

MICHIGAN
DEPARTMENT OF
TRANSPORTATION



Intelligent Transportation Systems (ITS)

Projects and Programs
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Michigan intelligent Transportation
Systems Center
1050 Sixth Street
Detroit, MI 48226

Phone: (313) 256-9800
Fax: (313) 256-9036

Transportation Systems
Michigan Department of Transportation
425 W. Ottawa, P.O. Box 30050
Lansing, MI 48909

Phone: (517) 373-2247
Fax: (517) 335-1815



FOREWORD

This is a brief outline of the current projects and programs related to the Intelligent Transportation Systems (ITS) initiatives, 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, and others. Also, MDOT is in contract with The University of Michigan on several ITS projects.

Further information can be obtained by contacting Eric Dhanak, Transportation Engineer, at (517) 3356999.

Dr. Kunwar Rajendra, PhD, P.E.
Engineer of Transportation Systems
Michigan Department of Transportation,
Phone: (517) 373-2247
Fax: (517) 335-1815
Email: rajendrak@state.mi.us

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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 basic 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 milli Watts to 10 Watts.
- 2) Automatic 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.

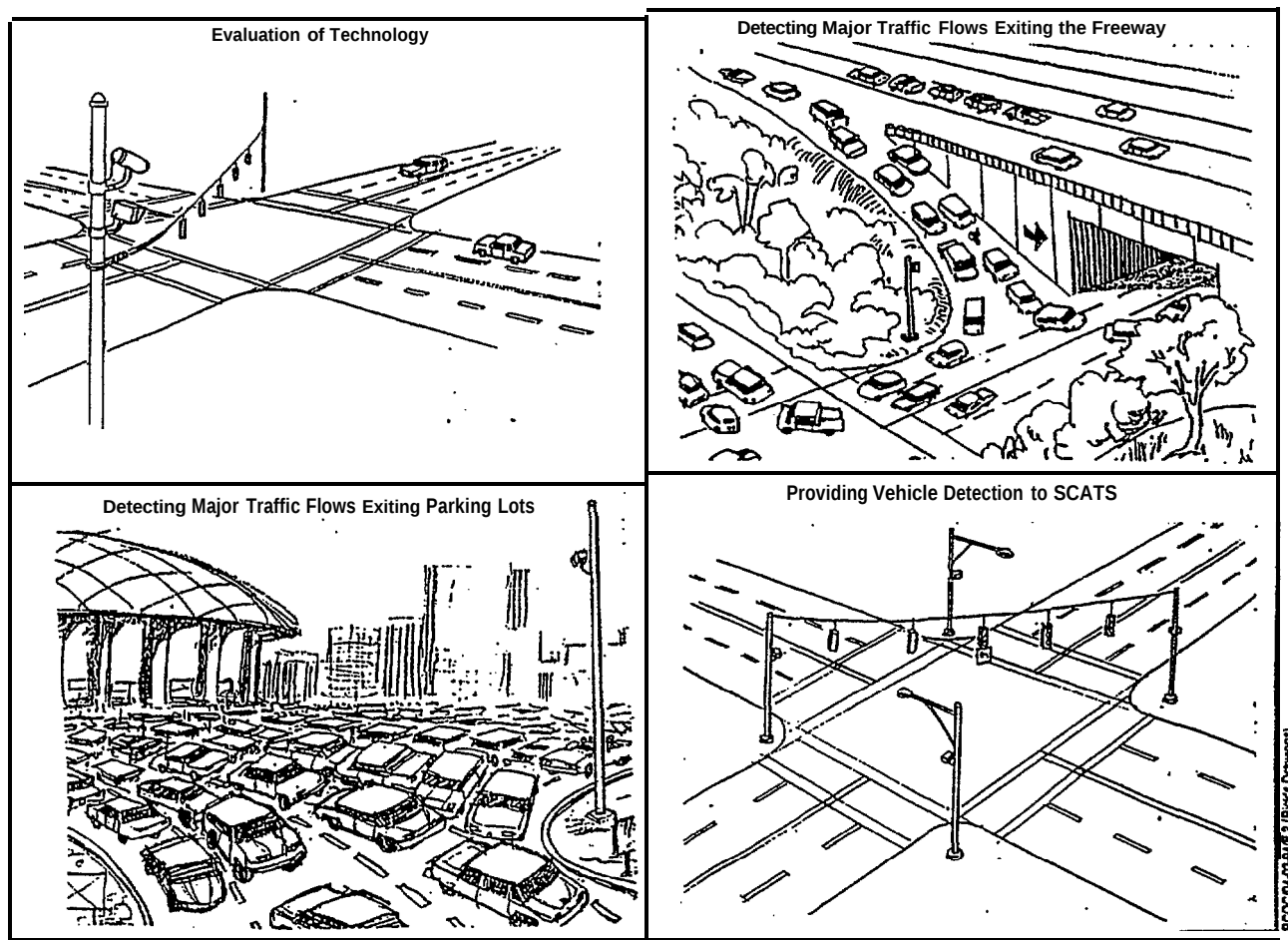
The system design contractor is ERIM of Ann Arbor, Michigan, and evaluation of the field test is being designed and conducted by the University of Michigan. Private industry partners for the project which are participating by contribution of equipment, cash and/or technical services include: General 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 procurement is currently in progress and it is expected that testing and evaluation will begin in the spring of 1996. The time period for completion of the test is 15 months.

