



COLORADO DEPARTMENT OF TRANSPORTATION

# Research Newsletter

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## Online Research Reports

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## A New Look for Research

2007-1

Research has a new Branch Director, a new name, a new logo, and three new Program Managers. We are now the DTD Applied Research and Innovation Branch. Our new logo is on the left.

Jake Kononov, the new Branch Director, is an internationally recognized authority on highway safety and the author of a number of safety-related research papers. He has worked for CDOT for almost 25 years. Jake is a member of the Transportation Research Board and has served on numerous research study panels at the National Cooperative Highway Research Program. He has a PhD in Civil Engineering from the University of Colorado and teaches transportation engineering and PE preparatory seminars there.

Pat Martinek is the new Environmental and Planning Research Manager. She succeeds Roberto de Dios, who has taken over the position of Pavement Research Manager. Pat has worked for state government for over 20 years in hazardous materials, mine reclamation, uranium mill tailings remediation, solid waste landfills, sustainability, water quality, and transportation research. She has a BS from Western Washington University and an MS in Geology from Colorado State University.

Aziz Khan, the new Structures and Geotechnical Research Manager, has extensive experience in both public and private sectors (state, consulting, and academia). Prior to joining Research, Aziz worked for CDOT at the Materials and Geotechnical Branch and the Safety and Traffic Engineering Branch. He has a MS from the University of Pittsburgh, Pennsylvania and a PhD in Civil Engineering from the University of Colorado at Boulder.



*New staff, from left to right, Jake Kononov, Pat Martinek, Aziz Khan, and Rich Sarchet*

Rich Sarchet, the new Safety and Risk Analysis Research Manager, has worked for CDOT for almost 13 years. His CDOT experience includes materials testing, construction management and design, safety assessment, traffic operations analysis, and traffic operations engineering. He has a BS in Business Administration from the University of Northern Colorado, a BS in Civil Engineering from the University of Colorado, and an MS in Civil Engineering from the University of Colorado.

*Contact information and responsibilities for all Research staff:*

<http://www.dot.state.co.us/Research/Staff.htm>

## FY 2008 Research Program Highlights

A program of research projects for FY 2008 offers a broad spectrum of new ideas from how to improve worker's safety to how to improve CDOT's revenue prediction model. Highlights of the proposed FY 2008 research program are provided below:



### ***Investigation of the Characteristics and Practices of Organizations with Exceptional Worker Safety Records (Worker Safety)***

Some improvement in reported accident rates has been achieved at CDOT in the last few years, but CDOT's worker safety performance still has a lot of room for improvement. Approximately 14% of our work force is injured every year.

Some highway construction companies and government agencies are significantly and consistently safer than others. The aim of the proposed research is to identify organizations performing work of types similar to CDOT which have exemplary worker safety records, determine what characteristics differentiate these organizations from their peers, and identify ways in which CDOT can emulate the best practices identified to become an exceptionally safe organization.

### ***Comprehensive Risk Analysis for Structure Type Selection***

The structure-type selection process aims to minimize structure cost (materials and construction) with only general consideration of risks related to erection and traffic impacts of detours. Optimization of girder shape sometimes makes erection more difficult and introduces additional risks to the traveling public and the workers.

Indirect costs of detouring (including accidents and delay) and safety risk to workers are not explicitly considered. A quantitative risk analysis procedure is proposed to strike an appropriate balance between initial cost of the structure and cost related to detour and erection. This research effort will result in the development of a quantitative risk analysis procedure for the structure type selection incorporating comprehensive costs, both to CDOT and to public at large (worker and travelers' accidents, user delay times).

### ***Effective Selection and Application of Transportation Modeling Software***

Transportation modeling is costly and complex and software varies in capabilities. Deciding to model (or not) and which software to use has been difficult at best. CDOT engineers need guidance on how to make appropriate decisions and select the right tools. This research will produce a decision support analysis framework and flow chart to assist CDOT engineers with making modeling-related decisions.

### ***Safety Performance Functions for Intersections and Freeway Ramp Junctions***

Safety Performance Functions (SPFs) are state-of-the-art statistical models for prediction of expected accident frequency and severity. CDOT uses SPFs extensively for highway segments, but SPFs aren't available to date for intersections and ramp junctions. This research will calibrate suites of SPFs for intersections and freeway junctions. It will enable CDOT staff to make better decisions affecting intersection and ramp safety. Availability of new SPFs will improve CDOT's ability to identify intersections and ramp junctions with potential for accident reduction.

