FTA

Federal Transit Administration

Trip Planning State of the Practice

Starting Point & Destination

Starting From:

◉ Street Address

Address: (e.g. 1234 Wish Street)

City:

e.g.BWI Airport

◯ Landmark

...ere for common landmarks

1 (e.g Sharp Street):

2 (e.g Pratt Street):

Going To:

◉ Street Address

◯ Landmark

◯ Intersection

...tion

hr : 45 ▾ min PM ▾ am/pm

Arriving

REPORT DOCUMENTATION PAGE		Form Approved OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE July, 2002	3. REPORT TYPE AND DATES COVERED Final Report

4. TITLE AND SUBTITLE Trip Planning State of the Practice	5. FUNDING NUMBERS HW252/H2150
6. AUTHOR(S) Sari Radin, Economist; David Jackson, Transportation Industry Analyst; David Rosner, Economist; Sean Peirce, Program & Policy Analyst	

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U. S. Department of Transportation Research and Special Programs Administration John A. Volpe National Transportation Systems Center Economic and Industry Analysis Division 55 Broadway, DTS-42 Cambridge, MA 02142-1093	8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Federal Transit Administration U.S. Department of Transportation Washington, DC 20590 Intelligent Transportation Systems Joint Program Office U.S. Department of Transportation Washington, DC 20590	10. SPONSORING/MONITORING AGENCY REPORT NUMBER FTA-TRI-11-02.6

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT Available From: The electronic document library: http://www.its.dot.gov/itsweb/welcome.htm	12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

Automated trip planning is one of the easiest ways for transit users to identify their best choice of routes using the internet. Trip planners use an input form to obtain information on desired trip characteristics then automatically generate an itinerary for the user. This report identifies opportunities for FTA to facilitate the development of trip planners. The report:

- Summarizes the current state of the practice in web-based single and multi-agency transit trip planning

- Identifies single and multi-agency trip planner development issues

- Groups transit agencies by likely capability and interest in developing trip planners

- Recommends appropriate federal assistance for each group and research to overcome barriers

The main text of the report summarizes the current status of trip planner deployment, expectations, benefits, development issues, standards, costs, and staffing. It also groups transit agencies by market segments. Appendices provide detail on methodology, related literature, and features of existing trip planners.

14. SUBJECT TERMS Transit Trip Planners Itinerary Planners Pre-Trip Traveler Information Systems Transit Intelligent Transportation Systems			15. NUMBER OF PAGES 60
			16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18
298-102

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U.S. Department
of Transportation

Research and
Special Programs
Administration

Trip Planning State of the Practice

June 2002

For

Office of Research, Demonstration, and Innovation
Federal Transit Administration
and
Intelligent Transportation Systems Joint Program Office
Federal Highway Administration
U.S. Department of Transportation

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PREFACE

This report provides the results of an analysis of interviews of transit agency and other organization staff, a detailed review of existing web-based trip planner features, existing data on transit agencies and their web sites, and a literature review and internet search. The objective of the report is to identify opportunities for the Federal Transit Administration (FTA) to facilitate the development of transit trip planners. In doing so, this report also provides information that could assist transit agencies decide how or whether to proceed with trip planner development.

Executive Summary

Introduction

Automated trip planning is one of the easiest ways for transit users to identify their best choice of routes using the internet. Trip planners use an input form to obtain information on desired trip characteristics then automatically generate an itinerary for the user. The FTA would like to facilitate the development of trip planners, and has requested this research to identify opportunities. This paper:

- Summarizes the current state of the practice in web-based single and multi-agency transit trip planning

- Identifies single and multi-agency trip planner development issues

- Groups transit agencies by likely capability and interest in developing trip planners

- Recommends appropriate federal assistance for each group and research to overcome barriers

A second phase of this project will examine the issues associated with the development of multimodal trip planners. Multimodal trip planners include driving directions, intermodal transfer points or intercity transportation in addition to trip planning for transit. A report summarizing recommendations from that phase will be completed in August 2002.

The conclusions presented in this paper were developed by analyzing information from a number of sources, including:

- Interviews of transit agency and other organization staff

- A detailed review of existing web-based trip planner features

- Existing data on transit agencies and their web sites

- A literature review and internet search

Recommended outreach and research

Both federal assistance and research could help transit agencies develop high quality transit trip planners. Potential actions are summarized by market segment. These market segments are:

Old pros: The twenty or so largest agencies with the best web sites currently.[1] Most of these agencies already have trip planners, and are on the cutting edge of technology.

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[1] Web site quality was assessed based on a review of web site content and usability by staff at the John A. Volpe Transportation Systems Center, Cambridge, MA, during the summer of 2001. The review was undertaken for the

Team players: The ninety next largest agencies with above average web sites. When they develop trip planners, they tend to collaborate with other agencies. They are more dependent than "Old pros" on state and federal funds for their trip planner development. While they are technically competent, there are opportunities for additional training or outreach.

Cooperative partners: The eighty mid-sized agencies with average web sites. Few currently have trip planners. They tend to work cooperatively with state agencies and their MPO, although some have developed trip planners independently. They have a greater need for financial and technical support and have fewer contacts with other transit professionals who have developed trip planners.

Contributors: The remaining smaller agencies. These agencies typically contribute information to regional trip planners where they exist. They are unlikely to develop a trip planner on their own because of limited benefits to their agency, as opposed to the region as a whole.

Table 1 summarizes potential federal outreach and assistance.

Table 1. Potential new and ongoing assistance and research by market segment

	New	Ongoing
Old Pros		
1. Recruit them to the Peer-to-Peer program to advise others.	X	
2. Provide them with the results from TCRP J-09, "eTransit: Electronic Business Strategies for Public Transportation", forthcoming in 2002.		X
3. Interview them about multimodal efforts and inform them of the results of the second phase of this project (development issues research)		X
Team Players		
1. Identify funding sources for operations	X	
2. Provide a source book containing example MOUs, vendor contracts, and a glossary of common terms.	X	
3. Train on the ITS architecture		X
Cooperative partners		
1. Connect states and MPOs to Peer-to-Peer program resources on trip planners	X	
2. Provide guidelines for good design of trip planners	X	
3. Supply guidelines for how to maintain a sophisticated web site	X	

	New	Ongoing
4. Suggest how to cost-effectively locate or develop geocoded data	X	
5. Summarize funding eligibility for trip planners and related efforts such as geocoding	X	
6. Develop a workshop to give an overview of trip planner development and introduce interested agencies to each other and resources	X	
7. Publicize good trip planners (see http://www.transitweb.its.dot.gov)		X
8. Distribute guidelines for good design of web sites		X
Contributors		
1. Suggest how to cost-effectively locate or develop geocoded data	X	
Research to support all segments		
1. Measure the effect of web-based trip planner use on long-term mode choice decisions and ridership attrition. See Appendix B for possible research methods	X	
2. Assess the effect of web-based trip planners on mode choice by visitors. See Appendix B for possible research methods.	X	
3. Develop a free software application to facilitate use of AVL data for geocoding stop locations	X	
4. Ascertain the current status of Geographic Information Systems (GIS) for transportation in terms of availability of standard base maps on a regional basis; identify ways in which USDOT could assist.[2]		X

Transit trip planner development

There is no need to "sell" agencies on developing trip planners. There are currently 30 transit web-based trip planners in the United States, with 22 serving single agencies and eight serving multiple agencies. The number is growing rapidly. Recently, about one new trip planner per month has been made available to the public. All of the six agencies contacted that currently do not have web-based trip planners are interested in developing one, or being part of a regional development. Five are developing a trip planner now. The majority of existing trip planners are on web sites developed by the largest agencies that have the best web sites.

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[2] A survey of MPOs by USDOT Volpe Center staff for the Metropolitan Capacity Building Program will provide information on GIS use in MPOs.

Most trip planners are developed by vendors. Although a few companies dominate, the market remains competitive because many companies submit bids. While developing a trip planner is expensive, it appears unlikely that the high price results from market power on the part of the vendors. There are more competitors in the market than there were a few years ago.

Agencies expect to save money, provide better service and increase ridership with trip planners, although few evaluations support these expectations. The best evidence is for cost savings through decreased call or e-mail volume. In addition, as part of the process of developing trip planners, geocoding bus stop data and improving consistency of existing sources help the agencies with other projects.

Developing geocoded data is a major part of trip planner development. Interviewees mentioned the following existing data sources and methods for developing data:

Existing data	Methods to develop
Scheduling database	Hand-held geocode devices
Bus stop database	Addresses
Locations geocoded for demand response service	Digitized ortho photos
MPO and State DOT	GPS data from AVL system

Development costs vary by the starting point and the ultimate complexity of the trip planner. Agencies or regions that have already completed development of a trip planner for call center staff can expect to spend another $40,000 to $50,000 to make it available on the web. These costs include both software and additional hardware, including servers. Starting without data development completed is significantly more expensive. In that case, development costs roughly $600 per square mile of service area.

Agencies that participate in a regional trip planner without having primary responsibility appear to incur the least operating and maintenance costs. It is likely that these costs are transferred to the organization with primary responsibility. This option of shifting costs to regional organizations could make it more feasible for smaller agencies to be included in trip planners, to the benefit of larger operators and the region as a whole. Automation can also save staff time, but certain tasks cannot be done automatically.

Interviewees expressed a number of concerns about trip planner development and operation, including:
- Accuracy
- Security and other technical issues
- Maintaining involvement of regional participants
- Business model changes
- Making sure they use what they pay for
- Bad press

Most agencies that currently do not have a trip planner also have specific concerns about knowledge or skills. These include a lack of knowledge related to:

- Geographic Information System (GIS) skills
- Intelligent Transportation Systems
- Trip planning vendor terminology
- Maintenance of a sophisticated web site

The trip planners currently available to the public are good services. With federal research and assistance, additional agencies will be able to assess whether or not developing a trip planner is appropriate for their services, overcome development concerns, build necessary skills, and identify resources.

Introduction

Automated trip planning is one of the easiest ways for transit users to identify their best choice of routes using the internet. Trip planners use an input form to obtain information on desired trip characteristics then automatically generate an itinerary for the user. The FTA would like to facilitate the development of trip planners, and has requested this research to identify opportunities. This paper:

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- Identifies single and multi-agency trip planner development issues

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- Recommends appropriate federal assistance for each group and research to overcome barriers

A second phase of this project will examine the issues associated with the development of multimodal trip planners. Multimodal trip planners include driving directions, intermodal transfer points or intercity transportation in addition to trip planning for transit. A report summarizing recommendations from that phase will be completed in August 2002.

