

CRACKING AND DEFLECTION BEHAVIOUR OF PARTIALLY PRESTRESSED HIGH STRENGTH CONCRETE BEAMS

Dr. Sanaul H. Chowdhury
Griffith School of Engineering
Griffith University Gold Coast Campus
PMB 50 Gold Coast Mail Centre
Queensland 9726, Australia

ABSTRACT

High strength concrete (HSC) has revolutionised the construction industry in the 1980's and in recent years a marked increase in the use of HSC (compressive strength, $f_c > 50$ MPa) has been evident in construction projects around the world.

HSC is more brittle than normal strength concrete (NSC). As such, the problem of cracking is more pronounced for HSC structures because of the higher brittleness in comparison to their NSC counterparts. Further, by using HSC, smaller cross-sections with reduced dead load and longer spans can be designed. For the smaller cross-sectional members, excessive deflections may become a problem.

In order to investigate the cracking and deflection behaviour of partially prestressed high strength concrete beams, 4 full-size beams have been tested to failure in which measurements were made of mid-span deflections, crack spacings and crack widths at different load levels. The simply-supported beams had varying span lengths, reinforcement ratios, concrete compressive strengths and degrees of prestressing. The concrete strengths for the beams varied from 99.3 to 103.1 MPa.

As expected, the beams exhibited less ductile and bordering on brittle behaviour characteristic of high strength concrete. There was less number of cracks developed but the cracks extended to much larger widths with increasing loads.

Two of the major code methods – the ACI Code and the Australian Standard - were used to predict mid-span deflections for the test beams and were compared with the experimental results. Both the code methods have been found to be inconsistent in either under- or over-predicting the deflections.