

Amy Mac Quarrie's Question Becomes Research

As an NDOT Assistant Road Designer, Amy Mac Quarrie knew that it was standard practice to use geotextile, synthetic fabrics, between aggregate base and sub-base layers in paved road designs. When she learned that geotextiles can also be used for reinforcement, separation, filtration, drainage, and protection, she dug deeper. She found that at NDOT, geotextiles are used for separation only and that the reinforcement value was not included in road designs for paved roads because, as she was told, there wasn't enough data. She wanted to get enough data. NDOT already incorporates geotextiles in designs for new roads anyway; including the strengthening effects of those fabrics should allow NDOT to reduce the design cross-section and save money in construction labor and materials costs.

This all started when Amy was working with Abbas Bafghi, P.E., Senior Geotechnical Engineer, who had developed a structural cross-section that included four types of geomaterials to compensate for extremely weak soils under State Route 447 near Gerlach, Nevada. In any point of the roadway, there were layers of geomembrane, geofoam, geotextile, and geonet between layers of soil. This will be NDOT's first project incorporating geofoam, and it



Amy Mac Quarrie

intrigued her and led her to enroll in a graduate class at the University of Nevada, Reno to learn more about geomaterials. While studying the characteristics of these materials, Amy contacted NDOT's Materials Section and asked them to help identify the information that could help her accurately calculate the effects of all the elements in current designs. But Materials did not have the resources (time or money) to help her. Then Amy received an e-mail from Manju Kumar, NDOT Research Coordinator, seeking problem statements.

Amy spoke with her supervisor, Steve Merrill, who encouraged her to participate. Amy also talked to Paul Frost, the Chief of Design, about the process. Paul helped her identify steps she needed to take in the process. Amy notes that both Steve and Paul are always very supportive of anyone who wants to expand knowledge and improve the processes within the Department. Amy drafted and submitted a problem statement within just a few months of first being exposed to the various applications for geomaterials.

Amy's problem statement was one of the fifty-two that were received last spring. The Research Advisory Committee rated her problem statement very highly; it was in the top ten! When the committee sent the top-ranked problem statements out for proposals, Amy compared hers to the other nine: "those problem statements were formal and articulate." She was impressed with the variety of the problems, as well as the quality of the ideas and their descriptions. She was also pleased that her problem statement was in such good company.

Problem statements are usually just a very short description of the problem or issue that is identified.

Continued on page 2

In This Issue:

Page 1-2
Amy Mac Quarrie's Research

Page 2-3
New Research Projects

Page 4
Library



It is typically 2-3 pages in a standard format that includes a title, a description of the problem, the objective and the proposed research, a description of the urgency and payoff potential for the project, identification and relevance of any related work, and contact information for the submitter.

The Research Advisory Committee that ranked the problem statements consists of fifteen representatives from across the Department: District Engineers, Section Chiefs, and a representative from FHWA. They chose the problem statements that they felt had the best chances to produce genuine benefits for the Department through research, then solicited proposals based on those problem statements.

Fifteen proposals were submitted from researchers across the State. These proposals are descriptions of the work that would be conducted to answer the questions raised in the problem statements. The proposals are more detailed documents than the problem statements, and include the title, the name of the researcher(s), the problem statement, background information about the problem, a detailed description of the research proposed, the anticipated benefits from the work, a plan to implement any anticipated results, a schedule for the project, the facilities and equipment to be used, a detailed budget for the project, and specific information about what involvement the researcher anticipates from NDOT.

Two proposals were submitted based on the problem statement Amy submitted: Use of Geotextile for Strengthening and Reducing the Roadway Structural Sections. One of the submitters contacted Amy and asked questions to learn more about the issue. Amy thought the researcher was really fine-tuning her problem statement, and that she was able to validate the researcher's ideas and direct the proposal for the best possible effectiveness.

