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UNIVERSITY OF CALIFORNIA
Institute of Transportation Studies
Technology Transfer Program

Tech Transfer

Technology Transfer for Local Transportation Agencies

TMC in Oakland *Photo by Gerald Stone*

California's TMC Future

Transportation management centers can help to move more traffic on existing roads

By Linda Howe

Between 1970 and 1995, the number of registered vehicles in California grew from nearly 117 million to well over 276 million. The number of miles traveled on California's highways jumped from almost 12 million to more than 22 million. So, if you think traffic on California's streets and highways has been increasing over the past twenty-five years, you are right.

Today nobody thinks that the way to solve all of the problems associated with increasing traffic is simply to build more or better roads. Rather, the focus is increasingly on managing the traffic better. And in California, this has meant development of a statewide system of transportation management centers (TMCs).

The modern TMC is a centralized operations and communications command center, jointly operated by Caltrans and the California Highway Patrol. From this center, TMC staff expedite the removal of stalled or crashed vehicles from travel lanes; monitor and manage traffic congestion created by construction zones, special events, and emergencies; respond to regional transportation needs in times of natural disaster; provide media information for traveler and traffic information systems; and control access to the freeway system by means of ramp meters and changeable lanes.

The first TMC in California opened in Los Angeles in 1971. Called the Traffic Operations Center (TOC), it successfully managed 42 miles of freeway, with a focus on providing faster response to vehicle accidents and managing congestion related to construction zones. The LA TOC became the model for establishment of seven other TOCs or TMCs in California during the following decades. Each of these seven was developed independently to meet specific needs of individual service areas. As the system developed, it became clear that there was some duplication of effort and much unused potential for enhancing overall management of the regional transportation.

In 1992, Caltrans and the CHP signed a Memorandum of Understanding to join forces on the development and operation of co-located and collaborative Transportation Management Centers. This MOU marked the beginning of the next level of TMC development, which, according to the state's 1997 TMC Master Plan, uses the latest computing and sensing technologies to manage regional and inter-regional transportation of people and goods. The plan will also support creation of partnerships with other transportation and governing agencies, the media, academia, and local emergency responders. It calls for joint policies and provides a map for standard development of a coordinated statewide system.

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Tech Transfer

Technology Transfer for Local Transportation Agencies

Technology Transfer Program (TTP) is a unit of the Institute of Transportation Studies at the University of California, Berkeley. Its mission is to support the development and implementation of advanced transportation systems by facilitating exchanges of information between research and practice and by providing a program of professional training and technical assistance in the areas of traffic operation; infrastructure maintenance; transportation planning and management; airport operations, planning and management; and traffic safety.

Linda Howe Ph.D., *AICP, Director, Technology Transfer Program*

Natalie Fay, MA, *Program Manager, Planning, Advanced technologies, Distance Learning and LTAP*

Susan Ker, *Program Manager, Engineering and Maintenance Training*

David Rompf J.D., *Program Manager, Aviation and Traffic Safety*

Donna Reid Ph.D., *Program Representative, Modeling, Hydrology, Newsletter Editor*

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Donna Reid, *Newsletter Editor*
Barbara Erickson, *Contributing Editor*
Phyllis Orrick, *Contributing Editor*
Betsy Wing, *Contributing Editor*

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Northern California
Scotty A. Bruce
5989 Santa Teresa Blvd.
San Jose, CA 95123
(408) 227-7282
snjtours@aol.com

Central California
Les Jorgensen
2697 W. Dovewood
Fresno, CA 93711
(209) 435-2437
itsltap@aol.com

Far Northern California
Don Raffaelli
3433 Trinity St.
Eureka, CA 95501
(707) 443-5485
DRaffelli@aol.com

Southern California
Dave Royer
23933 Via Aranda
Santa Clarita, CA 91355
(805) 259-8910 (phone)
(805) 255-6156 (fax)
droyer@earthlink.net

Asphalt
Larry Santucci
1355 S. 46th St., RFS 452
Richmond, CA 94804-4603
(510) 231-9428 (phone)
(510) 231-9589 (fax)
ohotsky@uclink.berkeley.edu

Letter from the Editor

By Donna Reid

This issue of *Tech Transfer* examines the transportation management center (TMC) and related issues of privacy. The TMC is believed to be the "heart" of the intelligent transportation system but I find it to be more like the "brain" directing various components of the system and relaying data between remote receivers.

Alex Skabardonis has been active in the research on advanced technology deployed within TMCs and he reports on the latest plans for utilizing the massive amounts of valuable data collected by TMCs. Diana Gould Wells, recently appointed manager for the TMC Training Center at Cal Poly San Luis Obispo, reports on their training program, which is one of the few in the country. Phil Agre raises important questions about the information which we collect through our intelligent transportation systems and how this affects notions of privacy that we as Americans have always held dear. Important questions will need to be asked as we march headlong into developing systems whose technological capabilities we have only just begun to realize.

Change is afoot here at Technology Transfer as we have said goodbye to Acting LTAP Director Kathie Studwell and welcomed on board our new LTAP Program Manager, Natalie Fay. You can read more about Natalie on page 5. We also bid a fond farewell to Field Engineer Bob Sandwick, who has left to pursue more of his own consulting work, and welcome a new Field Engineer, Dave Royer.

We hope you will enjoy receiving the first of our Technical Reports on "The Role of Compaction in the Fatigue Resistance of Asphalt Pavements" by Field Engineer Larry Santucci. We have made this report available through our newsletter to introduce the series. It is also available on-line at www.its.berkeley.edu/techtransfer. Be on the lookout for future reports and be sure to see what's new in our course offerings, which are also on-line.

As Program Representative for the Technology Transfer Program and new editor of the newsletter, I would welcome your comments and suggestions for future articles. All of us here at Technology Transfer look forward to seeking out exciting new topics in transportation to bring to you and welcome contact. You can e-mail me at <dreid@uclink4.berkeley.edu>. STOP

CALIFORNIA'S TMC FUTURE

(Continued from page 1)

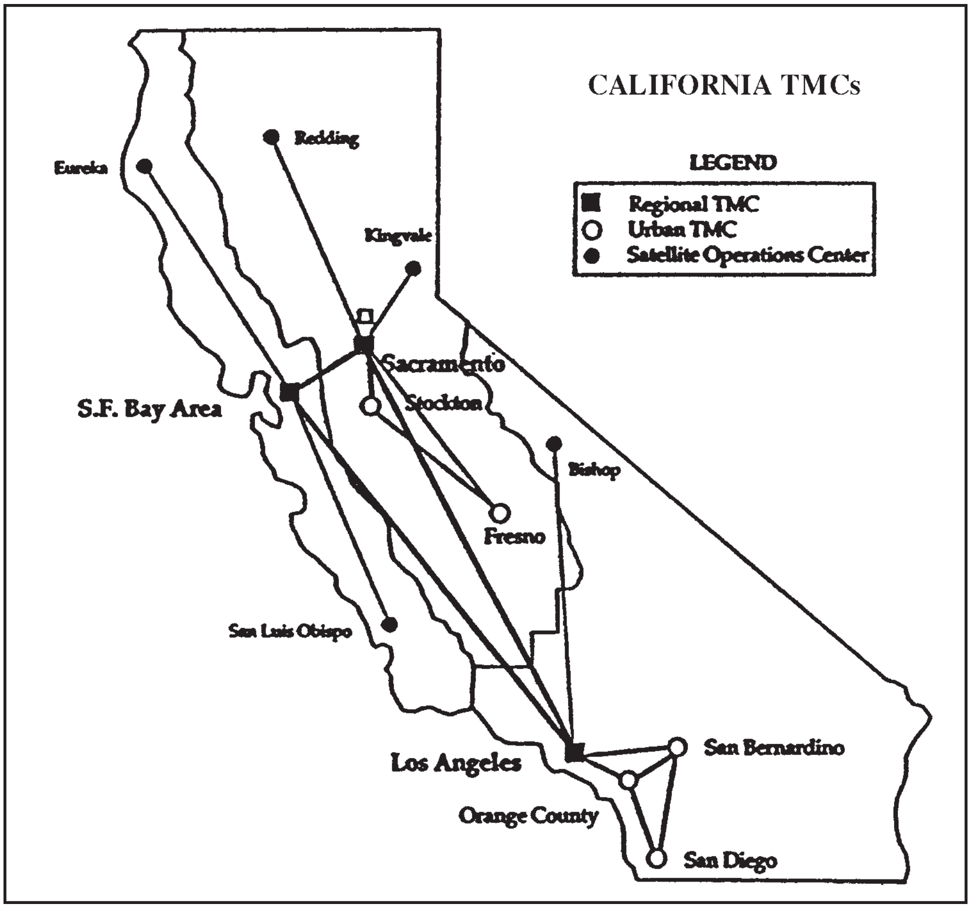
The plan identifies three levels of TMC: basic, intermediate, and advanced. The basic TMC collects data on traffic conditions and disseminates information to motorists, the media, and emergency response teams. It's a portable operation that can be used during peak traffic conditions. The intermediate level TMC includes technologies that can verify as well as detect incidents, and uses established processes to develop alternate route information and respond in a coordinated fashion to disaster-related events.

