Board Navigation System: On-Board Equipment and TISS Center Interaction Standard</td>
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<td>10.4</td>
<td>On-Board Navigation System: Data Dictionary</td>
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<td>On-Board Navigation System: Information Set</td>
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<td>On-Board Navigation System: Physical Interface</td>
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<td>10.7</td>
<td>On-Board Navigation System: Pre-Trip Guidance Technical Requirements</td>
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<td>10.8</td>
<td>On-Board Navigation System: En-Route Guidance Technical Requirements</td>
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<td>On-Board Navigation System: Navigation Information Expression Standard</td>
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<td>10.11</td>
<td>On-Board Navigation System: Accurate Marking of Navigation Digital Map Database</td>
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</table>
5 Analysis of Potential Benefits

5.1 Enhancing travel efficiency

With the increase of urban population and the social economic activities, the road traffic is developing rapidly with growth rate much higher than that of both urban and inter-city road capacity. The economic loss caused by traffic congestion every year is huge not only in developing countries such as PRC and India but also in developed countries such as the United States, Japan and Europe countries. In the national conference about giving priority to the development of urban public transport, Qiu Baosheng, the vice minister of the Ministry of Construction mentioned that the annual economic loss caused by the traffic congestion in PRC is equal to 5%~8% of GDP. The application of TISS will be effective instrument for transport demand management to help relieve traffic congestion, save the travel time, make efficient use of the road capacity with huge economic benefit.

According to relevant data, during rush hours in the United States, 27% of interstate expressways are blocked, and 54% of automobiles in congested traffic. Due to traffic congestion, people spend on average 1.5 more hours on the trip. The waste of fuel and time caused by traffic congestion every year in the United States exceeds 72 billion dollars. In order to solve the problem of congestion, if only the measure of increasing and extending transport infrastructure facility is taken, the cost needed will be huge fiscal burden, while if ITS is fully applied to transport management and service, the investment cost needed will be reduced by half.

By providing information such as road condition, traffic weather, traffic control, etc., TISS can help travelers to optimize travel route. By changing travel mode, travel time and travel route, TISS would help achieve the homogenized traffic distribution on the road network. A research institute carried out a computerized simulation of the situation of 247,000 automobiles' traveling from 6 a.m. to 10 a.m. based on the road network in regions of Tokyo. Two scenarios were simulated. One taking into account of optimizing travel route only without consideration of departure time, while the other with consideration of staggered departure time over 15-20 minutes. The result is that under the first scenario, 40% of the vehicles can avoid delay, while 80% of the vehicles can avoid delay...
Under the second scenario. So it is obvious that TISS can relieve congestion, reduce time consumption and enhance travel efficiency by helping travelers take optimized travel route and select proper departure time based the travel information.

Through reasonable planning and providing route guidance for drivers, drivers can drive with a relaxed mind and enhance driving speed more effectively, therefore, time consumption is reduced. According to the test study on ATIS in the United States, for drivers who are not familiar with the route, 79% of them can arrive at the right destination within 15 minutes with the help of ATIS, while only 42% of them can arrive at the right destination within 15 minutes without using ATIS. In 2007, the Information Center of Beijing Municipal Committee of Communications evaluated the benefits produced by the application of a dynamic on-board navigation system. According to the findings of analog simulation test, if 40% of the vehicles in Beijing are equipped with dynamic on-board navigation system, the travel time of all the vehicles in the road network will be reduced by 16% at the most.

A study carried out in Seattle, the U. S. showed that under the circumstance of severe weather, if only 6%~10% of the travelers can acquire traffic weather information from information service website, positive influence will be produced on the efficiency of the road network traffic.

Road network congestion caused by the collision and breakdown of vehicles can create 60% of road congestion, and the consequent traffic congestion can cause additional collision and delay the response to an emergency. Study showed that one minute delay of an incident on the road will cause an additional delay for 5 minutes. So it will effectively reduce congestion time to provide accident information for vehicles on the way, remind vehicles to change route, minimize the influence of accident section on road network, and clear up the scene of accident quickly. According to a study in Detroit, the U. S., if TISS is to release accident information combined with proper traffic control, the influence of an accident on the surrounding road network will be decreased by 60%~70%, of which, 52% of the vehicles can reduce delay by acquiring pass-by route. Compared with taking no measure in case of accident, 25%~41% of the average travel time can be shortened.

With the real-time road condition monitoring system, the information about the queuing length and average time of pass through expressway toll stations,
especially toll stations at the expressway section linked to the urban area, can be acquired quickly. When the information is released to travelers through TISS, vehicles can leave the expressway in advance and go to other common roads. In this way, driving delay is greatly reduced and the high efficiency utilization of road resource can be realized. For example, in Dujiakan Toll Station in Beijing-Shijiazhuang Expressway, a famous congestion point in Beijing, the queuing length usually exceeds 3 kilometers in rush hours, and it takes 40~60 minutes to pass through it. If travelers can get congestion information in advance, they can leave expressway at two previous toll stations and enter the urban area through Jingliang Road, usually no congestion will be encountered.

According to a simulation research carried out in an expressway in Michigan, the U. S., 22% of vehicle delay can be reduced by the application of radio and dynamic information, ramp control and other measures of traffic control. It is found in a one-year test specific to ATIS on a road section in Seattle, the U. S. that compared with conventional means of television, VMS and broadcast, etc., the application of the system can reduce vehicle delay by 3.4%, increase the expressway capacity by 0.1%, and increase daily vehicle operation mileage by 0.2%.

5.2 Enhancing the travel safety of travelers

Through the travel service system, travelers may get warnings of severe weather, dangerous section and accident/incident in time, to avoid travel risk and enhance safety. For example, the timely warning of accident information can help drivers to slow down actively, avoiding the occurrence of chain accident of rear-end collision. According to a study in the United States, relevant service can reduce the probability of occurrence of this kind of accident by 79%. It has been found in a study in Britain that under different conditions, 30%~90% of travelers will pay attention to the information transmitted by dynamic information sign while driving, and at least 40% of travelers will positively respond to the dynamic information and change their driving route and speed as the message suggests.

An information service center or transport monitoring center can provide more rapid rescue service for travelers and enhance rescue effectiveness and efficiency through strengthening the coordination with the rescue team. According to statistics, in case of fatal traffic accidents, 20% of the victim would
die immediately, 59% die of severe injury, and 21% die owing to the delay of the first-aid. If information service center can discover accident or receive accident information without delay, and rescue agencies carry out rescue immediately, the mortality rate of traffic accident will decrease largely. According to an investigation and statistics in Paris, France, through the information sharing among accident vehicle, information service center and relevant rescue agencies, the accident response time can be reduced by 9 minutes, which greatly improves the survival rate of the injuries. As indicated by the test study of similar systems in Japan, by use of in-vehicle terminal transmitting the accident location information to the control center, it would takes less than 59 seconds on average for medical team to precisely identify the accident information. It would take at least 101 seconds for the control center to acquire the location information by mobile phone. Though reducing rescue response time is not a direct index of safety, it obviously has important positive influence on reducing accident mortality.

According to the prediction of a study in the United States, by 2020, the economic loss caused by traffic accidents in the U. S. will exceed 150 billion dollars every year, however, the application of intelligent transport system will advance the prediction of risks and quicken response. Therefore, the traffic safety could be greatly improved and the loss of accident minimized. If drivers can predict danger 0.5 second earlier, then rear-end collision and cross intersection accident could be reduced by 50% and front collision will be reduced by 30%; if they can predict danger and react one second earlier, then 90% of traffic accidents could be avoided.

Road geometry warning information could effectively reduce accidents. For example, an advanced curve warning system was installed on five curves along I-5 in a mountainous portion of rural northern California. A before-and-after evaluation at two sites showed a significant reduction in truck speeds on downgrades greater than 5%. In a survey completed 10 months after installation of the northern California curve warning system described above, 70% of commercial vehicle drivers and 85% of passenger car drivers indicated the signs were useful. 69% percent of both types of drivers indicated they reduced their speed through the curves in response to the signs.

Sometimes, the safety of traveler is not only indicated by the reduction of accidents. In fact, safety perception is as important as that for travelers.
According to a survey carried out in the United States, 76% of people think that traveler information service system can enhance travel safety and improve travel quality.

5.3 Limited land resource for transport projects

In order to meet the increasing travel demand, PRC continuously launched construction of the expressway network and upgrading lower-class road. In 2007, CNY 777.682 billion was invested for the development of highway and waterway transport infrastructures, with an increase of CNY39.3 billion, 5.3% more than that of the previous year. It is estimated that by 2020, expressway in PRC will have a total length of 85,000 kilometers, the total mileage of the road network will exceed 3 million kilometers (excluding village road), and a total of land area of 1.75 million hectares are to be taken for road use.

However, land resource in PRC is precious, given the fact that the average per capita land area is 0.74 ha. One third of the world average 2.2 ha. For many big cities, it is unlikely to have sufficient land for new road to accommodate the increasing traffic demand. The decision-makers have realized that owing to limited land resource and other restrictive factors, the construction of road facility can never satisfy the increasing traffic demand.

Therefore, it is important to balance the demand and supply, by reducing the excessive demand on the one hand and enhancing potential capacity or effective capacity or the road system on the other. By use of information technology it is possible to achieve more effective capacity of the existing road system through informed travel decision based on understanding of the road and traffic condition information service. According to relevant research in the United States, the wide application of ITS technology can improve the expressway capacity and the whole road network by 20%~30%. The improved road capacity comes from the fact that the temporal and spatial traffic distribution on the road system is relatively more even or better with the information service than that without the information service, which would have the effect of reducing the need to construct or expand the road facilities.

5.4 Enhancing the efficiency of the public transport system and reducing resource consumption

PRC’s urbanization rate reached 44.9% in 2007, the number of the cities above
prefecture-level (excluding the counties under the jurisdiction of the municipality) at the end of 2007 reached 655, with a population of 371.56 million, of which 36 cities with a population above 2 million and 83 cities with a population between 1 million and 2 million. The acceleration of urbanization process would result in the increase of urban and inter-city travel and traffic. In 2007, urban resident private car ownership in PRC was 6.1 per hundred household. By the end of 2007, in all the cities, there were 960,000 taxis with total taxi passenger volume of 21.3 billion, and the total of public transport passenger volume of 53.3 billion.

Private car travel does bring convenience to a certain extent, but public transport is more efficient in energy use and environmental friendly with lower costs compared with private car.

Table 4-1 Transport Efficiency Index of Traffic Modes

<table>
<thead>
<tr>
<th>Index</th>
<th>Bus</th>
<th>Private Car</th>
<th>Bicycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area of road transport occupying (m²/person)</td>
<td>1~1.5</td>
<td>40~60</td>
<td>8~12</td>
</tr>
<tr>
<td>Fuel consumption rate</td>
<td>1</td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td>Discharge amount of hydrocarbon (g/100 persons*km)</td>
<td>12</td>
<td>130</td>
<td>-</td>
</tr>
<tr>
<td>Discharge amount of carbon monoxide (g/100 persons*km)</td>
<td>189</td>
<td>189</td>
<td>-</td>
</tr>
<tr>
<td>Discharge amount of hydroxide (g/100 persons*km)</td>
<td>95</td>
<td>934</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: Prior Development of Public Transport Abroad and Its Implication to China

Congested traffic also prevents the increase of operating speed of transit bus. In many big cities in PRC, the bus operation speed in rush hours is only 10~14 km/hour. According to the survey, it takes 40% of residents in Beijing more than 1 hour to go to work everyday, and only 5.5% of residents spend less than 20 minutes. The economic loss caused by traffic congestion is about CNY40 million every day. Giving priority to develop public transport improving the service of public transport to attract more people are inevitable choices to solve the traffic problem.

The service level of public transport can be greatly enhanced by establishing intelligent public transport systems, including TISS. The quality of public transport travel can be effectively improved and the attraction and utilization
efficiency of public transport system can be enhanced by various means, including establishing transport travel information service system, providing convenient and fast information of public transport through multiple media. The survey in Maine the United States showed that 90% of the respondents think that the arrival and leaving warning system of buses could help them, and 84% of the respondents consider excellent information service system as a necessary condition for the improvement of the service quality of public transport.

The improvement of the service level of public transport will effectively enhance the public transport share and bring huge social and economic benefit, including the reduction of environmental cost, the traffic congestion cost and the resource consumption. In 2007, the public transport passenger volume and share in Beijing was 15 million and 34.5% respectively. It is estimated that by 2020, the share of public transport in Beijing will be up to 50% and that of car travel will be down to 24.8%. If the annual trip length of a car is 30,000 km with fuel consumption of 10 L/100 km, then 1.23 million tons of fuel could be saved every year, so that 18.05 million tons of fuel could be saved for the whole country.

5.5 Relieving traffic congestion, reducing pollutant and greenhouse gas emission, and developing green transport

The environmental benefits from TISS are closely associated with the improvement of traffic conditions, driver behavior, the public transport patronage. Experience shows that the fuel consumption and exhaust emission of vehicles under congestion is much bigger than in normal traffic condition. When the average speed per hour is 20 km, the carbon dioxide emission is 400g/km, and when the average speed reaches 40 km/h, the emission would decrease by 25%, and it would decrease by 40% when the speed reaches 60 km/h. According to the study in Japan indicated that 10 km/h increase of average speed would result in the reduction of time loss of 5.6 billion vehicle hour/year and reduction of economic loss of JPY12,300 billion per year, with fuel consumption reduced by 25%, CO2 and NOx emissions reduced by 15% and 30% respectively.

According to a simulation research in Italy, it is found that if the average travel
speed on the road is optimized, resource consumption could be decreased by 8.3-13.8%, with CO2, HC and NOx emissions decreased by 3.9-5.4%, 4.2%-6.9% and 7.9-11.3% respectively. Therefore, if the load of road network can be optimized by TISS system to make the average traveling speed in the road network reach optimum state, resource consumption could be reduced effectively and the emissions could be lowered effectively.

In a system simulation evaluation with the combination of traffic monitoring control center, traveler information service and VMS that carried out in Atlanta, the United States, it is found that the system could reduce fuel consumption and vehicle emissions by diminishing accident occurrence, accelerating accident handling and reducing congestion caused by incidents. According to the study, it is found out that this system could reduce originally estimated annual delay of 1,354,000 vehicle hour to 629,000 vehicle hour, which is equal to per vehicle delay reduction of 54%; with annual fuel consumption reduction of 5.17 million gallon, diesel saving of 1.66 million gallon, and annual CO, HC and NOx emission reductions of 3,457 tons, 186 tons and 262 tons respectively. If the above time cost, fuel consumption cost and the cost for handling these pollutant emission are summed up, it will exceed USD182 million.

5.6 Industry development and the increase of job opportunity

As a rising industry group with huge economic benefit and an industry with great potentials of multimedia technology application, TISS has promising market in many fields, including road infrastructure facilities, communication, computer, electronics, automobile, automatic control, information service and network technology. The market players and stakeholders include application service provider, electronic map provider, guidance terminal provider, embedded operating system and software provider, information service provider, transport information background system provider, communication operator, information collection hardware provider and advertiser, and other service providers, but also include the public agencies.

All these stakeholders could carry out various commercial activities around information supply chain, that is, data collection, data processing, data transmitting and data releasing. In this supply chain, there are public and commercial activities, including basic public service, equipment manufacturing
and maintenance, data product supply, data processing service, commercial
data development, communication service, business planning and other
services such as maintenance and catering, etc.

In October 1996, VICS system was put into operation in Japan, and the scale is
expanding year by year. The direct manager of VICS is the Communication
System Center of Road Traffic Information of Japan. As a legal body of financial
group, part of the expenditure needed by the operation of the Center comes
from the government, and the rest comes from the sales of vehicle guiding
equipment. For every vehicle guiding equipment sold, the manufacturer of
vehicle guiding equipment shall pay JPY2,000 to the Communication System
Center of Road Traffic Information. At present, about 800,000 sets of vehicle
guiding equipment is sold in Japan every year, and the Center can gained an
income of about JPY1.6 billion to support the normal operation of the Center. In
2008, 1.41 million sets of VICS equipment was sold in Japan, and the
accumulated sales amount was 22.6 million sets.

At the same time, the technical development and market demand of TISS will
also promote the development of industries related to it, increase job offers and
promote the healthy development of social economy. According to the research
carried out in Guangdong Province, by 2010, the vehicles installed with GPS
unit in PRC will account for 25% of the total, the market sales value will reach
CNY10 billion, and the export sales value will exceed CNY2 billion; for the
market of front-end information collection and monitoring processing, the
investment in the monitoring system and front-end data/information collection
for each of the cities will account for 60%-70% of the total investment in the ITS
development.

In addition, as for travelers' willingness to pay, the American 511 might be taken
as an example. At present, except tourism information, large activity, parking
inducing and spare parking place, and travel route planning, all the rest basic
services of the 511 system are free. 74% of the respondents preferred a
per-use fee, 25% preferred a monthly fee, although 53% of those indicating
they would use the 511 service on a daily or weekly basis said that they would
be more likely to choose a monthly fee to access the system as needed.

It is also found out that bus passengers are more willing to pay for the
information service than driving travelers, and that 38% of bus passengers and
35% of train passengers are willing to pay while only 26% of private passenger
car drivers are willing to pay for that. Of all the respondents, 48% of transport operators are willing to pay for relevant information service, which has the highest willingness among all the surveyed groups. It is found out in the survey of charged service, 59% of people are willing to pay for optimal route or positioning, 50% willing to pay for detailed tourism route information, 42% willing to pay for information of interregional cities and routes, 36% willing to pay for tourism information and 34% for information of fueling, catering and maintenance, etc.
6 Development Targets, Principles and Strategies

6.1 Development Target Analysis

As mentioned above, there are great social and economic benefits from TISS development. To speed up TISS development and its commercialization will facilitate performance and improvement of the government service to meet the public demands for safe, convenient and efficient travel, and to balance the demand and supply, which will also have the effects of more efficient use of the transport infrastructure, more effective travel with less pollutant and greenhouse gas (GHG) emissions and with great support to resource use and environmental friendly green transport development mode. There are market potentials and opportunities in TISS development, which the public and private sectors may take advantages of. So it is necessary and imperative to make clear the development targets based on understanding the actual situation so as to take measures suited to local conditions. Based on the experiences learnt from the pilot demonstration TISS project, preparation work for systematic TISS development is going on supported by both public and private sectors.

TISS service use group coverage is one important development target and it can be expected that in the coming ten years TISS development will cover more cities and population. Table 6-1 shows the prefecture level cities in PRC and their population distribution, which are most likely to have suitable conditions to establish TISS infrastructure.

<table>
<thead>
<tr>
<th>City Scale (population)</th>
<th>Number of City</th>
<th>Population</th>
<th>Coverage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prefecture cities Total</td>
<td>287</td>
<td>371,557,100</td>
<td>100</td>
</tr>
<tr>
<td>Over 4 million</td>
<td>13</td>
<td>93,908,100</td>
<td>25.3</td>
</tr>
<tr>
<td>2 – 4 million</td>
<td>26</td>
<td>66,305,000</td>
<td>17.8</td>
</tr>
<tr>
<td>1 – 2 million</td>
<td>79</td>
<td>109,776,800</td>
<td>29.5</td>
</tr>
<tr>
<td>Total population over 1 million</td>
<td>118</td>
<td>269,989,900</td>
<td>72.7</td>
</tr>
</tbody>
</table>

Source: China City Statistics Yearbook 2008
Table 6-2 Prefecture Cities with Population over one Million in PRC

<table>
<thead>
<tr>
<th>Cities</th>
<th>East Region</th>
<th>Central Region</th>
<th>West Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>67</td>
<td>27</td>
<td>24</td>
</tr>
<tr>
<td>% share</td>
<td>56.8</td>
<td>22.9</td>
<td>20.3</td>
</tr>
</tbody>
</table>

Source: China City Statistics Yearbook 2008

By the end of 2007, there are a total of 118 prefecture cities in PRC with population over 1 million, with total population of 270 million, accounting for 72.7% of the prefecture cities' total population. TISS development targets for the years of 2015 and 2020 are to be determined based on ITS development strategy and the local conditions.

6.2 Development Principles

- To plan and develop TISS in a co-coordinated way

The plan for TISS development shall be included in the ITS development strategies as a special transport information project. As an important component of ITS, TISS needs the information collected from various detection, monitoring and management information systems. Therefore, it is very important to plan and develop TISS in a coordinated way by paying more attention to the relationship between and among TISS and other ITS components.

- To enhance the data collection and integrate different resources

Features of travel information include variable information types and contents, mass volume, rapid changes, wide coverage and difficult collection. Most of the information comes from the existing information systems used for daily management and service. During the implementation period of TISS, information collection and integration shall be taken as major tasks. Detailed analysis of different information types and its corresponding features shall be carried out, different collection and management methods shall be adopted accordingly; different information shall be integrated, to ensure the efficiency, effectiveness, accuracy and integrality. Since data/information quality is essential, any unqualified information shall not be disseminated to the public in order to avoid the misguidance, which could bring negative effects on TISS.

- To highlight emphases and pay more attention to practical effects
The system development should be based on the concrete practices of transportation industry, place emphasis on dynamic traffic information collection and dissemination, mainly on real time information about road condition, weather, road work, traffic incidents, and passenger tickets etc. and also include other secondary information including highway routes, entrance and exit, service facilities along the road, tolling charges, bus stops/stations, and bus run time schedule, route and price information; meanwhile, water transport, railway, aviation, and tourism information shall also be considered. The information most concerned and required by travelers shall be provided.

- To be people-oriented with inclusive and practical service

The system development should be based on real life, avoiding unnecessary technical terms while using the forms and contents that are easy to understand. The needs of different user groups should be taken into account in the user demand analysis. Consideration shall be given to the diversity, convenience, effectiveness and cost for travelers to obtain travel information via TISS. The principle of people-oriented shall run through the whole implementation period of TISS.

- To encourage stakeholder participation for sustainable development

As an information service system involve many stakeholders in both public and private sectors, TISS development and operation shall stress on the stakeholders’ participation based on the establishment of long-term sustainable operation mechanism. The system operator should pay more attention to value added and cost-effective service of TISS, attract more investors to participate in the development and operation of TISS, to achieve sustainable development and operation of TISS with stable quality service to the users.

6.3 Implementation Strategies

There are challenges as well as opportunities in TISS development, which call for appropriate development strategies and policy measures to deal with the key issues properly, so as to achieve the development targets more effectively and efficiently. Challenges mainly come from a number of constraints, such as traditional mindset, institutional barrier, limited financial and human resources, and etc. Opportunities mainly come from market potentials and public and private partnership, encouraging innovative solutions to meet the challenges
based on domestic and international experiences and what we have already achieved, as mentioned above.

The implementation strategies for the TISS development should follow the general strategy based on the TISS architecture framework, clear work division of the government departments at different levels, encouraging stakeholder participation, through government arrangement and market mechanism in the resource input, taking into account of following factors:

- **Status**: the government role and function in TISS development;
- **Hierarchy**: work division and coordination between and among ministerial, provincial and municipal levels;
- **Locality**: based on local social economic development conditions, different development targets should be set for each of the east, central and west regions;
- **Time schedule**: the development progress for the standardization; the local, regional and national network integration;
- **Procedures**: logical development procedures are necessary and essential for TISS development;
- **Marketing**: market strategy for development and operation of TISS.

### 6.3.1 Status: government role and function

The development of TISS is a long-term course that requires the government leadership in the development strategies and policies including stakeholder participation and marketing strategy and policy, for sustainable development of the information service combined with relevant ITS components. At present, since the government agencies at different levels hold most of the data required for TISS. So, it is necessary for the government to dominate the construction of TISS. With the gradual development of TISS, more resources are needed to meet the public demand on service contents, coverage and service quality, which calls for the government policy to facilitate more stakeholders’ participation and to implement market strategy. In the final analysis, long-term sustainable TISS development and operation would depend on well defined government role combined with market mechanism. In PRC the government role and function in TISS development and operation might evolve and go
through three stages, i.e. government domination, government facilitation and government supervision.

**Government Domination Stage**

Within this stage, the PCDs need to strengthen the communication and coordination with their subordinate administration departments, and enhance the capability for data collection, exchanging, sharing and dissemination, including: to establish the mechanism and administration system for data exchanging and sharing; to sign agreement with relevant data source providers in order to identify the duty, data content, data sharing method, data updating frequency and method, so as to establish the coordination mechanism with data providers gradually, and ensure providers to maintain their data sources respectively. Meanwhile, interactive communication with travelers should be strengthened, for information collection system, so that travelers could provide information to TISS, as an important supplementary information source. At present, it is the transport information administration departments under the PCDs and MTBs that are holding the maintenance of TISS data center and part of the data/information dissemination system, with the costs paid by the government financial budget.

![Figure 6-1 Operation Mechanism at Government Domination Stage](image-url)
6.3.1.1 Government Facilitation Stage

Figure 6-2  Operation Mechanism at Government Facilitation Stage

After the establishment of long-term, stable and continuous travel information collection system, the government shall encourage other social organizations to participate in the construction and operation of TISS. The operation and maintenance work of the data center and part of the dissemination system could be outsourced to professional firms via competitive bidding or negotiation. The government could share part of the revenue from the information service and use that for the information collection and processing system, which will reduce the investments from the government. For example, the cooperation between Zhejiang PCD and Zhejiang Telecom 118114, that between Chengdu MTB and Chengdu Telecom 118114, that between Jiangsu PCD and Traffic Radio of Jiangsu People’s Broadcast Station, and that between Beijing MTB and Honda, Toyota and other auto manufacturers in developing dynamic traffic Navigator and the product marketing. By getting professional firms involved in the operation, TISS could provide various value-added services with significant benefits; meanwhile, the quality of TISS service and user satisfaction could be improved as well.

Government facilitation will accelerate the development of travel information service industry, and improve its social and financial benefits and bring TISS industry into the benign developing track.
Government Supervision Stage

When the market of TISS service and related products is gradually developed as expected, the government shall pay more attention to the market operation, quality supervision, assessment and administration for TISS development and operation, to protect users’ rights and interests by making relevant standards and regulations, e.g., if the operator is in breach of the service guarantee or contract, the government could nominate an entity to be substituted for the operator. At this stage, the government will play a supervisor’s role, to ensure the smooth growth of TISS as well as improvement of service quality, and therefore the sustainable development of the whole industry.

6.3.2 Hierarchy

TISS development in PRC has three levels under the leadership of the government authorities of the national, provincial and municipal transport authorities.

