Linear Analysis of Slender Column Using Ultra-High Strength Concrete

Mr Sagar Chaskar[1], Prof. Shelar .V.V [2]
[1]Dept of Civil Engineering
[2]Professor, Dept of Civil Engineering
[1, 2] Trinity College of Engineering and research Pune, India.

Abstract- *This article shows the influence of axial force on ultra-high strength concrete columns design. The behavior of columns made of ultra high strength concrete with slenderness values an axial force has been studied. The modelling is done in Etabs as per IS 1893-2002. Structural analysis has been developed by means of software which considers both geometrical and mechanical non-linearity. As the analysis is been consider by using P-Delta effect for slender column. The sequence of points defined by increasing values of axial force and displacement produced has been represented on the cross-section interaction diagram until failure for each tested column. Then, diagrams depicting the relationship between failure axial force and column's slenderness have been drawn. Linear analysis is used for the slender column design. As the result shows the displacement and failure of slender column when increase in axial force.*

I. INTRODUCTION

Reinforced concrete rigid frames are the most widely employed structural system. They are composed by columns and beams. Columns are the structural elements whose prevailing internal force is an axial load which can be combined with one or two bending moments around two orthogonal axis. Since the mid-twentieth century they have been targeted in many researches whose results, after being contrasted with pilot testing, have led to several calculation methods. In the case of short columns whose strength depends only on the bearing capacity of their section. Gradual technological development has enabled the production of concretes with a higher strength to compression stress.

The use of columns made of ultra high strength concrete (UHSC) in high-rise buildings reduces their section and increases the available space around them. The reduction of the cross section caused by the use of ultra high strength concrete leads to slender columns whose bearing capacity is basically conditioned by their length. Therefore, a thorough analysis effect and the materials mechanic non-linearity is required. δ of second order effects derived from both the P-delta effect and the materials mechanic non-linearity is required. Columns are defined as structural elements that carry loads in compression. Usually they carry loads in compression and bending moments as well about one or both axes of the cross sections. A short column is one in which the ultimate load at a given eccentricity is governed only by the strength of the materials and the dimensions of the cross-section.

A slender column is one in which the ultimate load is governed not only by the strength of the materials and the dimensions of the cross section but also by the slenderness, which produces additional bending moment due to lateral deformations. For loaded the short columns behaviour will follow the linear path until intersect the interaction diagram. For loaded slender columns, the column will follow a linear path until intersects the interaction diagram. This means that, due to the linear effects the actual moment on the column is greater than the linear moment. In designing loaded slender columns, the second-order effects are very important parameters. Slender columns can be defined as columns with small cross sections compared to their lengths. Generally, slender columns have lower strength when compared to short columns, for a constant cross section, increasing the length causes a reduction in the strength. In the modern design of reinforced concrete (RC) buildings, architects often prefer using RC columns with small size, i.e., columns with a small width. Certainly, this process provides more free space and a good aesthetic internal look to the buildings. Reducing the column size results in slender (long) columns and consequently, the stability problem may be faced. Furthermore, reducing the column cross-sectional area does not eliminate square columns edges that emerged out of their partitions. The emergence of columns edges can directly affect the living space, the furniture arrangement, or cause accidents when the children are playing or moving around at home. Besides, they caused difficulty communicating because of the bulging part of the column.

To overcome these limitations, new types of RC columns called rectangular slender column concrete, columns are used as hidden columns between partitioning of the building. Using rectangular columns, results in many architectural and structural advantages such as avoiding prominent columns edges, easy in fashioning, reducing dead load, increasing flexural stiffness, as well as saving in cost when compared with RC frames with square columns.

1.1 Aim of Study

The main objective of the study is to analyses the behavior of the slender column under the action of Axail loads. To compare the different concrete like M30,M60,M90 and M100 used for column. To find the maximum displacement under the action of Axail load on the slender column.

1.2 Objective of Study

1: In order to study the behaviour of slender column structures created as per Is actually codes.

2: In order to check the outcome of column while using ultra high-strength concrete (UHSC) buildings

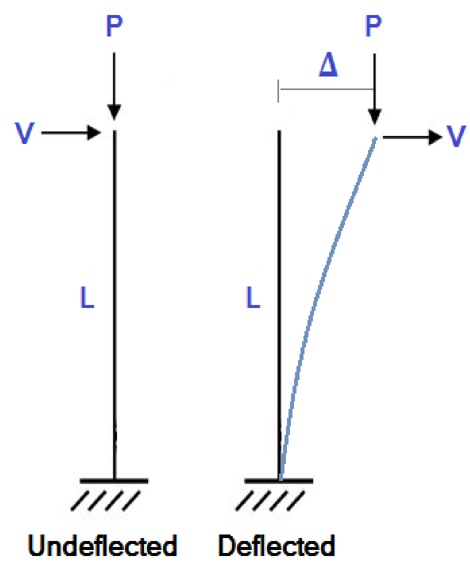
3: In order to study the effect of axial load on column to know the maximum displacement.

