SECTION **2**

LITERATURE REVIEW

An initial step in studying strategies for improved traveler information was to conduct a comprehensive literature search and review. The literature review for this project included reviewing papers, reports, and articles about ATIS, TTI, and the underlying transit intelligent transportation systems (ITS) technologies from numerous sources. These sources included the following:

- Intelligent Transportation Society of America (ITSA) annual meetings proceedings;
- ITS World Congress meetings proceedings;
- TRB annual meetings papers;
- Transportation Research Information Services (TRIS);
- FTA, FHWA and ITS Joint Program Office reports;
- Related TCRP projects (including Synthesis projects);
- Interviews with nontransit companies that provide innovative customer information systems;
- Documentation from numerous European Commission and U.K. studies about ATIS and TTI systems; and
- Key TTI websites from the United States, Canada, Europe, and Asia.

The literature review also included reviewing interim material and reports from TTI-related projects currently being conducted by FTA's Office of Mobility Innovation, including the real-time transit information assessment and ATIS human factors assessment projects. FTA's Real-Time Transit Information Assessment project included conducting telephone and on-site interviews with a total of 10 transit agencies that have deployed or are deploying real-time information systems. Information from these interviews provided significant insight into the deployment of TTI; where appropriate, this information is included in Sections 4.2 and 5 of this report.

Further, two TCRP projects conducted by Multisystems have generated reports that were reviewed for this project. These projects are TCRP J-09, "e-Transit: Electronic Business Strategies for Public Transportation, Topic 4: Customer Information," (*1*) and TCRP Project J-7, Synthesis Topic SA-14, "Real-Time Bus Arrival Information Systems" (*2*). Transit agency interviews were conducted as part of these projects as well, focusing on advanced features of transit websites in TCRP Project J-09, Task 4, and on the provision of real-time bus arrival information in TCRP Project J-7, Synthesis Topic SA-14. Relevant information from these projects has been used where appropriate in this project.

One key result of the literature review and experience conducting the aforementioned FTA and TCRP projects was that there is a great deal of activity in the area of providing real-time TTI. Transit agencies are becoming more sensitive to customers' needs for up-to-the-minute information and, consequently, are more interested in adopting the necessary underlying technologies. Most agencies are no longer satisfied by merely providing static information on their Internet sites. They have been very diligent in making their websites more appealing, user-friendly, and useful, and some have begun to provide real-time information via their websites and wireless media.

The literature review also revealed the large number of hardware, software, and communication tools available to improve the provision of TTI and at cheaper rates than ever before. In terms of disseminating TTI, there are now more media available: the Internet, DMSs at bus stops and train stations, mobile telephones using WAP and short message service (SMS), wireless PDAs, and cable television.

Specific key reports are summarized in the following subsections when they contributed to the knowledge of TTI and strategies for improving TTI; however, the literature review was not limited to these documents.

2.1 ADVANCED PUBLIC TRANSPORTATION SYSTEMS: THE STATE OF THE ART—UPDATE 2000

Advanced Public Transportation Systems: The State of the Art—Update 2000, prepared for FTA's ITS/Advanced Public Transportation Systems (APTS) program, provides summaries of U.S. and Canadian transit industries' most innovative and successful applications of advanced technologies (*3*). A significant portion of the report is devoted to TTI systems, including descriptions of pre-trip, en route (also known as in-terminal/wayside), and in-vehicle traveler information systems. Each of these types of systems is described in the report in the Technology Description, Challenges to Implementation, and Application Examples subsections. The technology description discusses the various technologies used in TTI systems and describes the functionalities found in many of these systems. The section on challenges to imple-

mentation sheds light on implementation issues, including those related to technological, communications, or financial areas. The application examples for each type of system describe several deployed systems, as follows:

- Pre-trip transit and multimodal traveler information systems:
  - Orange County Transportation Authority (California)—Travel Probe, TravelTIP, and Travel Advisory News Network systems;
  - Washington Metropolitan Area Transit Authority (WMATA) (Washington, DC)—RideGuide;
  - Seattle's King County MetroBusView, MyBus, and e-mail notification;
  - Los Angeles—regional multimodal information integration; and
  - New York City—Service Area Traveler Information Network.
- In-terminal/wayside (also called en route) transit information systems:
  - Miami's Tri-County Commuter Rail Authority TrainTrac system;
  - Eastern Connecticut—coordinated automated announcement system for Shore Line East commuter rail route stations;
  - Long Island Rail Road—Talking Kiosk;
  - San Francisco Municipal Railway—NextBus system;
  - San Francisco's Bay Area Rapid Transit—real-time estimated time to arrival (ETA) in stations; and
  - Seattle's King County—TransitWatch®.
- In-vehicle transit information systems:
  - San Antonio's VIA Metropolitan Transit—integrated in-vehicle information; and
  - WMATA—GPS-based automated annunciation system.

