Evaluation of RCC Framed Structure Under Seismicity

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Abstract – *The Seismic performance evaluation is used to identified deformation in the structure during an earthquake. The seismic analysis is carried out by using structural analysis computer programme STAAD Pro. and by mannual calculations. there are various factor involved in seismic analysis like Zone factor, Responce reduction factor, Importance factor, Fundamental natural period etc. The main parameters of analysis are Load carrying capacity, Ductility, Stiffness, Damping ratio and Mass.*

Key Words: **Seismic Analysis, IS1893 (Part 1), Seismic zone, Base shear, Storey drift, Storey displacement.**

1.INTRODUCTION

When an Earthquake struck any area, Hundreds of people get killed and many get injured. tremors can be felt from at hundreds of kilometer from the epicentre of earthquake. These tremors are important to be assessed and computed as to outline new structures. In present reasearch, the earthquake examination of G+7 storied working under zone III is finished by utilizing responce spectrum method. In seismic analysis the responce reduction was considered for special resisting moment frame. Total structure was analysed by using computer programme STAAD Pro.

1.1 Objective

1. To calculate Base shear, Storey drift, Storey displacement.
2. To identify deformation in structural component during an earthquake.
3. To improve beheviour of structure against the earthquake effect without significant loss.
4. To limit the damage in a building an acceptable level.

1.2 Problem Statement

In recent years seismic activities has increased a lot may be due to Volcanic erruption, Tsunami's plate tectonics etc.

Hence it is need of time to look for ductile and sustainable design. Therefore we wish to make an attempt towords structural safety for building under seismic loads.

2. METHODOLOGY

The methodology involves the planning of G+7 RC frame building and STAAD Pro.V8i analysis.

Steps of Evaluation of building(manual calculation)-

Step1: Determination of Eigenvalues and Eigenvectors-

From mass matrix and stiffness matrix eigenvalues and eigenvectors are calculated.

Step2: Determination of model participation factors-(PK)

$PK=\sum^{n}_{i=1}=Wi(\phi ik)/\sum^{4}_{i=1}Wi(\phi ik)^2$

Step3: Determination of modal-(MK)

$MK=(\sum^{n}_{i=1}Wi(\phi ik))^2/G(\sum^{n}_{i=1}Wi(\phi ik)^2)$

Step4: Determination of lateral forces at each floor in each mode-(Qik)

$Qik=AkPkWi\phi ik$

Step5: Determination of storey shear force due to all modes-(Vik)

$Vik=\sum^{n}_{j=i+1}Qik$

Step: Determination of storey shear force due to all modes-

$\lambda=\sum^{r}_{c}\lambda C$

Steps of Evaluation of Eight storey Residential RC building using structural programe STAAD Pro.

Steps of Evaluation of building(using software)-

- User provides the value for Z/2*I/R as factor for input spectrum.
- Proframe calculation time periods for first six modes or as specified by the user.
- Programe calculates Sa/g for each mode utilizing time period and damping for each mode.
- The programe calculates design horizontal acceleration spectrum AK for different modes.
- The programe then calculates mode participation factor for different modes.
- The peak lateral seismic force at each floor in each mode is calculated.
- All responce quantities for each mode are calculated.
- The peak responce quantities are then combined as per method (CQC or SRSS or ABS or TEN or CSM) as defined by the user to get the final results.

2.1 Statement of Project

Table 1: Building description and material specificaion

Sr. no	Parameter	Dimension
1	Storey Drift	3m
2	number of Storey	8
3	Column size	500mmx500mm
4	Beam size	380mmx450mm
5	Depth of slab	150mm
6	Seismic zone	3
7	Importance factor	1
8	Responce reduction factor	5
9	Damping ratio	5%
10	Unit weight of concrete	$25KN/m^3$
11	Grade of concrete	M_{40}
12	Grade of steel	Fe_{415}
13	Type of soil	Medium
14	Dead load on floor	$10KN/m^3$
15	Dead load on roof	$5KN/m^2$
16	Live load on floor	$4KN/m^2$
17	Live load on roof	$1.5KN/m^2$
18	Floor finish	$1.0KN/m^2$

Table 2: Frequency for load case1

Mode	Frequency(cycle/sec)	Period(sec)
1	0.612	1.6345
2	0.668	1.4973
3	0.727	1.376
4	1.278	0.783
5	1.879	0532
6	1.962	0509
7	2.014	0.496
8	2.069	0.483

Table 3: Peakstorey shear force

STOREY	Level(m)	x	z
7	12	0	1083.65
6	10	0	1085.49
5	9	0	1218.87
4	7.5	0	1224.24
3	6	0	1328.16
2	4.5	0	1331.58
1	3	0	1358.31
base	0	0	1358.31

