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INTELLIGENT TRANSPORTATION SYSTEMS STRATEGIC PLAN
(Phase I Report)

by

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in cooperation with

Kentucky Transportation Cabinet
Commonwealth of Kentucky

and

Federal Highway Administration
U.S. Department of Transportation

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EXECUTIVE SUMMARY

This interim report on an Intelligent Transportation Systems Strategic (ITS) Plan has been developed as documentation of the process of offering a vision for ITS and recommending an outline for organizational structure, infrastructure, and long-term planning for ITS in Kentucky. This plan provides an overview of the broad scope of ITS and relationships between various Intelligent Vehicle Highway Systems (IVHS) functional areas and ITS user service areas. Three of the functional areas of ITS have been addressed in this interim report with sections devoted to mission, vision, goals, and potential technology applications. Within each of the three areas, recommendations have been made for applications and technologies for deployment. A more formalized business plan for will be developed to recommend specific projects for implementation. Those three functional areas are 1) Advanced Rural Transportation Systems (ARTS), 2) Advanced Traveler Information Systems (ATIS), and 3) Commercial Vehicle Operations (CVO).

A survey of other states was conducted to determine the status of the development of ITS strategic plans. Information received from the 11 states that had completed strategic plans was used to determine the overall approach taken in development of the plans and to evaluate the essential contents of the reports for application in Kentucky.

Kentucky's ITS Strategic Plan evolved from an early decision by representatives of the Kentucky Transportation Cabinet (KyTC) to formalize the procedure by requesting the Kentucky Transportation Center to prepare a work plan outlining the proposed tasks. Following several introductory meetings of the Study Advisory Committee, additional focus group meetings were held with various transportation representatives to identify ITS issues of importance. Results from these meetings were compiled and used as input to the planning process for development of the Strategic Plan components of ARTS and ATIS.

The development of a strategic plan for Commercial Vehicle Operations originated from a different procedure than did the other functional areas of ITS. As part of well-developed commercial vehicle activities through the ITS-related programs of Advantage I-75 and CVISN, Kentucky has become a national leader in this area and has developed a strategic plan of advanced technology applications to commercial vehicles. The strategic plan for Commercial Vehicle Operations was developed out of the convergence of several parallel processes in Kentucky. Empower Kentucky work teams had met over a two-year period to develop improved and more efficient processes for CVO in Kentucky. Their conclusions and recommendations encouraged the further activities of the Kentucky ITS/CVO working group that first convened in the summer of 1996. In an effort to conceptually organize the various ITS/CVO activities in Kentucky, and as a commitment to the CVISN Mainstreaming plan, an inclusive visioning exercise was held in early 1997. Out of this exercise emerged the six critical vision elements that guided the CVO strategic plan.

The remaining functional areas to be included in the ITS Strategic Plan will be addressed in the second phase of this study. Those areas are Advanced Traffic Management Systems (ATMS), Advanced Vehicle Control Systems (AVCS), and Advanced Public Transportation Systems (APTS). It is anticipated that a process similar to that developed for the first phase of this study will continue.

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1.0 INTRODUCTION

As a result of rapidly developing electronic technologies and control systems, Intelligent Transportation Systems (ITS) offer promise as alternatives for enhancing Kentucky's and the nation's future mobility. These systems are expected to play a significant role in the post-Interstate highway program, supplementing road construction, transit expansion, and other more traditional means for accommodating increasing travel demands--safely and efficiently. At the same time, prospects for truly interactive, real-time communication with nearby vehicles and with roadway sensors and control systems add a whole new dimension to the task of providing and managing the highway infrastructure. No longer will it suffice to simply assure that the infrastructure is physically compatible with the vehicles that use it, that the lanes are wide enough, the pavement is strong enough, the curves are banked enough, or the grades are flat enough. Instead, with ITS, drivers, vehicles, and the roadway will be electronically linked by sophisticated systems for sensing, communication, computation, and control. Transmitted information will be precise and timely, indicating actual roadway conditions. Driver displays and other cues will optimize driver performance while minimizing human error. On-board instrumentation will carefully match roadside electronics. Control systems will reflect the dynamics of car and roadway interaction. In short, the driver/vehicle/roadway system will be genuinely integrated as never before.

To realize these ends will require unprecedented coordination between vehicle manufacturers, equipment suppliers, and transportation providers. Jurisdictions will have to work closely together to avoid duplication and to promote common objectives and standards. New lessons will have to be learned about the process of converting our nation's roads and streets into electronic thoroughfares. Taking an initial step and knowing how to manage that process, while both technology and its potential applications evolve rapidly, will be a major challenge.

1.1 BACKGROUND OF ITS

Recognition of problems related to congestion and safety within the surface transportation system in the United States led, in part, to passage of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). An outgrowth of ISTEA, and a means to meet some of the goals, was the concept of Intelligent Vehicle-Highway Systems (IVHS). Five functional areas were initially identified (and a sixth was later added) where technological applications offered significant potential for improving safety, reducing congestion, and enhancing the overall transportation efficiency in the United States. The following six functional areas were the basis for early IVHS planning and project implementation identified in a Strategic Plan for the United States in 1992.[1]

1) Advanced Traffic Management Systems (ATMS)
2) Advanced Traveler Information Systems (ATIS)
3) Advanced Vehicle Control Systems (AVCS)
4) Commercial Vehicle Operations (CVO)
5) Advanced Public Transportation Systems (APTS)
6) Advanced Rural Transportation Systems (ARTS)

Through an evolution of concept development, a National ITS Program Plan was prepared in 1995.[2] This document provided a comprehensive planning reference for application of ITS and illustrated how the goals of ITS could be addressed through deployment of inter-related user services. There were 29 user services identified as part of the national program planning process. These 29 user services were further grouped into the following seven areas of commonality.

1) Travel and Transportation Management
2) Travel Demand Management
3) Public Transportation Operations
4) Electronic Payment
5) Commercial Vehicle Operations
6) Emergency Management
7) Advanced Vehicle Control and Safety Systems

ITS technologies can play a major role in enhancing mobility during the post-Interstate highway program by supplementing road construction, transit expansion, and other more traditional means for accommodating increasing travel demands.

In Kentucky, several ITS projects have been planned and are in various stages of implementation. Among the ITS projects are ARTIMIS, Advantage I-75, CVISN, I-65 CVO project, and traffic management projects in Louisville and Lexington. In addition, there have been other isolated ITS activities at Clays Ferry Bridge and the Cumberland Gap Tunnel, and at various locations where weather information systems have been installed. There is a need to coordinate and integrate the existing ITS projects to obtain maximum benefit from the experiences gained and technologies evaluated. A strategic plan is a means to ensure that ITS technologies are applied wisely in the appropriate transportation projects.

1.2 POTENTIAL BENEFITS OF ITS

The traditional approach to providing increased mobility for users of surface transportation facilities has been to expand the system of streets and roads. Due to the levels of congestion that currently exist on many of our highways, alternatives must be considered for restoring mobility to ensure adequate safety and efficiency of transportation. Congestion-related lost productivity has been estimated to cost more than $100 billion annually in the United States. In addition, with over 40,000 people killed and 5 million injured, the accident costs are estimated to be $137 billion annually. Excessive costs and environmental concerns will not permit significant expansion of the existing surface transportation system.

Intelligent Transportation Systems (ITS) offer technological applications which can improve safety, reduce congestion, and enhance mobility, with minimal environmental impact. ITS provides tools that can assist in addressing current problems, as well as anticipate future demands with proper planning and managing of transportation systems. Direct benefits can be realized from the effective integration of advanced technologies for communication, control, and information processing into transportation systems. A comprehensive and well-developed plan for incorporating ITS concepts and technologies into Kentucky's transportation planning process offers potential for significant benefits to the overall transportation system.

1.3 PURPOSE OF ITS STRATEGIC PLAN

The purpose of this ITS Strategic Plan is to offer a vision for ITS in Kentucky and to recommend an approach for organizational structure, infrastructure, and long-term planning to create a proper foundation. ITS is a new direction in transportation that requires both strategic and tactical planning and considerable management support. This plan will provide an overview of the broad scope of ITS and the potential impact upon traditional approaches to transportation. Background will be presented on the transition of transportation from a expansive road construction and maintenance program to one of intensified management and refinement to optimize available resources. The relationship between various IVHS functional areas and ITS user service areas will be explained in terms of their application to transportation in Kentucky. Each of the functional components of the ITS will be addressed separately with sections devoted to mission, vision, goals, applicable technologies, and recommendations for deployment. The importance of adhering to the existing framework of ITS architecture will be emphasized as it relates to the selection of compatible and expandable technologies. An implementation plan for ITS in Kentucky will be presented through the Strategic Plan process. The benefits to be gained from marketing the ITS plan in Kentucky will be documented. In addition, a recommendation will be offered for an organizational structure which outlines ITS within the Kentucky Transportation Cabinet and other affected units or agencies.

1.4 VISION FOR TRANSPORTATION AND ITS IN KENTUCKY

The highway transportation system in Kentucky has evolved from a farm-to-market type system in the developmental stages to a sophisticated system of interstates, parkways, and primary roads which adequately serves the personal and commercial travel needs of the state. A plan or guide for future actions to continue to develop and maintain this system of highways has been envisioned through a Six-Year Highway Plan for several years. This Plan has been prepared and submitted to the Legislature and provided as a supplement to the Executive Branch Budget. Individual project listings have been recommended for the major highway improvements in both rural and metropolitan areas. A key to the Six-Year Plan has been the segregation of projects into the primary areas of "system preservation" and "access and mobility". The FY 1999-2004 Six Year Highway Plan contains over 1,300 major projects across Kentucky. In addition to the Six Year Plan, there is a long-range plan which reflects projects beyond the year 2004 and are considered to be the principal source for new projects that are added to the biennial updates of the Six Year Plan.

The importance of transportation in our society will likely increase with advances in technological development. Nearly every decision that we make daily is dependent upon transportation and mobility. Systems to accommodate the increased demands of transportation have been extended to the limits and technology has become the beacon of light to guide future generations of transportation users. With the evolution into an information and communications-intensive society, technology has been the means of achieving these levels of capabilities. It is envisioned that ITS will improve highway safety, relieve congestion, and enhance the efficiency of transportation. Computer-related technologies will dramatically influence the transportation systems of the future. Cellular telephones, satellite networks, and fiber optic links will profoundly influence our work, play, travel, and nearly every aspect of our lives. Significant changes have already begun to or will soon affect our transportation systems with advancements such as the following:

- Traffic control centers will be operational in most cities to collect data related to local and regional traffic flow and disseminate information to drivers through various communication media. Regional traffic control centers will also become operational to collect and distribute information on traffic/road conditions, weather conditions, and various recreational attractions.
- Transportation management systems will provide real-time status of traffic flow and operational devices which control and adjust lane usage, signal timing, speed limits, and access to various segments of the roadway system.
- Commercial vehicle operations are able to benefit significantly from the conveniences of electronic pre-clearance and reduced paperwork associated with automated credentials processes.
- Rural areas have also benefitted from the advanced technology applications in the form of improved emergency response, more efficient public transportation, increased tourism related to traveler information systems, and more accurate road condition/weather information.
- Advanced vehicle safety systems are available and applicable to school bus safety and radar equipment to improve vision in reduced visibility conditions.

Through ITS, Kentucky can share in the national technological advances which offer the opportunities to improve highway safety, increase efficiency of travel and transport, relieve congestion, boost productivity, and improve travel without harming the environment.

1.5 IVHS FUNCTIONAL AREAS AND ITS USER SERVICES

As noted previously, there were originally six IVHS functional areas which have evolved since the early 1990's into seven ITS user service bundles.[1,2] The seven user bundles represent the 29 user service areas which were identified as part of the national program planning process. It was noted in the development of the user services categories that they were not rigidly structured and were expected to change through program plan updates over time. (Highway Rail Intersection was recently added to make a total of 30 user services.) The user services included travelers using all modes of transportation, transportation management center operators, transit operators, Metropolitan Planning Organizations, commercial vehicle owners and operators, state and local governments, and many others who benefit from deployment of ITS. As detailed from the National ITS Program Plan, the user services areas share the following common characteristics and features:

- Individual user services are building blocks that may be combined for deployment in a variety of fashions,
- User services are comprised of multiple technological elements or functions which may be common with other services,
- User services are in various stages of development and will be deployed as systems according to different schedules,

- Costs and benefits of user services depend upon deployment scenarios, and
- Many user services can be deployed in rural, suburban, and/or urban settings.[2]

In an attempt at integration, the user services have been cross-tabulated with IVHS functional areas as shown below. The components of Kentucky's Strategic Plan have been developed to follow the six functional areas of IVHS. Within each functional area, there has been an attempt to address the user service areas most critical to the vision for transportation in Kentucky.

Commercial Vehicle Operations

Commercial Vehicle Electronic Clearance
Automated Roadside Safety Inspections
On-Board Safety Monitoring
Commercial Vehicle Administrative Processes
Hazardous Material Incident Response
Freight Mobility

Advanced Public Transportation Systems

Public Transportation Management
En-Route Transit Information
Personalized Public Transit
Public Travel Security

Advanced Vehicle Control Systems

Longitudinal Collision Avoidance
Lateral Collision Avoidance
Intersection Collision Avoidance
Vision Enhancement for Crash Avoidance
Pre-Crash Restraint Deployment
Safety Readiness
Automated Highway Systems

Advanced Traffic Management Systems

Traffic Control
Incident Management
Emissions Testing and Mitigation
Demand Management and Operations
Emergency Vehicle Management
Highway Rail Intersection

Advanced Traveler Information Systems

En-route Driver Information
Route Guidance
Traveler Service Information
Pre-Trip Travel Information
Ride Matching and Reservation

Electronic Payment Services
Emergency Notification and Personal Security
En-route Transit Information
Highway Rail Intersection

Advanced Rural Transportation Systems

Commercial Vehicle Electronic Clearance
Automated Roadside Safety Inspections
Hazardous Material Incident Response
Freight Mobility
Public Transportation Management
En-Route Transit Information
Personalized Public Transit
Public Travel Safety
Longitudinal/Lateral Collision Avoidance
Traffic Control
Incident Management
En-route Driver Information
Route Guidance
Traveler Service Information
Pre-Trip Travel Information
Ride Matching and Reservation
Emergency Vehicle Management
Emergency Notification & Personal Security
Electronic Payment Services
Highway Rail Intersection

[1] Strategic Plan for Intelligent Vehicle-Highway Systems in the United States; IVHS America, Washington, D.C.; April 1992.
[2] National ITS Program Plan; Vol. I; ITS America; Washington, D.C.; March 1995.

2.0 ITS ARCHITECTURE

2.1 THE NATIONAL ITS ARCHITECTURE

2.1.1 What is the National ITS Architecture?

The national ITS Architecture can be regarded as a blueprint that guides ITS implementation in the United States. It provides an accepted framework for ITS deployment, specifying how the necessary functionality will be assigned to various system elements and how the various systems will interface and exchange data. By so doing, the architecture helps to ensure that there is interoperability between systems, a seamless flow of information, standardization of equipment, multiple vendors for technology, and maximum benefit from early lessons learned.

In the April 1994 Interim Report on the architecture development process, the national architecture was described as follows:

> "A system architecture is the framework that describes how system components interact and work together to achieve total system goals. It describes the system operation, what each component of the system does and what information is exchanged among the components. . . . A system architecture is different from a system design. Within the framework of an architecture, many different designs can be implemented."[1]

A simple analogy may prove helpful in understanding the purpose of a system architecture. One such analogy is the component-based home audio system. There is a standard architecture for these systems, which spells out the functionality of each component (e.g., tape deck, amplifier, tuner, compact disc player, etc.), the types of connections between the components, and the way that data will flow between them. Because of this standard architecture, a buyer can select components from different manufacturers and different retailers, choosing the price and features that meet his or her needs, and be assured that the components will all work together. This, in a nutshell, describes the value of having a system architecture.

The following is excerpted from the executive summary for the national architecture documentation:

> "The National ITS Architecture provides a common structure for the design of intelligent transportation systems. It is not a system design nor is it a design concept. What it does is define the framework around which multiple design approaches can be developed, each one specifically tailored to meet the individual needs of the user, while maintaining the benefits of a common architecture. . . . The architecture defines the functions (e.g., gather traffic information or request a route) that must be performed to implement a given user service, the physical entities or subsystems where these functions reside (e.g., the roadside or the vehicle), the interfaces/information flows between the physical subsystems, and the communication requirements for the information flows (e.g., wireline or wireless). In addition, it identifies and specifies the requirements for the standards needed to support national and regional interoperability, as well as product standards needed to support economy of scale considerations in deployment."[2]

2.1.2 The National ITS Architecture Development Process

The need for a national architecture for ITS was identified in the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), which directed the US Secretary of Transportation to promote compatibility among intelligent transportation technologies implemented throughout the United States.

In September of 1993, the United States Department of Transportation (USDOT) selected four teams for Phase I of the National IVHS (now called ITS) Architecture Development Program. These four teams, led by Hughes Aircraft, Loral-IBM, Rockwell International, and Westinghouse

Electric, were each to develop an alternative IVHS architecture. Each architecture was to be based on a twenty-year planning horizon and was to address the current (at that time) list of 29 IVHS user services.[3]

As the teams developed their architecture concepts, numerous public forums were held to gain stakeholder input and feedback. By October of 1994, each team had developed an initial architecture concept and performed a preliminary evaluation of that concept.. This was followed by a review and evaluation period, which lasted through January of 1995. Based upon that review, two teams (led by Loral Federal Systems and Rockwell International) were selected to continue into Phase II.

Phase II of the architecture development process was a collaborative effort, where both of the remaining teams worked together to develop the final product. It was also intended to be a highly visible and open process, with continuous progress reporting and opportunities for public response. Phase II was completed on schedule, as the final products were delivered to the USDOT in July of 1996. This delivery consisted of over 5,000 pages of documents.

In total, the architecture development process took about three years to complete. The total cost for the Phase I and Phase II contracts was approximately $18 million.[4]

2.1.3 Content of the National ITS Architecture

The National ITS Architecture Documentation consists of 18 documents, each of which is described briefly in the following paragraphs. These descriptions are condensations of information contained in the National ITS Architecture Executive Summary.[5]

Executive Summary: This document provides a 21-page overview of the entire architecture, including a guide to navigating the architecture documentation.

Vision: This 25-page document presents a "magazine-style" description of travel in the years 1997, 2002, and 2012, highlighting those areas where significant advances have been achieved. It includes short narratives of the travel experiences of "typical" future travelers.

Mission Definition: This document tells how the ITS Architecture program supports the National ITS Program Plan. It describes the goals, objectives, user service requirements, expected benefits, and possible pitfalls of the National Architecture Program.

Logical Architecture: Description, Process Specifications, and Data Dictionary (three documents): The architecture documentation breaks the architecture down into a "logical" architecture and a "physical" architecture. The logical architecture, which is defined in three volumes, describes the functions (or process specifications) that need to be performed in order to provide ITS user services, as well as the information flows that need to take place between the functions. The functions and data flows are depicted using data flow diagrams. There is also a complete data dictionary.

Physical Architecture: The physical architecture takes the functions described in the logical architecture and groups them into four systems and nineteen subsystems. The grouping is based on the similarity of functions and the locations where the functions are performed. The four systems defined by the architecture are the center, the roadside, the vehicle, and the traveler. There are nine center subsystems, four roadside subsystems, four vehicle subsystems, and two traveler subsystems.

Center subsystems deal with those functions normally carried out by administrative, management, or planning agencies. There are nine center subsystems identified: Commercial Vehicle Administration; Fleet and Freight Management; Toll Administration; Transit Management; Emergency Management; Emissions Management; Planning; Traffic Management; and Information Service Provider.

Roadside subsystems cover those functions that involve roadside deployment of sensors, signals, variable message signs, or other technology to interface with vehicles and travelers. The four roadside subsystems are Roadway, Toll Collection, Parking Management, and Commercial Vehicle Check.

Vehicle subsystems are installed in a vehicle. The four vehicle subsystems are Vehicle, Transit Vehicle, Commercial Vehicle, and Emergency Vehicle.

Finally, traveler subsystems are those ITS platforms directly accessed by travelers (including commercial vehicle operators) in support of their traveling. The two traveler subsystems are Remote Traveler Support and Personal Information Access.

The physical architecture document contains a set of architecture flow diagrams that show all the data that passes between subsystems. The document also presents the characteristics of the data flows and the relevant constraints.

Theory of Operations: This document provides a simple discussion of how the ITS architecture supports ITS implementations. It explains the operational concepts used by the architecture to implement user services. It also presents advantages and disadvantages of alternative operational concepts.

Traceability Matrix: This document ties together the logical and physical architectures with a collection of cross-reference tables.

Communications Document: This is one of six documents that focus on the results of numerous evaluations of the architecture. The Communications Document presents an analysis of the communications aspects of the architecture. This analysis begins by analyzing the architecture data flows and determining the resulting communications requirements. Quantitative analyses are included, based on a hypothetical system design and projected data loading requirements. Also included is a technology assessment that evaluates several potential choices for communications technology. Each alternative is evaluated against estimated requirements. An extensive set of appendices is provided.

Evaluatory System Design: This document describes the hypothetical system design used for the communications analysis contained in the communications document.

Cost Analysis: This document uses the same hypothetical system design used for the communications analysis to provide a basis for estimating costs for ITS deployment.

Performance and Benefits Study: This document presents the results of applying a set of evaluation criteria to the architecture. The study concludes that the architecture is flexible and adaptable. Also included is a discussion of the overall benefits of the ITS architecture.

Risk Analysis: This document lists the risks that threaten deployment of the architecture and suggests strategies for mitigating those risks.

Evaluation Results Summary: This document provides a summary of the results of the evaluations.

Standards Development Plan: This is one of three documents that provide support for those implementing ITS technologies. This document provides guidance for standards development organizations (SDOs) in identifying and creating necessary standards. For each required standard, existing standards work is identified or new work is recommended.

Standards Requirements Document: This document presents detailed information for each of the 12 standards packages identified in the Standards Development Plan.

Implementation Strategy: This document presents a process for implementing ITS user services, including ways to identify interfaces that need to be standardized. Recommendations are presented for future research and development, operational tests, standards activities, and training.

2.1.4 Implications of the National Architecture to Kentucky

As ITS technologies are implemented in Kentucky, it is in everyone's best interests to implement them in a way that is consistent with the national architecture. Doing so helps to ensure that these systems will be interoperable with other systems throughout the country. It also maximizes the availability of off-the-shelf technology and increases the probability of having multiple vendors available. System designers and implementers benefit from the experience of earlier projects, and are able to minimize the possibility of overlooked requirements and unexpected problems. Through the use of standard interfaces with other systems, the costs (and potential problems) associated with sharing data between systems are minimized.

2.1.5 Sources of More Information

There is extensive documentation available on the National ITS Architecture. The full documentation set consists of over 5,500 pages of information. For those who desire a more cursory understanding, there is a 21-page executive summary that provides a solid overview. The documents can be ordered as paper copies, ordered on CD-ROM, or downloaded by accessing the US Department of Transportation's ITS Architecture web page at the following address:

www.its.dot.gov/architecture

[1] IVHS Architecture Development Program: Interim Status Report; IVHS America; Washington, DC; April 1994
[2] National Architecture Documentation; Executive Summary
[3] IVHS Architecture Development Program: Interim Status Report; IVHS America; Washington, DC; April 1994
[4] Inside ITS; Transport Technology Publishing; New York, NY; July 1, 1996
[5] National ITS Architecture Documentation; Executive Summary

3.0 INFRASTRUCTURE AND APPLICABLE TECHNOLOGIES

3.1 NATIONAL ITS INFRASTRUCTURE

Increased congestion and a lack of space has led transportation officials to consider new and innovative methods to increase mobility and safety on the roadways. Instead of adding to the already well established highway infrastructure, the current transportation system must be improved and optimized. This is being done with the implementation of ITS infrastructure.

