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ANALYSIS OF MULTISTOREYED STRUCTURES USING ETABS

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Abstract: **This paper describes the salient features of ETABS (i.e., Extended Three Dimensional Analysis of Building Systems) and its various applications in civil engineering. In this software the designer will be able to generate the geometry, define the boundary conditions, assign material properties, specify the loads and perform the analysis all conveniently and quickly. It helps in understanding the overall behaviour of the structure in terms of resulting bending moment, shear forces and deformations which can be viewed or plotted.**

This paper also presents illustration of a comparitive study of static loads for 5 and 10 storey multi storeyed structures. The significance of this work is to estimate the design loads of a structure.

Keywords: **ETABS, Bending moment, Shear force.**

I. INTRODUCTION

Computers are being extensively used to assist engineers in various aspects of design. Especially in the field of structural engineering, the early applications were in the areas of structural analysis of systems. With the advent of powerful graphic features this has been extended to various aspects of design, detailing, estimation and construction of structures.

A software integrating the analysis and design of R.C.C. Framed structures would be a highly desirable tool for trying out various alternate designs in order to arrive at an optimum design solution, which require minimum quantities of concrete and steel. With conventional programming practice, writing such a software would be quite complicated and even such software is written, it would be very difficult to modify or extend it. But, object oriented programming a conceptually new paradigm, offers several desirable features for the development of such complex application software.

There are many analysis packages available commercially for the analysis of high rise building frames. However, most of them are not easy to use with their rigid format and, it is required to key-in large amount of input data. Considerable amount of time is also required to interpret the results. In many cases it becomes really a tedious task to interpret the large volume of printed results. The main emphasis is on removing the drudgery of preparation of large amount of input data and helping in quick interpretation of the results through visual graphics.

II. SALIENT FEATURES OF ETABS

- Fully integrated interface within Windows 95/98/NT/2000
- Optimized for modeling of multistory buildings
- 3D perspective, plan, elevation, developed elevation, and custom views
- 3D model generation using plans and elevations
- CAD drawing/editing for fast, intuitive framing layout

- Extensive Analysis Capabilities
- Linear Static Analysis
- Linear Dynamic Analysis
- Static and Dynamic P-Delta Analysis
- Static Non-Linear Analysis
- Dynamic Non-Linear Analysis
- Pushover Analysis
- Multiple Response Spectrum Analysis
- Multiple Time History Analysis
- Construction sequence loading analysis
- Fast generation of model using the concept of similar stories
- Automated templates for typical structures
- Easy editing with move, merge, mirror and replicate
- Multiple views in 3D perspective with zooming and snapping
- Onscreen assignment of properties, loading and supports
- Powerful grouping, selection and Display options
- Cut copy and paste options

III. PROBLEM DEFINITION

A. A 30X30m 5 storey structure is considered for the study. Modeling, analysis and design of the structure is done in ETABS software.