National Level

At the national level, MOT takes the leadership for TISS across the country and MOT’s major functions in TISS development are as the following:

- To establish TISS development plan
- To develop TISS relevant standards
- To develop TISS Construction and Operation Guideline
- To establish Implementation Plan for national TISS
- To implement regional and cross-region TISS pilot demonstration projects, provide financial support, and supervise and guide the projects
- To set up attractive financing policies to introduce marketability fund, technology, and management
- To regularly organize comprehensive evaluation of each provincial and regional TISS, and to provide annual statistics and development report
- To develop and maintain transport GIS platform required for regional TISS development
To apply and retain the united national Travel Information Service Hotline number

To set up national one-stop travel information portal website disseminating the real-time traffic situation and weather information of the national trunk highways

**Provincial Level**

At the provincial level, PCDs take the leadership of the provincial and inter-city TISS development under the guidance of MOT, mainly focusing on cross-cities TISS development. The information provided by the provincial TISS shall include those concerning road network of the province, real-time traffic situation, weather, traffic control and road work, traffic incident/accident, long-distance bus service and etc. The main functions of PCDs for provincial level TISS development are as the following:

- To establish provincial TISS development plan
- To develop provincial TISS implementation plan
- To implement Inter-cities TISS development project
- To establish provincial TISS development and operation management systems
- To actively participate in exchange and share TISS development and operation information, components and experiences with other provinces under the guidance and coordination by MOT
- To develop paid and commercialized TISS services through working with relevant corporations, to facilitate TISS industrialization process

**Municipal Level**

At the municipal level, MTBs take the leadership of local TISS development under the guidance of PCD and MOT, stress on cross-provinces and cross-cities TISS construction. Road network information inner-province, real-time traffic situation, weather information, traffic control and road construction information, incident information, long-distance bus service information shall be provided by the provincial TISS. The main functions of provincial level TISS organization are:
• To establish local municipal TISS development plan
• To develop local municipal TISS implementation plan
• To implement local municipal TISS development project
• To actively participate in exchange and share TISS development and operation information, components and experiences with other municipalities under the guidance and coordination by PCD
• To develop paid and commercial TISS services through working with relevant corporations, to facilitate TISS industrialization process

6.3.3 Locality

Owing to a combination of natural, historical, social economic factors, PRC is characteristic of regional disparities in social economic development among the east, central and the west regions for many years and will continue for quite a period of time. So it is important to have different strategies in the TISS development for different regions.

- Eastern region

The east region of PRC is economically developed with higher population density, average annual per capita income, higher local government financial revenue than those in the central and the west regions. Transport infrastructures in the east are relatively developed with rich human and social capital resources, higher density of road network, well-developed infrastructures for the application of information technology and ITS. Therefore, the east region will be in the leading place in TISS development and operation in every aspect, particularly in commercialized TISS development and operation with less input from the government.

- Central region

The central region of PRC is less economically developed compared with the east region, but it is densely populated. There are many cities with population over one million. More transport infrastructure is needed to be developed. So TISS development in this region should focus on infrastructure development with more government input and learn TISS development and operation experiences from the east region.
West region

The west region of PRC is economically underdeveloped with low population density, weak transport infrastructure. However, some of the urban area travel demand and pattern are similar with those in many of the central and the east regions. More transport and TISS infrastructure will have to be developed in this region in need of more support from the government, the east and central regions in the resource input, including human and social capital resources support starting with pilot demonstration TISS project in selected cities/areas, to use the experience to promote TISS development in the entire region steadily.

6.3.4 Time schedule

According to the PRC's economic five-year development cycle, the targets and road-map of TISS development, in the last two years of the 11th five-year plan period, TISS development will mainly focus on demonstration project in selected cities/regions combined with systematic R&D activities and standard system development, to be prepared for large scale development in the following years. During the 12 five-year plan period, dissemination and application of the experiences from the demonstration project will be carried out in all the cities across the country and start with inter-city TISS, regional and national network system integration. It is expected that by the year of 2020 deployment of TISS across the country should be preliminarily completed.

6.3.5 Procedures

TISS development should follow logical procedures; involve quite a number of system components and sub-system development work as well as system coordination and integration. Based on demand oriented principle; starting from individual provinces with good conditions and cities with population over 4 million, to cross-regional, inter-provincial and national network integration; concurrently with individual system components to the completion of the architecture framework. Data/information quality is one of the key elements for the success of the TISS development, which requires great amount of and high efficient and effective data/information collection, and processing management systems’ support. Personnel technical training should be strengthened for data/information collection, communication, dissemination and information service performance quality management. Bilateral or multilateral data exchange and information sharing system should be established between and
among relevant provinces and regions.

6.3.6 Marketing

To ensure sustainability of TISS development and operation, it is necessary and imperative to incorporate a marketing strategy in the implementation of TISS development project. Commercialized implementation and operation may be materialized step by step. As mentioned above, the government should take the leadership in the initial stage of TISS development with financial support and organizational arrangement to create a good environment to attracting the market player actively participating in TISS development and operation. To this end, standardization, operation performance monitoring and assessment are essential elements for marketing and continuous improvement of TISS.
7 Policy Measures and Action Plan

7.1 Policy Measures

7.1.1 Develop strategic plans and prepare a top level design

The government should establish a series of documents concerning TISS development program and implementation guidelines, to strengthen the strategic status of TISS in transport planning, making sure consistency the development targets and the implementation policy measures for near-term and mid-long-term development. TISS development and its target should be as part of the Transport Information System Development Program, explicitly included in the 12th Five-year Transport Development Plan.

In the development program, it is important to strengthen the role and correlations of TISS with ITS components. Data/information collection and sharing system should be given priority, which involve cooperation and coordination between and among different departments, public and private stakeholders, at different levels and in different regions.

TISS development and operation guidelines for MTBs and PCDs should be developed and disseminated combined with personnel training and public awareness campaign. Long-term cooperation and coordination relations with relevant government department should be established for some fundamental issues such as the data collection, communication, information sharing and dissemination management system, as well standardization and performance monitoring and assessment system, based on the TISS architecture framework.

7.1.2 Organizational system and coordination mechanism

The organizational system for TISS development should be improved, by further clarifying functional division between the central government and the local government, the work division among each of the departments within the MOT and the administration mechanism, further making clear the leadership status and responsibilities of the PCDs for the implementation of TISS development program and setting up corresponding executive agencies with relevant performance monitoring and accountability system.
Transport data/information exchange and sharing system between and among each of the transport authorities, between the transport authorities and the relevant government departments, as well as regional cooperation and coordination mechanism for the information exchange and sharing should be established and implemented, to ensure effective and efficient TISS development.

Different operation mechanism may be established based on concrete local conditions of TISS development, i.e. available resource input from the public and private sectors.

7.1.3 To strengthen infrastructure capacity building

The infrastructure capacity for data/information collection should be strengthened in need of more resource input and coordination for reliable and real-time data/information collection. As mentioned above, the existing communications infrastructure which can be effectively used for TISS. There are also areas in need of newly built data/information communications infrastructure, which should be given priority with proper resource input. For effective and efficient infrastructure capacity building, both policy guidelines and standardization measures should be taken, including the implementation of PPP project, the capacity building for the system integration and the system operation performance monitoring and assessment.

7.1.4 To strengthen service capacity building

More efforts should be made in the information service capacity building, by use of multi-channel and mode to develop standardized in TISS brand service system.

Each of the official TISS websites of the PCDs should be further improved by enriching service contents with uniform style as well as local features, to a nationwide TISS website service system.

TISS hotline service in uniform special number (TISS number) across the country should be built. It is also necessary to design a special logo for TISS matched with the TISS number used in multi-mode visual service system.

7.1.5 To Speed up standard development and implementation

The TISS related standard system development and implementation, a
fundamental and prerequisite for the data collection, communication, dissemination, the information sharing and service, as well as industrialization of the TISS related products, should be one of the priorities for TISS development and operation.

Since the standard system development involves different areas and departments, a specialized working group should be set up under the ISO/TC204 responsible for the development and implementation.

7.1.6 Explore innovative development and operation mechanisms

It is natural and logical that in the initial stage of TISS development and operation the government takes the lead in the resource input. It is obvious that more resources shall be needed for long-term TISS development and operation, more effective and efficient resource input and output mechanism should be established by relying on the market based the TISS related industrial supply chain and value chain formation mechanism. To this end, it is up to the government to create a favorable market environment and platform to attract the market players actively participating in TISS development and operation, by use of technical neutral policy such as development and implementation of performance oriented and voluntary standards, promoting TISS related PPP projects, to encourage innovative design and practice.

Public awareness should be launched to encourage public participation in TISS development and operation, by use of incentives to get more public advices and comments on TISS products and services, by regular survey of the user or travel demands and satisfaction, and by publishing TISS related booklets and publications for continuous improvement.

There are market potentials in radio broadcasting, mobile and internet resource to be developed to enable TISS service commercialized to reach a wider range of users, to reduce the government financial input and to facilitate financial sustainability of TISS development and operation.

7.1.7 To strengthen TISS cost/benefit and service quality assessment

The MOT will make further efforts on in-depth TSS development and operation cost/benefit study, to gradually establish a sound TISS performance and service quality analysis and assessment system.
The MOT will issue TISS performance and service quality assessment criteria and its implementation method, to specify the PCDs and MTBs TISS development, operation and the system performance and service quality assessment work, to ensure scientific and equity of the assessment and to strengthen the system performance and service quality management and improvement.

At this stage the MOT should stress on monitoring and disseminating good experiences in the key issues for successful development and operation of TISS gained from the pilot demonstration TISS projects at different levels to lay solid foundation for further development.
### 7.2 Action Plan

<table>
<thead>
<tr>
<th>No.</th>
<th>Contents</th>
<th>Outcomes</th>
<th>Executive agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>To clarify National TISS development targets and strategy included in MOT’s 12th Five-Year Development Program</td>
<td>TISS development Program</td>
<td>MOT</td>
</tr>
</tbody>
</table>
| 1.2 | To develop instructive and guidance documents, including the guidelines, the standard framework, and the technical requirements, for the TISS development and operation. | Guidelines for TISS Development and Operation  
   TISS Technical Standard framework  
   TISS Service Quality Management Method | MOT              |
| 1.3 | To set forth priority TISS project program, financing and cooperation policy, including key pilot demonstration project. | TISS development implementation scheme                                    | MOT              |
| 1.4 | To develop TISS development program at various levels, set forth relevant policies, standards and specifications, with more investment in dynamic travel data collection system development. | Provincial TISS Development Plan  
   Municipal TISS Development Plan | PCD, MTB         |
<p>| 2.1 | The MOT to set up a joint steering committee with MPS, MIIT, and MOC.    |                                                                          | MOT              |</p>
<table>
<thead>
<tr>
<th>Mechanism</th>
<th>Description</th>
<th>Responsible Parties</th>
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<tbody>
<tr>
<td>2.2</td>
<td>To strengthen provincial and municipal TISS development under the leadership by PCD and MTB, with organizational arrangement of specialized agency responsible for TISS development and operation administration.</td>
<td>PCD, MTB</td>
</tr>
<tr>
<td>2.3</td>
<td>To clarify the functions of relevant departments of MOT in TISS development and coordination issues</td>
<td>MOT, MTB</td>
</tr>
<tr>
<td>2.4</td>
<td>To strengthen PCDs and MTBs leadership in TISS development, to designate special agencies responsible for TISS development, to separate the decision-making from executive work for better functioning of the government role.</td>
<td>MOT, PCD, MTB</td>
</tr>
<tr>
<td>2.5</td>
<td>To establish ministerial and provincial TISS development work meeting and interactive coordination mechanism</td>
<td>MOT, PCD, MTB</td>
</tr>
<tr>
<td>2.6</td>
<td>To sign bilateral agreements with each of the data source provider to define the responsibilities and duties for the data collection and provision, including the contents, provision manner, and updating frequency of the data.</td>
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</tr>
<tr>
<td></td>
<td>2.7</td>
<td>To establish liaison and communication mechanism with TISS related data source owners or providers, to make sure the data/information exchange and sharing system effective; Active public awareness campaign to encourage public participation in TISS information collection, exchange and sharing to enrich data/information and improve timeliness.</td>
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<td></td>
<td><strong>Data Collection Processing Exchange Sharing</strong></td>
<td>3.1</td>
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<td>3.2</td>
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<tr>
<td>3.3</td>
<td>To speed-up the national expressway traffic observation station development; Gradual promotion of trunk road traffic observation and automated data collection; To build class I and class II traffic survey stations, the expressway traffic survey data center, the provincial level traffic survey data center, the ministerial level road traffic survey data center.</td>
<td>National Travel Survey Data Center</td>
</tr>
<tr>
<td>3.4</td>
<td>To improve MOT’s the Traffic Interruption Incident Information Submission System and the relevant communications system, to improve the communications efficiency and the information quality.</td>
<td>MOT’s Road Network Management Data Center</td>
</tr>
<tr>
<td>3.5</td>
<td>In cooperation with China Meteorological Administration (CMA) to build national traffic weather forecast data center, to launch the studies on traffic weather monitoring station layout program and weather information communication mechanism.</td>
<td>National Traffic Meteorological Data Center</td>
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<tr>
<td>3.6</td>
<td>To conduct further study on the data collection and user payment mechanism to distinguish data for public interest from data for profit and to develop the user pay data classification criteria framework for the value-added data information service</td>
<td>TISS data collection &amp; user fee charge rate criteria framework and management measure</td>
</tr>
<tr>
<td>3.7</td>
<td>To initiate the data collection and user payment mechanism the information service provider may provide more value-added service with more pertinent data and accurate data monitoring and detection.</td>
<td>Local TISS data collection and use management measures</td>
</tr>
<tr>
<td>Information Service &amp; Application</td>
<td>4.1</td>
<td>To improve MOT website &amp; national road information website</td>
</tr>
<tr>
<td>4.2</td>
<td>Integrating the existing local TISS, according to MOT’s guidelines, standards and specifications; improving TISS website, call center, field information collection and dissemination system; To build the planned TISS in accordance with the uniform standards.</td>
<td>TISS website Call center Traffic radio broadcast ......</td>
</tr>
<tr>
<td></td>
<td>4.3</td>
<td>MOT’s emergency response platform building, including resource data bank for the emergency response.</td>
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<td></td>
<td>Each of the local transport authorities, off-sea salvage center speed up the existing and planned emergency response system, basic support system, command platform and emergency response resource bank building, to materialize integration of the emergency response systems, to gradually materialize the information sharing and coordinated command system.</td>
<td>Provincial level emergency response platform</td>
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<td>4.4</td>
<td>To improve national road network database, to develop national digital road map and the database maintenance system</td>
<td>National road data bank</td>
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<td>4.5</td>
<td>To apply special uniform TISS number across the country</td>
<td>TISS special Number</td>
</tr>
<tr>
<td>4.6</td>
<td>Workshops and personnel training for local TISS building</td>
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<td>Public</td>
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<tr>
<td>Awareness</td>
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<td>Information</td>
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<td>Dissemination</td>
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<tr>
<td>Application</td>
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<tr>
<td>5.1</td>
<td>Public participation and awareness campaign for TISS development, operation and to promote the public use of TISS.</td>
<td></td>
</tr>
<tr>
<td>5.2</td>
<td>Based on major municipal TISS demonstration project, to promote market oriented TISS industrialization development.</td>
<td>TISS demonstration project</td>
</tr>
<tr>
<td></td>
<td>To issue the Government support policy, including multiple channel funding, i.e. the public financial budget, equipment manufacturer, the information service provider, the financial institutions, and etc.</td>
<td>MOT, PCD, MTB</td>
</tr>
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<tr>
<td>6.1</td>
<td>To encourage outsourcing mode for TISS operation and maintenance, in addition to special public financial support; in addition to the financial support, to improve the system operation efficiency.</td>
<td>MOT; PCD, Financial authority MTB, Financial authority</td>
</tr>
<tr>
<td>6.2</td>
<td>TISS operator in cooperation with commercial service provider may provide tailor-made value-added information service, to gradually reduce government fund input.</td>
<td>Value-added information service TISS operator ISP</td>
</tr>
<tr>
<td>6.3</td>
<td>Active and rational use various social resources and active public awareness campaign; Cooperation and partnership with the telecommunications industry to reduce government fund input in TISS to enhance the system utilization rate.</td>
<td>MOT, PCD, MTB TISS Operator</td>
</tr>
<tr>
<td>Assessment</td>
<td>7.1</td>
<td>MOT will issue TISS performance and service quality assessment criteria and implementation measures, the PCD and MTB will implement the assessment criteria and conduct the assessment based on concrete local situation and may formulate refined and more detailed criteria and the management measures in accordance with the Criteria issued by MOT.</td>
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<tr>
<td>7.2</td>
<td>PCD and MTB will organize the provincial and municipal TISS assessment respectively and the TISS operator will implement the assessment under the guidance of the higher level transport authority.</td>
<td>TISS operation management report TISS service quality assessment report</td>
</tr>
<tr>
<td>Standards</td>
<td>8.1</td>
<td>MOT will issue TISS standard system framework, under this framework, relevant standard will also be developed</td>
</tr>
<tr>
<td>8.2</td>
<td>PCDs and MTBs may develop relevant standards suitable to local conditions and in line with the national standards.</td>
<td>Local TISS standards and specifications</td>
</tr>
</tbody>
</table>
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APPENDIX A: Typical International TISS Architecture Case Studies

1 UK

With the rapid growth of road and vehicle traffic, the United Kingdom’s transport information marketplace has rapidly matured and grown in recent years. This growth has been a direct result of Internet mainstreaming as a communications medium as well as the impetus given to developments by national transport policy and associated legislation and funding.

1.1 Policy

In the 1980s and 1990s, the ideology of privatization, competition and deregulation dominated transport policy; as a result bus and rail services have declined whilst traffic growth has resulted in higher levels of congestion. To tackle the problems of congestion and pollution, the UK Government began promoting a better, more integrated transport system.

To fulfill the sustainable and integrated transport policy, the transport information service plays an important role in promoting public transport and the continence of interchange among multi-mode transport.

In the ‘Ten Year Plan for Transport in 2000’, the UK Government announced its most important strategy of the integrated transport policy, ‘in an integrated transport system, information is crucial’. This strategy is to provide a travel information service that will present the public with the opportunity to compare travel options across public and private transport modes. This new and comprehensive transport information service called 'Transport Direct' will be available on the Internet.

1.2 Organization

- The Department for Transport (DFT)

The Department for Transport (DFT) provides leadership across the transport sector to achieve its objectives, working with regional, local and private sector
partners to deliver many of the services. One of DFT’s key tasks is ‘improving the current operation and capacity of transport networks and services, and providing better information for travelers’.

- The Highways Agency (HA)

The Highways Agency (HA), established in 1994, is an executive agency of the DFT. The Secretary of State is responsible for overall Government policy on motorways and trunk roads in England and determining the strategic framework and the financial resources within which it operates.

HA is delivering its strategic aim of ‘safe roads, reliable journeys and informed travelers’. The National Traffic Control Center (NTCC) is the HA’s source of real-time traffic information, a key role in this plan as it is the hub of the English motorway network.

1.3 Architecture Framework and Standard

- Urban Traffic Management and Control (UTMC) Program

In 1997, following some background research, the UK Department for Transport established the Urban Traffic Management and Control (UTMC) Program. UTMC aimed to provide assistance, primarily to UK local authorities in making effective and efficient use of mainstream technology, based on open standards, to deliver an increasing range of policy objectives.

The UTMC framework facilitates integration of transport systems, and enables information to be provided to system for traffic management and as a means of influencing traveler behavior. In practice UTMC acts as a framework enable the integration of ITS applications, ‘wrapping’ existing applications and providing a simple technical structure for new ones to be incorporated.

Two level reference modes are specified to the UTMC architecture, which are Logical Reference Model and Functional Reference Model. In the Logical Reference Model, a UTMC system is described as a series of interconnected nodes. The elements of the Functional Reference Model are user interface, applications, system management services and communication services. Communications services are based on five levels of architecture:

Information Level: Standards for the data elements, objects and messages to be
transmitted.

- Application Level: Standards for the process and structure of information exchange as well as session management.
- Transport Level: Standards for data packet subdivision, packet re-assembly, packet error detection and retransmission as well as routing.
- Sub-network Level: Standards for the physical interface and the data packet transmission method.
- Plant Level: Standards for the physical transmission media.

There is interaction with travel information services, for broadcast information and public transport, and a cross-boundary information exchange with neighboring authorities and the strategic roads network. The UTMC framework has taken into account the network management of this interaction, creating a unified approach.

Typical UTMC Compliant System architecture is illustrated in the following figure.

![Figure A-1 Typical UTMC Compliant System Architecture](Image)

- The Traveler Information Highway (TIH)
UTMC has long seen the TIH as the framework for local authorities to exchange traffic and travel information with third parties. TIH was conceived as a way of helping to relieve the deadlock by developing an electronic marketplace for the exchange of information. It allows information service providers to buy information easily from a range of data providers while at the same time providing a marketplace in which the data can be sold. In August 1996, the ‘Traffic Information Highway’ (TIH) started life as a research pilot to provide:

- A ‘one-stop-shop’ for travel information service providers, with instant access to information on present and future travel conditions; and

- An open communication mechanism allowing service operators to exchange operational information on the performance of their networks.

The main objectives of the TIH are to:

- Facilitate integration with other transport modes;
- Facilitate improved exchange of information between service operators;
- Facilitate partnerships between service providers;
- Encourage new services promoting choice and improved information services for travelers;
- Encourage a ‘marketplace’ for the exchange of information with recognition of commercial value;
- Maximize existing Systems.

The TIH uses communication standards that facilitate the exchange of information directly between systems. The use of Internet technology ensures connection costs are kept to a minimum and that hardware and software are readily available. The following figure shows the organizational architecture of the TIH.
Real Time Information Group (RTIG)

The Real Time Information Group (RTIG) was established in 2000 to provide a focus for all those involved in UK bus Real Time Information (RTI). RTIG has a wide membership drawn from UK local authorities, bus operators and system suppliers, with representatives from the government and other key industry groups.

In February 2002 RTIG published the National RTPI Strategy which was designed to bring together the technical, business and strategic requirements of local authorities and bus/light rail operators across the UK. This document is a medium term framework for the development of bus RTI and related technologies in the UK.

Historically, a significant part of RTIG’s resource has been devoted to standardization, either technical or operational guidelines. The purpose of the development of RTIG Standards and Guidelines was to ensure a suitable suite of robust, open specifications to support the necessary aspects of RTI system implementation. Currently available RTIG Standards and Guidelines include:

- RTIGT003: Quality of Service and evaluation (2003)

RTIG standards and guidelines currently under development are:
- Shelters – at stop infrastructure
- ETM-OBU bi-directional link
- DDA guidelines.

■ European ITS Framework

The European ITS Framework architecture was created to provide guidelines and a common approach to the planning, development and implementation of ITS throughout Europe. The UK was involved in this Framework project as one of the board members. It focuses mainly on road-based ITS applications and covers eight major functional areas. It incorporates further improvements based on the Update Requests and Problem Reports that are submitted by users of the ITS Framework architecture.

The following are the functional areas covered by the European ITS Framework:
- Architecture: Electronic Payment Facilities
- Safety and Emergency Facilities
- Traffic Management
- Public Transport Operations
- Advanced Driver Assistance Systems (ADAS)
- Traveler Journey Assistance
- Support for Law Enforcement
- Freight and Fleet Operations

Travel information services are involved in the Integrated Open Platform for Traffic and Travel Information Services. The Integrated Open Platform for Traffic and Travel Information Services system offers comprehensive traffic and travel
real-time data at different levels of detail, which consists of five main sub-systems:

- Interface Platform Sub-system: National and International Data Provider Sub-system
- Local Data Provider Sub-system
- Local Service Provider Sub-system
- Telecommunication Infrastructures for Services Sub-system
- User Terminals Sub-system

The traveler is informed of traffic information based on the architecture illustrated in the following figure.
1.4 Development and Deployment of UK TISS

Travel information service system (TISS) developed and deployed in the UK can be divided into three main types when considering the influence of information on mode choice.

- Unimodal Traveler Information (UTI)
This has always been the most common form of provision whether it is in the form of low tech paper timetables and road atlases; the Internet or telephone for more complex planning facilities; and real-time alerts concerning traffic or transport services’ operating conditions. UTI services may cover a wide geographic area or more than one transport service, but they are characterized by only informing the traveler about a single mode of travel. There are many UTI services operating at local and national levels associated with plane, car, rail, coach and bus travel. That such services are unimodal might suggest that they cannot provide travelers with this extensive information and/or influence mode choice. More accurately, these systems can be employed to inform and influence mode choice if the individual uses more than one method of travel. The National Traffic Control Centre, National Rail Enquiries and Real-time Passenger Information (RTPI) System deployed by local authorities are typical samples of UTI projects.

**NTCC**

The National Traffic Control Centre (NTCC) based in the West Midlands is an ambitious Telematics project aimed at providing free, real-time travel information. It is aimed at road users and national agencies on England's network of motorways and trunk roads, allowing them to plan routes and avoid congested areas. The main goal of this project is to reduce congestion and improve journey time reliability.

New and existing technology at 4,000 strategic monitoring sites are continuously monitoring the state of the country's core routes (5,130 miles) and feeding that information to the NTCC. This information is analyzed and fed back to roadside VMS and other public mediums.

The NTCC takes data from traffic detectors, Closed Circuit Television (CCTV) and weather monitoring (including fog sensing) systems and analyses it. This data is analyzed alongside information concerning planned and unplanned events and a GIS-based database of the core HA road network containing detailed physical descriptions and theoretical capacities. The TIS work closely
with the police and Local Highway Authorities (LHA) as well as other regional agencies (National Assembly for Wales, Scottish Executive, and Transport for London), the media and information service providers to ensure that information is accurately received and acted upon.

Utilizing the existing network of VMSs, the NTCC attempts to divert traffic around incidents and congested areas by simply warning drivers and offering alternatives. The information provided by the NTCC about the road network is also available in many other mediums. One such example is that Internet users are able to plan routes based around planned incident data, up-to-the-minute traffic reports and known network trends.

- Multimodal Traveler Information (MTI)

This concerns information provided for more than one mode within a single source. In effect, an MTI service consists of a series of UTI services housed together within a single website or available via a single telephone number. MTI services provide a portal that offers a single point of access to multiple sources of information, making information about the available modes more accessible and, consequently, making it easier to compare information about various modes. The MTI can also provide a convenient and logical common location for all travel information concerning a particular geographic area. Bristol City Council provides a good example of multi-modal information, promoted as, ‘For all of your travel information needs both in Bristol and further field you can now visit a new online one-stop shop at www.travelbristol.org.’
The above figure shows the homepage of the service. It has gathered together, for the convenience of the user, a range information sources potentially relevant to journeys to, from or within Bristol.

