INTELLIGENT TRANSPORTATION SYSTEMS (ITS)

PROJECTS AND PROGRAMS

NOTE TO READER:

THIS IS A LARGE DOCUMENT

Due to its large size, this document has been segmented into multiple files. All files separate from this main document file are accessible from links (blue type) in the table of contents or the body of the document.

ATTACHMENT #6

STATE REPORTS

- Connecticut
- Michigan
- Minnesota
- Florida
- Colorado
- Illinois
- Ontario, Canada
- Wisconsin
- Virginia
- Ohio
- California
- South Carolina
- New York
- New Jersey

CONNECTICUT'S ADVANCED TANSPORTATION SYSTEMS
OCTOBER 1995

- Hartford are ATMS - Ten overhead-mounted radar detectors cover approximately twelve miles of I-84 and I-91 in the Capital region. Detectors are both wide band and narrow band. Two CCTV camera utilizing CODEC technology digitize the video image and send it back to Newington Operations Center.
- Newington Operations Center - Operates twenty-four hours a day, seven days a week. Monitors Hartford ATMS as well as computerized traffic signal system. Receives calls from state and local police over a 1-800 number regarding accidents and need for DOT assistance.
- I-95 Incident Detection System – Ninety-one camera and two hundred seventeen radar detectors have been installed along fifty-six mile stretch of I-95 from the New York State Line to Bradford. A fiber optic communications system provides transmission of both data communications and video surveillance data to an Operations Center located within the dispatch area of the new Bridgeport State Police Barracks.
- Variable Message Signs – forty-two additional LED signs are being installed within the I-95 corridor, including two in New York State. Half of these will be tied directly to the I-95 fiber-optic system. Upon completion of this project, Connecticut will have approximately seventy-five VMS statewide.
- Computerized Traffic signals – The current closed loop system is presently being expanded. As part of that expansion, alternate timing plans are being developed with local authorities to be used when traffic conditions warrant.
- Service Patrols – About to be inaugurated within the I-95 corridor. Four DOT service patrols will operate five days a week between the hours of 6:00am – 6:30pm, offering motorist assistance and providing gas, water, fuel as needed. The vehicles will be equipped with push bumpers to remove vehicles from travel lanes to safe areas.
- Advanced Traveler Information Systems – currently considering options made available to us through various proposals, including Smarte Routes and providing direct television feed to operations centers.
- Special Projects: Hartford Area Early Development Study
  New Haven ITS Strategic Deployment Plan
  CVO Institutional Issues Study
- For additional information on these or any other ITS related topics, please contact:

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Intelligent Transportation Systems (ITS)

Projects and Programs

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FOREWARD

This is a brief outline of the current projects and programs related to Intelligent Transportation Systems (ITS), formerly known as Intelligent Vehicle Highway Systems (IVHS), being planned, developed or implemented by the Michigan Department of Transportation (MDOT).

The projects are funded by the Federal Highway Administration, MDOT, private industry partners such as General Motors, Ford, Chrysler, GE/Ericsson, AAA of Michigan, Ameritech, Air Touch Teletrac, and others. Also, MDOT is in contract with the University of Michigan on several ITS projects.

Further information can be obtained by contacting Dr. Kunwar Rajendra, Engineer of Transportation Systems, at (517)373-2247.

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1. OPERATIONAL FIELD TESTS

The Michigan Department of Transportation (MDOT) is the program administration agency for DIRECT and an active participant in FAST-TRAC and Advantage I-75.

A. DIRECT (Driver Information Radio using Experimental Communication Technologies) DIRECT is a federal/state/private industry partnership to conduct an advanced traveler information systems (ATIS) operation field test. The goal of the project is to evaluate user benefits, institutional, and technical issues of enroute traveler information services in an operational setting. Emphasis is on the testing and evaluation of voice-based communication systems that offer basis services at a minimal incremental cost to the traveler, and a high potential for operational deployment.

   The project will deploy, operate, and evaluate a selected group of communication technologies that satisfy these criteria. Communication methods to be tested are:

   1) Low Powered Highway Advisory Radio (LP HAR) using an AM broadcast band frequency and radiated power of 100 miliWatts to 10 Watts.

   2) Automated Highway Advisory Radio (AHAR) using one of the 220 Mhz frequency pairs recently made available to the FHWA.

   3) Radio Broadcast Data System (RBDS) combined with an analog Subsidiary Communication Authorization (SCA) voice message.

   4) Cellular Call Server using a three-tiered menu system to query information about specific segments of the highway system.

In addition, the project will provide incident locations for assessment by the partners of the enhanced services like route guidance and navigation applications.

This plan, while using elements of the work performed in Phase I, emphasizes simplicity, low cost, very limited expansion of the infrastructure, and an increased role of the public-private partnership already in progress. This partnership will allow the introduction of evolving communications technologies, such as: The 220 Mhz band; development of the MITS (Michigan Intelligent Transportation Systems) Centers as a metro-wide traffic information center; and the utilization of the MITS Center and metropolitan Detroit as a futuristic and visionary test-bed for new communication technologies.

The system design contractor is REIM, of Ann Arbor, Michigan, and evaluation of the field test is being designed and conducted by the University of Michigan. Private industry partners of the project which are participating by contribution of equipment, cash and/or technical services include: General Motors, Ford, Chrysler, GE/Ericsson, AAA of Michigan, Capstone, Inc for

GPS/AVL, Ameritech, Metro Networks, and the University of Michigan. The largest funding partner is the Federal Highway Administration.

The design and procurements is currently in progress and it is expected that testing and evaluation will begin in the fall of 1995. The time period for completion of the test is two years.

B. FAST-TRAC

FAST-TRAC (Faster And Safer Travel through Traffic Routing & Advanced Controls) is administered by the Road Commission for Oakland County. It has completed its first phase of deployment and is well along into the second phase. MDOT is participating in the project. Two hundred intersections are equipped with SCATS adaptive traffic signal control system and Autoscope machine-vision vehicle detectors. Ali-Scout beacons have been installed at 40 locations in the I-75 corridor in Oakland County. The beacons are communicating with 60 vehicles equipped with the Ali-Scout dynamic route guidance system.

Plans call for the installation of an additional 125 SCATS controlled traffic signals, 61 more Ali-Scout beacons, and another 740 beacons equipped with the route guidance system by the end of 1995. A data exchange test between SCATS and Ali-Scout is underway. Systems integration work has begun and will include a link between the FAST-TRAC traffic operations center in Troy and the MITS Center in Detroit, thereby facilitating an integrated corridor traffic management in metropolitan Detroit.

C. ADVANTGE I-75

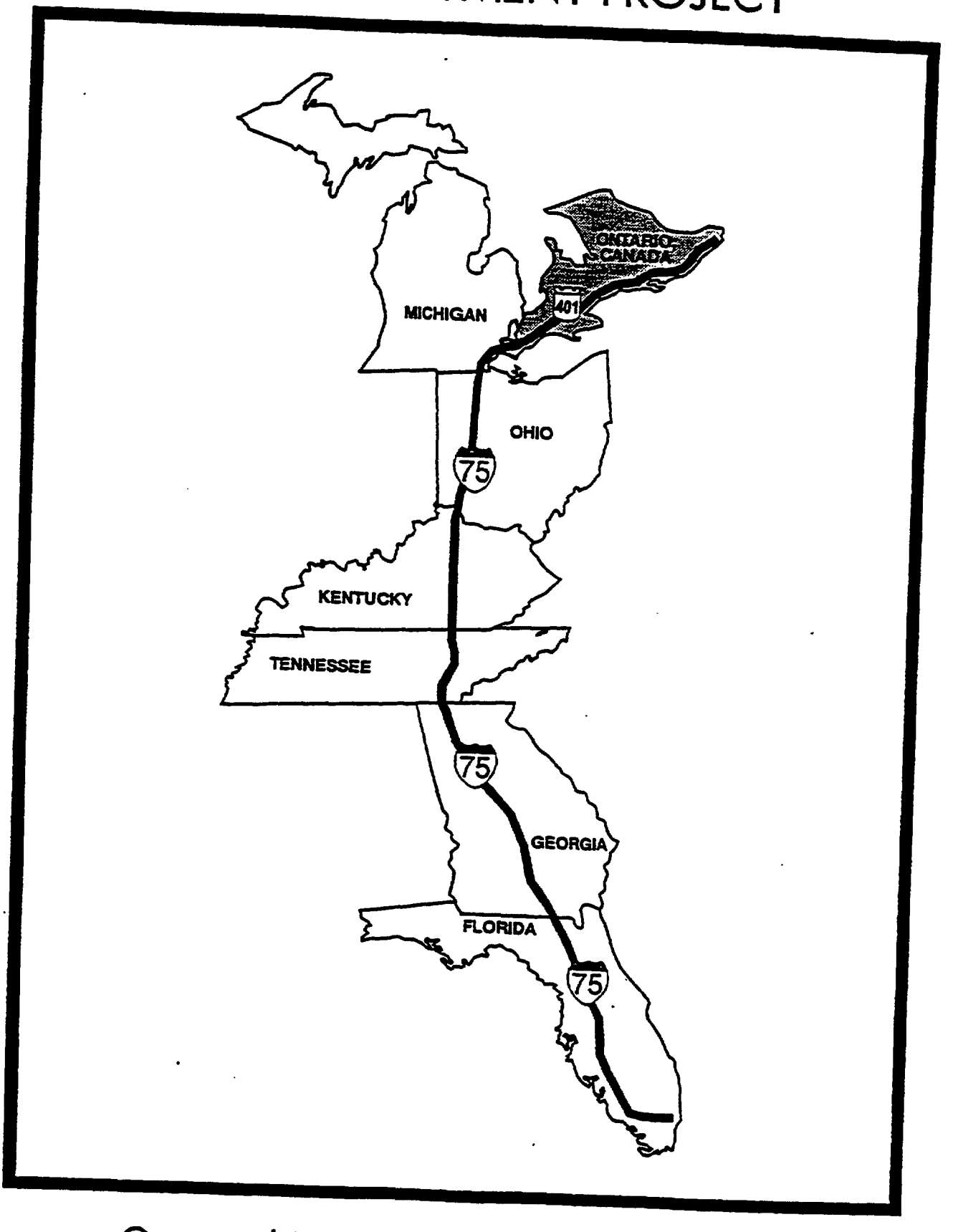
This project will deploy ITS technology to expedite clearance and movement of commercial vehicles across state lines between Ontario, Michigan, Ohio, Kentucky, Tennessee, Georgia, and Florida (Figure 1).

The system integrator is SAIC. Hughes Aircraft Company is the vendor for automatic vehicle identification/driver information. In-vehicle transponders have been designed and allocated initially to major carriers. Mainline weigh-in-motion (WIM) has been approved in several states including Michigan.

Michigan's portion of this effort will include WIM installation at the Erie weigh station on I-75 south of Detroit. Fiber optic communication will be used. Installation and testing have been completed. A ribbon cutting ceremony for the corridor was prepared by Secretary Pena on December 7, 1995. Rodney Slater of the FHWA preformed the ceremony at the Monroe County, Michigan on the same day.

ADVANTAGE I-75

IVHS DEPLOYMENT PROJECT



Geographic Location of Advantage I-75

Figure 1

2. ATMS/ATIS DEPLOYMENT IN METROPOLITAN DETROIT

The current system of traffic surveillance in the city of Detroit consists of 32 miles of freeways involving segments of I-94, M-10, and I-75. An expansion of the advanced traffic management systems/advanced traveler information systems (ATMS/ATIS) to cover an additional 148 miles of the freeway system in metropolitan Detroit is underway (Figure 2). The plan includes installation of CCTV camera, machine vision and inductive loop sensors, changeable message signs (CMS), ramp meters, and highway advisory radios (HAR).

Rockwell International will design and build the deployment to include 148 additional miles of freeway corridors in the City of Detroit, Wayne, Oakland, and Macomb counties, including I-75, I-696, I-94, I-96, I-275, M-39, M-10 and M-59. Integration of the Oakland county's FAST-TRAC traffic operation center in Troy with the MITS Center in Detroit is also included in this phase of expansion, thus making it one of the only areas in the country to link urban and suburban traffic monitoring systems. It is also proposed to integrate traffic information with Metro airport and the U.S.-Canada international border crossings in Detroit.

The Detroit ATMS/ATIS project will take about two years to complete at a cost of approximately $33 mullion.

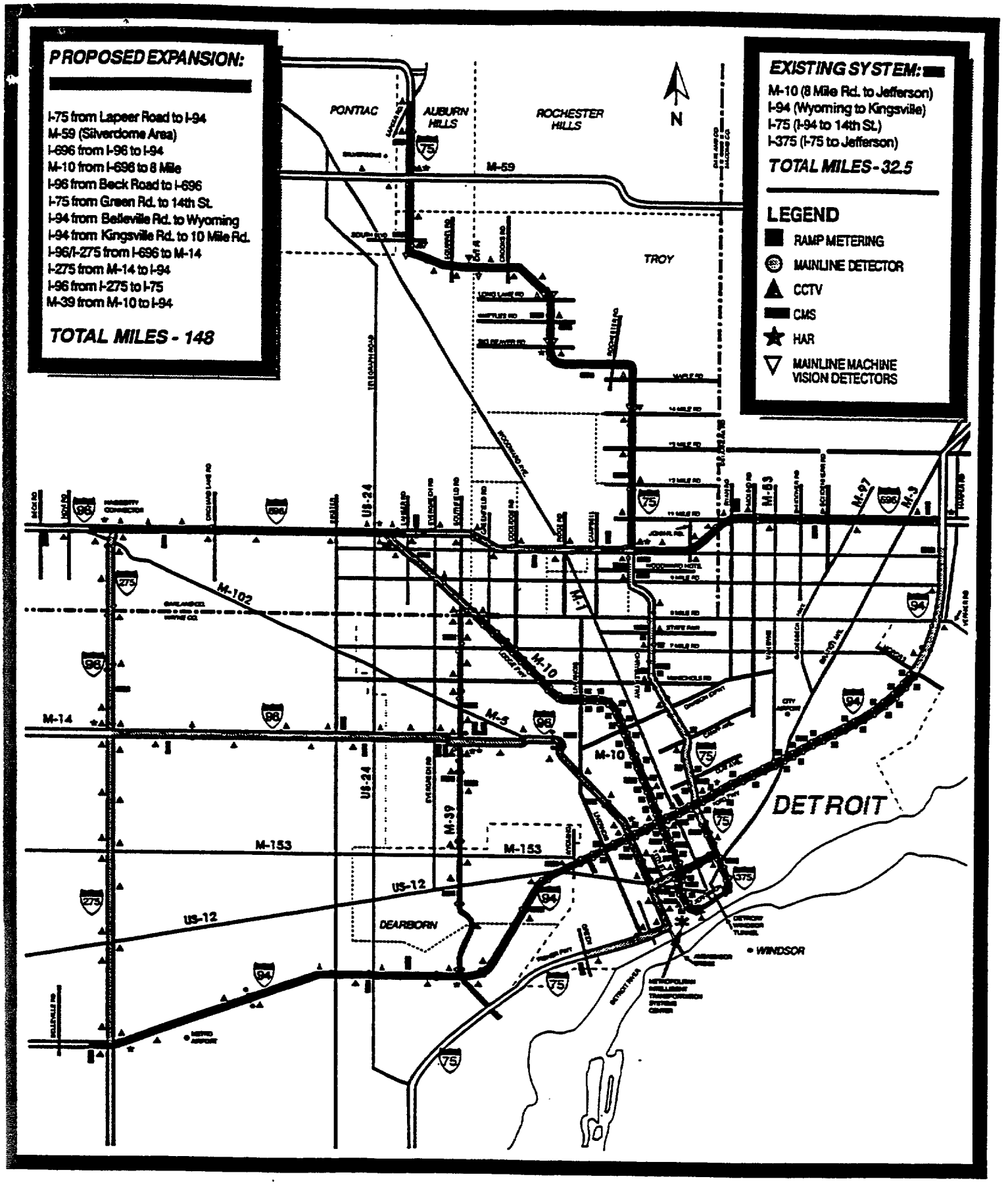
3. ATMS/ATIS EARLY DEPLOYMENT STUDY FOR METROPOLITAN GRAND RAPIDS

HNTB Michigan is conducting the ATMS/ATIS early deployment study for metropolitan Grand Rapids. This one year project with a budget of $500,000 will identify opportunities for application of advanced technologies to the transportation problems in the metropolitan area. An incident management plan for US-131 is also proposed to be completed as part of the contract.