With many state and local governments implementing ITS technology, it is critical that these systems have some underlying foundation that connects them all. To promote the compatibility and integration among these systems, the US Department of Transportation (USDOT) has published the "Intelligent Transportation Systems Infrastructure Initiative".[1]

The USDOT refers to the ITS infrastructure as the "information and communications backbone" to an ITS system. It is not merely a collection of technologies, but a system that allows for communication among technologies. It is that link between various ITS systems that creates the appearance of a single multimodal, multi-jurisdictional system. The USDOT's ITS Infrastructure Initiative focuses on the needs of metropolitan travelers, rural travelers, and commercial vehicle operators.

Infrastructure for metropolitan users will combine the components of traffic management, traveler information and public transportation. Technology applications focus on nine different areas, including: traffic signal control, freeway management systems, transit management systems, incident management programs, electronic toll collection, electronic fare payment systems, emergency response, and regional multimodal traveler information systems. The USDOT's objective in this area is to deploy ITS infrastructure in 75 of the nation's largest metropolitan areas.

The rural infrastructure will serve to improve transportation conditions in rural areas and may include applications from the five functional areas of ATMS, ATIS, CVO, APTS, and AVCS. There are seven areas of application for the rural traveler: traveler safety and security systems, emergency services, tourism and travel information services, public traveler services/public mobility services, infrastructure operation and maintenance technologies, fleet operation and maintenance systems, and commercial vehicle operation systems. The USDOT plans to deploy these elements as needed.

Commercial Vehicle Information Systems and Networks (CVISN) will improve commercial vehicle operations within the states by allowing information to be shared electronically. High-risk carriers will be more easily identified, while the issuance of credentials and permits will be simplified. The CVO infrastructure will include technology from the areas of: commercial vehicle electronic clearance systems, automated roadside safety inspection systems, onboard safety monitoring, commercial vehicle administrative processes, freight mobility systems, and hazardous materials incident response technologies. The objective is to deploy ITS infrastructure for commercial vehicles in all 50 states.

As summarized from the ITS Infrastructure Initiative, in order to reach each objective for metropolitan and rural travelers and commercial vehicle operators, the USDOT will:

1. Communicate the benefits to decision makers and agencies and encourage integration through a showcase of ITS infrastructure in metropolitan areas and for commercial vehicles through the Model Deployment Initiative (MDI),

2. Encourage integration with creative funding incentives targeted at ITS integration in metropolitan areas and for commercial vehicles and basic deployment elsewhere,

3. Provide training courses for transportation officials to enhance their professional capacity,

4. Provide documentation and technical assistance on the deployment of ITS infrastructure and the use of the National Architecture for state and local officials, and

5. Facilitate the development of ITS standards and require that federal funding be used on projects that comply with these standards and the National Architecture.

3.2 KENTUCKY ITS INFRASTRUCTURE

Kentucky has already deployed a significant amount of ITS infrastructure, and continues to do so. To date, the state is involved with 10 ITS projects (see section 4.0 for details), nine of which have deployed (or will deploy) ITS infrastructure. (The tenth is a project that encourages the deployment of commercial vehicle infrastructure in other states.)

Metropolitan infrastructure in Kentucky may be seen in the three most populated areas of the state: Louisville (infrastructure is planned, but not yet deployed), Northern Kentucky and Lexington. All these areas use similar technology for traffic and incident management, including: changeable or variable message signs, detailed reference markers, highway advisory radio, and closed circuit cameras. Both Louisville and Lexington use computerized signal systems.

Rural infrastructure may be seen in various parts of the state also. Closed circuit cameras and variable message signs are used at the Cumberland Gap Tunnel and the Clays Ferry Bridge Reconstruction project on I-75 for traffic and incident management. Road Weather Information Systems (RWIS) are implemented in six different areas around the state (two of which are in rural settings), providing information to a centralized location.

As part of the USDOT's Model Deployment Initiative, Kentucky has already begun to implement commercial vehicle infrastructure. Six different weigh stations will be electronically equipped with automatic vehicle identification (AVI) readers, allowing mainline screening of commercial vehicles by the Summer of 1998. (Four sites in Kentucky and 25 other sites along I-75 and Highway 401 in Canada have been operating seamlessly since October of 1995.) Kentucky also plans to implement a remote weigh station site using the same AVI technology. Also as part of the CVISN project, the state will implement the electronic issuance of permits and credentials and will subscribe to Safety and Fitness Electronic Records (SAFER), a national database containing safety information on commercial vehicles.

For communication among the state's ITS systems, Kentucky will be investigating the deployment of a statewide fiber optics network. This would be a shared resource project with a telecommunications provider. The fiber would be installed along the right-of-way of various major roadways throughout the state. The erection of cellular towers is also being considered on the right-of-way. These communication systems would allow the state to have a seamless method of communication among all its ITS applications.

[1] Intelligent Transportation Systems Infrastructure Initiative. U.S. Department of Transportation. Intelligent Transportation Systems Joint Program Office. October 1, 1997. Publication No. FHWA-JPO-97-0028.

4.0 ITS IN KENTUCKY

Kentucky's interest in ITS began as early as 1982 with the implementation of a closed circuit camera system in Lexington. Today, there are 10 ITS-related projects on-going or in development in urban and rural areas of the state involving traveler information, traffic management, and commercial vehicle operations. Following is a list containing a brief synopsis of each project. Specific information including: agency involvement, funding arrangements, time frame, physical location, technology and associated costs, benefits, and future applications for the projects may be found in Appendix A.

Advantage I-75

Kentucky is the lead state in this public/private partnership which promises to reduce congestion, increase efficiency, and enhance safety along the I-75 corridor and Canadian Highway 401. Transponder-equipped trucks are monitored on the mainline by weigh station personnel using weigh-in-motion scales and automatic vehicle identification (AVI) readers. Qualified commercial vehicles may travel the entire corridor without a single stop at one of the 29 participating weigh stations. Advantage I-75 is currently expanding to enroll 70,000 trucks.

I-65 Electronic Screening

Kentucky, in a partnership with Indiana, will start a simplified electronic screening system for commercial vehicles traveling along Interstate 65. This new system will consider prior weight compliance in the screening of trucks, eliminating the need for mainline weigh-in-motion. Due to its low implementation cost, simple design, and compatibility with other systems, it is being promoted as the model for electronic screening in other states.

CVISN Model Deployment

Kentucky has been named a Model Deployment state in the Commercial Vehicle Information Systems and Networks (CVISN) program. As part of this program, the state is implementing the electronic issuance of permits and credentials, using pen-based laptops for roadside inspections, and equipping weigh stations with state-of-the-art electronic screening technology.

Alliance for Commercial Vehicle Operations (Mainstreaming)

As a leader in Commercial Vehicle Operations, Kentucky has been chosen to guide the Southeast and Great Lakes regions in participating in the CVISN program. As Mainstreaming Regional Champion, the state will help 13 other states with the development of their own ITS/CVO strategic plan, encouraging nationwide deployment of CVISN architecture.

Advanced Regional Traffic Interactive Management and Information System (ARTIMIS)

Kentucky and Ohio have joined forces with the goal of increasing safety and decreasing travel time on about 88 miles of freeway in the Cincinnati-Northern Kentucky area. Technologies applied to improve traffic flow include video cameras for monitoring traffic, variable message signs, highway advisory radio, and improved reference signs for emergency response. This traffic management project includes five Good Samaritan freeway service patrol vans used to aid stranded motorists. The program also has a traveler advisory telephone system where motorists can dial 211 to obtain up-to-date information on traffic conditions from their car, home or place of business.

Lexington Traffic Management Projects

The city of Lexington has a traffic management plan that includes a control system for more than 300 signalized intersections, lane use signals, and closed circuit cameras. From the office, home, or car, motorists can obtain up-to-date traffic information by dialing 258-3611 or *311 from a cellular phone. The city also hosts the Traffic Information Network (TIN). The TIN supplies important traveler information to Lexington and 43 surrounding counties through 22 radio and 4 television stations.

Traffic Response and Incident Management Assisting the River Cities (TRIMARC)

Kentucky, along with Indiana, anticipates that this new incident management and traffic response project will improve travel time by notifying motorists of delays and detours. This multimillion dollar project will initially cover 7 miles of I-65 and includes an electronic detection system, closed circuit cameras and detailed reference markers. It is expected that quick response by emergency teams will not only reduce delays, but will also reduce the severity of accidents and the number of secondary accidents.

Cumberland Gap Tunnel

This $265 million project located in the Cumberland Gap National Historical Park relies on ITS technology for travelers' safe passage through the Tunnel. Closed circuit cameras within the 4,600-foot twin tunnels constantly monitor the traffic, while variable message signs are used to communicate with drivers. Emergency vehicles are dedicated to the Tunnel 24 hours a day in case of emergencies.

Condition-Responsive Work Zone Traffic Control System: Clays Ferry Bridge Reconstruction

Thanks to a condition-responsive work zone traffic control system on I-75, drivers approaching the Clays Ferry Bridge reconstruction project have experienced fewer delays and less congestion. A system of video surveillance cameras detects incidents on or around the Bridge. Using variable messages signs and highway advisory radio, drivers are made aware of delays and provided with valuable detour information.

Road Weather Information System (RWIS)

Six weather stations, or RWIS, along major roadways in Kentucky are used to monitor such things as air/pavement temperature, precipitation, ice formation, and wind speed. The data received from these six stations is used by highway maintenance personnel to enable more timely treatment of roadways. The Transportation Cabinet can also use this information to notify the public of changing weather and roadway conditions. The technology applied to a southbound bridge on I-75 at Corbin includes an experimental anti-icing system which can automatically dispense chemicals before the onset of critical freezing conditions. The bridge is equipped with RWIS technology and a video camera to monitor weather conditions and assist in the decision-making process for application of chemicals.

5.0 DEVELOPMENT OF KENTUCKY'S ITS STRATEGIC PLAN

Kentucky's ITS Strategic Plan evolved from an early decision by representatives of the Kentucky Transportation Cabinet to formalize the procedure by requesting the University of Kentucky Transportation Center to prepare a work plan outlining the proposed tasks for development of a strategic plan. The first meeting of the Study Advisory Committee was held in May 1997. The purpose of the meeting was to provide a forum for introduction of the goals and objectives of the ITS Strategic Plan for Kentucky and to offer input and direction to the Transportation Center staff. Following that initial meeting, there were several revisions to the proposal/work plan resulting in approval by the Transportation Cabinet on July 9, 1997. The next formal meeting involving the Advisory Committee members and others with transportation-related interests was a focus group meeting on October 10, 1997 where approximately 30 participants were requested to identify the ITS issues of importance. These issues were compiled and transmitted back to the participants to request that they prioritize the issues for inclusion in the Strategic Plan. Another meeting of transportation planners from state and local governments on December 3, 1997 was used as a focus group to solicit more information related to ITS issues of importance. Results from both these meetings were compiled and used as essential input to the strategic planning process for development of the Strategic Plan components of Advanced Rural Transportation Systems and Advanced Traveler Information Systems. A summary of the information solicited and obtained from participants in the two focus group meetings is presented in Appendix B.

One of the first steps in the development of the Strategic Plan was a survey of other states to determine their status in the development of ITS strategic plans. All of the states were contacted in the fall of 1997 and it was determined that 11 states had completed strategic plans and 13 others were in the process of preparing a plan. The primary objective of reviewing the work being conducted by other states was to determine the overall approach taken in development of their plans and to compare the essential contents of the reports. Specifically, an effort was made to determine the time frame of the plan, whether mission and vision statements were included, whether there was a list of goals, whether there was reference or adherence to state or national architecture, and whether the plan was organized into functional areas or user services. Another feature noted was whether the strategic plan was also a business plan for deployment or if a separate document was prepared as a business plan. Presented in Appendix C is a summary of the responses received from each of the states who were responsive to our inquiry about the status of their strategic plan. In addition, a summary of the contents of strategic plans received from 12 states is presented in Appendix C along with a tabular summary which allows comparisons of each of the reports.

The development of a strategic plan for Commercial Vehicle Operations originated from a different procedure than did the other functional areas of ITS. As part of well-developed commercial vehicle activities through the ITS-related programs of Advantage I-75 and CVISN, Kentucky has become a national leader in this area of advanced technology applications to commercial vehicles. A significant benefit in Kentucky is the organizational structure which results in all of the regulatory and enforcement functions regarding commercial operations under the umbrella of the Kentucky Transportation Cabinet within the administrative authority of the Secretary of Transportation. Strategic planning for commercial vehicle operations in Kentucky is intended to provide management guidance for all of the subsequent program and business planning to be carried out in the future. Strategic thinking that is implemented will provide clearer targets of opportunity and better advance warning of threats to commercial vehicle operations. It will also allow Kentucky to direct its limited resources on the most critical issues whether maintaining key strengths or correcting a critical weakness. Subsequent strategic planning sessions will be broadened to include industry, technical and legislative participants beyond the diverse state and federal interests represented in the earlier planning sessions.

The strategic plan for Commercial Vehicle Operations was developed out of the convergence of several parallel processes in Kentucky. Empower Kentucky work teams have been meeting for over two years to develop improved and more efficient processes for CVO in Kentucky. Their conclusions and recommendations prefigured and encouraged the further activities of the Kentucky

ITS/CVO working group that first convened in the summer of 1996. In an effort to conceptually organize the various ITS/CVO activities in Kentucky, and as a commitment to the CVISN Mainstreaming plan, an inclusive visioning exercise was held in early 1997. Out of this exercise emerged the six critical vision elements that guide this strategic plan. The vision, which demanded a broad base of input, drew on upper level administrators familiar with the broad array of projects in Kentucky.

6.0 COMPONENTS OF KENTUCKY'S ITS STRATEGIC PLAN

The following is a discussion of the three functional areas completed on the date of this interim report: Advanced Rural Transportation Systems (ARTS), Advanced Traveler Information Systems (ATIS), and Commercial Vehicle Operations (CVO). The remaining three areas, Advanced Traffic Management Systems (ATMS), Advanced Public Transportation Systems (APTS), and Advanced Vehicle Control Systems (AVCS), will be included with the final report which is scheduled to be completed in June of 1999.

6.1 ADVANCED RURAL TRANSPORTATION SYSTEMS (ARTS)

6.1.1 Mission Statement

To enhance the quality and efficiency of transportation in rural Kentucky through the selective application of ITS technologies.

6.1.2 A Vision of Rural Transportation in 2020

Travel on Kentucky's rural highways has continued to improve as Intelligent Transportation Systems are implemented throughout the state. A strategy of applying technologies that can provide the greatest benefits for Kentucky has resulted in improved travel conditions and increased safety for rural travelers.

Travel information is available from variable message signs, highway advisory radio, interactive kiosks, and the internet. Information about weather and road conditions is provided by Kentucky's RWIS. Travelers are informed of incidents and construction activities, and guided around them with minimal delays. In-vehicle guidance systems can suggest alternate routes to escape congestion.

Many lives have been saved by improving emergency response in rural areas. Most vehicles are equipped with Mayday systems to notify emergency personnel and provide the location of an incident. The dispatching of police, fire, and emergency medical services is coordinated to provide the fastest possible response without being limited by jurisdictional boundaries. All emergency vehicles have automatic vehicle location equipment using GPS technology so that the nearest vehicle can be dispatched to the scene. The emergency vehicles also have guidance systems that determine the best route to the incident location. These systems save valuable minutes when lives are in danger.

Public transportation is much improved in rural areas. There is now a coordinated statewide transit network providing seamless public transit with convenient connections between service providers. All transit vehicles are equipped with GPS location devices, so that they can be routed and controlled by regional dispatching centers. Riders can call the dispatcher, and a bus will be routed to pick them up within a reasonable time. The use of electronic payment systems makes payment for transit services much easier for both operators and passengers. The improvements in efficiency have made public transportation more convenient and affordable throughout Kentucky.

Kentucky has made significant improvements in the safety and efficiency of commercial vehicles. Both government and industry benefit from information technology that reduces paperwork and delay. Incentive programs and better targeting of enforcement activities have helped eliminate illegal and unsafe operations. Trucks carrying hazardous materials are monitored in a database which helps inform emergency personnel how to control any leaks or spills. Electronic pre-clearance of trucks has reduced congestion and conflicts near weigh/enforcement stations. Increased coordination with other modes of transport has reduced the number of trucks on rural highways.

Advanced vehicle safety systems are gaining acceptance in Kentucky. The detection equipment that senses the presence of children around school buses is being used on cars to provide collision warning and blind spot detection. Vision enhancement systems are reducing visibility problems in fog and darkness. These technologies are leading to safer highways in Kentucky.

Kentucky has seen dramatic changes in transportation. The use of ITS technologies has led to increases in safety, efficiency, and convenience which benefit both residents and tourists. The investment in new technology has made Kentucky a leader in rural transportation.

6.1.3 ARTS Issues and Goals

The following issues were identified as limiting or providing an opportunity to improve rural transportation in Kentucky:

1. Funding - Increased funding is necessary to implement ITS technologies.
2. Substandard road design and conditions - Problems with the existing road network could be mitigated somewhat with ITS technologies.
3. Remoteness/accessibility - The problems of remoteness and accessibility in many rural areas could be eased with ITS technologies.
4. Universal naming of streets and roads - A universal naming system must be adopted for the implementation of route guidance and 911 systems.
5. Poor communication among service providers - Increasing the flow of information between service providers could lead to improved efficiency.
6. Incident management - Efficient management practices can reduce the delay associated with traffic incidents.

These issues were identified as being important for long-term consideration:

1. Intermodal coordination - Coordination between various modes of travel will enhance rural transportation.

2. Funding - Increased funding is necessary to implement ITS technologies.

3. Multiple government jurisdictions - The barriers of neighboring government jurisdictions must be overcome for efficient management of emergency vehicles.

The following goals were developed for the implementation of ITS in rural Kentucky.

I. To enhance statewide emergency response capability.

Response times can be lowered through increased coordination between agencies and the application of Mayday systems, centralized dispatching, automatic vehicle location, and route guidance systems .

II. To improve connectivity between rural transportation systems.

Transportation systems should be coordinated so that travelers can easily move from one to the other in a "seamless" statewide system. This will require easily available information about the routes and schedules of transit systems.

III. To implement efficient traffic management practices for incidents and construction activity.

A well-planned traffic management system would reduce the delays caused by incidents and construction. Detour routes would allow traffic to keep moving, and traveler information would alert travelers and allow opportunities to avoid the incident.

IV. To promote communication and information sharing between agencies.

Increasing communication between transportation agencies would lead to improvements in service and efficiency. Sharing knowledge and experience would benefit all agencies, and allow better service through increased coordination.

V. To improve signing and traveler information resources.

Enhanced signing and real-time traveler information would significantly improve travel in rural areas. Information about road and traffic conditions would improve efficiency, while information about attractions and services would help visitors and tourist.

VI. To develop advanced vehicle safety systems.

The development of new vehicle safety systems would increase safety on highways across Kentucky. Most technologies in this area need more time to develop, but some could provide immediate benefits.

6.1.4 Potential Applications and Technologies

Advanced Rural Transportation Systems involve the application of technologies from the other functional areas of ITS in a rural setting. The user services from each functional area which apply to rural transportation are identified with a brief discussion of the related technology. More details about these technologies can be found in the corresponding functional area section of the ITS Strategic Plan. Much of the information for this section was found in the National ITS Program Plan[1].

6.1.4.1 Advanced Traveler Information Systems

Advanced Traveler Information Systems involve providing travelers with information such as road conditions, traffic problems, traveler services, and tourists attractions. The related user services that can be applied in rural Kentucky are:

En-Route Driver Information
Route Guidance
Traveler Service Information
Pre-Trip Travel Information
Ride Matching and Reservation
Electronic Payment Services
Emergency Notification and Personal Security

En-Route Driver Information provides real-time information to travelers after they have started their trip. Knowledge of road conditions and potential traffic problems would allow travelers the option of taking an alternate route or possibly choosing a new destination. Weather information from a RWIS could also be included. The information can be made available through radio, variable message signs, and rest area kiosks. In-vehicle signing provides another way to provide information to drivers. This technology allows the contents of roadside signs and other real-time information to be displayed inside the vehicle.

Route Guidance systems help travelers by suggesting a route and providing detailed directions to reach a desired destination. Real-time information about road and traffic conditions or transit schedules can be considered when determining the best route. The current position of the vehicle could be determined using GPS technology so that the directions can be constantly updated. The route could be displayed on a digital map showing the vehicle's position in the road network. This type of information would be valuable to tourists and business travelers who often visit unfamiliar areas.

Traveler Service Information provides improved access to travel related services. Travelers can be provided with information about food, gas, lodging, tourist attractions, public transit, repair services, hospitals, and police. The system could also allow travelers to make reservations and pay for services. The system could be accessed from home via the internet or from airports, bus stations, hotels, rest areas, and other public places using interactive kiosks. The technology could be expanded to allow travelers to use the system from their vehicles.

Pre-Trip Traveler Information informs travelers while they are planning a trip. Real-time information about weather, accidents, road conditions, congestion levels, parking availability, transit schedules, and ride matching could be accessed from home or the workplace using an interactive phone or internet system. The information would help travelers select the route, departure time, and mode of travel. This would be useful when planning a daily commute or a vacation.

Ride Matching and Reservation provide real-time ride matching information to users. The service could be accessed through the internet or an automated telephone system. Users would be able to announce trips, make reservations, or request a ride. This type of service would promote the use of car pooling and ride sharing, and provide an alternative to many single occupant vehicle trips.

Electronic Payment Services make it easier for travelers to pay for transportation expenses. A card with an embedded magnetic strip or computer chip would be used to pay for tolls and parking fees without requiring the driver to stop the vehicle or produce "exact change." The same card could be used to pay for transit fares and other services. The technology can be expanded to store personal information on the cards, allowing the payment card to function as an ID or driver's license.

Emergency Notification and Personal Security increase safety by alerting emergency personnel when necessary. A distress signal can be manually activated in situations such as minor accidents and mechanical failures. The signal would be automatically activated by vehicle sensors in more severe crashes. The source of the signal would be determined to help emergency personnel locate and reach the incident. Additional technology would allow the distress signal to transmit additional details such as crash severity and the number of people involved. This type of technology would significantly reduce the response time of emergency personnel.

6.1.4.2 Commercial Vehicle Operations

Increasing the safety and efficiency of commercial vehicles is an important part of improving rural transportation in Kentucky. This section provides an overview of applications and technologies that can be applied in rural areas. The user services that apply to rural areas are:

Commercial Vehicle Electronic Clearance
Automated Roadside Safety Inspections
Hazardous Material Incident Response
Freight Mobility

Commercial Vehicle Electronic Clearance increases productivity and safety by improving the clearance process at weigh stations and borders. The use of transponders allows trucks to communicate electronically with roadside readers. This allows officials to check credentials and safety status while the truck travels on the mainline. Weigh-in-motion sensors allow trucks to be weighed without stopping at a weigh station. Other applications for this technology include collecting tax data and using the trucks as probes to measure travel times or detect incidents.

Automated Roadside Safety Inspections increase safety and productivity by facilitating the roadside inspection process. The inspection officers can use computers to access a database that contains the safety performance records of drivers, vehicles, and carriers. New sensors and testing equipment are being developed that allow efficient safety evaluation of vehicle components. Real-time information and improved equipment reduce the time required to perform roadside inspections.

Hazardous Material Incident Response involves providing information about hazardous materials to emergency response personnel. Shipments of hazardous materials could be entered into a database before each trip. The data base would include a description of the materials and guidelines on how to control spills. When a vehicle carrying hazardous materials is involved in an accident, emergency personnel could have real-time access to the necessary information. This type of information can increase safety and reduce unnecessary delays. Trucks carrying hazardous materials can also be equipped with "Mayday" devices that automatically alert the proper authorities if the truck is involved in an accident.

Freight Mobility involves increasing efficiency through sharing information. It includes communication between drivers, dispatchers, and intermodal transportation providers. Automatic vehicle location using GPS technology allows shippers to track vehicles and provides information for real-time scheduling and routing. This type of information improves the efficiency of a vehicle fleet, which leads to lower shipping costs and prices.

