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Research Development Technology Transfer

SCDOT

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The R D & T Newsletter

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SCDOT Holds Research Topic Solicitation Meeting

The South Carolina Department of Transportation (SCDOT) held its Research Topic Solicitation Meeting on April 22, 2008 in Columbia, SC. The purpose of this meeting was to identify needs in the Department that can be addressed by research and to develop a prioritized list of possible research topics for consideration by the SCDOT Research and Development Executive Committee (RDEC) for funding as studies in the State Planning and Research (SPR) Program. As in past meetings of this kind, over 100 people from the SCDOT, FHWA, USGS, academia, and industry participated. Logistical and administrative support for the meeting was provided by the Transportation Technology Transfer Service (T3S) at Clemson University.

To aid in the organization of this meeting, the Research Unit contacted the Department's upper management to identify appropriate personnel to participate in the meeting ensuring all areas of the Department were included and to determine which breakout group each should attend. A moderator from the Office of Materials and Research was assigned to each breakout group. The seven breakout groups included:

- Construction / Materials
- Maintenance / Bridge Maintenance
- Traffic / Safety
- Bridge / Road Design
- Project Development / Planning
- Business Operations
- Hydrology

The meeting began with an overview of the SCDOT research program followed by each participant attending one of the seven breakout sessions. The first breakout

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session was held before lunch and allowed each group to brainstorm ideas for possible topics. Following lunch, a second breakout session was held to prioritize topics identified in the morning session. A closing session with all participants was held to allow moderators to present a few of the high priority research topics from each breakout group.

There appeared to be a good deal of interest in the results from the breakout groups. It is not unusual to lose a large percentage of the audience for the closing session of any meeting. However, a large number of the participants remained to hear the breakout reports during the closing session. The high attendance indicates that the participants were interested in hearing about the priority research topics from the various breakout groups.

The meeting was considered a success, with approximately 125 potential research topics identified, forty-two of which were identified as higher priority topics. A "Champion" from the DOT was identified for each of the higher priority topics and problem statements prepared. The RDEC will ballot the research topics and develop a final prioritized list for funding.

A final summary report was prepared for the 2008 Research Topic Solicitation Meeting. A link to the report can be found on the Research Unit webpage at http://www.clemson.edu/t3s/scdot/index.htm. Or you may contact Mr. Terry Swygert by phone at (803) 737-6652 or by email at swygerttl@scdot.org to obtain a copy.

TRB Representative Visits SCDOT

One of the many activities conducted by the Transportation Research Board (TRB) is a state visitation program. Each member of TRB's Technical Advisory Staff is assigned three to four state DOTs to visit on an annual or biennial basis. Objectives of the visits include:

- learning of problems facing the state DOTs,
- learning of current research activities and exchanging information on similar research being carried out elsewhere
- identifying new methods and procedures that may be applicable elsewhere
- identifying innovative or experimental work that may not be widely published
- describing TRB's range of services to new staff at transportation agencies
- identifying potential candidates for TRB committees.

As part of this program, Thomas Palmerlee visited SCDOT on May 22-23, 2008. The Department's Research staff coordinated the visit and prepared the agenda. Mr. Palmerlee, TRB's Transportation Data Specialist, staffs committees in areas such as transportation and data information systems, automated systems, artificial intelligence, and library and information science.

During his visit, Mr. Palmerlee met with the Secretary of Transportation and the Deputy Secretary for Engineering as well as representatives from the offices of Mass Transit, Preconstruction, Planning, Traffic Engineering, Finance and Administration, Maintenance, and Construction. He concluded his visit at the Office of Materials and Research.

TRB TRANSPORTATION RESEARCH BOARD OF THE NATIONAL ACADEMIES

Life Cycle Cost Analysis for Pavement Design

If you've ever had to decide between buying a tire with a 40,000-mile warranty for $50 or buying a tire with an 80,000-mile warranty for $95, or some similar alternative, then you have made a life cycle cost decision. Perhaps your budget is kind of tight or maybe you are not going to keep the car that much longer. In that case, even though you get more miles per dollar on the 80,000-mile tire, you've probably chosen the 40,000-mile tire. On the other hand, you might cover a lot of miles and don't like taking time to shop for new tires. In that case, the 80,000-mile tire is probably for you.