The advanced TMC uses the most advanced technologies and expert systems available, not only to respond to situations but also to aggressively manage and control the performance of the transportation system. It operates 24 hours a day.

The state is rapidly moving towards implementing a multi-layered, inter-connected regional system of TMCs. Regional designations were developed through a consensus-building process within Caltrans and CHP. The plan takes into account both topography and the need to provide a statewide backup and linkages in cases of emergency. (See adjacent map .)

Currently, advanced regional TMCs are being developed in Oakland, Sacramento, and Los Angeles. Operational components include: computer-aided dispatch, which automates and electronically organizes calls into the communications center; field data acquisition devices such as CCTV's that gather and validate data in real-time; electronic message displays that can be controlled from the TMC; state-of-the-art communications system infrastructure; processing equipment and software; and people who are well trained in both how to use the technical systems and how to respond to their team members at the center and members of the public or press who call in.

In twenty-five years the level of expertise and the sophistication of the technologies found in the California TMC have grown dramatically. Function also appears to be evolving. Ultimately, every transportation agency in California will be affected by traffic operations controlled through a TMC.



IMPRESSIONS OF A TMC

By Donna Reid

This past July, I made a visit to the TMC in District Four (Oakland) to see first-hand the working reality of a TMC today. This TMC is a regional facility which oversees 500 miles of traffic operations in the Bay Area and covers coastal California from the Oregon border to Santa Barbara. The TMC receives data from 450 closed circuit TV cameras and 2500 loop detectors and sends out information to 150 changeable message signs and 20 permanent Highway Advisory radios. The system also interacts with TravInfo, which provides real-time traffic information to the traveling public.

The day I arrived, Cyrus Mashoodi, the Engineer in charge, explained that they were in the middle of remodeling, moving banks of video display terminals in order to upgrade and expand their viewing capabilities. What immediately struck me were the contrasts. Although the TMC was hidden away quietly in the Caltrans building at the edge of downtown Oakland, it was in fact the central command and nerve center for some of the busiest traffic corridors in the United States. While I expected something like a movie depiction of a NASA mission control center – large, bright, bustling, full of people and technology handling crises – in fact I found it to be dark and quiet, with only a couple employees visible. Cyrus explained that they have more staff working during the peak hours which I had just missed. The most striking contrast however, was that in addition to being a conglomeration of computers and machines recording and processing data on thousands of vehicles in motion, many of the work areas were adorned with pictures of children, emblems of culture, popular humor. In other words, the TMC is not just some mechanized futuristic control center to regulate our transportation system, this is a facility operated by real people with families and hobbies. This realization helped balance the "big brother" aspect of TMCs. By the end of my visit I had a renewed sense, of our society's ability to design some wonderfully powerful technology and a somewhat lessened concern that this technology could be used for totalitarian purposes.

TMCs: Developing and Enhancing the Transportation System in California

By Diana Gould Wells

Introduction

The State of California recognizes that one way to reduce traffic congestion is to improve traffic operations. Thus, it has taken aggressive measures to promote the effective management of its transportation system. A key element in this effort is the network of Transportation Management Centers (TMCs), which are operated jointly by the California Department of Transportation (Caltrans) and the California Highway Patrol (CHP). There are eight TMCs in California. TMCs provide the foundation for all Intelligent Transportation Systems (ITS) activities and are an integral part of the national ITS architecture.

To ensure optimal use of the resources available and to promote the development of interagency partnerships, the TMC Master Plan was developed. It is the standard policy document for all state-managed TMCs in California and serves as the guide for future TMC development. The TMC Master Plan emphasizes the effectiveness of regionalization and standardization in managing the statewide TMC system.

As the state has placed greater responsibility on TMCs in recent years, it has made an effort to raise the expertise and preparedness levels of the CHP and Caltrans personnel who staff them. Computer programs to provide more comprehensive training for employees have been introduced, with a focus on improving traffic management technology and advancing the management skills of those who utilize it.

To meet these goals, Caltrans established a TMC Personnel Training Program at California Polytechnic State University (Cal Poly), San Luis Obispo in 1991. This program includes a full-scale, real-time simulation supported by the Cal Poly TMC Simulator Training and Research Facility which is the most extensive of its kind in the nation and the only one in California. In addition, the program uses classroom lectures and small-group interactive exercises that emphasize team building and problem-solving skills in an effort to enhance the effectiveness of TMC operations.

Master plan calls for statewide consistency

A TMC represents the joint efforts of Caltrans and the CHP. It functions as an information center, with the goal of managing the transportation system. It is the foundation of the Transportation Management System (TMS), which is designed to efficiently manage the existing infrastructure, mobile assets, and field personnel. Field personnel include the Freeway Service Patrol (FSP), maintenance crews, and Traffic Management Teams.

The TMC Master Plan was revised in December, 1997. It lays out goals and objectives which stress statewide uniformity and consistency within TMCs. Its mission statement calls for TMCs to "aggressively manage the transportation system to reduce congestion and provide safe and efficient movement of people, goods, services and information in order to promote economic vitality and enhance the quality of life for people in California."

The plan presents a combination of goals and strategies designed to increase safety and reduce incidents, traffic delays, harmful effects on the environment, and costs to taxpayers. They include:

- **GOAL: Implementation of these strategies demands coordination and teamwork among partnering agencies and resolution of major incidents in order to prevent secondary incidents and reduce delay**

  STRATEGY: CHP's computer-aided dispatch (CAD), loop detectors, closed circuit television (CCTV) cameras, and other field equipment provide instant information to the TMC. CHP and Caltrans personnel can then dispatch field units and other resources to mange the incident in question.

- **GOAL: Provide expedient response to and resolution of minor incidents on the highways**

  STRATEGY: When the TMC is notified of less serious problems, such as a vehicle with a flat tire or one that is out of gas, the TMC will coordinate with the Freeway Service Patrol (FSP) to supply services to the motorist. If the situation cannot be corrected within 10 minutes, the vehicle will then be towed by the FSP. This will assist in keeping traffic flowing at optimum speeds and reduce unnecessary delays.