These examples were current as of 2000.

2.2 ADVANCED PUBLIC TRANSPORTATION SYSTEMS: DEPLOYMENT IN THE UNITED STATES—YEAR 2000 UPDATE

Advanced Public Transportation Systems Deployment in the United States—Year 2000 Update, also prepared for FTA, is a compilation of existing and planned deployments of 17 APTS elements (*4*). The information was collected during 2000 and was obtained through contacts with one or more persons at each agency. A total of 572 agencies provided information for this study. In contrast to the APTS state of the art report (*3*), this reports surveys every public transit system in the United States that employs or has plans to employ APTS technologies (i.e., is expected to have operational APTS technologies by 2005), but provides relatively little specific information about the individual systems.

This FTA report reveals that the most widely deployed APTS element (for which data was collected for the entire United States) is automated transit information. Of the 572 agencies surveyed, 291 agencies had operational transit information system and 48 agencies were planning on implementing such a system. Further, the report illustrates that 334 agencies have or will have a pre-trip traveler information system, while 167 have or are planning to have an en route traveler information system. As for in-vehicle traveler information systems, 124 agencies stated that they have or are planning on having one deployed. Finally, the report says that the number of operational TTI systems increased by 506% from 1995 to 2000.

2.3 TRIP PLANNING STATE OF THE PRACTICE

Trip Planning State of the Practice describes the current state of the practice in web-based trip or itinerary planning (*5*). It identifies issues associated with trip-planning system development, identifies costs and benefits of these systems, and makes recommendations for outreach and further research that could assist transit agencies in developing and deploying high-quality trip planners. The report also provides detailed information on the features of the 34 systems that were assessed.

2.4 WHITE PAPER ON LITERATURE REVIEW OF REAL-TIME TRANSIT INFORMATION SYSTEMS

In May 2002, FTA initiated a project to develop a guidance document that would provide practical information to transit agencies and support them in fostering the deployment of real-time transit information systems (for both bus and rail). "White Paper on Literature Review of Real-Time Transit Information Systems" addresses the first step in developing that guidance: literature search and review (*6*). The white paper provides information on the successful implementation of real-time information systems in the United States and abroad. Through a comprehensive literature review, this paper examines the implementation and operation of real-time information systems and identifies the issues and problems associated with providing such information.

2.5 TCRP REPORT 84: E-TRANSIT: ELECTRONIC BUSINESS STRATEGIES FOR PUBLIC TRANSPORTATION, VOLUME 4: ADVANCED FEATURES OF TRANSIT WEBSITES

TCRP J-09, "e-Transit: Electronic Business Strategies for Public Transportation, Topic 4: Customer Information" documents the best practices associated with providing customer information via the Internet in *TCRP Report 84, Volume 4* (*1*). The website features that are the focus of this project are automated itinerary planners (AIP), real-time information display systems, electronic notification systems, and customer

relationship management (CRM) systems. The eight case studies were developed from detailed website reviews and from extensive telephone interviews with transit agencies that have AIP systems on their websites. Further, providing real-time information and e-mail notification via websites was examined, with a focus on system design and functionality, implementation issues, outcomes and benefits, and planned improvements. General concepts and concerns related to specific technology and application issues were described, crosscutting issues of advanced transit website features were discussed, and best practices and recommendations for further research were identified.

2.6 TCRP SYNTHESIS 48: REAL-TIME BUS ARRIVAL INFORMATION SYSTEMS

TCRP Synthesis 48 describes and documents the state of the practice in real-time bus arrival information systems, including both U.S. and international experience (*2*). A survey was conducted to obtain information on relevant technical capabilities, agency experience, cost, and bus rider reactions to these information systems. This synthesis also includes a review of the relevant literature and focuses on current practice in the field. An important element of this report is the documented interviews with key personnel at agencies that have implemented these types of systems.

2.7 TCRP SYNTHESIS 43: EFFECTIVE USE OF TRANSIT WEBSITES

TCRP Synthesis 43: Effective Use of Transit Websites describes the current practices and experiences in transit website design, content, marketing, and administration (*7*). Information was collected from 47 U.S. transit agencies via surveys and interviews with transit website managers and from other sources, such as logs of website usage, market research conducted by transit agencies, and relevant literature. The report provides information regarding general planning and expectations, priorities for website content, audience needs, marketing and promotion, design parameters, homepage and inside pages design, and website testing and usage monitoring.