Recommended outreach and research

Both federal assistance and research could help transit agencies develop high quality transit trip planners. Potential actions are summarized by market segment. These market segments are:

Old pros: The twenty or so largest agencies with the best web sites currently.[3] Most of these agencies already have trip planners, and are on the cutting edge of technology.

Team players: The ninety next largest agencies with above average web sites. When they develop trip planners, they tend to collaborate with other agencies. They are more dependent than "Old pros" on state and federal funds for their trip planner development. While they are technically competent, there are opportunities for additional training or outreach.

Cooperative partners: The eighty mid-sized agencies with average web sites. Few currently have trip planners. They tend to work cooperatively with state agencies and their MPO, although some have developed trip planners independently. They have a greater need for financial and

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[3] Web site quality was assessed based on a review of web site content and usability by staff at the John A. Volpe Transportation Systems Center, Cambridge, MA, during the summer of 2001. The review was undertaken for the Federal Highway Administration Office of Travel Management and the Federal Transit Administration Office of Research, Demonstration, and Innovation.

technical support and have fewer contacts with other transit professionals who have developed trip planners.

Contributors: The remaining smaller agencies. These agencies typically contribute information to regional trip planners where they exist. They are unlikely to develop a trip planner on their own because of limited benefits to their agency, as opposed to the region as a whole. Table 2 summarizes potential outreach and assistance.

Table 2. Potential new and ongoing assistance and research by market segment

	New	Ongoing
Old Pros		
1. Recruit them to the Peer-to-Peer program to advise others.	X	
2. Provide them with the results from TCRP J-09, "eTransit: Electronic Business Strategies for Public Transportation", forthcoming in 2002.		X
3. Interview them about multimodal efforts and inform them of the results of the second phase of this project (development issues research)		X
Team Players		
1. Identify funding sources for operations	X	
2. Provide a source book containing example MOUs, vendor contracts, and a glossary of common terms.	X	
3. Train on the ITS architecture		X
Cooperative partners		
1. Connect states and MPOs to Peer-to-Peer program resources on trip planners	X	
2. Provide guidelines for good design of trip planners	X	
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7. Publicize good trip planners (see http://www.transitweb.its.dot.gov)		X
8. Distribute guidelines for good design of web sites		X
Contributors		
1. Suggest how to cost-effectively locate or develop geocoded data	X	
Research to support all segments		
1. Measure the effect of web-based trip planner use on long-term mode	X	

	New	Ongoing
choice decisions and ridership attrition. See Appendix B for possible research methods		
2. Assess the effect of web-based trip planners on mode choice by visitors. See Appendix B for possible research methods.	X	
3. Develop a free software application to facilitate use of AVL data for geocoding stop locations	X	
4. Ascertain the current status of Geographic Information Systems (GIS) for transportation in terms of availability of standard base maps on a regional basis; identify ways in which USDOT could assist.[4]		X

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[4] A survey of MPOs by USDOT Volpe Center staff for the Metropolitan Capacity Building Program will provide information on GIS use in MPOs.

Methodology

The conclusions presented in this paper were developed by analyzing information from a number of sources:

- *Interviews of transit agency and other organization staff:* These interviews included agencies both with and without web-based trip planners. They were selected to cover the full distribution of agency size, regional size and internet expertise.[5] Interviewees are listed in Table 3. See Appendix D for interview guides.

- *A detailed review of existing web-based trip planner features:* All 30 trip planners in the United States were reviewed for input and output options and advanced features.

- *Existing data on transit agencies and their web sites:* National Transit Database and website content and usability data were used to select interviewees (as noted previously) and to provide a starting point for grouping agencies by their likely technical preparation and interest in developing trip planners.

- *A literature review and internet search:* Information from the literature review and internet search were used to develop the interview guide and to select interviewees. See Appendix F for a summary.

Staff at FTA, the Intelligent Transportation Systems Joint Program Office, and a steering committee including developers of trip planners reviewed the interview guides. Based on their comments, the preliminary interview guides were revised. The final guide for agencies with trip planners includes questions on timeline, benefits, costs and resources, motivation and obtaining buy-in, planning and standards, development, operations and maintenance, and skills needs. The guide for agencies without trip planners includes questions related to motivation and obtaining buy-in, planning and standards, and necessary skills.

Table 3. Interviewees

Location	Name of agency
With trip planners	
Ann Arbor, Michigan	Ann Arbor Transportation Authority (The Ride)
Baltimore, Maryland	Mass Transit Administration of Maryland (MTA)
Chicago, Illinois	Regional Transportation Authority (RTA)
Denver, Colorado	Regional Transportation District (RTD)
Los Angeles, California	Southern California Regional Rail Authority (Metrolink)
Portland, Maine	Portland Metro
Portland, Maine	City of Portland

[5] Size information, in terms of square miles of service area, was taken from National Transit Database data. Internet expertise was assessed based on a review of web site content and usability by staff at the John A. Volpe Transportation Systems Center, Cambridge, MA, during the summer of 2001. The review was undertaken for the Federal Highway Administration Office of Travel Management and the Federal Transit Administration Office of Research, Demonstration, and Innovation.

Location	Name of agency
Portland, Oregon	Tri-County Metropolitan Transportation District of Oregon (Tri-MET)
Rochester, Pennsylvania	Beaver County Transit Authority (BCTA)
Tacoma, Washington	Pierce Transit
Waukesha, Wisconsin	UW-Milwaukee working with Waukesha Transit Commission
Without web-based trip planners	
Everett, Washington	**Snohomish County Public Transit Benefit Area Corporation (Community Transit or CommTrans)**
Rock Island, Illinois	Rock Island County Metropolitan Mass Transit District (Metro Link)
Dallas, Texas	Dallas Area Rapid Transit Authority (DART)
Research Triangle Park, North Carolina	Triangle Transit Authority (TTA)
Burlington, Vermont	Chittenden County Transportation Authority (CCTA)
Peoria, Illinois	Greater Peoria Mass Transit District (GP Transit)
Suffolk County, New York	Suffolk County Department of Public Works- Transportation Division

Current status

There is no need to "sell" agencies on developing trip planners

There are currently 30 transit web-based trip planners in the United States, with 22 serving single agencies and eight serving multiple agencies. The number is growing rapidly. Recently, about one new trip planner per month has been made available to the public. All of the six agencies contacted that currently do not have web-based trip planners are interested in developing one, or being part of a regional development. Five are developing a trip planner now.

The majority of existing trip planners are on web sites developed by the largest agencies that have the best web sites. Figure 1 illustrates the distribution of transit web sites by quality of web site[6] and the natural log of the square miles of service area. The web site scores give an indication of the technical resources and expertise that the agencies have devoted to communication and customer service activities. The complexity of the system and the resources needed to geocode bus stops, stations and routes is represented by square miles of service area.

A number of trip planners are in the planning stages, mostly for agencies that are slightly smaller and have done less with their web sites. There are probably many more trip planners that are planned than are shown because the only sites for which information is available are those that were interviewed or who are working with interviewees.

Figure 1. Existing and planned web-based trip planners

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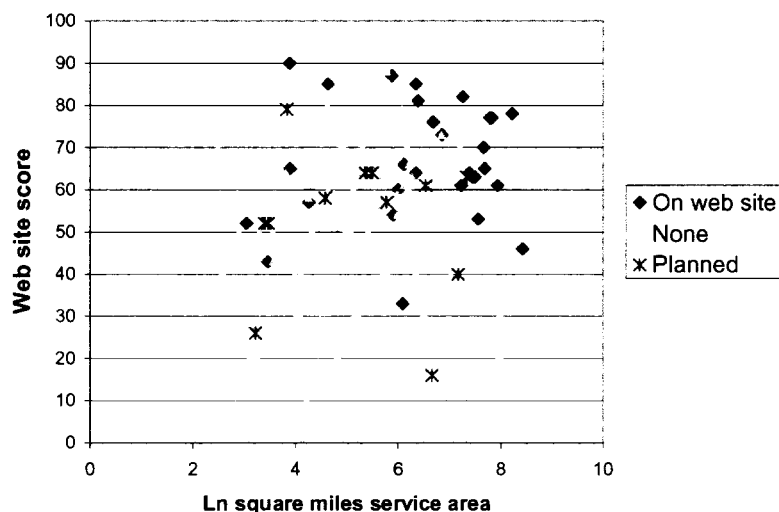
[6] Scores were assigned based on a review of web site content and usability during the summer of 2001. See Appendix C for criteria and weights.

Agencies share expertise and resources

Multi-agency trip planners are becoming more common. Figure 2 illustrates the current distribution of trip planners broken down by number of agencies served. While single agency trip planners are currently dominant, it is likely that this will change in the next few years because of the number of multi-agency trip planners under development, and the extension of single agency trip planners to include adjacent smaller agencies. Interviewees for two existing trip planners expect to extend the planners to serve additional agencies. Several interviewees with trip planners under development reported that their trip planners will serve multiple agencies.

Multi-agency trip planners often involve the coordination of agencies of different sizes as well as different levels of technical expertise. In these cases, a lead agency makes the greatest investment and coordinates the effort. The more agencies served by the trip planner, the more likely there is a single lead agency.

Situations also exist where agencies of similar size and overall technical experience cooperate to take advantage of different expertise. While they may be located in a single region, that is not always the case. For instance, Rock Island and Champaign-Urbana, Illinois and Lafayette, Indiana are hundreds of miles apart, but are cooperating to share expertise and resources.

Figure 2. Distribution of trip planners by number of agencies served (total = 30)

Number of agencies served by trip planner
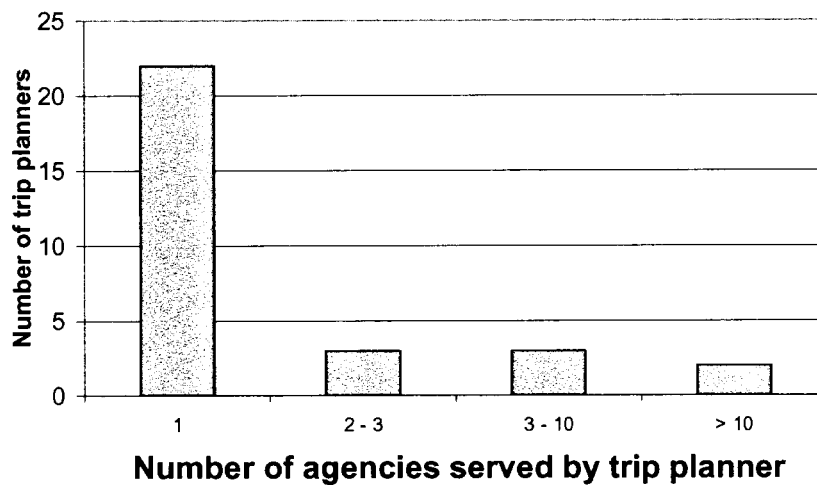
Accessible trip planning, and context are areas for improvement

Most trip planners include all of the basic input options related to identifying locations and time. These follow directly from geocoding stop locations and loading schedules. Optimization options, which include choosing among minimizing walking, transfers or journey time, are

generally either all present or all absent. This standardization is associated with particular vendors selling trip planning software to multiple agencies or regions.

