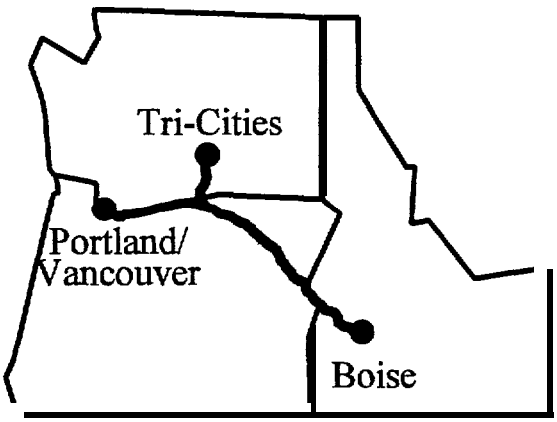
Corridor ITS Applications
Technical Memorandum
May 1996

Portland/Vancouver to Boise ITS Corridor Study



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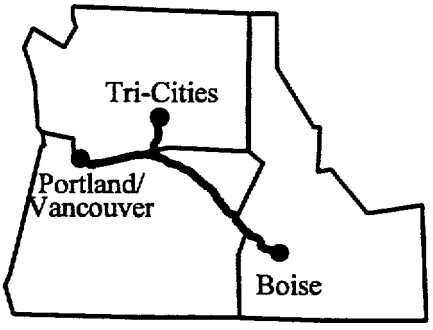
1.0 Project Overview

Intelligent Transportation Systems (ITS) (formerly Intelligent Vehicle Highway Systems [IVHS]) is the application of advanced information processing, communications vehicle sensing, and traffic control technologies to surface transportation systems. All highway and transit modes, as well as airport access, navigable waterway, and rail, can be included in ITS applications. The objective of ITS is to promote more efficient use of the existing highway and transportation network, increase safety and mobility, and decrease environmental impacts due to congestion.

The Portland/Vancouver, Washington to Boise, Idaho ITS Corridor Study consists of conducting an Intelligent Transportation System corridor study and developing recommendations for deployment of ITS and appropriate communications technologies along a multi-state, intercity corridor. The corridor limits are defined as follows:

- Interstate 84 from I-205 in Oregon to a point 20 kilometers east of Boise, a distance of 706 kilometers (439 miles).
- Interstate 82 from I-84 in Oregon to I-l 82 in Tri-Cities, Washington, a distance of 66 kilometers (41 miles).
- State Route 14 from I-205 in Washington to I-82 in Washington, a distance of 282 kilometers (175 miles).
- Union Pacific and Burlington Northern Santa Fe Railroads
- Columbia River Waterway



As mentioned, a primary purpose of this project is to develop recommendations for the implementation of appropriate ITS technology to address corridor transportation needs over the next 20 years. The study focuses on specific applications of Advanced Traffic Management Systems, Advanced Traveler Information Systems, Commercial Vehicle Operations, and Advanced Rural Transportation Systems technologies, with an emphasis on providing implementation guidelines that will facilitate the integration and expansion of future ITS components within the corridor.

The planning effort also investigates ways to provide traveler information for various modes. The information, including, but not limited to, current roadway congestion, weather conditions, incident information, and construction information, will be used by travelers to make informed choices regarding mode, route, and time of departure.

The study also investigates the surveillance and communications requirements of traffic management systems and traveler information dissemination. These requirements include incident detection, demand management techniques in urban areas of the corridor, and traffic flow monitoring.

A final purpose is to develop communication recommendations that take into account Idaho Transportation Department (ITD), Oregon Department of Transportation (ODOT), and Washington State Department of Transportation (WSDOT) communication requirements in the corridor. Communication requirements across state borders will receive particular attention.

The ITS implementation and communication plan will be developed for the following time frames:

- Short Term: The first period will encompass the interval from 1997 to 2002. The focus will be on the development of a detailed tactical plan that identifies specific projects and programs to be implemented.

- Medium Term: The second period will include 2003 to 2007. For this time frame, the study will address emerging trends and issues and will recommend steps that ITD, ODOT, and WSDOT should take to prepare for anticipated changes in the transportation operational environment.

- Long Term: The final period will be from 2008 to 2017. The plan will recommend a strategic approach to addressing long-term concerns.

The study is divided into seven major work elements:

Work Element 1– Assess Transportation Needs

This element generally consists of gathering data on transportation and traveler information needs and deficiencies in the corridor and identifying the magnitude of the problems.

Work Element 2 - Identify Corridor ITS Applications

Work Element 2 involves using the US DOT's user services categories to identify which ITS applications have the potential to address corridor needs.

Work Element 3 - Recommend ITS Strategies

This work element will identify ITS strategies that have a clear potential to meet corridor needs. items associated with individual strategies such as benefits, costs, implementation barriers, technology requirements, and funding will be addressed.

Work Element 4 - Develop Corridor PIan

This element will identify specific prajects and programs to be implemented. Short term projects will be developed in sufficient detail to allow them to be included in DOT and other funding and construction programs in the three states.

Work Element 5 - Assess ITS Communications Needs

Work Element 5 will identify the communication characteristics of various ITS field components and make recommendations for a communication system.

Work Element 6 - Conduct Outreach Effort

This work element contains the projects public involvement and outreach program, including stakeholder interviews, general media releases, targeted media kits, workshops, and stakeholder presentations.

Work Element 7 - Prepare Final Report

Work Element 7 will consolidate the results of previous work into a final action plan.

Technical Memorandums will be prepared for each work element, except the outreach effort. Recommendations of the public outreach will be incorporated into other technical memorandums.

2.0 Approach to Work Element 2

The purpose of this technical memordandum is to identify ITS applications appropriate for the corridor, including I-84 I-82 S R 14 the railroad and waterways. Applications considered include variable message signs variable speed limit signs speed advisory signs traveler information services, mayday systems commercial vehicle operations , and other elements of ATMS ATIS ARTS APTS and CVO ’

In identifying ther ITS applications most appropriate for the corridor a three step process was employed:

1. Match ITS goals benefits with corridor transportation needs.
2. Match ITS user services with ITS goals/benefits.
3. Match ITS user services with corridor transportation needs.

In essence, the process followed the simple mathematical formula:

If A=B
and B=C
then A=C

2.1 Match ITS Goals/Benefits With Corridor Transportation Needs

The first step was to match ITS benefits with the previously identified corridor transportation needs,. This steip identified the ITS related benefits that could be expected by solving ghe problems identified in the corridor.

The national ITS program has developed a series of goals and objectives that can b e met though deployment of ITS technologies In essence these golas represent benefits to the public such as increased safety improved system efficiency, reduced energy and environmental impacts enhanced economic productivity, and improved mobility.

As part of this step, Steering Committee memebers from ODOT WSDOT, ITD ,and FHWA participated in the matching process between ITS goals/benefits and corridor needs. Their responses were merged together and are included in **Appendix A.**

The following text describes the major benefits associated from ITS deployment

. ATM S (Advanced Traffic Management Systems), ATIS (Advanced Traveler Information Systems), ARTS (Advanced Rural Trasnportation Sytems), APTS (Advanced Public Transportation Systems), CVO (Commercial Vehicle Operations)

2.1.1 Improved Safety

Reducing the number and severity of accidents on the roadway is a goal or benefit that is possible through ITS implementation. ITS technologies can increase safety by assisting the driver to avoid collisions, provide information on the condition of the vehicle and driving environment, and enhance vehicle performance.

2.1.2 Improved Service Level Efficiency

ITS can also benefit the operational efftciency of the transportation system by reducing disruptions due to incidents, as well as improving the level of service and convenience provided to travelers.

2.1.3 Reduced Energy and Environmental Impacts

ITS services have a direct impact on achieving energy, environmental, and Clean Air Act goals by allowing travelers to select routes that enable them to avoid congested areas or use an alternative mode of transportation, thus reducing unnecessary fuel consumption and emissions. Route guidance, better driver information, improved traffic control, and more efftcient incident management and response will reduce emissions and wasted fuel caused by congestion and navigational inefficiency.

2.1.4 Enhanced Productivity

The productivity of individuals, the commercial vehicle industry, and the economy as a whole benefit from ITS by reducing the cost that congestion adds to both personal and business travel. ITS can also reduce the costs and improve the equity associated with collecting fares, tolls, parking fees, and surface transportation taxes.

2.1.5 Improved Mobility

ITS can enhance mobility by providing travelers with greater ease and confidence in using different routes and modes, improving travel time predictability, and reducing the stress associated with travel in unfamiliar or congested areas. Driver's can also benefit by being directed to services in less congested hours.

2.2 Match ITS User Services With ITS Goals/Benefits

The second step matched ITS user services with their associated ITS goals/benefits. This matching process was actually completed as part of the National ITS Program Plan and simply employed in this process as a link between Step 1 and Step 3. A table showing the relationship between ITS user services and ITS goals/benefits is located in **Appendix B.**

2.3 Match ITS User Services With Corridor Transportation Needs

The third step in the process matched ITS user services with the corridor transportation needs. To perform the process, the matrices from Step 1and Step 2 were combined to create the Step 3 matrix showing the relationship between user services and specific corridor needs. A match between an ITS user service and a specific corridor transportation need was made when a benefit desired to address the corridor transportation need (from Step 1) matched with a benefit provided by the ITS user service (from Step 2).

The following example illustrates this process: The benefit "Enhance driver performance" was identified in Step 1as appropriate to address the specific corridor need of ice and snow problems on I-84. This is illustrated in **Table 2-1,** a sample of the matrix for Step 1. A black cell indicates that the ITS benefit is desired to address the corridor need.

Table 2-l
Sample Matrix of ITS Benefits and I-84 Corridor Needs

In Step 2, the ITS user service En-Route Driver Information was recognized to provide the benefit of enhanced driver performance. This is illustrated in **Table 2-2,** a sample of the matrix for Step 2. A black cell indicates that the benefit is provided by the ITS user service.

Table 2-2
Sample Matrix of ITS User Services and ITS Benefits

Because there is a match between the benefit provided by the user service and the benefit desired to address the corridor need, one match would be recorded in the Step 3 matrix between the ITS user service En-Route Driver Information and the specific corridor transportation need "Ice and snow problems on I-84". This is illustrated in **Table 2-3,** a sample of the matrix for Step 3. The number 1 represents the match between the corridor need and the ITS user service for the specific benefit "Enhance driver performance".

Table 2-3
Sample Matrix of ITS User Services and I-84 Corridor Needs

This process was then repeated for each of the corridor transportation needs and each of the ITS user services. The total numbers of matches between each user service and each corridor transportation need was recorded and are shown in the Step 3 matrices. This number provides an initial indication of the extent to which the benefits provided by a user service meet the specific need. The number of matches does not indicate which user services should be implemented, because issues such as the prioritization of the transportation needs, cost-benefit ratios associated with the user services, and availability of technology have not yet been factored into this process. It does, however, identify the types of ITS solutions are most compatible with the specific needs in the corridor.

In an effort to provide greater detail about the user services, the final matrix was expanded to show the number of matches within each of the five ITS benefit categories (safety, efficiency, energy and environment, productivity, and mobility. This matrix shows compatibility between user services and needs, categorized by the type of benefit. For example, rather than simply indicating that En-Route Driver Information would be an appropriate ITS technology to address the ice and snow problems along I-84, the expanded matrix also shows that the primary benefits of providing En-Route Diver Information would be related to safety and mobility.

Sections 4.0,5.0,6.0, **and** 7.0 contain the results of the matching processes for each corridor. **Appendix** C contains the expanded Step 3 matrix. **Section** 3.0 contains a discussion of ITS user services from the National ITS Program Plan.

3.0 ITS User Services

The National ITS Program Plan focused on the development and deployment of a collection of inter-related user services. Twenty-nine user services have been defined as part of the national program planning process. The users of these services include travelers using all modes of transportation, transportation management center operators, transit operators, Metropolitan Planning Organizations (MPOs), commercial vehicle owners and operators, state and local governments, and many others who will benefit from deployment of Intelligent Transportation Systems.

3.1 User Service Descriptions

Although each user service is unique, they share common characteristics and features as described below.

- Individual user services are building blocks that may be combined for deployment in a variety of fashions. The combination of services deployed will vary depending upon local priorities, needs, and market forces. Within the National ITS Program Plan (NPP), user services have been grouped into "bundles" based on likely deployment scenarios as described below.

- User services are comprised of multiple technological elements or functions that may be common with other services. For example, a single user service will usually require several technologies, such as advanced communications, mapping, and surveillance, which may be shared with other user services. This commonality of technological functions is one basis for the suggested bundling of services.

- User services are in various stages of development and will be deployed as systems according to different schedules. Some of the technologies required by various user services are currently available in the market place, while others will require significant research and development before they can be deployed. The development and deployment of an individual service will be guided by the policies and priorities established by both the public and private sector participants. These policies and priorities will evolve based on changing technologies, economic factors, and market conditions.

- Costs and benefits of user services depend upon deployment scenarios. Once the basic technological functions, such as communications or surveillance, have been deployed for one user service, the additional functions needed by one or more related services may require only a small incremental cost to produce additional, often significant, benefits.

- Many user services can be deployed in rural, suburban and/or urban settings. User services are not specific to a particular location. Rather, the function of the service can be adapted to meet local needs and conditions.

3.2 User Service Bundling

Although it may be possible to deploy a system that provides a single user service, in many cases there are combinations of user services that can be considered related. These combinations of user services have been termed "bundles."

The relationship among user services in a bundle may relate to a number of different factors. In some cases, the institutional similarities of organizations that will deploy the services provide the basis for bundling. In other cases, user service bundling may center around common technical functions.

The bundles and user services are shown in **Table 3-1,** and are described in the following paragraphs.

Table 3-l
User Service Bundles

Bundle	User Services
1. Travel and Transportation Management	1. En-Route Driver Information 2. Route Guidance 3. Traveler Services Information 4. Traffic Control 5. Incident Management 6. Emissions Testing and Mitigation
2. Travel Demand Management	1. Pre-Trip Travel Information 2. Ride Matching and Reservation 3. Demand Management and Operations
3. Public Transportation Operations	1. Public Transportation Management 2. En-Route Transit Information 3. Personalized Public Transit 4. Public Travel Security
4. Electronic Payment	1. Electronic Payment Services
5. Commercial Vehicle Operations	1. Commercial Vehicle Electronic Clearance 2. Automated Roadside Safety Inspection 3. On-board Safety Monitoring 4. Commercial Vehicle Administrative Processes 5. Hazardous Materials Incident Response 6. Commercial Fleet Management
6. Emergency Management	1. Emergency Notification and Personal Security 2. Emergency Vehicle Management

Bundle	User Services
7. Advanced Vehicle Control and Safety Systems	1. Longitudinal Collision Avoidance 2. Lateral Collision Avoidance 3. Intersection Collision Avoidance 4. Vision Enhancement for Crash Avoidance 5. Safety Readiness 6. Pre-Crash Restraint Deployment 7. Automated Highway System

3.2.1 Travel and Transportation Management

The Travel and Transportation Management user services are included in a single bundle because of the information they share about the surface transportation system. These services collect and process information about the surface transportation system, and provide commands to various traffic control devices. Travel management services disseminate this information to the traveler. When used in concert, these services can provide a comprehensive travel and transportation management system. These services also provide information to support the Travel Demand Management and the Public Transportation Operations bundles.

En-Route Driver Information

Driver advisories are similar to pre-trip planning information, but they are provided once travel begins. Driver advisories convey real-time information about traffic conditions, incidents, construction, transit schedules, and weather conditions to drivers of personal, commercial and public transit vehicles. This information allows a driver to either select the best route, or shift to another mode in mid-trip if desired.

In-vehicle signing, the second component of en-route driver information, provides the same types of information found on physical road signs today, directly in the vehicle. The service could be extended to include warnings of road conditions and safe speeds for specific types of vehicles, such as autos, buses, and large trucks, but potential users include drivers of all types of vehicles. This service might be especially useful to elderly drivers, in rural areas with large numbers of tourists, or in areas with unusual or hazardous roadway conditions.

Route Guidance

The route guidance service provides a suggested route to reach a specified destination. Early route guidance systems are based on static information about the roadway network or transit schedules. When fully deployed, route guidance systems will provide travelers with directions to their destinations based on real-time information about the transportation system. The route guidance service will consider traffic conditions, status and schedule of transit systems, and road closures in developing the best route. Directions will generally consist of simple instructions on turns or other upcoming maneuvers. Users of the service include not only drivers of all types of vehicles, but also non-vehicular travelers, such as pedestrians or bicyclists, who could get specialized route guidance from a hand-held device.

Traveler Service Information

Traveler services information provides quick access to travel-related services and facilities. Examples of information that might be included are the location, operating hours, and availability of food, lodging, parking, auto repair, hospitals, and police facilities. Traveler services information would be accessible in the home, office or other public locations to plan trips; and would also be available en-route. When fully deployed, this service will connect users and providers interactively to request and provide needed information. A comprehensive, integrated service could support financial transactions, such as automatic billing for purchases.

Traffic Control

The traffic control user service provides for the integration and adaptive control of the freeway and surface street systems to improve the flow of traffic, give preference to public safety, transit or other high occupancy vehicles, and minimize congestion while maximizing the movement of people and goods. Through appropriate traffic controls, the service also promotes the safety of non-vehicular travelers, such as pedestrians and bicyclists. It requires advanced surveillance of traffic flows, analysis techniques for determining appropriate traffic signal and ramp metering controls, and communication of these controls to the roadside infrastructure. This service gathers data from the transportation system and organizes it into usable information to determine the optimum assignment of right-of-way to vehicles and pedestrians. The real-time traffic information collected by the Traffic Control service also provides the foundation for many other user services.

Incident Management

The Incident Management service uses advanced sensors, data processing, and communications to improve the incident management and response capabilities of transportation and public safety officials, the towing and recovery industry, and others involved in incident response. The service will enhance existing incident detection and verification capabilities to help these groups quickly and accurately identify a variety of incidents and implement a response. The improved response time will minimize the effects of these incidents on the movement of people and goods. This service will also help transportation officials predict traffic or highway conditions so that they can take action in advance to prevent potential incidents or minimize their impacts. While the direct users of this service are the public and private entities responsible for incident detection and response, the ultimate beneficiaries are commercial and transit operators, and the traveling public.

Emissions Testing and Mitigation

The Emissions Testing and Mitigation service uses advanced vehicle emissions testing systems to provide information to identify environmental “hot spots” and implement strategies to either reroute traffic around sensitive air quality areas or control access to such areas. Other technologies provide identification of vehicles that are emitting levels of pollutants that exceed state, local or regional standards, and provides information to drivers or fleet operators to enable them to take corrective action. The service also provides transportation planning and operating agencies with information that can be used to facilitate implementation and evaluation of various pollution control strategies.

3.2.2 Travel Demand Management

The Travel Demand Management user services support policies and strategies that are aimed at reducing vehicle demand by developing and encouraging modes of travel other than the single occupant vehicle. The services in this bundle are designed to increase the use of high occupancy vehicles and transit by providing intermodal information to travelers prior to the beginning of a trip, and by making ride sharing and transit more convenient and easier to use. These services are also aimed at decreasing congestion by alerting the timing or location of trips, or eliminating vehicle trips all together.
From a technical perspective, these services rely on information collected and processed by the Travel and Transportation Management services and the Public Transportation Operations services. Travel Demand Management services also interact with the Travel and Transportation Management services in terms of implementing control strategies that can provide incentives, or disincentives, to change travel behavior.

Pre-Trip Travel Information

Pre-trip travel information allows travelers to access a complete range of intermodal transportation information at home, work, and other major sites where trips originate. Real-time information on transit routes, schedules, transfers, fares, and ride matching services are available to encourage the use of alternatives to the single occupancy vehicle. Information needed for long, inter-urban or vacation trips would also be available. Real-time information on accidents, road construction, alternate routes, traffic speeds along given routes, parking conditions, event schedules, and weather information is also included. Based on this information, the traveler can select the best route, modes of travel and departure time, or decide not to make the trip at all.

Ride Matching and Reservation

The Ride Matching and Reservation service provides real-time ride matching information and reservations to users in their homes, offices or other locations, and assist transportation providers, as well as van/carpoolers, with vehicle assignments and scheduling. This will expand the market for ridesharing as an alternative to single occupant vehicle travel and will provide for enhanced alternatives for special population groups, such as the elderly or the handicapped.

Demand Management and Operations

The Demand Management and Operations service generates and communicates management and control strategies that support the implementation of programs to reduce the number of individuals who choose to drive alone, especially to work; increase the use of high occupancy vehicles and transit; and provide a variety of mobility options for those who wish to travel in a more efficient manner, for example in non-peak
periods. Demand management strategies could ultimately be applied dynamically, when congestion or pollution conditions warrant. For example, disincentives such as increased tolls and parking fees could be applied during pollution alerts or peak travel periods, while transit fares would be lowered to accommodate the increased number of travelers changing modes from driving alone. Such strategies will reduce the negative impacts of traffic congestion on the environment and improve overall quality of life.

3.2.3 Public Transportation Operations

The Public Transportation Operations bundle reflects the commonality of the transit authority as the most probable provider of these services. The transit authority is responsible for implementing systems that are capable of better managing the public transportation system and providing improved transit and mode choice information.

From a technical perspective, all of these user services will share a common public transit database. The data will be available for all of the services to customize for their specific function. This data will also support services in the Travel and Transportation Management and the Travel Demand Management bundles.

Public Transportation Management

The Public Transportation Management service provides computer analysis of real-time vehicle and facility status to improve transit operations and maintenance. The analysis identifies deviations from schedule and provides potential solutions to dispatchers and drivers. Integrating this capability with traffic control services can help maintain transportation schedules and assure transfer connections in inter-modal transportation. Information regarding passenger loading, bus running times, and mileage accumulated will help improve service and facilitate administrative reporting. Transit personnel management is enhanced by automatically recording and verifying tasks performed by transit personnel.

En-Route Transit Information

The En-Route Transit Information service provides information to assist the traveler once public transportation travel begins. Real-time, accurate transit service information on-board the vehicle helps travelers make effective transfer decisions and itinerary modifications as needed while a trip is underway.

Personalized Public Transit

Small publicly or privately-operated vehicles provide on-demand routing to pick up passengers who have requested service and deliver them to their destinations. Route deviation schemes, in which vehicles leave a fixed route for a short distance to pick up or discharge passengers, is another way of improving service. Vehicles can include small buses, taxicabs, or other small, shared ride vehicles. This service can provide almost door-to-door service, expanding transit coverage to lesser populated locations and neighborhoods. Potentially, this service can provide transportation at lower cost and with greater convenience than conventional fixed route transit.

Public Travel Security

This service provides systems that monitor the environment in transit stations, parking lots, bus stops, and on-board transit vehicles, and generate alarms, either automatically or manually, when necessary. This improves security for both transit riders and operators. Transportation agencies and authorities can integrate this user service with other anti-crime activities.

3.2.4 Electronic Payment

While this bundle contains only one user service, it supports deployment of many other servicesboth within and outside the transportation arena. This service will be developed, deployed, and operated by both public and private organizations.

Electronic Payment Services

Electronic Payment services will foster inter-modal travel by providing a common electronic payment medium for all transportation modes and functions, including tolls, transit fares, and parking. The service provides for a common service fee and payment structure using "smart cards" or other technologies. Such systems could be expanded to become truly multi-use, accommodating personal financial transactions that are made with today's credit/bank cards. The flexibility that electronic payment services offer will also facilitate travel demand management, if conditions warrant. They could, if local authorities so choose, enable application of road pricing policies which could influence departure times and mode selection.

3.2.5 Commercial Vehicle Operations

These user services support the goals of improving the efficiency and safety of commercial fleet operations, and will benefit both the States and the motor carrier industry. Thus, the CVO bundle reflects the commonality of using advanced computer and communications technologies to improve the safety and productivity of the motor carrier industry throughout North America.
From a technical perspective, the foundation for all of the CVO user services is information systems. Each service will require some set of information on the motor carrier, the vehicle, the driver, and, in some cases, the cargo. The services are interrelated in terms of the specific types and functionality of information and data required. This network of information will be accessible by States and motor carriers nationwide.

