TSB NEWSLETTER

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Hello, and welcome to the first of many *Technical Standards Branch Newsletters*. One of the challenges we are currently facing in these rapidly changing times, is how to keep everyone in the loop on what's going on, without being found guilty of information overload. Our attempts at keeping all staff advised of the many new things we are doing include Regional "tours", Tech Talks, and seminars, etc., but these vehicles are only partially successful in our technology transfer, and information exchange efforts.

This newsletter is intended to fill in the gaps we have in our current initiatives. The articles you will see will be technical in nature (but not "too" technical). They will be current, short, and designed to keep everyone up to speed on where we are with trial projects, new materials, and advances in planning, design, construction and maintenance techniques. Each article will also refer you either to the location of a detailed report, or the name of the "key people" involved, should you need further information. The newsletter will only be published when there is enough information of genuine interest to our staff, but having said that, we expect there will be three or four issues a year. Of course, the material in the newsletter will only "whet your appetite" and will not take the place of more detailed reports, which we produce at the end of all our trial projects, materials testing, and other research efforts. However, it is our hope that this medium will keep you in the loop on current events. So enjoy the read!

Tim Hawnt
Editor-In-Chief

"Rube Goldberg is the (R) and (c) of Rube Goldberg Inc." [1]

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C-TEP RESEARCH PROGRAM
Allan Lo

Since its beginning in 1998, C-TEP (Centre for Transportation Engineering and Planning) has co-sponsored nine research projects to the tune of $156,500. Underlined projects are linked to the C-TEP web pages that contain more detailed descriptions.

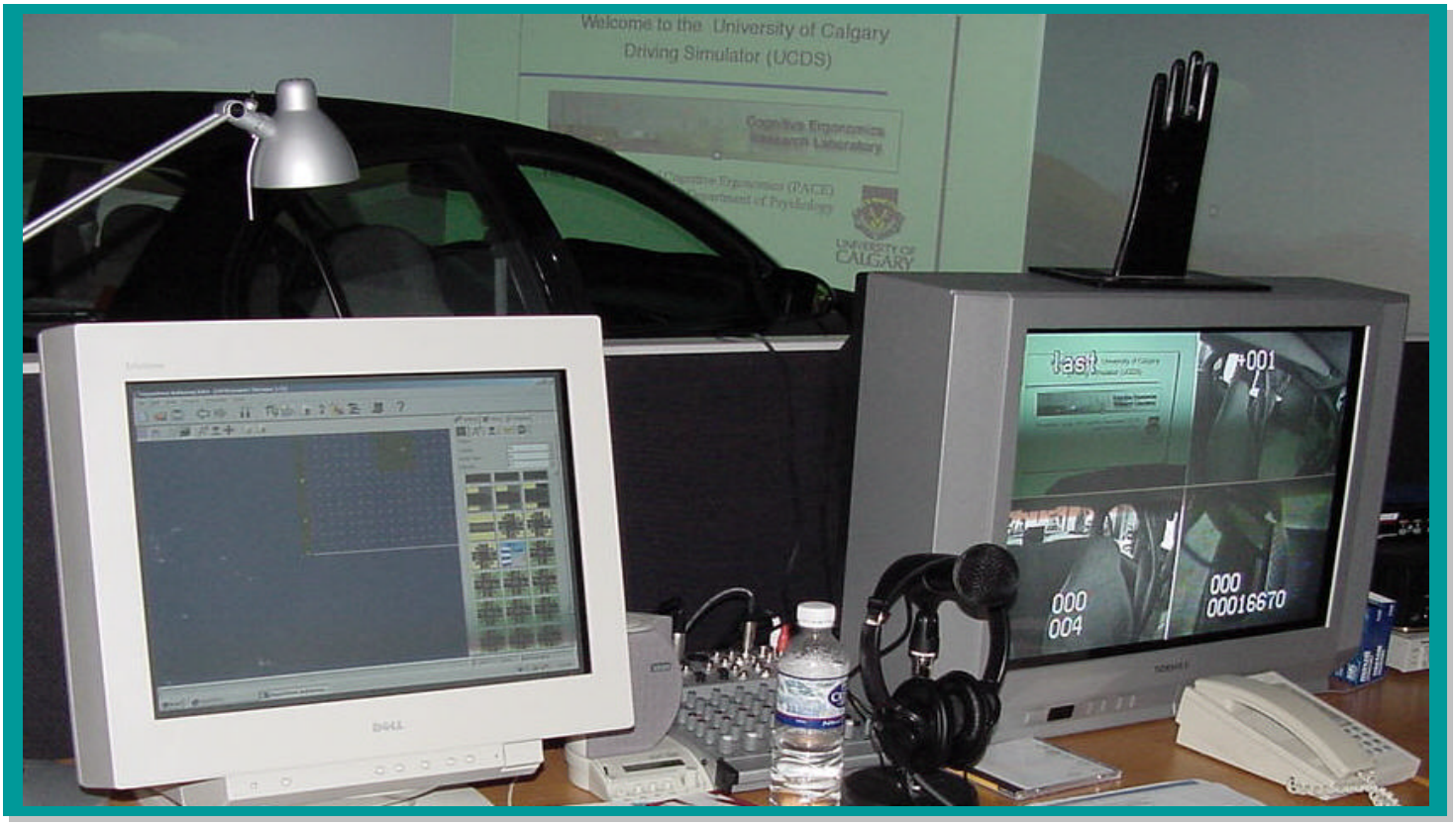
Fibre Optic Monitoring of GFRP Grid in Calgary
Rehabilitation of Reinforced Concrete Bridge Girders
Cracking Concrete Resulting from Restrained Shrinkage
Collisions at Right Turning Roadways with Yield Signs
Microscopic Traffic Simulation on Deerfoot Trail
Reducing Wildlife Vehicle Collisions
Dynamic Stability Analysis of Logging Trucks
Traffic Accident Reconstruction Using GPS
University of Calgary Driving Simulator (see photo)