**Integrated Multimodal Information (IMMI)**

This type of information provision attempts to further reduce the effort for the individual in comparing their travel options. Like MTI services, IMMI services provide a single point of access to information concerning more than one mode. However, rather than merely coordinating the provision of information on more than one mode, IMMI services integrate that provision. In other words, the service user can make a single request stipulating their journey requirements (the origin and destination as a minimum), and the service will interrogate its systems to provide travel options for the required journey that cover more than one mode. Such services are
now beginning to make their presence felt in the UK information marketplace. Some successful samples include Traveline, Transport Direct and Journey Planner (Transport for London), etc.

**Transport Direct**

Building upon traveline, the UK Government announced in its Ten Year Plan for transport the goal of providing the UK with travel information service that could present the public with the opportunity to compare travel options across public and private transport modes. The Transport Direct Program, based in the DfT, was established and funded to achieve this. The Transport Direct website was formally launched in December 2004.

The vision of Transport Direct is to provide travel planning for all modes, integrated travel booking, and actually running a real-time information system. Delivery of the service has been a feat of achievement in terms of establishing access to, managing and interrogating the different and vast databases of information across modes and regions.

The user can now request door-to-door travel options for any journey in Great Britain and from a single request compare public and private transport side-by-side. For city to city journeys, travel options by train, plane and coach can be similarly compared. As such the service stands out as a rare example of integrated multimodal information provision at a national level. Journeys by car take account of historic journey time data for the strategic road network thus reflecting, to some extent, the likely impact of traffic conditions depending upon the departure time and route of the planned journey. Users can register with the service, which allows them to save their favorite journeys and travel preferences and to email travel information to other people. The service also provides for mobile Internet access, WAP and SMS.

The government role in Transport Direct is to harness stakeholders, set the pace and direction in terms of targets and audits of the targets, provide standards support, and offer facilitation.

**2 United States**

As the most typically ITS technology-developed country in the world, the USA has developed the National ITS Architecture by FHWA (Federal Highway
 Administration, United States Department of Transportation) in the 1990s. The USA also applies advanced Travel Information Service System (TISS) technology in different states, the most famous TISS system being 511, which is deployed throughout the country. The deployment process and main features of the 511 system, other notable relevant TISS projects, corresponding ITS Architecture and Standards, also the lessons learned from these projects are all very important for reference to TISS development and operation in China.

2.1 511 Systems

On the 8th March 1999, the U.S. Department of Transportation (USDOT) petitioned the Federal Communications Commission (FCC) to designate a nationwide three-digit telephone number for travel information. On 21st July 2000, the FCC designated 511 as the national travel information number.

After considering a full range of consumer, business, technical and policy issues associated with 511, the 511 Deployment Coalition (Coalition) established a national vision for 511 which states that:

511 will be a customer-driven, multi-modal travel information service, available across the United States, accessed via telephone and other personal communications devices, realized through locally deployed interoperable systems, enabling a safer, more reliable and efficient transportation system.

The FCC ruling leaves nearly all implementation issues and schedules to state and local agencies and telecommunications carriers. There are no federal requirements to deploy 511 and currently no dedicated federal program to pay for 511. Consistent with the national designation of 511, the FCC expects that the transportation industry will provide the traveling public with a quality service that has a degree of uniformity across the country. The following figure shows the current status of 511 usages in USA.
Deployment Coalition Program

In early 2001, mindful of both the opportunity and challenge that 511 presents, the American Association of State Highway and Transportation Officials, in conjunction with many other organizations including the American Public Transportation Association and the Intelligent Transportation Society of America, with the support of the USDOT, established a 511 Deployment Coalition.

Implementation and Operational Guidelines

To reduce the chances of service confusion and inconsistency, the Coalition decided to enhance the established Guidelines in the areas of content and consistency, as well as provide additional assistance in other areas that 511 deploy should be concerned with.

The Guidelines document evolved from ‘best guesses’ and suggestions of what was needed to launch a successful 511 service to a document for those planning, and already operating, 511 services. This change is also reflected in the name of the document, from ‘Implementation Guidelines for Launching 511
Services' to '511 Implementation and Operational Guidelines'. The document now provides additional information and background, as well as operational examples and experiences. Any future versions of this document will provide additional specific information, parameters and recommendations as services gain valuable operational experience within their states, regions and/or metropolitan areas.

The updated 2005 guideline has developed to version 3.0.

2.2 Relative USA National ITS Architecture

In support of 511 and the advent of sophisticated voice portals, the traveler information portion of the National ITS Architecture was updated in October 2003 to include the Telecommunications System for Traveler Information (TSTI) entity and connecting information flows.

This entity represents the caller interface and voice processing (voice recognition/synthesis) that supports voice-enabled telephone traveler information systems. It lays on the boundary of the National ITS Architecture where a call is received and processed. Implementations of this TSTI could include voice portal capabilities in scenarios where a distinct voice portal exists between ITS Centers and telecommunications provider(s) and uses this information to support voice-based interactions with the traveler. The TSTI also supports voice-based alert notification to the traveling public regarding major emergencies such as natural or man-made disasters, civil emergencies, severe weather or child abduction. These capabilities are reflected in two market packages: Interactive Traveler Information and Wide-Area Alert.

The TSTI entity and voice-based architecture flows can be used in regional or project ITS architectures to represent the 511 voice system interface to the transportation information service provider (ISP).

- Standards

511 implementers should review the full range of standards available and consider using those that will aid in cost-effective system development and/or inter-system interoperability. The ITS framework-related National standards are designed to facilitate the efficient exchange of information and, as a result, have developed standard data elements and standard messages.
Some of these standards, consistent with the National ITS Architecture, are quite beneficial to system implementers in reducing the time and resources required to share information between transportation management systems and the 511 support systems. Existing standards that should be examined include:

- **Advanced Traveler Information System (ATIS) and Advanced Traffic Management System (ATMS) message sets and data dictionaries as well as several ‘business area standards’ from the Transit Communications Interface Profiles (TCIP) family of standards. An example of how these standards can help is the ATIS produced International Traveler Information Systems (ITIS) Phrase List standard (SAE J2540-2), which includes textual phrases and binary codes for over 1,500 types of highway event ‘descriptors.’**

- **The primary standard for exchanging traveler information between various systems and users is the J2354 ATIS message set standard developed by the Society of Automotive Engineers (SAE). The messages of this standard are implemented in both Abstract Syntax Notation number One (ASN.1) and in extensible Markup Language (XML), including formats for various events, incidents and weather occurrences.**

- **Current 511 systems can receive data from TMCs in a standard format developed by the American Association of State Highway and Transportation Officials (AASHTO)/ ITE Traffic Management Data Dictionary (TMDD) Committee. Message Sets for External Traffic Management Center Communications’ (MS/ETMCC) contains the approved ASN.1 message sets which are currently at Version 2.1 which also includes XML versions of its messages alongside ASN.1.**

- **NTCIP center-to-center standards may also be relevant.**

- **Regional systems employing incident management systems may be using the message set standards of the Institute of Electrical and Electronic Engineers (IEEE) Incident Management 1512 family of standards. These standards allow for multi-agency conduction of incident events and express public summaries of these events using the same formats developed in the SAE ATIS J2354 work. Regional deployment using this set of standards can receive data in this format**
using either the ASN.1 or XML formats as defined by this standard.

- All of these message set standards reuse many of the same data elements in defining their component parts to increase the coordination between them and leverage the development investment. One key data dictionary in this effort is the TMDD data dictionary that was produced by the AASHTO/ITE TMDD Committee.

- A User-Comment draft of the NTCIP 2306 Application Profile for XML Message Encoding and Transport in ITS Center-to-Center communications standard is currently available, defining the XML-based transport protocol and providing guidance to each message set implementation. In addition, evolving standards in Voice XML should be considered.

### Service Content

The following list is representative of the service content categories:

- Tourist Information
- Special Events
- Parking
- Local Information/Points of Interest
- Interregional Information
- Driving Directions
- Public Transportation Trip Itinerary Planning
- Multimodal Routing and Trip Planning
- Incident Reporting
- Local Transportation Facilities Information
- Local Transportation Services Information
- Concierge Services
- Personalized Services
- Caller Reports
Motorist Aid

Performance Evaluation

Since 511 is a collective product of many separate services, national performance measures are needed to gain an understanding nationally of the full scope, impact and effectiveness of 511. Recently, the Coalition has focused on the establishment and monitoring of a few key measures, so that the Policy Committee and Working Group can assess the nation’s overall progress towards meeting the 511 Vision described previously in this document. The Coalition has chosen to focus on coverage, usage, awareness and customer satisfaction as national measures and is currently developing a process to collect and present the necessary data. Optional System Performance Measures that focus on the design, operations and maintenance aspects internal to any 511 system have also been developed for deployment wanting to track their system performance.

Although performance measures need to be compiled on a national level, the collection will be a bottom-up effort. Each local 511 deployment will assist in the process of collecting and providing the relevant information. While some of the information is fairly easy to collect and can be achieved through the proper design of a telephone dissemination system, other collection efforts will be more sporadic and more dependent on funding.

On the national level, additional information on awareness and customer satisfaction may be collected through national surveys and techniques, like those used in 2001 by the Gallup Organization for ITS America.

2.3 Main TISS projects in USA

A number of operational tests of ATIS technologies are currently underway, funded from various public and private sources. The most notable U.S. projects are ADVANCE in Chicago, Illinois; TravTek in Orlando, Florida; and Pathfinder/Smart Corridor in Los Angeles, California.

ADVANCE

The ADVANCE project is one of the largest in the U.S. for testing the ‘Advanced Driver and Vehicle Advisory Navigation System’ (ADVANCE 1990). Participants include Motorola, Inc., the Illinois Department of Transportation, the Federal...
Highway Administration, and the Illinois Universities Transportation Research Consortium. The project tests a route guidance system, developed by Motorola, with GPS (Global Positioning System) links to the radio frequency communication technology. Real-time traffic information will be transmitted to 4,500-5,000 vehicles equipped with navigation and information systems within a 250-square-mile suburban area northwestern of Chicago. The number of participating vehicles is less than one percent of the vehicles in the region. However, this number should still be sufficient to gauge traffic conditions on at least forty percent of the links in the area at five-minute intervals on weekdays.

- **TravTek**

The goal of the TravTek project is to test a route guidance system (see Vehicle Navigation and Information System [VN.IS] Conference Proceedings 1991). 75 of the 100 GM test vehicles (1992 model Oldsmobile Trofeos) were assigned to specially recruited AAA members through Avis rentals. The remaining 25 were tested with local drivers who travel frequently. Real-time traffic information from the specially equipped TravTek vehicles was transmitted to and received by the traffic management center. Traffic information was gathered by and processed at the traffic center and then transmitted to the TravTek vehicles via two-way radios. The surveillance system used for this project was on an 11 mile segment of I to 4 which was equipped with video cameras, loop detectors and variable message signs installed and operated by the Florida Department of Transportation.

- **Pathfinder/Smart Corridor**

The Pathfinder, an ATIS experiment, preceded the current Smart Corridor activities in Los Angeles. The Smart Corridor project evaluated traffic surveillance and control technologies, incident management procedures, methods for minimizing delays through better coordination, and opportunities for improved motorist information (JHK & Associates 1990). The Santa Monica Smart Corridor Project, California's first demonstration project in integrated ATM&ATIS focuses on the concept of integrated freeway and arterial traffic operations along with the testing of technology options and development of related traffic models.
3 Australia

3.1 Overview

The first ITS systems were introduced in Australia in the early 1970s. This initial use of contemporary transport technologies were required mainly to overcome the burden of distance throughout Australia. As a result, efficient and effective transport systems have become a pillar of Australia’s social and economic development, specifically:

- Advanced traffic management applications for urban networks
- Electronic tolling systems
- Smart card systems for public transport
- Supply chain management with commodity goods over vast and difficult terrains
- Road and rail route planning
- Air traffic management
- Rail systems management
- Advanced traveler information systems

While Australia is recognized as a leader in certain aspects of ITS research, technology and implementation as outlined above, there are some areas requiring further progress. These include the adoption of ITS in the freight logistics industry, the lack of a single national traveler information number and continuing problems with the operability of the different toll collection systems throughout the country. The Australian Government recognizes this and the need to allocate funding and implement policies to address these issues. For example, one of the projects featured in AusLink is the development of the National Traveler Information Service. ITS applications currently operating in Australia include:

- Adaptive traffic control systems, to provide priority for road-based public transport vehicles;
- Freeway management and information systems to reduce delays due to
traffic incidents;

- Electronic fare collection systems to improve the convenience of public transport travel and reduce system costs;
- Electronic tolling;
- In-vehicle navigation and information systems to assist drivers and reduce unnecessary travel;
- Vehicle location and scheduling systems, to reduce theft, improve roadside service and improve efficiency of freight movement; and

Advanced traveler information systems to improve user’s understanding and efficiency of use of public transport systems.

### 3.2 Organizations

The Australian Government recognizes the importance of the ITS industry and the clear benefits associated with the use of ITS technologies. Therefore, many Federal Government departments are involved in the ITS industry and proactively promote ITS research and application, including the Department of Infrastructure, Transport, Regional Development and Local Government (www.dotars.gov.au) and the National Office for the Information Economy (NOIE) (www.noie.gov.au). The Federal Government is also prepared to increase its involvement in the ITS industry. In a recent House of Representatives White Paper, the recommendation was made to establish an ITS implementation bureau as an executive agency directly responsible and accountable to the Minister for Transport and Regional Services. This bureau will implement programs to promote the deployment of ITS within Australia.

### 3.3 Standards and Architecture

- **ITS Architecture**

Interested individuals and organizations have created ITS Australia (ITSA) to promote and implement ITS technology. ITSA has counterpart organizations (such as ITS America and ITS Europe, known as ERTICO) that embarked on
efforts during the early 1990s to address these standardization issues through the development of System Architecture for ITS.

Systems architecture for ITS has been described [NRA 1999] as comprising three major views:

- Reference architecture
- Logical (sometimes called functional) architecture
- Physical architecture

In 1999, the National ITS Reference Architecture was developed by ITS Australia, representing the first step in developing a National ITS System Architecture for Australia. The Logical Architecture was completed in early 2004.

Traveler information is the key application in ITS System Architecture.

![ITS System Architecture Diagram](image)

**Figure A-6 ITS System Architecture**

- **IT-023**
  - For transport systems, ITS Australia and AusLink are the subject of work for Standards Australia’s IT-023 Committee for Transport Information and Control Systems. IT-023 was responsible for developing the Interim
The latest IT-023 project was the publication on 30 June 2004 of AS ISO 14817 Transport Information and Control Systems – Requirements for an ITS/TICS please define TICS central data registry and ITS/TICS data dictionaries. This standard is based on the International Standard, which was developed by the ISO Technical Committee, TC-204, for Intelligent Transport Systems with significant input from former CSIRO scientist, Dr John Smith. Dr Smith was the Standards Australia representative on ISO/TC204/WG1 from 1994 to 2003.

AS ISO 14817 will provide the basis for a major innovation in transport systems: the development of the Australasian Intelligent Transport Systems Data Registry.

3.4 Development and Deployment of TISS

At present, there is not a nationwide TISS guideline in Australia, but most states have established Real Time Passenger Information systems for public transport; however some states, such as Queensland, have established their own statewide Transport Information Service Systems. The Australian Government will partner with State and Territory Governments and the private sector to implement a National Traveler Information Service. This service would use existing and emerging technologies to provide high quality real-time information to travelers, providing real-time information on scheduled road, rail and air public transport services. It would also provide road condition and traffic reports, improving transport system efficiency. The service would use a database that links to existing data collected by states, territories and local government.

- Traveler Information Strategy Study

Recognizing the importance of traveler information systems, Queensland Main Roads commissioned the development of the National Traveler Information Strategy, including the Highway Advisory Radio (HAR), on behalf of ITS Australia.

The study takes a national view of the provision of traveler information, with the primary focus on the delivery of real-time information to Australian road users, particularly via HAR. There are other initiatives focusing on traveler information for public transport users, hence those issues are not dealt with in the report.
Sources of data, processing and the integration of the data into information were recognized as key steps in the information chain but were not examined in detail in the report.

The report also studied the commercial models of TISS, highlighting the importance of commercializing TISS via the Value Added Service Provider (VASP). The VASP may perform many functions, such as ensuring the timeliness and reliability of information and user billing and authentication.

With regard to implementation, the report summarized that provision of traveler information in Australia should embody the following general principles:

- Consistent information relating to urban congestion/travel time, incidents (rural and urban), rural road condition, etc. provided through as many information delivery media as is practicable;
- Compliance with good traffic engineering practice, standards, including safety standards, and road rules;
- Adoption of standards and guidelines for hardware and interoperability of components systems; and
- Privacy, information ownership, legal liability, regulatory and legislative issues associated with ITS in general are being addressed as part of the National ITS Strategy.

Transport Information Centre, Queensland

The new Transport Information Centre (TIC) is located at the King George Square station, Ann Street concourse. Its aim is to help travelers incorporate sustainable travel modes including public transport (bus, train, and ferry), walking and cycling into their daily routine.

The TIC provides a wide range of services for travelers, including:

- Consultants who provide information about incorporating the use of public transport, walking and cycling into daily travel routines;
- Free personal journey planning session;
- Maps of walking and cycling paths for Brisbane;
- Timetables, service changes and public transport information;
• Self-serve touch screen kiosks with TransLink’s online journey planner; and
• Travel cards that can be bought and ‘topped up’ for use on public transport in South East Queensland.

4 Japan

4.1 Overview

In Japan, a small country with a population of over 120 million people and more than 78 million vehicles on the road each day, about 1.16 million people are either killed or injured in traffic accidents each year. Additionally, congestion in various parts of the country, due to increased vehicle demand, results in approximately 3.8 billion man-hours of lost time nationwide (worth about 12 trillion yen) each year.

However, it is difficult to construct a road network sufficient to accommodate Japan’s huge volume of traffic due to geographical restrictions such as the lack of land and steep terrain, as well as social restrictions such as excessively concentrated land use. Therefore, to resolve these problems it is necessary to maximize road resources efficiently.

Furthermore, in Japan’s rapidly aging society, it is estimated that the elderly (aged 65 years or older) will account for 25 percent of the population by 2020. This has created a need to establish an environment that supports greater mobility for the elderly population.

The Traveler Information Service System (TISS), which has steadily spread through Japan, has become an effective tool for the aforementioned solving social issues, such as traffic congestion and environmental problems.

4.2 Organization structure

Japan, one of first countries in the world to take on research and development for the Intelligent Transport Systems (ITS), inaugurated ITS work when the Ministry of International Trade and Industry started to develop CACS (Comprehensive Automobile Traffic Control System) in 1973. Later, in the 1980s, the Ministry of Construction established the Road/ Automobile Communication System (RACS) and the National Police Agency launched the Advanced Mobile...
Traffic Information and Communication System (AMTICS). These systems then led to the introduction of the Vehicle Information and Communication System (VICS) in cooperation with the Ministry of Posts and Communications, which had been developing and standardizing radio wave systems.

From the late 1980s to early 1990s, these government bodies promoted projects such as ARTS (Advanced Road Transportation Systems by the Ministry of Construction), SSVS (Super Smart Vehicle System by the Ministry of International Trade and Industry), ASV (Advanced Safety Vehicle by the Ministry of Transport), and UTMS (Universal Traffic Management Systems by the National Police Agency).

At the same time, the academic and industrial sectors organized the Vehicle, Road and Traffic Intelligence Society (VERTIS). This society worked closely with ITS America and ITS Europe (ERTICO) in various ITS-related activities, including information exchanges with the secretariat of the World Congress on ITS and ITS-related organizations in North America and European countries. Private firms are also actively involved in forming ITS markets and launching products for car navigation systems that use GPS based digital road maps developed jointly by the government and the private sector.

Thus, Japan has been actively involved in the research and development of specific technologies that could become ITS core technologies. As ITS affects a broad areas of road, traffic and vehicles as well as information and telecommunications, it also became necessary for people of various fields to work together, promote ITS based on international exchanges and provide in-demand User Services.

To promote the use of information technologies on roads, traffic and vehicles, the five related government bodies (National Police Agency, Ministry of International Trade and Industry, Ministry of Transport, Ministry of Posts and Telecommunications, and Ministry of Construction) jointly finalized a ‘Comprehensive Plan for ITS in Japan’ in July 1996. This plan was based on the ‘Basic Guidelines for the Promotion of an Advanced Information and Telecommunications Society’, which was determined by the Advanced Information and Telecommunications Society Promotion Headquarters in February 1996. These governing bodies also demonstrated a long-term vision of basic ITS development, implementation and User Services, promoting ITS.
systematically and efficiently from the users' view point. ITS will also be promoted in Japan based on the Comprehensive Plan in cooperation with industrial and academic sectors.

In order to secure system integration and ITS development efficiency during both its promotion and creation, it was decided that the five government bodies would compile the System Architecture for ITS in cooperation with VERTIS. The development phase commenced in January 1998 and the draft system finalized in August 1999. The draft was subsequently released in order to collect opinions from a broad range of both industrial and academic sectors and to actively address overseas information. In November 1999 the ‘System Architecture for ITS’ process was completed.

Thus, the system architecture for ITS was formed with 21 User Services described, many of which involved the Traveler Information Service System.

4.3 System Architecture

According to ‘System Architecture for ITS’ the procedure to develop a System Architecture is to:

- Define the details of User Services;
- Construct the Logical Architecture;
- Construct the Physical Architecture; and
- Prepare Standardization Candidate Areas.

Based on a detailed definition of User Services, 56 specific User Services and 172 specific User Sub-services are systematically organized under the nine developmental areas and 21 User Services. (Refer to Figure following)
Eight out of nine development areas are related to traveler information provision, including advances in navigation systems; assistance for safe driving; optimization of traffic management; increasing efficiency in road management; support for public transport; increasing efficiency in commercial vehicle operations; and support for pedestrians and support for emergency vehicle operations.
4.4 Vehicle Information and Communication System (VICS)

The Vehicle Information and Communication System (VICS) provides easy-to-understand and real-time information to drivers. Using graphics and written messages, VICS supplies information detailing congestion conditions, required travel time and other items required by individual road users. It is expected that VICS will appropriately disperse traffic flow, improve traffic fluidity and improve road environments.

Since its first deployment in Japan in 1996, VICS has become one of the representative Traveler Information Systems worldwide.

- System Configuration

The VICS contains four parts: data collection, data processing and editing, data providing, and data utilization. The system architecture is shown as below:

![VICS Architecture Diagram]

**Figure A-8 VICS Architecture**

*Data collection*

The traffic data resources VICS centre collected mainly include: traffic control data from police office, general city road traffic data, and highway traffic data from Japan Road company.

The equipments for inspecting traffic data mainly include: CCTV (Closed Circuit
Television Systems), emergency call, transport prowl car, patrol helicopter and electric beacon etc.

**Data processing and editing**

After automatically processing the collected data through computer system, VICS centre set up traffic signal control scheme based on current traffic amount, speed, and congesting level etc to adjust the traffic to a better and less jam situation. The type of traffic data after processing mainly include traffic accident, trouble vehicle, road construction, weather information, road situation, traffic control, parking information, and traffic amount etc.

**Data providing**

The VICS centre applies electric beacon, FM broadcast (Frequency Modernization) and sending processed traffic data messages to public. The ultrasonic and photoelectric beacon set around road sides are the local information service media to deliver processed and edited traffic information to navigation vehicle equipment and eventually supply to driver through LCD screen. Two third of equipments in VICS centre are used for FM broadcast, which expand data user coverage level. The clients can also use mobile to search real time traffic information from Internet.

**Data utilization**

Through setting, the types of display on VICS vehicle carried machine are divided into three different real time traffic information provider: Character display type, Simple Graph display type, and Map display type.
Funding and Financial Base

In principle, the costs associated with VICS administration would be paid by users who benefit from VICS's services. However, as it is generally vehicle drivers who benefit from VICS's services, it would be extremely difficult to implement a fee-collecting system based on this principle. Furthermore, as drivers using VICS information trigger an effect that benefits all drivers, financing VICS by collecting fees for this information would be contrary to the principle of the equitable bearing of expenses among all beneficiaries.

It was therefore decided to finance the administration of VICS primarily by collecting the appropriate fees when, in the course of VICS implementation, an associated project is launched or expanded. This means that suitable fees are collected from the corporations that will manufacture and market the onboard devices used to receive VICS information and build the infrastructure used by VICS.

Effectiveness Evaluation

At the end of April 2008, the number of vehicles fitted with car navigation units incorporating VICS units stood at 20.4 million. The percentage of car navigation systems with VICS units has increased to roughly 80 percent. It is expected that VICS will generate an effect of 7.75 trillion yen, which is six times the system's
cost of 1.2 trillion yen.

The result of a 2004 financial year user’s questionnaire showed that, when asked about specific areas where VICS is effective, approximately 80 percent of respondents answered that it ‘gives peace of mind’, ‘understand road conditions up to the destination’ and ‘can find routes to avoid congestion’.

- Advanced Cruise-Assist Highway System (AHS)

Measures to assist safe driving are being investigated in Europe, America and many other countries. Advanced Cruise-Assist Highway System (AHS) by road-vehicle cooperation, in which Japan is leading the way, is attracting worldwide attention and is now a major focus of research and development.

AHS provides drivers with information, warnings, and operational support to eliminate the three main causes of accidents:

- Delays in recognition
- Errors in judgment
- Errors in operation

AHS effectively prevents accidents through cooperation between roadside and on-board units and providing information to drivers in real-time.

*Evolutionary Process*

AHS can be divided into three subsystems according to the specific functions for assisting driving, namely AHS-i (Information), AHS-c (Control) and AHS-a (Automated cruise). In AHS-i, the system supports a part of the collection of information, and in AHS-c the system supports a part of the driving operation in addition to the information collection. AHS-a carries out 100 percent of the information collection and driving operation and assumes the responsibility for safe driving.
Of all accidents on the Metropolitan Expressway, 21 percent occur on accident-prone curves (6 percent of the entire expressway length). Since March 2005, the Ministry of Land, Infrastructure and Transport has responded by implementing a ‘pilot program on road-car harmonization systems’ in the Sangubashi curve section of the Metropolitan Expressway Route 4 Shinjuku Line as an AHS service.

