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EFFECT OF SHEAR WALL ON A RECTANGULAR BUILDING Using Staad Pro.

Ankush Aggarwal[1], Anil kumar[2]

[1]PG Student, Department of Civil Engineering, Galgotias University, Gr. Noida, Uttar Pradesh
[2]Professort, Department of Civil Engineering, Galgotias University, Gr. Noida, Uttar Pradesh

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Abstract - *The perusal concern the effect of shear wall on a rectangular building in Greater Noida Region that lies in the very sensitive Seismic zone 4 , projects and buildings here are deigned according to zone 5 using the code 1893 even as the risk of living in a high risk seismic zones persist, the development according to national codes.*

Shear wall have high rigidity to stable the structure from the earthquake in this we are using a staad.Pro. software to work out effective, economical rectangular building in the Greater Noida region and in this software STADD.PRO This software is used to creating, optimizing and modifying 3-D designs of building. This work is related to placement of shear wall at corner, Rectangular and channel. This study about three types of model using G+10 building. Shear wall is a reinforced concrete structure member that gives durability to building from sideward loads like wind, earth pressure and water,etc.

***Key Words*: Rectangular building(G+10), Shearwall, STAAD PRO.**

1.INTRODUCTION

In the structural engineering a shear wall is a reinforced concrete structure member that gives durability to building from sideward loads like wind, earth pressure and water, etc. it is a perpendicular factor of a seismic strength resisting channel i.e, designed to resist on sideward surface of earthquake, wind load and oppose load similar to the surface of wall. Drag members and collectors transfer the live load parallel to ground shear to shear walls and the upright members of seismic stress to the resist mode.

It is framed in a light weight and gives high rigidity to the frame for stable. Shear wall reduce the displacement, sway, destruction from loads of frame. This type of wall provide large flexion and rigidity.

This wall is easily apply and constructed. The cost is economical and minimize earthquake damage. It gives stress and hardness in the side of alignment. Walls are used in structure and non- structure element for minimize the damages and It will take less time in construction and well-distributed reinforcements.

Last time there is a measurement of earthquake intensity that will be measure by Richter scale i.e. 3.2 in zone Greater Noida in Uttar Pradesh on Wednesday Night on 3 june 2020 this information taken by national centre of Seismology. In this measuring the earthquake is record for 42 minutes at night time 10p.m in the direction of south-east of Noida at 19km in the depth of 3.8km.

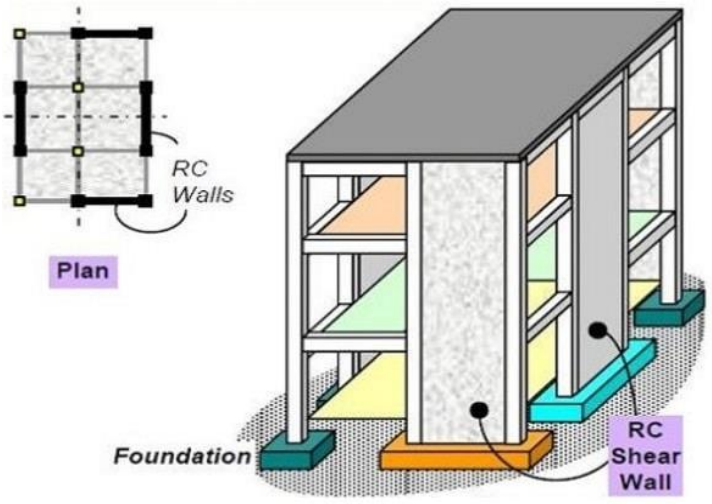

fig. Shear wall

2. LITERATURE REVIEW

G. Nagesh Kumar et al., this discussion mainly focus on analysis & design of s.w. in zone-III that resist the lateral forces in optimization way of 45 multi-storey structure. This technique was applied on frame many times that can oppose the forces apply the structure and assuming the strength. In this there are two cases i.e, dimension of shear wall and another is dimensions of shear wall is increased according the result of case 1.conclusion is sudden change in plan of struture above IVth floor in small lateral forces can change two factors rigidity and torsional irregularities that depend on seismic force.

Ehsan Salimi and Dr. K.R.M. Rao discuss about the seismic configuration of s.w. applied on structure . it was observed that the top storey drift can be reduce by swift the position of s.w. and suggested that the quantity of shear wall could not affect the seismic behavior of buildings. Different position of shear walls can decrease twice the top story drift

which means 100% drift in building is reduced from high to low value. The quantity of shear walls will increase to safe the structure.