Reports are available for three completed projects – Right-Turning Roadways, Concrete Cracking, and Logging Truck Stability, plus an interim report for Accident Reconstruction Using GPS.

Under the chairmanship of Tim Hawnt, the C-TEP Research Committee made a general call to its members in February to solicit ideas for new research topics. Based on these ideas, the Committee is working on three potential candidates for proposal development – rut-resistant pavements for urban intersections, pavement preservation strategy best practice study, and signal controls for dual left turn lanes.

On another research note, C-TEP recently joined forces with the federal government, the University of Calgary (U of C), and the Alberta Motor Association (AMA) to co-fund a newly created Canada Research Chair in Road Safety. With the federal government providing the seed money, C-TEP and AMA stepped up to contribute additional funding to help ensure this Chair is fully endowed for perpetuity.

"The primary goal of the new chair will be to create national expertise in research and training related to traffic safety, including the promotion of:



- multi- and interdisciplinary research into road safety in Alberta;
- technology transfer as it relates to best practices in road safety engineering and planning;
- a systems approach to road safety including all aspects of road design and planning;
- the development of quantifying safety benefits related to life cycle costs and associated safety benefits or trade-off;
- improved road safety data quality through intelligent transportation systems technology;
- a national forum for road safety practitioners."

The excerpt is taken from AMA's announcement in November 2001.

The worldwide search for the chair candidate has already begun and is expected to have the person in place later this year. Jeanette Espie-Lefebvre from Transportation Safety Services is the department's representative on the selection committee.

COLLISION DATA ANALYSIS USING SAS PROGRAMS

Francis Wu

The Highway Engineering Section has a powerful statistical tool to analyze collision data stored in the Alberta Collision Information System (ACIS) database. A consultant developed this computerized tool by using SAS - a specialized software suite consisting of statistical programs and database management. SAS was chosen because of its capability to manipulate large volumes of data and its flexibility to perform many standard statistical analyses. With this new tool, we can analyze the type, frequency and severity of collisions at a particular location or along a segment of highway, in order to identify locations where safety improvements may be needed.

