



RESEARCH SERVICES

OFFICE OF POLICY ANALYSIS,
RESEARCH & INNOVATION

TECHNICAL SUMMARY

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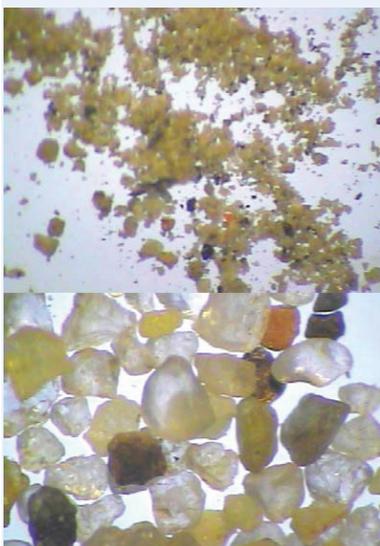
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PROJECT COST:

\$104,945



Among the sediments selected for study were pavement grindings (diameter: 0.008mm) and sand (diameter: 0.1mm).

Best Practices for Reducing Sediments in Concrete Wastewater

What Was the Need?

Working with concrete pavements and bridge decks creates significant amounts of dust. Grinding, resurfacing, saw cutting, rubblizing, and breaking up and removing concrete structures can create sediment that finds its way into waterways. Pouring concrete during bridge pier construction has the potential to cause additional pollution.

The Clean Water Act requires control of sediment from construction sites and other types of concrete operations. State and local agencies nationwide face a significant challenge in following this directive, and MnDOT is leading other states in reducing wastewater sediments from its concrete operations. Current methods for dust and runoff control rely on anecdotal evidence. Research was needed to fully examine these methods and to ensure that all Minnesota transportation districts are using the most effective tools and techniques available.

What Was Our Goal?

This study aimed to determine how best to update MnDOT construction practices to reduce the use of wastewater from concrete operations and to prevent suspended solids from such operations from entering stormwater and groundwater. The goal was to be able to meet federal clean air and water regulations during standard concrete operations.

Investigators aimed to understand and characterize discharge from typical concrete operations and define its erodibility, transportability, density and pH, and to determine whether it settles or suspends in water. Investigators then would develop best management practices for designers to use in managing the concrete sediments from various concrete operations, keeping it from leaving construction areas and migrating to the surrounding environment.

What Did We Do?

Researchers began by visiting 40 concrete operations sites. They observed and evaluated practices including pavement placing, pavement grinding, pavement and bridge deck demolition, high-pressure water demolition of concrete, underwater pours, masonry repair and saw cutting of green concrete. They categorized sediment in terms of how likely it was to suspend and migrate to water sources. They identified and defined methods used to trap and contain such sediments.

These observations were then investigated further through laboratory testing. Researchers created various pads of material and ran water over them. They identified the amount of material that runs off in water, that can be trapped by existing methods, and that responds to gravity and to flocculants (chemicals used to force settling in water). They also assessed the impact that curing times have on such activity. Then they identified best management practices for designers and planners of concrete operations.

What Did We Learn?

The study identified four concrete operations activities that create sediments and slurries which present risks to crews or the environment: grinding, saw cutting, concrete

This cutting-edge study quantified slurry mitigation needs for concrete operations by evaluating practices at a variety of sites, studying cementitious sediment characteristics and identifying best management practices.

“We can use geotextile capture, pH neutralization and pond sizing effectively now based on the recommendations and best management practices from this study.”

—Dwayne Stenlund,
CPESC, Erosion Control
Engineering Unit, MnDOT
Office of Environmental
Services

“Everything was a surprise. These are really novel sediments with very different behaviors, and geotechnical results are not always useful in predicting their behavior. Grain sizes are often impacted by chemistry.”

—Stephen Druschel,
Assistant Professor,
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Water spray keeps dust down during concrete bridge deck removal, but has the potential to create high volumes of slurry that must be controlled to protect waterways.

demolition of bridge decks and pavements, and casting bridge piers. These wet mixtures are susceptible to leaching, rainstorms and similar events in the first two hours following pours.

The sediments and slurries were found to behave in novel ways and exhibit a variety of tendencies due to grain size and chemistry. For example, during saw cutting of bridge decks, sediment re-cements in contact with water, an unanticipated finding.

According to researchers, current sediment mitigation practices cost \$0.001 per gallon of concrete while fully engineered solutions will cost \$0.01 to \$0.05 per gallon to employ. The report presents best management practices in several areas of sediment and erosion control, and includes the following observations and recommendations:

- Designers should define and conservatively assume the impact of particle grain size, gradation distribution, material density, pH and particle reactivity prior to design.
- Typical management mistakes occur because engineers underestimate how uniquely each concrete sediment type behaves, and they underestimate the amount of containment space required to adequately capture sediment. For example, a small pond feature with a roadside ditch may work fine for regular roadway construction, but for saw cutting would require 10 to 100 times the capacity to capture and contain concrete slurry. Filtering practices can work, but capacity needs to be increased by 10 to 100 times.
- Sediment removal requires hydrometer analysis of materials followed by sizing of the sedimentation basin for desired removal percentage and hydraulic flow.
- Filter material selection must rely upon grain-size characteristics of sediment and filter material to maintain sufficient hydraulic flow.
- When pH falls between a range of 6 and 9, flocculants may be effective in removing suspended concrete sediment.

What's Next?

Current methods for adequately managing slurries and sediments from concrete operations will not, on the scale they are currently employed, meet regulatory standards. Two research directions follow from this study: investigating fully engineered capture solutions with greater attention to sedimentary characteristics and volume needs, and investigating re-use of such slurries and sediments in transportation and other industrial operations.

This Technical Summary pertains to Report 2012-21, “Concrete Slurry, Wash and Loss Water Mitigation,” published August 2012. The full report can be accessed at <http://www.lrrb.org/PDF/201221.pdf>.