4. ADVANCED PUBLIC TRANSPORTATION SYSTEMS (APTS) – Suburban Mobility Authority for Regional Transportation (SMART) SYSTEMS

The Federal Highway Administration and the Federal Transit Administration have approved a total of $16 million to set up APTS programs and purchase computer hardware and software in order to coordinate services using ITS and automated dispatch. The programs, which are administered by the Suburban Mobility Authority for Regional Transportation (SMART) for several counties including Macomb, Oakland, and Wayne, are as follows:

Dispatch Systems – Automatic functions of reservation, scheduling, etc.
AVL System – Place hardware and software aboard SMART buses to track the fleet.
Dispatch/AVL – Budget funds for affiliated agencies.
Regional 800 Number - 800 number to refer potential customers and interface into the SMART dispatch.
Data Collection Systems – Development activities to collect and report on available data.



S.E. Michigan ITS-ATMS/ATIS Deployment Program: 1995

Figure 2

Traveler Information Systems – Timely information available to SMART traveler. The system is proposed to cover Oakland, Macomb, and Wayne counties. Any further information can be obtained from Maclister, (810) 223-2127.

5. APTS: GRAPHIC DISPLAY SYSTEM FOR REAL TIME TRAFFIC INFORMATION SYSTEM

This project applied TIS technology to communicate real-time traffic information by a graphic display of the congestion levels on freeways. The display is color coded: green for normal traffic flow, red for heavy congestion, etc. The project consisted of providing the graphic display system at the dispatch centers of five public transit agencies and fleet owners and evaluating the results of savings in time by conduction "before" and "after" studies.

The agencies participating in this experiment are: Greyhound, United Parcel Service (UPS), Detroit Department of Transportation, Suburban Mobility Authority for Regional Transportation (SMART), and Commuter Shuttle Company at the Detroit Metro Airport. The evaluation study has been completed in May 1995 by Wayne State University.

6. APTS: ANN ARBOR SMART BUS

This project will support the Ann Arbor Transportation Authority's operational test of the "smart bus" concept. Included are an on-board bus communications and navigation system, a central control system and a cashless payment system. The on-board system will monitor actual performance in regard to route, schedule and location. It will allow control of on-board electrical equipment such as destination signs, electronic engine controls, enunciators and fare collection systems. The on-board system will also enable the buses to interact with traffic signal controllers and to communicate with the central control system. The central control system will integrate the data from the bus fleet for coordinated supervision and will also provide real-time transit information to the public. The cashless payment system will test radio frequency proximity cards as an inter-modal payment method. It will enable creative cost-saving methods for fare payment.

The project is funded by a $1.5 million Federal Transit Administration (FTA) capital grant. The operational test will be evaluated by the University of Michigan and the Volpe National Transportation Systems Center. An RFP is being issued for selection of a consultant.

7. STATEWIDE INCIDENT MANAGEMENT EFFORTS AND MICHIGAN INCIDENT MANAGEMENT CONFERENCE, 1995

The Metropolitan Detroit Incident Management Coordinating Committee, with representatives from MDOT, FHWA, Wayne, Oakland and Macomb county Road commissions, City of Detroit, AAA of Michigan, Michigan State Police, and others meet at the MITS Center every month on incident management issues. Several task forces developed an incident management plan for Detroit, entitled "Blueprint for Action," published in October 1993. An updated version of the report has been prepared.

Currently, issues requiring legislative action are reviewed by the committee.

Michigan Incident Management Conference was held on October 5, 1995. This National Coalition for Incident Management had selected Detroit as the site for the second national conference hosted by MDOT, National Coalition for Incident Management, FHWA, SEMCOG, and several other agencies. Christine Johnson, Director of Joint Program Office with the USDOT was the key note speaker.

8. U.S. – CANADA INTERNATIONAL BORDER CROSSINGS

This is a joint project between the United States and Canada to provide a transparent, seamless, border for expeditious crossing of people and goods by application of ITS technologies. A state/providence team including Michigan, Ontario and New York has been established to conduct the functional requirements and individual site studies for the three Detroit area and four Niagara River areas international border crossings.

The project participants include MDOT, the Ministry of Transportation of Ontario, New York Department of Transportation, FHWA, the Ambassador Bridge and Detroit-Windsor Tunnel in Detroit, the Blue Water Bridge in Port Huron-Sarina, U.S. Immigration and Naturalization Services, Customs officials from both countries, the Peace Bridge and New York Thruway Authority, customs brokers, and trucking organizations. The institutional issues study has been completed on the Michigan-Ontario frontier and the preliminary engineering and design phase is in progress leading to the deployment phase.

A Request For Proposal for system integration and deployment of ITS technology at the Michigan-Ontario borders is scheduled for release in early January, 1996.

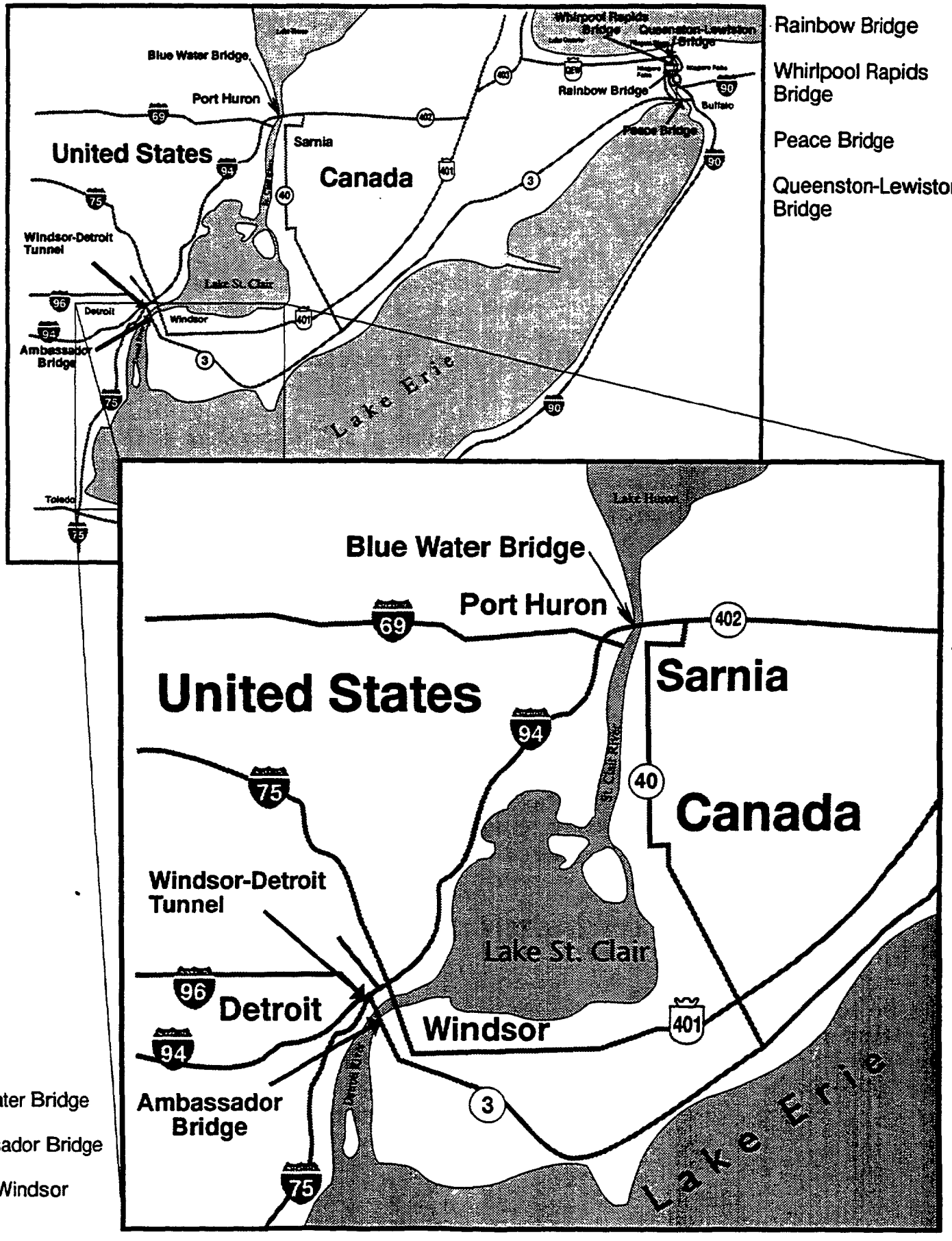
9. CONGESTION ANALYSIS OF SOUTHFIELD FREEWAY (M-39)

In partnership with MDOT, Ford, and Michigan State University Research Center of Excellence, MDOT has initiated an investigation of congestion along M-39. The University is conducting the analysis with the objectives to determine high risk locations, congestion patters and perceptions of travelers, and recommend strategies for action. The project is scheduled for completion in april 1996.

10. INTER-REGIONAL INSTITUTIONAL ISSUES STUDY FOR COMMERCIAL VEHICLE OPERATIONS

Twelve states, including Michigan, are evaluating the institutional impediments to efficient and cost-effective movement of commercial traffic at the interstate level. A Michigan working group including MDOT, State Police, Treasury, Secretary of State, Public Service Commission, and American Trucking Association has been established to review the progress.

U.S. - Canada International Border Crossings



Rainbow Bridge

Whirlpool Rapids Bridge

Peace Bridge

Queenston-Lewiston Bridge

Blue Water Bridge

Ambassador Bridge

Detroit-Windsor Tunnel

Figure 3

Design: MDOT/SpecTech/Graphics Unit F:\maps\border2.cdr

Institutional issues are being identified in the several alternative solutions. Recommendations include implementation of uniforms data requirements, “one-stop shopping”, and roadside enforcement.

11. ENTERPRISE

The Enterprise program represents an international forum for collaborative research, development, and deployment ventures comprising the interest of governmental entities and industrial groups. It emphasizes rural Advanced Traveler Information Systems (ATIS).

12. RURAL ITS

Rural development of ITS technology will extend from systems providing ATIS to enhancing safety of train crossing by the inclusion of ITS warning systems. Efforts are being made to develop the application of ITS technology to rural areas including rail road crossings.

13. SMART CRUISE CONTROL PLATFORM

In collaboration with the University of Michigan, a research/test project has been completed for this important component of the ITS portfolio. This program is likely to have far reaching consequences affecting design of facilities in the future.

Smart Cruise Control Systems are expected to appear as optional equipment for the first time on luxury cars in model years 1996 through 1998. This hardware automatically controls the headway between an equipped-vehicle and the vehicle ahead, whenever the present cruise speed causes one to overtake the other. This research project will provide and exercise a test-bed package of equipment to obtain a broad initial assessment of smart cruise control and make projections of long-term impact. For the next phase a new Operational Field Test has been funded to the University of Michigan, Ann Arbor.

14. AUTOMATED HIGHWAY SYSTEM (AHS)

The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 requires the U.S. Department of Transportation develop an automated highway and vehicle system, and establishes a goal of having a prototype demonstration by 1997.

MDOT is an associate of the General Motors Consortium for AHS which has been awarded the sole contract by the US DOT.

15. THE UNIVERSITY OF MICHIGAN ITS RESEARCH CENTER OF EXCELLENCE

The University of Michigan was selected in 1993 by the U.S. Department of Transportation as one of three ITS Research Centers of excellence in the nation.

MDOT is committed to an annual funding level of $250,000 from the State Planning and Research funds to the center. This commitment will not only benefit MDOT by research conducted in an environment of excellence, but will also stimulate the private sector in developing ITS initiatives in Michigan.

16. INTELLIGENT TRANSPORTATION SOCIETY OF MICHIGAN (ITS MICHIGAN)

On March 9, 1995 the creation of ITS Michigan was announced at a press conference held at the MITS Center in Detroit. It is a state chapter of the national organization, ITS America, a non-profit educational and scientific society which began operations in 1991 to coordinate and accelerate the development, deployment, and acceptance of advanced transportation technologies in the U.S.

The purpose of the society includes:

- To promote professional development of those interested in Intelligent Transportation Systems.

- To advocate the development and deployment of ITS for benefit to Michigan, and to serve as a voice for Michigan's ITS concerns at all levels.

- To build coalitions for the furtherance of ITS that take advantage of Michigan's unique blend of resources including, but not limited to, its transportation system, the domestic auto industry, the international borders with Canada, and a strong university system.

- To educate the people of Michigan on the benefits ITS holds for all citizens.

The headquarters for ITS Michigan is located at the MITS Center in Detroit. The First Annual Conference is scheduled for May 6-7, 1996.

Several committees have been setup. Membership issues are being aggressively pursued: the board of directors has them organized. Any further information can be obtained by calling Dr. Rajendra, Administrator for ITS Michigan, at (517)373-2247.

17. MICHIGAN ITS STRATEGIC PLAN

KCI (Kan Chen, Inc.) has been contracted to assist MDOT in the development of an ITS strategic plan for the state of Michigan. The plan will develop a vision and layout a strategy for implementation of the goals and objectives to deploy ITS technologies and services in Michigan. The contents of the strategic plan are expected to complement and work in conjunction with existing ITS projects and programs in Michigan. This action oriented plan will facilitate the forming of alliances among academic, private, Public, and private sectors of in ITS research, operational tests, deployment, and implementation.

The first version of this plan is anticipated for completion in Spring of 1996.

MICHIGAN INTELLIGENT TRANSPORTATION SYSTEMS CENTER DETROIT

The Michigan Intelligent Transportation Systems Center, known as the "MITS Center," is the hub of ITS technology application at the Michigan Department of Transportation. It is a world-class traffic management center where staff oversees a traffic monitoring system for 32 miles of Detroit freeways. The system includes 24 television monitors, 11 television cameras, 14 changeable message signs, 49 ramp meters, and 1,240 inductive vehicle detectors, and a coaxial cable communication link. The center has 16,000 square feet of space with administrative offices, conference rooms, Concurrent 3280 computer and PC hardware.

The MTIS Center was dedicated in 1994. An expansion of the current monitoring system to cover an additional 148 miles of freeways in metropolitan Detroit is underway. It will include integration with Oakland County's FAST-TRAC traffic operations center in Troy. Also, a proposed relocation of the Michigan State Police dispatch into the MITS Center will integrate incident management efforts in southeast Michigan.

MOTORIST INFORMATION RESEARCH SUMMARY
Mn/DOT Metro Division, Marketing Research
October, 1995

BACKGROUND AND OBJECTIVES

The Minnesota Department of Transportation's Traffic Management Center (TMC) is the communications and computer center for managing traffic on Twin Cities Metro Area freeways. Managing freeway traffic involves communicating "real-time" traffic information to the motoring public.