Commercial Vehicle Electronic Clearance

This service will enable transponder-equipped trucks and buses to have their safety status, credentials, and weight checked at mainline speeds. Vehicles that are safe and legal and have no outstanding out-of-service citations will be allowed to pass the inspection/weigh facility without delay.

By working with Mexico and Canada, a more efficient traffic flow would be provided at border crossings. The deployment of technologies in these countries could ultimately prevent overweight, unsafe, or improperly registered vehicles from entering the United States.

Automated Roadside Safety Inspection

Automated roadside inspections would allow real-time access at the roadside to the safety performance record of carriers, vehicles, and drivers. Such access will help determine which vehicle or driver should be stopped for an inspection, as well as ensuring timely correction of previously identified problems.

This service would also automate as many items as possible of the manual inspection process. It would, for example, allow for more rapid and accurate inspection of brake performance at the roadside. Through the use of sensors and diagnostics, it would efficiently check vehicle systems and driver requirements and ultimately driver alertness and fitness for duty.

On-Board Safety Monitoring

On-board systems would monitor the safety status of a vehicle, cargo, and driver at mainline speeds. Vehicle monitoring would include sensing and collecting data on the condition of critical vehicle components such as brakes, tires, and lights, and determining thresholds for warnings and countermeasures. Cargo monitoring would involve sensing unsafe conditions relating to vehicle cargo, such as shifts in cargo while the vehicle is in operation. Driver monitoring is envisioned to include the monitoring of driving time and alertness using non-intrusive technology and the development of warning systems for the driver, the carrier, and the enforcement official. A warning of unsafe condition would first be provided to the driver and then to the carrier and roadside enforcement officials. This warning notification would possibly prevent an accident from happening. This service would minimize driver-and equipment-related accidents for participating carriers.

Commercial Vehicle Administrative Processes

The Commercial Vehicle Administrative Processes service provides the commercial carrier with the capability to electronically purchase annual and temporary credentials via computer link it will reduce burdensome paperwork and processing time for both the State agencies and the motor carriers. For automated mileage and fuel reporting and auditing, this service enables participating interstate carriers to electronically capture mileage, fuel purchased, trip, and vehicle data according to state. It would also automatically determine mileage traveled and fuel purchased in each state, for use by the carrier in preparing fuel tax and registration reports to the State agencies. This service would reduce the significant administrative burden on commercial carriers to collect and report mileage and fuel purchased within each State.

Hazardous Material Incident Response

The Hazardous Material Incident Response service enhances the safety of shipments of hazardous materials by providing enforcement and response teams with timely, accurate information on cargo contents to enable them to react properly in emergency situations. The materials or combination of materials involved when an incident involving a truck carrying hazardous material occurs would be provided electronically to emergency responders and enforcement personnel at the scene so that the incident can be handled properly.

Commercial Fleet Management

The Commercial Fleet Management service provides real-time traffic information and vehicle location for commercial vehicles. This service significantly enhances fleet operations management by helping drivers to avoid congested areas and improving the reliability and efficiency of pickups and deliveries.

These benefits are particularly important for operators of intermodal and time-sensitive fleets who can use this ITS service to make their operations more efficient and reliable.

3.2.6 Emergency Management

Police, fire and rescue operations can use emergency management services to improve their management of and response to emergency situations. These user services have common functional elements such as vehicle location, communications, and response.

Emergency Notification and Personal Security

The Emergency Notification and Personal Security service includes two capabilities: driver and personal security, and automatic collision notification. Driver and personal security capabilities provide for user-initiated distress signals for incidents such as mechanical breakdowns or carjackings. When activated by an incident, automatic collision notification transmits information regarding location, nature, and severity of the crash to emergency personnel.

Emergency Vehicle Management

The Emergency Vehicle Management service provides public safety agencies with fleet management capabilities, route guidance, and signal priority and/or preemption for emergency vehicles. Fleet management improves the display of emergency vehicle locations and help dispatchers send the units that can most quickly reach an incident site. Route guidance directs emergency vehicles to an incident location and signal priority optimizes the traffic signal timing in an emergency vehicle's route. Primary users of this service include police, fire, and medical units.

3.2.7 Advanced Vehicle Control and Safety Systems

Although each of these services addresses a separate function, they all contribute to the common goal of improving vehicle safety. With the exception of Automated Highway Systems (AHS), all of these user services are characterized by near-term reliance on self-contained systems within the vehicle. The functionality of these user services, however, can be enhanced by supplementing the on-board capabilities with additional sensors deployed in the infrastructure.

Within the vehicle, common functional elements, such as data storage, processing units, sensors, or actuators, could be shared among the user services in this bundle, including AHS.

Longitudinal Collision Avoidance

The Longitudinal Collision Avoidance service helps reduce the number and severity of longitudinal collisions, such as head-on, rear-end or backing. It includes the sensing of potential or impending collisions, prompting a driver's avoidance actions, and controlling the vehicle temporarily.

Lateral Collision Avoidance

The Lateral Collision Avoidance service provides crash warnings and controls for lane changes and road departures. It will reduce the number of lateral collisions involving two or more vehicles, as well as, crashes involving a single vehicle leaving the roadway.

For changing lanes, a situation display can monitor the vehicle's blind spot continuously, and drivers can be actively warned of an impending collision. If needed, automatic control can provide rapid response to a situation. Warning systems can also alert a driver to an impending road departure, provide help in keeping the vehicle in the lane, and ultimately provide automatic control of steering and throttle.

Intersection Collision Avoidance

The Intersection Collision Avoidance service warns drivers of imminent collisions when approaching or crossing an intersection that has traffic control (e.g., stop signs or a traffic signa1). This service also alerts the driver when the proper right-of-way at the intersection is unclear or ambiguous.

Vision Enhancement for Crash Avoidance

The Vision Enhancement service provides drivers with improved visibility to allow them to avoid collisions with other vehicles or obstacles in the roadway, as well as help them comply with traffic signs and signals. This service requires in-vehicle equipment for sensing potential hazards, processing this information, and displaying it in a way that is useful to a driver.

Safety Readiness

Safety Readiness services provide in-vehicle equipment that unobtrusively monitors a driver's condition and provides a warning if the driver is becoming drowsy or otherwise impaired. This service could also monitor critical components of the automobile internally and alert the driver to impending malfunctions. Equipment within the vehicle could also detect unsafe road conditions, such as bridge icing or standing water on the roadway, and provide a warning to the driver.

Pre-Crash Restraint Development

The Pre-Crash Restraint Deployment service anticipates an imminent collision by determining the velocity, mass, and direction of the vehicles or objects involved in a potential crash. The service activates safety systems in the vehicle prior to a collision, such as tightening lap-shoulder belts, arming and deploying air bags at the optimal pressure, and deploying roll bars. The response is based on the number, location, and major physical characteristics of any occupants.

Automated Highway Systems

AHS is a long-term goal of ITS which would provide vast improvements in safety by creating a nearly accident-free driving environment. In AHS, the vehicle is guided automatically rather than by the driver. Driver error is reduced or possibly eliminated with full implementation. Drivers could buy vehicles with the necessary instrumentation or retrofit an existing vehicle. During the transition period, vehicles that are incapable of automated operation would drive in lanes without automation. AHS benefits include increased roadway capacity, enhanced safety, reduced fuel consumption, and reduced emissions.

4.0 ITS Applications in the I-84 Corridor

In a previous memorandum, an assessment was made of the transportation needs in the I-84 corridor. At that time a number of needs and deficiencies were identified. **Table 4-l** lists the I-84 needs.

Table 4-l
Transportation Needs and Deficiencies in the I-84 Corridor

Ice and Snow near Ladd Canyon, Blue Mtns., Cabbage Hill, Gorge, 3 Mile Hill.
High Winds.
Congestion near Portland and Boise.
Rock Slides.
isolated areas in southeast corridor hard to reach during incidents, detour problems.
Water on road creates visibility/safety problems from spray and on-coming lights.
Additional turnouts needed at scenic views.
Overuse and high traffic at Gorge tourist attractions, e.g. Multnomah Falls.
More safety rest areas needed. Can no longer use some parks due to day use fees.
Trucks drive too fast, more enforcement needed.
Height limits at tunnel near Cascade Locks.
Shaded areas stay icy, especially. bridges.
Wrldlife crossings near Lime, Pleasant Valley, Gorge, near orchards.
Triple trailer conflicts with cars
Inadequate parking for recreationalists. Park on shoulders and create safety problems.
Need more tourist information, e.g. kiosks at pullouts.
Signage is restricted in Gorge area.
Need more road information. Motorists get caught in places and can't turn back.
Bridges and tunnels too narrow for bikes and pedestrians.
Dust storms.
Steep Grades.
Fog.
High rate of wet weather related accidents in Portland area.
High rate of ice related accidents areas outside of Portland.
High rate of roadside assistance calls in eastern Oregon and near Caldwell.
Need improved CVO clearance at weigh stations.
Need to track out of service vehicles
Some bridges have restricted load limits.
Tooth Rock tunnel near Cascade Locks needs better lighting.
Roadway heavily rutted in Gorge and on eastbound Cabbage Hill.
Communication limitations in Ladd Canyon.

Substandard curves east of Baker City.

Interagency coordination to develop policies and plans for incidents.

This Technical Memorandum documents potential ITS user services that could be deployed to solve the transportation problems.

4.1 ITS User Services and I-84 Transportation Needs

As discussed in Section 2.0, ITS user services were matched with the transportation needs in the corridor. These relationships were recorded in a matrix. **Table 4-2** documents the results of the matching process. In an effort to provide greater detail about the user services, an expanded matrix was also prepared to show the degree of benefits that can be expected from a particular user service. The expanded matrix is located in **Appendix C.**

Table 4-2
Matrix of ITS User Services and I-84 Corridor Needs

4.2 Discussion of I-84 Results

Table 4-2 shows the total number of matches between each specific transportation need and the 29ITS user services for the I-84 corridor. The numbers listed in the matrix provide an indication of the extent to which the benefits provided by a user service meet the specific need. This matrix does not take into account the prioritization of the transportation needs, or the cost-benefit ratios associated with ITS alternatives. As a result, the matrix does not indicate which user services should be implemented, but rather how well the benefits they provide address the identified transportation needs.

Route Guidance, En-Route Driver Information, and Pre-Trip Travel Information had the highest numbers of matches with needs identified in the I-84 corridor. They all scored high with most of the needs identified in the corridor, and in particular with needs associated with traffic congestion in Portland and Boise. They also matched well with weather related needs. Automated Highway Systems and several other of the Advanced Vehicle Safety Systems also had a large number of matches. Most of these technologies are not immediately available for implementation and are not appropriate short term solutions; however, they should be included in the development of long term ITS strategies.

Of the remaining user services, Incident Management, Commercial Vehicle Electronic Clearance, On-Board Safety Monitoring, Traffic Control, and En-Route Transit Information also matched well with some of the transportation needs.

Examination of the total number of matches for each transportation need indicates which needs can best be addressed with ITS user services. Congestion near Portland and Boise had the highest number of matches with user services. This is mostly likely a result of the fact that many of the user services were developed with the goal of addressing problems related with urban traffc congestion. Weather related needs also consistently matched well with ITS user services.

The following text summarizes the short, medium, and long term corridor needs and the ITS user services most appropriate for addressing the needs.

4.2.1 Short Term Needs

Need to Address High Volumes. Weather. and Congestion Problems in Idaho

Of all the transportation needs, congestion related problems had the highest number of matches with ITS user services. The user services which best match these needs are En-Route Driver Information, Route Guidance, Pre-Trip Travel Information, Traffic Control, Public Transportation Management, and En-Route Transit Information. For weather-related needs, the most applicable user services are Route Guidance, En-Route Driver Information, and Pre-Trip Travel Information. Advanced Vehicle Safety Systems also had a large number of matches with weather related needs, but these systems are generally dependent on technology which is not currently available. Therefore, these systems are not considered as short term solutions.

Need Road Weather Information Systems

Several of the specific needs identified in the corridor are related to weather conditions. For these needs. En-Route Driver Information, Route Guidance, and Pre-Trip Travel Information all had a large number of matches.

Need Weather and Recreation Information in the Gorge

Many of the specific transportation needs previously identified in the corridor are related to weather and recreation information in the Columbia Gorge. The ITS user services that are most applicable to these needs were determined to be Route Guidance, En-Route Driver Information, and Pre-Trip Travel Information. Specifically related to recreation needs, Demand Management and Operations also had a large number of matches.

Need to Provide General Corridor Information at State Borders

The need to provide various types of information to motorists can be addressed with Route Guidance, En-Route Driver Information, and Traveler Services Information.

Need to Improve Efficiency of Commercial Vehicle Operations

Commercial Vehicle Electronic Clearance, Automated Roadside Safety Inspection, Electronic Payment Services, On-Board Safety Monitoring, Commercial Vehicle Administrative Processes all matched well with meeting the needs improve CVO clearance and track out-of-service vehicles. Although these needs were not specifically mentioned by the stakeholders

Need Better Police Enforcement

The need for more police enforcement in the corridor is primarily a funding and staffing issue. However, some ITS applications may help improve the efficiency of law enforcement personnel. User services designed to reduce the number and severity of accidents and the number of roadside assistance calls would help decrease the amount of time personnel spend responding to these events. The user services which best match these needs are Route Guidance, En-Route Driver Information, Pre-Trip Travel Information, On-Board Safety Monitoring, and several of the Advanced Vehicle Safety Systems. Improving incident management and response may also help improve the efficiency of law enforcement personnel. The user services which best address thisissue are Incident Management, Hazardous Materials Incident Response, Route Guidance, Traffic Control, Emergency Notification and Persona1 Security, and Emergency Vehicle Management.

Need Interagency Incident Policies and Procedure

This need did not have a large number of matches any of the ITS user services. This was expected, as this need is associated primarily with administrative and coordination issues. Several ITS user services, however, did have a small number of matches and may contribute to the solution for this problem. These services include Incident Management, Hazardous Materials Incident Response, Route Guidance, Traffic Control, Emergency Notification and Persona1 Security, and Emergency Vehicle Management. All of

these services are related to improving incident management, but do not specifically address the need for interagency coordination. Rather, these user services should be considered during the development of interagency incident policies and procedures.

Need Corridor ITS Implementation and Communications Master Plan

The need for a master plan is not an issue that can be addressed with specific ITS user services. The appropriate user services, however, should be selected and prioritized before the development of this plan.

4.2.2 Medium Term Needs

Need Weather Information in the Blue Mountains

For weather-related needs, the most applicable user services are Route Guidance, En-Route Driver Information, and Pre-Trip Travel Information.

Need Better Incident Management and General Traveler Information

The most applicable ITS user services for improving incident management in the Gorge and throughout the corridor are Incident Management, Hazardous Materials Incident Response, Route Guidance, En-Route Driver Information, Traffic Control, Emergency Notification and Personal Security, and Emergency Vehicle Management. Traveler Services Information and Pre-Trip Travel Information can provide additional traveler information.

Need Advance Information about Multnomah Falls Parking Lot

Several ITS user services may be part of the solution to the problems at the Multnomah Falls parking lot. Route Guidance, En-Route Travel Information, Pre-Trip Travel Information, Traffic Control, Incident Management, and Traveler Services Information all may have applications which could be used to meet the needs.

Need More and Safer Rest Areas

In relation the need for additional rest areas, there were generally few matches with ITS user services. ITS solutions could help address this problem by better guiding motorists to the existing rest areas. The user services that apply are En-Route Driver Information, Route Guidance, Pre-Trip Travel Information, and Traveler Services Information. Safety issues can be addressed with Emergency Notification and Personal Security user service.

Need Coordination With Existing and Future ITS Systems

The need for coordination between existing and future ITS Systems is not addressed by specific user services. Rather, the appropriate user services in the corridor should be considered in the development of a coordination plan.

4.2.3 Long Term Needs

Need More Freeway Overcrossings

The lack of overcrossings and median turn-arounds is predominantly a problem in Eastern Oregon. ITS user services may be applicable to help reduce response time by making more efficient use of existing overcrossings and emergency resources. The services that apply are Incident Management, Hazardous Materials Incident Response, Route Guidance, En-Route Driver Information, Traffic Control, Emergency Notification and Personal Security, and Emergency Vehicle Management.

Need to Resolve Truck Restrictions on Bridges

The bridges at Cascade Locks, Hood River, and The Dalles have weight and size limitations for trucks. Some ITS user services may be applicable to detect, alert, and reroute overweight or oversized vehicles. These services are En-Route Driver Information, Route Guidance, and On-Board Safety Monitoring.

Need to Resolve Height Limitations in Tooth Rock Tunnel

Generally, this is a roadway geometric and design issue that needs can not be solved with ITS user services. Until a permanent solution is implemented, some ITS user services may help address this problem. Some ITS user services may be applicable to detect, alert, and reroute overheight vehicles. These services include En-Route Driver Information, Route Guidance, and Pre-Trip Travel Information.

5.0 ITS Applications in the I-82 Corridor

In a previous memorandum, an assessment was made of the transportation needs in the I-82 corridor. At that time a number of needs and deficiencies were identified. **Table 5-l** lists the I-82 needs.

Table 5-l
Transportation Needs and Deficiencies in the I-82 Corridor

Dust storms.
Water on road creates visibility problems from spray and on-coming lights.
Trucks drive too fast.
icy bridges.
Wildlife crossings near Kenewick.
Significant commuter traffic near Tri-Cities.
High Winds.
Fog.
High rate of ice related accidents.

5.1 ITS User Services and X-82 Transportation Needs

As discussed in Section 2.0, ITS user services were matched with the transportation needs in the corridor. These relationships were recorded in a matrix. **Table 5-2** documents the results of the matching process. In an effort to provide greater detail about the user services, an expanded matrix was also prepared to show the degree of benefits that can be expected from a particular user service. The expanded matrix is located in **Appendix C.**

Table 5-2
Matrix of ITS User Services and I-82 Corridor Needs

5.2 Discussion of I-82 Results

Table 5-2 shows the total number of matches between each specific transportation need and the 29 ITS user services for the I-82 corridor. The numbers listed in the matrix provide an indication of the extent to which the benefits provided by a user service meet the specific need. This matrix does not take into account the prioritization of the transportation needs, or the cost-benefit ratios associated with ITS alternatives. As a result, the matrix does not indicate which user services should be implementedbut rather how well the benefits they provide address the identified transportation needs.

As with the I-84 corridor, Route Guidance, En-Route Driver information, and Pre-Trip Travel Information had the highest numbers of matches with needs identified in the J-82 corridor. Consistent with the I-84 corridor, Automated Highway Systems and several other of the Advanced Vehicle Safety Systems also had a large number of matches.

Of the remaining user services, Incident Management, Commercial Vehicle Electronic Clearance, On-BoardSafety Monitoring, Traffic Control, and En-Route Transit Information also matched well with some of the transportation needs.

Examination of the total number of matches for each transportation need indicates which needs can best be addressed with ITS user services. Congestion near the Tri-Cities had the highest number of matches with user services. Weather related needs also consistently matched well with ITS user services.

5.2.1 Short Term Needs

Need Road Weather Information Systems

Several of the specific needs identified in the corridor are related to weather conditions. For these needs, En-Route Driver Information, Route Guidance, and Pre-Trip Travel Information all had a large number of matches.

Need to Provide General Corridor Information at State Borders

The need to provide various types of information to motorists can be addressed with Route Guidance, En-Route Driver Information, and Traveler Services Information.

Need Better Police Enforcement

The need for more police enforcement is common to all the highway corridors and is primarily a funding and staffing issue. However, some ITS applications may help improve the efficiency of law enforcement personnel. User services designed to reduce the number and severity of accidents and the number of roadside assistance calls would help decrease the amount of time personnel spend responding to these events. The user services which best match these needs are Route Guidance, En-Route Driver Information, Pre-Trip Travel Information, On-Board Safety Monitoring, and several of the Advanced Vehicle Safety Systems. Improving incident management and response may also help improve the efficiency of law enforcement personnel. The user services which best address this issue are Incident

Management, Hazardous Materials Incident Response, Route Guidance, Traffic Control. Emergency Notification and Personal Security, and Emergency Vehicle Management.

Need Interagency Incident Policies and Procedure

This need is common to I-82, I-84, and SR 14; although, this need is associated primarily with administrative and coordination issues. Several ITS user services, however, did have a small number of matches and may contribute to the solution for this problem. These services include Incident Management, Hazardous Materials Incident Response, Route Guidance, Traffic Control, Emergency Notification and Personal Security, and Emergency Vehicle Management. All of these services are related to improving incident management, but do not specifically address the need for interagency coordination. Rather, these user services should be considered during the development of interagency incident policies and procedures.

Need Corridor ITS Implementation and Communications Master Plan

The need for a master plan is common to all of the highway corridors included in this study. It is not an issue that can be addressed with specific ITS user services. The appropriate user services, however, should be selected and prioritized before the development of this plan.

5.2.2 Medium Term Needs

Need Better Incident Management and General Traveler Information

The most applicable ITS user services for improving incident management in the corridor are Incident Management, Hazardous Materials Incident Response, Route Guidance, En-Route Driver Information, Traffic Control, Emergency Notification and Personal Security, and Emergency Vehicle Management. Traveler Services Information and Pre-Trip Travel Information can provide additional general Traveler Information.

Need Coordination With Existing and Future ITS Systems

The need for coordination between existing and future ITS Systems is not addressed by specific user services. Rather, the appropriate user services in the corridor should be considered in the development of a coordination plan.

6.0 ITS Applications in the SR 14 Corridor

In a previous memorandum, an assessment was made of the transportation needs in the SR 14 corridor. At that time a number of needs and deficiencies were identified. **Table 6-1** lists the SR 14 needs.

Table 6-1
Transportation Needs and Deficiencies in the SR 14 Corridor

Ice and snow near Cape Horn.
Congestion near Vancouver.
Narrow roadway' and tunnels.
Rock Slides.
Additional turnouts needed at scenic views.
Water on road creates visibility problems from spray and on-coming lights.
More rest areas needed.
Trucks drive too fast.
More truck climbing lanes needed in steep areas.
Difficult for trucks on narrow and steep areas west of Bingen. Many switch to I-84.
Height limits at tunnels
Blind curves and left hand turns at intersections and driveways create safety problems.
High winds.
Icy bridges.
Inadequate parking for recreationalists. Park on shoulders and create safety problems.
Need increased tourist information to capture more traffic from I-84.
Signage is restricted in Gorge area.
Trucks using road to avoid Oregon weight-mile tax, especially east of Bingen.
Auto/rail conflicts at grade crossings.
Turn onto Hood River Bridge too tight. Causes trucks to blow tires.
Bridges too narrow for bikes and pedestrians.
High rate of wet weather related accidents.
Need for more view corridors in Gorge..
Some bridges have restricted load limits.
Conflicts with bikes in narrow tunnels.
Some tunnels are not lined. Freezing water causes rocks to fall from ceiling.

6.1 ITS User Services and SR 14 Transportation Needs

As discussed in **Section 2.0,** ITS user services were matched with the transportation needs in the corridor. These relationships were recorded in a matrix. **-Table 6-2** documents the results of the matching process. In an effort to provide greater detail about the user services, an expanded matrix was also prepared to show the degree of benefits that can be expected from a particular user service. The expanded matrix is located in **Appendix C.**

Table 6-2
Matrix of ITS User Services and SR 14 Corridor Needs

6.2 Discussion of SR 14 Results

Table 6-2 shows the total number of matches between each specific transportation need and the 29 ITS user services for the SR 14 corridor. The numbers listed in the matrix provide an indication of the extent to which the benefits provided by a user service meet the specific need. This matrix does not take into account the prioritization of the transportation needs, or the cost-benefit ratios associated with ITS alternatives. As a result, the matrix does not indicate which user services should be implemented, but rather how well the benefits they provide address the identified transportation needs.

As with the I-84 and I-82 corridors, Route Guidance, En-Route Driver Information, and Pre-Trip Travel Information had the highest numbers of matches with needs identified in the SR- 14 corridor. Automated Highway Systems and several other of the Advanced Vehicle Safety Systems also had a large number of matches.

