Link To Table Of Contents

Chapter 3
User Services

Agency Perceptions of Local Applicability of ITS User Services

Twenty-nine intelligent transportation system (ITS) user services have been identified by the Federal Highway Administration (FHWA). These user services have been grouped into seven "bundles", each of which represents the application of advanced technology to a specific transportation function. The seven bundles of user services are:

- Travel and Transportation Management.
- Travel Demand Management.
- Public Transportation Management.
- Electronic Payment.
- Commercial Vehicle Operations.
- Emergency Management.
- Advanced Vehicle Safety Systems.

The following sections discuss the bundles of user services, provide a brief description of each user service[1], and a discussion of its applicability in the Kansas City area. Each user service is discussed in the context of how it would potentially enhance the efficiency or capability of the transportation system, and how it would help meet the needs identified by the various users of the transportation system. The discussion of each user service is based on input received during interviews with local agencies. Over twenty interviews were held with local agencies, including public works, emergency response, transit, and private agencies (such as towing and freight). Input on the user services was also received during two public meetings.

TRAVEL AND TRANSPORTATION MANAGEMENT

The Travel and Transportation Management bundle includes six user services that are designed to use advanced systems and technologies to improve the safety and efficiency of the transportation system, and to provide motorists with current information about traffic and roadway conditions, as well as traveler services. The user services in the Travel and Transportation Management bundle are shown in Table 3-1 and discussed in greater detail below.

En-Route Driver Information - The En-Route Driver Information user service provides motorists with information about traffic and roadway conditions due to both scheduled activities (such as construction or special events) and unscheduled activities (such as accidents). En-Route Driver Information is provided after the trip has begun. Driver information may be provided via radio, variable message sign (VMS), or in-vehicle signing. Because anything that would divert the driver's eyes from the road might have a negative impact on safety, it has

[1] Descriptions of user services and user service bundles are based on the definitions provided in *National ITS Program Plan, Intelligent Transportation System*, edited by Gary W. Euler and H. Douglas Robertson, March 1995.

Table 3-1. Travel and Transportation Management User Services

Bundle	User Services
Travel and Transportation Management	En-Route Driver Information
	Route Guidance
	Traveler Services Information
	Traffic Control
	Incident Management
	Emissions Testing and Mitigation

been suggested that in-vehicle visual displays would be limited when the vehicle is moving. Furthermore, alternatives such as "heads up" displays would be used to display the limited visual information provided when the vehicle is in motion.

Local Applicability: En-Route Driver Information was identified as an appropriate user service for the Kansas City area by a number of agencies. En-Route Driver Information meets the critical need for communication with motorists. One mechanism for En-Route Driver Information, a highway advisory radio (HAR) system, has been set up by the Missouri Highway and Transportation Department (MHTD) and was discussed in a previous section, *Current and Planned ITS Applications in the Kansas City Area.*

Multiple agencies would expect benefits from the provision of En-Route Driver Information. In addition to allowing public works and engineering agencies to communicate information about road closings and road construction, En-Route Driver Information may benefit emergency response agencies, because it may facilitate access to incidents, and decrease response time. Fire departments, in particular, noted the advantages of warning drivers that equipment would be accessing the incident site by traveling on the freeway in the "wrong" direction (fire equipment often accesses an incident on the northbound lanes by traveling northbound on the southbound lanes from the nearest interchange).

Although transportation and public works agencies did perceive a potential benefit from the provision of En-Route Driver Information, some agencies felt that the benefits were limited by a lack of alternative routes. This illustrates the close link between user services, in this case between the En-Route Driver Information user service and the Route Guidance user service, which is discussed next.

Route Guidance - The Route Guidance user service provides motorists with a suggested route to reach their destination, along with instructions for upcoming turns or other maneuvers. Ultimately, a route guidance system would provide travelers utilizing all modes with directions to their destinations based on real-time information about the transportation system, including lane closures, traffic conditions, and transit information.

Local Applicability: Route Guidance was considered a priority for many agencies because it provides another mechanism for communication with motorists. The role of Route Guidance during incident management was of particular interest, as indicated by local agency comments.

Public works agencies noted that the success of route diversion was constrained by the availability of alternate routes. Johnson County indicated that the potential for diversion in their jurisdiction was constrained by a lack of alternative routes, and a lack of available capacity on the alternative routes that do exist. In these cases, it was noted that congestion would merely be moved, rather than reduced. On the other hand, Kansas City, Missouri, felt that capacity was available in some cases, and identified Route Guidance as a priority.

Enforcement agencies felt that route guidance information would be very helpful. It was noted that such a system could be used to direct motorists back onto the freeway when the freeway is closed due to an incident, thus freeing officers to direct traffic rather than give directions. One enforcement agency noted that even local motorists can easily lose their bearings when they are diverted from the freeway into an unfamiliar neighborhood. The importance of route guidance information was also supported by a traffic reporter, who said that listeners indicate that route guidance information is the most valuable information provided.

Traveler Services Information - The Traveler Services Information user service provides the traveler with information regarding local services and facilities, and has been compared to a computerized version of the "yellow pages". This information would be available for pre-trip planning via a terminal in the home, office or hotel. This information would also be available en-route via either a terminal in the vehicle or at public facilities such as highway rest stops or transit terminals. Information regarding the location, services or amenities, and operating hours would be available for a variety of goods and services, including food, lodging, parking, auto repair, hospital and medical, and police stations. This service would also allow the traveler to communicate with service providers interactively, which would allow travelers to reserve rooms or confirm services.

The type of information provided would vary depending on whether the information is accessed at a fixed location (such as a hotel lobby or transit center) or en-route (such as in a transit vehicle, private auto, or commercial vehicle). The type of information and method of presentation would also vary, information presented to drivers while the vehicle is in motion would be restricted for safety reasons; when the vehicle is parked, the driver would be free to access and utilize all available information.

Local Applicability: The perceived importance of Traveler Services Information varies from agency to agency. From one perspective, this kind of service is of little importance, at least in the short or medium term. Another perspective considers traveler information fairly important due to Kansas City's role as a regional center.

Some applications of the Traveler Services Information user service have been implemented in the area. Missouri currently has computer touch screens that provide traveler information at all visitors centers, and there is a kiosk with traveler services information at Bartle Hall, as discussed in a previous section, *Current and Planned ITS Applications in the Kansas City Area.*

Traffic Control - The Traffic Control user service focuses on increasing the safety and efficiency of traffic flow on streets and highways. It includes adaptive signal systems on surface streets and freeway control techniques such as ramp metering on freeways.

The Traffic Control user service would gather data from the field, analyze it, and use it to assign right-of-way to users of the transportation system. The goal is to maximize the efficiency of the movement of people and goods through the roadway network, thus it may provide preferential treatment to transit and other high occupancy vehicles (HOVs), if preferential treatment is in accordance with local objectives and operating policies. The proper deployment of traffic control would help alleviate congestion problems and improve air quality. The information generated by the Traffic Control user service can also be disseminated to the general public and to service providers, laying the foundation for other user services.

Traffic Control, which includes monitoring, control, and communications, provides the basis for many of the other user services. The data collected, processed and used by traffic control will be utilized by virtually all of the other services in the Travel and Transportation Management bundle, as well as some of the services in the Public Transportation Operations and Emergency Management bundles.

Local Applicability: Many agencies identified Traffic Control as a priority for Kansas City. Traffic control is considered a priority partly because it is necessary for deployment of other user services that depend on the information gathered and processed by the Traffic Control user service.

Not all elements of Traffic Control are necessarily desirable in the Kansas City area, at least in the short term. For example, while some agencies expressed a great interest in ramp metering and thought that it had the potential to reduce recurring congestion and increase safety on the freeway, not all agencies thought that ramp metering would be an appropriate strategy. Some agencies felt that freeway ramp metering would create more problems than it would solve, and many noted the difficulty ramp metering would create with respect to driver education and enforcement.

Advanced signal systems for arterial traffic control are also of interest. Overland Park and Lenexa, Kansas, both have plans to implement video monitoring at selected high volume intersections. Plans for deployment in Overland Park may, however, be delayed due to a lack of available capacity on the communications cable currently used.

Incident Management - The Incident Management user service focuses on enhancing incident detection and response. Incident detection would be enhanced by advanced sensors, data processing, and communications, which would allow officials to quickly and accurately identify a variety of incidents, and would allow immediate deployment of actions to minimize the effects of incidents. The service would also help officials identify and forecast hazardous weather, as well as traffic and roadway conditions, so that preventative action could be taken to minimize the possible consequences. Incident Management also involves activities that minimize the negative impacts of planned events, such as lane closures or special events. Incident Management may include coordinating the schedules of construction or other planned roadway activities.

Local Applicability: An effort to coordinate incident management activities is currently underway in the Kansas City area as discussed in the section, *Institutional Characteristics.* These activities may help provide the framework for the institutional coordination needed for incident management. Many of the agencies interviewed felt that Incident Management was an important user service, and identified it as a priority area.

All agencies who respond to incidents noted that information regarding the exact location of the incident would be very helpful. Information called in by motorists is often vague and/or inaccurate, and multiple callers referencing the same incident may tie up the dispatcher. Video monitoring or some other mechanism for identifying the kind of emergency equipment needed would also be helpful. This information would not only assure that the needed equipment was available in a timely manner, but would also help avoid situations where large equipment is brought to the scene when it is not needed, which not only further disrupts traffic flow, but also ties up equipment that may be needed elsewhere.

MAST, the emergency medical provider in Kansas City, Missouri, noted that information regarding weather and roadway conditions would be very helpful. Because MAST services a wide geographic area, and because roadway and weather conditions vary throughout the region, these conditions have a significant impact on which ambulance can most quickly access the incident. Weather information is currently collected by the Kansas Department of Transportation (KDOT) and MHTD, Kansas City, Missouri, and Olathe, Overland Park, and Lenexa, Kansas.