6.1.4.3 Advanced Traffic Management Systems

Although Advanced Traffic Management Systems are usually associated with urban areas, this section reviews the applications and technologies that can also apply to rural areas. The following user services have some rural applications:

Traffic Control
Incident Management
Emergency Vehicle Management
Highway Rail Intersection

Traffic Control includes traffic surveillance and flow optimization. This technology is used in the traffic signal systems of many urban areas. A rural application is the flexible use of traffic control devices to increase the safety of pedestrians and motorists. Cellular technology can be used to remotely activate flashing beacons which are used on school pedestrian crossing or fog warning signs. This allows more flexibility than the traditional timer systems or manual activation. The same technology can be used to activate variable message signs or variable speed limit signs in response to weather or traffic conditions.

Incident Management reduces the congestion and safety hazards associated with traffic incidents. Traffic can be monitored with sensors and video cameras so that any incidents are quickly detected. The monitoring activities can be automated to reduce cost and manpower requirements. The use of data recording and communication technologies allows the scene to be cleared with minimum delay. Incident management technology and practices can also be applied to many maintenance and construction activities. Communication technology can be used to alert motorists so that they can avoid the area or be prepared for delays. If an incident or construction activity makes closing the road necessary, traffic can be quickly diverted to pre-planned detour routes.

Emergency Vehicle Management reduces the reaction time of emergency services. It is often combined with Incident Management. Traffic signal priority or preempting can help reduce travel times for emergency vehicles. The vehicles can be equipped with automatic vehicle location devices so that dispatchers always know the exact location of each vehicle. Communication and cooperation between agencies allows the nearest vehicle to be dispatched to the scene. The vehicles can also be equipped with route guidance systems which indicate the most direct route to an incident site. A video camera system mounted on emergency vehicles could be linked to the dispatching center to provide real-time information. The time saved with these technologies can be very valuable when treating injuries.

Highway Rail Intersection technologies increase the safety of at-grade rail crossings. Approaching trains can be detected by radar, GPS tracking devices, or existing track sensors. Sensors can detect vehicles stopped on the track and alert train operators. Existing warning signals can be supplemented with variable message signs which indicate the number of trains, direction of approach, and which track is being used. The information could also be displayed by in-vehicle information systems.

6.1.4.4 Advanced Public Transportation Systems

Public transit systems are key elements of a rural transportation system. Improving these systems leads to increased mobility for rural residents. The transit related user services that can be applied to rural Kentucky are:

Public Transportation Management
En-Route Transit Information
Personalized Public Transit
Public travel security

Public Transportation Management improves the efficiency of a transit operation by automating many planning and operations functions. Computer software monitors vehicle status to detect and correct schedule deviations. Data is collected from vehicles, routes, and passengers to enable managers to make better operations and maintenance decisions and optimize route scheduling.

En-Route Transit Information makes information available to people using public transportation. Information about incidents, traffic conditions, and route or schedule changes is given to travelers while they are using the transportation system. The travelers can be informed through radio broadcasts, in-vehicle announcements, and kiosks at rest areas and bus stations. The informed travelers would be able to change routes or schedules to avoid congestion and delays.

Personalized Public Transit allows a transit system to be more flexible and provide better service to travelers. Rather than following fixed routes, vehicles can be dispatched to meet traveler's needs. Customers would be able to call a dispatching center requesting a ride to a specific location. Route optimization software is used each day to allow the vehicle fleet to efficiently provide the requested service. Factors such as requested pick-up times, travel times, allowable time variations, vehicle capacity, and driver shifts are considered in the scheduling process. The fleet can be equipped with automatic vehicle location equipment so that the dispatcher can track the vehicles and modify routes to accommodate new requests throughout the day. The technology can be applied to conventional transit systems by allowing vehicles to make minor deviations from a fixed route. This type of service is more convenient than traditional transit systems.

Public Travel Security provides a safe environment for transit users. Vehicles, stations, bus stops, and parking areas can be monitored remotely through audio or video signals. This allows alarms to be activated when necessary, and police or other officials can immediately be alerted to any safety problems. The increased level of safety benefits both operators and passengers.

6.1.4.5 Advanced Vehicle Control Systems

Advanced Vehicle Control Systems is one of the most technology-intensive areas of ITS. More research will be needed before many of these technologies can be applied. The user services that can be feasiblely applied to rural Kentucky are:

Longitudinal Collision Avoidance
Lateral Collision Avoidance

Longitudinal Collision Avoidance prevents accidents by detecting objects in front of or behind a vehicle. Lateral Collision Avoidance detects objects near the side of a vehicle. These systems are usually deployed together, often using radar technology, to detect pedestrians or other vehicles. The driver will receive a visual warning and often an audible alert when an object is detected near the vehicle. Some systems can also activate the brakes to help avoid a collision. A collision avoidance system is especially effective on trucks or buses that have large "blind spot" areas.

6.1.5 Recommended Applications and Technologies

The previous section discussed technology from each functional area that could be applied to rural areas. This section identifies the applications and technologies that are most suitable for immediate use in Kentucky.

6.1.5.1 Advanced Traveler Information Systems

En-Route Driver Information is useful in rural areas. Valuable information can be made available to travelers through expanded use of variable message signs and kiosks. Kentucky is acquiring variable messages signs by retaining the signs used on construction projects for use in other applications. Kentucky is currently providing pre-trip traveler information through a toll free telephone number (1-800-4KY-ROAD) and electronic message displays in rest areas. An interactive system accessed by internet or telephone should be established to improve access to pre-trip information and ride matching services for rural travelers.

The RWIS should be expanded to provide valuable information for travelers and maintenance personnel. Route guidance systems are useful for rural travelers and are being developed and marketed commercially. Emergency notification systems which can significantly reduce emergency response times in remote areas are also being commercially developed.

6.1.5.2 Commercial Vehicle Operations

Most of the technology associated with Commercial Vehicle Electronic Clearance is already being applied in Kentucky. Transponders and mainline weigh-in-motion sensors are in use along Interstate 75. These systems should be expanded to other highways in Kentucky.

Automated Roadside Safety Inspections technology does not require extensive infrastructure and should be used in areas that are not covered by permanent weigh stations. The information data base of Hazardous Material Incident Response would be useful on the state level, but would be more effective if deployed nationally. Freight Mobility technologies should be implemented by the private sector.

6.1.5.3 Advanced Traffic Management Systems

The use of cellular technology to activate signs should be implemented, especially in remote rural areas. The use of sensors and variable message signs at rail crossings to increase safety should be considered at locations which have multiple tracks and the possibility of more than one train at the crossing at the same time.

Incident Management technologies should be implemented because most rural highways have few alternate routes. Clearing the scene promptly is often the only way to keep traffic moving. Although the small size of many rural emergency services makes many Emergency Vehicle Management technologies impractical, route guidance systems would be very useful in a rural setting.

6.1.5.4 Advanced Public Transportation Systems

The technology of Personalized Public Transit can be very useful for reducing the accessibility problems associated with many parts of rural Kentucky, and should be implemented in areas with a population insufficient to support a conventional transit system. The in-vehicle technologies that are part of Public Travel Security and En-Route Transit Information should be included in this type of transit system.

6.1.5.5 Advanced Vehicle Control Systems

The vehicle detection technologies of a collision avoidance system can be a valuable safety improvement. The warning system should be used on school buses to allow safer driving and to protect children that the driver may not see. This technology is being developed by private industry for use with all types of vehicles.

[1] National ITS Program Plan; Vol. I; ITS America; Washington, D.C.; March 1995.

6.2 ADVANCED TRAVELER INFORMATION SYSTEMS (ATIS)

6.2.1 Mission Statement

To improve the efficiency and safety of the transportation system by providing motorists with a variety of information allowing them to make intelligent decisions concerning their route and mode of transportation.

6.2.2 A Vision for Traveler Information in 2020

Kentucky's transportation system has experienced some significant changes since the turn of the century. Perhaps the most noticeable changes have evolved due to the rapid growth in available information to motorists around the state. Information to aid in route choice, mode choice, and emergency response may be accessed en-route or prior to trips and is available to both tourists and residents.

With the creation of a statewide information network, including the integration of traffic management systems in Louisville, Lexington, and Northern Kentucky, transportation data is provided to travelers throughout the state. Real-time traffic data is collected at a statewide traffic center and disseminated to motorists while en-route through highway infrastructure and in-vehicle communication technology. The network also provides drivers with specific guidance on detour routes.

Using the state's Traffic Internet Page, motorists may make route and mode choices before leaving for their destination. Interactive maps pinpoint trouble spots, estimate clearance times, and suggest detours. The region's comprehensive information network also utilizes other devices, including television, AM/FM radio, and a 24-hour telephone line to communicate traffic news to potential travelers.

Transit has become more convenient and simpler to use, providing an attractive alternative for some motorists. Real-time information about arrival and departure times may be obtained at transit stops or at the home or office from a computer. Transit systems track their riders more closely through the use of electronic payment systems, allowing them to optimize their routes for better utilization.

To aid in emergency response, detailed reference markers have been added to all of Kentucky's interstates and major rural highways. Emergency response vehicles equipped with automatic tracking technology allow dispatchers to know the exact location of all available units. All new cars are equipped with communication devices allowing both manual and automatic reporting of emergency situations. Improvements to roadway signs, emergency vehicles, and automobiles have reduced the response time to accidents and have resulted in saved lives in both urban and rural areas.

Kentucky has also enjoyed increased tourism revenues, as more tourists take advantage of the amenities the state has to offer. Electronic pre-trip travel information and new tourist related signs are allowing the state's visitors to enjoy the scenic countryside of Kentucky. The state has also established electronic information booths at welcome centers, airports, transit stops, hotels, and even busy street corners. These information booths give specific directions to and information on hotels, restaurants, and tourist attractions around the state.

Tourists and residents have seen the benefits of making traveler information accessible to the public. The surge of information to travelers has given Kentucky one of the most efficient transportation systems in the country and made the state one of the most enjoyable places to live and visit.

6.2.3 ATIS Goals

The following goals were established and prioritized for ATIS based on the transportation issues facing motorists in Kentucky.

I. Reduce traffic congestion resulting from construction projects, roadway hazards, and adverse weather conditions by improving traveler awareness of these situations.

Congestion and construction management and the advanced warning of roadway events/conditions were considered the most critical issues in Kentucky concerning traveler information. By providing accurate and timely information, motorists can avoid these roadway situations.

II. Improve the response time and increase the availability of emergency services.

Officials in Kentucky would like to make improvements in the detection and management of incidents. Another issue is the minimal number of emergency response teams available. By using tracking technology, emergency response vehicles can be used more efficiently and respond more quickly to incidents, possibly reducing the severity of injuries.

III. Enhance traffic information and management services by integrating them on a regional basis.

Kentucky's current traffic management systems are a great strength for motorists in those areas. By integrating the Lexington, Louisville and northern Kentucky systems, travel can be simplified not only within those cities, but among those cities. Areas in eastern and western Kentucky should also be included in such a system to provide complete traffic information for all Kentuckians.

IV. Increase the attractiveness of public transit through the use of better transit information systems.

Another big issue facing Kentucky is the lack of an efficient transit system. Very few Kentuckians see public transit as a viable option to driving their automobile. Providing accurate and real-time information about the transit system will make it more attractive to the public. The increased use of transit may reduce demand and decrease congestion.

V. Increase tourism travel in Kentucky through better dissemination of information.

Many of Kentucky's tourist attractions are in remote settings. Without proper travel information, some areas may not be easily accessed. By making this tourist information available, more people can enjoy the amenities the state has to offer. This will mean increased revenues for the state and its businesses.

VI. Improve driver performance through the use of traveler information systems.

By providing traffic information to motorists, they can avoid congestion and delays. This will allow them to better concentrate on driving; therefore improving performance. This may lead to fewer accidents and less congestion.

6.2.4 Potential Applications and Technologies

Pre-Trip Information - used to inform motorists of roadway conditions or events, traveler services or ride matching opportunities before their trip, allowing them to make changes in their route and/or schedule. This information may be provided at home, in the office, on busy street corners, or in other public areas (i.e., airport, welcome centers). Currently, this type of information may be provided through telephone advisory systems or over the Internet, radio or television. There are also hand-held systems and kiosks that can provide specific information to users.

En-Route Information - used to inform motorists who are already en-route. This allows motorists to become aware of recent incidents or conditions that may cause delay to their trip. En-route information may be provided along the roadside or within the vehicle. General traffic, highway rail intersection, weather or emergency information may be communicated to drivers using variable messages signs, highway advisory radio, or radio rebroadcast systems. Traveler services information, such as the location of gas stations, restaurants, or hospitals may be provided by roadside signs. To help emergency response teams to better locate accidents or stranded motorists, detailed reference markers may be used. There are also systems that can provide near real-time traffic information and roadway sign information directly inside the vehicle. A cell phone or radio may also be used to obtain traffic information within the vehicle.

Route Guidance - used to help guide motorists to their destination. This in-vehicle system may provide maps and written directions for specific trips, as provided by the user. Using Geographical Information Systems (GIS) and Global Positioning Systems (GPS), emergency vehicles can be tracked, allowing dispatchers to send the closest vehicle to the scene of an accident.

Transit Information - used to improve the transit system by providing information to both transit users and providers. Transit users need information concerning arrival times, departure times and cost prior to and during their trips. Specific transit information may be provided through electronic message boards at transit stops or through Internet access. Telephone systems or transportation television stations may also provide this information. Transit providers need information that will help them better serve their customers. By using electronic payment systems, such as smart cards, providers can improve their service.

In-Vehicle Safety Systems - used within the vehicle to improve safety for the driver and all the passengers. Mayday systems provide a communication link between motorists and emergency personnel. Notification of an emergency may be sent automatically, upon the event of an accident, or manually by someone in the vehicle. These systems may also allow emergency personnel to communicate with occupants of the vehicle to determine the nature of the emergency. Sensors may be used to detect potential problems with the vehicle or driver.

6.2.5 Recommendations for Deployment

From the previously mentioned ATIS goals, a list of appropriate technologies (or systems) for Kentucky have been developed. These applications are recommended for deployment to implement the vision for ATIS in Kentucky. Full project descriptions can be found in Appendix D (not inserted yet).

Pre-Trip Information
Telephone Advisory System
Statewide Traffic Information System
Traffic Internet Page
Kiosks
Radio and Television Broadcast Systems

En-Route Information
Variable Message Signs
Highway Advisory Radio
Radio Broadcast Systems
Rebroadcast Systems

Traveler Services Signs
Detailed Reference Markers

Route Guidance
Vehicle Location/Dispatching Systems (Public Vehicle applications)

Transit Information
Electronic Message Boards
Transit Internet Page
Telephone Advisory System (Transit Application)
Statewide Traffic Information System (Transit Application)

In-Vehicle Safety Systems
Sensing Systems (Public Vehicle Applications)

(Technologies and applications will be replaced with project information after the development of the ATIS Business Plan.)

6.3 COMMERCIAL VEHICLE OPERATIONS

6.3.1 Mission Statement

To engage in the enforcement of motor carrier safety and regulatory laws in a manner which maximizes public safety while enhancing motor carrier efficiencies to promote commerce in Kentucky and the nation.

6.3.2 A Vision for Commercial Vehicle Operations in 2007

The processes of documenting and assuring the safe operation of commercial vehicles in Kentucky has shown dramatic improvement over the past several years. A streamlined process has been designed and installed, demonstrating Kentucky's ongoing leadership from that landmark success with Advantage I-75 near the end of the 20th Century. Now, secure and accurate electronic information allows commercial vehicle operations to proceed without the burden of paper documents.

The new information technology systems enhance safety, efficiency, and productivity providing numerous benefits to both government and industry. Unsafe and illegal operations have been effectively eliminated and an incentive-driven process of continuous performance improvement exists. Commercial vehicle operations also benefit from the many integrated improvements made as part of the North American Intelligent Transportation System initiative – especially the traveler information and hazard warning capabilities that have been fully deployed by Kentucky.

And most remarkably, this was done in an environment of cost-reduction for both government and industry. These systems, which now assure greater over-the-road transportation productivity, have been built as a service to industry. No new taxes or surcharges were placed on the industry. Efficient technology goods and services have been developed by the private-sector largely because of the open systems and modular architecture standards that were championed by Kentucky in the national arena.

The success of Kentucky's approach has been attributed to its relentless pursuit of process improvement and enabling technologies—carriers and states working together to produce significant improvements for commercial vehicle operations supported by the research and development capabilities of industry and university.

6.3.3 CVO Goals

Building on several team work sessions with a strong representation of the commercial vehicle operations community, the following set of long-term goals were established. They represent the specific problem areas to which subsequent programs and individual projects will be addressed.

I. Improve and streamline CVO

The first vision element enables Kentucky to pursue opportunities in establishing a systematic and uniform direction for CVO. Such improvements will make tax and other CVO application processes quicker and easier for both the applicant and the administrator. This vision element also provides the opportunity to use higher forms of technology in improving CVO. Streamlined CVO using higher forms of technology should help reduce roadside delays for commercial vehicle operators and enforcement personnel. It is anticipated that improved and streamlined CVO will improve Kentucky's image as a proactive, technologically advanced and customer-driven state.

Kentucky believes that improving and streamlining CVO are necessary in order to address increased commercial vehicle traffic on the Commonwealth's roadways. While better and more efficient CVO present Kentucky with the chance to improve its image, it should be noted that process reengineering will not compromise the State's highway safety mission.

II. Continuation of Kentucky's Leadership Role in ITS/CVO

By continuing its leadership role in ITS/CVO, Kentucky stands to improve its image as a technologically advanced and customer-driven state. By focusing enforcement efforts on unsafe and non-compliant carriers, the state may create a more fair and equitable environment for commercial vehicle operations and help eliminate any industry perception that Kentucky is a regulatory "unfriendly" state. As a leader in ITS/CVO, Kentucky also has the opportunity to improve industry awareness of highway safety issues and motor carrier safety and economic regulations.

Through this leadership role, the Commonwealth also positions itself positively to address funding challenges. Kentucky believes its ITS/CVO leadership role will directly enhance its ability to conduct commercial vehicle enforcement in an effective and efficient manner, and continue to ensure full Federal compliance and enjoy Federal support.

III. Conduct Paperless CVO Operations with Timely, Current, Accurate and Verifiable Electronic Information, while Maintaining Security and Privacy

One of the primary opportunities of Kentucky's ITS/CVO initiative, the conduct of electronic CVO operations allows the State to use technology in higher capacity. This will help improve the current CVO application processes. Furthermore, the development of this "paperless" application environment will help ensure a systematic and uniform direction for CVO application processes. The electronic application processes will provide "real time" carrier economic regulatory and credentialing data which, coupled with timely carrier safety data, will assist enforcement personnel in targeting carriers which pose a high safety risk on the Commonwealth's roadways.

Conducting paperless CVO which emphasizes timely, current, accurate and verifiable electronic information is attractive because it will allow administrators to effectively and efficiently process the ever-increasing volume of carriers moving through Kentucky. The data gathered will help the Transportation Cabinet collect additional tax revenues and help reduce damage to the Commonwealth's highway infrastructure.

IV. Enhance CVO Productivity, Safety and Efficiency by Eliminating Unsafe and Illegal Operations and Providing Incentives for Improved Performance

Kentucky envisions an operational environment that emphasizes the detecting of motor carriers found operating in an unsafe and/or illegal manner. Conversely, safe carriers will see the amount of time spent in weigh station queues and inspection facilities reduced, saving the carrier money. By reducing unsafe and/or illegal carriers, the Commonwealth will reduce CMV-related crash costs and infrastructure damage.

It is anticipated that these process refinements address the opportunities to use technology in a higher capacity to target high-risk carriers, while also improving industry awareness of highway safety issues and motor carrier safety regulations. Furthermore, by enhancing CVO productivity, safety and efficiency, Kentucky stands to improve its image as a customer-oriented, safety-based state. Similarly, this will also promote just-in-time logistics, which is critical for attracting high-value manufacturing jobs. This may provide a climate suitable to increasing the state's motor carrier base.

V. Integrate and Coordinate ITS Operations and Empower Kentucky

Empower Kentucky has produced the changed environment supportive of ITS/CVO deployment. Uniform system direction relies on coordination, and a thorough integration of processes necessary to fully realize a paperless environment, speeding up the slow application process. Targeting high-risk carriers demands accurate and timely information from a variety of sources be shared in a coordinated manner, so that mission safety is not compromised. The higher use of technology can emerge in an environment where all parties understand its role and usefulness. Successful implementations that reduce paperwork and enforcement costs for carriers encourage all segments of the enforcement community to act in concert to reward safe carriers which will then improve the image externally of Kentucky and it will not be considered unfriendly by carriers.

Having a coherent plan for the implementation of improvements avoids complicated and competing funding issues for complementary ITS initiatives, and each implementation leverages the resources invested in all other implementations. External grant applications are easier to generate when the overall logic and role of each component is fully understood and rationalized. The Empower Kentucky charge to avoid lost taxes makes Intelligent Transportation Systems truly "intelligent", and focuses deployment on the need to lower crash costs and infrastructure damage.

VI. Create a CVO System that is Self-sufficient, Uses Multiple Vendors, and is User Friendly

This vision is important for the long-term health of Kentucky's ITS-CVO community. To maintain a uniform system direction, Kentucky must be able to control and modify its processes and the accompanying technologies at will. By being able to draw on multiple vendors in addition to its own expertise, Kentucky can choose processes that optimize user friendliness, improving its image with the carrier base. This should increase the carrier base, reducing the demand on redundant legacy systems. Increased participation in a faster process then minimizes both slow application process and roadside delays for carriers. Kentucky can reduce costs by having options for each process, relieving some of the funding issues with new projects.

6.3.4 Potential Applications and Technologies

Deskside Operations

These are technologies used to automate and streamline the process of credentialing for CVO. This includes such functions as interstate fuel tax allocations (IFTA), international registration allocations (IRP), single-state operating authority (SSI), and oversize/overdimensional permits (OS/OD). These technologies generally take the form of a computer interface that provides a "one-stop" way for a carrier to obtain multiple kinds of credentials without re-submitting the same information repeatedly. The interface may take the form of a software installed on the carrier's PC that connects to the state's systems via modem, or a web-based interface resident on the state's side, that can be accessed by the carrier using only a standard type of web browser.

On the state side, the effective provision of these technologies requires the integration of the information systems for the various disparate functions, which may be administratively and physically distant from each other. Thus, much of the "technology" is hidden from the carrier, but is vitally important to the successful deployment of deskside CVO technologies.

Roadside Operations

These technologies are generally used by the public sector to streamline and improve the quality of roadside safety, weight and credentialing compliance. The basic strategy is to use electronic transponders within each vehicle to transmit the vehicle identification number to enforcement readers. At the same time, the vehicle may be weighed by weigh-in-motion scales to verify weight compliance. The identification number can then be referenced against safety and credentialing databases to verify past safety and credentialing performance. This information, in combination with the enforcement officer's training, will assist in focusing attention on unsafe and illegal operations.

Safety Information Systems

These systems generally support the roadside operations reviewed above. They represent the technologies for collecting, managing, and providing the safety information used in focusing enforcement efforts. Generally the systems are used to electronically collect safety inspection information, transmit it to a central database for building a statistical rating, retransmit that rating back to inspection officers, and also provide credentialing information to the officers.

Carrier Systems

This is generally used to refer to the private-sector side of CVO technologies. Because of the close integration of the technologies, however, carrier systems can be thought of as subsets of the three above areas. Carrier transponders integrate closely with the readers operated by the state, and the credentialing interface may exist completely on state systems as a web-based system.

6.3.5 Recommendations for Deployment

Consistent with the goals of Kentucky's ITS-CVO community, a set of current and proposed projects follow that this plan recommends be pursued to fully implement the vision for the Commonwealth. Full project descriptions can be found in Appendix D.