The ability to choose a disabled-accessible route or to select a particular travel mode are the least common options. Identifying routes and stops that are accessible requires additional data, potentially including operations information about whether or not an accessible bus will be operating on any given route on a specific day. Selecting a preferred transit travel mode may not be a relevant choice for many trip planners, since they serve bus-only systems. Figure 3 illustrates the prevalence of input options for existing trip planners.
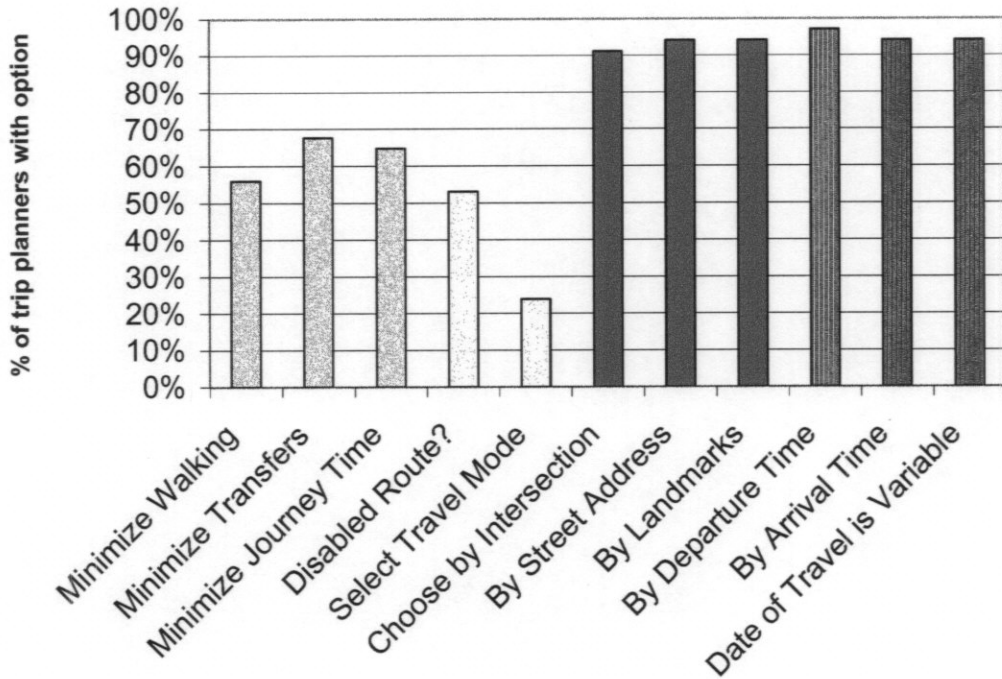
Figure 3. Input options: optimization, constraints, location and time

Approximate trip time and fare information are the most common output information provided in addition to the basic itinerary. Additional context is uncommon. Figure 4 shows the prevalence of links, trip length and other context.

Advanced features are rare. These features reach additional audiences, by providing a choice of

Figure 4. Output options: links, trip length and context
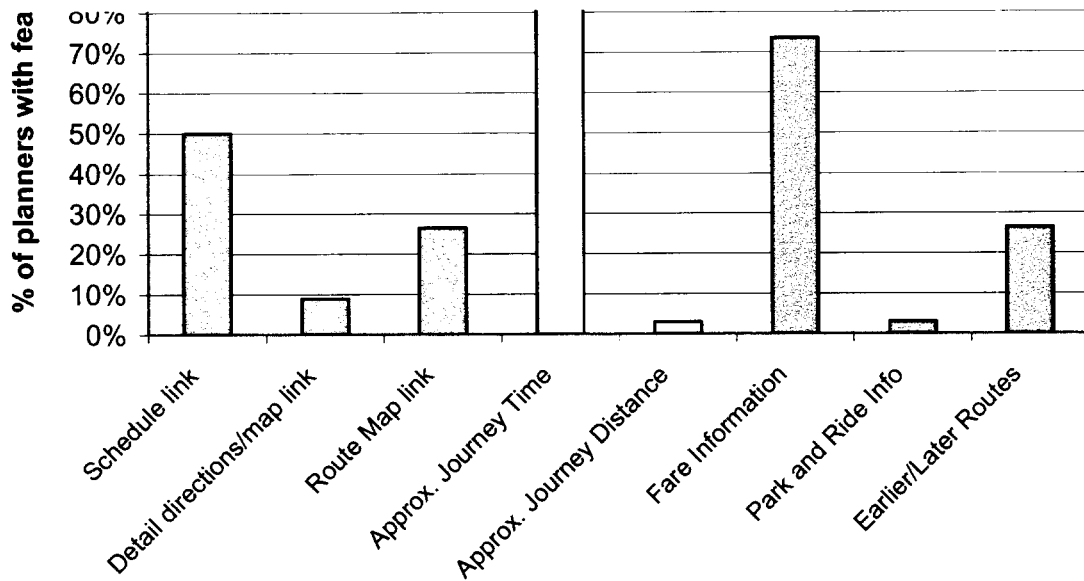
language, downloading the itinerary to PDA, or giving multimodal (driving) directions to the stop. They require additional data or software to implement. Figure 5 shows the prevalence of advanced features.

Figure 5. Advanced features
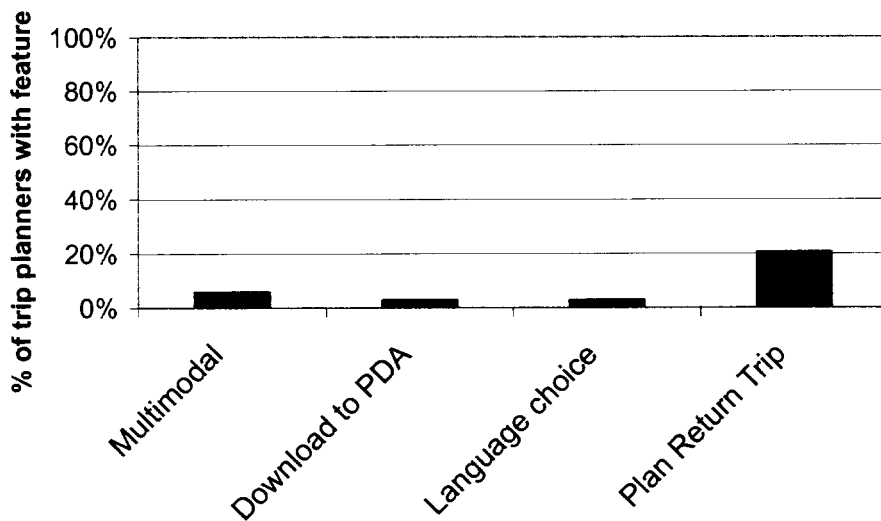
Vendors are competitive

Most trip planners are developed by vendors. Although a few companies dominate, the market remains competitive because many companies submit bids. While developing a trip planner is expensive (see the section on "Costs"), it appears unlikely that the high price results from market power on the part of the vendors.

There are more competitors in the market than there were a few years ago. Aside from the acquisition of the trip planner group at ManTech by Trapeze, no other companies have exited the market or merged. There are other companies or organizations that have developed systems for a single agency or region. Also, at least two other firms have developed trip planning software, although their web pages do not indicate that they have finished implementing any systems. Table 4 summarizes the companies and other organizations that have recently been active in the trip planner development market.[7] It is likely that there are more organizations involved in single implementations than are listed, but their planners are not available to the public, yet.

Table 4. Companies and other organizations in the trip planner development market

Multiple sales	Trip planning software available	Single implementation
• SCAG • GIS/Trans • ManTech (recently acquired by Trapeze) • Trapeze	**Transit software vendors** • GIRO • Multisystems **Other** • **EZ-Ways**	• Intersystems • Spherix • University of Wisconsin-Milwaukee • ITQ LATA

The companies with multiple sales or trip planning software available typically obtain their contracts through a competitive bidding process, and take two approaches to trip planners:

1. A stand alone system
2. A module in a suite of software (including scheduling, runcutting, etc.)

Trapeze, GIRO, and Multisystems offer software suite products, while the other companies provide stand-alone systems.

Most of the organizations that have done single implementations developed the systems for the agencies as a result of existing contracts or relationships, rather than through a competitive bid process. They have other relevant experience, such as operating transit call centers or developing customer information systems for other nontransit transportation modes. The exception is ITQ LATA, the company that assisted Denver RTD with the development of the web interface for their existing call center trip planner. They won the contract through competitive bid.

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[7] Based on internet searches and interviewee reports of companies responding to requests for proposals.

Finally, there is a venture capital backed company, EZ-Ways, which has developed a multiagency regional trip planner for the Northeast with very limited involvement of the agencies included. EZ-Ways relies on the schedule and route information that the agencies make publicly available. While they do not currently successfully compete with the other companies in this market, a company representative reports that they are engaged in selling trip planning technology and integration services to transit agencies, regional consortia, and private enterprises.[8]

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[8] March 25, 2002 e-mail from Gregory C. Belmont, EZ-Ways.

Expectations and benefits

Expectation to save money, provide better service and increase ridership

There was very little quantitative information on benefits, but interviewees noted qualitative benefits or expectations. Table 5 summarizes the benefits and expected benefits sorted by the amount of time the trip planner has been available to the public. Interviewees with trip planners that have been available for at least a year primarily cited fewer phone calls and customer satisfaction as the benefits. Interviewees with new trip planners were very enthusiastic about them and mentioned a range of benefits or expected benefits including cost savings, better service and increases in ridership. The interviewees whose trip planners are in development focused more on the potential to increase ridership.