It was also noted that there would be some benefit to the coordination of planned events, such as construction. By coordinating the construction schedules of various agencies, disruption may be minimized. For example, ideally construction activities on a major facility would not occur concurrently with construction activities on an alternative route. The need for coordination of construction projects is relevant for arterials, as well as freeway facilities, as was noted at the public meetings.

Most of the agencies felt that coordination among the various agencies working at the incident site is generally very good, and there are rarely any problems with respect to authority. However, one agency noted that all agencies could benefit from a better understanding of the objectives of other agencies, as well as a better understanding of the effects of one agencies activities on the activities of other agencies. Another agency noted that incident management activities would benefit from a plan for traffic control. Currently, traffic control is handled by the police officer, who bases decisions on judgment and experience, but not with guidance from any plan. Many of the public works and engineering agencies, agencies that might have some valuable insight regarding traffic control, indicated that they are not involved in any incident management activities, however, in other jurisdictions such agencies are involved. For example, KDOT is a key player with respect to incident management on Kansas freeways.

The representative from the Visitors and Convention Bureau further noted that an incident involving a motor coach could be particularly disastrous. Evacuation would be complicated not only by the fact that many emergency responders are not trained to evacuate a motor coach, but also by the fact that many of the passengers may be older and less mobile.

Emissions Testing and Mitigation - Emissions Testing and Mitigation can be used to provide area-wide pollution information for use in monitoring air quality and providing data to be used to develop strategies to improve air quality. Emission information may be used to re-route traffic around sensitive air quality areas, or even, under severe conditions, to control access to such areas. Other applications include roadside monitoring of individual vehicles to identify vehicles that exceed emission standards and diagnostic systems that provide in-vehicle monitoring of emissions levels. In-vehicle monitoring systems would alert the driver of non-compliance so that corrective measures could be taken.

Local Applicability: Kansas City generally has very few problems with respect to air quality. In fact, Kansas City has been an attainment area for all "criteria" pollutants defined in the 1990 Clean Air Act Amendments. However, there were a number of ozone exceedances in the summer of 1995. As long as Kansas City does not have significant problems with respect to pollution, Emissions Testing and Mitigation would not be considered a priority by any of the agencies surveyed.

TRAVEL DEMAND MANAGEMENT

The Travel Demand Management (TDM) bundle includes three user services that are designed to reduce congestion on the transportation infrastructure by encouraging commuters to use modes other than the single occupant vehicle (SOV), to alter the time and/or location of their trip or to eliminate a trip. In response to congestion and air quality concerns, many cities have already initiated travel demand management activities, and others will be required to in response to the mandates of the 1990 Clean Air Amendments. The user services in the Travel Demand Management bundle are shown in Table 3-2 and discussed in greater detail below.

Table 3-2. Travel Demand Management User Services

Bundle	User Services
Travel Demand Management	Demand Management and Operations Pre-Trip Travel Information Ride Matching and Reservations

Demand Management and Operations - The Demand Management and Operations user service attempts to accomplish three primary goals: reduce SOV travel, particularly SOV commuting; affect a mode change from SOVs to HOVs, specifically in certain targeted markets; and provide a variety of mobility options. In an effort to accomplish these goals, demand management and operations may facilitate convenient alternatives to the SOV in an effort to affect a change in mode, such as transit service enhancements, the development and/or improvement of HOV facilities, and the deployment of carpool and vanpool programs.

This user service may also affect mode choice through travel incentives and disincentives, through controls on the availability, location, and price of roadways and parking. These measures are expected to improve traffic and transit operations, and increase auto occupancies. Alternative work arrangements, such as variable work hours, compressed work weeks, and telecommuting may also be implemented to in an effort to manage demand.

Local Applicability: Air quality concerns and congestion are often the primary impetus for the deployment of Demand Management and Operations activities. Because Kansas City has not had significant problems with respect to either air quality or congestion, Demand Management and Operations activities may be more appropriate in the medium to long term.

Various agencies, for example MHTD, did state that strategies that provide and encourage alternatives to the SOV would be needed in the long term. This perspective is also illustrated by studies such as the commuter rail study currently being conducted for Johnson County, and the light rail study recently completed for the Kansas City Area Transportation Authority (KCATA). Furthermore, the KCATA has plans to implement a vanpool program, although the details of the plan were not available.

Pre-Trip Travel Information - The Pre-Trip Travel Information user service provides travelers with information prior to departure, before a mode has been chosen. This information may encourage alternatives to SOV travel, including either an HOV mode or the elimination of a trip. Information about transportation demand management (TDM) pricing strategies may also be available to further encourage alternatives to the SOV. Coordination with electronic payment services (discussed later) would further enhance the capabilities and presumably the effectiveness of Pre-Trip Travel Information.

Pre-trip information includes a range of multimodal transportation information that may be accessed at home, work, or other major sites where trips originate. Information to be provided may include transit routes, schedules, transfers, fares, intermodal connections, and ride matching services; current traffic and highway conditions, regulations and tolls; information on incidents, accidents, and road construction; current and predicted congestion and traffic speeds on specific routes; parking conditions and fees; availability of park-and-ride facilities, special event information, and weather information.

Local Applicability - Pre-Trip Travel Information was deemed appropriate for deployment in the medium to long term. While some agencies thought it would be of minimal benefit, others thought it was important and noted that once the information was available for En-Route Driver Information, it would be easy and relatively inexpensive to provide this information for pre-trip planning.

Enforcement and emergency response agencies indicated that Pre-Trip Travel Information would be beneficial to the extent that it would reduce the volume of traffic near an incident location. If this information causes motorists to alter their travel plans (time of travel, travel route, mode of travel or the elimination of a trip), then it would be beneficial.

Interviews with transit agencies suggest that Pre-Trip Travel Information would be of interest only if it were proven to pay for itself in terms of increased efficiency or decreased personnel costs (if it would eliminate or reduce the need for operators answering individual questions on the transit information line). Furthermore, the information provided would have to be simple to understand.

Ride Matching and Reservations - Ride Matching and Reservations provide a strategy for reducing demand by facilitating and encouraging ridesharing as an alternative to the SOV. This service expands the market for ridesharing by providing real-time ride matching information along with reservations and vehicle assignments.

Under this service, people who wish to rideshare would provide a travel itinerary (date, time, origin and destination) and any specific restrictions or preferences (the need for wheelchair access, mode preference, etc.) to a ride matching service. The traveler would then receive ridesharing options for that itinerary, considering the preferences noted.

Local Applicability: All of the agencies surveyed currently direct ridesharing inquiries to the Mid-America Regional Council's (MARC) ridesharing program. Although MARC has no plans to change their ride matching program, they are interested in new technologies. Because Kansas City has been an attainment area with respect to pollution, there have been few employers that have offered incentives for ridesharing. Due to the preference for autos and the current lack of disincentives associated with the personal auto, as well as the current lack of incentives for HOVs (there are no preferential facilities such as freeway HOV lanes or preferential parking), the current potential for ride matching is limited.

In the long term, however, circumstances may change, and there may be a greater potential for Ride Matching and Reservations. Various agencies mentioned that HOV lanes might become a viable alternative in the future. In fact, in 1995 Missouri attempted to introduce laws that would enable MHTD to build, operate, and maintain HOV facilities, and would allow penalties for violations. The deployment of HOV lanes or other incentives to ridesharing would complement the deployment of user services such as Ride Matching and Reservations, making deployment more feasible.

Interviews with transit agencies suggest that some agencies believe that ride matching and vanpooling have the potential for growth in the future, and some agencies are exploring the market. KCATA has plans underway for a vanpool program. However, a ride matching and reservation system would be of interest only if it were proven both in terms of hardware and software capabilities, as well as cost effectiveness.

PUBLIC TRANSPORTATION MANAGEMENT

The Public Transportation Management bundle includes four user services that are designed to utilize advanced vehicle electronic systems to provide data which is then used to improve transit service to the public. The user services in the Public Transportation Management bundle are shown in Table 3-3 and discussed in greater detail following a general discussion regarding the local applicability of this bundle of user services.

Table 3-3. Public Transportation Management User Services

Bundle	User Services
Public Transportation Management	Public Transportation Management
	En-route Transit Information
	Personalized Public Transit
	Public Travel Security

Local Applicability - Transit agency interest in ITS user services is tempered due to financial limitations. Faced with tight budgets and threats of federal budget cuts, transit agencies are more concerned with providing basic services than with advanced technologies and ITS user services. In this environment, it appears that the only ITS user service elements of interest are

those that are proven with respect to technology, user acceptance, and cost effectiveness. Thus, in general, the Public Transportation User Services may be considered appropriate for deployment in the medium or long term, unless noted otherwise below.

Public Transportation Management - Public Transportation Management automates the operations, planning, and management functions of public transportation systems. It would provide real-time computer analysis of vehicles and facilities to improve transit operations and maintenance. The analysis would identify deviations from the schedule and offer potential solutions to dispatchers and drivers. This service would help maintain transportation schedules and assure transfer connections from vehicle to vehicle and between modes, and could be coupled with traffic control services to facilitate quick response to service delays.

Information regarding passenger loading, vehicle running times, accumulated miles and hours, and vehicle maintenance would help improve service and provide managers with extensive information on which to base decisions. Service schedulers would have timely data to adjust trips. Personnel management would be enhanced with automatic recording and verification of driving and maintenance task performance. Reports, including management, operations, and Section 15 reports, would be prepared with greater efficiency.

Local Applicability: KCATA currently has an automatic vehicle location (AVL) system, a critical component in a Public Transportation Management system, as was discussed in a previous section, *Current and Planned ITS Applications in the Kansas City Area.* Although the AVL system is not currently working due to hardware failure, a grant has been awarded by the Federal Transit Administration (FTA) to purchase equipment that will return the AVL system to working order.