Manjeet dua et al., discuss about the Effect on Deflection by use of s.w. in multi-storey by staad. And conclusion that observe that displacement without s.w. is max^m comparison about the different-different location of s.w. and the position of shear wall in multi-story is near the origin of structure and get finally result that seismic behavior will be affected, rigidity and the strength of the structure will be increased.

A. Ahmad et al., about the 'Effect Of Shape Of S.W. On Mid-Rise Structure Under Seismic Load' and conclusion about the various types of shear wall L,T,C,H and I walls of 20 storey building and discussion about the role of shear wall in a seismic zone rectangular and l shaped wall are more resisting seismic forces along direction orthogonal and reduce seismic forces

3. Objectives

- Creating model in Stadd. Pro.
- Analysis of G+S structure
- Economical structure
- Reduce the demages
- Reduce sway of structure
- Structure is Earthquake resistant
- To check the flexion and rigidity of structure

4. METHODOLOGY

The perusal are related to "Effect of shear wall on a rectangular building" firstly we observe the seismic zone of a rectangular building and we collect data of that building and compare the building to the another building in same zone. Using the software Stadd.pro. This software is used to creating, optimizing and modifying 3-D designs of building.

4.1. MODELLING

A rectangular building of G+10(10 Storey) structure have size 15m*21m of plan 315 square metre means 377 square yard with typical floor height 3m and thickness of slab 4 inch is considered for analysis and designed the building in the software stadd.pro.

4.2. LOADS

Assign the loads according to codes

DL
LL
WL
Earthquake load

4.3. ANALYSIS

Analysis of RCC Structure
Analysis of concrete design
Analysis of shear wall design
Calculations of shear wall and bending moment

4.4. DESIGN

- Design of slab, Beam and column
- Design of loads
- Design of shear wall

4.5. GEOMETRIC PARAMETERS

- Beam :230mm*400mm
- Column:300mm*600mm
- Slab:120mm

5.1 About the Software

In this software we can design and analyse all types of structues.

This software is used for analyse and design 3-D model or structure.

It can analyse all codes and processed in 1997 by international engineers.

It is used for creating, optimizing and modifying designs of building.

It is easy to analyse the load, support, material, properties etc..
it can easy our work to analyse the error in the structure.

5.1. Design of Shear wall

The study of this design is carried out on the same plan with different –different condition i.e. given below :

