Using CGR from diamond grinding roads as a road shoulder stabilizer may reduce negative environmental effects.

RESEARCH SOLUTIONS

Using concrete grinding residue to stabilize road shoulders

Iowa DOT rehabilitates its roads for longer service life. The rehabilitation process can produce concrete grinding residue (CGR), which is potentially valuable as a construction material or soil stabilizer. This research explored the use of CGR as a stabilizer in road shoulders to reduce the negative impacts of rain and wind erosion and lower the costs of shoulder stabilization.

THE NEED

Diamond grinding to rehabilitate roads produces CGR, a slurry by-product that construction crews often discharge along the roadside. Releasing CGR near sensitive environmental areas such as farms, bodies of water, and high groundwater tables may negatively affect the environment because of CGR's composition. However, its composition also represents significant potential as a construction material or soil stabilizer.

To explore a possible economical and sustainable alternative use of CGR, Iowa DOT evaluated it as a soil stabilizer in highway road shoulders. The project tested soil mixtures containing CGR at different ratios in both the laboratory and in the field to evaluate its ability to reduce water and wind erosion while also measuring its ability to stabilize road shoulders.

RESEARCH APPROACH

In two laboratory tests and one field evaluation, researchers measured and compared the strength, stiffness, and erosivity of untreated and CGR-amended soils.

(continued)

"One field site showed the potential of CGR. However, additional field demonstrations are recommended in addition to performing a cost–benefit analysis to determine its overall value."

— **MELISSA SERIO,**
Iowa DOT Earthwork Field Engineer

The rainfall erosion test in the laboratory compared the performance of untreated loess soil with 20 percent CGR-treated soil by simulating rainfall of 2 inches, 4 inches, and 6 inches per hour. The wind erosion test in the laboratory compared the performance of untreated loess soil, 20 percent and 40 percent CGR-amended soil, and gravel aggregate from five locations under simulated wind conditions that produced wind speeds of 35 mph.

In the field, CGR-amended soil in road shoulders was assessed at two locations. The test compared the performance of CGR applied to the surface of the shoulder, CGR blended with the shoulder materials at 20 percent, and a commonly used proprietary stabilizer. A dynamic cone penetrometer and a lightweight deflectometer measured the strength and stiffness of the tested areas.

WHAT IOWA LEARNED

The test results indicate that using CGR as a soil amendment may be beneficial under specific conditions. In the rainfall erosion testing, CGR-amended soil exhibited more erosion, had poorer water quality and led to a higher concentration of total suspended solids in stormwater runoff. In the wind erosion testing, the use of CGR decreased erosion when mixed with some site soil mixtures but increased erosion from wind when mixed with other site soil mixtures.

Field evaluation results were both positive and negative for integrating the use of CGR into shoulder stabilization. Blending CGR with the road shoulder materials demonstrated effective stabilization, while applying CGR only on the surface of the road shoulder did not. Overall, field application testing results demonstrated that blending CGR with shoulder materials may be an effective stabilization technique to potentially improve stiffness, reduce traffic-induced deformation, and extend roadway service lives.

Researchers further indicated that CGR is most effective when engineers mix the slurry homogenously with the soil and sufficiently compact the treated area. This requires proper equipment, specific application processes, and training of the construction workers.

PUTTING IT TO WORK

Identifying productive uses for CGR from road rehabilitation projects while also mitigating its potential negative environmental impacts is a desirable outcome. While this project has identified some beneficial uses for CGR, further research is recommended to better understand the effects of employing the by-product as a road shoulder stabilizer and to document application processes that maximize its use.

ABOUT THIS PROJECT

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PROJECT CHAMPION:
Melissa Serio, P.E.
Earthwork Field Engineer
Iowa DOT
melissa.serio@iowadot.us
515-239-1280

TECHNICAL ADVISORY COMMITTEE:
Vanessa Goetz, Todd Hanson, John Hart, Todd Kinney, Brian Moore, Melissa Serio, Jacob Thorius, and Bob Younie.

PROJECT MANAGER:
Vanessa Goetz, P.E.
State Research Program Manager
Iowa Highway Research Board
Iowa DOT
vanessa.goetz@iowadot.us
515-239-1382

PRINCIPAL INVESTIGATOR:
Halil Ceylan, Ph.D.
Institute for Transportation
Iowa State University
hceylan@iastate.edu
515-294-8051

IOWA DOT RESEARCH:

iowadot.gov/research
ideas.iowadot.gov

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