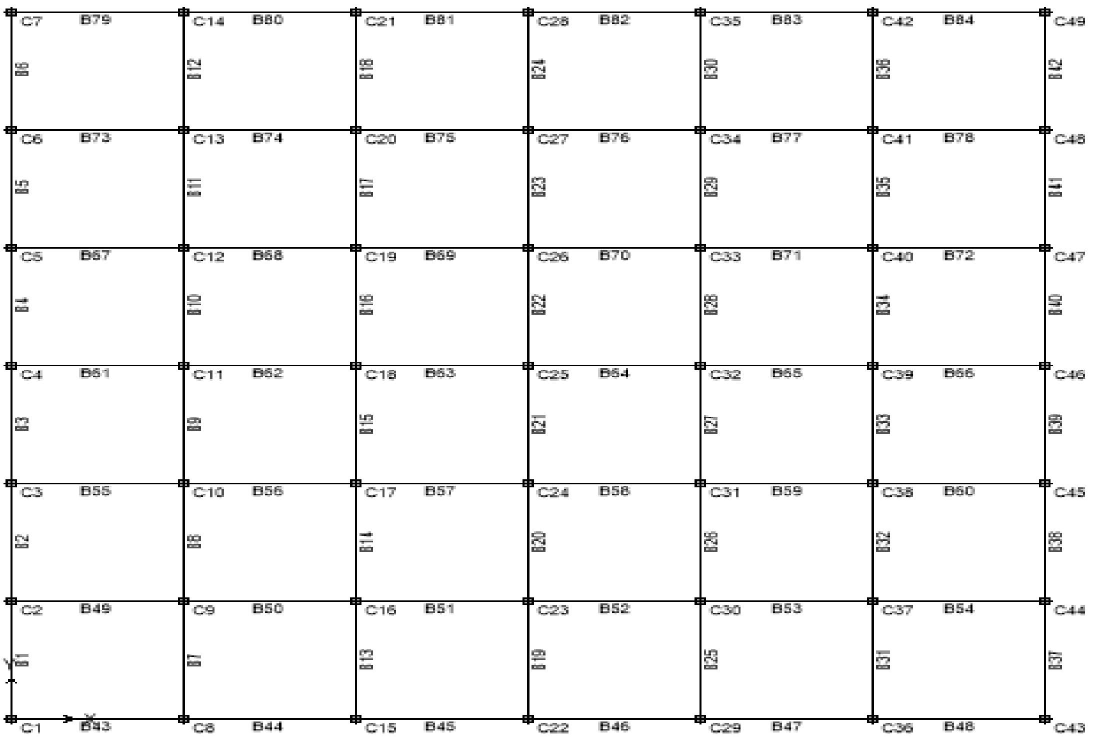


Figure 1. Plan of a Regular Structure Considered

Table 1. Preliminary Data

Length x Width	30mx30m
No.of storeys	5
Storey height	3m
Beam	300x300mm
Column	300x300mm
Slab thickness	125mm
Support Conditions	Fixed

Loading consideration:

Loads acting on the structure are dead load (DL), Live Load (LL).