As a result, during the 2005 financial year, accidents targeted by the AHS service (rear-end collisions and secondary accidents caused by forward obstructions) fell significantly to just seven, a fall of 79 percent compared to the previous fiscal year. A similar low rate has continued ever since trial application of the service began.
APPENDIX B: Traveler Information Service System Nationwide Case Studies

1 Beijing Public Traveler Information Service System

The development of Beijing Public Traveler Information Service System Demonstration Project includes four main parts: traffic data collection and access, communication network, traffic data processing and traffic information dissemination. Traffic data collection and access is the data foundation of the system; communication network is a network platform for data transferring and dissemination; data processing system is the hub of system responding for primary treatment and storage of collected data and further analysis, which generates traffic information to clients. The adoption of a data dissemination system can provide various traffic information services through several approaches before or during the travel.

In terms of data collection and access, the development of demonstration projects includes: setting a microwave detector in the section between Jingshun Road and Sunheqiao Road to collect real-time traffic data; using Beijing taxis equipped with GPS on-board devices as floating cars to collect real-time traffic flow data of urban roads matching with GIS map. The floating technique uploads real time GPS data by using public traffic vehicles (e.g. Taxis), then obtains road net real time information after calculation. This technique is low cost, has high efficiency and covers a wide scope. There are currently 13,000 floating cars adopted, which is the biggest system in domestic and international cities. In December 2006, according to NAST, the system’s covering rate on Beijing’s Fifth Ring Road achieved 75% and the accuracy rate of roads information achieved 85%. According to the testing results from domestic and overseas automobile manufacturers and information service suppliers, this system has already achieved application stage. It is ready for gradual application to internet, cell phone and navigating instruments with development of data entry and import programs to store the data of the existing application system and the static and dynamic data obtained from the third party accurately, conveniently and quickly into the public travel database.
Figure B-1 Beijing Travel Information Service Website

In terms of the development of communication networks, the demonstration project made full use of the
existing network resources and selected the communication network system type according to the bandwidth and data communication quality requirements.

In terms of its data processing center, its function includes data pre-processing, data storage and data processing and transport information dissemination. The detailed functions include: Jingshun Road traffic data processing, floating cars data processing, three-dimensional GIS guide service, static journey plan for self-driving long distance travel within city’s scope, public transport transferring, long distance transport information searching, various inter-city journey plans from other cities to Beijing surrounding area or some areas within Beijing.

In terms of dissemination of transport information, the demonstration project provides five methods: On April 2006, a website providing relatively comprehensive traffic information services was formally released to the public, which is the first website in Beijing to provide integrated traffic information services. This website is based on the resource from the transportation industry databases and mainly provides 25 services to public transport passengers, self drivers and long distance passengers, including real time city road situation, highway issues, road construction, public transport and underground transferring, and long distance public transport schedule and price. In 2007, based on the public travel website, the column setup and art design were renewed. The columns were adjusted to 7 major columns and 95 sub-columns and one transport forum from previous 8 major columns and 32 sub-columns, which is more reasonable, more accessible, and more practical.
The Beijing Transport Service hot line provides public transport routes and transfer information for the city. It integrates the previous existing resources, such as Beijing City public transport service hot line, Transport is convenient for Residents hot line, Sponsor Company service line, Metro Company service line and Beijing Road Searching hot line. This provides government information consultancy, public transport information consultancy, road information consultancy, renting consultancy, vehicle maintenance and rescue information consultancy, long distance public transport information consultancy, tour transport consultancy, and integrated information services by accessing one number – 96166. Road condition information is provided by short message; Jingshun Road traffic situation information is disseminated through setting a changeable information board on both entering into Beijing and leaving Beijing. Basic travel information services are providing to the public through paper advertisement materials.

2 Zhejiang Province Road Public Travelers Information Service System

Zhejiang Province Road Public Traveler Information Service System made full use of the existing resources of its service system to develop a Public Traveler
Information Service System based on public transport information service website, mobile service channel, voice information services and broadcasting information services.

Figure B - 3  Zhejiang Province TISS Function Framework

Call Centre of Zhejiang Province Road Public Traveler Information Service

Since the population of telephones and cell phones is relatively high, the significance of the call centre as one of the most important ways to obtain travel information is rather outstanding in this project. The call centre provides the users with a number of personalized travel information services such as road condition, route assistance and car calling services via 0571-28811111.
Zhejiang province public travel information service broadcast

Zhejiang radio station Transportation Voice (FM93) is a professional transportation radio station belonging to Zhejiang Broadcasting Group. Transportation Voice has an overall audience of 21,000,000 in Zhejiang province, in which the percentage of listening Transportation Voice frequently is 27%. The cooperation of Zhejiang public travel project and Zhejiang radio station Transportation Voice demonstrate professional radio stations providing professional services, on time road information provided from the Transportation Department. It helps drivers to make the correct travel decisions or route adjustments.
Zhejiang province public travel information service website

Travelers can obtain transport information from a website, which includes not only text information, but pictures, audio and video multi media information. Travelers can communicate with a service platform, which provides not only Zhejiang Province authority transport map information, but supports users to choose the most economic and convenient, travel routes and relevant travel information. Meanwhile, customers can provide and publish effective transport information through the platform interaction or customize personal service. The general function framework of Zhejiang province public travel website is shown below:
Figure B - 6  Zhejiang public travel information service website
Figure B - 7  Public travel information service website functional frameworks
Zhejiang Province Public TISS SMS Platform

With the popularity of mobile communication facilities, combining with the feature of mobile phone platform, a traveler friendly (mobile customers) SMS, which adopts a special service number (China Mobile 01239101, China Unicom 70166661601) has been designed. Cooperation with China Mobile and China Unicom, according to travel feature, traveler can obtain SMS Service on Demand using mobile phone wireless network, such as bus timetable, flight schedule, and highway mileage and toll information, which meets people’s requirement for travel information.

3 Shandong Province Highway TISS

Shandong Highway TISS integrates, develops and publishes transportation information, of which the main development contents include a gateway website and a consulting centre. The public can search for transport information by the Internet, telephone hotline, wireless SMS, radio, roadside electric screen and service handbook. The travel information includes: road network pictures, electric maps, road condition information, real time traffic information, road weather, station information, and passenger transport schedule information etc.

Unified Travel Information Platform formation

Shandong’s TISS integrates the relative information from the province’s entire transport industry, to form a unified and open TISS Platform. The travel information comes from the Resource Integration pilot project, related intra-industry companies’ input, and operation people collection and maintenance, which guarantees on time data collection and publishing. Moreover, in order to ease the relative intra-industry companies’ data input maintenance a unified maintenance function has been designed and developed.

23 types of Travel Information Combination

The Travel Information Platform combines dynamic data and static data from within and outside the transportation industry. The data includes passenger transportation station, train station information, airport information, harbour information, travel general knowledge, travel express, road condition, site introduction, hotel introduction, city introduction, folk customs, Province wide road networks, regional road networks, main cities, main routes, highway weather, highway introduction, normal park introduction, service zone
introduction, toll station introduction etc, total in 23 information types.

Providing six types of Information Service Method

The aims of system development are to 'provide convenient and effective information services to the public'. Six commonly adopted media have been used to provide a relatively comprehensive travel information service and fulfil service method diversity, which includes a gateway website, consulting centre, SMS platform, broadcasting media, service handbook, and highway graphic text system. Travelers can obtain travel information in advance from the gateway website, consulting centre, SMS platform, and service handbook to plan their journey route. Travelers can obtain travel information on time during the journey from the consulting centre, SMS platform, broadcasting media, highway graphic text system, and service handbook. The public can experience “transportation transport with you’ all the time when travelling.

- Portals website

The "Travel system" portal website is named “Shandong public travel service network”, the domain name: www.sdjtcx.com (Shandong Travel). It provides all travel information to the public.

The website provides information on road conditions, traffic information, network indications, tourist guides, travel guides, search engines, also have two pathfinder programs namely, “Drive Qilu" and " Travel Shandong by car". The program ' Drive Qilu' can provide travel related information to specific to the driver's route. All the relevant driving information is displayed on the webpage such as network indications, travel guides, travel route planning, road and highway travel and other common sense knowledge. Travel route planning is based on Shandong provincial WEBGIS Highway System which can provides detailed travel paths and highway toll service charges for the users. ‘Travel Shandong by car’ program provides car or boat travel related information, such as travel guides, travel alerts, road traffic, by car. In the travel guide section, people are able to check the information of Province to the secondary inspection station for more than 151 passenger stations and more than 12,400 flights, and also query to the incoming flights, train and air services, and other information.

The website uses easy to read diagrams to indicate road networks, and city and district services. It has enhanced browsing speed and reduced equipment
requirements for websites.

- Information center

Jinan Affairs Bureau hotline is fully in use and was established as a provincial coverage travel information center----96669. Advisory services provided by the center include highway traffic (in line) auto-response services, as well as, weather, road and passenger services, port services and travel information, such as artificial advisory services.

- SMS platform

This platform provides travel information for the traveler either pre-trip or on the way. To receive the latest highway information the traveler chooses to subscribe to use of text messages or for on-demand information they go through mobile network, China Unicom.

- Broadcasting

"Travel system" cooperates with the Shandong traffic music radio station (FM 101.1), in order to broadcast highway and expressway weather information, the platform release up-to-date travel information system to the radio for the announcer to make selective broadcast information.

- Service manual

There are two types of Shandong provincial highway travel service manual to assist the public traveler; a folding brochure, this is to introduce the single highway detailed sketch of the main line, and the other is the manual with more pages to provide Shandong Road Trip Information service system, guide services, Shandong section of the main highway entrances and exits and diagram, a full range of services along the area, the image of the all-diagram interchange overpass and highway traffic information.

- Graphic Systems

The Jinan-Qingdao highway system of Shandong province provides real-time traffic information to drivers. Motorists can easily make arrangements for their trip and a reasonable choice of travel routes to increase the efficiency of travel. Graphic system displays different parts with different colors. A green light
indicates good services on the road, yellow indicates traffic is slow moving and red means congestion or shut down of the services. Travelers can choose different routes according to the indications of the current traffic conditions.

4 Chengdu public TISS

Chengdu public TISS pilot project provides omni directional and multi channel services to the public through a variety of ways, such as website, hotline (962999), SMS platform, touch screen and travel handbook, which is detailed in content, suits a wide population, provides a variety media and has strong practicality. It includes 11 sub systems:

- Highway dynamic data access system
- Transportation data collection system
- Public travel data processing centre
- Chengdu city public travel service website
- Call centre system
- SMS system
- Radio
- Variable message signs
- Station touch screen
- Paper advertisement materials

The system structure is shown below.
The above 11 sub systems are divided into three main types: data collection, data processing, and data publishing. The Public Travel Data Processing Centre is responsible for the data processing part, which is the original data resource of all public travel data publishing systems, and meanwhile takes parts of data processing functions. It is divided in detail into 5 parts in terms of function contents, including public travel special electric map, ‘public travel information database’, ‘static route planning’, ‘multi model journey planning’, and ‘transport data statistic analyses.’
5 Public TISS development in other regions

Not long after this pilot project was finished, through the summary of pilot project experience, under the guidance of Transportation Department, a transportation
extension project, the “Provincial Transportation Information Integration and Service project” was developed in 14 provinces and cities across the nation. This includes the development of a provincial public TISS.
Travel Information Service System
Implementation and Operation Guideline

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Introduction

The last two decades saw continuous economic growth, the improvement of people’s living standard, the speedup of urbanization, road and motor vehicle development with more private car ownership in PRC. Travel demand was increasing rapidly arising from different economic and social activities, such as business, visiting relatives and friends, working, entertainment and sightseeing. To accommodate the ever increasing transport demand, the Ministry of Transport (MOT) promoted the implementation of Traveler Information Service Systems (TISS) in different regions based on people-oriented transport development concept. In 2005, Road Travel Information Service System demonstration projects were initiated in Shandong and Zhejiang provinces, and Beijing and Chengdu cities. In 2007, more 14 TISS projects named traveler information resource integration and service systems were implemented in other provinces or municipalities. The objectives of these projects were providing traveler information service to the general public including private drivers and travelers by public transit by means of Internet, call center, short messages service (SMS), paper media and variable message sign (VMS). The TISS is entering into a rapid development period with more and more enterprises and organizations setting foot in the TISS markets.

Since each of the provinces and municipalities develops its own TISS independently, under different conditions, guiding principles, with different financial and technical support, there are a number of problems/barriers that exist, namely segmented administration system, lack of information sharing system, lack of service methods, limited service coverage, low service quality, lack of data updating and real-time dynamic service. Meanwhile, owing to the lack of standard architecture system framework, the existing travel information service is limited in each of the independent regions, without information sharing and across regional and nationwide service, a TISS standard architecture framework is required to assist further integration and improvement between and among different provinces or municipalities to improve the service quality and to meet the travel demand more effectively and efficiently.

For this consideration, a technical assistance project of Transport Information System (TA Project) financed by the Asian Development Bank (ADB) and implemented by the MOT. The outcomes of the TA Project include a main
report and a Guideline for TISS Development and Operation, which will facilitate the implementation of the transport information system development strategy and policy as well as the TISS standard architecture framework recommended in the main report, by providing practical and operable instructions and guidelines for an integrated local, regional and national TISS development and operation, aimed at cost effective solutions, improved quality service, and market oriented long term sustainable development and operation mechanism.

Who are the readers of the Guideline?

All the TISS stakeholders can get useful information from this Guideline, including provincial and municipal TISS implementation departments, system operators, maintenance agencies, research institutions, information value-added service providers, information service equipments manufactures and the end users.

![Figure0-1 Readers of the Guideline](image)
How to use the Guideline?

The Guideline sets out the concept of TISS, its architecture framework, the users and user service contents; the technical requirements and relevant standard system, which need to be followed for the TISS implementation; the TISS development and operation mechanism; the service quality evaluation measures and some valuable recommendations for the TISS development in the future.

The Guideline provides for the transport competent authorities with practical and operable instructions on how to promote and implement TISS development project, including comprehensive implementation guideline for the implementation departments. For system operators, it presents available measures for the system operation and maintenance, system monitoring and service quality evaluation.

It is strongly recommended that all the readers read through the whole guideline firstly, and then read the contents you are mostly concerned about carefully.
## Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>511</td>
<td>America’s Travel Information Number</td>
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<tr>
<td>3G</td>
<td>The Third Generation Mobile Communication System</td>
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<tr>
<td>AASHTO</td>
<td>American Association of State Highway and Transportation Officials</td>
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<tr>
<td>ACC</td>
<td>Adaptive Cruise Control</td>
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<tr>
<td>ADB</td>
<td>Asian Development Bank</td>
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<tr>
<td>AHS</td>
<td>Automated Highway System</td>
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<tr>
<td>AMTICS</td>
<td>Advanced Mobile Travel Information and Communication System</td>
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<tr>
<td>APTA</td>
<td>American Public Transportation Association</td>
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<tr>
<td>APTS</td>
<td>Advanced Public Transportation System</td>
</tr>
<tr>
<td>ASN.1</td>
<td>Abstract Syntax Notation One</td>
</tr>
<tr>
<td>ATIS</td>
<td>Advanced Traveler Information System</td>
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<td>ATMS</td>
<td>Advanced Traffic Management System</td>
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<tr>
<td>AVL</td>
<td>Automatic Vehicle Location</td>
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<tr>
<td>B/S</td>
<td>Browser/Server</td>
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<tr>
<td>BRT</td>
<td>Bus Rapid Transit</td>
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<tr>
<td>CA</td>
<td>Civil Aviation</td>
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<td>CACS</td>
<td>Comprehensive Automobile Traffic Control System</td>
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<td>CATS</td>
<td>China Academy of Transport Sciences</td>
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<tr>
<td>CCTV</td>
<td>Closed-Circuit Television</td>
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<tr>
<td>CEDR</td>
<td>Conference of European Directors of Road</td>
</tr>
<tr>
<td>CEN</td>
<td>European Committee for Standardization</td>
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<tr>
<td>CMS</td>
<td>Changeable Message Sign</td>
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<tr>
<td>CNY</td>
<td>China Yuan</td>
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<tr>
<td>CO₂</td>
<td>Carbon Dioxide</td>
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<tr>
<td>DFT</td>
<td>Department for Transport (U.K.)</td>
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<tr>
<td>DMS</td>
<td>Dynamic Message Sign</td>
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<td>DoTaRS</td>
<td>Department of Transport and Regional Service</td>
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EDI  Electronic Data Interchange
EOI  Expressions of Interest
ERTICO  European Road Transport Telematics Implementation Coordination Organization, (ITS Europe)
ETC  Electronic Toll Collection
EU  European Union
FCC  Federal Communication Committee
FHWA  Federal Highway Administration
FM  Frequency Modulation
FVD  Floating Vehicle Data
GALILEO  European Satellite Navigation System
GDP  Gross Domestic Product
GHz  Giga Hertz
GIS  Geographical Information System
GL  Guideline
GNSS  Global Navigation Satellite System (Russia)
GPRS  General Packet Radio Service
GPS  Global Positioning System
GSM  Global System for Mobile
HA  Highway Agency (U.K.)
ha.  Hectare
HAR  Highway Advisory Radio
IATA  International Air Transport Association
IEEE  Institute of Electrical and Electronics Engineers
IMMI  Integrated Multiple Mode Information
ISO  International Standardization Organization
ISP  Information Service Provider
IT  Information Technology
ITS  Intelligent Transport System
<table>
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<tr>
<th>Abbreviation</th>
<th>Expansion</th>
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<tbody>
<tr>
<td>ITSA</td>
<td>Intelligent Transport System of Australia</td>
</tr>
<tr>
<td>IVU</td>
<td>In-Vehicle Unit</td>
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<tr>
<td>KPL</td>
<td>Kilometer per Liter</td>
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<tr>
<td>LAN</td>
<td>Local Area Network</td>
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<td>MATTISSE</td>
<td>Midlands Traveler Information Systems (UK)</td>
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<td>MDT</td>
<td>Mobile Data Terminal</td>
</tr>
<tr>
<td>MOF</td>
<td>Ministry of Finance</td>
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<td>MOST</td>
<td>Ministry of Science and Technology</td>
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<td>MOT</td>
<td>Ministry of Transport</td>
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<tr>
<td>MPS</td>
<td>Ministry of Public Security</td>
</tr>
<tr>
<td>MTB</td>
<td>Municipal Transport Bureau</td>
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<tr>
<td>MTI</td>
<td>Multiple Mode Traveler Information</td>
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<tr>
<td>NDRC</td>
<td>National Development and Reform Commission</td>
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<tr>
<td>NOIE</td>
<td>National Office of Information Economy</td>
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<tr>
<td>NOX</td>
<td>Nitrogen Oxygen</td>
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<tr>
<td>NTCC</td>
<td>National Traffic Control Center (U.K.)</td>
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<tr>
<td>NTCIP</td>
<td>National Transportation Communications for ITS Protocol</td>
</tr>
<tr>
<td>O&amp;M</td>
<td>Operation and Maintenance</td>
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<tr>
<td>OBU</td>
<td>On-board Unit</td>
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<tr>
<td>OCC</td>
<td>Operation Control Center</td>
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<tr>
<td>PCD</td>
<td>Provincial Communications Department</td>
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<tr>
<td>PDA</td>
<td>Personal Digital Assistant</td>
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<td>PPP</td>
<td>Public Private Partnership</td>
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<td>RACS</td>
<td>Road Automobile Communication System</td>
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<td>RIOH</td>
<td>Research Institute of Highway</td>
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<td>RTIG</td>
<td>Real Time Information Group</td>
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<td>RTPI</td>
<td>Real Time Passenger Information</td>
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<tr>
<td>RTTI</td>
<td>Real-time Traffic and Travel Information (Europe)</td>
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<td>SAC</td>
<td>Standard Administration Commission</td>
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<tr>
<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>SAE</td>
<td>Society of Automotive Engineers</td>
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<tr>
<td>SIRIUS</td>
<td>Motorway Information System using VMS (France)</td>
</tr>
<tr>
<td>SITA</td>
<td>Société Internationale de Télécommunications Aéronautiques</td>
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<tr>
<td>SMS</td>
<td>Short Message System</td>
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<tr>
<td>TA</td>
<td>Technical Assistance</td>
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<tr>
<td>TDCS</td>
<td>Train Dispatching Command System</td>
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<tr>
<td>TIC</td>
<td>Traffic Information Center</td>
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<tr>
<td>TICS</td>
<td>Traffic Information and Control System</td>
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<tr>
<td>TIH</td>
<td>Travel Information Highway</td>
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<tr>
<td>TIS</td>
<td>Traveler Information System</td>
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<td>TISS</td>
<td>Travel Information Service System</td>
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<tr>
<td>TPRI</td>
<td>Transport Planning Research Institute</td>
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<tr>
<td>TSTI</td>
<td>Travel</td>
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<tr>
<td>TTI</td>
<td>Transport and Travel Information</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
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<tr>
<td>USDOT</td>
<td>United States Department of Transportation</td>
</tr>
<tr>
<td>UTI</td>
<td>Unimode Traveler Information</td>
</tr>
<tr>
<td>UTMC</td>
<td>Urban Traffic Management Control</td>
</tr>
<tr>
<td>VASP</td>
<td>Value Added Service Provider</td>
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<tr>
<td>VICS</td>
<td>Vehicle Information Communications System</td>
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<tr>
<td>VMS</td>
<td>Variable Message Sign</td>
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<tr>
<td>VNIS</td>
<td>Vehicle Navigation Information System</td>
</tr>
<tr>
<td>WAP</td>
<td>Wireless Application Protocol</td>
</tr>
<tr>
<td>XML</td>
<td>Extensible Markup Language</td>
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</table>
1 TISS Architecture Framework

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1.1 What is TISS?

As one of the most important component of ITS, TISS is an integrated information technology system with the objectives of meeting the users’ demands for safe, convenient, cost-effective travel, by integrated information service based on data collection, transmission and dissemination. TISS provides for the users with practical, real-time, and accurate travel information according to the users’ travel needs for the right time, origin and destination through appropriate and quality service.

TISS is an integrated service system, under the standard architecture framework, unified institutional system and coordinated organizational arrangement between and among different level transport authorities built on a unified data transfer and information sharing platform, capable of providing one-stop information service. The fundamental features of TISS mainly include:

- comprehensive information collection;
- stable and reliable information transmission;
- efficient and effective information process;
- rapid and convenient information dissemination in multiple manner;
- normative and coordinated operation and management; and
- high quality user service.

1.2 Why need to develop TISS?

Along with the continuous economic growth, and motor vehicle development with more private car ownership in PRC, travel demand was increasing rapidly arising from different economic and social activities, such as business, visiting relatives and friends, working, entertainment and sightseeing. To meet the ever-increasing demand, there was more road infrastructure development and improvement over the past few years. It is, however, obvious that great gaps still exist between the expectation of the people’s demand and the actual supply of quality service in terms of safety, convenient, cost-effective and comfortableness. In addition there are more considerations of environmental protection, which calls for more effective and efficient environmental friendly travel to minimize pollutant emissions by taking advantages information systems. To this end, TISS is an effective way to materialize the goal and objectives in meeting with the public demand for both travel and sustainable transport development.
TISS’s benefits are reflected in the following aspects.

1.2.1 To improve the travel efficiency and save travelers’ time

In order to help the travelers plan their trip, TISS provides for private car and public transport users with pertinent travel information, including weather forecasts, road and traffic conditions, available en route services, bus schedules and etc, to help the travelers avoid the traffic congestions, save time and enhance travel efficiency.

1.2.2 To improve the travel safety

The timely information service concerning weather condition, road conditions, accidents or incidents will help the users understand the traffic situations so as to avoid risk and enhance travel safety. By cooperating with emergency response and first-aid systems, TISS will assist to mitigate negative impacts arising from possible road traffic accidents or incidents, which will improve the service of emergency response system.

1.2.3 To integrate travel information resources and maximize its values

A great amount of road transport related information systems have been developed to improve the road transport system management over the past few years, of which the equipments and data are essential valuable resources and can be effectively and efficiently used for more purposes. TISS is an effective way to take advantages of these resources to provide practical travel information service to the public.

1.2.4 To better use land resources

The real time and dynamic information service available from the TISS will have the effect of more efficient use of the existing road capacity through informed travel decision based on understanding of the road and traffic condition information service. This will improve the efficiency of land use and public transport and assist to reduce the pressures on the need to construct or expand the road facilities.
1.2.5 To improve the efficiency of the public transit and reduce the energy consumption

Private car traveling do bring convenience to certain extent, but public transport is more efficient in energy use and environmental friendly with lower costs compared with private car. Public transit priority is one of the important transport and energy policy promoted by the government for optimal resource use and sustainable development. By use of TISS, the public transit will be more attractive due to improved quality service more reliable, convenient and efficient.

1.2.6 To relieve traffic congestion and reduce emissions

TISS real time road and traffic information service can assist travelers to adjust travel route and time, which will avoid traffic jam. According to relevant statistic data, the amounts of fuel consumption and exhaust emissions of the vehicle under congested traffic condition are much higher than those under normal traffic. The amount of CO2 emission is 400g/km when the average traffic speed is 20km/h. This will be reduced by 25% when the average speed is 40km/h, and reduced by 40% when the speed is 60km/h. Therefore informed travel decision could have the effect of more evenly distributed traffic over the road system, but also improved traffic flow with less fuel consumption and the vehicle emissions.

1.3 Who are the users of TISS?

The users of TISS can be classified according to different travel modes adopted, including private car and public transit users (subway, bus, long, taxi, airplane, railway and ship) trip purpose and special user groups such as handicapped, elders and foreigners, as shown in Figure 1-1.
1.3.1 Private car users

The private car users have their own vehicles and normally they have more requirements on travel time, route selection and travel costs. Their travel purposes include commuting, sightseeing, entertainment, visiting relatives and friends etc. Therefore, the information they are mainly concerned with include:

Road condition and real time traffic information relating to the direction and distance of their trip routes, traffic congestion, traffic control, speed restriction, road construction, road class information (expressway, urban expressway, high class road, ordinary road sub-standard road or incident information and incidents;

Weather information, such as the rain, snow, wind, fog etc.

Relevant service en route, including expressway service area, gas station, repair and first-aid, food and accommodation, and tourism information;

Travel cost: toll charges of the roads and bridges, fuel consumption and the cost.

The public transport operators, including short/long-distance bus, tourist bus, chartered bus, are more concerned with the real-time traffic situation, weather,
roadwork and incident information and their impact on the bus operation schedules.