Deskside Operations
Registration, Taxation, And Permitting Improvements
Institutional Issues Working Group
Mini-CVO IRP Joint State Test

Roadside Operations
Advantage CVO
Electronic Screening
I-65 Electronic Screening Test
Kentucky-Tennessee Joint Weigh Station Project
MAPS-Advantage CVO Interoperability Agreement
Infra-red Brake Testing Technology

Safety Information Systems
Safety Information Systems

7.0 ITS STRATEGIC PLAN IMPLEMENTATION

7.1 PRIORITY OF USER SERVICES AND APPLICABLE TECHNOLOGIES

From the large array of ITS user services, there are some which have significantly more potential for implementation in Kentucky. For example, there are numerous applications already in place as documented in the summary of ITS projects in Kentucky presented in Appendix A of this report. Among those considered most likely for expanded deployment include the various components of Advanced Traffic Management Systems and Advanced Traveler Information Systems. There are several Commercial Vehicle Operations projects in place in Kentucky, making the Kentucky Transportation Cabinet in conjunction with the Kentucky Transportation Center regional and national leaders in the advancement of ITS commercial vehicle projects. ITS projects in rural areas as related to ARTS have significant potential for numerous applications and many of the ITS user services appear to cross the functional areas of ATMS, ATIS, APTS, and CVO. There are also limited applications of Advanced Vehicle Control Systems which are being used to improve vehicular safety.

The applicable technologies include the systems associated with traffic management and traveler information such as variable message signs, highway advisory radio, video monitoring, RWIS, and various technologies which disseminate information to travelers. There appears to be nearly unlimited potential for applications of various forms of communication technologies to link the driver, vehicle and roadway in ways to improve the safety and operation of the highway system. Transmission of information through the capabilities of fiber optics and cellular telephone systems is expanding at a rapid pace and appears to be limited only by the available infrastructure. Commercial Vehicle Operations are being optimized through the uses of automatic vehicle identification, weigh-in-motion, and other technologies which permit the electronic transfer and verification of safety, registration, and other credentials information. ARTS is broad-based in potential applications and incorporates technologies from most other functional areas of ITS. Specific applications of technology for consideration in rural areas include the following: 1) location and vehicle management systems for public transportation; 2) pre-clearance technologies for commercial vehicles; 3) various forms of measurement, monitoring, and communications equipment for traffic management systems; 4) en-route information for rural travelers related to weather data and tourist travel, and 5) applications of sensing and warning/communication devices at selected locations with high potential for accidents and resulting congestion.

The previously described areas of ITS which appear to have high potential for implementation serve to indicate that the ITS concept will impact a wide range of areas sufficient to gain the support of highway agencies and other decision-makers. This is not intended to be an action plan; however, another section of the Strategic Plan documentation will address the need to outline specific projects which have the greatest potential for implementation. A business plan will be prepared in conjunction with representatives of the Kentucky Transportation Cabinet to identify the highest priority technologies and applications.

7.2 PLAN REVISIONS AND UPDATE

It is anticipated that this ITS Strategic Plan will be the type of document which can and will be updated frequently. As noted in previous sections, this version of the Strategic Plan includes three (ARTS, ATIS, CVO) of the six functional areas of ITS; with the remaining three (ATMS, AVCS, APTS) not expected to be completed until June 1999. The ITS Strategic Plan Advisory Committee will be a participant in the update process through biannual meetings and interactions with the Kentucky Transportation Center staff responsible for the Plan. While a definitive schedule is not in place for revising and updating the Plan, it is proposed that when an organizational structure is established, a permanent and formalized Advisory Committee will be assigned responsibilities for continued attention to the Strategic Plan. Efforts will be made to insure that the Business Plan section of the ITS Strategic Plan is compatible with the Kentucky Transportation Cabinet's Six Year Plan of proposed projects. The Strategic Plan will also be prepared and updated consistent with KyTC's existing vision and goals, and those currently being established through the activities associated with Empower Kentucky. There are technology issues and projects being initiated through Empower Kentucky which have potential impact and influence on existing and planned ITS applications.

8.0 ITS PUBLIC RELATIONS/MARKETING

The success of any new concept, whether it be in transportation or another field is somewhat dependent upon the amount of useful information which is made available to those in a position to influence the outcome of the concept. ITS is a new concept and traditional transportation approaches may not be appropriate and acceptable to guarantee that full success and implementation is achieved. The national organizations promoting ITS have made significant progress in the development of marketing tools to improve the overall knowledge level of participants in the various projects and evolving technologies. Program development and funding support for ITS has received nearly unprecedented attention from the leadership positions in Federal agencies. Consultants and contractors have embraced the ITS concept, as well as most state and many highway agencies. Excellent videotape presentations of the ITS concept and the technologies available for implementation are available. National meetings have been held to share ITS technologies and applications.

Kentucky has shared much of the early success of ITS and has been recognized as a national leader in the area of Commercial Vehicle Operations. The ARTIMIS project in northern Kentucky and Cincinnati has achieved national attention with accomplishments in the areas of Advanced Traffic Management Systems and traveler information. Lexington has been identified as a model for applications of advancements in traffic management for small to medium sized cities. These and other successes have offered adequate opportunities to promote and market ITS. The focus group sessions used to solicit ideas from participants during the first phase of the ITS Strategic Plan development process were found to be beneficial. It is expected that additional focus group sessions will be used in the second phase of the Strategic Plan development. Other forums for solicitation of ideas for inclusion in the Strategic Plan should be considered for short and long range updates to the Plan.

It will be important to identify actions to emphasize the importance of ITS and to develop a formalized plan for promoting ITS. Available opportunities to discuss the role of ITS in the development of current and future transportation initiatives to improve safety and travel efficiency should be aggressively pursued. A brochure developed to outline the types of ITS projects existing in Kentucky will be distributed to interested parties within and outside Kentucky. A presentation will be developed to promote the concept of strategic planning for ITS. This will include a packaged presentation of slides or computer-generated graphics which will be available to Transportation Center or Transportation Cabinet employees to use when attending national local or national meetings where opportunities exist for promoting the ITS concept. The organization structure selected to identify the roles and responsibilities of ITS participants will influence many of the directions related to public relations and marketing. Roles to be assumed by the Transportation Cabinet and the Transportation Center will need to be identified and clarified, as well as vendors, consultants, and others with interest and/or influence.

9.0 ITS ORGANIZATIONAL STRUCTURE

This section of the plan highlights organizational structure and the roles and responsibilities of various ITS related entities in the Commonwealth. Determining what is the best organizational structure requires an understanding of administrative context, ITS mission, and ITS resources (funds, expertise, time). It is also a matter of management/leadership will (do enough to get by, pursue a leadership position, or something in between). At the core, these issues may rest on the perceived short-term and long-term benefits of ITS in any particular area.

9.0.1 Purpose and Principles

Any organization structure is meant to bring human resources to bear upon a mission. Having the right human resources in the right relationship is the challenge. The major organizational development and management trends at the end of this century include downsizing (or rightsizing, or de-layering), team-based methods, flexibility (or agility), process re-engineering (simplification), and appropriate technology (particularly information technology). Establishing any new organization or component should take these concepts and their potential benefit to resource constrained mission into account. Our purpose here is to propose the best organizational structure in context that maximizes resources in pursuit of the Kentucky ITS mission/vision. The driving principles should include: **simplicity** (of components and process), **team-based methods** (bringing to bear the right human resources in a consensus building environment), **skilled communication** (with maximum use of appropriate information technology), **accountability** (milestone guidance toward mission/vision), and **learning** (knowing its best practices and past mistakes).

9.0.2 Resources and Mission/Vision

Other sections of this plan spell out the strategic direction and the how much and when business aspects of Kentucky's ITS development. It is now clear that efficient ITS development and deployment requires knowledge in <u>five basic areas</u>: **1) subject sector needs** and application environment, **2) appropriate ITS technologies** (sensing, control, and display), **3) information**

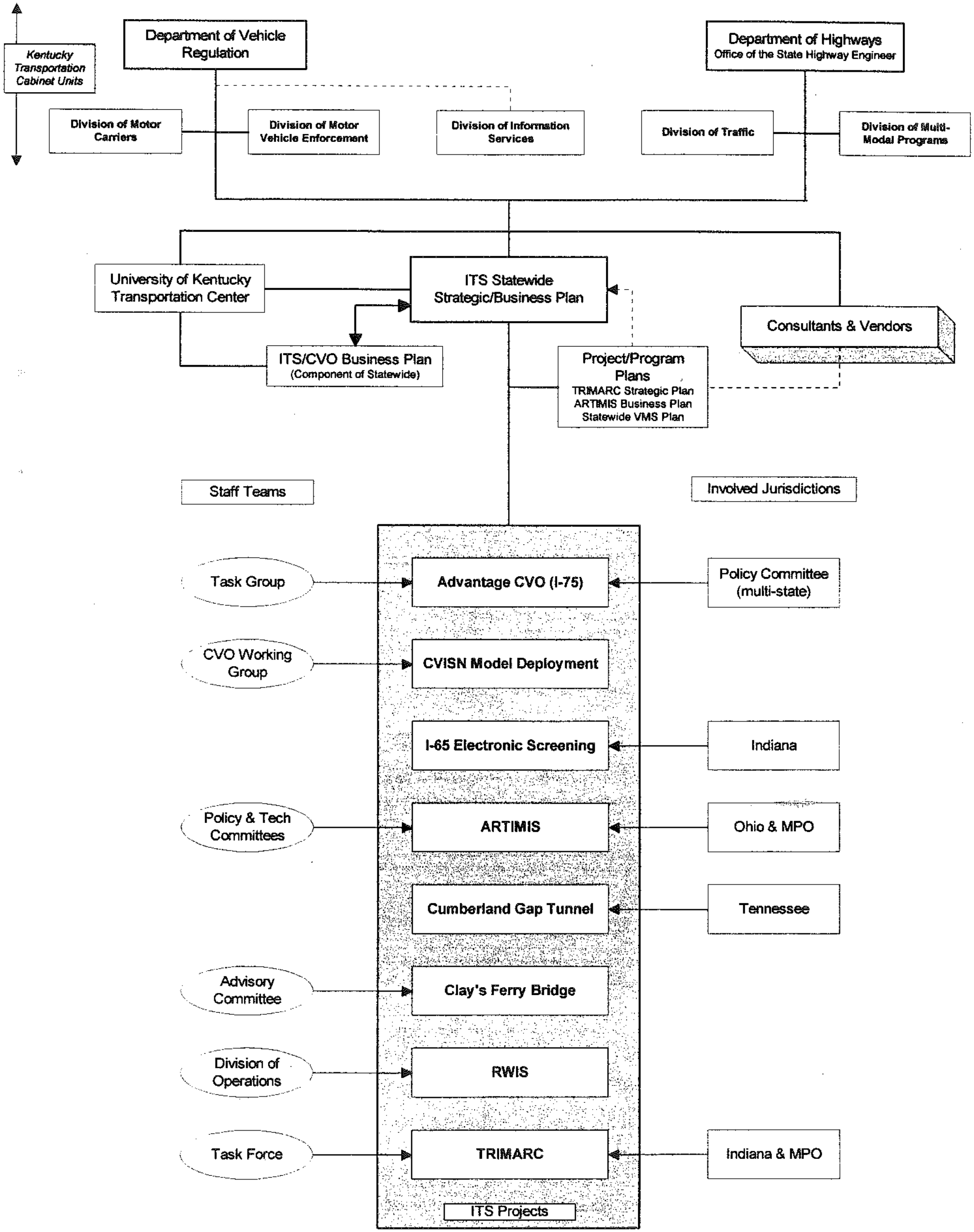
technology (communication and computer processing), **4) systems integration/engineering**, and **5) systems operations** (training, maintenance, etc.). It has been proven for automotive development that the closer you bring the diverse knowledge areas together, working toward an accepted mission, the more effective and efficient is the product. It's probably no different for an ITS development/deployment.

9.0.3 Organizational Considerations

The options for organizational structure range from the existing "structures" which are somewhat disjointed and complex to a more unified focused structure of roles and responsibilities. It should be mentioned that the so called ITS technologies, while currently packaged to be unique, are simply new ways of doing things that are aimed at improving safety and efficiency. These new ways are information technology based, but must be integrated into old highways and old processes. As they become integrated the lines blur and these technologies become just part of doing business in the next century. They will not be treated as unique requiring special development/deployment staffs set aside from everyone else. Just as the Internet has become a part of everyday life for most of us, so will these ITS technologies in transportation agencies. But it requires new expertise for users and some kind of designated support staff. We will have more information technologists on the team and we will have to learn a little more about using these technologies on a regular basis. Ideally the need for a 'separate' ITS staff/organization within or without the Cabinet will in the longer-term diminish. However, if there is a desire to significantly accelerate the development and deployment of ITS technology then a coordinated task focused staff and adequate technical support capability is warranted in the near-term.

The ITS working relationships chart on the next page shows clearly the diversity and complexity that has grown as each ITS project has developed to date. (The projects depicted on the chart are described elsewhere in this plan.) The chart indicates the hierarchy of planning involved: ITS Statewide Strategic/Business Plan; ITS/CVO Business Plan (includes deskside and roadside project initiatives--completed to meet federal guidelines prior to the statewide plan, but is now a component of this statewide plan); and various specialized program or project plans. Within the Kentucky Transportation Cabinet two departments have been primarily involved in ITS which brings several departmental divisions into play. In addition, the Division of Information Services (part of the Department of Administration within the Transportation Cabinet) provides ongoing support for most of the ITS/CVO (Commercial Vehicle Operations) projects. Each project shown is unique in terms of involved jurisdictions (states and MPO's) and designated 'staff' teams that include: committees, groups, task force, and a division. This indicates the unusual amount of diversity of institutional jurisdictions and bureaucratic structures that contribute to the uniqueness of ITS projects.

Kentucky ITS Working Relationships



10.0 APPENDICES

Appendix A.	**ITS Projects in Kentucky**
Appendix B.	**Summary of ITS Issues From Focus Group Meetings**
Appendix C.	**Summary of Results From Survey of ITS Activities in Other States**
Appendix D.	**Business Plan for ITS-CVO Projects in Kentucky**

10.1 APPENDIX A

ITS PROJECTS IN KENTUCKY

This appendix includes a summarization of the ten ITS-related projects on-going or in development in Kentucky. Those ten projects include: Advantage CVO, I-65 Electronic Screening, CVISN Model Deployment, Alliance for Commercial Vehicle Operations (Mainstreaming), Advanced Regional Traffic Interactive Management and Information System (ARTIMIS), Lexington Traffic Management Projects, Traffic Response and Incident Management Assisting the River Cities (TRIMARC), Cumberland Gap Tunnel, Condition-Responsive Work Zone Traffic Control System: Clays Ferry Bridge Reconstruction, and the Road Weather Information Systems (RWIS). Information including the responsible agencies, objective, funding arrangement, time frame, physical location, ITS technologies, associated costs, ITS applications, benefits, and the potential for future applications for the projects has been reported if available. Some projects include additional information.

10.1.1 Advantage CVO

Responsible Agencies/Partners

Partners: Federal Highway Administration, the states of Florida, Georgia, Tennessee, Kentucky, Ohio, and Michigan, the province of Ontario, the Canadian Ministry of Transportation, U.S. and Canadian Trucking Associations, and various trucking companies.

Lead Agency: Kentucky Transportation Cabinet
Initial System Design: JHK & Associates
Initial System Integrator: Science Applications International Corporation (SAIC)
AVI Technology and Maintenance: Raytheon (Hughes Transportation Management Systems)
Transponder Suppliers: Raytheon and Mark IV
Weigh-in-Motion Equipment and Maintenance: International Road Dynamics
Enhanced Computer Software Development: TRW
Enhanced System Design and Management of Operations Center: KY Transportation Center

Objective

To reduce congestion, increase efficiency, and enhance the safety of motorists and other users of I-75 using advanced vehicle and highway technologies.

Funding Arrangements[1]

Total Cost (as of July 15, 1997) - $12,154,392

Federal Funds-ITS (70%) - $8,550,511
State Funds (17%)
Kentucky - $410,190

Georgia - $393,845
Florida - $378,627
Michigan - $318,478
Tennessee - $271,830
Ohio - $255,578
Ontario Funds (5%) - $625,333
Private Funds - SAIC (8%) - $950,000

(The participating states and Ontario are providing funding in the amount of $800,000 for an additional year (October 1, 1997 - September 30, 1998). The funding arrangement for each jurisdiction is dependent on the number of sites and the presence of weigh-in-motion equipment.)

Time Frame for Project

Concept conference: June 1990
Operational Test Begins: October 1, 1995
Operational Test Ends: September 30, 1997

Physical Location of Project

All weigh stations along the I-75 corridor from Charlotte County, Florida to Monroe County, Michigan and seven weigh stations on Canadian Highway 401

Charlotte, FL - NB
Charlotte, FL - SB
Marion, FL - NB
Marion, FL - SB
Hamilton, FL - NB
Hamilton, FL - SB
Lowndes, GA - NB
Lowndes, GA - SB
Monroe, GA - NB
Monroe, GA - SB
Catoosa, GA - NB
Catoosa, GA - SB
Knoxville, TN - NB
Knoxville, TN - SB
Laurel, KY - NB
Laurel, KY - SB
Scott, KY - NB
Kenton, KY - SB
Hancock, OH - SB
Wood, OH - NB
Monroe, MI - NB
Monroe, MI - SB
Windsor, CAN. - EB
Windsor, CAN. - WB
Putnam, CAN. - EB
Putnam, CAN. - WB
Trafalgar, CAN. - EB
Trafalgar, CAN. - WB
Whitby, CAN. - EB

ITS Technologies

Transponder - a two-way radio communication device installed on the windshield of the truck that notifies the driver of bypass or pull-in status with a green (bypass) or red (pull-in) light and a corresponding audible tone. The transponder contains identifying information about the truck along with data obtained from the previous weight station and/or data from the weigh-in-motion (WIM) scale, if available.

Advanced AVI Reader - a roadside antenna approximately ½ mile before the weigh station ramp that reads the data on the truck's transponder. The reader makes a clearance decision based upon the available information and communicates it back to the transponder.

Compliance AVI Reader - a roadside antenna past the weigh station ramp and within sight of the weigh station building that works with in-pavement truck detectors to determine compliance with the system. If an unauthorized truck bypasses the weigh station, an alarm is sounded within the weigh station building.

Ramp AVI Reader - a rampside (entrance) antenna that reads the truck's transponder data and correlates it with data from the ramp WIM. The reader writes the correlated weight data to the trucks's transponder.

Exit AVI Reader - a rampside (exit) antenna that records available information to the transponder for use at downstream weigh stations.

Truck Detectors - located in the pavement at the compliance reader. They detect the passage of a truck, and communicate this information to the compliance reader.

Mainline WIM Scale - an in-pavement scale located on the mainline just prior to the advanced AVI reader that weighs trucks at highway speeds. The mainline WIM transmits the weight data to the advanced AVI reader, to be used in the clearance decision.

Ramp WIM Scale - an in-pavement scale located on the weigh station entrance ramp just prior to the ramp AVI reader that weighs trucks at slightly less than highway speeds. The information from the ramp WIM is transmitted to the ramp AVI reader.

Host Computer - a computer located inside the weigh station that controls the system and provides an interface to the system for enforcement personnel.

Gateway Computer - a computer located in the I-75 Operations Center that receives information from all 29 weigh stations along the corridor. The computer collects and maintains AVI reader obtained vehicle data and system statistics while distributing carrier enrollment information.

ITS Applications

Functional Areas:

Commercial Vehicle Operations
Advanced Rural Transportation Systems

User Services:

Commercial Vehicle Operations

Commercial Vehicle Electronic Clearance

Costs[1]

Weigh Station Equipment - $2,268,552

Readers, detectors, transponders, etc.

Mainline WIM - $204,437

Host Computers (22) - $302,485

Gateway Computer - $97,572

Benefits

The primary benefit from this project is expected to be increased productivity for carriers. Less waiting time at weigh stations should also mean more reliable, on-time deliveries, directly translating into cost savings for the carrier and the consumer.

Accelerating and decelerating with traffic can be dangerous for motorists. With fewer trucks needing to stop at the weigh stations, the highways can be safer for all drivers. This should also result in improved fuel economy and reduced exhaust emission.

Advantage CVO (formerly Advantage I-75) can be very beneficial for enforcement personnel also. With this electronic screening program, officers can monitor vehicles on the mainline and have the confidence that only safe and legal trucks are bypassing the weigh station. This makes the weigh stations less congested and allows officers to pay closer attention to the more problematic or questionable carriers.

Those carriers currently enrolled in the Advantage CVO project only represent a very small portion of all trucks traveling I-75. Enrollment of an additional 15,000 carriers is expected to begin immediately, with hopes of expanding to 50,000 or more trucks enrolled in the near future. This project also has the potential to grow geographically, with many states already interested in the technology. An interoperability agreement has been established with the Multi-jurisdictional Automated Preclearance System (MAPS) states on the west coast. This agreement allows vehicles in the Advantage CVO program to use their transponder on other roadways in Oregon, Washington, Idaho, and Utah. With more carriers involved and the system expanded on various highways, benefits can be expected to increase for the carriers, public, and participating state governments.

Potential for Future Applications

There are also potential system enhancements that exist. Truck drivers may purchase a transponder with an interface, allowing it to be connected to an onboard display screen to provide the driver with important traveler information. Also with the transponder, trucks carrying hazardous materials could be more easily tracked, ensuring the quickest possible response to accidents. There is also the possibility that tax data could be collected for the states through this system. The data would be more accurate, and the collection would be less of a burden for carriers. Although all permitted trucks (oversize and/or overweight trucks with a permit) are now required to pull-in to every weigh station, Advantage CVO will soon allow these trucks to be monitored electronically on

the I-75 corridor. Also in the near future, the partnership plans to use SAFER (Safety and Fitness Electronic Records) to monitor the safety performance of the trucks.

Possible ITS applications in the future include:

Functional Areas:
- Advanced Traffic Management Systems
- Advance Traveler Information Systems

User Services:
- Commercial Vehicle Operations
  - Automated Roadside Safety Inspection
  - On-Board Safety Monitoring
  - Commercial Vehicle Administrative Processes
  - Freight Mobility
- Travel and Transportation Management
  - En-Route Driver Information
  - Route Guidance
  - Incident Management

[1] Walden, Leon. "Advantage I-75 Summary of State Funds Contracted and Spent as of July 15, 1997." Kentucky Transportation Cabinet. July 1997.

10.1.2 I-65 Electronic Screening

Responsible Agencies/Partners

Partners: Federal Highway Administration, Kentucky Transportation Cabinet, Indiana Department of Transportation, and various trucking companies.

Lead Agency: Kentucky Transportation Cabinet
System Design: Kentucky Transportation Center
Computer Software Development: TRW
AVI Technology and Transponder Providers: To be determined

Background

In 1990, a research project entitled, "Evaluation of Electronic Truck Monitoring" began at the Kentucky Transportation Center. Electronic clearance equipment was installed on Interstate-65 in Simpson County, Kentucky at the northbound weigh station. (Automatic vehicle identification (AVI) technology was supplied by Amtech Corporation and weigh-in-motion equipment was supplied by International Road Dynamics.) Bumper mounted transponders were placed on 114 trucks from United Parcel Services and Averitt Express allowing them to bypass the station on the Interstate mainline. The system was evaluated from July 1991 through June of 1993.

A meeting was held among the Kentucky Transportation Cabinet and the Indiana and Tennessee Departments of Transportation in July of 1993 to discuss the expansion of the electronic clearance system. In September of that year, Indiana committed to participate. The project was delayed by significant discussion of interoperability with the I-75 technology, and a proposal for a new system was submitted by Amtech in May of 1996. After revisions and discussions with Amtech related to cost and interoperability issues, the proposal was rejected by the project partners.

This report details the current I-65 electronic clearance project underway in Indiana and Kentucky. The sites are expected to be operational by August of 1998.

Objectives

1. To install and operate a mainline electronic clearance system at three northbound weigh stations on Interstate-65 in Kentucky and Indiana.

2. To demonstrate successful operation of an alternative approach to electronic screening which:
   a. is low in cost and complexity;
   b. utilizes a "stand-alone" approach for each weigh station;
   c. utilizes "quality control" sampling techniques for screening trucks;
   d. incorporates electronic checking of safety and fitness records; and
   e. is interoperable with the Mainline Automated Clearance System on the Interstate-75 corridor.