Civil engineers making decisions about pavement investment are confronted with a very similar problem. Some pavement alternatives are expected to last longer than others. If the longer-lasting alternative is also cheaper to build, then the decision is easy. But, more typically, the longer lasting alternative also carries a larger initial price tag.

SCDOT has long performed life cycle cost analyses to try and quantify what is the best pavement investment. These analyses were of the "present value deterministic" type. That is, estimates were made of how much each pavement alternative cost, how long it would last until it needed rehabilitation, and how much future rehabilitation would cost. These future costs would then be converted to a "present value," which corresponded to how much money would have to be invested at a certain interest rate today in order to have the future amount when the time comes. The present value of the future costs would be added to the initial cost to come up with a life cycle cost that represented the overall long-term cost of the alternative. The life cycle costs of each alternative could be compared and used in the pavement selection process.

Unfortunately, when it comes to pavement, things are not quite that simple. Construction costs often vary from the initial estimate. Times to pavement rehabilitation are not consistent. This can be true even on interstate pavements where the lanes going in one direction can be significantly worse than those going in the other, despite having traffic, soils, construction materials, and pavement designs that are supposedly the same. Also, circumstances often dictate that needed rehabilitation gets delayed, changing both the timeline and future costs.

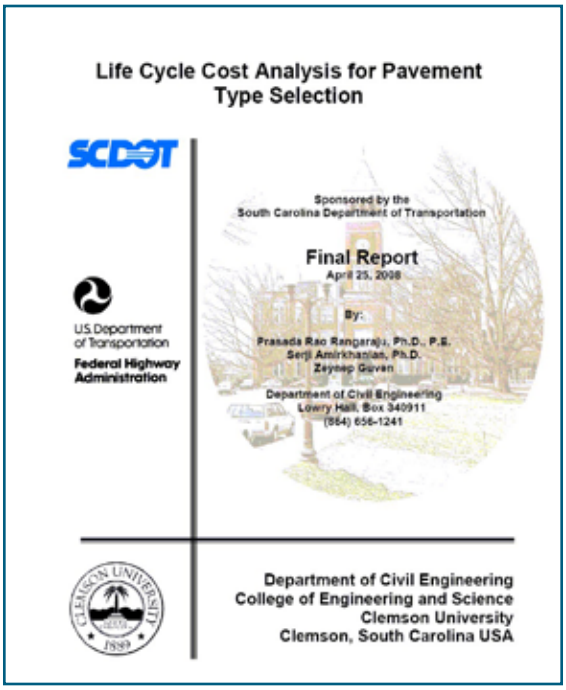
Despite this variability, in a traditional deterministic life cycle cost analysis the analyst has to assume one set of costs, one timeline, and one rehabilitation scenario. The final cost comparison in these situations is often so close that a minor change in assumptions can change the outcome of the cost comparisons. For this reason, SCDOT initiated Research Project 656, "Life Cycle Cost Analysis for Pavement Design," with Professors Prasada Rangaraju and Serji Amirkhanian of Clemson University.

The goals of the research were to establish the current state-of-the-practice by studying the life cycle cost analysis procedures of other state transportation agencies and then make recommendations on how SCDOT could improve its procedures. Their recommendation was that SCDOT should go to a "probabilistic" procedure that objectively considers the potential variability in costs and service life between pavement alternatives. This is done through a process called Monte Carlo Simulation where the various items in the analysis are assigned variability rather than a discrete value. A computer program, developed by the Federal Highway Administration, then takes each item and "rolls the dice" to come up with random values controlled by the assigned variability for each item.

The computer does this process thousands of times and compiles the results as a series of probability curves. So, instead of coming up with a black-and-white deterministic answer such as, for instance, "Alternative A will cost $3 more than Alternative B," the probabilistic analysis expresses the answer in terms of probability. So, the probabilistic outcome would be that, "Alternative A has a 25% chance of costing the same or less than Alternative B, a 50% chance of costing between $0 and $4 more than Alternative B, and a 25% chance of costing in excess of $4 more than Alternative B."

