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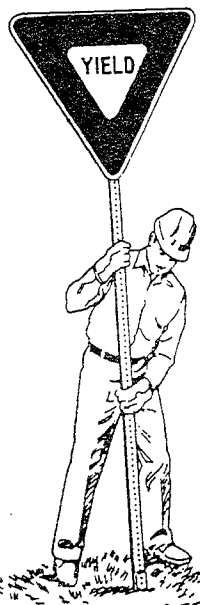
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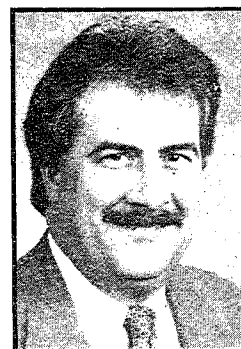


SUMMER 1990

# michiganite

VOLUME XXV, NUMBER 2

OFFICIAL PUBLICATION OF THE MICHIGAN SECTION OF THE INSTITUTE OF TRANSPORTATION ENGINEERS



## PRESIDENT'S COLUMN

FROM THE DESK OF .....

ROGER K. WALTHER

In my last President's column, I wrote much about the Bush Administration's new National Transportation Policy and suggested its major potential effect to be a shift of cost to the State and Local levels. I should have said a further shift of costs to the state and local levels. The APWA REPORTER in its June issue commented on a new report from the U.S. DOT. The report, titled "Federal, State and Local Transportation Statistics, Fiscal Years 1978-1988", notes that over this ten year period the Federal share of funding for total transportation has declined from 45% to 31%. The report also states that transportation funding represents approximately 3.5% of government revenues and less than 5% of its expenditures. The questions that come to mind from all this are, what is an appropriate Federal participation level in transportation funding, will it continue to decline and can the State and Local agencies continue to assume a greater cost burden if Federal funding does continue to decline? A recent report from the National Governor's Association may provide some of the answers. Twenty states in FY 1990 cut budgets in order to address revenue shortfalls. Transportation and the economy of our country are very much interdependent. For us to be competitive in a world market we must maintain efficient and effective transportation systems. If we allow these systems to decline and do not invest in new and improved systems, then the economic viability of this nation we live in will suffer greatly. This, if allowed to happen, will affect all of us in a decline of standard of living. Our elected representatives must be made aware of the need for efficient and advanced transportation systems and their importance to the economies of our national, state and local levels.

See PRESIDENT... PAGE 3

## Intelligent Vehicles & Highways: The Future or a Passing Fancy?

By Michael F. Kobran

Intelligent vehicle/highway systems, or IVHS as it is commonly known, is certain to be the acronym of the 1990's in the transportation engineering profession as TOPICS was in the 1970's and TSM in the 1980'. Right now there is a great deal of energy being expended by our profession and allied professions to advance the state of the art in the areas of IVHS. The unspoken question is "How real is the promise of IVHS? Will it prove to be a giant step in the evolution of transportation systems or a great concept with no practical applications?"

IVHS is a concept for integrating the drive, vehicle, highway, and infra-structure into a total system for communications and control. The goal is to achieve new systems functionality in highway transportation on behalf of safety and efficiency. Its primary elements are :

- Advanced Traffic Management Systems (ATMS)
- Advance Driver Information Systems (ADIS)
- Automated Vehicle Control Systems (AVCS)
- Commercial Vehicle Operations (CVO)

See IVHS...PAGE 8

ITE Meeting Schedule	3
ITE International President	4
Recent Court Decisions	5
Student Papers	10
ITE Membership List	12

**MICHIGANITE**  
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Interest \$ 52.25

**2. EXPENSES**

Sept. Outing \$189.00  
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Plaque 47.16

Plaque 35.00

Total Expenses \$271.16

Balance as of July 13, 1990 \$6,374.67

*Respectfully Submitted,* Michael J. Labadie,  
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**MICHIGANITE** is published quarterly by the Michigan Section of the Institute of Transportation Engineers. It is distributed to more than 300 ITE members and over 100 cities and counties in Michigan. Address communications regarding the Michiganite to the Editor, Michael F. Kobran, 1312 Kings Coach Circle, Grand Blanc, Michigan 48439; 313/695-8942. Send change of address to: Barton-Aschman Associates, 27600 Northwestern Highway, Suite 100, Southfield, Michigan 48034-4704.

**Notes**

# Notes

## MICHIGAN SECTION ITE 1990 MEETING SCHEDULE

<u>DATE</u>	<u>LOCATION</u>	<u>HOST</u>	<u>COMMENTS</u>
09/13/90	Grand Rapids	Meredith	Golf/Dinner
10/18/90 10/19/90	Dayton	Bob Wert	District III Annual Mtg.
11/01 /90	Kalamazoo	Carroll, Start, Warner	Lunch/Tech Session
12/06/90	Detroit	Kobran	Annual Meeting Tech Session

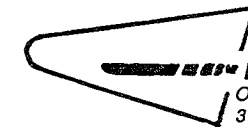
### President...Continued P. 1...

Staying with national issues, but shifting gears just a bit, I'd just like to remark here on national tax issues. I'm sure you've all heard by now that budget negotiators are still considering recommending to Congress an increase to the Federal gas tax which would be used for deficit reduction. The Federal gas tax is a tax which is more appropriately a user fee. In the past, revenues from this user fee have been dedicated to the improvement and maintenance of our transportation systems. I believe the concept should continue. We all know that our need for funds to finance transportation projects far exceed any of our abilities to pay for such. Why not think about contacting your Congressmen and letting them know the needs you see in your everyday work and that something needs to be done. Perhaps if enough of us follow through on this the message will get through that yes, a Federal gas tax increase is needed, but needed to fund improvements to our deteriorating transportation systems and not to reduce the Federal budget deficit. Users are paying gas taxes for their transportation systems and Congress must not use this method of budget deception in order to avoid having to deal with the budgeting items which have caused this deficit situation in the first place. I will propose to your Michigan Section Board that a letter be sent to Washington expressing our concerns in this very regard.

I want to extend a special thank you to one of our members, Joe Meszaros, for his dedicated efforts over the past several years, serving as our "MICHIGANITE" editor. This is no easy job, it's time consuming and I think a lot of us just assume the newsletter will happen. Believe me, it-'s not that simple. Joe has made it happen, but along the way he's also racked up several national ITE awards for our newsletter. Joe, thanks for a job well done.

As I'm writing this, our July section meeting in East Lansing is tomorrow. I'm hoping to see and meet with many of you there. Further, our national meeting in Orlando is now less than one month away. Again, I hope to see many of you there. Have a safe and enjoyable summer.

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**INTERNATIONAL  
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Richard F. Beaubien



**Traffic Safety Summit -  
Chicago, Illinois, April 1-3, 1990**

April 1 through 3rd, U. S. Transportation Secretary, Samuel Skinner convened a Traffic Safety Summit in Chicago, Illinois. The Traffic Safety Summit was patterned after the education summit conducted by President Bush in mid-1989. At the Education Summit, all of the State's governors were invited to discuss the problem of education. At the Traffic Safety Summit, Secretary Skinner invited primarily law enforcement officials to discuss the problem of traffic safety. The intent of the Traffic Safety Summit was to develop an agenda for traffic safety and prepare a list of solutions. The secretary indicated that the nation was now on a plateau with law enforcement and that some additional effort would be needed to elevate the attention being paid to the traffic safety problem. In his opening statement, he asked, "Why don't the 45,000 traffic deaths each year grip the soul of America?"