- **GOAL: Provide weather warnings to motorists**

  STRATEGY: A weather detection system provides motorists with important information about road conditions, impending storms, or areas where visibility is very poor. Changeable message signs (CMSs) can be used to communicate to motorists information about hazards that they may encounter ahead.

- **GOAL: Control traffic demand on the system**

  STRATEGY: The rate of vehicles entering the freeway system is regulated by ramp meters. The TMC has the authority to set or change their timing in order to provide a steady flow of traffic on the freeway on-ramps. High occupancy vehicle (HOV) lanes also aid in controlling the demands on the traffic system. HOV lanes allow a greater number of people to travel through the traffic system with the same number of vehicles. This helps reduce the overall impact of traffic on the system.

- **GOAL: Disseminate transportation information to the public**

  STRATEGY: The TMC collects traffic information from units in the field, the dispatchers, and other elements. The public is notified of lane closures, incidents,


Photo by Scott Plamondon

Simulated TMC at Cal Poly

and other events through CMSs, the media, telephone information lines or the Internet. This in turn will help motorists choose the best route to their destination, which will help keep the flow of traffic at an optimum level.

The Cal Poly TMC Simulator

Cal Poly plays an important role in the implementation of the TMC Master Plan's goals and objectives. Working in conjunction with Caltrans, Cal Poly faculty and staff have developed a TMC Training Program. It includes training activities for both Caltrans and CHP personnel. Classes address key skills required to work efficiently and effectively in a TMC, providing the techniques and procedures necessary for optimum traffic management. Both TMC supervisors and TMC operators have the opportunity to participate.

One of the most important components of Cal Poly's TMC Training Program is the TMC Simulator facility. This includes seven workstations which are set up just as an actual TMC would be. The trainees have the opportunity to learn about all the different equipment used in a TMC, the functions that each staff member performs, and how to effectively work as a team to manage multiple incidents.

TMC Operators Training Programs are held four times a year, with the dates established a year in advance to accommodate staffing needs and travel constraints. The program consists of four days of classroom training and simulator experience. The classroom sessions include presentations by Cal Poly faculty, staff, and outside consultants.

The most recent Operators Training Workshop was held in June, 1998. During this session, consultants addressed the issues of Partnerships and Team Building, Communication Skills, and Total Quality Management. In addition, a day-long session on Disaster Preparation and Management was presented by a representative from the Sacramento Police Department.

Cal Poly faculty and staff presented information on the fundamentals of traffic operations and case studies of incidents which have occurred in real life. To illustrate presentations, students may deal with problems such as a plane landing on a freeway, a mudslide onto the highway, and a car chase through several counties – all incidents which require cooperation from several TMC's. During simulation exercises, operators oversee the deployment of personnel and the dissemination of information while dispatchers make radio contact with agencies and learn TMC software. The simulation software also creates detailed graphic displays of congestion, traffic patterns and realtime response scenarios. Caltrans and CHP personnel presented information on meeting identified goals and objectives of the TMC Master Plan and discussed policies and procedures and the need for uniformity and consistency, both within each TMC region and on the statewide level.

TMC supervisors undergo training at Cal Poly every July, in TMC Supervisors Workshops. The focus of these sessions is to establish effective management skills, develop teams and partnerships, and improve communication, both within the TMC and between the allied agencies. This three-day session is an important tool in the development of efficient and effective teams at the local TMCs. It includes classroom presentations and small-group interactive exercises. There is also an opportunity for a facilitated problem-solving discussion. This is a crucial step in developing, at the local TMC level, a plan that will help meet the goals and objectives established by the TMC Master Plan.

Summary

Cal Poly has a significant role to play in helping to achieve the goals and objectives of the 1997 TMC Master Plan. Ongoing improvements are occurring in both the classroom and simulator portions of the TMC Training Programs. The overall goal is to provide the tools to efficiently and effectively manage TMCs both on a local and regional level.

Diana Gould Wells is Transportation Specialist and Program Manager at the Transportation Management Center, Applied Research and Development Facilities and Activities, California Polytechnic State University, San Luis Obispo.

Natalie Fay Joins the Technology Transfer Program

Natalie Fay, who has worked for the last 16 years as a transportation planner and project manager in the San Francisco Bay Area, joined the Institute of Transportation Studies Technology Transfer Program (TTP) in July. Natalie will manage the Local Technical Assistance Program (LTAP) and she will develop programs on planning and advanced technologies. She also intends to develop and expand TTP's distance learning offerings.

Natalie came to TTP from the City of Berkeley, where she was Senior Transportation Planner. She has also served as project manager for the Bay Area Telecommuting Project, a regional technical assistance and training program; and as a planner for both the Metropolitan Transportation Commission (MTC) and the Southern California Association of Governments (SCAG).

Natalie holds a BA in Sociology from UC Berkeley and an MA in Urban Planning from UCLA. She is the mother of Meghan, 19, and Danny, 10. In her spare time she likes to read and work out. Please welcome her!

Using the Data from TMCs

By Alex Skabardonis

Transportation management centers (TMCs) are central to the California Department of Transportation's overall transportation management strategy. They currently operate in eight of the state's twelve transportation districts.

One area where TMCs have considerable room for growth is the storage, analysis, and dissemination of the data they collect. Improved data management can create greater efficiencies internally, and it can expand TMCs' relevance to and impact on outside users, public and private. The advanced TMC is also positioned to support – and take advantage of – future developments in Advanced Traffic Management Information Systems (ATMIS). The end result, it is hoped, will be a more efficient transportation system.

Valuable Data

Currently, TMCs routinely collect massive amounts of potentially valuable traffic information, from sources such as loop detectors, closed-circuit television cameras (CCTVs), individual incident reports from the California Highway Patrol's Computer Aided Dispatch system (CHP/CAD), and calls from individual drivers using their cell phones or call boxes. But the data is often gathered and stored with little consideration of its future use or cost.

Some efforts are already underway to change that. In District 4, the TMC works closely with a contractor-run operation, TravInfo, which gathers, organizes, and disseminates traveler information for the nine-county region in the Bay Area. TravInfo supplies information on highway conditions, public transit schedules and routes, ridesharing, park-and-ride lots, bikeways, and paratransit services.

Loop detector reports on traffic speed, flow, and lane occupancy and CCTV images of traffic are among the types of data the TMC shares in its collaboration with TravInfo. TMC operators also screen incident reports for the TravInfo database and enter them into the TravInfo advisory telephone system.

Elsewhere in the state, Maxwell Technologies, a private firm that provides real-time traffic information (speeds on certain freeways, for example), gets all of the loop detector and CHP/CAD data from the Southern California districts. Its Web site has become a popular destination as a result of this use of TMC data.

But much remains to be done. According to ITS America sources, the TMCs' most pressing needs nationwide are revising agency procurement rules to speed up the purchase of hardware and software and devising algorithms and other kinds of analysis tools to turn data into useful information for monitoring, managing and operating systems.

A New System

In June of 1998, Caltrans awarded a contract to the Institute of Transportation Studies to take the first step in improving how TMC data is organized and used. The proposal, which I assisted UC Berkeley Professor Pravin Varaiya in preparing, is titled: "Implementing a Practical Performance Management System."

The contract calls for building a transportation accounting system (TransAcct) that will allow easy access to statistical summaries of how a transportation system is operating.

TransAcct will be launched as a demonstration project at the District 12 TMC in Orange County. Initially it will use loop detector data exclusively.

Loop detectors provide TMCs with their single largest batch of information. But currently, this data has been grossly underutilized. Often loop detectors are simply not functioning at all, or, when they are working, their data are misinterpreted, which can lead to false alarms.