The need to provide traffic information is clear, but the types of traffic related messages that are most useful required study, as did how these messages should be delivered. Therefore, this marketing research effort was undertaken in order to develop our understanding of: 1) the usefuless of Mn/DOT's current traffic information tools. 2) how these can be enhanced, and 3) what additional delivery options would be useful to Metro commuters. The information will be used to make traffic communication investment decisions.

METHODOLOGY:

During July and August of 1995, 300 telephone interviews were conducted among frequent peak period commuters using a random probability sample. The sample reflected the population proportions of the eight county Metro Area reaching both listed and unlisted households.
All respondents were screened to be regular freeway system users by meeting the following criteria:

- Drive to work at least 3 times a week during peak periods,
- Use a freeway for part of their trip,
- Commute at least 15 minutes; and
- Experience some level of congestion regularly.

NOTE: The total sample (n=300) yields an error range of +/- 5.8% at the 95% confidence level. While reading the report caution must be taken when looking at percentages from a aubset of this sample. The smaller the subsample, the higher the error range.

KEY CONCLUSIONS:

1. Traffic radio information is commonly used, relied upon, and built into the daily routine of Metro commuters.

   - 98% of commuters are aware of traffic radio reports, and 95% hear these reports while in their vehicle commuting to work.

   - Almost half (44%) listen to traffic reports via the radio or on television prior to leaving home in the morning. Of this group, 81% listen daily.

   - Nine out of ten respondents state that they already have an alternate route in mind should traffic conditions warrant.

2. Metro commuters have confidence in traffic-related messages they receive: They show this by frequently acting upon this information.

- 81% cite they have taken an alternate route because of information received through traffic reports. The average number of times this group claims to have taken an alternate route in the past year is six.

- 96% of commuters are aware of the large electronic signs over the freeways advising of accidents or traffic delays. Of this group, the average number of times they've taken an alternate route based on this information in the past year is four.

- 71% of the respondents recall seeing the blue KBEM signs with flashers on the freeway. Of this group, half claim to have tuned to 88.5 when they saw the lights were flashing, and two out of three report changing their route based on what was heard after tuning in.

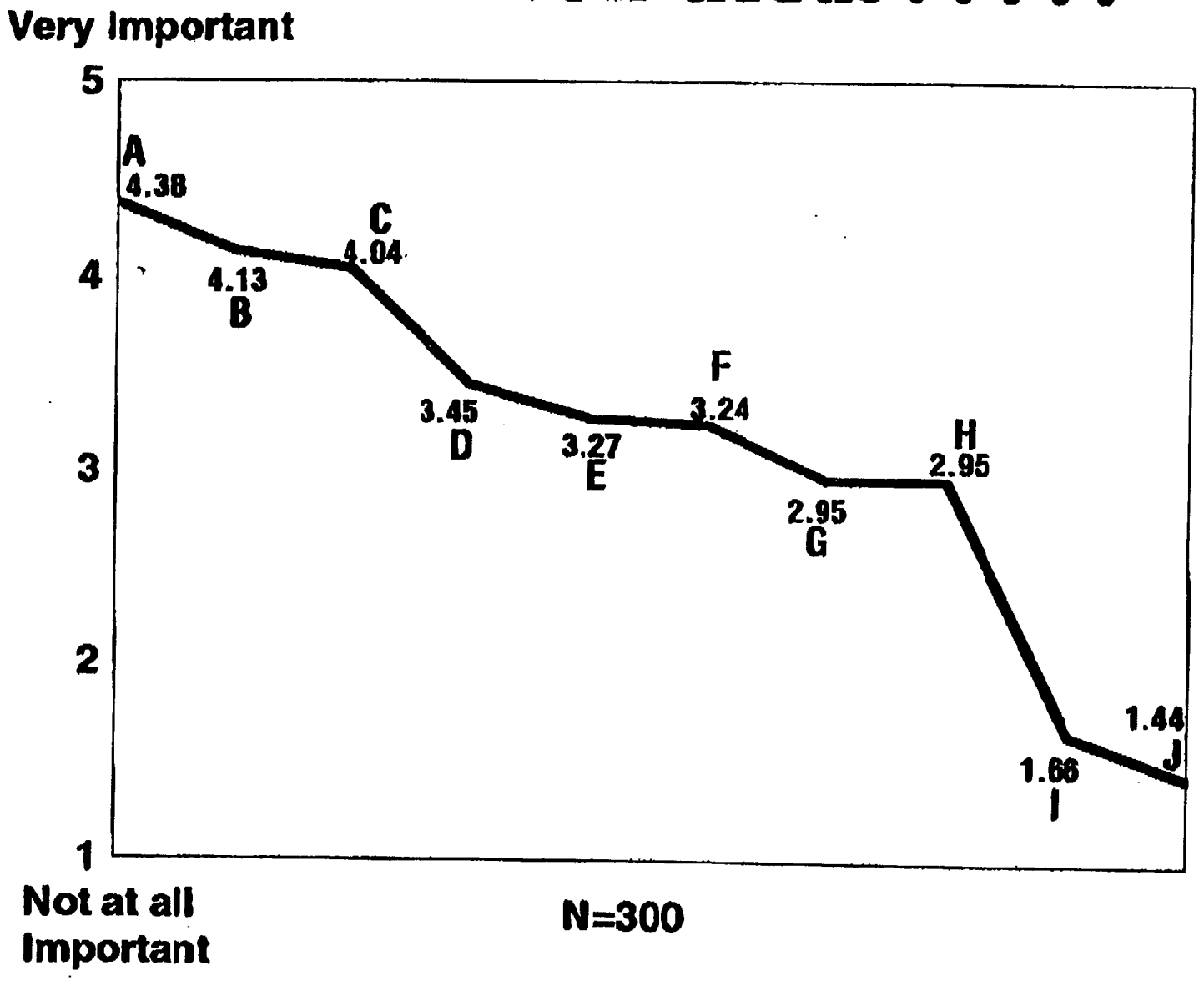
3. Respondents characterize as "most useful" those mechanisms for reporting traffic information that they see as simplistic and least disruptive to daily routines. The current traffic communication devices – traffic radio and the electronic signs over the freeway are very useful to Metro commuters.

- Below is a chart showing the percent stating "very useful" when inquiring about various traffic reporting mechanisms:

CURRENT SERVICES	Percentage (%)	POTENTIAL SERVICES
Electronic Signs over Freeway	55%	
	47 %	Constant)peak)traffic radio
Current traffic radio	32%	
	27%	Phone number for cellular phones (among cellular phone users only)
Cable TV program showing AM Traffic (among cable users only)	19%	
	20%	Phone number to call & hear traffic reports

4. Traffic informational messages of most value to Metro commuters are those that report closed lanes, blocked lanes and slippery or icy mad conditions. Information that clearly does not interest peak period drivers includes parking space availability at downtown garages and at area Park and Ride lots. (See chart).

How important is it for you to know about . . . . .



LEGEND

A. Lanes closed for roadwork
B. Slippery/icy road cond.
C. Accidents/stalls blocking lane
D. General rating A,B,C,D traffic conditions
E. Normal congestion in high traffic areas
F. Accidents stalls not blocking but slowing traffic
G. Current speeds or MPH info. on various freeways
H. Length of waiting times at metered ramps
I. Avail. of parking at dtwn. garages
J. Avail. parking spaces at Park n' Ride Lots

STUDY RECOMMENDATIONS:

After reviewing the data, the following recommendations are offered:

- Continue offering the highly credible KBEM traffic reports emphasizing information regarding lane closures, lane blockages and winter road condition.

- Consider further expansion of the electronic freeway signs and the blue KBEM signs throughout the Metro area. These are useful to drivers by alerting them to problem traffic areas and thus providing drivers the information needed to make decisions about alternate travel routes.

- Consideration should be given to offering a peak period, constant radio broadcast.

- Any new mechanisms for reporting traffic information should be simple and should not break driver routine. This will create the highest impact. Now that the "perceived benefit" is known, a cost-benefit analysis will highlight those mechanisms with the greatest impact and the least investment of tax dollars.

- Motorist highly value the traffic radio messages that are offered today because the messages are so useful. Therefore, be selective about what other messages are added to the current repertoire. More may not be better in traffic reporting; rather focusing on information with high utility to the mass commuting market is likely to ensure continued value.

- Share this information we've learned with other traffic reporting stations. The more stations that emphasize the highest utility information, the greater the impact on congestion reduction.

- The demographic information shows high penetration of computer usage at work (84%). Given this level of use within the workplace, the TMC should explore the computer as another medium to share traffic information. Positioning this as a mechanism to check afternoon traffic conditions prior to "logging off" would be convenient and non-disruptive to daily work routines.

- Lastly, after the first level of traffic communication mechanisms have been evaluated (e.g. traffic radio and freeway signs) the next item for further study should be a call-in number for cellular phones users. Among current cellular phone users, this item was rated nearly as useful as the current traffic radio broadcasts.

Any questions regarding this research can be directed to Karla Rains, Minnesota Department of Transportation, Metro Division 612-582-1396. Copies of the full report will be made available through the Traffic Management Center at the Minnesota Department of Transportation by calling 612-341-7500.

MN DOT

POLARIS

- System architecture
- Consultant-Loral

PROJECT MANAGER: RAY STARR (612-296-7596)

DURING INCIDENTS VEHICLES EXIT TO REDUCE TRAVEL TIME (DIVERT)

- Traffic diversion in the capitol interchange area
- Fixed alternative routes with CMS to divert in case of incidents
- Alarm system alerts St. Paul and Mn/DOT TMC of potential incident to initiate route diversion
- City signals retimed and additional detection systems placed to coordinate traffic

PARTNERSHIPS: SAFETRAN CORP., CITY OF ST. PAUL PUBLIC WORKS

PROJECT MANAGER: SAMUEL BOYD - (612-282-5317)

U OF M TRANSITWAY

- Video detection and signaling system to alert presence of pedestrian, bus or bike traffic at intersections with transitway
- Operating lab

PARTNERSHIPS: UNIVERSITY OF MINNESOTA

PROJECT MANAGER: BOB WORKS - (612-296-2533)

PORTABLE TRAFFIC MANAGEMENT SYSTEM (PTMS)

- Central computer center linked to controllers monitoring real time traffic from three cameras
- Controllers change signal and put status information on CMS and HAR channel

PARTNERSHIPS: MINNESOTA AMATEUR SPORTS COMMISSION (MASC); CITY OF BLAINE; ANOKA COUNTY; ROSEDALE SHOPPING MALL; ADDCO; WARNING LITES OF MINNESOTA, INC.

PROJECT MANAGER: MARTHAND NOOKALA - (612-779-5194)

SMART WORKZONES

- Real-time information: speeds through workzone, presence of Construction workers in workzone, accident information
- CMS, machine vision & lighted barriers for speed control

PARTNERSHIPS: ADDCO

PROJECT MANAGER: MARTHAND NOOKALA (612-779-5194)

INTEGRATED CORRIDOR TRAFFIC MANAGEMENT (ICTM)

- Parallel arterial signal systems coordinated
- Multi-jurisdictional partnership with three cities, county and state

PARTNERSHIPS: MINNESOTA GUIDESTAR; AWA TRAFFIC SYSTEM AMERICA, INC.; CITIES OF EDINA, RICHFIELD, & BLOOMINGTON; HENNEPIN COUNTY; CENTER FOR TRANSPORTATION STUDIES; RENNIX CORP.

PROJECT MANAGER: LINDA TAYLOR - (612-582-1461)

ADAPTIVE URBAN SIGNAL CONTROL INTEGRATION (AUSCI)

- Installation and test of an adaptive signal sytem operation in a 56 intersection portion of the CBD area of the City of Minneapolis
- Using version 3.0 of the Scoot adaptive control program connected to Minneapolis computerized signal system
- Additional detection will be video based
- Cameras added for video surveillance purposes

PARTNERSHIPS: FORTRAN TRAFFIC SYSTEMS LIMITED; CITY OF MINNEAPOLIS

PROJECT MANAGER: DICK MADDERN - (218-749-7793)

TRILOGY

- FM sideband broadcasts on two local radio stations-utilizing RBDS-TMC (Radio Broadcast Data System-Traffic Message Channel) and a high speed protocol
- In-vehicle receivers - a map based display with icons and text to present traffic information - icons are geographically located to show locations of incidents occurring; vehicle icon displaying current vehicle location via GPS; a second system using text display with voice synthesized speech

PARTNERSHIPS: UNIVERSITY OF MINNESOTA HUMAN FACTORS LABORATORY, FORD, AB VOLVO, INDIKTA DISPLAY SYSTEMS, DIFFERENTIAL CORRECTIONS, INC., MINNEGASCO, ROAD RUNNER TRANSPORTATION

PROJECT MANAGER: GARY HALLGREN - (612-582-1472)

GENESIS

- Pagers with real time traffic conditions (alpha numeric type pagers)
- Palm-type personal digital devices (apple newton)

PARTNERSHIPS: UNIVERSITY OF MINNESOTA HUMAN FACTORS LABORATORY; MOTOROLA; LORAL FEDERAL SYSTEMS

PROJECT MANAGER: RAY STARR (612-296-7596)

HIGHWAY HELPER AUTOMATIC VEHICLE LOCATION SYSTEM

- Enhanced incident management through improved response time using advanced technologies
- Vehicles equipped with AVL and mobile data terminals
- Traffic Management and State Patrol Dispatch Centers equipped with workstation showing location and status of all Highway Helper vehicles

PARTNERSHIPS: MINNESOTA STATE PATROL; ETAK, INC.

