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## **NON-DESTRUCTIVE ANALYSIS SHOWS AGGREGATE DETERIORATION CREATED AIR VOID SYSTEM IN 1910’s PAVEMENTS**

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### **Abstract**

Some portland cement concrete (PCC) pavements in Iowa, USA, have shown negligible deterioration despite long service lives (>75 years). These pavements were built with no entrained air, a modern method to reduce cold-weather deterioration. Thirteen concrete cores were collected and analyzed by image analysis (ASTM C457) and helium pycnometry. Porosity negatively correlated with pavement age ( $R^2 \approx 0.8$ ) for both methods (increasingly higher porosity in younger pavements). Helium porosity was offset to higher values from C457 porosity by ~5 percentage points. Three cores were subjected to computed tomography image analysis: two “historical” cores (from 1909 and 1921) and one “modern” core (from 1999). Pores, paste, and grains were clearly distinguishable. Pores with the size and shape of coarse aggregate grains suggested that dissolution could produce a well-connected air void network in PCC despite lack of air entrainment during construction. This pore network has likely permitted sufficient drainage to allow these pavements to escape significant deterioration over their service lives.

**Keywords: Non-Destructive Evaluation—Portland Cement Concrete—Computed Tomography—Helium Pycnometry—Coarse Aggregate**

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