Table 5. Benefits and expectations of benefits

Agency or Service Area	Years since first public	Save money		Provide better service		Increase ridership	
		Fewer calls	Less e-mail	Shorter calls/less waiting	Customer satisfaction	New customers	New types of trips
Denver	4	●			●		
MetroLink	2	●					
Ann Arbor	2	●					
Chicago	1	●			●		
Portland, OR	1				●		
Waukesha	<1			●	●	●	
Portland, ME	<1	●			●	●	●
MD MTA	<1		●	●	●		
Pierce Transit	<1	●		●	●	●	
Beaver County	0	●					
CommTrans	0						●
Rock Island	0				●	●	

Evaluation results are limited and do not support all expectations

There is some evidence of cost savings. For instance, Maryland MTA required a full time employee to answer e-mail prior to their web site revision and development of the web based trip planner. They now receive about half as much e-mail. In Chicago, there has been a downturn in

the number of calls since the trip planner was implemented, but not a one-to-one decrease where the number of unique trip planner visits exactly matches the reduction in calls. In contrast, Tri-met in Portland, Oregon reported that customer service still spends the same amount of time responding to telephone inquiries.

There are also signs that the trip planners lead to better customer service. Bus riders in Waukesha's user test loved it. Although many riders do not own a computer, they use them at the library, work or school. Denver RTD sees the benefits of having a trip planner as principally in the customer satisfaction area. People appreciate being able to plan their own trips without getting on the phone to an agent. Maryland MTA call center performance has been improving, measured by fewer complaints about waiting for an agent. The trip planner is one of the top five uses of the Metrolink web site, and they get about 9000 sessions per month.

There are no reports, either quantitative or qualitative, of ridership increases resulting from trip planners. No interviewees have tried to evaluate the effects on ridership. However, based on preliminary results from research in the Seattle area, it appears that any effect is likely to be small. Only about 3 percent of all recorded trips in the study involved any information use – this includes radio reports, internet websites, phone calls, and the like. And even on those trips where information was used, only in about 1 percent of cases did the respondent act on the information by deciding to switch modes. Even if all of these mode switches were *to transit* (which they were not), this is still a very small proportion of trips – less than 0.03 percent. By this analysis, the net effects on ridership are likely to be quite small. However, the diary format does not indicate anything about trips that were planned but never taken, nor about long-term mode choice decisions and ridership attrition. Moreover, information use is slightly higher – around 10 percent – for public transit trips.[9] Additional discussion of how ridership might be affected and a suggestion for research in this area is provided in Appendix B.

Other benefits accrue from data clean-up

Geocoding bus stop data and improving consistency of existing sources help the agencies with other projects. One agency noted that when they started, there were two bus stop databases and they did not match. Benefits of improving bus stop location data mentioned by CommTrans and Suffolk County, New York interviewees include:

- Improved statistical information that is tracked at the bus stop level.
- Better information for a contractor to replace bus stop signs.

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[9] Taken from a forthcoming report by Sean Peirce and Jane Lappin, John A. Volpe Transportation Systems Center, Cambridge, MA, based on analysis of survey data from Wave 9 of the Puget Sound Regional Council (PSRC) Transportation Panel, fielded October 2000-February 2001. The Panel is sponsored by PSRC with support from the Washington State Department of Transportation and the USDOT ITS Joint Program Office; survey development and analysis at the Volpe Center is supported by the ITS Joint Program Office.

Development and standards

The expectations of the benefits previously described resulted in relatively easy approval to develop the trip planners. Trip planners that have been developed most recently have taken less time to win approval and have been developed faster than the ones that started the process earlier. Improvements in technology and examples of existing trip planners may have made the process of developing a trip planner easier. In one case, the agency waited two years after the vendor made the web module available because they were not happy with the quality of the routes it planned. When the quality improved they purchased the module and made the planner available to the public.

Accuracy, security and maintaining regional involvement are biggest concerns

The risks described were similar whether or not agencies already had a web-based trip planner. Some who had software for their customer service staff had few or no concerns about adding the capability to their web site. Other interviewees noted concerns in the following areas:

- *Accuracy:* The most common concern was the possibility of providing customers with inaccurate or less than optimal information. In one agency, the call center staff acts as troubleshooters to find problems and identify aspects of the trip planner that need to be fine-tuned. Metrolink, a rail operator, is concerned about current software not providing preferential routing to rail for trips planned on the web, and is considering switching to the other regional trip planning system.

- *Security and other technical issues:* Several agencies noted concerns about web users accessing internal data, so they implemented firewalls or established the trip planner on a separate server. Other technical concerns, such as incompatible platforms across participating agencies or software licensing were also raised. These issues were described as easy to address once identified.

- *Maintaining involvement of regional participants:* The lead agencies for the Portland, Maine and Research Triangle Park, North Carolina trip planners expressed concern about maintaining the involvement of other regional participants. In North Carolina, the local agencies involved do not have dedicated internet or IT staff. Without IT staff, keeping the information up-to-date could be challenging. In Portland, Maine, to keep people involved, they have regular meetings and keep communications open with regular phone calls. In Maine, public operating agencies have been more likely than private transportation providers to have a person to help with the regional effort.

- *Business model changes:* For Maryland MTA, the development of the trip planner was one part of changing the web site's function from an advertising venue to an information provider. Schedule slippage for the New York metropolitan regional trip planner, Trips 1-2-3, has led to concerns that the commercial aspect might not be realized because the information that was going to be sold is now free on the web.

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- *Making sure they use what they pay for:* Trip planners are significant investments. In Rock Island, they plan to market the planner, by going to schools and other public places to showcase it. The marketing of the trip planner will be an opportunity for them to talk about other aspects of their services as well.

- *Bad press:* New Jersey Transit received bad press when they launched their trip planner, and an interviewee noted that there was concern that the same could happen to them. This interviewee discussed development issues for their trip planner with staff at a nearby agency that already had a trip planner to help identify potential pitfalls.

Staff from multiple departments

The development of trip planners usually involves staff from multiple departments. There is no pattern for which department takes the lead. Depending on how the agency is organized and what was already in place, some subset of the following staff was involved in the following roles:

- *Information technology:* programming, database development, hardware and connectivity

- *Planning:* GIS, geocoding

- *Operations/Scheduling:* geocoding, cleaning scheduling data and integration with scheduling software

- *Marketing/communications/community relations:* responsibility for web site content

- *Customer service:* institutional knowledge of trips, connections, and nodes; troubleshooting prior to making the planner available to the public

Portland, Maine and Waukesha, Wisconsin were exceptions to this pattern. In Portland, because the city and the MPO led the multi-agency project, the primary staff on the project were the Manager of Surface Transportation Programs and a person responsible for supporting technology in city government. Funds came through the MPO, and staff at the MPO took responsibility for making sure that the trip planner would be consistent with the regional ITS architecture and federal regulations. In Waukesha, the lead staff were at the University of Wisconsin – Milwaukee, and they worked closely with the transit staff.

A consistent geocoded database takes time and new data

To provide accurate trips, the underlying data in the trip planner must be good. Developing geocoded data for bus stops and other landmarks is labor-intensive. The Waukesha developer estimated that 60% of the work is cleaning the data. Even with this work, some agencies report that they do not have geocodes or time codes in their trip planner for every bus stop. In the case

of Maryland MTA, they have over 300 routes with approximately 35,000 bus stops. The most critical points were coded first, including all transfer points. About 75% of the 35,000 points have been coded so far, and the system appears to work well enough, although they are continuing to improve the data.

Operations also affect how data are coded or presented. For instance, Rock Island allows customers to board buses anywhere along the route that it is safe, rather than designating stops. In the trip planner, there will be stops, but for Rock Island there will be information indicating that riders can get on the bus anywhere along the route where it is safe to board.

Agencies use a variety of methods to put together their database. Table 6 summarizes potential sources of geocoded data, and any comments about its use.

Table 6. Sources of location data

Geocoding data sources	Comments
Possible existing sources	
Scheduling database	
Bus stop database	
Locations geocoded for demand response service	If demand response service has never gone there, that location information would not be available.
MPO and State DOT	
Potential methods to develop data	
Hand-held geocode devices	Staff who are on the road can contribute. These might include staff who do National Transit Database (formerly Section 15) surveys and monitor service quality, or who distribute print media.
Addresses	Large buildings with a single address encompassing an entire city block present problems. Park and ride lots and railroad stations may not have addresses.
Digitized ortho photos	Locations for park and ride lots and other elements without addresses
GPS data from AVL system	Provides information on wherever bus stops, not necessarily the exact location of the bus stop

Accessible trip planning needs more data

There are two additional types of data required to enable a trip planner to generate accessible trips when requested: individual stop accessibility, and vehicle accessibility. CommTrans designed their system using three pieces of information. There are two items in the stop inventory that they check, as well as the scheduling software. The stop inventory includes information on the surface at the stop and whether or not there is a controlled traffic crossing. There is also information on whether or not a lift equipped bus stops there. King County Metro gets into more detail and provides different grades of accessibility. They track steep slopes as a

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barrier. Snohomish County did not find that necessary since they do not have the same terrain issue.

Most agencies do not user test with the public

Most agencies performed user testing only within the agency prior to making the trip planner available to the public. After the trip planners became public, agencies made modifications based on feedback from the public or from call center staff. Both Waukesha and Tri-met tested the trip planner with internal and external users. Beaver County is user testing its trip planner now. Tri-met has recently been focus testing the overall usability of its website.

Most trip planners are accessible to the blind

Trip planners can be accessible with respect to either the trip planner or the trip. Accessibility of the trip planner was considered in many, but not all cases. Additional outreach could be helpful in increasing the number of agencies who address this issue. Agencies who have done so:

1) Required the vendors to guarantee compliance with Section 508.
2) Asked an expert to review, such as in Waukesha, where the University of Wisconsin School of Allied Health Professions reviewed the site.
3) Followed standard practice, based on training in ADA compliance or available guidelines.[10]
4) Used a compliant site as an example.

Standards

There are two perspectives on standards. Some agencies that integrate transit trip planning regionally or with highway information want standards and/or an architecture. There are others who point out the burden to small agencies to change their systems. Most interviewees currently rely on contractors to be compliant with existing standards.

A standard base map on a statewide or regional basis would help address problems with matching streets across county lines. This issue could be taken up at the state or MPO level. A standard for mapping routes or bus stops could be helpful, but different systems have different needs. For instance, CommTrans has 2000 stops and not much in the way of legacy systems. King County is much larger with 10,000 stops and has many legacy systems that need to be considered.