The proposals were ranked once again by the Research Advisory Committee and forwarded to the Research Management Committee. The Research Management Committee consists of the two Deputy Directors and the four Assistant Directors. They reviewed the proposals and the Research budget, and selected five proposals. One of the proposals selected was from Dr. Nader Ghafouri at UNLV, and it was based on Amy's problem statement! "It was a high, hearing that it was selected from the many problem statements, and I felt proud that it was selected," Amy said with a grin.

Amy is serving on the panel that will review the work over the duration of the project. She will be making sure that the researcher gets what he needs from NDOT to accomplish his task, and that his work meets the needs of the Department and conforms to the proposal and the agreement. "I'm excited that the benefit/cost potential is so huge: it won't cost a dime to implement if the data supports this idea. Design won't have to add any steps to our process to implement any findings, there will be no new materials needed, and no staff training – we're already doing it! Though Materials may have to add a simple step in their process," Amy said.

Congratulate Amy the next time you see her – she is helping make the most of our tax dollars. And if you have an idea or a problem that may make a good problem statement, contact Manju Kumar, NDOT Research Coordinator, at (775) 888-7803. He can help get your problem submitted for consideration; he always accepts problem statements and will be sending the solicitation for the next cycle soon.

NEW RESEARCH PROJECTS FOR 2012

Based on the recommendations of NDOT Research Advisory Committee (RAC), the Research Management Committee (RMC) has approved five new research projects that focus on examining implementable solutions to critical NDOT needs. The following is a brief introduction of the five selected projects. If you are interested and would like to be involved in any of them, please contact **Manju Kumar** (mkumar@dot.state.nv.us or (775) 888-7803) or **Ken Chambers** (kchambers@dot.state.nv.us or (775) 888-7220).

Investigation of Corrosion of MSE Walls in Nevada, Phase II

Earlier research by NDOT and University of Nevada Reno (UNR) has revealed that there is high potential for Mechanically Stabilized Earth (MSE) Walls in Nevada to experience higher corrosion rates than they were designed for. This research project will focus on establishing the basis for a Long-Term Corrosion Monitoring program (LTCMP) and also help NDOT progress towards its Asset Management goals for both geotechnical and bridge aspects of the transportation infrastructure. The research will be led by **Dr. Raj Sidharthan** at UNR.

Post-Earthquake Capacity and Assessment of Columns and Bridges

Nevada is the second most seismically active state in the continental U.S with high probability of a major seismic event. This research to be led by **Dr. David Sanders** at UNR will focus on combining the past seismic bridge research, knowledge of the Nevada bridge inventory, and state-of-the-art analytical methods to produce tools that would better prepare our state for swift post-earthquake evaluation.

This effort will also help NDOT implement the ShakeMap/ShakeCast tool be implemented and combine it with damage estimates and repair schemes to enable a quicker post-earthquake response.

Use of Geotextile for Strengthening and Reducing the Roadway Structural Sections

Presently, NDOT only uses geotextile to separate aggregate base layer from subgrade for new and reconstructed roadways. The increase in structural strength provided by geotextile can potentially reduce roadways structural sections. The proposed research will conduct a laboratory-based experimental program to examine the extent to which geotextiles can reduce the thickness of structural aggregate base course layer placed over the subgrades of varying strengths, and analyze the results for determination of the reduction factors from geotextiles for different subgrade conditions, as well as cost saving associated with the reduction in thickness of base course layer. This study will be led by **Dr. Nader Ghafoori at University of Nevada Las Vegas (UNLV)**.

Investigation of Innovative Maintenance Contracting Strategies: Performance-Based Maintenance Contracts (PBMCs)

NDOT has been considering the use of Performance-Based maintenance Contracts (PBMC) for some of the roadway Maintenance activities. To determine whether the maintenance done under this contract is performing as expected, it is necessary to evaluate the work of the contractors. PBMC differs from the traditional way of contracting in the sense that with this method, the payment of the maintenance work done by private contractor is made based on the performance and not based on the quantity of work done. This

research effort to be led by **Dr. Pramen Shrestha at UNLV** proposes to develop evaluation methods to determine the performance of contractors and also examine whether the PBMC method can be expanded for other road maintenance activities with private contractors.

