ANALYSIS AND BEHAVIOUR OF R.C. TALL BUILDINGS INCORPORATING CREEP AND SHRINKAGE

By

SAVITA MARU

DEPARTMENT OF CIVIL ENGINEERING

Submitted

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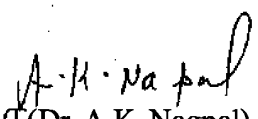
CERTIFICATE

This is to certify that the thesis entitled, "Analysis and Behaviour of R.C. Tall Buildings Incorporating Creep and Shrinkage" being submitted by Savita Maru to the Indian Institute of Technology, Delhi for the award of the degree of Doctor of Philosophy is a bonafide record of research work carried out by her under my supervision and guidance. The thesis work, in my opinion, has reached the requisite standard fulfilling the requirement for the degree of Doctor of Philosophy.

The results contained in this thesis have not been submitted, in part or full, to any other University or Institute for the award of any degree or diploma.



(Dr. A.K. Nagpal)
Professor,
Department of Civil Engineering
Indian Institute of Technology,
Delhi
Hauz Khas, New Delhi - 110016
India

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Ph. D. is like living life in its microcosm, where you meet all sorts of people and go through all kinds of experiences. In all this drama, as probably the great bard Shakespeare would have loved to refer it, there is a tiny minority, who with their caring, helping and understanding attitude makes this arduous human endeavor successful. My thanks are due to this minority, which has in one way or other, contributed towards my efforts during almost 4 years.

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Then, there are people who almost descend from heaven and without caring for their personal inconveniences, are ready to work for you day and night. Here comes to my mind the name of Hasan, without whose support, this work would never have been completed.

Not everybody can support you emotionally, when your mind is plagued by constant doubt and heart beset by innumerable frustration of work. It's then that one needs a person who can just listen to you without evaluation, a person who takes you away from the suffocating web that your work sometimes weaves around you. I can not but only feel indebted to Shipra and Anu, who never made me feel that I was stranded 705 kms away from my family. I am grateful to Chitra, who despite being a different individual, became a part of me and helped me in search of a meaningful way of life.

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To a great extent, our success is, but a result of the constant support, one's family provides. I feel quite fortunate in this regard. Yet, I find it very awkward to thank my family. I must secretly admit that I took their support for granted. Four years is a long time in this age of heady changes and I must say that there was not single occasion, when my family, especially my mummy and papa, wavered in the confidence, they have shown in my abilities all along.

History shows that all the great advances have been made by the constant urges, which have defined the very individual, we all are in ourselves. To that extent, this work is my own effort. Beyond all this, the whole exercise has also been a period of my personal development. Endless days and nights, I spent doing at times, monotonous and repetitious work, listening to my own inner stirrings and Gazals, reflecting the hopes and frustrations of human existence, enjoying sometimes with gay abandon at various places in Delhi, shall remain an abiding part of my memory.

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Savita-Mara

ABSTRACT

In the procedure available in literature for considering creep and shrinkage effects in R.C. buildings, the shearing action of beams is neglected and the effects of differing nature of application of dead load and live load is ignored. No procedure exists which takes into account the sequential nature of application of dead load, simultaneous nature of application of live load, creep and shrinkage effects in concrete and shearing actions of beams while evaluating creep deflections. The present work is devoted to the development of such a procedure, to the development of softwares and to carrying out numerical studies.

The proposed procedure considers shearing action of beams for evalaution of elastic axial forces as well as redistribution of axial forces resulting from creep and shrinkage deformations. In addition to elastic axial forces, the effect of inelastic axial forces on creep deformations which get generated progressively with time is also taken into account.

It is shown that errors in the approximate procedure available in the literature (AP) in differential vertical deflections (between adjacent columns) and column axial forces increases with higher beam stiffness. These errors are quite large even for low beam stiffness values.

For tall buildings modelled as a set of independent frames (2-D) numerical studies are carried out for predominant structural parameters which affect creep and shrinkage behaviour.

No work is available in literature on the effect of interaction among frames in 3-D buildings. A part of present work directed towards this end. The proposed procedure is adopted to the 3-D model of the building and numerical studies carried

out. In order to study the interaction among frames, results from 3-D model are compared with those of 2-D model.

Further, to make rapid estimate of inelastic deflections, needed for compensation, the development of a Neural Network model which simulates the inelastic deflections of proposed procedure from the inelastic deflections of AP has been initiated with the 2-D frame model. Governing structural parameters which influence the inelastic deflection ratio, η are identified. These parameters become input parameters of the Neural Network. The output parameter is a multiplication factor which when multiplied with the inelastic deflections of AP gives an estimate of the inelastic deflections of proposed procedure. The validity of the Neural Network has been demonstrated for a number of example buildings having a wide variation in structural properties within the practical range.

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