Small agencies might benefit from easily adding their services to existing trip planners, but all data issues would not necessarily be solved by creating standards. For instance, Dallas Area Rapid Transit would like to share data with an adjacent transit agency, The-T of Fort Worth. Since they are using common software and application platforms, most potential problems should be of no consequence. However, they have issues related to naming conventions, routes

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[10] See http://www.w3.org or http://www.cast.org/bobby for guidelines and a tool for checking web pages for accessibility.

with identical route abbreviations, and unique keys within the database conflicting when Dallas attempts to import and append Fort Worth's route and schedule data.

One interviewee suggested that a current routing preference problem could be addressed through the development of an open architecture available at no cost for the license. On the current MTA system in Los Angeles, when a transit operator provides a trip plan, the vendor charges $0.03 per transaction for a non-MTA trip. This transaction charge distorts the routing of passengers by creating a barrier to directing passengers onto a different operator's service, even when that would provide the best service.

Costs

Web enabling costs less than data development

Development costs vary by the starting point and the ultimate complexity of the trip planner. Based on the experience of CommTrans and Tri-met, agencies or regions that have already completed development of a trip planner for call center staff can expect to spend another $40,000 to $50,000 to make it available on the web. These costs include both software and additional hardware, including servers.

Starting without the data development work completed is significantly more expensive. A rough estimate of development costs is about $600 per square mile of service area. It is not clear whether or not there are economies of scale. It is also not possible to tell if there are differences in development costs between single agency and multiagency trip planners. Figure 6 illustrates costs by square mile of service area covered by trip planners. Several interviewees' systems were excluded because they were unable to provide development cost information due to staff turnover. The largest system included in the figure, Maryland MTA, also had the most data preparation before starting on the trip planner, so the low cost compared to the smaller systems is not completely due to size.

Figure 6. Development cost per square mile of service area
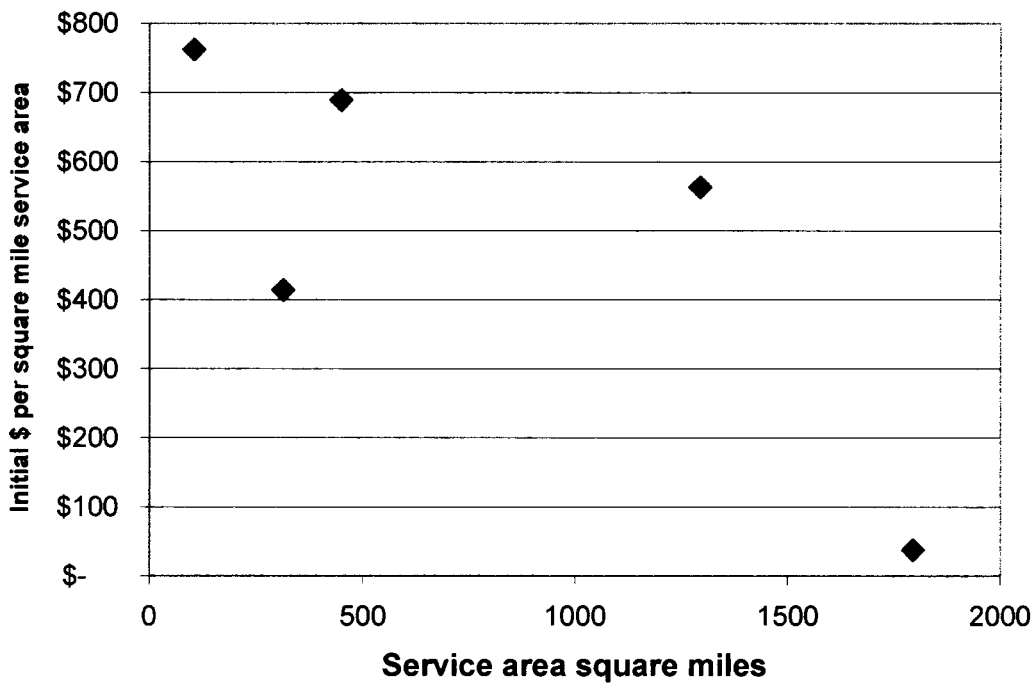
Lower O&M costs for all by automation or some by regionalization

Agencies that participate in a regional trip planner without having primary responsibility appear to incur the least operating and maintenance costs. It is likely that these costs are transferred to the organization with primary responsibility. While Metrolink takes half an hour a month to update their data, and pays a $12,000 per year license fee for access to the trip planner at seven desks, the Los Angeles County Transportation Commission is spending about half a million dollars a year to maintain the system. This option of shifting costs to regional organizations could make it more feasible for smaller agencies to be included in trip planners, to the benefit of larger operators and the region as a whole.

Automation can save staff time, but certain tasks cannot be done automatically. For instance, CommTrans has some routes that provide guaranteed transfers, where the drivers are expected to wait to make sure that people can transfer. The default for transfers is to allow the trip planner to identify a transfer only when there is at least five minutes between the arrival time of the first bus and the departure of the second. In the schedule, it looks like there are no minutes between the arrival and departure times, so the trip planner will not allow the transfer without making an exception. When there is a schedule change, the exceptions must be identified manually.

Table 7. Operating and maintenance costs

	Money	Time	Automation
Stand-alone trip planner or regional effort with equal responsibilities			
Ann Arbor	$5000-$6000/year software maintenance; $2500/month web hosting	Minimal; file downloads	Automated
Denver		40-50 hours/quarter	Plans to do so
CommTrans	$74,000 over the 5 years operations & management contract	A "busy week" for one staff person three times per year	Routines to look for errors
Maryland MTA	Part of maintenance for new web site; do not have new costs, yet	4 hours/month (but still TBD and expected to change)	
Pierce County	2002: $15.0K for upgrade / technical support for on-line and Desk top system; 2003: $16.2K; 2004 $17.5K; Pickup for years 4 & 5 (2005-06) will be negotiated	Two staff have responsibility (no indication of time requirements)	
Portland, OR	Part of maintenance contract for other software	1 hour/week	Mostly automated
Beaver County	Annual hosting and mailbox fees of $600	Expect <2 hours/month	Automated

	Money	Time	Automation
Primary responsibility for regional trip planner			
City of Portland, ME	In negotiation	City: 120 hours/month split between two staff, but expect it to diminish	No automation
RTA Chicago		75-100 hours/month	Logs to identify problems
Use regional trip planner, without primary responsibility			
Metrolink	Web-based trip planner is free; license for call center software	0.5 hours/month	No automation, but extra effort is just an e-mail
Portland Metro, ME	No charges by the city	8 hours twice a year	No automation

Staffing and Training

Contract for software development and put staff time into data development

Agencies with trip planners contracted for skills that were needed to develop the trip planner. Agency staff provide the institutional knowledge and experience. The contractors developed the software, and in many cases, the web interface. One agency noted that if they had implemented or hosted the trip planner in-house, they would have needed more skills, and as Maryland MTA pointed out, it is costly to develop those skills in-house.

In most cases, some or all of the data development was done in-house. The least amount of work involved providing the vendor with overlay information to clean up the data points. At the other extreme, the work was done entirely in-house, including staff from multiple divisions.

The Maryland MTA Transit Information Center supervisor collaborated with contractor program developers to populate the trip planner database, and to identify nodes and time points where modes intersected to plan connecting trips. This information is not available electronically at this time, but exists as institutional knowledge among experienced transit information agents.

Train call center and maintenance and operations staff

Most web-based trip planners have counterpart software for the call center for which the staff need training. In one case, the vendor provided two or three formal training sessions, which were not effective. It seems to be more effective to do half hour one-on-one training sessions with the staff, asking them for directions and having them use the system to provide the information.

Some agencies have found that maintaining and operating the trip planner has required some additional training. After development of the trip planner, the in-house IT staff may be capable of handling on-going operations and maintenance, but some training might be necessary. The technical person at the City of Portland, Maine has taken classes, and the extra knowledge and responsibilities associated with the project has led to a promotion and expansion of duties. In two other agencies, staff that were not involved in the development of the trip planner will input data and maintain the system. In these cases, some training is involved.

One of these agencies, CommTrans, is grooming two call center staff in technology so that they can be promoted to ATIS administrators. The ideal person to play that role would have a transit background, technical skills and availability. With these skills, they would understand the customer questions and operations, be able to make changes to the database or software to address problems, and be able to handle problems as they arise, rather than after a delay. For a call center application, it is best to have the ATIS administrators in the call center.

Agencies without trip planners need training on technical issues

Most agencies that currently do not have a trip planner have more concerns. These include a lack of knowledge related to:

- Geographic Information System (GIS) skills
- Intelligent Transportation Systems
- Trip planning vendor terminology
- Maintenance of a sophisticated web site

The GIS skills have been addressed by training in Suffolk County, New York, while Peoria mentioned the possibility of hiring high school students. High schools teach GIS in the classroom, so it should be possible to put high school students to work on GIS for the transit agency. The students would get the cooperative learning experience and get a start on their careers. Smaller communities could get GIS help that way, rather than trying to rely on universities that are farther away.

Market segments

The transit agencies reporting to the National Transit Database (NTD) can be grouped into four market segments based on their size, internet expertise, and responses of the interviewees. These segments overlap, with agencies in the overlap exhibiting some characteristics of one segment and some of the other. A discussion of each segment follows, starting with the segment in the upper right hand corner, the "old pros".

Figure 7. Market segments

Old pros

There are about 20 agencies in this category. Most already have trip planners. The interviewees included in this group are Denver RTD, Tri-met, Chicago RTA, and Maryland MTA.

In general, these agencies are comfortable with technology, have an in-house IT staff, and are able to fund special projects like a web-based trip planner. In development of their trip planners, they sought assistance from consultants to get additional context, and talked to other agencies with trip planners. They had trip planning software in use or in development for their customer service staff prior to developing the web-based planner.

Also, these agencies are aware of ADA compliance issues for the web, and have helped their contractors make their sites and trip planners compliant. Their software either works together so that updates to the trip planner are automated, or there are plans to automate. However, their trip planners are not necessarily part of an IT plan or ITS architecture. In some cases the trip planners preceded development of these plans and the architecture is in progress.

Some of these agencies have trip planners with advanced features, such as driving directions or choice of language. On average, they have the best trip planners of any group.

They have learned a number of lessons in the development of their trip planners, and listed a variety of suggestions for other agencies that are just starting. These suggestions related to providing information on pitfalls, the timeline, data development, and getting external advice.

Based on the interviews, no outreach or assistance is necessary to enable these agencies to build good quality transit trip planners. However, this is the group that may take advantage of new ideas for advanced features. They could also be the leaders of regional trip planner development, or coordinate with state DOTs to provide multimodal traveler information. Some of the things that they did in development could be transferred to other agencies currently developing trip planners.