3. Make the system design and weigh station computer software available to other states that wish to implement electronic screening using the I-65 model.

Estimated Budget

Item	Anticipated Cost
Third-Party Contract Items	
Software development	$50,000
Site preparation (civil, electrical, etc.–assume $20K per site)	$60,000
AVI equipment and installation (assume $50K per site)	$150,000
Host computers and peripherals (assume $6K per site)	$18,000
AVI/Host integration (assume $20K for first site, $5K per add'l site)	$30,000
System maintenance (one year–assume $10K per site)	$30,000
Subtotal third-party contract items	$338,000

Kentucky Transportation Center Items	
System Design and Engineering	$20,000
Project Management and Administration	$10,000
Motor Carrier Enrollment and Marketing	$15,000
System Evaluation	$15,000
Subtotal Kentucky Transportation Center Items	$60,000
TOTAL PROJECT COST	**$398,000**

Funding Arrangements

Total Cost - $398,000
Kentucky (62%) - $247,000
Indiana (38%) - $151,000

The funding arrangement for the two states is based on the estimated cost for the system and the number of sites. (Kentucky will install the equipment at two stations while Indiana will only install at one.)

Time Frame for the Project

Task	Start	Complete
Establish Project and Funding Agreements	9/15/97	3/31/98
Software Development	3/1/98	6/30/98
Select/Procure AVI Technology	3/1/98	6/30/98
Procure Host Computers and Peripherals	5/1/98	6/30/98
Install and Test System at First Site	7/1/98	8/31/98
Install and Test System at Additional Sites	8/1/98	9/30/98

Physical Location of Project

Simpson County, Kentucky
Elizabethtown, Kentucky
Seymour, Indiana

ITS Technologies

Transponder - a two-way radio communication device installed on the windshield of the truck which notifies the driver of bypass or pull-in status with a green (bypass) or red (pull-in) light and a corresponding audible tone. The transponder contains identifying information about the truck.

Advanced AVI Reader - a roadside antenna approximately ½ mile before the weigh station ramp which reads the data on the truck's transponder. The data is sent to the host computer where a clearance decision is made.

Host Computer - a computer located inside the weigh station which controls the system and provides an interface for enforcement personnel. The computer makes a clearance decision based upon information received from the advance reader and available information on the carrier. This decision is then transmitted to the notification reader.

Notification AVI Reader - a roadside antenna just prior to the weigh station ramp which receives the clearance decision from the host computer. The reader then transmits that decision to the truck's transponder.

Compliance AVI Reader - a roadside antenna past the weigh station ramp and within sight of the weigh station building which is used to determine if trucks are compliant with the system. If an unauthorized truck bypasses the weigh station, an alarm is sounded within the weigh station building.

ITS Applications

Functional Areas:
Commercial Vehicle Operations

User Services:
Commercial Vehicle Operations
Commercial Vehicle Electronic Clearance

Benefits

Motor carriers will see the most benefit from this project, but enforcement officials, participating states, and motorists will profit also. Motor carriers will have fewer delays translating to more on-time deliveries and savings for the carrier and possibly the consumer. Idling, and merging in and out of traffic is also costly for companies and can be minimized with the weigh station equipment.

The roadways will be safer with fewer trucks entering and exiting from weigh stations, which means better driving conditions for all motorists. Enforcement officials will be able to spend more time on problematic carriers. If station ramps are full, trucks are permitted to bypass, which allows some violators to avoid inspection. With more transponder-equipped trucks, the stations will be less crowded, and fewer trucks will bypass due to a closed station.

It is estimated that the I-65 technology will only be about 1/3 of the total cost per station of previously installed electronic clearance systems. This significant reduction in cost will allow many other states to begin installing this system. This will lead to greater benefits for the carriers, enforcement officials, participating states, and all motorists.

Potential for Future Applications

The transponders used in this application could potentially be used to communicate traveler information to drivers or to track important or hazardous cargo information. The states could use the transponders as a way to collect information on the carriers for tax purposes. This method of collection would be less of a burden and would produce more accurate information.

The software used and equipment installed at the I-65 sites will be used at other weigh stations around the state and country to install electronic screening systems. Officials in Kentucky hope to install this system at every weigh station in the state (excluding the already equipped I-75 sites).

Possible ITS applications in the future include:

Functional Areas:
- Advanced Traffic Management Systems
- Advanced Traveler Information Systems

User Services:
- Commercial Vehicle Operations
  - Automated Roadside Safety Inspection
  - On-Board Safety Monitoring
  - Commercial Vehicle Administrative Processes
  - Freight Mobility
  - Automated Roadside Safety Inspection
- Travel and Transportation Management
  - En-Route Driver Information
  - Route Guidance
  - Incident Management

10.1.3 CVISN Model Deployment

Responsible Agencies/Partners

Partners: Federal Highway Administration, Kentucky Transportation Cabinet, Department of Vehicle Regulation, Motor Carrier Advisory Committee, and the Motor Coach Advisory Council.

Program Support and Development: Kentucky Transportation Center
Technology Exchange, Training, & Public Relations: Kentucky Transportation Center
Non-System Evaluation: Battelle and Kentucky Transportation Center

Objective

To demonstrate CVISN architecture at a few sites for a portion of the truck and motor coach industry in Kentucky within a two-year period.

Funding Arrangements

Total Cost (FY 1997) - $1,000,000

Federal Funds (50%) - $500,000
State Funds (50%) - $500,000

A number of early successes in the deployment has made it possible for Kentucky to move into a more prominent leadership role among CVISN prototype/pilot states. Accordingly, additional funds have been made available by FHWA. The amount of those funds for fiscal year 1998 and 1999 has not been determined.

Time Frame for Project

Objective	Start	Complete
1. Architecture and Plan	Q4/96	Q2/97
2. CAT(Carrier Automated Transaction) System and IRP (International Registration Plan) Ready	Q3/97	Q4/97
3. CAT and IFTA (International Fuel Tax Agreement) Ready	Q4/97	Q1/98
4. Clearinghouse Connectivity Ready	Q3/98	Q1/99
5. CVIEW(Commercial Vehicle Information Exchange Window)/SAFER(Safety and Fitness Electronic Records)	Q2/98	Q4/98
6. Screening Ops	Q2/98	Q3/98
7. Full CAT Deployment	Q3/98	Q1/99
8. Full Screening Deployment	Q1/99	Q3/99
9. Wrap Up	Q3/99	???

Physical Location of Project

The Kenton County Weigh Station will be where CVISN technologies will be initially prototyped for Kentucky. Other weigh stations on I-75 will have secondary priority, followed by the remaining stations throughout the state. The administrative systems will be located in the Transportation Cabinet offices in Frankfort. Software to be developed for motor carrier use will be tested on site at the selected carrier locations.

ITS Technologies - Deskside

Electronic Submissions of Credential Applications - with the Carrier Automated Transaction (CAT) system, carriers may electronically submit registration and taxation forms. In Kentucky, carriers will be able to register electronically for IRP (International Registration Plan) credentials, IFTA (International Fuel Tax Agreement) credentials, a Kentucky Intrastate Tax license, Kentucky Weight Distance Tax forms, and Single State Registration credentials. Carriers will also be able to apply for various permits including oversize/overweight and special temporary permits. Since this is all done electronically, various checks on credentials may be made before any license or permit is awarded to the carrier. If the carrier has not reported any false information or is not delinquent in any way to any state or organization, then the carrier is approved. Confirmation or rejection is sent to the carrier electronically, or if necessary my mail or fax.

ITS Technologies - Roadside

Electronic Screening (fixed sites) - using the mainline automated clearance system (MACS), carriers will be screened according to available safety information (CVIEW) and/or available weight information. Model MACS will be slightly different from the system used on I-75; safety information will come from the SAFER (Safety and Fitness Electronic Records) database and will allow near real-time information to be used for clearance decisions. Equipment at the weigh stations will include: automatic vehicle identification readers, trucks detectors, a host computer, and weigh-in-motion equipment (optional). The stations may eventually use optical character recognition (OCR) readers (license plate readers) to verify that trucks are not carrying over their registered weight.

Electronic Screening (remote sites) - these unmanned sites are located on bypass routes and remotely operated by the nearby mainline station. Equipment at the site will include video cameras and possibly weigh-in-motion scales. The cameras will video illegal carriers and transmit the image back to weigh station personnel. License plate readers may eventually be used to automatically check registration information on the vehicle and inform weigh station personnel of the license plate number of violating vehicles.

Aspen - a pen-based laptop that offers improved communications between field and administrative personnel. Enforcement officers will put inspection information into the computer and data will be electronically transmitted to Safetynet. From Safetynet, the SAFER database will be updated. The Aspen software also streamlines the process of safety inspections.

ITS Applications

Functional Areas:
- Commercial Vehicle Operations

User Services:
- Commercial Vehicle Operations
  - Commercial Vehicle Electronic Clearance
  - Automated Roadside Safety Inspection
  - Commercial Vehicle Administrative Processes

Costs

Carrier Systems - $38,000
Credentialing Systems - $288,500

Electronic Screening - $338,000
Safety Systems - $61,000

(Costs are approximate for fiscal year 1997.)

Benefits

The CVISN project promises to benefit the commercial vehicle community, state agencies, and the driving public in the various ways:

1. Reduced cost in processing credentials and permits.
2. More timely processing of credentials and permits.
3. More effective safety screening.
4. More effective weight screening.
5. A friendlier, more cooperative environment for the trucking industry.
6. Less congestion.

10.1.4 Alliance for Commercial Vehicle Operations (Mainstreaming)

Responsible Agencies/Partners

Partners: Federal Highway Administration/Office of Motor Carriers; Great Lakes States: Indiana, Michigan (Model Deployment State), Minnesota (Model Deployment State), Ohio, West Virginia, Wisconsin; Southeast States: Georgia, Louisiana, North Carolina, Tennessee, and Virginia (Prototype State).

Lead State: Kentucky
Regional Mainstreaming Champion: Kentucky Transportation Center
Affiliated States: Mississippi, South Carolina

Objective

To maximize the involvement of "participating" states in the Commercial Vehicle Information Systems and Networks (CVISN) program.

As the Lead State, Kentucky is expected to produce or be the catalyst for producing:

Phase I
* ITS/CVO Strategic Business Plan for Kentucky
* Regional Consortiums for the cooperative support of CVISN adoption
* State Strategic Business Plans for CVISN adoption
* Regional Plans coordinating the states' Strategic/Business Plans

Phase II
* Training for ACVO states to enable pursuit of Strategic Business Plans
* Continued support for new ACVO member states

Funding Arrangements

Total Cost - $519,000

Phase I: $329,000
Phase II: $190,000

(Costs are approximate and include the Regional Champion budget only.)

Time Frame for Project

Project Initiation Date: September 15, 1996
Phase I Completion Date: May 31, 1998
Phase II Completion Date: February 28, 1999

Tasks

Phase I
Task 0 - Provide Introductory Materials to the Participating States
Task 1 - Determine Current Program Status in the States
Task 2 - Initial Draft of State Plans
Task 3 - Prepare Regional Plans
Task 4 - Conferencing and Teamwork Facilitation for Functional Areas
Task 5 - Outreach Strategy and Information Dissemination

Phase II
(Continue to provide Phase I support to new ACVO states)
Task 6 - Provide Training for Future Project Planning

ITS Applications

Functional Areas:
Commercial Vehicle Operations

User Services:
Commercial Vehicle Operations
Commercial Vehicle Electronic Clearance
Automated Roadside Safety Inspection
Commercial Vehicle Administrative Processes

10.1.5 Advanced Regional Traffic Interactive Management And Information System (ARTIMIS)

Responsible Agencies/Partners

Partners: Kentucky Transportation Cabinet, Ohio Department of Transportation, Federal Highway Administration, OKI Regional Council of Governments, and the City of Cincinnati.

Consultants & Contractors: TRW, Pflum, Klausmeier,& Gehrum, Proudfoot Associates, Samaritania, SmartRoute Systems, TEC Engineering, JHK & Associates, Alcatel NA, W.G. Fairfield, Spartan Construction, C.R. & R. Inc.

Objective

To improve air quality and overall safety and decrease motorists' travel time.

Funding Arrangement[1]

Total Cost (approximate) - $38,000,000

Kentucky's Cost (31%) - 11,885,000
Federal Funds (Congestion Mitigation Air Quality) - $9,443,000
State Funds - $2,442,000

(Costs from the start of the project through September 30, 1998.)

Time Frame for Project[1]

Start date: January 28, 1994
Telephone Travel Information Start Date: June 28, 1995
Construction Start Date: September 1995
Control Center Building Completion Date: July 15, 1996
Variable Message Sings erection starts: July 20, 1996
Full Operation Begins: July 1998

Physical Location of Project

Approximately 88 miles of freeway in the Cincinnati-Northern Kentucky area.

ITS Technologies[2]

Closed Circuit Television Cameras - 60 color cameras with zoom, pan, and tilt control that are used for accident verification along various freeways in the Cincinnati-Northern Kentucky area.

Slow-Scan Cameras - 16 phone controlled cameras with zoom, pan, and tilt control that are used on interchange ramps in the Cincinnati-Northern Kentucky area for accident verification.

Electronic Detection System - uses 1100 inductance loops, wide-beam radar detection units, and video detectors to examine real time freeway data and detect changes in traffic flow which might indicate an incident.

Variable Message Signs - 40 permanent and 3 portable signs used along various freeways in the Cincinnati-Northern Kentucky area that are used to provide information to motorists regarding delays and possible alternate routes.

Highway Advisory Radio - a short range radio broadcast designed to inform motorists of conditions existing and anticipated on an upcoming section of highway. Roadway signs and variable message signs are used to alert drivers to tune to 530 AM or 580 AM.

Freeway Service Patrol Vans - five vans (called the Good Samaritans) used to aid motorists and detect incidents. These vehicles are able to clear small accidents from the roadway in a timely manner using push bumpers.

SmarTraveler Traffic Advisory Telephone System - provides current and route-specific traffic information to anyone who calls 211 from a touch-tone or wireless phone or (513) 333-333. SmarTraveler uses closed-circuit cameras, one aircraft, a network of drivers using cellular phones, local police and fire departments, and state and local transportation agencies to continuously update reports from 6:00am to 7:00pm, Monday through Friday.

Other ITS technologies include:

- 54 miles of single and multi-mode fiber optic cable
- Detailed reference markers (every tenth of a mile)

ITS Applications

Functional Areas:

- Advanced Traffic Management Systems (ATMS)
- Advanced Traveler Information Systems (ATIS)
- Advanced Rural Transportation Systems (ARTS)

User Services:

- Travel and Transportation Management
    - En-Route Driver Information
    - Route Guidance
    - Traffic Control
    - Incident Management
- Travel Demand Management
    - Pre-Trip Travel Information

Costs[1]

Telephone Information Service - $104,000/month
Use of 211 (cellular) - $14,000/month

(Costs are approximate.)

Benefits[2]

ARTIMIS saves time for motorists by supplying them with the information they need to find the best and quickest route. Frustration is reduced by the incident notification system. Motorists who are aware of problems can avoid them. ARTIMIS also helps to save one million gallons of fuel each year and reduces hydrocarbon and nitrogen oxide emissions by 45 tons annually. There is less idling when traffic is not stalled on the freeway.

Finally, ARTIMIS can help to save lives. Immediately upon verification of an accident, Control Room personnel notify emergency response teams electronically. The correct teams are notified and can respond quickly. Early benefits show that ARTIMIS has reduced interstate highway accidents by at least 10%. Total savings from the reduction in congestion, fuel consumption and accidents are expected to be $15.9 million per year. ARTIMIS will also help the city of Cincinnati to comply with federal ozone standards.

<u>Case Study</u>[1]

On January 8, 1998 at 3:00pm, a tank truck overturned on the entrance ramp to I-75 from Glendale-Milford Road in Evendale. The interstate was closed for two and one-half hours when the truck, which was carrying caustic soda, ruptured after hitting a guardrail. Southbound traffic was stopped for 2.5 miles and northbound traffic for 1.5 miles, equaling about 1,743 stopped vehicles. Without ARTIMIS, the estimated traffic queue would have been 5.3 miles and 7.5 miles respectively, or 5,568 stopped vehicles. Using a $10 cost per hour rate, ARTIMIS saved approximately $95,600 in loss of work time for this one incident. Vehicular emissions were reduced by 51 pounds of volatile organic compounds (VOCs), 3,457 pounds of carbon monoxide (CO), and 66 pounds of nitrogen oxide (NOX).

Potential for Future Applications[3]

In the future, the management system could be expanded to cover a larger area. An additional 34 miles of freeway may be equipped with fiber optic cable, closed circuit television cameras, and incident detection equipment. The actual coverage area of the ARTIMIS system would be extended to an additional 119 miles of freeway.

Officials are considering new technologies and applications to add to the already successful ARTIMIS system. A cable television channel may be established to broadcast live reports of traffic conditions, including delays and alternative routing. The channel would also provide information on airport arrivals and departures, transit schedules, and registration for the area's rideshare program.

Additional RWIS systems may be installed on the heaviest traveled bridges and freeway segments to improve maintenance of roadways and to inform travelers of icy conditions, and kiosks may be provided at the Cincinnati/Northern Kentucky International Airport for traffic information. Due to the high number of railroad crossings in the area, officials are considering implementing technology that would inform travelers of approaching trains.

Traffic signals may be integrated with ARTIMIS to improve the movement of traffic. Ramp meters may be installed to control traffic entering the freeways, and on-board computers may eventually be used to communicate traffic information and route guidance to drivers. Officials are also considering providing detailed transit information through public transit vehicles.

Possible ITS Applications in the future include:

Functional Areas:
- Advanced Public Transportation Systems

User Services:
- Travel and Transportation Management
  - Highway Rail Intersection
- Travel Demand Management
  - Ride Matching and Reservation
- Public Transportation Operations
  - Public Transportation Management
  - En-Route Transit Information

[1] Walden, Leon. Personal Interview. ARTIMIS Program Manager for the Kentucky Transportation Cabinet. March 1998.
[2] "Advanced Regional Traffic Interactive Management and Information Systems." District 8, Ohio Department of Transportation. http://www.dot.state.oh.us/dist8/arti.htm (20 March 1998).
[3] Looking Ahead: 2020 Metropolitan Transportation Plan. "Building an Intelligent Transportation System." Chapter 9. Ohio-Kentucky-Indiana Regional Council of Governments.

10.1.6 Lexington Traffic Management Projects[1,2]

Responsible Agencies/Partners

Partners: Lexington-Fayette Urban County Government (LFUCG), the Lexington Area Metropolitan Planning Organization, the Transit Authority of Lexington, 22 radio and 4 television stations, and government agencies.

Cellular telephone (*311): GTE Wireless
Cable channel: Intermedia of Lexington
On-Call (a phone-in information service): General Telephone (GTE) and WKYT Television
Fiber Optic Cables: ACSI and Intermedia

Objective

To provide the region's citizens and guests with the best possible transportation system.

Funding Arrangements

Total Costs - $2,100,000

Federal Funds (80%) - $1,700,000
Local Funds (20%) - $400,000

(Costs are approximate.)

Time Frame for Project

Closed Circuit Camera System: started in1982
Urban Traffic Control System: completed in 1986
Traffic Information Network: started 1990
Electronic Total Stations: July 1993
Cellular Telephone System: 1994
RWIS: Summer of 1996
Flip-Down Signs: Fall of 1997
Detailed Reference Markers - Fall of 1997

Physical Location of Project

Urban Traffic Control System (UTCS) - 307 signalized intersections in metropolitan Lexington
Closed Circuit Television Cameras - 34 intersections in Lexington and 2 at the Clays Ferry Bridge
Reversible Lane System - along Nicholasville Road in Lexington
Traffic Information Network (TIN) - the Lexington area and 43 surrounding counties
Electronic Total Stations - two used by Lexington Police and one at each of the 12 State Police Posts
RWIS - Clays Ferry Bridge
Flip-Down Signs - along I-64, I-75, and various alternate roadways in Central Kentucky
Detailed Reference Markers - along Interstate 75 through Lexington and the surrounding areas

ITS Technologies

Urban Traffic Control System - a centralized system controlling 307 signalized intersections in the metropolitan Lexington area which is operated and maintained by the LFUCG's Division of Traffic Engineering. The traffic signal control computer is a Perkin-Elmer 3210 mini-computer linked to the local intersection by 53 separate telephone lines. The city optimizes signal timing patterns along major arterials depending on the time of day and the specific situation at the intersection.

Closed Circuit Television Camera System - includes 37 closed-circuit color video surveillance cameras which are configured for pan/tilt/zoom and controlled by the Traffic Management Center

(TMC). (Several other state and local agencies have access to these videos, including Fayette County Schools.) There are also 150 locations where system loops can collect information on vehicle occupancy, traffic volumes, and speed. The cameras provide real time traffic conditions and support maintenance, snow and ice removal, and public safety needs. There are two additional cameras at the Clays Ferry Bridge on I-75 which transmit information back to the TMC.

Traffic Information Network - a public service network started in 1990 which provides around-the-clock traffic information to motorists in the metropolitan Lexington area and 40 surrounding counties. Pre-trip travel information is distributed via the radio, television, newspapers and the internet. During peak travel times throughout the week, information such as road construction, lane blockages, accidents, fire emergency runs, traffic signal malfunctions, weather related emergencies, and any traffic flow-affecting activity is provided. Information is collected from various government and private agencies and then disseminated to the media via fax transmission or direct interview with the TMC staff. Current traffic information can also be accessed toll-free from a vehicle with a GTE wireless phone by touching *311. Variable Message Signs (VMS) and electronic arrowboards are also used to inform and guide drivers while in route.

Electronic Total Stations - this is used by the Lexington and Kentucky State Police to reduce the amount of time investigating an accident. Combined with a plotter, computer, and printer, the equipment can produce scale drawings for each collision.

RWIS - an in-pavement weather detector consisting of a surface sensor, a subsurface temperature probe, a visibility sensor, and a weather identifier. Information such as pavement surface temperature, wet/dry pavement conditions, and snow or icy pavement conditions are recorded. The system also records air temperature, relative humidity, precipitation, and wind sensor data. There are two systems in Fayette County.

Detour Routing Plans - twenty plans have been developed to direct congested traffic flow along alternate roadways in the event an incident closes either I-64 or I-75 for extended periods of time. Emergency response vehicles and all media are given a notebook containing the detour route maps.

Flip-Down Signs - eighty-eight flip-down signs are being deployed to guide motorists along detour routes as necessary.

Detailed Reference Markers - 152 of 234 have been deployed on I-75, and 122 are planned for I-64 to aid emergency services in responding to incidents or stalled motorists. These signs are placed in the median and display the direction, route number, whole number milepoint, and a number representing the 0.2-mile interval of a reference location.

ITS Applications

Functional Areas:

Advanced Traffic Management Systems (ATMS)
Advanced Traveler Information Systems (ATIS)

User Services:
- Travel and Transportation Management
  - En-Route Driver Information
  - Route Guidance
  - Traffic Control
  - Incident Management
- Travel Demand Management
  - Pre-Trip Travel Information

Costs

Urban Traffic Control System - $2.5 million
Closed Circuit television - $20,000 (installed and tested)
Traffic Information Network - $680,000
Electronic Total Stations - $120,000
RWIS - $176,770
Detour Route Maps (Flip-Down Signs) - $270,000
Reference Markers - $50,000
(Costs are approximate.)

Benefits

Through the Traffic Information Network (TIN) and the closed circuit television camera system, motorists can be informed of real time traffic conditions. This can improve the flow of traffic, by aiding motorists in choosing different routes to avoid problem areas. With the flip-down route guidance signs and the various pre-planned detour routes, motorists can avoid major delays. The RWIS can be used to inform motorists of threatening weather conditions. This system is also beneficial to state maintenance managers who must make decisions concerning roadway upkeep and treatment.

The electronic total stations have benefits for enforcement officers and the public. The investigators are safer because they can spend less time documenting accidents while having more accurate information on the incident. The public can be satisfied that this method of investigation is much quicker than previous ways and saves time and money for all motorists.