Truck drivers are more flexible to choose their trip routes and time apart from hazardous goods transport operators need to strictly follow drive on proper time and route as specified by traffic management department. Similar to the above types of travelers, the truck drivers are also concerned about traffic, weather, roadwork and incident information. In addition, they are more interested in the information of road and bridge toll charges, the service along the way, and other traffic control such as the limits on height, load and traffic.

1.3.2 Public transit users

There are different kinds of public transport modes for the travelers to choose, which include long-distance bus, short-distance bus, touring bus etc. The factors affecting travelers’ trip plan include travel time, service, route and cost, with demands on such information as bus station and stops, time schedule, ticket price, lost and found service etc.

1.3.2.1 Intercity bus travelers

Intercity bus travelers are concerned with the bus operation relevant information in order to plan their trip accordingly, which include the location of station and stops, ticket-selling spots, interchange stations, bus operator information, service information such as route, time schedule, price, vehicle type, available seats information, transferring, traffic control measures for special public event and temporary service change information etc.

1.3.2.2 Urban transit passengers

Urban bus travelers are mainly concerned with the information relevant to bus route, including route type, origin and destination and stops, first and last bus departure time, schedule, ticket types and prices, transferring stop information, newly open route, and the route adjustment and extension, traffic control measures for special public event and temporary service change information etc.
1.3.3 Railway, airplane and ship passengers

Now passengers can access comprehensive information of railway and aviation via their independent information service system, including railway station or airport information, train or flight ticket price, departure and arrival time, flight or mode transfer and etc... And they are also concerned with temporary change information of trains or flights, in order to make sure that they can adjust their trip plan in time.

1.3.4 Vulnerable and special groups

In terms of the special group, such as the elders, the weak, the sick, the disabled, the pregnant and foreigners, in addition to basic travel information, barrier-free facilities information, barrier-free route information, barrier-free bus and taxi information, wheelchair information and video, character, Braille for arrival time on the bus stop shall also be provided. The characters displayed shall be amplified and provided with Chinese-English conversion functions on the website or touch screen, etc.

1.4 Who are leading the development of TISS?

Figure 1-2 TISS Organizational Architecture

The transport authorities at the national, provincial and municipal levels will take the leadership of the TISS development.
1.4.1 National Level

At the national level, MOT is the leader for the National TISS development with main functions and responsibilities as the following:

- To establish national TISS development strategy, policy and program;
- To develop national TISS relevant standards;
- To develop TISS Development and Operation Guideline;
- To establish national TISS Implementation Action Plan;
- To organize regional or cross-regional TISS pilot demonstration projects, provide financial support, supervision and guidelines for the projects;
- To set up market oriented financial policies to attract private investors input in the TISS development and operation, as well as related product and technological development;
- To regularly organize comprehensive evaluation of each regional and national TISS, and to provide annual statistics for the TISS development;
- To develop and maintain transport related GIS platform necessary for regional and national TISS development;
- To apply and retain the national Travel Service Hotline number;
- To coordinate regional and national TISS related information exchange;
- To set up national one-stop travel portal website to provide the real-time national trunk road traffic condition and related weather information.

1.4.2 Provincial Level

Each of the provincial communications departments (PCDs) is the leader for TISS development in the province, particularly the inter-region and inter-city TISS development with main functions and responsibilities as the following:

- To establish provincial TISS development plan;
- To develop provincial TISS implementation plan;
- To provide guidance for inter-cities and inter-region TISS development;
- To establish provincial management system for TISS development and operation, particularly the provincial level coordinated and integrated information collection, processing and dissemination for the TISS, from different sources and departments, including road administration, traffic
management, weather forecast, transport operator, emergency response etc. related information sources and departments;

- To actively participate inter-province TISS development and operation related information exchange and sharing under the leadership of MOT;
- To develop market oriented commercial TISS services through public private partnership to encourage private sector participate the TISS development and operation, and to facilitate TISS industrialization process.

### 1.4.3 Municipal Level

Each of the municipal transport bureaus (MTBs) is the leader for local TISS development and operation with main functions and responsibilities as the following:

- To organize local TISS development work;
- To establish the implementation action plan for local TISS development;
- To establish municipal management system for TISS development and operation, particularly the municipal level coordinated and integrated information collection, processing and dissemination for the TISS, from different sources and departments, including road administration, traffic management, weather forecast, transport operator, emergency response etc. related information sources and departments;
- To develop TISS data exchange and sharing with the surrounding cities under the organization and cooperation of provincial transport department;
- To develop market oriented commercial TISS services through public private partnership to encourage private sector participate the TISS development and operation, and to facilitate TISS industrialization process.

The factors which affect TISS development include organization structure, financial input, technology used, policies, standards, operation mechanism, human resource and so on.

With rapid development of current information technology, technical factor is not longer a major barrier affecting the TISS development. However, each of the TISSs at different levels should have stable information sources, and it is up to the transport authorities at different levels to establish databank and the
data/information collection and transmission system, such as the road traffic
data/information detection and collection system, inter-city networked bus ticket
sales system, and etc.

Policies, standards, operation mechanism are major factors have to be dealt
with seriously, systematically and consistently for continuously improvement.
An effective and efficient organizational and sufficient financial support is the
key to ensure the startup of TISS development successfully.

An effective and efficient organizational support means that at the very
beginning of the TISS development, it is very important to have an
implementation agency responsible for the TISS development, with clear work
plan and sound management system for the TISS development project
including operation arrangement and management.

Sufficient financial support means that necessary financial input for both
implementation and operation should be taken into account to ensure financial
sustainability of the TISS development. Therefore, long-term sustainable
multiple source financial solution should be one of the development targets.

1.5 What kind of fundamental preconditions shall be
required for TISS implementation?

The factors which effect TISS implementation include organization structure,
finance investment, technology chosen, policies, standards, operational
mechanism, and personnel and so on.

With rapid development of current information technology, technical reason is
not longer to be a problem which affects on the implementation of TISS.
However, policies, standards, operational mechanism still have a space to
make it better. An effective organization and substantial finance guarantee is
the key to ensure the startup of TISS implementation successfully.

It is very important to clarify the units which implement, organize and manage
the TISS at the first stage of TISS implementation. Under a healthy
organization management system and operation, a clear arrangement would
ensure the smooth operation of TISS.

Substantial finance will guarantee to support the various finance requests of
TISS needs in different stages. The costs of maintaining need to be considered,
and the source and amount of finance should be clarified. Meanwhile, multiple financing schemes need to prepare.

1.6 What principles should be followed during the system development?

1.6.1 To integrate resources based on current situation

The travel information is characteristic of variety information types and sources, mass volume, rapid changes, wide coverage and difficult to collect. Most of the information comes from existing information systems used for daily management and service. During the implementation of TISS, information collection and integration will be a major task. Detailed analysis of different information types and its corresponding features shall be carried out, different collection and management methods shall be taken accordingly; necessary information processing and integration shall be carried out, to ensure the efficiency, effectiveness, and accuracy for practical service use. Those unqualified information shall not be disseminated to the public in order to avoid the misleading with negative effects.

1.6.2 To highlight priorities and pay attention to practical effects

The system implementation should be based on the existing road and transport system, focusing on dynamic traffic information collection and dissemination, mainly on real time road condition, weather, road maintenance work, incidents and accident, and ticket of public transport etc. and also including static information such as road network, entry and exit, en route service facilities, toll information, public transport stations, and public transport schedule, route and price information; meanwhile, water transport, railway, aviation, and tourism information shall also be considered. Thus information that is most concerned and required by travelers shall be provided.

1.6.3 To adhere to people-oriented and serve for real life

The system implementation should be based on real life, avoiding unnecessary technical terminology while using easy understood plain language. The principle of people-oriented should be followed all the way through the whole process of TISS development and operation. User demand analysis should take into account of various practical demands to provide pertinent information
in need, and quality service in deed, in terms of convenience, cost effective for
the travelers.

1.6.4 To encourage stakeholder participation for long-term solution

As an information service system for the general public, long-term development
and operation mechanism should be one of the key tasks for the TISS
development. The system operator should pay more attention to value-added
service and economic growth of TISS in addition to its social benefits, by
establishing effective monitoring and performance evaluation system, to attract
more stakeholders to participate in the development and operation of TISS, to
establish sustainable development and operation mechanism for TISS and
provide long-term stable service to the users.

1.7 What are the objectives for TISS development in
PRC?

The target of ISS development aims at establishing an ITS based travel
information service system through full integration and efficient use of the
transport related information resource and adopting multiple service manners, it
shall meet the public’s pre-trip, en-route and post-trip travel information service
demands; by strengthening the system performance monitoring and the
operation service quality assessment, to constant improve public’s satisfaction,
to facilitate the development of a safer, more reliable, more efficient transport
system.

By the year of 2010, each of the provinces, municipalities directly under the
central government and the autonomous regions shall start the implementation
of each own inter-city TISS under unified development plan and standard
architecture framework, with unified data platform, unified information
dissemination manner. By the year of 2015, all the cities abive the prefecture
level with population over one milion shall start municipal TISS, with its
population coverage rate (share of municipal total population) over 75%.

It is expected that by the year of 2020, all the provinces, municipalities directly
under the central government and the autonomous regions shall have
established relatively sound inter-city TISS; all the cities abive the prefecture
level shall urban travel TISS, with the user satisfactoriness above 90%.
2 General Technical Requirement for TISS Development

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2.2 FUNCTIONAL ARCHITECTURE ...................................................... 24
2.3 TECHNICAL ARCHITECTURE .......................................................... 30
2.1 General Architecture

Figure 2-1 TISS General Architecture

2.1.1 Network platform layer

Network platform layer is fundamental for data communication and exchange. TISS should take advantage of the existing information network and available communication means to ensure the data collection, transmission, exchange and dissemination in an efficient and steady way.

2.1.2 Software and hardware supporting layer

Software and hardware supporting layer comprises hardware equipment and system software. Consideration should be given to make full use of existing hardware and software, select high quality application server and database
server, storage equipments etc, with good performance and large capacity, suitable for future development needs, combined with supporting software, middle ware, data analysis software and GIS software used to establish application support environment.

2.1.3 Application system layer

This layer is composed of a set of application software system. TISS shall be developed based on uniform software architecture and uniform information coding system, to enhance multiple-use function of the software components in order to improve the development efficiency and reduce the develop cost.

2.1.4 Data exchange platform layer

As one of the most important component of TISS data center, data exchange layer provides a data integration, exchange and sharing service platform for each of the local, regional and departmental agencies with uniform data access as well as data synchronization, exchange and integration. It is also capable of materializing the data exchange for heterogeneous data sources, and providing support to the data collection, integration and transformation.

2.1.5 Data resource layer

Data resources layer is another important component of the data center, comprising database and data warehouse. TISS database are composed of base information database, subject database, model database, knowledge database and evaluation database etc. The main functions of TISS data warehouse are extracting relevant data, to materialize mass data storage and management.

2.1.6 Application presentation layer

Application presentation layer is unified and integrated portal of TISS, which comprises multiple interfaces for end users, including website, call center, SMS platform and information display terminals (Kiosks) etc.

2.1.7 Security layer

Security layer comprises information security system, standard and specification system, development and operation security system. Information security system is to ensure information safety through appropriate
technologies and administration means. Standard and specification system is to specify TISS design, development and implementation in compliance with the relevant national and industry standards. Development and operation security system is to guarantee the TISS development and operation under reasonable management system and long-term operation mechanism, with adequate human resource and financial support.

2.2 Functional Architecture

![TISS Functional Architecture](image-url)

Figure 2-2 TISS Functional Architecture
2.2.1 What pre-trip information should be provided?

2.2.1.1 Inter-city

- **Transport infrastructure information service**
  Road infrastructure information service mainly provides basic information about the road system including related auxiliary facilities information enquiries. Including start and end point of road section, mileage, cities along the road section, road class information etc; and road auxiliary facilities information includes the name and location of passenger station, toll station, entry and exit, overpass bridge, tunnel and bridge etc.

- **Ticket booking/sale**
  Long-distance bus, railway, flight, waterway passenger shipping information enquiry, fare structure, time schedule, temporary time schedule alteration, unsold ticket; Bus, boat and flight ticket booking or buying
- **Traffic condition information service**
  To provide the road condition information including real-time traffic congestion, traffic control and restriction, road or lane closure information and detour route recommendation etc. to help traveler make trip plan.

- **Weather forecasts**
  To provide weather information along the planned route, especially issue warnings of extreme weather like heavy rain, snow, wind, ice, fog etc., and their possible effects on the travel.

- **Trip route planning**
  — Electronic map service: To allow the users to check the location of the destination, road attribute information, and the route surrounding area conditions etc., such as passenger station, hotel and petrol station etc.
  — Route planning: To provide alternative trip routes between two or more spots, for comparison in terms of distance, travel time, cost, to find out the optimal path, with the shortest travel time, the lowest cost, etc.
  — Transferring planning: To provide transferring scheme and the corresponding travel time and cost information. Should the public transit information be included, TISS shall provide ‘door to door’ trip route planning service.

- **Travel cost information**
  To provide the travel cost information along the trip route including road and bridge tolls, petrol prices of different pump stations, food and accommodation, and the ticket price of tourist attractions.
2.2.1.2 Intra-urban area travel

- **Urban Transport Infrastructure information service**
  Urban transport infrastructure information service mainly provides basic information about the urban road and the road auxiliary facility related information enquiry. The road infrastructure information includes road name, mileage, road condition etc; and road auxiliary facilities information includes the name and location of bus stops, entry and exit, interchange name and position etc.

- **Urban public transit information service**
  The passengers can inquire urban public transit information via TISS relating to the urban bus, suburban bus, light-rail, sunway route, schedule, ticket price structure, temporary service change, lost and found.

- **Traffic condition information service**
  To provide the urban road condition information including real-time traffic congestion information, traffic control and restriction information, road closure information, and detour recommendation etc.

- **Trip route planning**
  —Electronic map service: To allow the users to check the locations of different kinds of geographical features such as landmark buildings, government department, public area, car park, interchange station, bus stop, and further provide the transport service information e.g. the bus route etc.
  
  —Interchange scheme plan: based on the electronic map, to provide alternative interchange schemes between two or more spots, for comparison to find out optima scheme with the shortest distance, the shortest travel time, the lowest cost, etc.

- **Travel cost information**
  Including the information of toll charges for the urban road and bridge, vehicle repair and first-aid fee standard, driver training fee standard, violation fine, and the ticket price of tourist attractions.

- **Other travel information services**
  To provide other relevant travel information of tourist attraction, pump station, driving school, garage, parking lot, vehicle inspection station and etc.
2.2.2 What en-route information should be provided?

- **Real-time road condition information**
  To provide for the traveler with information about traffic incident/accident, road condition, temporary traffic control and detour route etc.

- **Weather information**
  To provide the weather information of the areas along the trip route and the destination.

- **Guidance and instruction**
  Route instruction service can instruct the travelers to reach the destinations by continuously reminding them to turn and enter/exit the expressways at appropriate positions. The available parking spaces and parking route plans are provided through parking information service.

- **Emergency services**
  To provide specific information for emergency response, including the introduction and contact information of traffic police, vehicle maintenance garages, pump stations, hospitals, etc.

- **En-route information and communication**
This service offers the travelers a channel to report their finding during the trip on such information as traffic incident/accident, traffic congestion and pavement distress/damage to the related transport management departments.

### 2.2.3 What post-trip information should be provided?

- **Complaints and advices**
  Travelers can submit an evaluation, such as satisfaction levels and suggestions to the related management departments through this service, which will help improve the TISS service quality.

- **Lost and found**
  Travelers can look for their properties lost during the travel through this service.

- **Travel information forum**
  A communication platform for the travelers to exchange their experiences and travel information service advices and recommendations.

### 2.2.4 What methods can be used for the information dissemination?

#### Table2-1 Travel phases and available service methods

<table>
<thead>
<tr>
<th>No.</th>
<th>Phase</th>
<th>Suitable Service Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Website</td>
</tr>
<tr>
<td>1</td>
<td>Pre-trip</td>
<td>★</td>
</tr>
<tr>
<td>2</td>
<td>En-route</td>
<td>★</td>
</tr>
<tr>
<td>3</td>
<td>Post-trip</td>
<td>★</td>
</tr>
</tbody>
</table>
2.3 Technical Architecture

Figure 2-3 TISS Technical Framework
Figure 2-4 TISS Network topology diagram
During the process of TISS development, it is necessary and imperative to ensure standardization and in the data collection, transmission, processing, and dissemination, and the consistancy of the service quality, which is fundamental to facilitate TISS development and convenient use of the information service by the public.

2.3.1 Data collection and transmission

2.3.1.1 Where are the data from and how are they collected? What types of technology are required?

2.3.1.1.1 Inter-city information collection

- **Basic Information from PCD and MTB**
  The basic information is mainly about transport infrastructure inventory including expressway, highway, urban road and related transport infrastructures collected and exchanged from management information system in each of the PCDs and MTBs. Normally, these data are static and updated once a year.

Currently, the methods adopted for basic road spatial data collection are based on GPS data collection terminal and satellites remote sensing.

- **Information from Road Department and Traffic Police**
  Traffic control information, such as lane closure, road blocking and by-pass route, due to roadwork, is released by municipal engineering office. Temporary traffic control information, such as roadblock, lane closure, traffic restriction, owing to traffic incident/accident or public event is released by Traffic Management Police.

- **Information from Traffic Surveillance & Control**
  There are different equipment and devices for automatic traffic surveillance and control system installed at different road area, such as video camera to monitor road traffic condition, emergency response, at entry exist or interchange hubs, toll stations and key road sections and bridges; traffic
counting detectors on the existing expressway system; the road patrol vehicle on-board equipment. The information from these equipment is dynamic and under the road department or traffic police.

The dynamic information from the traffic surveillance and control may be uploaded by different time divisions or in real-time, depending on the management requirements.

- **Road traffic condition**

Road traffic condition on urban, expressway and highway includes vehicle speed, lane occupancy and traffic volume. Expressway and urban road management authorities collected data by using automatic or manual counting methods, such as circular loops under road surface, microwave sensors, infrared detectors and distance measure instrument (DMI).

Dynamic road traffic condition information usually requires real-time information. Intercity road traffic condition information is usually updated every 30 minutes.

- **Weather Information**

Regional or city weather information is normally provided by local weather forecasting agency.

The weather for the sections of expressway, highway and urban road, such as snow, rain, fog, wind speed, humidity, temperature, visibility, disaster warning etc., is normally provided and released by relevant road management department by using freezing point detectors, road surface sensors,
temperature sensors and visibility detectors installed on key road sections or suitable locations, or on-board infrared temperature sensors. Comprehensive weather monitoring stations are established at suitable locations to collect the information.

According to the type of data collected, weather information needs to be updated (transmitted and updated when changes take place) or in real-time.

### Ticket Information

Each passenger transport system reports the information such as intercity long distance transport routing, ticket pricing, time schedule, temporary alteration and bus station information. Ticket center of passenger transport online ticket system collects passenger-ticketing information such as ticket buying and unsold tickets. Such dynamic information normally requires to be updated in real-time.

The timetable and ticket information of railway, civil aviation and waterway and other information are collected by relevant transport service network.

2.3.1.1.2 Urban information collection

### Basic Traffic Information

Basic information on urban road, road infrastructure and other information are mainly collected and exchanged through municipal management information
system of urban municipal management department. Normally these static information are updated once or twice a year, based on changing circumstances.

- **Traffic Control Information**
  Urban traffic control information such as lane closure, road blocking and by-pass route, due to roadwork, is collected by management system of municipal engineering department. Temporary traffic control information such as road blocking, lane closure and traffic restriction is released by traffic management department of the Police.

- **Video Surveillance and Control Information**
  Urban road traffic condition, emergency incidents and video information of overpasses, key road sections, bus interchanges and subway stations can be collected through fixed video surveillance and control cameras. Corresponding management departments such as Urban Traffic Management Bureau of the Police, hub terminal operator and subway corporation are in charge of the surveillance and control and the information upload. Video surveillance and control information in urban areas are normally uploaded in continuous real-time or by different time divisions.

- **Road Condition Information**
  Urban road traffic condition, including section vehicle speed, lane occupancy and traffic volume are normally collected through automatic methods such as circular loops under road surface, microwave sensors and infrared detectors, installed by urban traffic management department of the Police. It can also be
collected through manual methods such as traffic police patrol and taxi driver report. Such information needs to be exchanged and shared with urban traffic management department and taxi company.

At present, major cities in PRC adopt floating car technology that installs GPS terminals on taxis to collect, analyze and disseminate road traffic speed and traffic condition information. After the road condition information having been processed, it is released to the public in the forms of different color to indicate free flow respectively, congestion and low speed (green: >40km/h; yellow: 20-40km/h; red: <20km/h). Dynamic road condition information requires real-time information. Thus, urban road condition information is normally updated less than every 5 minutes.

- **Weather Information**

Urban weather information is normally provided by local weather forecast agency.

Weather information for sections of urban road such as ice, snow, rain, humidity, temperature, visibility and disaster warning is normally released by urban traffic management department of the Police. The devices used are similar with those used in highway weather information collection. According to the severity of the weather condition and information type, urban road weather information is updated in time or in real-time.

- **Urban Public Transport Information**

Information such as routing, frequency, stops, timetable, mode transfer and temporary alterations of transport service is collected by dispatch management system of corresponding bus company and subway company.

Each public transport operation management authority is in charge of collecting public transport information such as routing, stops, timetable, temporary alterations and interchange information, etc.
2.3.1.2 How to transmit data?

There are two major methods to automatically transmit data, wireless and cable, with manual assistance when it is necessary.

Operation management data (roadwork, traffic control information), video surveillance information collected from toll station and interchange hub, dynamic information collected by transport service operator (e.g. ticketing) are normally transmitted by cable network such as own or leased highway optical fiber.

Data collected by field equipments (e.g. traffic observation spot, microwave detector, comprehensive traffic analysis instrument, weather monitoring equipment, etc.) and emergency information (e.g. road damage, traffic accident, etc.) are normally transmitted through wireless communications network such as CDMA and GPRS.

Where condition allows, the wireless transmitted data can be switched into cable network to improve data transmit quality and efficiency.

2.3.2 Data processing

2.3.2.1 What is the system architecture of data processing center and what functions can it provide?

Data processing center system is the core of TISS with such functions as classifying, analyzing, filtrating, transferring and storing the collected data dynamically. Thus, a basic traveler information service database will be generated and the traveler information service will be provided by information dissemination system through different display system. Data processing center shall have sufficient capacity for mass data process and data storage, with good stability and extendibility and advancement.

It is mainly consisted of four parts, including data access, data processing, database and dissemination gateway.

(1) Data Access

Based on different data types and sources, data access system can be divided into three functions: data extraction, data import and data input.
Data extraction: using extraction system based on EAI to collect data regularly or in real-time and developing corresponding adapters to each of the data sources. Data can be counted and adjusted through management interface.

Data import: mainly dealing with raw data from division application system and geographic information layer data. Data is imported into public travel database through corresponding import program.

Data input: The system provides manual input interface for the recorders to input updated data.

(2) Data Processing
The main functions include:

- Digital map processing
- Floating car data processing
- Traffic flow survey data processing
- Highway video surveillance data processing
- Traffic weather data processing
- Online ticketing data analyzing and processing
- Static route planning and analyzing
- Multi-modal trip planning and analyzing
- 3D GIS demonstration and processing

(3) Database System
The functions of database system mainly include user interface establishment, data storage, visiting control, inquiry optimization, data restoration, data verification, data directory management, concurrent control and data maintenance, etc. The main functions of the database management system should be combined with the transport management information system data center.

(4) Dissemination Gateway
As the general dispatcher of dissemination system, the dissemination gateway is for uniform classification of different types of information and format conversion. Dissemination gateway software is mainly used for the conversion and processing of data information for different dissemination systems and data dispatching and management; also for the realization of access and communication with interface gateway. The methods of information dissemination include website, cell phone short message text, VMS system,
public travel information service hotline. The end-users are Internet users, cell phone users, private car travelers, and the hotline users. In correspondence with different dissemination methods and objects, dissemination gateway provides relevant operation modules for protocol conversion, data dispatching and management, etc.

Communication interface gateway is mainly used to receive and release gateway software information, complete communication protocol conversion and to realize the connection and communication with outer communications gateway. It also provides gateway operation data for future business development. Communication interface gateway includes public web gateway, SMS gateway and inter-system gateway.

2.3.2.2 What kinds of database should be designed in the data processing center?

**Figure 2-5 General Structure of Database System**

TISS database includes basic database, specialized database, model database, knowledge database and assessment database. Database is mainly for storage and management of mass data extracted from travel database.

TISS stores general basic information, GIS data; data from relevant departments obtained through data sharing and exchange system. The format and original data standard of related database refers to national and industrial standards.

1. Basic Database
   - Highway basic attribute database
   - Highway spatial attribute database
   - Urban road basic attribute database
   - Urban road spatial attribute database
   - Long distance coach station basic attribute database
- Intercity passenger transport line database
- Urban bus stop database
- Urban bus line database
- Passenger transport operator, vehicle maintenance operator, driver training operator and emergency response first-aid operator

(2) Specialized Database
- Real-time road condition database
- Roadwork database
- Traffic weather database
- Emergency response database
- Long distance coach run schedules database
- Long distance coach ticketing database
- Urban bus ticket fare database
- Urban bus timetable database
- Traffic yellow page database

(3) Model Database
- Route planning model database
- Bus interchange model database
- Operation quality analysis model database

(4) Knowledge Database
Travel related common knowledge information, accumulated knowledge and strategic information, including common knowledge, laws and regulations and travel forums, etc.

(5) Assessment Database
Background system operation monitoring statistic database and assessment database.
- User satisfaction survey database
- Website and call center operation monitoring statistic database
2.3.3 Data exchange and sharing

![TISS Data Exchange System Structure](image)

Figure 2-6 TISS Data Exchange System Structure

2.3.3.1 Data exchange

TISS data exchange system shall comply with uniform standard, regular data updating to ensure the data integrity and consistency. The exchanged data shall be uniformly enveloped and expressed to realize data exchange and sharing between different local or regional TISS. The exchangeable data types include text, image, related database and audio/video data.

Data exchange mode includes real-time exchange and regular exchange. Real-time exchanged information includes real-time road condition, weather, incident/accident and travel related dynamic information. Regularly exchanged information includes regularly changed travel related information.

