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Review Paper on Pushover Analysis of Tube in Tube structure with different plan configuration

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***Abstract**:*

In India construction and study of tall structure having in a large manner couldn't be done because of lack of knowledge and practical studies in engineer and researcher's. So in this research paper I study the behavior of specific type of tall structure. In which tubular structure is studied with constant plan area with different plan irregularity in horizontal direction by changing the position of shear wall in modeling. The behavior of tubular structure under the action of wind load and seismic effect, could suffer a considerable degree of shear lag in the normal-to-panels. The performance based (pushover analysis) study of tube-in-tube structure shows the more accurate result against the lateral loading based on ATC-40 and FEMA-356 depends the ductility and non-linear performance of material to show plastic rotation of components of the structure.

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Keywords

Pushover analysis, tall structure, seismic effect, plastic rotation etc.

1. Introduction

In construction field tall structure and light in weight construction for covering large area in vertical direction is studies' the main purpose of designing this structure to cover less geological earth area. The basic design philosophy in all of those forms has been to place as much as possible of the load-carrying material around the external periphery of the building to maximize the flexural rigidity of the cross section. The original development was the framed tube, which under the action of wind loading could suffer a considerable degree of shear leg in the normal-to-wind panels. The later more efficient bundled-tube systems were designed to produce a more uniform axial stress distribution in the columns of the "normal" panels. Some recent irregular "postmodern" buildings have evolved a hybrid form of structure. In which only part of periphery is of framed tube construction while the remainder consists of a space-frame system. The general analysis of three-dimensional tubular structures is considered briefly initially, and then the techniques that have been developed to reduce the amount of computation for symmetrical system are described.

2. Structural Behavior Of Tubular Structures

The structural behavior of the basic rectangular framed-tube structure when subjected to lateral forces and improvements that have been made in the subsequent bundled-tube developments. Some of the more important assumptions made in the modeling of these systems are discussed.

2.1 Framed-Tube Structure

The most basic framed-tube structure consists essentially rigidly jointed frame panels forming a tube in plan as shown in figure 2.1. The frame panels are formed by closely spaced perimeter columns that are connected by deep spandrel beams at each floor levels. The basic requirement has been to place as much of the load-carrying material at the extreme edges of the building to maximize the inertia of the building's cross section. The essential uniformity of the system enables industrialized techniques to be used in the construction sequence. For steel structure large elements of the façade frame may be prefabricated in a factory and transported to the site where they are hoisted into place and fixed.

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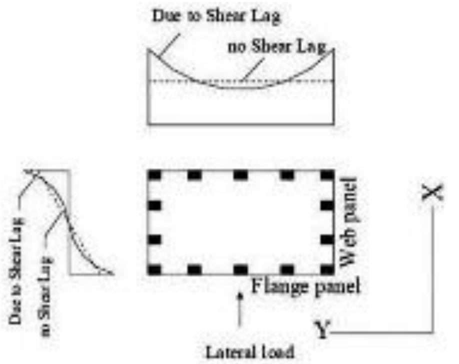

Figurer2.1 distribution of axial stress in tubular structure.

3. Literature Review

A brief review of previous studies on the application of the tubular structure. This literature review also includes previous studies on different application of tube in tube structure. This literature review on recent contribution related to nonlinear static pushover analysis of building structure with tubular tall structure.

Ray P.S. Han (1989) in his research paper an efficient three-dimensional analysis of framed tube structures with arbitrary cross sections, but of uniform panel properties, is presented. It is based on the finite strip method (FSM) and involves transforming the discrete structure into an elastically equivalent orthotropic tube. Unlike the usual FSM, the different modes in the stiffness matrix given here are uncoupled. These results in a much smaller matrix and consequently the analysis of the highly redundant framed tube structures can be conveniently and economically handled on a microcomputer. To assess the accuracy of the proposed formulation, two unperforated tubes of rectangular and triangular cross sections are analyzed, and the results are found to be in good agreement with solutions obtained using the finite element method (FEM). As an application, a 30-story framed tube structure is analyzed. Comparison with solutions from a three-dimensional finite element model.

Navin R. Amin in his study to define general procedures for design of multiple framed tube high rise steel structures in seismic region. The analytical methods and design procedures are outlined special considerations such as beam/column joints and member's proportions are discussed. Three recent high rise projects completed using the multiple tubular concepts are presented followed by the discussion relative merits of multiple tubular systems.

M.L. Gambher in his paper presented a qualitative study of the behavior of some of the commonly used structural systems for the high rise building subjected to earthquake forces the system analyses are frame-shear core interactive system, framed-tube system and tube-in-tube system. The percentage of lateral load resisted by each of the constituent systems has been determined for buildings of various heights. The characteristics of the core as a load carrying element and its efficiency as a bracing element have own studied. Recommendations are made regarding the stability of a system for building of various heights.