DL= 2 KN/Sq.m is considered

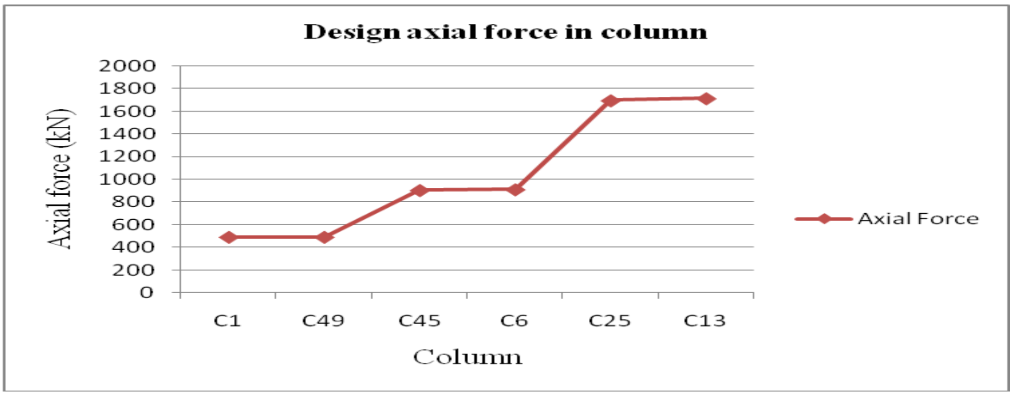
LL= 3 KN/Sq.m is considered

IV. RESULTS AND DISCUSSIONS

A. FIVE STOREY RESULTS:

Table 2: Design Axial Force In Column

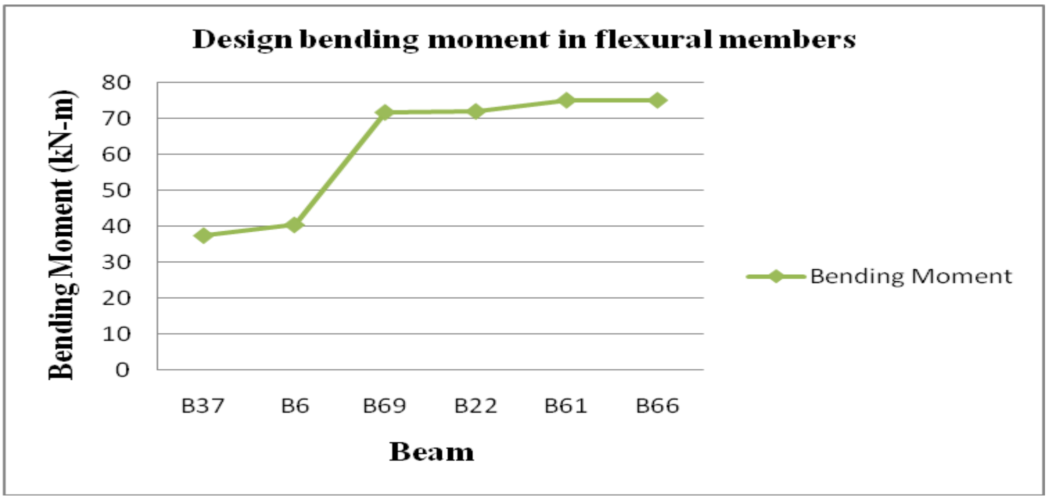
S.No	COLUMN	Axial Force (KN)
1	C1	487.93
2	C6	908.59
3	C13	1714.62
4	C25	1696.58
5	C45	902.24
6	C49	487.93



Graph 1: Design axial force in column

Table 3 : Design Bending Moment in Flexural Members

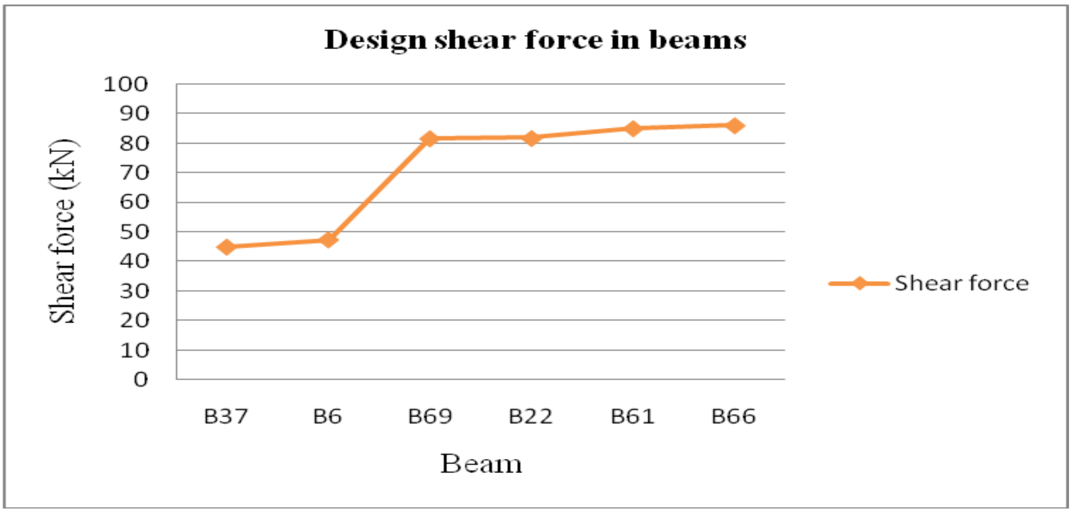
S.No	Beam	Bending Moment(KN)
1	B6	40.545
2	B22	71.988
3	B37	37.575
4	B61	75.085
5	B66	75.085
6	B69	71.715



