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BLAST RESISTANCE OF STRUCTURES BY SHEAR WALL REPOSITONING

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ABSTRACT

Structures are continually advancing concerning their wellbeing and convenience rule. The structures are relied upon to give safe sanctuary to the occupants with giving economy and incentive simultaneously. As we progress further into the twenty-first century the specialists are given present day issues that their archetypes were practically none acquainted with. Blast loads on the structures is one such load that the architects in the past were minimal stressed however as the urban communities create at an entrancing rate the dangers of terror based oppressor movement have additionally expanded. The international situation has changed the manner in which the urban areas used to be and the security has become a major concern. The terrorist exercises as well as the mishaps happening unintendedly or by machine error are likewise a major danger. Truth be told, more lives are lost because of unintended accidents than terror based oppressor exercises. It is important to be ready for any load on the structure similarly as we plan the structures for seismic action. The examination of a structure exposed to Blast loads and afterward a safe structure are introduced in the accompanying investigation.

Keywords: blast load, analysis, drift, shear force, displacements.

I. INTRODUCTION

The activity of Blast load on the structure is as capricious as it is complex[1]. The structure can't be configured to withstand all kinds of Blast loads all the occasions[2]. The kind of Blast loads it's occurrence as expected and whether it will happen are all the factors of an exceptionally perplexing arrangement of probabilities[3]. The impact that as of late occurred at the port of Beirut is an ideal illustration of the gravity of the situation. Normally the significant structures, for example, insight workplaces and government organizations are checked for impact Blast loads yet the impact in Beirut has enormously changed the point of view of designers everywhere around the world[4]. The structure regardless of how huge or little ought to be checked for Blast loads and one such endeavor on little structure is done in the current examination. In the current examination two models with indistinguishable arrangement design are made and examined utilizing ETABS software. The two models are broken down for the important parameters that are crucial while checking for the Blast loads. The blast loadings are laterally applied along with some of the load being transferred from the top floor to the base along with the dead load. What makes this load special is that it lasts for just seconds before totally dissipating itself after peaking for a fraction of a second. All these patterns are well taken care of by the guidelines of the Indian standard codes as the blast loads are converted into static point loads applied to the structure at the points where the loads are intended to act during a blast occurrence[5].

II. METHODOLOGY

A G+14 structure symmetrical about both the axes is selected for the study. The structure is a typical residential arrangement assuming two separate apartment arrangements on each floor. The loading parameters and the seismic parameters are taken from the Indian standard codes for reference. The structures are identical being acted upon by the Blast load from a pre calculated distance, also same for the two structures. The structures differ in the positioning of the shear wall as the model 1 has a shear wall arrangement as of a conventional building with the shear wall at the core of the building and model 2 has nearly the same amount of material used for the shear wall at the perimeter of the building creating an envelope of the shear wall at the perimeter of the structure. The criterion for the blast load application on the structure depends on the region of the structure and many other situations, in this case the Indian code of practice for blast resistant buildings known as IS 4991:1968 is used for the calculations of the

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loadings. The model 1 also referred to as the conventional building model is created and analyzed and the comparative factors such as the storey drift, the storey shear and the storey shear generated at the base is tabulated in the column one of the tables. Model 2 is then modelled by the name of blast resistant structure and the special shear wall arrangement is also done and the model is subjected to the same excitations as that of model 1. The results of the analysis are entered in the column 2 of the tables generated before. The table 1 shows different parametric considerations and figure 1, 2 and 3 shows the different structures.

Loads applied for the front face

Centre joint applied loads = $P_{ro} \times H \times L = 1080$ kN

Side joint applied loads = $P_{ro} \times H \times L/2 = 540$ kN

Centre joint applied loads = $P_{ro} \times H/2 \times L/2 = 270$ kN

Loads applied on roof top of structure and on the side walls:

$P_{so} + c_d \times q_o = 0.35 + 0.4*0.051 = 0.3377$ Kg/Cm^2

Centre joint applied loads = $P_{so} \times H \times L = 468$ kN

Centre joint applied loads = $P_{so} \times H \times L/2 = 234$ kN

Centre joint applied loads = $P_{so} \times H/2 \times L/2 = 117$ kN

Loads applied on the back of the building:

As $t_r > t_d$ no load to be considered on the backside.