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 implementation and is well along into the second phase. Over two hundred intersections are equipped with SCATS (a system that monitors traffic flow and adjusts signal timing in response to the changes in traffic), and Autoscope, machine-vision vehicle detectors. Ah-Scout roadside beacons have been installed at 100 locations throughout Southeast Oakland County. The beacons are communicating with 400 vehicles equipped with the Ah-Scout dynamic route guidance system. Work has begun on the design and installation of SCATS at 70 new intersections.

System integration is well underway. The FAST-TRAC transportation information management system will include interfaces with Ah-Scout, SCATS, Autoscope, SMART, and MDOT. Both video and traffic data will be shared by the new FAST-TRAC Traffic and Operations Center in Waterford and MDOT's MITS Center in Detroit, thereby facilitating integrated corridor traffic management in metropolitan Detroit.



The Rockwell Team will Provide the RCOC the Opportunity to Evaluate the Benefits of Low-Cost Machine Vision Detection in a Variety of Applications

Figure 1

C. ADVANTAGE 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 2).

In-vehicle transponders have been designed and allocated participating major carriers. Mainline weigh-in-motion (WIM) has been installed in several states including Michigan with WIM installation at the Erie weigh station on I-75 south of Detroit. Fiber optic communications have been used. SAIC is the system integrator, and Hughes Aircraft Company is the vendor for the transponders.

Installation and testing have been completed. Evaluation of the operational test is being conducted by the University of Iowa and is estimated for completion in two years.

A ribbon cutting ceremony for Michigan's portion of the project was preformed at Monroe County Michigan in December 1995.