Graph 2: Design bending moment in flexural members

Table 4: Design shear force in flexural members

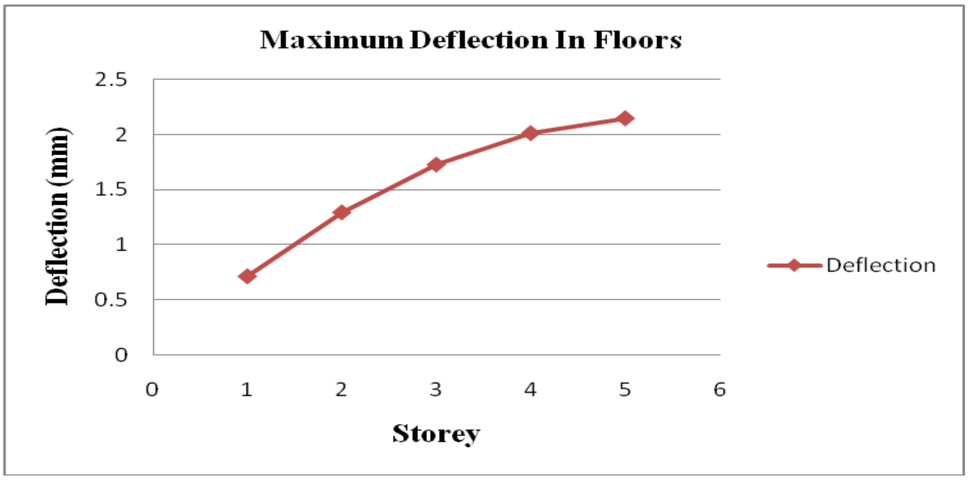
S.No	Beam	Shear Force (KN)
1	B6	47.25
2	B22	81.75
3	B37	44.79
4	B61	85.07
5	B66	86.08
6	B69	81.64



Graph 4: Maximum deflection in floors

Table 5: Maximum deflection in floors

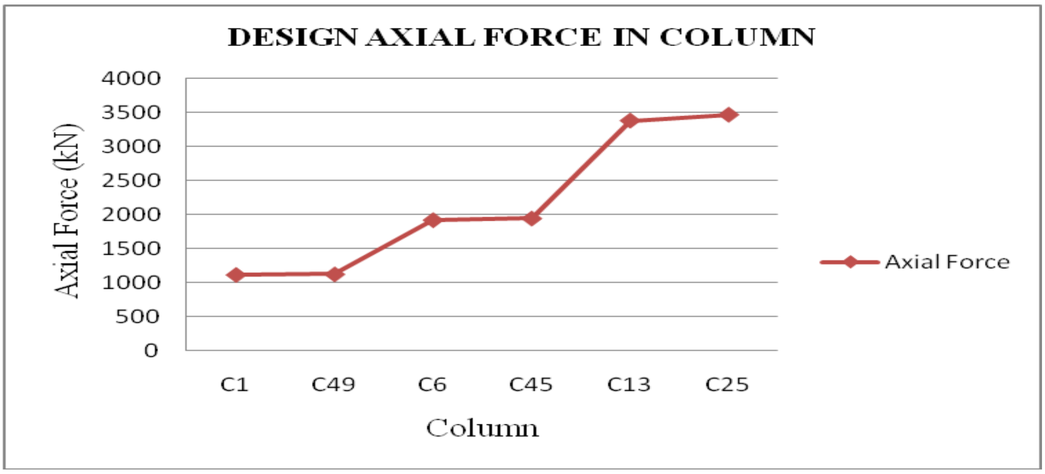
S.No	Floor Level	Deflection (MM)
1	5	2.1452
2	4	2.0113
3	3	1.7279
4	2	1.2973
5	1	0.7203



TEN STOREY RESULTS:

Table 6: Design axial force in column

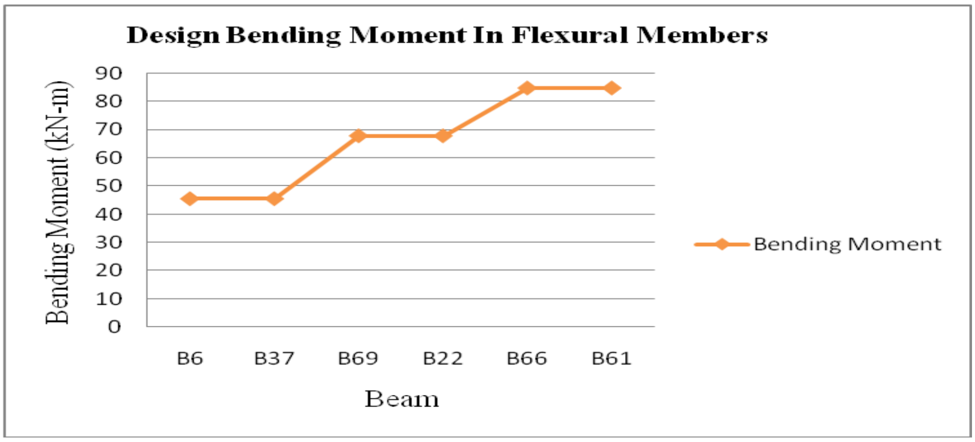
S.No	COLUMN	Axial Force (kN)
1	C1	1112.85
2	C6	1917.27
3	C13	3380.36
4	C25	3467.43
5	C45	1941.89
6	C49	1120.48



Graph 5: Design axial force in column

Table 7: Design bending moment in flexural members

S.No	Beam	Bending Moment(kN)
1	B6	45.609
2	B22	67.851
3	B37	45.609
4	B61	84.755
5	B66	84.755
6	B69	67.85



Graph 6: Design bending moment in flexural members

Table 8: Design shear force in flexural members

S.No	Beam	Shear Force (kN)
1	B6	48.5
2	B22	81.34
3	B37	48.5
4	B61	89.06
5	B66	89.06
6	B69	81.34

Graph 7: Design shear force in flexural members

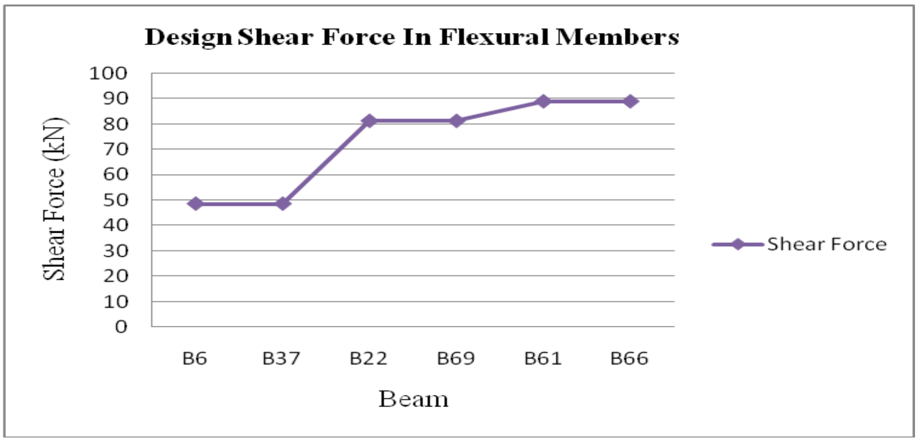
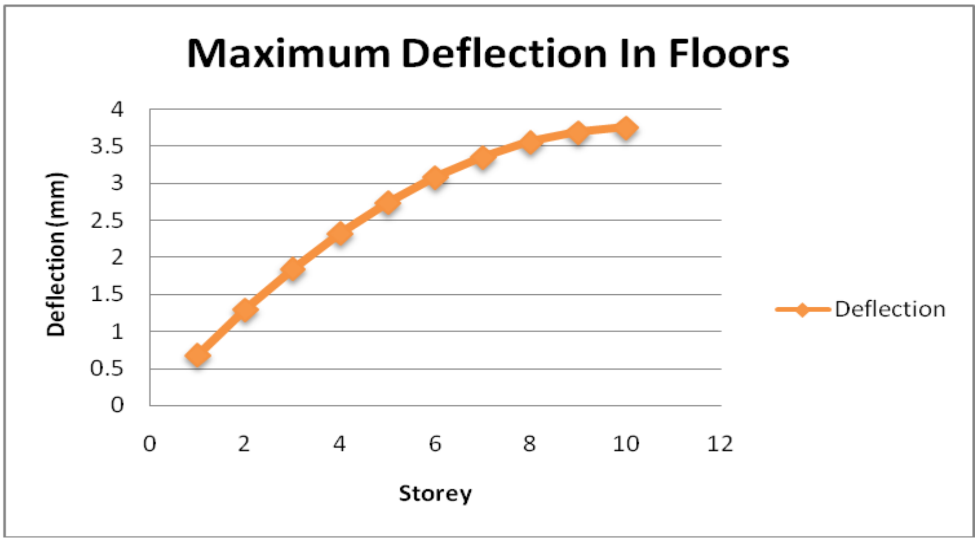