En-Route Transit Information - En-Route Transit Information would provide information to travelers using public transportation after they begin their trips. Real-time, accurate transit service information would be available on-board the vehicle, and at transit stations and bus stops to assist travelers in making informed decisions and itinerary modifications once a trip is underway.

Personalized Public Transit - Personalized Public Transit would provide transit vehicles with flexible routes which offer more convenient, and often more cost effective, service to customers where traditional, fixed route operations cannot be economically justified. Small, publicly or privately operated vehicles would provide on-demand routing to pick up passengers who have requested service and deliver them to their destinations. Route deviation schemes, where vehicles leave a fixed route for a short distance to pick up or discharge passengers, is another possible approach. Vehicles providing this service include small buses, taxis, or other small, shared-ride vehicles. This type of service could expand transit service to lesser populated locations and neighborhoods and could potentially provide transportation at a lower cost and with greater convenience than conventional fixed route transit.

Local Applicability: KCATA currently offers one version of Personalized Public Transit, called MetroFlex, on two routes. MetroFlex includes two services: rush hour service, during which the bus will deviate a few blocks (within a certain zone) from its designated route if a "standing order" has been requested (by phone); and midday service, during which door-to-door service can be arranged anywhere within the service zone. This service, which became available in April (the first route) and July 1994 (the second route), has proven to be very successful and

more cost effective than regular route transit (a special wage agreement with the labor union has enhanced the cost effectiveness of the service). Arrangements for this service are currently provided by a single human operator/dispatcher.

Public Travel Security - The Public Travel Security user service would create a more secure environment for transit patrons and operators by providing systems that monitor the environment in transit stations, parking lots, bus stops, and on transit vehicles. These systems would generate alarms, either automatically or manually, when necessary. Deployment of this user service would improve security, and the perception and acceptance of transit. This service can be integrated with other anti-crime activities.

Local Applicability: Security on public transit is reported not to be a major issue for Johnson County. KCATA and Kansas City Kansas, however, indicate that personal safety and security is a major issue, particularly with respect to the perception of security. However, security is an issue not necessarily on the bus itself, but on the street and in the neighborhood where patrons must wait for the bus. Security at park-and-ride lots is also a concern. Note that safety and security in this case refers not so much to freedom from accidents (as is implied when discussing freeway safety), but rather freedom from incidents of crime.

ELECTRONIC PAYMENT

The Electronic Payment bundle includes one user service, Electronic Payment Services, shown in Table 3-4 and discussed below.

Table 3-4. Electronic Payment User Service

Bundle	User Service
Electronic Payment	Electronic Payment Services

Electronic Payment Services would allow travelers to pay for transportation services with electronic cards or tags. The goal is to provide travelers with a common electronic payment medium for all transportation modes and functions, including tolls, transit fares and parking. Electronic payment services would encompass the integration of payment systems of various modes to create an intermodal user service, as well as the improvement of payment systems for separate transportation modes. Payment systems for various modes would have to be perfected independently before they could be integrated.

Another goal is integration among systems in different states, especially with respect to toll payment. Electronic toll collection, transit fare payment, and parking payment would be linked through an intermodal multi-use electronic systems. A common fee payment structure could be used with all modes, possibly tying into roadway pricing options. Coordinated pricing strategies and incentives for HOV travel would be facilitated by such a system. Components of Electronic Payment Services include electronic toll collection, electronic fare collection for transit, and electronic parking payment.

Local Applicability - Electronic toll collection was recently implemented on the Kansas Turnpike. Additionally, there are some potential applications for Electronic Payment Systems in the medium to long term. Public works and engineering agencies note that, in the long term, some form of congestion pricing might be viable. Under a congestion pricing system, commuters would pay a premium for use of roadways that are in high demand during the peak period, with reduced cost or no cost travel during the off peak period. While there may be limited applications for this scenario, one concept explored in other metropolitan areas is the deployment of an HOV facility that may be used by single occupant vehicles during the peak period for a fee.

Local transit agencies may wish to explore a "smart card" technology to facilitate electronic payment, particularly for patrons transferring from one transit provider to another. This would be especially beneficial if commuter rail, which is currently being studied by Johnson County, is implemented and coordinated with KCATA transit services at the proposed Union Station intermodal facility. Ideally, transit patrons would pay for transit services on a weekly, monthly or even annual basis, rather than on a per-ride basis. Eventually, a "cashless system" would be preferred. This would not only be more convenient for transit patrons but it would also allow bus drivers to focus on driving, rather than fare collection. A cashless system would also provide benefits if it would allow patrons to board the bus more quickly.

The potential for integration and coordination is illustrated by the fact that the Kansas Turnpike has offered to let KDOT use the "toll tags" for commercial vehicle operations services, if needed.

COMMERCIAL VEHICLE OPERATIONS

The Commercial Vehicle Operations (CVO) bundle includes six user services that are concerned primarily with freight movement and focus in two specific areas, one to improve private sector fleet management, and one to streamline regulatory functions. The user services in the Commercial Vehicle Operations bundle are shown in Table 3-5 and discussed in greater detail following a general discussion of the local applicability of this bundle of user services.

Table 3-5. Commercial Vehicle Operations User Services

Bundle	User Services
Commercial Vehicle Operations	Commercial Vehicle Electronic Clearance
	Automated Roadside Safety Inspection
	On-Board Safety Monitoring
	Commercial Vehicle Administration Processes
	Hazardous Material Incident Response
	Freight Mobility

Local Applicability - An interview with Yellow Freight indicated that they have explored the feasibility of CVO user services through a number of pilot studies. Although in every case the results of the studies showed that the ITS technology worked as it should, the benefits were not great enough to offset the costs. Many of the ITS user services may, however, be very well suited to serve niche markets, for example, trucks delivering goods to "just-in-time" customers and other trucking entities whose services are very time sensitive.

An *Intermodal Freight Strategies Study*[1] provides some insights regarding the major issues confronting the trucking industry in Kansas City. Survey responses indicate that trucking efficiency and roadway congestion are both significant issues.

Trucking efficiency is usually measured in terms of profit, which is affected by cargo losses due to damage, transit time, cost per pound, and on-time delivery for "just-in-time" customers. In an effort to enhance efficiency, many trucking agencies apparently would like to use triple trailers, which would also alleviate problems associated with driver shortages. Although the subject was not specifically addressed, use of triple trailers would probably be opposed by many of the agencies interviewed for the ITS study, based on the fact that many of these agencies wanted to limit even conventional truck traffic to certain roadways and during certain hours.

Roadway congestion, another major issue, affects both truckers and motorists. With respect to congestion, trucking agencies noted that both access and traffic flow need to be addressed. Trucking agencies apparently try to avoid commuter peaks, which benefits both truckers and commuters. Trucking agencies' interest in avoiding congestion would also imply that additional benefits that could be gained from information systems that provide truckers with real-time traffic information. This is supported by the fact that Yellow Freight works very closely with the traffic control center in Minneapolis, Minnesota, providing traffic information as well as receiving it. In Kansas City, specific facilities that were noted for congestion include the Chouteau Bridge and I-70, which trucking agencies noted carries too much traffic, but is a key corridor for highway use.

Trucking agencies also indicated interest in a number of issues related to public policy. These include a need for better understanding of new technologies and their effects, public and private partnerships including issues of equity, and movement and routes for hazardous material. These issues may relate to ITS in a number of ways. The need for a better understanding of new technologies relates to ITS and the need to better communicate its capabilities and limitations; public and private partnerships relate to ITS funding issues; and routes for hazardous materials tangentially relate to the ITS user service Hazardous Material Incident Response.

Commercial Vehicle Electronic Clearance - Commercial Vehicle Electronic Clearance would allow enforcement personnel to electronically check safety, credentials, and size and weight data for transponder-equipped vehicles before they reach an inspection site, selecting only illegal or potentially unsafe vehicles for an inspection. Safe and legal carriers would be able to travel without stopping for compliance checks at weigh stations, ports-of-entry, and other

[1] *Intermodal Freight Strategies Study, Working Paper No. 3: Industry Input and Survey*, JBM in association with R.L. Banks and Associates, Inc., eTc Institute, and Jane Mobley Associates, March 1995.

inspection sites. This service will also support the North American Free Trade Agreement (NAFTA) by expediting international carriers at the Mexican and Canadian borders.

Local Applicability: There are a number of local applications of the Commercial Vehicle Electronic Clearance user service. For example, Missouri is conducting a study to determine the feasibility of combining electronic CVO screening and clearance with the electronic toll collection process presently used on the Kansas and Oklahoma Turnpikes. This activity demonstrates the potential not only for CVO activities, but also for coordination between various ITS activities for enhanced effectiveness.

If state agencies did not initiate activities such as Commercial Vehicle Electronic Clearance, it is likely that would be slow to be initiated by the private sector. Benefits of the Commercial Vehicle Electronic Clearance user service to large carriers are limited by the fact that large carriers such as Yellow Freight are often waved through when there is a queue, which is when time savings would be most significant. Furthermore, Yellow Freight indicated that their drivers are paid based on mileage, and thus time savings from electronic clearance are not of benefit to the company. Thus, one barrier to implementation of this and other CVO user services is the fact that the individual drivers who would stand to benefit significantly from the time savings due to deployment are unable to benefit from any economies of scale (as would a large trucking firm), and probably have limited capital available to invest in the necessary equipment.

Automated Roadside Safety Inspection - Automated Roadside Safety Inspections would use safety data provided by electronic clearance combined with advanced technologies to allow more selective and rapid inspections. Through the use of sensors and diagnostics, inspectors will eventually be able to check vehicle systems and driver requirements and ultimately driver alertness and fitness for duty.

Local Applicability: Enforcement agencies noted that vehicle inspections serve not only to identify unsafe vehicles and vehicles that are in violation of trucking regulations, but vehicle inspections also result in the apprehension of narcotics and other illegal substances.

