SOLUTIONS

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RESEARCH PROGRAMS
SUMMER 2005

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PROJECT HIGHLIGHTS

ROCKFALL HAZARD CLASSIFICATION AND MITIGATION SYSTEM

http://www.mdt.mt.gov/research/projects/geotech/rockfall.shtml

The Montana Department of Transportation (MDT) sought to develop and implement a comprehensive rockfall management system for use on the Department's state-maintained roadways. The goal of this research project was to define the extent of rockfall conditions and to gather data to allow MDT to strategically plan a statewide rockfall mitigation program. The system selected for implementation, and then customized and made suitable for Montana conditions and MDT protocols, was the Rockfall Hazard Rating System (RHRS). The RHRS is used by many states and is a nationally recognized rock slope management tool. Landslide Technology of Portland, Oregon, with Montana-based team members NTL Engineering & Geoscience and Armstrong and Associates completed the project in August 2005.

The RHRS system uses a phased approach to allow a more efficient and economical implementation. The phases include Preliminary Ratings in conjunction with a rock slope inventory, Detailed Ratings of the more hazardous sites, and development of Conceptual Designs and Cost Estimates for the most serious locations.

As a precursor to the Preliminary Ratings, an initial screening of MDT's roadways was completed to minimize travel to roadway corridors without rockfall hazards. This was accomplished by observing the approximately 10,800

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miles of MDT roads using MDT's ImageViewer program, which displays an image of the roadway every ten meters. Although many potential rockfall sites were identified, the need to travel to many of Montana's non-mountainous roadways was eliminated. A list of the rockfall sites located in each maintenance section was prepared, and using a web-based maintenance interview, important rockfall history and behavior information was gathered for each site.

During the Preliminary Rating phase, each site was visited, rated based on its rockfall potential and the site's rockfall history, and assigned a preliminary rating of either "A", "B", or "C". Sites assigned an "A" or "B" rating were entered into the rockfall database and had location information recorded and photographs taken. Detailed Ratings were completed on the A-rated sites. The sites were assessed using a 12-category rating system. Each category represents a certain element that contributes to the overall rockfall hazard, such as slope height, ditch effectiveness, geologic character, etc. The categories are scored using an exponential scoring system and then added together to determine an overall rockfall site score.

The top 100 A-rated sites, those with a score greater than 471 points, had preliminary designs and cost estimates prepared to allow cost considerations to be used as part of project planning and development. The design concepts include only the design elements directly associated with rockfall mitigation so that sites can be compared to each other strictly from a rockfall mitigation standpoint. This allows project-planning decisions to be made based on the benefits of rockfall hazard reduction per dollar invested.

The number of sites visited and evaluated during the Preliminary Rating phase was 2,653. Of these, 1,869 received either an "A" or "B" rating and were incorporated into the RHRS database. The remaining sites fell into the "C" category and were excluded from further consideration. The detailed rating was applied at 869 sites. The RHRS database contains 367 A-rated sites. The highest RHRS score assigned to a site in Montana was 687.

The data generated during the RHRS study is stored in the Transportation Information System (TIS) Oracle Database. This database stores the fully implemented Preliminary and Detailed Rating data, GPS coordinates and several photographs of each site.

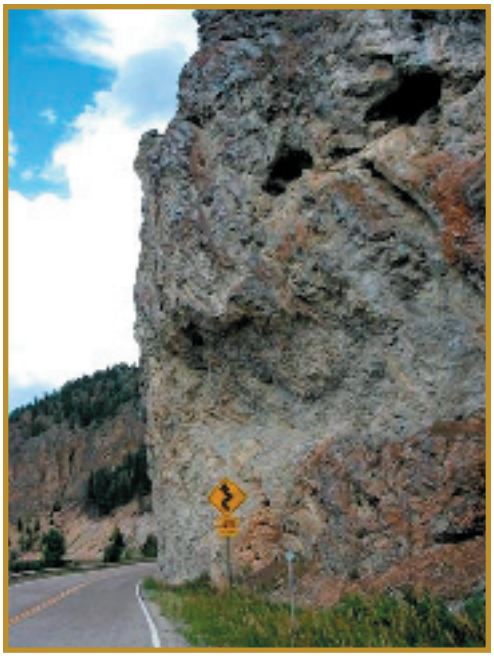
The Conceptual Design and Cost Estimates for the top 100 rated slopes provides MDT with comprehensive information to use in developing rockfall mitigation projects based on a rational and consistent approach. This extensive rockfall information is the key product of the RHRS process and it allows an unbiased comparison between rockfall sites. The information can be used in a variety of ways to identify mitigation projects including the RHRS score, mitigation costs, location factors, or the mitigation measures used.

The systematic rating of rockfall sites in Montana resulted in a $150 average cost/site. This proved to be much more efficient and cost effective than could have been achieved had implementation been addressed on a case-by-case basis. The cost of completing a statewide rating system is offset by the opportunity to improve public safety and reduce the state's rockfall liability exposure by having a rational approach and reliable information to use in allocating limited funds.