Potential for Future Applications

The city of Lexington is considering purchasing signs with flashing lights to notify motorists to tune to the AM highway advisory radio station. This would allow motorists to obtain traffic information whenever it is needed.

The Division of Traffic Engineering has applied for a grant to replace the mini-computer that operates the traffic signal system. The new computer will be a pc-based system. This grant, if received, will also cover the replacement of some telephone lines with fiber optic cable.

[1] Herrington, Ron. Personal Interview. Lexington-Fayette Urban County Government Director of Traffic Engineering. August 1997 and June 1998.
[2] Dennis, Brian. Personal Interview. Traffic Information for the Lexington-Fayette Urban County Government. May 1998.

10.1.7 Traffic Response And Incident Management Assisting The River Cities (TRIMARC)[1]

Responsible Agencies/Partners

Partners: Kentucky Transportation Cabinet, Indiana Department of Transportation, Kentuckiana Regional Planning and Development Agency (KIPDA), and the Federal Highway Administration.

System Design and Integration: TRW
System Construction and Operation: TRW

Objectives

To improve travel time and efficiency of the roadway system
To reduce severity of accidents and personal injury
To better inform motorists of unusual or unanticipated conditions

Funding Arrangements

Total Costs - $26,000,000

Kentucky (75%) - $19,500,000
Indiana (25%) - $6,500,000

(Costs are approximate and cover a period of 10 years.)

Time frame for project

Partial System Operational: May 1998
Full System Operational: End of 1998

Physical Location of Project

The traffic monitoring equipment will be in place on I-65 from the Watterson Expressway to approximately the Stansifer Avenue Exit in Southern Indiana. Guidance equipment, such as the variable message signs and the reference markers will extend to I-265 in Southern Indiana. The operations control center will be located in the existing 9th street interchange facility. This is a building that was built along with the interchange to monitor some new technology that was later abandoned. The facility is currently used as a resident's office, a motor pool, and an office for motor vehicle enforcement. The resident's office and the motor pool will be relocated and the building will be renovated for the traffic control center.

ITS Technologies[2]

Highway Advisory Radio - a short range radio broadcast designed to inform motorists of conditions existing and anticipated on an upcoming section of highway. In Louisville, it is expected that the broadcast messages would be on the available AM frequencies 530 and 1610. Variable message signs alert the drivers to tune to the proper frequency.

Variable Message Signs - should be installed at key entry points to the Metropolitan Louisville area freeway system to provide motorists with roadway information. Portable message signs may also be used to inform motorists of accidents, special events, or construction delays.

Total Station Accident Investigation Equipment - this equipment measures distances quickly and accurately, reducing the time necessary for accident investigations.

Dedicated Freeway/Service Patrols - these service patrols are effective in aiding motorists and detecting incidents. These vehicles are able to clear small incidents from the roadway in a timely manner using push bumpers.

Electronic Detection System - uses inductance loops, radar detection units, and video imaging detection systems (VIDS) to assist in incident identification.

Closed Circuit Television Cameras - approximately eight cameras will be used for incident verification. The cameras will be located about a mile apart at interchanges and turns in the freeway.

RWIS - an in-pavement weather detector on the Kennedy Bridge consisting of a surface sensor, a subsurface temperature probe, a visibility sensor, and a weather identifier. The collected information is processed at the Traffic Operations Center.

Detailed Reference Markers - mile markers every two-tenths of a mile used to improve the ability of emergency response teams to locate an incident. Markers display the direction, route number, mile point, and 0.2-mile reference location.

Informational Kiosks - interactive video screens placed in offices, busy street corners, transit stops, etc., that allow users to access specific traffic, weather, tourist, or general information.

Traveler Advisory Telephone System - a local or toll-free telephone number that the public may use to access up-to-date traveler information.

ITS Applications

Functional Areas:

- Advanced Traffic Management Systems (ATMS)
- Advanced Traveler Information Systems (ATIS)
- Advanced Rural Transportation Systems (ARTS)

User Services:

Travel and Transportation Management

- En-Route Driver Information
- Route Guidance
- Traffic Control
- Incident Management

Travel Demand Management

- Pre-Trip Travel Information

Costs[2]

Kiosks - $13,000 to $17,000
Variable Message Signs (Fiber Optic/Shutter type) - $135,000
Closed Circuit Television Cameras - $20,000 - $75,000

(Costs are approximate and vary based on the type of the specific technology that will be deployed.)

Benefits

TRIMARC will help to more quickly notify the appropriate agencies for the immediate removal of accidents or other roadway debris. Emergency response teams will be able to respond more quickly to accidents. This early identification of incidents may help to save lives and reduce the number of secondary accidents on the freeway.

By informing motorists of delays and hazards, the roadways should be less congested. Drivers will be able to detour problem areas or delay their trips accordingly. Idling vehicles pollute the air and consume additional fuel. By reducing the number of idling vehicles, TRIMARC can save time and money for motorists and improve the quality of life in the Louisville area.

Potential for Future Applications

Eventually, the system will be integrated with the city's current signal system, allowing more comprehensive traffic management. There are also plans to extend the system onto other freeways in the area. Officials would like to integrate radio communication with all emergency response agencies.

[1] Albright, Nancy. Personal Interview. TRIMARC Program Manager for the Kentucky Transportation Cabinet. March 1998.

[2] I-65 Freeway Incident Management Study, Final Report. HNTB in association with Presnell Associates Inc. August 1994. Job No. 21078-PL-001-005.

10.1.8 Cumberland Gap Tunnel[1]

Responsible Agencies/Partners

Partners: National Park Service (Facility Owner), Federal Highway Administration (Design and Construction Contract Administration), Kentucky Transportation Cabinet (Operations and Maintenance), and the Tennessee Department of Transportation (Operations and Maintenance).

Contract Administration: Vaughn & Melton
Design: Parson, Brinckerhoff, Quade and Douglas
Construction: Walsh Construction DBA Archer-Western Contractors
Tunnel Management: Cumberland Gap Tunnel Authority
ITS Subcontractors/Vendors: SESCO, Traffic Management Associates, Johnson Control, Simplex, M.B. Nixon

Funding Arrangements

Total Costs - $265,000,000

Federal Funds (100%)

Time Frame for Project

Start Date: 1986
Open to Traffic: October 18, 1996
Contract with ITS Technologies: February 1995
ITS Technologies Completely Operational: October 1997
Project Completion: 2001

Physical Location of Project

Cumberland Gap National Historical Park in Bell County, Kentucky and Claiborne County, Tennessee (includes 4600 foot twin tunnels through Cumberland Mountain and approach roads).

ITS Technologies

Traffic Control System - This system is monitored and controlled by computers within the Tunnel and includes pre-programmed scenarios for emergencies or special situations.

Variable Message Signs - three signs located on both the Kentucky and Tennessee approaches to the Tunnel. These signs are used to notify motorists of HAZMAT vehicle stoppages or roadway hazards. Any message may be programmed into these signs.

Changeable Message Signs - these signs are used specifically for the HAZMAT vehicles and can display two different messages: "Follow Lead Vehicle with Caution" and "Stop Wait Here for Escort".

Variable Speed Limit Signs - these signs are posted on both approaching sides of the Tunnel and are used to change the speed limit. These signs normally display a 45 mph speed limit, but are changed during times of hazardous weather conditions, excessive congestion, or escort of hazardous material vehicles.

Lane Use Signals - these signs are located above the lanes and are used to inform drivers of which lane they may use inside and outside of the Tunnel.

Closed Circuit Cameras - These cameras monitor activities within the Tunnel and are transmitted to televisions in the Tunnel control room.

Magnetic Loop Detectors - These detectors are used to monitor the traffic and continuously count the vehicles in the Tunnel. This data is used by computers in the Tunnel control room to regulate the traffic and ventilation conditions in the Tunnel.

Incident Detection System - The Tunnel contains smoke and fire detectors to alarm Tunnel personnel of any incidents. In case of an emergency, crews are dedicated to the Tunnel and are on-call 24 hours per day.

Other technologies within the Tunnel include:

- Jet Fan Ventilation System
- Carbon Monoxide Monitoring
- Motorist-aid telephones every 300-feet

ITS Applications

Functional Areas:

- Advanced Traffic Management Systems (ATMS)
- Advanced Traveler Information Systems (ATIS)
- Advanced Rural Transportation Systems (ARTS)

User Services:

- Travel and Transportation Management
  - En-Route Driver Information
  - Route Guidance
  - Traffic Control
  - Incident Management
- Emergency Management
  - Emergency Notification and Personal Security

Costs

Variable Message Signs - $2,000,000
Closed Circuit Televisions - $200,000
Smoke and Fire Detectors: Linear Heat Detection - $200,000
Fans for the Ventilation System - $750,000
Tunnel Lighting - $1,000,000

(Costs are approximate.)

Benefits

Benefits from the construction of the Tunnel include improved traffic flow and safety and an enriched economy in the area through tourism. The ITS technologies will show benefits through less congestion on the roadway, informed motorists who can avoid problems or at least be aware or them, and quick emergency response for a safer roadway.

Potential for Future Applications

Currently, HAZMAT vehicles are escorted through the Tunnel while all other traffic is stopped. Officials are investigating other methods to make this process more efficient. This may mean implementing technologies such as transponders or global positioning system (GPS) units on the vehicles, allowing personnel to locate HAZMAT vehicles which are approaching the Tunnel.

Officials also hope to implement an AM/FM broadcast override system. Emergency messages would override all radio broadcasts in the immediate Tunnel area. In conjunction, a highway advisory radio system (HAR) could be used to cover a larger area, reaching more travelers with roadway and tourist information.

A network of VMS may be used to help inform travelers of Tunnel closures or other roadway hazards. Signs located at critical locations could be used to reroute travelers away from the Tunnel or other problem areas. RWIS may also be implemented with the VMS to help inform motorists of dangerous weather conditions.

Possible ITS Applications in the future include:

Functional Areas:
- Commercial Vehicle Operations

User Services:
- Commercial Vehicle Operations
  - Freight Mobility

[1] Hamm, David. Personal Interview. FHWA Project Manager for the Cumberland Gap Tunnel Project. July 1997.

10.1.9 Condition-Responsive Work Zone Traffic Control System: Clays Ferry Bridge Reconstruction[1]

Responsible Agencies/Partners

Partners: Federal Highway Administration, Kentucky Transportation Cabinet, and the Lexington-Fayette Urban County Government Division of Traffic Engineering.

Prime Contractor: C.J. Mahan Construction Co.
Highway Advisory Radio: Information Station Specialists
RWIS: Surface Systems Inc.
Variable Message Signs: American Signal Co.

Objective

To apply advanced technologies to accomplish real-time control and management of traffic at the Clays Ferry Bridge and along the I-75 corridor in advance of the bridge.

Funding Arrangement

Total Costs - $31,970,000

Federal Funds (85%) - $27,174,500
State Funds (15%) - $4,795,500
(Costs are approximate.)

Time Frame for Project

Contract Letting: October 22, 1993
Work Started: December 17, 1993
Phase I Completed: October 1995
Phase II Completed: September 1996
Phase III Completed: July 1996
Expected Project Completion: Summer 1998

RWIS Installed: June 1996
RWIS Functional: January 1997
Other ITS Technologies Functional: Spring 1994

Physical Location of Project

In advance and along the Clays Ferry bridge (over the Kentucky River, connecting Fayette and Madison counties).

ITS Technologies

Video Surveillance Cameras - two slow-scan cameras positioned on either side of the Clays Ferry Bridge, one in Fayette county and the other in Madison county. The cameras have the capability to pan, tilt, and zoom and have color monitors. The video signals are sent across telephone lines and are monitored by Lexington Traffic Management Center (TMC). The data received by the TMC is then distributed to the Police Dispatch Center, the Fire Communications Dispatch Center, and the Department of Highways, District 7.

Variable Message Signs - six portable message signs (three used in each direction) and located along the I-75 highway right-of-way. Messages are changed remotely by the resident engineer or other representatives from the Department of Highways.

Highway Advisory Radio - a short range radio broadcast designed to inform motorists of conditions existing and anticipated on an upcoming section of highway. On the Clays Ferry project, broadcast messages are on AM frequencies 530 and 1610. Variable message signs alert the drivers to tune to the proper frequency.

RWIS - an in-pavement weather detector consisting of a surface sensor, a subsurface temperature probe, a visibility sensor, and a weather identifier. This information is transmitted to the Kentucky Transportation Cabinet where decisions may be made to activate driver warning systems (variable message signs and highway advisory radio).

ITS Applications

Functional Areas:
- Advanced Traffic Management Systems (ATMS)
- Advanced Traveler Information Systems (ATIS)
- Advanced Rural Transportation Systems (ARTS)

User Services:
- Travel and Transportation Management
  - En-Route Driver Information
  - Route Guidance
  - Traffic Control
  - Incident Management
- Travel Demand Management
  - Pre-Trip Travel Information

Costs

Variable Message Signs (6) - $240,000
Highway Advisory Radio - $20,000
RWIS - $177,000
(Costs are approximate.)

Benefits

Travelers can be informed of emergency weather conditions, accidents and congestion problems in time to take alternate routes. Emergency response teams can be deployed accurately and immediately, translating to lives saved. Traffic can flow more efficiently and safely, making driving a more pleasant experience for everyone.

Future Applications

The surveillance cameras and the RWIS will be left in place at the end of the project. The variable message signs are the property of the Kentucky Transportation Cabinet and will be used throughout the state. Permanent variable message signs may be used in the future to relay travel messages to motorists in the Clays Ferry Bridge area.

[1] Ballinger, James. Personal Interview. Kentucky Transportation Cabinet Resident Engineer for the Clays Ferry Bridge Project. September 1997.

10.1.10 Road Weather Information System (RWIS)

Responsible Agencies/Partners

Kentucky Transportation Cabinet, Lexington-Fayette Urban County Government, and the Kentucky Transportation Center

RWIS: Surface Systems, Inc.
Evaluation of System: Kentucky Transportation Center

Objective

To monitor roadway conditions at various strategic sites from one central location by observing such things as temperature, precipitation, relative humidity, and wind speed.

Funding Arrangement

Total Costs - $50,000

State Funds (100%)

(Costs for the evaluation of the system only.)

Time Frame for Project

Start Date: May 1, 1997
Project Completion: June 3, 1999

Physical Location of Project

I-75 Clays Ferry Bridge
I-75 and I-64 Interchange, East of Lexington
I-275 and KY 17 Interchange, Covington
I-265 and KY 1447 (Westport Rd.) Interchange, Louisville
I-65 Kennedy Bridge, Louisville
I-75 and US 25E Interchange, Corbin

ITS Technologies

RWIS - includes three basic components: a weather detector, a remote processing unit (RPU), and a central processing unit (CPU).

Weather detector - consists of a surface sensor, a subsurface temperature probe, a visibility sensor, and a weather identifier. Atmospheric data such as air temperature, dew point temperature, relative humidity, wind speed and direction, gust speed, precipitation type, rate, intensity, and accumulation are collected. (Visibility information is obtained at the Clays Ferry location only.) The sensors also gage pavement data such as surface status and temperature, subsurface temperature, freeze point, chemical percent, ice percentage, depth of precipitation, and chemical factor.

Remote Processing Unit (RPU) - collects information from the weather detector on site and sends the information to a central processing unit in Frankfort.

Central Processing Unit (CPU) - collects information from the RPU at the six various locations and distributes it to the state maintenance managers and the Lexington-Fayette Urban County Government for timely and correct upkeep and treatment of the roadways.

ITS Applications

Functional Areas:
- Advanced Traffic Management Systems (ATMS)
- Advanced Rural Transportation Systems (ARTS)

User Services:
- Travel and Transportation Management
  - Incident Management

Costs

Clays Ferry	$176,770
I-75/I-64	$ 99,500
I-275/KY 17	$ 75,991
I-265/Westport Freeway	$ 75,304
Kennedy Bridge	$ 71,229
I-75/US 25E	$ 68,417

Benefits

The use of RWIS can lower resource usage and enable more timely treatment of icing conditions. Better and more appropriate treatment of roadways may lead to safer roadways, fewer accidents, and lives saved.

Potential for Future Applications

This system has the potential to be very valuable to motorists. With technology such as variable message signs, highway advisory radio, etc., drivers can be more informed of weather and roadway conditions. Motorists could also be informed of roadway conditions before leaving their home via the radio, television, or Internet. With expanded use of weather information systems and various communications sources to disseminate the information, more people will benefit from this system.

Future ITS applications include:

Functional Areas:
- Advanced Traveler Information Systems (ATIS)

User Services:
- Travel and Transportation Management
  - En-Route Driver Information
  - Route Guidance
- Travel Demand Management
  - Pre-Trip Travel Information

10.2 APPENDIX B

SUMMARY OF RESULTS FROM FOCUS GROUP MEETINGS

This appendix includes a summarization of the data collected and the methods used for collection in the development of the Strategic Plan. Data for Advanced Rural Transportation Systems (ARTS) and Advanced Traveler Information Systems (ATIS) was collected at two different meetings, a focus group meeting held on October 10, 1997 and an Area Development District (ADD) meeting held December 3, 1997. Data and collection methods for Advanced Traffic Management Systems (ATMS), Advanced Public Transportation Systems (APTS), and Advanced Vehicle Control Systems (AVCS) will be included with the final report in June of 1999.

10.2.1 Advanced Rural Transportation Systems

Following is a list of information contained within this section of Appendix B.

Surface Transportation Issues Form - This form was used at the focus group meeting on October 10, 1997, to identify issues relating to surface transportation.

Focus Group Issues - This is a summary of results from the focus group meeting. It is a list of all issues, top three issues, and longer term issues with the number of people including each issue in parentheses.

Prioritization of User Service Areas - This shows how the focus group ranked the importance of the User Services. The number of votes for a "high," "medium" or "low" ranking is given with a total score for each User Service. The votes were scored as: "high" - 3 points, "medium" - 2 points, and "low" - 1 point.

Visioning Process Form - This form was used at the focus group meeting for participants to describe their vision for specific areas of ITS.

Vision Focus Areas - This is a summary of the vision elements on the "Vision Process Form."

Issues List Form - This form was used at the ADD meeting on December 3, 1997, to provide additional input concerning which issues should be considered top three or longer term.

ADD Issues - This is a summary of results from the ADD meeting. The top three and longer term issues are listed with the number of people including each issue in parentheses.

Vision and Goals Comment Sheet - This comment sheet was given to the participants of the focus group and ADD meetings. They were asked to comment on the vision and rank the goals.
Vision and Goals Comments - This is a summary of responses from the "Vision and Goals Comment Sheet" with a ranking of the goals.

Surface Transportation Issues
Relating to Rural Kentucky

Issue Identification:
(Please identify at least five issues that you believe constrain or limit [or constitute significant opportunities for improving] rural transportation quality, capacity and service to Kentuckians and tourists.)

1. ______________________________

2. ______________________________

3. ______________________________

4. ______________________________

5. ______________________________

6. ______________________________

7. ______________________________

Most Important Issues Selection:
(After all issues have been identified, please select the major or most important issues that you believe deserve attention. First list your top three that deserve more immediate attention. Then list at least one issue that you believe deserves longer-term attention.)

TOP THREE ISSUES
(For immediate attention)

1. ______________________________

2. ______________________________

3. ______________________________

LONGER-TERM ISSUE(S)

1. ______________________________

2. ______________________________

Note: It is important that you turn in this sheet at the end of your group session. If you wish to remain anonymous, it's ok with us. Otherwise, please provide your name and telephone and e-mail below. Thank you for participating.

Focus Group Issues

Remoteness/accessibility
Cost effectiveness (b/c ratio)
Multiple government jurisdictions
Intermodal coordination
Inadequate/substandard facilities
Poor communication among service providers
Political constraints
Real-time accident information
National publicity for transportation
Rural (I-75) corridor reliability
Universal naming of streets and roads
Lack of street names on maps
Traffic management in construction
Lack of technical assistance for agencies
Substandard road design and conditions
Truck capacity/safety (capacity of highway system)
Few alternate routes
Highway reconstruction
Extreme terrain conditions
Lack of connectivity
Lack of spokesperson
Signing
Delay information
Detour information
Traveler information
Few mode choices
Attitudes of rural drivers
Travel distances
Funding
Incident management
Weather and visibility

Issues voted as top three by participants:

1. Remoteness/connectivity/accessibility (5)
2. Funding/budget constraints (4)
3. Lack of information and technical assistance (3)
4. Construction/incident traffic management (3)
5. Substandard roadway design/geometry (3)
6. Standard/uniform names (2)
7. Lack of communication (2)
8. Crash detection/location (1)
9. Jurisdictional conflicts (1)
10. Signing and traveler information (1)
11. Improve safety and efficiency along I-75 (1)
12. Truck capacity/safety improvements (1)
13. Cost effectiveness (1)
14. Need more rural freeway construction (1)

Longer term issues:

1. Jurisdictional/political issues (6)
2. Budget constraints (3)
3. National intermodal coordination (3)
4. National visibility for transportation (3)
5. Cost effectiveness (b/c ratio) (2)
6. Road design (1)
7. Statewide coordination (1)

Prioritization of User Service Areas

	High	Med	Low	Score	Rank
Travel and Transportation Management					
En-route driver information	6	3	0	24	2
Travel services information	2	3	4	16	10
Route guidance	3	5	1	20	6
Traffic control	3	5	1	20	6
Incident management	7	1	1	24	2
Emissions testing	0	1	8	10	12
Travel Demand Management					
Demand management	3	1	5	16	10
Pre-trip travel information	3	6	0	21	5
Ride matching and reservation	1	6	2	17	9
Public Transportation Operations					
Public transportation management	6	2	1	23	3
En route transit information	2	5	2	18	8
Personalized public transit	6	2	1	23	3
Public travel security	3	1	5	16	10
Electronic Payment					
Electronic payment services	3	2	4	17	9
Commercial Vehicle Operations					
Electronic screening	5	3	1	22	4
Automated safety inspections	3	3	3	18	8
On-board safety monitoring	5	3	1	22	4
Administrative processes	4	3	2	20	6
HAZMAT incident response	8	1	0	26	1
Freight mobility	6	3	0	24	2
Emergency Management					
Emergency notification and personal security	8	1	0	26	1
Emergency vehicle management	8	1	0	26	1
Advanced Vehicle Control And Safety Systems					
Longitudinal collision avoidance	4	3	2	20	6
Lateral collision avoidance	4	3	2	20	6
Intersection collision avoidance	5	3	1	22	4
Vision enhancement for crash avoidance	4	3	2	20	6
Safety readiness	4	3	2	20	6
Pre-crash restraint deployment	3	4	2	19	7
Automated highway systems	0	2	7	11	11

Visioning Process Form

Relating to Rural Transportation

Selected Vision Focus Areas:

Which of the following areas are important to you in the Commonwealth of Kentucky's vision for Rural Transportation as part of ITS? (Check one or more below)

_____ A. Travel and Transportation Management
_____ B. Travel Demand Management
_____ C. Public Transportation Operations
_____ D. Electronic Payment
_____ E. Commercial Vehicle Operations
_____ F. Emergency Management
_____ G. Advanced Vehicle Control and Safety Systems

Key Vision Components for Selected Area(s):

Please tell us about your vision for the areas selected in the space below. You may combine categories if you like. Use back of sheet if necessary.

A B C D E F G (circle the one(s) you're writing about)

____

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A B C D E F G

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A B C D E F G

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Note: Please give use your name, telephone, and e-mail address:

Vision Focus Areas

B. Travel Demand Management

A system to provide information pertaining to roadway conditions, route and mode of travel. Transit information such as timetables and connecting points of urban areas would also be included.

C. Public Transportation Operations

A seamless (coordinated) statewide public transit should be established with funding available to allow "affordable" service to all rural residents. A personalized system that includes automated reservations and dispatching will ensure efficient use of resources. This will require better communication and consolidation of transportation providers. Increased use of information technology will also be necessary.

D. Electronic Payment

Payments will be made by electronic swipe cards and transponders which can identify the user.

