

FLEXURAL FATIGUE STRENGTH OF HVFA CONCRETE SYSTEMS

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Reference: CBU-1998-07

ABSTRACT

The primary objective of this work was to evaluate flexural fatigue properties of high-volume fly ash concrete systems. A total of eight concrete mixtures were proportioned using four sources of fly ash and two Type I portland cements (low-alkali and high-alkali). Both fly ash content (58% of total cementitious materials) and water to cementitious materials ratio (0.33) were kept constant for this investigation. Flexural fatigue loads were applied using a third-point loading system in accordance with ASTM C 78. The resulting data were analyzed to establish stress versus number of cycles to failure curve. Additionally, experiments were also carried out to evaluate the modified cube compressive strength ASTM C 116 of each mixture using portions of the beam, which were previously broken in flexure. Test data showed a non-linear behavior between flexural fatigue stress and number of cycles of loadings. Endurance or fatigue limit was defined as flexural fatigue stress at two million loading cycles. The value of this limit was found to vary from mixture to mixture. However, this variability was greatly reduced when the endurance ratio (endurance limit divided by the static flexural strength) versus number of cycles was used. The endurance ratio was found to generally vary between 0.42 and 0.54 with an overall average of approximately 0.5. These values are similar to those observed for non-fly ash concrete.