RMRC

Recycled Materials Resource Center

THE UNIVERSITY of WISCONSIN MADISON

Research Project 71

Strength Contribution and Equivalency of Subgrade Reinforcement Materials

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

This single RMRC report consists of two separate reports, one detailing the equivilency of crushed rock with by-product materials and one detailing the strength contribution of by-product material.

The equivalency tests were centered around four alternative materials used in lieu of "breaker run" crushed rock as a working platform for highway construction on very soft subgrade. Breaker run is commonly used for working platforms, and thus was selected as the reference material. Three industrial byproducts (bottom ash, foundry slag, and foundry sand) and a granular backfill were used as alternative materials. A working platform of alternative material was considered equivalent to that with breaker run if the total deflection of the alternative material was equal to the total deflection of breaker run under the same construction loading.

Large-scale model experiments were conducted to define the relationship between total deflection and working platform thickness for a typical construction loading. A simulated soft subgrade was used in the experiments so that the findings could be used for most soft subgrade applications.

Results of the large-scale tests were used to develop design charts relating the thickness of an alternative material required to achieve the same total deflection as a working platform of breaker run. Comparisons were favorable.

The strength tests were based off two approaches. In one approach, the structural contribution of the working platform is included by defining a structural number for the working platform as if it was a subbase. In the other approach, the contribution of the working platform is included using a composite effective roadbed modulus. The structural number approach is more direct and is preferred. However, in some cases the structural number approach indicates that the working platform provides no structural contribution, whereas some improvement to the pavement system is expected when a strong working platform is placed on top of a soft subgrade.

Two design charts were presented that relate the structural number or the combined effective roadbed modulus to the thickness of the working platform. They are examples of how the structural contribution of working platforms can be incorporated into pavement design

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

Equivalency shows that very thick working platforms may be required for alternative materials having a CBR < 20. Thus, some alternative materials may not be economical substitutes for working platforms constructed with crushed rock in some projects. The strength tests were inconclusive and leave more research to be conducted.

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.

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