Of the remaining user services, Incident Management, Commercial Vehicle Electronic Clearance, On-Board Safety Monitoring, Traffic Control, and En-Route Transit Information also matched well with some of the transportation needs.

Examination of the total number of matches for each transportation need indicates which needs can best be addressed with ITS user services. Congestion near Vancouver had the highest number of matches with user services. Weather related needs also consistently matched well with ITS user services.

6.2.1 Short Term Needs

Several of the specific needs identified in the corridor are related to weather conditions. For these needs, En-Route Driver Information, Route Guidance, and Pre-Trip Travel Information all had a large number of matches.

Need Weather and Recreation Information in the Gorge

Similar to I-84, many of the specific transportation needs previously identified in the corridor are related to weather and recreation information in the Columbia Gorge. The ITS user services that are most applicable to these needs were determined to be Route Guidance, En-Route Driver Information, and Pre-Trip Travel Information. Specifically related to recreation needs, Demand Management and Operations also had a large number of matches.

Need to Address Ice Problems Near Cape Horn

The ITS user services that are most applicable to address problems associated with ice near Cape Horn were determined to be Route Guidance, En-Route Driver Information, and Pre-Trip Travel Information.

Need Better Police Enforcement

This problem is common to all the highway corridors and is primarily a funding and staffing issue. However, some ITS applications may help improve the efficiency of law enforcement personnel. User services designed to reduce the number and severity of accidents and the number of roadside assistance calls would help decrease the amount of time personnel spend responding to these events. The user services which best match these needs are Route Guidance, En-Route Driver Information, Pre-Trip Travel Information, On-Board Safety Monitoring, and several of the Advanced Vehicle Safety Systems. Improving incident management and response may also help improve the efficiency of law enforcement personnel. The user services which best address this issue are Incident Management, Hazardous Materials Incident Response, Route Guidance, Traffic Control, Emergency Notification and Personal Security, and Emergency Vehicle Management.

Need Interagency Incident Policies and Procedure

This need is common to I-84, I-82, and SR 14. It did not have a large number of matches any of the ITS user services. This was expected, as this need is associated primarily with administrative and coordination issues. Several ITS user services, however, did have a small number of matches and may contribute to the solution for this problem. These services include Incident Management, Hazardous Materials Incident Response, Route Guidance, Traffic Control, Emergency Notification and Personal Security, and Emergency Vehicle Management. All of these services are related to improving incident management, but do not specifically address the need for interagency coordination. Rather, these user services should be considered during the development of interagency incident policies and procedures.

Need to Address Capacity and Safety Problems

The need for passing lanes and turnouts on the western part of SR 14 (MP 20 to 37) is not an issue that can be solved with specific ITS user services. Some user services may be applicable to help manage the problems associated with these needs. These user services include En-Route Driver Information, Route Guidance, Pre-Trip Travel Information, and Traffic Control.

Need Corridor ITS Implementation and Communications Master Plan

The need for a master plan is common to all of the highway corridors included in this study. It is not an issue that can be addressed with specific ITS user services. The appropriate user services, however, should be selected and prioritized before the development of this plan.

6.2.2 Medium Term Needs

Need Better Incident Management and General Traveler Information

The most applicable ITS user services for improving incident management in the Gorge and throughout the corridor are Incident Management, Hazardous Materials Incident Response, Route Guidance, En-Route Driver Information, Traffic Control, Emergency Notification and Personal Security, and Emergency Vehicle Management. Traveler Services Information and Pre-Trip Travel Information can provide additional general Traveler Information.

Need More and Safer Rest Areas

In relation to the need for additional rest areas or roadside services, there were generally few matches with ITS user services. ITS solutions could help address this problem by better guiding motorists to existing services. The user services that apply are En-Route Driver Information, Route Guidance. Pre-Trip Travel Information, and Traveler Services Information. Safety issues can be addressed with the Emergency Notification and Personal Security user service.

Need Better Access Management

Access management deficiencies on SR 14 are policy and roadway design issues which can not addressed with ITS user services, however, some ITS technologies may be appropriate to alert drivers of congested or hazardous locations.

Need Coordination With Existing and Future ITS Systems

The need for coordination between existing and future ITS Systems is not addressed by specific user services. Rather, the appropriate user services in the corridor should be considered in the development of a coordination plan.

Need to Address Problems Associated with the Oregon Weigh-Mile Tax

This is primarily a policy issue which must be addressed by both Washington and Oregon. ITS user services are not directly applicable to this problem.

6.2.3 Long Term Needs

The bridges at Cascade Locks, Hood River, and The Dalles have weight and size limitations for trucks. Some ITS user services may be applicable to detect, alert, and reroute overweight or oversized vehicles. These services are En-Route Driver Information, Route Guidance, and On-Board Safety Monitoring.

Need to Resolve Height Limitations in Tunnels

Generally, this is a roadway geometric and design issue that needs can not be solved with ITS user services. Until a permanent solution is implemented, some ITS user services may help address this problem. Some ITS user services may be applicable to detect, alert, and reroute overheight vehicles. These services include En-Route Driver Information, Route Guidance, and Pre-Trip Travel Information.

7.0 ITS Applications for Other Transportation Modes

In a previous memorandum, an assessment was made of the Columbia River and railroad transportation needs in the corridor. At that time a number of needs and deficiencies were identified. **Table 7-l** lists the Columbia River needs.

Table 7-l
Columbia River Transportation Needs and Deficiencies in the Corridor

Draw down below the minimus operating pool may restrict river traffic.
Better coordination wl railroads.
Wind surfers and fishermen get in the way of barges.
Road access into port facilities is difficult.
Need upgraded facilities at the Port of Morrow.

Table 7-2 lists the railroad needs.

Table 7-2
Railroad Transportation Needs and Deficiencies in the Corridor

Lack of passenger services. Frequency too low.
Rail corridors at or above capacity.
Restrictions in scenic areas prevent capacity expansion.
Yard constraints in Portland and Vancouver, Gorge sidings used for storage.
Expensive to transfer freight across the river.
Better coordination wl barge operators.
Rock slides.
People crossing tracks to get access to river.
Auto/rail conflicts at grade crossings.
Some of SR 14 in BNSF right of way, limits road expansion

7.1 ITS User Services and Barge and Railroad Transportation Needs

As discussed in Section 2.0, ITS user services were matched with the transportation needs in the corridor. These relationships were recorded in a matrix. **Table** 7-3 and **Table** 7-4 documents the results of the matching process. In an effort to provide greater detail about the user services, an expanded matrix was also prepared to show the degree of benefits that can be expected from a particular user service. The expanded matrix is located in **Appendix C.**

Table 7-3
Matrix of ITS User Services and Columbia River Needs

Table 7-4
Matrix of ITS User Services and Railroad Needs

7.2 Discussion of Columbia River Results

Results from **Table** 7-3 indicate that the greatest number of matches between ITS user services and Columbia River needs are associated with En-Route Driver Information, Route Guidance. Pre-Trip Travel Information, Public Transportation Management, and Electronic Payment Services. Although several user services were matched with the Columbia River issues, the user services are generally more suited to the land side of the barge operations. When considered with the specific river needs, there appear to be no ITS technologies that clearly address the priorities of the river. If ITS projects are deployed for river operations, the greatest potential benefit would be to improve the coordination with the railroad and improving access to the port facilities.

Although collaborative opportunities for ITS deployment in association with river transportation appear limited, barge operators are working to make river transportation more competitive. For example, new barge designs are using computerized systems to speed up the loading and unloading process. These new generation barges are almost 300 feet long and carry 4,000 tons of grain. Although their capacity is 60% greater than some of the older barges on the river, their new designs allow grain elevators to off-load two barges in a shift instead of one. Barges are also using Global Positioning Systems (GPS) to more accurately track the position of the vessel, especially in fog or inclement weather. With recent advances in technology, grain haulers are hoping to lure business away from the railroads and onto the river.

7.3 Discussion of Railroad Results

Results from **Table 7-4** indicate that the greatest number of matches between ITS user services and the railroad needs are associated with En-Route Driver Information, Route Guidance, Traffic Control, Incident Management, Pre-Trip Travel Information, Ride Matching, Public Transportation Management, En-Route Transit Information, and Automatic Highway Systems. Although several user services were matched with the railroad issues, the user services are generally more suited to the highway elements of the rail operations. When considered with the specific river needs, there appear to be few ITS technologies that address the priorities of the railroads. If ITS projects are deployed for rail operations, the greatest potential benefit appears to address capacity issues and rock slides in the corridor.

The Transportation Needs Technical Memorandum previously noted that business economics and competition between the railroads reduce the possibilities for intermodal activity and technology sharing: however, recent rail developments may allow for improved rail capacity in the corridor. The port of Seattle, port of Tacoma, and Burlington Northern Santa Fe are planning to reopen Stampede Pass in Washington. Due to a recent agreement, the pass could be reopened as soon as 1997, thus allowing more rail freight to move through central Washington while freeing up capacity in the study corridor.

8.0 Summary and Conclusions

As stated earlier, the purpose of this technical memorandum is to identify ITS applications appropriate for the corridor, including I-84, I-82, SR 14, the railroads and waterways. Results for previous sections of this memorandum have been prepared in graphical format for clarity. Corridor needs that cannot be addressed by ITS deployment were omitted from the graphical results.

8.1, I-84 Results

The results of the matching processes were summarized into solution sets, that illustrate which ITS user service are most compatible with the specific needs in the corridor. **Figure 8-l** illustrates the solution set for the I-84 corridor short term needs. **Figure** 8-2 illustrates the solution set for the I-84 corridor medium term needs. **Figure** 8-3 illustrates the solution set for the I-84 corridor long term needs.

In general, Route Guidance, En-Route Driver Information, and Pre-Trip Travel Information had the highest numbers of matches with needs identified in the I-84 corridor. They all scored high with most of the needs identified in the corridor, and in particular with needs associated with traffic congestion in Portland and Boise. They also matched well with weather related needs. Automated Highway Systems and several other of the Advanced Vehicle Safety Systems also had a large number of matches. Most of these technologies are not immediately available for implementation and are not appropriate short term solutions; however, they should be included in the development of long term ITS strategies.

Of the remaining user services, Incident Management, Commercial Vehicle Electronic Clearance, On-Board Safety Monitoring, Traffic Control, and En-Route Transit Information also matched well with some of the transportation needs.

Figure 8-1
Solution Set for I-84 Short Term Needs

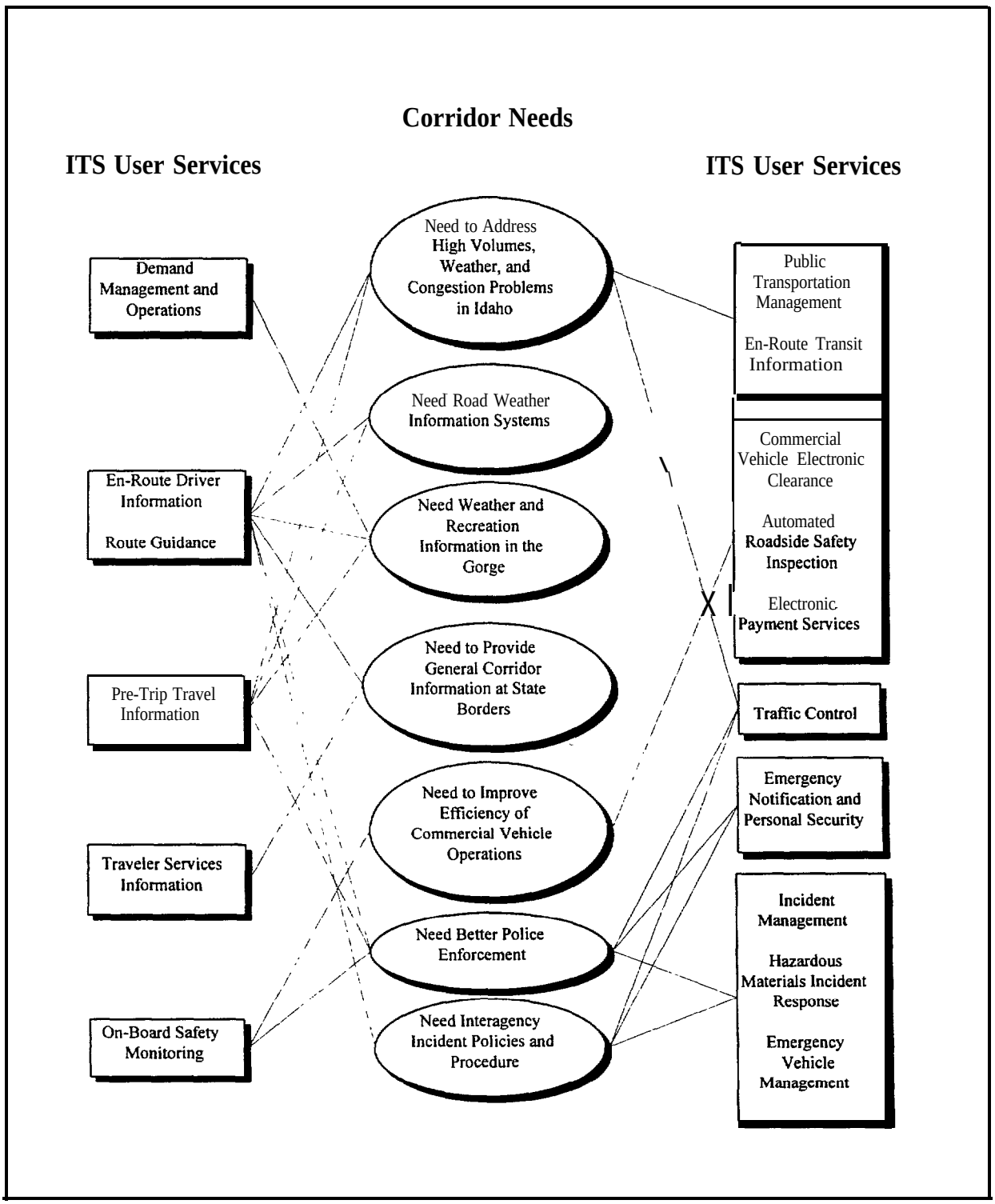


Figure 8-2
Solution Set for I-84 Medium Term Needs

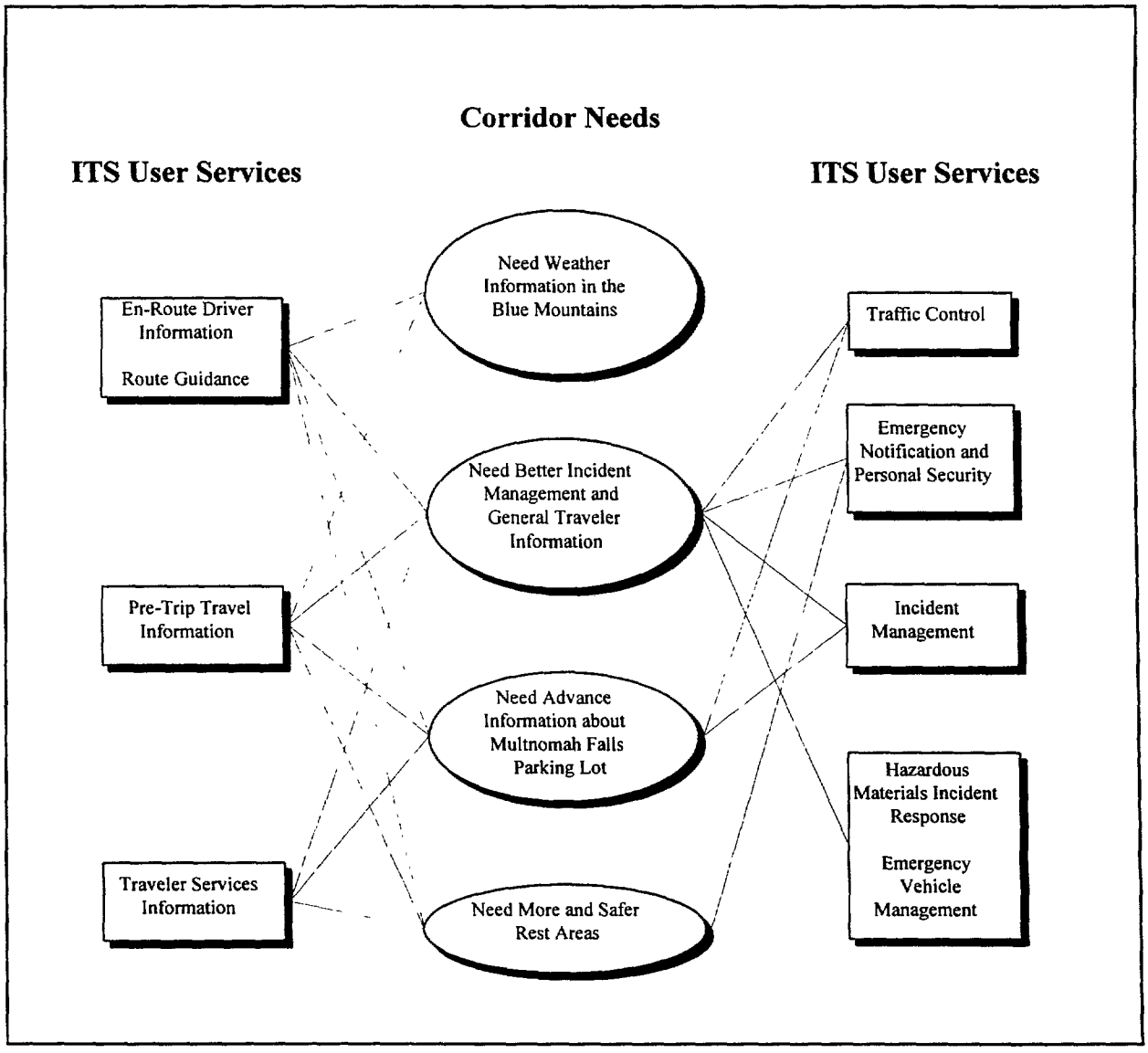
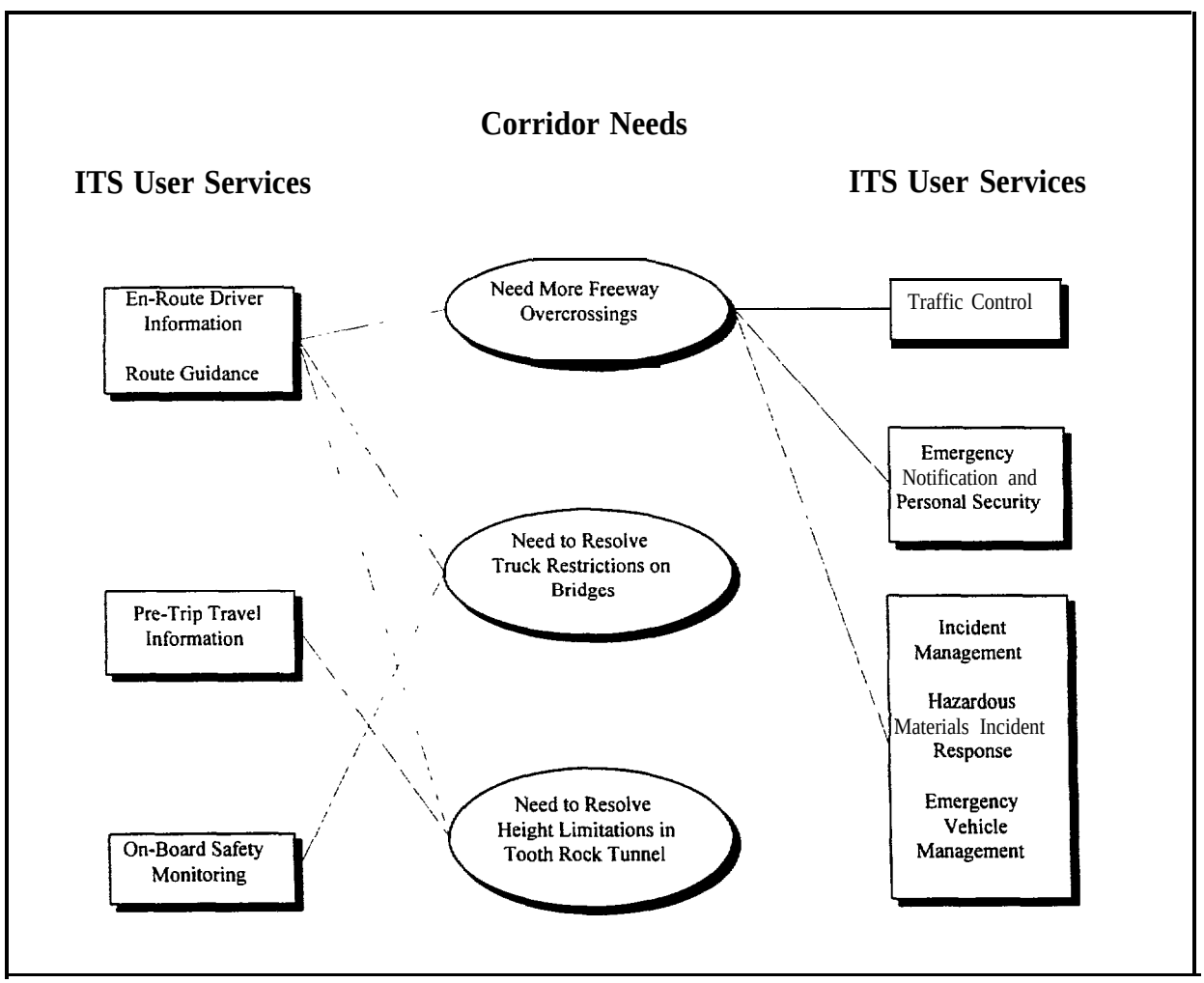


Figure 8-3
Solution Set for I-84 Long Term Needs



8.2 I-82 Results

The results of the matching processes were summarized into solutionsets, that illustrate which ITS user service are most compatible with the specific needs in the corridor.**Figure 8-4** illustrates the solution set for the **I-82** corridor short term needs. **Figure 8-5** illustrates the solution set for the I-82 corridor medium term needs. No long term needs were identified in the corridor.

As with the I-84 corridor, Route Guidance, En-Route Driver Information, and Pre-Trip Travel Information had the highest numbers of matches with needs identified in the I-82 corridor. Consistent with the I-84 corridor, Automated Highway Systems and several other of the Advanced Vehicle Safety Systems also had a large number of matches.

Of the remaining user services, Incident Management, On-Board Safety Monitoring, Traffic Control, and En-Route Transit Information also matched well with some of the transportation needs.