With respect to advanced sensors and diagnostics, technology capable of identifying driver alertness may be beneficial, because it is not uncommon for drivers to keep multiple log books to avoid compliance with regulations. Application of this element of the user service is currently constrained by a lack of available and proven technology.

On-Board Safety Monitoring - On-Board Safety Monitoring would allow non-intrusive monitoring of the driver, vehicle, and cargo and notification of the driver, carrier, and possibly enforcement personnel if an unsafe situation arises. An unsafe situation might involve driver fatigue, vehicle systems, or cargo shifting. Eventually, this service would tie into the Automated Roadside Safety Inspection and Commercial Vehicle Electronic Clearance user services.

Local Applicability: Although On-Board Safety Monitoring is of interest to numerous local agencies, limited available technologies currently preclude deployment.

Commercial Vehicle Administrative Processes - Commercial Vehicle Administrative Processes would allow carriers to purchase credentials and collect and report fuel and mileage tax information electronically. Through automation, this user service should significantly reduce the paperwork burden for both carriers and states, and furthermore, it has the potential for simplifying compliance operations.

Local Applicability: Some action has been taken to coordinate trucking permits across state lines. Missouri and Kansas are both currently working with other states to provide cooperative permitting agreements. Such agreements could eventually provide the foundation for the elimination of "invisible barriers" between states. Kansas and Missouri are both participants in an ongoing project to develop and perform an operational test of an electronic system that will enable commercial vehicles to request, pay for and receive registration, fuel tax, operating authority, and oversize/overweight permits from a single state and legally operate in up to eight states. Missouri is also developing technical specifications for vehicle screening at weigh stations that would include automatic vehicle identification, weigh-in-motion, and credential, safety and permit verification.

Hazardous Materials Incident Response - Hazardous Materials Incident Response would provide emergency response personnel at the scene of a hazardous materials incident immediate information on the types and quantities of hazardous materials present in order to facilitate a quick and appropriate response.

The National Academy of Sciences has determined that it is not cost effective to track all hazardous material shipments. For certain types and quantities of hazardous materials, it may be important to locate shipments only when they are involved in a serious accident or incident. This specific cargo information would then be provided to the appropriate emergency responders.

Local Applicability: Although it may not be cost effective to track all hazardous material shipments, hazardous material emergency response personnel indicated that it would be beneficial to track certain kinds of hazardous material. Furthermore, the volume of hazardous material traveling through the Kansas City area is of interest. It has been estimated that Kansas City ranks fourth in the nation in terms of hazardous cargo in transit.

Yellow Freight indicated that all trucks carrying hazardous material are legally required to bear yellow placards and carry associated paperwork on board. Furthermore, their existing computer system already has the capability to locate and identify cargo, including hazardous material. Enforcement agencies indicate that small, independent truckers may be less familiar with the regulations regarding the transport of hazardous material, and in some cases are even unaware that the cargo being carried is, in fact, considered hazardous.

Freight Mobility - Freight Mobility would provide links between drivers, dispatchers, and intermodal transportation providers, enabling carriers to take advantage of real-time traffic information, as well as vehicle and load location information, to increase productivity.

Local Applicability: There would presumably be some local applications for the Freight Mobility user service, based on the volume of truck and train cargo that comes through Kansas City. However, deployment of this user service would perhaps be more appropriate by private entities. Private entities may not be interested in deployment of this user service until the

benefits outweigh the costs. Yellow Freight has conducted pilot studies on Freight Mobility projects, and found that although the systems worked as they should, the costs were greater than the benefits. This is partly due to the fact that Yellow Freight already has a system to track its cargo, and thus some of the benefits are redundant and/or marginal.

EMERGENCY MANAGEMENT

The Emergency Management bundle includes two user services that relate directly to the detection, notification, and response to emergency and non-emergency incidents which take place on or adjacent to the roadway. The focus is the improvement of the ability of roadside service providers, as well as the ability of police, fire, and rescue operations to respond appropriately, thereby saving lives and reducing property damage. The user services in the Emergency Management bundle are shown in Table 3-6 and discussed in greater detail below.

Table 3-6. Emergency Management User Services

Bundle	User Services
Emergency Management	Emergency Notification and Personal Security Emergency Vehicle Management

Emergency Notification and Personal Security - Emergency Notification and Personal Security focuses on decreasing the time it takes for responding agencies to be notified of emergency and non-emergency incidents, and providing an accurate estimate of the location of the vehicle in need of assistance. This service includes both driver safety and personal security, in instances where manual notification of incidents is possible, and automated collision notification, in cases where incident severity precludes manual notification of incidents.

Local Applicability: As noted with respect to the Incident Management user service, both enforcement and emergency response personnel would benefit from rapid identification of incidents, as well as from accurate identification of incident location. Currently, incidents are often identified by motorists who call in using cellular telephones. These motorists frequently provide insufficient and inaccurate information regarding the type and location of incident.

Emergency Vehicle Management - Emergency Vehicle Management focuses on decreasing the time it takes for agencies to respond once the incident is reported to the operator or dispatcher. This includes three subservices, emergency vehicle fleet management, route guidance, and signal priority. Emergency vehicle fleet management would provide information regarding emergency vehicle location, and automated support to dispatchers to help determine which vehicle can most quickly reach the incident site. Route guidance would assist in the determination of the quickest route to the incident scene, and from the scene to the hospital, if needed. Signal priority would provide the capability to pre-empt traffic signals on emergency vehicle's route, and the capability to warn drivers that an emergency vehicle is approaching.

Local Applicability: There appear to be some opportunities for the local application of components of the Emergency Vehicle Management user service. Automatic vehicle location (AVL) systems, the basis for emergency vehicle management, have been considered at many of the enforcement and emergency response agencies, although few are planning to implement such systems in the near future due to cost restraints. And, in fact, some agencies indicated that such an AVL system would not be desirable, because personnel would resist having their location tracked.

Med-Act (the emergency medical response agency in Johnson County, Kansas), has plans to procure an AVL system, and MAST (the emergency medical response agency in Kansas City, Missouri) currently has an AVL system, as discussed in a previous section, *Current and Planned ITS Applications in the Kansas City Area*. MAST has tried various fleet management systems to identify the vehicle that can most quickly reach the incident site, but these systems have not proven satisfactory. MAST noted that a route guidance system that provided information about weather and roadway conditions would be of particular benefit. Weather information is currently collected by KDOT, Kansas City, Missouri, and the Cities of Overland Park, Olathe, and Lenexa, Kansas. This weather information could presumably be utilized by MAST and other emergency vehicle responders.

With respect to signal priority, there are a variety of perspectives. Some jurisdictions have implemented such systems with satisfactory results (such as the Overland Park Fire Department and Med-Act in Johnson County Kansas, and the City of Independence, Missouri), but other agencies (such as MAST) prefer not to have signal priority because they feel that it is safer if their drivers do not expect to have signal priority, as discussed in the section, *Current and Planned ITS Applications in the Kansas City Area*.

ADVANCED VEHICLE SAFETY SYSTEMS

The Advanced Vehicle Safety Systems bundle includes seven user services that are related primarily to the safety goals of ITS. These user services enhance safety by introducing technologies that would diminish the number and severity of crashes. The user services in the Advanced Vehicle Safety Systems bundle are shown in Table 3-7. A brief definition of each user service is provided following a general discussion regarding the local applicability of this bundle of user services.

Local Applicability: The technologies necessary for user services in the Advanced Vehicle Safety System bundle are not appropriate for local application during the planning horizon considered in this study. Many of these technologies are currently in the research and development stages. Technologies that have been developed are perhaps more appropriate for deployment by private entities, such as car manufacturers, rather than public agencies at this point in time. When the technologies needed for these user services are fully developed and tested, there may be some applications in the Kansas City area. For example, Delco is working on FOREWARN, a microwave radar detector device introduced in 1993 to alert school bus drivers to the presence of children in the driver's blind spots.[1] This kind of system could be implemented not only on school buses, but also on transit vehicles.

[1] "Closing the Gap on Intelligent Vehicles, Traffic Technology International Talks to Gary Dickenson, Delco Electronic Corporation", *Traffic Technology International*, Spring 1995.

Table 3-7. Advanced Vehicle Safety Systems User Services

Bundle	User Services
Advanced Vehicle Safety Systems	Longitudinal Collision Avoidance
	Lateral Collision Avoidance
	Intersection Collision Avoidance
	Vision Enhancement for Collision Avoidance
	Safety Readiness
	Pre-Collision Restraint Deployment
	Automated Highway Systems

Longitudinal Collision Avoidance - Longitudinal Collision Avoidance systems address vehicle collisions in which one or two vehicles are moving in essentially the same path prior to the collision, or in which one of the vehicles is stationary (for example, a rear end collision).

Lateral Collision Avoidance - Lateral Collision Avoidance systems address one or two vehicle collisions that arise when a vehicle leaves its own lane of travel while moving forward, for example, for the merge or lane change maneuver.

Intersection Collision Avoidance - Intersection Collision Avoidance systems address collisions that arise when vehicles improperly violate the right of way of other vehicles, or when right-of-way at an intersection is not clear (for example, right angle accidents). This service would provide warnings of imminent collisions with crossing traffic, as well as warnings of control devices at upcoming intersections.

Vision Enhancement for Collision Avoidance - Vision Enhancement for Collision Avoidance would address collisions in which limited visibility is a factor. The system will enhance visually acquired information when driving visibility is low, such as at night or in fog. It will not, however, compensate for blind spots or other visual obstructions.

Safety Readiness - Safety Readiness addresses collisions caused by fatigued or impaired drivers, malfunctioning vehicle components, or degraded infrastructure conditions. Safety Readiness includes three subsystems: driver condition warning and control override, vehicle condition warning, and in-vehicle infrastructure condition warning.