PROJECT MANAGER: SUE GROTH - (612-341-7500)

TRAVLINK

- Computer aided dispatch/automatic vehicle location of metro buses
- Real time bus status at park and ride facilities
- Interactive touch screen kiosks provide bus status for surrounding bus stops in downtown Minneapolis
- Home/office computers provide real time bus status

PARTNERSHIPS: ETAK, INC.; US WEST COMMUNICATIONS SERVICES, INC.; MOTOROLA COMMUNICATIONS AND ELECTRONICS, INC.;RENNIX; WESTINGHOUSE ELECTRIC CORP.; METROPOLITAN TRANSIT COMMISSION (MTCO)

PROJECT MANAGER: MARILYN REMER - (612-282-2469)

ADVANCED RURAL TRANSPORTATION INFORMATION & COORDINATION (ARTIC)

- Coordinate communication systems of several public agencies to improve response time to accident and road condition emergencies
- Eliminate redundant communications systems, provide real-time vehicle status and schedule information and improve transit service
- Coordinated communications center - Mn/Dot, State Highway Patrol and transit providers

PARTNERSHIPS: ARROWHEAD REGIONAL DEVELOPMENT COMMISSIONER; ARROWHEAD TRANSIT; US WEST; STATE PATROL

PROJECT MANAGER: MARILYN REMER - (612-282-2469)

SMARTDARTS

- Demand responsive transportation system that provides services to elderly and disabled mobility-impaired residents
- Computerized scheduling and dispatching
- Future phases will include (1) additional hardware and software that will support avl and GPS systems and (2) smart card bus passes including handling passenger records and billing information

PARTNERSHIPS: DAKOTA AREA RESOURCES AND TRANSPORTATION SERVICES (DARTS); DAKOTA COUNTY; 3M

PROJECT MANAGER: SARAH BRODT LENZ - (612-296-3441)

ADVANCED PARKING INFORMATION SYSTEM (APIS)

- Automated, real-time parking information & guidance system
- Parking space availability & routing instructions on CMS

PARTNERSHIPS: AGS GROUP; CITY OF ST. PAUL PLANNING & ECONOMIC DEVELOPMENT

PROJECT MANAGER: SAMUEL BOYD - (612-281-5317)

MAYDAY PLUS

- Emergency detection and response system
- Evaluate emergency call services using automatic vehicle locations and communications technologies (including cellular, two-way paging, wireless personal communications services, etc.)
- Evaluate technical enhancements required to fully automate collision and severity notification at an acceptable cost
- Promote national/international standards for information exchange relating to advanced emergency call systems

PARTNERSHIPS: NAVSYS CORP. & MAYO CLINIC-GOLD CROSS AMBULANCE

PROJECT MANAGER: MIKE SOBOLEWSKI - (612-296-4935)

ROAD AND WEATHER INFORMATION SYSTEM (RWIS)

- Road maintenance system
- Weather and surface conditions information for traveling public

PROJECT MANAGER: MARK WIKELIUS - (612-296-1103)

TELEWORK CENTERS

- Test the possibility of establishing a small neighborhood facility to be used jointly by several employers for telecommuting activities
- Two centers: one in rural community with a large commuting population and one in the inter-city area of Minneapolis/St. Paul area

PROJECT MANAGER: BOB WORKS - (612-296-2533)

MINNESOTA GUIDESTAR CVO

- CVO process re-engineering process architecture/structure definition of all the processes
- Refinement and implement process improvements
- Advanced ITS initiatives

PROJECT MANAGER: SCOTT SANNES - (612-297-7166)

MIDWEST ELECTRONIC ONE-STOP

- Joint project with eight Dot's
- Application of credentials electronically at single location reducing paper transfer between states, eliminate multiple points of contact and shorten overall process for issuing credentials
- Utilize pc/workstation-based system

PARTNERSHIPS: MINNESOTA DEPARTMENT OF PUBLIC SAFETY, STATE DEPARTMENT'S OF TRANSPORTATION (ILLINOIS, IOWA,KANSAS, MISSOURI, NEBRASKA, SOUTH DAKOTA, & WISCONSIN), AAMVANET, INC.,LOCKHEED, ROCKWELL INTERNATIONAL, IOWA TRANSPORTATION CENTER, WESTERNS HIGHWAY INSTITUTE/ATA FOUNDATION, NORTH CAROLINA A&T

PROJECT MANAGER: CATHY ERICKSON - (612-296-8533)

CRUISE

- Video traffic sensor utilizing artificial intelligence algorithms to deduce traffic data parameters from videotaped road scenes

PARTNERSHIPS: 3M

PROJECT MANAGER: AMY POLK - (612-215-0402)

IN-VEHICLE NAVIGATION (IVN)

- Development of and procuring a prototype ivn system capable of incorporating real-time traffic information and operable in twin cities metro area
- Demo for Human Factors Research, technology evaluation and demonstration of IVN technology

PARTNERSHIPS: ETAK, INC.; DELCO ELECTRONICS

PROJECT MANAGER: AMY POLK (612-215-0402)

IN-VEHICLE SIGNING SYSTEM - (IVSS)

- In-vehicle signing system which warns drivers of on-coming trains at railroad crossings
- Test will be in school buses in a rural area of Minnesota
- System will include wireless communications system in "RR" sign, in-vehicle signing and detection technology to detect presence of an on-coming train

PARTNERSHIPS: 3M; HUGHES TRANSPORTATION MANAGEMENT SYSTEM; DELCO ELECTRONICS

PROJECT MANAGER: AMY POLK - (612-215-0402)

MAGNETIC LATERAL INDICATION SYSTEM FOR VEHICLES - (MLISV)

- Lateral control system utilizing magnetized pavement marking tape and magnetic sensor which detects distance of vehicle from tape
- Second phase to test lateral control of snow plows during winter operations
- Utilize Mn/DOT's MnRoads pavement test facility

PARTNERSHIPS: 3M; HONEYWELL

PROJECT MANAGER: AMY POLK - (612-215-0402)

NON-INTRUSIVE TRAFFIC DETECTION TECHNOLOGIES - (NITDT)

- Evaluate performance, installation requirements, long-term maintenance requirements and costs of various types of non-intrusive traffic detection technologies
- Evaluate magnetic, sonic, ultrasonic, microwave, infrared and video image technologies
- Evaluate both freeway monitoring and intersection control situations

PARTNERSHIPS: ELECTRONIC INTEGRATED SYSTEMS; WHELEN ENGINEERING CO.; SAFETRAN TRAFFIC SYSTEMS; BROWN TRAFFIC PRODUCTS; ELTEC INSTRUMENTS, INC.; PEEK TRAFFIC, INC.

PROJECT MANAGER: AMY POLK - (612-215-0402)

LIGHT DETECTION AND RANGING (LIDAR)

- Laser-based scanning system to detect and track particulate plumes
- Evaluated as air quality tool and impacts of other its projects on air quality

PARTNERSHIPS: SANTA FE TECHNOLOGIES; IBM

PROJECT MANAGER: MIKE MANORE - (612-296-4010)

ITS Activities in Florida

- Member of ITS America
- ITS Florida State Chapter formed
  - first meeting Nov. 1 in Tallahassee

November , 1994

Task Team Report

Florida ITS Conceptual Plan
(Operations Perspective)

ITS Advisory Committee

- Asst. Sec. Trans. Policy
- State Planner
- State Public Trans. Adm.
- State Hwy. Eng.
- Dir.. Tolls
- FHWA
- State Trf. Ops Eng.
- Tech. Adv.. Committee

Technical Advisory Committee

- Traffic Operations
  - district
  - central
- CVO
- Planning
- Transit
- FHWA

Technical Advisory Committee

- Recommendations
  - technical
  - institutional
- Task teams
- Managers and staff

Current issues

- Partnerships
- Specifications
  - CMS
  - closed loop systems
- Acceptance testing

Current issues (con't)

- Technology exchange
- Technology lab

SUMMARY OF ITS CORE INFRASTRUCTURE

ELEMENTS IN FLORIDA

Compiled by:

Federal Highway Administration
Florida Division

July 1995

This summary will be periodically updated as projects advance or as conditions change. Any information to help keep this summary correct and updated would be greatly appreciated. Please contact the Traffic Management/ ITS Engineer, FHWA Florida Division at (904) 942-9693 to report any corrections or additions to this summary.

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Summary of ITS core Infrastructure
Elements in Florida

This summary is intended to describe the core infrastructure elements and advanced transportation technologies that exist in Florida. Also included are proposed systems or expansions of systems currently in the design or final planning stages.

Traffic Signal Control Systems

UTCS Systems

- City of Jacksonville/Duval County: There are 1039 signalized intersections in Duval County. In 1991 a UTCS system was installed to manage 144 signals in the CBD area. A comprehensive Traffic Signal System Master Plan Study was completed in July 1994 to determine feasible options for upgrading the system and a design project is now underway (expected completion late 1995) to upgrade 145 intersections in the CBD with a new system With the exceptions of a closed loop system in Jacksonville Beach that controls 32 signals, and a 10 signal closed loop system on Riverside Drive (presently under construction), the remaining Jacksonville area signals either operate isolated or in hardwire interconnected and time based coordinated systems.

- City of Orlando: System controls 296 intersections.

- City of Tallahassee: Of the 211 signalized intersections in the Tallahassee/Leon County area, approximately 160 are managed by the UTCS system. The remaining operate as isolated or in time base coordination systems. The system was installed in 1980. Plans are underway to upgrade to a new system.

- City of Tampa: System controls 462 intersections

- Broward County: Present system controls 683 intersection. A design project is underway to expand the UTCS and eliminate all remaining leased line communications with fiber optics to accommodate future ITS activities.

- Dade County: The system was put into operation in 1976.The maximum system capacity of 2048 signals is insufficient to handle the existing 2250 signals. A project to upgrade the system is underway.

- Palm Beach County: System controls approximately 230 intersections.

- Pinellas County/Cities of Clearwater and St. Petersburg: City of Clearwater controls 133 intersection; City of St. Petersburg controls 250 intersection; Pinellas county controls 235 intersections.

Summary of ITS Core Infrastructure Elements in Florida
July 1995

Closed Loop Systems

City of Bradenton (43 intersections)
City of Daytona Beach (140 intersections)
City of Gainesville (150 signals in Gainesville and Alachua County)
City of Inverness (8 intersections)
City of Jacksonville Beach (32 intersections)
City of Kissimee (9 intersections)
City of Melbourne (19 intersections)
City of Naples (25 intersections)
City of Ocala (69 intersections)
City of Plant City (28 intersections)
City of Winter Haven (44 intersections)
Brevard County (39 intersections)
Charlotte County/Punta Gorda (under design)
Escambia County/Pensacola (136 intersections)
Hillsborough County/Brandon (87 signals)
Lee County (86 intersections)
Manatee County (96 intersections)
Orange County (93 intersections)
Pasco County (73 intersections)
Polk County/Auburndale & Bartow (7 and 5 intersections)
Sarasota County (184 intersections)
Seminole County (89 intersections)
St. John's County/St. Augustine (43 intersections)
Volusia County (94 intersections)
Walt Disney World/Reedy Creek (24 intersections)

Distributed Master Systems
City of Boca Raton
City of Belle Glade (under design)
City of Fort Myers
City of Fort Pierce
City of Sarasota
Charlotte County
Indian River County
Martin County
St. Lucie County

Hybrid Systems
City of Lakeland (Distributed control and centralized monitoring of 250 signals)

Freeway/Traffic Management Systems

Miami

A preliminary phase of a Freeway Management System (FMS) is operational at the Golden Glades interchange on I-95 (a complex interchange where several major freeways and arterials intersect). The project, referred to as mini-FLAMINGO, was implemented as an "IVHS Operational Test" to evaluate several technologies for detection and information dissemination. The field elements include 12 CCTV cameras, 10 CMS's, inductive loop detectors, and video image detectors. Fiber optic cables facilitate the communication between video cameras and the field hub. Spread Spectrum Radio (SSR) technology is used for communication between the hub and the CMS's. Leased T-1 lines connect the field hub with the two control centers (FHP and District 6 office). The project serves as a test bed for assessing technologies under the local conditions.

Information gathered from the Operational Test will assist in the design of the Southeast Florida Intelligent Corridor System (ICS). The ICS will expand the use of CCTV cameras, detector technologies, and CMS's in southeast Florida. This system will ultimately cover all of the freeways in the three county region (Palm Beach, Broward, and Dade). The initial implementation will be along I-95 in Dade County and will expand to cover other areas as funding becomes available. The system is envisioned to include an operations center in Dade County (near the FDOT District 6 office) and another in Broward County (staffed by FDOT District 4 personnel). The ICS will be a very comprehensive system in that it will also incorporate HOV parking lots, Tri-Rail commuter lots, and information dissemination methods (TV, Radio, kiosks, etc.) that will encourage not only route shifts but mode shifts as well.

Ft. Lauderdale/West Palm Beach

Design of the I-595 Stationary Changeable Message Sign System (SCMSS) began in December 1994 and is expected to be completed by June 1996 with construction scheduled for FY 96/97. The System will consist of 29 signs connected by a fiber optic communication system that will be accessible from remote locations over standard telephone lines.

The I-595 System will eventually incorporate CCTV cameras, loop detectors, and additional CMS's to manage traffic along this extremely congested east-west route in Broward County. This system will eventually be incorporated into the Southeast Florida ICS.

Tampa Bay

Hillsborough County (Tampa) plans to implement a CCTV system on several major arterial routes in the area.

The Sunshine Skyway Bridge (I-275) has a CCTV and CMS system for inci ent and weather condition detection and management. The system components include:

13 video cameras
6 flip-disc VMS's
18 call boxes hard-wired to a monitoring station
2 remotely operated stop lights before the main span on each end of the bridge

Orlando

The I-4 Surveillance and Motorist Information System (SMIS) in the Orlando metropolitan area is Florida's largest existing Freeway Management System (FMS). This system was initially installed in 1991 (Phase I) and consists of loop detectors, closed circuit te evision cameras (CCTV), and changeable message signs. Information to and from the syste n components is coordinated through a Freeway Management Center (FMC) located at the Florid Highway Patrol (FHP) station in Orlando. This center is electronically linked to the Orlando Tra fic Management Center (TMC) in downtown Orlando which coordinates Orlando's UTCS. The inkage provides for information sharing and coordination between the city streets and I-4.

System expansion under Phase II has been implemented and should be fully op rational by mid-1995. Phase II expands the system from a 17.6 kilometer (11 mile) cov rage area to an approximate 64 kilometers (40 miles) along I-4; from the Disney vicinity south of Orlando to Lake Monroe on the north side of Orlando. System elements include 22 CMS's, 50 cameras, 70 Vehicle Detection Stations, Fiber Optic trunk line, and a T-1 ring network.

In addition, Seminole County has established a Traffic Management Center, and has installed cameras on major surface streets with communications through a fiber optic cable network.

Jacksonville

A Master Plan Study for a Jacksonville Surveillance and Control System (SCS) was completed in May 1994. The Study recommended implementing CCTV cameras, loop detectors, and CMS's to monitor and control traffic on I-95, I-10, and I-295 in the Jacksonville metropolitan area. As an initial phase of implementation, 8 CMS's and 2 CCTV cameras are being installed to assist in maintenance of traffic for several major Interstate construction projects in the area. This initial system will include an operations center to be located at the FDOT Urban Office in Jacksonville. The system is under construction and is expected to be operational in early 1996. Future expansions to the system will occur as funding is made available.

Daytona Beach

The DASH (Daytona Area Smart Highways) project in Daytona Beach will be let to contract in mid-1995. This system will consist of 10 color CCTV cameras, 4 CMS's, and inductive loop detectors, in the area of the I-4 interchanges with US 92 and I-95. The system along I-4 and I-95 will complement the existing 16 surveillance cameras operated by the City along several arterials leading to the beaches. The communications will be handled by fiber optic transmission cables and by microwave transmission (for areas on the beach where cabling fiber optic back to the mainland is more expensive). A traffic operations center is also planned for this system to coordinate data retrieval and dissemination.

Pensacola

The City of Pensacola has installed video surveillance equipment along Cervantes Street (US 90) at important intersections in the City. Video cameras are installed at the intersections of US 90 and 9th Avenue, I-110 ramps, US 29, and "A" Street. Monitors are located at the City traffic engineering facility. System expansion along Ninth Avenue and the Pensacola Bay Bridge is under review.

A small changeable message sign system (2 flip-disc signs) is on the I-10 Escambia Bay Bridge. These signs inform drivers of lane closures and roadway conditions along the bridge. A project to improve this system is under consideration.

Motorist Assistance Systems

Call Boxes

The most extensive existing motorist assistance system in Florida is the statewide Motorist Aid Call-Box System. The system includes push-button call boxes located at approximate 1.6 kilometer (one-mile) intervals, ultimately on all Interstates in Florida. Call boxes are currently in place along most of the rural Interstate routes. Completion of the final "missing links" is scheduled for late 1996.

A microwave communications system transports the call box information from the roadside to a designated Florida Highway Patrol (FHP) station. The communications system is being upgraded from a 2 GHz analog technology to provide a 6 GHz digital technology system. The microwave backbone of the system has the capacity to support other communications needs adjacent to the Interstate corridors. The final system will have the capacity to carry 600 simultaneous channels that can support data transfer, voice communications, and surveillance video transmissions.