Detecting Faulty Loops

One of the early tasks for TransAcct developers, therefore, will be to create software which identifies faults in the system of loop detectors. Not only could this software automatically alert TMC operators to faulty loops requiring maintenance, but it could suggest or estimate data to "fill in" missing loop values. Other routines performed with computer software will filter data flowing into TMCs to smooth out random fluctuations.

Researchers plan to develop software that will automatically identify faulty loop detectors.

As TransAcct and other systems make it easier for TMCs to analyze their data, it is hoped that TMCs will find ways to use information from sources that are now being left out of the loop, so to speak.

Already, closed-circuit television cameras, which now are primarily used for incident verification, also can supply information through video image processing about vehicle classifications, estimate travel times and vehicle trajectories, and gauge queue lengths at urban intersections. But their images must be extensively processed using sophisticated software to get useful results, and this has been one obstacle to more exploitation. Similar limitations afflict data gathered from satellite surveillance. It is hoped that an enhanced data management system such as the one envisioned in TransAcct would supply the means to attack these problems more aggressively.

Freeway Service Patrol (FSP) trucks are another underutilized source of data. They are already equipped with Automatic Vehicle Location (AVL) and Global Positioning Satellite (GPS) systems, so that when not attending to incidents, these vehicles could be used as natural "probe vehicles." (Probe vehicles sample the traffic environment and relay information about conditions back to the TMC.) How such information might be

Alex Skabardonis is Associate Research Engineer, Institute of Transportation Studies, and Lecturer, Department of Civil Engineering, UC Berkeley.

used in combination with loop data to estimate average travel speeds is under investigation (J.E. Moore, et al., "Use of Los Angeles Freeway Service Patrol Vehicles as Probe Vehicles," Interim Report, University of Southern California, 1997). Currently, however, one reason TMCs do not employ FSP truck data is that drivers are not required to supply it, and TMC operators do not have the means to fit it into their existing calculations.

The technology behind Electronic Toll Collection (ETC) holds perhaps the greatest promise for expanding TMCs' databases. By 1999, Electronic Toll Collection devices should be operational on all seven Caltrans toll bridges in District 4. Drivers will be offered the option of purchasing a small plastic transponder to be mounted inside their windshields. The device works like a value-added transport pass, deducting the toll from the owner's account. But since each transponder has a discrete code, it could be used to track across the toll network. This could then be used to estimate link travel times and construct Origin/Destination (O/D) tables. *[Editor's note: Privacy issues may be raised in this connection.* *See the article on page 8.]*

Helping Drivers

For any data to be fully utilized, of course, it must be disseminated to and acted upon by someone. The immediate concern for most motorists seeking information on the transportation system is how long a specific trip is likely to take. Research is currently being conducted on how to use data from the existing loop detector infrastructure to calculate link travel times and construct tables of typical trip segments for use by the general public through radio broadcasts, telephone information lines, and Web sites. If successful, this kind of effort could be an important element in coordinating TMCs and Advanced Traveler Information Systems (ATIS).

Ramp Metering

Ramp metering is another traffic management tool that could be better used if the data were easier to manipulate and interpret in real-time. Currently, most ramp meters are operated on a fixed-time schedule and can only be adjusted (setting timing for example) in the field.

Where TMC operators have remote control of ramp meters, they are generally limited to turning them on or off. That severely limits the TMCs' flexibility, since in most cases changing the timing of the ramp meters in response to traffic would be a more desirable tactic.

Even in the best-case situations, though, TMC operators are limited in their use of metering because ramp access is controlled locally. There are no algorithms to coordinate their use corridor-wide. Some algorithms that could do this job are now being developed, and this is a key area where better data management would speed the testing and design of improved tools.

A final benefit of enhanced data analysis will be to develop methods to monitor system performance. At the click of a button, TMC operators and system managers will be able to measure the quality, and quantity, of travel in the transportation system. Ideally, performance would be correlated to the degree that TMC actions reduce delays caused by congestion for a TMC performance measure. This would substantiate the benefits and costs of having a TMC in place.

As the role played by ATMIS in managing transportation continues to grow, it only makes sense that TMCs, with their wealth of data, step up their efforts to put their information to ever greater use. In that way, TMCs, too, will play an increasing part in efforts to ensure that California's transportation network operates on the most efficient level practicable. STOP

Dave Royer Becomes a UC Field Engineer

The newest University of California Field Engineer for the southern California region is Dave Royer. Dave will serve the following counties: Los Angeles, Orange, Ventura, Imperial, Riverside, San Bernardino and San Diego.

Dave is no stranger to the Technology Transfer Program, having spent 20 years developing and teaching courses for ITS Extension and TTP on traffic safety in work zones, roadside safety features and neighborhood traffic control. Dave draws upon 32 years of experience in traffic and highway engineering for the City of Los Angeles, where he served as Principal Engineer. He has also worked as a consultant on many projects. He is a graduate of Cal State Long Beach and is past President of the Southern California Section of the Institute of Transportation Engineers. We are certain that Dave's vast experience will contribute much to our program. Welcome, Dave!

Dave can be reached at:

23933 Via Aranda
Santa Clarita, CA 91355

Tel.: (805) 259-8910
Pager (h): (805) 255-6556
Fax: (805) 255-6156

e-mail: droyer@earthlink.net STOP

Risks to Personal Freedoms in ITS Applications

A Note from the Editor

The widespread use of sensing and computer-based technologies to gather and process information is increasingly a part of modern life. Generally, these technologies are being promoted as a way to improve operations and management of the transportation system, with the highest cost efficiency being achieved through public-private partnerships. Waiting at the edge of this technological revolution, however, are some major social issues. Among these is the issue of individual privacy. Just how much information and what kinds of information should be accessible, and to whom? Who monitors what kind of data is gathered and how it is used, and according to what rules? Doctors and lawyers work according to a well established code of ethics that protects the personal integrity of their patients and clients while allowing for the full disclosure of information that the professionals need to provide advice. But what about the information that is gathered or could be gathered on the travel movements and behaviors of people using public highways and roads? [See the article by Alex Skabardonis on pages 6 and 7 of this newsletter.] Transportation is on the brink of joining the information revolution. Outside of the ITS community, few have begun to think about the broader implications of traveler information systems or video traffic surveillance. Anyone who has visited a traffic management center, however, is immediately struck by the potential use, misuse, and abuse of information being collected while monitoring freeway traffic.

Currently, much data is dumped or stored away unused, not only because the tools to analyze the data are not yet sufficiently developed but also because agencies want to avoid potential infringements of privacy or liability that might arise should their data become "evidence". Although many transportation professionals have recognized that better use of this data could enhance the value of these publicly funded TMCs, to what extent do convenience and efficiency have priority over protection of an individual's privacy and freedom to travel where and when they want to? These questions require more attention from the transportation community. How they are answered will have an effect on how many of the new transportation technologies are deployed. In the interest of alerting our readers to issues on the horizon, we provide you with some excerpts from Technology and Privacy: The New Landscape, *edited by Philip E. Agre and Marc Rotenberg, MIT Press, 1997.*

From the Introduction:

Since the 1980s, the policy debate around technology and privacy has been transformed. Tectonic shifts in the technical, economic, and policy domains have brought us to a new landscape that is more variegated, more dangerous, and more hopeful than before. These shifts include the emergence of digital communication networks on a global scale; emerging technologies for protecting communications and personal identity and new digital media that support a wide range of social relationships. In the years ahead, the public will increasingly confront important choices about law, technology, and institutional practice.

The pervasive spread of computer networking has had numerous effects. It is now easier to merge databases. Personal information now routinely flows across jurisdictional boundaries. Computer networking also provides an infrastructure for a wide variety of technologies that track the movements of people and things. Many of these technologies depend on digital wireless communications and advanced sensors. Intelligent Transportation Systems, for example, presuppose the capacity to monitor traffic patterns across a broad geographic area.