Pre-Collision Restraint Deployment - Pre-Collision Restraint Deployment provides a means to anticipate an imminent collision and activate safety systems (such as side impact airbags) prior to impact. The equipment is contained entirely in the vehicle.

Automated Highway Systems - The Automated Highway Systems user service focuses on improving the safety, efficiency, and comfort of the roadway system by providing fully automated control of instrumented vehicles on instrumented highways, as well as partial vehicle control (an extension of the collision avoidance systems).

Agency Rankings of ITS User Services

All of the representatives of the agencies interviewed were requested to rank the 22 ITS user services in terms of priority (all user services were ranked except those in the Advanced Vehicle Safety Systems bundle). User services were ranked from 1 to 22, with 1 indicative of the highest priority. Twenty-six completed priority rankings were returned, and the results are shown in Table 3-8 (on the next page). Although the priorities in Table 3-8 include the responses from the three local transit agencies, the priorities of the transit agencies are obscured due to the fact that most of the agencies responding were interested primarily in the roadway system. In an effort to adequately address the needs of local transit agencies, the priority rankings indicated by the three local transit agencies were considered separately for the transit related user services; these transit priority rankings are shown in Table 3-9. Based on the agency rankings, the user services were divided into four groups, indicating relative priority.

Table 3-9. Priority Rankings of Transit Related User Services by Local Transit Agencies in Kansas City Area

User Service	Transit Ranking[1]		Overall Ranking[2]		Priority Based on Transit Rankings[3]
	Average Value	*Rank*	Average Value	*Rank*	
En-Route Transit Information	3.7	*1*	13.3	*17*	Highest
Public Travel Security	4.0	*2*	10.3	*10*	
Public Transportation Management	4.3	*3*	11.8	*14*	
Ride Matching and Reservation	8.3	*4*	13.2	*16*	Medium-High
Personalized Public Transit	8.7	*5*	14.3	*18*	
Demand Management and Operations	13.0	*6*	11.6	*12*	Low

[1] Based on 3 returned surveys from local transit agencies.
[2] Based on 26 returned surveys from all local agencies. Some surveys reflect the input of more than one person.
[3] Priority determined by using the average rank indicated by transit agencies, and the categories defined in Table 3-8. For example, in Table 3-8, the highest priority user services have an average rank of less than or equal to 6.8, thus all transit related user services in Table 3-9 with an average rank of less than 6.8 are considered highest priority.

HIGHEST PRIORITY

The highest priority group includes the ITS user services in the first four rows of the Table 3-8: Incident Management, Traffic Control, Emergency Notification and Personal Security, and Emergency Vehicle Management. These user services address both recurring and incident related congestion. Note that these user services all contribute to the efficient identification and removal of incidents, and contribute to a reduction in the impact of incidents. These user services address both typical conditions such as recurring congestion (Traffic Control), as well as conditions related to incidents (Traffic Control, Incident Management, Emergency

Table 3-8. Overall Priority Rankings of ITS User Services by Local Agencies in Kansas City Area

User Service	Average[1]		Median		Priority
	Value	*Rank*	Value	*Rank*	
Incident Management	3.6	*1*	2.5	*1*	Highest
Traffic Control	4.7	*2*	4	*3*	
Emergency Notification and Personal Security	5.5	*3*	3.5	*2*	
Emergency Vehicle Management	6.8	*4*	4.5	*4*	
En-Route Driver Information	8.1	*5*	7.5	*5*	Medium-High
Route Guidance	8.5	*6*	8	*6*	
Hazardous Material Incident Response	9.4	*7*	9	*7*	
On-Board Safety Monitoring	10.0	*8*	10	*8*	
Pre-Trip Travel Information	10.2	*9*	10.5	*9*	
Public Travel Security	10.3	*10*	11.5	*10*	
Automated Roadside Safety Inspection	11.4	*11*	13	*14*	Medium
Demand Management and Operations	11.6	*12*	11.5	*10*	
Traveler Services Information	11.7	*13*	11.5	*10*	
Public Transportation Management	11.8	*14*	11.5	*10*	
Commercial Vehicle Electronic Clearance	13.1	*15*	14	*15*	Low
Ride Matching and Reservations	13.2	*16*	14.5	*18*	
En-Route Transit Information	13.3	*17*	14	*15*	
Personalized Public Transit	14.3	*18*	16	*20*	
Freight Mobility	15.0	*19*	14	*15*	
Emissions Testing and Mitigation	15.0	*20*	15.5	*19*	
Commercial Vehicle Administrative Processes	15.2	*21*	17	*21*	
Electronic Payment Services	15.9	*22*	20	*22*	

[1] All values are based on 26 returned surveys. Some surveys reflect the input of more than one person.

Notification and Personal Security). The fact that all user services of the highest priority relate to incidents reflects the fact that much of the delay in the Kansas City area is incident related.

Transit Agency Priorities - Transit related user services identified as highest priority by transit agencies are shown in Table 3-9 and include En-Route Transit Information, Public Travel Security, and Public Transportation Management. These user services address the need for communication with the public, the need for enhanced security, and the need for enhanced management of resources. Note that the highest priority user services identified by transit are, to some extent, analogous to the user services identified for roadways. For example, Public Transportation Management for management of transit resources may be considered analogous to Traffic Control for management of roadway resources, and Public Travel Security address incidents on transit, just as Incident Management and Emergency Notification and Personal Security addresses roadway incidents.

MEDIUM-HIGH PRIORITY

The medium-high priority group includes six ITS user services: En-Route Driver Information, Route Guidance, Hazardous Material Incident Response, On-Board Safety Monitoring, Pre-Trip Travel Information, and Public Travel Security. These user services relate primarily to communications with motorists (En-Route Driver Information, Route Guidance, Pre-Trip Travel Information), as well as incident response (En-Route Driver Information, Route Guidance, Hazardous Material Incident Response, On-Board Safety Monitoring, Pre-Trip Travel Information) and safety (Hazardous Material Incident Response, On-Board Safety Monitoring, Public Travel Security). Note that, in many cases, there is overlap between the user services and the functions that they contribute to. For example, the user services related to communications (En-Route Driver Information, Route Guidance, Pre-Trip Travel Information) not only inform the public about roadway conditions and alternate routes, but also facilitate the Incident Management user service.

Transit Agency Priorities - Transit related user services identified as medium-high priority by transit agencies included Ride Matching and Reservations and Personalized Public Transit. These user services offer alternatives to traditional, fixed route transit, and may be more appropriate in areas of low density development that are not easily served by traditional transit.

MEDIUM PRIORITY

The medium priority group includes four ITS user services: Automated Roadside Safety Inspection, Demand Management and Operations, Traveler Services Information, and Public Transportation Management. Although some of these user services relate to safety (Automated Roadside Safety Inspection) and communications (Traveler Services Information), which are issues that are considered a priority, these user services are generally more specific and serve a smaller audience. For example, Automated Roadside Safety Inspection is targeted to commercial vehicle operations, and might be expected to have a minimal impact on the overall operations of the transportation system. Traveler Services Information, while it might be used to some extent by all motorists, would probably address the needs of visitors and tourists to a greater extent than it would address the primary concerns of local transportation users. Similarly, the Demand Management and Operations and Public Transit

Management user services are not targeted to benefit the primary roadway user, which at this time is the single occupant commuter.

Transit Agency Priorities - No transit related user services are identified as medium priority by transit agencies.

LOW PRIORITY

The low priority group includes eight ITS user services: Commercial Vehicle Electronic Clearance, Ride Matching and Reservations, En-Route Transit Information, Personalized Public Transit, Freight Mobility, Emissions Testing and Mitigation, Commercial Vehicle Administrative Processes, and Electronic Payment Services. These are user services that would primarily benefit a smaller audience, and address issues that are not currently of the highest priority in the Kansas City area. Some of these user services are primarily targeted to commercial vehicle operators (Commercial Vehicle Electronic Clearance, Freight Mobility, Commercial Vehicle Administrative Processes), others are primarily targeted to transit and ridesharing (Ride Matching and Reservations, En-Route Transit Information, Personalized Public Transit), and others address issues that have not been identified as critical problems in the metropolitan area (Electronic Payment Services, Emissions Testing and Mitigation).

Transit Agency Priorities - Demand Management and Operations was the only transit related user service identified as a low priority by transit agencies. This user service may be of relatively low priority because the Kansas City area does not have significant air quality problems or extreme traffic congestion.

Public Involvement Activities

The public involvement activities reflected the fact that an early deployment study differs from more traditional transportation planning projects in many respects. The lack of direct impact to property or land use and the abstract nature of the subject required not only that the public be informed, but perhaps more importantly, that public interest be generated, and that the public be educated about ITS concepts and applications.

Two sets of public meetings were held. The first set was held in July 1995, and the second set in January 1996. Each set included a meeting at Johnson County Community College in Overland Park, Kansas, and at the Adam's Mark Hotel in Kansas City, Missouri. All meetings were held from 6:30 to 8:30 p.m., with a presentation at 7 p.m., followed by a question and answer period.

The meetings also included an interactive multimedia presentation explaining the Kansas City Early Deployment Study. This presentation, which allowed users to selectively explore ITS concepts at their own pace, included descriptions of ITS and the user services, film clips demonstrating transportation problems and solutions, and brief interviews with local citizens and agency representatives regarding their perceptions of transportation problems.

Activities to generate interest and inform the public included press releases, newspaper advertisements, and media coverage. For the first set of meetings, newspaper advertisements

appeared in the *Kansas City Star*, *The Examiner*, the *Lee's Summit*, the *Kansas City Kansan*, the *Johnson County Sun* papers, the *Townsend Publications*, the *Advocate*, and the *Call*. Media coverage of the first set of meetings also included two newspaper articles (in the *Kansas City Star* and *The Examiner*), radio broadcasts on two stations (including the one hour "Russ Johnson Show"), and two television interviews (Channel 4 and Channel 9). Media coverage for the second set of meetings included a feature article and editorial in the *Kansas City Star*, an article in *The Examiner*, and a segment on the Channel 9 news.