While the Transportation Safety Services Division produces province-wide collision statistics for Alberta using ACIS, highway engineers often need to relate collision statistics to specific locations and their roadway geometry. Through the newly developed SAS programs, highway designers and planners can now calculate average collision and severity rates over a five-year period for any highway control section. We can also compute and compare the means and standard deviations of collision rates for groups of highways with similar geometric designs such as multi-lane or undivided highways, and by different levels of Average Annual Daily Traffic (AADT). Similarly for "special location monitoring" at intersections, interchanges, bridges or curves, the programs can generate separate sets of results. On an annual basis, all highway control sections and special monitoring locations are collectively ranked in order of their safety improvement needs.

Ad-hoc queries can also be performed on any segment of the highway system as long as the highway number, control section number and the start and end kilometre values of the segment in question are known. This facilitates the computation of road user costs for specific projects that require a cost-benefit analysis.

This tool saves highway designers and planners valuable time by providing packaged or custom designed crash analysis reports within minutes as opposed to hours or days using the manual methods. The programs are accessed similar to other Windows-based applications. Currently, the Highway Engineering Section only has two SAS software licenses and since interpretations of the results are often needed, all ad-hoc requests for highway-related collision analyses should be channeled through to Bill Kenny at (780) 415-1048.

TO SALT OR NOT TO SALT
Moh Lali and Allan Lo

We don't have many choices when it comes to maintaining our highways for year-round travel. Road salts are a staple for many agencies in combating icy roads. It is plentiful, effective and by far, the cheapest substance available. Unfortunately, as our vehicles' bodies may show, it is not the most environmentally friendly material. Concerns about the harsh effects of salts on the soil and water sources prompted an extensive five-year assessment by Environment Canada. The findings concluded that road salts are toxic to the environment and should be added to the Priority Substances List 2 (PSL2) under the Canadian Environmental Protection Act (CEPA). However, this is still being debated and the designation has not been finalized. More information is available at http://www.ec.gc.ca/press/000811_b_e.htm.

What immediate impacts will the designation have on this department and you as a driver? Not very much at first, here are some key points:

- Although Environment Canada is declaring road salts as a toxic substance, Environment Canada does not plan to ban its use on roadways.
- Road salt is NOT toxic to humans.
- Road safety will not be compromised.
- Alberta is a light user of road salts, compared to other jurisdictions.

On a longer outlook, there are steps being taken nationally and in Alberta:

- The Transportation Association of Canada (TAC) has developed a primer on road salts as well as a recommended communications plan (http://www.tac-atc.ca/roadsalt/roadsalt.htm).
- A TAC Road Salt Working Group was formed to develop a Road Salt Management Action Plan. This group has representatives from federal, provincial and municipal governments across Canada. Moh Lali and Don Snider are the department's representatives.
- As of 2002, Alberta highway maintenance contractors are required to submit salt management plans for department owned facilities as part of their contract obligations.
- Alberta Transportation, Alberta Infrastructure and Alberta Environment are working together to prepare a formal action plan to address salt contamination at highway maintenance yards.

Under CEPA, the Government of Canada is legally bound to act within a two-year window to develop management measures to reduce the impact of road salts, and a further 18 months afterwards to implement the measures. During this period, the Road Salt Management Group will endeavor to provide input to Environment Canada on what measures are reasonable and feasible without incurring economic hardship. This is why the Road Salt Management Action Plan will be an important milestone as it will demonstrate the transportation sector's commitment to Best Management Practices and provide a basis for Management Instruments under CEPA.

We have also started to investigate some potential innovative tools:

- Road Weather Information System (RWIS) – a suite of atmospheric and road sensors designed to furnish actual weather and road data which is then used to generate an accurate forecast of impending weather and road conditions. We have "inherited" five installations from the City of Calgary along the Deerfoot Trail.
- Pre-wetting procedures – the concept is to spray a liquid chemical such as calcium chloride onto the sand/salt mixture prior to spreading. At the right temperature, the chemical will cause the grits to adhere to the road, providing more effective snow-melting/ice-breaking actions than loose sand and salt. A pilot with all the maintenance contractors began in 2001/02.
- Snowplow tracking using Global Positioning System (GPS) – while the idea behind this project is to create more accurate work tracking and invoicing system, the potential is there to monitor and manage use of salt. Tests took place last winter.