Attending the summit were all of the top traffic safety and traffic operations administrators from the Washington D. C. office of Federal Highway Administration. Also in attendance were the Federal Highway Administrator, the National Highway Traffic Highway Safety Administrator, the Federal Railroad Administrator, all of the Regional Federal Highway Administrators, 10 of the Governor's Highway Safety Representatives, and the top law enforcement officials of each of the States. The vast majority of the 250 to 300 attendees of the Summit were law enforcement officials. Those who were not law enforcement officials were invited to listen to group discussions, but to save their comments for the end of the Conference.

After the opening ceremonies on Monday morning, which included a video address from President Bush, the conference attendees were broken into four working groups. These groups discussed: 1) drunk and drugged driving, 2) speed, grade crossings and other hazardous moving violations, 3) occupant protection and 4) commercial vehicle safety. I was assigned to the group discussing speed, grade crossings and other hazardous moving violations. At the end of the conference, each of the group leaders reported on their findings of problem areas and possible solutions.

Secretary Skinner attended a portion of each working groups discussion.

At the end of the conference, comments from non-law enforcement attendees were invited. I indicated that the Institute of Transportation Engineers was very pleased to see a renewed emphasis on traffic safety. I noted that this was one of the goals for the Institute during 1990, and the U. S. Department of Transportation has certainly brought the traffic safety issue to the attention of the American Public with the Traffic Safety Summit. I also commented that the problem of speed and speed law enforcement is partly related to the speed law itself. Unless the speed limit is set with the aid of traffic engineering studies and the guidance of traffic engineering principles, motorists are unlikely to obey. I noted that the traffic laws and ordinances should be so obviously reasonable that they are, in effect, self enforcing. It is important that law enforcement activities be directed toward the small minority of drivers (approximately 15%) who drive in an unsafe manner. A traffic law which results in a violations rate of 50% is detrimental to the credibility of both the legislative body and the enforcing officer.

**Conclusion**

The Traffic Safety Summit was directed to law enforcement officials. It was, in fact, organized by the National Association of Chiefs of Police. Therefore, the Conference focused primarily on the driver portion of the drive vehicle roadway equation of traffic safety. Although Federal Highway Administrator, Thomas Larson, made some mention of the importance of modern highway design to facilitate traffic safety, there was very little mention of the role of highway design in traffic safety after that statement. All things considered, however, the Traffic Safety Summit was a success in that it brought attention to the traffic safety problem, particularly within the law enforcement community. Both law enforcement officials and engineers made the point that cooperation between the engineering and enforcement communities is important to promote traffic safety.

Richard F. Beaubien, P.E.  
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## Recent Court Decisions of Interest to ITE Members

By Michael Kobran

*The law firm of Fraser Trebilcock Davis & Foster, P.C. in Lansing periodically issues updates on recent court decisions. The following summaries are excerpted from 1989 Michigan Appellate Court decisions that are thought by the editor to be of interest to ITE members. Special thanks to Michael K. Cavanaugh of Fraser Trebilcock Davis & Foster for permission to reprint this article. Their office is located at 1000 Michigan National Tower in Lansing, Mich., 48933.*

### Lain v. Beach

The two parties to the suit were involved in a fatal traffic accident at the intersection of a state highway and a county road. A traffic signal had recently been installed at the intersection and Beach ran a red light, striking the other car. The victims sued MDOT and the county road commission claiming they had a duty to post signs warning of the new traffic signal. Both the trial court and the court of Appeals dismissed the suit against the road commission stating:

"...Intersections of state highways and county roads are within the state's jurisdiction... Since the accident occurred at an intersection under the exclusive jurisdiction of MDOT and the road commission had no jurisdiction over that intersection, the road commission had no duty to warn of possible hazards associated with the intersection. The failure of the road commission to post signs on its own road warning of possible dangerous condition which are under the exclusive jurisdiction of another governmental entity is not actionable. There is not duty on the part of the road commission to warn of possible dangerous conditions which are under the exclusive jurisdiction of another governmental entity, in this case MDOT." (emphasis added).

*Editor's note:* There is not indication in this summary of whether or not MDOT was held liable nor is it clear why a new traffic signal would be inherently a "possible dangerous condition." We also do not know whether this was a previously uncontrolled intersection.

### Berry v. City of Belleville

The city constructed a pedestrian mall along the edge of Main Street and closed off Fourth Street at that point. Main Street is a county road and Fourth Street a city street. The city created an indentation at the end of the mall which was not intended for parking but cars did park there. No prohibitory or warning signs were placed there. Berry was hit by a vehicle that had been parked in the indentation and was pulling out into Main Street. Berry sued the city and the county claiming they both had jurisdiction over the intersection. The road commission filed a claim against the city for failing to obtain a permit for the mall construction which would have contractually indemnified the county. Both the trial court and the Court of Appeals held:

-The mall was constructed outside the county's right-of-way and no county permit was required.

-There can be not concurrent jurisdiction over highways. The county had sole jurisdiction over the intersection and the duty to remedy a dangerous situation, if there was one, by posting appropriate signs.

### Killen v. Department of Transportation

The Governmental Tort Liability Act allows recovery of damages from a governmental agency that fails to keep a highway under its jurisdiction in reasonable repair and safe and fit for travel. A county road was transferred to MDOT for redesign and reconstruction and, after completion of the work, was transferred back to the county road commission. Ten years later a traffic accident on the road led to a man being killed. His estate claimed the accident resulted from the road not being reasonable safe and fit for travel as a result of design and construction deficiencies by MDOT.

The court held that MDOT is liable for any loss resulting from deficient design and reconstruction while the State had jurisdiction over the road. The State is not released from liability by a retransfer of jurisdiction over the deficient road, but the county is liable for any failure to thereupon maintain the road "to reasonable acceptable standards of renovation, repair, or reconstruction..."

### Isabella County v. State of Michigan

A person was injured in an auto accident in Isabella County when his car was struck at an intersection by another car. The stop sign supposed to be posted at the intersection was missing and the other car did not stop. The sign had been knocked down one week earlier. The State Police were aware of the knockdown but did not report it to the county road commission. When the injured person sued the road commission, they filed a claim for indemnification and contribution against the Department of State Police and the individual officers. The court of Appeals dismissed the road commission's claims against the state police and the individuals because of governmental immunity.





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## ITE District 3 Annual Meeting: Dayton, Ohio By Ken Johnson Oct. 19, 1990

The ITE District 3 Annual Meeting will be held in Dayton, Ohio on October 18 and 19, 1990. The tentative technical program has been announced and is listed below for the member's information.

### Thursday, October 18, 1990:

- National transportation policy: federal, state, and local views
- Intelligent vehicle highway systems in Michigan
- Transportation education in the 1990's: consultant, state, and educator views
- Older drivers

### Friday, October 19, 1990:

- Freeway incidents and special events: consultant, state DOT, and police
- 65 mph speed limit in Michigan and highway safety
- GM air bag test center
- The success of toll roads and bridges-Ohio Turnpike; public/private partnership

More information will be forthcoming in a special mailing from the District.