The primary goals of this project were to reduce the rockfall hazards faced by the motoring public and to gain better tools for managing rockfall costs. By implementing the RHRS, MDT has established the basis for attaining each of these goals:

- Safety improvements for the motoring public will be accomplished by allocating mitigation funds at the most appropriate sites based on the identification of rockfall hazard sites statewide. The extensive rockfall information will allow the state to perform targeted strategic planning aimed at optimizing system wide improvements.
- The RHRS will allow more efficient management of MDT's maintenance and construction funds. By targeting rockfall mitigation projects where the greatest score reduction can be realized per dollar invested or where the location allows grouping of sites or mitigation methods, resulting in lower design and unit costs, MDT will reduce rockfall-related operational costs. For the first time, the important statewide rockfall history from Maintenance has been gathered and documented.

For more information contact Rich Jackson at 406-444-6275 or ricjackson@mt.gov or Craig Abernathy at 406-444-6269 or cabernathy@mt.gov.



EVALUATION OF THE ENGINEERING CHARACTERISTICS OF RAP/AGGREGATE BLENDS

http://www.mdt.mt.gov/research/projects/mat/rap_aggregate.shtml

Recycling milled asphalt has great potential not only for preserving valuable resources, but also for controlling escalating construction costs. However, the engineering characteristics of blends made from mixtures of reclaimed/recycled asphalt pavement (RAP) and aggregate have not been fully investigated; consequently, the long-term suitability and performance of RAP-aggregate blends in highway pavement sections is unknown. This study was designed to supplement previous tests by others while providing a focus on the most critical engineering properties for RAP blended materials, which include: durability, strength, stiffness, compressibility, and drainage.

Based on the results of this work, the outlook for the continued implementation of RAP as an additive to granular base and subbase materials for use in highway construction looks promising. Laboratory testing conducted during this study indicates that blending asphalt millings with granular cohesionless material like crushed aggregate or pit run gravel results in only minor changes to the engineering properties of the virgin material.

Small changes to strength and compressibility were observed; however, the changes did not appear to increase or decrease in a regular manner. Measured R-values for two different virgin aggregates were acceptable even when as much as 75% millings were used to create the RAP blends. Because shear strength and stiffness are highly particle dependent, it is recommended that these parameters be evaluated on a project-by-project basis as necessary, until enough data becomes available to statistically evaluate any trends that may exist.

This laboratory study should be regarded as a step towards full-scale adaptation of RAP/aggregate blends in highway pavement sections. Supplemental field testing and controlled highway test sections should be considered to evaluate the affect of regional soil, weather, and traffic loading conditions. The long-term performance of RAP blends is likely to be highly dependent on the methods used during construction and the quality control/quality assurance testing that occurs during material placement. It is recommended that future studies include an investigation and evaluation of these practices.

For more information contact Matt Strizich, mstrizich@mt.gov, (406)444-6297 or Sue Sillick at 406-444-7693 or ssillick@mt.gov.

LIBRARY CORNER

TLCat is a union catalog (group of library catalogs searchable via one interface) provided by the National Transportation Library. It includes transportation-related books and other materials held in government, university and other transportation libraries. Users can search over twenty transportation library catalogs at one time using OCLC's FirstSearch. To search TLCat, go to MDT's library catalog (http://mtscprod.msl.mt.gov/uhtbin/cgisirsi/x/0/0/49?user_id=MT-DOTWEB&password=) and click on Transportation Libraries Catalog under Cool Sites.

For more information, contact Sue Sillick at 406-444-7693 or ssillick@mt.gov.

Watch future newsletter issues for Library Corner articles on:

- Library Connectivity Pooled Fund Study
- Montana Library Network Group Catalog
- Literature Searches

DID YOU KNOW?

Transportation Research Board

The mission of the Transportation Research Board (TRB) is to promote innovation and progress in transportation through research. TRB is one of six major divisions of the National Research Council – a private, nonprofit institution that is the principal operating agency of the National Academies in providing services to the government, public, and scientific and engineering communities. A resource to the nation and transportation community worldwide, TRB provides an extensive portfolio of services: opportunities for information exchange on current transportation research and practice, management of cooperative research and other research programs, analyses of national transportation policy issues and guidance on federal and other research programs, and publications and access to research information from around the world .

TRB fosters information exchange through the Annual Meeting (http://www.trb.org/meeting/) where nearly 10,000 transportation professionals from around the world gather to participate in the world's largest forum designed specifically for the formal and informal exchange of information among transportation researchers and practitioners. Also, TRB organizes nearly 100 specialty conferences and workshops (http://gulliver.trb.org/calendar/) on subjects and issues of interest to the transportation community. In addition, TRB maintains more than 200 standing committees and task forces (http://trb.org/directory/) that address all aspects and modes of transportation. Committee members identify research needs; provide information to the transportation community on research priorities and procedures; review papers for presentation at the Annual Meeting and for publication; encourage the incorporation of appropriate research findings into practice; and develop special programs, conferences, and workshops. Finally, each year, TRB technical staff visit all state transportation departments, many academic and research institutions, and other transportation-related agencies and organizations to exchange information concerning research and practice.

