SOUND TRANSIT
STAFF REPORT

MOTION NO. M2002-101

Sound Transit and Regional Transit Technology Plans

Meeting:	Date:	Type of Action:	Staff Contact:	Phone:
Executive Committee	9/5/02	Discussion/Possible Action to Recommend Board Approval	Paul Matsuoka, Policy and Planning Officer	(206) 398-5070
Board	9/12/02	Action	Barbara Gilliland, Program Manager	(206) 398-5051
			Nick Marquardt, Project Manager for Research and Technology	(206) 689-4903

Contract/Agreement Type:	✓	Requested Action:	✓
Competitive Procurement		Execute New Contract/Agreement	
Sole Source		Amend Existing Contract/Agreement	
Memorandum of Agreement		Contingency Funds Required	
Purchase/Sale Agreement		Budget Amendment Required	

✔ Applicable to proposed transaction.

OBJECTIVE OF ACTION

Adoption of the Sound Transit Technology Plan for funding the development and implementation of advanced transit technologies.

ACTION

- Adopts the Sound Transit Technology Plan (Plan) for funding the development and implementation of advanced transit technologies
- Authorizes the Executive Director to take necessary steps to implement the Plan.

KEY FEATURES

- Establishes an array of transit technology projects that will meet the established goals of improving current transit service in such areas as Customer Service, Safety and Security, Operating Efficiencies, Speed and Reliability, Accessibility, and Interoperability between agencies.
- Defines the Sound Transit Technology projects that will receive the remaining funds from the Research and Technology (R&T) Program. Actual appropriations will be made in accordance with Sound Transit's procurement process.
- Creates a set of regional technology projects and initial consensus for regional technology grant opportunities.

- Improves many transit "building block" technologies that provide needed data and systems for a variety of technology benefits that would not be achievable without their implementation.
- Funding for such advanced technologies for Regional Express and Sounder are not a part of their Sound Move operating or capital budgets. Therefore, this will allow for many technology investments to be funded and designed with, or retrofitted in the capital projects and on existing fleets.
- Allows Sound Transit and the partner transit agencies to align plans and fund future technology upgrades together.

BUDGET IMPACT SUMMARY

Project Description: Transit Technology Plan
Current Status: Project development and research
Projected Completion Date: 2006

Action Outside of Adopted Budget:	Y/N	Y Requires Comment
This Line of Business	N	
This Project	N	
This Phase	N	
This Task	N	
Budget amendment required	N	
Key Financial Indicators:	**Y/N**	**Y Requires Comment**
Contingency funds required	N	
Subarea impacts	N	
Funding required from other parties other than what is already assumed in financial plan	N	

N = Action is assumed in current Board-adopted budget. Requires no budget action or adjustment to financial plan

BUDGET DISCUSSION

The project budget contains sufficient funds for this effort and committing these funds does not endanger any other project elements that are to be funded out of the overall project.

REVENUE, SUBAREA, AND FINANCIAL PLAN IMPACTS

The proposed action is consistent with the current board-adopted budget and is affordable within Sound Transit's current long-term financial plan and the subarea financial capacity.

SUMMARY FOR BOARD ACTION

Table 1: Current 2002 Budget relative to expenditures and this action:

Projects	Current Project Budget (1) (A)	Expenditures to Date (B)	Total Amount Identified in Plan (C)	Budget Remaining (Committed) (A-[B+C])
Current on-going and completed projects (2)	$9.0	$3.4	0	$5.6
Transit Systems Enhancements/ Transit Technology Plan	$10.7	$0	$10.7	$0.0
Total Research & Technology	**$19.7**	**$3.4**	**$10.7**	**$5.6**

(Dollars in Millions)

Notes:
(1) Current budget reflects Board Motion No. M2002-58 approving the Regional Fund Task Force in the amount of approximately $19M.
(2) Current on-going and completed projects include Smart Card Project, Hybrid Bus / Smart Bus Demonstration, Transit-oriented development and several smaller projects.

Table 2: Summary of Proposed Technology Initiatives:

Technology Initiatives	Cost Estimates	
Sound Transit Corridor Technology Initiative	$9	93% of remaining TSE Funds
Sound Transit Security Technology Initiative	$1	
Regional Technology Initiative Participation	$.7	7% of remaining TSE Funds
Total Transit Systems Enhancements	**$10.7**	

(Dollars in Millions)

M/W/DBE – SMALL BUSINESS PARTICIPATION

Not Applicable

HISTORY OF PROJECT

The Research and Technology Fund was included in Sound Move to explore new technologies that could be, where practical, incorporated into the implementation of existing services and/ or to provide the Board with the information which could be used in developing future programs and projects. Per Sound Move, Sound Transit will "evaluate...innovative ways to provide transit service, reduce dependency on single occupancy vehicles, improve public transportation's cost effectiveness, and better respond to customer needs" (Sound Move).

In 1998, the Board established the mission of the fund: "to evaluate new ideas, services, and technological innovations that improve the comfort, convenience, and reliability of the transit ridership experience, while reducing operating expenses, environmental impacts, and reliance on single-occupancy" (Motion No. M98-74). Since this direction, the Program has funded and

implemented a variety of projects including the Smart Bus Demonstration Project, expanding a Traveler Information Application, and procuring a Diesel/ Electric Hybrid Bus (delivery early 2003).

These projects and demonstrations have benefited Sound Transit and our transit agency partners by providing needed information and evaluations of advanced technologies before procurements. However, as the Program evolved the need to better identify and strategically determine the technology projects to fund became apparent. In 2001, the Board directed staff to develop a Transit Technology Plan (Motion No. M2001-116) that would assess and identify an array of technological advancements to existing rail and bus transit service that will be implemented by 2006.

During this plan development process, a Board appointed Regional Fund Task Force was assembled to provide recommendations to the Board on funding levels and policy direction of the Regional Fund Projects; one of which is the Research and Technology Program. The Board approved recommendations (Motion No. M2002-58) from the Task Force setting the following policy regarding the R&T Program:

- Retain the Program but at a reduced funding level;
- Eliminate Alternative Transit Technologies category ($7 million); cancel and reduce 2002 projects (approx. $2 million); reduce Transit System Enhancements category (≈$10 million); total reduction of approximately $19 million and a total remaining through 2006 of $16.3 million;
- Complete the Technology Plan (due in 90 days) and present specific scope and cost of proposed new projects for approval by the Board. Focus on projects that enhance Customer Service, Operations, and Safety and Security. (Note: this staff paper is in response to this Board directive).

The development of this Transit Technology Plan included multiple workshops, inventories and interviews with regional transit agency staff that are members of a Regional Transit Technology Group (RTTG). The RTTG is a technology-oriented group made up of Puget Sound area transit agencies, Washington State Ferries, and the Puget Sound Regional Council.

The Plan is comprised of two sets of technology initiatives that are traceable to high-level technology outcomes. For instance, an outcome is, "Customers on transit vehicles or waiting at major bus stops and train stations receive a visual and audible announcement of the stop location or arriving service." A technology initiative is a description and package of projects that are the underlying technologies and operating conditions that must occur for the outcome to be achieved.

The first set contains Sound Transit Technology Initiatives that improve customer service, customer safety and security, and operations. These initiatives will receive 93% of the remaining R&T Funds. This set of initiatives primarily focus on Phase I of Sound Move (2006) and will augment both capital projects and service for bus and rail. The second set of initiatives, called the Regional Transit Technology Initiatives, identifies an array of transit technology enhancements that require regional coordination and support. The R&T Funds would earmark 7% of the funds for matching and participation along with Sound Transit's transit partners in the Regional Technology Initiatives.

Examples of the outcomes achieved by both sets of Initiatives are:

- Passengers experience shorter travel times and operating costs are reduced because arterial signal delay is reduced for transit vehicles.

- Customers waiting at bus stops and platforms know how long they will need to wait for the next bus or train. (Information could include the current time, whether the bus/ train they're waiting for has arrived, when the next bus is scheduled, whether the next bus is early or late and when a train or bus is arriving).

- Customers know that activities in transit vehicles or facilities (stations, centers, park-and-ride lots) are under video surveillance, that facilities are monitored in real-time when appropriate, and that recorded video will be available to help identify whom to hold responsible for incidents. Customers can be informed by audible and/ or visual displays of incidents or situations.

(1) Sound Transit Technology Initiatives

The Corridor Technology Initiative. The purpose of this initiative will be to provide technology support for bus rapid transit type technology applications, and provide next train arrival information for commuter rail in select corridors. Examples of these applications include:

- Expansion of transit signal priority in specific corridors
- Automated next stop displays for passengers on ST buses
- Automated next stop annunciation for passengers on ST buses
- Automated passenger counting
- Real-time passenger information at select transit centers and Sounder Stations

The Security Technology Initiative. This initiative will develop requirements, implementation plans and cost estimates for surveillance of Sounder stations and on-board Regional Express buses. This will provide funding to augment current security technology budgets for each line-of-business and establish agency standards for video surveillance and monitoring. Also, it will assess the benefits of co-locating surveillance, security dispatch, and service control dispatchers, and determine benefits and costs of consolidating security between ST lines of business and developing security partnerships with local transit agencies or police.

(2) The Regional Transit Technology Initiatives

The second set of Regional Transit Technology Initiatives would require multi-agency participation and funding. The intent of these Initiatives is to define projects and establish initial consensus for Regional Transit Technology Projects that will be used for grant solicitations, to provide needed coordination between agencies before technology investment and procurement decisions are made, and to ensure that the region is able to leverage transit technology investments where there is opportunity.

The composite of these two sets of initiatives is the Sound Transit Transit Technology Plan. These identified technology initiatives will be the focus of the Research and Technology Transit System Enhancement Fund for the remainder of Sound Move. Any direct funding appropriations for the Regional or Sound Transit Technology Initiatives and subsequent projects

will adhere to Sound Transit's contracts and procurements process. (Upon request a copy of the plan and/or briefing paper will be provided).

Prior Board or Committee Actions and Relevant Board Policies

Motion or Resolution Number	Summary of Action	Date of Action
M2002 – 58	Approval of the recommendations of the of the Regional Fund Task Force to revise the work plan for the Research and Technology program.	6/13/02
M2001-116	Authorizing the development of Sound Transit and Regional Transit Technology Plan, and the completion of the Alternative Transit Technology Report.	11/1/01
M98-74	Adoption of the basic program elements of the Research and Technology fund program.	10/22/98

CONSEQUENCES OF DELAY

Delay will not cause any major problems.

REGIONAL PARTNERSHIP AND COOPERATION

There were 5 workshops, 12 meetings, and multiple agency interviews held between November 2001 and August 2002 with the partner transit agencies, including members of the Regional Transit Technology Group, and the Transit Integration Group's Accessibility Committee. The Regional Transit Technology Group is meeting on August 29, 2002, and their endorsement of the Plan is expected.

PUBLIC INVOLVEMENT

Not Applicable

LEGAL REVIEW

JDW 8/23/02

SOUND TRANSIT

MOTION NO. M2002-101

A motion of the Board of the Central Puget Sound Regional Transit Authority adopting the Sound Transit Technology Plan for funding the development and implementation of advanced transit technologies and authorizing the Executive Director to take necessary steps to implement the Plan.

Background:

The Sound Transit Transit Technology Plan is comprised of two sets of technology initiatives that are traceable to high-level technology outcomes. For instance, an outcome is, "Customers on transit vehicles or waiting at major bus stops and train stations receive a visual and audible announcement of the stop location or arriving service." A technology initiative is a description and package of projects that are the underlying technologies and operating conditions that must occur for the outcome to be achieved.

The first set contains Sound Transit Technology Initiatives that improve customer service, customer safety and security, and operations. These initiatives will receive 93% of the remaining Research and Technology (R&T) Funds. This set of initiatives primarily focus on Phase I of Sound Move (2006) and will augment both capital projects and service for bus and rail. The second set of initiatives, called the Regional Transit Technology Initiatives, identifies an array of transit technology enhancements that require regional coordination and support. The R&T Funds would earmark 7% of the funds for matching and participation along with Sound Transit's transit partners in the Regional Technology Initiatives.

The composite of these two sets of initiatives is the Sound Transit Transit Technology Plan. These identified technology initiatives will be the focus of the Research and Technology Transit System Enhancement Fund for the remainder of Sound Move. Any direct funding appropriations for the Regional or Sound Transit Technology Initiatives will require approval by the Finance Committee.

The Board approval of this motion will approve the Sound Transit Transit Technology Plan for funding the development and implementation of advanced transit technologies.

Motion:

It is hereby moved by the Board of the Central Puget Sound Regional Transit Authority that the Sound Transit Technology Plan for funding the development and implementation of advanced transit technologies is adopted and the Executive Director is authorized to take necessary steps to implement the Plan.

APPROVED by the Board of the Central Puget Sound Regional Transit Authority at a regular meeting thereof held on September 12, 2002.

Ron Sims
Board Chair

ATTEST:

Marcia Walker
Board Administrator

SOUND TRANSIT TECHNOLOGY PLAN

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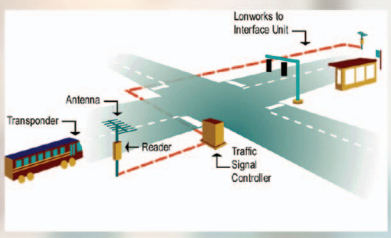
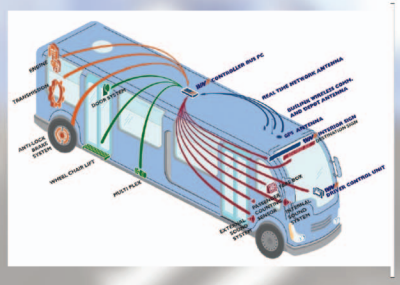
CENTRAL PUGET SOUND
REGIONAL TRANSIT TECHNOLOGY PLAN

Prepared by: | PB Farradyne

Prepared for: | Sound Transit





September, 2002

Regional Transit Technology Plan

-- and --

Sound Transit Technology Plan

Prepared for:

Sound Transit

Prepared by:

PB Farradyne
in association with
The IBI Group

SEPTEMBER, 2002

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION AND PLAN DEVELOPMENT PROCESS

This document describes technology-related transit projects that require coordination and cooperation between agencies in order to achieve regionally significant outcomes. Chapter two describes fourteen "high priority outcomes," and assesses the status of delivering them within the region. Chapter three describes the recommended initiatives and projects. Two of these initiatives are proposed for funding from the Sound Transit Technology fund, and five others are proposed as potential partnership efforts between the region's transit agencies.

Sound Transit has sponsored the development of two plans that are combined into this single document:

- The Central Puget Sound **Regional Transit Technology Plan** is a collaborative effort of the region's transit agencies to identify transit technology projects that require regional cooperation. Projects identified in the Regional Transit Technology Plan represent opportunities for agencies to align budgets or to pursue grant funding opportunities to enhance investments being made at each of the region's transit operators. The plan identifies the most promising interagency technology initiatives. It serves as a starting point for developing working partnerships, but does not represent a commitment by any agency to fund or participate in the projects it identifies.

- The **Sound Transit Technology Plan** identifies and recommends technology-related investment projects that enhance Sound Transit services and contribute to regional transit agency goals. The Sound Transit Technology Plan is an agency-specify plan intended to guide budget decisions related to the Technology Fund approved as part of the Sound Move ballot measure in 1996, subject to approval by the Sound Transit Board.

Figure 1-1 illustrates the relationship of these two plans.

The plans are intended to result in:

- Regional initiatives meeting the goals set forth by General Managers
- Regional agreements, standards, and protocols
- Individual agencies plan and budget alignment
- Support for project selection from the Sound Transit Technology Fund

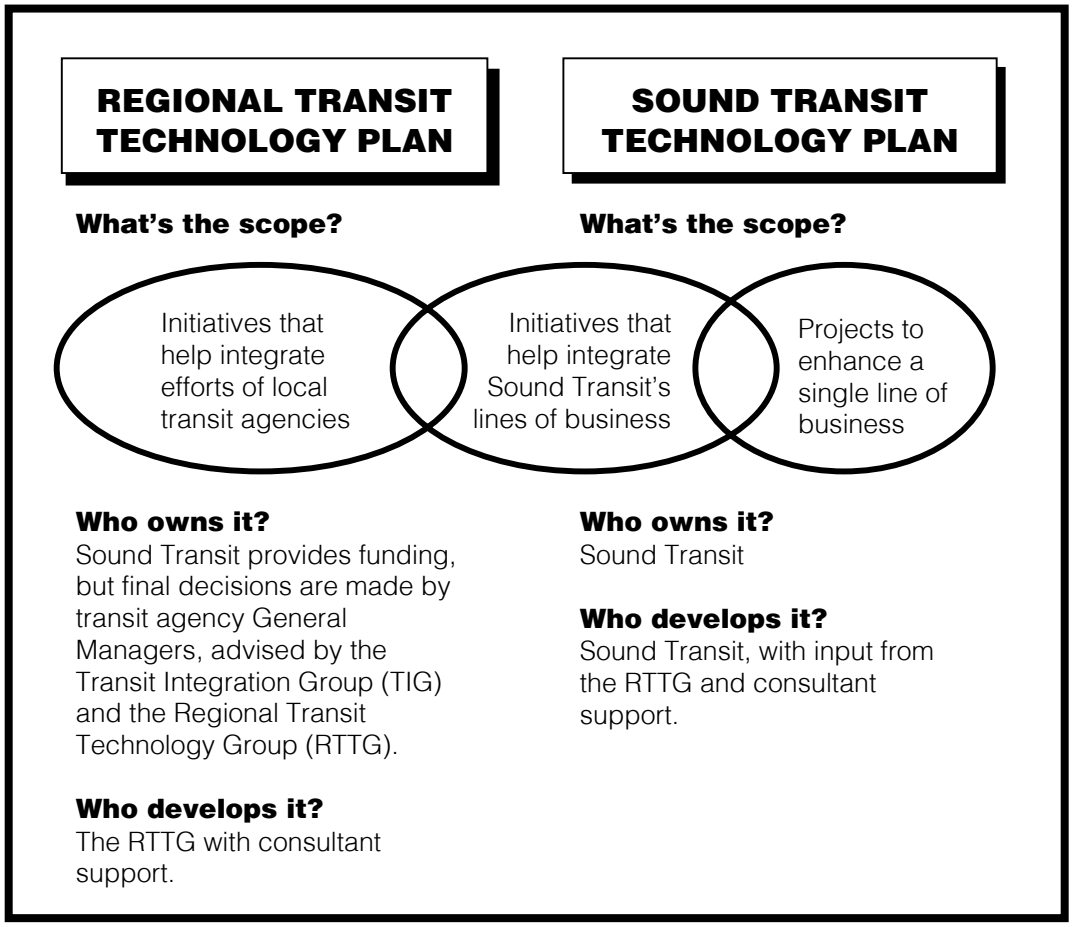
The Regional Transit Technology Group (RTTG) was the primary forum for discussing and developing the Regional Transit Technology Plan. This group represents technology managers and specialists at the region's transit properties, among Sound Transit's lines of business (Link Light Rail, Sounder Commuter Rail and Regional Express Bus), and also includes the Puget Sound Regional Council (PSRC). At its monthly meetings, the RTTG helped identify, prioritize, screen and improve the contents of the plans. More information about the RTTG can be found on its web site at http://www.rttg.org.

The Plan identifies regional initiatives and Sound Transit initiatives:

- ***Regional initiatives and projects*** (numbers beginning with 'R' in Chapter 3) are potential cooperative efforts that could be funded by developing agreements to align individual agency budgets, by preparing cooperative grant applications, or both. For each project or initiative, an interlocal agreement will be required. These projects have not been adopted by local agencies. By including these projects in the Plan, the RTTG begins a conversation between agencies that could lead to funding and implementation if a project is embraced by each affected agency.

- ***Sound Transit initiatives and projects*** (numbers beginning with 'S' in Chapter 3) are proposed to the ST Board as staff-recommended projects to be funded by the ST Technology Fund that was part of the voter-approved Sound Move program. These initiatives are consistent with regional priorities, and will directly benefit Sound Transit patrons or operations.

Figure 1-1:
Scope of the Regional Transit Technology Plan and the Sound Transit Technology Plan



SCOPE

Transit agencies are engaged in many types of technology-related activities. The technologies addressed in this Plan affect operations or customer service, excluding the many data systems that are used to manage the organization itself (such as financial or personnel systems).

Among service-related and customer-related technologies, this Plan is interested only in those that would be enabled or enhanced by coordinating efforts between agencies. Transit and paratransit patrons make trips that cross the lines dividing service providers, and each agency seeks to make that interagency trip as uncomplicated as possible. For example, if two agencies want to provide information at a bus stop about when the next bus will arrive, coordination is needed to get consistent information to a common point where it can be displayed. However, there are many other transit technologies that can be implemented by a single agency without coordinating with others, since basic operation and maintenance of buses is done independently by each agency without negative impacts to passengers.

Sound Transit has a special interest in coordination between agencies because it provides service in the same service areas as local providers, and because it contracts with local providers for Regional Express Bus service. Sound Transit passengers make transfers regularly to and from local services. As a multi-modal transit agency, Sound Transit is also interested in providing consistent customer service between its lines of business: bus, commuter rail and light rail services. The scope of the plan for Sound Transit services includes technology initiatives that require regional coordination, and adds initiatives that will improve Sound Transit services or improve coordination between it's lines of business.

OVERVIEW OF THE PLAN DEVELOPMENT PROCESS

In 2001, the General Managers of the region's transit agencies approved seven goals for regional technology programs. These goals include:

- Improving customer service and satisfaction
- Enhancing safety and security
- Increasing efficiency
- Reducing fuel consumption and emissions
- Improving transit speed and reliability
- Increasing accessibility
- Improving interoperability between agencies.

Members of the RTTG are adamant that technology initiatives should be developed to achieve identifiable outcomes. Although this sounds like simple common sense, technologies are often promoted for their own sake, and the delivery of ultimate benefits is not always achieved.

Figure 1-2 illustrates the steps that were taken to develop the Plan. These steps are discussed further in later in this chapter, presented in chronological order.

The RTTG developed high-priority outcomes using a brainstorming and group prioritization process. The consultant team conducted interviews with agency staff and performed additional research, developed a status report on local transit agencies' efforts to deliver each of the identified outcomes, and identified delivery gaps. These status reports are included in Chapter 2.

Each of the status reports suggested some next steps that could be taken to deliver the desired outcomes. The RTTG began with those next steps and added some additional ideas, and over the course of two meetings, the group combined or eliminated these to produce a project list. Separately, Sound Transit staff worked with the consultant team to define projects to propose to the ST Board for use of the Technology Fund. The consultant team then defined a combined set of initiatives and related projects, which were refined by the RTTG. The initiatives and projects are included in Chapter 3.