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Perez, Theodore M. Parking System Administrator	T	Grand Rapids Transp. Dept. 616-456-3290	509 Wealthy, S.W.	Grand Rapids	MI 49503
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Reid, Philip John Transportation Engineer IX	R	Michigan Dept of Transp. 517-372-8991	425 W. Ottawa P.O. Box 30050	Lansing	MI 48909
Rempala, John C. Sr Transportation Planner	R	SEMCOG 313-961-4266	660 Plaza Dr, Suite 1900	Detroit	MI 48226
Riley, Paul J Dist. Traffic & Safety Engr.	R	Mich. Dept. of Transportation 313-569-3993	18101 W. Nine Mile Rd.	Southfield	MI 48075
Robbins, John E. Transportation Engineer	R	City of Troy 313-524-3379	500 W Big Beaver Road	Troy	MI 48084
Ronan, Frank A.	L				
Rosser, Lea Traff. Engr. Operations Supv	T	City of Flint 517-625-6684	1101 S. Saginaw	Flint	MI 48502
Rossiter, Kealoha C Traffic Technician II	T	City of Grand Rapids 616-456-3066	509 Wealthy SW	Grand Rapids	MI 49503
Rothwell, Kitty M. Asst District Traffic Engineer	R	Mich Dept of Transportation	301 E Louis Glick Hwy	Jackson	MI 49201
Rushlow, Michael J. Senior Project Supervisor	T	Wayne Co Office of Public Ser.	29900 Goddard Road	Detroit	MI 48242
Saller, John J	T				
Santia, Carlo Asst County Highway Engineer	R	Macomb County Road Commission 313-463-8671	115 S Groesbeck Highway	Mt Clemens	MI 48043
Sarkisian, John	C	MDI Traffic Control Products 313-478-1900	24450 Indoplex Circle	Farmingtn Hills	MI 48018
Saunders, Carolyn Transportation Engineer	R	SEMCOG 313-886-8343	660 Plaza Dr. Suite 1900	Detroit	MI 48226
Savage, William F. Traffic Engineering Consultant	R		2224 Tulane Drive	Lansing	MI 48912

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PAGE 8

Marble, Robert J Traffic Technician V	T	Mich Dept of Transportation			
Marson, Joseph A. Senior Associate	R	Barton-Aschman Associates 313-350-0326	27600 Northwestern Hwy, Ste 100	Southfield	MI 48034-4704
Mathiasen, Jack Area Sales Manager	T	3M Company 312-920-7391			
Matich, Marc Traffic Technican	T	City of Rochester Hills 656-4640	1000 Rochester Hills Drive	Rochester Hills	MI 48309
Matuszak, John M Director of Engineering	T	City of East Lansing 517-337-9459			
McAlister, Michael D. Division Manager	C	B & G East 219-665-8733	P.O. Box 218	Angola	In 46703
McCarthy, Kevin P. Traffic Engineer	T	City of Farmington Hills 313-473-9590	31555 Eleven Mile Road	Farmingt n Hills	MI 48018
McGillivray, Ronald K.	L				
McKinney, Randall D. Transportation Engineer	R	Mich Dept of Transportation 313-569-3993	18101 W Nine Mile Road	Southfield	MI 48075
Mejia, Pauline General Engineer vi	R	Mich Dept of Transportation 517-335-2912	P.O. Box 30050	Lansing	MI 48909
Mercer, Donald J Supervising Engineer	T	Mich Dept of Transportation 517-372-6116	P.O. Box 30050	Lansing	MI 48909
Merchant, David A.	R	517-351-0360			
Meredith, Jere E. Traffic Safety Director	R	City of Grand Rapids 616-456-3066	509 Wealthy Street SW	Grand Rapids	MI 49503
Meszaros, Joseph L. Supv Engineer, Tech Services	R	Mich Dept of Transportation 517-373-2334	425 W Ottawa St	Lansing	MI 48909
Meyers, Franklin D.	T	F. D. Meyers Associates 313-625-6717	P.O. Box 389	Clarkston	MI 48016
Michalski, Charles S.	L				
Miller, Dawn A. Special Projects Engineer	R	Oakland Co. Road Commission 313-858-4761	2420 Pontiac Lake Road	Pontiac	MI 48054
Miller, Larry A Transportation Planner	R	M.D.O.T.- Transp. Planning 517-335-2967	425 W Ottawa St	Lansing	MI 48909
Miller, Paul F. Maint Tech Services Engineer	T	Mich Dept of Transportation 517-394-8654	3222 S Logan St	Lansing	MI 48910
Milne, Donald D. Transp. Engineering Assistant	R	City of Saginaw	1315 S. Washington Ave.	Saginaw	MI 48601
Mohamed, Sami A.	S	Michigan State University			
Morena, David A Safety & Traffic Oper Engineer	T	Federal Highway Administration	315 West Allegan	Lansing	MI 48901
Mullin, Thomas D Coordinator	R	SEMCOG 313-961-4266	1900 Edison Plaza	Detroit	MI 48226
Murphy, William L	C	Carrier & Gable	24110 Research Dr.	Farmington Hill	MI 48024
Myers, Thomas E.	R	517-373-2876	356 Haslett Road	Haslett	MI 48840
Myrie, Winston J Traffic Engineer	R	Oakland Co. Road Commission 313-858-4830	2420 Pontiac Lake Road	Pontiac	MI 48054
Nevarez, Frank Transportation Engineer	R	Mich Dept of Transportation 517-372-0631	425 W Ottawa	Lansing	MI 48909
Neve Jr., James P. Manager, Hwy. Safety Programs	R	Michigan State University 517-353-1790	Civil & Environmental Eng Dept	E. Lansing	MI 48224
Northrup, Robert Traffic Engineer	T	City of Southfield 313-354-5755	26000 Evergreen Road	Southfield	MI 48034
Nustad, Lyle M. Traffic Engineer	R	AAA Michigan 313-336-1405	1 Auto Club Drive	Dearborn	MI 48126
Nwankwo, Adiele G.	R	SEMCOG	660 Plaza Dr, Suite 1900	Detroit	MI 48226
O'Berry, Kenneth J. Traffic Technician Supervisor	T	Mich Dept of Transportation 517-335-2981			
Olender, Bernard L. Officer in Charge, Traffic Bur	T	City of Trenton Police Dept.	2872 W. Jefferson Ave.	Trenton	MI 48183

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PAGE 7

### New Members: Michigan Section I.T.E.

By Michael F. Kobran

Six new members were approved at the May 5, 1990 Michigan Section I.T.E. Board meeting following a review of their applications. The new members and some information about each of them is listed below as an introduction to the rest of the membership. Welcome to I.T.E. and may your profession and your career benefit!

**Yvette D. Ware** is the Supervisor of Traffic and Safety Engineering for the Washtenaw County Road Commission in Ann Arbor. Yvette is a graduate of Bradley University and lives in Ann Arbor. She is also a member of the International I.T.E.

**John Philip Reid** is a Transportation Engineer IX for the Michigan Department of Transportation in Lansing and also lives in Lansing. He is registered as a professional engineer in Michigan and lives in Lansing. John has also applied for membership in the International I.T.E.

**Abed Itani** is a Senior Transportation Planner II for the West Michigan Regional Planning Commission in Grand Rapids and also lives there. Abed is a graduate of the University of Florida and is a member of the International I.T.E.

**Christian R. Luz** also works for the West Michigan Regional Planning Commission. He is the Transportation Program Manager and lives in Grand Rapids. Christian is graduate of the University of Wisconsin at Madison and is a member of the International I.T.E.