In addition to the newspaper, radio and television coverage, which was directed at the general public, efforts were made to directly contact people who had a professional interest in ITS. Letters of invitation to the public meetings were sent to people in both the public and private sector who had some tie to transportation. The mailing list, which was based on the mailing list used by the Mid-America Regional Council for the 1994 Incident Management activities, included local politicians, emergency responders, transit employees, and public works engineers, as well as people in the private sector who might have an interest in transportation issues. Over 700 letters of invitation were sent out for the July public meetings. By January, the mailing list for letters of invitation had grown to over 900.

Turnout at the public meetings was higher than expected. More than 40 people attended each of the meetings. The aggressive effort for media exposure and the large number of letters of invitation may be one factor contributing to the turnout at the meetings.

There were a variety of interests and concerns expressed at the public meeting, including: the impact of trucks on safety; the need for coordination of construction activities and signal operations among jurisdictions; the benefits and costs of the system, including the operating costs and who would be responsible for these costs; the need for public education; applications for public transit; and the inclusion of facilities to encourage high occupancy vehicles. Concern was also expressed that ITS facilitates travel by personal auto, whereas public policy and activities should encourage less dependence on the auto, with more opportunities for mobility by transit, bicycle, and pedestrian modes.

SURVEY RESULTS

Surveys were conducted at each set of public meetings. The surveys were designed to identify the transportation concerns of local citizens and interested professionals, and relate these concerns to the ITS user services and applications. Forty-two surveys were completed and returned during the first set of public meetings, and 34 were returned during the second set of meetings.

The survey completed at the first set of public meetings obtained feedback regarding the objectives and user services. The results confirm the priorities identified by the agency rankings. The general objectives identified by the survey results were (in decreasing order of priority):

- Reduce congestion.
- Manage traffic.
- Provide information.
- Encourage alternatives to single occupancy vehicles.

The user services identified as most appropriate include (in decreasing order of priority):

- Incident Management.
- En-Route Driver Information.
- Traffic Control.
- Emergency Notification and Personal Security.
- Emergency Vehicle Management.

The survey completed at the second set of public meetings obtained feedback regarding the preferred technologies in the metropolitan area. The results confirm the recommendations of the Strategic Deployment Plan. The preferred applications include (in decreasing order of priority):

- Incident detection and freeway monitoring.
- Variable message signs.
- Arterial signal coordination.
- Transit Improvements.

The preferred means for traveler information include (in decreasing order of priority):

- Variable message signs.
- Highway advisory radio.
- Commercial radio and television.

Performance Criteria for ITS User Services

Fifteen performance criteria have been developed to evaluate the impacts of the deployment of ITS user services. These performance criteria may be used in the project selection process or for project evaluation after deployment. The performance criteria, which are shown in Table 3-10, address a variety of transportation issues:

- Capacity, including recurring congestion (#1) and transportation efficiency (#2).

- Incidents, including incident related congestion (#3), and incident management activities (#4).

- Safety, including the safety of emergency personnel at an incident site (#5) and public safety in private vehicles and on public transit (#6).

- Alternatives to the single occupant vehicle (SOV), including transit service (#7), ridesharing (#8), and the provision of the incentives for the use of high occupancy vehicles (HOVs) (#9).

- Environmental, including compliance with mandates for clean air (#10).

Table 3-10. Performance Criteria and Sample Measures of Effectiveness

Transportation Issue	Performance Criteria	Sample Measure of Effectiveness
Capacity	1. Reduce Recurring Congestion	Vehicle hours of delay in peak hour
	2. Increase Transportation Efficiency	Person miles traveled per lane mile
Incidents	3. Reduce Incident Related Congestion	Vehicle hours of delay due to incident
	4. Enhance/Facilitate Incident Management	Capability to detect incident and identify incident location
Safety	5. Improve Safety of Emergency Personnel at Incident Site	Volume and speed of traffic adjacent to incident site
	6. Increase Safety	Accident rate
Alternatives to the Single Occupant Vehicle	7. Enhance Transit Service	Schedule adherence, on-time performance
	8. Enhance Ridesharing	Number of employer and employee participants in ridesharing program
	9. Increase Average Vehicle Occupancy / Provide Incentives for HOV Use	Number and percentage of SOV, carpool, vanpool, and bus trips
Environmental	10. Facilitate Compliance with Clean Air Mandates	Capability to monitor vehicle emissions
Institutional	11. Enhance Agency Activities	Reduction in personnel hours required to perform necessary functions
	12. Integrate Transportation Services	Number of coordinating agencies
User Related	13. Improve User Convenience	Qualitative assessment of convenience
	14. Enhance Communications with Public	Number and percentage of public with access to information
	15. Affect Commuter Behavior	Number and percentage of commuters who change travel route, time of travel, or travel mode

- Institutional, including activities within an agency (#11), and the coordination of the activities of various agencies (#12).

- User Related, including user convenience (#13), communications with users (#14), and impacts on user behavior (#15).

Because multiple performance criteria often address various aspects of a single issue, the inclusion of one performance criteria often leads to the inclusion of other performance criteria, for example:

- A user service that enhances/facilitates incident management (#2) would often be expected to reduce incident related congestion (#3).

- A user service that enhances transit service or ridesharing (#7 and #8), may be expected to increase average vehicle occupancy levels (#5), which would in turn increase transportation efficiency (#2) and facilitate compliance with clean air mandates (#10).

- A user service that reduces recurring congestion (#1) would be expected to increase transportation efficiency (#2).

Note that, in general, the performance criteria may be used to evaluate impacts either for specific projects or on an area wide basis. For example, attainment of the first performance criteria, Reduce Recurring Congestion, can be evaluated by examining either a specific facility or facility segment, or by examining all major facilities in the area to determine an average or aggregate level of recurring congestion on an area wide basis.

MEASURES OF EFFECTIVENESS

The performance criteria are generally quantified by measures of effectiveness (MOEs), which may be used to compare actual performance to project objectives. MOEs for each of the 15 performance criteria have been identified, sample MOEs are shown in Table 3-10.

Multiple MOEs have been identified for each performance criteria, both qualitative and quantitative measures are included for many of the performance criteria. Qualitative measures are especially important for the evaluation of agency coordination, user convenience, and other measures that are critical to the success of a project but that are difficult to quantify.

Note that the performance criteria do not address all of the issues that would need to be evaluated upon deployment of a user service. For example, the maintenance, reliability and accuracy of a system would be critical to its success, although these issues are not directly addressed by the performance criteria. Furthermore, impacts of maintenance activities (frequency of maintenance, disruption of traffic due to maintenance, etc.) and impacts of equipment reliability and accuracy (frequency of "false alarms" for incident detection systems, disruption of traffic due to such false alarms in terms of deployment of emergency response vehicles, inaccurate reports to motorists, etc.) must be considered, although they are not addressed by these performance criteria.

The following text discusses the performance criteria for the user services identified as highest priority and medium-high priority, based on agency rankings.

PERFORMANCE CRITERIA FOR HIGHEST PRIORITY USER SERVICES

Performance criteria that may be appropriate for the evaluation of each of the user services identified as highest priority in the section *Agency Rankings of ITS User Services* are shown in Table 3-11 and briefly discussed in the following text.

Performance Criteria for Incident Management and Traffic Control - The performance criteria for both Traffic Control and Incident Management reflect the fact that these user services would be expected to increase the safety and efficiency of the transportation system during and after incidents. Thus performance measures include those related to incidents: Reduce Incident Related Congestion (#3), Enhance/Facilitate Incident Management (#4), Improve Safety of Emergency Personnel at Incident Site (#5); and those reflecting the resulting increase in safety and efficiency: Increase Safety (#6) and Increase Transportation Efficiency (#2). Enhance Agency Activities (#11) is also identified as a performance measure, because deployment of these user services would be expected to provide agencies with data and information not currently available. Traffic Control would also be expected to provide benefits during typical operating conditions, and thus it would Reduce Recurring Congestion (#1) and Facilitate Compliance with Clean Air Mandates (#10). Incident Management would be expected to Integrate Transportation Services (#12), because it would enhance coordination between agencies involved in incident management activities.

Performance Criteria for Emergency Notification and Personal Security and Emergency Vehicle Management - Performance criteria for Emergency Notification and Personal Security and Emergency Vehicle Management reflect the fact that these user services would be expected to Reduce Incident Related Congestion (#3) and Enhance/Facilitate Incident Management (#4) because they would facilitate incident detection and emergency response to incidents. Emergency Notification and Personal Security would also Increase Safety (#6) for the public, by assuring that an incident would be quickly identified and located, while Emergency Vehicle Management would Enhance Agency Activities (#11) for the emergency response agencies.

Performance Criteria for Transit Related Highest Priority User Services - Note that all of the highest priority transit related user services have four performance criteria in common. All of these user services would be expected to Enhance Transit Service (#7), and subsequently to Increase Average Vehicle Occupancy/Provide Incentives for HOV Use (#9). An increase in vehicle occupancy would be expected to Increase Transportation Efficiency (#2) and Facilitate Compliance with Clean Air Mandates (#10).

En-Route Transit Information: En-Route Transit Information performance criteria focus on the convenience and the communications capabilities of the provision of transit information, as well as the impact that this information has on commuter behavior, and ultimately, on increased vehicle occupancies. Performance criteria include those common to all the highest priority transit related user services (#2, #7, #9, #10). En-Route Transit Information would also be expected to Improve User Convenience (#13), Enhance Communications with Public (#14), and Affect Commuter Behavior (#15).

