Magnitude Assessment of Free and Hydrated Limes Present in RPCC Aggregates

Executive Summary

The tendency of tufa to block pavement drains in northeastern Ohio can be associated with the total calcium content of the aggregate material. In the present project, recycled Portland Cement Concrete (RPCC) aggregates are examined when leached with acidic water formed by carbon dioxide dissolved in water. The RPCC aggregates were supplied by the Ohio Department of Transportation (ODOT) from various sections of the interstate highways in the state of Ohio. The locations of sample and a summary of the components in terms of course aggregate, fine aggregate, and cement are quoted in the study of D-cracking report. All the RPCC aggregates were around 30 years old. X-ray power diffraction (XRD) data and thermal analysis (thermogravimetry, TG and differential thermal analysis, DTA) data established the portlandite, dolomite, and calcium carbonate content of the RPCC aggregates. The presence of quartz is established from the DTA plots and its relative abundance established from the XRD data. The ethylene glycol test indicated that the free calcium oxide content has been reduced in most samples to around 0.5% due to carbonation over 30 years. All the samples were subjected to leaching tests in the presence of acidic water (CO_2 in water) and the concentration of Ca^{2+} and Mg^{2+} ions established using Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES). A ratio of Mg/Ca ions >0.60 indicates that the aggregates have higher concentration of Ca^{+2} ions and may result in the precipitation of calcium carbonate or tufa. In laboratory studies, the ambient temperature of pouring of concrete (below 50^0 F) has shown a higher incidence of tufa precipitation. It may be due to incomplete hydration. The study recommends establishing Mg/Ca ratio before using RPCC aggregates as base/subbase course. Also it is recommended to limit the use of RPCC aggregates to coarse size only.