Figure 8-4
Solution Set for I-82 Short Term Needs

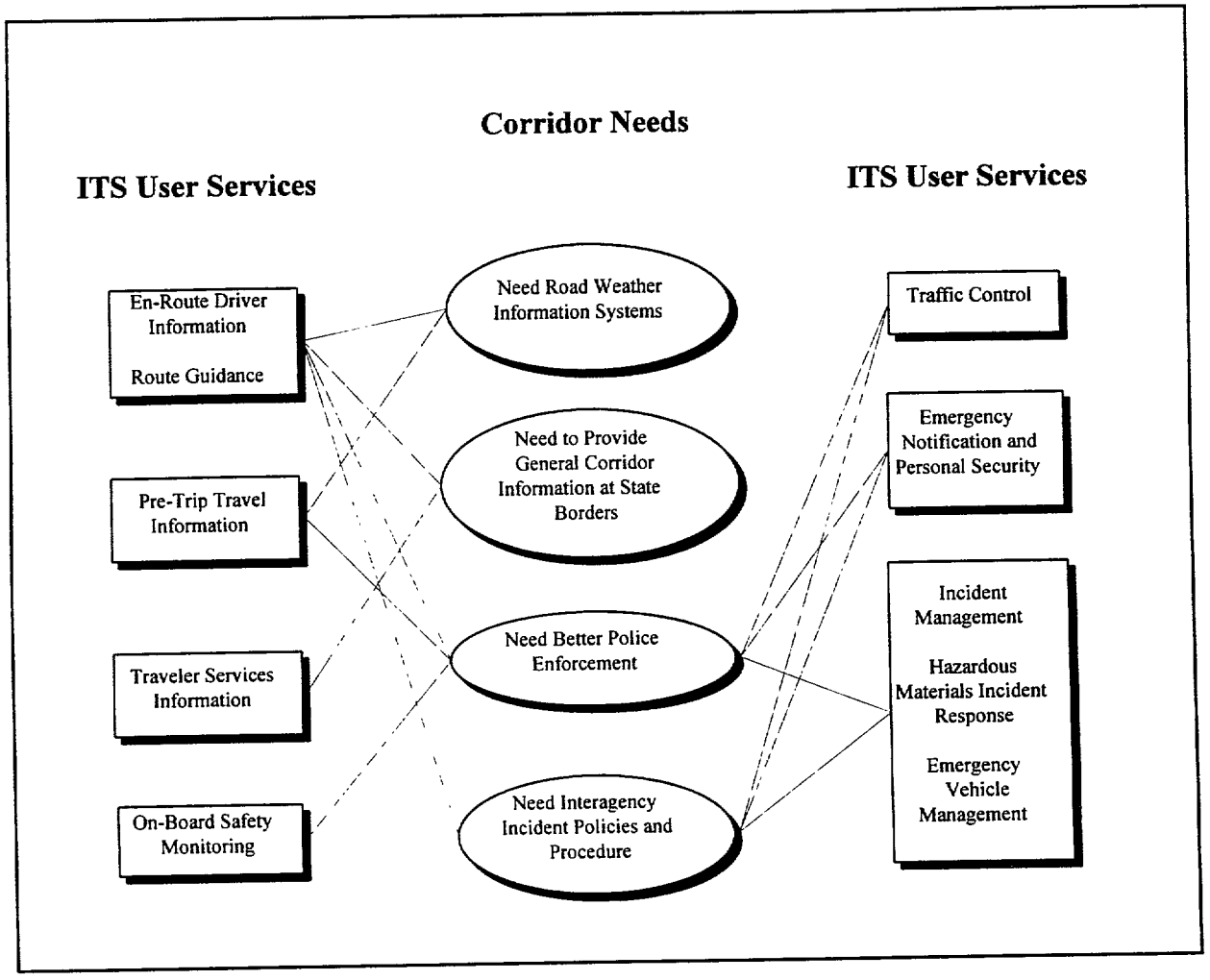
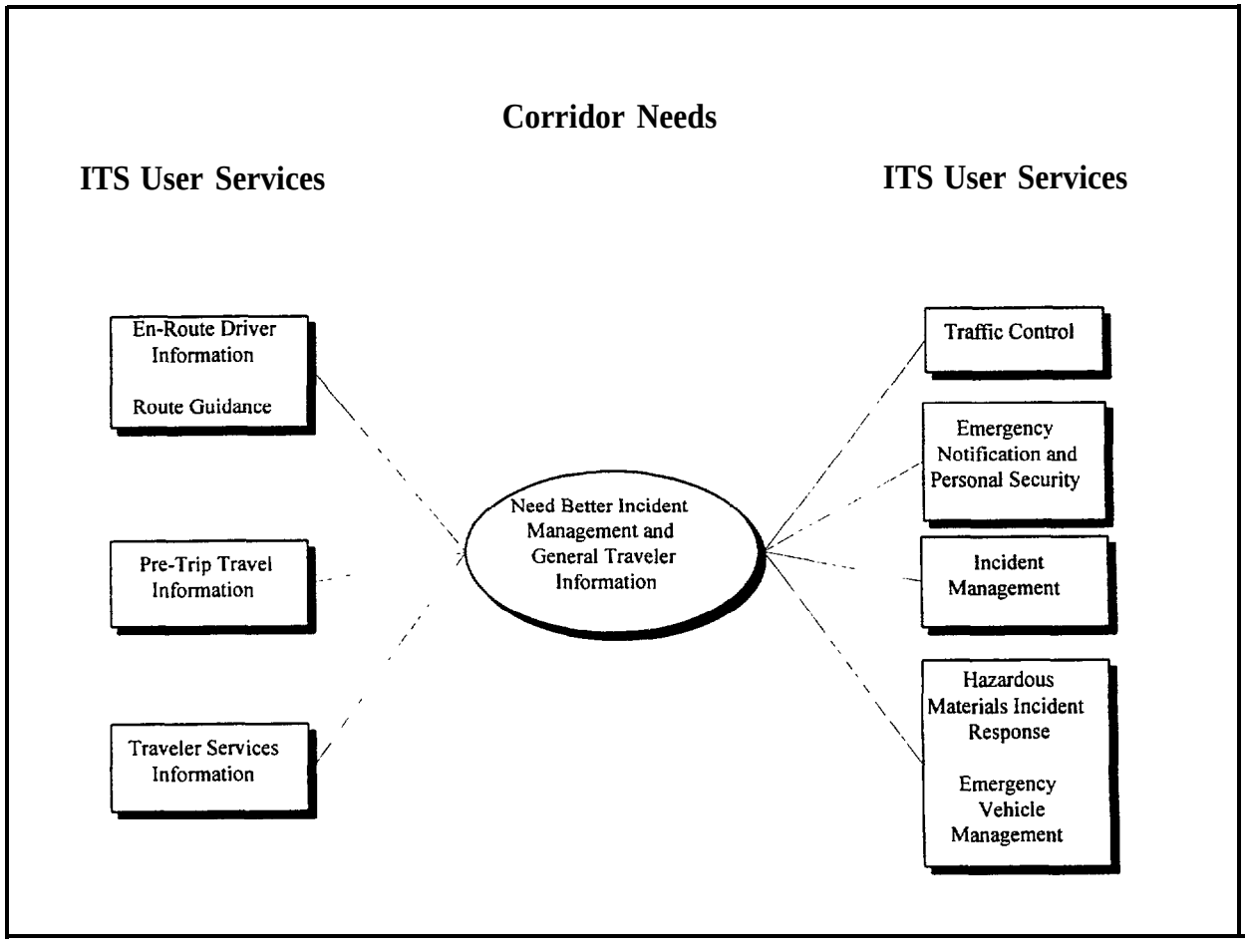


Figure 8-5
Solution Set for I-82 Medium Term Needs



8.3 SR 14 Results

The results of the matching processes were summarized into solution sets, that illustrate which ITS user service are most compatible with the specific needs in the corridor. **Figure** 8-6 illustrates the solution set for the SR **14** corridor short term needs. **Figure** 8-7 illustrates the solution set for the SR 14 corridor medium term needs. **Figure** 8-8 illustrates the solution set for the SR 14 corridor long term needs.

As with the I-84 and I-82 corridors, Route Guidance, En-Route Driver Information, and Pre-Trip Travel Information had the highest numbers of matches with needs identified in the SR- 14 corridor. Automated Highway Systems and several other of the Advanced Vehicle Safety Systems also had a large number of matches.

Of the remaining user services, Incident Management, Traffic Control, and En-Route Transit Information also matched well with some of the transportation needs.

Figure 8-6
Solution Set for SR 14 Short Term Needs

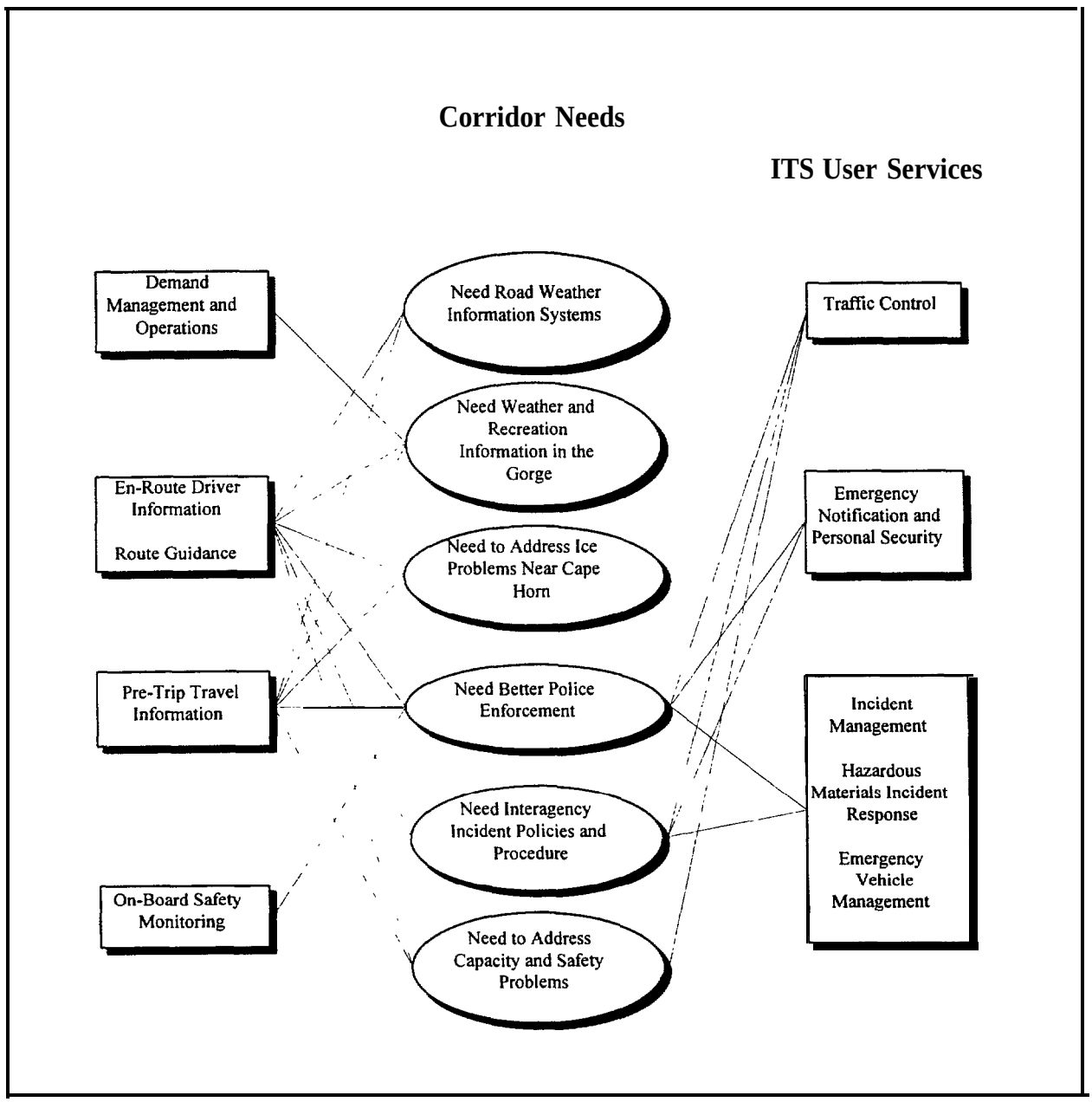


Figure 8-7
Solution Set for SR 14 Medium Term Needs

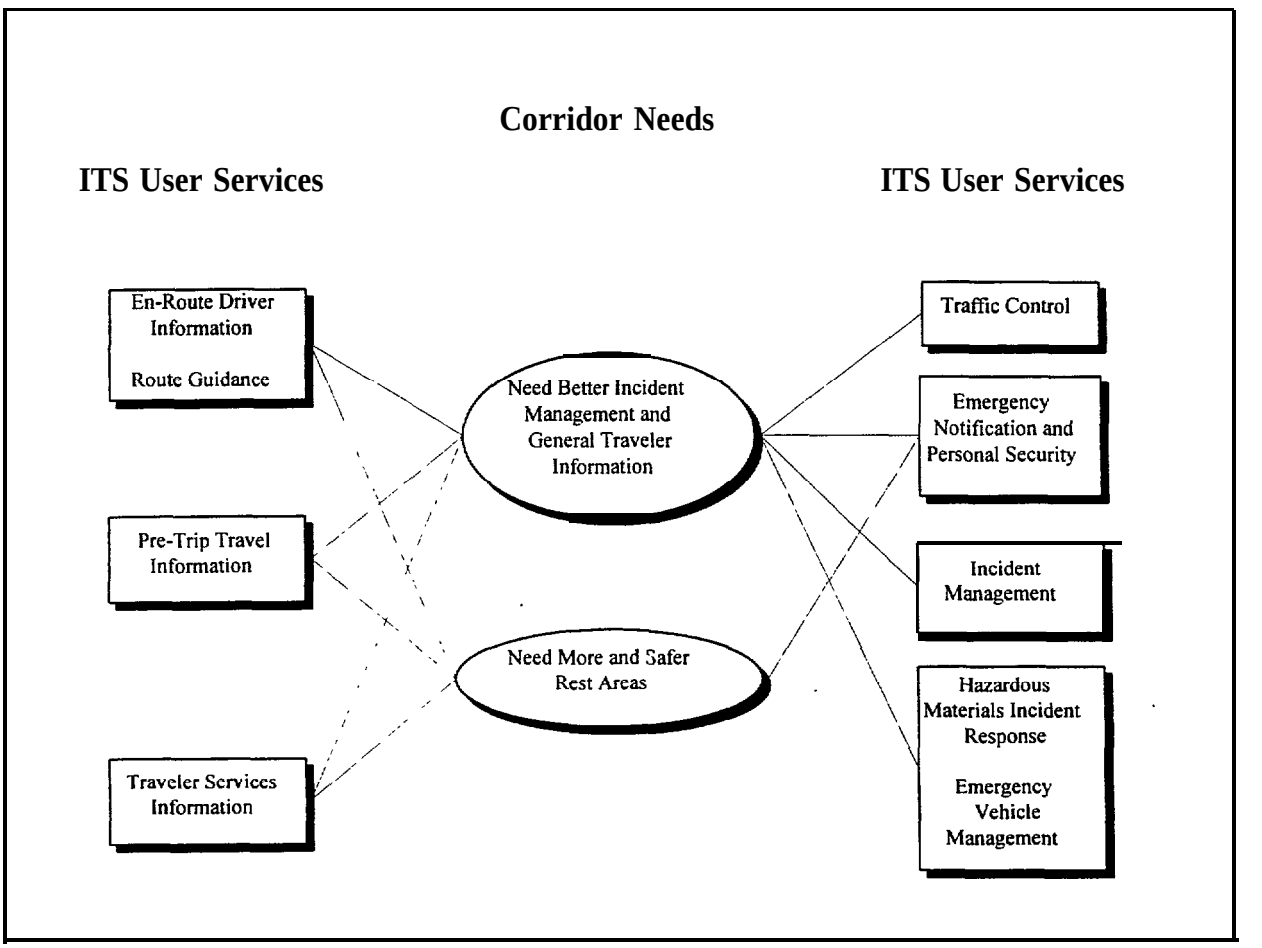
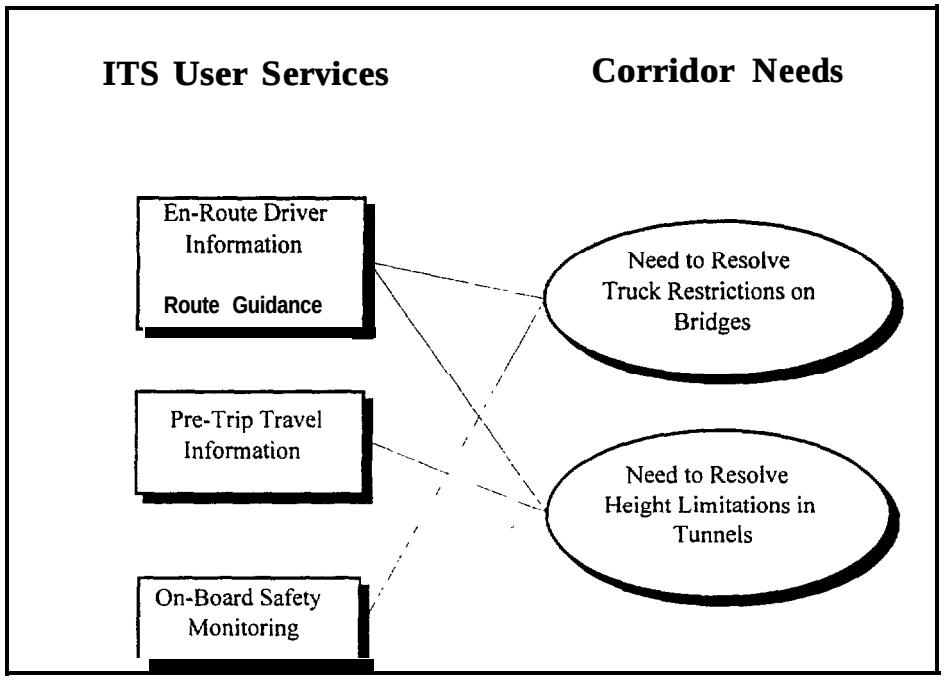


Figure 8-8
Solution Set for SR 14 Long Term Needs

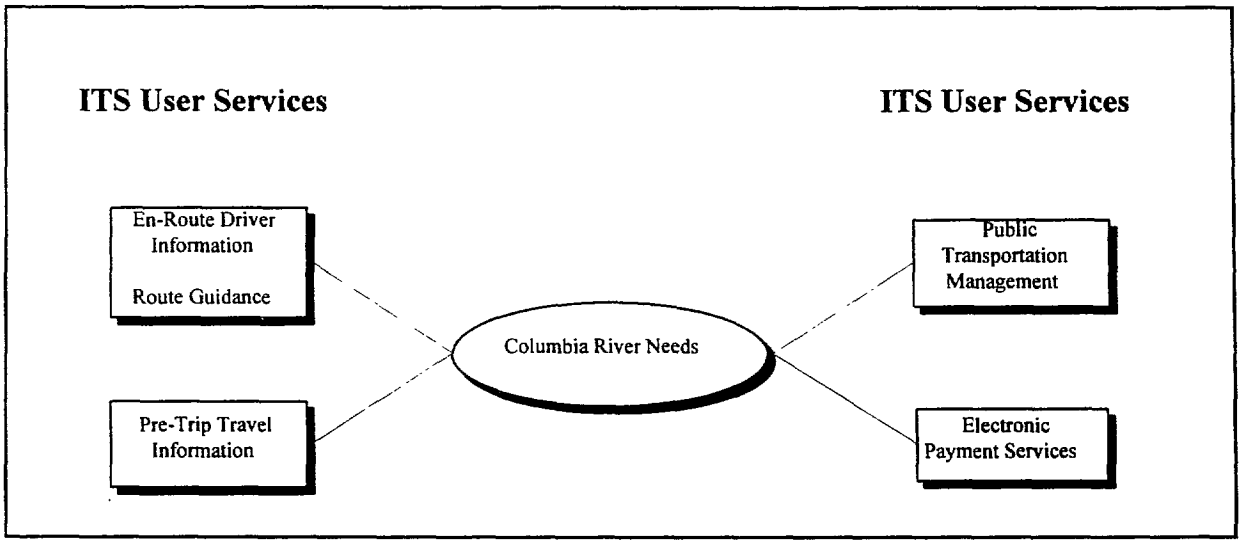


8.4 Columbia River Results

The results of the matching processes were summarized into solution sets, that illustrate which ITS user service are most compatible with the specific needs in the corridor. **Figure 8-9** illustrates the solution set for the Columbia River needs.

In general, results indicate that the greatest number of matches between ITS user services and Columbia River needs are associated with En-Route Driver Information, Route Guidance, Pre-Trip Travel Information, Public Transportation Management, and Electronic Payment Services. Although several user services were matched with the Columbia River issues, the user services are more suited to the land side of the barge operations. When considered with the specific river needs, there appear to be no ITS technologies that clearly address the priorities of the river. If ITS projects are deployed for river operations, the greatest potential benefit would be to improve the coordination with the railroad and improving access to the port facilities.

Figure 8-9
Solution Set for Columbia River Needs

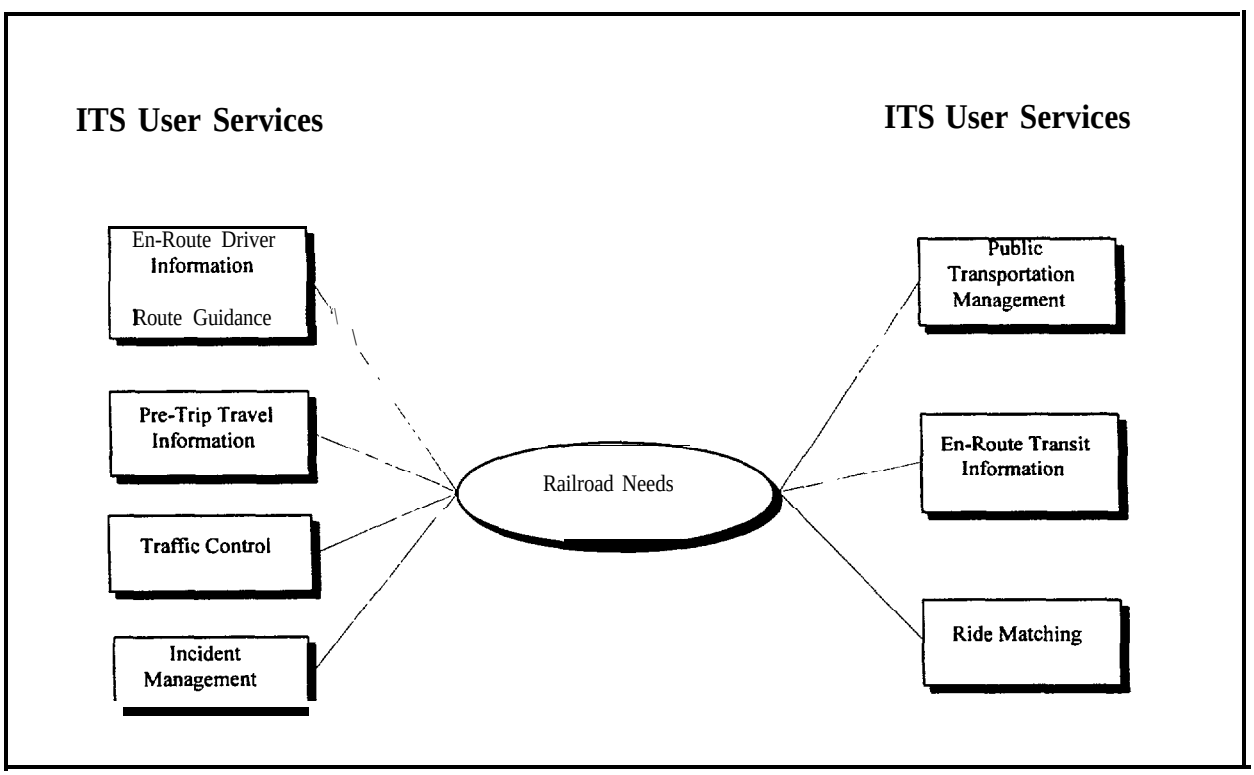


8.5 Railroad Results

The results of the matching processes were summarized into solution sets, that illustrate which ITS user service are most compatible with the specific needs in the corridor. **Figure 8-10** illustrates the solution set for the Railroad needs.

Results indicate that the greatest number of matches between ITS user services and the railroad needs are associated with En-Route Driver Information, Route Guidance, Traffic Control, Incident Management, Pre-Trip Travel Information, Ride Matching, Public Transportation Management, En-Route Transit Information, and Automatic Highway Systems. Although several user services were matched with the railroad issues, the user services are generally more suited to the highway elements of the rail operations. When considered with the specific river needs, there appear to be few ITS technologies that address the priorities of the railroads. If ITS projects are deployed for rail operations, the greatest potential benefit appears to address capacity issues and rock slides in the corridor.

