

Project Summary Report: 8213

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Testing and Evaluation of Recovered Traction Sanding Material

<http://www.mdt.mt.gov/research/projects/planning/benchmarks.shtml>

Introduction

Large amounts of abrasive traction sanding material (traction sand) are applied to roadways in northern climates every winter season to increase tire-road friction and improve traction control. In the spring, the deployed traction sand is collected along the roadway as part of highway maintenance operations, which include: sweeping and vacuuming roadway surfaces, shoveling accumulated material from between guardrail posts, and cleaning and collecting material from road shoulders and borrow ditches. While removing accumulations of material helps to alleviate problems alongside highways, it can create storage/disposal problems unless

cost-effective alternatives are identified and implemented.

The recovery and reuse of this material represents a potentially desirable option to reduce the quantity of landfilled materials and to conserve natural resources. However, when used without any further treatment, recovered traction sand may create problems, including sedimentation in streams, clogging of culverts, and environmental contamination from chemicals, heavy metals, and volatile organic compounds. The practical suitability and cost effectiveness of a statewide program for recycling and reusing traction sand on Montana roadways was evaluated in this study to determine if recycling could be a reasonable, practical and cost effective option.

synthesis of current literature on the topic, material sampling at Lookout Pass and Bozeman Pass, geotechnical and chemical testing, evaluation of alternatives, and a cost-benefit analysis that compares the recycling option to current practices that primarily utilize virgin materials. Two high-elevation highway mountain passes in Montana were selected as sampling sites because these locations experience relatively large quantities of snowfall and prolonged periods of sub-freezing temperatures during the winter months. Consequently, large amounts of traction sand are used in these areas as part of winter maintenance and snow fighting operations.

Physical and chemical testing was performed on samples collected during the study to provide a basis for the investigation of reuse options. Physical or mechanical tests consisted of sieve analyses and material characterization laboratory tests including Atterberg Limits and moisture contents. Three primary categories of contaminant concentrations were examined to identify the presence of potentially harmful materials in the collected sand for which elevated concentrations above certain levels are known to pose a risk to the environment and to people. Laboratory testing categories included: Total Petroleum



Figure 1 - Cleaning previously deployed traction sand from the roadway shoulder of I 90 near Bozeman Pass

What We Did

This study included the sampling and testing of traction materials used in Montana to investigate viable options for reuse and recycling. The research included the development of a protocol for sampling stockpiled traction material, a focused



Figure 2 - Obtaining sample along the shoulder of I 90 near Bozeman Pass

Hydrocarbons (TPH), Oil and Gas (O&G), and heavy metals.

Twelve individual sites were sampled in northwestern Montana along the Lookout Pass stretch of I-90 in Mineral County to examine the stockpiles of material that were previously cleared from the roadway surface and in some cases included material excavated from the roadside ditches. Geographically, the sampling area extended, east to west, from the MDT Maintenance Facility in St. Regis to near the border of Idaho and Montana. The samples were collected from a range of locations along the highway, including: shoulder deposits, stockpiles from roadway sweeping operations, ditch material, and a background sand sample from a stockpile of unused traction sand at the St. Regis Maintenance Facility.

Eleven individual sites were sampled in southwestern Montana along the Bozeman Pass stretch of I-90 in Gallatin County. The stretch of highway that was examined begins near Belgrade, MT and extends approximately midway between Bozeman and Livingston, MT. The majority of the samples taken from this area were located near Bozeman Pass, which experiences relatively high volumes of traffic and severe winter conditions. Similar to Lookout Pass, the Bozeman Pass samples were taken from a range of locations, including shoulder deposits, stockpiles from roadway sweeping operations, ditch material, and background sand samples obtained from stockpiles of traction sand that has not been applied to the highway.

What We Found

This study indicates that collected traction sand can be considered a viable product for reuse and recycling, rather than categorizing it as a waste product. By recycling and reusing traction sand, MDT could potentially save money by eliminating landfill costs and by reducing the amount of new abrasives and aggregates that are purchased every year.