Figure 1-2: Steps to Develop the Plan

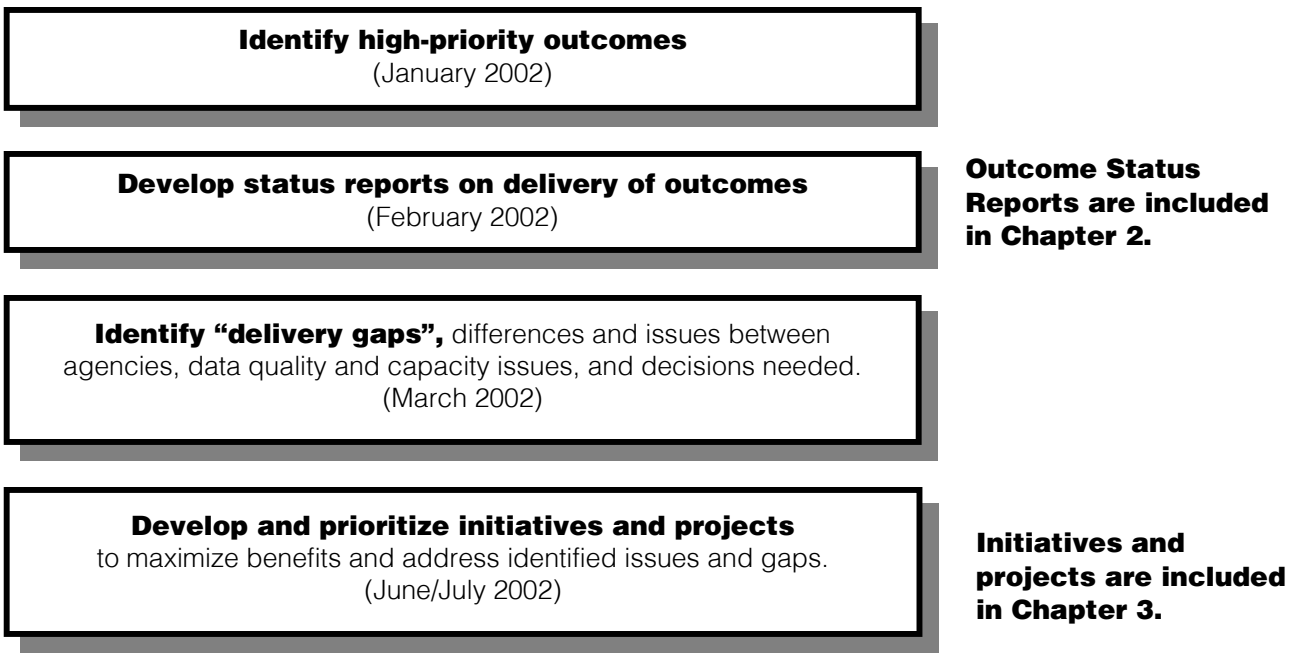


Table 1-1
High-Priority Outcomes Agreed on at the January 3, 2002 RTTG Meeting

Goals	DESIRED OUTCOMES
Customer Service / Satisfaction	1. Customers planning a trip can obtain **consistent itinerary options** from any transit agency that includes all transit, paratransit and rideshare options. (Delivery via telephone, the Internet, downloaded to a PDA, and/or through public interactive terminals, if provided).
	2. Customers waiting at bus stops and platforms **know how long they will need to wait for the next bus or train**. (Information could include the current time, whether the bus they're waiting for has arrived, when the next bus is scheduled, whether the next bus is early or late, and when a train or bus is arriving).
	3. Transit, vanpool and paratransit customers can use any transit service and pay for it with a **single fare media** that will charge the appropriate fare for the service and their fare eligibility, and allow agencies to more easily reconcile pass transactions.
	4. Any traveler can **obtain transit service information, purchase a pass, or contact customer services over the Internet.**
Safety / Security	5. Customers know that activities in **transit vehicles or facilities (stations, centers, P&R lots) are under video surveillance**, facilities are monitored in real-time when appropriate, and recorded video will be available to support post-incident investigations.
Efficiency	6. Bus drivers can interact with all electronic components on their bus from **a single driver display**.
	7. Maintenance staff can automatically **download data on bus conditions**, as well as data from a variety of bus-bound data systems.
	8. Transit agencies can obtain **archival data** that includes consistent passenger counts to reconcile pass transactions, as well as passenger loading and schedule adherence profiles.
Fuel	9. **Fuel consumption and emissions are reduced.**
Speed / Reliability	10. Passengers experience shorter travel times and operating costs are reduced because **arterial signal delay is reduced** for transit vehicles.
	11. Bus drivers, dispatchers and **service control staff have the information they need** to maintain reliable service, including managing incidents and breakdowns, eliminating early operation, and controlling bus schedule adherence and headways. (Information for service controllers and dispatchers could include visual display of bus location and alarms in cases of early operation, severe bunching, overloading or late operation. Information for bus drivers could include status on schedule adherence and/or location status of leading and following buses).
Accessibility	12. Customers on transit vehicles or waiting at major bus stops and train stations receive **a visual and audible announcement** of the stop location or arriving service.
	13. **Paratransit customers can reserve or cancel and receive reservation confirmations for multi-county trips with a single phone or Internet contact.**
Inter-operability	14. Transit and paratransit **dispatchers, drivers and service control staff can contact each other** from any location with minimal delay, and can be connected directly to emergency services or connecting service controllers, including during an area-wide emergency. (This outcome could also include alternative dispatch locations with full communications to emergency services).

RTTG IDENTIFICATION OF HIGH PRIORITY OUTCOMES

The consultant team brainstormed a lengthy list of desired technology outcomes, and the RTTG added to these during its January 3, 2002 workshop. RTTG members rated each of these brainstormed outcome statements based on the following questions:

- Will customers feel the benefits directly?
- Will operators save money or add functionality?
- Will policy-makers and the public take notice?
- Is value added by coordinating this regionally?

As a result, several outcome statements were eliminated, and others were consolidated or rewritten following group discussion. The 14 outcome statements adopted by the group are shown in Table 1-1.

INTERVIEWS WITH AGENCY STAFF TO DEVELOP OUTCOMES STATUS REPORTS

To determine the implementation status of the high-priority outcomes at each agency and identify interagency coordination issues and needs, the consultant team conducted interviews with RTTG members and other technology specialists at each of the region's transit agencies and each Sound Transit line of business. Several consistent themes were identified during these interviews. . These interview results were used to identify high priority outcomes, and to prepare the outcome status reports included in chapter two.

Following is a summary of the most significant and consistent comments heard:

- ***Trip Planning:*** All interviewed felt this is a great service to the customer that should be completed and expanded. There was agreement that trip planning should support itineraries that cover the three counties, and several people felt paratransit and ridesharing options should be incorporated as well. The primary benefit was seen to be support for information operators (to allow them to handle more calls and provide more consistent multi-county information), and to provide web support.
- ***Smart Cards:*** Many of those interviewed continue to feel that Smart Cards are a high priority, but there was concern about delays, and the ongoing operating costs that will be needed to maintain the system that won't be offset by additional revenue collection. One person wondered whether we needed to develop a contingency plan in case the Smart Card project falters.
- ***On Line Passenger Service:*** All agencies are committed to providing a strong web interface for customer service, including schedule information, pass sales and other routine functions. Several people mentioned the need to control their agency's public identity in interactions with customers. Although regionally consistent information is desired, most would prefer to deliver it through their own corporate branded web interface.
- ***Bus Rapid Transit:*** Metro is considering developing or demonstrating a bus rapid transit concept. This could require technology support beyond what is currently provided or planned, to implement pre-pay systems to reduce dwell times, complete signal priority systems to minimize running time, and provide next-bus arrival information at stations. Sound Transit Regional Express representatives also expressed some desire to differentiate their service using these techniques.
- ***Bus Stop or Kiosk Information:*** There is no shared vision in the region about whether or how bus-stop data should be provided. This is an area where there was a great deal of mixed feelings. Many of those interviewed felt that it would be valuable to provide next-bus arrival information at bus stops, but few felt it was a priority for their agency. Light rail will provide displays for this information, but no other specific plans have been made. Interactive kiosks were supported by some and disliked by others due to their typically low use and high maintenance costs.

- ***Smart Bus:*** Metro is committed to purchasing Smart Buses, and to upgrade their AVL system to use the GPS-based system packaged with the Smart Buses. Implementation requires a great deal of detail and upkeep of GIS data. Other agencies mentioned concern that operators are not complying with ADA requirement to announce stops (Community Transit reported 25% compliance), but felt this could be controlled through better supervision.
- ***Automatic Vehicle Location (AVL):*** Agencies differ in their estimation of the need for AVL. Metro's is mature and well used, and the agency plans to upgrade it further. Other interviewees reported management concerns that the data would not be used in any way worth the cost, and were concerned that AVL systems should be able to be implemented and upgraded incrementally. Any outcomes dependent on AVL data will require that this data be reported in a consistent way. The Washington State Transportation Center (TRAC) is investigating whether cellular digital packet data (CDPD) can be used to convey AVL data from transit vehicles to the regional backbone, allowing agencies without a data capability in their radio system to participate. It was noted that there are currently no plans to provide for cellular communications in the Metro Bus Tunnel.
- ***Transit Signal Priority (TSP):*** Agencies differ both in their priority and approach. Metro, Community Transit (CT) and Pierce Transit (PT) are committed to TSP. PT uses Opticom® detection, and Metro and CT use radio tags. Sound Transit Light Rail will use a different system using track circuits for detection. Everett Transit (ET) is not convinced that the cost is justified, and all agencies were unclear about the priority to place on TSP implementation. Concerns were raised that compromises made to satisfy the traffic signal managers have diluted the effectiveness of existing TSP programs.
- ***Radios:*** CT has upgraded its radio system recently, and Metro is investigating its upgrade options due to the need to relocate to other frequency bands, requiring more base stations to ensure adequate coverage. Some interviewees wondered whether there are regional issues that ought to be considered as part of the Metro radio upgrade, including the need for controllers and service supervisors at different agencies to be able to contact each other; others felt that contact between dispatch centers by telephone works well.
- ***Security and Monitoring:*** Metro and CT will both provide in-vehicle video recording to assist in investigations if incidents occur; Metro's system will allow transit police to monitor video in real time remotely if they are within short-range radio distance. Video monitoring is planned at Sound Transit light rail and commuter rail stations, and it has been installed in some large structured park-and-ride lots. There has been no regional discussion about whether and how transit capital facilities should be actively monitored, and if so, where they should be monitored from. Everett Station will be integrated into Everett's downtown security camera system and monitored by the Everett Police. Sound Transit plans to run commuter rail security camera video to its private security provider. The light rail branch was less certain about where monitoring will occur, and the issue is related to knowing who will operate the light rail service, and where the tunnel and light rail will be dispatched from. The issue of whether security cameras should be monitored, and who should monitor them, was raised repeatedly.
- ***Wireless Downloads:*** The ability to download data from all the subsystems on a bus was brought up several times; this will be addressed through the Smart Card program, but it was considered important that all data download needs be addressed.
- ***Paratransit Systems:*** There was strong interest from some interviewed that paratransit services should be integrated into trip planning and other data systems, but recognition that at most agencies paratransit is seen as a separate agency function from fixed route transit. With paratransit costing approximately ten times as much per trip compared to regular service, there is a strong interest in any enhancements that will identify when mainline transit can be substituted for a paratransit trip, or other cost-saving measures. All the agencies use Trapeze scheduling software, though it was noted that different agencies have different versions of the software and update on different schedules. It was noted that about 20% of reservations end up being canceled, and many times the cancellations are not called in – so an Internet reservation/cancellation system might reduce the need to dispatch unneeded calls.

- ***Ticket Vending Machines:*** Sound Transit is working to install ticket vending machines at commuter rail and light rail stations. These would be configured to sell Smart Cards as well. It was felt that these would only be needed at rail stations, but if they are popular, they might be implemented at ferry terminals and major bus transfer points.
- ***Emergency Dispatch and Contingencies:*** Community transit has equipped a bus that can be used as a dispatch center in case of emergencies.
- ***University of Washington Developed Data Systems:*** The UW has developed several transit-related web-based information systems (TransitWatch, BusView, and My Bus) that use bus AVL data from King County Metro Transit. The AVL data is transmitted to other users over of a regional transportation information "backbone" also developed and maintained by UW. The web applications require upkeep; King County is negotiating with the UW to take over these systems, but licensing issues may need to be resolved for agencies beyond King County to use them. Continued operation of these transit applications by UW is not funded.
- ***Passenger Counting:*** The differences between passenger counting methods at different agencies came up rarely, but it was noted that passenger counting consistency is key to reconciling the repayment between agencies for PugetPass use. Some agencies use farebox data, others use automatic passenger counters, and some also use survey data.
- ***511:*** There are no current plans to provide transit information on the new 511 regional transportation telephone service, other than providing transit agency telephone numbers.
- ***Sound Transit Lines of Business:*** The interviewees at Sound Transit all commented on the lack of consistency or standards between ST lines of business. Those responsible for agency-wide issues felt they had limited ability to raise and resolve issues or to set standards for the agency.

IDENTIFICATION OF DELIVERY GAPS AND POTENTIAL PROJECTS

Each of the status reports in Chapter 2 identifies delivery gaps and potential next steps to achieve a desired outcome. At the February 7,2002 RTTG meeting, additional potential next steps (or projects) were brainstormed. Each RTTG member rated the potential projects to determine whether they were within the scope of either the Regional Transit Technology Plan or the Sound Transit Technology Plan, and whether they were complementary to their agencies' plans. The consultant team proposed an initial project list based on the RTTG discussion, and that initial list was further refined at the April 25, 2002 meeting. Following that meeting, the consultant team rearranged the project list into seven "initiatives." Of these, two are specific to Sound Transit (initiatives S1 and S2) and five are regional (initiatives R1 through R5). The initiative descriptions were discussed and approved by the RTTG at its June 27th meeting, and project descriptions for each were discussed at its July 27th meeting.

The initiatives are shown in Table 1-2, and the complete initiative and project descriptions are shown in Chapter 3. Table 1-3 shows the correspondence between the General Manager goals, RTTG desired outcomes and the initiatives included in the plan. Table 1-4 shows estimated costs for each project. Many regional projects will not have cost estimates defined until concept planning is completed.

NEXT STEPS

For Sound Transit initiatives, the ST Board will decide whether to fund and initiate the identified projects. For regional projects, interagency discussions will be needed to determine whether, when and how to pursue the identified projects. The ST projects have been specified to be completed within the remaining four years, funded by the 1996 Sound Move voter-approved ballot measure.

For each initiative, a "concept planning" project has been identified to develop the architecture, scope and detailed estimates needed to pursue subsequent implementation projects. In most cases, the concept planning is required before other projects can be funded. During concept planning, technical specifications will be developed, and roles and responsibilities for each agency will be negotiated.

Table 1-2: Initiatives Agreed to at the June 27, 2002 RTTG Meeting

S1: Sound Transit Corridor Technology Initiative	The purpose of this initiative will be to provide technology support for bus rapid transit type technology applications, and provide next train arrival for commuter rail. These applications include transit signal priority and real-time passenger information on buses and at stations. This group of projects will address many of the RTTG goals (see Table 1-2) including Customer Service / Satisfaction, Efficiency, Speed / Reliability, and Accessibility.
S2: Sound Transit Security Technology Initiative	This initiative will establish agency standards for video surveillance and monitoring. This includes: assessing the benefits of co-locating surveillance, security dispatch, and service control dispatchers, determining the benefits and costs of consolidating security between ST lines of business; and developing security partnerships with local transit agencies or police. Implementation plans and cost estimates for surveillance of Sounder stations and on-board Regional Express buses will be developed, and current security technology budgets for each line-of-business will be augmented.
R1: Regional Transit GIS	This initiative will develop the capability to share current geographically based data between transit agencies. Based on a needs assessment of potential users and uses of multi-county geographical information, a method of data exchange, updating and maintenance will be proposed to share and maintain GIS data a variety of uses, including stop announcements, trip planning, paratransit reservations, modeling support, etc. The result could include developing a unified transit Geographic Information System (GIS) database to which individual agencies would publish data to and subscribe to data published by others, or it could result a means of storing and translating data to facilitate regular importing and exporting of data from one agency's GIS system to another.
R2: Common Web and Phone Interface	This initiative will provide a unified web and telephone access to existing and future regional transit data applications such as MyBus, BusView, Regional Automated trip Planning, Regional Rideshare etc. It will involve the development of agreements on consistent way to make transit data available for web and audio delivery. It also includes the provision of automated telephone information for use on the emerging regional 511 system and dedicated customer service telephones.
R3: Regional AVL Deployment and Computer Aided Dispatch	Automatic vehicle location (AVL) data will have many potential uses, including for passenger information. To use AVL data to provide bus location data to customers that includes all intersecting services, AVL data needs to get to a data backbone in a consistent format, regardless of how each agency collects it. This initiative will identify how that will occur, and deploy systems that will be needed. Computer-aided dispatching (CAD) needs of agencies that do not currently have CAD capabilities will also be assessed.
R4: Regional Security and Communications Interoperability	This initiative will assess needs for inter-system service control communications, and emergency communications needs. This project could also be broadened to assess options for joint transit security arrangements in each county, security and service control communications or co-location needs, and control center strategy and communications needs, and video surveillance plans.
R5: Paratransit and Ridesharing Technology Initiative	This initiative includes a set of related projects to improve service delivery and customer service for paratransit users, and to integrate paratransit and ridesharing data systems with transit data systems where appropriate.

Table 1-3: Correspondence Between Goals, Outcomes and Initiatives

GM GOALS	DESIRED OUTCOMES (abbreviated)	INITIATIVES THAT ADDRESS DESIRED OUTCOMES
Customer Service / Satisfaction	1. Customers planning a trip can obtain consistent itinerary options from any transit agency that includes all transit, paratransit and rideshare options.	R2: Common Web and Phone Interface
	2. Customers waiting at bus stops and platforms know how long they will need to wait for the next bus.	S1: ST Corridor Technology Initiative R3: Regional AVL Deployment and Computer Aided Dispatch
	3. Transit, vanpool and paratransit customers can use any transit service and pay with a single fare media.	R2: Common Web and Phone Interface (also by Smart Card project)
	4. Any traveler can obtain transit service information, purchase a pass, or contact customer services over the Internet.	S2: ST Security Technology Initiative R4: Regional Security and Communications Interoperability
Safety / Security	5. Customers know that activities in transit vehicles or facilities are under video surveillance, and are recorded or monitored in real-time when appropriate.	R4: Regional Security and Communications Interoperability
Efficiency	6. Bus drivers can interact with all electronic components on their bus from a single display.	(Addressed as part of the Smart Card project)
	7. Maintenance staff can download data on bus condition, as well as data from a variety of bus-bound data systems automatically.	S1: ST Corridor Technology Initiative R5: Paratransit and Ridesharing Technology Initiative
	8. Transit agencies obtain archival data that includes consistent passenger counts to reconcile pass transactions, as well as passenger loading and schedule adherence profiles.	S1: ST Corridor Technology Initiative R1: Regional Transit GIS R5: Paratransit and Ridesharing Technology Initiative
Fuel	9. Fuel consumption and emissions are reduced.	(No regional coordination required)
Speed / Reliability	10. Passengers experience shorter travel times and operating costs are reduced because arterial signal delay is reduced for transit vehicles.	S1: ST Corridor Technology Initiative
	11. Bus drivers, dispatchers and service control staff have the information they need to manage incidents and breakdowns, to eliminate early operation, and to control bus schedule adherence and headways.	S1: ST Corridor Technology Initiative R5: Paratransit and Ridesharing Technology Initiative
Accessibility	12. Customers on transit vehicles or waiting at major bus stops and train stations receive a visual and audible announcement of the stop location or arriving service.	S1: ST Corridor Technology Initiative R3: Regional AVL Deployment and Computer Aided Dispatch
	13. Paratransit customers can reserve or cancel and receive reservation confirmations for multi-county trips with a single phone or Internet contact.	R5: Paratransit and Ridesharing Technology Initiative
Inter operability	14. Transit and paratransit dispatchers, drivers and service control staff can contact each other from any location with minimal delay, and be connected directly to emergency services or connecting service controllers.	R3: Regional AVL Deployment and Computer Aided Dispatch R5: Paratransit and Ridesharing Technology Initiative

Table 1-4: Summary of Estimated Costs

(all costs in $1000s of 2002 dollars)

		Cost Range Low	Cost Range High
S1	**Sound Transit Corridor Technology Initiative**		
S1-1	Concept Planning	$ 175	$ 200
S1-2	Corridor Demonstration Project	$ 7,273	$ 7,273
S1-3	Sound Transit Signal Priority Program	$ 1,755	$ 1,755
S1-4	Real-Time Passenger Info Expansion to Other ST Corridors	---- TBD * ----	
S2	**Sound Transit Security Technology Initiative**		
S2-1	Agency Wide Security Guidelines and Co-Location Options	$ 55	$ 55
S2-2	Sounder CCTV, PA and VMS Plan	$ 1,000	$ 1,000
S2-3	Regional Express On-Board Video Surveillance Plan	$ 35	$ 35
	TOTAL of all costs estimated:	**======**	**======**
	Sound Transit Projects	**$ 10,293**	**$ 10,318**
R1	**Regional Transit GIS**		
R1-1	High-Level Concept Planning	$ 50	$ 50
R1-2	Develop Technical Requirements	---- TBD * ----	
R1-3	Deployment	---- TBD * ----	
R2	**Common Web and Phone Interface**		
R2-1	Concept Planning	$ 90	$ 90
R2-2	Regional Standard for My Bus and Bus View Applications	$ 25	$ 25
R2-3	Develop 511 System and Interfaces	$ 300	$ 900
R3	**Regional AVL Deployment and Computer Aided Dispatch**		
R3-1	Concept Planning	$ 55	$ 55
R3-2	Computer Aided Dispatch Needs Assessment	$ 150	$ 150
R4	**Regional Security and Communications Interoperability**		
R4-1	Center-to-Center Communications Needs Assessment and Interagency emergency Communications Plan	$ 150	$ 200
R4-2	Multi-modal Facilities Surveillance Plan	$ 50	$ 50
R5	**Paratransit and Ridesharing Technology Initiative**		
R5-1	Paratransit Technology Plan	$ 95	$ 95
R5-2	Coordinated Purchase And Upgrade Options for Paratransit Reservation And Dispatching Software	$ 50	$ 50
R5-3	Ridematch / Trip Planning Integration	$ 225	$ 400
R5-4	Transit / Paratransit Data Integration	---- TBD * ----	
	TOTAL of all costs estimated:	**======**	**======**
	Regional Projects	**$ 1,240**	**$ 2,065**

* Note:

For these initiatives, implementation costs will be estimate during the Concept Planning project. Concept Planning costs are based on judgment and on experience with similar projects elsewhere.