**Carolyn Saunders** is a Transportation Planner for the Southeast Michigan Council Or Governments in Detroit and lives in Grosse Pointe Woods. Carolyn has also applied for membership in the International I.T.E.

**Robert M. King** is an account representative for the 3M Company and lives in Kentwood. Robert is a commercial affiliate of the Michigan Section.

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Marketing Manager

7327 Henry Clay Blvd., P.O. Box 0399  
Liverpool, New York 13088  
(315) 451-9500

**IVHS .....Continued from Page 1**

ATMS provides local transportation officials with the ability to monitor and control traffic operations. ADIS provides the driver with navigation, traffic condition and alternate route information. AVCS provides the driver with better control over the vehicle and CVO provides more efficient regulatory and operational control of commercial vehicles.

**ATMS INITIATIVES**

Much of the ADIS described below depend, for their effectiveness, on the ability of local officials to monitor local traffic conditions so that the appropriate information can be transmitted to the driver of the vehicles. Advanced traffic management systems are, however, usually stand-alone projects which can deal with all vehicles on the system, even those (the vast majority, at present) which have no on-board communications and display equipment except for the almost ubiquitous radio. Michigan Department of Transportation SCANDI system (Surveillance, Control and Driver Information) in Detroit is a good example of an evolving ATMS. Much of the progress in traffic management is expected to be done jointly with ADIS projects.

**PROGRESS IN ADIS**

A significant number of ATMS projects are underway. *Pathfinder* is the name of a cooperative project between the Federal Highway Administration (FHWA), the California Department of Transportation (Caltrans) and the General Motors Corporation. It is being tested to see how drivers could benefit from receiving onboard information through a computerized mapping device on a monitor display. A control center will manage the communication. The center will detect traffic speed and volume and send back to the test vehicles an electronic map helping motorists to find the most efficient path of travel the their destination.

The *Pathfinder* project will take place in a 13-mile stretch of the Santa Monica Freeway between Santa Monica and Los Angeles. The corridor includes the freeway, service roads and five major parallel arterials and was scheduled to start early in 1990. The test vehicles will be loaned to various categories of drivers and information will be collected by Caltrans on how many drivers perceive and use the data and which modes of presentation are preferred.

*TravTek* is a joint project of FHWA, American Automobile Association, Florida Department of Transportation, the city of Orlando, and the General Motors Corporation. The vehicle information equipment, which consists of a video screen, a microcomputer, and a radio for data communication, will be installed in about 75 general-use rental cars and about 25 vehicles used by high-mileage local drivers. The drivers will receive continuous information while driving in the Orlando area about congested routes, traffic incidents, construction and maintenance activities, etc.

Once they select destinations, drivers will be offered alternate routes that reflect the shortest travel time. In addition drivers can view services available in the area such as service stations, hotels, motels, restaurants, or tourist attractions on a map display or as textual information. Drivers may also place a call to a listed establishment via a dedicated cellular telephone.

The cost of the *TravTek* system, including operations for a one-year period beginning in 1992 and subsequent evaluations is estimated to be \$8 million to be shared by the partners.

A pilot system in 28 square kilometers in western Tokyo, known as Comprehensive Automobile Traffic Control Project or CAC, has been in operation since October, 1977. The system consists of a two-way exchange of digital information between instrumented vehicles and roadside equipment to provide the drivers with a visual display of routing information based on current traffic conditions. Drivers of non-instrumented vehicles are given routing information over roadside displays and through use of a roadside radio system.

The Berlin field trial of a beacon-supported route guidance system started in operation in June, 1989. A total of 250 (out of 12000) intersections with traffic lights and 10 freeway locations have been equipped with infra-red beacons for communications with 700 specially equipped vehicles.

*Autoguide* is the name given in the United Kingdom to an in-vehicle dynamic route guidance system. A small scale demonstration scheme in London has been successful and in April, 1988, the Secretary of State for Transport launched a proposal for a major *Autoguide* pilot system, also in London, to be followed by expansion to full commercial availability in the United Kingdom. The medium of communication between roadside equipment and vehicles was infrared. A year later, in 1989, two proposals were received for development and installation of the London pilot system and an award may have been made by now, although I do not have that information handy.

The European automotive, electronics, and vehicle components supply industries, with specialists from basic research institutes, have formed a team to undertake the research program *Prometheus*. This program, which has been underway a few years, has an operational aim of providing an intelligent on-board computer system which, on the basis of the inputs perceived by the traffic environment, the vehicle conditions and the inputs given to the control system, supplies the driver with opportune support for safe, effective and convenient vehicle operation.

Kostyniuk, Dr. Lidia P.	R	Ann Arbor Planning Associates	321 S. Main St., Suite 206	Ann Arbor	MI 48104
Krause, Michael P	R				
Krycinski, Thomas R Chief Deputy Director	R	Office of Hwy Safety Planning	300 South Washington Suite 300	Lansing	MI 48913
Kunde, Kurt Transportation Engineer IX	R	M.D.O.T.-Traffic & Safety Div.	425 W. Ottawa, P.O. Box 30050	Lansing	MI 48909
Kuzma, Richard Administrative Engineer	R	Mich. Dept. of Transportation	517-669-3396		
Labadie, Linda	T	Oakland County Road Comm.	31001 Lasher Road	Birmingham	MI 48010
Labadie, Michael J. Senior Associate	R	Barton-Aschman Associates, Inc.	27600 N.W. Hwy. - Suite 100	Southfield	MI 48034-4704
LaHourie, Peter C.	R	WBDC Group	50 Monroe Place	Grand Rapids	MI 49503
Lampela, Allen A. Transportation Engineer	T	Mich Dept of Transportation	517-335-2992		
Lariviere, Robert Litigation Engineer	R	Mich Dept of Transportation	P.O. Box 30050	Lansing	MI 48909
Lawson, Jr., Samuel City Transportation Engineer	R	City of Detroit- Transp. Dept.	1301 East Warren	Detroit	MI 48207
Lebbos, George President	C	National Sign and Signal	301 S. Armstrong Rd. P.O. 1553	Battle Creek	MI 49016-1553
Lebel, William T. Traffic Operations Engineer	R	Mich Dept of Transportation	425 W Ottawa	Lansing	MI 48909
Lee, Daniel G. Director	T	Traffic Safety Consultants	517-349-3989		
Leroy, Holden M.	L				
Lewak, Piotr T. Civil Engineer	T	Grand Rapids Trans. Dept.	509 Wealthy St, SW	Grand Rapids	MI 49503
Lewis, Walter F. President	R	Washtenaw Engineering Co.			
Lighthizer, Dale R. General Engineer V	R	MDOT - Traffic & Safety Div.	425 W Ottawa	Lansing	MI 48909
Lilienthal, Brad Regional Sales Manager	C	Pave Mark Corporation	1855 Plymouth	Atlanta	Ga 30318
Lingeman, Stanley D. Transportation Engineer	R	M.D.O.T. Traffic & Safety	425 W. Ottawa	Lansing	MI 48909
Livingston, James R. Vice President/General Manager	C	National Sign & Signal	P.O. Box 1553	Battle Creek	MI 49016-1553
Loridas, Nick G.	R	C & W Consultants, Inc.	3290 W Big Beaver Rd Suite 416	Troy	MI 48084
Lund, Daniel J General Engineer IV	R	Mich Dept of Transportation	425 W Ottawa	Lansing	MI 48909
Lutfi, Mohammed T. Civil Engineer	R	Hubbell, Roth & Clark, Inc.	555 Hulet	BloomfieldHills	MI 48013
Luz, R. Christian Trans. Program Manager	R	West Michigan Regional Plann.	Two Fountain Place Suite 240	Grand Rapids	MI 49503
Lybeck, Henry Ass't. Dir. of Public Works	T	City of Southfield	25501 Clara Lane	Southfield	MI 48034
Lyles, Richard W. Associate Professor	T	Michigan State University	Civil Engineering Department	East Lansing	MI
Madsen, Bruce B Executive Director	T	Traffic Improvement Assoc.	2510 S. Telegraph Road	Bloomfield Hill	MI 48013
Mahmood, Tariq	S	Michigan State University	517-355-1137		
Maki, Robert E Engineer, Transp Systems	R	Mich Dept of Transportation	425 W Ottawa St	Lansing	MI 48909
Maleck, Thomas L Associate Professor	R	Michigan State University	Dept of Civil Engineering	East Lansing	MI 48824
Mann, Christopher R. Senior Transportation Engineer	R	SEMCOG	660 Plaza Drive	Detroit	MI 48226
Mansell, Robert D. President	T	Mansell Associates, Inc.	28830 W Eight Mile Road	Farmingtn Hills	MI 48024