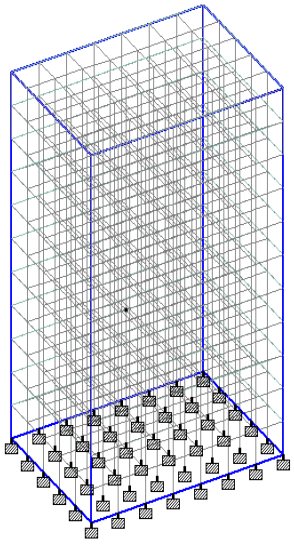

Fig.1 Without Shearwall

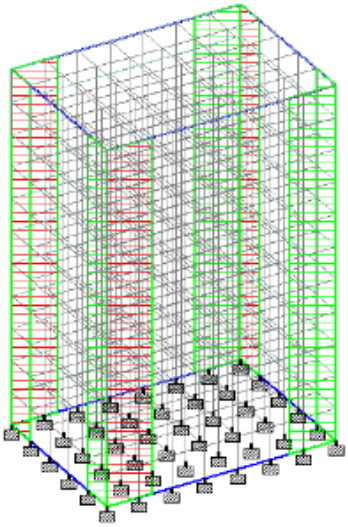

Fig.2 Corner Shearwall

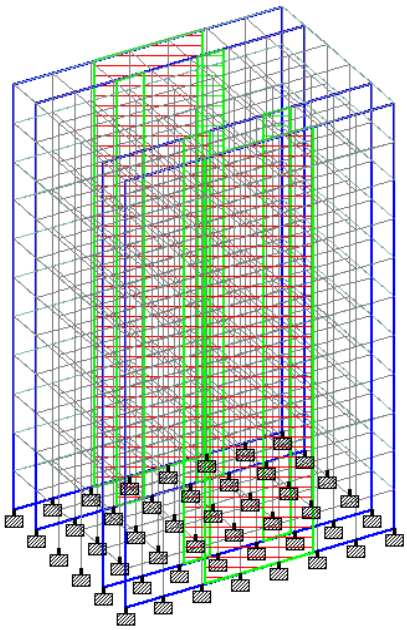

Fig.3 Channel Shear Wall

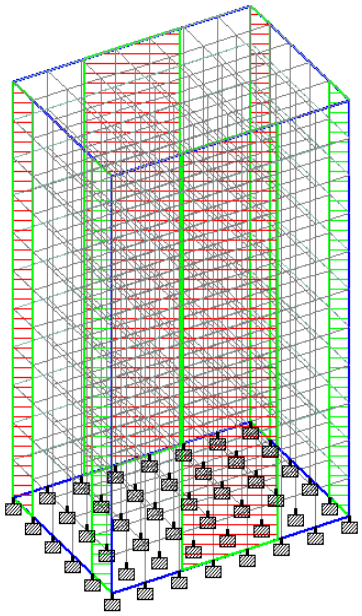

Fig.4 Rectangular shear wall

5.2. Calculation of loads

In structural design, To analyse and design the effect of shear wall on rectangular building of G+10 height types of loads are given below:

5.2.1 Dead load

The dead load is calculated according to zone of Greater Noida. The value is taken for design load for building and structure other than earthquake by IS code 875:1987 part 1.
Self Weight for building in Y Direction = -1

- Density of concrete=25kn/m^3
- Member Load(Uniform Force)

Self weight of Beam =Density of concrete *Dimension of beam

= 25*(0.23*0.40)
= 2.3kn/m

Self weight of Column=Density of concrete * Dimension of column

=25*(0.30*0.60)
=4.5kn/m

- Load of Slab

Self weight of Plate =Density of concrete *thickness of slab
Thickness of Slab=0.120m
=25*0.120
=3 KN/m^2
Self weight of Surface=Density of concrete *thickness of slab
Thickness of Slab = 0.120m
=25*0.120
= 3 KN/m^2

5.2.2 Live load

It is calculated according to zone of Greater Noida. The value is taken for design load for building and structure other than earthquake by IS code 875:1987 part 2 imposed load.
Live load Intensity Pressure =3 KN/m^2
Live load intensity in Y Range
Minimum = 3m
Maximum = 33m

5.2.3 Wind load

The wind load is calculated according to zone of Greater Noida. The value is taken for design load for building and structure other than earthquake by IS code 875:2015 part 3.
Basic wind speed (V_b) =47m/s
Probability factor (k_1)=1
Terrain factor (k_2) =0.91 for 10m height
= 0.97 for 15m height
= 1.01 for 20m height
= 1.06 for 30m height
= 1.12 for 33m height
Topography factor (k_3) = 1
The above data which we are given that can be taken by IS code 875 part 3 the details of data according to tables and clause are given below

- In this the basic speed is taken by annex A clause 6.2
- Terrain category is taken by clause6.3.2.1 which defines the category 3.
- K_1 is taken by table 1 clause 6.3.1 for all general buildings and structures
- K_2 is taken by table 2 clause 6.3.2.2 that are given below according to height v/s terrain category 3

Height(m)	Terrain and height multiplier(k_2)
10	0.91
15	0.97
20	1.01
30	1.06
33	1.069

- K_3 is taken by clause 6.3.3.1 the range of k_3 is 1-1.36
- k_d is taken by clause 7.2.2
- k_a is taken by clause 7.2.1
- k_c is taken by clause 7.3.3.13

➢ Design wind speed (V_z)

- **$V_Z = V_b K_1 K_2 K_3$**

V_b = Basic wind speed
K_1 = Risk coefficient
K_2 = Terrain roughness and height
K_3 = Topography Factor

V_b(m/s)	K_1	K_2	K_3	V_Z(m/s)	Height(m)
47	1	0.91	1	42.77	10
47	1	0.97	1	45.59	15
47	1	1.01	1	47.47	20
47	1	1.06	1	49.82	30
47	1	1.12	1	50.243	33

- **$P_Z = 0.6\ V_Z^2$**

P_z = wind pressure
V_Z = Design wind speed

V_Z(m/s)	$P_Z = 0.6\ V_Z^2$(N/m^2)
42.77	1.098
45.59	1.247
47.47	1.352
49.82	1.489
50.243	1.515

➢ Design wind pressure

- **$P_d = k_d\ k_a\ k_c\ P_Z$**

K_d = Wind directionality factor
K_a = Area average factor
K_c = combination factor

p_d shall not be taken less than 0.70 p_z

k_d	k_a	k_c	P_Z	P_d(KN/m^2)
0.9	0.9	0.9	1.098	0.800
0.9	0.9	0.9	1.247	0.909
0.9	0.9	0.9	1. 352	0.986
0.9	0.9	0.9	1.489	1.085
0.9	0.9	0.9	1.515	1.104