2. DEPLOYMENT STATUS REPORTS FOR DESIRED OUTCOMES

This chapter contains a compilation of the outcome statements discussed by the RTTG at their January 3rd workshop, including a two-page status report on the progress to date on delivering each outcome within the region as of January 2002. This is a work in progress that will be updated and maintained by the RTTG over the life of the plan.

A standard outline has been used to prepare each of the status reports, which includes the following:

- A description of the outcome and its benefits
- Known conceptual approaches to delivering the outcome
- Building blocks that are in place
- The value of regional coordination
- Implementation issues
- Decisions needed
- Potential next steps.

Please note that the next steps were not intended to be project ideas, because the best project ideas may integrate more than one outcome. However, they do suggest some of the elements that projects might include.

LIST OF OUTCOMES FROM THE JANUARY 3RD RTTG MEETING

Table 1-1 (page 1-4) contains a list of the 14 outcomes for which delivery status and implementation issues were inventoried in order to determine delivery gaps, interoperability issues, capacity or quality concerns, implementation options, and issues that must be resolved before further progress can be made. This list was synthesized from the results of the January 3 RTTG workshop. These outcomes are grouped to show their primary relationship to the transit General Managers' adopted goals.

The RTTG workshop objective was to produce a set of outcome statements that, when inventoried, would yield the most complete view of the current status of transit-related technology systems, and the broadest range of possible applications. The group had strong consensus on some of the outcome statements, but there was less agreement on others, and the consultant team was directed to try to combine some of them to make sure good ideas would not be lost.

Outcome #1 Customers planning a trip can obtain consistent itinerary options from any transit agency that includes all transit, paratransit and rideshare options. (Delivery via telephone, the Internet, downloaded to a PDA, and/or through public interactive terminals, if provided).

DESCRIPTION AND BENEFITS

An information system is developed to provide transit itinerary recommendations when information on travelers and trips is entered. Transit customer support staff can access the application and pass information on to customers, or customers can access it over the Internet or through Internet-aware personal digital assistants (PDAs). If interactive public terminals or kiosks are provided, customers can use the application over the Internet using a customized browser. The application can be accessed via any of the transit agencies' web sites, which each have their own look and feel.

Enhancements to this application could include:

- Expanding the capability to provide route options for all of King, Snohomish and Pierce counties
- Expanding to include ferry and commuter rail options
- Expanding to include rideshare and paratransit options (and possibly for reservations)
- Expanding to identify park-and-ride options (sensitive to average available capacity)
- Developing/improving customer interfaces, especially for PDAs and public access terminals

A trip planning application has several benefits:

- It improves the consistency and quality of information provided to customers
- It increases the efficiency of telephone information operators, which reduces costs
- It makes it easier for customers to find basic information they need to use the transit system
- If expanded to all counties, it provides a single contact to plan for a multi-county trip
- If expanded to rideshare and paratransit, it presents a fuller range of commute options
- It can potentially move paratransit trips to mainline services, which reduces costs substantially

CONCEPTUAL APPROACHES

Providing itinerary options is a challenging information technology problem, but making it available to customers over the Internet is not technically difficult, and most of the needed infrastructure exists. This application and database can be replicated on each agency's web site, or web links can be provided from each agency's site to a common regionally maintained trip planning web server.

Once the application is in place, expanding the geographic scope is a matter of building and maintaining a service database that includes current route and schedule information for all of the agencies and modes that can be included in a recommended itinerary. Expanding to include paratransit options would require additional programming to determine whether paratransit service is available for the trip, what transfers would be needed, and whether mainline service options are competitive for the trip. If a paratransit trip is recommended, a link could be made to a separate application that could make a reservation (if available). Including rideshare options would require developing a software interface between the trip planning application and the regional ridesharing database in order to provide both transit and rideshare options in a unified report.

Providing access to trip planning at transit terminals and public access kiosks is challenging, primarily because of the cost of providing the equipment, power, and communications connection and purchasing equipment that is vandal-proof and can handle intensive use and abuse. If a terminal can be provided, the only additional programming needed is to customize the web browser to provide a direct connection to the transit web-based information, and perhaps to accommodate a touch-screen interface to eliminate the need for keyboards and pointing devices.

WHAT'S IN PLACE?

King County Metro and Pierce Transit have developed and implemented web-based trip planning, and made it available to their telephone information operators. Community Transit has contracted with the same vendor that supplied the trip planning application to Metro (Trapeze) in order to extend trip planning to include the three-county service area.

WHAT VALUE COULD BE ADDED DUE TO REGIONAL COOPERATION?

A chief benefit to customers – getting multi-agency and multi-modal trip planning from a single contact – can only be achieved through regional coordination. Transit coordination requires developing a consistent user interface that accepts the same user inputs, developing a regionally consistent service database that includes all agencies' services, developing a regionally consistent geographic information system database to determine origins and destinations and to support mapping, and successfully coordinating to provide trip planning information over each agency's web site.

IMPLEMENTATION GAPS, ISSUES AND CONCERNS

- Database and web links to allow three-county implementation
- Interface between regional ridesharing and trip planning applications
- Integration of paratransit availability information
- Mechanism to provide trip-planning capability to private information providers (Yahoo, MapQuest, etc.)

WHAT DECISIONS ARE REQUIRED FOR THIS OUTCOME TO BE ACHIEVED?

- Regional agreement specifying scope, roles and financial contributions
- Agreement on enhancements that will be supported regionally, particularly whether to include paratransit and ridesharing trip options.

POTENTIAL NEXT STEPS

- Complete steps to expand trip planning to three-county area: develop consistent regional bus stop, transfer and landmark dataset; test and deploy the system.
- Fund new project to integrate paratransit and ridesharing information into trip planning
- Fund new project to provide park-and-ride location guidance, including average lot occupancy.
- Demonstration of and standards development for delivering trip planning using public access transit information terminals, and/or by providing content to private kiosk providers.

Outcome #2 Customers waiting at bus stops and platforms know how long they will need to wait for the next arrival.

DESCRIPTION AND BENEFITS

Schedule information is provided at the bus stop to help passengers determine how long they will need to wait for the next bus to arrive. By knowing the time, whether the previous bus has passed, when the next bus is scheduled, or whether the next bus is delayed, passenger uncertainty is reduced and therefore the perceived wait time is reduced. This allows customers to make other choices if they miss a bus or if the next bus is running late.

CONCEPTUAL APPROACHES

- Static signs, in place at many bus stops today, display the schedule. Clocks can be provided (currently found at major transit centers).
- Service-related approaches: frequent headways or schedules with departure times at the same times every hour (clock-face headways) reduce the need for schedule information, and improved schedule adherence reduces the uncertainty associated with waiting.
- An intelligent device at the bus stop, equipped with a short-range radio capability and a display, could detect bus arrival times and route/run numbers, and synchronize clocks. Compared to static signs, this would reliably let passengers know what time it is and whether their intended bus has already passed. This requires the capability to detect buses and know what route they are on (similar to bus detection for signal priority), but does not require a vehicle location system. Power would need to be provided at the bus stop. An extension of this approach would be to also provide information transmission between bus stops so passengers at bus stops further down the line could be alerted to the location of an approaching bus. This alternative would require a wireless data communications mechanism.
- A computer with access to vehicle location data can compose a display of bus arrival information and transmit it over a fixed connection or dedicated radio channel to a simple computer display at a bus stop. Another option would be an intelligent device at a bus stop that can monitor vehicle location data over a fixed or wireless connection and can prepare and display the same information. (Passengers could also access this data using a PDA or web-enabled cell phone). The display would provide information on whether a bus is on or behind schedule. If Automatic Vehicle Location (AVL) information is calculated at a central location based on data received from buses every 90 seconds (as in the Metro AVL system), there would be some delay in passing the departure information to the bus stop device, providing less certainty about whether a bus has already passed. Only additional detection at the bus stop can fully address a need for this level of certainty.

WHAT'S IN PLACE?

Transit Watch: At the Northgate and Bellevue Transit Centers, King County Metro and Sound Transit Express bus arrivals and status are shown on LCD computer monitors. The information is derived from Metro's AVL system and picked up by the regional backbone. The web-based display is composed at the UW and delivered over the Internet to a computer running a specialized browser on Metro's network at the transit center. A similar system is in place at the Renton Boeing plant.

BusView: King County Metro and Sound Transit's King County customers can view bus locations on the BusView website (*http://busview.its.washington.edu*).

My Bus: Current bus arrival status is available for thousands of bus stops in King County on the MyBus website (*http:www.mybus.org*). MyBus is also available in a format for use on Internet-enabled PDAs and cell phones.

WHAT VALUE COULD BE ADDED DUE TO REGIONAL COOPERATION?

If next-bus arrival data is provided at places where different operators' vehicles (buses, trains, ferries) meet, it would be desirable to show information on all the buses in a consistent manner. If one operator pursues this outcome, it would be desirable to implement it in a way that would allow other operators to join in incrementally.

If the information is provided through a server to remote terminals, AVL data would need to be provided by each of the operators and placed on the backbone using a consistent protocol. If the information is provided through a short-range radio connection between the bus and the bus stop, buses would need to be equipped with short-range radio capability and programmed to transmit a standard data packet on arrival at the bus stop.

IMPLEMENTATION GAPS, ISSUES AND CONCERNS

None of the region's transit operators have embraced this outcome as a high priority, so there has been little planning to achieve it. As a result, there are many issues to be addressed if this outcome were to become a priority. These issues include:

- AVL systems are not currently planned at all transit agencies.
- Although one has been proposed, there is not yet a USDOT-approved standard for short-range communications, and within the region several different technologies are being used for applications such as signal priority. An 802.11x standard is planned to download bus information at the end of the day as a part of the Smart Card program, and no interface has been considered at the bus stop level.
- If a short-range communications capability were provided at bus stops, high priority would need to be given to identifying other potential uses that could be made of that capability. Examples include downloading data, to identifying disabled riders waiting at bus stops, providing signal priority detection, or supporting a lower-tech AVL system.
- An assessment is needed to ensure that the data protocols used to transmit AVL data over the regional backbone are compliant with TCIP standards.
- There is no standard approach to formatting this data or delivering it to the customer. This is also true for the display device and the communications technology it would use to receive data.
- If King County Metro successfully takes on the operation of these applications and they were expanded to include Pierce Transit, Everett Transit and Community Transit, it would be necessary to decide which agency would take on the responsibility for operating the system as an integrated whole, and licensing issues would need to be resolved.

WHAT DECISIONS ARE REQUIRED FOR THIS OUTCOME TO BE ACHIEVED?

The fundamental decision to be made is whether this outcome is a high enough priority to pursue, either currently or at a later date.

POTENTIAL NEXT STEPS

- Studies: Can commercial wireless data services be used to communicate with bus-stop displays (extending the current TRAC regional AVL study)? How important are the existing applications to current and potential riders, and what would make them more useful or effective?
- Development: What are potential regional standards for bus-stop information systems, and what strategy would allow these systems to be staged incrementally?
- Demonstration: Develop an intelligent bus-stop information system on a demonstration bus rapid transit route or a Sound Transit regional express route. This could be one piece of a larger bus rapid transit ITS demonstration project.

Outcome #3: **Transit, vanpool and paratransit customers can use any transit service and pay for it with a single fare media** that will charge the appropriate fare for the service and their fare eligibility, and allow agencies to more easily reconcile pass transactions.

DESCRIPTION AND BENEFITS

Travelers that ride buses, vanpool vans or paratransit vehicles can use a single fare media (i.e. a fare card) to pay for their transportation services. The same fare media can be used to pay fares on any mode of transportation (bus, van, paratransit) and across jurisdictional boundaries.

There are numerous benefits to having a single card that can automatically determine the amount of fare owed based on trip and fare eligibility (including reduced fares due to age or disabilities, transfers, or other reduced fare eligibility criteria). Transit customers will not need exact change, nor will they be required to know the different fare categories that they may utilize (e.g. peak, off-peak, transfers etc). This would be advantage, given that fare structures are very complex across the different transit agencies in Puget Sound. Transit customers can use a single fare media for multiple transportation modes (including ferry trips). Currently vanpool customers are assigned to a single van, but it's conceivable that transit or vanpool riders could use vanpools on a single trip basis and/or transfer between vans.

Transit drivers are not required to track how much fare is deposited in the fare box – this could reduce the potential for driver/passenger conflicts. Transit agencies could benefit from a reduction in insufficient fare transactions, and they can more easily track and reconcile pass and inter-agency transactions. Vanpool program administration effort can be reduced, both for the riders and agency.

CONCEPTUAL APPROACHES

There are two ways to provide this outcome:

1. Extend existing paper pass products (where applicable and needed) to cover vanpool and paratransit service (note that King County ACCESS vans already accept regular fare media).

2. Implement an electronic fare payment system. The Regional Fare Coordination Project (RFCS), currently under negotiations, includes functionality to use a Smart Card across fixed route and paratransit services, and includes a demonstration of the use of Smart Card technology for vanpool access.

The basic requirements for this type of system are as follows:

- The ability to charge the correct fare for the trip taken (including transfers).
- The ability to handle multiple fare structures for different fare categories, multiple agencies and inter-jurisdictional or multi-agency trips.
- The ability to track ridership, particularly for employer-subsidized transportation.

The Regional Fare Coordination System is currently assessing the feasibility of providing a system as described above, and is considering the following questions:

- What data is collected and stored by the system? Who has access to it and who can modify it? How will it be stored and for how long?
- Who is responsible for customer service, particularly for transfers between different services?
- How will fares be charged, paid for and reconciled?

WHAT'S IN PLACE?

The Puget Pass is a regional transit pass that is currently available. It can be used to ride Community Transit, Everett Transit, King County Metro, Pierce Transit and Sound Transit services. The pass can be purchased for a one-month, three-month or annual time-period. Over 20 different types of passes can be purchased depending on service denominations and pass period.

Community Transit, Everett Transit, King County Metro, Kitsap Transit, Pierce Transit, Sound Transit, and Washington State Ferries are also collaborating to plan and implement the Regional Fare Coordination System, which enables customers to use one fare card on multiple systems throughout the four-county Central Puget Sound area. Smart Card fare collection technology will be used to allow linked trips between transit, ferries and rail and to significantly expand each agency's strategic fare policy capabilities. The participating agencies are in the process of negotiations to select the preferred system provider/operator.

WHAT VALUE COULD BE ADDED DUE TO REGIONAL COOPERATION?

The primary benefits of this system stem from the regional cooperation needed to implement it. A key benefit to customers - the ability to use a single fare media on multiple agencies' services – can only be achieved through regional coordination. The participating transportation agencies have been working together since 1995. This type of system requires that agencies agree on common technologies for all system components, including on-board transaction processors.

A specific benefit would be the ability to coordinate vanpool operations across jurisdictions and vanpool operators. This provides an additional "tier" of flexible transit service that supports fixed route and paratransit service.

IMPLEMENTATION GAPS, ISSUES AND CONCERNS

- A regional Smart Card system does not currently exist, but assuming the RFCS project moves ahead, such a system will be deployed for transit services region-wide.
- A conceptual model for how an integrated payment system would be applied to fixed route services has been developed, however work is still underway on how it might be applied to paratransit and vanpools. Vanpools don't report to a central location where data offloads can occur, and the logistics of collecting fare and offloading ridership data need to be addressed.
- Operational concepts for van-van transfers or the occasional use of vanpools by bus riders are still conceptual at this time, and detailed service strategies have not been developed.
- The Smart Card project will not include integrating the Smart Card and farebox keypad/display. If this is desired, it will need to be provided through a separate effort.
- If the Smart Card system does not proceed, an alternative payment approach will be needed. If desired, the keypad/display, wireless data offload system, and data acquisition system for each base would need to be purchased separately.

WHAT DECISIONS ARE REQUIRED FOR THIS OUTCOME TO BE ACHIEVED?

- Decision on the implementation of the Smart Card system.
- Agreement on enhancements that will be supported regionally.

POTENTIAL NEXT STEPS

- Develop a concept of operations for vanpool and paratransit service fare payment.
- If the Smart Card system proceeds, implement the vanpool demonstration as described in the RFP, and also implement the Smart Card system on all fixed-route and paratransit services (as applicable). (Note: Vanpool programs would be expanded based on the demonstration.)

Outcome #4 Any traveler can obtain transit service information, purchase a pass, or contact customer services over the Internet.

DESCRIPTION AND BENEFITS

A web interface(s) will be developed to allow travelers to purchase transit passes and other fare media via the Internet. Existing on-line customer support capabilities will be enhanced where necessary so that travelers visiting transit agency web sites will be able to clarify requests, receive feedback, and obtain specialized transit information. Existing transit agency web sites will provide a platform from which to access information generated by additional regional Internet applications. Examples of existing web applications that could be regionalized include trip planning, UW-developed systems such as TransitWatch and BusView, the regional ride-match system, and Internet pass sales systems.

Benefits of the additional web interface will include:

- The ability for travelers to interact directly with customer support via the Internet.
- The ability to purchase transit passes and other fare media on-line.
- Increased customer use of existing agency web sites (by providing enhanced user support capabilities of the system).
- Enhanced public perception of regional transit agency services.

CONCEPTUAL APPROACHES

There are several approaches to making regional applications available as part of each transit agency's web page. Each of the following approaches can be mixed and matched:

- A central web server can provide regionally generated content, linked to each local agency's site. A regional server could be set up to use a different web page format (depending on what page the user visited previously) in order to maintain a local agency identity. For on-line sales or other e-commerce applications, the application and server must include secure capabilities for accepting and processing customer orders, and providing order response feedback electronically. A centralized server may be preferable for this purpose.
- A regional database server can be developed and accessed by web applications located on each agency's web site, to provide consistent data while maintaining independence between sites. A high-speed data connection is needed between the web and data server. Secure e-commerce capabilities would need to be provided on each agency's web site.
- Web applications developed by one agency can be designed to be replicated on other agency's sites. For some applications this will require each agency to maintain databases that are standardized and synchronized between agencies.

WHAT'S IN PLACE?

Community Transit, Everett Transit, King County Metro Transit, Pierce Transit, and Sound Transit currently operate Internet web sites offering travelers a variety of transit information to assist with trip planning efforts and travel throughout the region. Each site contains a variety of customer support, schedule and fare information. King County Metro and Pierce Transit currently offer direct links that enable travelers to purchase passes and tickets on-line. Community Transit, Everett Transit, and Sound Transit web sites do not currently provide a direct interface for purchases via the Internet.

The UW has developed several web applications (see Outcome #2) that provide information on bus locations to King County users. King County is negotiating to license and operate these services.

WHAT VALUE COULD BE ADDED DUE TO REGIONAL COOPERATION?

If a mechanism and model for developing regional transit data applications were adopted, it would reduce the need to negotiate every detail of each new application from scratch, making it easier to develop new applications and share existing capabilities.

By paralleling King County Metro and Pierce Transit's efforts to support on-line purchase, the remaining transit agencies could join forces to develop and maintain a region-wide on-line outlet for fare media purchases (including regional Puget Passes). The proposed regional Smart Card project (under negotiations) includes efforts to establish a regional web site to handle Smart Card fare media sales, but does not provide general transit information (see Outcome #4 for more information on providing for regional web-based applications).

IMPLEMENTATION GAPS, ISSUES AND CONCERNS

- Agencies wishing to provide fare media sales over the Internet should consider providing information on other jurisdictions, to assist travelers utilizing more than one mode of transit or transit agency.
- Transit agencies will need to address traveler concerns and questions regarding purchasing passes and tickets via the Internet. This includes the ability to establish secure communications for all transactions.
- Transit agencies will need to provide adequate, knowledgeable staff to respond to customer support and customer service requests in a timely and appropriate manner.
- Existing web sites are primarily focused on the services provided by a specific agency. Systems are required to either integrate existing web sites or integrate the source data to provide regional information.
- Interfaces with existing sales and financial systems will need to be developed.
- Smart Card deployment will likely impact the desired design approach.

WHAT DECISIONS ARE REQUIRED FOR THIS OUTCOME TO BE ACHIEVED?

- Transit agency agreements must be developed to specify the design scope and the implementation of additional web interfaces (in the case of a cooperative region-wide interface). These agreements will describe the roles and responsibilities of each transit agency.
- An approach to providing integrated, regional information needs to be developed. This includes a technical approach to integrating data, development of web site capabilities to access that data, and the establishment of appropriate inter-agency agreements to allow sharing and integration of data (as a corollary to the previous bulleted item).
- Agreement is needed on who will update and maintain any regional data or web application.

POTENTIAL NEXT STEPS

- Investigate requirements for developing individual pass and ticket purchase interface links for the transit agencies that currently lack these capabilities.
- Fund a new project to integrate these agency web pages into the existing on-line purchase interfaces offered through either King County Metro or Pierce Transit.
- Investigate requirements for developing a longer-term region-wide on-line pass and ticket purchase interface.
- Develop a system concept and design for providing other transit information on a regional basis.
- Fund a new project to provide other transit information on a regional basis.

Outcome #5 Customers know that activities in transit vehicles or facilities (stations, centers, P&R lots) are under video surveillance, that facilities are monitored in real-time when appropriate, and that recorded video will be available to support post-incident investigations.

DESCRIPTION AND BENEFITS

Transit vehicles and facilities are monitored with video cameras, and the video is recorded and/or monitored in real time.

There are many potential benefits to video monitoring, including:

- Reduced incidence of theft, vandalism and assault
- Increased sense of personal security while using transit
- Increased ability to identify and prosecute criminals
- Reduced cost for on-site patrolling and monitoring
- Faster notification of and response to incidents, injuries and service disruptions.

CONCEPTUAL APPROACHES

- Providing video surveillance in capital facilities is technically uncomplicated. Video feed can be recorded and/or fed to a live monitor.
- Effectiveness can be increased by incorporating new technologies, including the ability move the camera and zoom or to automatically focus and zoom in response to a motion detector or activation of an alarm or panic button.
- Video surveillance can be provided on buses and recorded for later downloading. Digital recordings have advantages over analog systems, including reduced maintenance and the ability to automate the download process.
- Video surveillance on buses can be monitored at close range over high-speed short-range radio. Due to the speed and bandwidth required, it is technically challenging to provide ongoing live monitoring of vehicles at a greater distance, but it could be possible to monitor a single vehicle in response to a driver or passenger-activated alarm.
- Live monitoring of capital facilities is not technically challenging. It requires the ability to feed the video signal to a monitoring site. The bigger organizational challenge is agreeing on who should monitor which sites, and on how to pay for the monitoring and to coordinate with law enforcement and service control staff.

WHAT'S IN PLACE?