Table 3-11. Performance Criteria for Highest Priority User Services

Performance Criteria	Overall Highest Priority User Services				Transit Related Highest Priority User Services		
	Incident Mgmt.	Traffic Control	Emergency Notification and Personal Security	Emergency Vehicle Mgmt.	En-Route Transit Information	Public Travel Security	Public Transp. Mgmt.
1. Reduce Recurring Congestion		X					
2. Increase Transportation Efficiency	X	X			X	X	X
3. Reduce Incident Related Congestion	X	X	X	X			
4. Enhance/Facilitate Incident Management	X	X	X	X			
5. Improve Safety of Emergency Personnel at Incident Site	X	X					
6. Increase Safety	X	X	X			X	X
7. Enhance Transit Service					X	X	X
8. Enhance Ridesharing							
9. Increase Average Vehicle Occupancy/ Provide Incentives for HOV Use					X	X	X
10. Facilitate Compliance with Clean Air Mandates		X			X	X	X
11. Enhance Agency Activities	X	X		X			X
12. Integrate Transportation Services	X						X
13. Improve User Convenience					X		
14. Enhance Communications with Public					X		
15. Affect Commuter Behavior					X		

Public Travel Security: Public Travel Security performance criteria focus on the increased security of transit, and the extent to which this enhances transit service and increases vehicle occupancies. Performance criteria include those common to all the highest priority transit related user services (#2, #7, #9, #10), as well as Increase Safety (#6).

Public Transportation Management: Benefits of Public Transportation Management include applications of the data collected and resulting increases in efficiency. Performance criteria include those common to all the highest priority transit related user services (#2, #7, #9, #10), as well as Enhance Agency Activities (#11) and Integrate Transportation Services (#12), which

are included because the data resulting from deployment of this user service would be expected to benefit transit agencies, and might allow multiple transit agencies to better coordinate their services. Some elements of this user service would also Increase Safety (#6). For example, an automatic vehicle location (AVL) system would increase safety because it would notify the transit dispatcher if a vehicle were stopped for an unusual length of time, or were off the transit route. Many AVL systems also come with an emergency button which would allow the bus driver to alert the dispatcher in case of an emergency.

PERFORMANCE CRITERIA FOR MEDIUM-HIGH PRIORITY USER SERVICES

Performance criteria that may be appropriate for the evaluation of each of the user services identified as medium-high priority in the section *Agency Rankings of ITS User Services* are shown in Table 3-12 and briefly discussed in the following text.

Performance Criteria for En-Route Driver Information and Route Guidance - In terms of impacts on the transportation system, the most significant benefits of En-Route Driver Information and Route Guidance would be expected to result during and after incidents. The capability to communicate current conditions to drivers may result in drivers taking alternative routes (reducing the volume of traffic adjacent to an incident), or at least approaching the incident site with greater caution. Thus, performance criteria include those related to incidents: Reduce Incident Related Congestion (#3), Enhance/Facilitate Incident Management (#4), and Improve Safety of Emergency Personnel at Incident Site (#5); as well as those related to communications with the user: Improve User Convenience (#13), Enhance Communications with Public (#14), and Affect Commuter Behavior (#15). Performance criteria also address the impacts of any changes in commuter behavior, which would potentially Increase Transportation Efficiency (#2).

Reduce Recurring Congestion (#1) and Enhance Agency Activities (#11) are also identified as performance criteria for Route Guidance. Enhance Agency Activities (#11) is identified as a performance criteria because the provision of route guidance information via advanced technologies would allow enforcement personnel to concentrate on traffic control during incidents, and relieve them of the duty of providing directions. Reduce Recurring Congestion (#1) is specified as a performance criteria based on the assumption that some recurring congestion is due to the fact that drivers do not always select their route based on a complete analysis of all the available routes. A Route Guidance user service that provides the "minimum time route" would reduce the impacts of recurring congestion by diverting motorists from routes that are typically congested to less congested routes, assuming that less congested routes exist. While many of the benefits of Route Guidance on a systemwide basis are related to incidents, it is important to note that the Route Guidance user service also provides valuable information to tourists and motorists unfamiliar with the local roadway network. This benefit would be quantified under the performance criteria Improve User Convenience (#13).

Performance Criteria for Hazardous Materials Incident Response - Hazardous Materials Incident Response performance criteria reflect the fact that the provision of immediate information about hazardous material would be expected to improve safety, both Improve Safety of Emergency Personnel at the Incident Site (#5), as well as Increase Safety (#6) for the motorists. The provision of hazardous material information would also Enhance/Facilitate

Table 3-12. Performance Criteria for Medium-High Priority User Services

Performance Criteria	Overall Medium-High Priority User Services					Transit Related Medium-High Priority User Services	
	En-Route Driver Information	Route Guidance	Hazardous Material Incident Response	On-Board Safety Monitoring	Pre-Trip Travel Information	Ride Matching and Reservation	Pers. Public Transit
1. Reduce Recurring Congestion		X					
2. Increase Transportation Efficiency	X	X			X	X	X
3. Reduce Incident Related Congestion	X	X			X		
4. Enhance/Facilitate Incident Management	X	X	X				
5. Improve Safety of Emergency Personnel at Incident Site	X	X	X		X		
6. Increase Safety			X				
7. Enhance Transit Service					X		X
8. Enhance Ridesharing					X	X	
9. Increase Average Vehicle Occupancy/ Provide Incentives for HOV Use					X	X	X
10. Facilitate Compliance with Clean Air Mandates					X	X	X
11. Enhance Agency Activities		X	X	X			
12. Integrate Transportation Services					X		
13. Improve User Convenience	X	X		X	X	X	X
14. Enhance Communications with Public	X	X			X		
15. Affect Commuter Behavior	X	X			X	X	X

Incident Management (#4), as well as Enhance Agency Activities (#11) for the agencies responsible for identifying and cleaning up hazardous materials.

Performance Criteria for On-Board Safety Monitoring - Performance criteria for On-Board Safety Monitoring reflect the fact that it would be expected to Improve User Convenience (#13) for commercial vehicle operators and Enhance Agency Activities (#11) by improving the efficiency of operations for enforcement agencies.

Performance Criteria for Pre-Trip Travel Information - Many of the benefits of Pre-Trip Travel Information are expected due to the fact that information regarding transportation alternatives is provided before a mode choice has been made, thus performance criteria focus on changes in commuter behavior that result from provision of this information and the impacts of these changes.

Pre-Trip Travel Information performance criteria related to a change in mode include Enhance Ridesharing (#8), which would be expected to Affect Commuter Behavior (#15) and Increase Average Vehicle Occupancy/Provide Incentives for HOV Use (#9). An increase in vehicle occupancy would be expected to Increase Transportation Efficiency (#2) and Facilitate Compliance with Clean Air Mandates (#10). While performance criteria such as these related to increases in HOV modes are included for this and other user services, it is important to note that such mode changes would only be expected if there were some incentives for HOV use (employer incentives, exclusive HOV lanes, pricing incentives, etc.).

In addition to impacts related to changes in mode choice, Pre-Trip Travel Information would be expected to have impacts due to incidents or other unusual conditions. Because some motorists may be expected to delay or re-route their trip when they find out about an incident, Pre-Trip Travel Information would be expected to Reduce Incident Related Congestion (#3), and thus Improve Safety of Emergency Personnel at Incident Site (#5) by reducing the volume of traffic adjacent to the incident location. Pre-Trip Travel Information would also Enhance Transit Service (#7), Improve User Convenience (#13) and Enhance Communications with Public (#14), as well as Integrate Transportation Services (#12) by providing information about a variety of transportation alternatives.

Performance Criteria for Transit Related Medium-High Priority User Services - Note that all of the medium-high priority transit related user services have five performance criteria in common. All of the user services would be expected to Improve User Convenience (#13), Affect Commuter Behavior (#15), and Increase Average Vehicle Occupancy/Provide Incentives for HOV Use (#9). An increase in vehicle occupancy would be expected to Increase Transportation Efficiency (#2) and Facilitate Compliance with Clean Air Mandates (#10). In addition, Ride Matching and Reservations would Enhance Ridesharing (#8), while Personalized Public Transit would Enhance Transit Service (#7).

Intelligent Transportation Infrastructure (ITI)

The Intelligent Transportation Infrastructure (ITI) consists of nine elements that contribute to the deployment of ITS user services in a metropolitan area, and will establish a foundation for

the deployment of future ITS user services[1]. The ITI focuses on metropolitan traffic, information, and safety systems, and does not address the user services in the Commercial Vehicle Operations bundle. The nine elements included in the ITI are as follows:

1. Regional Multimodal Traveler Information Center (RMTIC). The RMTIC compiles and maintains current roadway and transit information, and is the link between the general public and the transportation system managers.

2. Traffic Signal Control Systems: Signal control systems increase transportation efficiency by adjusting green times to maximize vehicle and person capacity and minimize delay.

3. Freeway Management Systems: Freeway management systems monitor freeway traffic conditions, identify recurring and non-recurring congestion, and allow deployment of control and management strategies such as route diversion and traveler information via variable message signs (VMS) and highway advisory radio (HAR).

4. Transit Management Systems: Transit management systems include fleet management systems, and advanced computer and communications equipment on vehicles and in dispatching centers. These systems improve security and increase the efficiency of operations and maintenance.

5. Incident Management Program: Incident management programs facilitate the rapid identification and removal of incidents on freeways and arterials, reducing delay and driver frustration.

6. Electronic Fare Payment: Electronic fare payment for transit eliminates the need for transit patrons to provide exact change, and facilitates the coordination of fares among multiple transit providers.

7. Electronic Toll Collection: Electronic toll collection allows drivers to pay tolls without stopping, decreasing delays and enhancing transportation efficiency.

8. Regional Grade Crossings: Regional grade crossings would utilize in-vehicle warning systems to encourage safe driving behavior by better focusing driver attention on the danger of trains approaching a railroad crossing.

9. Emergency Management Services: Emergency management services save people's lives and improve security through immediate notification of the precise location of crashes and breakdowns.

