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COMPARATIVE STUDY OF SEISMIC ANALYSIS BY IS CODE METHOD, ETABS AND STADD PRO

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ABSTRACT

This paper concern on the seismic analysis of G+10 building which is subjected to live, dead, seismic load as per IS codes. Earthquake occurred in any structure shows that if the structures are not designed for earthquake loads then it may lead to the complete collapse of the structures. To ensure safety against lateral forces that will act on multi-storied building hence, there is need to study of seismic analysis to design earthquake resistance structures. In this paper Base shear, time period and storey displacement is evaluated by using Manual method, STAAD and Etabs software and the results are compared with IS1893 and this paper building is analyzed for zone IV. The study includes the modeling of building having plan areas 24mx24m and the height of storey is 3m.These analysis are carried out by considering zone IV with hard soil and using OMRF type building The results obtained for base shear and other design parameters from STAAD and Etabs software were compared and matched with IS1893:2002

Keywords: Base shear, storey displacement, ordinary moment resisting frame, static analysis Etabs, STAAD Pro, Manual method.

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I. INTRODUCTION

Earthquake motion causes vibration of the structure leading to inertia forces. Thus a structure must be able to safely transmit the horizontal and the vertical inertia forces generated in the super structure through the foundation to the ground. Hence, for most of the ordinary structures, earthquake-resistant design requires ensuring that the structure has adequate lateral load carrying capacity. Seismic codes will guide a designer to safely design the structure for its intended purpose. Seismic codes are unique to a particular region or country. In india, is 1893 is the main code that provides outline for calculating seismic design force. This force depends on the mass and seismic coefficient of the structure and the latter in turn depends on properties like seismic zone in which structure lies, importance of the structure, its stiffness, the soil on which it rests, and its ductility. Part i of is 1893:2002 (here after we refer it as the code) deals with assessment of seismic loads on various structures and buildings. Whole the code centres on the calculation of base shear and its distribution over height. Depending on the height of the structure and zone to which it belongs, type of analysis i.e., static analysis or dynamic analysis is performed.

II. MODELLING

A 10 Storey OMRF Building

Soil Below Foundation Hard Starta

Size Of Beam:-600mmx300m

Size Of Column:-300mx600m

Floor Area= 24X24m = 576m^2

Height Of Building 30 M(Each floor to floor 3m)

Dead Load= 4 KN/m^2

Weight of Partitions= 2KN/m^2

Live load Each Floor = 3KN/m^2

Live Load On Roof=1.5KN/m^2

For Delhi (zone IV)