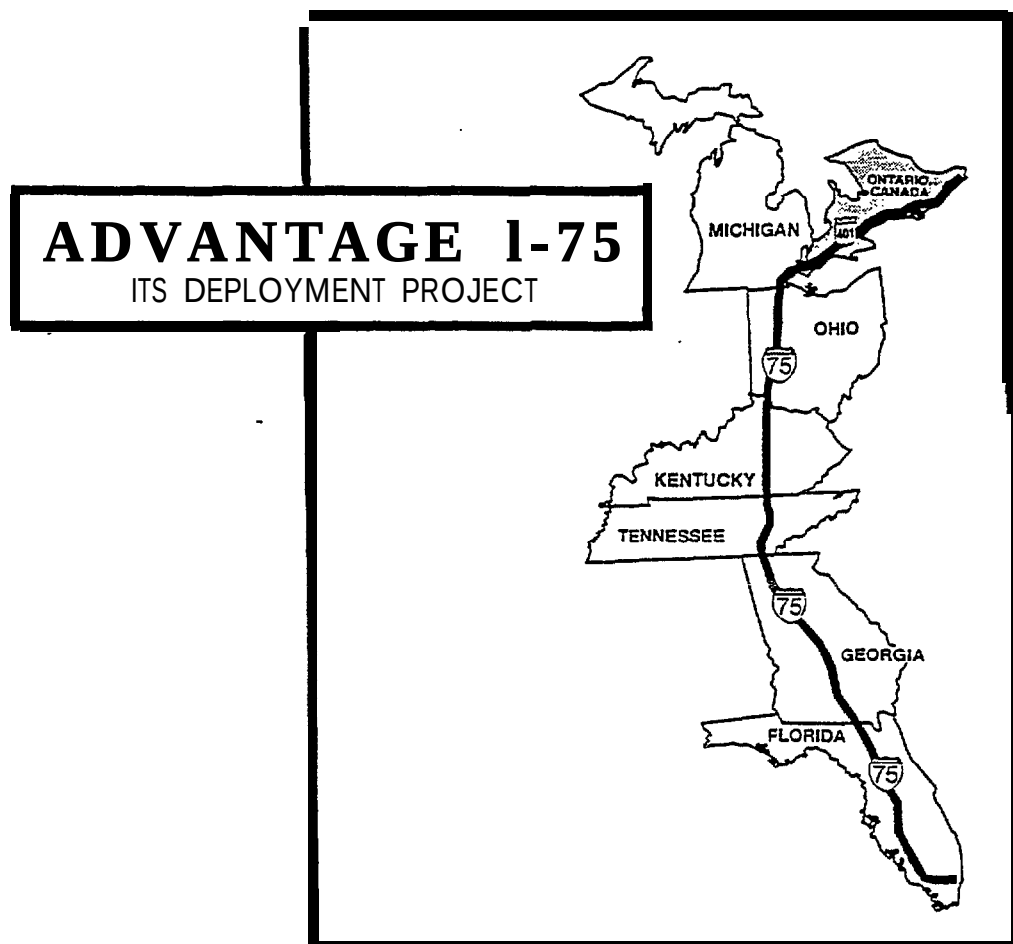


Figure 2

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, I-75, and I-375. 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 3). The plan includes installation of 145 CCTV cameras, 43 changeable message signs (CMS), ramp meters, highway advisory radios (HAR), machine vision, and approximately 700 loop sensors

Rockwell International is designing and building the deployment which includes freeway corridors in the City of Detroit, Wayne, Oakland, and Macomb Counties, including portions of 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 operations 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 the Michigan State Police 911 dispatch unit by relocating them to the MITS center.

The Detroit ATMS/ATIS project is estimated to cost \$33 million and will take about two years to complete.

3. *ATMS/ATIS EARLY EMPLOYMENT STUDY FOR METROPOLITAN GRAND RAPIDS*

Grand Rapids, the second largest metropolitan area in the State, has a freeway system with locations that experience recurring as well as nonrecurring congestion through the downtown area. In an effort to effectuate a solution, ITS applications are being considered for incorporation into the Grand Rapids Strategic Deployment Plan. HNTB Corporation in association with TRW, Inc. and Ed Swanson & Associates is conducting an ATMS/ATIS early deployment study for metropolitan Grand Rapids. The study focuses on the freeway, the arterial, and transit systems.

The early deployment study is being administered by the Michigan Department of Transportation. A project advisory committee, which includes representatives from MDOT, FHWA, the Grand Rapids and Environs Transportation Study, Michigan State Police, City of Grand Rapids, area county representatives, and the Grand Rapids Area Transportation Authority, have provided critical input throughout the study. The study has a planned completion date of April , 1996.

4. *APTS: Suburban Mobility Authority for Regional Transportation (SMART)*

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 are administered by the Suburban Mobility Authority for Regional Transportation (SMART) for several counties including Macomb, Oakland, and Wayne.

I-75 from Laper Road to I-94
 M-59 (Silverdome Area)
 I-696 from I-96 to I-94
 M-10 from I-696 to 8 Mile
 I-96 from Beck Road to I-696
 I-75 from Green Rd. to 14th St
 I-94 from Belleville Rd. to Wyoming
 I-94 from Kingsville Rd. to 10 Mile Rd.
 I-96/I-275 from I-696 to M-14
 I-275 from M-14 to I-94
 I-96 from I-275 to I-75
 M-39 from M-10 to I-94