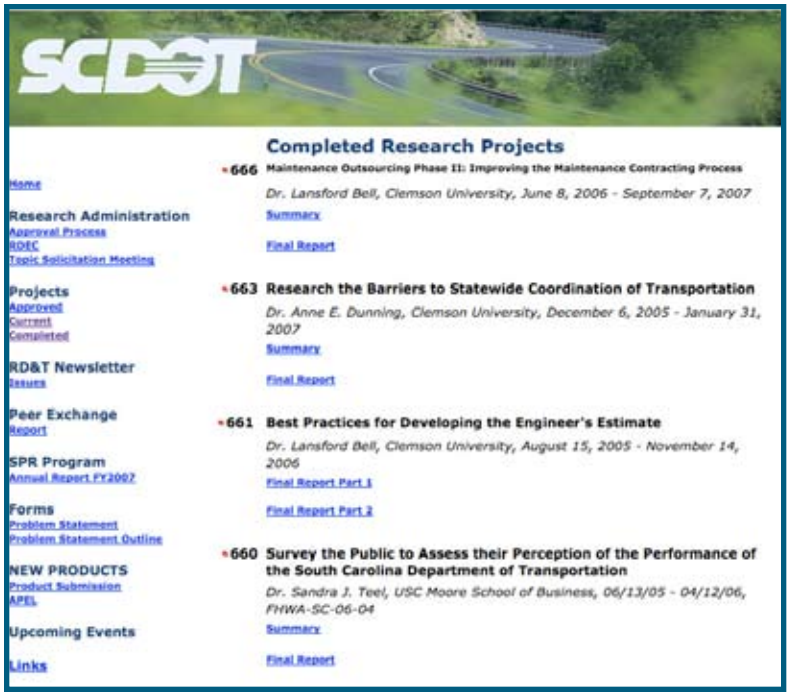
This gives the analyst a better picture of not only the typical cost difference between alternatives, but of the chances of the costs being more or less than predicted. SCDOT is currently working to develop the appropriate variability values for the analysis and implement the findings of this research. Once implemented, the agency should be able to make more informed decisions on where to place its scarce resources most effectively.

An electronic copy of the final report is available on the SCDOT Research Webpage at http://www.clemson.edu/t3s/scdot/.



SCDOT Current and Completed Research Projects

For a complete list of current and/or completed research projects, please visit the Materials and Research web site located at www.clemson.edu/t3s/scdot. The current research projects page lists the project name, principal investigator, and the objective of the project. The completed research project page shows summaries of completed research projects and a number of them have pdf copies of final reports attached. The Research Problem Statement Form is also located on the web site for your convenience.



Comments and Suggestions

The *RD&T Newsletter* is published on behalf of the SCDOT by the SC Transportation Technology Transfer Service (T^3S) at Clemson University.

If you have suggestions, comments or article submissions for the newsletter, please contact Mike Sanders at 803-737-6691, or mail them to:

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Comparing High-visibility Apparel

One important proposed change in the MUTCD requires that all workers who operate in a public right-of-way wear highvisibility safety apparel that meets ANSI Type 2 or Type 3 standards. What is the difference between the two performance classes?

Type 2 apparel includes shirts, jackets or sleeveless vests that provide 360 degrees of torso visibility with horizontal and vertical retroreflective stripes. Look for genuine Class 2 tags to avoid violations. Typical occupations using this class include forestry operations, roadway construction, trash collection, high-volume parking, emergency response and law enforcement.

Type 3 safety apparel provides more coverage for individuals in the category of roadway construction personnel, utility workers, survey crews, and emergency responders. This apparel class includes full jackets and pants with retroreflective stripes to improve safety for workers exposed to high-speed traffic who cannot pay attention to approaching traffic. MUTCD recommends using Type 3 if in doubt about what degree of coverage to choose.

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