Zone factors Z=0.24

Importance factor I=1.0

Response Reduction Factor R=3.0

Percentage of live load to be considered= 25%

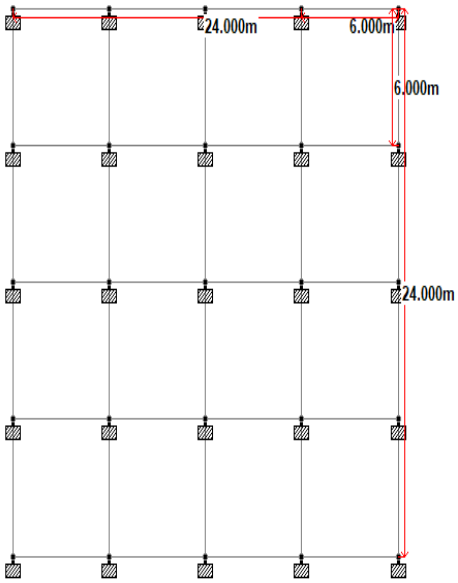

FIG 1:-PLAN OF THE STRUCTURE

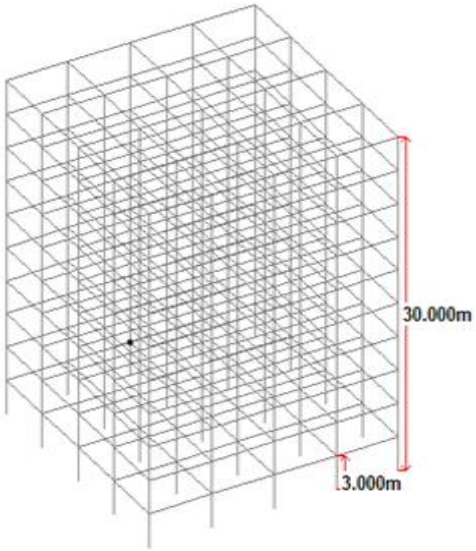

FIG 2:- ELEVATION OF THE STRUCTURE

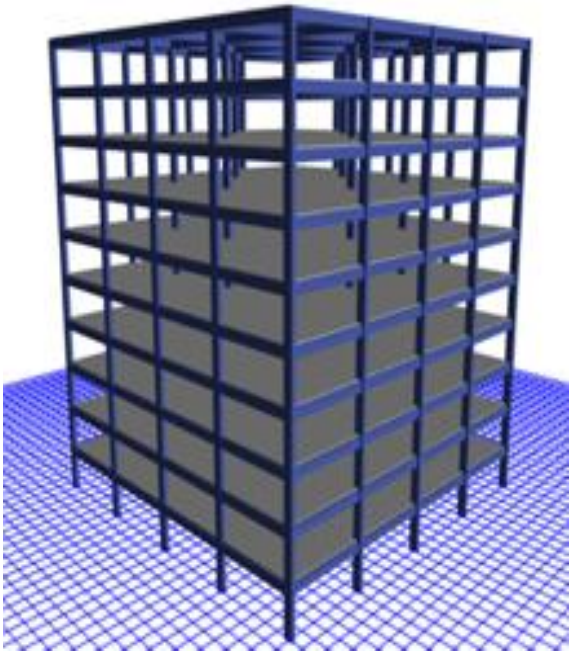

FIG 3:-ETABS 3D MODEL

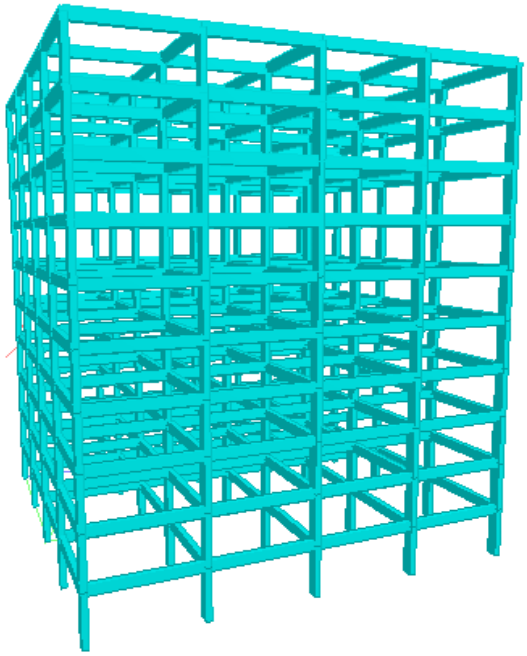

FIG 4:- STAAD PRO 3D MODEL

III. CALCULATION

effective weight at each floor except the roof = 4+2+0.25X3 =6.75 KN/m^2 and at the roof = 4.0 KN/m^2

weight of beams at each floor and the roof =0.3 X 0.6 X 240 X 25 =1080

KN weight of column at the each floor =1/2 X 270 =135 KN

total plan area of the building =24 X 24m =576m^2

equivalent load at roof level = 4 X 576+ 1080+ 135 = 3519 KN

equivalent load at each floor = 6.75X576+1080+135 = 5238 KN

seismic weight of the building W = 3519+ 5238X9 = 50661KN

base shear:

fundamental natural period of vibration of a moment resisting frame without infill

$T_a=0.075h^{0.75}=0.075(30)^{0.75}=0.96$

average response acceleration coefficient S_a/g for 5% damping and type I soil is 1.04

design horizontal seismic coefficient;

$A_h=ZI(S_a/g)/2R = 0.24X1.0X1.04 / 2X3 = 0.0416$

the valve of Z is from table no 2 IS 1893 (Part 1)2002

base shear $V_B = A_hW =0.0416 X 50661 = 2107.5$ KN

Lateral load and shear force at various floor levels

Design lateral force at floor 1;$Q_i = V_B (W_1h_1^2/\sum W_1h_1^2)$

IV. RESULT

Time (sec) as per IS 1893:2002	Time (sec) STAAD	Time (sec) Etabs	Sa/g IS 1893:2002	Sa/g STAA D	Sa/g Etabs	Ah as per IS 1893:2002	Ah STAAD	Ah Etabs
0.96	0.96	0.97	1.040	1.042	1.046	0.0416	0.0417	0.042

Comparison of Design horizontal seismic coefficient Ah

Weight as per IS 1893:2002(KN)	Weight of structure STAAD (kN)	Weight of structure Etabs (kN)	Base Shear as per IS 1893:2002(KN)	Base Shear STAAD (kN)	Base Shear Etabs (kN)
50661	50655.41	50481.975	2107.5	2110.64	2103.4156

Comparison of Base Shear

STOREY	IS CODE METHOD(KN)	STAAD PRO(KN)	ETABS(KN)
10	402	399.961	397.67
9	484.6	486.194	484.78
8	382.9	384.153	383.04
7	293.3	294.117	293.26
6	215.5	216.086	215.46
5	149.5	150.06	149.62
4	95.7	96.038	95.7
3	54	54	53.86
2	24	24	23.94
1	6	6	5.98

Comparison of storey shear G+10 Building

V. CONCLUSION

The main purpose of this study is to analyses building by STAAD and Etabs static analysis has been carried out to know time period , natural frequency , deformations . The building is tested for various load combinations. The base shear, lateral forces at each storey with tabulated and compared. The major conclusions drawn from the present study are as follows:

1. It can be observed that the design seismic coefficient parameters such as fundamental natural period and spectral acceleration coefficient calculated by IS 1893:2002 match by STAAD and ETABS software.

2. The design horizontal seismic coefficient obtained by STAAD and Etabs also matches with code.

3. The base shear obtained for the models varies a little.

4. The weight of building is calculated manually and by software are different.

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