Outreach and research needed for this group include:

- Recruit them to the peer-to-peer program to advise others.
- Provide them with the results from TCRP J-09, "eTransit: Electronic Business Strategies for Public Transportation," forthcoming in 2002.
- Interview them about multimodal efforts and inform them of the results of the second phase of this project, investigating multimodal trip planners.

Team players

There are about 90 NTD agencies in this group. The interviewees included in this group are DART, Pierce Transit, CommTrans, Metrolink, Ann Arbor, Rock Island and Triangle Transit. Most collaborate with other agencies on existing or planned regional or multi-agency trip planners.

These agencies span a range of sizes and technical expertise. However, they have enough knowledge, both of technology and contacts in other agencies, that they can collaborate with others to put together a good quality trip planner. They have some questions about working with trip planner vendors, in terms of understanding terminology and communicating clearly.

This is the only group that mentioned using a Memorandum of Understanding (MOU) among participants. They generally have done IT planning, but are not as uniformly aware of connections to the ITS architecture.

They pay for the development using federal and state funds. Operating funds are more likely to come from the regular operations budget. One interviewee raised the question of federal funding for ongoing upgrades and routine maintenance of technology systems. They currently use funds designated for preventive maintenance.

Outreach and research needed for this group include:

- Example MOUs, vendor contracts, and a glossary of common terms
- ITS architecture training
- Funding sources for operations

Cooperative partners

About 80 NTD agencies are in this category. Very few have trip planners. The interviewees included in this group are Waukesha; Portland, Maine; Beaver County, Pennsylvania; Peoria, and Burlington, Vermont. When they have trip planners, most of these agencies participated in developments led by the MPO, state, or other active organization. These other organizations provide the funding and technical expertise that these mostly smaller agencies lack.

Because in most cases the lead organizations are not transit professionals, unless there was substantial involvement by the transit operator, the trip planners are not as good. Figure 8 illustrates the comparison of trip planners by market segment. While this comparison shows the quality measured by features, it is likely that the underlying data accuracy would show a similar pattern by market segment. There are two possible explanations for the difference. One is that the developers have not had prior experience with web-based transit trip planners, so they have not had the opportunity to learn from prior systems. Another is that the lead staff do not have the transit industry contacts that a transit professional lead would have, so they are less aware of best practices or pitfalls. Two of these agencies have user-tested their trip planners prior to making them available to the public, but that is not a universal practice in this segment.

The advantage of having non-transit lead agencies is that they tend to be more flexible with the inclusion of multiple modes. They also tend to be more uniformly aware of the ITS Architecture. This segment is interested in how the trip planner functions in a regional context. In the long run, these characteristics could be advantageous to all participants.

Figure 8. Quality of trip planners by market segment
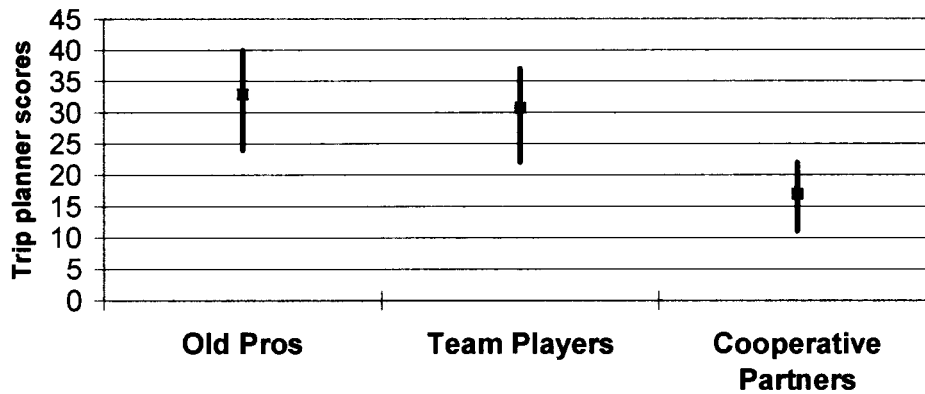
Another good news/bad news aspect to agencies in this segment is that they tend to have less technology and automation to start with than the agencies in the previously discussed groups. This means that they are less likely to have geocoded information on their routes or stops. On the other hand, they do not have consistency problems with legacy systems.

Outreach or research that could be helpful includes:

- Peer-to-Peer program outreach to states and MPOs
- Guidelines for good design of trip planners
- Guidelines for how to maintain a sophisticated web site
- Suggestions for cost-effectively locating or developing geocoded data for their system.
- A summarization of funding eligibility for trip planners and related efforts such as geocoding
- A workshop to give an overview of trip planner development and introduce interested agencies to each other and resources
- Examples of good trip planners (see http://www.transitweb.its.dot.gov)
- Guidelines for good design of web sites

Contributors

About 100 NTD agencies fall into this category. Of the interviewees, Suffolk County was the only one that fell in this group. Some partners of interviewees in other groups, such as Chapel Hill Transit, are also in this group.

The benefits to these agencies of a stand-alone web-based trip planner are limited. They tend to have smaller, simpler systems. If there are only five routes, they do not need a trip planner for planning local trips. Because they serve smaller populations, the savings from fewer phone calls or e-mails are less substantial than the savings for the other groups.

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The advantage of drawing them into a regional trip planner is that they may connect with other systems, especially commuter rail or buses. If they are the feeders to these other systems, it is to the advantage of the larger system, state or MPO to facilitate their participation.

Because their resources are stretched thin just to provide service, they are less likely to have technical expertise in-house. New York DOT provided Suffolk County with GIS software for their participation. To involve these agencies, the lead trip planner agency should limit the time and technical demands.

Outreach that could be helpful includes:

- Suggestions for cost-effectively locating or developing geocoded data for their system.

Appendix A: Relative importance of features in trip planner assessment

In assessing the quality of trip planners, features were assigned importance and weighted as follows:

	High	**Medium**	**Low**
General Options	Multimodal		• Download to PDA • Disabled Route Info
Input Options	Minimize • Walking • Transfers • Trip Time Choose by • Intersection • Street Address • Landmarks • Departure Time • Arrival Time	• Variable Date of Travel • Earlier/Later Routes • Plan Return Trip	Select Travel Mode (Bus/Rail or Both)
Results Page	Fare Information	Link to • Detailed Directions/Map Showing Station Location • Route Map • Schedule Approximate Trip Time Multi-Agency Itinerary	• Approximate Trip Distance • Park and Ride Info

Appendix B: Does an internet-based itinerary planner increase transit ridership?

There are a number of (non-mutually exclusive) scenarios in which a web-based trip planner could potentially lead to increased ridership:

1. Reducing the information costs associated with planning public transit trips might create *diversions from other modes*.
   - For example, people may decide to take transit rather than drive if a quick website visit indicates that the transit trip would be more convenient.
   - The ability to plan trips beforehand via the internet might generate more knowledge and comfort with the system among visitors; they would then be more likely to rely on the transit system instead of using taxis, rental cars, or their own vehicles.

2. Lower information costs can also *generate extra trips* that otherwise would not have been made at all. This might be particularly true for monthly pass holders, for whom the cost of an additional trip is effectively zero.

3. Higher levels of customer satisfaction can lead to *improved rider retention*. In this scenario, ridership grows over time as the attrition rate falls but the attraction of new customers holds at least steady.

4. Cost savings associated with reduced call-center volume could be ploughed into *service enhancements or marketing efforts* with the goal of increasing ridership.

Measuring the effects

The first possibility is not supported by currently available data from commuters. In the Puget Sound area, only about 3 percent of all recorded trips involved any information use. Visitors might be easier to influence with information, because they are probably more likely to seek it. To assess what information they use and how it affects their decisions, an *intercept survey at hotel check-in* or on the website could provide basic data.

Intercept surveys of website users might help determine the extent to which the trips planned over the internet are (1) trips that are definitely going to be made by transit, versus (2) potential trips that might be made by another mode or dropped altogether if the transit itinerary is somehow inconvenient. Perhaps this could even be added as an optional part of the trip planner module itself, after the user receives the proposed itinerary.

The third possibility, increased ridership through improved rider retention, would prove somewhat difficult to measure directly, because ridership rises and falls in response to a number of other factors. *Opinion surveys* of riders might help here. For example, in previous studies, attitudes toward the statement, "As soon as possible, I'd like to switch to driving" have been used as a proxy for the level of overall customer (dis-)satisfaction with the transit system. Tracking these levels over time gives a *sense* of whether rider attrition will be increasing or

decreasing – e.g. in Seattle, Volpe Center surveys show that the mean level of agreement has risen from 2.7 to 3.0 (out of 10) over the past two years. Of course, translating changes in attitudes into changes in actual ridership is not an exact science, but demographic profiles can at least help determine who is more likely to be able to switch to driving.

The fourth possibility is a matter of budgetary priorities for the agency. Statistical models of travel demand and mode choice would help estimate the effects of service enhancements on ridership, while past experience and "comparables" from other agencies might be the best guide to estimating the effectiveness of marketing campaigns.

Appendix C: Criteria and weights for scoring transit web sites

Criteria are yes/no questions or groupings of these questions. For each yes rating, the site will receive a certain number of points, dependent on the importance of the criteria rated:

> Critical = 4
> High = 3
> Medium = 2
> Low = 1

The total number of points received determines the ranking of the site. The higher the score, the better the site.

Critical—can't do the task without it

Content
- Route maps
- Schedules
- One form of contact information—phone number for transit or unspecified questions

High—impacts primary task

Content
- Existence of one form of route choosing content: a system map, vicinity table or itinerary planner
- Fare information
- Information on rules and restrictions

Presentation
- Good information grouping (route selectors, route details, fare, rules and tips, demand response or accessibility)
- Information organized by route
- System map provides context through landmarks or streets
- Each page has a menu to major pages
- Each page has a link to the root page
- Alt tags on graphic elements (accessibility for blind)

Medium—impact secondary tasks/consistency issues

Content
- A second form of route choosing content: a system map, vicinity table or itinerary planner
- List of locations for purchase of fare media
- Current, but not real-time information (temporary re-routing, special events, etc.)
- Information on park-and-ride
- Information oriented toward tourists

- Links to other transit information sites in the region
- Links to traffic information sites

Presentation
- The system map shows transfer points
- The system map supports point-and-click inquiries
- Schedules formatted well
- Each page has a unique URL (enables bookmarking specific pages)
- Text links are discriminated from ordinary text
- Lists of routes or places are in alphabetic order or grouped by geographic region
- Privacy policy information if the site captures information on a user
- Root page loads without errors, requests for plug-ins or requests to download controls

Low—"It would be nice."

