

HR-336 Thermogravimetric Analysis of Carbonate Aggregate

Key Words: Aggregate, Aggregate durability, Aggregate quality, Aggregate testing, Thermogravimetric Analysis

ABSTRACT

Research has shown that one of the major contributing factors in early joint deterioration of portland cement concrete (PCC) pavement is the quality of the coarse aggregate. Conventional physical and freeze/thaw tests are slow and not satisfactory in evaluating aggregate quality. In the last ten years the Iowa DOT has been evaluating X-ray analysis and other new technologies to predict aggregate durability in PCC pavement.

The objective of this research is to evaluate thermogravimetric analysis (TGA) of carbonate aggregate. The TGA testing has been conducted with a TA 2950 Thermogravimetric Analyzer. The equipment is controlled by an IBM compatible computer. A TA Hi-ResN software package allows for rapid testing while retaining high resolution.

The carbon dioxide is driven off the dolomite fraction between 705°C and 745°C and off the calcite fraction between 905°C and 940°C. The graphical plot of the temperature and weight loss using the same sample size and test procedure demonstrates that the test is very accurate and repeatable. A substantial number of both dolomites and limestones (calcites) have been subjected to TGA testing. The slopes of the weight loss plot prior to the dolomite and calcite transitions does correlate with field performance. The noncarbonate fraction, which correlates to the acid insolubles, can be determined by TGA for most calcites and some dolomites. TGA has provided information that can be used to help predict the quality of carbonate aggregate.