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BLAST RESISTANT ANALYSIS AND DESIGN TECHNIQUES FOR RCC MULTISTOREY BUILDING USING ETABS

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ABSTRACT

The normal headway to engineering offered growth should manufacture skyscraper structures which attains keep tabs from every one other ordinary structures. This unclearly stress terrorists with concentrate on titan structures, in happened for those Taj castle hotel, India What's more twin towers, USA. Thusly those results from claiming impact loads for structures need aid a unsmiling issue that ought be drawn under attention Previously, configuration.

This paper presents architectural planning, blast resistance analysis and design of multi-storey RCC building using ETABS software as per IS 4991-1968. The analysis of the structure is carried out using two loading combinations separately as a) Dead load +Live load b) Earthquake load c) Wind load d) Blast load.

Key words: Blast load, Displacement, Earthquake load, Shock wave, Wind load.

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1. INTRODUCTION

From the past years the terrorists are focusing on the buildings which are multi-storage and tall structures because as they have to kill vast number of people and they have to show their strategy and fear to the country and their weapon power .Due to increase in technology , the building in large cities are concentrated on the comfort of living and the safety against earthquake and wind loads but they are not concentrated on blast loads ,so that the framework is totally collapsed during the terrorist blast. The scope of the paper is the civil engineers has to implement different techniques in planning during the construction and to design the building taking consideration of blast loads from IS:4991-1968 and to look after the building against any terrorist explosives. And to minimize the loss of the framework and loss of life's.

1.1. Explosives

Explosives at dives through a fast substance response substantial amount about gasses results would framed for great temperature. The vitality freed toward the explosives produces the impacts for example, displacements, fragmentation, vibration What's more air impact. The explosives when explosion happens produces a secondary accelerated stun wave. This waves cracks those dividers and produces interior anxiety over beams Furthermore columns What's more crushes the material Furthermore it will diminish those quality of the structure. Those cracks are loaded for the detonative gasses and the cracks are produced till those gas weight gets feeble.

1.2. Classification of explosives

Low explosives: At the speed for material may be less 200 to 300 ft for every second they would dealt with concerning illustration low explosives. Sample dark powder.

Helter skelter explosives: helter skelter explosives are admixture of chemicals hosting speed about 500feets for every second. Instance dynamite.

1.3. Techniques to be followed in planning

While planning the building we have to lead the minimum distance for the face where building is exposed to roads and based on the type of structure from IS: 4991-1968. The safety room should be provided where the effect of explosion is minimum and to provide the facility to inform the information of blast to all the floors in the building. The blast resistant building should contain the less glazing on the exposure face of building to the road because when the blast wave with high speed causes the glass to break and to move the glass particle to larger distance and increase the loss of life's. We should not provide the cellars for parking because when the explosive material enters below the cellar portion creates an internal pressure below the slab and cause damage. The water tanks are provided at the exposure faces. Proper fire extinguishers and the more no of exit entries should be provided for every floor. The building should contain less wood works because wood will catch easily fire. The room should contain less ventilation, where the exposure gases enters inside the buildings and increase the pressure inside the buildings and increase the loads of the buildings.

1.4. Techniques to be followed in designing of structure

The structure ought to not hold those cantilever slabs since the point when those explosion happen beneath the slabs that produces those reflected waves and elevate the structure and makes harm of the associations in the structure. Those structure ought to be given for colossal number of domes Also arches in view they didn't reflect the impact waves. The utilization from claiming fortified bond cement beams Furthermore columns are favored when contrasted with steel areas. Those structure ought to a chance to be outline to vast quake for high back on account of the vibrations created toward those detonative may be short of what the configuration recurrence from claiming vibration of the fabricating afterward the structure won't influence because of that vibrations. Utilize secondary quality Furthermore shoot safe materials to plastering. The point when those blast occurs, those impact wave achieves the dividers What's more prompts result in the level relocation looking into column's and the upside and the downside power on the section reasons the verthandi uprooting of the pillar In this way provide additional bars toward the joints will join the beams and columns.