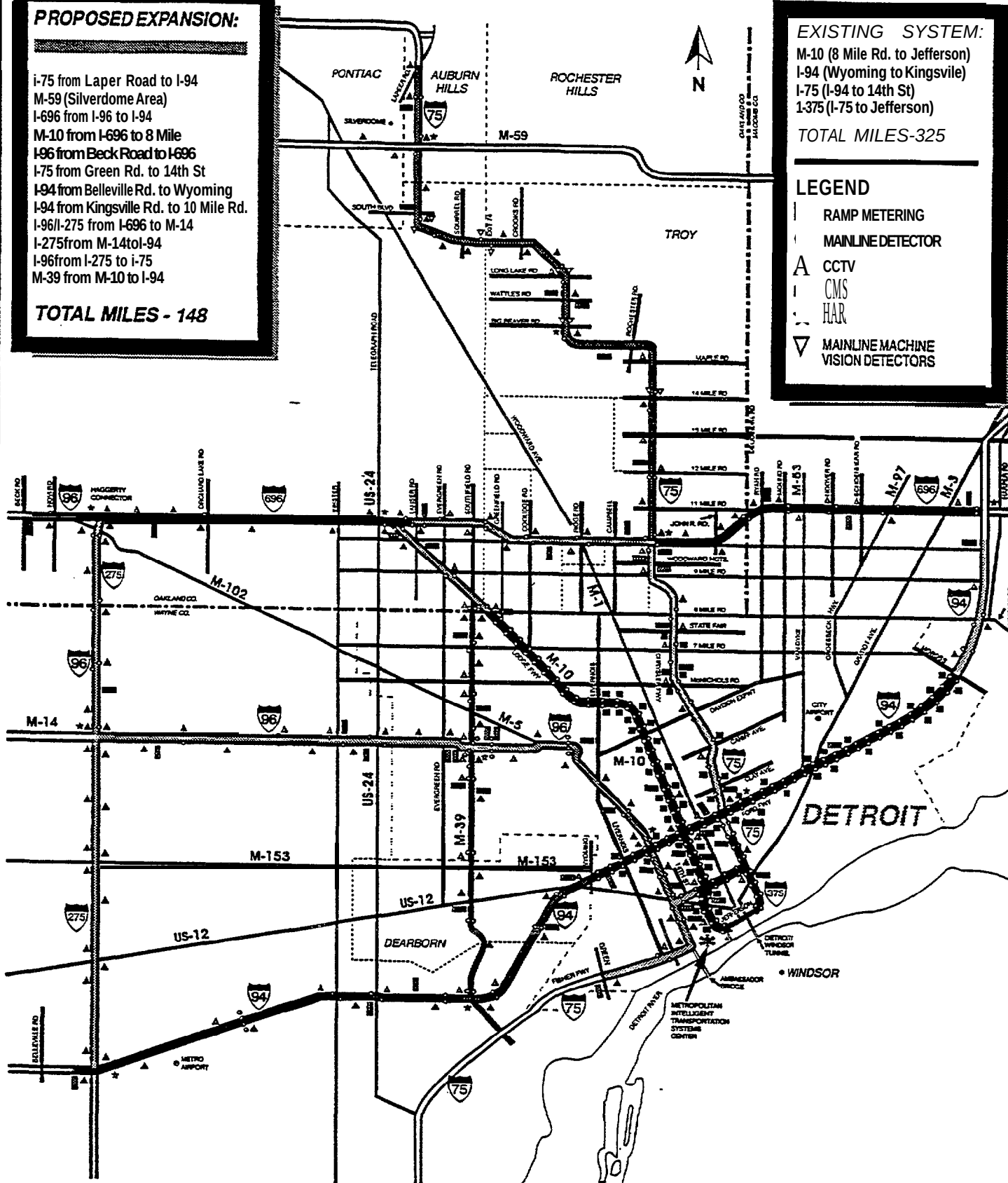
EXISTING SYSTEM:

**M-10 (8 Mile Rd. to Jefferson)
I-94 (Wyoming to Kingsville)
I-75 (I-94 to 14th St)
1-375 (I-75 to Jefferson)**

TOTAL MILES-325

LEGEND

RAMP METERING
 MAINLINE DETECTOR
 CCTV
 CMS
 HAR
 MAINLINE MACHINE
 VISION DETECTORS



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

Figure 3

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

This project applied ITS 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 conducting “before” and “after” studies.

The agencies that participated in this experiment were: 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 was 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.

Michigan Incident Management Conference was held on October 5, 1995. The 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 Programs 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/province team including Michigan, Ontario and New York was established to conduct the functional requirements and individual site studies for the three Detroit area and four Niagara River area 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-Sarnia, U.S. Immigration and Naturalization Service, Customs officials from both countries, the Peace Bridge and New York Thruway Authority, customs brokers, and trucking organizations. The institutional issues study and the preliminary engineering and design has been completed. The deployment phase is currently in progress.