Hodges, Richard L. Engineer of Traffic Operations	R	Wayne County Road Commission	29900 Goddard Road	Detroit	MI 48242
Hoffman, Max R.	L				
Holben, Gary R. Planning Coordinator	T	Office of Hwy Safety Planning	300 S Washington Sq, Ste 300	Lansing	MI 48913
Holden, Steven W. Project Engineer	R	HDR Engineering, Inc.	703-683-3400		
Holland, Victoria J. Asst. Engr. Traffic Operations	R	Wayne Co. Office of Public Ser	29900 Goddard	Detroit	MI 48242
Holmberg, Gerald M. County Highway Engineer	R	Oakland County Road Commission			
Holmes, Donald M. Director	T	Traffic Safety Consultants	517-485-7400		
Homrich, William C. Resident Engineer	R	Mich Dept of Transportation	701 S. Elmwood Dr. #10	Traverse City	MI
Hoogerwerf, Julia K.	S	Michigan State University	517-337-7912		
Hornbeck, Dwight A. Dist Traffic & Safety Engineer	T	Mich Dept of Transportation	301 E Louis Glick Hwy	Jackson	MI 49201
Hoving, Jack W. President	T	Traffic Specialty, Inc.	12017 Lake St.	Bitely	MI 49309
Hudak, Mary T. General Engineer VI	R	Mich Dept of Transportation	425 W Ottawa	Lansing	MI 48913
Itani, Abed Senior Transp. Planner II	R	West Michigan Regional Plann.	Two Fountain Place Suite 240	Grand Rapids	MI 49503
Izdebski, Stephen J. Senior Traffic Technician	T	City of Lansing-Trans. Div.	517-483-4240		
Jadun, Lenora K. Dir. of Public Services	T	City of Novi	45175 W Ten Mile Road	Novi	MI 48050
Jain, Mukesh Kumar	S	Michigan State University			
Jentzen, Harold E	T				
Johnson, Kenneth W. Transportation Engineer	R	Mich Dept of Transportation	P.O. Box 30050	Lansing	MI 48909
Jones, Katharine H	R	Mich Dept of Transportation	517-373-9570		
Judd, Harold R.	T		503 W. Maple	Mason	MI 48854
Kane, Martin R.	S	Michigan State University	517-351-0102		
Karns, Gordon F. County Engineer	T	Calhoun County Road Commission	13300 15 Mile Road	Marshall	MI 49068
Karr, Patricia A. Executive Director	T	Battle Creek Area Tran. Study	601 Avenue A	Springfield	MI 49015
Kavalaris, James G.	S	Michigan State University	517-355-6982		
Khan, Wasim Ali	S	Michigan State University			
Khasnabis Ph.D, Snehamay Prof., Depart. of Civil Engr.	R	Wayne State U. - Civil Eng'g.	2168 Engineering Bldg.	Detroit	MI 48202
Kilian, Rolf P. Principal Associate	R	Barton-Aschman Associates, Inc.	27600 N.W. Highway -Suite 100	Southfield	MI 48034-4704
Kine, M. Robert Account Representative	C	3M Company	908 North Elm Street	Hinsdale	IL 60521
Kleitsch, Karl L. Principal	T	Reid, Cool & Michalski	29623 Northwestern Hwy	Southfield	MI 48034
Kloeker, Delmar L ITE District 3 Director	R	Traffic Engineering Studies	P.O. Box 1022	Seymour	IN 47274
Klucens, Raymond Transportation Engineer	R	Mich. Dept. of Transportation	2211 E. Jefferson Suite 101	Detroit	MI 48207
Kobran, Michael F.	R	Kobran Professional Eng. Svcs.	15369 Grandville	Detroit	MI 48223
Koert, Dr. Adrian	L				

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PAGE 5

## IVHS.....Continued

*Prometheus* will focus on (1) systems in vehicles to assist and relieve the driver, (2) systems based on a communication network between vehicle computers, and (3) infrastructure communication and information equipment to assist the on-board computer and enable higher level traffic management functions.

Meanwhile, back in the United States, the Michigan Department of Transportation has put together a proposal, with the assistance of the a University of Michigan Transportation Research Institute, to develop a roadside radio driver guidance system on I-94 between Detroit and Detroit Metropolitan Airport.

## AVCS RESEARCH

There are many initiatives underway in the vehicle control area and many that are already optional equipment such as anti-lock braking systems. Cruise control is another element of AVCS common on many present vehicles and there is research in progress to bring automatic headway control to cruise control systems so that the vehicle will automatically reduce speed when approaching a slower vehicle until the desired headway is reached.

One of the most fascinating projects, however, is *Lanelok*, a lane-sensing system being developed by the General Motors Research Labs in Warren, MI. *Lanelok* is a real-time computer vision system that identifies road markers and curvature then calculates vehicle position with respect to roadway geometry. It is expected to be an essential component in the development of collision warning systems, headway control, route guidance systems, driver impairment detection and automatic steering.

*Lanelok* has been implemented in a van and successfully demonstrated on test tracks and in actual traffic on an interstate highway. The system collects data via a monochrome video camera mounted near the rearview mirror of the van and aimed to capture the driver's view of the road. Video output is transferred to an on-board computer where it undergoes a series of image-processing steps to generate the lane-sensing information. In the future, *Lanelok* will be combined with other computer-based systems to provide driving assistance and vehicle control for drivers of the vehicles so-equipped.



## COMMERCIAL VEHICLE OPERATIONS

CVO systems are being investigated by companies that have large vehicle fleets and a need to know where those vehicles are when they are out on the road. Obvious candidates are taxi fleets, package delivery services, and governmental emergency vehicles such as police cars, fire trucks, and EMS units. United Parcel Service has a subsidiary, II Morrow, Inc., which is developing a fleet system being tested on UPS trucks.