1.5. Building data

Beam : 0.45m X 0.45m
Column : 0.45m X 0.45m
Slab thickness : 120mm
Materials : **M30, Fe500**

Shear wall thickness: 230mm

- Dead loads (IS 875 -Part 1) : 12 kN/m^2 for outer walls.
  : 6 kN/m^2 for inner walls.
  : 3 kN/m^2 for parapet walls.
  : 4 kN/m^2 for floor load.
- Live loads (IS 875- Part 2) : 3 kN/m^2 on slab
- Earthquake loads :(IS1893:2002(part 1)
- Wind loads :(IS 875- Part 3)
- **Load combination**

1.5 (dead load +live load)
1.2 (dead load +live load)

1.6. Calculation of blast force for a 100 kg charge of explosive

The blast loads are calculated by using this formulas

Scaled distance (m) = Actual distance/ Charged weight in tons

Actual distance is obtained from the code book IS4991:1968 from table no: 7 based on the type of building

The corresponding values of Pro, Pso are taken from Table 1 of IS: 4991-1968.

We adopt the source at a point (0, 1.5, 0).

Table 1 Represents the distance between source and the target

Coordinates of point of intrest			Distance between source and target	slab
30	1.5	0	30	SLAB 1
30	1.5	4.11	30.21	
30	1.5	7.75	30.98	
30	4.5	0	30.14	SLAB 2
30	4.5	4.11	30.42	
30	4.5	7.75	31.12	
30	7.5	0	30.59	SLAB 3
30	7.5	4.11	30.86	
30	7.5	7.75	31.56	
30	10.5	0	31.32	SLAB 4
30	10.5	4.11	31.58	
30	10.5	7.75	32.26	
30	13.5	0	32.31	SLAB 5
30	13.5	4.11	33.57	
30	13.5	7.75	33.22	
30	16.5	0	33.54	SLAB 6
30	16.5	4.11	34.79	
30	16.5	7.75	34.42	
30	19.5	0	34.98	SLAB 7
30	19.5	4.11	35.22	
30	19.5	7.75	3557	

Table 2 (Pro) Blast load on front face of the building

Slab	Scaled Distance	Pro (kg/cm2)	Pro (KN/m2)	A(m2)	Force (KN)
SLAB1	65	0.87	77	2.7	207
	65	0.80	77	2.7	207
	67	0.75	73	2.1	153
SLAB2	65	0.79	77	2.7	207
	66	0.77	75	2.7	202
	67	0.75	73	2.1	153
SLAB3	66	0.77	75	2.7	202
	67	0.75	73	2.7	197
	68	0.71	69	2.1	144
SLAB4	68	0.71	69	2.7	186
	68	0.71	69	2.7	186
	70	0.69	67	2.1	140
SLAB5	70	0.69	67	2.7	180
	71	0.69	67	2.7	180
	72	0.67	65	2.1	136
SLAB6	72	0.67	65	2.7	175
	73	0.65	63	2.7	170
	74	0.64	62	2.1	130
SLAB7	76	0.60	58	2.7	156
	76	0.60	58	2.7	156
	77	0.59	57	2.1	119

2. MODELING

The demonstrating will be accomplished for An rectangular molded building Likewise indicated starting with the highest point perspective in the figure Similarly as underneath. The encircled structure demonstrating will be done for ETABS product. The cement property which are utilized within those structure would take from IS456:2000. Those materials that are made similarly as M30 cement & Fe500 steel. Those framework profundity we need aid made similarly as 2m from those ground surface. The tallness for each floor may be taken as 3m. The downright tallness of the structure is 21m from ground surface. The encircled components in the structure are beams Also columns. Those shell item in the structure would slab, shear divider. The thickness of the dividers are taken Similarly as 45cm In view of code book is 4991:1968 table no: 8. The thickness of the shear divider may be made Similarly as an 230mm.