TISS data exchange needs to use data exchange system. Front-end PC is set up before providing and release TISS, which realizes data exchange via data exchange services. Front-end PC system comprises operation system, front-end PC exchange information database, information exchange database, information exchange interface, information exchange bridge interface and front-end PC security model.
The function of data exchange system includes data loading, data adapting, data transmitting, data conversion and routing, exchange process monitoring, configuration management and log management, etc.

Data exchange supports: XML format and use the same code (UNICODE); supports SOA technology framework based loosely-coupled data exchange system, providing WEB SERVICE interface; supports multiple communication modes, such as point-to-point, release/subscription, request/reply communications etc.; meanwhile, it supports synchronous and asynchronous communication and provides data encryption function which ensure the data security; supports TCP and UDP. Spatial data exchange adopts GML format following OGC standard and specification, mainly WMS and WFS.

![Figure2-7 Data Exchange System](image)

2.3.3.2 Data sharing

TISS data sharing includes data resource sharing, service resource sharing, which can be realized via travel information source directory and EBS.

A travel information service directory system should be established according to universal data requirement and data exchange standard; based on actual travel service demand to generate travel information source directory by cataloging travel relevant information; with uniform management of shared information resource directory, to provide traveling information release, finding and positioning service and the traveling information resource directory visiting control.

Data resource provider units should register their directory contents in the data exchange system and be responsible for the data updating and maintenance, according to the travel information resource system structure and the registration mechanism determined by the sharing exchange system. The user
units of the data resource may call directory service provided by the data sharing exchange system, to find out travel information resource directory, positioning the travel information related directory contents and obtain the information from relevant system, to realize the information sharing.

The resource directory interface is used for the establishment, inquiry and management of the travel information resource directory. The resource directory supports HTTP positioning mode. The directory service provides unified external service interface.

2.3.4 Information dissemination

2.3.4.1 Website

![Service descriptions](image)

Website can provide information in different forms, such as text, figure, video and audio, which is very straightforward and convenient, offering various contents, suitable for the service with rich contents, including transport infrastructure information service, road condition information service, ticketing service, trip route planning service, weather information service, emergency response service, complain and advice service, travel information report, customized travel information, lost and found service, travelling information forum service and other travel related information service.
## Construction mode

Model 1: travel plan website is to set up by the government transport authority such as MTB and fully in charge of the operation and management. The government is responsible for all the financial and human resource input for the website operation, including hardware stock, software development, maintaining, and all necessary working staff.

Mode 2: Outsourcing can be adopted for travel information service website development and operation. The government transport authority is responsible for providing necessary information and operation costs for the information service. Daily maintenance work can be handed over to professional company. Later-on, based on continuous improvement of the information service system, the operation company may conduct individual value-added commercial service which will assist to gradually decrease the government input for the development and operation of the TISS system. Under this mode, government is responsible for travel information and the operation agency is responsible for daily operation and management of the website. It can raise money for information collection and processing as well as advertisement and value added services.

### 2.3.4.2 Call center

## Service description

All the static information and most of the dynamic information in relation to public transport could be released via a call center. A call center could provide traffic situation, ticketing service, weather information service, instructive service, emergency response service, complaint and advice service, transport information reporting service, customized travel information, lost and found service, and other related information services.
Development mode

Mode 1: Joint cooperative mode is used for the call center establishment and operation between the transport authority and the existing communications department such as China Telecom (118114) and China Mobile (12580), etc. By setting up data interface with the cooperative parties, the transport authority would be in charge of providing travel related information to the telecom department responsible for the call center operation and management including the facilities and staffing. Part of the profit of telecom authority from call center services could be used as one of the funding sources of the transport authority for the information collection and maintenance.

Mode 2: By application of a unified special service hotline number, the transport authority may invest in the establishment of the call center on its own. Under this mode, the transport authority will take full charge of the call center, from the deployment of the call center, infrastructure facilities to staffing arrangement, etc, with specific department and personal for the call center operation and management.
2.3.4.3 Radio broadcasting station

- **Service Description**
  
  Via radio broadcasting stations, transport authority could provide the traffic condition information, traffic accident information to travelers on the road in time, so that they can get the information in advance and plan appropriate routing earlier. Major information service of radio broadcasting stations are traffic condition and weather information, etc.

- **Development mode**

  Cooperative development mode should be adopted for the development and operation of traffic information broadcasting station between the transport authority and the local radio broadcasting station. The radio broadcasting stations could set up live broadcasting room at the TISS Data Center, or it could be operated by transmitting information to the live broadcasting room in the radio broadcasting station through direct communication cable.
2.3.4.4 Television

- **Service descriptions**
  Television currently as a most popular media tool, it is suitable for broadcasting static and dynamic information. It has approved to be wildly accepted by the public with low costs. Weather and road condition and other information can be easily released to the public via TV system.

- **Development mode**
  In cooperation with local TV station, traffic channel broadcasts and maintains the information provided from highway, expressway and urban road management departments. Presently, there are many cities having city TV channel as a public media with display terminals on buildings, bus stops and other public areas, which can be treated as one of important means to release travel related information.

2.3.4.5 Travel guide book

- **Service descriptions**
  Travelling guide book contains travel related information like maps, tourist attractions in the form of paperback brochures etc

- **Development mode**
  The brochures can be provided free of charge or sponsored by commercial entities, with commercial advertisement included in the brochures.
2.3.4.6 Mobile communication terminal

- **Service descriptions**
There are many flexible and easy ways to get travel related information in anytime and anyplace, for instants, cell phone message text, multimedia message, WAP, PDA wireless internet, community note. Information can be in text, picture and any other multimedia forms. Via mobile communication terminals, traffic information, ticketing, travel plan, weather, instructive, emergency, and tailor-made travel related information can be sent to users.

- **Development mode**
Mode 1: transport authority provides related information to the message service providers (SP) who have mature technology and platform for the travel information and tailor-made message service. Part of the revenue from the short message and advertisement can be taken as financial input for the travel related information collection, processing and maintenance by the transport authority.

Mode 2: message platform is set up by transport authority with special inhouse management agency and staff for daily maintaining and management financed by the government.

2.3.4.7 VMS

- **Service descriptions**
VMS is very suitable to release dynamic information, such as road situation, accident, weather, traffic guidance etc. especially, the road information displayed on VMS can immediately related to the road sections ahead proved to be effective.
Parking guide system uses a lot of VSM. Majority of the road users know the car park space information via VMS.

- **Development mode**

  The VMS mainly used for expressway and urban road traffic management, with investment mainly from local government. In-house or outsourcing may be adopted for the field equipment operation and maintenance.

2.3.4.8 Fixed information terminal

2.3.4.9 Electronic bus stop sign

- **Service description**

  Electronic bus stop sign is compatible with GPS, communication system, monitor system etc. Passenger interchange hub or bus stops can use electronic sign to display bus timetable, routing, departure time and other static information. Meanwhile, it can also provide dynamic information, like next bus arrival time, emergency and change of bus schedule with audio and picture for handicapped.

- **Development mode**

  Electronic sign normally set up and maintain by passenger transport and bus operation companies.
2.3.4.10  Information kiosk

- **Service description**
  Information kiosk is mainly located on the roadside of highway service areas, streets, stations, tourism spots, community areas, business areas, hospitals, schools, hotels and other public areas. Travellers can search travel information they need. The weak point of this is not able to be installed anywhere, with limited application areas.

  By using Touch screen on information display terminal, travel information such as road conditions, tickets, travel route plan, weather, emergency response and cost information service can easily be realized.

- **Development mode**
  Government or companies provide investment in the system, which may include public or commercial advertisement. Transport authority is responsible for the collection of travel information and providing financial subsidy under special circumstances.

2.3.4.11  On-board information terminal

- **Service description**
  The travel information can be released by transport authority via FM radio or wireless
communication via on-board terminal, which receive different forms of static and dynamic information, including text, audio and geographic information.

On-board terminal can provide services including GPS based navigation, road traffic condition, travel plan information, weather, emergency rescue and tailor-made information service.

### Development mode

Information dissemination system is funded by government or enterprises initially. The onboard equipment has potential market, which may have commercial revenue as part of fund source for TISS development.

#### 2.3.5 Information Security

The security design of TISS includes 7 aspects, such as security management, network security, host security etc, as shown in the figure below:

![Figure2-11 Security Pyramid](image)

Figure2-11 Security Pyramid
2.3.5.1 Security management

There is no absolute security or safety in the world. Good management system will be effective supplement to the technical security protection. Security management includes: security risk assessment, security reinforcement, security audit, emergency response, security training, and other security management measures can be provided.

2.3.5.2 Network security

Network security is the key element of the whole security strategy, which is mainly supported by the functions of network facilities including network firewall, network switch, network intrusion detection system, shadow security scanner, etc.

2.3.5.3 Host security

High security will be achieved for the host system in the development of TISS by using well-developed and verified servers, memory system and tape driver system together with stable and reliable operating system.

2.3.5.4 System security

There are 3 aspects of the TISS system security: operating system security, database security and employed software security.

- **Operating system security**
  It should be in accord with C2 level operating system. UNIX system is recommended.

- **Database security**
  Large-scale database system is recommended to enhance the reliability, capability and extendibility of the system.

- **Employed software security**
  Middleware platform is recommended to realize the middle-business platform between C/S and B/S to improve the security, reliability and compatibility of the system.

2.3.5.5 Data security

Data security design includes data storage security, data transmission security and data backup security.
Data storage security
It is recommended to use RAID technology in the data storage process to prevent the loss of data due to disk failure.

Data transmission security
SSL should be deployed, when accessing vital data, to protect the data from being seen or modified by other people during the data transmission in the network.

Data backup security
Data backup and recovery system should be adopted to minimise the impact from different kinds of disasters on the application of TISS.

2.3.5.6 Application security
The main security consideration in the application system will focus on the user ID authentication and authorisation management, data backup, data saving and transmission.

2.3.5.7 Virus prevention
The upgrade and deployment function of the virus prevention system should be automatically carried out with the ability of daily renovation. Centralised management and monitoring should be achieved for the whole system with the creation of daily report and statistic information.

2.3.6 Main Software and Hardware

2.3.6.1 Support software of the system

Table 2-2 Name List and Function Description of the Support Software

<table>
<thead>
<tr>
<th>Number</th>
<th>Software Name</th>
<th>Function Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Database</td>
<td>Database software is the basic platform of the data storage to save all the resource data from the data centre and provide data support for the application of various application system.</td>
</tr>
<tr>
<td>2</td>
<td>Application Middleware</td>
<td>All the application software being developed will be deployed on the application middleware platform for users.</td>
</tr>
<tr>
<td>3</td>
<td>Middleware</td>
<td>To provide systematic support for the applications based on electronic map.</td>
</tr>
</tbody>
</table>
4 Data Backup and Recovery
Scheduled regular backup for the key data in the data centre; to make recovery, if necessary, when in abnormal circumstances.

5 Operating System
Such as LINUX, Unix, WINDOWS.

6 Data Exchange and Integration
For the exchange, processing and saving of the collected data.

7 Data Analysis
For the analysis and display of the data.

2.3.6.2 Application software

Table 2-3 Name List and Function Description of the Application Software

<table>
<thead>
<tr>
<th>Number</th>
<th>Software Name</th>
<th>Function Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Data Collection System</td>
<td>Automatic and manual collection and recording of various data.</td>
</tr>
<tr>
<td>2</td>
<td>Portal Website System</td>
<td>Provide functions such as travel information browsing, enquiry search, analysis, map-based displaying, forum and background dissemination, monitoring and management.</td>
</tr>
<tr>
<td>3</td>
<td>Call Centre System</td>
<td>Automatic speech, manual desk client, chief operator, multi-line facsimile, recording</td>
</tr>
<tr>
<td>4</td>
<td>Message Platform System</td>
<td>Short message customization and issuing for travel information, cell broadcast</td>
</tr>
<tr>
<td>5</td>
<td>Information Release System</td>
<td>To disseminate the travel information to the release terminals.</td>
</tr>
<tr>
<td>6</td>
<td>GIS Data Processing and Displaying System</td>
<td>To achieve the GIS data processing and displaying.</td>
</tr>
<tr>
<td>7</td>
<td>Data Interface System</td>
<td>To achieve the exchange and share with other application systems.</td>
</tr>
</tbody>
</table>

2.3.6.3 Hardware

Table 2-4 Name List and Function Description of the Hardware

<table>
<thead>
<tr>
<th>Number</th>
<th>Hardware Name</th>
<th>Function Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Database Server</td>
<td>To form a dual-redundant standby system to ensure high reliability and practicability for deploying database software.</td>
</tr>
<tr>
<td>2</td>
<td>Application System Server</td>
<td>To serve all the subsystems of public travel information services.</td>
</tr>
<tr>
<td></td>
<td>Equipment</td>
<td>Description</td>
</tr>
<tr>
<td>---</td>
<td>--------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>3</td>
<td>GIS Server</td>
<td>To deploy GIS middleware software to provide hardware support for E-map based application.</td>
</tr>
<tr>
<td>4</td>
<td>Data Backup Server</td>
<td>For the deployment of backup software to provide hardware support for scheduled data backup and data recovery under disasters.</td>
</tr>
<tr>
<td>5</td>
<td>Fabric Switch</td>
<td>For the connection between the host system and disk array.</td>
</tr>
<tr>
<td>6</td>
<td>Disk Array</td>
<td>For the storage of all the data in data center.</td>
</tr>
<tr>
<td>7</td>
<td>Fabric Tape Library</td>
<td>For the storage of scheduled backup data.</td>
</tr>
<tr>
<td>8</td>
<td>Firewall</td>
<td>To control the visit between the extranet and the internal network.</td>
</tr>
<tr>
<td>9</td>
<td>Intrusion Detection</td>
<td>To provide real time protection from internal and external attack as well as faulty operation, which can hold up and respond to the intrusion to avoid the broken-down of the network.</td>
</tr>
<tr>
<td>10</td>
<td>Virus Prevention</td>
<td>To prevent the virus for all the network and terminals.</td>
</tr>
</tbody>
</table>
3 TISS Standard System

3.1 HIERARCHICAL DIVISION OF TISS STANDARD.................................................. 57
3.2 EXISTING NATIONAL AND INDUSTRIAL STANDARDS .................................... 59
3.3 LIST OF CHINA TISS STANDARD....................................................................... 60
3.1 Hierarchical division of TISS standard

The establishment and implementation of TISS standards is an important basis to guarantee the information exchange and sharing between different layers of TISS systems and to promote industrial development. In order to establish a well-arranged TISS standard framework, the national standard of GB/T13016-1991, Principals and Requirements for Standard System Establishment is taken as a reference, and TISS standard framework is shown in Figure 4-5 based on the existing standards and TISS functional demand analysis.

In TISS standard framework there are four types of standards: basic standards, professional common standards, professional dedicated standards and relevant standards, etc., in which:

(a) Basic standards, referring to the common standards in the field of ITS, such as ITS terminology. These will not be listed in the report.

(b) Professional common standards, referring to the common standards in the field of TISS, including the data set, information classification and coding applied in travel information service will be divided according to the content of different service information, including road network attribute, road traffic condition, long-distance passenger transport, urban road network, urban public transport, taxi, multi-mode transport, parking, dynamic road condition, emergencies, roadwork, weather, etc..

(c) Relevant standards, referring to standards of other industries applicable to TISS, such as communications standards, computer standards, road industry standards, which will not be listed in our standard system structure, as shown in dashed line in the following Figure 3-1.
TISS Standard Framework

TISS Terminology & Definition
TISS Basic Information Classification & Coding
TISS Operation Management & Service Quality Assessment Standard
TISS Data Access & Exchange Standard

Professional Common Standard

Information safety Standard
Geographic Information Standard
Communication Standard
TISS Related Industry Professional Standard

Basic standards

Transportation Information System
TISS Standard System Framework

Figure 3-1 TISS Standard System Framework
3.2 Existing national and industrial standards

Up to June 2008, National Standards related to Traveler Information Service System that have been officially published are shown in Table 3-1. These 12 standards are established by ITS Standard Association of China (SAC/TC268).

<table>
<thead>
<tr>
<th>No.</th>
<th>Standard</th>
<th>Standard Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Intelligent Transport System: General Terminology</td>
<td>GB/T20839-2007</td>
</tr>
<tr>
<td>3</td>
<td>Intelligent Transport System: Data Management Mechanism Requirement for Central Data Register</td>
<td>GB/T20611-2006</td>
</tr>
<tr>
<td>5</td>
<td>Road Traffic Information Collection: Information Classification and Coding</td>
<td>GB/T 20133-2006</td>
</tr>
<tr>
<td>6</td>
<td>Road Traffic Information Collection: Incident Information Set</td>
<td>GB/T 20134-2006</td>
</tr>
<tr>
<td>7</td>
<td>Traffic Management Information Attribute Classification and Coding: Urban Road</td>
<td>GB/T21379-2008</td>
</tr>
<tr>
<td>8</td>
<td>Traffic Management Geographic Information Entity Identification Coding Rules: Urban Road</td>
<td>GB/T21381-2008</td>
</tr>
<tr>
<td>10</td>
<td>Traffic and Traveler Information (TTI), Transport Message Coded TTI Message, Part II: Radio Data System – Transport Message Channel (RDS-TMC) Incident and Information Coding</td>
<td>GB/T20612.2-2006</td>
</tr>
<tr>
<td>11</td>
<td>Traffic and Traveler Information (TTI), Transport Message Coded TTI Message, Part III: ALERT-C Locating Reference</td>
<td>GB/T20612.3-2006</td>
</tr>
<tr>
<td>12</td>
<td>Road Traffic Information Service: Information Classification and Coding</td>
<td>GB/T21394-2008</td>
</tr>
</tbody>
</table>
3.3 List of China TISS Standard

A list of TISS Standard is provided according to the hierarchical division of the Standard Framework. The TISS Standard List is based on the modification of the existing standards according to new demands.

(a) Professional common standards include 17 standards, mainly referring to TISS General Framework, TISS Terminology and Definition, TISS Basic Information Classification and Coding, Central Data Register Standard, TISS Operation Management and Service Quality Assessment Method Standard and TISS Data Dictionary, etc. They are the commonly used standards during TISS system construction. Traveler Information Service: General Framework and Traveler Information Service: Operation Management and Service Quality Assessment Method Standard are the guideline and assessment standard of our TISS construction in the current situation. Traveler Information Service: Data Dictionary and Traveler Information Service: Central Data Register Standard are the base for realizing data exchange between different systems and different organizations/divisions, in which, Central Data Register Standard could be referred to relative existing standards in ITS field.

(b) The core components of the TISS standards system are classified into three series of standards, i.e. those for the TISS data input and exchange, the TISS data process, and the TISS information publication, with those for the in-vehicle navigation system as one specialized standard, which make a total of 4 series of standards, including a total of 39 standards, 11 of which are for in-vehicle navigation system.

(c) To accommodate the development of the TISS technology, two specialized standards are to be developed, i.e. the field data input standards of "the traffic information service, floating car data input standard" and "the traffic information service, the mobile phone data input data standard".

(d) According to the definition of the TISS interface, the data input center of the TISS will have data input from each of the stakeholders' data input centers. Therefore, there are a total of 9 standards to be developed for the data exchange between the said data input centers, including "the traffic information service, the road data input/exchange standard (with the road data center)", "the traffic information service, the incident/accident data exchange standard (with the emergency response data center)", "the traffic information service, the
weather information exchange standard (with the weather information center)", and etc.

(e) For the storage and classification of each of the data series, additional standard for the data processing is to be developed, i.e. "the traffic information service, multiple data processing specifications"; and to unify the specifications for determination and description of the traffic conditions, additional standard of "the traffic information service, road network traffic condition classification and description specifications" is to be developed.

Table 3-2 List of TISS Standard System (Modified)

<table>
<thead>
<tr>
<th>No.</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Terminology and Definitions</td>
</tr>
<tr>
<td>1.1</td>
<td>Travel Information Service: Terminology</td>
</tr>
<tr>
<td>1.2</td>
<td>Travel Information Service: Data Dictionary</td>
</tr>
<tr>
<td>1.3</td>
<td>Travel Information Service: Schedule/Route (SCH)</td>
</tr>
<tr>
<td>1.4</td>
<td>Travel Information Service: Spacial Expression</td>
</tr>
<tr>
<td>1.5</td>
<td>Travel Information Service: Passenger Information</td>
</tr>
<tr>
<td>1.6</td>
<td>Travel Information Service: Service Quality Requirement</td>
</tr>
<tr>
<td>1.7</td>
<td>Travel Information Service: Man-Machine Interface Requirement</td>
</tr>
<tr>
<td>1.8</td>
<td>Travel Information Service: Personal Visit Information Set</td>
</tr>
<tr>
<td>1.9</td>
<td>Traveler Information Service: Multimodal Transport Information Set</td>
</tr>
<tr>
<td>1.10</td>
<td>Traveler Information Service: Vehicle Guidance Information Set</td>
</tr>
<tr>
<td>1.11</td>
<td>Traveler Information Service: Emergency Information Set</td>
</tr>
<tr>
<td>1.12</td>
<td>Traveler Information Service: Taxi Information Set</td>
</tr>
<tr>
<td>2</td>
<td>Traveler Information Service: Basic Information Classification and Coding</td>
</tr>
<tr>
<td>3</td>
<td>Traveler Information Service System General Framework</td>
</tr>
<tr>
<td>No.</td>
<td>Standard</td>
</tr>
<tr>
<td>------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>4</td>
<td>TISS Operation Management and Service Quality Assessment Standard</td>
</tr>
<tr>
<td>5</td>
<td>Traveler Information Service: Data Dictionary</td>
</tr>
<tr>
<td>6</td>
<td>Traveler Information Service: Central Data Register Standard</td>
</tr>
<tr>
<td>7</td>
<td>Data Access Standard (Including Data Content, Data Format, Data Transmission Frequency, etc.)</td>
</tr>
<tr>
<td>7.1</td>
<td>Traveler Information Service: Floating Car Data Access Standard</td>
</tr>
<tr>
<td>7.2</td>
<td>Traveler Information Service: Mobile Phone Data Access Standard</td>
</tr>
<tr>
<td>7.3</td>
<td>Traveler Information Service: Road Industry Data Access Standard (with Road Data Center)</td>
</tr>
<tr>
<td>7.4</td>
<td>Traveler Information Service: Long Distance Passenger Transport Industry Data Access Standard (with Long Distance Passenger Data Center)</td>
</tr>
<tr>
<td>7.5</td>
<td>Traveler Information Service: Traffic Management Data Access Standard (with Traffic Management Center)</td>
</tr>
<tr>
<td>7.6</td>
<td>Traveler Information Service: Urban Public Transport Data Access Standard (with Public Transport Center)</td>
</tr>
<tr>
<td>7.7</td>
<td>Traveler Information Service: Railway Data Access Standard (with Railway Data Center)</td>
</tr>
<tr>
<td>7.8</td>
<td>Traveler Information Service: Civil Aviation Data Access Standard (with Civil Aviation Data Center)</td>
</tr>
<tr>
<td>7.9</td>
<td>Traveler Information Service: Waterway Data Access Standard (with Waterway Data Center)</td>
</tr>
<tr>
<td>7.10</td>
<td>Traveler Information Service: Emergency Data Access Standard (with Processing Center)</td>
</tr>
<tr>
<td>7.11</td>
<td>Traveler Information Service: Weather Data Access Standard (with Weather Forecast Center)</td>
</tr>
<tr>
<td>7.12</td>
<td>Traffic Information Service: Vehicle Location Reference</td>
</tr>
<tr>
<td>8</td>
<td>TISS Data Center Standards</td>
</tr>
<tr>
<td>8.1</td>
<td>Traveler Information Service: Multiple Data Processing Standard</td>
</tr>
<tr>
<td>No.</td>
<td>Standard</td>
</tr>
<tr>
<td>------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>8.2</td>
<td>Traveler Information Service: Road Network Condition Classification and Expression Standard</td>
</tr>
<tr>
<td>8.3</td>
<td>Traveler Information Service: Dissemination Information Format Standard</td>
</tr>
<tr>
<td>8.3.1</td>
<td>Traveler Information Service: Parking Guidance Information Set</td>
</tr>
<tr>
<td>8.3.2</td>
<td>Traveler Information Service: Television Traffic Information Set</td>
</tr>
<tr>
<td>8.3.3</td>
<td>Traveler Information Service: On-board Audio Broadcast System Information Set</td>
</tr>
<tr>
<td>8.3.4</td>
<td>Traveler Information Service: Information Set On Limitless Broadband</td>
</tr>
<tr>
<td>8.3.5</td>
<td>Traveler Information Service: Roadside VMS Traffic Information Set</td>
</tr>
<tr>
<td>8.3.6</td>
<td>Traveler Information Service: Digital Radio Traffic Information Set</td>
</tr>
<tr>
<td>8.3.7</td>
<td>Traveler Information Service: Information Set On Limited Broadband</td>
</tr>
<tr>
<td>9</td>
<td>Information Dissemination Standard</td>
</tr>
<tr>
<td>9.1</td>
<td>Traveler Information Service: Variable Message Sign Equipment Standard</td>
</tr>
<tr>
<td>9.2</td>
<td>Traveler Information Service: Roadside Kiosk Equipment Standard</td>
</tr>
<tr>
<td>9.3</td>
<td>Transport and Traveler Information (TTI): Traffic Information Encoded TTI Message</td>
</tr>
<tr>
<td>9.4</td>
<td>Transport and Traveler Information (TTI): Cellular Network Transmitted TTI Message</td>
</tr>
<tr>
<td>9.5</td>
<td>Transport and Traveler Information (TTI): DSRC Transmitted TTI Message</td>
</tr>
<tr>
<td>9.6</td>
<td>Transport and Traveler Information (TTI): TPEG Transmitted TTI Message</td>
</tr>
<tr>
<td>9.7</td>
<td>Transport and Traveler Information (TTI): TPEG Extensible Markup Language TTI Message</td>
</tr>
<tr>
<td>10</td>
<td>On-Board Navigation System Standards</td>
</tr>
<tr>
<td>No.</td>
<td>Standard</td>
</tr>
<tr>
<td>--------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>10.1</td>
<td>On-Board GPS Navigation System General Standard</td>
</tr>
<tr>
<td>10.2</td>
<td>On-Board Navigation System: On-Board Equipment and TISS Center Interaction Standard</td>
</tr>
<tr>
<td>10.4</td>
<td>On-Board Navigation System: Data Dictionary</td>
</tr>
<tr>
<td>10.5</td>
<td>On-Board Navigation System: Information Set</td>
</tr>
<tr>
<td>10.6</td>
<td>On-Board Navigation System: Physical Interface</td>
</tr>
<tr>
<td>10.7</td>
<td>On-Board Navigation System: Pre-Trip Guidance Technical Requirements</td>
</tr>
<tr>
<td>10.8</td>
<td>On-Board Navigation System: En-Route Guidance Technical Requirements</td>
</tr>
<tr>
<td>10.9</td>
<td>On-Board Navigation System: Navigation Information Expression Standard</td>
</tr>
<tr>
<td>10.11</td>
<td>On-Board Navigation System: Accurate Marking of Navigation Digital Map Database</td>
</tr>
</tbody>
</table>
4 TISS Development Mode

4.1 **During the initial stage of TISS implementation and operation, what mode shall be adopted to operate the system? What is the corresponding fund management mode?** ................................................................. 66

4.2 **During the interim stage of TISS development and operation, what mode shall be used to operate the system? What is the corresponding fund management mode?** ............................................................. 70

4.3 **During the mature stage of TISS development, what mode shall be used to operate the system? What is the corresponding fund management mode?** ........................................................................ 71
The development of TISS is a long-term course that requires gradually in-depth and constant improvement. In order to meet the public’s demand for travel information service, the funding for the system long-term operation and follow-up implementation must be solved properly. The actual situation now in China is that each of the government departments holds most of the data required for TISS. Therefore, it is necessary for the government to dominate the implementation of TISS at its early stage. However, with the gradual growth of the public’s demand for the information service, the service coverage and quality, the government dominant development mode is not sustainable. In terms of travel information service market, companies have better innovative capability and entrepreneurship than the government, therefore in order to promote long-term sustainable development of TISS, the government shall cooperate with companies, to create high value-added travel information service. In terms of the government function, the development of TISS operation mechanism should consist of three stages: government domination, government facilitation and market oriented government supervision.