Metro has video cameras in the Downtown Seattle Transit Tunnel that are displayed but not actively monitored at the Metro dispatch center. Everett Transit is installing video surveillance at the new Everett Station. The Everett Police will monitor these and other cameras in downtown Everett. The Tacoma Dome Park-and-Ride and Transit Center includes a complete video surveillance system that is monitored on-site. Link Light Rail stations will have video cameras installed, including cameras to monitor the edge of platforms to detect passengers in the railway, but no decision has been made on whether or where they will be monitored. Funding for cameras at commuter rail stations has been deferred. Community Transit has installed cameras at recently constructed park-and-ride lots that are recorded, but they are not actively monitored in real time. WSDOT has installed fiber-optic cables along most of the region's interstate freeway corridors that could provide communications connection to cameras at most of the region's park-and-ride lots, and at passenger facilities at flyer stops and direct access ramp locations. Fiber lines will also be built into Link and Commuter Rail rights-of-way.

Community Transit has installed video monitoring on its bus fleet that continuously records onto standard videotape using a tape loop. If the recordings are not needed, the tape is written over. Metro is installing digital video surveillance cameras in it bus fleet, which will be able to be downloaded at the end of a service day in conjunction with other bus-based data. To manage serious incidents, Metro's system will also allow remote real time monitoring of a bus within a short distance of the bus by service control or security staff who have specialized monitoring equipment.

WHAT VALUE COULD BE ADDED DUE TO REGIONAL COOPERATION?

Because it is expensive to assign staff to monitor video cameras, there is value in monitoring several cameras at once at a single monitoring location. If that location can be near the point from which transit service and/or security is dispatched, quicker responses to security issues and incidents can be made. If panic buttons are installed for passengers, it is helpful to conduct monitoring at the same place where the alarms are located. This does not need to be coordinated regionally, but there could be a benefit to providing a centralized monitoring facility in each county that would be shared between Sound Transit and local agencies. This would allow all passenger and driver-actuated alarms to come to a single location where monitoring would occur.

If it is desirable to enable transit security, service control and/or local police to be able to monitor in-vehicle cameras remotely, it would be important to choose a standard technology for remote monitoring that would allow transit service serving inter-county trips to be monitored in either county where it operates. If local police are to have this capability, it will be even more important to agree on standards.

There may be value in using WSDOT's fiber-optic system to monitor park-and-ride lots and passenger facilities along freeway rights-of-way. This would require some regional agreement on cost sharing, an upgrade of existing freeway cameras to increase multiplexing, and agreement on where the cameras will be monitored and by whom.

IMPLEMENTATION GAPS, ISSUES AND CONCERNS

- Community Transit noted that their in-vehicle monitoring systems are not always in working order. As a result, if nobody needs to look at the tape, malfunctions are not detected.
- If it is desirable not to preclude the ability to monitor transit vehicles remotely (either short-range or longer-range in response to an alarm), standards need to be adopted so that equipment can be specified that does not preclude adding new capabilities in the future.
- Cameras are not specified inside transit vehicles for Pierce Transit, Everett Transit, Link Light Rail or Sounder Commuter Rail (although Commuter Rail will have conductors on each train). Cameras are included in plans for all commuter rail stations, but funding has been deferred. Cameras are installed in only a few park-and-ride lots or transit centers.

WHAT DECISIONS ARE REQUIRED FOR THIS OUTCOME TO BE ACHIEVED?

There has been little regional discussion on standard expectations and specifications for transit security, and there has been little to no discussion on whether and how cameras should be monitored and how roles and costs should be shared between agencies. The most important steps to be taken in delivering this outcome is a developing a plan and agreement that lays out security objectives, standards, roles, and cost sharing between agencies.

POTENTIAL NEXT STEPS

- Prepare a regional transit surveillance plan that sets standards for surveillance at transit facilities and on vehicles, addresses options for shared or co-located monitoring and dispatch centers, addresses the feasibility of using the WSDOT fiber-optic system for monitoring transit facilities along highways, and prepares a draft inter-local agreement for implementation.
- Provide funding for cameras at Sound Transit bus and rail stations and transit centers.

Outcome #6 Bus drivers can interact with all electronic components on their bus from a single keypad and display.

DESCRIPTION AND BENEFITS

Buses operated by each transit agency contain a variety of on-board electronic systems that require control and operation by the driver. Control includes: initializing each device at the start of a driver's shift; setting initial route, run, trip and other parameters (log-on data) in each device; updating settings to reflect a new run or trip; and powering down devices at the end of the shift. Display includes monitoring the status of each device under control, and the status/messages of any customer information devices. Desirable attributes include:

- Software programmable keys and display that can be customized (i.e. the key assignments and display messages would reflect the specific devices being controlled by each agency). The display would be used to indicate key assignments and provide device status display.
- A multi-page display that allows high-priority functions to be displayed "at the top level", with subsidiary functions accessible through menu selection of sub-pages.
- The ability to control multiple devices from each page of the display. For example, on any particular display page, some keys may be "assigned" to control one device and other keys would be assigned to control other devices.
- The ability to override displays when high-priority messages are received (e.g. change in status of a device, priority operation of one device over another).
- The ability to add new devices and functions as new systems are added on the bus, and to interface with legacy systems that may not be based on industry-standard interfaces.

A single keypad and display would consolidate control and display functions across multiple devices, providing the following benefits:

- Reduced time required for a bus driver to log into all devices and make en-route changes (information need only be entered once).
- Improved accuracy of data entry (less potential for keystroke errors).
- Provision of a single display for all devices, resulting in less clutter in the driver compartment and fewer distractions.

CONCEPTUAL APPROACHES

- Each device on the bus can be adapted or specified to use a common display device for driver interaction.
- A multi-purpose intelligent device can be installed on each bus to handle the driver interface, manage communications between on-board components, provide a common interface to wireless communications and download systems, and provide the computer logic capabilities needed to integrate on-board systems.

WHAT'S IN PLACE?

No transit agencies currently have an integrated keypad and display in place fleet-wide. King County Metro has demonstrated that an off-the-shelf display device (QSI K-60) can run its radio system. Community Transit has considered using a similar device (QSI W-85) to operate their transit signal priority (TSP) equipment and destination sign. Both of these are software-programmable keypad and display systems.

The Regional Fare Coordination System (Smart Card) project includes the provision of a programmable keypad and display that would perform the functions described above. Currently, King County Metro and Community Transit are considering using the proposed device to control onboard functions. In addition to the Smart Card system, King County would use the device to control on-board systems such as the radio/AVL, and potentially the destination sign and passenger information devices. Community Transit is considering using the device to replace or augment the device that will control the Smart Card, TSP and destination sign systems (W-85).

IMPLEMENTATION ISSUES AND CONCERNS

- The assumption is that the Regional Fare Coordination System, currently under contract negotiations, will provide this device. Award of the contract will not be known until the end of 2002.
- Many of the on-board devices have proprietary interfaces and/or have no capability to interface with an external keypad and display. It may therefore not be feasible to interface with all devices.
- There is little commonality between devices and versions between agencies. This may require that multiple interfaces be developed and that functionality be customized for each agency.
- Transit Communications Interface Profiles (TCIP) and other on-board systems standards are currently under development. A device deployed based on the current status of these standards may not be compliant with future changes.
- Processor capabilities, display capabilities, and memory capacity will need to be based on the best estimation of future requirements, as those system details have not been defined.

WHAT VALUE COULD BE ADDED DUE TO REGIONAL COOPERATION?

The development and deployment of keypad and display devices across the combined fleet size of multiple agencies can avoid redundancy and duplicated efforts. Functionality can be developed now to support on-board devices that a specific agency may not be currently operating but may wish to add in the future. An example is developing TSP and destination sign control functionality for Community Transit that could be used by other agencies in the future if they were to add such devices.

King County Metro, Community Transit, and Pierce Transit operate Sound Transit Express buses in addition to their own coaches, and drivers may alternate assignments between services. Implementing the same device and operational procedures across all agencies in the Sound Transit service area will avoid confusion for drivers.

WHAT DECISIONS ARE REQUIRED FOR THIS OUTCOME TO BE ACHIEVED?

If a decision is made to move forward with the Smart Card project, the subsequent decisions will be of a technical nature, such as defining the required functionality and designing devices. If the Smart Card project does not move forward, an alternative procurement approach will be needed.

In either case, the specific devices to be controlled, structure and function of the display and keypad, and interfaces required need to be defined. Modification of legacy systems may also be required to accommodate interfacing with an external device.

POTENTIAL NEXT STEPS

- Monitor the status of the Regional Fare Coordination System procurement.
- Develop individual agency requirements for the keypad and display functionality, and system interfaces to meet agency-specific needs.
- Modify existing systems as needed to interface with an external keypad and display.

Outcome #7: Maintenance staff can download data on bus condition, as well as data from a variety of on-board data systems automatically.

DESCRIPTION AND BENEFITS

Buses operated by each transit agency contain a variety of on-board electronic systems that collect data during operations. Data may be related to ridership (e.g., passenger counts, fare system transactions), revenue (e.g., fare system transactions), device operation (e.g. wheelchair lift operation), security information (e.g., on-board video surveillance), and vehicle and drive train status. Information may also need to be uploaded to the bus (e.g., automated stop announcements and device parameter/configuration data).

An electronic system to transfer data would reduce or eliminate the need for drivers and maintenance staff to generate paper reports. It would also allow ridership, revenue, device configuration, and other data to be transferred without driver or vehicle maintenance staff action.

CONCEPTUAL APPROACHES

Implement a wireless data transfer system based on IEEE 802.11x wireless LAN or dedicated short-range communications (DSRC) technology. The system would include:

- Data transmission equipment on the bus to connect and interface with on-board systems, either discretely or through an on-board vehicle network.
- Implementation of wireless access points at transit bases, to upload and download data when the bus is in the yard.
- Possible implementation of wireless access points at transit centers or along key routes to upload/download data en-route.
- Interfaces to an agency-wide area or local area network (LAN) to allow data to be transferred to the associated maintenance management, data collection, or other central computer systems.

Vehicle maintenance staff would have a wireless handheld device (e.g. a “palm pilot” with a wireless network interface) that would interface with the transit base network. This device would replace paper for displaying vehicle status information, and allow onboard devices to be interrogated.

WHAT’S IN PLACE?

All agencies operating GFI fareboxes (King County Metro, Community Transit, Pierce Transit and Sound Transit) have a wireless (infrared) system to download farebox data. This is a proprietary system not suitable for broader data transfer needs.

The Regional Fare Coordination System (Smart Card) project includes provision of a wireless data on/off-load system that would perform the functions described above. King County Metro also expects to soon implement a system using Cisco equipment (compatible with the Institute of Electrical and Electronics Engineers (IEEE) 802.11b specification for wireless communications) to download data from a new onboard closed circuit television (CCTV) security system.

No agency has a wireless handheld diagnostic device as described above.

IMPLEMENTATION ISSUES AND CONCERNS

- IEEE 802.11 represents the computer industry standard for wireless data transfer. DSRC is the standard adopted under the ITS National Architecture. The two are not compatible.

- Computer "hacking" of IEEE 802.11 has proven to be a problem. With any wireless system, there is the potential to intercept communications and "hack into" an agency's network through the wireless interface.
- There is potential for interference and performance degradation in both the IEEE 802.11 and DSRC frequency bands due to the proliferation of devices.
- Many existing on-board devices have proprietary interfaces and/or have no capability to interface with a wireless data transfer system.
- The concept of using a handheld wireless device to display vehicle maintenance information is new and unproven.
- 802.11 may not allow for reliable data transfer while the vehicle is in motion. An interface with a data radio system may be required (e.g. King County AVL).
- Existing GFI fareboxes must be downloaded at the time the cashbox is emptied with a key. This data offload process will remain separate.

WHAT VALUE COULD BE ADDED DUE TO REGIONAL COOPERATION?

Developing and deploying the wireless system across the combined fleet/base size of multiple agencies can realize economies of scale. A common system would allow data to be transferred at any base, transit center, or at other locations. This is important, given that many express and other services cross geographic boundaries and service areas.

WHAT DECISIONS ARE REQUIRED FOR THIS OUTCOME TO BE ACHIEVED?

If a decision is made to move forward with the Smart Card project, the decisions required will be of a technical nature (i.e., the specific technology, equipment, and configuration to support data transfer needs). If the Smart Card project does not move forward, an alternative procurement approach may be needed. Note that for the CCTV project, King County Metro will be implementing an IEEE 802.11 system.

A decision is required on whether to adopt computer industry standards (i.e. IEEE 802.11) or existing ITS National Architecture standards (i.e. DSRC).

Concepts for using a wireless handheld device to display and manage bus information need to be further developed.

POTENTIAL NEXT STEPS

- Monitor the status of the Regional Fare Coordination System and King County CCTV surveillance system projects
- Decide on whether to adopt IEEE 802.11 or DSRC standards. If the former is adopted, an approach to demonstrating National Architecture conformance will need to be developed.
- Develop an on-board system architecture to support data transfer. Alternatives include communicating with each on-board device individually or routing all communications through a single device.
- Develop a concept for using a wireless handheld device to display vehicle data and interface with an agency's network.

Outcome #8 **Transit agencies obtain archival data** that includes consistent passenger counts to reconcile pass transactions, as well as passenger loading and schedule adherence profiles.

DESCRIPTION AND BENEFITS

Managers and planners have the service-based information they need to adjust routes, schedules and bus assignments to respond to changing passenger demand and traffic conditions, and to complete federal and state reporting needs. Transit agencies can exchange reasonably consistent passenger count and farebox data to ensure that fare reconciliation between agencies is accurate and fair.

Field data that is most useful for planning and scheduling includes average passenger load per trip at a peak load point, and average travel time and incidence of late or early operation. It is also useful to have loading and speed profiles by route segment, to identify portions of routes requiring more or less service and bottlenecks where speeds or running times should be increased. These can be captured manually through screenline or on-board surveys or can be automatically collected. If they are automatically collected, then systems to automate download and presentation can improve the quality and detail of the data and reduce collection and inputting costs. The benefits of improved planning and scheduling are significant and can result in more responsive and reliable service, improved utilization and reduced crowding, reduced costs, and increased cost effectiveness.

Transit agencies have agreements in place to compensate one another when one agency accepts another's transfer or pass for payment. Some agencies also participate in Flex-Pass programs, where an employer agrees to pay for the cost of transit trips made by their employees in return for all employees being given a multi-agency transit pass. This program requires consistent accounting between agencies that can be disaggregated by employer or passholder groups. Finally, Sound Transit contracts with other agencies for bus service, and passenger count data are required to determine the reimbursement needed. The benefit of accurate counting is primarily the perception that transactions between agencies and reimbursement rates between agencies and employers are fair.

CONCEPTUAL APPROACHES

- Farebox Data: To collect data on fares paid, a variety of means is possible, including counting the money at the end of each day, requiring drivers to count paying passengers by fare type at the time they pay, or automatically collecting data as fares are paid using registering fareboxes.
- Passenger Count Data: Drivers can collect passenger count data as fares are paid (excluding passengers using Seattle's free-ride zone). Passengers can also be surveyed occasionally along an entire route using an on-board survey or at a single location from outside the bus. Counts can also be derived from pass sales and farebox data based on survey data, or they can be collected by automatic passenger counters (APC). APC data can be collected by sensing pressure on steps entering and leaving the bus, but this method can't be used on low-floor buses where steps have been eliminated. Infrared sensors can also be used to count passengers automatically.
- Operating Data: A variety of operating data can be collected from bus subsystems. Platform hours can be collected from odometers. If vehicle location data is available on a bus, vehicle speeds can be reported and correlated with passenger loading data on APC-equipped buses, and reported by trip and route segment.
- Archival Storage and Reporting: Every agency will store and report data using its own database management system. If data to be shared between agencies is stored using a consistent definition for shared data fields, transferring data between agencies is not technically challenging. If farebox, counting, operating and schedule-based data are stored in a single database, elements can be combined to provide robust planning and scheduling support.

WHAT'S IN PLACE?

Community Transit, King County, Sound Transit, and Pierce Transit all use registering (GFI) fareboxes, and Everett Transit is buying them. If the Smart Card program is implemented, the swipe readers on these fareboxes will no longer be used. Data from the farebox and Smart Card systems may be integrated "after-the-fact", once both have been offloaded to a database system.

Metro has outfitted a portion of its fleet with APC equipment that is rotated among different scheduled trips, to collect data on each trip periodically. Metro's APC system captures location data as a bus passes wayside signpost detectors, and captures speedometer and odometer data to associate passenger load data with specific route segments.

WHAT VALUE COULD BE ADDED DUE TO REGIONAL COOPERATION?

Sound Transit requires archival data from the operators they contract with, to bill for services and refine routes and schedules in response to customer demand and operating conditions. All agencies that use PugetPass, offer multi-agency flex-pass programs, or accept each other's transfers on a reimbursable basis require accurate usage and fare data for the reimbursement process to have credibility. The need for regional coordination is primarily to define the data that agencies need to share and to agree on common data collection and validation standards.

IMPLEMENTATION GAPS, ISSUES AND CONCERNS

- Some transit signal priority systems will require transit agencies to report passenger-load data in real time to gain priority at an intersection. This would require APC data collection and the ability to make that data available to the signal controller. Real-time passenger-load data, if available, may also be valuable to dispatchers and service control staff.
- To correlate loading data with locations along a route, bus location data must also be available on the vehicle.
- Multi-agency Flex Passes are intended to provide employers with data on their employees' actual transit use, to determine the pass reimbursement cost. This requires each agency to track and report pass use disaggregated by employer using a magnetic strip or Smart Card reader on the bus.
- The reporting and display of archival data for planning purposes could be improved by providing a visual profile of loading, speed, and transfer activity along a route. This would pinpoint mismatches between service levels or fleet mix with demand, unproductive route segments or diversions, transfers that could be optimized, or recurring delays that could be reduced or mitigated.

WHAT DECISIONS ARE REQUIRED FOR THIS OUTCOME TO BE ACHIEVED?

Each agency needs to decide whether APC data collection is a priority.

POTENTIAL NEXT STEPS

- Develop consistent standards for reporting the performance of each Sound Transit route, to be prepared by each of its local service providers. This would include a route performance monitoring system and integrating passenger loading and speed data to create a visual route profile of each ST route.
- Develop a standard specification for automatic passenger counting that can be included in vehicle purchases or a block purchase agreement.

Outcome #9 Fuel consumption and emissions are reduced.

DESCRIPTION AND BENEFITS

New buses are specified and purchased that consume less fuel and produce fewer harmful or noxious emissions. Benefits include cleaner air and less reliance on scarce natural resources, as well as compliance with federal requirements, which have been strengthened recently to further restrict fine particulates found in diesel emissions. Side benefits may also be possible, including possibly replacing troublesome dual-powered buses in the downtown Seattle transit tunnel with a different technology, and potentially reducing noise or increasing bus life, depending on the chosen technology.

CONCEPTUAL APPROACHES

- Alternative fuel vehicles are available and in use in the region. They require specially equipped buses and may require specialized fuel delivery and additional maintenance.
- "Clean diesel" buses are also available and in use. These are standard diesel buses equipped with exhaust filters to remove particulates.
- Hybrid diesel-electric buses have been demonstrated and are under active consideration in the region. There are several approaches to building hybrid buses. The approach currently under consideration uses both diesel and electric motors to power the bus. The diesel motor provides most of the power in freeway applications, and the electric motor provides more power in arterial settings. The diesel motor provides power for the electric motor. A different approach is to use the diesel motor exclusively to provide power to the electric motors. The manufacturer claims that these buses reduce fuel consumption and emissions by up to 60%.
- Electric trolleybuses are in place in Seattle. They eliminate bus emissions and oil consumption and are quiet, but are not widely manufactured and require overhead wires that are expensive to build and maintain, and not always welcomed in neighborhoods.
- Fuel cell technology is getting a lot of attention, but fuel cell buses are not yet commercially available and may be expensive until they become widespread. Fuel cells convert hydrogen and oxygen from the air into water, releasing energy in the process. One approach to fuel cells requires buses to be fueled with hydrogen, which is explosively combustible, so care must be taken to provide for safe delivery systems and storage on the bus and to prepare and respond in accidents. A different approach uses a "fuel reformer" on the vehicle to utilize hydrogen contained in hydrocarbon fuel. This approach also results in lower fuel consumption and emissions than traditional diesel-powered engines.

WHAT'S IN PLACE?

Pierce Transit has purchased a fleet of vehicles powered by compressed natural gas (CNG). Pierce Transit plans to equip its entire fleet with CNG buses by 2003. Sound Transit has also purchased CNG buses using the Pierce Transit procurement for ST service operated by Pierce Transit.

Metro has a fleet of electric trolleybuses, which it is now upgrading by placing existing motors and electrical components into new bus shells. There are no plans for major expansion of the trolleybus system. Metro has also purchased "clean diesel" buses and plans to continue supporting that technology. Metro and Sound Transit are committed to demonstrating and likely purchasing hybrid diesel-electric buses in the near future. The diesel engine would idle during low-speed operation, which may allow these buses to operate in the downtown Seattle bus tunnel and replace the existing fleet of dual-powered buses.

WHAT VALUE COULD BE ADDED DUE TO REGIONAL COOPERATION?

It's not clear that there is value in standardizing bus technologies between agencies, but there may be value in jointly demonstrating new technologies or developing cooperative purchase agreements.

IMPLEMENTATION GAPS, ISSUES AND CONCERNS

Bus technologies and the infrastructure needed to service alternative technology buses are being addressed at the industry level because vehicle technologies are difficult to address regionally. Before most agencies will risk investing in a risky new technology, a demonstration of the technology is usually needed to better assess risks and infrastructure needs before plunging ahead.

WHAT DECISIONS ARE REQUIRED FOR THIS OUTCOME TO BE ACHIEVED?

Each agency needs to assess the risks, costs and benefits of investment in new technologies, as well as the agency's commitment to reducing emissions and fuel consumption and its aversion to risk. In order for Sound Transit to do this, it needs to negotiate vehicle specifications with the local transit service operator with whom they contract. If this outcome is a priority, Sound Transit may be able to make it more desirable or less risky for other operators by funding demonstrations, agreeing to cover unexpected maintenance or retrofit costs, or factoring reduced emissions and/or fuel consumption into decisions on how contract service will be allocated between agencies.

POTENTIAL NEXT STEPS

- Provide funds to speed demonstration of hybrid diesel-electric buses, or to expedite or expand the purchase of an initial fleet to replace the dual -powered fleet.
- When fuel cell technology approaches readiness, fund a demonstration project, perhaps for a circulator bus in a downtown area.

Outcome #10: Passengers experience shorter travel times and operating costs are reduced because arterial signal delay is reduced for transit vehicles.

DESCRIPTION AND BENEFITS

By implementing a transit signal priority (TSP) system, buses may be given "priority" over other vehicles when approaching TSP-equipped traffic signals. A typical TSP system will have the capability to detect the presence of a transit vehicle and to request priority treatment through an interface with the traffic signal controller, in order to adjust the cycle length of the applicable traffic signal. Depending on the priority strategy and current conditions (i.e. whether the bus is behind schedule), a request for priority could result in the traffic signal advancing to the green phase sooner than programmed, or remaining in the green phase longer than programmed.