E. Commercial Vehicle Operations

The time required for registration, toll collection and inspection of commercial vehicles will be reduced. Using incentives ro reward safe carriers will help reduce the number of unsafe commercial vehicles on the highways. Increased use of alternative modes of transportation will reduce the number of commercial vehicles on rural roads and highways.

F. Emergency Management

Develop a system for rural areas to avoid incidents by improving signing and alleviating roadway problems such as substandard design, and through quicker notification of emergency agencies and travelers when incidents occur. Information about alternate routes and times roads are closed would be made available.

Emergency management will be coordinated between jurisdictional areas. Communication and vehicle location technologies will improve routing and reduce response times. Vehicles will be equipped with mayday systems for immediate notification of incidents.

G. Advanced Vehicle Control and Safety Systems

In ten years, vehicles will have road weather warning devices and be able to sense the presence of all surrounding vehicles. The warning from these systems will allow driver response or automated vehicle computerized response to avoid accidents.

A&B. Travel and Transportation Management & Travel Demand Management

An advanced corridor will be established that uses current technologies such as HAR, overhead message signs, CVO, traveler info systems and alternate corridor - signing/signalization/bypasses to reduce congestion, handle accidents/construction delays and improve truck/auto conflicts. This advanced corridor would be the state-of-the-art for interstates. This "pilot" corridor should be I-75 because of its total VMT, economic importance, nationwide visibility and opportunity to interface with existing/ongoing ITS projects. This pilot project would make Kentucky an ITS leader and could help mobilize interest in transportation. This increased interest in transportation would contribute to increased funding for all other ITS projects and to transportation in general.

A&E. Travel and Transportation Management & Commercial Vehicle Operations

Includes incident management, jurisdictional coordination, and route guidance for cars and trucks.

C&G. Public Transportation Operations & Advanced Vehicle Control and Safety Systems

Coordinated dispatching for regions will be dictated by connection rather than political boundaries.

ISSUES LIST

Advanced Rural Transportation Systems (ARTS)

Issues that may limit or provide opportunity for improving the quality of rural transportation in Kentucky: (Please list any issues that you feel have been left out.)

Remoteness/accessibility
Cost effectiveness (b/c ratio)
Multiple government jurisdictions
Intermodal coordination
Inadequate/substandard facilities
Poor communication among service providers
Political constraints
Real-time accident information
National publicity for transportation
Rural (I-75) corridor reliability
Universal naming of streets and roads
Lack of street names on maps
Traffic management in construction
Lack of technical assistance for agencies
Substandard road design and conditions
Truck capacity/safety (capacity of highway system)
Few alternate routes
Highway reconstruction
Extreme terrain conditions
Lack of connectivity
Lack of spokesperson
Signing
Delay information
Detour information
Traveler information
Few mode choices
Attitudes of rural drivers
Travel distances
Funding
Incident management
Weather and visibility

Top Three Issues

Please select the three most important issues that you believe deserve immediate attention and list them in order of importance.

1. ______________________________

2. ______________________________

3. ______________________________

Long Term Issues

Please list two issues that you believe deserve longer-term attention.

1. ______________________________

2. ______________________________

ADD Issues

Issues voted as Top Three by Participants:

1. Substandard road design and conditions (5)
2. Funding (5)
3. Universal naming of streets and roads (4)
4. Inadequate/substandard facilities (3)
5. Attitudes of rural drivers (3)
6. Weather and visibility (3)
7. Poor communication among service providers (3)
8. Remoteness/accessibility (2)
9. Real-time accident information (2)
10. Delay information (2)
11. Political constraints (2)
12. Lack of street names on maps (2)
13. Capacity/safety of highway system (2)
14. Incident management (2)
15. National publicity for transportation (1)
16. Traffic management in construction (1)
17. Highway reconstruction (1)
18. Extreme terrain conditions (1)
19. Signing (1)
20. Cost effectiveness (b/c ratio) (1)
21. Lack of connectivity (1)

Long Term Issues:

1. Intermodal coordination (4)
2. Inadequate/substandard facilities (3)
3. Highway reconstruction (3)
4. Lack of connectivity (3)
5. Funding (3)
6. Cost effectiveness (b/c ratio) (2)
7. Real-time accident information (2)
8. Substandard road design and conditions (2)
9. Traveler information (2)
10. Multiple government jurisdictions (1)
11. Political constraints (1)
12. Lack of street names on maps (1)
13. Traffic management in construction (1)
14. Extreme terrain conditions (1)
15. Signing (1)
16. Few mode choices (1)
17. Weather and visibility (1)

COMMENT SHEET

Advanced Rural Transportation Systems (ARTS)

Do you feel that this vision accurately reflects your views of what rural transportation in Kentucky should be like in approximately 20 years?

____ Yes ____ No

If possible, please explain your answer.

____

____

____

____

____

We have developed the following goals relating to ITS in rural transportation. Please write in any goals that you feel should be added to this list then rank them in order of importance.

Rank

____ 1. To enhance statewide emergency response capability.
____ 2. To improve connectivity between rural transportation systems.
____ 3. To promote communication and information sharing between agencies.
____ 4. To implement efficient traffic management practices for incidents and construction activities.
____ 5. To improve signing and traveler information resources.
____ 6. To develop advanced vehicle safety systems.
____ 7. ________________________________
____ 8. ________________________________

Additional comments:

____

____

____

____

NOTE: It is important that you turn in this sheet at the end of the session. If you wish to remain anonymous it's ok with us. Otherwise, please provide your name, telephone and e-mail below. Thank you for participating.

____

Vision and Goals Comments

Does the vision reflect your views?

Yes - 19
No - 1

There were no comments or suggestions included with the "No" response.

The goals were ranked from 1 to 6. The rankings were assigned a score (1 = 6 points, ..., 6 = 1 point). The results are given below.

Goal	Score
To enhance statewide emergency response capability.	92
To improve connectivity between rural transportation systems.	71
To implement efficient traffic management practices for incidents and construction activity.	67
To promote communication and information sharing between agencies.	65
To improve signing and traveler information resources.	54
To develop advanced vehicle safety systems.	49

Other goals listed were:

1. To improve substandard road construction.
2. To implement "smart" cards for toll roads.
3. To develop advanced warning for animal (deer) xings.
4. To take drivers licenses away from people over 75 or retest them.

10.2.2 Advanced Traveler Information Systems

Following is a list of information contained within this section of Appendix B.

Surface Transportation Issues Form - This form was used at the focus group meeting on October 10, 1997 to identify issues relating to surface transportation.

Focus Group Issues - This is a summary of results from the Surface Transportation Issue Form. First is a list of issues that may constrain or present opportunities for advancement in transportation. Participants then identified their top three and longer term issues. (The number in parenthesis represents the number of people that listed that particular issue.)

Prioritization of User Service Areas - This shows how the focus group ranked the importance of the User Services to traveler information. The votes were scored as: "high" - 3 points, "medium" - 2 points, and "low" - 1 point. Based on this, the highest possible score for any user service area would be 21.

Visioning Process Form - This form was used at the focus group meeting for participants to describe their vision for specific areas of ITS.

Vision Focus Areas - This is a summary of the vision elements provided by participants on the "Vision Process Form." The number in parentheses refers to the number of people with comments on that particular area.

Issues List Form - This form was used at the ADD meeting on December 3, 1997, to provide additional input concerning which issues should be considered top three or longer term.

ADD Issues - This is a summary of results from the ADD meeting. The top three and longer term issues are listed with the number of people including each issue in parentheses.

Vision and Goals Comment Sheet - This comment sheet was given to the participants of the focus group and ADD meetings. They were asked to comment on the vision and rank the goals.

Vision and Goals Comments - This is a summary of responses from the "Vision and Goals Comment Sheet" with a ranking of the goals. The goals were scored as: First - 7 points, Second - 6 points, Third - 5 points, Fourth - 4 points, Fifth - 3 points, Sixth - 2 points, and Seventh - 1 point. (Not all participants ranked every goal.) The final ranking in the far right-hand column is based on the overall score for each goal.

Surface Transportation Issues

Relating to Traveler Information

Issue Identification:

(Please identify at least five issues that you believe constrain or limit [or constitute significant opportunities for improving] transportation quality, capacity and service to Kentuckians and travelers in the Commonwealth.)

1. ______________________________

2. ______________________________

3. ______________________________

4. ______________________________

5. ______________________________

6. ______________________________

7. ______________________________

Most Important Issues Selection:

(After all issues have been identified, please select the major or most important issues that you believe deserve attention. First list your top three that deserve more immediate attention. Then list at least one issue that you believe deserves longer-term attention.)

TOP THREE ISSUES
(For immediate attention)

1. ______________________________

2. ______________________________

3. ______________________________

LONGER-TERM ISSUE(S)

____

____

Note: It is important that you turn in this sheet at the end of your group session. If you wish to remain anonymous, it's ok with us. Otherwise, please provide your name and telephone and e-mail below. Thank you for participating.

Focus Group Issues

Issues List

Advanced Warning of Roadway Events/Conditions
Programable Signage/HAR
Construction Management
Resource Availability
Unavailability of efficient transit
Congestion Management
Air Fare
Incident Detection/Management
Linking TMC's
Public/Private Partnerships
Internet
Budgets - Prioritizing
Education
Apathy for Change
Availability of Services
Agency Turfism
Lack of Forethought
Too Few Persons per Vehicle
Public Ttransit/Attractiveness
Reduction in Vehicle-Miles Traveled
Remote Areas
Lower than Average Vehicle Turnover

Issues voted as top three by participants

1. Construction Management (4)
2. Incident Detection/Management (3)
3. Linking Urban Areas (3)
4. Congestion Management (2)
5. Legal Review/Changes (2)
6. Education of Public (2)
7. Budgets/Prioritizing (2)
8. Increase Public Transit Attractiveness (1)
9. Resource Availability (1)
10. Programmable Signs (1)
11. Reduce VMT (1)
12. Turfism (1)

Longer-Term Issues

1. Budgets/Prioritizing (5)
2. Public Transit Availability/Attractiveness (3)
3. Education (3)
4. Public/Private Partnerships (2)
5. Construction Management (1)

Prioritization by User Service Area

	HIGH	MEDIUM	LOW	SCORE
Travel and Transportation Management				
En-route Driver Information	6	1	0	20
Travel Services Information	2	4	1	15
Route Guidance	1	4	2	13
Traffic Control	6	1	0	20
Incident Management	7	0	0	21
Emissions Testing	2	1	4	12
Travel Demand Management				
Demand Management	4	2	1	17
Pre-trip Travel Information	3	3	1	16
Ride Matching and Reservation	1	4	2	13
Public Transportation Operations				
Public Transportation Management	1	6	0	15
En-route Transit Information	4	3	0	18
Personalized Public Transit	1	4	2	13
Public Travel Security	0	5	2	12
Electronic Payment				
Electronic Payment Services	1	2	4	11
Commercial Vehicle Operations				
Electronic Screening	3	2	2	15
Automated Safety Inspections	2	2	3	13
On-board Safety Monitoring	3	4	0	17
Administrative Processes	1	2	4	11
HAZMAT Incident Response	6	1	0	20
Freight Mobility	1	2	4	11
Emergency Management				
Emergency Notification and Personal Security	6	1	0	20
Emergency Vehicle Management	5	2	0	19
Advanced Vehicle Control and Safety Systems				
Longitudinal Collision Avoidance	1	4	2	13
Lateral Collision Avoidance	1	4	2	13
Intersection Collision Avoidance	1	5	1	14
Vision Enhancement for Crash Avoidance	2	4	1	15
Safety Readiness	2	4	1	15
Pre-crash Restraint Deployment	1	2	4	11
Automated Highway Systems	0	1	6	8

Visioning Process Form

Relating to Advanced Traveler Information Systems Development

Selected Vision Focus Areas:

Which of the following areas are important to you in the Commonwealth of Kentucky's vision for Advanced Traveler Information Systems as part of ITS? (Check one or more below)

____ A. Travel and Transportation Management
____ B. Travel Demand Management
____ C. Public Transportation Operations
____ D. Electronic Payment
____ E. Commercial Vehicle Operations
____ F. Emergency Management
____ G. Advanced Vehicle Control and Safety Systems

Key Vision Components for Selected Area(s):

Please tell us about your vision for the areas selected in the space below. You may combine categories if you like. Use back of sheet if necessary.

A B C D E F G (circle the one(s) you're writing about)

____
____
____
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____
____

A B C D E F G

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____
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A B C D E F G

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____
____

Note: Please give use your name, telephone, and e-mail address:

Vision Focus Areas

A. Travel and Transportation Management (7)

Integration (on a regional or state wide basis) of HAR, cell phones, variable message signs, etc.
Link TRIMARC, ARTIMIS, and Lexington (including I-75, I-71, I-65, and some of I-64)
Traveler information: weather, construction, accidents, congestion (3)
Incident Detection
Re-routing of traffic (pre-determined routes, timing plans, signage) (2)
Information on services available (hotels, fuel, food, etc.)
Variable message signs (2)

B. Travel Demand Management (4)

Reduce the vehicle-miles traveled
Reduce the number of single occupancy vehicles
Make public transit more attractive
Updated information at entry points to Kentucky
Traveler information: construction, weather, etc.
Information for use in timing and routing (2)
Information from television, computers, etc. (2)
Public transit information
Infrequent users should be able to use (transit) without a hassle
Real-time and accurate information

C. Public Transportation Operations (3)

Personalized information for travelers
Accurate times should be available (arrival, departure, destination)
Make public transit attractive to driving public
Support new and different transit modes
Make changes to impediments for transit access (gas tax, etc.)
Develop in major urban areas, and between these areas

D. Electronic Payment (1)

Use pricing techniques to control travel (parking and highway)

E. Commercial Vehicle Operations (1)

All weigh stations in Kentucky with electronic clearance
Fifty percent of all trucks have transponders

F. Emergency Management (2)

Data systems to allow resource allocation
Enhanced reference markers (beyond interstate)
Cellular phones - mandatory on new cars
Emergency button - Mayday
A maximum distance between EMS stations, established by law
Response time - established state wide

G. Advanced Vehicle Control and Safety Systems

H. Total Overhaul of Laws and Regulations

Laws should protect the individual motorist

Issues List
Advanced Traveler Information Systems (ATIS)

Issues that may limit (or constitute significant opportunities for improving) transportation quality in Kentucky:

- Advanced Warning of Roadway Events/Conditions
- Programable Signs/HAR
- Construction Management
- Resource (Emergency response) Availability
- Unavailability of Efficient Transit
- Congestion Management
- Air Fare
- Incident Detection/Management
- Linking Traffic Management Centers
- Public/Private Partnerships
- Internet
- Budgets - Prioritizing
- Education
- Apathy for Change
- Availability of Services
- Agency Turfism
- Lack of Forethought
- Too Few Persons per Vehicle
- Public Transit/Attractiveness
- Reduction in Vehicle-Miles Traveled
- Remote Areas
- Lower than Average Vehicle Turnover

Most Important Issues Selection

Please select the three most important issues that you believe deserve immediate attention and list them (in order of importance) under "Top Three Issues". Then list two issues you believe deserve longer-term attention. (You may identify issues not listed above.)

Top Three Issues

1.____

2.____

3.____

Longer-Term Issues

1.____

2.____

NOTE: It is important that you turn in this sheet at the end of this session. If you wish to remain anonymous it's ok with us. Otherwise, please provide your name, telephone and e-mail below. Thank you for participating.

____

ADD Issues

Issues voted as top three by participants
1. Congestion Management (11)
2. Advanced Warning of Roadway Events/Conditions (10)
3. Construction Management (7)
4. Unavailability of Efficient Transit (3)
5. Resource Availability (3)
6. Education (2)
7. Incident Detection/Management (2)
8. Programmable Signs/HAR (2)
9. Public Transit/Attractiveness (2)
10. Budgets - Prioritizing
11. Education - Emergency Response - Engineering
12. Remote Areas
13. Availability of Services
14. Apathy for Change
15. Agency Turfism

Longer-Term Issues
1. Education (4)
2. Too Few Persons Per Vehicle (4)
3. Incident Detection/Management (4)
4. Budgets/Prioritizing (3)
5. Remote Areas (3)
6. Linking Traffic Management Centers (2)
7. Resource Availability (2)
8. Public/Private Partnerships (2)
9. Reduce Vehicle-Miles-Traveled (2)
10. Availability of Services (1)
11. Air Fare (1)
12. Public Transit Attractiveness (1)
13. Programable Signs (1)
14. Construction Management (1)
15. Internet (1)
16. GPS Systems in Cars (1)

COMMENT SHEET
Advanced Traveler Information Systems

Do you feel that this vision accurately reflects your views of what traveler information in Kentucky should be like in approximately 20 years?

___ Yes ___ No

Please explain your answer.

____
____
____
____
____
____
____
____

We have developed the following goals relating to traveler information. Please write in any goals that you feel should be added to this list then rank them in order of importance.

Rank

_____ 1. To reduce traffic congestion resulting from construction projects, roadway hazards, and adverse weather conditions by improving traveler awareness of these situations.
_____ 2. To enhance traffic information and management services by integrating them on a regional basis.
_____ 3. To improve the response time and increase the availability of emergency services.
_____ 4. To increase the attractiveness of public transit through the use of better transit information systems.
_____ 5. To increase tourism travel in Kentucky through better dissemination of information.
_____ 6. ____
_____ 7. ____

Additional comments:

____
____
____
____
____
____
____

Vision and Goals Comments

Do you agree with vision?

13 YES 03 NO (ADD)
07 YES 00 NO (Focus Group)

The current vision has been revised to reflect the "NO" comments if possible. A summary of those comments follows:

Technology
Technology should be more advanced by 2020.

Deployment Areas
Deployment should not be confined to the metropolitan areas only.

Education
Drivers need better education as to the rules, signs, and laws of the highway and driving.

Goals	1st	2nd	3rd	4th	5th	6th	7th	Score	Rank
To reduce traffic congestion resulting from construction projects, roadway hazards, and adverse weather conditions by improving traveler awareness of these situations	10	8	1	1	1			130	1st
To enhance traffic information and management services by integrating them on a regional basis	5	4	7	3	2	1		114	3rd
To improve the response time and increase the availability of emergency services	4	10	6	2				128	2nd
To increase the attractiveness of public transit through the use of better transit information systems	1		4	7	9			82	4th
To increase tourism travel in Kentucky through better dissemination of information			3	9	9			78	5th
To reduce traffic congestion	1							7	6th
Education of drivers	1							7	6th

10.3 APPENDIX C

SUMMARY OF SURVEY OF ITS ACTIVITIES IN OTHER STATES

Survey of ITS Strategic Plan Status

STATE	STATEWIDE PLAN COMPLETE	STATEWIDE PLAN IN PROGRESS	COMMENTS
Alabama	No		Let urban areas act/plan independently
Alaska	No		Have a rural scoping study concentrated on CVO
Arizona	No	Yes	Have rural corridor study, infrastructure study, two urban plans.
Arkansas	No		Are not currently using ITS
California	Yes		Have both a plan and an update
Colorado	Yes	Yes	Working on new version
Connecticut	No		Working on two urban plans
Delaware	No	Yes	
Florida	No	Yes	
Georgia	No	Yes	
Hawaii	No		Use very little ITS
Idaho	No		Use very little ITS
Illinois	No		Have draft of urban plan and ITS fact sheets
Indiana	No	Yes	
Iowa	No	Yes	
Kansas	No		Working on urban plans
Kentucky	No	Yes	
Louisiana	No	Yes	
Maine	No		Starting urban plan for Portland
Maryland	Yes		Have separate document to describe projects
Massachusetts	No		Have plans for urban areas
Michigan	Yes		
Minnesota	Yes		Also have shorter executive report and rural scoping study
Mississippi	No		Do not see a need for one
Missouri	No		Have urban plans
Montana	No	Yes	
Nebraska	No	Yes	
New Hampshire	No		Using very little ITS
New Jersey	Yes	Yes	Working on new, better plan to replace current unapproved plan
New Mexico	No		Considering starting a plan
New York	No		Have brief ITS statement

North Carolina	No		Have urban plans
North Dakota	No		Use some ITS technology
Ohio	No		Have six urban plans and a rural corridor study
Oklahoma	No		Working on urban plan for Oklahoma City
Oregon	No	Yes	
Pennsylvania	Yes		Also have paper about planning process
Rhode Island	No	Yes	Have preliminary draft
South Carolina	No		Starting with urban areas
South Dakota	No		Working with CVO only
Tennessee	No	Yes	Just completed a progress report
Texas	Yes		
Utah	No		Have urban plan for Salt Lake City
Vermont	No		ITS included in overall transportation plan
Virginia	Yes		Also have update with project list
Washington	Yes		Also have video about ITS
West Virginia	Yes		
Wisconsin	No		Refer to ITS in their DOT strategic plan
Wyoming	No		Using some ITS

Note: Most of the "urban plans" were referred to as Early Deployment studies for ITS in urban areas.

Comparison of Selected ITS Strategic Plans

CALIFORNIA

Date Completed:	October 1995 (update in Dec. 1996)
Plan Preparer:	New Technology and Research Program
Plan Time Frame:	15 years (5 years for details)
Vision Statement:	Yes
Mission Statement:	Yes (called a charge)
List of Specific Goals:	Yes
Discussion of National Architecture:	No, but mentioned in plan update
Discussion of State Architecture:	No
Use of Functional Areas or User Services:	No separate plans for functional areas or user services. Services are sorted by elements, many of which match the user services (the update incorporates the market packages of the National ITS Architecture).
Business Plan:	No business plan

COLORADO

Date Completed:	February 1995
Plan Preparer:	Castle Rock Consultants, Centennial Engineering
Plan Time Frame:	Not given
Vision Statement:	No
Mission Statement:	No
List of Specific Goals:	Yes
Discussion of National Architecture:	No
Discussion of State Architecture:	No
Use of Functional Areas or User Services:	No separate plans for functional areas or user services, but uses the user services and the user service bundles.
Business Plan:	This is a combined strategic plan and business plan.

MARYLAND

Date Completed:	October 1996
Plan Preparer:	Maryland DOT
Plan Time Frame:	6 years
Vision Statement:	No
Mission Statement:	Yes
List of Specific Goals:	No
Discussion of National Architecture:	No
Discussion of State Architecture:	No
Use of Functional Areas or User Services:	No separate plans for functional areas or user services. Projects sorted by categories similar to user services.
Business Plan:	Entire two volume document is called a Business Plan. The first volume is a strategic plan including some general funding information. The second volume contains descriptions and costs for specific projects.

MICHIGAN

Date Completed:	1996
Plan Preparer:	Kan Chen, Incorporated
Plan Time Frame:	15 years
Vision Statement:	No, does have entire vision section
Mission Statement:	No
List of Specific Goals:	No
Discussion of National Architecture:	Yes
Discussion of State Architecture:	No
Use of Functional Areas or User Services:	No separate plans for functional areas or user services, but uses the user services and market packages are covered in the appendix.
Business Plan:	No business plan, but does include a long project list.

MINNESOTA

Date Completed:	March 1997
Plan Preparer:	SRF Consulting Group, Castle Rock Consultants, and Cambridge Systematics, Inc.
Plan Time Frame:	Not given
Vision Statement:	Yes
Mission Statement:	No
List of Specific Goals:	Yes
Discussion of National Architecture:	No
Discussion of State Architecture:	Briefly mentioned
Use of Functional Areas or User Services:	No separate plan for functional areas or user services. Potential projects are divided into "Deployment Concepts" which include a mix of functional areas, user services, and other concepts.
Business Plan:	This strategic plan includes a list of several potential projects. A three year work plan will be created to provide project details such as schedule and budget.

NEW JERSEY

Date Completed:	Not given
Plan Preparer:	Parsons Brinckerhoff - FG, Inc.; PB Farradyne, Inc.; TransManagement, Inc.; Dunn Engineering Associates; Roper and Associates; HNTB Corporation; Frederic R. Harris, Inc.; Texas Transportation Institute; and Howard/Stein-Hudson Associates.
Plan Time Frame:	Not given
Vision Statement:	Yes
Mission Statement:	Yes
List of Specific Goals:	No
Discussion of National Architecture:	Yes
Discussion of State Architecture:	Yes
Use of Functional Areas or User Services:	No separate plans for functional areas or user services. Eleven of the user services are recommended for application in New Jersey.
Business Plan:	There is not a separate business plan. Specific locations are recommended for ITS applications and there is a listing of current and future projects.