### ***Estimating Current and Future State Transportation Revenue***

CDOT's current revenue model is not sufficiently sensitive to the most recent trends in motor fuel consumption. Last year's prediction overestimated revenues (4-5%). Development of a refined model to improve CDOT's ability to plan for long- and short-term expenditures is proposed.

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## Roads Scholar Program - Happy “Sweet 16”

2007 marks the 16<sup>th</sup> year of the Roads Scholar Program at the Colorado Local Technical Assistance Program (LTAP.) The Roads Scholar Program has been hugely successful for Colorado LTAP and today, even after 16 years, remains the foundation of LTAP’s training program. Over 655 Colorado transportation professionals have graduated from the program, becoming “Roads Scholars,” 106 of them CDOT employees. The success of the Roads Scholar Program prompted the start of the Roads Scholar II program – the Supervisory Skills and Development Program which has had 29 graduates. Both programs require the completion of 9 one-day classes.

The Roads Scholar program provides participants training on transportation safety and local road maintenance for \$40 a class. By the way – this cost has not increased in 16 years! The Supervisory Skills

and Development Program is for those employees making the step up to Supervisor, each one-day class for this program is \$75. All one-day training programs include lunch.

Want to learn more about the Colorado LTAP program? Give them a call at 303.735.3530 or visit their website at <http://ltap.colorado.edu/> and check out the training opportunities they have lined up for this spring. Read the latest newsletter and sign up to be added to their mailing list.

The Research Branch oversees the Colorado LTAP program on behalf of the FHWA. The FHWA, CDOT, and CU-Boulder are all sponsors of the program.

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## EPA Recycling Grant Study

In October 2006, CDOT’s Environmental Programs Branch was awarded an EPA Resource Conservation Grant to help increase the national recycling rate by 5 percent, reduce and recycle industrial byproducts, reduce and recycle construction and demolition debris, and reuse and recycle waste tires. The study is now being overseen by the DTD Applied Research and Innovation Branch.

In January, a survey was sent to CDOT’s construction and maintenance engineers to evaluate how large tonnage materials are generated, reused, recycled, and disposed of on CDOT’s projects. The response was overwhelming, and the survey results now are being compiled to determine recycling rates, practices, and ideas.

The next phase of the study will be a literature search of how other DOTs and similar agencies are putting reusable industrial materials into their projects; what local Colorado markets and opportunities are available to CDOT; and what changes and training are needed to allow, promote, and better track increased recycling.

The goals of the study are to help CDOT reduce project costs, improve and maintain materials performance, improve public perception, comply with the Governor’s Greening Government Executive Order requiring more recycling, and improve the recycling rate of large tonnage materials. The study results should be available by September 2007.

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*Concrete recycling*

# Escape Ramp Revamp

On I-70, about six miles west of the Eisenhower Tunnel, is the most used truck escape ramp (TER) in the state of Colorado. On average, once a week a truck loses its brakes and enters the ramp at between 30 and 90 mph. The steep uphill arrester bed (the gravel in the TER) is uniform sized round aggregate about 1-1/2 inch in diameter. Runaway trucks are supposed to sink into the gravel, coming to a controlled stop, and be prevented from rolling back down the hill. But by late summer, 2006, it became apparent that this ramp was losing effectiveness. At least one truck continued the entire length of the ramp and stopped near the trees at the top. Another went 800 feet up the ramp and nearly went over the edge.



In August 2006, as part of a study to develop an aggregate gradation standard for CDOT's TERs, Staff Materials did gradation tests on samples from this ramp and 12 others throughout the state. The I-70 ramp aggregate is very evenly graded – like good road base. The consensus was that the mixing action of trucks in the ramp brought fine material up from below the arrester bed and combined it with the bed aggregate. Additional fine material washed into the arrester bed from the side hill above made the problem worse. As a comparison, the aggregate in the ramp on US-550 south of Silverton is very clean 3/4 inch to 1-1/2 inch rounded gravel. It's hard to walk on; a truck quickly sinks to its axles and has to be pulled out.

In September 2006, CDOT Maintenance put 18 inches of 1-1/2 inch rounded gravel over the old I-70 arrester bed and put concrete barrier on the left side of the ramp. Now, nearly every truck stops in the bottom 500 to 600 feet. Plans are underway to rebuild the I-70 TER. The new ramp will have concrete side barriers and a paved bottom to keep native soil out of the arrester bed and a system to contain spills. The new ramp will probably be widened to accommodate two trucks at once (an exciting occurrence that happens all too often).

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