Locating the vehicle can be done any one of several different ways but the method of choice seems to be using the LORAN-C system in which a minimum of three transmitters (of which there are presently 18 scattered throughout the U.S.) are used to determine position within an accuracy of 18-90 meters. Low frequency transmission is used and the typical cost of a navigation receiver is \$600.

Another method, which is useful for systems where vehicles follow routes, is the proximity sign post. A roadside transmitter sends a signal to the passing vehicle which forwards that signal to the dispatch center so the vehicle progress can be plotted as it passes different roadside transmitters. Transit systems are helped by this type of system.

In all CVO operations the intent is to have the dispatch center always know the location and heading of all its vehicles and, through a communication system, be able to give the driver navigation information, provide intelligent dispatch, and, it is hoped, decrease operating costs. Other IVHS technologies, such as weigh-in motion sensors, automated vehicle identification transponders and automated vehicle classification devices, some already deployed, will further increase commercial efficiency.

## WHAT WILL THE FUTURE BRING?

It is very likely that transportation engineering in the 21st Century will be remarkable different than it was in the last half of the 20th. IVHS will assuredly influence the changes that will be made. There are many questions that are unanswered, not the least of which is the long-range availability of inexpensive petroleum as the raw material for vehicle fuel. In coming issues, we will explore IVHS issues in depth to give our readers the opportunity to anticipate the changes that will be coming. Contributions by the membership to this discussion of the future of our profession will be most heartily welcomed.

*The writer is a member of ITE's national IVHS committee and recently attended an IVHS engineering short course at the University of Michigan.*

## STUDENT PAPERS: 1990 SECTION WINNERS

By Michael Kobran

Summaries of the three student papers that won the first three prizes in the 1990 Section competition

The three winners in the 1990 Michigan Section I.T.E. student paper competition were announced at the July 12, 1990 Technical Session in East Lansing along with a presentation of the papers and the awarding of \$100 and a plaque for first prize, \$50 for second prize, and a calculator for the third prize. There were fifteen submissions of papers, thanks to Bill Savage (who also led the judging committee) and the winners and summary of their papers follow. All of the papers were submitted by Michigan State students.

**First prize went to P. Brian Wolshon of Sterling Heights for his work on *Safety Hazards of Passive Traffic Control of At-Grade Railroad Crossings*.** Brian looked at the contribution of passive traffic control devices (both signs and pavement markings) to the number of traffic accidents at highway-railroad crossings. These devices only warn drivers that a rail crossing is located shortly ahead and not whether or not a train will be crossing the highway.

Other problems identified with passive devices are motorists failing to see them, confusion as to their meaning, and lack of respect for the importance of the warning. These factors can lead to many preventable accidents and fatalities. The study examined the current criteria for highway-railroad crossing design and their associated control devices and looked at the problems associated with motorist confusion and disobedience of control devices to determine if they are leading to additional accidents at rail crossings.

Brian then analyzed accident records of rail crossings in three Michigan counties to see if a relationship existed between certain passive warning devices and the accident history. Because the study area was quite small and the time period short, Brian felt it was difficult to draw significant conclusions from the data but did conclude that the random distribution of accidents at the sites studied meant that "...there does not appear to be any higher risk of accidents due to the fact that only passive control devices are present." The data also showed that a great percentage of the time the driver was in violation of traffic laws.

Other suggestions in the paper included the addition of reflectors to railroad rolling stock to make crossing trains more visible during night crossings at very dark rural crossings. Brian also pointed out the danger of conditioning at crossings with infrequent rail movements and urbandrivers at rural crossings where passive devices are more prevalent.

**The second place winner was Jack Wheatley on *"The Relationship between Accident Occurrence and Clear Vision Non-Signalized Intersections on Rural Michigan Trunklines*.** Jack's paper tried to determine if the State money spent on constructing and maintaining clear vision triangles in all quadrants of State Trunkline intersections resulted in increased traffic safety. It was patterned after a 1973 paper studying the same relationship for signalized intersections.

Mr. Wheatley looked at trunklines in mid-Michigan with volumes ranging from 2,000 to 10,000 vehicles per day and looked at right-of-way documents to determine whether or not clear vision existed in all quadrants. Photologs were used to verify the records. The clear vision triangle was defined as a minimum of 250 feet along the trunkline and 150 feet along the cross street.

The results indicated that property damage, injury, and total accident rates for clear vision intersections were not significantly different than the rates for non-clear vision intersections. This unexpected result was attributed to the small sample size (49 and 58 intersections, respectively), the focus only on two classes of intersections (ADT's less than or greater than 5,000 vehicles), and a possible lack of maintenance at clear-vision intersections.

**The third paper was by Timothy R. Drews of Stevensville on *The Aspects of Frictional Forces*.** The purpose of Timothy's paper was to show what friction is, how coefficients of friction are determined, what kinds of applications friction has in the design of highways, and to discuss some controversy surrounding the coefficient of friction.

The methods of measuring the coefficient are from tables, from skid tests, and from drag tests with the skid test being the most common in accident investigation procedures. Mr. Drews points out some of the problems associated with skid tests including improper measurements and not keeping the test vehicle at a constant speed.

The friction coefficient is used to determine stopping sight distances with wet pavement conditions used to give a factor of safety. The paper found that accident investigators use higher values for the coefficient than highway designers. This leads to the controversy surrounding the issue especially with regards to the determination of vehicle speed before an accident by measuring skid marks.