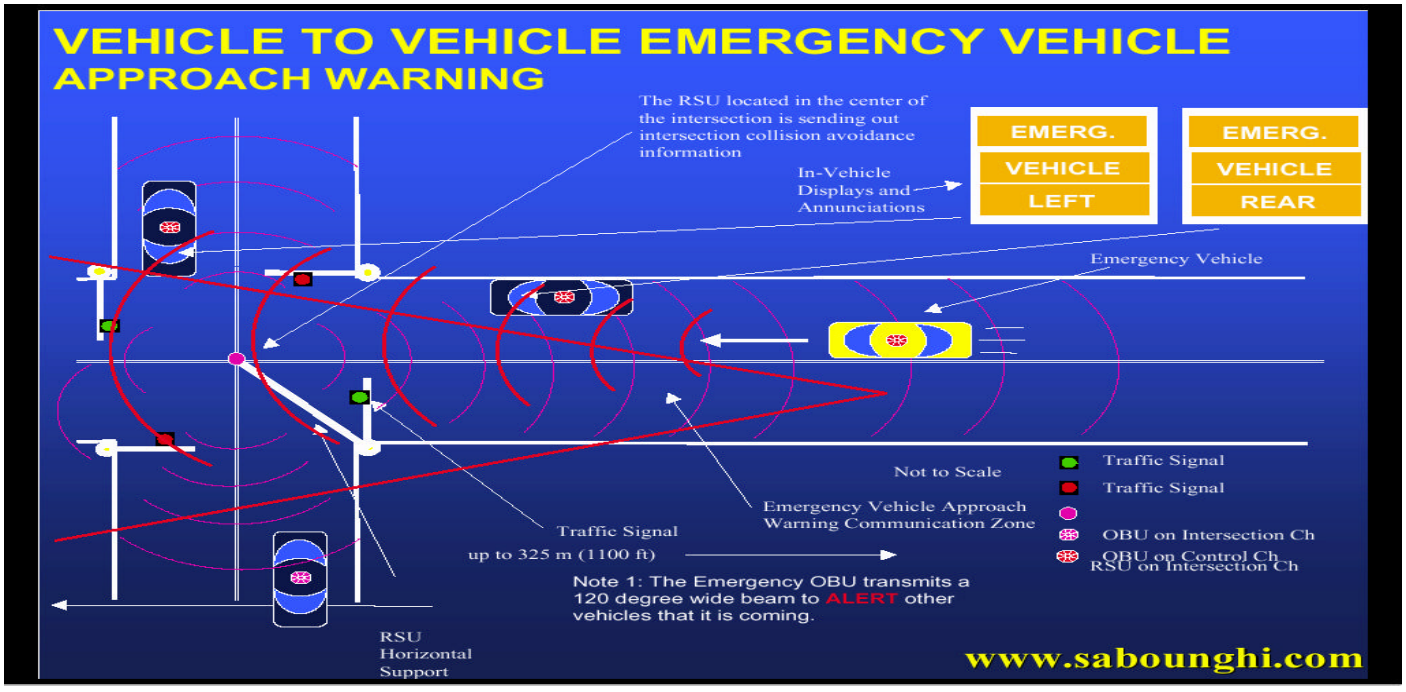
WELCOME TO A DSRC FUTURE!