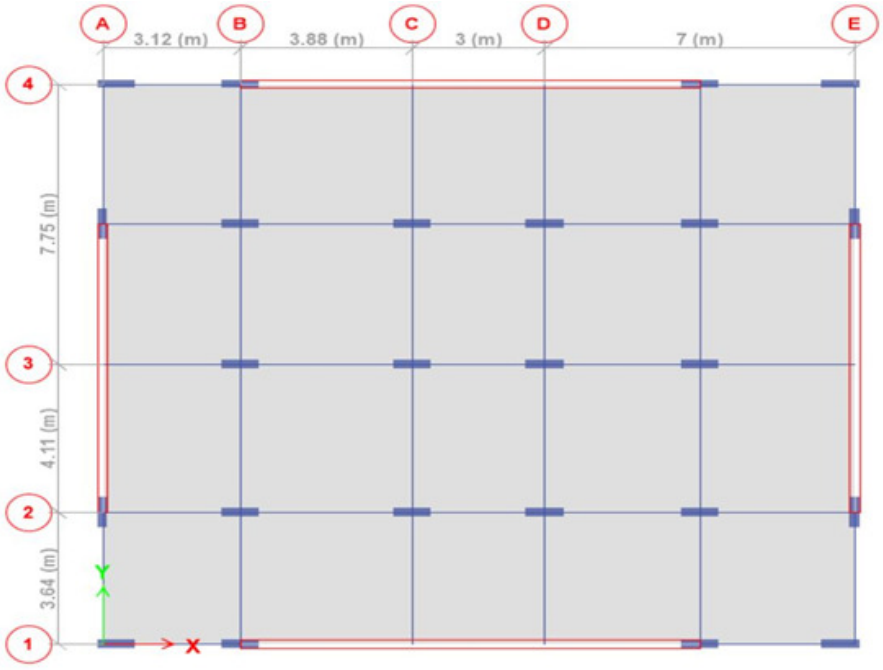

Figure 1 Top View of plan

3. ANALYSIS AND DESING

Modal Investigation might have been conveyed crazy because of acknowledging the extra minutes of the impact loads. The dividers loads need aid made as 3 sorts In light of their thickness and the stature of the divider. The divider loads need aid connected on the beams. The examination will be conveyed out for diverse sorts about loads for example, such that dead, live, wind, earthquake, impact loads. To start with step we are making diverse load patterns, after making those load designs we would recognizing load combination, afterward relegating loads of the beams and slabs. The restraints (supports) are made likewise an altered help. After that dissection is conveyed out. We are examining to three separate states from claiming impact they would.

- Though the impact happened on the face from claiming X- heading.
- Though those impact struck them on the face about Y- course.
- On the impact happened on the face for negative Y- bearing.

To this three conditions, the relocation Also shear anxiety happens for separate story would indicated in the underneath figure.

If the blast occurred on the face of x- direction.

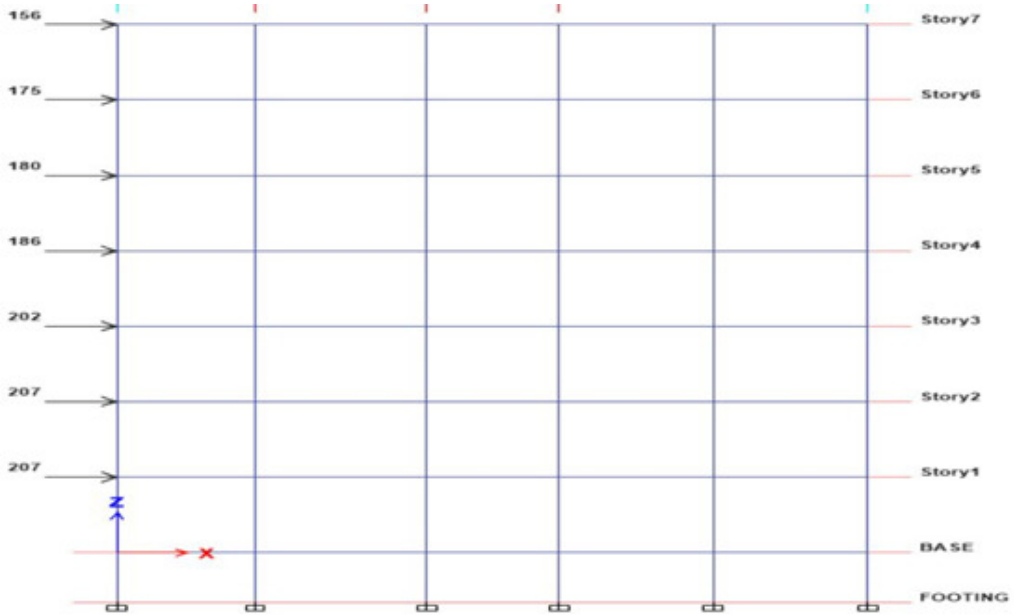

Figure 2 The blast forces are acting in the direction of x from the face of the building.