TRB administers a number of applied research programs: National Cooperative Highway Research Program (NCHRP) sponsored by the state departments of transportation (http://www4.trb.org/trb/crp.nsf/reference/appendices/NCHRP+Overview), Transit Cooperative Research Program (TCRP) sponsored by the Federal Transit Administration (http://www4.trb.org/trb/crp.nsf/reference/appendices/TCRP+Overview), Commercial Truck and Bus Safety Synthesis Program (CTBSSP) sponsored by the Federal Motor Carrier Safety Administration, and the Airport Cooperative Research Program (ACRP) sponsored by the Federal Aviation Administration (http://www4.trb.org/trb/crp.nsf/reference/appendices/ACRP+Overview). TRB also administers the Innovations Deserving Exploratory Analysis (IDEA) programs, which encourage investigation of innovative but untested concepts offering the potential for technological breakthroughs in transportation (http://www4.trb.org/trb/dive.nsf/web/idea_programs). Finally, TRB conducts policy studies at the request of Congress, executive-branch federal agencies, the states, and other organizations on an array of complex and often controversial transportation topics of national significance (http://www4.trb.org/trb/homepage.nsf/web/policy_studies). See http://www4.trb.org/trb/homepage.nsf/web/programs?OpenDocument for a complete listing of TRB programs.

TRB disseminates transportation research results worldwide through its publications and research information services. TRB produces and distributes about 200 publications annually (http://www4.trb.org/trb/onlinepubs.nsf). TRB also provides many resources (http://www4.trb.org/trb/homepage.nsf/web/resources), including two databases: Research in Progress (RiP) and Transportation Research Information Services (TRIS). The RiP database (http://rip.trb.org/) provides access to nearly 10,000 current or recently completed research projects from federal and state agencies, universities, and international organizations. The TRIS database (http://trisonline.bts.gov/search.cfm) is the world's largest and most comprehensive online bibliographic database of published and ongoing transportation research.

GET INVOLVED! Attend the annual meeting; join a committee; or participate on a panel.

For further information contact Sue Sillick at 406-444-7693 or ssillick@mt.gov.

CALENDAR OF EVENTS

October

MDT RRC Meeting – 10/25
TRB Annual Meeting Preliminary Announcement Distributed
New TCRP Projects Selected

November

NCHRP Problem Submitters' Responses to Evaluations Due

December

MDT RRC Meeting – 12/13
MDT Research External/Internal Solicitation for Research Ideas Ends – 12/31
NCHRP Ballot on New Projects Distributed to SCOR and RAC

January

RAC/SCOR meet during TRB Annual Meeting – 1/22
TRB Annual Meeting in Washington, D.C. – 1/22-1/26
MDT RRC Meeting (1/31) – Solicitation Research Ideas to be Rated
NCHRP Synthesis of Practice Topics Due – 1/31
TCRP Panel Nominations Due

February

MDT RRC Meeting (2/27) – Champions Present Research Ideas
NCHRP Ballots on New Problem Statements Due
Obligation of NCHRP Funding Due (month may vary)

March

MDT RRC Meeting – 3/28
NCHRP Summary of Ballots Distributed to SCOR
Schedule and Guidance for TRB Annual State Visits Distributed
SCOR Selects New NCHRP Projects
TRB Core Program Contributions Due
TCRP Synthesis of Practice Topics Due
Nominations for New AASHTO TIG Topics Due

NEW RESEARCH PROJECTS

Comparative Analysis of Coarse Surfacing Aggregate Using the Micro-Deval, L.A. Abrasion, and Sulfate Soundness Tests
http://www.mdt.mt.gov/research/projects/mat/coarse_aggregate.shtml

Evaluation of MDT's Research Project Solicitation, Prioritization, and Selection Processes
http://www.mdt.mt.gov/research/projects/admin/research_eval.shtml

OJT Program Evaluation
http://www.mdt.mt.gov/research/projects/admin/ojt.shtml

Dynamic Passive Pressure on Abutments and Pile Caps
http://www.pooledfund.org/projectdetails.asp?id=950&status=1

Extending the Season for Concrete Construction and Repair: Phase III
http://www.pooledfund.org/projectdetails.asp?id=960&status=1

A listing of all past and current projects can be found at: www.mdt.mt.gov/research/projects/sub_listing.shtml.

NEW RESEARCH REPORTS

Bat Use of Highway Bridges in South-Central Montana
http://www.mdt.mt.gov/research/docs/research_proj/bat/final_report.pdf

Evaluation of the Engineering Characteristics of RAP/Aggregate Blends
http://www.mdt.mt.gov/research/projects/mat/rap_aggregate.shtml

Rockfall Hazard Classification and Mitigation System
http://www.mdt.mt.gov/research/projects/geotech/rockfall.shtml

Soil Air Voids Method for Compaction Control
http://www.mdt.mt.gov/research/projects/mat/airvoids.shtml

A listing of all past and current projects can be found at:
www.mdt.mt.gov/research/projects/sub_listing.shtml

REMINDER

Information on research services and products, such as research and experimental project processes and reports, and technology transfer services, including our library catalog can be found on the Research web site at www.mdt.mt.gov/research.

CONTACT US

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