Benefits of transit signal priority (TSP) include:

- Improved schedule reliability and reduced trip time
- Vehicle service-hour reductions and reduced operating costs
- Increased customer confidence, ridership, and revenue

CONCEPTUAL APPROACHES

There are various TSP strategies, including pre-emptive signal operations (unconditional priority), fixed priority strategies (buses are always given priority if late), and "intelligent" bus priority (the priority request is weighed against other impacts). Depending on the strategy selected, the TSP system may include some or all of the components described below:

- Transit Vehicle Detection or Prediction: Bus arrival at an intersection can be detected using infrared optical detectors or a variety of radio frequency transponders. Alternatively, some manufacturers are now using AVL systems to "locate" transit vehicles and predict arrival times. Some systems also include entrance and exit detection, to determine that the transit vehicle has passed through the intersection and that the priority request can be cancelled.
- Priority Assessment: If transit signal priority is conditional on schedule adherence or bus passenger loading, several approaches are possible. Passenger loading and schedule adherence data can be transmitted to the signal controller box from the bus or a central location, where a pre-processor connected to the signal controller can determine whether to indicate a priority request. If loading data is not needed, schedule data can be loaded into the pre-processor directly. Bus priority requests can also be disabled by the bus driver when operating ahead of schedule, or by on-board systems based on schedule and loading.
- Signal Control Strategy: Traffic signal controllers can be programmed to react to priority requests based on a number of inputs, and can provide the logic to determine the best strategy based on current conditions. Example strategies include extending a green phase extension, inserting a new phase, and beginning a green phase early. This logic can be located roadside or centrally.

WHAT'S IN PLACE?

- King County Metro has recently completed a priority system in partnership with the City of Seattle on Rainier Avenue. The county is also working with the cities of Seattle and Shoreline on another TSP project on Aurora Avenue North, and has several other funded TSP projects throughout the county. King County's TSP system uses radio-frequency-based transponder/readers and roadside units that interface with the local traffic signal controller.

- Community Transit is currently working with WSDOT to deploy TSP in the City of Lynnwood and in other areas of Snohomish County. The TSP system deployed here is identical to the equipment being installed in King County.
- Pierce Transit uses an Opticom priority system as the foundation of its TSP system. This system uses infrared detection and results in a second-tier priority request that is sent to the signal controller. The local signal system controllers then determine if priority can be given to the bus. The controller technology throughout the region varies, and as a result the TSP control strategies being deployed also vary from basic-priority strategies (e.g., extension of the loop detection system) to more complex strategies.
- Sound Transit buses operating in the Pierce County area will have Opticom installed by the end of 2002. This strategy is being deployed for consistent operations and enhanced traffic movement in the downtown Tacoma area for Regional Express buses, especially in areas close to I-5 access such as Tacoma Dome Station and the main transit stop on Commerce Street.

WHAT VALUE COULD BE ADDED DUE TO REGIONAL COOPERATION?

Transit services that operate across service area boundaries could use signal priority systems. This could be particularly important for Sound Transit services (operated by King County Metro, Community Transit and Pierce Transit) that cross jurisdictional boundaries in the three-county area. By adopting standards across agencies, it's possible that equipment procurement and software development costs could also be reduced and economies of scale realized.

IMPLEMENTATION GAPS, ISSUES AND CONCERNS

- Need for Open Standards: The region has not adopted a standard for TSP communications, although the emerging dedicated short-range communication (DSRC) standard for radio frequency (RF) transponders may be applicable. For signal priority, RF transponders (King County and Community Transit) and optical systems (Pierce Transit) are used to communicate with signal controllers. These two deployments are not interoperable.
- Interoperability between the range of existing signal systems (all with different capabilities) is a concern.
- Transit signal priority systems for buses must be integrated into the larger traffic signal system. Benefits for transit must be balanced against the needs of other modes, including general traffic, pedestrians, cyclists, emergency vehicles, and heavy and light rail.
- Transit agencies do not control signal timing, signal equipment, automobile driver behavior, land use, and pedestrian behavior (jurisdictional and "real life" operational issues).

WHAT DECISIONS ARE REQUIRED FOR THIS OUTCOME TO BE ACHIEVED?

- A regional (preferable but not mandatory) agreement on common technology and system architecture. Since significant investments have been made in competing approaches due to local concerns and constraints, an agreement on standards could focus on standards for upgrading to "next generation" technology in the future, especially if joint procurement for on-board systems integration equipment is considered. Transit providers and local traffic engineers must both agree on the technology and the signal priority strategy to be deployed.
- A regional decision on the need for interoperability of TSP systems in the region.

POTENTIAL NEXT STEPS

- Continued advocacy of transit signal priority to local traffic engineering staffs and decision-makers, and continued expansion of current TSP programs.
- Dialogue on regional TSP interoperability for TSP deployment.
- Sound Transit could study or agree on standards for TSP for its services.

Outcome #11: **Bus drivers, dispatchers and service control staff have the information they need to maintain reliable service**, including managing incidents and breakdowns, eliminating early operation, and controlling bus schedule adherence and headways.

DESCRIPTION AND BENEFITS

Bus location data is used to help service control staff identify and manage vehicle and fleet operations, and help bus drivers routinely maintain their position relative to schedules or service headways. When a transit vehicle is disabled or involved in an incident or emergency, the vehicle location is known (typically displayed on a dispatch monitor) to help dispatch assistance quickly and accurately. In the case of an emergency, a driver can trigger a silent alarm, and emergency assistance can be called without the driver calling attention to him or herself by using the radio to identify the vehicle location. The location of the vehicle relative to schedule, timed transfer points, and other vehicles is known and can be used to manage the operation of the fleet in real time. Unusual operating conditions such as a bus running ahead of or significantly behind schedule can be detected at central dispatch without the need for the driver to call in.

Bus drivers control their location in traffic using a printed run card and by comparing scheduled timepoints with actual departure times using their watches or a radio-calibrated clock. If accurate vehicle location data is available on the bus, it is possible to provide feedback to the driver (with a warning indicator or text display) if the bus is ahead of or behind schedule. For headway-based routes, it is more important to maintain even headways than to adhere strictly to a schedule, and if the location of the vehicle leading and following is known, a headway indicator can be displayed which allows the driver to maintain even spacing between vehicles.

Routine management of vehicle schedules and headways and management of exceptions and incidents contribute to transit service's overall reliability. The benefits include reduced passenger wait times, improved transfer coordination, reduced crowding (due to reduced vehicle "bunching"), better utilization of the fleet, faster travel times, and improved customer service. Indirectly, reliability contributes to transit ridership and cost-effectiveness.

CONCEPTUAL APPROACHES

- This outcome requires a vehicle location system to be in place. AVL systems can collect location data by registering the points when a vehicle passes a wayside detector or "signpost", using a global positioning system (GPS), or through some combination of these methods along with compass and odometer (dead reckoning) systems. The accuracy of the location varies by technology used, and the degree to which it can monitor position as the vehicle travels the route.
- Specialized software is needed to allow a dispatcher to use AVL data to manage service. The software needs to display the location including streets and landmarks, and needs to be integrated with several other data sources to be most useful (including schedule data, vehicle assignments, operator assignments, geographic reference points, etc.). The software has to have the capability of matching abstract data such as latitude and longitude to the street network.
- To use location data to improve schedule adherence, this data needs to be calculated on the bus or conveyed to the bus over a wireless connection. For headway control, the schedule status of the leader and follower need to be conveyed over a wireless connection.
- If vehicle location is available remotely through a wireless or Internet connection, incidents can be managed remotely at an alternative emergency dispatch center or by field supervisors.

WHAT'S IN PLACE?

King County Metro has a computer-aided dispatch/automatic vehicle location (CAD/AVL) system in place that is used to control service on Metro bus routes and Sound Transit routes operated by Metro. This AVL system calculates vehicle location at a central computer based on information gathered from buses every 90 seconds (e.g., the last signpost passed and the number of axle clicks that have occurred since – a form of dead reckoning). The CAD/AVL system was developed in-house at Metro and is capable of showing bus location, highlighting early or late buses, and automatically windowing in on buses calling on the radio or indicating an alarm. Washington State Ferries also has a vehicle location system that uses GPS data to monitor vessel location, and displays locations on a dispatch screen. Kitsap Transit installed a vehicle location system on a trial basis, but discontinued the trial when the vendor went out of business. Other transit agencies do not have vehicle location systems or computer-aided dispatch.

Metro's AVL system is not precise enough to be useful to drivers to help control schedules, and bus location information is not available on the bus, because it is processed and calculated centrally and there is no mechanism for buses to request location information from the AVL system. The Smart Bus demonstration used GPS data to generate location data on the bus that is precise enough to enable bus stop announcements as a bus approaches a zone. This information could be made available to the driver along with runcard timepoint or schedule/headway adherence using the driver's interface display.

WHAT VALUE COULD BE ADDED DUE TO REGIONAL COOPERATION?

Each transit agency dispatches its own services, so little regional cooperation or consistency is needed if the primary goal is for each agency to manage its own fleet. However in the long run, each agency can benefit by regionalizing investments made by a single agency, or through demonstrating and developing systems that can be used by other agencies.

Regional cooperation and coordination, and integration of the AVL systems (or use of a common system) would benefit routes where different agency services overlap or intersect. Sound Transit contracts with local transit agencies for its bus services, and may have an interest in specifying the capabilities of its service providers to provide reliable service. Sound Transit has not settled on how different lines of business will dispatch and how light rail and buses in the tunnel will be dispatched in a coordinated manner.

IMPLEMENTATION GAPS, ISSUES AND CONCERNS

- AVL is not yet present at all agencies.
- The accuracy of AVL data; the ability to reference it to routes, schedules, stops; and the ability to correlate data with schedules and headway tables will be factors in determining whether data can be made useful to improve operations.
- The subsystems required for this outcome also contribute to other outcomes, and need to be specified in order to satisfy a variety of uses or potential uses.

WHAT DECISIONS ARE REQUIRED FOR THIS OUTCOME TO BE ACHIEVED?

- Are the benefits of AVL worth pursuing at the region's smaller transit agencies?
- Is it a priority to help bus drivers manage their schedule and headway?

POTENTIAL NEXT STEPS

- Identify local and regional AVL needs, and conduct a communications and technology analysis.
- Demonstrate a system on ST coaches operating regionally.
- Deploy the system in a staged manner and integrate it with other ITS initiatives.

Outcome #12 Customers on transit vehicles or waiting at major bus stops and train stations receive a visual and audible announcement of the stop location or arriving service.

DESCRIPTION AND BENEFITS

The Americans with Disabilities Act (ADA) requires that announcements be made so visually-impaired transit riders will know when the bus or train they are waiting for has arrived, or when traveling on the vehicle to know whether their destination is the next stop. Transit agencies require drivers to announce major stops, and to announce what bus they are driving when they see a blind person at a bus stop, but not all drivers comply (one agency reported only 25% compliance) and not all visually-impaired passengers can be easily identified from the driver's seat. To meet ADA requirements, one option is to automate these announcements.

CONCEPTUAL APPROACHES

- The least expensive option is to monitor and supervise bus drivers to raise compliance with ADA. This is not cost-free, since ongoing supervision is needed and it is unlikely to be 100% effective, but compliance could be raised significantly.
- Programming a bus to automatically announce its destination using an external speaker is not difficult technically. It requires a system that plays a pre-recorded announcement whenever the door is opened and is synchronized with the destination sign.
- The Smart Bus demonstration program deployed a more sophisticated passenger announcement system: It used a GPS system, a compass, the odometer, and a detailed electronic map to determine the bus location relatively precisely. When approaching a bus stop, the Smart Bus played a pre-recorded announcement identifying the stop, and made an announcement on external speakers identifying its destination.
- If an intelligent device at the bus stop provides next-bus arrival information, it is not technically difficult for the same device to provide an audible announcement in advance of the bus arrival.

WHAT'S IN PLACE?

- Most local transit buses have PA systems, including external speakers that the driver can actuate when needed (in practice rarely used).
- Commuter rail trains have conductors on board who make announcements at every stop, and station attendants who make announcements when a train has arrived.
- Bus drivers are required to make announcements at major stops. Ferryboat crews also make passenger announcements. Some drivers and crew are diligent and others are not.
- Light rail is specified to include devices to automatically announce train arrivals both visually and audibly. It is not clear from the specifications whether these devices will indicate arrivals as they happen, or whether they will show the estimated time of the next arrival.
- Metro and Sound Transit have demonstrated the Smart Bus, which combines a number of sophisticated on-board systems including systems needed to provide passenger announcements.

WHAT VALUE COULD BE ADDED DUE TO REGIONAL COOPERATION?

- Demonstrating new technology can reduce risks to other agencies of adopting new technology.
- Joint purchasing can increase clout with bus manufacturers for unusual specifications.
- Sound Transit may wish to adopt standards for ADA compliance on its contracted bus services.
- Consistent GIS mapping will allow coaches to provide announcements on multi-county trips.

IMPLEMENTATION GAPS, ISSUES AND CONCERNS

- Making passenger stop announcements requires the capability to identify a vehicle's location relatively precisely. Metro's existing computer-aided dispatch (CAD) system will need to be adapted to work with location data, which is reported and calculated differently than the existing signpost-based AVL system.
- Care will be needed in ensuring that a stop announcement system is specified to meet or not to preclude the full range of desired uses.
- If a technology similar to the SmartBus is selected, there is considerable work needed to prepare and maintain sufficiently accurate electronic mapping of every bus route and variation in order for automated stop announcements to work. Whenever service or streets are altered, mapping needs to be updated to reflect the changes.

WHAT DECISIONS ARE REQUIRED FOR THIS OUTCOME TO BE ACHIEVED?

Each agency will need to weigh the benefits and costs of automated announcements. Sound Transit will need to decide whether automated announcements will be a standard feature of ST service.

POTENTIAL NEXT STEPS

- Demonstrate a system that will make an audible announcement of a bus destination outside the bus when the door is opened.
- Develop a regional specification and block purchase of Smart Bus equipment that can be used by any transit agency in the region.
- Conduct a bus rapid transit ITS model deployment project that includes the accelerated purchase of equipment that includes passenger announcements as a standard feature.

Outcome #13 Paratransit customers can reserve or cancel and receive reservation confirmations for multi-county trips with a single phone or Internet contact.

DESCRIPTION AND BENEFITS

Paratransit customers can make a single contact to reserve a trip, even if it crosses the paratransit provider's service boundaries. This contact can be made over the phone, TDD (Telecommunications Device for the Deaf), or by using the Internet. Achieving this outcome would provide better customer service to disabled customers. Depending on the solution proposed, there might also be other benefits.

Paratransit is a labor-intensive service by nature, and this service now costs some transit agencies nearly 10% of their budgets. Metro has calculated that an increase of only 0.1 rides per hour on paratransit service would save the agency $1M per year in operating costs. Cost savings may be achieved if the solution to this outcome results in a streamlined or automated reservation process, or if Internet access makes it easier for patrons to cancel reservations that they no longer require. One agency reported that up to 20% of reservations go unused and are often not canceled beforehand, resulting in extra cost, delay and underutilized services.

CONCEPTUAL APPROACHES

- The simplest approach to providing a single contact for paratransit trips between service areas is to develop an agreement among agencies specifying that the person who takes the original customer contact is to coordinate with dispatchers at both agencies to make reservations for the entire trip. This is currently done, but not consistently.
- The simplest approach to providing Internet access to make and confirm reservations is to allow customers to send email to the dispatch center, perhaps using an automated form on a web page that would prompt for needed information. This will only work if the customer can provide all of the information needed to make the reservation. Reservations for a trip that is made regularly could be simple to handle this way.
- An automated dispatch system could enter a reservation without intervention and respond to the customer in real time. This requires sophisticated software, but the vendor that provides paratransit reservation and dispatching software to all of the region's paratransit providers offers a module with this capability. If dispatching could be automated for trips that are made regularly, these trips could be reserved in real time (either over the Internet or through an automated phone tree), leaving dispatchers free to handle more difficult situations, including non-recurring trips, inter-county trips and people who can't easily use automated systems.
- In theory, automated dispatching systems at different agencies could be programmed to communicate with each other electronically to make reservations across service boundaries. This requires that different agencies use compatible reservation systems, and that a single geographic mapping system be shared between agencies. An existing software vendor also offers this capability.

WHAT'S IN PLACE?

Each of the region's transit agencies provides for paratransit services differently. Some are publicly operated and others are contracted to other agencies or private operators. Different agencies have different eligibility requirements for paratransit service, but the region's transit agencies have a reciprocity agreement that calls for each to honor fares from other agencies' paratransit riders. All paratransit agencies use the same vendor for reservation and dispatching software (Trapeze). Calls are taken over the phone, and the call-taker uses the Trapeze software to reserve the trip. The software also handles assigning the reservation to a van and dispatching the service.

No agencies have purchased software to automate the reservation process or to provide automated telephone or Internet access. Metro plans to purchase AVL for paratransit services and mobile data terminals for paratransit vans, to improve routing and dispatching in real time.

WHAT VALUE COULD BE ADDED DUE TO REGIONAL COOPERATION?

All of the region's transit agencies have an interest in improved paratransit productivity. An agreement between agencies that allows one agency to act as a reservation agent for the other in reserving trips crossing service boundaries would be an added value. Automated reservation systems and Internet access to reservation systems primarily benefit the individual operator, but regional benefits may be gained if new technology can be demonstrated, or if a regional purchase agreement reduces costs or increases purchasing clout.

IMPLEMENTATION GAPS, ISSUES AND CONCERNS

- Although all of the region's operators use software from the same vendor, there is no coordination between agencies when software is upgraded; so different agencies are not always using the same version of the software.
- No major research has been done on whether the products available to provide for automated or coordinated reservations will meet local paratransit operators' needs, and the amount of work to localize the software is unknown.

WHAT DECISIONS ARE REQUIRED FOR THIS OUTCOME TO BE ACHIEVED?

- Is it feasible or cost-effective to develop automated reservation systems that can be accessed electronically?
- Will the region's paratransit providers benefit by cooperating to coordinate software purchases and the development and demonstration of dynamic dispatching tools?

POTENTIAL NEXT STEPS

- Conduct a study of regional paratransit system technology needs. This study could address the following: coordinated or joint procurement for reservation and dispatch software; needs and standards for automated and/or coordinated dispatching and related communications and display equipment; and automated Internet or telephone reservation and notification systems (e.g., to automatically call before regularly scheduled trips to confirm or cancel the reservation before the trip is dispatched).
- Develop a regional agreement on coordinating dispatch for trips crossing service-area boundaries.
- Convene an inter-agency working group to coordinate software purchases and upgrades for paratransit reservation and dispatching.

Outcome #14 **Transit and paratransit dispatchers, drivers and service control staff can contact each other from any location** with minimal delay and can be connected directly to emergency services or connecting service controllers, including during an area-wide emergency. (This outcome could also include alternative dispatch locations with full communications to emergency services.)

DESCRIPTION AND BENEFITS

By the nature of their work, transit and paratransit dispatchers, drivers, and service control staff are situated in separate (and mobile) locations. However, they still need to be in contact with each other, both continuously and in emergency situations. The more these groups communicate with each other, the more smoothly traffic incidents and emergencies can be handled.

CONCEPTUAL APPROACHES

Each transit agency currently operates its own radio/dispatch system. These systems are in general not interoperable (different equipment and different frequencies). Varying levels of integration are possible to achieve the outcome. The conceptual approach involves three primary system capabilities:

- Ability to communicate between dispatch centers, including transit and emergency operations during major events such as snowstorms, earthquakes, terrorist events, etc. All communications would be center-to-center, designed to allow the dispatchers to monitor event status region-wide, and coordinate service between agencies. New center-to-center communications links can be provided without replacing radio systems used for field communications.
- Provision of back-up communications for each agency. Most agencies can invoke a secondary dispatch center (fixed or mobile) if needed. This would provide similar functionality for all agencies if needed, and equip Emergency Operations Centers with transit radio capabilities.
- Provision of interoperable communications with other agencies. This would include center-to-center and field-to-center communications. This would allow the dispatcher at one agency to communicate with the fleet of another agency during a major catastrophe. Radio systems would need to be compatible, and policies and procedures established for what the second agency could do (given that they would not have all the fundamental dispatch information for the first agency's fleet). Such functionality may be restricted to only providing emergency response to the vehicle, and could conceivably be provided by a back-up emergency radio system.

WHAT'S IN PLACE?

- Community Transit has two-way voice and data communications between the transit vehicle and the transit center tracking and dispatch. Community Transit plans to upgrade their radio system by 2001. Their mobile supervisors also communicate with the tracking and dispatch center via two-way radio and cellular phone. Paratransit schedule changes are communicated to drivers over the voice radio.
- King County Metro has two-way voice and data communications between the transit vehicle and the transit center tracking and dispatch. King County Metro also supports on-board fixed-route schedule management by using mobile supervisors who communicate with the transit agency's tracking and dispatch center via two-way radio. King County Metro's supervisors are also able to communicate with Pierce Transit's supervisors. Paratransit schedule changes are communicated to drivers over the radio. Metro plans to study its radio system upgrade needs and switch to a different frequency range. They will also enhance their current system of paratransit voice radio with mobile data terminals (MDTs).

- The Kitsap Transit dispatch center can communicate with drivers while en-route using their two-way radio system.
- Pierce Transit manages schedule performance through two-way voice and data communications between the transit vehicle and the transit center tracking and dispatch. Pierce Transit also supports on-board fixed route schedule management by using mobile supervisors who communicate with the transit agency's tracking and dispatch center via two-way radio. Pierce Transit supervisors are also able to communicate with King County Metro's supervisors. Paratransit schedule changes are communicated to drivers over MDTs. Paratransit drivers are also able to communicate to dispatch over the radio.

WHAT VALUE COULD BE ADDED DUE TO REGIONAL COOPERATION?

Regional cooperation has already started between King County Metro and Pierce Transit supervisors. They have seen the value of having the agency closest to the situation respond. Because Sound Transit crosses county boundaries, it makes sense to have an integrated communications system, and it provides an ideal opportunity to leverage investment in new infrastructure to provide regional benefits. An increased focus on safety and security warrants more seamless communication capabilities between agencies and with regional enforcement and emergency operations.

IMPLEMENTATION GAPS, ISSUES AND CONCERNS

- A critical gap is the definition of a regional transit operations concept. The region needs an operational concept that defines how the transit agencies intend to operate together and what enhancements to the current communications systems are necessary to support that operation.
- There are sizable incompatibilities with the existing radio systems, but the level of regional compatibility needed will be directly reflected in the operational concept.
- There has been a significant investment in the current communication system and King County Metro and Community Transit are in the midst of significant system upgrades. Funding for significant modifications and/or upgrades is limited.

WHAT DECISIONS ARE REQUIRED FOR THIS OUTCOME TO BE ACHIEVED?