Allan Lo

In the coming months, the department will be sponsoring a major study on the potential uses of Intelligent Transportation Systems (ITS definition: http://www.trans.gov.ab.ca/Content/doctype52/production/ITS%20Strategic%20Plan.pdf). Through a series of short articles, I hope to de-mystify some of the ITS technologies, and explain how their applications may impact us as drivers and the department as a whole. To kick it off, I will talk about a little-known technical development that will have a substantial impact as the title boldly suggests. Dedicated Short Range Communications or DSRC for short stands for wireless communication between vehicles and roadside equipment. This communication is generally restricted to a localized zone (less than 100 m). One of the most recognizable applications is electronic tolling at modern tollbooths around the world. If the department wishes to deploy weigh-in-motion and vehicle identification systems for commercial carrier compliance checks, DSRC equipment will be needed; if and when the federal government is prepared to create an electronic border crossing at Coutts, DSRC standards will need to be specified.

One important objective for developing DSRC standards (as petitioned by the ITS America organization) is to ensure interoperability between different manufacturers' equipment. At present, a truck driver operating in the US has to carry several transponders or tags (transceivers that send/receive data to the roadside readers) in order to pay tolls electronically on various turnpikes.

The road to standardization began when in 1999 the US Federal Communications Commission (FCC) allocated the range of 5850-5925 megahertz (MHz) for DSRC uses only. Then, during last fall, the DSRC standards received another boost when the DSRC 5.9 GHz Standards Writing Group selected the IEEE 802.11a R/A as the preferred wireless technology. IEEE stands for the Institute of Electrical and Electronics Engineers, and in the spectrum of wireless protocols, the 802.11 protocols are in between the long-range wide area network (WAN) and the bluetooth personal network standards. With the embrace of these standards, people from inside the industry such as Dick Schnacke of TransCore (a US firm specializing in electronic tolls and other ITS technologies) are predicting an explosion of other non-traditional uses of this technology.



"Imagine the following:

- Warning messages, like 'Icy Bridge Ahead' or 'Traffic Accident Ahead', sent to your vehicle in time to allow you to make decisions and take action;
- Beacons placed at work zones and other pedestrian areas, sending messages to your car and warning when there are people in the roadway;
- A beacon in your garage, using the Web-connected home computer to update vehicle systems before you leave for the day. If the home system knows your schedule, it can update many onboard systems, including appointments, weather advisories, route guidance (including transient problems)…"

The next-generation of DSRC will mean longer-range capability (100 to 300 m), a much wider bandwidth (75 MHz) and operating at higher throughput (6-10 Mbits per second and more). Greater memory capacity and more secure transactions will be possible, leading to many more applications: "safety warnings of many kinds, map database updates, dynamic route guidance, weather advisories, mobile Internet, entertainment downloads, transit and emergency vehicle signal priority/preemption (see diagram on previous page), and intersection collision avoidance."

When will we actually see some of this taking place on our highways? For one, Industry Canada still has to adopt the same frequency allocation as the Americans. This is being pursued through the efforts of ITS Canada and the industry, and the frequency allocation should occur relatively soon. Some experts predict that new vehicles with built-in DSRC devices will start appearing in the US as early as 2004. That future is not far off!

(Quotations are reprinted from a *Tolltrans* article with the permission of Dick Schnacke; the diagram is courtesy of Dr. Lewis Sabounghi.)

INNOVATIVE VIDEO TECHNIQUE FOR OVERHEIGHT COLLISION MONITORING

Ed Kowal

An innovative video monitoring system is being developed to detect and report overheight collisions under highway overpasses. The first system of its kind was installed at the Leduc overpass of Highway 2/2A. Consisting of four progressive scan cameras and a computer, the system captures and transmits video images onto a secured Internet web-site and provides telephone and e-mail notifications of overheight load impacts.

While the department has installed standard *overheight warning systems* at this and other overpasses, collisions and heavy damages continue to occur (see photo of damages to a steel girder). These overheight warning systems, based on radio waves or light sensors, are placed well in advance of the structure to trigger roadside warnings whenever an overheight vehicle breaks the invisible beam. Whether it was due to driver inexperience, inattentiveness or poor weather conditions, some of these warnings were not always heeded. In many instances the driver did not remain at the scene of the collision, leaving the owner of the structure to pay for the expensive repairs. These warning systems are also plagued by false alarms due to rain, snow, fog, wind, and birds.