Figure 8-10
Solution Set for Railroad Needs

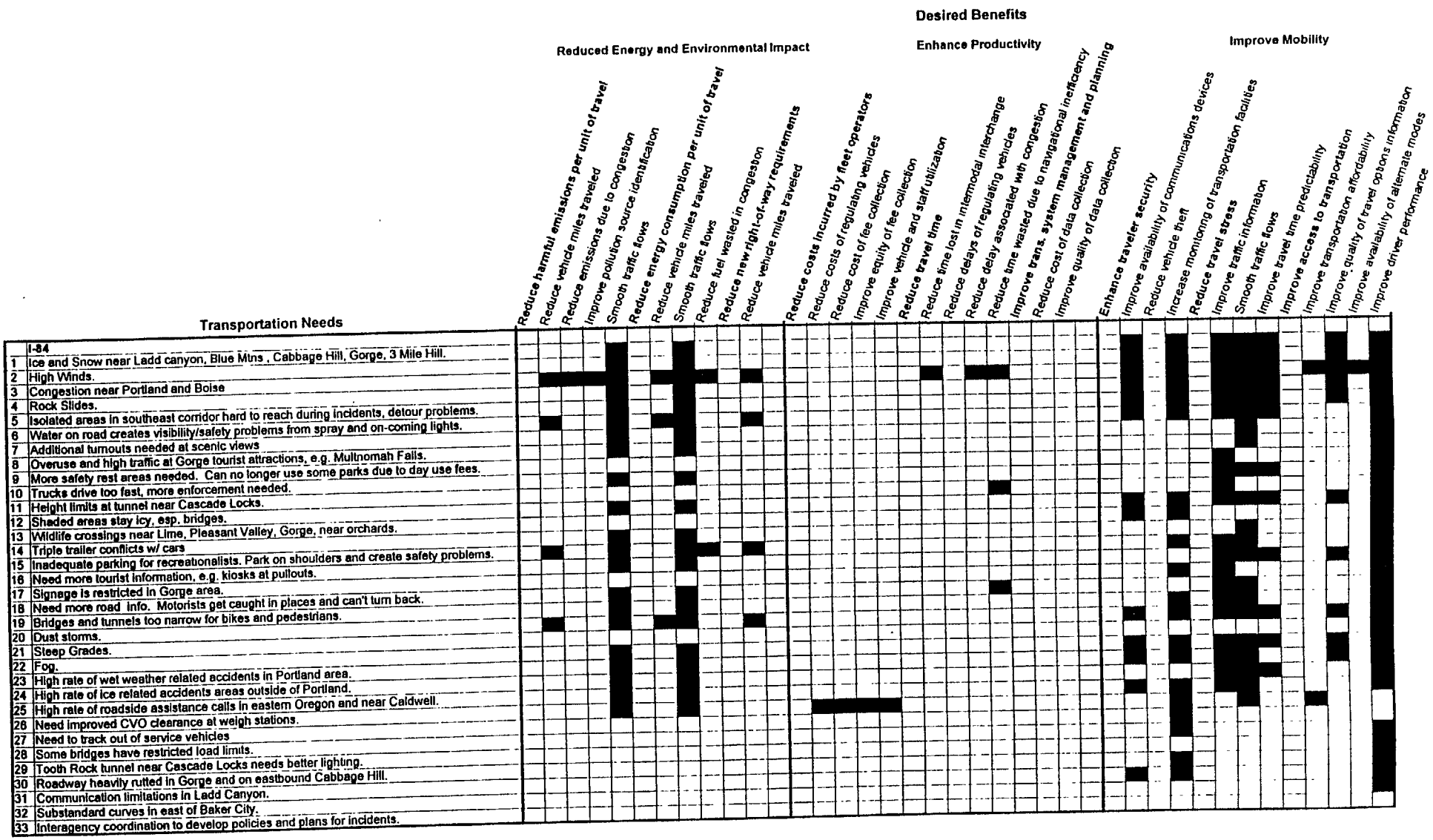


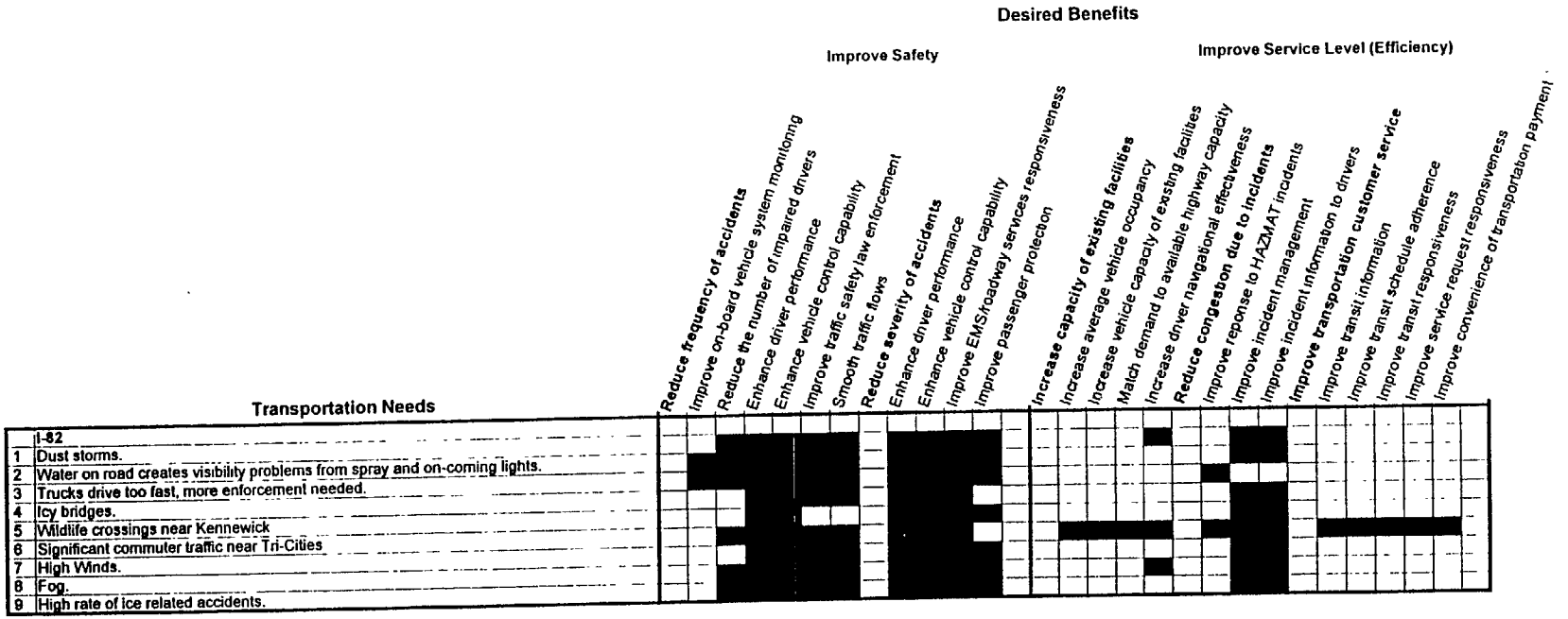
Appendix A

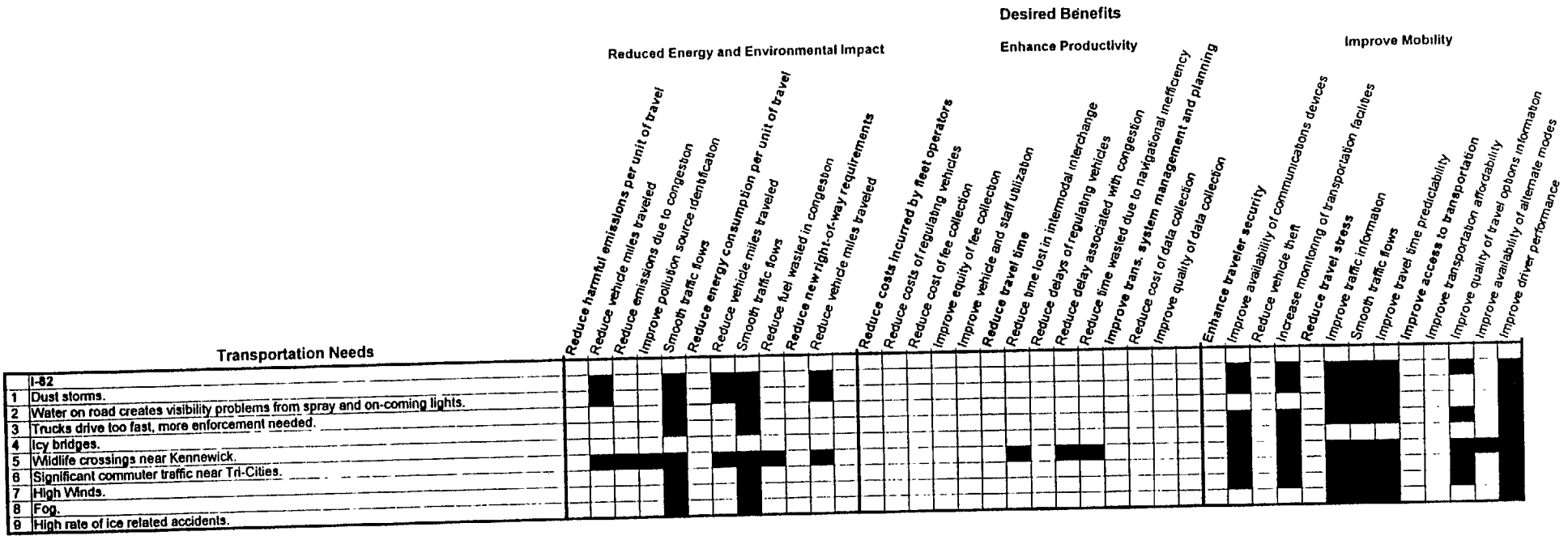
Matrix of ITS Goals/Benefits and Corridor Needs

Desired Benefits

	Transportation Needs	Improve Safety											Improve Service Level (Efficiency)											
		Reduce frequency of accidents	Improve on-board vehicle system monitoring	Reduce the number of impaired drivers	Enhance driver performance	Enhance vehicle control capability	Improve traffic safety law enforcement	Smooth traffic flows	Reduce severity of accidents	Enhance driver performance	Enhance vehicle control capability	Improve EMS/roadway services responsiveness	Improve passenger protection	Increase capacity of existing facilities	Increase average vehicle occupancy	Increase vehicle capacity of existing facilities	Match demand to available highway capacity	Increase driver navigational effectiveness	Reduce congestion due to incidents	Improve reponse to HAZMAT incidents	Improve incident management	Improve incident information to drivers	Improve transportation customer service	Improve transit information	Improve transit schedule adherence	Improve service request responsiveness	Improve convenience of transportation payment
	I-84																									
1	Ice and Snow near Ladd canyon, Blue Mtns., Cabbage Hill, Gorge, 3 Mile Hill.				■	■	■	■		■	■	■														
2	High Winds.				■	■	■	■		■	■	■	■					■	■							
3	Congestion near Portland and Boise.			■	■	■	■	■						■		■	■					■	■	■	■	
4	Rock Slides.				■	■	■	■		■	■	■						■	■							
5	Isolated areas in southeast corridor hard to reach during incidents, detour problems.				■	■	■	■		■	■	■				■		■	■							
6	Water on road creates visibility/safety problems from spray and on-coming lights.		■	■	■	■	■	■		■	■	■	■													
7	Additional turnouts needed at scenic views.				■	■	■	■		■	■	■				■										
8	Overuse and high traffic at Gorge tourist attractions, e.g. Multnomah Falls.				■	■	■	■		■	■	■				■										
9	More safety rest areas needed. Can no longer use some parks due to day use fees.		■	■	■	■	■					■	■			■			■							
10	Trucks drive too fast, more enforcement needed.		■	■	■	■	■	■		■	■	■														
11	Height limits at tunnel near Cascade Locks.				■	■	■	■		■	■	■				■	■									
12	Shaded areas stay icy, esp. bridges.				■	■	■	■		■	■	■							■							
13	Wildlife crossings near Lime, Pleasant Valley, Gorge, near orchards.				■	■	■			■	■	■														
14	Triple trailer conflicts w/ cars		■		■	■	■	■		■	■	■														
15	Inadequate parking for recreationalists. Park on shoulders and create safety problems.			■	■	■	■	■		■	■	■				■	■									
16	Need more tourist information, e g. kiosks at pullouts.			■	■	■	■	■		■	■	■				■										
17	Signage is restricted in Gorge area.				■	■	■	■		■	■	■														
18	Need more road info. Motorists get caught in places and can't turn back.		■		■	■	■	■		■	■	■				■										
19	Bridges and tunnels too narrow for bikes and pedestrians.				■	■	■	■		■	■	■	■													
20	Dust storms.				■	■	■	■		■	■	■	■			■			■							
21	Steep Grades.				■	■	■	■		■	■	■	■			■										
22	Fog.			■	■	■	■	■		■	■	■	■						■							
23	High rate of wet weather related accidents in Portland area.			■	■	■	■	■		■	■	■														
24	High rate of ice related accidents areas outside of Portland.			■	■	■	■	■		■	■	■	■						■							
25	High rate of roadside assistance calls in eastern Oregon and near Caldwell.		■		■	■	■	■		■	■	■	■													
26	Need improved CVO clearance at weigh stations.					■	■	■							■											
27	Need to track out of service vehicles			■	■		■	■																		
28	Some bridges have restricted load limits.				■					■	■															
29	Tooth Rock tunnel near Cascade Locks needs better lighting.				■					■	■															
30	Roadway heavily rutted in Gorge and on eastbound Cabbage Hill.				■	■				■	■	■														
31	Communication limitations in Ladd Canyon.				■					■	■	■				■			■							
32	Substandard curves in east of Baker City.				■	■				■	■															
33	Interagency coordination to develop policies and plans for incidents.											■							■							


Desired Benefits
Reduced Energy and Environmental Impact
Enhance Productivity
Improve Mobility
Transportation Needs
I-84
1 Ice and Snow near Ladd canyon, Blue Mtns , Cabbage Hill, Gorge, 3 Mile Hill.
2 High Winds.
3 Congestion near Portland and Boise
4 Rock Slides.
5 Isolated areas in southeast corridor hard to reach during incidents, detour problems.
6 Water on road creates visibility/safety problems from spray and on-coming lights.
7 Additional turnouts needed at scenic views
8 Overuse and high traffic at Gorge tourist attractions, e.g. Multnomah Falls.
9 More safety rest areas needed. Can no longer use some parks due to day use fees.
10 Trucks drive too fast, more enforcement needed.
11 Height limits at tunnel near Cascade Locks.
12 Shaded areas stay icy, esp. bridges.
13 Wildlife crossings near Lime, Pleasant Valley, Gorge, near orchards.
14 Triple trailer conflicts w/ cars
15 Inadequate parking for recreationalists. Park on shoulders and create safety problems.
16 Need more tourist information, e.g. kiosks at pullouts.
17 Signage is restricted in Gorge area.
18 Need more road info. Motorists get caught in places and can't turn back.
19 Bridges and tunnels too narrow for bikes and pedestrians.
20 Dust storms.
21 Steep Grades.
22 Fog.
23 High rate of wet weather related accidents in Portland area.
24 High rate of ice related accidents areas outside of Portland.
25 High rate of roadside assistance calls in eastern Oregon and near Caldwell.
26 Need improved CVO clearance at weigh stations.
27 Need to track out of service vehicles
28 Some bridges have restricted load limits.
29 Tooth Rock tunnel near Cascade Locks needs better lighting.
30 Roadway heavily rutted in Gorge and on eastbound Cabbage Hill.
31 Communication limitations in Ladd Canyon.
32 Substandard curves in east of Baker City.
33 Interagency coordination to develop policies and plans for incidents.
Reduce harmful emissions per unit of travel
Reduce vehicle miles traveled
Reduce emissions due to congestion
Improve pollution source identification
Smooth traffic flows
Reduce energy consumption per unit of travel
Reduce vehicle miles traveled
Smooth traffic flows
Reduce fuel wasted in congestion
Reduce new right-of-way requirements
Reduce vehicle miles traveled
Reduce costs incurred by fleet operators
Reduce costs of regulating vehicles
Reduce cost of fee collection
Improve equity of fee collection
Improve vehicle and staff utilization
Reduce travel time
Reduce time lost in intermodal interchange
Reduce delays of regulating vehicles
Reduce delay associated with congestion
Reduce time wasted due to navigational inefficency
Improve trans. system management and planning
Reduce cost of data collection
Improve quality of data collection
Enhance traveler security
Improve availability of communications devices
Reduce vehicle theft
Increase monitoring of transportation facilities
Reduce travel stress
Improve traffic information
Smooth traffic flows
Improve travel time predictability
Improve access to transportation
Improve transportation affordability
Improve quality of travel options information
Improve availability of alternate modes
Improve driver performance


Desired Benefits
Improve Safety
Improve Service Level (Efficiency)
Transportation Needs
I-82
1 Dust storms.
2 Water on road creates visibility problems from spray and on-coming lights.
3 Trucks drive too fast, more enforcement needed.
4 Icy bridges.
5 Wildlife crossings near Kennewick
6 Significant commuter traffic near Tri-Cities
7 High Winds.
8 Fog.
9 High rate of ice related accidents.
Reduce frequency of accidents
Improve on-board vehicle system monitorng
Reduce the number of impaired drivers
Enhance driver performance
Enhance vehicle control capability
Improve traffic safety law enforcement
Smooth traffic flows
Reduce severity of accidents
Enhance driver performance
Enhance vehicle control capability
Improve EMS/roadway services responsiveness
Improve passenger protecton
Increase capacity of existing facilities
Increase average vehicle occupancy
Increase vehicle capacity of existing facilities
Match demand to available highway capacity
Increase driver navigational effectiveness
Reduce congestion due to incidents
Improve reponse to HAZMAT incidents
Improve incident management
Improve incident information to drivers
Improve transportation customer service
Improve transit information
Improve transit schedule adherence
Improve transit responsiveness
Improve service request responsiveness
Improve convenience of transportation payment

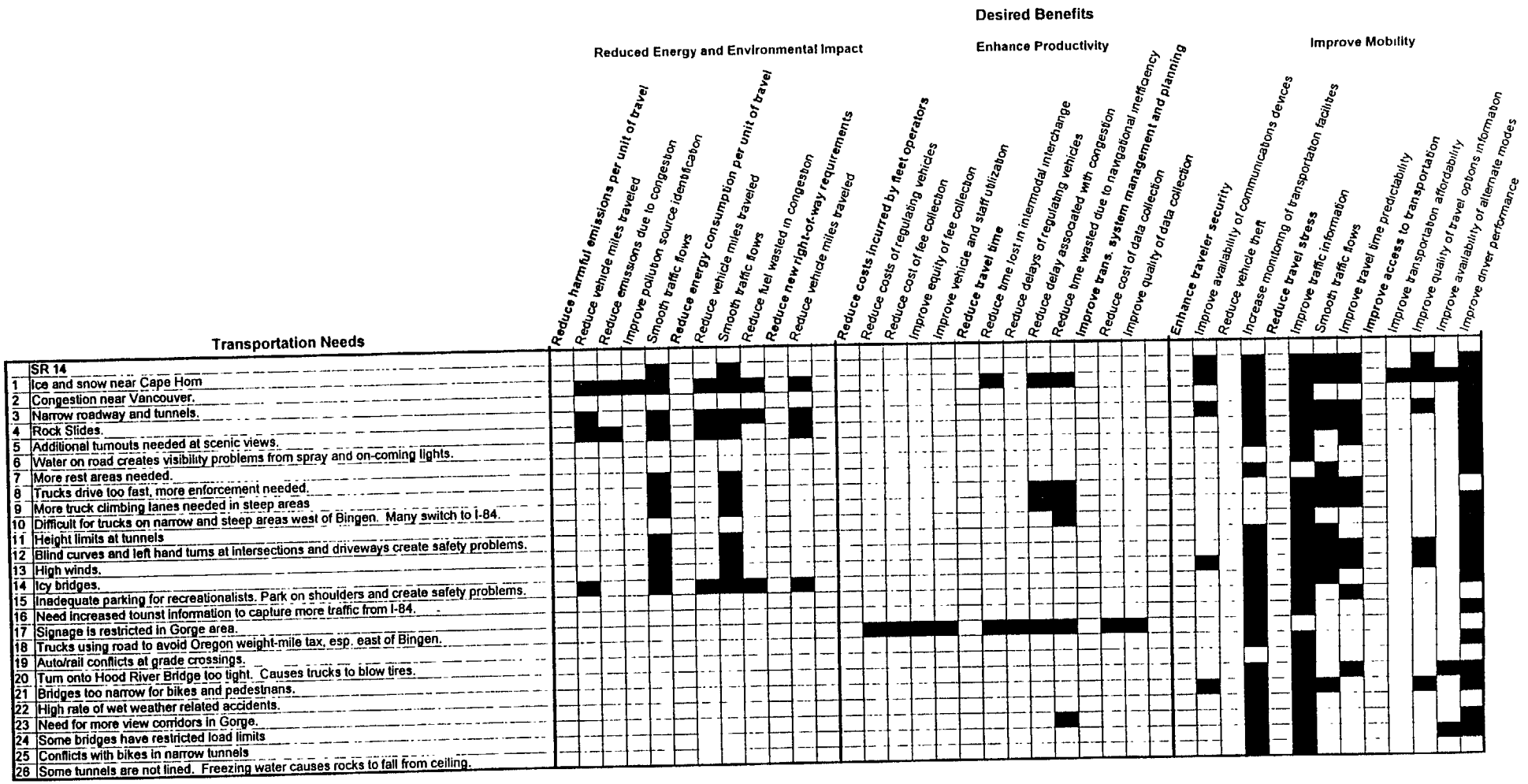

Desired Benefits
Reduced Energy and Environmental Impact
Enhance Productivity
Improve Mobility
Transportation Needs
Reduce harmful emissions per unit of travel
Reduce vehicle miles traveled
Reduce emissions due to congestion
Improve pollution source identification
Smooth traffic flows
Reduce energy consumption per unit of travel
Reduce vehicle miles traveled
Smooth traffic flows
Reduce fuel wasted in congestion
Reduce new right-of-way requirements
Reduce vehicle miles traveled
Reduce costs incurred by fleet operators
Reduce costs of regulating vehicles
Reduce cost of fee collection
Improve equity of fee collection
Improve vehicle and staff utilization
Reduce travel time
Reduce time lost in intermodal interchange
Reduce delays of regulating vehicles
Reduce delay associated with congestion
Reduce time wasted due to navigational inefficency
Improve trans. system management and planning
Reduce cost of data collection
Improve quality of data collection
Enhance traveler security
Improve availability of communications devices
Reduce vehicle theft
Increase monitoring of transportation facilites
Reduce travel stress
Improve traffic information
Smooth traffic flows
Improve travel time predictability
Improve access to transportation
Improve transportation affordability
Improve quality of travel options information
Improve availability of alternate modes
Improve driver performance
I-82
1 Dust storms.
2 Water on road creates visibility problems from spray and on-coming lights.
3 Trucks drive too fast, more enforcement needed.
4 Icy bridges.
5 Wildlife crossings near Kennewick.
6 Significant commuter traffic near Tri-Cities.
7 High Winds.
8 Fog.
9 High rate of ice related accidents.

