

BEHAVIOUR OF REINFORCED CONCRETE PORTAL FRAMES
UNDER THE EFFECTS OF CREEP AND SHRINKAGE AT
ELEVATED TEMPERATURES

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Thesis submitted to the
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CERTIFICATE

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ABSTRACT

The author has examined the behaviour of reinforced concrete portal frames (two-hinged) under the combined effects of creep and shrinkage of concrete at elevated temperatures. Five portal frames, two with sustained transverse loads and three without, and all subjected to elevated temperatures, were tested for periods varying from two to four months. The measured parameters included the horizontal reaction at the hinge, deflections, axial strains, steel strains and temperatures. The beams of the portals were heated either 'uniformly' or with a view to obtain temperature crossfalls.

Subsidiary tests were performed on a number of specimens made of the same concrete as used in the portal frames to obtain creep-time-temperature and shrinkage-time-temperature relationships and other pertinent data.

An analytical prediction method, which is iterative and which can be programmed in a computer, has been developed using the rate of creep principle and adapting the force (flexibility) method of structural analysis. The method incorporates the tensile strength of concrete and takes into account possible tensile cracking of concrete.

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The tests show that, even in the absence of significant axial forces, thermoelastic moments are never realised in the portal frames. Both due to creep and shrinkage of concrete (and due to possible moisture migration when thermal gradients are encountered) significant redistributions of moments take place. On cooling, significant changes occur in the moments on the structure, which moments are quite different from those predicted thermoelastically.

The reinforcing steel absorbs a large amount of the enormous shrinkage and creep strains and develops very large compressive stresses. Such stresses are very large compared with the values, which would be predicted by the conventional reinforced concrete theory.

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