Due to the action of the blast forces the maximum displacement is occurred at a storey 7 of 7.357mm which is represented graphically in the below figure.

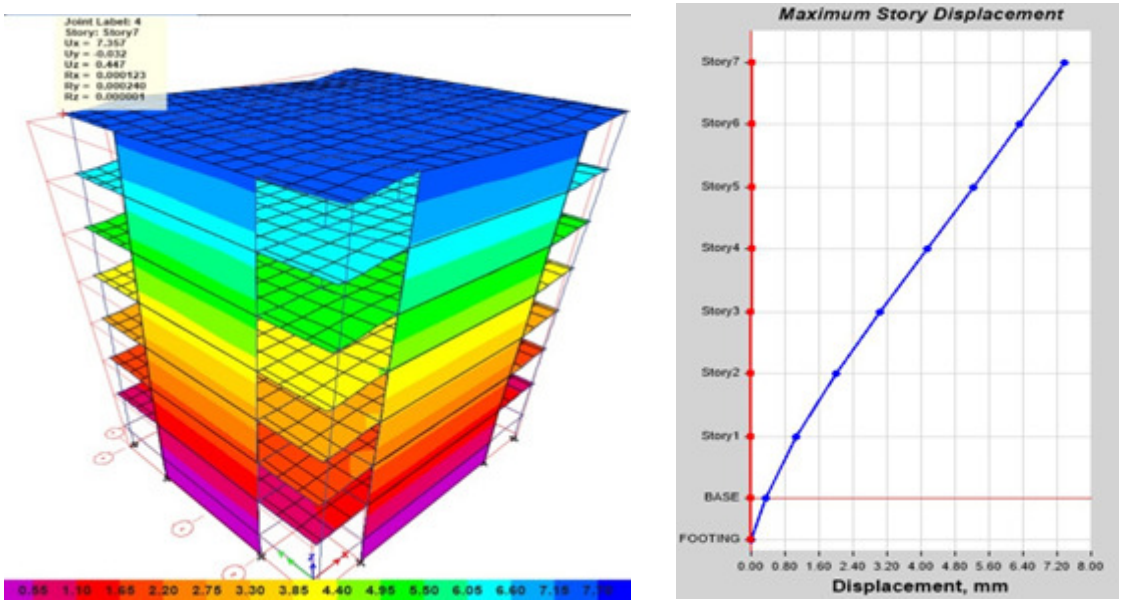

Figure 3 Total resultant displacement if the blast occurred on the face of x- direction.

The shear force is maximum at a footing of 6.5 kN which is represented graphically in the below figure.

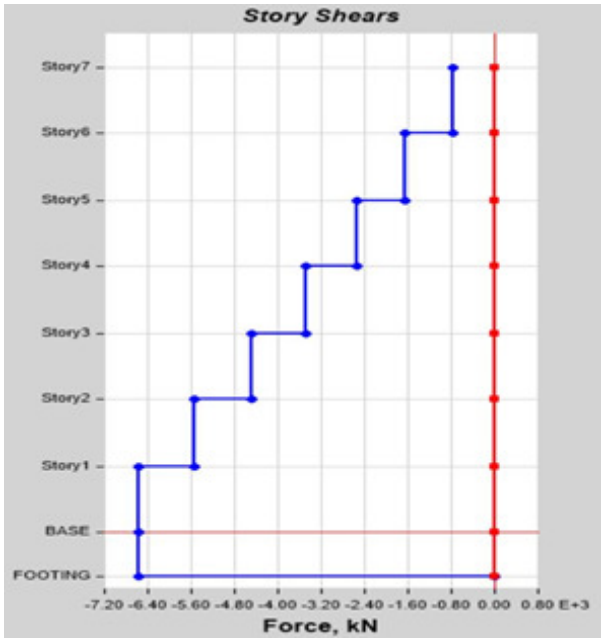

Figure 4 Shear force if the blast occurred on the face of x- direction.