Define an operations concept that addresses inter-agency center-to-center (including enforcement agencies), field-to-center, and field-to-field connections.

POTENTIAL NEXT STEPS

- Agreement by the transit agencies on the common goal and implementation timeline.
- Agreement on a coordinated technology approach.
- Supplement ongoing upgrades of Community Transit and King County Metro systems and provide alternative communication solutions to reflect regional integration goals.

3. INITIATIVE AND PROJECT DESCRIPTIONS

Based on the potential next steps identified in the Outcome Status Reports (Chapter 2), the consultant team produced an initial set of projects. The RTTG and Sound Transit staff added to this list, and then combined and filtered the list to create a shorter, revised set of initiatives that (1) address the identified goals and outcomes, and (2) best complement technology plans and budgets at each of the member agencies. The RTTG settled on seven initiatives at the June 27, 2002 RTTG meeting, with concurrence from Sound Transit staff. The seven initiatives are:

S1: Sound Transit Corridor Technology Initiative

S2: Sound Transit Security Technology Initiative

R1: Regional Transit GIS

R2: Common Web and Phone Interface

R3: Regional AVL Deployment and Computer Aided Dispatch

R4: Regional Security and Communications Interoperability

R5: Paratransit and Ridesharing Technology Initiative

Initiatives S1 and S2 are Sound Transit initiatives, to be funded from the ST Technology Fund and applied to Sound Transit services. These initiatives are consistent with regional goals and high-priority outcomes. Initiative S1 will provide the blueprint and much of the infrastructure needed for other agencies to build on, if they choose to provide real-time passenger information.

Initiatives R1 through R5 are regional initiatives. These initiatives will help integrate technology programs at the region's transit agencies, to improve efficiency and provide a consistent and "seamless" customer experience between agencies and modes.

INITIATIVES AND PROJECTS

For each initiative, a series of projects has been identified. In most cases, the first project is Concept Planning, to work out implementation issues and agreements between agencies, specify the precise architecture and components required, and develop a detailed scope of work and cost estimate for subsequent implementation projects. Costs for Concept Planning projects have been estimated based on judgment and experience with similar projects elsewhere. These projects need to be funded and carried out before other projects within each initiative are programmed. Implementation costs for the regional initiatives will need to be updated over the life of the plan.

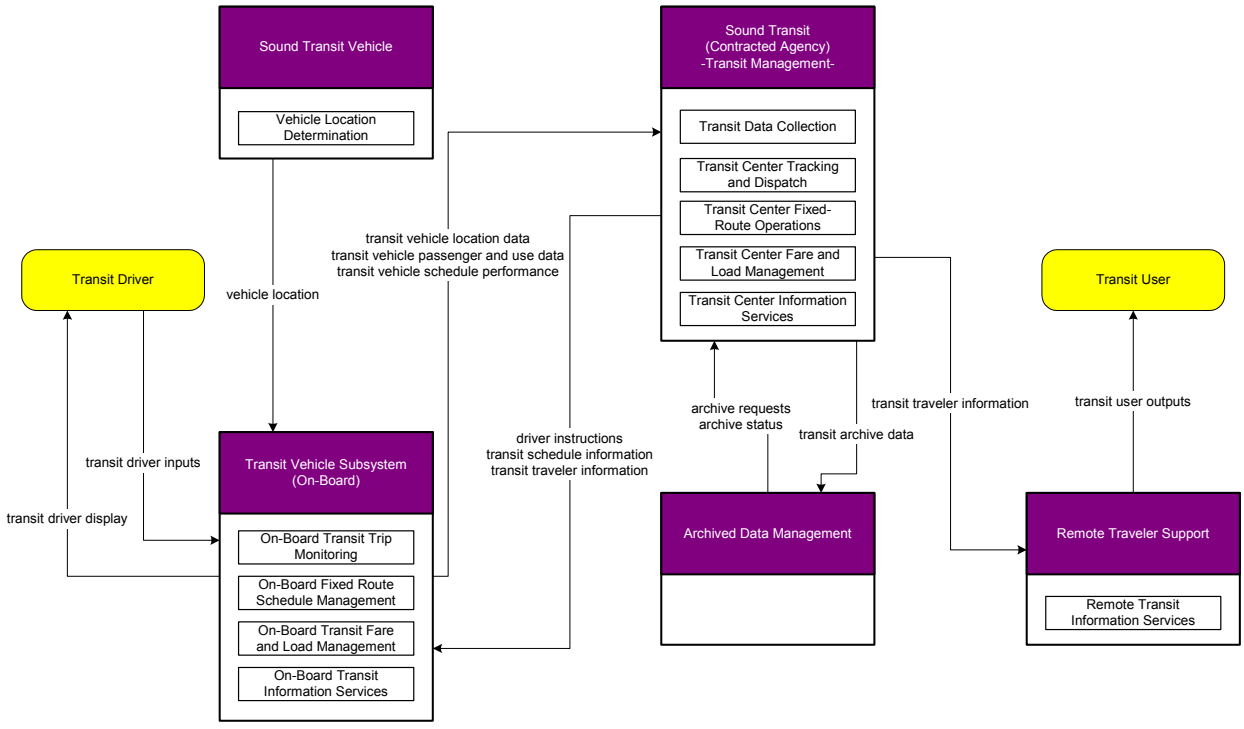
Regional initiatives and projects are not currently included in local transit agency budgets. Before these projects can be initiated, agencies need to agree to work together on them, and to either align their budgets to pursue a project together using agency funds, and/or apply together for grant funding. These initiative and project descriptions are intended to provide a starting point for discussions between agencies that will lead to bettering communication to achieve outcomes that are regionally significant.

Initiative **S1**	**Sound Transit Corridor Technology Initiative**
DESCRIPTION	The purpose of this initiative will be to provide technology support for bus rapid transit-type technology applications, and to provide next-train arrival information for commuter rail. These applications include transit signal priority and real-time passenger information on buses and at stations. In accordance with the goals of RTTG, this group of projects will improve many areas including Customer Service / Satisfaction, Efficiency, Speed / Reliability, and Accessibility.
DESIRED OUTCOMES	♦ Increased level of customer service with the capability to give customers real-time information. ♦ Augment safety and security with the ability to monitor buses en-route and respond to emergency situations. ♦ Increased efficiency and trip time reliability with the capacity to monitor route schedule adherence and implement adjustments as necessary. ♦ Increase speeds and maintain or improve schedule reliability in specific corridors.
FUNCTIONAL ELEMENTS	♦ Automated stop announcements ♦ Next-bus/train arrival information ♦ Transit Signal Priority (TSP) ♦ Automatic passenger counting
PHYSICAL ELEMENTS	♦ Automatic Vehicle Location ♦ On-board signs/announcements ♦ Off-board signs / hi-tech stops ♦ TSP equipment ♦ Passenger counting equipment ♦ Other on-board equipment, e.g. mobile data terminal (MDT) or vehicle logic unit (VLU) ♦ Communications
PROJECTS	S1-1. Concept Planning (fleet, corridors, systems) S1-2. Sound Transit Corridor Demonstration Project (functional elements to be determined by corridor) ♦ I-90 - To Issaquah - To Bellevue Way ♦ I-5 - South to Lakewood - North to Everett S1-3. Sound Transit Signal Priority Program S1-4. Real-Time Passenger Info Expansion to Other ST Corridors

Project **S1-1**	**Sound Transit Corridor Technology Initiative**: **Concept Planning**
DESCRIPTION	This project will create a plan to implement automated stop announcement, next-bus arrival information, and transit signal priority capabilities along regional / express bus routes. This project will focus on defining technology requirements and component design specifications for all elements of Regional Express services.
MAJOR SCOPE ELEMENTS	1. State-of-the-Art Report on Real-Time En-route Passenger Information and Signal Priority at Transit Agencies 2. Wayside Information Data Presentation Options Assessment 3. Public Opinion Research on Passenger Data Needs and Bus Rapid Transit Concepts (focus group, bus stop surveys) 4. Accessibility Options Assessment 5. System Architecture and Specifications 6. Technology Demonstration Corridor Implementation Plans 7. Signal Priority Corridor Assessment and Prioritization 8. Signal Priority Corridor Implementation Plans 9. ST Corridor Technology Concept Plan Final Report
LINKAGES WITH OTHER PROJECTS	This project is a pre-requisite to all of the other projects under this initiative. This project is dependent on, or will need to include a portion of, concept planning for the AVL/CAD Initiative (Initiative R3).
PROJECT PHASES	Real-time passenger information and signal priority assessments can be scheduled independently.
AGENCY ROLES	
ST:	Project lead and owner
Other Agencies:	Members of Steering Committee; and operators of affected services and facilities (steering committee members operate services/facilities?). Concurrence between ST and Steering Committee needed at major milestones.
COSTS	Approximate Total: $175,000 – 200,000

Project **S1-2**	**Sound Transit Corridor Technology Initiative: Corridor Technology Demonstration Project**
DESCRIPTION	This project will plan and implement automated stop announcement and next-bus arrival information along two priority regional / express bus routes.
FUNCTIONAL ELEMENTS	The functional elements included in this project will be determined during the conceptual planning stage (see Project S1-1). The functional elements may include one or more of the following: ♦ Automated stop announcements ♦ Next bus/train arrival information ♦ Automatic passenger counting
PHYSICAL ELEMENTS	The functional elements selected for implementation for each corridor will dictate the physical elements required. The physical elements will include one or more of the following: ♦ Automatic Vehicle Location ♦ On-board dynamic signs, announcements ♦ Wayside dynamic signs, announcements ♦ Passenger counting equipment ♦ Other on-board equipment (e.g. MDT, Communications, VLU) ♦ Central control systems ♦ Communications

ARCHITECTURE



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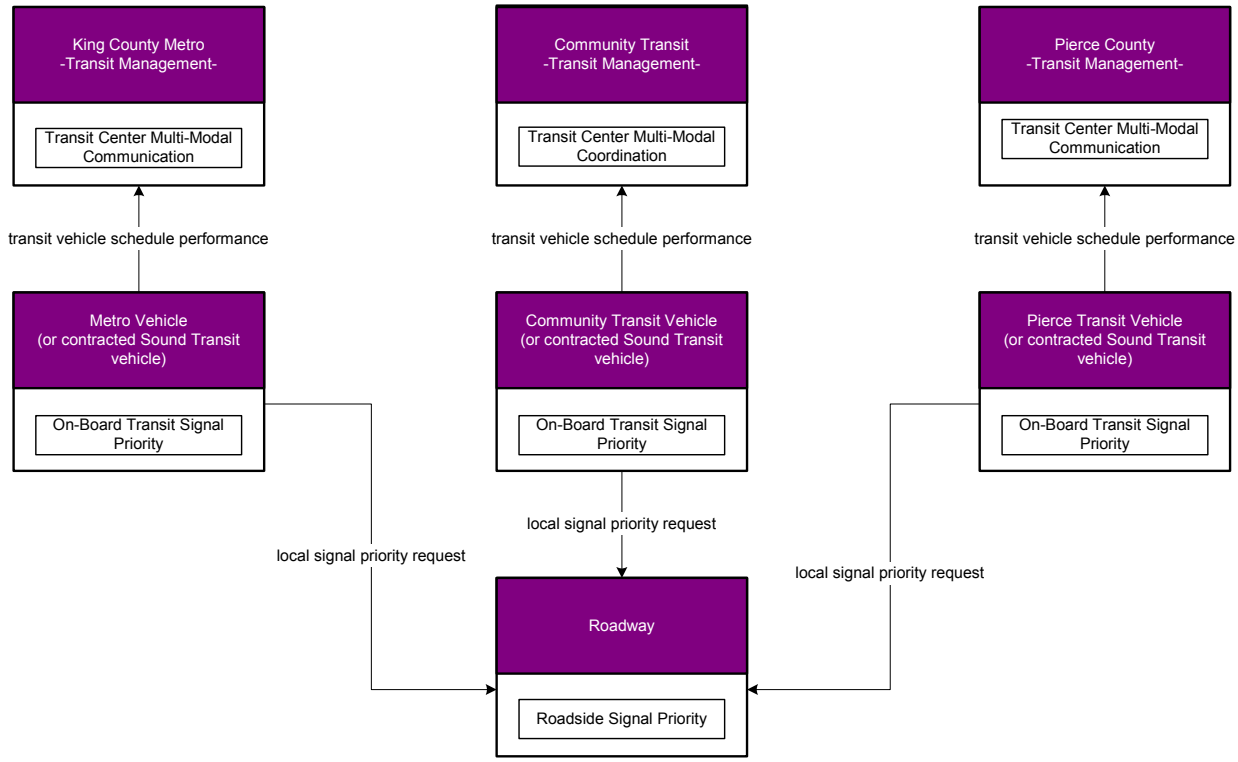
(Project S1-2, continued)

LINKAGES WITH OTHER PROJECTS	This project is dependant on the Concept Planning project (See Project S1-1). Project S1-4 will follow after the completion of this project. This project is also associated with the Regional AVL/CAD project (Initiative R3) and coordination is required.	
PROJECT PHASES	The following corridor projects can be implemented in separate stages (not in any priority or sequential order): ♦ I-90 - Seattle to Issaquah - Seattle to Bellevue via Bellevue Way ♦ I-5 - Seattle to Lakewood - Seattle to Everett	
AGENCY ROLES	***IMPLEMENTATION***	***OPERATION & MAINTENANCE***
ST:	ST will be responsible for managing system design and implementation	ST in conjunction with contracted operators. O&M Memoranda of Understanding (MOUs) will need to be developed to describe roles and responsibilities
Other Agencies:	PT, CT and KCM will operate the service under contract to ST. They will participate in system design and will implement elements of the project. Specific roles will be determined during concept planning (project S1-1).	PT, CT and KCM will provide operations and maintenance of bus equipment under contract to ST.
COSTS	***IMPLEMENTATION***	***OPERATION & MAINTENANCE***
	$7,273,000	To be determined during concept planning

Project **S1-3**	**Sound Transit Corridor Technology Initiative**: **Sound Transit Signal Priority Program**
DESCRIPTION	This project will fund expansion of local transit agency signal priority programs to provide improved speed and reliability for selected regional / express bus routes.
FUNCTIONAL ELEMENTS	The functional elements included in this project will be determined during the conceptual planning stage. The functional elements may include one or more of the following: ♦ Bus detection systems ♦ Signal control strategies and coding ♦ Signal control and optimization
PHYSICAL ELEMENTS	The functional elements selected for implementation for each phase will dictate the physical elements required. The physical elements will include one or more of the following: ♦ On-board vehicle identification tags or devices ♦ Wayside detection devices ♦ Signal controllers ♦ Communications ♦ Complementary street improvements and channelization may be required.

ARCHITECTURE



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(Project S1-3, continued)

LINKAGES WITH OTHER PROJECTS	This project is dependant on the Concept Planning project to determine the priority corridors for signal priority treatments (See Project S1-1). High priority will be given to signal priority treatments that will reduce delay on corridor demonstration routes.	
Project Phases	Project staging will be defined during concept planning (see Project S1-1). Corridors will be prioritized and divided into immediate-term and longer-term implementation horizons.	
AGENCY ROLES	***IMPLEMENTATION***	***OPERATION &MAINTENANCE***
ST	Responsible for project management, corridor prioritization and funding	ST will provide funding for share of O&M. O&M MOUs will need to be developed to determine share.
Local TransitAgencies:	Responsible for implementation (with local/state traffic control staff).	Responsible for overseeing transit share of O&M expenses (with local/state traffic control staff).
COSTS	***IMPLEMENTATION***	***OPERATION &MAINTENANCE***
	$1,755,000 will be set aside for this program by Sound Transit	To be completed once project details are determined

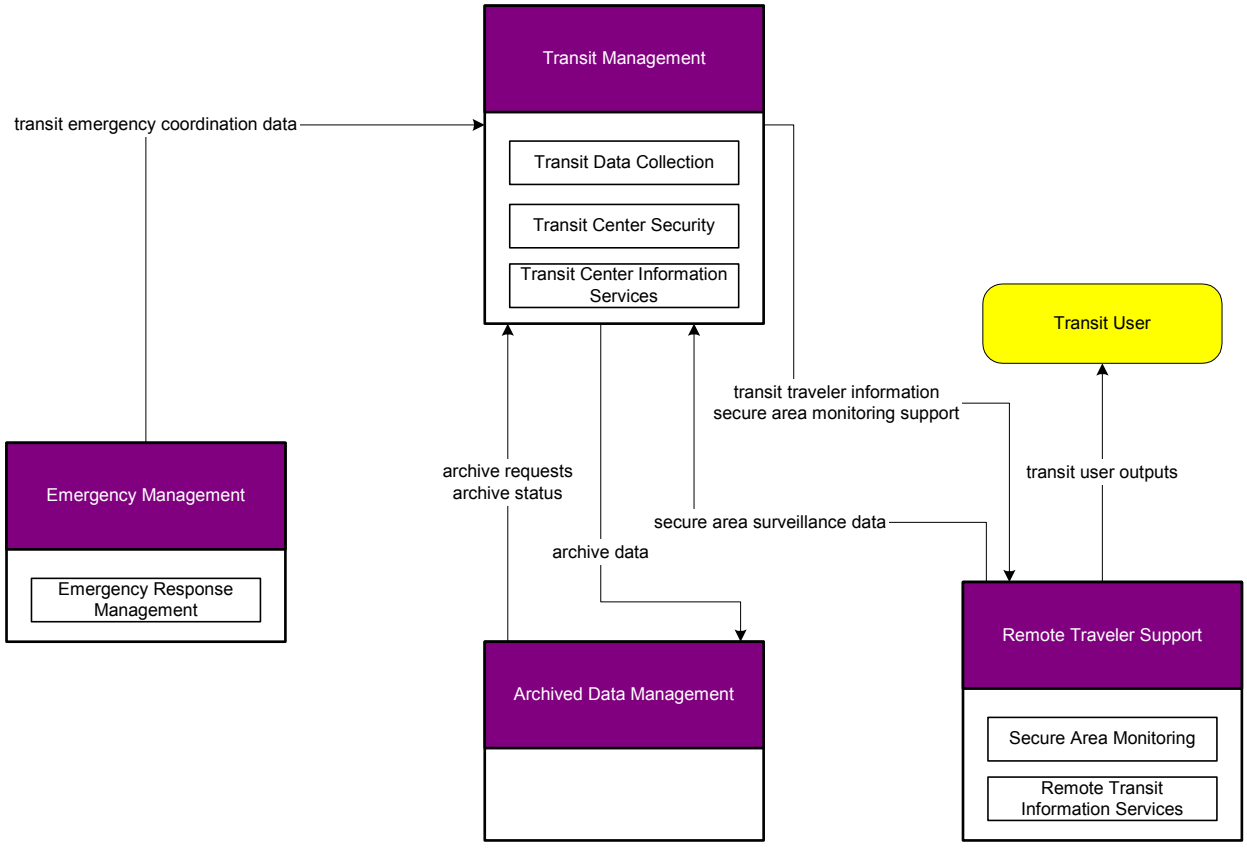
Project **S1-4**	**Sound Transit Corridor Technology Initiative**: **Expansion to Other ST Corridors**	
DESCRIPTION	The purpose of this project will be to leverage the experience, expertise and standards developed in Projects S1-1 and S1-2 to implement automated stop announcement, next-bus arrival information, and transit signal priority capabilities along additional ST corridors.	
FUNCTIONAL ELEMENTS	The functional elements included in this project will be determined during the conceptual planning stage. The functional elements may include one or more of the following: ♦ Automated stop announcements ♦ Next bus/train arrival information ♦ Transit signal priority ♦ Automatic passenger counting	
PHYSICAL ELEMENTS	The functional elements selected for implementation for each phase will dictate the physical elements required. The physical elements will include one or more of the following: ♦ Automatic Vehicle Location ♦ On-board signs/announcements ♦ Off-board signs / hi-tech stops ♦ TSP equipment ♦ Passenger counting equipment ♦ Other on-board equipment (e.g. MDT, Communications, VLU) ♦ Central control systems ♦ Communications	
ARCHITECTURE	See architecture diagrams for Projects S1-2 and S1-3.	
LINKAGES WITH OTHER PROJECTS	This project will follow the Concept Planning Project (See Project S1-1) and the ST Demonstration Project (See Project S1-2 This project is also associated with the Regional AVL/CAD Project (Initiative R3) and coordination is required.	
PROJECT PHASES	TBD. It is assumed that this project would occur after 2005 in a second phase of the Sound Move Project.	
AGENCY ROLES	***IMPLEMENTATION***	***OPERATION & MAINTENANCE***
ST:	Responsible for funding and overall project management. Responsible for implementation at ST-owned facilities.	ST is responsible for operating and maintaining ST-owned facilities. ST will fund a share of O&M costs for service provided by local transit agencies. MOUs will be needed.
Local Transit Agencies:	PT, CT and KCM will operate the service under contract to ST. They will implement elements of the project.	PT, CT and KCM will provide operations and maintenance of bus equipment under contract to ST
COSTS	***IMPLEMENTATION***	***OPERATION & MAINTENANCE***
	Scalable depending on results of corridor demonstrations.	To be determined.