PENNSYLVANIA

Date Completed:	October 1995
Plan Preparer:	Pennsylvania DOT
Plan Time Frame:	Not given
Vision Statement:	Yes
Mission Statement:	No
List of Specific Goals:	Yes
Discussion of National Architecture:	No
Discussion of State Architecture:	No
Use of Functional Areas or User Services:	No
Business Plan:	No business plan

TENNESSEE

Date Completed:	June 1997
Plan Preparer:	Vanderbilt Engineering Center for Transportation Operations and Research
Plan Time Frame:	Not given
Vision Statement:	No
Mission Statement:	No
List of Specific Goals:	No
Discussion of National Architecture:	No
Discussion of State Architecture:	No
Use of Functional Areas or User Services:	No separate plans for functional areas or user services. Organized by the ITS user services.
Business Plan:	No business plan

Note: Information for Tennessee is taken from a strategic planning progress report which is not a completed strategic plan.

TEXAS

Date Completed:	May 1996
Plan Preparer:	Texas Transportation Institute
Plan Time Frame:	Not given
Vision Statement:	No
Mission Statement:	No
List of Specific Goals:	No
Discussion of National Architecture:	Yes
Discussion of State Architecture:	No
Use of Functional Areas or User Services:	No separate plans for functional areas or user services. Organized by 12 "emphasis areas" which include several of the user services.
Business Plan:	No business plan

VIRGINIA

Date Completed:	March 1993
Plan Preparer:	Virginia DOT
Plan Time Frame:	20 years
Vision Statement:	No
Mission Statement:	Yes
List of Specific Goals:	No
Discussion of National Architecture:	Yes
Discussion of State Architecture:	No
Use of Functional Areas or User Services:	No separate plans for functional areas or user services. Organized using the first five functional areas.
Business Plan:	A ten year business plan was completed in 1997.

WASHINGTON

Date Completed:	November 1993
Plan Preparer:	JHK & Associates
Plan Time Frame:	20 years
Vision Statement:	No
Mission Statement:	No
List of Specific Goals:	Yes
Discussion of National Architecture:	No
Discussion of State Architecture:	Yes
Use of Functional Areas or User Services:	No separate plans for functional areas or user services. Organized by five categories which are similar to the user services.
Business Plan:	No separate business plan, but does include a detailed project list and an action plan with some funding information.

WEST VIRGINIA

Date Completed:	December 1996
Plan Preparer:	West Virginia DOT
Plan Time Frame:	Not given
Vision Statement:	Yes
Mission Statement:	No
List of Specific Goals:	No
Discussion of National Architecture:	No
Discussion of State Architecture:	No
Use of Functional Areas or User Services:	No separate plans for functional areas or user services. Divided into the six functional areas.
Business Plan:	No business plan

Summary of ITS Strategic Plans

State	Date Completed	Plan Preparer	Time Frame	Vision Statement	Mission Statement	List of Goals	National Architecture	State Architecture	Functional Areas / User Services	Business Plan
California	Oct. 1995	New Technology and Research Program	15 years	Yes	Yes	Yes	No	No	No	No
Colorado	Feb. 1995	Castle Rock Consultants, Centennial Engineering	**	No	No	Yes	No	No	User Services	Included
Maryland	Oct. 1996	Maryland DOT	6 years	No	Yes	No	No	No	No	Separate
Michigan	1996	Kan Chen, Inc.	15 years	No	No	No	Yes	No	No	No
Minnesota	Mar. 1997	SRF, Castle Rock, Cambridge Systematics	**	Yes	No	Yes	No	No	No	No
New Jersey	**	Parsons Brinckerhoff, Farradyne, HNTB, TTI, ...	**	Yes	Yes	No	Yes	Yes	No	No
Pennsylvania	Oct. 1995	Pennsylvania DOT	**	Yes	No	Yes	No	No	No	No
Tennessee	June 1997	Vanderbilt Engineering Center	**	No	No	No	No	No	User Services	No
Texas	May 1996	Texas Transportation Institute	**	No	No	No	Yes	No	No	No
Virginia	Mar. 1993	Virginia DOT	20 years	No	Yes	No	Yes	No	Functional Areas	Separate
Washington	Nov. 1993	JHK & Associates	20 years	No	No	Yes	No	Yes	No	Included
West Virginia	Dec. 1996	West Virginia DOT	**	Yes	No	No	No	No	Functional Areas	No

** Information not given in report.

Note: Information for Tennessee is taken from a planning progress report, not a completed strategic plan.

10.4 APPENDIX D

BUSINESS PLAN FOR ITS-CVO PROJECTS IN KENTUCKY

ITS-CVO Projects for Kentucky

10.4.1 Deskside Operations

10.4.1.1 Registration, Taxation, and Permitting Improvements

Sponsoring Projects: FHWA/OMC CVISN Model Deployment: $269,000; Empower Kentucky & KTC: $685,000 & $456,000

Other Agencies/clients: Commercial Vehicle Operators, Safety and Enforcement, Taxation

Project Objectives: Reduce time and money costs to public and private sectors of registration, taxation and permitting. Increase levels of compliance with registration, taxation and permitting requirements.

Products/Outcomes: Simplified registration, taxation and permitting processes through electronic application, information sharing, employee cross-training, and improved compliance incentives. Relatively greater benefits for smaller carriers, but significant benefits for nearly all carriers.

Project Narrative:

This project is a cooperative effort composed of electronic upgrades sponsored by CVISN Model Deployment and process improvements advocated by the Empower Kentucky initiative. The Empower Tax Process Team recognized at the outset that the registration process was costing enforcement and carriers time and money. Thus they concentrated on improving processes. Registration will be performed from carriers' PC or through public access points, such as county court houses or libraries. Cross-trained staff will assure that in-person visits will involve a minimum of contact people. Participation in regional registration and fuel tax clearinghouses will speed and smooth allocation of tax funds. Oversize/Overdimensional permitting will be automated so that they may be issued more rapidly. Registration information will also be made available to enforcement personnel at the roadside. Conceptually, the overall project addresses Credentialing and Carrier Systems, Clearinghouse Interfaces, Bonding Requirements, Staff Training, and Regulation Uniformity.

Credentialing and Carrier Systems

As part of CVISN Model Deployment, the credentialing projects are aimed primarily at reducing the time and labor costs of the permitting function. They involve automating the current paper-based registration process, so that electronic information transfers can substitute for information and money currently transmitted through the mail. Successful deployment of this component is especially reliant on user-friendly software.

One of the objectives of the Kentucky model deployment is to demonstrate electronic application for credentials by motor carriers through appropriate PC software interface (CATS) in the carriers' office and a similar interface in the state office for purposes of entering data in that office, when needed. A further articulation of this concept envisions the interface as web-based, so that carriers can use the most popular web browsers to reach a CAT interface that resides on the state's servers.

As part of Kentucky's objective to—

- demonstrate electronic application, permitting, and tax processing for credentials by motor carriers and
- interface the state's systems to the International Registration Plan (IRP) and the International Fuel Tax Agreement (IFTA) Clearinghouses,

the state is planning to demonstrate the implementation of a Credentials Interface (CI) that will communicate with the CAT or Web Interface on one hand and translate the information into a useable format for legacy systems on the other. Those legacy systems interfaces to be upgraded are:

- KY Intrastate Tax System
- Oversize / Overweight
- Single State Registration
- KY Weight-Distance Tax
- KY Special Permitting (Temporary Authority)
- IFTA, and
- IRP.

The Credentialing System improvements will also include establishing a state web interface for the IRP, IFTA, and Overweight/Overdimensional, along with appropriate connections to the IFTA and IRP clearinghouses.

Clearinghouse Interfaces

Clearinghouse interface improvements concentrate on completing the information circuit with regional clearinghouses, so that important tax and registration information about carriers can be shared between states. Thus integration and coordination are the primary concerns of Clearinghouse Interface projects, and user-friendliness is slightly less of a concern.

Eliminate Bonding Requirements

This initiative responds to a problem whereby the price to ensure compliance is greater than the compliance fees themselves. The current bonding arrangement costs carriers several million dollars a year, while yielding the Cabinet around $775,000. The new policy will only require bonding from carriers with a record of poor reliability.

Regulation Uniformity with Other States

This initiative, while broadly stated, is aimed at improving the operational climate for carriers by reducing the complex of regulations faced by them.

Cross-Train Staff

While process improvements often take the form of new configurations of people and technology, few recognize the need for versatile staff that can accommodate the increasing rate of change.

Resources Required:

Implementation:
Personnel: Software modifications, Employee retraining
Capital Investment: Software & hardware in agency, carriers' sites, and public sites

Operations:
Personnel: Four to five new staff, Training at remote sites
Maintenance: Software & hardware maintenance and upgrades
Operations: Carrier Outreach, Local Site Support

Total Cost
$1.4 million over 3 years.

Major Issues/Problems

External software development schedule lagging. Carrier support and training obligations may grow with increasing adoption of the concept. Additional money may be needed to extend coverage to more carriers in the following 3 years.

Schedule/Timing

Initial IRP installations of system and 3 pilot carriers by 1/1/98. Extension to 12 carriers by 1/1/99, 10% of carriers by 1/1/00, and 50% of carrier market by 1/1/02. Motor carrier education on the adoption and use of the system will need to extend to at least 7/1/99.

10.4.1.2 Institutional Issues Working Group

Sponsoring Projects/Agencies: FHWA/OMC: $600,000
Participating States: $600,000 (Kentucky $50,000)

Other Agencies/clients: 14 Southeast and Midwest states

Project Objectives: Devote collective resources of member states to solving common institutional issues of CVO.

Products/Outcomes: Common data requirements for registration, permitting functions among member states.

Project Narrative:

The working group has at its disposal approximately $1.2 million with which to resolve any relevant institutional issues associated with CVO. Current attention is aimed at common data requirements and format for CVO registration. The prime contractor tasked is Georgia Tech.

Resources Required:

Implementation:
Personnel: Interviews, collating, dictionary preparation, requirements summary

Total Cost:
$1.2 million

Major Issues/Problems:

Conducting the research and implementation in a manner that is complementary to the CVISN architecture. Potential exists to define an extended CVIEW snapshot common to a region.

Schedule/Timing:

ASAP: Project must be completed by 1/1/99.

10.4.1.3 Mini-CVO IRP Joint State Test

Sponsoring Projects: Kentucky Transportation Cabinet, interested private carriers

Other Agencies/clients: Other states

Project Objectives: Extend the advantages of electronic registration to the less-than-26,000 lb. parcel van.

Products/Outcomes: Expanded registration capabilities for CATS. Extension of registration, taxation, and permitting information to cover small CVO as well as TL and LTL.

Project Narrative:

The primary advantage of CATS is the time and inconvenience saved in registering large numbers of trucks. Some companies have equally large numbers of small CV that require registration. While attention has been focused on large CV because of their greater complex of regulation requirements, the advantages of the automated process can nevertheless be extended to smaller vehicles.

Resources Required:

Implementation:

Personnel: Modification of existing software

Operations:

Operations: Expanded volume of automated registration

Total Cost:

Unknown at this time

Major Issues/Problems:

Unknown.

Schedule/Timing:

Following proofing of system under CVISN: 1999 or later.

10.4.2 Roadside Operations

10.4.2.1 Advantage CVO (I-75)

Sponsoring Projects/Agencies: FHWA/OMC: 80% cash; Participating States: 20 % cash + infrastructure preparation (approximately 50%-50% split for total costs); Post-Pilot Funding: Participating States: $100,000/year

Other Agencies/clients: 6 states and 2 provinces along the I-75 corridor from Florida to Canada, commercial carriers, general public

Project Objectives: Test the efficacy of technologies for screening trucks along major highways, and build the necessary institutional framework to support a multi-state communications and technology system.

Products/Outcomes: A safety and weight-based screening system for a set of approved carriers operating on the I-75 corridor that reduces the frequency of stops. This contributes to efficiency and safety for all traffic on the corridor.

Project Narrative:

This project is responsible for much of Kentucky's current opportunity, by providing a regional test-bed for roadside ITS-CVO. It has nearly reached maturity, having demonstrated the potential for electronic information systems to screen and clear trucks at highway speeds. It has brought together an array of states and two countries and tested a variety of exotic technologies while maintaining a stable institutional umbrella within which to conduct these tests. It is now the vehicle that will allow the deployment of MACS2, an improved and rationalized version that provides greater interoperability and improved carrier service. Enrollment in the system will be increased to over 10,000 in the next year, even as the system is transitioning. While it faces internal integration weaknesses, it has at the same time demonstrated superb external integration capabilities, bringing together a great many public and private entities in a common endeavor.

Resources Required:

Implementation:

Personnel: Installation and modification of hardware/software
Capital Investment: WIMs, Readers, Communication system, Transponders, PCs, Software

Operations:

Personnel: Operations center to track enrollments and daily data
Maintenance: Hardware and software modifications and troubleshooting

Total Cost:

Estimated $13.5 million to date for all participating states

Major Issues/Problems:

Hardware reliability posed the greatest challenge. System complexity created many opportunities for failure. Current system reliable. Institutional issues of cooperation mostly solved. System finance strategy unsolved at national level.

Schedule/Timing:

System shifts from Federally-supported test-bed to stand-alone operation on October 1, 1997. Participating states have adopted a modified operational concept for the coming fiscal year that enables them to continue operation of the system through public sector funds. Entire system is anticipated to shift to CVISN compliance in next 2 years. (See Electronic Screening Project)

10.4.2.2 Electronic Screening

Sponsoring Projects: FHWA/OMC CVISN Model Deployment: $630,000; Kentucky Transportation Cabinet: $313,000

Other Agencies/clients: Commercial Vehicle Operators, General Public

Project Objectives: Improve speed and selectiveness of current method of screening. Extend screening capability to all weigh stations in state. Reward safe carriers, target unsafe carriers.

Products/Outcomes: Screening hardware/software that relies on CVISN-based information as to safety history, registration and permitting records, to indicate the likelihood of selecting trucks for weighing and/or inspection. Installations that are interoperable technically and institutionally with other CVISN compliant screening systems. Unmanned, remote installations on selected bypass routes to better monitor carriers who may be avoiding mainline inspection stations. Remote sites would employ the same screening philosophy as mainline stations.

Project Narrative:

Kentucky's redesigned roadside clearance system emphasizes clearing safe carriers and weighing those who are pulled in for other reasons. This creates a system more user-friendly, and reliant on good safety performance and information integration. Again, the primary issue is currency and accuracy of information.

While Kentucky has had much experience with mainline automated clearance systems (MACS), the expansion of the concept to include satellite sites and video/OCR capability results in a more dynamic and effective system.

MACS currently exists at 4 stations in Kentucky along the I-75 corridor in the Advantage CVO Partnership. While currently in operational test, Advantage CVO will not be deployed as the CVISN electronic screening model for Kentucky. A different and more open model known as MACS2 will be developed and deployed instead. Using lessons learned from the Advantage CVO Partnership, MACS will be relying less on the in-vehicle transponder and more on the processing of snapshot data at the roadside. The current plan is to retro-fit the Kenton County station to be compatible with CVISN. Ideally, this will also serve to demonstrate system interoperability generally.

MACS2 will be the primary sub-system within Kentucky's screening strategy. Satellite sites and video/OCR technology, however, will greatly enhance mainline screening. Satellite sites will be unmanned sites located on by-pass routes remotely operated by the nearby mainline station. The basic system will utilize video readers for vehicle identification. The system will be designed to permit OCR and WIM upgrades when determined cost-effective for this application.

OCR readers offer great flexibility to the screening process. The basic configuration entails a video/OCR reader at the ramp sorting WIM processing against the snapshot database. An additional function of this reader would be to validate the registered weight against actual weight.

Resources Required:

Implementation:

Personnel: Software modifications, training

Capital Investment: Readers, WIMs, Cameras, Computers, Land and Installation at satellite site

Operations:

Personnel: Monitor Satellite Sites, Retraining

Maintenance: Hardware/Software Upgrades, WIM and Camera Care

Total Cost:

$943,000 over 5 years, including all weigh stations

Major Issues/Problems:

Smooth conversion path from current weight-based Advantage CVO installations to CVISN information-based evaluation. Adoption of philosophical shift from weight-based to safety and compliance-based screening. Evaluation of effectiveness of remote sites.

Schedule/Timing:

Testing new system at one station by 7/1/98. Accompanying remote site by 1/1/99 Three sites by 1/1/00, all sites by 6/1/02.

10.4.2.3 I-65 Electronic Screening Test

Sponsoring Projects: Kentucky Transportation Cabinet $100,000; Indiana DOT: $100,000

Other Agencies/clients: Commercial carriers.

Project Objectives: To develop a low-cost approach to electronic screening which encourages maximum participation.

Products/Outcomes: A system design which can be (relatively) inexpensively procured, installed, and maintained.

Project Narrative:

In the process of redesigning the Advantage CVO Mainline Automated Clearance System (MACS) software for CVISN, a number of interoperable, but alternative models, were designed. It became clear from the experiences learned from Advantage CVO that a low-cost alternative was needed to maximize the number of states which could deploy electronic screening systems. The challenge was to eliminate the need for a weigh-in-motion scale and the expensive networking between weigh stations, which are/were features of the original I-75 MACS.

I-65 MACS will utilize a "quality control" approach to screening where trucks will be pulled-in for weight and safety checks randomly. As a history of their weight and safety performance is compiled over time, the rate of "pull-ins" can be varied according to their weight and safety performance. This system and methodology is very similar to the electronic screening system to be used by Kentucky for CVISN (*Model MACS*); however, it does not require the near real-time data link to acquire snapshot data from the CVIEW.

Resources Required:

Implementation:
- Personnel: Installation of new software
- Capital Investment: New software

Operations:
- Personnel: No effect
- Maintenance: Reader maintenance
- Operations: Expanded screening capabilities

Total Cost:

$200,000 over two years

Major Issues/Problems:

Acceptance of the motor carrier industry of this screening approach.

Schedule/Timing:

Installation at one station to be completed by 1/1/00.

10.4.2.4 Kentucky-Tennessee Joint Weigh Station Project

Sponsoring Projects: Kentucky Transportation Cabinet, Tennessee D.O.T.

Other Agencies/clients: Commercial carriers

Project Objectives: Reduce enforcement costs by cooperating on the enforcement efforts in weigh stations along shared borders.

Products/Outcomes: Tandem weigh stations, one on each side of the border, that both meet the weight and inspection enforcement and information needs of both states, thereby eliminating the need for two additional stations. The northbound weigh station would be provided by Kentucky, and the southbound by Tennessee.

Project Narrative:

This project is an outgrowth of the regional philosophy pioneered by the Advantage CVO (I-75) project and formalized by the CVISN architecture. The exact nature of this field enforcement cooperation is in part a function of the final form of other ITS-CVO projects underway in the two states, so that enforcement philosophies and needs can be harmonized. This project will also help enable future similar efforts with West Virginia.

Resources Required:

Implementation:

Personnel

Capital Investment: Communications equipment installation at both stations

Operations:

Personnel

Communications

Maintenance
Operations

Major Issues/Problems:

Cooperation on issues of enforcement needs, requirements, registration information, inspection techniques, and electronic information sharing.

Schedule/Timing:

No firm schedule has been established, as it is reliant on resolving other interoperability issues.

10.4.2.5 MAPS-Advantage CVO Interoperability Agreement

Sponsoring Projects/Agencies: Advantage CVO Partnership, Multi-Jurisdictional Automated Preclearance System

Other Agencies/clients: Member states, Future member states, Commercial carriers

Project Objectives: Create a common application, technology, and clearance environment for the participating carrier

Products/Outcomes: Participating carriers can use one transponder to electronically clear weigh stations allied with either system.

Project Narrative:

This agreement is the first of its kind to commit to operationally solve the potential interoperability issues between two independently developed electronic screening systems, all the while remaining compliant with the CVISN architecture.

Resources Required:

Implementation:
Personnel: Information Systems, Project Management, Client Outreach, Public Information

Total Cost:
Unknown, anticipated to be minimal

Major Issues/Problems:

Creating a common application form. Resolving differences in the market approach to distributing transponders.

Schedule/Timing:

Initial agreement signed January 29, 1998. Full implementation expected by September 30, 1998.

10.4.2.6 Infra-Red Brake Testing Technology (IRISYSTEM)

Sponsoring Projects/Agencies:	FHWA/OMC, Kentucky Transportation Cabinet, Virginia, North Carolina, Tennessee
Other Agencies/clients:	Commercial Carriers
Project Objectives:	Assess the utility of a system for quickly measuring the condition of brakes, under a variety of conditions and geographical settings.
Products/Outcomes:	Recommendations as to improvements to and further deployment of brake testing technologies in the participating states.

Project Narrative:

This technology appears to hold promise as a way to quickly evaluate the condition of brakes on a large number of trucks, thus speeding up the inspection process and improving the quality. An infrared camera detects a surplus or deficit of heat in brakes, tires, and loads, thus indicating overloaded or low pressure tires, failing or non-functioning brakes, and certain characteristics of some cargo. An added video camera provides overall truck identification for later use, if needed.

Resources Required:

Implementation:
Personnel: Extensive training required (min. one week)

Total Cost:
Approx. $500,000 (per equipped van)

Major Issues/Problems:

High cost of equipment. Requires a trained crew for effective use. Reliable and useful results require personnel dedicated to that enterprise alone, removing them from other enforcement activities.

Schedule/Timing:

Complete by 7-1-99

10.4.3 Safety Information Systems

Sponsoring Projects/Agencies:	FHWA/OMC CVISN Model Deployment: $60,000; Empower Kentucky: $1.04 million; MCSAP $100,000
Other Agencies/clients:	Commercial Vehicle Operators, General Public
Project Objectives:	Make near real-time safety and compliance information available to enforcement officers at inspection stations.
Products/Outcomes:	Electronic access to safety, registration and taxation databases, both nationally and state-based (CVIEW snapshot), on PC's in each inspection station. PC's also provide input to same databases for inspection results. Communication network extending into each inspection station for purposes of carrying data in and out.

Project Narrative:

Safety information system projects are designed to get current safety information to the roadside for immediate evaluation of carriers. The emphasis is on improving safety and rewarding safe carriers, regardless of whether the information is paperless or not.

In its most simple form, the CVISN safety system involves the collection of safety information at the roadside, the forwarding of that information so that it can be aggregated with other information, and finally making that aggregated data available to those making screening decisions and conducting inspections. This process, while not requiring a real-time automated screening decision, is greatly limited without one.

To accommodate the volume of data flowing to and from the weigh stations, we anticipate installing a high speed network connection such as frame relay which offers some measure of backward compatibility.

Suggestions arising from the Empower Kentucky initiative have pointed to alternatives to the strict use of pen-based computers for inspection purposes. While offering the mobile officer a greater degree of autonomy, at fixed sites we believe we can be more productive with networked workstations on which all weigh station operations will be integrated.

This offers several advantages. First, the workstation will not be dedicated to only one function, thereby permitting weigh station personnel greater flexibility in performing their duties. Second, the intended network architecture at the weigh station will offer better system reliability in the event one machine fails. Third, the workstations will offer generally improved communications between field and administrative personnel. Accordingly, laptop PCs, which offer the portability of the pen-based units and the flexibility of the workstation, will be used. Ultimately, these machines can be expected to perform many associated functions such as automated citations and accident reporting.

Resources Required:

Implementation:

Personnel: Communications infrastructure installations, PC installations
Capital Investment: Software & hardware

Operations:

Personnel: Retraining
Maintenance: Software & hardware upgrades
Operations: Subscription costs to databases

Total Cost:

$1.2 million over 3 years

Major Issues/Problems:

Persuading carriers that extensive information access is in their best interest. Reliability and current nature of information.

Schedule/Timing:

All 18 weigh stations to be networked by 1/1/99.