

FLEXURAL FATIGUE STRENGTH OF HVFA CONCRETE SYSTEMS

By Tarun R. Naik, V.M. Malhotra, Shiw S. Singh, and Bruce W. Ramme

Reference: CBU-1997-25

ABSTRACT

There is a lack of information on fatigue behavior of fly ash concrete, especially concrete incorporating large amounts of fly ash. The major focus of this investigation was to establish fatigue properties of high-volume fly ash concrete systems. In this work, 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). The levels of fly ash content (58% of total cementitious materials) and water to cementitious materials ratio (0.33) were maintained constant for all test mixtures. Each mixture was tested under both static as well as cyclic flexural loadings. These loads were applied using third-point loading in accordance with ASTM C 78. The resulting data were analyzed to establish stress versus number of cycles to failure curve (S-N curve). Experiments were also carried out to determine the modified cube compressive strength (ASTM C 116) of each mixture using portions of the beam, which were previously tested for static flexural strength. Fatigue or endurance limit was defined as fatigue stress at 2 million of loading cycles. This limit was found to vary significant from mixture to mixture. The ratio of fatigue limit to static flexural strength varied in the range of 0.45-0.60. Based on pooled data, a fatigue limit for HVFA concrete system was found to be 0.51, which is in the range of values observed for non-fly ash concrete systems.