Initiative **S2**	**Sound Transit Security Technology Initiative**
DESCRIPTION	Establish agency standards for video surveillance and monitoring. Assess the benefits of co-locating surveillance, security dispatch, and service control dispatchers, and determine benefits and costs of consolidating security between ST lines of business and developing security partnerships with local transit agencies or police. Develop implementation plans and cost estimates for surveillance of Sounder stations and on-board Regional Express buses. Provide funding to augment current security technology budgets for each line of business.
DESIRED OUTCOMES	♦ Consistent surveillance and monitoring standards for all lines of business. ♦ Improved security at Sounder stations, consistent with Board direction, including ability to monitor operations at Sounder platforms and provide automated announcements and variable message signage. ♦ Improved security on Regional Express buses, by maintaining a video record that can be viewed after an incident to identify offenders.
FUNCTIONAL ELEMENTS	♦ Real-time monitoring or recording needs ♦ VMS and PA announcement for passengers ♦ On-board surveillance of specific Regional Express routes
PHYSICAL ELEMENTS	♦ CCTV camera placement identification and monitoring requirements ♦ LED message board placement at Sounder Stations ♦ Quantity and best placement of Public Announcement (PA) system ♦ Identification of central monitoring and equipment/staff needs for Sound Transit ♦ Interagency architectures and communications needs assessments or requirements.
PROJECTS	S2-1. Develop standards for surveillance and monitoring to apply across Sound Transit lines of business, and assess co-location options for dispatch and monitoring functions. S2-2. Prepare functional requirements for Closed Circuit Television (CCTV), Public Announcements (PA), and Variable Message Signage (VMS) at Sounder stations, including rough order-of-magnitude cost estimates and implementation schedules S2-3. Assess needs and prepare function requirements for on-board bus surveillance of Regional Express routes, including rough order-of-magnitude cost estimates and implementation schedules

Project **S2-1**	**Sound Transit Security Technology Initiative** **Agency-wide Security Guidelines and Co-location Options**
DESCRIPTION	This work will develop surveillance and monitoring standards to apply across the Sound Transit lines of business, to determine the level of surveillance and the type of monitoring, storage and retrieval of surveillance data required in different circumstances. Options for co-locating security and service-related dispatching and monitoring functions will be assessed, including with other agencies and across lines of business.
MAJOR SCOPE ELEMENTS	1. Survey current transit surveillance practices and experiences with co-location of transit dispatch, and transit police and security monitoring at peer agencies (interviews and literature review). 2. Develop surveillance and monitoring options, strategy and agency standards. 3. Develop and assess options for co-locating dispatching and security monitoring functions between agencies and ST lines of business. 4. Prepare cost estimate for Regional Express on-board video surveillance (project S2-3) 5. Prepare project final report
LINKAGES WITH OTHER PROJECTS	This project is closely tied to Initiative R4, which addresses regional security and communications operability needs. This project is focused on establishing standards specific to Sound Transit. Policy issues and standards are a prerequisite to estimating needs for Sounder and Regional Express in Projects S2-2 and S2-3.
PROJECT PHASES	Scope element 3 can be conducted on an independent timeline from Scope elements 1 and 2 (shown above under Major Scope Elements).
AGENCY ROLES	
ST:	Project lead and owner. All lines of business would participate on Steering Committee.
Other Agencies:	Any promising co-location options that involve other agencies would be explored through direct agency-to-agency meetings.
COSTS	Approximate Total: $55,000

Project **S2-2**	**Sound Transit Security Technology Initiative** **Sounder CCTV/PA and VMS Plan**
DESCRIPTION	This project will provide expert knowledge and assist in drafting requirements for application of Closed Circuit Television (CCTV), public address (PA), and variable message signs (VMS) at Sounder Commuter Rail Stations. It will develop rough order-of-magnitude estimates for station capital improvements and operating costs.
FUNCTIONAL ELEMENTS	♦ Video surveillance at stations ♦ Video monitoring and/or retention ♦ Public address and dynamic signage
PHYSICAL ELEMENTS	♦ Video cameras ♦ Monitoring and recording equipment ♦ Control room ♦ Public address / variable signs ♦ Communications

ARCHITECTURE



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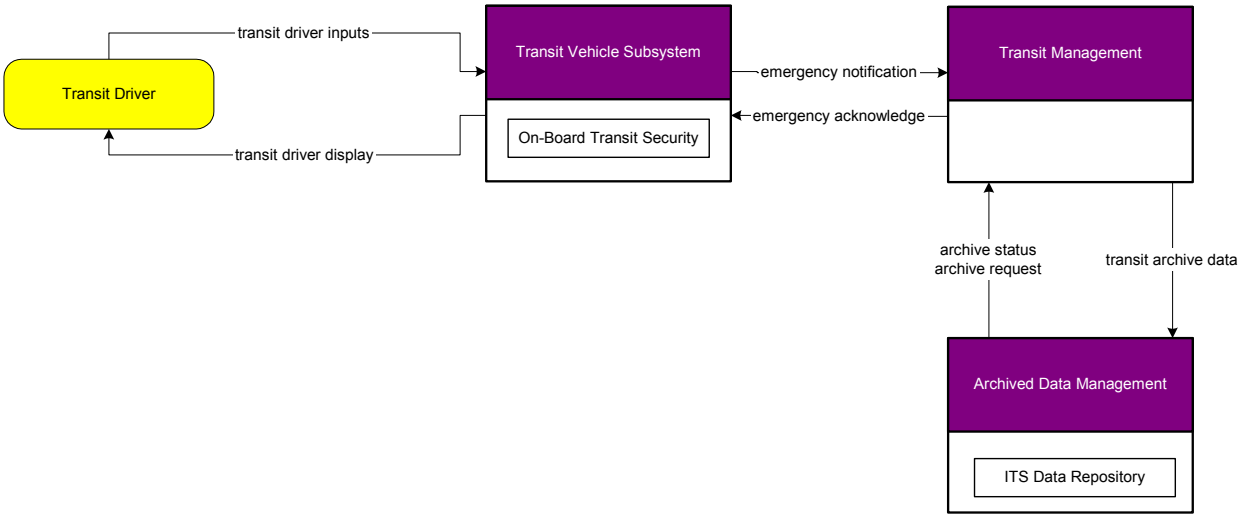
(Project S2-2, continued)

LINKAGES WITH OTHER PROJECTS	Dependent on Project S2-1 to establish surveillance and monitoring level-of-service standards. Related to Project S1-1, which will survey wayside equipment options that could be applied in this project.	
PROJECT PHASES	1. Develop plans, requirements and cost estimates for CCTV, PA and VMS at Sounder Stations 2. Final design, purchase and installation of CCTV, PA and VMS capabilities.	
AGENCY ROLES	***IMPLEMENTATION***	***OPERATION & MAINTENANCE***
ST	Project lead and owner, implementer.	Responsible for all O&M.
COSTS	***IMPLEMENTATION***	***OPERATION & MAINTENANCE***
	Phase 1 costs are covered under existing ST commuter rail budgets. $1,000,000 is set-aside for Phase 2; Detailed Phase 2 costs will be developed during Phase 1.	O&M costs for Phase 2 to be developed during Phase 1.

Project **S2-3**	**Sound Transit Security Technology Initiative** **Regional Express On-Board Video Surveillance**
DESCRIPTION	This task will provide expert knowledge and assist in drafting requirements for application of on-board surveillance on Sound Transit Regional Express buses, and develop rough order-of-magnitude estimates for capital and operating costs.
FUNCTIONAL ELEMENTS	♦ On-board video surveillance and recording ♦ Off-line data download capability ♦ Optional: close-range real-time monitoring capability ♦ Video data retention and recall
PHYSICAL ELEMENTS	♦ On-board video camera ♦ Digital or analog video recorder ♦ Data download system (if digital) ♦ Short-range communications
ARCHITECTURE	
LINKAGES WITH OTHER PROJECTS	Related to projects at each local transit agency to develop this capability. ST would equip their buses with equipment used at each agency.
PROJECT PHASES	Local transit operators operate ST service. Implementation at each local transit agency can be a separate phase of this project.

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(Project S2-3, continued)

AGENCY ROLES	***IMPLEMENTATION***	***OPERATION & MAINTENANCE***
ST	Project and funding lead	Funding for O&M on ST services
Local Transit Operators	Operate ST service; would purchase equipment using existing specifications	Responsible for all O&M, charging back to ST.
COSTS	***IMPLEMENTATION***	***OPERATION & MAINTENANCE***
	$35,000 to develop requirements and rough order of magnitude cost estimates.	NA

Initiative **R1**	**Regional Transit GIS**
DESCRIPTION	This initiative will develop the capability to share static geographically based data between transit agencies. Based on a needs assessment of potential users and uses of multi-county geographical information, a method of data exchange, updating and maintenance will be proposed to share and maintain GIS data for a variety of uses, including stop announcements, trip planning, paratransit reservations, modeling support, etc. The result could include developing a unified transit Geographic Information System (GIS) database to which individual agencies would publish data and subscribe to data published by others. It could also result in a means of storing and translating data to facilitate regular importing and exporting of data from one agency's GIS system to another.
DESIRED OUTCOMES	♦ All agencies use consistent and current geographic data to support transit applications that are regional in scale. ♦ Improved consistency and quality of GIS information on a region-wide basis by requiring systematic and uniform data formats and exchange protocols. ♦ Improved data for regional planning purposes. ♦ Providing the foundation for new and existing regional applications that provide transit information to the public.
FUNCTIONAL ELEMENTS	♦ Regional transit route information ♦ Regional stop location information ♦ Regional rail information
PHYSICAL ELEMENTS	♦ Common data structure ♦ Centralized database (optional) ♦ Interfaces - Database to database - Access to central database (optional)
PROJECTS	R1-1. High-level concept planning and assessment of current regional efforts R1-2. Development of data requirements, interfaces, data structures and GIS system standards. R1-3. Deploy/build database and/or data exchange applications - Beta test - Roll-out by agency

Project **R1-1**	**Regional Transit GIS** **High Level Concept Planning**
DESCRIPTION	This project will assess the range of potential users and uses for regional geographically oriented transit data, and create a plan for sharing, updating and maintaining GIS data between agencies. Options to be examined include creation of a common regional GIS databank to which individual agencies can publish data and subscribe to data published by others, or agreement on a plan to facilitate translation, importing and exporting of GIS data between agencies. The plan will examine transit data layer requirements as well as base map needs, and data formats will be consistent with national standards for spatial data. The planning effort would also identify operations and maintenance requirements. Agency GIS staff and users will oversee the concept development process and make recommendations for future projects under this initiative.
MAJOR SCOPE ELEMENTS	1. Prepare report on the status of regional transit-related GIS data, including systems and ongoing efforts at transit agencies, WSDOT, the PSRC and others. Identify differences in data definition and format. 2. Identify data that must be regionally consistent to support operations, public information, and transit data systems. Identify and assess options for data exchange to allow each agency to use consistent regional data 3. Propose a preferred data exchange method, including agency roles and responsibilities, and develop an agreement between agencies. 4. Prepare refined scope of work and cost estimates for Projects R1-2 and R1-3.
LINKAGES WITH OTHER PROJECTS	This project will act as a pre-requisite to all of the other projects/phases under this initiative. Transit data applications are not dependent on this project, but the quality and consistency of regional data could be improved.
PROJECT PHASES	N/A
AGENCY ROLES	Roles for this project have not yet been identified. All affected agencies will participate on a Project Steering Committee; recommendations will require interagency agreement.
COSTS	Approximate Total: $50,000

Project **R1-2**	**Regional Transit GIS** **Develop Technical Requirements**	
DESCRIPTION	The purpose of this project is to develop technical requirements and design guidelines for the Regional GIS system. This project will identify data structures, interface requirements and any applicable standards.	
FUNCTIONAL ELEMENTS	This project will address all functional elements including transit route and stop location information. Additional functional elements defined in Project R1-1 will also be addressed.	
PHYSICAL ELEMENTS	♦ Consistent definition of key regional data elements ♦ Optional: centralized database (publish. subscribe model) ♦ Interfaces (translation code, procedures, communications): - Database to database - Access to Central (if applicable)	
ARCHITECTURE	Architecture will be developed based on results of Concept Planning (Project R1-1).	
LINKAGES WITH OTHER PROJECTS	This project follows Project R1-1 (High Level Concept Planning) and precedes Project R1-3 (Deployment).	
PROJECT PHASES	N/A	
AGENCY ROLES	***IMPLEMENTATION***	***OPERATION & MAINTENANCE***
	Agency roles for this project have not been determined. All participating agencies would participate in a project Steering Committee.	N/A
COSTS	***IMPLEMENTATION***	***OPERATION & MAINTENANCE***
	To be determined during concept planning.	To be determined during concept planning.

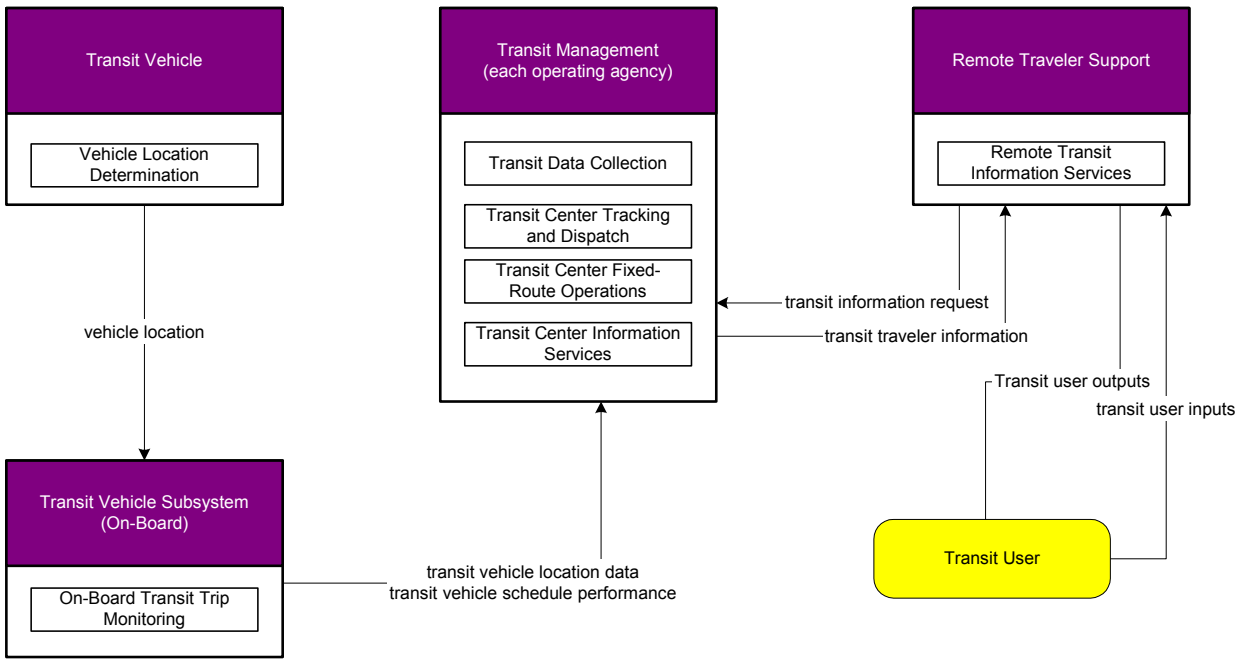
Project **R1-3**	**Regional Transit GIS** **Deployment**	
DESCRIPTION	The purpose of this project is to construct and deploy the Regional GIS system. Depending on the preferred data exchange method defined in Project R1-1, it may involve the development and population of a central database. It will include development of interfaces between different agency GIS systems. Each component of the system will include design and testing phases.	
FUNCTIONAL ELEMENTS	The Concept Planning project (R1-1) will determine which functional elements can be provided by a regional GIS system. At a minimum, the system shall provide transit route and stop location information.	
PHYSICAL ELEMENTS	Elements will depend on the results of previous projects, and may include: ♦ Common data structure ♦ Centralized database ♦ Interfaces - Database to database - Access to Central	
ARCHITECTURE	Architecture will be developed based on results of conceptual planning	
LINKAGES WITH OTHER PROJECTS	This project follows Project R1-1 (High Level Concept Planning) and R1-2 (Development of Technical Requirements) for this initiative. Other regional and agency-specific projects that require a GIS database can benefit from coordination with this project, such as regional trip planning, and Regional AVL/CAD (Initiative R3).	
PROJECT PHASES	This project may include multiple phases. The first phase may consist of a Beta test with interfaces to only one agency being tested. Subsequent phases could include the roll-out to other agencies.	
AGENCY ROLES	***IMPLEMENTATION***	***OPERATION & MAINTENANCE***
	Roles for this project have not been identified.	O&M roles and responsibilities will be agreed on during concept planning (Project R1-1).
COSTS	***IMPLEMENTATION***	***OPERATION & MAINTENANCE***
	To be determined during concept planning.	To be determined during concept planning.

Initiative **R2**	**Common Web and Phone Interface**
DESCRIPTION	This initiative will provide unified web and telephone access to existing and future regional transit data applications such as MyBus, BusView, Regional Automated Trip Planning, Regional Rideshare, etc. It will involve the development of agreements to make transit data consistently available for web and audio delivery. It also includes the provision of automated telephone information for use on the emerging regional 511 system and dedicated customer service telephones.
DESIRED OUTCOMES	♦ Common point of access for transit data for agency systems and private information providers (web and/or public access kiosks). ♦ Ability for travelers to access consistent and comprehensive traveler information, regardless of which agency they contact or how the contact is made. ♦ Adherence to Americans with Disabilities Act (ADA) requirements to make visual data available to the sight impaired. ♦ Supports customer view of a "seamless" transportation system.
FUNCTIONAL ELEMENTS	♦ Regional trip planning ♦ Regional rideshare ♦ Real-time vehicle arrival information ♦ General transit information
PHYSICAL ELEMENTS	♦ Common database for each application ♦ New website(s) as needed ♦ Links to agency websites ♦ 511 system transit application
PROJECTS	R2-1. Concept Planning a. Functions/applications b. Business procedure/plans (i.e. "how you do business") c. Website approach / architecture d. Phone system (511) requirements and concept e. Define web deployment project if applicable R2-2. Regional Standards for MyBus and BusView R2-3. Develop 511 system and interfaces

Project **R2-1**	**Common Web and Phone Interface** **Concept Planning**
DESCRIPTION	This project will result in a plan for the development of common web and phone interfaces for transit services and information. This will include the development of a system concept and conceptual design for the provision of regional trip planning, regional rideshare, and regional real-time vehicle arrival applications/systems.
MAJOR SCOPE ELEMENTS	1. Produce background report on current and planned customer-oriented transit data applications among Puget Sound transportation agencies, and on state-of-the art practices for providing consistent voice and web-based data across multiple agencies and web sites. 2. Propose and assess models for making regional data applications available on each agency's web server, including centralized and distributed approaches. Develop cost estimate for preferred approach. 3. Propose and assess options to provide a voice interface to existing regional data applications. Identify changes needed to data application, and scope of work and cost estimate to develop voice interface and to implement connections to the regional 511 system. 4. Define project description, scope of services and cost estimate for web applications deployment project, if applicable. 5. Prepare final project report.
LINKAGES WITH OTHER PROJECTS	This project will act as a pre-requisite to all of the other projects/phases under this initiative. This project may have implications for all regional transit data applications when completed.
PROJECT PHASES	NA
AGENCY ROLES	Roles for this project have not yet been identified. All affected agencies will participate on a Project Steering Committee; recommendations will require interagency agreement.
COSTS	Approximate Total: $90,000

Project **R2-2**	**Common Web and Phone Interface** **Regional Standard for My Bus and BusView Applications**
DESCRIPTION	The MyBus and BusView applications provide real-time transit vehicle location information over the web and at transit stops within King County. The system was developed at the University of Washington and is being transferred to King County Metro for maintenance and further development. This project would develop standards and protocols to give all regional transit agencies access to these systems when they acquire automatic vehicle location capabilities in the future.
FUNCTIONAL ELEMENTS	♦ Real-time vehicle location and arrival information
PHYSICAL ELEMENTS	♦ Common database for each application. Note: this will consist of procedures and design standards for expansion of existing My Bus and BusView databases ♦ Links to agency websites (if not already available) ♦ Possibly a next-bus arrival voice interface for 511 system (see project R2-3)

ARCHITECTURE



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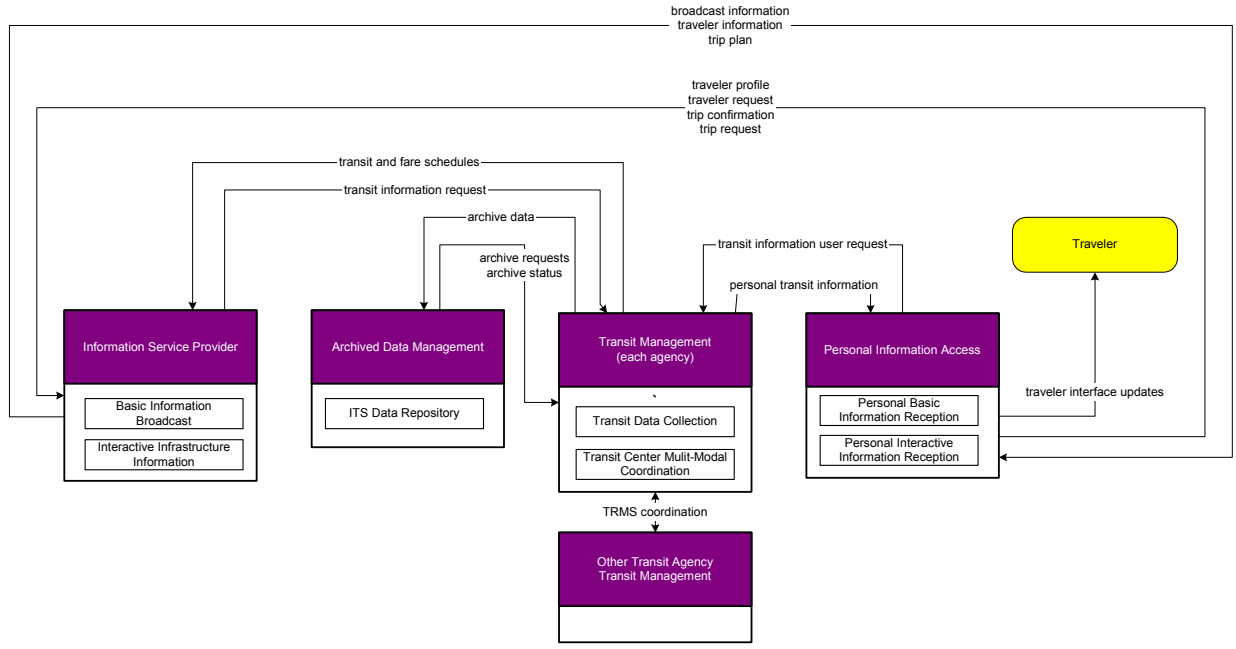
(Project R2-2, continued)

LINKAGES WITH OTHER PROJECTS	This project follows Project R2-1 (Common Web and Phone Interface Concept Planning).	
PROJECT PHASES	1. Develop standards and protocols 2. This project may include an implementation phase depending on agency interest and available funding.	
AGENCY ROLES	***IMPLEMENTATION***	***OPERATION & MAINTENANCE***
KC METRO	Project lead for BusView	Responsible for BusView O&M
UW	Project lead for MyBus	Responsible for MyBus O&M
Other Agencies	Members of Steering Committee; responsible for equipment needed to use applications.	Responsible for O&M for any on-board or wayside equipment needed to use applications. MOUs may be required to clarify roles.
COSTS	***IMPLEMENTATION***	***OPERATION & MAINTENANCE***
	$25,000 for developing standards and protocols. A cost estimate for a second implementation phase to be determined based on Phase 1 outcome.	NA for Phase 1, TBD for Phase 2.

Project **R2-3**	**Common Web and Phone Interface** **Develop 511 System and Interfaces**
DESCRIPTION	This project is to develop the 511 system application and interfaces. Software and operational procedures will be developed to deploy the 511 system.
FUNCTIONAL ELEMENTS	The Concept Planning project (R2-1) will determine which functional elements can realistically be provided over an automated telephone system. May include some or all of: ♦ Regional trip planning ♦ Regional rideshare ♦ Real-time vehicle arrival ♦ General transit information
PHYSICAL ELEMENTS	♦ One or more common database(s) for information to be provided by the 511 system ♦ Voice interfaces to databases ♦ 511 system transit application ♦ Communications and switching to connect to 511 system.