4.1 **During the initial stage of TISS implementation and operation, what mode shall be adopted to operate the system? What is the corresponding fund management mode?**

4.1.1 **Operation mode during the initial stage of TISS implementation**

Within this stage, PCDs need to strengthen the communication and coordination with relevant business departments, and strengthen the data collection, exchanging, sharing and dissemination, including: to establish the mechanism and administration system for data exchanging and sharing; to sign agreement with relevant data source providers in order to identify the responsibility, data content, data sharing method, update frequency and method; to establish the coordination mechanism with data providers gradually, and ensure providers to maintain their data sources respectively; to strengthen the mutual complementary actions with travelers, such as information collected by travelers to enrich the travel information service, which means that traveler could be important information provider. At present, the TISS data center and part of the information dissemination system maintaining work are undertaken by the information administration division of each of the PCDs, with the costs paid by the government from daily financial budget.
4.1.2 What procedure shall the system implementation follow?

During this stage, the implementation and operation of TISS are mainly accomplished by the government. In order to strengthen the management and supervision of fund and construction, it is necessary to be in compliance with the basic procedure for construction project and the procedure for the use of government fund as specified under relevant national laws and regulations.

The figure shows the basic implementation procedure dominated by the government during the initial stage of TISS development. It covers every step of the project establishment, approval, implementation, inspection and acceptance and assessment.
Figur4-2 TISS Implementation Procedure
It is recommended that in the upper layer design of regional TISS, the following questions should be answered.

(1) Benefits analysis

- Who are the stakeholders of this regional TISS development?
- What kind of interests of each of the stakeholders are in the regional TISS development?
- Is there any aspect of the regional TISS development could not accepted by the stakeholder? Could this kind of situation be avoided or improved?
- Do the stakeholders have any plan for the TISS development?
- It is possible to roughly estimate the benefit brought about by the TISS development and could be accepted by the stakeholders?

(2) Institutional system analysis

- Who should be responsible for the leadership, organization, and operation of the TISS development project?
- What kind of organizational modality should be adopted for local TISS development and operation?
- Is the current institutional system suitable to meet the organizational requirement?
- What is the common problems or what kind of problem might arise in the institutional system? And how to solve or make up for the problem?
- How to establish an institutional check and balance system against the stakeholders?

(3) Technical analysis

- What kind of relevant sub-systems are there associated with TISS?
- What kind of data/information should be collected and where are the data/information sources?
- How to exchange the data/information between and among each of the agencies and what kind of strategies should be adopted for the exchange?
- What kind of data standards have been adopted?
- What kind of information releasing manners have been identified?
- How large it is the information dissemination terminal layout scale?
4.2 During the interim stage of TISS development and operation, what mode shall be used to operate the system? What is the corresponding fund management mode?

![Operation Mechanism at Government Facilitation Stage](image)

After the establishment of long-term, stable and continuous travel information collection system, the government shall encourage other relevant entities to participate in the construction and operation of TISS. The operation and maintenance of the data center and part of the dissemination system could be contracted out via competitive bidding or outsourcing. The government could share part of the revenue used for the maintenance of travel information collection and processing system, which will reduce the investments from the government. For example, Zhejiang PCD cooperated with Zhejiang Telecom 118114, Chengdu Municipal Transport Committee cooperated with Chengdu Telecom 118114, Jiangsu PCD cooperated with Traffic Radio of Jiangsu People’s Broadcast Station, and Beijing Municipal Transport Committee cooperated with Honda, Toyota and other auto manufacturers in developing and marketing dynamic road Navigator. By getting professional firms involved in the operation, TISS can create tremendous value-added services and make outstanding profitable; meanwhile, the quality of TISS service and user satisfaction will be improved as well.
Government facilitation will accelerate the development of travel information service industry, and improve its social and economic benefits and bring TISS industry onto sustainable development track.

4.3 During the mature stage of TISS development, what mode shall be used to operate the system? What is the corresponding fund management mode?

Once TISS industry is shaping up, the government should pay more attention to the market oriented administration of TISS development and operation, to the protection of the users’ rights and interests by strengthening supervision and assessment of the system operation, e.g. if the system operator in breach of the contract, the government could effect a substitution of the system operator. At this stage, the government will play a supervisor’s role, to ensure smooth growth of TISS as well as improvement of service quality, and therefore sustainable development of the industry.
5  Operation and Management of TISS

5.1  What kind of management system should be established to ensure the effective operation of TISS? ............................................................... 73

5.2  Who will do the system operation monitoring and assessment with what requirements? ................................................................. 73

5.3  How to acquire the data needed for the system operation assessment? .................................................................................... 73

5.4  What kinds of indicators are included in the system operation assessment? ............................................................................. 74

5.5  What kind of assessment system shall be established to guarantee TISS service quality? ............................................................... 78

5.6  Who shall carry out TISS service quality assessment? .............. 78

5.7  How to obtain the data for TISS service quality assessment? ..... 78

5.8  What are the key assessment contents of the system service quality? ....................................................................................... 90
System operation monitoring and assessment is a key function of the government in the TISS development, which can assist the system operator to manage the hardware and software resources effectively and assess the system service capability.

The purpose of the system operation monitoring and assessment is to facilitate the stabilization and effectiveness of the system operation based on the lifecycle of the system with dynamic qualitative and quantitative assessment of the effectiveness and efficiency of the standard norms and regulatory arrangements, so as to develop optimal development and operation mechanism for the sustainability and scientificness of TISS.

5.1 What kind of management system should be established to ensure the effective operation of TISS?

To make sure the effectiveness and efficiency of the monitoring and assessment work for TISS development and operation, rules and guidelines for the monitoring and assessment should be developed including scheduled assessment report, to specify and enhance the quality management of the assessment.

5.2 Who will do the system operation monitoring and assessment with what requirements?

The monitoring and assessment can be carried out by the TISS operator or be commissioned to an eligible third party with scheduled monitoring and assessment report. The TISS operator should continually improve the operation efficiency and service quality according to the assessment result.

5.3 How to acquire the data needed for the system operation assessment?

The system operation assessment is mainly based on the background operation data statistics and the running log issued by system management and maintenance departments to find out the problems of the system operation and the gap between the design objectives and the user demand from the operation data statistics, which will help develop effective solutions to improve the system performance and the service level.
5.4 What kinds of indicators are included in the system operation assessment?

Detailed assessment indicators and standards need to be developed according to specific technical characteristics and practical requirements when monitoring the operation status of the TISS system and subsystems, with the indicators shown in Table 5-1 as the following.
<table>
<thead>
<tr>
<th>Assessment Object</th>
<th>Key Indicator</th>
<th>Index Explanation</th>
<th>Assessment Standard</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Host System</td>
<td>Mean Time Between Failures (MTBF)</td>
<td>Mean time of the normal working order between two system failures</td>
<td>Need continuous work (24h*7) or MTBF &gt;50 thousand hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean Time to Repair (MTTR)</td>
<td>Mean time from the software failure to the system repaired to the normal working order</td>
<td>MTTR &lt; 30 minutes</td>
<td></td>
</tr>
<tr>
<td>Network System</td>
<td>Capacity Fitness</td>
<td>Network bandwidth can meet the needs of data transmission and save the system construction</td>
<td>Network bandwidth should have 30% redundancy except for the load of peak data transmission</td>
<td></td>
</tr>
<tr>
<td>Security System</td>
<td>System Security Monitoring and Processing Report</td>
<td>Monitoring, alarm and processing report of the system firewall, intrusion inspection and virus prevention</td>
<td>Refer to the national specifications of information security technique developed by National Information Security Standardization Technical Commission and issued by Standardization Administration of China</td>
<td></td>
</tr>
<tr>
<td>Website System</td>
<td>Concurrent Request in Peak</td>
<td>Total visitors number of the website at the same time in peak hours</td>
<td>Processing capacity should meet the 90th percentile of the peak system visit demand</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Limited Access Statistics</td>
<td>Average visitors number restricted to access the website due to excessive visitors</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Website Availability</td>
<td>Ensure the website can work in order and be available at any time.</td>
<td>Continuous available for 24H*7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Enquiry Feedback Time</td>
<td>From the time users input enquiry to the Simple enquiry time &lt; 30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessment Object</td>
<td>Key Indicator</td>
<td>Index Explanation</td>
<td>Assessment Standard</td>
<td>Remarks</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------------</td>
<td>-------------------</td>
<td>---------------------</td>
<td>---------</td>
</tr>
<tr>
<td></td>
<td>time users get the feedback result</td>
<td>seconds, complex enquiry &lt; 1 minute</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error Type and Number of Web Search</td>
<td>Statistic report of the web search error</td>
<td>Error rate &lt; 0.1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily Average Click Rate</td>
<td>Visiting numbers of the website per day</td>
<td>The more the better</td>
<td>Reflect the attraction level of the website to the users</td>
<td></td>
</tr>
<tr>
<td>Daily Call hours, Average Calls Per Month</td>
<td>All the phone calls into the center, including obstructed calls, give-up calls, and replied calls</td>
<td>The more the better</td>
<td>Reflect the attraction level of the call center to the users</td>
<td></td>
</tr>
<tr>
<td>Peak Seats Capacity</td>
<td>Number of Calls can be processed in peak time</td>
<td>Processing capacity meet the 90th percentile peak calling in number</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Busy Line Rate</td>
<td>Busy line rate =100*(talking time + holding time)/(talking time + holding time + idle time)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Give-up Call Time</td>
<td>Average waiting time of the abandoned calls</td>
<td>&lt;60 seconds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Give-up Call Rate</td>
<td>The ratio of give-up calls to total get through calls</td>
<td>&lt; 15% of international standard (&lt; 5% for professional call center)</td>
<td>Review per week and per month</td>
<td></td>
</tr>
<tr>
<td>Average Call Queuing Time</td>
<td>The waiting time of the callers after being listed in ACD until being responded from the server</td>
<td>&lt; 60 seconds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Busy Tone Rate</td>
<td>The percentage of callings encountered busy signal and not even connected to ACD. This rate can be obtained from</td>
<td>1%~3%</td>
<td>Check every one hour and find out when is the blocked peak</td>
<td></td>
</tr>
<tr>
<td>Assessment Object</td>
<td>Key Indicator</td>
<td>Index Explanation</td>
<td>Assessment Standard</td>
<td>Remarks</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------------</td>
<td>-------------------</td>
<td>---------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Telecom Bureau.</td>
<td>Data Loss Rate</td>
<td>The ratio of lost data package to the total transmission data package</td>
<td>Losing rate &lt; 0.1% under light router load (10% turnover), Losing rate &lt; 0.3% under heavy router load (80% turnover)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Error Information Rate</td>
<td>Daily error information type and number</td>
<td>Total error information rate &lt; 0.1% due to transmission control and wrong messages per se</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Information Update Frequency</td>
<td>Time interval of information update</td>
<td>Urban real time information update interval &lt; 5 minutes, intercity expressway real time information update interval &lt; 30 minutes</td>
<td></td>
</tr>
<tr>
<td>Electric Information Displaying System, VMS, Fixed Information Terminal)</td>
<td>Average Time between Enquiry and Feedback</td>
<td>The time between the enquiry and feedback</td>
<td>Feedback time shall less than 2 minutes under normal working order of the network</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Concurrency Request in Peak</td>
<td>Enquiry request number at the same time in peak hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short Message Platform</td>
<td>Daily Enquiry and Customization Number</td>
<td>Total request number of daily enquiries and customizes information</td>
<td>The more the better</td>
<td>Reflect the attraction level of the short message service to the users</td>
</tr>
<tr>
<td></td>
<td>Error Enquiry Type and Number</td>
<td>The number of unavailable database or returned error result during the information enquiry and customization</td>
<td>Error rate &lt; 0.5%</td>
<td></td>
</tr>
</tbody>
</table>
The system service quality assessment aims at improving system service efficiency and user satisfaction. Based on qualitative and quantitative analysis, a full-scale comprehensive service quality assessment mechanism for TISS shall be established, to realize the comprehensive, scientific and effective assessment of system service quality. Thus, the assessment result could be used to improve system service quality.

5.5 What kind of assessment system shall be established to guarantee TISS service quality?

In order to normalize the TISS service quality assessment and enhance quality management, relevant standards and specifications for the assessment as well as guidelines to implement the normalized assessment should be developed, including regular reports on TISS performance and service quality assessment.

5.6 Who shall carry out TISS service quality assessment?

TISS operator shall carry out TISS service quality assessment, or an eligible third-party could be entrusted to carry out the service quality assessment. Service quality report shall be published on a regular basis and system service quality shall be constantly improved according to the assessment result.

5.7 How to obtain the data for TISS service quality assessment?

The data source of system service quality assessment consists of two parts:

The first part is the running results that could be directly measured and from the background statistics. On one hand, by comparing the estimated data with the actual data, the reliability of information service and the quality indicators of the system service could be reflected. On the other hand, by analyzing the click statistics of the system service contents, the system service quality and the major causes of existing problems could be indirectly reflected.

The second part is the questionnaire survey and the flexible compulsive survey methods, through which the customer satisfaction and the service quality that are subjective, macro qualitative assessment rather than quantitative could be obtained.
The user survey method of the system service quality includes: on-site interview, website survey, telephone survey (real-time and random), questionnaire survey, etc. Each TISS operator could adopt one or more of the survey method and adjust the questionnaire, based on local characteristics and actual demand. After the survey assessment, however, it is more important to obtain some suggestions from the assessment results for the system optimization to help improve the system operation and service quality.

5.7.1 Inquiry meeting

The primary purpose of inquiry meeting is to collect information that can be used to enhance and refine the effect of website survey, telephone survey, etc. The collection of information focuses on what information the public are concerned with travel, by which means do they wish to obtain these information, what are the decision-making factors for trip plan and what suggestion and advice do the public have for TISS, etc. Commonly, the questions covered in the inquiry meeting are:

- What types of information do travelers need pre-trip and en-route?
- From what sources do travelers obtain travel information?
- How does travel information affect traveler’s decisions?
- Are travelers aware of TISS?
- What information do travelers want to obtain from TISS?
- What is the traveler’s general opinion on the current TISS in the region?
- What other suggestions do the travelers have for the improvement of TISS?

The inquiry meeting could be in the form of on-the-spot Q&A or by issuing questionnaire. Questionnaire could be either comprehensive or focusing on a certain TISS subsystem. The participants may be residents, tourists, drivers or other travelers. The inquiry meeting should follow the following 10 steps:

1. Determine the objective
2. Determine the sample
3. Determine the venue
4. Retain participants
5. Design the meeting guideline
6. Test the meeting guideline
7. Hold the inquiry meeting
8. Transcribe the survey data collected from the meeting
9. Analyse the survey data
10. Report the survey results

For example, the interview or questionnaire of an inquiry meeting could refer to the following table.
COLUMN 1: Comprehensive Questionnaire on Public Demand and Satisfaction of Transport Information Service System

Welcome to take part in this TISS satisfaction survey. Thank you very much for your active participation and cooperation! First of all, please complete the form by filling in your basic information and valuable advice. This will be beneficial to our statistical analysis and will help us improve our quality of service more targeted.

1. Basic information

<table>
<thead>
<tr>
<th>Age</th>
<th>under 25</th>
<th>25-45</th>
<th>45-60</th>
<th>&gt; 60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>middle school and below</td>
<td>high school</td>
<td>college university</td>
<td>master of above</td>
</tr>
<tr>
<td>Occupation</td>
<td>student</td>
<td>employed</td>
<td>Freelance</td>
<td>farmer</td>
</tr>
</tbody>
</table>

2. Daily travel in urban area

<table>
<thead>
<tr>
<th>Usual trip purpose</th>
<th>work/school</th>
<th>business</th>
<th>shopping</th>
<th>recreation</th>
<th>visit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usual travel mode</td>
<td>bus</td>
<td>subway</td>
<td>private car</td>
<td>taxi</td>
<td>bicycle</td>
</tr>
<tr>
<td></td>
<td>train</td>
<td>plane</td>
<td>ferry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are you concerned with TISS</td>
<td>no</td>
<td>occasionally</td>
<td>often</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If you select “occasionally” or “often”, please continue to complete the following (multiple choice)

<table>
<thead>
<tr>
<th>What kind of service manner would you get before your trip?</th>
<th>internet web</th>
<th>broadcast</th>
<th>SMS</th>
<th>call center</th>
<th>TV</th>
<th>VMS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>in-veh. navig</td>
<td>kiosk</td>
<td>newspaper</td>
<td>others</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What kind of service manner would you get en route?</td>
<td>internet web</td>
<td>broadcast</td>
<td>SMS</td>
<td>call center</td>
<td>TV</td>
<td>VMS</td>
</tr>
<tr>
<td></td>
<td>in-veh. navig</td>
<td>kiosk</td>
<td>newspaper</td>
<td>others</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

You choose your trip path by

<table>
<thead>
<tr>
<th>experience</th>
<th>friend advice</th>
<th>TISS</th>
</tr>
</thead>
</table>

### Transport Information System

#### Information you concerned with

- [□] traffic congestion
- [□] traffic accident/road block
- [□] transit transfer
- [□] path choice
- [□] parking lot

#### Information service you prefer

- [□] trip advice
- [□] traffic guide
- [□] transfer advice
- [□] special warning

#### Please give your advice on the present urban travel information service manner

<table>
<thead>
<tr>
<th>Service manner your prefer (multiple choice)</th>
<th>internet web</th>
<th>broadcast</th>
<th>SMS</th>
<th>call center</th>
<th>TV</th>
<th>VMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>(multiple choice)</td>
<td>in-veh. navig</td>
<td>kiosk</td>
<td>newspaper</td>
<td>others</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Comment about satisfaction

- [□] satisfied
- [□] acceptable
- [□] not satisfied

#### Why not satisfied?

- [□] less content
- [□] inaccurate
- [□] inconvenient

#### 3. Inter-city travel

##### Your normal trip purpose is

- [□] sightseeing
- [□] business
- [□] visiting
- [□] work
- [□] school

##### Trip mode you usually take

- [□] bus
- [□] private car
- [□] train, ship, airplane with mode transfer

##### Information mode you are concerned

- [□] no
- [□] occasionally
- [□] often

If you select “occasionally” or “often”, please continue to complete the following (multiple choice)

##### What kind of service manner would you get before your trip?

- [□] internet web
- [□] broadcast
- [□] SMS
- [□] call centre
- [□] TV
- [□] in-veh. navig

##### En route you usually use

- [□] broadcast
- [□] SMS
- [□] call centre
- [□] in-veh. navig
- [□] VMS
- [□] map

##### You choose your trip path by

- [□] experience
- [□] friend advice
- [□] TISS

##### Information you concerned with

- [□] road condition
- [□] ticket
- [□] transfer
- [□] timetable
- [□] toll charge
- [□] trip time

##### Information service you prefer

- [□] trip advice
- [□] traffic guide
- [□] transfer advice
- [□] special warning

Please give your advice on the present urban travel information service manner
<table>
<thead>
<tr>
<th>Service manner your prefer (multiple choice)</th>
<th>☐ internet web</th>
<th>☐ broadcast</th>
<th>☐ SMS</th>
<th>☐ call center</th>
<th>☐ TV</th>
<th>☐ VMS</th>
<th>☐ in-veh. navig</th>
<th>☐ kiosk</th>
<th>☐ newspaper</th>
<th>☐ others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comment about satisfaction</td>
<td>☐ satisfied</td>
<td>☐ acceptable</td>
<td>☐ not satisfied</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Why not satisfied?</td>
<td>☐ less content</td>
<td>☐ inaccurate</td>
<td>☐ inconvenient</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Your general impression is</td>
<td>☐ not satisfied</td>
<td>☐ acceptable</td>
<td>☐ good</td>
<td>☐ very good</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.7.2 Website survey

Website survey is to confirm whether the website service meets the user demand and whether it is satisfactory. An open, unlimited and optional website survey is suggested to be displayed for 6 to 8 months on a travel service website. A satisfaction questionnaire is placed on the front page in active display inviting all visitors to participate. Refer to the following on the content of the survey. The questionnaire should be able to be finished in 3 minutes.

<table>
<thead>
<tr>
<th>COLUMN 2: Public Demand and Satisfaction Survey for Transport Service Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welcome to take part in this survey on the travel information service system (TISS) website service quality evaluation. Please fill in your relevant information to help improve our service quality. Thanks!</td>
</tr>
<tr>
<td>1. Your Age ✗ under 25 ☐ 25-45 ☐ above 45</td>
</tr>
<tr>
<td>2. Your Occupation ✗ student ☐ employee ☐ freelance ☐ others</td>
</tr>
<tr>
<td>3. How often you visit this website ☐ first time ☐ 5 /month ☐ 5 – 10 /month ☐ before every trip</td>
</tr>
<tr>
<td>4. Your choose your trip path mainly based on ☐ experience ☐ friend advice ☐ travel information service</td>
</tr>
<tr>
<td>5. You visit this website mainly for ☐ urban travel information ☐ inter-city travel information</td>
</tr>
<tr>
<td>6. When your visit this website you are expecting to get information about ☐ electronic map ☐ transfer ☐ real-time road condition</td>
</tr>
<tr>
<td>☐ trip path advice ☐ unsold ticket ☐ bus/train run / ticket price</td>
</tr>
<tr>
<td>☐ road block ☐ weather ☐ toll charge</td>
</tr>
<tr>
<td>☐ news ☐ policy regulation ☐ telephone number</td>
</tr>
<tr>
<td>☐ tourism ☐ complaint ☐ others</td>
</tr>
<tr>
<td>7. Your impression about the information content is ☐ very rich ☐ rich ☐ not much ☐ just a few</td>
</tr>
<tr>
<td>8. In your opinion the most useful information content of the website is (Based on the content of this website)</td>
</tr>
<tr>
<td>9. In your opinion, the least useful information of this website is (Based on the content of the website)</td>
</tr>
<tr>
<td>10. The information that you wish to obtain but not offered is _____________________________________________________________</td>
</tr>
</tbody>
</table>
11. In your opinion, the information inquiry and feedback speed of our website is
   □ very quickly □ within 30 seconds □ very slowly

12. In your opinion, the function and design of this website is
   □ simple and convenient □ not very convenient □ hard to use

13. Your comment on the accuracy of the information is
   □ accurate □ not so accurate □ inaccurate

14. Your general comment on the quality of service of this transport service website is
   □ very satisfied □ satisfied □ unsatisfied

15. Please write down your suggestion or advice on the improvement of the current travel
   information service website: ________________________________

5.7.3 Telephone survey

Telephone survey is to confirm whether the call center meets the user satisfaction and how telephone service affects the travelers' behavior.

- Sampling Strategy

Two methods could be deployed in telephone survey: random number selection and telephone invitation survey.

Random Number Selection: A random number list is generated from all telephone numbers in a given sampling area. The main limitation with this strategy lay in the fact that some may have their calling ID blocked owing to privacy concerns.

Telephone Invitation Survey: Deployed through automated message informing users of the survey with monetary incentive to the respondent who would be willing to participate. If the respondent is interested in participating in the survey, he/she may leave his/her name and phone number. Then the phone survey team members call the participants back and conducted the survey.

- Sampling Frame

Before taking the sample, the sample size shall be determined. Based upon statistical theory, the sample size should have 95% confidence interval, with maximum error rate of +/– 5% for a large sample space; a minimum sample size shall be produced according to the quantity of hotline service callings of each region. Meanwhile, actual response rate should be considered in the
determination of the duration of sample survey (normally between 4 to 6 months).

Please refer to the following for telephone survey questionnaire. A telephone survey normally takes 5 to 8 minutes.