A cost-benefit analysis of reuse and recycle options of salvaged traction sand was conducted using results of mechanical and chemical tests conducted on samples collected along the Bozeman Pass and the Lookout Pass areas. The results indicate there are viable alternatives to landfilling or roadside dumping of collected traction sand. The most appealing and cost-effective option is to reuse the collected material as traction sand in subsequent winters. Research conducted during this study indicates a potential secondary option would be to process and mix (co-mingle) collected sand with gravel to produce a material that meets MDT gradation specifications for imported aggregate. The most promising co-mingling options are those that only necessitate the addition of finer aggregate

and do not require extra coarse particles. It was determined in this study that MDT materials including plant mix surfacing, cement treated base, shoulder gravel, and crushed top surfacing could be economically produced by co-mingling collected traction sand with additional aggregate.

Based on chemical lab tests conducted in this study and compared to background chemical and metal concentrations, it appears that the samples collected and tested from the Lookout Pass and Bozeman Pass sites have chemical and metal concentrations that are generally characteristic of naturally occurring background soil levels at the sites. Nevertheless, a quality assurance process may be necessary before reusing recovered traction sanding material, which may entail a standardized process of random sampling of previously applied sand and subsequent testing to confirm that it does not contain unreasonably high levels of contaminants.

Gradation data (Figures 3 and 4) from samples collected in this study indicate the salvaged sand will likely have particle size distributions that are on the finer border of the specified gradation range for traction sand. This indicates that over time, as the sand is reused and recollected over multiple seasons, the gradation will continue to drift toward the finer specification limit. Consequently, the amount of necessary processing is expected to increase over time. This additional processing will

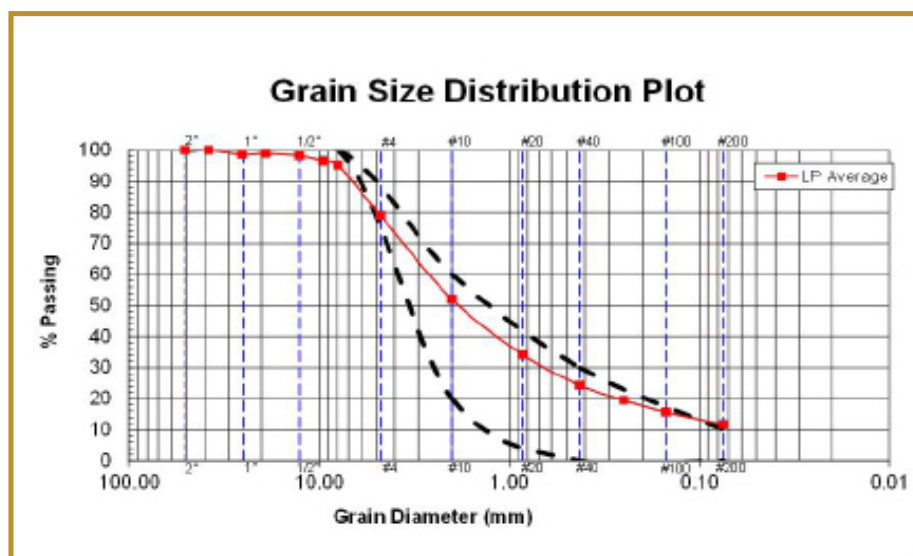


Figure 3 - The solid red line represents the average gradation results at the Lookout Pass sites. The dashed black lines represent the permissible gradation range for new traction sand.

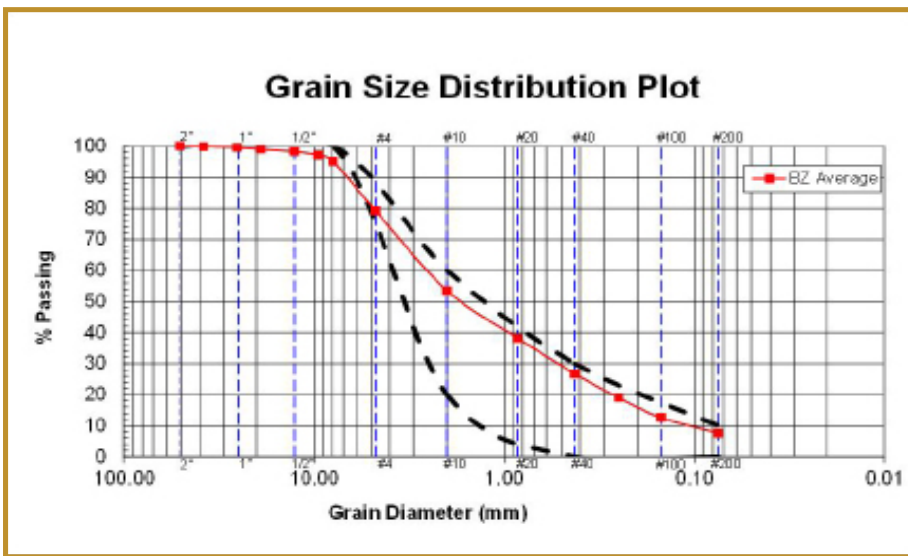


Figure 4 - The solid red line represents the average gradation results at the Bozeman Pass sites. The dashed black lines represent the permissible gradation range for new traction sand.

involve either screening and removing (discarding) undersize material or blending in additional course material. It is anticipated that the most cost efficient option would involve the blending of salvaged sand with newly imported virgin traction sand.