Drawing on recent work on the economics of information, Professor Agre worries with Mark Casson that information technologies will be used to create an unnecessary conflict between economic efficiency and freedom of movement.

Mark Casson has offered a science fiction story about the future of road transportation in a world of very low information costs. Nowadays most roads are provided collectively, and their use is governed by customary mechanisms (such as traffic lights and right-of-way rules) that permit drivers to move toward their destinations without colliding very often. From an economic standpoint, this scheme has obvious inefficiencies: road utilization is uneven, congestion is common, and drivers spend much time waiting. With lower information costs, however, roads could operate more like railroads. Drivers wishing to go from point A to point B would call up a reservation system and bid for available itineraries, each precisely specifying the places and times of driving. Driver's movements would still be regulated by traffic signals, but the purpose of the signals would now be to keep the drivers within the space-time bounds of the journey they had purchased. Lower-paying drivers would be assigned slower and less scenic routes, other things being equal, than higher-paying drivers. Overall efficiency would be maximized by the market mechanisms embodied in the reservation system. Issues of technical workability aside, Casson points out that such a scheme would raise concerns through its reliance on detailed monitoring of driver's movements. Nor are all these concerns entirely hypothetical, in view of the automatic toll-collection technologies now being deployed as part of the Intelligent Transportation Systems program. Decreasing information costs make toll roads cheaper to operate, thus contributing to their spread. Information costs alone, of course, do not explain the full political and institutional dynamics of these developments, but they do lower one barrier to them.

Philip E. Agre is an Associate Professor of Information Studies at UCLA. He is the author of Computation and Human Experience *(Cambridge University Press).*

If the potential exists to collect information and thereby control our freedoms will somebody take this advantage?

Excerpted from Chapter One, "Beyond the Mirror World: Privacy and the Representational Practices of Computing" by Philip E. Agre

In January 1996, the California Air Resources Board (ARB) issued a Request for Proposals (RFP 95-7) entitled Incorporation of Radio Transponders into Vehicular On-Board Diagnostic Systems. The ARB observed that, starting in 1996, new cars and light trucks in California will be equipped with an on-board diagnostic (OBD) system that illuminates a dashboard indicator when it detects a malfunction in the vehicle's emissions system. It also observed that drivers may not actually get their malfunctioning cars fixed until their next scheduled inspection check. With an eye to enforcing compliance with emissions laws, therefore, the ARB proposed to build a fleet of ten test cars, each equipped with a transponder capable of transmitting the OBD system's error codes to roadside or satellite-based receivers. Specifically, in response to a query from the receiver, the RFP specifies that the transmitter be able to supply the following information:

- the full 17-digit vehicle identification number
- any fault codes reported by the OBD system
- the location of the vehicle at the time of query
- a status code

The receiver is to be able to store the dates and times of all queries to passing cars, along with the information that the cars return, including "vehicle location (to the zip code level, and city)." Although this RFP only envisions the construction of test vehicles, the successful bidder is asked to analyze the system's cost effectiveness "assuming the 1,000,000 vehicles equipped with [transponder-equipped diagnostic system] are added to the fleet beginning in the year 2000."

The ARB system is presumably intended to be used only for its stated purpose: ensuring compliance with emissions regulations. The system as specified, however, could easily be used to track the location of every car that is equipped with it, regardless of whether it has any fault codes to report. The potential for abuse ought to figure significantly in any weighing of risks and benefits from the system, especially given that the newer cars on which the system would first be installed are the cars least likely to experience emissions-system malfunctions. What is most striking about the RFP, though, is that it takes for granted a whole vocabulary of technical methods that has become familiar and widespread. The winning bidder, for example, is instructed to "investigate the possibility of coordinating this effort with other agencies or entities," so as to "suggest the most effective and efficient infrastructure for statewide electronic fleet monitoring." The "other agencies" include the California Department of Transportation, which has been working on transponder-based toll-collection projects for several years, using a transponder architecture that is expressly designed to be extensible to other applications.

These scenarios are not yet reality, but they could, however, carry important lessons.

Tech Transfer invites readers to send in their comments and observations on this topic. STOP

Mobile surveillance trailer at on-ramp on I-5
Photo by Lawrence Emerson

ITS Training Calendar

For more information, call the Technology Transfer Program at (510) 231-9590 or visit our Web site at <www.its.berkeley.edu/techtransfer>. To enroll, call University Extension at (510) 642-4111.

Advanced Geometric Design
San Diego — Dec. 3-4

Applied Open Channel Flows and the HEC RAS Program
Redondo Beach-Workshop A — Jan. 25-27, 1999

Introducing the New HEC RAS Version 2.1
Redondo Beach-Workshop B — Jan. 28-29, 1999

Asphalt Mix Design and Analysis
Richmond — Dec. 7-11

Asphalt Pavement Fundamentals: Design, Construction and Rehabilitation
Anaheim — Oct. 27-29
Richmond — Feb. 23-25

Asphalt Pavement Maintenance
San Bernardino — Oct. 6
Bishop — Oct. 8
Fresno — Oct. 15

Building Public/Private Partnerships
Richmond — Oct. 28
Los Angeles — Oct. 29

Construction Inspection for Traffic Signals and Highway Lighting Systems
Ontario — Oct. 6-8

Deploying Integrated Intelligent Transportation Systems
Richmond — Oct. 7-9
Los Angeles — Oct. 12-14

Fundamentals of Geometric Design
San Jose — Oct. 29-30
San Diego — Nov. 12-13

Introduction to Construction Project Scheduling and its Impact on Delay Claims
Riverside — Nov. 5-6

Introduction to Inspection Practice
San Diego — Oct. 29-30
Yuba City — Dec. 3-4

Introduction to Urban Travel Demand Forecasting
Redondo Beach — Nov. 16-19

Project Management and Claims Avoidance
Modesto — Dec. 10-11
Burbank — Oct. 19-20

Public Contract Laws Governing Specifications, Advertising, Award and Contract Administration of Capital Projects
Modesto — Dec. 9

Stream Stability and Scour at Highway Bridges for Bridge Inspectors
Ontario — Nov. 19

Traffic Signal Design
Fresno — Oct. 20-22
Santa Ana — Feb. 23-25

What's New in Asphalt Paving?
Redding — Oct. 14
Burbank — Nov. 18

Walkable Communities: Designing for Pedestrians
Sacramento — Nov. 23-24

The Technology Transfer Program's spring catalogue will be mailed in January. If you would like to receive one, please call (510) 231-5675.

Four New Lab Workshops on Traffic Corridor Analysis Software

This new series provides hands-on training on the best of todays's off-the-shelf micro-simulation software for analyzing traffic operation in freeway local arterial corridors. The series was designed with support from Caltrans' Office of Travel Forecasting and Analysis and delivered during spring 1998 to selected professionals from Caltrans district offices. The courses on particular software packages are taught in the computer lab and include significant hands-on work. For dates and locations in Spring '99, please call (510) 231-9590 or visit our Web site <www.its.berkeley.edu/techtransfer>. Courses are:

Introduction to Traffic Micro-Simulation Models (1 day)
Understanding and Using CORSIM (3 days)
Understanding and Using FREQ11 (3 days)
Understanding and Using INTEGRATION (3 days)

More Free Training on Federal-Aid Project Development

This free series was developed to ease the change of responsibility for carrying out federal administrative procedures for federal-aid highway projects from Caltrans to local agencies. The series consists of five one-day training programs and is based on the new California Local Assistance Procedures Manual.