2.8 INFOPOLIS PROJECTS

The European projects Infopolis 1 (conducted in 1996–1997) and Infopolis 2 (conducted in 1998–2000) provide significant insight into TTI systems. The primary goal of Infopolis 1 was "to improve user accessibility to Public Transport information in terms of its presentation as well as its content, and to produce guidelines for European Standards for Human Computer Interface" (*8*). Infopolis 1 produced a significant amount of documentation, including a detailed review and analysis of 53 public transport information systems in Europe that were in operation or being implemented in 1996.

Infopolis 2 was an extension of Infopolis 1, and its primary goal was "to improve user access to electronic intermodal traveler information by developing guidelines for the presentation of information" (*9*). Infopolis 2 also generated many documents, some of which were reviewed as part of the literature review for this project. More than 150 European public transportation information systems were investigated, and almost 100 were surveyed. As in Infopolis 1, a detailed review was conducted of the surveyed systems.

2.9 PUBLIC TRANSPORT INFORMATION WEB SITES—HOW TO GET IT RIGHT: A BEST PRACTICE GUIDE

A comprehensive guide, *Public Transport Information Web Sites—How to Get It Right: A Best Practice Guide* focuses on how to present various types of TTI to website users (*10*), ensuring that a TTI website meets the users' needs and is easy to use. This guide is divided into five major sections:

1. Principles of a user-focused approach;
2. Definition of key usability principles;
3. Identification of web TTI elements, or the "toolkit";
4. Examples of good and not-so-good websites; and
5. Site provider's perspective in developing a TTI website.

2.10 REFERENCES AND ENDNOTES FOR SECTION 2

1. *TCRP Report 84: e-Transit: Electronic Business Strategies for Public Transportation, Volume 4: Advanced Features of Transit Websites.* Transportation Research Board of the National Academies, 2003.
2. Schweiger, C.L. *TCRP Synthesis 48: Real-Time Bus Arrival Information Systems.* Transportation Research Board of the National Academies, 2003.
3. Casey, R. F., L. N. Labell, L. Moniz, J. W. Royal, C. L. Schweiger, M. Sheehan, T. Sheehan, A. Brown, M. Foy, M. Zirker, J. B. Marks, B. Kaplan, and D. Parker. *Advanced Public Transportation Systems: The State of the Art—Update 2000,* DOT-VNTSC-FTA-99-5 and FTA-MA-26-7007-00-1; FTA/Office of Mobility Innovation, December 2000; http://www.itsdocs.fhwa.dot.gov//JPODOCS/REPTS_TE/13583.pdf.
4. Casey, R. F. *Advanced Public Transportation Systems Deployment in the United States—Year 2000 Update,* DOT-VNTSC-FTA-02-06 and FTA-MA-26-7007-02.1, FTA/Office of Mobility Innovation, May 2002; http://www.itsdocs.fhwa.dot.gov/JPODOCS/REPTS_TE/13680.html.
5. Radin, S., D. Jackson, D. Rosner, and S. Pierce. *Trip Planning State of the Practice,* FTA-TRI-11-02.6, FTA/ITS Joint

Program Office, July 2002; http://www.itsdocs.fhwa.dot. gov/JPODOCS/REPTS_TE/13685.html.

6. Battelle and Multisystems. "White Paper on Literature Review of Real-Time Transit Information Systems," prepared for the FTA Real-Time Transit Information Assessment project, Contract Number # DTFT60-99-D-41022/Order No. 00007, August 2002.
7. Schaller, B. *TCRP Synthesis 43: Effective Use of Transit Websites,* Transportation Research Board of the National Academies, Washington, DC, 2002; http://gulliver.trb.org/publications/tcrp/tsyn43.pdf.
8. "Review of Public Transport Access Information Systems," prepared for the Infopolis 1 Project (No. TR 1031), WP03, Version 3.0, December 1996; ©Infopolis Consortium 1996–1997; http://www.ul.ie/~infopolis/library/info1/del3.html.
9. "Review of Current Passenger Information Systems," prepared for the Infopolis 2 Project (No. TR 4016), Deliverable 1, WP03, Version 1.0, August 1998, ©Infopolis 2 Consortium; http://www.ul.ie/~infopolis/library/del/del1.html.
10. Kenyon, S., G. Lyons, and J. Austin. *Public Transport Information Web Sites—How to Get It Right: A Best Practice Guide,* The Institute of Logistics and Transport, 2001.