Content
- Real-time information
- E-mail alerts
- On-line purchase of fare media
- Contact information for site feedback
- Links to public intercity transportation
- Links to governmental organizations involved in transit
- Bicycle information

Presentation
- "You are here" marker on system map

Appendix D: Interview Guides

Questions For Agencies With Trip Planners

Interviewee's Position

1. What is your job title?
2. What are your job responsibilities? What decisions are under your authority?

Background

3. When did your web-based trip planner become available to the public? How long did it take to develop?
4. Prior to the implementation of the web-based trip planner did you have similar software for the use of your customer service representatives? If so, was that developed as a separate project or as part of the development of the web-based trip planner?

Benefits

5. How do you monitor the use and success of the web based trip planner? What performance measures (measures of effectiveness/efficiency) are used?
6. Have any cost savings or other quantifiable benefits directly resulted from the use of the trip planner? Any non-quantifiable benefits?

Costs and resources

7. Does your agency have an itemized cost summary of the trip planner development, operation and maintenance? (Inquire when setting up each appointment and request them to send it in advance if possible.)
8. What funds have been used to develop the trip planner? How much from each funding source?
9. What funds have been used to manage, operate, and maintain the trip planner? How much from each funding source?
10. If multiple agencies are involved, have IGAs or MOUs been developed among the partners to cover on-going trip planner costs and responsibilities?

Motivation and obtaining buy-in

11. Who within your agency initiated development of the trip planner? What were the primary objectives and expected benefits?
12. Did your Board, executive management, department management or staff raise institutional, labor, or legal issues that had to be overcome? If so, how were they addressed?
13. Were there any risks identified related to development or implementation? If so, how have these risks been managed or reduced?

Planning and Standards

14. Has your agency (or region) developed an Information Technology Plan? Was the trip planner included within this plan?
15. Is the trip planner incorporated into any ITS architectures (project, agency, regional, statewide)?
16. How did you deal with ADA/Sec. 508 requirements in your design?
17. Have you had any interoperability or consistency concerns or issues between the trip planner and other agency or regional (information, data management) systems?
18. Are there particular issues that could be addressed by the development of data standards? What standards, if any, have already been applied in developing the trip planner? (Could include TCIP standards, such as passenger information objects, scheduling/runcutting objects, spatial representation objects)

Development

19. What agency staff and departments were involved in the trip planner development? In what role(s)?
20. What issues were addressed in developing consistent agency data for the trip planner (e.g., multiple, manual systems, incompatible file formats, etc.)?
21. Did you use focus groups or user testing to develop the system?
22. Have other agencies been involved? How? In what role?
23. Did you contract with a vendor to develop the trip planner?

If development of the trip planner was contracted out:

24. Did you develop the RFP/RFB internally, or with consultant assistance? Did you model your RFP/RFB on those of other agencies?
25. If not a separately bid RFP/RFB, was this contract a component of, or an extension to an AVL, scheduling, or other passenger information system contract?
26. Which companies responded to the RFP(s)?
27. Was the project completed within the original contract budget? If not, how much additional funding was required?
28. Were post-development tasks and concerns included in the contract, e.g., maintenance, training, support? Were there provisions for assuring access to and maintainability of proprietary code?

If development of the trip planner was not contracted out:

29. Who developed the trip planner software?
30. Were costs within the original project budget plan?

Operations and maintenance

31. What agency staff and departments are involved in the trip planner operations and maintenance? In what role(s)?

32. How is the system maintained? What has been the greatest maintenance problem?
33. How many staff hours per month are required to input changes and maintain the database? Is any of it automated, such as by updating the data from databases associated with other applications?

Knowledge, skills and abilities necessary for agency staff

34. Did current staff have sufficient skills to implement the project? If not, what skills did they need and how did you address the issue?

Questions For Agencies Without Trip Planners

Interviewee's Position

1. What is your job title?
2. What are your job responsibilities? What decisions are under your authority?

Motivation and obtaining buy-in

3. Has anybody within your agency proposed the development of a web-based trip planner? What were the primary objectives and expected benefits?

If a trip planner has been proposed

4. Did your Board, executive management, department management or staff raise institutional, labor, or legal issues that had to be overcome?   If so, how were they addressed?
5. Were there any risks identified related to development or implementation? If so, how have concerns about these risks been addressed?
6. Have you been able to obtain funding for initial deployment of a trip planner?
7. Have you been able to obtain funding for ongoing operations and maintenance of a trip planner?

Planning and Standards

8. Has your agency (or region) developed an Information Technology Plan? Was development of a trip planner considered within this plan?
9. If there is an ITS architecture (project, agency, regional, statewide), was the development of a trip planner considered?

If a trip planner has been proposed

10. Have you had any interoperability or consistency concerns or issues with other agency or regional (information, data management) systems if development of a trip planner was considered? Are there particular issues that could be addressed by the development of standards?

Knowledge, skills and abilities necessary for agency staff

If a trip planner has been proposed

11. If you considered developing a web-based trip planner, have any concerns about knowledge, skills or abilities of staff arisen? Within each department, what were the concerns?

Appendix E: Literature Review

Summary

The purpose of the current study is to identify issues and solutions associated with providing seamless, door-to-door trip itinerary planning. It will identify what integration barriers exist and the complexities associated with them as well as the potential solutions. The study will be performed in two phases, with the first considering transit trip planners, and the second looking at multimodal planners. The first phase will identify issues and provide recommended solutions by market segment. The second phase will yield criteria for selecting an area for a multimodal trip planner operational test, and make suggestions for future research or outreach.

There have been at least two studies specific to transit trip planners prior to this effort, one completed in June 2001 under contract to the Oregon Department of Transportation (ODOT), and the other expected to have a draft completed at the end of March 2002 under contract to TCRP.[11] It is likely that other states, MPOs, or transit agencies have also conducted studies prior to implementing their systems, but based on internet searches, none of these studies have been made public on the internet.

The ODOT study was done for the purpose of examining the issues and feasibility of developing a statewide multimodal trip planner system in Oregon, and included surveys of worldwide top multiagency trip planning agencies and Oregon public transportation providers. Much information can be drawn from this study. It asks specific enough questions related to development issues and technology use to provide a solid basis for Oregon to make investment decisions. Because it is focused on multimodal trip planners, it will be more useful for the second phase of the project than the first, however it is the only source that has interviewed agencies without trip planners for their interest, which could be valuable for the first phase.

The TCRP study focuses to a large extent on best practices and customer relationship management (CRM) for transit, with general questions related to development issues and outcomes. Because of the focus on best practices, it concentrates on the high-end trip planners, mostly to the exclusion of other planners that have been developed. There is some overlap in questions, but it would not provide sufficient information on the development of more basic trip planners to meet the needs identified by the FTA. It also does not examine the development of multimodal trip planners.

Other relevant information is also available, including software vendor web sites, press releases, a performance review by the Texas Comptroller of Public Accounts, conference presentations on transit information technology (IT), a draft TCRP report on transit web sites, and a final report on the development of an internet trip planner for an FTA Job Access Planning Challenge Grant. These sources helped inform the selection of interviewees and development of specific questions for the interview guide. The Texas performance review was particularly helpful highlighting institutional issues and development hurdles.

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[11] TCRP J-09, "eTransit: Electronic Business Strategies for Public Transportation", forthcoming in 2002.

The following sections discuss each source in turn, highlighting the potential contributions to the current effort and the possible overlap.

Oregon Department of Transportation

The Oregon Department of Transportation is beginning the development of a statewide multimodal trip planner, taking a phased approach. They hired a consultant to conduct two surveys, leading to three reports summarizing the survey results and providing recommendations to Oregon on how they should proceed.

The survey of national and international implementations of transit trip planning systems was designed to provide an understanding of transit trip planning systems currently developed, including the identification of issues and opportunities related to developing and implementing a system. They found a range of benefits, and several issues that needed to be addressed. In particular, data quality is of paramount importance and identified certain actions that should be taken, such as implementing processes to keep the data current, and developing institutional agreements with participating agencies. System implementation considerations related to advance planning and integration also were raised.

The survey of public transportation providers in Oregon was designed to elicit the degree of interest in participating in a statewide trip planner and to assess capabilities and resources available. It was done in the context of ODOT taking the lead in development. Most agencies expressed interest and were willing to contribute staff time or similar resources, but the technological infrastructure necessary was not always present.

TCRP J-09: e-Transit

The TCRP project is looking at cutting edge systems, to derive best practice recommendations, rather than the state of the practice. As such, they have chosen most of their sites based on how high end they are, rather than to be representative of all trip planners in existence. The cities that they covered include Salt Lake, San Francisco, San Diego, Ventura, DC, Minneapolis, Anchorage, and Philadelphia. Salt Lake was primarily for CRM, although they've recently added a trip planner. With the exception of Anchorage, these are all high-end trip planners. The only additional agencies they were considering interviewing were foreign as of the end of February 2002, but they hadn't identified any specific ones yet.

No results of the interviews and other analysis were available as of the start of this project. It is likely that some information from this research will be informative, but it may overlap significantly with the work done for ODOT since they are contacting agencies with similar implementations.

Texas Comptroller of Public Accounts Performance Review

The Texas Comptroller of Public Accounts conducted a performance review of Capital Metro, including a chapter on information systems. They note that Capital Metro has a long history of mismanaging the implementation of large contracts, and notes a number of problems with the procurement of a trip planning system. These problems include

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- Lack of skills to develop appropriate specifications, implement and test systems
- Lack of a strategic plan for IT
- Information flows to various departments, but is not available to support other activities, resulting in duplication, inconsistency and inefficiency
- Customer Service has not solicited the ongoing advice or expertise of the Information Systems Department
- The project contract has no performance bond to reduce the risk of a nonfunctional system, which is standard practice for contracts of this type
- No provision to link the trip planner's database to the Planning Department's computer systems for updating
- No ongoing involvement of the Planning Department in the project, although they will have ongoing responsibilities.

On the positive side, Capital Metro included a provision in the contract for the vendor to guarantee access to the program's source code and other files should the vendor be unable or unwilling to do so.

Other sources

The other sources available either reiterated aspects of the three major sources just described or served as a basis for discussion of vendors and the market. Press releases from vendors were particularly helpful in that respect.