To attend a workshop, you must call your Caltrans District Local Assistance Engineer (DLAE) to get on an enrollment list. The series will be offered up to five times between September, 1998, and February, 1999. One-day workshops are:

Overview: Getting Your Federal-Aid Project Started
Federal Requirements for Environmental Analysis
Right-of-Way Acquisition
Project Development from Design to Construction
Contract Administration and Project Completion

Workshops on Hydraulic Analysis for Flood Control Projects

Two new workshops on Applied Open Channel Flows and HEC-RAS (3 days) and Introducing HEC-RAS Version 2.1 (2 days) will be presented in southern California this January.

Participants will review basic concepts of applied river flows to highway situations and the principles of the HEC-RAS program. The second workshop will look at the latest features of the program. Professor Hsieh Wen Shen of UC Berkeley is leading the course with Mark Jensen of the Army Corps of Engineers (a developer of HEC-RAS 2.1) and Robert Janssen of Bechtel Corporation.

In addition, two new hydrology workshops are being developed. The first is on the permit and regulatory process in transportation hydrology to be offered late spring/early summer of 1999. The second is a workshop on scour at bridges planned for debut in the fall of 1999. Stay tuned for future announcements.

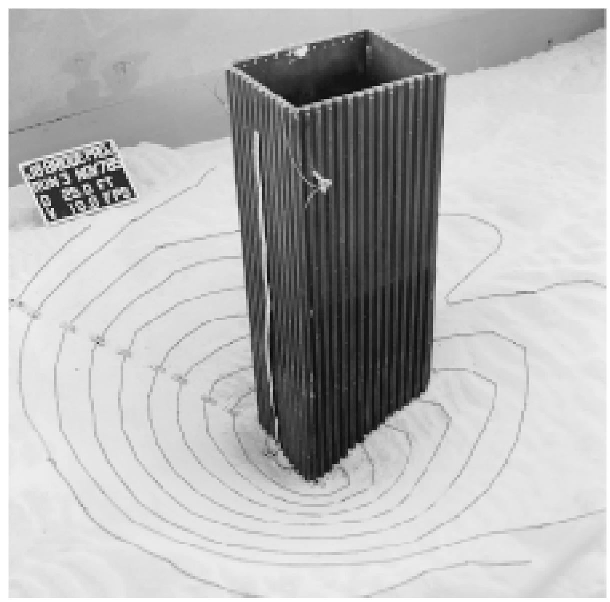


Photo of bridge scour modeling erosion pattern

TMC Surf City

Those interested in finding out more about TMCs or the issue of privacy in the emerging transportation infrastructure are encouraged to visit the following Web sites:

<http://www.dot.ca.gov/dist6/tmc/tmc.htm>
Caltrans District 6 Traffic Management Center has its own Web site.

<www.dot.ca.gov/hq/newtech>
Caltrans outlines its new technology plans.

<www.caats.org/>
The CAATS (California Alliance for Advanced Transportation Systems) is a public-private partnership created to deploy advanced transportation technologies in California.

<http://herman.tamu.edu/itmc-concept.html>
The Texas Transportation Institute at Texas A&M University has a Web site devoted to explaining the ITMC (Integrated Transportation Management Center).

<http://www.itsonline.com/atlan1.html>
Intelligent Transportation Systems (ITS) online has a "Lessons Learned" article about Atlanta's new advanced TMC set up just prior to the '96 Olympics.

<http://www.fta.dot.gov/library/technology/APTS/update/CHAP5.HTM>
The Federal Transit Authority discusses TMCs along with other Transportation Demand Technologies.

(Continued on page 12)

SURF CITY

(Continued from previous page)

<http://www.tfhrc.gov/safety/humanfac/rd95127.htm>
<http://www.alumni.gatech.edu/news/alummag/sum96/humantch.html>
Georgia Tech conducted research for the FHWA on traffic management center design "lessons learned" and describes its Interactive Media Technology Center.

<http://rapidttp.com/transponder/trends.html>
Transponder News provides an independent report on recent developments in RFID technologies. Everything from smart refrigerators to golf balls can be found at this site.

<http://www.cohu.com/cctv/tmt.htm>
Three leading technology companies have come together to teach seminars on traffic management. Cohu, which makes CCTVs, Econolite, which makes control products and BARCO, which designs visual systems, have formed a consortium to stage free seminars for professionals at a local level. Their course covers TS2 Standards; Communications Systems; Overview of ITS Protocol; Distributed and Central TMS; Video Detection Systems & display; CCTV cameras; incident detection; and TMC design.

<www.uidaho.edu/ncatt>
The University of Idaho maintains a site on video-based traffic detection which provides information on manufacturers of equipment, links to end users and a forum for discussion of the advancing technology.

<www. epic.org/>
The premiere information source for privacy issues in the U.S.

<www.eff.org/>
The Electronic Frontier Foundation confronts challenges to civil liberties in our increasingly digital world. They recently wrote US DOT to protest the creation of the national ID.

(Surfer sign courtesy of Richard C. Moeur. Visit his Web site for the FHWA Manual of traffic signs at http://members.aol.com/rcmoeur/signman.html)

Posting the Safest Variable Message Sign

By Nazy Sobhi, Federal Highway Administration

In areas with large numbers of variable message signs (VMSs), traffic management center (TMC) operators often have a tough time deciding what messages to post, where to post them, and when to change or delete them. Automating VMS systems management may help, but how much automation is needed?

Recent research shows automated support systems improve TMC operators' performance in identifying and responding to incidents. These systems allow operators to respond more quickly and accurately to freeway incidents.

This finding echoed those of earlier experiments on the effectiveness of automated support systems. In discovering these findings, two primary human factors were researched (1) whether an automated traffic control system (ATCS) that supports VMS management improves operator and TMC performance, and (2) whether a support system that automatically posts a system of messages is more effective than a system that recommends the messages but requires operator approval before posting.

Groups of subjects representing TMC operators were tested on their handling of realistic traffic management scenarios in the Traffic Management Center Human Factors research Simulator. Three different support system configurations were tested. Subjects in the No ATCS group had no automated support systems available to them. Subjects in the ATCS Suggest group had an ACTS configured to generate a suggested VMS message response plan within 30 seconds after the IDLA reported an incident. The operator had to accept, reject, or modify the VMS messages before they were posted. Subjects in the ATCS Post group had an

(Continued on page 15)

Photo by Peg Skorpinski

When the Rubber Hits the Road

By Robert K. Sandwick

For the past five years, Rubberized Emulsion Aggregate Slurry (REAS) has been successfully applied to pavements in Southern California to protect the asphalt of streets and highways as well as parking lots and airports. This relatively new product, which incorporates finely ground rubber from discarded tires, has been well received by cities and counties throughout the state. The City of San Diego has applied 90 million square feet of REAS over the past two years. The Los Angeles County Public Works Department has applied this product to more than 75 million square feet of streets and highways, as well as on all the paved surfaces at El Monte Airport, including runways, taxiways, airplane tie-down areas and parking lots.

Local agencies report good results from pavement maintenance using Rubberized Asphalt Slurry Seal.