Desired Benefits

Improve Safety

Improve Service Level (Efficiency)

	Transportation Needs	Reduce frequency of accidents	Improve on-board vehicle system monitoring	Reduce the number of impaired drivers	Enhance driver performance	Enhance vehicle control capability	Improve traffic safety law enforcement	Smooth traffic flows	Reduce severity of accidents	Enhance driver performance	Enhance vehicle control capability	Improve EMS/roadway services responsiveness	Improve passenger protection	Increase capacity of existing facilities	Increase average vehicle occupancy	Increase vehicle capacity of existing facilities	Match demand to available highway capacity	Increase driver navigational effectiveness	Reduce congestion due to incidents	Improve reponse to HAZMAT incidents	Improve incident management	Improve incident information to drivers	Improve transportation customer service	Improve transit information	Improve transit schedule adherence	Improve transit responsiveness	Improve service request responsiveness	Improve convenience of transportation payment
	SR 14																											
1	Ice and snow near Cape Horn.				■	■	■	■		■	■	■	■															
2	Congestion near Vancouver.			■	■	■	■	■		■	■		■		■	■	■		■			■	■	■	■	■	■	
3	Narrow roadway and tunnels.				■	■	■			■	■	■	■				■		■									
4	Rock Slides.				■		■	■		■	■		■		■	■	■											
5	Additional turnouts needed at scenic views					■	■	■		■			■															
6	Water on road creates visibility problems from spray and on-coming lights.	■			■	■	■			■			■				■			■								
7	More rest areas needed.					■	■	■		■			■															
8	Trucks drive too fast, more enforcement needed.	■					■	■		■			■															
9	More truck climbing lanes needed in steep areas.			■				■					■		■	■			■									
10	Difficult for trucks on narrow and steep areas west of Bingen. Many switch to I-84.				■					■			■			■	■											
11	Height limits at tunnels					■		■					■		■		■			■		■						
12	Blind curves and left hand turns at intersections and driveways create safety problems.			■	■			■		■			■															
13	High winds.			■	■	■	■	■		■	■		■				■											
14	Icy bridges.			■	■		■	■		■	■		■															
15	Inadequate parking for recreationalists. Park on shoulders and create safety problems																											
16	Need increased tourist information to capture more traffic from I-84.																■											
17	Signage is restricted in Gorge area.				■					■			■															
18	Trucks using road to avoid Oregon weight-mile tax, esp. east of Bingen.				■		■			■			■						■	■			■					
19	Auto/rail conflicts at grade crossings.																■											
20	Turn onto Hood River Bridge too tight. Causes trucks to blow tires.																						■					
21	Bridges too narrow for bikes and pedestrians.			■	■	■	■	■		■	■		■						■									
22	High rate of wet weather related accidents																■											
23	Need for more view corridors in Gorge.																■											
24	Some bridges have restricted load limits.				■		■	■		■	■		■															
25	Conflicts with bikes in narrow tunnels					■	■				■		■															
26	Some tunnels are not lined. Freezing water causes rocks to fall from ceiling.					■	■				■		■							■								

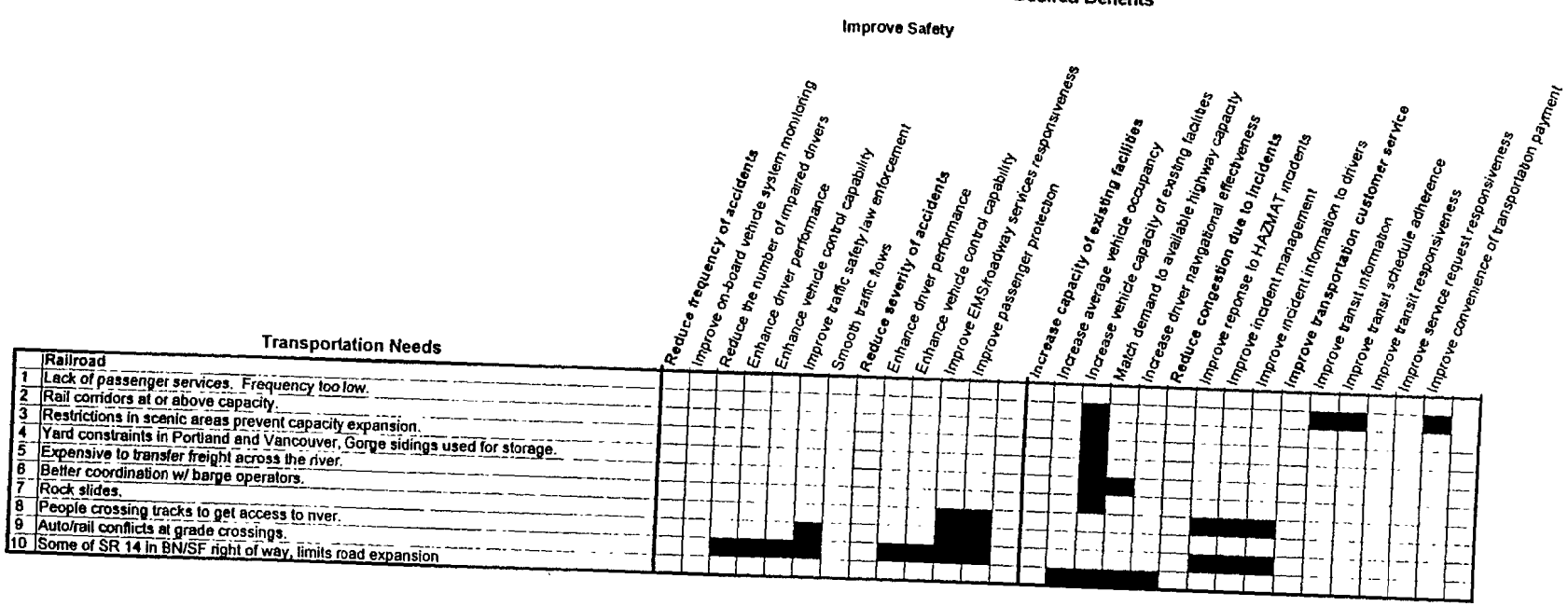

Desired Benefits
Reduced Energy and Environmental Impact
Enhance Productivity
Improve Mobility
Transportation Needs
SR 14
1 Ice and snow near Cape Horn
2 Congestion near Vancouver.
3 Narrow roadway and tunnels.
4 Rock Slides.
5 Additional turnouts needed at scenic views.
6 Water on road creates visibility problems from spray and on-coming lights.
7 More rest areas needed.
8 Trucks drive too fast, more enforcement needed.
9 More truck climbing lanes needed in steep areas
10 Difficult for trucks on narrow and steep areas west of Bingen. Many switch to I-84.
11 Height limits at tunnels
12 Blind curves and left hand turns at intersections and driveways create safety problems.
13 High winds.
14 Icy bridges.
15 Inadequate parking for recreationalists. Park on shoulders and create safety problems.
16 Need increased tounst information to capture more traffic from I-84.
17 Signage is restricted in Gorge area.
18 Trucks using road to avoid Oregon weight-mile tax, esp. east of Bingen.
19 Auto/rail conflicts at grade crossings.
20 Turn onto Hood River Bridge too tight. Causes trucks to blow tires.
21 Bridges too narrow for bikes and pedestrians.
22 High rate of wet weather related accidents.
23 Need for more view corridors in Gorge.
24 Some bridges have restricted load limits
25 Conflicts with bikes in narrow tunnels
26 Some tunnels are not lined. Freezing water causes rocks to fall from ceiling.
Reduce harmful emissions per unit of travel
Reduce vehicle miles traveled
Reduce emissions due to congestion
Improve pollution source identification
Smooth traffic flows
Reduce energy consumption per unit of travel
Reduce vehicle miles traveled
Smooth traffic flows
Reduce fuel wasted in congestion
Reduce new right-of-way requirements
Reduce vehicle miles traveled
Reduce costs incurred by fleet operators
Reduce costs of regulating vehicles
Reduce cost of fee collection
Improve equity of fee collection
Improve vehicle and staff utilization
Reduce travel time
Reduce time lost in intermodal interchange
Reduce delays of regulating vehicles
Reduce delay associated with congestion
Reduce time wasted due to navigational inefficiency
Improve trans. system management and planning
Reduce cost of data collection
Improve quality of data collection
Enhance traveler security
Improve availability of communications devices
Reduce vehicle theft
Increase monitoring of transportation facilities
Reduce travel stress
Improve traffic information
Smooth traffic flows
Improve travel time predictability
Improve access to transportation
Improve transportation affordability
Improve quality of travel options information
Improve availability of alternate modes
Improve driver performance

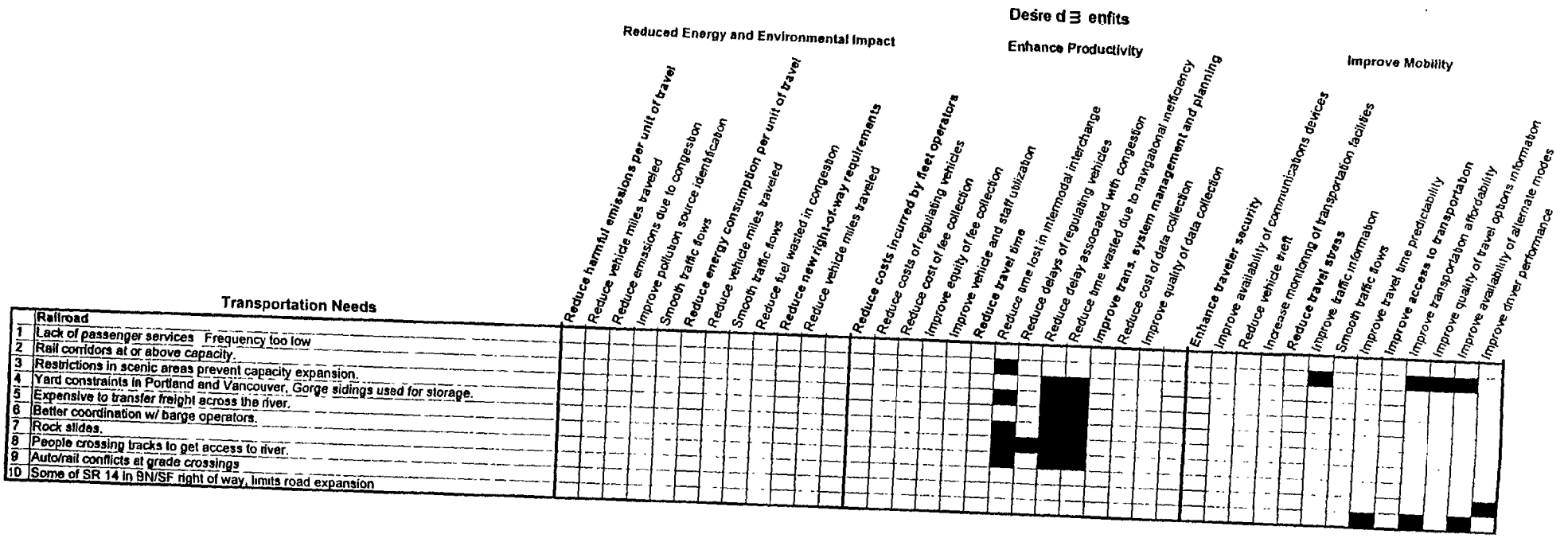
Desired Benefits

	Transportation Needs	Improve Safety												Improve Service Level (Efficiency)													
		Reduce frequency of accidents	Improve on-board vehicle system monitoring	Reduce the number of impaired drivers	Enhance driver performance	Enhance vehicle control capability	Improve traffic safety law enforcement	Smooth traffic flows	**Reduce severity of accidents**	Enhance driver performance	Enhance vehicle control capability	Improve EMS/roadway services responsiveness	Improve passenger protection	**Increase capacity of existing facilities**	Increase average vehicle occupancy	Increase vehicle capacity of existing facilities	Match demand to available highway capacity	Increase driver navigational effectiveness	**Reduce congestion due to incidents**	Improve reponse to HAZMAT incidents	Improve incident management	Improve incident information to drivers	Improve transportation customer service	Improve transit information	Improve transit schedule adherence	Improve transit responsiveness	Improve service request responsiveness	Improve convenience of transportation payment
	Columbia River																										
1	Draw down below the minimus operating pool may restrict river traffic.																										
2	Better coordination w/ railroads.																										
3	Wind surfers and fishermen get in the way of barges.																										
4	Road access into port facilities is difficult.														■	■	■										
5	Need upgraded facilities at the Port of Morrow.																										

Desired Benefits

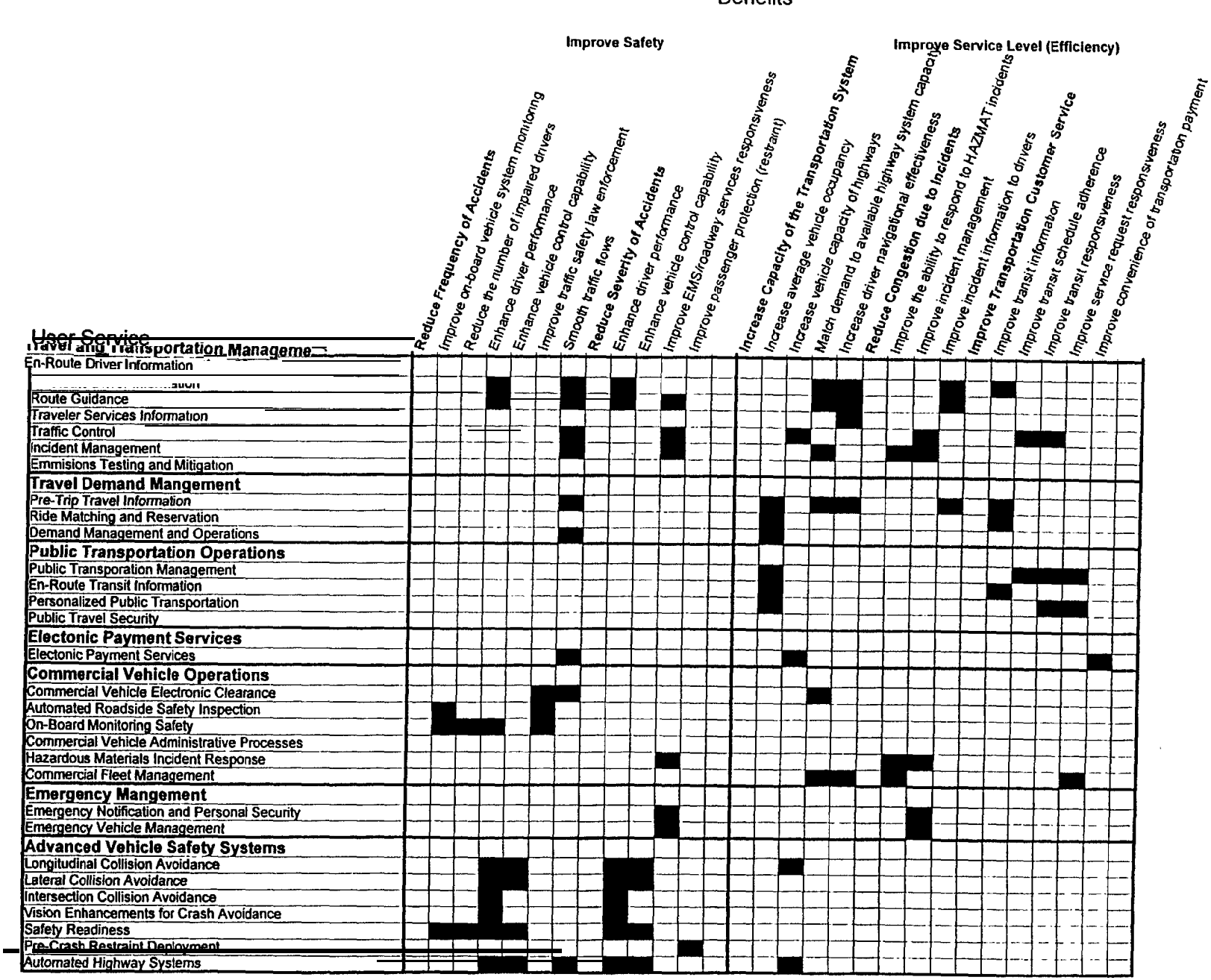
Transportation Needs	Reduced Energy and Environmental Impact										Enhance Productivity											Improve Mobility										
	Reduce harmful emissions per unit of travel	Reduce vehicle miles traveled	Reduce emissions due to congestion	Improve pollution source identification	Smooth traffic flows	Reduce energy consumption per unit of travel	Reduce vehicle miles traveled	Smooth traffic flows	Reduce fuel wasted in congestion	Reduce new right-of-way requirements	Reduce vehicle miles traveled	Reduce costs incurred by fleet operators	Reduce costs of regulating vehicles	Reduce cost of fee collection	Improve equity of fee collection	Improve vehicle and staff utilization	Reduce travel time	Reduce time lost in intermodal interchange	Reduce delays of regulating vehicles	Reduce delay associated with congestion	Reduce time wasted due to navigational inefficiency	Improve trans. system management and planning	Reduce cost of data collection	Improve quality of data collection	Enhance traveler security	Improve availability of communications devices	Reduce vehicle theft	Increase monitoring of transportation facilities	Reduce travel stress	Improve traffic information	Smooth traffic flows	Improve travel time predictability	Improve access to transportation	Improve transportation affordability	Improve quality of travel options information	Improve availability of alternate modes	Improve driver performance
Columbia River																																	
1 Draw down below the minimus operating pool may restrict river traffic.																																	
2 Better coordination w/ railroads.																																	
3 Wind surfers and fishermen get in the way of barges																																	
4 Road access into port facilities is difficult.																																	
5 Need upgraded facilities at the Port of Morrow.																																	

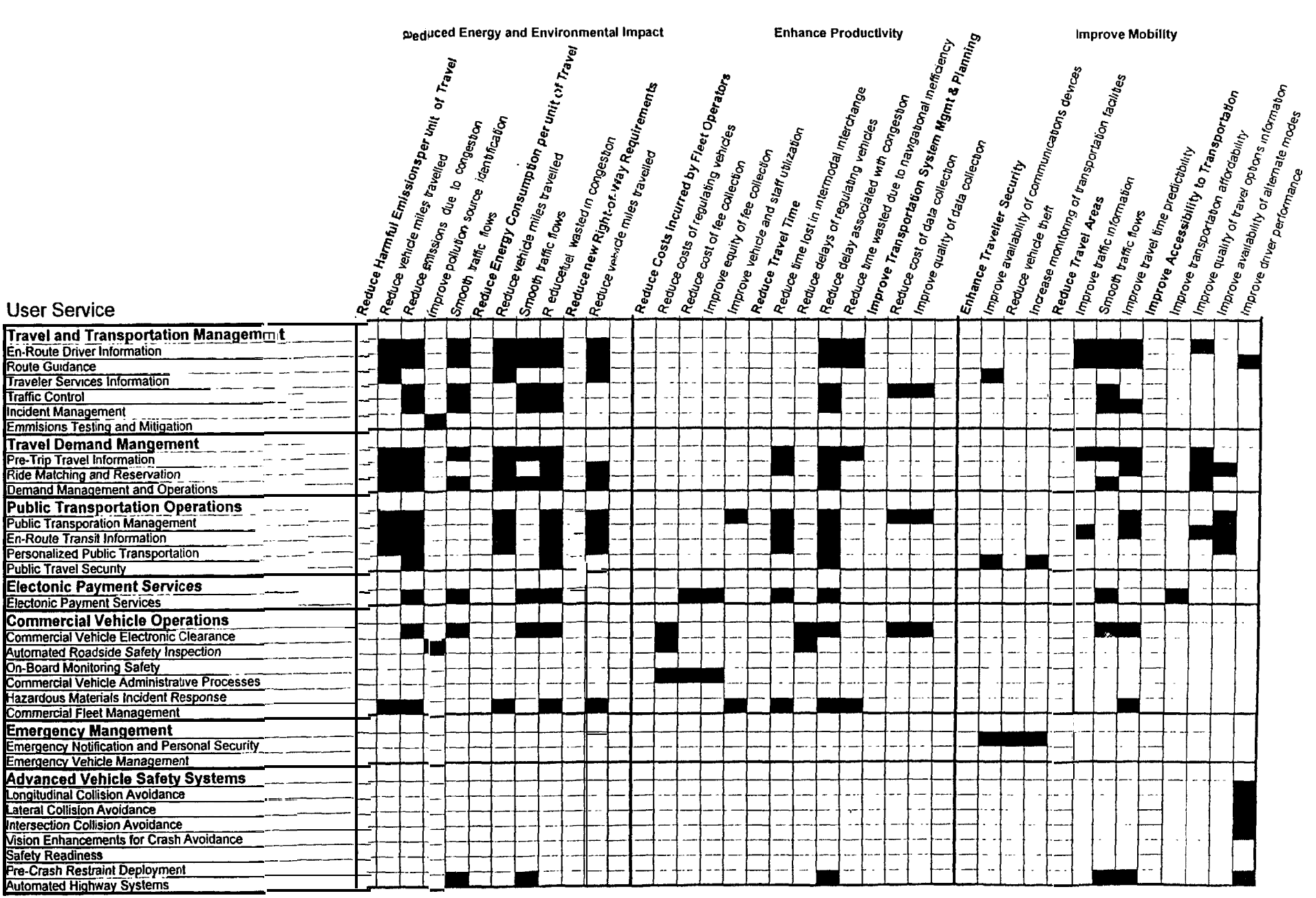

Desired Benefits
Improve Safety
Transportation Needs
Railroad
1 Lack of passenger services. Frequency too low.
2 Rail corridors at or above capacity.
3 Restrictions in scenic areas prevent capacity expansion.
4 Yard constraints in Portland and Vancouver, Gorge sidings used for storage.
5 Expensive to transfer freight across the river.
6 Better coordination w/ barge operators.
7 Rock slides.
8 People crossing tracks to get access to river.
9 Auto/rail conflicts at grade crossings.
10 Some of SR 14 in BN/SF right of way, limits road expansion
Reduce frequency of accidents
Improve on-board vehicle system monitoring
Reduce the number of impaired drivers
Enhance driver performance
Enhance vehicle control capability
Improve traffic safety law enforcement
Smooth traffic flows
Reduce severity of accidents
Enhance driver performance
Enhance vehicle control capability
Improve EMS/roadway services responsiveness
Improve passenger protection
Increase capacity of existing facilities
Increase average vehicle occupancy
Increase vehicle capacity of existing facilities
Match demand to available highway capacity
Increase driver navigational effectiveness
Reduce congestion due to incidents
Improve reponse to HAZMAT incidents
Improve incident management
Improve incident information to drivers
Improve transportation customer service
Improve transit information
Improve transit schedule adherence
Improve service request responsiveness
Improve convenience of transportation payment


Desired Benefits
Reduced Energy and Environmental Impact
Enhance Productivity
Improve Mobility
Transportation Needs
Railroad
1 Lack of passenger services Frequency too low
2 Rail corridors at or above capacity.
3 Restrictions in scenic areas prevent capacity expansion.
4 Yard constraints in Portland and Vancouver. Gorge sidings used for storage.
5 Expensive to transfer freight across the river.
6 Better coordination w/ barge operators.
7 Rock slides.
8 People crossing tracks to get access to river.
9 Auto/rail conflicts at grade crossings
10 Some of SR 14 in BN/SF right of way, limits road expansion
Reduce harmful emissions per unit of travel
Reduce vehicle miles traveled
Reduce emissions due to congestion
Improve pollution source identification
Smooth traffic flows
Reduce energy consumption per unit of travel
Reduce vehicle miles traveled
Smooth traffic flows
Reduce fuel wasted in congestion
Reduce new right-of-way requirements
Reduce vehicle miles traveled
Reduce costs incurred by fleet operators
Reduce costs of regulating vehicles
Reduce cost of fee collection
Improve equity of fee collection
Improve vehicle and staff utilization
Reduce travel time
Reduce time lost in intermodal interchange
Reduce delays of regulating vehicles
Reduce delay associated with congestion
Improve trans. system management and planning
Reduce time wasted due to navigational inefficiency
Improve quality of data collection
Reduce cost of data collection
Enhance traveler security
Improve availability of communications devices
Reduce vehicle theft
Increase monitoring of transportation facilities
Reduce travel stress
Improve traffic information
Smooth traffic flows
Improve travel time predictability
Improve access to transportation
Improve transportation affordability
Improve quality of travel options information
Improve availability of alternate modes
Improve driver performance