- If the blast occurred on the face of Y- direction:

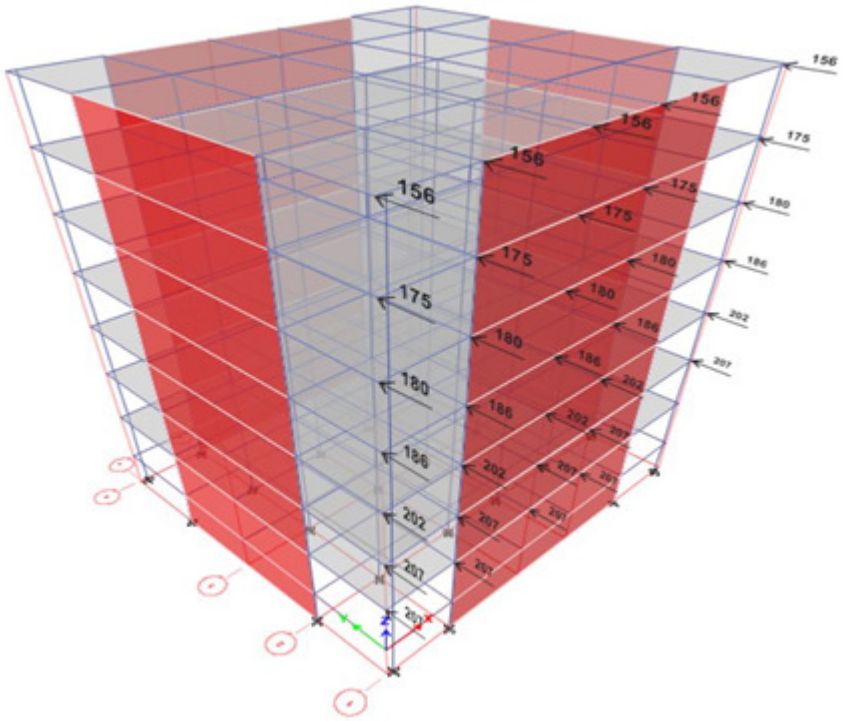

Figure 5 The blast forces are acting in the direction of Y from the face of the building.

Due to the action of the blast forces the maximum displacement is occurred at a storey7 of 13.161 mm which is defined graphically in the below figure.