The identification of ITI elements is intended to guide near-term deployment decisions, and at the same time to facilitate future opportunities for the deployment of ITS user services. Deployment of the ITI is expected to be led by the public sector, although private sector participation is encouraged. The deployment of ITI elements is expected to provide a

[1] Discussion based on *The Department of Transportation Initiative: Intelligent Transportation Infrastructure (ITI)*, January 1996 and Draft *Core ITS Infrastructure Elements for Metropolitan Areas, ATMS/ATIS Deployment*, provided at the *Early Deployment Planning Workshop*, March 14, 1995.

foundation which will allow the private sector to develop products and industries for future ITS user services.

The following sections discuss the principles which guided the definition of the ITI elements, and key considerations for deployment of the elements of the ITI. These principles and key considerations provide insight into justification for the elements in the ITI, as well as guidance regarding deployment of projects that contribute to the ITI.

ITI PRINCIPLES

A number of principles were considered in the definition of the ITI elements, these include:

- Implementation of elements will enable deployment of advanced traffic management and advanced traveler information systems and supporting user services, and facilitate deployment of other ITS user services.

- Each element can be deployed independently, although concurrent deployment would provide economies of scale through either increased overall benefits or decreased marginal costs.

- Elements can be deployed in the near term using state-of-the-art concepts and technologies, and would often be eligible for federal funding.

- Elements can be deployed using varying technologies, from low-tech to high-tech.

- Elements are appropriate for deployment in a variety of environments (considering institutional arrangements, geographic/spatial development patterns, etc.) and elements will evolve to provide increased benefits and/or lower costs.

- Private sector participation in the development of ITI elements and ITS user services is encouraged, particularly with respect to the collection and provision of traveler information.

KEY CONSIDERATIONS FOR DEPLOYMENT

Key considerations for the deployment of the ITI elements include the fact that multiple elements utilize common hardware and software components, and face similar institutional issues prior to and upon deployment. Many of the key considerations address equipment, communications, institutional, and management issues, as noted below:

- Capability to distribute multimodal traveler information to the general public.

- Capability for monitoring and detection, resulting in current, complete and accurate traffic and transit information.

- Communications systems linking field equipment with central systems for database management.

- Communications among jurisdictions, agencies and organizations, in both the public and private sectors, without any implied change in control and/or responsibility (for example, information sharing and coordination with emergency and hazardous material responders).

- Proactive management of resources, both roadway and transit, to achieve the transportation objectives of the metropolitan area.

- Continuing support for system operations and maintenance needs, including personnel requirements, such as training.

Short, Medium, and Long Term ITS User Services

A time frame for deployment has been identified for each of the ITS user services, and is shown in Table 3-13. The time frame associated with each user service was based on a number of things, including input from local agencies (discussed in the section *Agency Perceptions of the Local Applicability of ITS User Services*), agency rankings of priority (discussed in the section *Agency Rankings of ITS User Services*), the state of the technology that is needed to implement various aspects of the user service, and whether or not the user service contributes to the ITI. In general, the specified deployment time frame corresponds to the priority indicated by the local agencies unless there are other limiting factors, such as available technology. User services are identified for deployment in the short term, medium term or long term. In general, short term is considered within five years, medium term is considered within ten years, and long term is considered more than 10 years.

It is important to note that a single user service could encompass any number of specific projects, some of which require minimal technology and thus could be implemented in the short term, and others which require very sophisticated technology that is currently in the research, or even theoretical, stage. For example, consider the Emergency Notification and Personal Security user service. A "low tech" project geared toward the objectives of this user service would be to install reference markers on the freeway, as well as identify the roadway on bridge overpasses, so that people calling in to report an incident could more accurately communicate their exact location. On the other hand, a "high tech" project geared toward the objectives of this user service would be automatic collision notification, which might be an in-vehicle device that would be activated upon impact (much like an airbag) and would automatically send out a distress signal that would be received at the traffic control center or by emergency dispatch.

The issue of technologies brings up the point that any plan that incorporates "advanced technologies" as a component must necessarily be dynamic, changing to reflect and utilize new technologies and applications. Many technologies are rapidly evolving, and these evolutions cannot always be anticipated. This plan must be modified to reflect not only changing circumstances, but also changing technologies.

It is also important to re-iterate that there is often overlap between the various user services. A single project might fulfill the objectives of two or more of the user services. For example, a

Table 3-13. Priority and Deployment Time Frame for ITS User Services

User Service	Deployment Time Frame			
	Existing or Planned	Short	Medium	Long
Incident Management	X	High		
Traffic Control		High		
Emergency Notification and Personal Security		High		
Emergency Vehicle Management		High		
Public Transportation Management	X	High		
Public Travel Security	X	High		
En-Route Driver Information	X	Medium-High		
Route Guidance		Medium-High		
En-Route Transit Information	X	Medium-High		
Hazardous Material Incident Response			Medium-High	
Pre-Trip Travel Information	X		Medium-High	
Personalized Public Transit	X		Medium	
On-Board Safety Monitoring				Medium-High
Traveler Services Information	X			Medium
Demand Management and Operations	X			Medium
Automated Roadside Safety Inspection				Medium
Commercial Vehicle Electronic Clearance	X			Low
Ride Matching and Reservations				Low
Freight Mobility				Low
Emissions Testing and Mitigation				Low
Commercial Vehicle Administrative Processes	X			Low
Electronic Payment Services	X			Low

variable message sign could be used to provide En-Route Driver Information, moreover, the information provided could be regarding a detour or alternate route around an incident, thus providing Route Guidance, and enhancing Incident Management.

The many factors discussed above that relate to the ITS user services, priority, and deployment time frame are not intended to negate the value of the identification of priority and deployment time frame for each user service, but are rather intended to emphasize the limitations of the identification of priority and deployment time frame. In summary, the priority and deployment time frame noted for each user service should perhaps be considered a general, rather than an absolute, guideline. Actual deployment time frame would be affected not only by priority and the availability of proven technology, but also by opportunity and available funding. Road widening projects and other activities may present the opportunity to implement advanced technologies at a much lower cost, making deployment of certain user services appropriate, even though they might not otherwise be.

EXISTING OR PLANNED ITS USER SERVICES

Twelve user services are identified as either existing or planned, as shown in Table 3-13. Additional details about the projects that have been implemented for each of these user services were provided in a previous section, *Current and Planned ITS Applications in the Kansas City Area*. A priority and deployment time frame have also been identified for each of these user services, this is intended to address other projects that would also address the objectives of the user service.

USER SERVICES FOR DEPLOYMENT IN THE SHORT TERM

Nine user services are identified as appropriate for deployment in the short term. These user services include all of the user services that were identified as highest priority in the agency rankings. These user services address both recurring congestion (Traffic Control) and incidents (Traffic Control, Incident Management, Emergency Notification and Personal Security, Emergency Vehicle Management). These user services also enhance communications with drivers (En-Route Driver Information, Route Guidance). The user services related to recurring congestion and incidents are considered highest priority, while those related to communications with the driver are considered medium-high priority, reflecting the input of all of the agencies surveyed. All of these user services provide significant contributions to the ITI.

Transit Related User Services for Deployment in the Short Term - Three transit related user services are identified for deployment in the short term. These user services include all of the user services that were identified as the highest priority by the transit agencies: Public Transportation Management, Public Travel Security, and En-Route Transit Information. Note that these user services contribute to the ITI.

USER SERVICES FOR DEPLOYMENT IN THE MEDIUM TERM

Three user services are identified as appropriate for deployment in the medium term. These user services reflect agency interests in communications with motorists (Pre-Trip Travel Information) and incident response (Hazardous Material Incident Response, Pre-Trip Travel Information). Although a medium high priority, On-Board Safety Monitoring not specified for implementation in the medium term. Limited technologies have been proven for On-Board Safety Monitoring and moreover, deployment will be governed more by national standards than by the activities of local agencies at the metropolitan level.

Transit Related User Services for Deployment in the Medium Term - The only transit related user services identified for deployment in the medium term is Personalized Public Transit. This user service, which is considered a medium priority, would allow transit to provide more convenient service which would be more competitive with the automobile.

USER SERVICES FOR DEPLOYMENT IN THE LONG TERM

The remaining ten user services are identified as appropriate for deployment in the long term. These user services address a variety of issues, including issues primarily targeted to commercial vehicle operators and enforcement agencies (Commercial Vehicle Electronic Clearance, Freight Mobility, Commercial Vehicle Administrative Processes, On-Board Safety Monitoring, Automated Roadside Safety Inspection), issues primarily targeted to ridesharing (Ride Matching and Reservations and Demand Management and Operations), and issues that have not been identified as critical problems in the metropolitan area (Electronic Payment Services, Emissions Testing and Mitigation). None of these user services makes significant contributions to the ITI for metropolitan areas.

It should be noted that some of the user services related to commercial vehicle activities are identified for deployment in the long term, and are also indicated as existing or planned. The apparent discrepancy is due to the fact that the CVO activities currently underway are being implemented at a regional or state level, rather than by local agencies at the metropolitan area level. While state and regional activities will certainly continue, it is anticipated that CVO user services will not become a priority for local agencies until other ITS user services that address the ITI are deployed. The priority and time frame indicated do not preclude coordination of user services being deployed by various entities. In fact, local ITS activities will need to be coordinated with other ITS activities, including CVO services implemented at the state and regional level, whenever possible. This coordination should be on-going throughout the short, medium, and long term.

Note that the priority of some of these user services would be expected to change with changing circumstances. For example, if Kansas City becomes a non-attainment area with respect to ozone or carbon monoxide, then Emissions Testing and Mitigation may become a higher priority. In other cases, changing circumstances would be expected to affect the deployment time frame. For example, On-Board Safety Monitoring would be appropriate for deployment in the medium term, if proven technologies to provide this user service are developed.