RMRC

Recycled Materials Resource Center

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Research Project 72

# Field Performance of Subbases Constructed with Industrial Byproducts

## Project Objectives

- Define an equivalency criterion for five materials used for working platforms during pavement construction on a poor subgrade
- Develop a methodology to incorporate the structural contribution of working platforms into the design of flexible pavements

## Project Summary


Alternative methods for providing a stable platform over soft subgrade were evaluated using a 1.4-km section along a Wisconsin state highway that incorporated twelve test sections to evaluate nine different stabilization alternatives. A variety of industrial by-products were evaluated for stabilization. The industrial by-products included foundry slag, foundry sand, bottom ash, and fly ash as subbase layer materials. Additionally, several types of geosynthetics sections were incorporated as alternative platforms including geocells, a nonwoven geotextile, a woven geotextile, a drainage geo-composite, and a geogrid and presented in this report. The same pavement structure was used for all test sections except for the subbase layer, which varied depending on the properties of the alternative material being used. All test sections were designed to have approximately the same structural number as the conventional pavement structure used for the highway, which included a subbase of granular excavated rock.

The longer-term performance (>5 years) and contribution to pavement structure strength as evidenced from maximum deflections and back calculated moduli from the FWD surveys indicate that the alternative platforms have varying median moduli although comparable structural contributions due to their varying thicknesses (i.e., comparable maximum deflections). At the end of 5 years, back-calculated median moduli could be grouped into 4 categories. The first category includes foundry sand, foundry slag, and geocell sections and had the lowest mean moduli. The second category includes breaker run in control sections and reinforced geotextile and drain geo-composite sections and had somewhat higher mean moduli than the first category but comparable to each other. The third category includes bottom ash and geogrid-reinforced sections and had mean moduli higher than the second category. Fly ash section had the highest mean modulus at the end of 5 years, which was markedly higher than even the third category. Grouping the back-calculated moduli in this way indicates that these materials have varying stiffness; however, if the stiffness of breaker run is taken as the reference, the stiffness of most alternative materials is equal or higher than breaker run except foundry sand, foundry slag, and geocell.


## Project Partners

Wisconsin Department of Transportation, Wisconsin Highway Research Program, Alliant Energy Corporation, Grede Foundries Inc., Yahara Materials, Amoco Fabrics and Fibers Corporation

## End Products

Observations made during and after construction indicate that all sections provided adequate support for the construction equipment and that no distress is evident in any part of the highway. Each of the alternative stabilization methods, except a subbase prepared with the specific high clay-content foundry sand used in this project, appeared to provide equivalent working platform like the control section constructed with excavated rock. However, the foundry sand subbase is also providing adequate support and other foundry sands with lower clay content are expected to provide even better support.

## Further Information

The Recycled Materials Resource Center (RMRC) is a national center that promotes the appropriate use of recycled materials in the highway environment. It focuses on the long-term performance and environmental implications of using recycled materials.