Foster, Don R.	R	Mich Dept of Transportation.			
Friel, John W. Design Engineer	R	Oakland County Road Commission 31001 Lahser Road 313-645-2000	Birmingham	MI	48010
Gaberty II, Mathew J. Transportation Planner	T	Oakland County Road Comm. 31001 Lahser Road 313-645-2000	Birmingham	MI	48010
Gensley, Louis C.	T	313-349-1849			
Gibson, Nancy Greenleaf- Traffic Engineer	R	City of Ann Arbor-Trans. Dept. P.O. Box 8647 313-994-2818	Ann Arbor	MI	48107
Gibson, Nancy Greenleaf- Traffic Engineer	R	City of Ann Arbor-Trans. Dept. P.O. Box 8647 313-994-2818	Ann Arbor	MI	48107
Gierlack, Greg A. Senior Project Supervisor	T	Wayne Co. Office of Public Ser			
Goli, Ravi Kumar Transportation Engineer	T	SEMCOG 660 Plaza Drive, Suite 1900 313-961-4266	Detroit	MI	48226
Goryl, Michael Traffic & Safety Engineer	R	Livingston County Road Comm.			
Gould, Richard M. Asst Dist Maintenance Engineer	R	Mich Dept of Transportation 18101 W Nine Mile Road 313-569-3972	Southfield	MI	48075
Grady, Robert E. Sr Traffic Technician	T	Oakland County Road Comm. 2420 Pontiac Lake Road 313-858-4828	Pontiac	MI	48054
Gray, John R. County Highway Engineer	R	Macomb County Road Comm. 115 Groesbeck Highway 313-463-8671	Mt Clemens	MI	48043
Greiner, Scott T. Sales Representative	C	Carrier & Gable, Inc. 24110 Research Drive 313-477-8700	FarmingtonHills	MI	48024
Grennell, Mark Transportation Engineer	R	Mich Dept of Transportation P.O. Box 30050 517-335-2847	Lansing	MI	48909
Groenleer, David M. Director of Engineering	T	Kent County Road Commission 1500 Scribner Ave, NW 616-242-6912	Grand Rapids	MI	49504
Grylicki, Dennis Director of Engineering	R	Genesee County Road Comm. 211 West Oakley Street 313-767-4920	Flint	MI	48503
Gupta, Deepak Assistant Design Engineer	T	Saginaw County Road Commission 3020 Sheridan Avenue 517-752-6140	Saginaw	MI	48605
Haagsma, Timothy J. Traffic Engineer	R	Kent County Road Commission			
Hagerty, Bradley Analyst	T	Mich Dept of Transportation P.O. Box 30050 517-335-2631	Lansing	MI	48909
Hamilton, Paul Chief Planner	R	Tri-County Regional Pl Comm. 913 W. Holmes, Suite 201 517-393-0342	Lansing	MI	48910
Hammond, Jerry H.	T	Giffels-Webster, Inc. 2871 Bond St., P.O. Box 57004	Auburn Hills	MI	48057
Harrison, PE, Russel E.	L				
Hartwig, William C. Assistant Administrator	R	MDOT-Bureau of Trans. Planning 425 W. Ottawa, P.O. Box 30050 517-373-2316	Lansing	MI	48909
Harwood, Frederick W.	R	M.D.O.T. -Testing & Research P.O. Box 30049	Lansing	MI	48909
Hawkins, David S.	C	Safety & Security Systems/3M			
Hayes, Allen T.	L				
Helinski, Mark A.	S	Michigan State University 313-422-1955			
Henry, Herbert J. Telespar Product Manager	C	Unistrut Corporation			
Herf, Lynne Assistant Traffic Engineer	R	City of Southfield 25501 Clara Lane 313-354-9180	Southfield	MI	48034
Hershkowitz, Paul Supervisor-Analysis Section	R	MDOT,PDI Section UTP Division P.O. Box 30050 517-373-9038	Lansing	MI	48909
Hickman, Harold L.	L	5383 Sturbridge Road	Grand Blanc	MI	48439
Hicks, Robert R.	R				
Hodges, Andrew E. General Engineer IV	R	Mich Dept of Transportation 425 W Ottawa 517-335-2840	Lansing	MI	48909

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DeLong, Matthew W.	R	Senate Republican Office	966 Haslett Road	Haslett	MI 48840
DeMaso, Thomas E. Permit Supervisor	T	Calhoun County Road Commission	616-781-9841		
Derks, Dean A. Construction Signing Engineer	R	M.D.O.T. Traffic & Safety	P.O. Box 30050	Lansing	MI 48909
Dewey, Alfred H.	T	Michigan Department Trans.			
DeWitt, Timothy D.	C	Carrier & Gable Inc.	24110 Research Drive	Farmington Hills	MI 48024
Domke, Dawn M. General Engineer IV	R	Mich Dept of Transportation	P.O. Box 30050	Lansing	MI 48909
Doyle, Judson J. Traffic Regulations Coord.	T	Mich Dept of Transportation	P.O. Box 30050	Lansing	MI 48909
Dressander, Ronald L. Public Works Foreman	T	City of Wyoming	2660 Burlingame Ave	Wyoming	MI 49509
Dresselhouse, Gerald H. President	R	G.H. Dresselhouse, Inc.	20235 Scio Church	Chelsea	MI 48118
Drews, Timothy R.	S	Michigan State University	517-337-7340		
Drongowski, William C.	T				
Dunithan, Victoria A. Traffic Engineering Technician	T	City of Battle Creek	P.O. Box 1717	Battle Creek	MI 49016-1717
Dunlap P.E., Duane F.	R	CNAWLAECAN, Inc.	204 E. Church St.	Adrian	MI 49221
Durgin, Robert L. Vice President	C	Traffic Control Products, Inc.	38301 Apollo Parkway	Willoughby	OH 44094
Dutta, Utpal	R				
Egiebor, Benjamin I. Transportation Engineer	T	MDOT - Traffic & Safety Div.	P.O. Box 30050	Lansing	MI 48909
Elsner, Trudy B. Project Manager	R	Carl Walker Engineers, Inc.	445 W. Michigan Ave. Suite 101	Kalamazoo	MI 49007
Endres, Gary R. Traffic Technician Specialist	T	M.D.O.T. Traffic & Safety Div.	P.O. Box 30050	Lansing	MI 48933
Enustun, Nejad	R				
Etelamaki, Glen R.	R				
Everhart, Kenneth W Regional Manager	C	Stimsonite Products, Amerace	P.O. Box 1497	Martinsville	IN 46151-0497
Falck, Katherine Engineer	R	Mich. Dept. of Transportation	425 W. Ottawa	Lansing	MI 48909
Farnum, Norman Manager	T	Mich Dept of Transportation	517-335-2641		
Feldt, Kenneth J. City Engineer	R	City of Lapeer			
Fenner, Mortimer P.	R	M.D.O.T. Traffic & Safety	P.O. Box 30050	Lansing	MI 48909
Ferguson, Eugene E. Michigan Manager	C	Chemi-Trol Chemical Co	517-351-3266		
Ferraro, George D. Client Services Manager	R	Wade, Trim and Assoc., Inc.	25185 Goddard Road	Taylor	MI 48180
Finch, Joseph K. Asst Dist Traffic/Safety Engr	R	Mich Dept of Transportation	1501 E Kilgore Road	Kalamazoo	MI 49001
Floyd, Bruce L.	R	Engineering Design Inc.			
Fody, Sgt. John Traffic Safety Div.	R	Dearborn Police Department	16099 Michigan	Dearborn	MI 48126
Fognini, William J.	R		313-626-3588		
Forbes, T.W.	L				
Forestal, Richard F. President	C	HI-VU Inc.	1000 E. 9th Street	Indianapolis	IN 46202