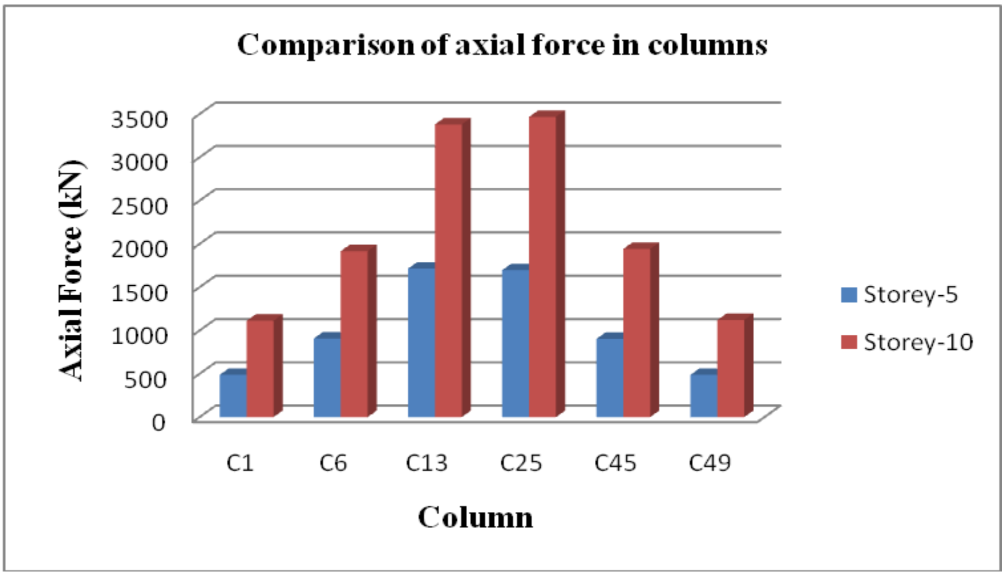
Table 9: Maximum deflection in floors

S.No	Storey	Deflection (MM)
1	10	3.7562
2	9	3.6945
3	8	3.5618
4	7	3.3587
5	6	3.0854
6	5	2.7423
7	4	2.3299
8	3	1.8487
9	2	1.2995
10	1	0.6829