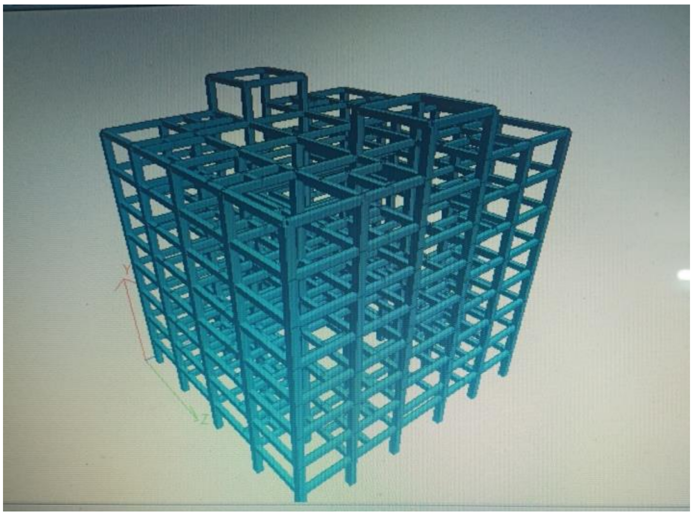

Fig1: 3D Render view of STAAD.PRO model

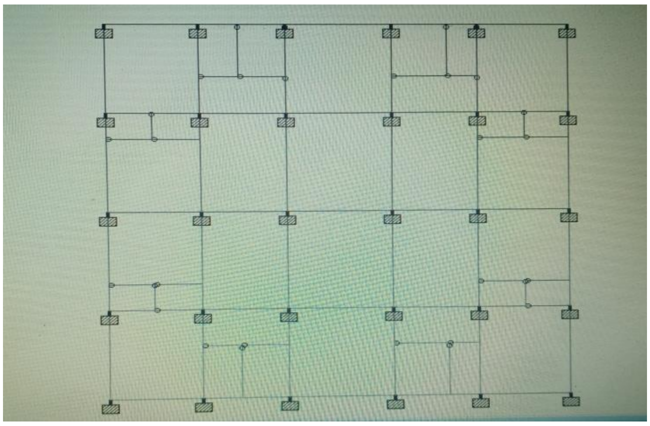

Fig2: Plan of Building

3. CONCLUSIONS

- Design base shear(by manual calculation)=
- Design base shear(using STAAD Pro.)=
  in X-direction=
  in Z-direction=
  - Storey shear force to be maximum and it decreased to a minimum in the top storey.
  - As shear force increases in the building the base shear and displacements are increases.

- Multi-storey reinforced concrete building framed with shearwall are now fast becoming as popular as an alternate structural form for resisting the earthquake forces.

REFERENCES

[1] Kaushal Vijay Rathod Sumit Gupta (2020) Describe The Result of the Time History Analysis On The Ten Storey Structure.

[2] Divyabharthi S,Ashwin R, Akilan S,Arunprabhu K. S(2020) Seismic Analysis Of Multi-Storey Building Using ETAB.

[3] Muhaned Abass Mohammed(2020)Seismic Analysis Of Structure By Etabs In B.S Code And IS Code.

[4] Runbahadur Singh, Oshin Victor, Shilpa Indra Jain(2019) Seismic Analysis Of Buildings On Different Types Of Soil.

[5] Ali Kadim Sallal(2018) Design And Analysis 10 Storey Building Using ETAB Software 2016

[6] Ishita Arora, Er. Rajinder Singh,(2017) Studied The Earthquake Resistant Design Of Structure.

[7] Pushkar Rathore Rahul Chandrashekhar(2017) Seismic Analysis Of Multi Sorey Building For Different Plans Using Etabs 2015.

[8] Mahmood Hosseini Banafsnehahashemi And Zahra Safi (2017) Seismic Design Evaluation Of Reinforced Concrete Building For Near Source Earthquake.

[9] Mohammed Ziauddin Patowary(2017) Seismic Behavior Of Tall Building Structure B Horizontal Damper Using Time History Analysis

[10] Roberto Tomasi(2017) Analysis And Design Of Earthquake Resistant Building

[11] P. Patil, A.Chaskar, P.Landage, B.Bendre(2017) Seismic Behavior Of Multi-Storied RCC Framed Structure Considering Soil Structure Interaction.

[12] N.A.Kasliwal, R.S.Rajguru(2016) effect of numbers and positions of shear walls on seismic behavior of multi-storied structure.

[13] Pardeshi Samir, Pro N. G. Gore (2016) study of seismic analysis and design of multi storey of symmetrical and asymmetrical building.

[14] Anirudh gottala, kintali sai nanda kishore(2015) describes the comparitive study of static and dynamic seismic analysis of a building.

IS codes:

[15] IS13920-1993:code of practice for ductile detailing of reinforced concrete structures subjected to seismic forces.

[16] IS1893:2016 Part1, Indian standard criteria for earthquake resistant design of structure- part 1: general provision and buildings, bureau of Indian standard, New Delhi, India.

[17] IS1893:2002 part 1, Criteria for earthquake resistant design of structures, Bureau of indian standard ,New Delhi.

[18] IS875 (part1,2,3)-1987, Code of practise for design loads (other than earthquake) for buildings and structures, Bureau of Indian standard, New Delhi.