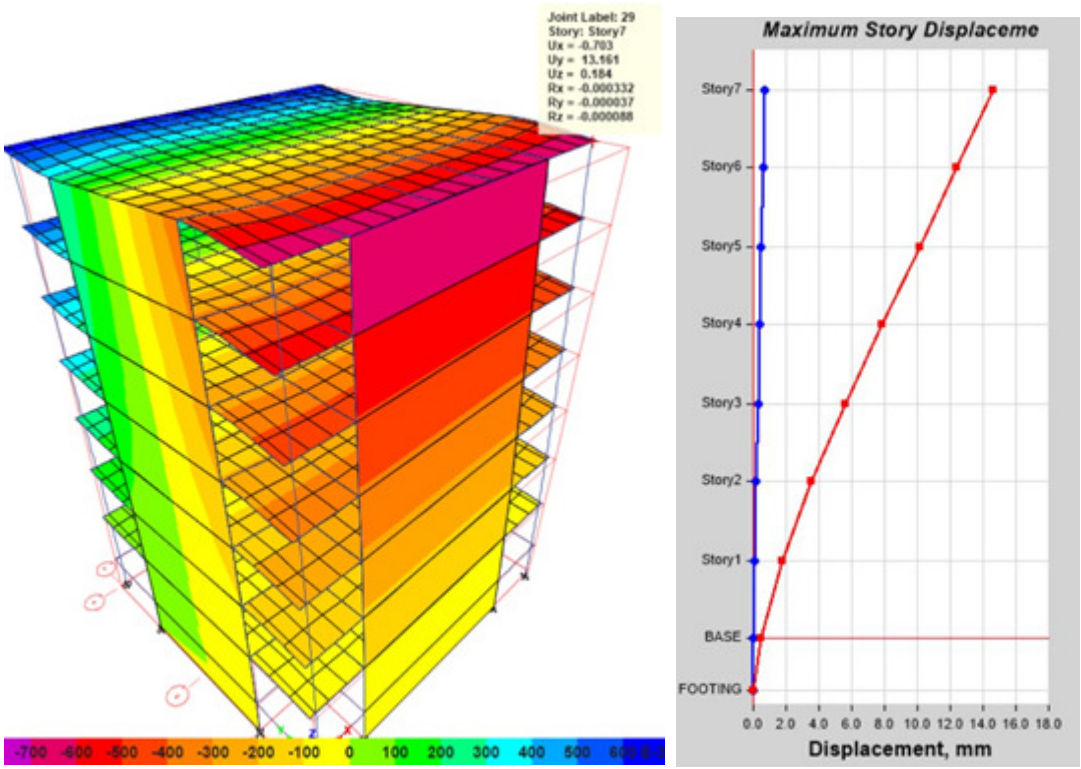

Figure 6. Total resultant displacement if the blast occurred on the face of Y-direction.

The shear force is maximum at a footing of -6.40 kN which is represented graphically in the above figure.

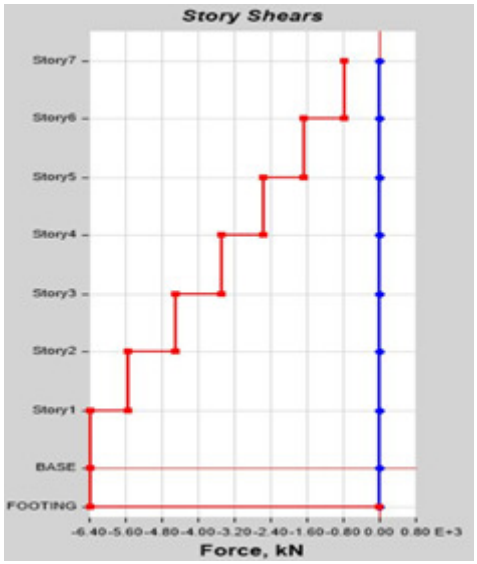

Figure 7 Shear force if the blast occurred on the face of Y- direction.

- If the blast occurred on the face of Negative Y- direction.

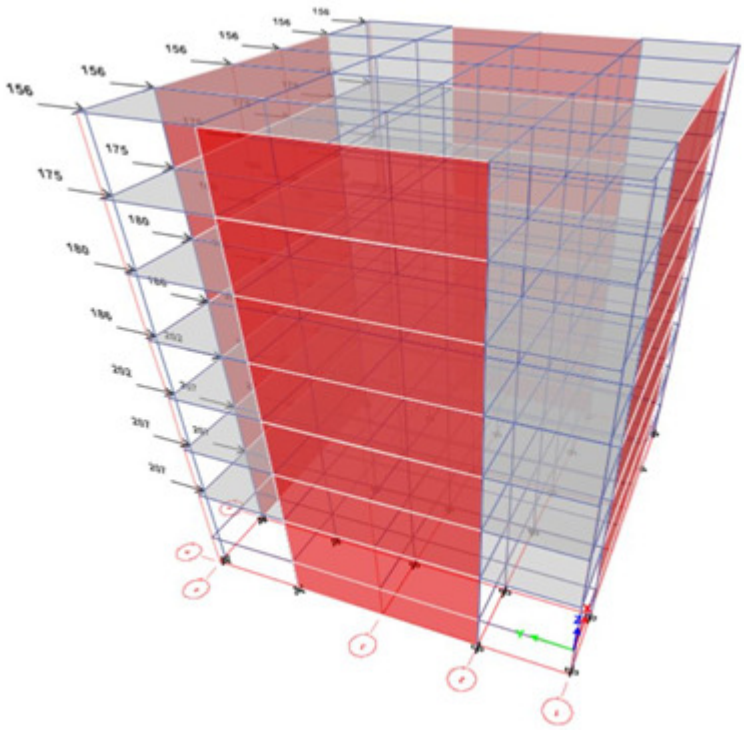

Figure 8 The blast forces are acting in the negative direction of Y from the face of the building.

Due to the action of the blast forces the maximum displacement is occurred at a storey7 of -17.18mm which is represented graphically in the below figure.