The key to the new collision monitoring system is the patented SoundPrint® Acoustic Monitoring Technology, a world-class innovation conceived and developed by a Calgary firm, Pure Technologies. It was invented in 1994 to specifically address corrosion concerns in unbonded building and parking structures in Western Canada. Working on the principal that acoustic energy is released when a prestressed wire breaks inside the concrete structure, and by installing an array of sensors to "listen" for these sound waves, and developing software to interpret these signals, SoundPrint® can provide continuous monitoring for the entire length of the structure.

The company recognized there are other potential applications for this technology such as the overheight collision system. In addition to implementing full-motion video captures and high-speed data acquisition capability, they also altered the acoustic monitoring system to "listen" for collision impacts. The video system captures still images from multiple camera angles on a continuous basis (but the images are not kept permanently); at the precise moment the acoustic detection system registers a hit, the bufferized images of about 1-2 seconds (30 to 60 frames) from before and after the strike are immediately stored locally. Through a dialup modem connection with the Internet to Pure Technologies' secure web site, the digitized video images are transmitted and automated email alerts are generated.

Alberta Transportation personnel do have access to Pure Technologies' secure web site to review recorded events. The system is being expanded so that automated telephone calls may also be made to appropriate personnel to alert them that a strike has occurred.

Once the technology is proven to work accurately and consistently for this application, the system may become a reasonable means of recovering repair costs from overheight bridge strikes. Future installations will incorporate more real-time communications and other "smart" instrumentation to monitor not only incidents but other distresses within the structure as well.

For more information, contact Ed Kowal at (780) 415-8321 or visit the company's web site: http://www.puretechnologiesltd.com/

Video Camera

Overheight Load Struck Leduc Overpass

ASPHALT MIX TYPES REVIEW
Chuck McMillan

From 1990 to 2001 the department asphalt mix* requirement for many paving projects called for a premium mix type with manufactured fines (MF) and a 16 mm top-size. The 1990's requirements were based on an analysis of mixtures placed during the 1970's and 1980's and expectations of future traffic loading.

Industry feedback and department data and observation identified that premium mix types were being used on many projects where rutting would not be expected to be a concern.

In 2000, EBA Engineering Consultants Ltd. was awarded a contract to review the performance of existing mix types and to identify potential changes to the department's mix type selection process.

Although this study has not been finalized, the following observations were made:

- Pavements constructed from 1985 to 1995 are performing well
- Pavement rutting is not a significant problem
- Mix type specifications are conservative and capable of carrying more ESALs (Equivalent Single Axle Load) than allowed for by the current criteria.

As a result the following department mix types changes are recommended:

- Go to a single 16 mm high stability mix
- Add one 12.5 mm high stability mix
- Add two 12.5 mixes to replace Mix Types 3, 4, 5 and 6
- Add a 10 mm mix for thin lift overlays
- Add a large top-size mix for thick lower lift "specialty" mixes
- Add option to use modified asphalt on new construction projects
- Add option to use harder (120-150A) asphalt on some high ESAL roads.
- Adopt three Climatic Zones.

The mix type recommendations are based on:

- Alberta's experience with pavement performance
- High pavement temperature determined from Long Term Pavement Performance (LTPP) weather information
- Strategic Highway Research Program (SHRP) SuperPave ESAL traffic groups.

The proposed changes are expected to maintain the quality and service life of our pavements while reducing the amount of premium mix required. They will conserve aggregate and save money for the paving industry. The result:

- 70% reduction of 16 mm mixtures
- 40% reduction of 'high stability mixes' and
- 40% increase of lower stability mixes.

(Lower stability mixes have improved durability)

Additional changes are also required to materials and design specifications. Since the impact of a materials/design change is not fully understood the department will review each change independently during the summer of 2002.

*Asphalt Mix - Crushed heated aggregate mixed with asphalt cement.

For more information contact Chuck McMillan at (780) 415-4875.

If you have an interesting technical article or know of an interesting project that you like to share, we will be happy to hear about your ideas and newsletter-related comments.

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