ARCHITECTURE



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(Project R2-3, continued)

LINKAGES WITH OTHER PROJECTS	This project follows Project R2-1 (Common Web and Phone Interface).	
PROJECT PHASES	This project may include multiple phases to be defined in concept planning. Likely phasing: ♦ Voice interface and 511 deployment for general transit info ♦ Voice interface and 511 deployment for schedule and arrivals ♦ Voice interface and 511 deployment for rideshare/trip planning and other data applications.	
AGENCY ROLES	***IMPLEMENTATION***	***OPERATION & MAINTENANCE***
WSDOT	Lead for the 511-system design and implementation.	Responsible for O&M for overall 511 system.
Other Agencies	Provide data content for transit information. Funding roles for deployment TBD.	Responsible for maintaining transit data applications. MOUs may be required to determine maintenance roles.
COSTS	***IMPLEMENTATION***	***OPERATION & MAINTENANCE***
	Approximate cost: $300,000 to $900,000, to be refined during concept planning.	To be determined during concept planning.

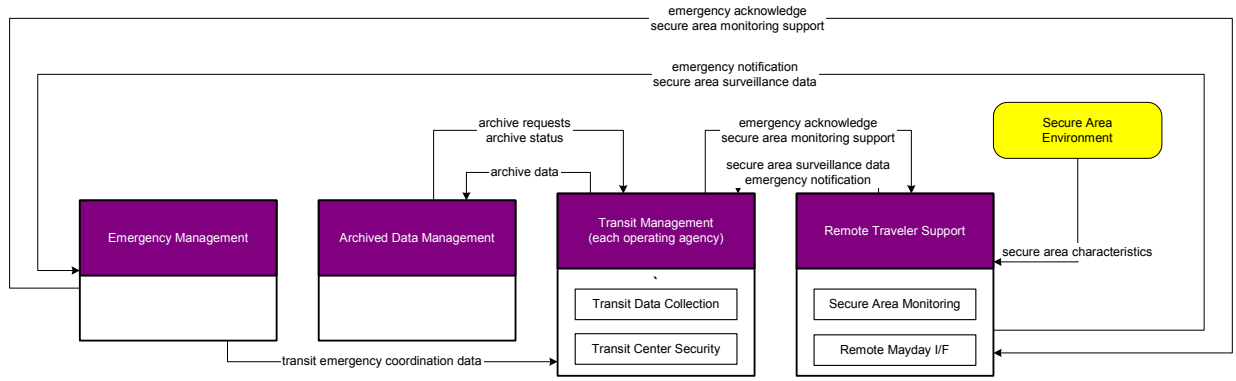
Initiative **R3**	**Regional AVL Deployment and Computer Aided Dispatch**
DESCRIPTION	Automatic vehicle location (AVL) data will have many potential uses, including for passenger information. To use AVL data to provide bus location data to customers that includes all intersecting services, AVL data needs to get to a data backbone in a consistent format, regardless of how each agency collects it. This initiative will identify how that will occur, and deploy systems that will be needed. Computer-aided dispatching (CAD) needs of agencies that do not currently have CAD capabilities will also be assessed.
DESIRED OUTCOMES	♦ Enable provision of transit vehicle location data to customers and other users, regardless of which agency operates the service. ♦ Enable private information providers to add value to AVL data. ♦ Assess the needs and benefits of CAD at agencies without this capability, and potentially leverage Metro's existing CAD investment or initiate a new procurement to reduce implementation costs and risks for other agencies.
FUNCTIONAL ELEMENTS	♦ AVL communications and protocols ♦ Computer-Aided Dispatch (CAD) systems
PHYSICAL ELEMENTS	♦ Communications ♦ Data backbone and related equipment ♦ CAD displays and related equipment
PROJECTS	R3-1. Concept Planning: AVL standards, protocols and communications (with potential Phase 2 deployment) R3-2. CAD needs assessment for transit agencies that do not have current CAD capabilities.

Project **R3-1**	**Regional AVL Deployment and Computer Aided Dispatch** **Concept Planning**
DESCRIPTION	This project will develop a common data structure for vehicle location data and a plan to broadcast that data on a common data "backbone" that is accessible over the Internet and can be picked up and used for a variety of uses. Potential uses include automated dispatch applications, remote dispatch, real-time passenger information systems, private information providers, etc.
MAJOR SCOPE ELEMENTS	1. Prepare a background report that describes the state of the art for sharing AVL data between transit agencies and with private information providers nationally. The report should address data definition and the mechanics of making the information available for customer information, operations and planning purposes. 2. Propose and assess options to bring AVL data collected and communicated using different mechanism to a common location and using a common data format, and broadcast on an Internet "backbone". Propose a logical and physical architecture. 3. Define project description, scope of work and cost estimate for an implementation project (potential Phase 2). 4. Prepare a final project report.
LINKAGES WITH OTHER PROJECTS	This project precedes Projects R3-2 and R3-3. Depending on timing, this project could influence projects included in Initiative S1; or elements of Initiative S1 could supercede this project.
PROJECT PHASES	1. Concept planning 2. Potential Phase 2 implementation project.
AGENCY ROLES	Roles for this project have not yet been identified. All affected agencies will participate on a Project Steering Committee; recommendations will require interagency agreement.
COSTS	Approximate Total: $55,000

Project **R3-2**	**Regional AVL Deployment and Computer Aided Dispatch** **Computer Aided Dispatch Needs Assessment**	
DESCRIPTION	This project will prepare a needs assessment for computer-aided dispatching (CAD) at local transit agencies other than King County Metro. Interviews will be conducted with service control and management staff, and information on the state –of –the art in CAD systems will be prepared. If Metro proceeds with a CAD/AVL procurement, this needs assessment will assist other agencies in determining whether to use Metro's procurement, or to purchase CAD/AVL capabilities on their own. If Metro chooses to maintain their existing CAD system, the feasibility of adapting Metro's existing CAD/AVL system for use at other agencies will be assessed.	
MAJOR SCOPE ELEMENTS	All of these tasks will build on work already completed by Metro, focusing on the needs of other transit agencies in the region. 1. Prepare background report on the state –of –the art for transit CAD/AVL systems. 2. Prepare needs assessment for CAD/AVL support for dispatchers at local transit agencies that do not currently have this capability. Conduct interviews and document review. 3. Assess the feasibility and potential benefit of leveraging Metro's investment in the existing CAD/AVL system, or joining Metro's CAD/AVL procurement. This will depend on the outcome of Metro's internal assessments of CAD/AVL options. 4. Prepare a final project report.	
LINKAGES WITH OTHER PROJECTS	Related to Projects R4-1, R5-4	
PROJECT PHASES	Could be multiple phases, including separate phases to assess needs at each agency, and a follow-up phase to assess opportunities to leverage Metro's CAD investment.	
AGENCY ROLES	***IMPLEMENTATION***	***OPERATION & MAINTENANCE***
	Agency roles have not yet been determined.	Agency roles have not yet been determined.
COSTS	***IMPLEMENTATION***	***OPERATION & MAINTENANCE***
	Approximately $150,000.	NA

Initiative **R4**	**Regional Security and Communications Interoperability**
DESCRIPTION	Assess needs for inter-system service control communications and emergency communications needs. This project could also be broadened to assess options for joint transit security arrangements in each county, security and service control communications or co-location needs, control center strategy and communications needs, and video surveillance plans.
DESIRED OUTCOMES	♦ Optimized interagency communication between service control, security and emergency dispatch staff ♦ Integration of center-to-center communications needs into agency communication and surveillance plans and procurements ♦ Potentially, consideration of opportunities for shared control centers or dispatch functions where desirable. ♦ Preparation of emergency contingency plans for transit operations and security.
FUNCTIONAL ELEMENTS	♦ Center-to-center communications ♦ Surveillance systems
PHYSICAL ELEMENTS	♦ Communication protocols and equipment ♦ Surveillance cameras and monitors
PROJECTS	R4-1. Center-to-Center Communications Needs Assessment and Interagency Emergency Communications Plan R4-2. Multi-Modal Facility Surveillance Plan

Project **R4-1**	**Regional Security and Communications Interoperability** **Center-to-Center Communications Needs Assessment and Interagency Emergency Communications Plan**	
DESCRIPTION	This project will assess communications needs between transit, paratransit, police and emergency dispatch centers in Pierce, Snohomish and King counties. Communications requirements between field staff at different agencies will also be assessed. Communications needs will be assessed under routine conditions and for major events, emergencies, and service disruptions. A discussion of the state of the art in regional transit communications will be included, as well as a discussion of advantages and disadvantages of options to co-locate related dispatch and/or security monitoring functions.	
MAJOR SCOPE ELEMENTS	1. Produce background report: ♦ Produce survey of state-of-the-art practices for transit communications in peer regions with multiple transit providers. ♦ Report on the status of emergency planning in the Puget Sound region and on related communications systems and protocols planned or in place. ♦ Assess current communications systems and needs between communication centers involved in providing transit, transit security and emergency services, including needs for remote or backup dispatching capabilities (interviews and research, supplemented by results of Project R4-1). 2. Conduct workshop to assess significant risks that emergency communication plans should prepare for, and to consider contingencies that could influence emergency communication requirements. 3. Identify processes and roles to reconfigure transit communications to respond to emergencies, and communications needs that could arise in the case of an emergency. 4. Propose and assess options to improve communications capabilities where needed between agencies and dispatch functions. 5. Final project report.	
LINKAGES WITH OTHER PROJECTS	Project R4-1 will provide input to this project. Project S2-1 will consider similar issues for Sound Transit. These efforts should be closely coordinated.	
PROJECT PHASES	NA	
AGENCY ROLES	***IMPLEMENTATION***	***OPERATION & MAINTENANCE***
	Agency roles for this project have not been determined. All affected agencies will be represented on a Project Steering Committee.	NA
COSTS	***IMPLEMENTATION***	***OPERATION & MAINTENANCE***
	Approximately $150,000 – 200,000.	NA. O&M costs will be assessed during the project.

Project **R4-2**	**Regional Security and Communications Interoperability** **Multi-Modal Facilities Surveillance Plan**
DESCRIPTION	This project will assess security surveillance and monitoring needs for multi-modal facilities operated jointly by multiple agencies (e.g., Park-and-Ride lots) and prepare an implementation plan and cost estimate. Potential use of WSDOT's camera and fiber-optic system for Park-and-Ride surveillance will be considered. A deployment phase may follow.
FUNCTIONAL ELEMENTS	♦ Facility video surveillance ♦ Video monitoring and/or recording ♦ Passenger alarms ♦ Communications
PHYSICAL ELEMENTS	♦ Video cameras ♦ Video recording equipment ♦ Illumination ♦ Optional: high-speed communications ♦ Optional: panic buttons ♦ Optional: monitoring equipment
ARCHITECTURE	
LINKAGES WITH OTHER PROJECTS	None required.
PROJECT PHASES	1. Needs Assessment 2. Deployment (if indicated).

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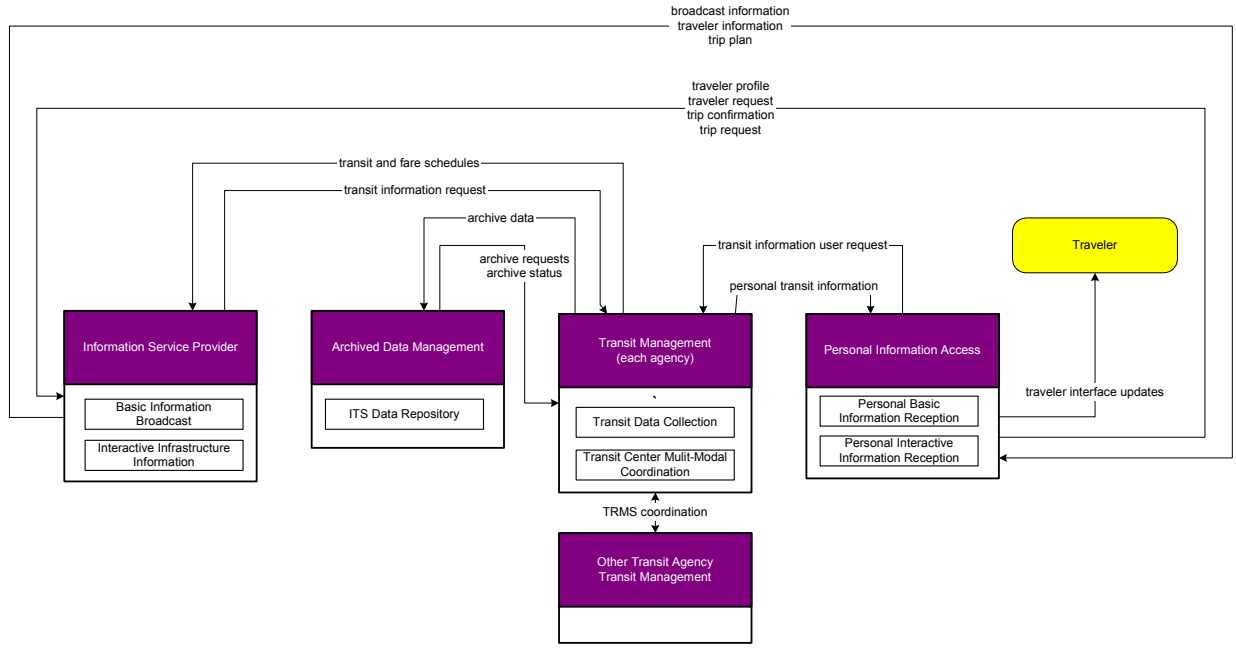
(Project R4-2, continued)

AGENCY ROLES	***IMPLEMENTATION***	***OPERATION & MAINTENANCE***
	Agency roles have not yet been determined.	O&M roles and costs would be determined during needs assessment.
COSTS	***IMPLEMENTATION***	***OPERATION & MAINTENANCE***
	$50,000 for needs assessment, functional requirements and implementation cost estimates.	O&M roles and costs would be determined during needs assessment.

Initiative **R5**	**Paratransit and Ridesharing Technology Initiative**
DESCRIPTION	This initiative includes a set of related projects to improve service delivery and customer service for paratransit users, and to integrate paratransit and ridesharing data systems with transit data systems where appropriate.
DESIRED OUTCOMES	♦ Reduced wait times for paratransit users connecting to transit services or to using paratransit services for inter-county trips ♦ Better integration of data systems between paratransit providers. ♦ Information available to paratransit scheduler/dispatchers to determine options for moving paratransit trips to mainline bus services. ♦ Integration of transit and ridesharing options in regional trip planning systems. ♦ Consistent customer data available to all regional paratransit providers.
FUNCTIONAL ELEMENTS	♦ Customer reservation and eligibility data systems ♦ Reservation and dispatching software ♦ Regional Ridematch system ♦ Regional Trip Planning system ♦ Automatic vehicle location system (backbone)
PHYSICAL ELEMENTS	♦ Paratransit reservation and dispatching software ♦ Software interface between data systems ♦ (Physical hardware is provided by local agencies.)
PROJECTS	R5-1. Paratransit Technology Plan R5-2. Coordinated Purchase and Upgrade of Paratransit Reservation and Dispatching Software R5-3. Ridematch / Trip Planning Integration R5-4. Transit / Paratransit Data Integration

Project **R5-1**	**Paratransit and Ridesharing Technology Initiative** **Paratransit Technology Plan**
DESCRIPTION	This project will develop a plan to enhance paratransit technologies and data systems, focusing on improving customer service and ensuring reliable connections for customers making inter-county or multi-leg journeys. Specific attention will be paid to enhancements that would ensure a coordinated hand-off between services and reduce wait time at transfer points. Options for maintaining a unified customer database, including eligibility data for each agency, will be assessed. Projects for delivering enhanced services will be defined, including determining costs for equipment and data system enhancements.
MAJOR SCOPE ELEMENTS	1. Prepare a background report that identifies: - Existing reservation and dispatching practices and technologies at regional paratransit service providers - Interview providers and users to identify perceived service-delivery gaps that cause delays or missed connections between providers and transit services. 2. Identify and assess technology and procedural improvements to improve paratransit for users who make multi-leg trips or use multiple providers. 3. Prepare draft scope of work and budget estimate for promising projects. 4. Produce final project report. 5. A deployment phase may be added depending on the results of the first four scope elements.
LINKAGES WITH OTHER PROJECTS	This project will produce information needed for Project R5-4 (Paratransit/Transit Data Integration)
PROJECT PHASES	1. Scope elements 1-4 (Plan) 2. Scope element 5 (Potential Deployment).
AGENCY ROLES	***CONCEPT PLANNING***
	Roles for this project have not yet been identified. All affected agencies will participate on a Project Steering Committee; recommendations will require interagency agreement.
COSTS	Plan: Approximate total: $95,000 Deployment: TBD based on concept plan.

Project **R5-2**	**Paratransit and Ridesharing Technology Initiative** **Coordinated Purchase And Upgrade Options for Paratransit Reservation And Dispatching Software**	
DESCRIPTION	This project would assess options to coordinate purchasing and upgrading of paratransit reservation and dispatching software. A report on the state of the art of paratransit software will be prepared, including available vendor products and feedback from existing product users. Options for coordination will be assessed, including reaching agreement on a joint specification and upgrading schedule, purchasing software jointly, and using third parties or in-house staff to enhance and maintain software capabilities.	
MAJOR SCOPE ELEMENTS	1. Prepare a background report on the state of the art in paratransit reservation and dispatch support software, including information on available vendor products and interviews with users of available systems. 2. Identify and assess options for regional coordination of software purchase, upgrades and/or maintenance, and enhancement of paratransit software.	
LINKAGES WITH OTHER PROJECTS	Should be coordinated with Project R5-1.	
PROJECT PHASES	NA	
AGENCY ROLES	***IMPLEMENTATION***	***OPERATION & MAINTENANCE***
	Agency roles have not yet been determined	O&M responsibilities and costs will be developed during this study.
COSTS	***IMPLEMENTATION***	***OPERATION & MAINTENANCE***
	$50,000 for state-of-the-art review, technical workshop(s) and technical memo.	O&M responsibilities and costs will be developed during this study.

Project **R5-3**	**Paratransit and Ridesharing Technology Initiative** **Ridematch / Trip Planning Integration**
DESCRIPTION	This project will develop an interface between the regional Ridematch data system and the regional trip planning system, to present the user with transit and ridesharing trip planning options. It will provide an assessment of GIS data needs to support multi-agency data needs.
FUNCTIONAL ELEMENTS	♦ Regional trip planning system (existing) ♦ Regional Rideshare system (existing) ♦ Data interface (new)
PHYSICAL ELEMENTS	Project R2-1 (Common Web and Phone Interface) may affect this project's implementation. It will most likely include: ♦ Trip planning and regional rideshare databases ♦ Web server and software at each agency ♦ Potential interface with 511 system
ARCHITECTURE	
LINKAGES WITH OTHER PROJECTS	This project is closely linked to Project R2-1 (Common Web and Phone Interface Concept Planning), and potentially with Project R1-1 (Regional GIS Concept Planning).
PROJECT PHASES	1. System planning and design 2. Interface development (implementation)

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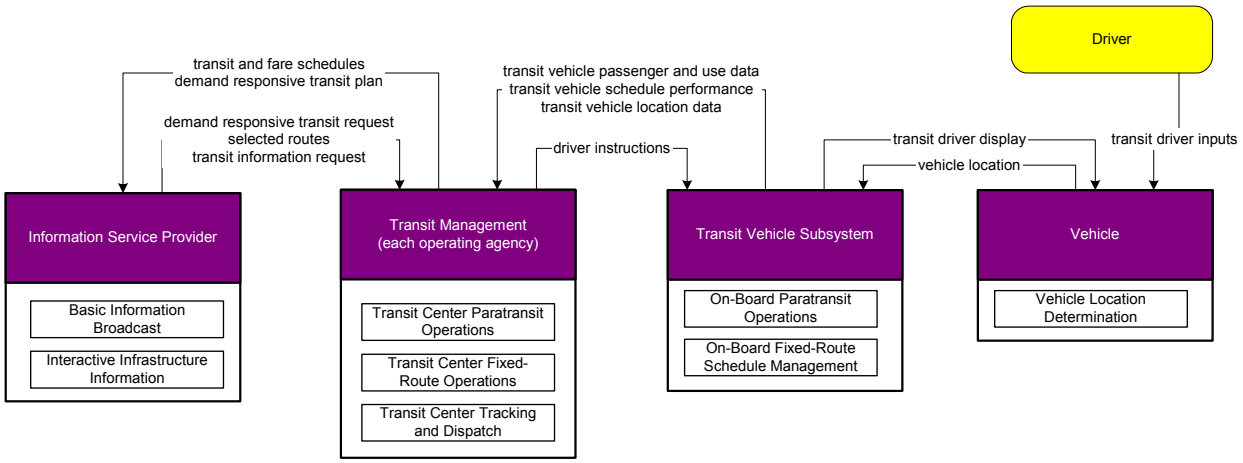
(Project R5-3, continued)

AGENCY ROLES	***IMPLEMENTATION***	***OPERATION & MAINTENANCE***
	Agency roles have not yet been determined	O&M responsibilities and costs will be developed during this study.
COSTS	***IMPLEMENTATION***	***OPERATION & MAINTENANCE***
	System planning: Approximate cost: $75,000 – 100,000 Implementation: Approximate cost: $150,000 – 300,000.	O&M responsibilities and costs will be developed during this study.

Project **R5-4**	**Paratransit and Ridesharing Technology Initiative** **Transit / Paratransit Data Integration**
DESCRIPTION	This project will tailor transit trip planning information, ridematching data, and real-time location data to assist paratransit schedulers and dispatchers in substituting mainline transit service for paratransit trips and improving the hand-off between paratransit and transit services when customers transfer between them (as defined in Project R5-1)
FUNCTIONAL ELEMENTS	♦ Transit trip planning system ♦ Regional Ridematch System ♦ Transit automatic vehicle location ♦ Paratransit reservation systems ♦ Paratransit CAD/AVL systems ♦ Potential interfaces between these systems ♦ Communications / AVL Internet "backbone"
PHYSICAL ELEMENTS	♦ Paratransit scheduling/dispatching workstations ♦ Trip planning, regional ridematch and paratransit software ♦ Software interfaces
ARCHITECTURE	
LINKAGES WITH OTHER PROJECTS	Project R5-1 will identify some of the user and operator needs that this project will address.
PROJECT PHASES	This project will include a concept planning and implementation phase.

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(Project R5-4, continued)

AGENCY ROLES	***IMPLEMENTATION***	***OPERATION & MAINTENANCE***
	Agency roles have not been determined	O&M responsibilities and costs will be assessed during concept planning.
COSTS	***IMPLEMENTATION***	***OPERATION & MAINTENANCE***
	To be determined during concept planning.	O&M responsibilities and costs will be assessed during concept planning.