The call boxes use "push buttons" to report what type of problem is encountered (mechanical,

medical, or law enforcement). There is no voice transmission capability. The microwave call box transmits a unique signal to an FHP dispatch location that indicates the type of problem reported and the location of the call box. The appropriate tow truck, ambulance, or Highway Patrol Officer is then dispatched to the call box location. A recent evaluation of the call boxes installed along a 376 kilometer (235-mile) length of I-10 in the Florida Panhandle indicated that, on average, over 20 motorists per day are serviced as a result of call box usage on this segment.

Service Patrols

Contracted service patrols (through private companies) exist on I-95 in Broward and Palm Beach Counties. Future expansion of contracted service patrols along I-595 and I-75 in the Ft. Lauderdale area are being considered.

Service patrols for temporary periods during major Interstate construction projects have been used in Miami, Ft. Lauderdale, and Jacksonville. Service patrols are also expected to be used during major Interstate reconstruction projects in the Tampa area.

Cellular Phone Numbers

Another motorist assistance system currently being used in Florida is the *FHP system. The Florida Highway Patrol is working with all cellular companies in Florida to institute *FHP on a statewide basis. This system will enable motorists with cellular phones to dial *FHP and their calls will automatically be routed to the nearest FHP dispatch center.

The *911 emergency call-in system is also active in many areas of Florida.

Several local radio and television stations in Florida offer toll free "star" numbers for cellular phone users and encourage the public to report in traffic conditions. Also, many commercial traffic reporting services have a toll free number for the public to report traffic conditions. As an example, MetroTraffic in Orlando uses the *456 number.

Incident Management Programs

Freeway Incident Management Teams have been developed in the following Florida areas or counties:
- Jacksonville (Duval County)
- Gainesville (Alachua County)
- Lake City (Columbia, Suwannee and Hamilton Counties)
- Broward County
- Palm Beach County
- Orange County
- Seminole County
- Osceola County

- Volusia County
- Marion County
- Brevard County

New Incident Management Teams or expansions of existing Teams are anticipated to include the following:

- Flagler County
- Sumter County
- Martin County
- St. Lucie County
- Indian River County

Highway Advisory Radio and Commercial Radio Traffic Information Services

The FDOT has used Highway Advisory Radio (HAR) through major Interstate construction projects to warn drivers of real-time conditions through the work zone. Numerous advisory radio systems are in operation at many Florida tourist attractions and airports. Although they are not specifically used for reporting traffic conditions, many of these systems do provide information on parking and travel directions.

Many commercial radio stations in Florida use a variety of sources to report incidents and traffic conditions. Many use a private information service that gathers traffic data from sources such as aerial surveillance, driver call-ins, police scanners, and ground based traffic reporters. The services then generate revenue from sponsors whose advertisements accompany the traffic announcements. The Metro Traffic service operates in Miami/Ft. Lauderdale, Tampa/St. Petersburg, and Orlando. The TrafficCenter service operates in Jacksonville. Many local radio stations in these and other areas gather traffic information on their own and report periodically to their listeners.

Electronic Toll Payment/Automatic Vehicle Identification (ETTM/AVI) Systems

Rickenbacker Causeway

The Rickenbacker Causeway AVI system in Miami utilizes Radio Frequency (RF) technology with a read-only transponder (i.e. the system cannot "write" updated information to the transponders). In these type systems, the central database tracks credits and debits to individual accounts with the transponder only acting to identify that a certain vehicle passed through the toll plaza. Message boards at the toll plaza indicate when the account balance gets low and accounts can be replenished at the toll plaza. This system also has "pre-read" to determine the number of axles and total

charges and an "exit-read" to determine correctness of charges. A video enforcement system, in place at the toll plaza, is used to issue tickets/citations to the registered owner of vehicles that pass without paying.

The tags (transponders) are sold at the toll plazas to be mounted internally in the upper left corner of the windshield. There is a $50 deposit for the tags and they are not transferable to other vehicles. They are automatically rendered inoperable if removed. The tags can theoretically be read at any speed but since these lanes are "mixed use" (they also have coin baskets and lift gates), the tags are generally read at 8 - 16 kph (5 - 10 mph). The gate stays down until the tag is read. The central computer is capable of producing statements of each account's activity (down to the level of date, time, and direction the vehicle passed through) although these statements are only available on request as a monthly mailing would increase expenses on the operation.

Venetian Causeway

The Venetian Causeway system in Miami also utilizes RF technology and is essentially the same as the Rickenbacker system described above. The system is read-only whereby the central database tracks credits and debits to individual accounts with the transponder acting to identify the vehicle. A video enforcement system is used to issue tickets/citations to the registered owner of vehicles that pass without paying. The tags are sold at the toll plazas to be mounted internally in the upper left corner of the windshield. There is a $50 deposit for the tags and they are not transferable to other vehicles. They are automatically rendered inoperable if removed. The tags can theoretically be read at any speed but since these lanes are not "open" lanes (the lanes are classified as "mixed use" since they have coin baskets and lift gates), the tags are generally read at 8 - 16 kph (5 - 10 mph) The gate stays down until the tag is read.

Broad Causeway

The City of Bay Harbor Isles (north of Miami) uses bar coded decals (optical technology) for toll collection on the Broad Causeway. Optical/infrared (bar code) technology is similar in practice to grocery store scanners that read bar codes for information.

Recent counts at the Broad Causeway toll plaza indicate that approximately 25% of the 20,000 vehicles per day that pass through the toll plaza are decal equipped vehicles.

Pinellas Bayway

The Pinellas Bayway AVI System in St. Petersburg, uses a bar code decal sold to motorists for a yearly use fee. There are different usage amount fare structures depending on the motorist's anticipated use. A laser scans continuously over the vehicle area where the tag is expected and

the reflected signal is processed to extract the code which uniquely identifies the vehicle. Based on the prearranged account, a message display indicates how many passages through the toll plaza are left on the account. Those participating in the system receive a discount on the regular toll rates to encourage more participation.

Sanibel Island Causeway

The Sanibel Island Causeway AVI System in Lee County uses a bar code decal sold to motorists for a yearly use fee. A laser scans continuously over the area where the tag is expected to be and the reflected signal is processed to extract the code which uniquely identifies the vehicle.

Orlando-Orange County E-Pass System

The Orlando-Orange County Expressway Authority (OOCEA) has implemented the "E-Pass" system on the East-West Expressway and the Orange County portion of the Greeneway Expressway. This system utilizes inductive loop technology to read transponders mounted on the front bumper of participating vehicles. The Orange County segments of the Beeline Expressway are also planned to be on the system by mid-1995. There are currently over 5000 vehicles equipped with E-Pass transponders.

The system basically works like this; 1) a transponder mounted on the front bumper of a vehicle communicates via an antenna in the road with a computer in the toll plaza; 2) the computer registers the vehicle and checks how much money is in the account; and 3) upon verification, the gate arm will rise to let the vehicle through. If the account is low on money, a "low balance" light alerts the driver. If there's no money in the account, the gate doesn't rise.

Florida Turnpike SunPass System

The Florida Turnpike has plans to implement the "SunPass" system. This will be an RF AVI/ETTM system with "read-write" interactive capabilities. The transponder will carry all account information and will be updated after every transaction. A central computer will also track all transactions. This type system has the potential for use in tracking vehicle movements to determine travel speed and congestion conditions on area highways. The transponders could also be capable of receiving programmed information on traffic conditions.

The first phase of implementation is expected along the southeast Florida corridor from Homestead north to Lantana Road in Palm Beach County. The second priority is in Orlando between the Kissimmee/St. Cloud and Orlando West exit plazas. Eventually, the Florida SunPass System is envisioned to cover the entire Turnpike, making it one of the world's largest AVI/ETTM systems encompassing over 500 toll lanes.

Miami Airport AVI System

The Miami International Airport uses an AVI system to better manage the passenger carriers and courtesy vans operating near the airport. These passenger carriers are called "pre-arranged transportation" and include buses, vans, limousines, and employee shuttles. The airport charges a fee for these companies to operate at the airport based on how many trips they make through the airport. The system utilizes an RF AVI technology consisting of antennas (readers) mounted at 33 locations around the airport. Each participating vehicle is equipped with a transponder which sends a signal to these antennas identifying the particular vehicle as having passed an antenna. The antennas are hard-wired back to a central computer that tracks the movements of participating vehicles and determines the number of trips made by each through the airport. There are approximately 700 vehicles participating with more joining the program as necessary. The goal of the system is to provide reliable billing to the different carriers.

In-Vehicle Navigation Systems

TravTek

The TravTek project in the Orlando area was one of the most comprehensive in-vehicle navigation projects in the world. The project became operational in 1992 and combined in-vehicle navigation and tourist information with up-to-the-minute traffic data. The test project consisted of 100 vehicles, Oldsmobile Toronados, equipped with computer screens for interaction with the driver, two computer hard drives in the trunk for routing and navigation, a Global Positioning System (GPS) antenna, and wheel sensors for dead-reckoning positioning.

A Traffic Management Center (TMC), operated by the City of Orlando, provided up-to-the-minute traffic information from area police agencies, traffic signal detectors at over 400 intersections and detectors along I-4. The system vehicles were in radio communications with the TMC and received the real-time traffic information for use in the routing and navigation decisions. The on-board computer system also included "yellow pages" information on hotels, motels, restaurants, shopping, attractions, and many other services. The driver could be routed to any of these services simply by making the appropriate selection on the in-vehicle touch screen.

This project was an IVHS Operational Test and was in operation from April 1992 to March 1993. An evaluation period followed which has since been completed and all results indicated a very successful test. There are currently six TravTek vehicles still operational in the Orlando area. They are used by FDOT primarily for demonstrations of the technology.

Guidestar

Another in-vehicle navigation system is the Guidestar project in Miami. This project, conducted solely by the private sector, is presently limited to vehicles rented from Avis at the Miami International Airport. These vehicles (Buicks) contain an after-market computer screen that includes maps of the southeast Florida region. Destinations can be selected either from a "saved destinations" list, a services and attractions menu, or entered by address or cross street. Routing is then performed and indicated on the computer screen. Progress and location is monitored by GPS and the map automatically updates location. A computer voice indicates upcoming turns. Unlike the TravTek project, this system does not incorporate any real-time traffic or congestion information into its routing algorithms. More than 200 Guidestar equipped Avis rentals are expected to be available by mid-1995.

An additional feature of this system is the "panic button". In response to the growing concern over tourism crime in Florida, this is an actual button located next to the cellular phone that, when depressed, routes a signal through to the nearest police department. The car's location is pinpointed by satellite and forwarded to the police in less than 30 seconds.

Technologies for Commercial Vehicle Operations:

Advantage I-75

The Advantage I-75 Operational Test includes three weigh stations in Florida. The project goal is to demonstrate the benefits of using advanced technology to reduce the redundant weight and document checks for trucks travelling along I-75. The project will link all the weigh stations along I-75 with one central computer so that a truck weighed (and approved) in Florida will not have to be checked again until some time threshold has been exceeded indicating that the truck has made a stop along the way. When the project becomes fully operational, each participating carrier will have a transponder on board that will identify the truck and its load weight and travel information. If the truck has already been weighed and passed, and a threshold time period has not been exceeded, the truck can pass the upcoming weigh station and the transponder is appropriately updated. It is anticipated that the test will become operational in the Fall of 1995 and that approximately 4500 trucks will participate.

Advanced Public Transportation Systems

Metro-Dade Transit Agency

The Metro-Dade Transit Agency (MDTA) operates a fleet of 584 buses servi g a 800 square kilometer (310 square mile) service area. The Metrobus System operates a to al of 71 routes including a series of express buses using I-95 and serving the Golden Glades pa k-and-ride lot. Annual Metrobus ridership is approximately 55 million passengers with an a erage weekday ridership of 180,000 passengers. It is estimated that 70% are captive riders.

The MDTA is proposing automated vehicle monitoring (AVM) and AVL sys ms with some applications expected to be operational by mid-1996. The cornerstone of this in lementation is a countywide digital trunked communication system to be installed on all county- wned vehicles. The MDTA buses will be equipped with a GPS-based AVL system as part of thi program. The full range of AVL and AVM applications have not yet been determined but a anticipated to include:

- On-time performance monitoring
- Improved vehicle and passenger security
- Automated stop announcements to support ADA requirements
- Vehicle diagnostics
- Real-time schedule adjustments
- Support for improved passenger information programs

Broward County Transit

Broward County Transit (BCT) is in the process of implementing an AVL syste n. The goal is to obtain an AVL system that will provide schedule adherence information ac rate within 60 seconds and bus location information accurate within 75 meters (250 feet). This c ta will be used internally to improve on-time performance and to help in coordinating transfers It will also be used to provide real-time transit information to passengers, through the use of kiosks or other devices at the Fort Lauderdale bus terminal and other major transfer points.

Palm Beach County Transit

Palm Beach County Transit (CoTran) is implementing new technologies to improve their operations in a number of areas. They have recently implemented an advanced vehicle monitoring and communications system along with an AVL system that uses the Teletrac technology provided by Pactel. Potential applications of this system include computer-assisted dispatching, providing real-time schedule information to passengers at major transfer and intermodal centers, improving transfer coordination both internally and with Tri-Rail, and an automated telephone information system. For implementation on newly purchased buses, an on-board video surveillance system

for improved customer and driver security is proposed.

Central Florida Regional Transportation Authority

The CFRTA operates the local bus system (known as LYNX) with approximately 122 vehicles. Future expansion is expected with about 530 buses by the end of the decade. During 1993, LYNX served over 11 million passengers. LYNX operates several shuttle bus services including; Freebee, a free-of-charge shuttle in the CBD and Centroplex parking garages; LASER, a shuttle from apartment complexes along Alafaya Trail to the University of Central Florida; Little LYNX along SR 436 in the congested Altamonte Mall retail area; and shuttle busses along International Drive. The shuttle buses along International Drive are equipped with traffic signal preemption control that is compatible with the existing emergency vehicle preemption system.

Hillsborough Regional Transit Authority

The HRTA in Tampa is implementing an AVL for monitoring their fleet of HARTline buses.

High Occupancy Vehicle (HOV) Lanes

Miami/Ft. Lauderdale/W. Palm Beach

Concurrent flow HOV lanes (one in each direction) are along I-95 in Dade, Broward, and Palm Beach Counties. They are restricted to HOV-2 from 7-9 am and 4-6 pm. The system includes an HOV fly-over into the Golden Glades park-and-ride lot and an HOV left-hand ramp to SR 112 leading to and from the Miami Airport. Metro-Dade Transit also uses the HOV lanes to provide a series of express bus services. Carpools, as a mode of travel to work, represent 16% of the trips in Dade County and 13% in Broward and Palm Beach Counties.

Orlando

Concurrent flow HOV lanes (one in each direction) are along I-4 in Orlando. High violation rates are dificult enforcement reduces the efectiveness of these lanes.

Rail Transit, Commuter Trains and High Speed Rail Systems

Rail Transit

The Dade county MetroRail system is a heavy rail rapid transit line operating from Dadeland Mall in Kendall through the Miami CBD to the Okeechobee station in Hialeah. The system is 34 km

(21 miles) long and served by 21 stations. Annual ridership is approximately 14 million passengers.

The Dade County MetroMover is an automated rail system operating on a 3 km (1.9 mile) double track loop through downtown Miami. Two MetroMover extensions, Omni Extension to the north and Brickell extension to the south, have recently been completed. The MetroMover provides access between the downtown MetroRail station and the major business centers in the CBD. Annual MetroMover ridership is approximately 3 million passengers.