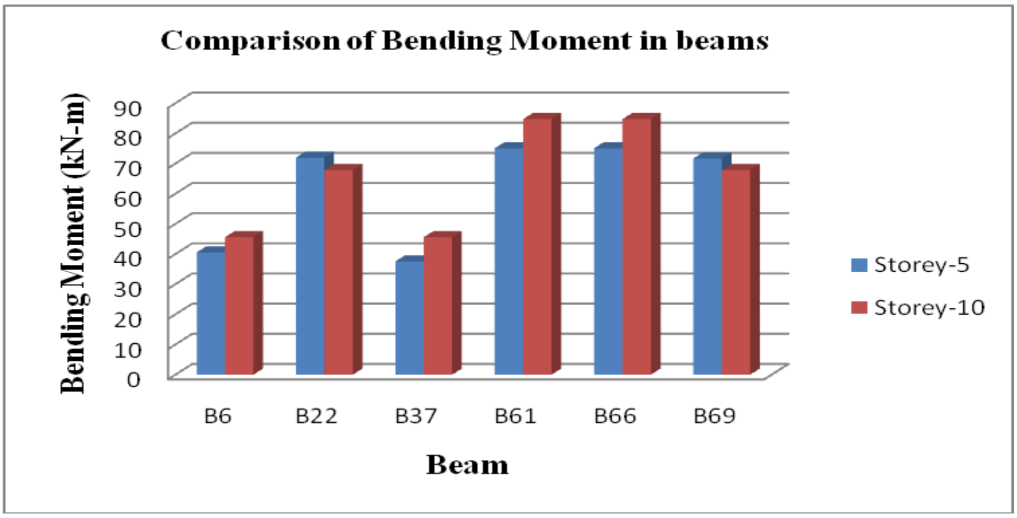


Graph 8: Maximum deflection in floors

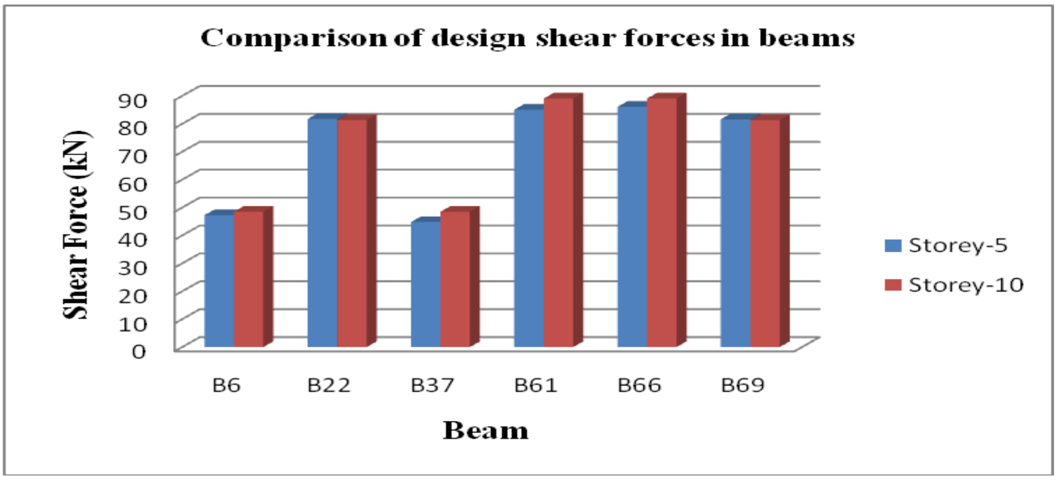
IV. COMPARISON OF RESULTS



Graph 9: Comparison of axial force in columns



Graph 10: Comparison of bending moment in beams



Graph 11: Comparison of design shear forces in beams

Graph 12: Comparison of deflections

V. CONCLUSIONS

- The essential features of ETABS is explained.
- The capability of the important concepts of effective memory management, plot options and user interface are described.
- Using the wide variety of options available for analysis of multi storeyed structures, ETABS can be used to understand the behavior of concrete structures under complex loading conditions.
- In this paper, using E tabs software the analysis of two multi storeyed buildings is carried out with different heights (15m and 10m).
- Thus it can help the consulting engineers, construction experts, research scientists and students in the analysis of concrete structures.
- From graph 9, it can be observed that axial force is high in 10-storey compared to 5-storey building.
- Comparison of various design parameters is carried out and respective results are plotted.

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