Chemical and Mineralogical Characterization of Blast Furnace Slag (BFS) as a Road Base Material

Speerpunt BOUW

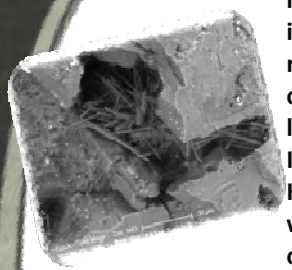
RESEARCH SCHOOL
INTEGRAL DESIGN OF STRUCTURES

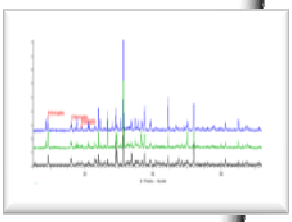
The main goal of this research is to develop an accelerated evaluation protocol for self-cementing materials.

1 **Pavement materials are being exposed to various environmental factors and loading conditions. Due to their chemical composition and mechanical properties their performance may vary considerably after designed service life.**

2 **Available records show that although secondary materials such as BFS satisfy required criteria, the pavements made from them may suffer form unusual mechanical failures.**

3 **During the study a variation was observed in the chemical and mineralogical composition, mainly due to the hydration reactions. The presence of the hydration phases and their intensity indicated the differences in the nature of this reaction in comparison with ordinary cement. Volume changes may happen due to ettringite formation using a long-term available source of water.**
In summary, BFS is suitable for (sub-)base construction. However, the question remains whether this type of material will be chemically stable in wet conditions for a long period of time.





3TU.

Researcher: S. Akbarnejad / s.akbarnejad@tudelft.nl / 0152783090.
Supervisors: A.A.A. Molenaar / A.A.A.Molenaar@tudelft.nl / 015 2784812 & /L.J.M. Houben / l.J.M.houben@tudelft.nl / 0152784917.
Program/Subprogram: Energy and Durability/ Pavement materials
Host University: Delft University of Technology / Road and Railway Engineering.

TU Delft
Delft University of Technology

Chemical and Mineralogical Characterization of Blast Furnace Slag (BFS) as a Road Base Material

S. Akbarnejad [a], A.A.A. Molenaar [b] and L.J.M. Houben [c]
[a] Ph.D. Researcher, s.akbarnejad@tudelft.nl
[b] Promotor, a.a.a.molenaar@tudelft.nl
[c] Co-promotor, l.j.m.houben@tudelft.nl
Delft University of Technology, Faculty Civil Engineering and Geosciences, Section of Road and Railway Engineering, P.O. Box 5048, 2600 GA Delft, the Netherlands.

Subject

In the Netherlands the scarcity of suitable natural aggregates has forced contractors to utilize secondary materials in road bases such as blast furnace slag (BFS) that either degrade the environment or pose problems for their disposal. But current acceptance specifications for secondary base materials are mainly empirical and they do not specify materials in terms of long-term properties. Accordingly, in the Netherlands motorways for instance, the records show that after designed service life expansion and shrinkage cracks within BFS base layers reflect into the top layer and appear as heaves and transverse cracks.

Goals

The great focus of this study is to evaluate self cementing secondary materials on chemical and mechanical bases and to develop a set of material selection specifications. Also it is desirable to develop a test program which is able to predict service life time of self-cementing mixtures.

Research Question

How can we estimate the performance of secondary materials in road (sub-) base construction?

Strategy

This experimental assessment firstly will try to determine the relationship between chemical composition and any potentially long-term 'negative' properties of self-cementing materials. Further chemical analysis will be performed on mechanisms which may produce harmful components for long-term performance. In the next phase the long-term mechanical performance of BFS in mixed granulates due to accelerated ageing will be investigated. Finally, based on the practical results and service life modelling, a protocol for accelerated evaluation of mixed granulates stabilized with GBFS will be proposed.

Expected Results

During this study the potential durability issues associated with self-cementing materials will be studied and subsequently their mechanical long term performance will be investigated. As a final research product an accelerated and reliable test procedure will be proposed to evaluate and estimate the long term performances of self-cementing mixtures for (sub-) base application.

Research Period

April 2008 – April 2012