Two other public transportation people mover systems exist in Jacksonville and Tampa. The Automated Skyway Express (ASE) is an automated rail people mover system in downtown Jacksonville. A short section currently operates with an extension into the CBD nearly complete. Future expansions are proposed. In Tampa, a short distance people mover operates between the CBD and Harbour Island (retail and residential complex).

Commuter Rail

The Tri-County Commuter Rail Authority (Tri-Rail) operates a 108 km (67 mile) long system in southeast Florida. It stops at 15 stations between downtown West Palm Beach and the NW 79th Street station north of the Miami International Airport. Tri-Rail feeder bus service is available at most stations to transfer passengers between the rail station and major trip generators (including airports). Ridership exceeds 10,000 passengers per weekday.

To improve customer information, an electronic message board system is proposed for the train platforms to provide important information to Tri-Rail riders. The signs could be programmed to provide "canned" messages, and also have the capability of being programmed to provide information on delays and other incidents to customers waiting for the trains.

High Speed Rail

The State of Florida issued a Request for Proposals (RFP) to private firms interested in bidding on a 523 km (325 mile) high-speed rail system to link Tampa, Orlando, and Miami. The RFP gives private firms until October 31, 1995, to submit a technical proposal, financial plan, and implementation schedule for the project. The State anticipates awarding a franchise early in 1996. State Rail Planners have devised a plan that gives bidders maximum flexibility in designing a system that could be operational sometime between 2000 and 2005. A major difference between this plan and previous efforts is that the FDOT has committed to provide as much as $70 million a year for 25 years beginning in 1997. The estimated cost of the system is $2 billion to $3.5 billion.

MAGLEV

The proposed magnetic levitation (maglev) project was to run on an approximate 22.4 kilometer (14-mile) track south of Orlando from the Orlando International Airport to International Drive at speeds up to 400 kph (250 mph). This project was earmarked for almost $100 million in the 1991 ISTEA. Unfortunately, the company that was awarded certification to pursue funding and construction of the project was unable to achieve the necessary financial commitments. Their certification was withdrawn in early 1995 and the project officially ended.

In September 1994, American Maglev Technology of Florida, Inc. announced plans to build a test track for magnetically levitated trains in Volusia County. They plan to build a 3.2 kilometer (two-mile) linear track at the facility as well as a 360 square meter (4000 square foot) research facility. They've indicated that if their testing proves successful, they'll set up a manufacturing facility at the site for maglev equipment. They had originally scheduled groundbreaking on the track to be October 1994 with actual testing to begin in January 1995. However, there has as yet been no construction on the proposed test track and it appears that plans have been delayed substantially.

SUMMARY OF ITS ACTIVITIES
COLORADO DEPARTMENT OF TRANSPORTATION

October, 1995

- Statewide Traffic Operations Center: Now completing the interim TOC co-located with the Colorado State Patrol dispatching center. As of November 1, the TOC will receive and distribute statewide traveler information around the clock. The State Transportation Commission has given CDOT staff until Spring 1996 to provide them with a plan/proposal to design, build and operate a permanent TOC.

- Highway Advisory Radio: Expanding to rural areas of the state with six new transmitters and converting six Denver-area construction advisory HARs to real-time traffic information concerning major events. Messages will be generated from the interim TOC.

- Variable Message Signs: Nine new VMS will be installed along rural highways and six existing VMS are being modernized and their software upgraded. These signs will be controlled from the interim TOC.

- Icy Bridge Warnings: Two automatically actuated signs are in operation.

- Remote Weather Stations: 39 are currently in operation statewide, with a total of 80 planned. These are networked through a central site.

- Ramp Metering: 13 freeway interchanges in the Denver metro area are included in CDOT's demand responsive closed-loop system. New central-site hardware has been purchased and the software is being re-written to make it machine-independent.

- Communication: 900 MHz radio is being used to communicate with automatic traffic recorders (ATR). Digital radio has been installed in over 100 Denver area traffic signals (300 planned within 2 years): this system is used principally for exception reporting.

- Courtesy Patrol: Currently operates in the Denver metro area during rush hours. A similar system will operate this winter on the approaches to the Eisenhower Tunnel west of Denver.

- Automated Highway Systems: Colorado is an associate member of the Consortium and has run "driverless" vehicles on our highways as part of our participation. We've committed $50,000/year contribution in cash and services to the program as a co-partner with Lockheed-Martin.

- ENTERPRISE: CDOT is an active member of the organization and is involved in several projects:

  - ITIS, the protocols for broadcasting digital traveler information;
  - MAYDAY, with a field demonstration in Colorado involving up to 2,000 vehicles. Efforts include work on a national standard for open architecture systems.
  - HERALD, AM radio sub-carrier broadcasting test involving transmitter sites in Colorado.
  - WRIC, the weather and road information coordination program with Arizona, Minnesota and Iowa.
  - Other ENTERPRISE projects involve vehicle to roadside communications and informational projects on the benefits of rural ITS.

- Operational Tests and Special Projects:

  - Automated Ports of Entry: In operation on I-25 near Trinidad; planned within the next year for I-70 at Dumont/Downieville and on State Highway 160/666 at Cortez.
  - Colorado is an active member in HELP.
  - Dynamic Truck Warning System that weighs trucks in motion and advises the driver of his safe descent speed on mountain downgrade.
  - North Denver I-25 reversible HOV lanes opened to traffic October 1.
  - The Denver area Regional Transportation District (RTD) is constructing "smart" kiosks to display real time bus arrival/schedule information.
  - A mobile emissions project is underway in Denver. As vehicles pass the test site on a freeway ramp, their emissions are measured and a VMS message urges those out of compliance to have their vehicles repaired. The system also tracks the effectiveness of this approach.
  - Colorado is the lead state in the commercial vehicle institutional barrier study (COVE).

- ITS Organization: CDOT has recently consolidated its headquarters ITS activities into a single office under the Chief Engineer for Highway Operations and Maintenance. The six CDOT Operational Regions also have active ITS programs, many of which are mentioned above. For additional information about any of the Department's ITS activities contact John Kiljan, CDOT ITS Program Manager; 4201 E. Arkansas Avenue; Denver, CO 80222 or by telephone at 303-757-9306, 303-757-5139, 303-757-1026 (fax).

CHICAGO AREA FREEWAY OPERATIONS

For more than 35 years, the Illinois Department of Transportation (IDOT) has continued an active freeway traffic management program in the Chicago area. For nearly 33 years, the first "smart" freeway section has been continuously operated and expanded. The real-time instrumented network operated by the IDOT Traffic Systems Center (TSC) now covers 136 centerline miles with 2,000 loop detectors, including circular loops for the most recent mainline installations. Expansions underway will boost the network total to nearly 150 miles.

Ramp metering stations total 113, all centrally supervised. Remote dial-up CB radio monitoring sites for incident verification number 24. On-line changeable message signs total 20: 5 reflective-disk matrix, 9 fiber-disk matrix, and 6 fibre-disk retrofits. All but one of the reflective-disk matrix signs are scheduled for fiber retrofit. Construction is nearing completion for the first fiber-optic communications link for hybrid transmission of CCTV from three locations. This fiber will eventually connect to other barrier wall located links currently served by twisted pair or leased lines.

The IDOT Emergency Traffic Patrol ("Minutemen") continues to provide more than 110,000 expressway motorist assists each year. More than 125,000 incidents were handled in 1994, another new record. The equipment fleet features 35 basic patrol units and 9 special units, including a 60-ton crash crane ("Mad Max"), a 50-ton rotator ("Sweet Pea"), and a prototype of the patrol "vehicle of the future", which features a "state-of-the-art" quick retrieval underlift system. The equipment fleet has been upgraded with 13 newly developed "smokeless" diesel powered units replacing the oldest patrol trucks. The ex-Navy crash crane ("Popeye") was retired from its second career with IDOT and has been replaced by a 60-ton rotator ("Popeye II") featuring a 360-degree boom and all-wheel drive. The number of accident investigation sites provided for the program is now up to nine.

The *999 Cellular Express Line continues to produce more than 18,000 incoming calls per month, with more than 95% of the calls classified as "Good Samaritan." As calls for IDOT freeways and Illinois State Toll Highway Authority (ISTHA) tollways are approximately equal, ISTHA offered to "take its turn" at operating the *999 Center, and this responsibility was transparently transferred to ISTHA in late summer 1992. (Industry sources now report more than one million cellular phone users in the Chicago area.)

The 21-year-old comprehensive public/private network of radio/TV stations and others using traffic reports provided through hookups with the IDOT TSC computer continues to expand. The IDOT computerized reports provide near-real-time congestion and travel time information as often as every minute around-the-clock. Special messages, including commuter rail transit and suburban bus information, and traffic incident bulletins, are added as warranted through keyboard use. Internet access to the Chicago area traffic maps was recently initiated in partnership with the University of Illinois at Chicago: (http://mana.eecs.uic.edu:8001/GCM/GCM.html).

Eleven highway advisory radio stations continue to operate in a real-time automatic update mode made possible by having the surveillance sensors continuously produce digitized voice broadcasts for each site. Expressway congestion limits are broadcast on 1610 AM, with estimated travel times on 530 AM. A public information hotline (#312-DOT-INFO, or #708-705-4618, or #708-705-4620) also uses these traffic data, along with a commercial *123 cellular service.

In October 1994, major expressway reconstruction on the I-90/94 Kennedy Expressway was completed. Extensive traffic management measures were in use, including changeable message signs, HAR stations, accident/incident investigation sites, alternate route improvements, and public information program. Since the roadway reconstruction completion, a new mechanized closure of entry ramps to the expressway's reversible lanes along seven miles has been in successful operation, improving safety and operational effectiveness during the twice-daily reversal of traffic flow. The system incorporates several types of advance signing, "swing gates" which rotate out of concrete barrier walls to re-direct traffic away from reversible lane entry ramps, and "restraining barrier" mechanisms which are deployed across entry ramps to safely stop errant vehicles before a wrong-way incursion into the reversibles. As part of the final reconstruction work, this system will be enhanced next year with considerable automation technology to further improve operations and system reliability.

In order to improve the quality of traffic flow on major regional arterials, many of which are in freeway corridors, IDOT has contracted the Northwestern University Traffic Institute to develop quick clearance and other incident management guidelines for use by the multiple agency teams involved in arterial traffic operations. This project is more than half way completed. From a signal coordination and timing standpoint, IDOT also continues to add "closed loop" signal systems, at the rate of about 25 per year. There are currently 160 systems involving 1,068 intersections in operation.

The technology transfer project of videotapes documenting the IDOT Freeway Traffic and Incident Management Program is complete. All four videos received widespread FHWA distribution, and are available through FHWA or IDOT.

Finally, the Public Employees Roundtable selected the IDOT Freeway Traffic and Incident Management Program as its state government winner of the 1995 Public Service Excellence Award.

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10/1/95

Under the targeted deployment plan, a wide variety of individuals will have use of a Project vehicle for two to four weeks. This will allow evaluators to study the effectiveness of the units in the public's hands without the significant costs of installing and maintaining the units in a large number of vehicles over a lengthy period.

The targeted deployment has several other benefits. This includes a significant reduction in the costs of the project. With the reduced time frame, the project will also be able to provide results much earlier than anticipated. This will allow developers of other systems access to reports to aid in the design of their project. This will also help transition to early deployment on the GCM corridor. The *ADVANCE* TIC is being developed to also serve as a prototype information clearinghouse proposed for GCM. With the early completion of *ADVANCE*, the TIC will be transitioned into a Corridor Transportation Information Center (C-TIC) by the fall of 1996.

Illinois continues to pursue using the latest technologies as cost effective opportunities develop. IDOT, in coordination with the Illinois State Toll Highway Authority, is conducting a test of an AVI traffic management system using the Tollway's I-PASS electronic toll collection system. This project centers on I-355, where I-PASS has been installed and functioning for over one year. The effort is to develop and test software for obtaining travel time information with the potential to further deploy the system later. Compatibility with data obtained from traditional detection systems will also be reviewed. This project will serve as a prototype which can be used as the Tollway's I-PASS system is expanded. The initial factory test of the system will be in November of 1995.

Not all of IDOT's ITS efforts are in the densely populated areas of Illinois. IDOT is working with Amtech Systems Inc. on a public/private initiative at the Williamsville weigh station just north of Springfield on Interstate 55. The project will test the use of AVI transponders with high speed weigh in motion for commercial vehicle electronic pre-clearance. The configuration includes video and Illinois State Police electronic paging for enforcement. Several local cartage companies will participate in the study. The system is currently under design and is expected to be deployed in the fall of 1996. If successful, the future of weigh stations in Illinois may be high speed weigh in motion with electronic pre-clearance instead of low speed sorting.

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Ministry of Transportation of Ontario

Summary of Intelligent Transportation System Activities

The Ministry of Transportation has been actively engaged in development and of Intelligent Transportation Systems in Ontario. Through partnerships with other levels of government, academia and private industry, Intelligent Transportation Systems have helped to improve the safety, efficiency and productivity of Ontario's transportation system and provided opportunities for Ontario's industry.

The ministry's major Intelligent Transportation System activities are described briefly on the following pages:

Current Intelligent Transportation Systems Activities

Strategic
Intelligent Transportation Systems Strategic Plan for Ontario
Intelligent Transportation Systems Ontario On-Line
Roadway Electrification

Advanced Traffic Management Systems
Automated Speed Warning and Enforcement
Emergency Tracking and Response Demonstration
Freeway Traffic Management Systems
INTEGRATION
Remote Traffic Microwave Sensor

Advanced Fleet Management Systems/Commercial Vehicle Operations
AVION / Advantage I-75
Border Crossing Automation
Electronic Toll Collection
Weigh-in-Motion

Advanced Public Transportation Systems
Ontario Advanced Vehicle Location/Control Initiative
Electronic Payment Systems - Ontario Universal Public Transportation Card Initiative

Advanced Traveler Information Systems
International Traveler Information Interchange Standard
Metropolitan Transportation Information Production System
TravelGuide

Advanced Rural Transportation Systems
Mayday System

Advanced Vehicle Control Systems
National Automated Highway System Consortium
Vehicle to Roadside Communications Protocol

Strategic Intelligent Transportation Systems Activities

Intelligent Transportation Systems Strategic Plan for Ontario

It is important that the restricted resources available for the deployment of Intelligent Transportation Systems be allocated to achieve the greatest benefits to the transportation system user. The Intelligent Transportation Systems Strategic Plan for Ontario will define a framework in which Intelligent Transportation System activities and initiatives can be placed. It will provide an opportunity for all groups participating in the deployment of Intelligent Transportation Systems to define their roles and coordinate their activities.

Intelligent Transportation Systems Ontario On-line

The Intelligent Transportation Systems Ontario On-Line project is creating an Internet World Wide Web site that will allow a sharing of ideas, directions and technical information among all the participants in Intelligent Transportation Systems in Ontario. This facility will provide a focal point for Intelligent Transportation Systems activities in Ontario's public sector, private industry, and academia. Possible applications will include an Intelligent Transportation Systems information repository and clearing house for use by Ontario ministries, private sector companies, and universities. Other applications may include presentation of real-time traffic data; educational on-line presentations for business, libraries, and the general public; on-line distribution of Intelligent Transportation Systems related reports and publications; and a forum for discussion of innovative and strategic ideas.

Roadway Electrification

Electric vehicles provide one opportunity to reduce the environmental impact of transportation. The Ministry of Transportation of Ontario is undertaking a strategic evaluation of low cost solutions to provide charging facilities to electric vehicles on major roadway segments. The ministry will explore the impact and opportunities of electric vehicles and highways on Ontario's economy, and assess the policy and planning needs in this area.