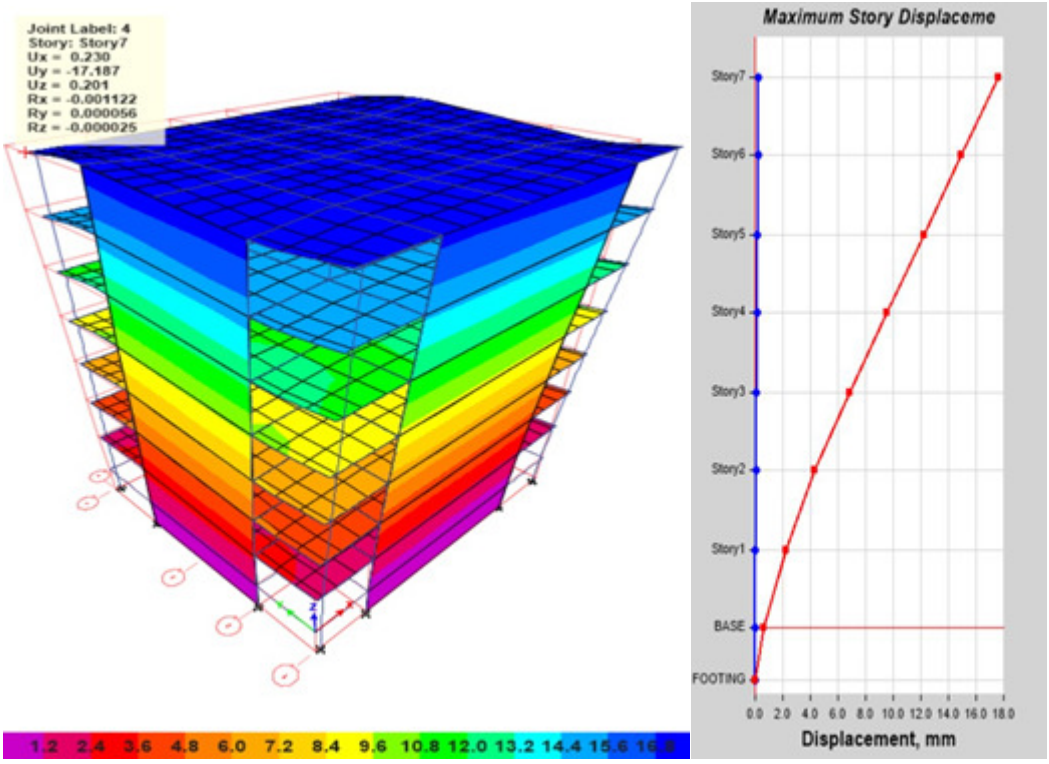

Figure 9 Total resultant displacement if the blast occurred on the face of negative Y-direction.

The shear force is maximum at a footing of 8 kN which is represented graphically in the below figure.

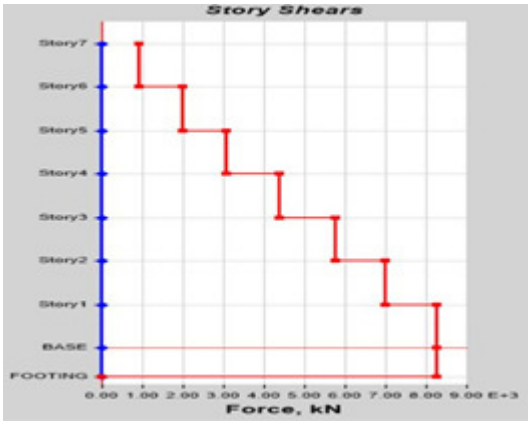

Figure 10 Shear force if the blast occurred on the face of negative Y- direction.

4. CONCLUSION

Blast resistant design refers to improving structural integrity of structure instead of complete collapse of building, present study on G+7 residential building proves that increase in stiffness of structural members by increasing in size provide better results which also resist the uplift force on footings by increasing in dead weights. Effects of blast loads can also be decreased by providing lateral moment resisting frames like shear wall thereby decreasing the effect of lateral loads which also reduces damage and increase structural integrity of the building.

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