Site selection for the Custom's NAFTA Prototype will be the Ambassador Bridge and the Peace Bridge. A Request For Proposal for system integration and deployment of ITS technology at both sites is currently under preparation.

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 patterns 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. Institutional issues are being identified in several alternatives. Recommendations include implementation of uniform data requirements, "one-stop shopping," and roadside enforcement. 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

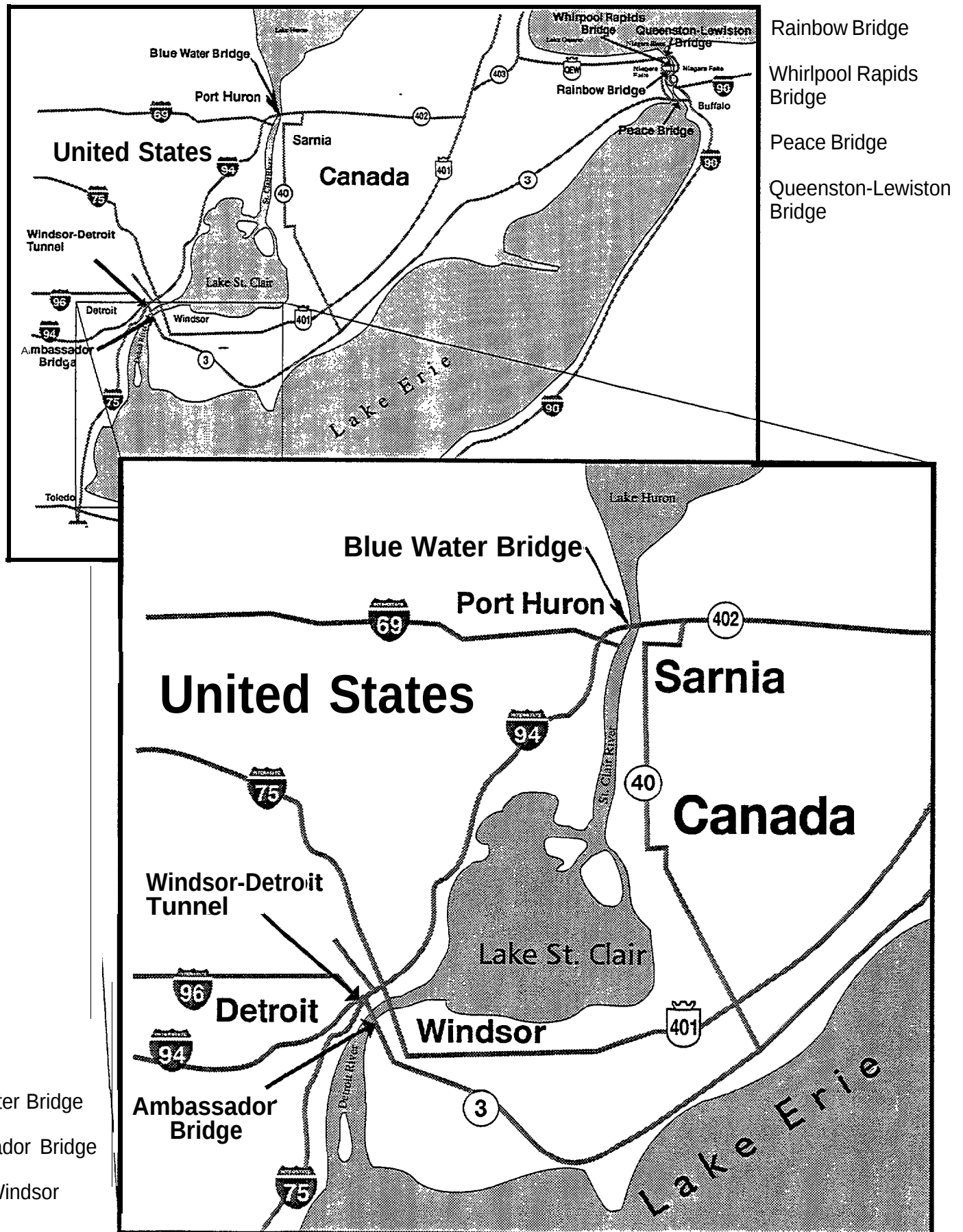


Figure 4

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 crossings by the inclusion of ITS warning systems. Efforts are underway to develop an ITS prototype grade crossing warning system to be deployed along the Detroit-Chicago high speed rail corridor.