Advanced Traffic Management Systems

Automated Speed Warning and Enforcement

The Ministry of Transportation of Ontario is undertaking initial investigation of a system to automatically warn drivers and other road users explicitly whenever the speed limit is exceeded.

Emergency Tracking and Response Demonstration

An early response to incidents on a congested highway is critical to minimizing the detrimental impact on the traveling public. The Ministry of Transportation of Ontario will be demonstrating the use of emergency vehicle monitoring and deployment using geopositioning system technology and geographic information systems in the Toronto area.

Freeway Traffic Management Systems - COMPASS

The Ministry of Transportation of Ontario has been active in the development and operation of Freeway Traffic Management Systems for over 15 years. The ministry's largest system, COMPASS, operates on highway 401 through Toronto. Vehicle detector stations, closed circuit television cameras, changeable message signs and a fibre optic communications network make up the field equipment. Information from the loops and the roadside-mounted cameras is fed back to the traffic control centre where computers automatically detect traffic incidents. Motorists are advised of expected traffic conditions ahead and emergency service providers are notified when necessary. The system is able to provide travel time information for use with traveler information systems. Feeds from the camera network are provided to numerous media outlets in the Toronto area.

Advanced Traffic Management Systems continued

INTEGRATION

INTEGRATION is a state-of-the-art traffic simulation model developed explicitly for Intelligent Transportation System applications by Professor Van Aerde of Queen's University with assistance from the Ministry of Transportation of Ontario. Applications include route guidance system analysis, origin-destination assignment modeling and emergency evacuation system evaluation. Future work may include development of a real-time version of the INTEGRATION road network simulation software with advanced incident detection capability.

Remote Traffic Microwave Sensor

The Remote Traffic Microwave Sensor is a radar based vehicle detection device. It is currently designed to simultaneously monitor vehicle presence in several lanes in a cross-fire mode. The system was developed by EIS of Toronto, with development funding provided by the Ontario government. Demonstration units are now being evaluated for permanent placement in both freeway and arterial modes of operation.

Advanced Fleet Management Systems/Commercial Vehicle Operations

AVION / Advantage I-75

The Ministry of Transportation initiated the AVION project in cooperation with the Advantage I-75 project in the United States. Jointly, the two projects use Intelligent Transportation System technologies, such as automatic vehicle identification, weigh-in-motion, automatic vehicle classification, smart cards and two-way communications, to monitor and verify truck movements and compliance along highway 401 in Ontario. AVION will allow a pre-qualified and pre-cleared commercial vehicle equipped with automatic vehicle identification equipment, to bypass downstream inspection stations along Interstate I-75 and Highway 401.

Border Crossing Automation

The cost of delays to commercial vehicles crossing Ontario's borders affects the cost of goods imported to and exported from Canada. These costs make it more difficult for Ontario producers to enter the United States market and increases costs to the Ontario consumer of goods coming from the United States. With the North American Free Trade Agreement, trade with the United States and Mexico will increase further. A more efficient border transportation system is key to Ontario's economic well being. In cooperation with international border crossing agencies, this project had engaged a consultant team to undertake the task of preliminary engineering and design of an automated border crossing system at Michigan-Ontario-New York international borders. This is to be followed by a field prototype trial and demonstration. The system will incorporate automated vehicle identification technology to allow for electronic toll collection at bridges/tunnels, and cargo travelers clearance through customs and immigration at border crossings.

Electronic Toll Collection

The Ministry of Transportation of Ontario, in partnership with an Ontario-based private sector consortium is building Highway 407, one of the first all-electronic toll roads in the world. The toll system will make use of automated vehicle identification transponders mounted inside vehicles to identify the vehicle at entrance and exit ramps of the highway. Vehicles without tags will have their licence numbers read by video cameras and the licence numbers extracted automatically, in most cases.

Electronic tolling offers several advantages over mixed or manual systems. These include greater safety to drivers and operators, lower capital and operating costs, reduced pollution and the total elimination of delays at the toll booths. Electronic tolling also permits a wide range of tolling strategies such as tolling by distance, time of day, level of congestion or a combination of the above. The first section of the highway is expected to open in late 1996.

Advanced Fleet Management Systems/Commercial Vehicle Operations continued

Weigh-in-Motion
The Ministry of Transportation is evaluating Weigh-in-Motion technology to identify and weigh 100% of commercial vehicle traffic passing a Truck Inspection Station. This information will be used to determine which vehicles should enter or bypass the station. The application has the ability, when combined real time with Commercial Vehicle Operators Registration and or Safety Rating data, to focus enforcement efforts on repeat violators, while clean operators are directed to proceed, reducing industry delays and keeping the truck inspection station lanes free for offenders.

Advanced Public Transportation Systems

Ontario Advanced Vehicle Location/Control Initiative
The Ministry of Transportation of Ontario, in cooperation with several Ontario transit properties and industry, has developed a generic functional specification and bid package for Automatic Vehicle Location and Control systems specifically targeted to small and medium-size fleets. The specifications are modular and take advantage of standardization while giving properties the flexibility to customize their applications. The system will monitor the location of all transit vehicles on the road, monitor predictive schedule adherence and provide a dynamic response to changes; guarantee transits, and provide increased safety and security to the transit users and operators. Real time transit information can be made available to transit users. Improved service to the public and greater operational productivity is expected through the use of the system. The first implementation of an Advanced Vehicle Location Control system is under way in London, Ontario. The development of the next generation of generic functional specifications is underway.

Electronic Payment Systems - Ontario Universal Public Transportation Card Initiative
Public transportation includes, but is not limited to, Ontario's municipal public transit agencies (transit, commuter buses, commuter rail), private sector transportation companies (inner-city, taxi, limousine, shuttle buses) and private sector and municipal parking authorities. This initiative is evaluating the opportunity for Ontario to move toward electronic payment for all public transportation within the province. Initial work is focused on the Greater Toronto Area - but the potential for expansion to the whole province, and coordination nationally or internationally presents great opportunities for Ontario. Phase I of the project will attempt to identify relevant stake holders and collect and analyze the overall systems end user functional requirements as a basis for developing a strategic systems infrastructure plan.

Advanced Traveler Information Systems

International Traveler Information Interchange Standard
The Ministry of Transportation of Ontario has been leading an international effort, with agencies such as ENTERPRISE, the Society of Automotive Engineers and the International Standards Organization to develop a set of standards to support Advanced Traveler Information System projects. The International Traveler Information Interchange Standard defines protocols and standards for traffic incident messages, route guidance information - including link travel times, incident messages, transit vehicle arrival times, location codes and other relevant information. As well, communications standards for a variety of broadcast media are being developed. Ontario is also leading the incorporation of French Canadian language messages into the standard.

Acceptance of the International Traveler Information Interchange Standard will make possible the use of Advanced Traveler Information Systems devices internationally, increasing both the potential services available to Ontario, and the market available to Ontario based industry.

Advanced Traveler Information Systems continued

Metropolitan Transportation Information Production System
The Metropolitan Toronto Information Production System is an inter-jurisdictional real-time traffic information acquisition, processing and distribution system to support traveler information systems. Traffic information is gathered from arterial roads, freeways and transit, processed and distributed in digital form over a variety of communications media to provide accurate real-time, traffic and transit information to travelers in the Greater Toronto Area. The Metropolitan Toronto Information Production System forms a component of a broader Regional Traffic Information System.

TravelGuide
TravelGuide was a proof-of-concept prototype of an Advanced Traveler Information System for automobile and transit users. Based on advanced communications and computer technologies TravelGuide featured a hand held, palm top computer which received real-time traffic and transit information. This type of information will assist travelers to plan their optimum route and provide en-route voice based route guidance and traffic incident information. The development of TravelGuide was based on a public-private partnership.

Advanced Rural Transportation Systems

Mayday Systems
This project will evaluate the implications of emergency warning systems and gather operational experience for the design and implementation of similar systems in Ontario. Work will be coordinated with the Colorado Department of Transportation, who will be pursuing a similar project in Colorado.

Advanced Vehicle Control Systems

National Automated Highway System Consortium
The National Automated Highway System Consortium was formed in 1994 with the United States Department of Transportation support, to specify, develop and demonstrate a prototype Automated Highway System by the year 2002.

Automated Highway Systems are seen as the most significant way to improve surface transportation in a manner which is safe, efficient and socially acceptable. As an Associate Participant in the National Automated Highway System Consortium, the Ministry of Transportation of Ontario will ensure that Ontario's needs and concerns are voiced.

Vehicle to Roadside Communications Protocol
The Ministry of Transportation of Ontario has participated in the development of a communications protocol to enable sharing of Vehicle to Roadside Communications hardware across multiple applications.

Available Documents

Smart Trucking in Ontario (AVION & Border Crossing)

TravelGuide - Ontario Route Guidance System Concept

TravelGuide - Ontario's Portable Traveler Information System brochure

A Technical and Economic Review of a Route Guidance System

COMPASS Technical Video

COMPASS and FTMS brochures

Integrated Road and Traffic Information System

The Remote Traffic Microwave Sensor

Automatic Vehicle Location and Control Systems for Small and Medium Ontario Transit Properties Phase I Report

Ontario Advanced Vehicle Location and Control Initiative. Phase II -- Recommendations Report

Ontario Advanced Vehicle Location and Control Initiative. Generic Bid Document Package

Ontario Advanced Vehicle Location and Control Initiative: Paper to IVHS America

Additional Information Available From

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WISCONSIN DEPARTMENT OF TRANSPORTATION
MILWAUKEE FREEWAY SYSTEM

Status Report - October 1995

MILWAUKEE AREA FREEWAY TRAFFIC MANAGEMENT SYSTEM (FTMS) is also known as
"**MONITOR**" - **M**ilwaukee area freeway **O**rganization **N**etwork **I**nformation on **T**raffic **O**perations and **R**esponse

1. The firm of JHK & Associates is presently engaged in developing plans for implementation of **MONITOR** System for the Milwaukee Area Freeway System. The project area includes approximately 100 miles of freeway that will ultimately have FTMS elements installed. The plans will include staging plans to complete construction for full implementation over a 6 year period.

2. The Design & Construction of the Early-Action **MONITOR** System (EA system) is completed. Testing of equipment and partial operation began in September of 1994, with full operations of the (EA system) in March of 1995.

   The EARLY ACTION system is intended to be used as a means to mitigate traffic impacts during resurfacing & reconstruction on 12 miles of I-94 (E-W Freeway) from Marquette Interchange in Milwaukee County to Goerkes Corners in Waukesha County. I-94 is a six lane freeway and carries traffic volumes of 150,000 to 175,000 vpd. Construction work will have a major impact on traffic with congestion potential for 10 to 16 hours per day. Construction is scheduled for 1996 and 1997.

   The EARLY ACTION system covers about 32 miles of freeway in the Milwaukee area, and includes FTMS elements being implemented on I-94; on I-894/USH 45, I-43/894 which forms a loop/bypass route to I-94; and approach legs to these sections of freeway.

   Eleven Variable Message Signs (VMS) are installed over the freeway in this early action project. Each sign is full-matrix with 3 lines of twenty one 18-inch characters. Full-matrix will be utilized to provide the ability to use oversize characters during periods when extra emphasis is requested. Nine freeway VMS are flip-disk/fiber-optic hybrid type signs. One LED (amber) and one flip-disk/LED (amber) hybrid sign. Three flip-disk/fiber-optic hybrid type VMS are installed on surface street approaches to the freeway where drivers can be given appropriate information on alternate freeway routes available. Each sign is full-matrix with 2 lines of 21 characters per line.

   The EARLY ACTION system also includes detectors such as loop detectors, overhead micro-wave detectors, one video-image detector unit, micro-loops, 14 closed circuit television (CCTV) cameras, 17 new ramp meters in addition to 26 existing ramp meters, 7 of the new metered ramps have high occupancy vehicles (HOV) bypass lanes.

A leased site for an interim Traffic Operation Center (TOC) is located in the Milwaukee Central Business District, with convenient access to Ameritech's fiber optic communication network to be leased for CCTV. Due to short lead time available for implementation, a leased interim Traffic Operations Center (TOC) was deemed necessary. The interim Traffic Operation Center houses the mainframe computer, system operators for the FTMS, VMS and ramp metering systems. Ultimately a permanent TOC will be built.

A leased communication system was chosen based on the short lead time for EARLY ACTION system implementation and construction activity providing cable installation. Communication between the field equipment and interim TOC is handled as followed:

1.) Leased telephone for ramp meters and detector stations within the I-94 construction area.
2.) A combination of spread-spectrum radio and leased telephone is used on the bypass route and approaches leg.
3.) Leased analog fiber-optic cable and leased telephone is used on CCTV cameras.

JHK & Associates also assisted in developing system software, provided system integration and provided construction management during EA system construction. CCTV's have been connected to TOC, and VMS integrated. EA system integration has been completed.

The EA system will eventually be integrated into the ultimate system implementation. The leased communication facilities will eventually be dropped and a state-owned communication system constructed.

3. The Department has completed construction of **MONITOR** element enhancements for I-894 to include loop detectors at ½ mile spacing, 12 new ramp meters with provision to incorporate HOV bypass lane and communication conduits.

4. The Department is currently constructing phase 3 of the system in Milwaukee and Waukesha Counties, along I.H. 43, I.H. 94, & I.H. 894. This includes loop detectors, 12 CCTV cameras and 20 ramp meters. This phase is expected to be operational by spring of 1996.

5. Signal System Integration Study for Milwaukee Area
The consulting firm of Edwards & Kelcey, Inc. has been retained to conduct a study of integration of local arterial traffic signal into the **MONITOR** system to maximize traffic movement on both the freeway system and local arterial. This 10 month study will develop and implement a pilot program test segment.

6. Southeastern Wisconsin Incident Management Program (SWIM)
The consulting firm of HNTB has been retained to provide project management for an incident management program in southeastern Wisconsin. The goals of the project are to create regional consensus, identify user needs, develop organizational structures, identify immediate deployment actions, & enhance the existing incident management system.

7. COMMERCIAL VEHICLE OPERATIONS (CVO)

CVO INSTITUTIONAL BARRIERS STUDY: The purpose of this study is to identify and analyze the institutional barriers which exist with respect to the potential deployment of ITS technology for commercial vehicle operations (CVO) within Wisconsin. The study will evaluate the institutional barriers from the perspective of both commercial motor carriers and regulatory agencies. The study focus will be limited to organizational, regulatory, legislative, and administrative issues. These issues will be applied to the transparent borders, productivity, safety (free flow of interstate vehicle operations) and electronic processing concepts. Estimated cost, $50,000. Completion by October, 1995.

CVO ON-BOARD AUTOMATED MILEAGE AND STATE LINE CROSSING TEST: The approved FHWA ITS Operational Test will demonstrate and evaluate the capability of technology to automatically collect and file motor carrier fuel jurisdictional mileage data. This data is used by states to compute vehicle fuel tax and registration apportionment. The project will develop standards for automated equipment that will cover data collection accuracy, integrity, adaptability, and format for electronic filing. Participants, States of Iowa (lead agency), Minnesota, Wisconsin, Rockwell Corp., ATA, Rand McNally - TDM Inc., FHWA, The Western Highway Institute, Motor Carrier and trucking associations from each state. Estimated cost $1,619,000. Draft plan by September, 1995.