According to Harry W. Stone, Los Angeles County Department of Public Works, test results indicate that REAS "has the potential to decrease the maintenance frequency for re-

(Continued on page 15)

State and National Events

11th Annual California Childhood Injury Control Conference
Sponsor: California Office of Traffic Safety
Oct. 6-8, Marriott Mission Valley, San Diego
Contact: Janice Yuwiler 619/ 594-3691

Integrating Transit and Traffic ITS Applications
Sponsor: National Transit Institute
Oct. 14-16, Oakland, CA
Contact: Eric Bruun 732/ 932-1700 ext. 18

ASCE 1998 Annual Convention
Sponsor: American Society of Civil Engineers
Oct. 18-21, Boston, MA
Contact: Meggan Farrell 703/ 295-6078

OTS Traffic Safety Summit
Sponsor: California Office of Traffic Safety
Oct. 18-22, Los Angeles
Contact: OTS 916/ 278-4830

Reinventing Transit: Using Information Technologies to Reinvent Transit Services
Sponsor: National Transit Institute
Oct. 19-20, Oakland
Contact: NTI 732/932-1700

5th Annual United States Hot Mix Asphalt Conference and SuperPave Workshop
Sponsor: National Asphalt Pavement Association
October 29-31, Phoenix, AZ
Contact: Jennifer Thornberry 301/ 731-4748

33rd Annual Fall Conference
Sponsor: California Transit Association
November 11-13, Santa Barbara, CA
Contact: Karin Doerschlag 805/ 963-3364

CAATS 4th Annual Meeting
Sponsor: California Alliance for Advanced Transportation Systems
Dec. 2-4, Anaheim/Disneyland
Contact: Randi Dixon 916/ 449-9644

Statewide Travel Demand Forecasting Conference
Sponsor: Transportation Research Board
Dec. 6-8, Irvine, CA
Contact: Jim Scott 202/ 334-2965

AASHTO Annual Meeting
Nov. 6-10, Boston, MA
Contact: 202/ 624-5800

Transportation Research Board
Jan. 10-14, Washington, D.C.
Contact: 202/ 334-2933

Local Meetings

Bay Area Section, ITE
Contact: Steve Colman, 510/ 839-1742

Central California APWA Chapter
Contact: Jim Martin, 209/ 224-1674

Central California Section, ITE
Contact: Michelle Bitner, 805/ 861-2191

Central Coast APWA Chapter
Contact: Christine Ferrara, 805/ 542-9840

City Traffic Engineers' Association
Oct. 14, Dec. 9
Contact: James T. Harris, 909/ 477-2740 Ext. 2370

East Bay Traffic Engineers
Oct. 8, Nov. 12, Dec. 10
Contact: John Templeton, 510/ 671-3129

Los Angeles City & County Engineers' Association
Oct. 1, Dec. 3
Contact: Desi Alvarez, 562/ 904-7102

Monterey Bay APWA Chapter
Contact: G.H. Nichols, 408/ 755-4815

North Bay Engineers Club
Contact: Paul Wiese, 707/ 421-6072

Northern California APWA Chapter
Oct. 16, Nov. 20, Dec. 18
Contact: Merrily Burger, 510/ 339-8659

Sacramento APWA Chapter
Oct. 2, Nov. 6, Dec. 4
Contact: Timothy Fleming, 916/ 381-9100

San Diego/Imperial APWA Chapter
Oct. 8, Nov. 12, Dec. 10
Contact: Steve Wallace, 619/ 533-4102

San Luis Obispo Branch, ASCE
Oct. 15, Nov. 19, Dec. 17
Contact: Dean Benedix, 805/ 239-3127

South Bay Area APWA Chapter
Oct. 21, Nov. 18, Dec. 17
Contact: Jim Fiedler, 408/ 256-2607 Ext. 2080

Southern California APWA Chapter
Oct. 22, Nov. 13, Dec. 11
Contact: Rod Haraga, 213/ 847-8769

Ventura County APWA Chapter
Contact: Craig Prentice, 805/ 650-7000

If your professional organization meets on a regular basis, let us include it here. Call Linda Ohotsky at (510) 231-9590 or write to Institute of Transportation Studies, Technology Transfer Program, 1355 South 46th Street, Bldg. 452, Richmond Field Station, Richmond, CA 94804-4603.

Hot Parking Issues

A bibliography compiled by Catherine Cortelyou of the Harmer E. Davis Transportation Library, Institute of Transportation Studies

For these materials, write to Interlibrary Lending, ITS Library, 412 McLaughlin Hall, University of California, Berkeley, CA 94720-1720; telephone us at (510) 642-3604; send a fax to (510) 642-9180 or e-mail us at itslib@uclink4.Berkeley.edu.

Charging for Parking in Suburban Areas: Case Studies of Worksites in King County, Washington
By Diana Ehrlich. Paper presented at the 75th Annual Meeting of the Transportation Research Board, Washington, D.C., 1996. 24p.

Trip reduction ordinances, parking shortages and changes in worksite location are motivating an increasing number of suburban employers to implement employee parking fees. Seven major employers who charge employee parking fees were surveyed and compared on the basis of parking, site, and business characteristics. It was found that implementing an employee parking fee in suburban areas can encounter a number of obstacles. These are described, and broad recommendations are given for instituting a suburban parking fee program.

Trip Generation and Parking Requirements in Traditional Shopping Districts
By Ruth L. Steiner. Paper presented at the 77th Annual Meeting of the Transportation Research Board, Washington, D.C., 1998. 21p.

Six traditional shopping areas in the Berkeley-Oakland area are compared for their trip generation and parking demand in order to test the claims of "new urbanists" that neo-traditional neighborhood design will reduce the need for automobile access and parking. It was found that these shopping areas may be so successful that the higher level of overall activity in the shopping areas offsets trips by modes other than autos, in part because the areas attract a significant number of customers who do not live in the adjacent residential areas. Finally, it is noted that the ITE's trip generation rates do not provide an adequate match for this type of shopping area.

"Downtown Traffic and Parking Needs Related to Downtown Economic Trends"
By John D. Edwards. Washington, D.C., Transportation Research Board, 1996. *(Transportation Research Record 1552)* pp.107-111.

Many small towns (under 50,000 population) in the U.S. have suffered a decline in the economic vitality of their downtowns since the 1950's. This article argues that the corresponding declines in traffic volumes and parking demand allow for a re-thinking of traffic controls and re-design of the downtown area into a more pedestrian-friendly environment and provide a stimulus to revitalization. Examples of changes in traffic and parking needs are given, and suggestions are made for improvements to accommodate them. Recognizing these changes, the author argues, can be important to the survival of downtowns.

"Using Intelligent Transportation Technology to Make the Parking Industry Smarter"
By Roger M. Carlton. *Parking*, vol. 36, no. 2, February 1997, pp. 34-37.

Automatic toll collection technology is being used to collect parking garage fees at a Costa Mesa office, shopping and entertainment complex. This project allows commuters to pay for their parking with the same windshield-mounted transponder they use to pay their highway tolls. This brief article notes the growth of automated toll collection throughout the U.S. and suggests that, while it might be prohibitively expensive to implement the use of transponders for parking access independent of toll collection, value and convenience are added for customers when toll authorities and parking operators share a customer base. The inference is that these new technologies offer opportunities for joint development.

"Toward a Common Parking Policy: A Cross-Jurisdictional Matrix Comparison of Municipal Off-Street Parking Regulations in Metropolitan Dade County, Florida"
By John Bradley. Washington, D.C., Transportation Research Board, 1996. *(Transportation Research Record. 1564)* pp. 40-45.

Localized parking policy changes may simply chase parking users from one place to another, increasing total VMT rather than reducing it. In an effort to promote regional approaches that take into account the impact of parking policies on transportation problems, this study was designed to show in matrix form the off-street parking requirements regulated by local municipal zoning ordinances within a region and to identify basic parking policy issues to serve as starting points in joint development of a regional parking policy.

"My Own Private Idaho: Staking Claims to the Public Streets"
By Steven N. Gofman. *Journal of Transportation Law, Logistics and Policy*, vol. 64, no. 4, Summer 1997, pp. 495-505.