Statewide Guidelines for Signal Timing Parameters Considering Safety and Efficiency

More than 20% of traffic crashes occur each year at signalized intersections in Nevada. One of the major factors that contribute to signalized intersection crashes is signal change intervals: yellow and all-red. Guidelines by the Institute of Transportation Engineers (ITE) and in the Traffic Signal Timing Manual are the primary sources for determining yellow and all-red intervals. However, these guidelines lack specific coverage of left-turn movements and high speed locations. This new research study to be headed by **Dr. Zong Tian at UNR** has the primary objective to develop statewide guidelines for determining yellow and all-red signal intervals. A particular focus will be on left-turn movements and all-red intervals. Other typical signal-timing parameters will also be examined.

VENDOR PRESENTATIONS

- **September 13, 2011 Product Evaluation Committee Meeting with Jeff Ericson, American Polywater Corporation**, presented information on FST 250 Duct Sealant and BonDuit Conduit. FST 250 Duct Sealant is a multi-use, quick setting, two-part, foam base duct sealant designed to seal out water, dirt, oil gases, rodents, and other contaminants.
- **June 14, 2011 Product Evaluation Committee Meeting with Pat Owens, Clearline Manufacturing**, presented information on the newly designed RackStar. RackStar is an automated, heavy-duty, ergonomic, truck rack system that allows a single operator to lift loads between 500 and 1,000 pounds into a 1/2 ton pickup, flatbed, or other similar vehicle.

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Construction / Materials

Composites for Construction
Construction Engineering and Management
Materials in Civil Engineering

Engineering Mechanics

Engineering Mechanics
Nanomechanics and Micromechanics

Environment and Water Resources

Environmental Engineering
Hazardous, Toxic, and Radioactive Waste Management
Hydraulic Engineering
Hydrologic Engineering
Irrigation and Drainage Engineering
Water Resources Planning and Management

Geotechnical Engineering

Geomechanics
Geotechnical and Geoenvironmental Engineering

Management / Professional Issues / Legal Affairs

Leadership and Management in Engineering
Legal Affairs and Dispute Resolution in Engineering and Construction
Management in Engineering
Professional Issues in Engineering Education and Practice

Structural Engineering

Bridge Engineering
Structural Design and Construction
Structural Engineering

Transportation and Urban Development

Infrastructure Systems
Transportation Engineering
Urban Planning and Development

Waterway, Ports, Coasts, and Oceans

Waterway, Port, Coastal, and Ocean Engineering

Other Technical Areas

Aerospace Engineering
Architectural Engineering
Cold Regions Engineering
Computing in Civil Engineering
Energy Engineering
Natural Hazards Review
Performance of Constructed Facilities
Pipeline Systems Engineering and Practice
Surveying Engineering

Library Corner

The library is here to help! It holds a large selection of magazines, journals, study materials, and publications from AASHTO, FHWA, TRB, TRR, and US DOT. If the library doesn't have what you want, the librarian can get it! We can purchase items for the library that you feel would be beneficial for everyone to have access to as well! The library is located in room 115 of the NDOT Headquarters building.

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If you are in need of assistance, don't hesitate to email, call or visit the librarian: Sena Loyd, sloyd@dot.state.nv.us, 775-888-7895, Research Library Room #115, 1263 S. Stewart Street, Carson City, NV 89712.



The NDOT Research Section administers the NDOT's research, development and technology transfer program and serves as the "clearing-house" for product evaluations. **Research and Technology Review is published quarterly by the NDOT Research Section.** Its purpose is to provide the latest information on the NDOT research activities including product information and other pertinent research topics.

If you have comments or need additional information regarding any of the topics discussed in this issue, please contact the Research Section. Edited by: Gizachew Zewdu

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