CVO OUT-OF-SERVICE VERIFICATION OPERATIONAL TEST: This approved FHWA ITS Operational Test will integrate technology with the existing State Patrol real-time data base to allow inspectors to detect vehicles or drivers operating in violation of out-of-service (OOS) orders. The test aims to increase the effectiveness of OOS enforcement efforts, establish a bi-state enforcement program and provide insight on the potential for future applications of this project of the technology. Study area, IH 90/94 westbound corridor between St. Paul, MN and the state line at Beloit. Estimated cost $270,000. Participants, WisDOT State Patrol and Division of Highways, FHWA, Minn. DOT, and Minn. Department of Public Safety. Initiate Phase I, September, 1995.

CVO MULTI-STATE ONE STOP ELECTRONIC PURCHASE OPERATIONAL PHASE: The approved FHWA ITS Operational Test will design and evaluate a one stop electronic system for the purchase of motor carrier credentials allowing for the application, payment, and receiving of credentials and permits. The transactions could take place between the carriers base state or any other states participating. The proposed streamline process for motor carrier credentials will be evaluated for the improvements to both state agencies and motor carrier industry. Estimated Cost $2,378,000. Participants, States of Minnesota (lead agency), Iowa, Illinois, Wisconsin, Kansas, Missouri, Nebraska, and South Dakota, FHWA, AAMV Anet Inc., AT&T, Lockheed & Western Highway Institute. Define system needs and design modular configuration by September, 1995.

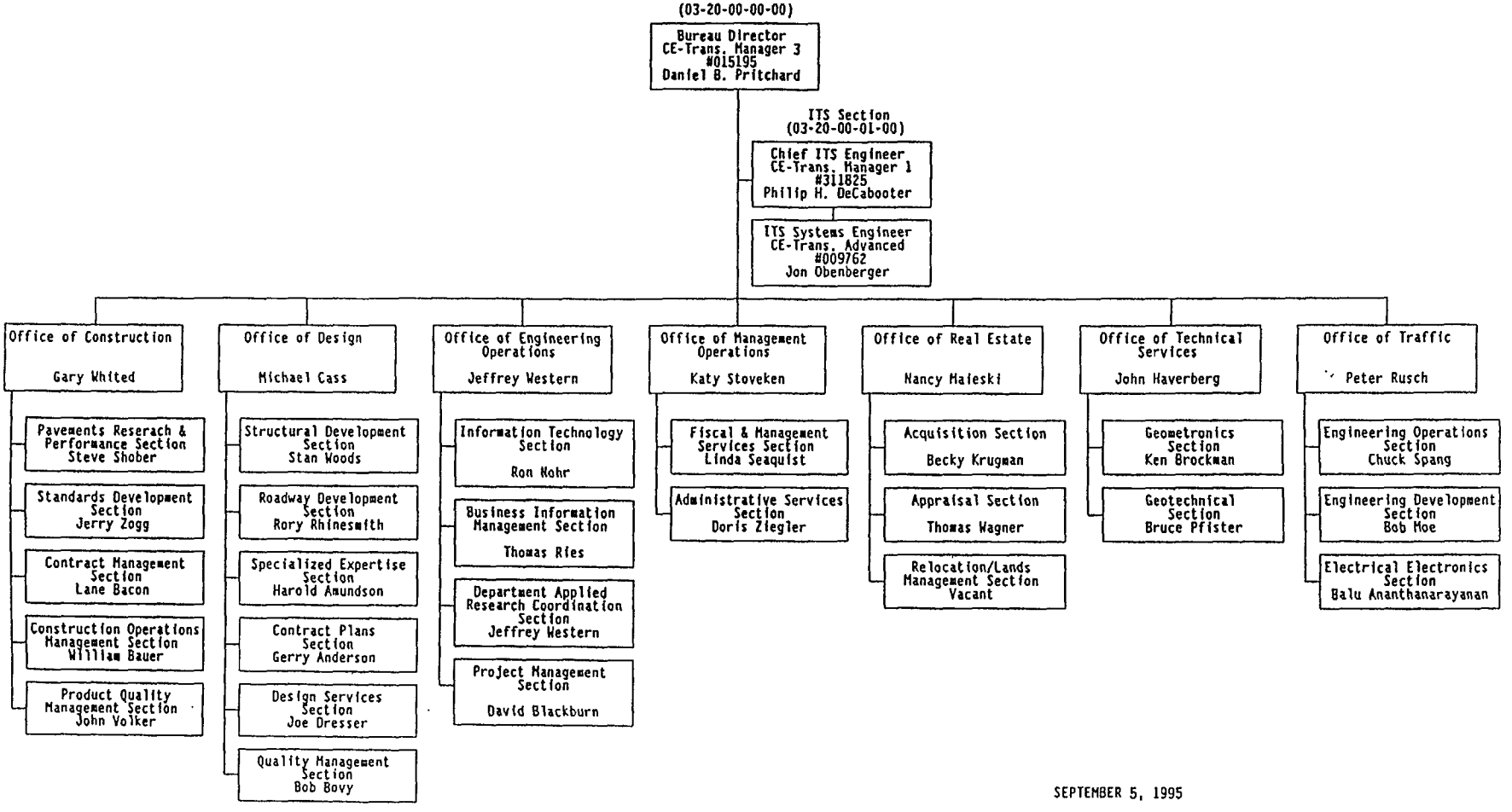
8. WISDOT ITS PROGRAM INITIATIVES

ITS STRATEGIC PLANNING PROCESS SUPPORT: The purpose of this effort is to provide the resources necessary to conduct an environmental scan and organizational assessment related to current activities and anticipated future state of practice of ITS within the state of Wisconsin. This activity has been identified by the WisDOT Steering Committee as a priority to be completed due to the appropriate resources and time not available to adequately address when the ITS Strategic Plan was prepared. The results of this project will provide information to the Steering Committee which support them in providing direction to the program, assist in prioritizing near term priorities, support long range planning and a future update of the ITS Strategic Plan. No estimate as yet. Establish project scope, September, 1995.

GCM ITS CORRIDOR PROGRAM PLAN: The states of Illinois, Indiana, and Wisconsin have formed a coalition to apply ITS in the corridor connecting Gary, Chicago, and Milwaukee. The GCM Corridor Coalition established this project to develop a 20 year Corridor Program Plan. The plan will outline a vision for ITS applications and create a state-of-the-art test bed within the corridor. Program areas, schedules, priorities, and estimated funding needs will be identified in the plan. Estimated cost $450,000. Participants, Illinois, Indiana, Wisconsin. Submit WisDOT application for funding to FHWA, September, 1995.

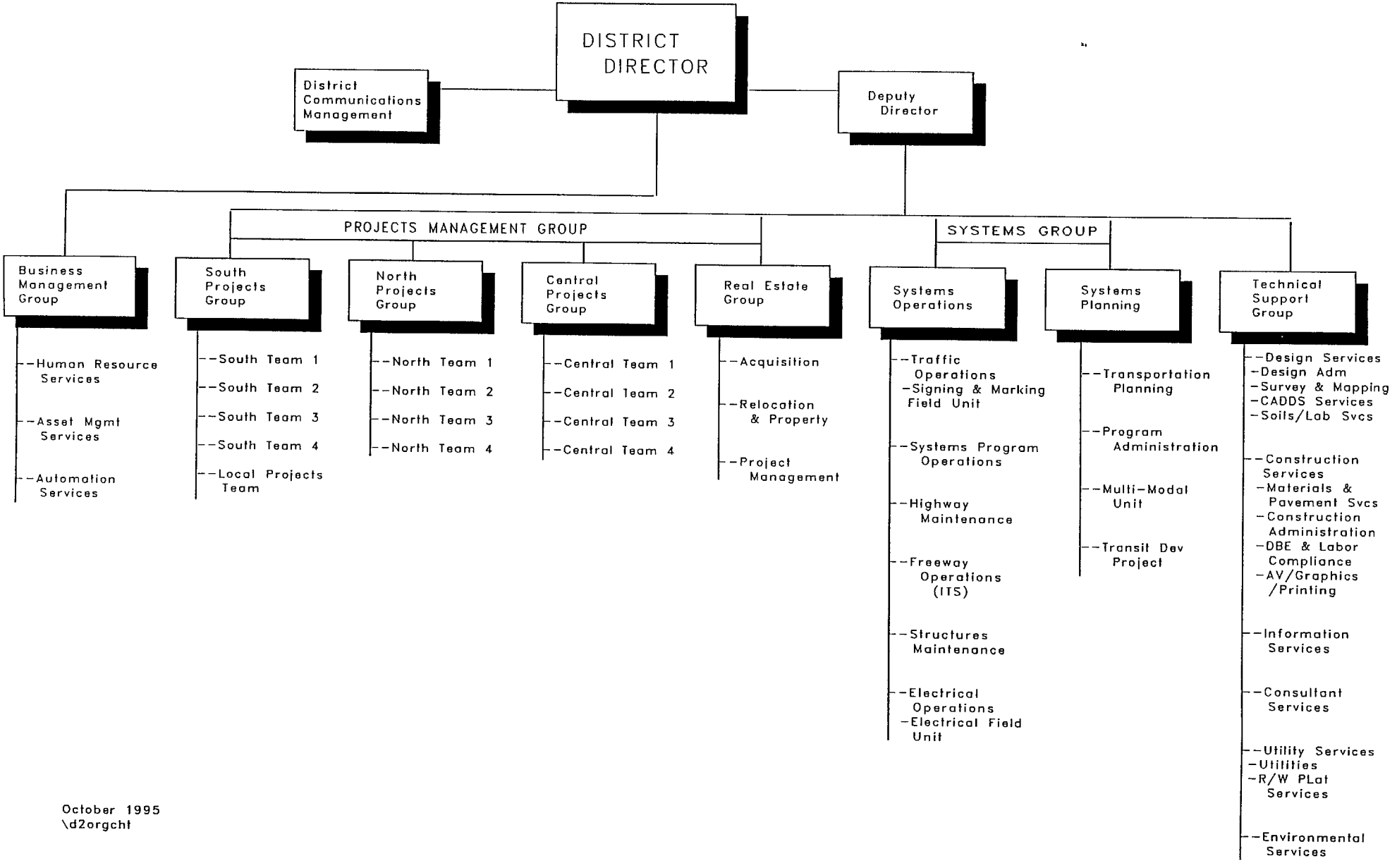
IH 90/94 ITS INTERCITY CORRIDOR STUDY: The study will evaluate the need for and identification of ITS technologies necessary to improve mobility, efficiency, productivity, and safety of travel within the IH 90/94 rural corridors. The proposed study process is based on a user needs assessment and user services evaluation resulting in a strategic deployment plan for the consideration of ITS technology within the corridor. The plan will include multi-year staged implementation strategy for deployment efforts to integrate the operation of the multi modal surface transportation system in Wisconsin within these corridors. Estimated cost, $350,000. Initial technical team meeting, September, 1995.

BUREAU OF HIGHWAY ENGINEERING
ORGANIZATIONAL CHART



SEPTEMBER 5, 1995

WISCONSIN
TRANSPORTATION DISTRICT 2



October 1995
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Can we measure cost savings?

About 55% of traffic delays and excess fuel consumption on Milwaukee freeways are caused by "incidents" such as crashes, spills, stalled vehicles, roadway debris, maintenance and bad weather.

Assuming costs of vehicle delay at $6 per vehicle hour - a conservative estimate - and fuel at $1.10 per gallon, costs to Milwaukee area drivers from incident-related congestion would be about $65 million per year in 1992 dollars by 2005.

In general, similar systems in other cities have saved motorists about $4 for each dollar spent - a significant return on investment.

MONITOR enables us to make much more efficient use of existing freeways.

Will MONITOR be expanded?

Long-range plans will expand the MONITOR network to 100 miles of southeastern Wisconsin freeways, including all 68 miles in Milwaukee County by the year 2000.

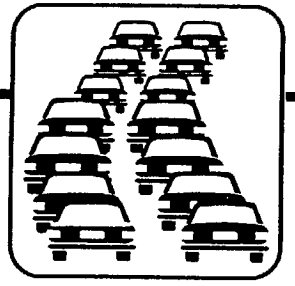
Where are the message signs located?

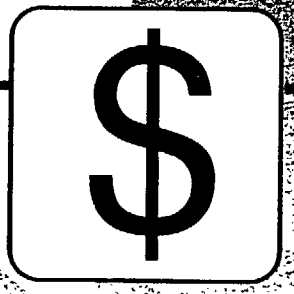
On eastbound US 18 near the eastbound I-94 on ramp in Waukesha, at WIS 100 northbound south of W. Edgerton Ave., on US 45/41 southbound south of Main St. in Menomonee Falls, US 45 southbound north of W. Locust St., I-94 eastbound west of Elm Grove Rd., US 41 southbound at W. Cherry St., I-894 northbound south of W. Cleveland Ave., I-94/43 northbound near the Kinnickinnic River, I-43 northbound south of W. Beloit Rd., I-94 northbound south of W. Ramsey Ave., WIS 119 (Airport Spur) at S. 5th St. and WIS 190 (W. Capitol Dr.) eastbound near N. 124th St.

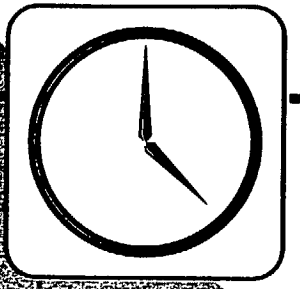
Milwaukee's Freeway Traffic Management System

Wisconsin Department of Transportation Dist 2 Freeway Operations

633 W. Wisconsin Avenue
Suite 1200
Milwaukee, WI 53203







What is MONITOR?

MONITOR is a computerized system of electronic detectors, ramp meters and message signs. The system is designed to improve the efficiency and safety of the Milwaukee freeway system by reducing accidents and congestion.

How does it work?

MONITOR tracks freeway traffic with cameras mounted on 45-foot poles, wire sensor loops in the pavement and overhead detectors on bridges.

Data is transmitted to a Wisconsin Department of Transportation control center in downtown Milwaukee. When the system alerts staffers to freeway accidents or congestion, closed-circuit television confirms problems. Messages are then transmitted on large electrically operated signs, advising motorists to consider alternate routes.

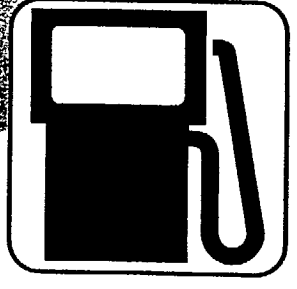
These large message signs are strategically located on the freeways and on nearby streets.

How effective is MONITOR?

As motorists are advised to avoid traffic jams, congestion is reduced. And as bottlenecks clear more quickly, there are fewer slowdowns, accidents and polluting emissions. Drivers often are able to reach destinations quicker, and save time, money and fuel in the process.

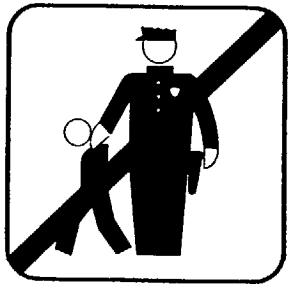
Can we measure these savings?

Yes. Similar systems in other cities have cut fuel consumption on freeways by nearly 22% and time lost to congestion delay by about 33%.



Does it enhance safety?

MONITOR technology has helped cut accidents on similar freeway systems in other cities by up to 30%.

Is it a law enforcement tool?

No. MONITOR is designed to ease congestion by regulating freeway access, inform drivers of adverse conditions such as accidents, traffic jams or lane closures, and to create a rapid response for clearing blockages. It is NOT intended to locate or apprehend speeders.