4. Modeling And Material

Tube-in-tube structural model is constructed as a rigid frame structure with central core of shear wall in which shear wall is modeled as an equivalent column placed at the central line of shear wall for analysis purpose according to the FEMA-273. Three models are generated with different plan having a constant area of 1200m^2 shown in figure. Tubular structure have an assumption that the placing of the column is constant therefore in each model central to center distance between the column is 5m.**model1,model2** and **model3** having a shape of rectangular, L-shape and T-shape. The models are generated using software sap2000vs16.

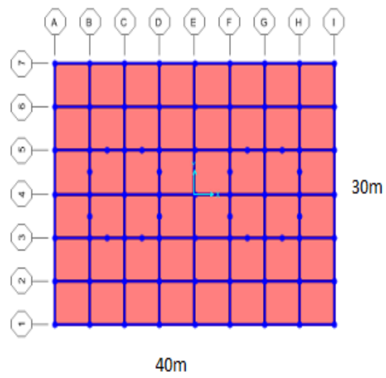

Figure4.1 paln view of model-1

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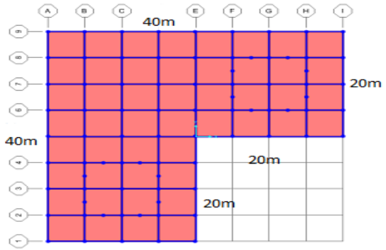


Figure4.2 plan view of model-2

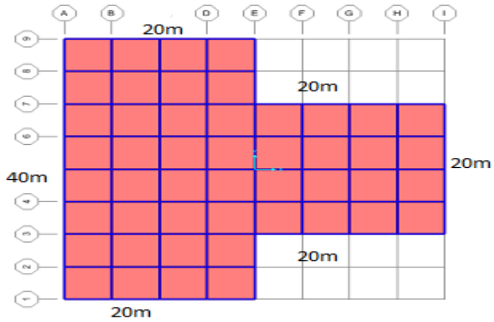


Figure4.3 plan view of model-3

Particulars	Details
Plan Area	1200m^2
Size of beam	0.45m*0.45m
Size of column	1m*1m
Equivalent size of shear wall	0.5m*0.5m
Slab thickness	150mm
Unit weight of brick wall	18.85 KN/m^3
Earth quake load	As per IS: 1893(part 1) – 2002
Building importance factor	1
Zone factor	0.36
Story height	3
No. Of floors	G+49
Live load on floor	3 KN/m^2

Table4.1 Detail of material

4.1 Material properties

In analysis procedure of pushover method nonlinear properties of concrete and steel material are defined according to mander confined concrete theory, in which ε_{su} (ultimate strain of concrete) is a function of the confinement steel. The following figure shows the stress –strain curves for confined concrete. The tensile yield stress for the mander confined curves is taken as $7.5(f_{ck})^{0.5}$ in psi.

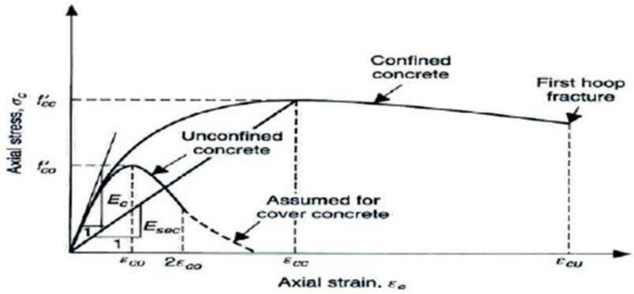


Figure4.4 stress-strain curve of concrete (non-linear).

5. Methodology

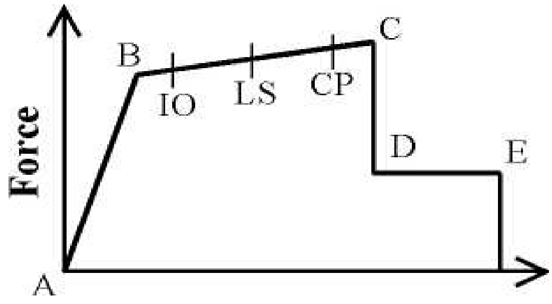
A performance (pushover analysis) having an objective of specifies the desired seismic performance of the building. Seismic performance is described by designating the maximum allowable damage state for an identified seismic hazard. A performance objective may include consideration of damage states for several level of ground motion would then be termed a dual or multiple-level performance objective. A performance level describes a limiting damage condition which may be considered satisfactory for a given building and a given ground motion. The limiting condition is described by the physical damage within the building. The threat to life safety of the building's occupants created by the damage, and the post-earthquake serviceability of the building.

Structural performance levels and Ranges

Structural performance levels and Ranges are assigned a title and, for case of reference, a number. The number is called structural performance number and is abbreviated SP-n (where n is the designated number).

Structural performance levels-

- Immediate occupancy
- Life safety
- Structural stability (damage control)



Deformation

Figure5.1 performance levels in pushover analysis

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