

AN ABSTRACT OF A THESIS

**UTILIZING TCA MIX DESIGN AND ADJUSTMENT
METHOD TO IMPROVE PERVIOUS PCC**

John P. Hendrix, P.E.

Master of Science in Civil Engineering

The Tennessee Concrete Association (TCA) recently developed a method for pervious concrete mixture adjustment. Adjustment requires mixture modifications to achieve a target ASTM C1688 void content. Pervious concrete mixture designs have always been a trade-off between permeability and strength. The purpose of the TCA adjustment method is to provide a rational means for optimizing pervious concrete properties.

Increasing the cementing materials content, amount of fine aggregate, and/or water usually reduces voids and increases strength by providing more aggregate surface area for paste bonding and/or increasing paste volume. Unfortunately, these same modifications tend to reduce permeability. In this study, an attempt is made to maximize the compressive strength of a typical mixture while maintaining constant head permeability greater than 100-inches/hour (0.07-cm/sec). The control mixture had 600-lbs/CY (356-kg/m³) of cementing materials with a 0.3 w/cm ratio, 2584-lbs/CY (1533-kg/m³) of No. 89 limestone coarse aggregate and no fine aggregate. Twenty replications of the control mixture yielded average ASTM C1688 voids, 28-day compressive strengths, and constant head permeabilities of 19.4%, 2080-psi (14.3-Mpa), and 427-inches/hour (0.30-cm/sec), respectively.

Guidance from the TCA Mixture Adjustment Method indicated that for the desired permeability, ASTM C1688 voids should be approximately 15%. The voids were reduced by including seven percent river sand in the combined aggregate gradation and increasing the w/cm ratio to 0.315. Coarse aggregate content was reduced to accommodate the changes. Twenty replications of the modified mixture yielded average ASTM C1688 voids, 28-day compressive strength, and constant head permeabilities of 15.0%, 2630-psi (18.1-MPa), and 149-inches/hour (0.11-cm/sec), respectively. The 26.4% increase in compressive strength appears very promising for the TCA Mixture Adjustment Method. Information on compressive strength, effective void, and constant head permeability variability is also provided.