<table>
<thead>
<tr>
<th>COLUMN 3: Public Demand and Satisfaction Survey for Travel Information Service Hotline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welcome to take part in this assessment on the service quality of the local travel information service call center. Please fill in your relevant information to help improve our service quality. Thanks!</td>
</tr>
<tr>
<td>1. Age □ under 25 □ 25-45 years old □ above 45</td>
</tr>
<tr>
<td>2. Your Occupation □ student □ employee □ freelance □ others</td>
</tr>
<tr>
<td>3. Why do you use hotline? □ it is convenient □ used to □ occasional □ no alternative</td>
</tr>
<tr>
<td>4. How often you use the hotline? □ never □ 5/month □ 5 – 10/month □ before every trip</td>
</tr>
<tr>
<td>5. Could you get the information you need through the hotline? □ yes □ some □ no</td>
</tr>
<tr>
<td>6. The information you hope to obtain from the hotline is (multiple choice) □ bus schedule □ ticket info □ transfer plan</td>
</tr>
<tr>
<td>□ road restriction info □ real-time road info □ fee charging info</td>
</tr>
<tr>
<td>□ stop location info □ policy &amp; regulation □ phone number</td>
</tr>
<tr>
<td>□ call for first-aid □ complaints □ others</td>
</tr>
<tr>
<td>7. Did you get the information you need? □ yes □ some □ no</td>
</tr>
<tr>
<td>8. The information you hope to obtain but actually not get from the hotline is</td>
</tr>
<tr>
<td>9. Your normal waiting time for calling the hotline is □ no need to wait □ within 1 min □ hang up due to long wait</td>
</tr>
<tr>
<td>10. What kind of service mode do you prefer? □ machine voice reply □ human service</td>
</tr>
<tr>
<td>11. In your opinion, the service attitude of the call center staff is □ very good □ acceptable □ not good □ very bad</td>
</tr>
<tr>
<td>12. In your opinion, the communication ability of the call center staff is □ easy to understand □ acceptable □ hard to understand</td>
</tr>
<tr>
<td>13. In your opinion, the efficiency of the call center staff is □ high □ normal □ rather low □ too low</td>
</tr>
</tbody>
</table>
14. Your comment on the accuracy of the information is
   □ accurate           □ somewhat accurate         □ inaccurate
15. Your general comment on the quality of service of this transport service hotline is
   □ very satisfied     □ satisfied                □ acceptable      □ unsatisfied
16. Please write down your suggestion or advice on the improvement of the current travel information service hotline: _____________________________________
5.7.4 Specific survey

In order to obtain the user satisfaction level for the roadside VMS, touch screen and other service facilities, specific survey could be carried out manually. Taking VMS user satisfaction level as an example, questionnaire should be issued at the entrance and exit of large parking lots and collecting bins should be provided as well, to encourage the drivers and passengers to participate in the assessment of the service quality. Meanwhile, the questionnaire should be issued to drivers of large taxi companies and freight companies.

<table>
<thead>
<tr>
<th>COLUMN 4: Driving Behavior and Satisfaction Survey Based on Roadside Dynamic Transport Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Driving years</td>
</tr>
<tr>
<td>□ under 1 year  □ 1—5 years  □ 6—10 years  □ above 10 years</td>
</tr>
<tr>
<td>2. Age                                                  □ under 25  □ 25-45 years old  □ above 45</td>
</tr>
<tr>
<td>3. Your usual travel is</td>
</tr>
<tr>
<td>□ within the city  □ between cities  □ between provinces</td>
</tr>
<tr>
<td>4. Your familiarity with the road network is</td>
</tr>
<tr>
<td>□ not familiar  □ neutral  □ very familiar</td>
</tr>
<tr>
<td>5. Do you pay attention to the roadside VMS while you are driving?</td>
</tr>
<tr>
<td>□ yes  □ no</td>
</tr>
<tr>
<td>6. Do you take the fixed route when no information is provided?</td>
</tr>
<tr>
<td>□ yes  □ no</td>
</tr>
<tr>
<td>7. Your trip route choice mainly depending on</td>
</tr>
<tr>
<td>□ previous experience  □ friend advice  □ traffic information</td>
</tr>
<tr>
<td>8. In your opinion, what kind of information is most likely to affect your trip route choice?</td>
</tr>
<tr>
<td>□ in-vehicle navigation system  □ traffic broadcast  □ roadside VMS  □ SMS</td>
</tr>
<tr>
<td>9. The reason you pay attention to the roadside VMS is (multiple)</td>
</tr>
<tr>
<td>□ used to  □ road traffic congestion  □ accident report</td>
</tr>
<tr>
<td>10. If the VMS shows congestion information ahead, you (or passenger) normally will</td>
</tr>
<tr>
<td>□ ignore and keep on original route  □ under some circumstances (e.g. in a hurry), choose a new route</td>
</tr>
<tr>
<td>□ trust the VMS and change the route</td>
</tr>
<tr>
<td>11. Do you pay attention to the roadside VMS while you are driving very fast?</td>
</tr>
<tr>
<td>□ yes  □ no</td>
</tr>
<tr>
<td>12. Is there any impact of your look out roadside VMS on driving while you driving fast?</td>
</tr>
<tr>
<td>Question</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>13. What kind of roadside variable message type do you prefer?</td>
</tr>
<tr>
<td>14. Do you have time to see clearly the text information on VMS while you are driving?</td>
</tr>
<tr>
<td>15. If you are familiar with the route, will you change your decision due to the information guidance?</td>
</tr>
<tr>
<td>16. If you are unfamiliar with the route, will you change your decision due to the information guidance?</td>
</tr>
<tr>
<td>17. The accuracy of the information you expect to get from roadside VMS should be</td>
</tr>
<tr>
<td>18. Your comment on the accuracy of the information provided by VMS is</td>
</tr>
<tr>
<td>19. Your general comment on the information service quality of VMS system is</td>
</tr>
<tr>
<td>20. Please write down your suggestion or advice on the improvement of road network, traffic management and vehicle navigation.</td>
</tr>
</tbody>
</table>
5.7.5 Quick survey

Certainly, TISS supervisor could use a few simple questions to collect information quickly. These questions are suitable for telephone and website surveys.

<table>
<thead>
<tr>
<th>COLUMN 5: Quick Survey Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Did you find the information you needed from our system?</td>
</tr>
<tr>
<td>□ yes □ no</td>
</tr>
<tr>
<td>2. In your opinion, what is the most useful information of this website?</td>
</tr>
<tr>
<td>□ road condition □ traffic weather □ regulation □ ticket info</td>
</tr>
<tr>
<td>□ route planning □ road restriction info □ transfer plan</td>
</tr>
<tr>
<td>□ accident info □ fee charging info □ electronic map</td>
</tr>
<tr>
<td>□ travel time prediction □ tourist info □ parking info</td>
</tr>
<tr>
<td>□ other____________</td>
</tr>
<tr>
<td>3. Your comment on the service of this website is</td>
</tr>
<tr>
<td>□ very satisfied □ satisfied □ neutral □ unsatisfied □ very unsatisfied</td>
</tr>
</tbody>
</table>

In terms of the call center, a program can be set to guide the user to comment on the calling service before hanging up.

5.8 What are the key assessment contents of the system service quality?

Survey results analysis is to conclude and summarize TISS system users’ behavior characteristics and feelings. The service quality of Travel Information Service System is mainly reflected by the changes of public behavior and satisfaction, including user scope, changes in the users’ dependence on TISS, improvement in travel efficiency and public’s satisfaction with service fee and service quality. Usually, the key analysis points include:

- Has TISS met travelers’ demand and improved travelers’ experience?
- Has the rate of traveler using TISS increased?
- Has the scope of traveler using TISS extended?
- What changes have there been in the method of public’s obtaining travel information?
Has the effect of TISS on travelers’ decision making been improved?

Has TISS information reduced the influence of congestion?

Has TISS saved travel time (distance) for travelers? Or enabled them to reach their destination successfully?

Has the public’s travel expense been reduced due to TISS?

What is the most needed service information? What is the current provision condition?

What is the most satisfactory service information? What is the cause?

What is the most unsatisfactory service information? What is the cause?

What is the satisfaction rate of the feedback speed of information inquiry? How to improve it?

What is the satisfaction rate of the information accuracy? How to improve it?

What is the satisfaction rate of the information efficiency? How to improve it?

What is the satisfaction rate of the service attitude? How to improve it?

What is the satisfaction rate of the complaint handling? How to improve it?

TISS supervisors obtain relative data from different reasonable user surveys, thus finding approach to improve service quality through data analysis. The final purpose is to make travelers satisfied with the accuracy and efficiency of TISS information and realize the convenience and economy of information service.

Figure 0-1 Process Model of User Satisfaction Assessment
6 Suggestions

6.1 Systematic TISS development plan and criteria system are the basis of the TISS development

It has been the primary task in the transportation management department to conduct the TISS specific plan, put forward overall development strategy, define the objective and implementation emphases, and specify the implementation strategies to push the TISS development.

The establishment of TISS standard system has been increasing exigency, before which the industry guideline needs to be produced in time as an alternative choice.

6.2 The promoting of TISS industry development is the essential way for survival and the government and enterprises should cooperate with each other to promote the industry chain development.

The future TISS service will be much characteristic and extensive, however, it is difficult to meet the needs only depending on the investment of government. The strength of TISS vitality is basically determined by the speed of TISS industrialization. The implementation, promoting and maintaining TISS industrial value chain should be the core thought of the government in the TISS development decision-making.

The government needs to review and design a comprehensive and appropriate industrial value chain in a market-oriented view, recognize the cost and benefit of all the stages, accelerate the development of the industrial chain with the support of policies and funding, and remove the obstacles of current policies, regulations and standards. It will have little effectiveness if under inappropriate time, stages and measures. Ministry of Transportation should constantly support the implementation of TISS projects via demonstration projects, and promote coordinated TISS development of cross departments and regions with the strategies of multi-cities cooperation, regional integration and national implementation.

At the same time, the developers of TISS need to create a unified and easily remembered brand of TISS by effective marketing measures to timely convince
the travelers to user TISS. However, it is high quality service that forms the basis of the brand value.

6.3 Variety of strong data collection capability is the basic approach for the development of TISS and it is necessary and imperative to have more input to strengthen dynamic information collection and exchange

The government should establish relevant planning, policies, standards and specifications to enhance the investment on the traffic dynamic information collection system. Appropriate collecting and communication methods should be adopted with customized approaches based on variety of PRC geographic environment to improve the effectiveness and practicability of the information collected.

It is essential to expedite the construction of national expressway traffic observation station, strengthen the arrangement of monitoring equipments for weather forecasting and traffic situation inspection, and speed up the construction of the city-wide online ticket system of long distance passenger transport.

Pilot cross regional traveler information exchange platform should be developed based on the demand to achieve the sharing and exchange of region-wide data/information.

6.4 It is essential to enhance the assessment and improvement of service quality since TISS is a kind of service product group with the center of travelers.

For TISS project with continuous development potentials in terms of its continuous integration with ITS, it is not realistic to pin one’s hope on the project completion and acceptance phase. The completion and acceptance is merely a start of the system’s life cycle, more attentions should be paid to regular monitoring and assessment.

TISS developer should always pay close attention to the users’ demand. It is the users’ demand that gives impetus to continual improvement of TISS. It is extremally important to listen and in response to the users’ demand and meet
their demand. It is also very important to be interactive with the users and create a standard feedback mechanism for travelers’ satisfaction and demand.

Normally, the most effective demand investigation is during the planning and design stages. Validation check will be conducted half or one year after the system’s initial operation. Scheduled investigation will then be carried out every 12 to 18 months.

The stakeholders’ participation, particularly the professional firms and the public participation, in TISS project implementation should be carried out all the way through the project process.

6.5 A moderate balance needs to be obtained between the capacity and cost of the TISS implementation taking into account of the great pressures in case of emergency incidents

Great pressures may be encountered during the emergencies, such as bad weather, important accident, road damage, social events. The number of network visitors and incoming phone calls will increase suddenly. The timeliness and accuracy of the system reaction need to be highly raised, which is also a test to the data collection system, transmission network, database, host system, release facilities and management mechanism. It is also an opportunity to attract customers and gain benefit via high quality services. However, powerful system capacity will need more investment. Thus, intensive design will be required in the early stage of the system implementation, fully taking into account of various factors, such as network bandwidth, host capability, communication circuit, service staff etc., to obtain the balance between the system capacity and the implementation cost.

Each of the steps in the process of the equipment procurement, installation, development and test should be strictly follow relevant rules, to ensure achieve the expected system capacity and reliability. In the case that there is any impact of the equipment on the TISS performance, written records should be made with evidence for proper solution in due course. Price is not the only criterion for the product selection, the product developer’s commitment and capability are more important, particularly for those products need long period of time maintenance and improvement work provided by the developer.
The cost of communication system would account for 15% ~ 40% of TISS project, the project design should take into considerations of the system development trend (such as 3G) and diversified selection.

6.6 **Effective coordination mechanism needs to be developed due to the diversity of the data source.**

TISS involve multiple department/agency cooperation and coordination work, which call for unified coordination of the government. Bilateral cooperation agreement should be set up with important data sources providers in the beginning of the project. The duty of the data suppliers shall be identified. Also, the data contents, supply method, data update interval and update mode etc. shall be clarified.

Communication mechanism of the messengers from data source suppliers shall be established to ensure that specific persons can be assigned for data exchange and sharing. Meanwhile, the public is encouraged to provide information, which could extend the scope and timeliness of the information.

6.7 **A comprehensive cost analysis shall be conducted as far as possible due to the different construction cost of TISS.**

The construction cost of TISS varies, depending on the capacity, contents and manners of the services, which is difficult to be evaluated using one united standard. Operation cost in early stages shall also be considered in addition to careful calculation of the construction cost, since there are few benefits during these stages.

Normally, the operation cost in early stages include staff wages, municipal facilities, network rents, consumable hardware spending, software improvement, service contents upgrading, and even some for marketing and public awareness campaign.
6.8 **It is essential to get financial support in early stages while financing platform must be exploited to get long term fund support.**

Financial support is the key factor for the development of TISS in early stages since there is no cooperation with other capital source and not enough earnings to operate the system.

However, limited success can be obtained from the financial support. Heavy financial load to the government, if there is not enough earning, may force the managers of the system decrease the service contents and quality, and even abandon the system.

High quality services of TISS need long-term financial support. The government should help develop financing platform to achieve marketization operation. Divers sources of TISS implementation financial input shall be established, including government, equipment manufactories, data service corporations, financial credit departments, etc.

In terms of the specific funding or financing solution for the source of system operation and maintaining, Ministry of Finance shall give positive financial supports and encourage service outsourcing operation mode to effectively control the fund input.

The operation corporations shall cooperate with service suppliers to carry out specific added value services to reduce the implementation and operation financial input from the government. All kinds of social resources should be utilized positively. Strategic cooperation with Telecom shall be developed extensively to reduce government implementation cost and improve system utilization efficiency.
# Appendix C: TISS Service Information Content List

<table>
<thead>
<tr>
<th>Service Content</th>
<th>Information Type</th>
<th>Details of Information Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Traffic Information</td>
<td>Basic highway information</td>
<td>Route code number, name, location, route sketch map, road classification, mileage stake, number of lane, name of linked road; entry and exit ramp, bridge, tunnel, culvert code number, name, mileage stake of each of the classified highways; location of service facility and tolling station; village and landform along the highway.</td>
</tr>
<tr>
<td></td>
<td>Separated interchange</td>
<td>Location of complicated interchanges and vehicle routing sketch within the interchange area along the highway and in urban area.</td>
</tr>
<tr>
<td></td>
<td>Expressway toll station information</td>
<td>Toll station name, location, toll collection method, toll charge criteria, vehicle type classification standard.</td>
</tr>
<tr>
<td></td>
<td>Ordinary toll bridge and road</td>
<td>Ordinary road and bridge toll station number, location, toll collection method, toll charge criteria and etc.</td>
</tr>
<tr>
<td></td>
<td>Passenger transport terminal</td>
<td>Name, location, scale, direction, contact number and etc. of third class provincial and municipal road passenger transport terminal.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Transfer bus station, rail transit station, taxi stop and etc. information of long-distance stops and terminal station.</td>
</tr>
<tr>
<td>Service Content</td>
<td>Information Type</td>
<td>Details of Information Content</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Urban road basic</td>
<td>Information and auxiliary facility information</td>
<td>Urban road basic information includes road name, mileage, classification, code number, number of</td>
</tr>
<tr>
<td></td>
<td></td>
<td>lane, linked road name, etc.;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Auxiliary facility information include entry and exit, interchange and parking location, etc.</td>
</tr>
<tr>
<td>Urban expressway</td>
<td>Related information</td>
<td>Routing sketch, section name, origin/destination, main entry and exit, number of lane, toll</td>
</tr>
<tr>
<td></td>
<td></td>
<td>charge criteria, etc.</td>
</tr>
<tr>
<td>Bus terminal basic</td>
<td>Information</td>
<td>Name, location, scale, contact phone number and etc. of main urban bus terminals.</td>
</tr>
<tr>
<td>Airport information</td>
<td></td>
<td>Airport location, scale, contact phone number and access routing.</td>
</tr>
<tr>
<td>Railway station</td>
<td>Information</td>
<td>Railway station name, location, scale, contact number and access routing.</td>
</tr>
<tr>
<td>Port and wharf</td>
<td>Information</td>
<td>Port and wharf location, scale, throughput, contact number and access routing, etc.</td>
</tr>
<tr>
<td>Barrier-free facility</td>
<td>Information</td>
<td>Barrier-free passage and public transport sign board, etc. especially for the disabled.</td>
</tr>
<tr>
<td>Expressway closure</td>
<td>Information</td>
<td>Closure route name, closure road section, cause of closure, closure duration, update time, etc.</td>
</tr>
<tr>
<td>Service Content</td>
<td>Information Type</td>
<td>Details of Information Content</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>-------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Road Condition Service</td>
<td>Traffic control information</td>
<td>Traffic restriction, cause of restriction, restriction duration of expressway, highway and urban road, freight load limit and height limit information of special road, bridge and tunnel, etc.</td>
</tr>
<tr>
<td></td>
<td>Traffic congestion information</td>
<td>Congestion road name, location, cause, queue length and vehicle speed, etc. of expressway (highway) and urban road; Video surveillance image information of congested section and bus terminal</td>
</tr>
<tr>
<td></td>
<td>Traffic accident information</td>
<td>Road section name, location, cause and time of the accident, and accident impact, duration and the conditions of accident process, etc.</td>
</tr>
<tr>
<td></td>
<td>Major navigation waterway control information</td>
<td>Section open/close, water level, accident, congestion and repair and maintenance condition of major navigation waterway</td>
</tr>
<tr>
<td></td>
<td>Video surveillance and control information</td>
<td>Video surveillance and control image at such places as long-distance passenger transport terminal, bus transit terminal and rail transit, civil aviation, railway and port terminal, etc.</td>
</tr>
<tr>
<td>Ticketing Service</td>
<td>Long-distance passenger transport information</td>
<td>Bus run operation routing, frequency, arrival and departure time, mileage, stop and vehicle type, etc. of long-distance passenger transport.</td>
</tr>
<tr>
<td></td>
<td>Long-distance passenger transport ticket information</td>
<td>Fare, ticket booking/sale mode, ticket sale location and commission charge, etc. of long-distance passenger transport route</td>
</tr>
<tr>
<td>Service Content</td>
<td>Information Type</td>
<td>Details of Information Content</td>
</tr>
<tr>
<td>-----------------</td>
<td>----------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Temporary bus run alteration information</td>
<td>Added and cancelled route and bus run information of long-distance passenger terminal, due to passenger flow changing, special events, road construction and other reasons, and temporary route alteration information due to other reasons.</td>
</tr>
<tr>
<td></td>
<td>Railway transport information</td>
<td>Route, frequency, arrival and departure time and fare, etc. of railway train service; Ticket availability, train behind schedule, and temporary alteration etc.</td>
</tr>
<tr>
<td></td>
<td>Flight information</td>
<td>Flight route, flight number, stop, takeoff and landing time, flight mileage information of civil aviation and real-time information such as ticket fare and availability, etc.</td>
</tr>
<tr>
<td></td>
<td>Ship passenger transport information</td>
<td>Voyage route, sail and anchor wharf, stop, mileage, estimated arrival time, ticket fare and availability, etc.</td>
</tr>
<tr>
<td></td>
<td>Public transport related information</td>
<td>Urban bus and rail transport routing, stop and fare information, etc. Bus transfer information; Bus route adjustment and temporary alteration information.</td>
</tr>
<tr>
<td>Route Planning</td>
<td>Transfer information of railway with other transport mode</td>
<td>Transfer information after leaving the station, e.g. bus line and stop location near the railway station, taxi stop near the rail station or bus stop; Best route to other railway station, major long-distance passenger terminal, civil aviation airport and major tourist site, etc.</td>
</tr>
<tr>
<td>Service Content</td>
<td>Information Type</td>
<td>Details of Information Content</td>
</tr>
<tr>
<td>-----------------</td>
<td>------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>Transport Information System</td>
<td>Transfer information of civil aviation with other mode</td>
<td>Transfer information after arrival at airport, e.g. airport bus location, route, stop, frequency, first and last bus, etc., and taxi stop, bus line and stop location and rail station near the airport; Best route to railway station, major long-distance passenger terminal and major tourist site, etc.</td>
</tr>
<tr>
<td></td>
<td>Transfer information of ship with other transport mode</td>
<td>Relevant transfer information of port/wharf with other transport mode, e.g. bus, urban rail transport location, route, stop, frequency, first and last bus, etc. near the port, and taxi stop information near the port; Best route to railway station, major long-distance passenger terminal and major tourist site, etc.</td>
</tr>
<tr>
<td></td>
<td>Route option information</td>
<td>Provide preferable route (based on time, distance, fee or general advantage) and spare route choice between two points or among multiple points.</td>
</tr>
<tr>
<td>Government Traffic Affair and Aiding Information Service</td>
<td>Government administration information</td>
<td>Information on transport related important event and relevant government administration website link, etc.</td>
</tr>
<tr>
<td></td>
<td>Transport law and regulation</td>
<td>Transport law and regulation, and management rule and system related to public travel.</td>
</tr>
<tr>
<td></td>
<td>Rules for traveler</td>
<td>Rules and precautions for long-distance passenger transport, bus, subway, civil aviation, railway and ship, etc., e.g. restriction on carriage property, volume and weight, etc.</td>
</tr>
<tr>
<td></td>
<td>Common contact information</td>
<td>Location and contact information of transport enterprise (e.g. vehicle inspection and repair, parcel delivery, transport service, etc.) and industry management department</td>
</tr>
<tr>
<td>Service Content</td>
<td>Information Type</td>
<td>Details of Information Content</td>
</tr>
<tr>
<td>-----------------</td>
<td>------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>Weather Informatio n</td>
<td>Weather information</td>
<td>Weather condition information, such as temperature, humidity, wind speed, ice, snow, rain and fog, etc., and disaster warning along urban road, highway and expressway.</td>
</tr>
<tr>
<td>Locating and Tracking Service</td>
<td>GPS data</td>
<td>GPS location information of taxi, passenger bus and danger goods truck.</td>
</tr>
<tr>
<td>Vehicle inspection station and repair garage information</td>
<td>Location (layout map), classification, scale, business scope, major vehicle type repaired, contact phone number, open hours, legal person, main principal, jurisdiction area and other information on vehicle repair garage and inspection station along highway, expressway and in urban area.</td>
<td></td>
</tr>
<tr>
<td>Pump station information</td>
<td>Location (layout map), scale, fuel category, price, open hours, contact phone number and other information of pump station along highway, expressway and in urban area.</td>
<td></td>
</tr>
<tr>
<td>First-aid information</td>
<td>Information about emergency response and first-aid related organization, such as contact information, business scope, service method, location and jurisdiction area of accident process, road administration, towing service, vehicle rescue, medical service first aid and fire-fighting agency.</td>
<td></td>
</tr>
<tr>
<td>Service Content</td>
<td>Information Type</td>
<td>Details of Information Content</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------------------------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Complaints and Advices</td>
<td>Complaint information</td>
<td>The public can input complaint content, time, object and complainer.</td>
</tr>
<tr>
<td></td>
<td>Advice information</td>
<td>The public can input advice on the information service content and system function, etc. of the travel information service system.</td>
</tr>
<tr>
<td>Lost and Found Service</td>
<td>Lost and found information</td>
<td>The lost and found information service is available to get by input basic attributes of the lost, location, time and contact information.</td>
</tr>
<tr>
<td>Travel Forum Service</td>
<td>Travel experience exchange information</td>
<td>Exchange travel experience and travel information, travel advice and suggestion.</td>
</tr>
<tr>
<td></td>
<td>Ticket transfer information</td>
<td>Provide ticket transfer information</td>
</tr>
<tr>
<td></td>
<td>Real-time road condition information exchange</td>
<td>Provide road traffic condition and accident information, etc.</td>
</tr>
<tr>
<td></td>
<td>Joint renting/riding a car information</td>
<td>User’s intention of joint car renting or riding (car pool)</td>
</tr>
<tr>
<td>Service Content</td>
<td>Information Type</td>
<td>Details of Information Content</td>
</tr>
<tr>
<td>-----------------</td>
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</tr>
<tr>
<td>Other</td>
<td>Fee payment information</td>
<td>Provide call-up information on road maintenance fee, transport management fee, freight additional fee.</td>
</tr>
<tr>
<td></td>
<td>Parking lot information</td>
<td>Parking lot location, capacity, open hours, charging, route and available parking space along expressway, national and provincial trunk highway and in urban area.</td>
</tr>
<tr>
<td></td>
<td>No stop section</td>
<td>Information about road sections where vehicles are allowed to stop for loading/unloading.</td>
</tr>
<tr>
<td></td>
<td>Car renting information</td>
<td>Bilingual information of each car renting company, such as address, contact phone number, business scale, service manner, business scope and relevant car type, condition, type of rent and charging, etc.</td>
</tr>
<tr>
<td></td>
<td>Taxi booking service information</td>
<td>Contact information and fee charging criteria, etc. of taxi booking.</td>
</tr>
<tr>
<td></td>
<td>Passenger and freight transport enterprise information</td>
<td>Owner name, company address, contact phone number, principal and business scope, etc.</td>
</tr>
<tr>
<td></td>
<td>Terminal surroundings information</td>
<td>Service zone, accommodation, food, entertainment and fee charging, etc. near passenger and freight terminal and along trunk road.</td>
</tr>
<tr>
<td></td>
<td>Tourism information</td>
<td>Telephone number and brief introduction of tourism service center, tourist site basic introduction, location, ticket price, open hours, transport solution (including travel mode choice, relevant route suggestion and reference price), surrounding establishment information, car hiring information and link to the tourism website.</td>
</tr>
<tr>
<td>Service Content</td>
<td>Information Type</td>
<td>Details of Information Content</td>
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<tr>
<td></td>
<td>Non-barrier equipment provision information</td>
<td>Location, contact information and fee charging, etc. to get non-barrier bus, taxi and wheelchair.</td>
</tr>
<tr>
<td></td>
<td>Taxi type and pricing inquiry</td>
<td>Car type information, basic introduction and pricing information of taxi service.</td>
</tr>
<tr>
<td></td>
<td>Driving school information</td>
<td>Name, address, type, certificate number, principal, trade and industry’s license number, telephone, classroom space, coaching venue, training scope and contact information, etc.</td>
</tr>
<tr>
<td></td>
<td>Mover company information</td>
<td>Company name, telephone number, address, business scope, license number, issuing date, principal and truck basic information, etc.</td>
</tr>
</tbody>
</table>