TALL BUILDINGS WITH STAGGERED SHEAR WALLS

by

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CERTIFICATE

This is to certify that the thesis entitled "TALL BUILDINGS WITH STAGGERED SHEAR WALLS", being submitted by Mr. K.N.V. Prasada Rao to the Indian Institute of Technology, Delhi, for the award of the degree of DOCTOR OF PHILOSOPHY in Civil Engineering, is a bonafide research work carried out by him.

To the best of our knowledge the thesis has reached the requisite standard. The material presented in this thesis has not been submitted in part or in full to any other University or Institute for the award of any degree or diploma.

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ABSTRACT

Tall buildings are usually provided with shear walls extending from foundation to roof to resist lateral loads. For architectural, structural or functional reasons it may be necessary, sometimes, to omit the wall in ground floor or discontinue it in some intermediate storeys. The concept of providing storey-deep and bay-wide discrete panels to resist lateral loads is now introduced. Three different systematic arrangements of panels are investigated. Both static and dynamic responses are evaluated for the proposed staggered shear panel system and are compared with those of the conventional shear wall system.

Three methods of analysis are presented based on the idealisation of a discrete panel as (i) rigid panel (ii) wide column with rigid or finite arms and (iii) assembly of finite elements. The first two methods do not correctly predict the behaviour of the system. A finite element method using Macleod's pair of elements, which consider inplane rotation is found to be adequate. Mesh divisions of 4x4 elements in each panel lead to fairly accurate overall solution. For precast large panel construction a simpler method of analysis (Stringer Method) amenable for hand computations is suggested.

In the proposed system the skeletal members attract more end forces. But it is superior to the conventional system in respect of sway at top and panel base moments and shears. By suitable disposition and dimensioning of discrete panels the

lateral deflections due to horizontal loading can be controlled which gives flexibility to the designer. Distress at the corners of a panel where concentration of stresses occurs can be avoided by extending column and girder reinforcements into the panel.

The dynamic response of the proposed system is comparable with that of the conventional one. In respect of top displacements the proposed system is superior for buildings of moderate height.

Four perspex models and three reinforced concrete panels were tested for assessing the overall behaviour (static and dynamic) and to investigate the effect of stress concentrations at panel corners, respectively.

C O N T E N T S

CHAPTER I

Introduction and Literature Review

CHAPTER II

Analytical Investigation - Static Response of Staggered Panel Syste