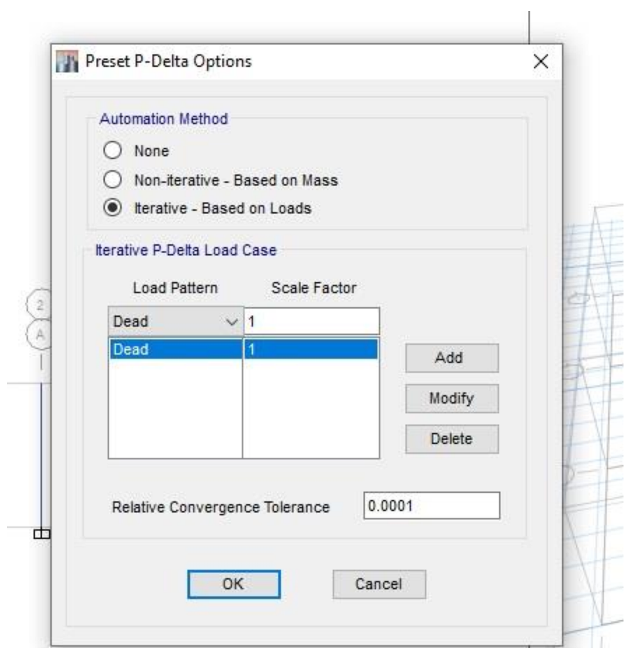
1.3P-Delta Analysis

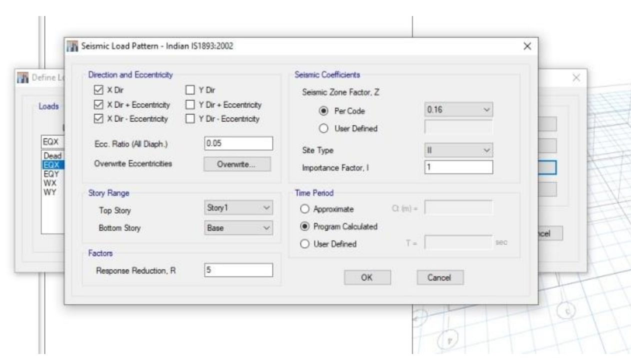
In structural engineering, the P-Δ or P-delta effect refers to the abrupt changes in ground shear, overturning moment, and/or the axial force distribution at the base of a sufficiently tall structure or structural component when it is subject to a critical lateral displacement. A distinction can be made between P-delta effects on a multi-tiered building, written as P-Δ, and the effects on members deflecting within a tier, written as P-δ.

P-delta is a second-order effect on a structure which is loaded laterally. One first-order effect is the initial deflection of the structure in reaction to the lateral load. The magnitude of the P-delta effect depends on the magnitude of this initial deflection. P-delta is a moment found by multiplying the force due to the weight of the structure and applied axial load, P, by the first-order deflection, Δ or δ.

Iterative Based on Load Cases**,** in which load is computed from a specified combination of static load cases, then known as the P-Delta load combination. This is an iterative method which considers P-Delta on an element-by-element basis. Local buckling is captured more effectively. An example application may be when load includes the dead load case and a fraction of a live load case.

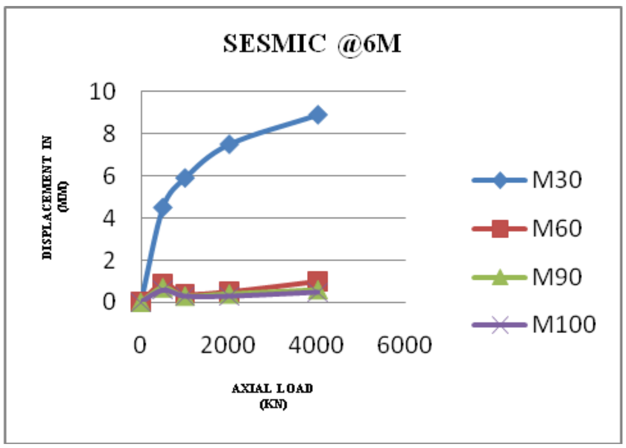


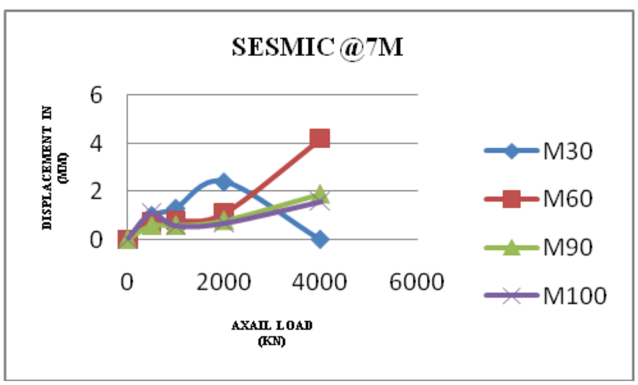


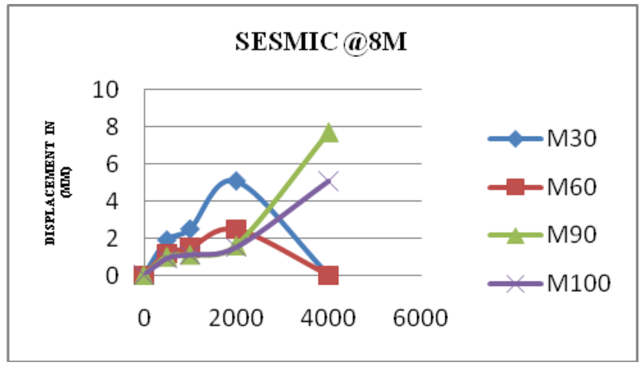


Model Description	
Column sizes	300X450mm
Length	6m 7m 8m
Concrete grade	M30 M60 M90 M100
Axial Load	500 KN 1000 KN 2000 KN 4000 KN

1.4 Result And Comparison







II. CONCLUSION & FUTURE SCOPE

In this project I have done analysis using P-Delta effect, but it was fail when 4000 KN load applied for M30 @7m, M30 & M60 @8m so by using ultra-high strength concrete for slender column we get displacement. In future scope for high rise building you should use slender column but increasing the size of the column for more strength an do analysis and find result .

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