Because there will be some variability in the recovered material, both spatially and temporally, it will be necessary to periodically collect random samples of salvaged sand to help establish the amount of processing that will be necessary. Samples should also be obtained to periodically check for chemical contaminants, even though the tests conducted as part of this study indicated that most readings were near the levels in the background soil.

What the Researchers Recommend

The principle investigators recognize the advantages and practicality of collecting and reusing traction sand. An important aspect of this recycling operation will be to develop efficient methods for salvaging previously deployed sand during highway cleaning operations. The amount of necessary screening and processing could be minimized by separating collected materials during spring maintenance. For example, material cleaned from side ditches is likely to contain excessively large coarse material and other debris.

This material could be isolated (stockpiled separately) and evaluated apart from the other collected sand because it will likely require a higher level of processing in comparison to material that is swept or vacuumed off of the roadway surface. Likewise, depending on the topography, material cleaned from the roadway shoulder and from between guardrail posts may have different characteristics than sweepings and ditch material. Separating these materials will result in a more efficient reuse process and could minimize the amount of screening and washing required for effective reuse applications.

The researchers determined that the most economical recycle option would be the reuse approach, summarized as follows.

1. Previously deployed traction sand is collected at the end of the winter or when conditions allow.
2. Random samples of the collected material are obtained for contaminant testing (metals, TPH, and O&G) and sieve analyses.
3. Based on the measured particle size gradations, collected material is screened and washed to remove excessive fines (providing the collected material does not contain contaminant levels excessively higher than measured in background virgin sand samples). If necessary, the collected material could be blended with virgin traction sand and re-sieved to check that the particle gradation is within specified limits.

4. The processed material is stockpiled for re-use on state highways the following winter.

At each primary traction sand deployment location (e.g., Bozeman Pass or Lookout Pass), we recommend that samples be randomly collected from a minimum of two areas each spring during collection of the deployed sand. The samples should be sufficiently large enough to conduct a sieve analysis and chemical tests. Gradation curves developed from the sieve results should be compared to the specified gradation band or range for traction sand. If the gradation is too fine, then additional coarse sand should incrementally be added to the lab sample, as necessary, to achieve the target gradation. In the field, an equivalent percentage of coarse sand or fine aggregate should be processed with the stockpiled salvaged sand and an additional sieve analysis conducted after blending to verify the modified gradation. It is anticipated that 40 pounds of sample will be sufficient for conducting the sieve analyses and blending experiments.

Conduct a minimum suite of chemical and metals concentration tests on at least three randomly collected samples at each site to identify potential environmental issues associated with reuse or disposal options. The suite of chemical and metals tests are not all-encompassing, but rather are structured after the testing protocols that have been used in the past and based on guidelines set forth in the Pacific Northwest Snowfighters Snow and Ice Control Chemical Products Specifications and Test Protocols. The Montana Department of Environmental Quality has not established risk-based levels for chemical, petroleum or heavy metals concentrations for highway reuse options. The researchers suggest using criteria from the Pacific Northwest Snowfighters manual and the Environmental Protection Agency criteria for sewage sludge fertilizer as benchmarks when evaluating results from the laboratory environmental tests conducted on samples of salvaged sand. Results of the laboratory analyses should also be compared to equivalent tests conducted on background samples that were obtained from virgin stockpile sources.

For More Details . . .

The research is documented in Report FHWA/MT-13-003/*Testing and Evaluation of Recovered Traction Sanding Material*.

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MDT Implementation Status

April 2013

Maintenance and district personnel will meet and discuss the results of this research project during a May 2013 meeting. This meeting and implementation activities will be documented in an implementation report. Copies of the implementation report will be available on the project website at <http://www.mdt.mt.gov/research/projects/env/recycling.shtml>

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