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 Traffic & Safety Engineer 313-569-3993  
 Abel, Dee Ann R Ed Swanson and Associates 2920 Fuller NE Suite 206 Grand Rapids MI 49505  
 Transportation Engineer 616-363-8181  
 Aggarwal, Gian C. R Detroit Dept of Transportation 1301 E Warren Detroit MI 48207  
 Sr Associate Traffic Engineer 313-833-1849  
 Agrawal, B.D. R MDOT 425 W. Ottawa Lansing MI 48909  
 Transportation Engineer 517-335-2997  
 Ahmad, Zubair S  
 Ala, Michael J. T City of Monroe 736 Winchester Monroe MI 48161  
 Director of Public Services 313-241-6800  
 Allyn, David F. T Oakland County Road Comm. 2420 Pontiac Lake Rd. Pontiac MI 48054  
 Director, Traffic Safety Dept. 313-858-4832  
 Alspaugh, Lewis C I.D.C. Corporation 5096 Canal Road Dimondale MI 48821  
 517-646-0358  
 Amato, Kathy C 3M Company St. Paul MN  
 Sales Representative 800-553-1380  
 Arens, Leo L. R MDOT - Traffic & Safety Div. 425 W Ottawa Lansing MI 48933  
 Transportation Engineer 517-335-2989  
 Arnold, Michael R. S Michigan State University  
 313-694-0081  
 Arroyo, Rodney Lee R Birchler/Arroyo Associates 3248 Greenfield Berkley MI 48072  
 Principal 313-543-0690  
 Bacon, David C. R Carrier & Gable, Inc. 24110 Research Dr. Farmington Hill MI 48024  
 Sales Manager 313-477-8700  
 Baehr, Douglas M. T City of Flint 1101 S Saginaw St Flint MI 48502  
 Senior Traffic Analyst 313-766-7165  
 Bannon, James P. C Indicator Controls Corporation 3000 East Las Hermanas Street Rncho Dominguez CA 90221  
 Vice President - Marketing 213-603-8825  
 Barbaresso, James C. R Oakland County Road Comm. 31001 Lahser Road Birmingham MI 48010  
 Director, Planning & Development 313-645-2000  
 Barnes, Joyce T SEMCOG 660 Plaza Drive, Suite 1900 Detroit MI 48226  
 Transportation Engineer 313-961-4266  
 Barnes, Michelle A. R SEMCOG 660 Plaza Drive, Suite 1900 Detroit MI 48226  
 Traffic & Safety Engineer 313-961-4266  
 Beaubien, Richard F. R Hubbell, Roth & Clark, Inc. 555 Hulet Drive Bloomfld. Hills MI 48013  
 Transportation Director 313-338-9241  
 Beckon, Robert D. R MDOT 425 W Ottawa St Lansing MI 48909  
 Transportation Engineer 517-373-0752  
 Berridge, David A. R City of Lansing 219 N. Grand Ave. Lansing MI 48911  
 Transportation Engineer 517-483-4240  
 Berry, Donald E. R City of Flint-Traffic Engg 1101 S. Saginaw St. Flint MI 48502  
 Traffic Engineer 313-766-7165  
 Bertalan, Paul G. T City of Madison Heights 300 W. 13 Mile Road Madison Hgts MI 48071  
 313-588-1200  
 Best, Jeffrey J R Kent County Road Commission  
 Director of Safety  
 Biasell, Thomas P. T City of Farmington Hills 31555 Eleven Mile Rd. Farmington MI 48018  
 Director of Public Services 313-473-9518  
 Biegun, Charles C Giffels-Webster Engineers 2871 Bond Street Auburn Hills MI 48057  
 President 313-852-3100  
 Blake Jr., Ronald R City of Jackson 521 Water Street Jackson MI 49203  
 Traffic Engineer 517-788-4174  
 Blikken, Wendell A. R Mich Dept of Transportation 2211 E Jefferson Detroit MI 48207  
 Acting Mgr, Freeway Operations 313-256-2704  
 Boehm, Jeff R. C 3M Company 4683 Ottawa Drive Okemos MI 48864  
 Highway Safety Representative 800-942-3961  
 Borton, Weldon L. L 1014-B Montevideo Drive Lansing MI 48917  
 Bott, Mark R Mich Dept of Transportation 425 W Ottawa Lansing MI 48909  
 Transportation Engineer 517-335-2827  
 Bowman, Brian L. R Goodell-Grivas, Inc. 17320 W. Eight Mile Southfield MI 48075  
 Manager, Civil Engineering 313-779-0539

Branch, David R. T Mich Dept of Transportation P.O. Box 30050 Lansing MI 48909  
 Traffic Technician 517-335-2845  
 Bremer, Ross J. R City of Detroit 1301 E. Warren Detroit MI 48207  
 Engineering Services Coord. 313-833-2292  
 Briere, A. Robert R Michigan Dept. of Transp.  
 District Traffic Engineer  
 Brown, Larry R. T Mich Dept of Transportation  
 District Operations Engineer  
 Brown, Theodore J. T City of Saginaw 1315 S. Washington Saginaw MI 48601  
 Traffic Foreman 517-776-1680  
 Bueche, Brian J R City of Bay City 301 Washington Ave Bay City MI 48708  
 Civil Engineer 517-894-8181  
 Bunker, Lawrence D T Mich Dept of Transportation 301 E Louis Glick Hwy Jackson MI 49201  
 Traffic Technician 517-784-7172  
 Bush, Jr., John E. T US Army Corps of Engineers 100 Liberty Ave, Moorehead Bldg Pittsburgh PA 15222  
 Civil Engineer 412-644-6736  
 Bushnell, Keith R Mich. Dept. of Transportation  
 Call, David E. R City of Farmington Hills 31555 Eleven Mile Road Farmington Hill MI 48018  
 Assistant City Manager 313-473-9506  
 Carrier, Daniel C Carrier & Gable 24110 Research Drive Farmingtn Hills MI 48024  
 Sales Representative 313-477-8700  
 Carrier, Gerald W. C Carrier & Gable 24110 Research Drive Farmingtn Hills MI 48024  
 President 313-477-8700  
 Carrier, Paul J. C Carrier & Gable 24110 Research Drive Farmingtn Hills MI 48024  
 Sales Representative 313-477-8700  
 Carroll, Robert B. R Kalamazoo Co. Road Commission 3801 E. Kilgore Rd. Kalamazoo MI 49001  
 Traffic Engineer 616-381-3171  
 Chesney, Randall J. R City of Saginaw 1741 S Jefferson Ave Saginaw MI 48601  
 City Engineer 517-759-1680  
 Cleveland, Donald E. R University of Michigan P.O. Box 1938 Ann Arbor MI 48106-1938  
 Clyde, Max N. R 3400 N. Timberwood Drive Traverse City MI 49684  
 Cole, Richard S. R City of Royal Oak 313-544-6636  
 City Engineer  
 Connelly, Clifford M. C Pathmasters, Inc. 216-531-0841  
 Salesman  
 Conradson, Stephen B. R MDOT - Traffic & Safety Div. 425 W Ottawa Lansing MI 48909  
 General Engineer V 517-335-2987  
 Cool, Stanley D. R Reid, Cool & Michalski 29623 Northwestern Hwy Southfield MI 48034  
 President 313-356-3515  
 Cox, W. Howard R 313-531-9221  
 Crane, Herbert L. R 29374 Sherry Madison Hgts MI 48071  
 313-548-4742  
 Crane, Jonathan R. R C & W Consultants, Inc. 3290 W Big Beaver Rd Suite 416 Troy MI 48084  
 President 313-649-3770  
 Cubera, James T City of Farmington Hills 31555 Eleven Mile Road Farmingtn Hills MI 48018  
 Senior Engineer 313-473-9590  
 Cuendet, Arthur T City of Ann Arbor 415 W. Washington St. Ann Arbor MI 48103  
 Supt. Traffic Control 313-994-1618  
 Culpepper, Michael W. T City of Troy 500 W Big Beaver Road Troy MI 48084  
 Supt - Streets and Drains 313-524-3396  
 Cyberski, Barney L  
 Davies, Leo T Orchard, Hiltz & McCliment 34935 Schoolcraft Livonia MI 48150  
 Project Engineer 313-522-6711  
 Davis, John D. R Mich. Dept. of Transportation 425 W Ottawa Lansing MI 48909  
 Asst Federal Aid Urban Engr 517-373-9570  
 Dearing, Steven T City of Rochester Hills 1000 Rochester Hills Drive Rochester Hills MI 48309  
 Traffic Engineer  
 DeCorte, P.E., Robert V. R Traffic Improvement Assoc 2510 S Telegraph Rd BloomfieldHills MI 48013  
 Dir, Engineering & Data Serv 313-334-4971  
 DeHondt, Thomas R. T City of Sterling Heights 40555 Utica Road Sterling Hgts. MI 48078  
 City Engineer 313-977-6123