Appendix B

Matrix of ITS User Services and ITS Goals/Benefits


Benefits
Improve Safety
Improve Service Level (Efficiency)
User Service
Reduce Frequency of Accidents
Improve on-board vehicle system monitoring
Reduce the number of impaired drivers
Enhance driver performance
Enhance vehicle control capability
Improve traffic safety law enforcement
Smooth traffic flows
Reduce Severity of Accidents
Enhance driver performance
Enhance vehicle control capability
Improve EMS/roadway services responsiveness
Improve passenger protection (restraint)
Increase Capacity of the Transportation System
Increase average vehicle occupancy
Increase vehicle capacity of highways
Match demand to available highway system capacity
Increase driver navigational effectiveness
Reduce Congestion due to Incidents
Improve the ability to respond to HAZMAT incidents
Improve incident management
Improve incident information to drivers
Improve Transportation Customer Service
Improve transit information
Improve transit schedule adherence
Improve transit responsiveness
Improve service request responsiveness
Improve convenience of transportation payment
Travel and Transportation Manageme
En-Route Driver Information
Route Guidance
Traveler Services Information
Traffic Control
Incident Management
Emmisions Testing and Mitigation
Travel Demand Mangement
Pre-Trip Travel Information
Ride Matching and Reservation
Demand Management and Operations
Public Transportation Operations
Public Transporation Management
En-Route Transit Information
Personalized Public Transportation
Public Travel Security
Electonic Payment Services
Electonic Payment Services
Commercial Vehicle Operations
Commercial Vehicle Electronic Clearance
Automated Roadside Safety Inspection
On-Board Monitoring Safety
Commercial Vehicle Administrative Processes
Hazardous Materials Incident Response
Commercial Fleet Management
Emergency Mangement
Emergency Notification and Personal Security
Emergency Vehicle Management
Advanced Vehicle Safety Systems
Longitudinal Collision Avoidance
Lateral Collision Avoidance
Intersection Collision Avoidance
Vision Enhancements for Crash Avoidance
Safety Readiness
Pre-Crash Restraint Deployment
Automated Highway Systems


Benefits
Reduced Energy and Environmental Impact
Enhance Productivity
Improve Mobility
User Service
Travel and Transportation Management
En-Route Driver Information
Route Guidance
Traveler Services Information
Traffic Control
Incident Management
Emmisions Testing and Mitigation
Travel Demand Mangement
Pre-Trip Travel Information
Ride Matching and Reservation
Demand Management and Operations
Public Transportation Operations
Public Transporation Management
En-Route Transit Information
Personalized Public Transportation
Public Travel Secunty
Electonic Payment Services
Electonic Payment Services
Commercial Vehicle Operations
Commercial Vehicle Electronic Clearance
Automated Roadside Safety Inspection
On-Board Monitoring Safety
Commercial Vehicle Administrative Processes
Hazardous Materials Incident Response
Commercial Fleet Management
Emergency Mangement
Emergency Notification and Personal Security
Emergency Vehicle Management
Advanced Vehicle Safety Systems
Longitudinal Collision Avoidance
Lateral Collision Avoidance
Intersection Collision Avoidance
Vision Enhancements for Crash Avoidance
Safety Readiness
Pre-Crash Restraint Deployment
Automated Highway Systems
Reduce Harmful Emissions per unit of Travel
Reduce vehicle miles travelled
Reduce emissions due to congestion
Improve pollution source identification
Smooth traffic flows
Reduce Energy Consumption per unit of Travel
Reduce vehicle miles travelled
Smooth traffic flows
Reduce fuel wasted in congestion
Reduce new Right-of-Way Requirements
Reduce vehicle miles travelled
Reduce Costs Incurred by Fleet Operators
Reduce costs of regulating vehicles
Reduce cost of fee collection
Improve equity of fee collection
Improve vehicle and staff utilization
Reduce Travel Time
Reduce time lost in intermodal interchange
Reduce delays of regulating vehicles
Reduce delay associated with congestion
Reduce time wasted due to navigational inefficiency
Improve Transportation System Mgmt & Planning
Reduce cost of data collection
Improve quality of data collection
Enhance Traveler Security
Improve availability of communications devices
Reduce vehicle theft
Increase monitoring of transportation facilities
Reduce Travel Areas
Improve traffic information
Smooth traffic flows
Improve travel time predictability
Improve Accessibility to Transportation
Improve transportation affordability
Improve quality of travel options information
Improve availability of alternate modes
Improve driver performance

Appendix C

Expanded Matrix of ITS User Services and Corridor Needs

User Services

	Transportation Needs	Travel and Transportation Management																																					
		En-Route Driver Information					Route Guidance					Traveler Services Information					Traffic Control					Incident Management					Emmisions Testing & Mitigation				
		Safety	Efficiency	Energy. Environ.	Productivity	Mobility	Safety	Efficiency	Energy. Environ.	Productivity	Mobility	Safety	Efficiency	Energy. Environ.	Productivity	Mobility	Safety	Efficiency	Energy. Environ.	Productivity	Mobility	Safety	Efficiency	Energy. Environ.	Productivity	Mobility	Safety	Efficiency	Energy. Environ.	Productivity	Mobility
	I-84																																						
1	Ice and Snow near Ladd canyon, Blue Mtns , Cabbage Hill, Gorge, 3 Mile Hill	3		2		4	4		2		4					1	2		2		1	2		2		2												
2	High Winds	3	1	2		4	4	1	2		4					1	2	1	2		1	2	1	2		2												
3	Congestion near Portland and Boise	3	4	7	2	4	4	3	7	2	4		1	3		1	2	4	4	1	1	2	3	4	1	2			1										
4	Rock Slides	3		2		4	3		2		4					1	1		2		1	1		2		2												
5	Isolated areas in southeast corridor hard to reach during incidents, detour problems	3	2	2		4	3	2	2		4		1			1	1	1	2		1	1	2	2		2												
6	Water on road creates visibility/safety problems from spray and on-coming lights	3	1	5		3	4	1	5		4			3		1	2	1	2		1	2	1	2		2												
7	Additional turnouts needed at scenic views	3	1	2		1	3	1	2		2		1				1		2		1	1		2		1												
8	Overuse and high traffic at Gorge tourist attractions, e g Multnomah Falls	3	1	2		1	3	1	2		2		1				1		2		1	1		2		1												
9	More safety rest areas needed Can no longer use some parks due to day use fees	2	1			1	2	1			2		1																									
10	Trucks drive too fast, more enforcement needed	3		2		3	4		2		4						2		2		1	2	1	2		2												
11	Height limits at tunnel near Cascade Locks	2	2		1	1	2	2		1	2		1										1															
12	Shaded areas stay icy, esp bridges	3	1	2		4	4	1	2		4					1	2	1	2		1	2	1	2		2												
13	Wildlife crossings near Lime, Pleasant Valley, Gorge, near orchards	2	1				3	1			1					1	1	1				1	1															
14	Triple trailer conflicts w/ cars	3		2		1	3		2		2						1		2		1	1		2		1												
15	Inadequate parking for recreationalists Park on shoulders and create safety problems	3	2	5		2	3	2	5		3		1	2			1		3		1	1	1	3		1												
16	Need more tourist information, e g kiosks at pullouts	3	2	2		4	3	2	2		4		1				1		2		1	1		2		2												
17	Signage is restricted in Gorge area	2	1			1	2	1			2		1																									
18	Need more road info. Motorists get caught in places and can't turn back	3	2	2	1	2	3	2	2	1	3		1				1		2		1	1		2		1												
19	Bridges and tunnels too narrow for bikes and pedestrians	3		2		2	3		2		3						1		2		1	1		2		1												
20	Dust storms	3	2	5		4	4	2	5		4		1	3		1	2	1	2		1	2	1	2		2												
21	Steep Grades	2					2				1																											
22	Fog	3	2	2		4	4	2	2		4		1			1	2	1	2		1	2	1	2		2												
23	High rate of wet weather related accidents in Portland area	3	1	2		3	3	1	2		3					1	1	1	2		1	1	1	2		1												
24	High rate of ice related accidents areas outside of Portland	3	1	2		3	4	1	2		4						2	1	2		1	2	1	2		2												
25	High rate of roadside assistance calls in eastern Oregon and near Caldwell	3	1	2		2	4	1	2		3					1	2	1	2		1	2	1	2		1												
26	Need improved CVO clearance at weigh stations	1		2		1	1		2		1						1	1	2		1	1		2		1												
27	Need to track out of service vehicles																																					
28	Some bridges have restricted load limits	2					2				1																											
29	Tooth Rock tunnel near Cascade Locks needs better lighting	2					2				1																											
30	Roadway heavily rutted in Gorge and on eastbound Cabbage Hill	2					2				1																											
31	Communication limitations in Ladd Canyon	2	2				3	2			1		1			1	1	1																				
32	Substandard curves in east of Baker City	2					2				1																											
33	Interagency coordination to develop policies and plans for incidents		1				1	1									1	1				1	2														
	Total by Category	81	32	66	4	63	94	31	68	4	83		13	11		13	34	17	45	1	21	34	21	45	1	33			1									
	User Service Total	226					258					37					118					134					1											

User Services

	Transportation Needs	Travel Demand Management: Pre-Trip Travel Information					Travel Demand Management: Ride Matching And Reservation					Travel Demand Management: Demand Managment & Operations					Public Transportation Operations: Public Transportation Management					Public Transportation Operations: En-Route Transit Information					Public Transportation Operations: Personalized Public Transit					Public Transportation Operations: Public Travel Security					Electronic Payment: Electonic Payment Services				
		Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility
	I-84																																						
1	Ice and Snow near Ladd canyon, Blue Mtns , Cabbage Hill, Gorge, 3 Mile Hill	1		2		4					2	1		2		2					1															1		2		1
2	High Winds	1	1	2		4					2	1		2		2					3															1		2		1
3	Congestion near Portland and Boise	1	5	6	3	4		2	5	2	3	1	1	7	1	2		4	5	2	2		2	5	2	4		3	5	2	1			2	1	2	1	2	4	2	2
4	Rock Slides	1		2		4					2	1		2		2					1					3										1		2		1
5	Isolated areas in southeast corridor hard to reach during incidents, detour problems	1	2	2		4					2	1		2		2					1					3										1		2		1
6	Water on road creates visibility/safety problems from spray and on-coming lights	1	1	4		3			3		1	1		5		1		3			1			3		2		3							2	1		2		1
7	Additional turnouts needed at scenic views	1	1	2		1						1		2		1										1										1		2		1
8	Overuse and high traffic at Gorge tourist attractions, e.g Multnomah Falls	1	1	2		1						1		2		1										1										1		2		1
9	More safety rest areas needed Can no longer use some parks due to day use fees		1			1																				2										1		2		1
10	Trucks drive too fast, more enforcement needed.	1		2		3					1	1		2		1					1					1														
11	Height limits at tunnel near Cascade Locks		2		1	1																				3										1		2		1
12	Shaded areas stay icy, esp bridges	1	1	2		4					2	1		2		2					1															2					
13	Wildlife crossings near Lime, Pleasant Valley, Gorge, near orchards		1																																	1		2		1
14	Triple trailer conflicts w/ cars	1		2		1						1		2		1																				1		3		1
15	Inadequate parking for recreationalists Park on shoulders and create safety problems	1	2	4		2			3			1		5		1		3						3		1		3							1	1		2		1
16	Need more tourist information, e.g. kiosks at pullouts	1	2	2		4					2	1		2		2					1					3														
17	Signage is restricted in Gorge area.		1			1																				1										1		2		1
18	Need more road info. Motorists get caught in places and can't turn back	1	2	2	1	2						1		2		1										1									1	1		2		1
19	Bridges and tunnels too narrow for bikes and pedestrians.	1		2		2						1		2		1										1									1	1		2		1
20	Dust storms	1	2	4		4			3		2	1		5		2		3			1			3		3		3							2	1		2		1
21	Steep Grades																																							
22	Fog	1	2	2		4					2	1		2		2					1					3										1		2		1
23	High rate of wet weather related accidents in Portland area	1	1	2		3					1	1		2		2										2										1		2		1
24	High rate of ice related accidents areas outside of Portland	1	1	2		3					1	1		2		1					1					2										1		2		1
25	High rate of roadside assistance calls in eastern Oregon and near Caldwell.	1	1	2		2						1		2		1										1										1		2		1
26	Need improved CVO clearance at weigh stations.	1		2		1						1		2		1			1							1										1	1	2	2	2
27	Need to track out of service vehicles																									1														
28	Some bridges have restricted load limits																									1														
29	Tooth Rock tunnel near Cascade Locks needs better lighting																									1														
30	Roadway heavily rutted in Gorge and on eastbound Cabbage Hill		2																							2														
31	Communication limitations in Ladd Canyon																																							
32	Substandard curves in east of Baker City		1																																					
33	Interagency coordination to develop policies and plans for incidents																																							
	Total by Category	21	33	52	5	63		2	14	2	23	21	1	56	1	31		4	14	3	13		2	14	2	43		3	14	2	1			3	1	31	21	3	45	4	23
	User Service Total	174					41					110					34					61					20					35					96			

User Services

	Transportation Needs	Commercial Vehicle Operations: Commercial Vehicle Electronic Clearance					Commercial Vehicle Operations: Automated Roadside Safety Inspection					Commercial Vehicle Operations: On-Board Monitoring Safety					Commercial Vehicle Operations: Commercial Vehicle Administrative Processes					Hazardous Materials Incident Response					Commercial Fleet Management					Emergency Management: Emergency Notification & and Personal Security					Emergency Management: Emergency Vehicle Management				
		Safety	Efficency	Energy. Environ	Productivity	Mobility	Safety	Efficency	Energy. Environ	Productivity	Mobility	Safety	Efficency	Energy. Environ	Productivity	Mobility	Safety	Efficency	Energy. Environ	Productivity	Mobility	Safety	Efficency	Energy. Environ	Productivity	Mobility	Safety	Efficency	Energy. Environ	Productivity	Mobility	Safety	Efficency	Energy. Environ	Productivity	Mobility	Safety	Efficency	Energy. Environ	Productivity	Mobility
	I-84																																								
1	Ice and Snow near Ladd canyon, Blue Mtns , Cabbage Hill, Gorge, 3 Mile Hill	2		2		2	1		2			2										1										1				2	1			
2	High Winds	2		2		2	1		2			2										1	1									1				2	1	1		
3	Congestion near Portland and Boise	2	1	4	1	2	1		7			3										1	2									1	1			2	1	1		
4	Rock Slides.	1		2		2			2			1																								2				
5	Isolated areas in southeast corridor hard to reach during incidents, detour problems	1		2		2			2			1											2									1				2	1			
6	Water on road creates visibility/safety problems from spray and on-coming lights	2		2		2	2		5			4										1	1									1	1			2	1	1		
7	Additional turnouts needed at scenic views	2		2		1	1		2			2																												
8	Overuse and high traffic at Gorge tourist attractions, e g Multnomah Falls	2		2		1	1		2			2																												
9	More safety rest areas needed. Can no longer use some parks due to day use fees	1					1					3																												
10	Trucks drive too fast, more enforcement needed.	2		2		2	2		2			4										1	1									1					1			
11	Height limits at tunnel near Cascade Locks		1									1																												
12	Shaded areas stay icy, esp bridges.	2		2		2	1		2			2										1	1									1	1			2	1	1		
13	Wildlife crossings near Lime, Pleasant Valley, Gorge, near orchards											1										1	1									1	1			2	1	1		
14	Triple trailer conflicts w/ cars	2		2		1	2		2			3																												
15	Inadequate parking for recreationalists Park on shoulders and create safety problems	2	1	3		1	1		5			3																								1				
16	Need more tourist information, e g kiosks at pullouts	1		2		2			2			2																												
17	Signage is restricted in Gorge area											1																								1				
18	Need more road info Motorists get caught in places and can't turn back.	2		2		1	2		2			3																												
19	Bridges and tunnels too narrow for bikes and pedestrians	2		2		1	1		2			2																								1				
20	Dust storms.	2		2		2	1		5			3										1	1									1	1			2	1	1		
21	Steep Grades	1					1					2																												
22	Fog.	2		2		2	1		2			3										1	1									1	1			2	1	1		
23	High rate of wet weather related accidents in Portland area	2		2		1	1		2			3											1									1				2		1		
24	High rate of ice related accidents areas outside of Portland	2		2		2	1		2			3										1	1									1	1				1	1		
25	High rate of roadside assistance calls in eastern Oregon and near Caldwell	2		2		1	2		2			3										1	1									1	1			2	1	1		
26	Need improved CVO clearance at weigh stations.	2		2	1	1	1		2	1		1								3																1				
27	Need to track out of service vehicles	1					1					2																								1				
28	Some bridges have restricted load limits											1																								1				
29	Tooth Rock tunnel near Cascade Locks needs better lighting											1																												
30	Roadway heavily rutted in Gorge and on eastbound Cabbage Hill											1																								1				
31	Communication limitations in Ladd Canyon											1										1	2									1	1			2	1	1		
32	Substandard curves in east of Baker City											1																												
33	Interagency coordination to develop policies and plans for incidents																					1	2									1	1				1	1		
	Total by Category	42	3	45	2	33	26		56	1		67								3		13	18									13	13			33	13	13		
	User Service Total	125					83					67					3					31										59				26				

User Services

Advanced Vehicle Control and Safety Systems

	Transportation Needs	Lateral Collision Avoidance					Intersection Collision Avoidance					Vision Enhancement for Collision Avoidance					Safety Readiness					Pre-Crash Restraint Deployment					Automated Highway System					Totals by Need
		Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	
	I-84																														
1	Ice and Snow near Ladd canyon, Blue Mtns , Cabbage Hill, Gorge, 3 Mile Hill	4				1	2				1	2				1	4										5		2		3	99
2	High Winds	4				1	2				1	2				1	4					1					5		2		3	110
3	Congestion near Portland and Boise	4				1	2				1	2				1	5										5	1	2	1	3	230
4	Rock Slides.	2				1	2				1	2				1	2										3		2		3	84
5	Isolated areas in southeast corridor hard to reach during incidents, detour problems	2				1	2				1	2				1	2										3		2		3	98
6	Water on road creates visibility/safety problems from spray and on-coming lights	4				1	2				1	2				1	6					1					5		2		3	139
7	Additional turnouts needed at scenic views	2				1	2				1	2				1	2										3		2		2	68
8	Overuse and high traffic at Gorge tourist attractions, e g Multnomah Falls	2				1	2				1	2				1	2										3		2		2	68
9	More safety rest areas needed Can no longer use some parks due to day use fees	2				1	2				1	2				1	3					1					2				1	37
10	Trucks drive too fast, more enforcement needed	4				1	2				1	2				1	6					1					5		2		3	99
11	Height limits at tunnel near Cascade Locks	2				1	2				1	2				1	2										2				1	39
12	Shaded areas stay icy, esp bridges.	4				1	2				1	2				1	4										5		2		3	109
13	Wildlife crossings near Lime, Pleasant Valley, Gorge, near orchards	4				1	2				1	2				1	4					1					4				1	51
14	Triple trailer conflicts w/ cars	4				1	2				1	2				1	5										5		2		2	75
15	Inadequate parking for recreationalists Park on shoulders and create safety problems	2				1	2				1	2				1	3										3		2		2	114
16	Need more tourist information, e g kiosks at pullouts	2				1	2				1	2				1	3										3		2		3	88
17	Signage is restricted in Gorge area.	2				1	2				1	2				1	2										2				1	33
18	Need more road info. Motorists get caught in places and can't turn back	2				1	2				1	2				1	3										3		2		2	81
19	Bridges and tunnels too narrow for bikes and pedestrians	4				1	2				1	2				1	4										5		2		2	78
20	Dust storms	4				1	2				1	2				1	5					1					5		2		3	145
21	Steep Grades	4				1	2				1	2				1	4										4				1	34
22	Fog	4				1	2				1	2				1	5					1					5		2		3	116
23	High rate of wet weather related accidents in Portland area	4				1	2				1	2				1	5										5		2		2	96
24	High rate of ice related accidents areas outside of Portland	4				1	2				1	2				1	5					1					5		2		3	102
25	High rate of roadside assistance calls in eastern Oregon and near Caldwell	4				1	2				1	2				1	5					1					5		2		2	99
26	Need improved CVO clearance at weigh stations																										1	1	2		1	56
27	Need to track out of service vehicles																1															7
28	Some bridges have restricted load limits	2				1	2				1	2				1	2										2				1	25
29	Tooth Rock tunnel near Cascade Locks needs better lighting	2				1	2				1	2				1	2										2				1	23
30	Roadway heavily rutted in Gorge and on eastbound Cabbage Hill	4				1	2				1	2				1	4										4				1	33
31	Communication limitations in Ladd Canyon	2				1	2				1	2				1	2										2				1	48
32	Substandard curves in east of Baker City.	4				1	2				1	2				1	4										4				1	31
33	Interagency coordination to develop policies and plans for incidents																															16
	Total by Category	94				30	60				30	60				30	110					9					115	2	42	1	63	
	User Service Total	124					90					90					110					9					223					

User Services

	Transportation Needs	Travel and Transportation Management																																					
		En-Route Driver Information					Route Guidance					Traveler Services Information					Traffic Control					Incident Management					Emmisions Testing & Mitigation				
		Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility
	I-82																																						
1	Dust storms	3	2	5		4	4	2	5		4		1	3		1	2	1	2		1	2	1	2		2													
2	Water on road creates visibility problems from spray and on-coming lights	3	1	5		3	4	1	5		4			3		1	2	1	2		1	2	1	2		2													
3	Trucks drive too fast, more enforcement needed	3		2		3	4		2		4						2		2		1	2	1	2		2													
4	Icy bridges	3	1	2		4	4	1	2		4					1	2	1	2		1	2	1	2		2													
5	Wildlife crossings near Kenewick	2	1				3	1			1					1	1	1				1	1																
6	Significant commuter traffic near Tri-Cities.	3	4	7	2	4	4	3	7	2	4		1	3		1	2	4	4	1	1	2	3	4	1	2			1											
7	High Winds	3	1	2		4	4	1	2		4					1	2	1	2		1	2	1	2		2													
8	Fog	3	2	2		4	4	2	2		4		1			1	2	1	2		1	2	1	2		2													
9	High rate of ice related accidents.	3	1	2		3	4	1	2		4						2	1	2		1	2	1	2		2													
	Total by Category	26	13	27	2	29	35	12	27	2	33		3	9		7	17	11	18	1	8	17	11	18	1	16			1										
	User Service Total	97					109					19					55					63					1												

User Services

	Transportation Needs	Travel Demand Management															Public Transportation Operations															Electronic Payment				
		Pre-Trip Travel Information					Ride Matching And Reservation					Demand Managment & Operations					Public Transportation Management					En-Route Transit Information					Personalized Public Transit					Public Travel Security					Electonic Payment Services				
		Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility
	I-82	1	2	4		4			3		2	1		5		2			3		1			3		3			3					2		1		2		1
1	Dust storms	1	1	4		3			3		1	1		5		1			3		1			3		2			3					2		1		2		1
2	Water on road creates visibility problems from spray and on-coming lights	1		2		3					1	1		2		1					1					2										1		2		1
3	Trucks drive too fast, more enforcement needed	1	1	2		4					2	1		2		2					1					3								2		1		2		1
4	Icy bridges		1																															2						
5	Wildlife crossings near Kenewick	1	5	6	3	4		2	5	2	3	1	1	7	1	2		4	5	2	2		2	5	2	4		3	5	2	1			2	1	2	1	2	4	2	1
6	Significant commuter traffic near Tri-Cities	1	1	2		4					2	1		2		2					1					3								2		1		2		1
7	High Winds	1	2	2		4					2	1		2		2					1					3								2		1		2		1
8	Fog	1	1	2		3					1	1		2		1					1					2										1		2		1
9	High rate of ice related accidents																																							
	Total by Category	6	14	24	3	29		2	11	2	14	8	1	27	1	13		4	11	2	9		2	11	2	22		3	11	2	1			2	1	14	6	2	18	2	6
	User Service Total	78					29					50					26					37					17					17					38				