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 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.

Intelligent Cruise Control (ICC) Systems are expected to appear as optional equipment for the first time on luxury cars in model years 1999 through 2000. The ICC automatically controls the headway between an equipped-vehicle and the vehicle ahead, whenever the preset cruise speed causes overtaking to occur. When the headway constraint no longer exists, the equipped vehicle accelerates back up to speed. The ICC system incorporates a Leica infrared sensor.

Each of the ten Chrysler Concorde passenger cars is to be equipped with Intelligent Cruise Control and placed in the hands of lay persons for use as their personal vehicle for a period of 2 to 5 weeks. Approximately 180 participants are expected. Testing will run for 12 months beginning in mid-1996.

Partners include the University of Michigan, Michigan Department of Transportation, Leica AG, and Haugen Associates. The Volpe National Transportation Systems Center will serve as the independent evaluator of the results.

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 7-8, 1996.

Several committees have been setup. Membership issues are being aggressively pursued by the Board of Directors.

1% 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. This action orientated plan will facilitate the forming of alliances among academic, private, public, and private sectors of ITS research, operational tests, deployment, and implementation. The first version of this plan is anticipated for completion in Spring of 1996.

GLOSSARY OF TERMS

ITS (Intelligent Transportation Systems) is the application of new and emerging technologies to the field of transportation. It involves a wide array of technologies, including electronics, computer hardware, software, control, and communications. It consists of five functional areas with which these technologies are applied. All five areas are overlapping and can be applied to rural areas as well as urban.

ATMS (Advanced Traveler Management Systems)

ATMS is the building block of ITS. All other functional areas will use the information provided by ATMS. ATMS integrates management of various roadway functions, including freeway ramp metering and arterial signal control. In more sophisticated implementations, ATMS predicts traffic congestion and provides alternative routing instructions to vehicles over wide areas in order to maximize the efficiency of the freeway network. ATMS collects, utilizes, and disseminates real-time data for congestion on arterial streets and expressways, and alerts transit operators of alternative routes. Also included are dynamic traffic control systems which respond to changing traffic conditions by routing drivers around delays. Rapid detection and response to traffic incidents is especially effective in reducing congestion.

ATIS (Advanced Traveler Information Systems)

ATIS provides a variety of information that assists travelers in reaching a desired destination via private vehicle and/or public transportation. On-board navigation systems are a building block of ATIS. Information includes location of traffic accidents, weather and road conditions, optimal routes, and, recommended speeds. Applicable also to this functional area is pre-trip planning through television, personal computers and kiosks.

AVCS (Automated Vehicle Control Systems)

AVCS enhances the drivers control of the vehicle. AVCS includes concepts that will become operational on different time scales. Safety being the key factor in AVCS, collision avoidance systems would alert the driver of imminent collision conditions with other vehicles, hazardous objects, or when the vehicle leaves the road. In more advanced systems the vehicle will respond to the conditions. Such systems usually require communications within the vehicles and thus involve to a larger extent the automobile manufactures.

CVO (Commercial Vehicle Operations)

CVO is applicable to trucks, busses, commercial vans, taxis, and emergency vehicles and is broadly defined as the movement of goods, and services in an expeditious manner. Automatic vehicle identification systems and locating systems are the basis of CVO. CVO benefits the transportation industry by the improved efficiency to the movement of goods through such technologies as weigh-in-motion, advanced communication devices that link drivers with weigh stations and their dispatch centers.

APTS (Advanced Public Transportation Systems)

APTS uses constituent technologies of ATMS, ATIS, CVO, and AVCS to improve operations of lanes dedicated for vehicles with a large number of passengers. Real-time ride matching, electronic payment through smart cards, automated dispatch systems, as well as automated collision avoidance technology are utilized.

MICHIGAN INTELLIGENT TRANSPORTATION SYSTEMS CENTER
DETROIT

The Michigan Intelligent Transportation Systems Center, known as the "MITS Center," is the hub of ITS technology applications 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 MITS 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.