FREEZING AND THAWING RESISTANCE OF DRY COMPACTED SEGMENTAL RETAINING WALL UNITS

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ABSTRACT

In 1998 the Minnesota Department of Transportation (Mn/DOT) adopted an aggressive testing program, test method and standard for performance of dry compacted segmental retaining wall units. These units are traditionally used in the construction of retaining walls and other similar highway structures. They are produced by vibrating the concrete internally and externally.

The testing program presented consisted of measuring physical properties of the units including compressive strength, density and absorption, as well as running the MN/DOT procedure. In addition, thin sections were prepared from each sample and observed to evaluate the microstructural impact on durability. Woods Metal Intrusion Porosimetry (WMIP) was used to qualitatively review the distribution of pore structure within the paste.

The compressive strength, absorption, and density are relatively poor indicators of performance of the units in freezing and thawing, however there is no clear theory as to why this should be the case. The thin section analysis indicated that those units showing good freeze/thaw performance had been well cured, based upon the relative abundance of hydrated Portland cement. In contrast, those samples which had not shown good performance showed a large amount of unhydrated Portland cement and mineral admixtures in particular in the finer fraction. WMIP showed that the resulting pore structure of the latter units compromised their freeze-thaw durability, in that better cured samples had considerably finer pore size distribution. A model of the microstructure of dry cast retaining wall units is proposed which explains the poor relationship between compressive strength, absorption density and freeze thaw resistance.