User Services

	Transportation Needs	Commercial Vehicle Electronic Clearance					Automated Roadside Safety Inspection					Commercial Vehicle Operations: On Board Monitoring Safety					Commercial Vehicle Operations: Commercial Vehicle Administative Processes					Hazardous Materials Incident Response					Commercial Fleet Management					Emergency Management: Emergency Notification & and Personal Security					Emergency Management: Emergency Vehicle Management				
		Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility
	I-82																																						
1	Dust storms	2		2		2	1		5			3										1	1										1	1				1	1			
2	Water on road creates visibility problems from spray and on-coming lights	2		2		2	2		5			4										1	1										1	1				1	1			
3	Trucks drive too fast, more enforcement needed	2		2		2	2		2			4										1	1										1					1				
4	Icy bridges	2		2		2	1		2			2										1	1										1	1				1	1			
5	Wildlife crossings near Kenewick											1										1	1										1	1				1	1			
6	Significant commuter traffic near Tri-Cities	2	1	4	1	2	1		7			3										1	2										1	1				1	1			
7	High Winds	2		2		2	1		2			2										1	1										1	1				1	1			
8	Fog	2		2		2	1		2			3										1	1										1	1				1	1			
9	High rate of ice related accidents	2		2		2	1		2			3										1	1										1	1				1	1			
	Total by Category	16	1	18	1	16	10		27			26										9	10										9	8				9	8			
	User Service Total	52					37					25										19											31					17				

User Services

Advanced Vehicle Control and Safety Systems

	Transportation Needs	Longitudinal Collision Avoidance					Lateral Collision Avoidance					Intersection Collision Avoidance					Vision Enhancement for Collision Avoidance					Safety Readiness					Pre-Crash Restraint Deployment					Automated Highway System					Totals by Need
		Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	
	I-82																																			
1	Dust storms	4				1	4				1	2				1	2				1	5					1					5		2		3	145
2	Water on road creates visibility problems from spray and on-coming lights	4				1	4				1	2				1	2				1	6					1					5		2		3	139
3	Trucks drive too fast, more enforcement needed	4				1	4				1	2				1	2				1	6					1					5		2		3	99
4	Icy bridges	4				1	4				1	2				1	2				1	4										5		2		3	109
5	Wildlife crossings near Kenewick	4				1	4				1	2				1	2				1	4					1					4				1	51
6	Significant commuter traffic near Tri-Cities	4	1			1	4				1	2				1	2				1	5										5	1	2	1	3	229
7	High Winds	4				1	4				1	2				1	2				1	4					1					5		2		3	110
8	Fog	4				1	4				1	2				1	2				1	5					1					5		2		3	116
9	High rate of ice related accidents	4				1	4				1	2				1	2				1	5					1					5		2		3	102
	Total by Category	36	1			9	36				9	18				9	18				9	44					7					44	1	16	1	25	
	User Service Total	46					45					27					27					44					7					87					

User Services

Travel and Transportation Management

	Transportation Needs	En-Route Driver Information					Route Guidance					Traveler Services Information					Traffic Control					Incident Management					Emmisions Testing & Mitigation				
		Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility
	SR 14																													
1	Ice and snow near Cape Horn	3	1	2		4	4	1	2		4					1	2	1	2		1	2	1	2		2				
2	Congestion near Vancouver.	3	4	7	2	4	4	3	7	2	4		1	3		1	2	4	4	1	1	2	3	4	1	2			1		
3	Narrow roadway and tunnels	2	2			1	2	2			2		1					1					1							
4	Rock Slides	3	1	6		4	4	1	6		4			3		1	2	1	3		1	2	1	3		2				
5	Additional turnouts needed at scenic views	3	2	6		3	3	2	6		4		1	3			1	1	3		1	1	1	3		2				
6	Water on road creates visibility problems from spray and on-coming lights	2	1			2	2	1			3							1					1			1				
7	More rest areas needed	2	1			1	2	1			2		1																		
8	Trucks drive too fast, more enforcement needed	3		2		1	3		2		2						1		2		1	1	2	2	1	1				
9	More truck climbing lanes needed in steep areas	1	1	2	2	3	1	1	2	2	3						1	1	2	1	1	1	1	2	1	2				
10	Difficult for trucks on narrow and steep areas west of Bingen Many switch to I-84.	3	2	2	2	3	3	2	2	2	4		1				1	1	2	1	1	1	1	2	1	2				
11	Height limits at tunnels	2	2		1	1	2	2		1	2		1										1							
12	Blind curves and left hand turns at intersections and driveways create safety problems	3	3	2		2	3	2	2		3		1				1	2	2		1	1	1	2		1				
13	High winds	3	1	2		4	4	1	2		4						2	1	2		1	2	1	2		2				
14	Icy bridges	3	1	2		4	3	1	2		4					1	1		2		1	1	1	2		2				
15	Inadequate parking for recreationalists Park on shoulders and create safety problems	3	2	6		2	3	2	6		3		1	3			1		3		1	1	1	3		1				
16	Need increased tourist information to capture more traffic from I-84					2					2															1				
17	Signage is restricted in Gorge area	2	1			1	2	1			2		1																		
18	Trucks using road to avoid Oregon weight-mile tax, esp east of Bingen		1		2			1		2			1							3					1					
19	Auto/rail conflicts at grade crossings.	2	2			1	2	1			2							1					2							
20	Turn onto Hood River Bridge too tight Causes trucks to blow tires		2			1		2			1		1										1							
21	Bridges too narrow for bikes and pedestrians.	3	1			2	3				3						1					1				1				
22	High rate of wet weather related accidents	3	1			3	3	1			3					1	1	1			1	1	1			1				
23	Need for more view corridors in Gorge		2			1		2			1		1										1							
24	Some bridges have restricted load limits	2	1		1	1	2	1		1	2		1																		
25	Conflicts with bikes in narrow tunnels	2				1	2				2																				
26	Some tunnels are not lined. Freezing water causes rocks to fall from ceiling		1			1		1			1							1					1							
	Total by Category	63	36	39	10	63	67	32	39	10	67		13	12		5	17	17	27	6	12	17	22	27	4	23			1		1
	User Service Total	191					205					30					79					93					1				

User Services

	Transportation Needs	Travel Demand Management															Public Transportation Operations														Public Travel Security					Electronic Payment				
		Pre-Trip Travel Information					Ride Matching And Reservation					Demand Managment & Operations					Public Transportation Management					En-Route Transit Information					Personalized Public Transit										Electonic Payment Services				
		Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility
	SR 14																																							
1	Ice and snow near Cape Horn	1	1	2		4					2	1		2		2					1					3					2	1		2		1			
2	Congestion near Vancouver	1	5	6	3	4		2	5	2	3	1	1	7	1	2		4	5	2	2		2	5	2	4		3	5	2	1		2	1	2	4	2	2	
3	Narrow roadway and tunnels		2			1																				1													
4	Rock Slides.	1	1	5		4			4		2	1		6		2			4		1			4		3			4			1		2	1		3		1
5	Additional turnouts needed at scenic views	1	3	5		3		1	4		1	1	1	6		1		1	4		1		1	4		2		1	4			1		1	1	1	3		1
6	Water on road creates visibility problems from spray and on-coming lights.		1			2					1															2						1							
7	More rest areas needed		1			1																				1													
8	Trucks drive too fast, more enforcement needed	1		2		1						1		2		1										1						1		1			1		1
9	More truck climbing lanes needed in steep areas	1	1	2	2	3				1	1	1		2	1	1				1	1				1	2				1				1	1	2	1	1	
10	Difficult for trucks on narrow and steep areas west of Bingen Many switch to I-84	1	2	2	2	3				1	1	1		2	1	1				1	1				1	2				1				1	1	2	1	1	
11	Height limits at tunnels		2		1	1																	1			1													
12	Blind curves and left hand turns at intersections and driveways create safety problems	1	3	2		2		1				1		2		1										1									1	1	2		1	
13	High winds.	1	1	2		4					2	1		2		2					1					3									1	2		1	
14	Icy bridges.	1	1	2		4					2	1		2		2					1					3									1	2		1	
15	Inadequate parking for recreationalists Park on shoulders and create safety problems	1	2	5		2			4		1	1		6		1			4					4		1			4					1	1		1	
16	Need increased tourist information to capture more traffic from I-84.					2					1										1					2									1				
17	Signage is restricted in Gorge area		1			1																				1									1				
18	Trucks using road to avoid Oregon weight-mile tax, esp. east of Bingen		1		3	1				2					1					5					2				2					1			4	
19	Auto/rail conflicts at grade crossings		2			1		1															1			1													
20	Turn onto Hood River Bridge too tight. Causes trucks to blow tires.		2			1					1										2		1			3				1					1				
21	Bridges too narrow for bikes and pedestrians	1	1			2		1			2	1				2										2									2	1			1
22	High rate of wet weather related accidents	1	1			3					1	1														1									1				
23	Need for more view corridors in Gorge		2			1																				1									1				
24	Some bridges have restricted load limits		1		1	1																				2				1					1				
25	Conflicts with bikes in narrow tunnels.					1					1										1					1									1				
26	Some tunnels are not lined Freezing water causes rocks to fall from ceiling		1			1																				1									1				
	Total by Category	13	38	35	12	53		6	17	6	20	13	2	39	4	18		5	17	9	14		6	17	6	44		4	17	6	3			5	4	26	13	5	27	8	13
	User Service Total	151					49					76					45					73					30					35				66				

		User Services																																		
		Advanced Vehicle Control and Safety Systems																																			
		Longitudinal Collision Avoidance					Lateral Collision Avoidance					Intersection Collision Avoidance					Vision Enhancement for Collision Avoidance					Safety Readiness					Pre-Crash Restraint Deployment					Automated Highway System					Totals by Need
	Transportation Needs	Safety	Efficency	Energy, Environ.	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility	
	Columbia River																																			
1	*Draw down below the minimus operating pool may restrict river traffic*																																1			23
2	Better coordination w/ railroads																																1			39
3	Wind surfers and fishermen get in the way of barges																																1			17
4	Road access into port facilities is difficult		1																												1		1			31
5	Need upgraded facilities at the Port of Morrow		1																												1		1			36
	Total by Category		2																												2		5			-
	User Service Total		2																												7					

User Services

Advanced Vehicle Control and Safety Systems

	Transportation Needs	Longitudinal Collision Avoidance					Lateral Collision Avoidance					Intersection Collision Avoidance					Vision Enhancement for Collision Avoidance					Safety Readiness					Pre-Crash Restraint Deployment					Automated Highway System					Totals by Need
		Safety	Efficiency	Energy, Environ.	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ.	Productivity	Mobility	Safety	Efficiency	Energy, Environ.	Productivity	Mobility	Safety	Efficiency	Energy, Environ.	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ.	Productivity	Mobility	
	SR 14																																			
1	Ice and snow near Cape Horn	4				1	4				1	2				1	2				1	4					1					5		2		3	110
2	Congestion near Vancouver	4	1			1	4				1	2				1	2				1	5										5	1	2	1	3	230
3	Narrow roadway and tunnels	4				1	4				1	2				1	2				1	4										4				1	49
4	Rock Slides	4				1	4				1	2				1	2				1	4					1					5		2		3	150
5	Additional turnouts needed at scenic views	2	1			1	2				1	2				1	2				1	2					1					3	1	2		3	142
6	Water on road creates visibility problems from spray and on-coming lights	4				1	4				1	2				1	2				1	6										4				2	62
7	More rest areas needed	2				1	2				1	2				1	2				1	2					1					2				1	35
8	Trucks drive too fast, more enforcement needed	4				1	4				1	2				1	2				1	6					1					5		2		2	80
9	More truck climbing lanes needed in steep areas																															1		2	1	2	78
10	Difficult for trucks on narrow and steep areas west of Bingen Many switch to I-84	2	1			1	2				1	2				1	2				1	2										3	1	2	1	3	104
11	Height limits at tunnels	2				1	2				1	2				1	2				1	2										2				1	39
12	Blind curves and left hand turns at intersections and driveways create safety problems	2	1			1	2				1	2				1	2				1	3					1					3	1	2		2	90
13	High winds	4				1	4				1	2				1	2				1	5										5		2		3	108
14	Icy bridges	4				1	4				1	2				1	2				1	5										5		2		3	102
15	Inadequate parking for recreationalists Park on shoulders and create safety problems	2				1	2				1	2				1	2				1	3										3		2		2	124
16	Need increased tourist information to capture more traffic from I-84.																																			1	15
17	Signage is restricted in Gorge area.	2				1	2				1	2				1	2				1	2										2				1	33
18	Trucks using road to avoid Oregon weight-mile tax, esp. east of Bingen																																		1		48
19	Auto/rail conflicts at grade crossings	2				1	2				1	2				1	2				1	2					1					2				1	44
20	Turn onto Hood River Bridge too tight Causes trucks to blow tires																																				13
21	Bridges too narrow for bikes and pedestrians	4				1	4				1	2				1	2				1	5										5				2	68
22	High rate of wet weather related accidents	4				1	4				1	2				1	2				1	5										5				2	76
23	Need for more view corridors in Gorge																																				18
24	Some bridges have restricted load limits.	2				1	2				1	2				1	2				1	2										2				1	36
25	Conflicts with bikes in narrow tunnels.	4				1	4				1	2				1	2				1	4										4				1	44
26	Some tunnels are not lined Freezing water causes rocks to fall from ceiling	2					2															2										2					22
	Total by Category	64	4			20	64				20	40				20	40				20	75					18		7			77	4	22	4	43	
	User Service Total	88					84					60					60					75					25					150					

User Services

	Transportation Needs	Travel and Transportation Management																											
		En-Route Driver Information					Route Guidance					Traveler Services Information					Traffic Control					Incident Management					Emmisions Testing & Mitigation				
		Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ.	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility
	Columbia River																													
1	Draw down below the minimus operating pool may restrict river traffic				2					2										1					1					
2	Better coordination w/ railroads				2					2										3					1					
3	Wind surfers and fishermen get in the way of barges				2					2										1					1					
4	Road access into port facilities is difficult		1		2			1		2			1					1		1					1					
5	Need upgraded facilities at the Port of Morrow.		2		2			2		2			1					1		1			1		1					
	Total by Category		3		10			3		10			2					2		7			1		5					
	User Service Total		13					13					2					9					6							

User Services

Travel Demand Management

	Transportation Needs	Pre-Trip Travel Information					Ride Matching And Reservation					Demand Managment & Operations				
		Safety	Efficiency	Energy, Environ.	Productivity	Mobility	Safety	Efficiency	Energy, Environ.	Productivity	Mobility	Safety	Efficiency	Energy, Environ.	Productivity	Mobility
	Columbia River															
1	Draw down below the minimus operating pool may restrict river traffic				3					2					1	
2	Better coordination w/ railroads.				3					2					1	
3	Wind surfers and fishermen get in the way of barges				2					1					1	
4	Road access into port facilities is difficult		1		3					2					1	
5	Need upgraded facilities at the Port of Morrow		2		3					2					1	
	Total by Category		3		14					9					5	
	User Service Total	17					9					5				

Public Transportation Operations

	Transportation Needs	Public Transportation Management					En-Route Transit Information					Personalized Public Transit					Public Travel Security				
		Safety	Efficiency	Energy, Environ.	Productivity	Mobility	Safety	Efficiency	Energy, Environ.	Productivity	Mobility	Safety	Efficiency	Energy, Environ.	Productivity	Mobility	Safety	Efficiency	Energy, Environ.	Productivity	Mobility
	Columbia River																				
1	Draw down below the minimus operating pool may restrict river traffic				2					2					2					1	
2	Better coordination w/ railroads.				5					2					2					1	
3	Wind surfers and fishermen get in the way of barges				1					1					1					1	
4	Road access into port facilities is difficult				2					2					2					1	
5	Need upgraded facilities at the Port of Morrow				2					2					2					1	
	Total by Category				12					9					9					5	
	User Service Total	12					9					9					5				

Electronic Payment

	Transportation Needs	Electonic Payment Services				
		Safety	Efficiency	Energy, Environ.	Productivity	Mobility
	Columbia River					
1	Draw down below the minimus operating pool may restrict river traffic				2	
2	Better coordination w/ railroads.				4	
3	Wind surfers and fishermen get in the way of barges				1	
4	Road access into port facilities is difficult		1		2	
5	Need upgraded facilities at the Port of Morrow		1		2	
	Total by Category		2		11	
	User Service Total	13				

User Services

	Transportation Needs	Commercial Vehicle Electronic Clearance					Commercial Vehicle Operations: Automated Roadside Safety Inspection					Commercial Vehicle Operations: On-Board Monitoring Safety					Commercial Vehicle Operations: Commercial Vehicle Administative Processes					Hazardous Materials Incident Response					Commercial Fleet Management					Emergency Management: Emergency Notification & and Personal Security					Emergency Management: Emergency Vehicle Management				
		Safety	Efficiency	Energy, Environ.	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility
	Columbia River																																						
1	Draw down below the minimus operating pool may restrict river traffic				1																																		
2	Better coordination w/ railroads				5					2										3																				
3	Wind surfers and fishermen get in the way of barges				1																																		
4	Road access into port facilities is difficult				1																																		
5	Need upgraded facilities at the Port of Morrow		1		1																																		
	Total by Category		1		9					2										3																				
	User Service Total		10					2										3																						

User Services

Advanced Vehicle Control and Safety Systems

	Transportation Needs	Longitudinal Collision Avoidance					Lateral Collision Avoidance					Intersection Collision Avoidance					Vision Enhancement for Collision Avoidance					Safety Readiness					Pre-Crash Restraint Deployment					Automated Highway System					Totals by Need
		Safety	Efficiency	Energy, Environ.	Productivity	Mobility	Safety	Efficiency	Energy, Environ.	Productivity	Mobility	Safety	Efficiency	Energy, Environ.	Productivity	Mobility	Safety	Efficiency	Energy, Environ.	Productivity	Mobility	Safety	Efficiency	Energy, Environ.	Productivity	Mobility	Safety	Efficiency	Energy, Environ.	Productivity	Mobility	Safety	Efficiency	Energy, Environ.	Productivity	Mobility	
	Columbia River																																			
1	Draw down below the minimus operating pool may restrict river traffic																																	1		23
2	Better coordination w/ railroads																																	1		39
3	Wind surfers and fishermen get in the way of barges																																	1		17
4	Road access into port facilities is difficult		1																													1		1		31
5	Need upgraded facilities at the Port of Morrow		1																													1		1		36
	Total by Category		2																													2		5		
	User Service Total		2																													7				

User Services

	Transportation Needs	Travel and Transportation Management																													
		En-Route Driver Information					Route Guidance					Traveler Services Information					Traffic Control					Incident Management					Emmisions Testing & Mitigation				
		Safety	Efficency	Energy, Enviro	Productivity	Mobility	Safety	Efficency	Energy, Enviro	Productivity	Mobility	Safety	Efficency	Energy, Enviro	Productivity	Mobility	Safety	Efficency	Energy, Enviro	Productivity	Mobility	Safety	Efficency	Energy, Enviro	Productivity	Mobility	Safety	Efficency	Energy, Enviro	Productivity	Mobility
	Railroad																														
1	Lack of passenger services. Frequency too low.		1			2					1							2													
2	Rail corridors at or above capacity				2					2								1		1					1					
3	Restrictions in scenic areas prevent capacity expansion				2					2								1		1					1					
4	Yard constraints in Portland and Vancouver, Gorge sidings used for storage				2					2								1		1					1					
5	Expensive to transfer freight across the river		1		2			1		2								1		1			1		1					
6	Better coordination w/ barge operators.				2					2								1		1					1					
7	Rock slides.		1		2		1	1		2							1	1		1		1	2		1					
8	People crossing tracks to get access to river						1										1					1								
9	Auto/rail conflicts at grade crossings.	2	1				3	1			1						1	1				1	2							
10	Some of SR 14 in BN/SF right of way, limits road expansion		2			1		2			1		1					1					1			1				
	Total by Category	2	6		12	3	5	5		12	3		1				3	10		6		3	6		6	1				
	User Service Total	23					25					1					19					16									

User Services

	Transportation Needs	Commercial Vehicle Operations: Commercial Vehicle Electronic Clearance					Commercial Vehicle Operations: Automated Roadside Safety Inspection					Commercial Vehicle Operations: On-Board Monitoring Safety					Commercial Vehicle Operations: Commercial Vehicle Administative Processes					Commercial Vehicle Operations: Hazardous Materials Incident Response					Commercial Vehicle Operations: Commercial Fleet Management					Emergency Management: Emergency Notification & and Personal Security					Emergency Management: Emergency Vehicle Management				
		Safety	Efficiency	Energy, Environ.	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility	Safety	Efficiency	Energy, Environ	Productivity	Mobility
	Railroad																																						
1	Lack of passenger services. Frequency too low				1																																		
2	Rail corridors at or above capacity				1																																		
3	Restrictions in scenic areas prevent capacity expansion				1																																		
4	Yard constraints in Portland and Vancouver. Gorge sidings used for storage		1		1																																		
5	Expensive to transfer freight across the river				2					1																														
6	Better coordination w/ barge operators.				1																		1	2									1	1			1	1			
7	Rock slides																						1										1				1				
8	People crossing tracks to get access to river	1					1					1											1	2									1	1			1	1			
9	Auto/rail conflicts at grade crossings	1					1					3																												
10	Some of SR 14 in BN/SF right of way, limits road expansion		1			1																																	
	Total by Category	2	2		7	1	2			1		4											3	4								3	2				3	2			
	User Service Total	12					3					4											7									5					5				

User Services

	Transportation Needs	Travel Demand Management															Public Transportation Operations														Electronic Payment				
		Pre-Trip Travel Information					Ride Matching And Reservation					Demand Managment & Operations					Public Transportation Management					En-Route Transit Information					Personalized Public Transit					Public Travel Security					Electonic Payment Services				
		Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility	Safety	Efficency	Energy, Environ	Productivity	Mobility
	Railroad																																		
1	Lack of passenger services. Frequency too low		1		1	2		1		1	2					1		1		1	1		1		1	3				1	1				2		1	1
2	Rail corridors at or above capacity.				2					1					1					1					1					1				1		1	
3	Restrictions in scenic areas prevent capacity expansion.				3					2					1					2					2					2				1		2	
4	Yard constraints in Portland and Vancouver, Gorge sidings used for storage				2					1					1					1					1					1				1		1	
5	Expensive to transfer freight across the river.		1		3					2					1					2					2					2				1		2	
6	Better coordination w/ barge operators				3					2					1					2					2					2				1		2	
7	Rock slides.		1		3					2					1					2					2					2							
8	People crossing tracks to get access to river.																																		
9	Auto/rail conflicts at grade crossings.		1																																
10	Some of SR 14 in BN/SF right of way, limits road expansion		3			1		1			2		1					1			2		1			2		1			1				1		1
	Total by Category		7		17	3		2		11	4		1		6	1		2		11	3		2		11	5		1		11	2				8		11	2
	User Service Total		27					17					8					16					18					14					6				21		

	Transportation Needs	User Services: Advanced Vehicle Control and Safety Systems — Longitudinal Collision Avoidance: Safety	Efficiency	Energy, Environ.	Productivity	Mobility	Lateral Collision Avoidance: Safety	Efficiency	Energy, Environ.	Productivity	Mobility	Intersection Collision Avoidance: Safety	Efficiency	Energy, Environ.	Productivity	Mobility	Vision Enhancement for Collision Avoidance: Safety	Efficiency	Energy, Environ.	Productivity	Mobility	Safety Readiness: Safety	Efficiency	Energy, Environ.	Productivity	Mobility	Pre-Crash Restraint Deployment: Safety	Efficiency	Energy, Environ.	Productivity	Mobility	Automated Highway System: Safety	Efficiency	Energy, Environ.	Productivity	Mobility	Totals by Need
	Railroad																																				
1	Lack of passenger services. Frequency too low.		1																														1				31
2	Rail corridors at or above capacity		1																														1		1		21
3	Restrictions in scenic areas prevent capacity expansion		1																														1		1		27
4	Yard constraints in Portland and Vancouver, Gorge sidings used for storage		1																														1		1		21
5	Expensive to transfer freight across the river.		1																														1		1		32
6	Better coordination w/ barge operators.		1																														1		1		29
7	Rock slides																											1							1		40
8	People crossing tracks to get access to river.																											1									10
9	Auto/rail conflicts at grade crossings.	4				1	4				1	2				1	2				1	5					1					4				1	53
10	Some of SR 14 in BN/SF right of way, limits road expansion		1																														1		1		33
	Total by Category	4	7			1	4				1	2				1	2				1	6					3					4	7		6	2	
	User Service Total	12					6					3					3					6					3					19					