Appendix F: Trip planner features

	Feature	Alameda-Contra Costa Transit District (AC Transit)	Anchorage People Mover	Ann Arbor Transportation Authority (The Ride)	Beaver County Transit Authority	BetterCommute.org	Chicago Transit Authority (CTA)
	Agency Name						
	Url	http://www.actransit.dst.ca.us	http://www.peoplemover.org/	http://theride.org/	http://www.bcta.com/trip_planner/trip_planner.php	http://www.bettercommute.org/transit_planner.html	http://www.transitchicago.com/
	Location	Oakland, CA	Anchorage, AK	Ann Arbor, MI	Rochester, PA	Los Angeles, CA	Chicago, IL
Input Options	Minimize Walking			X		X	X
	Minimize Transfers	X	X			X	X
	Minimize Journey Time	X	X			X	X
	Disabled Route	X				X	X
	Select Travel Mode (Bus/Rail or Both)					X	
	Choose by Street Address	X	X	X	X	X	X
	Choose by Landmarks	X	X	X	X	X	X
	Choose by Intersection	X	X	X		X	X
	By Departure Time	X	X	X	X	X	X
	By Arrival Time	X	X	X		X	X
	Date of Travel is Variable?	X	X	X	X	X	X
Output Options	Link to Schedule?	X		X			
	Link to Detailed Directions/Map Showing Station Location?						X
	Link to Route Map?	X					
	Approximate Journey Time	X			X		X
	Approximate Journey Distance		X				
	Fare Information	X			X		X
	Park and Ride Info?						
	Earlier/Later Routes						
Advanced Features	Multimodal?						
	Download to PDA						
	Language Choice						
	Plan Return Trip?	X					
	Creator of Planner	GIS/Trans		Trapeze			ATIS (Trapeze)

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Feature	City of Waukesha	Denver RTD	Ground Hop	King County Department of Transportation (Metro)	Los Angeles County Metropolitan Transportation Authority	Mass Transit Administration of Maryland (MTA)
Agency Name	City of Waukesha	Denver RTD	Ground Hop	King County Department of Transportation (Metro)	Los Angeles County Metropolitan Transportation Authority	Mass Transit Administration of Maryland (MTA)
Url	http://129.89.72.108/Waukesha	http://www.rtd-denver.com/	http://www.ez-ways.com/	http://transit.metrokc.gov/	http://www.mta.net/	http://www.mtamaryland.com
Location	Waukesha, WI	Denver, CO	NY, NY	Seattle, WA	Los Angeles, CA	Baltimore, MD
Minimize Walking		X		X		
Minimize Transfers		X		X		X
Minimize Journey Time		X		X		
Disabled Route				X	X	
Select Travel Mode (Bus/Rail or Both)						
Choose by Street Address (Input Options)	X	X	X	X	X	X
Choose by Landmarks	X	X		X	X	X
Choose by Intersection	X	X	X	X	X	X
By Departure Time	X	X	X	X	X	X
By Arrival Time	X	X	X	X	X	X
Date of Travel is Variable?	X	X	X	X	X	X
Link to Schedule? (Output Options)			X	X		
Link to Detailed Directions/Map Showing Station Location?			X	X		X
Link to Route Map?					X	
Approximate Journey Time	X	X	X	X	X	X
Approximate Journey Distance						
Fare Information		X	X	X	X	X
Park and Ride Info?						
Earlier/Later Routes			X			
Multimodal? (Advanced Features)						X
Download to PDA						X
Language Choice						
Plan Return Trip?						
Creator of Planner	University of Wisconsin	TranStar (SCAG)		ATIS (Trapeze)	MTA Internet Team and MapVision Technologies, Inc	Spherix

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	Metro Transit	Metropolitan Council	New Jersey Transit Corporation	North County Transit District (NCTD)	North County Transit District Commuter Rail (Coaster) (unofficial)	Northeast Illinois Regional Commuter Railroad Corporation (METRA)
Agency Name						
Url	http://www.metrotransit.org/	http://www.metrocouncil.org/transit/index.asp	http://www.njtransit.state.nj.us/	http://www.gonctd.com/	http://www.sandag.cog.ca.us/sdmts/	http://www.metrarail.com/
Location	Minneapolis and St Paul, MN	St. Paul, MN	Trenton, NJ	Oceanside, CA	Oceanside, CA	Chicago, IL
Input Options						
Minimize Walking	X	X	X	X	X	X
Minimize Transfers	X	X	X	X	X	X
Minimize Journey Time	X	X	X	X	X	X
Disabled Route	X	X	X			X
Select Travel Mode (Bus/Rail or Both)			X			
Choose by Street Address	X	X	X	X	X	X
Choose by Landmarks	X	X		X	X	X
Choose by Intersection	X	X	X	X	X	X
By Departure Time	X	X	X	X	X	X
By Arrival Time	X	X	X	X	X	X
Date of Travel is Variable?	X	X	X	X	X	X
Output Options						
Link to Schedule?	X	X		X	X	
Link to Detailed Directions/ Map Showing Station Location?						X
Link to Route Map?	X	X		X	X	
Approximate Journey Time	X	X	X	X	X	X
Approximate Journey Distance						
Fare Information	X	X	X	X	X	X
Park and Ride Info?						
Earlier/Later Routes	X	X				
Advanced Features						
Multimodal?						
Download to PDA						
Language Choice						
Plan Return Trip?	X	X				
Creator of Planner	ATIS (Trapeze)	ATIS (Trapeze)	ATIS (Trapeze)	TranStar	TranStar	ATIS (Trapeze)

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	Feature	Orange County Transportation Authority	Pace Suburban Bus Service	Pierce Transit	Portland, Maine Transportation Page	Riverside Transit Agency (RTA)	San Diego Trolley (SDT)
	Agency Name						
	Url	http://www.octa.net/	http://www.pacebus.com/	http://www.ptbus.pierce.wa.us/	http://www.transportme.com	http://www.riversidetransit.com/	http://www.sdcommute.com/
	Location	Orange, CA	Arlington Heights, Illinois	Tacoma, WA	Portland, ME	Riverside, CA	San Diego, CA
Input Options	Minimize Walking	X	X	X		X	X
	Minimize Transfers	X	X	X		X	X
	Minimize Journey Time	X	X	X		X	X
	Disabled Route	X	X	X		X	X
	Select Travel Mode (Bus/Rail or Both)			X			
	Choose by Street Address	X	X	X		X	X
	Choose by Landmarks	X	X	X		X	X
	Choose by Intersection	X	X	X	X	X	X
	By Departure Time	X	X	X		X	X
	By Arrival Time	X	X	X		X	X
	Date of Travel is Variable?	X	X	X		X	X
Output Options	Link to Schedule?						X
	Link to Detailed Directions/ Map Showing Station Location?	X	X		X		
	Link to Route Map?			X		X	X
	Approximate Journey Time	X	X	X			X
	Approximate Journey Distance				X	X	X
	Fare Information		X	X			
	Park and Ride Info?						X
	Earlier/Later Routes						
Advanced Features	Multimodal?			X	X	X	
	Download to PDA						
	Language Choice						
	Plan Return Trip?						
	Creator of Planner	TranStar (SCAG)	ATIS (Trapeze)	ATIS (Trapeze)	Intersystems	TranStar (SCAG)	TranStar

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Category	Agency Name	San Francisco Bay Area Rapid Transit District (BART)	San Francisco Municipal Railway (Muni)	Santa Barbara Metropolitan Transit District (MTD)	Southeastern Pennsylvania Transportation Authority (SEPTA)	Southern California Regional Rail Authority (Metrolink)	Transitinfo.org (MTC)
	Url	http://www.bart.gov	http://www.sfmuni.com	http://www.sbmtd.gov/	http://www.septa.org/	http://www.metrolinktrains.com/cgi-bin/	http://www.transitinfo.org/cgi-bin/taketransit
	Location	Oakland, CA	San Francisco, CA	Santa Barbara, CA	Philadelphia, PA	Los Angeles, CA	San Francisco, CA
Input Options	Minimize Walking						
	Minimize Transfers		X				X
	Minimize Journey Time		X				X
	Disabled Route		X	X			X
	Select Travel Mode (Bus/Rail or Both)				X		
	Choose by Street Address		X	X	X	X	X
	Choose by Landmarks	X	X	X	X	X	X
	Choose by Intersection		X	X	X	X	X
	By Departure Time	X	X	X	X	X	X
	By Arrival Time	X	X	X	X	X	X
	Date of Travel is Variable?	X	X	X	X	X	X
Output Options	Link to Schedule?		X	X		X	X
	Link to Detailed Directions/ Map Showing Station Location?	X	X	X	X		X
	Link to Route Map?						
	Approximate Journey Time	X	X	X	X	X	X
	Approximate Journey Distance	X	X				
	Fare Information	X	X	X		X	X
	Park and Ride Info?	X				X	
	Earlier/Later Routes	X			X	X	
Advanced Features	Multimodal?	X					
	Download to PDA	X					
	Language Choice						
	Plan Return Trip?		X				X
	Creator of Planner	TranStar (SCAG)	GIS/Trans	TranStar (SCAG)		TranStar (SCAG)	GIS/Trans

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	Tri-County Metropolitan Transportation District of Oregon (Tri-MET)	Utah Transit Authority (UTA)	Ventura County Transportation Commission	Washington Metropolitan Area Transit Authority (Metro)
Url	http://www.tri-met.org/	http://www.utabus.com/tripplanner/tp/	http://216.103.38.3/default.htm	http://www.wmata.com/
Location	PORTLAND, OR	OGDEN, UT	Ventura, CA	WASHINGTON DC, DC
Input Options				
Minimize Walking	X			X
Minimize Transfers	X		X	X
Minimize Journey Time	X		X	X
Disabled Route			X	
Select Travel Mode (Bus/Rail or Both)				X
Choose by Street Address	X	X	X	X
Choose by Landmarks	X	X	X	X
Choose by Intersection	X	X	X	X
By Departure Time	X	X	X	X
By Arrival Time	X	X	X	X
Date of Travel is Variable?	X	X	X	X
Output Options				
Link to Schedule?	X	X	X	
Link to Detailed Directions/ Map Showing Station Location?				X
Link to Route Map?	X	X	X	
Approximate Journey Time	X	X	X	X
Approximate Journey Distance				
Fare Information	X	X	X	X
Park and Ride Info?	X			
Earlier/Later Routes				
Advanced Features				
Multimodal?				
Download to PDA				
Language Choice			X	
Plan Return Trip?	X			X
Creator of Planner	ATIS (Trapeze)			

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