After calculation we get the intensity v/s height

Intensity(KN/m^2)	Height(m)
0.800	10
0.909	15
0.986	20
1.085	30
1.104	33

5.2.4 Earthquake load

As per Indian code 1893 (Part 1):2002 this structure is in Greater Noida region of zone 4 but according to Greater Noida authorities this zone is earthquake –ready. The district administration and development authorities emphasized that although the region falls in zone 4, all the buildings that have constructed or designed in this zone according to seismic zone 5using the code 1893 even as the risk of living in a high risk seismic zones persist. The following parameters are given below according to Indian code: 1893-2002/2005

- Earthquake zone= 5
- Zone Factor(Z)=0.36
- soil and rock site factor(SS)= 2
- Structure type(ST)= 1
- Importance Factor(I)= 1
- Response Reduction Factor(RF)= 5
- Damping=0.05
- Soil = IInd

Design constant

- Using M30 and Fe500 grade of concrete and steel to design RCC elements like beams, slabs, columns.
- F_c = Compressive strength of concrete
- F_{ysec} = Yield Strength of shear Reinforcement
- F_{ymain} = Yield Strength for main Reinforcement

Commands

- Design Beam
- Design Column
- Take off

Code used

- IS 456:2000
  FOR PLAIN AND R C C
- IS 875 Part 1 (1987)
  FOR D L
- IS 875 Part 2 (1987)
  FOR L L
- IS 875 Part 3 (2015)
  FOR W L
- IS 1893 (Part 1):2002
  FOR EARTHQUAKE LOAD

Results

Earthquake displacement values of shear wall

Distance(m)	Without s.w.		Corner S.W.		Channel S.W.		Rectangular S.W.	
	X	Z	X	Z	X	Z	X	Z
33	26.634	29.658	24.342	27.366	20.900	23.424	24.942	28.322
30	25.683	28.544	23.185	26.046	19.876	21.675	23.885	26.946
27	24.183	26.823	22.234	25.074	17.965	20.435	22.934	25.674
24	22.174	24.554	20.098	23.087	15.374	18.454	20.798	23.880
21	19.756	21.854	17.564	19.667	13.731	15.566	17.734	20.067
18	17.028	18.832	15.598	17.498	11.967	13.563	15.798	17.997
15	14.081	15.585	11.589	13.489	10.523	12.334	11.789	13.689

Material used and Dimensions

- Concrete grade : M30
- Steel grade : Fe500
- Beam :230mm*400mm
- Column:300mm*600mm
- Slab:120mm

Design of RCC elements

- In this design of structure the RCC elements are slab, beam, column etc…

Conclusion:

By comparing all the structure channel shear wall is better as compare to others and we conclude about the channel shear wall that
It will help in the deformation in building
It will help in the strength of building
It will help effect of zone to provide the shear wall
It will help to know building is economical or not

12	10.992	12.201	9.634	11.764	8.234	10.435	10.634	12.360
9	7.834	8.755	6.174	8.095	3.521	5.456	7.374	8.795
6	4.688	5.323	3.956	4.591	1.034	2.333	4.556	4.991
3	1.762	2.08	1.542	1.974	0.936	1.388	2.524	1.874
base	0	0	0	0	0	0	0	0

Value of storey stiffness

Storey Height	**Without s.w.**		**Corner S.W.**		**Channel S.W.**		**Rectangular S.W.**	
(m)	**X**	**Z**	**X**	**Z**	**X**	**Z**	**X**	**Z**
33	265917.31	204334.24	210945.00	200334.00	210045.00	150334.00	230945.00	203334.24
30	346019.57	271673.46	301510.11	251673.20	301110.11	200673.20	321510.11	270673.49
27	365888.60	292118.99	320888.21	265118.70	311188.21	211118.70	340888.21	290118.96
24	374629.98	302423.77	300629.33	300423.14	300029.33	250423.14	330629.33	300423.74
21	380043.64	309172.49	380043.44	300172.33	320043.44	251172.33	390043.44	300172.48
18	384294.58	314520.63	332294.91	311520.12	310094.91	255520.12	352294.91	310520.63
15	388345.20	319478.97	300345.25	300478.11	300045.25	255478.11	340345.25	310478.98
12	393228.24	324831.26	332228.15	311831.52	322228.15	265831.52	352228.15	320831.22
9	402430.46	332500.50	400430.5	322500.41	350030.5	267500.41	4020430.5	330500.45
6	435867.46	354501.24	411867.56	333501.32	401167.56	300501.32	421867.56	350501.24
3	727518.56	555412.03	700518.14	500412.00	659918.14	495412.00	710518.14	550412.07
base	0	0	0	0	0	0	0	0

As compare all; the models we get the result that channel shear is better.

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