Legal and emotional issues surrounding neighborhood residential permit parking are reviewed in this lively survey of court cases and neighborhood conflicts. The author's biases are readily apparent ("...resident-only parking makes it harder and harder for the average person to park anywhere but in his or her own neighborhood...") but the alert reader will find many points on which to base local implementation and administration — or revocation— of residential permit parking. STOP

An Update on Roundabouts

Modern Roundabout Practice in the United States
Washington, D.C., Transportation Research Board, 1998. (NCHRP Synthesis of Highway Practice 264) 73p.

Available from the Transportation Research Board— $23.00
Phone orders: (202) 334-3214
Fax: (202) 334-2519

This new report on state-of-the art roundabouts practice presents findings from a survey of North American State and Provincial DOT's. The publication describes the principles and design of modern roundabouts, working examples and discussion of such issues as safety performance, capacities and delays and non-motorized users. Many resources are listed for additional information.

THE SAFEST VARIABLE MESSAGE SIGN

(Continued from page 12)

ACTS configured to generate and automatically post a message or series of messages within 30 seconds of an incident report. Notification of the posting was sent to the operator for verification. Findings show that given sufficiently reliable support systems, the ATCS should be configured to post the incident-related messages directly to the signs without waiting for operator approval. The results demonstrated that operator review of suggested messages creates significant delays in posting time-critical messages. In addition, little or no improvement in message quality or accuracy results from the required operator review.

Reprinted from *Research & Technology Transporter*, August 1998, FHWA, Nazy Sobhi, Highway Research Engineer.

WHEN THE RUBBER HITS THE ROAD

(Continued from page 12)

coating asphalt surfaces while providing a highly skid resistant surface." At El Monte Airport, for instance, the surfaces show no wear even though it has been 4 1/2 years since they were applied. The seal coat is continuing to provide uniform coverage and maintain its dark color. Other products used to seal coat the airport pavements have not performed this well over a comparable time period.

To produce REAS, finely ground rubber from discarded tires is introduced into an anionic asphalt emulsion along with a polymer modifier to stabilize viscosity, setting and curing characteristics of the slurry mixture. Obviously this recycling of used tires into a useful product provides an environmental side benefit. One tire finds its way into approximately 750 square feet of REAS. This translates to about 85 old tires being used for one 12 foot lane mile of seal coat.

Advantages of REAS

Three gradations of aggregate are used for REAS: Fine Aggregate, Type I and Type II. The Type I and Type II aggregate gradation is the same specification used in non-rubber slurry seal and has been used successfully on major highways as well as local streets.

A REAS slurry mix uses twice as much emulsion as is used in conventional slurry seals. A standard wet track abrasion test is necessary to certify the formulation of the REAS slurry mix. The results have exceeded the same tests for the non-rubber emulsion slurry. This translates into a longer life in the field.

Other benefits to REAS include an extremely black color due to the carbon black that is added to the rubber of tires when they are manufactured. The black color of the seal coat is retained for over five years after application and provides a high contrast for painted traffic markings. This in turn provides for safer roads. The added polymers fortify the REAS to provide a superior water barrier to protect the asphalt pavement. Another benefit is protection from the sun's ultra-violet rays, which can deteriorate the underlying asphalt pavement.

REAS is easy to apply. Because it is used with 1/8-inch aggregate rather than 1/4-inch, it forms a thinner layer than non-rubber asphalt emulsion slurry, allowing it to set in the same amount of time as the non-rubber product. This occurs without the addition of an accelerator or retarder which often becomes necessary for non-rubber slurry seal.

Regular slurry seal develops scuff marks caused by tires reacting to power steering. This recurring problem requires frequent returns to the project site to reapply the slurry seal in the scuffed-up areas. Where REAS is used, very few scuffed areas require repairs.

REAS may be applied with standard continuous flow slurry seal equipment or by hiring the services of a central mixing plant and its distributor trucks. Application with continuous flow equipment would be the same as applying traditional slurry seal, with an on-board mixer discharging the slurry mix into a screed for uniform application onto the pavement.

A Central Mix Plant

Petrochem Marketing, Inc. has set up a central REAS slurry mix plant located at the Industrial Asphalt site in Irwindale, California. From there the company can dispatch the REAS mix in special trucks with a built-in agitator to keep the material mixed while it is being transported to the job site. A spreader box is attached to the rear of the truck so that the slurry mix can be deposited from the tank for spreading onto the pavement. A water tank and spray bar is also built onto the truck at the front end to dampen the pavement before applying the material.

The advantage of this portable system is that it allows any size project to be slurry sealed, so the local agency can rent the necessary equipment and perform the application when desired. The local agency does not need to maintain a stockpile of aggregate near the project. The installation of more REAS slurry mix plants in California is planned.

What is the life of REAS compared to traditional slurry seal? Joel Halbert, recently retired as Materials Engineer for the City of San Diego, has been involved with the use of this product on San Diego's streets. He states that the nearest source of crushed granite aggregate suitable for slurry seal was in the Riverside area, some 90 miles away. Before REAS, Mr. Halbert said, San Diego had to reseal pavement after 3 or 4 years. But test strips of REAS placed about 4 1/2 years ago in San Diego still retain the black seal coat, and it appears that the seal will last at least 6 years. Mr. Halbert stated that the extended life of REAS over the long haul outweighs the fact that it costs approximately 15% more than traditional slurry seal. For that reason, the City of San Diego is spending $5 million dollars per year for its Rubberized Emulsion Asphalt Slurry Program.

Specs Available

The 1998 Supplement of the "Standard Specifications for Public Works Construction" (Green Book) has added Section 600-3.2 Rubberized Emulsion - Aggregate Slurry to the Specifications. The Supplement may be purchased from Building News, 1612 South Clementine Street, Anaheim, CA 92802. The phone number is (714) 517-0970.

To summarize, it appears that the REAS slurry seal is truly a miracle product which provides many benefits, including the diversion of used tires from waste sites back to the streets. Another advantage is that the long-lasting, thinner, tighter, emulsion-rich, continuously black product creates a blacker surface. This provides a superior contrast with pavement markings, making them easier to see, which in turn leads to safer streets and highways for the motoring public. REAS is also more cost-effective as an asphalt pavement protection material than normal slurry seal. For all these reasons, we shall probably see more rubber hitting the roads in the near future.

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50th Annual Symposium Looks to the Future

Our 50th Symposium, "Envisioning the Future: Trends and Transformations," will be held Thursday, Oct. 22 and Friday, Oct. 23 at the Radisson Hotel in Sacramento. Supported by Caltrans, the American Public Works Association, the Institute of Transportation Engineers and the County Engineers Association of California, it offers exciting new presentations for anyone interested in the latest developments in transportation practice.

The featured speaker is David Pearce Snyder, Lifestyles editor of the *The Futurist* magazine and a social forecaster whose seminars have been attended by representatives of many Fortune 500 companies. His interactive presentation promises to stimulate symposium attendees with a compelling and dramatic portrait of the demographic, socioeconomic and technological realities that will shape the future of transportation in America.

Features:

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- a small-town and rural communities track especially designed to meet the needs of these areas
- a poster session showcase for agencies to highlight special projects and to network with participants

Two plenary sessions

- Building Public Support for Transportation Projects
- Emerging Tools and Advanced Technologies: The New Mobility

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Small Town/Rural Communities:
What Managers Need to Know; Best Practices in Traffic Engineering; Improved Technologies for Pavement Management and Maintenance

For a brochure or more information, call (510) 231-9590.

- On-site registration is $175, or $45 for students (without lunch).
- The regular symposium registration fee includes lunch and a reception on Thursday.
- Pre-conference workshops run Wednesday afternoon and cost $50.
- Rooms at the Radisson may be reserved by calling (916) 922-2020.

For more program details, visit our Web site at www.its.berkeley.edu/techtransfer.

See you there!