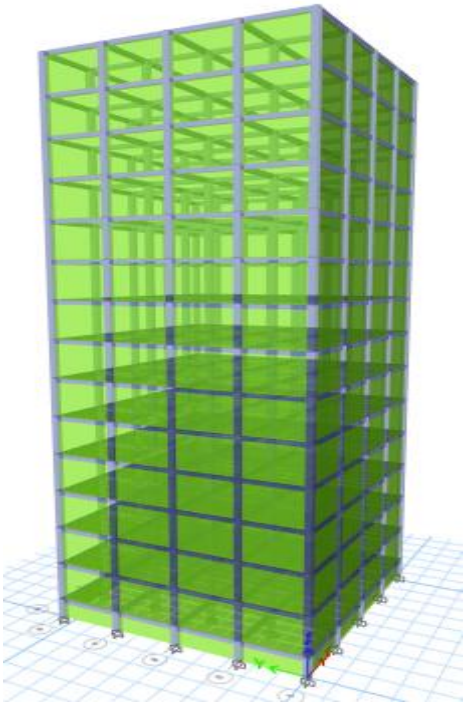

Fig.-1: Beam column configuration of the structure

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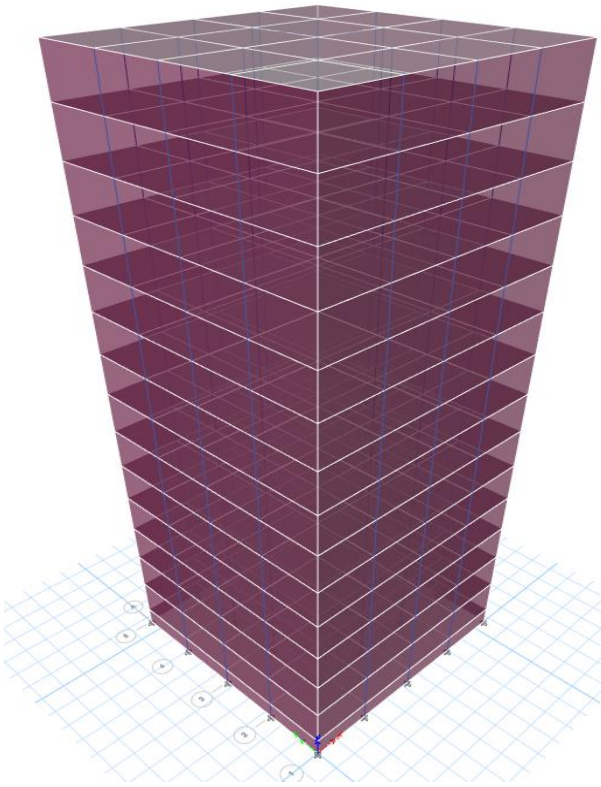

Fig.-2: Shear wall at the perimeter -Model 2

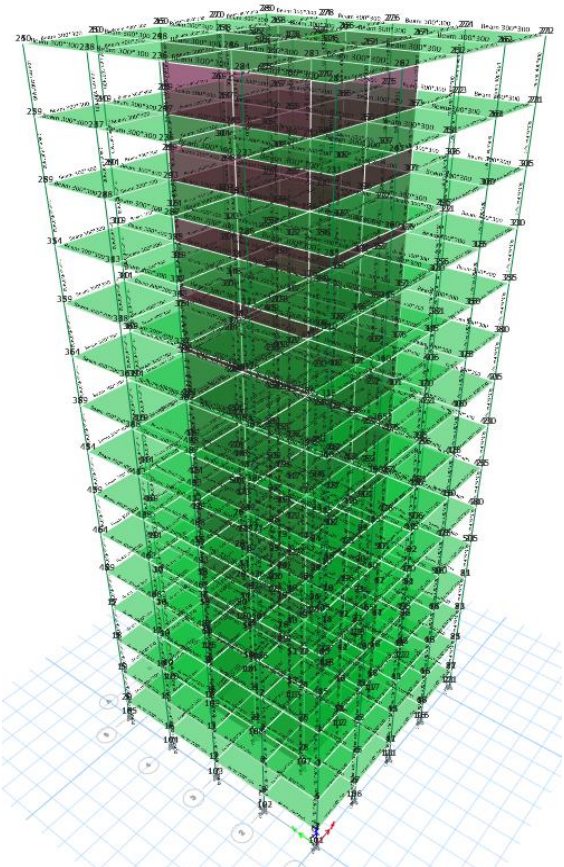

Fig.-3: Conventional model with shear wall at the core

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III. RESULTS AND DISCUSSION

Model 1 with conventional structural arrangement and the model 2 which is the blast resistant structure are compared and tabulated in the tables below.

Storey drift: Blast loading is particularly critical around the storey drift criteria as an excessive drift can cause serious deformation of the structure. Due to this the designers are particularly cautious about the drift. The storey drift comparison is given in table 2 below.

Table-2: Storey drift comparison model 1 and 2

Parameter	Model 1	Model 2
Drift corresponding to Dead load	0.006773	0.002585
Drift corresponding to dead combination	0.010162	0.003883

Storey displacement: Storey displacement is yet another critical factor when Blast resistance is taken into consideration. The storey displacement of the model 1 and 2 were both found to be under the codal provisions and are compared. The table 3 shows storey displacement values for both the models.

Table-3: Storey displacement comparison for model 1 and 2

Parameter	Model 1	Model 2
Displacement corresponding to Dead load	329.07 mm	78.03 mm
Displacement corresponding to dead combination	219.38 mm	117.07 mm

Base shear: Base shear is the force in kilo newton that is found out at the base of the structure subjected to various excitements,. The base shear is calculated by the program for both the models with and without shear wall and the results are tabulated below in table 4.

Parameter	Model 1	Model 2
Base shear corresponding to Dead load	46170 kN	46170 kN
Base shear corresponding to dead combination	69255 kN	69255 kN

IV. CONCLUSION

Comparison of the model 1 and 2 has led to the following conclusions being drawn,

1. Model 1 that is the conventional model with shear wall at the core has a higher value of storey drift as compared to the model 2 which is the model with shear wall at the perimeter.

2. Storey displacement is high in the model 1 for both the loading cases as compared to the model 2.

3. Base shear is same for both the models.

As every structure has some or the other unique features because of which it reacts differently than others, same laws cannot be applied to every structure or as they say you cannot paint everything with the same brush. Hence, every structure should be checked for the Blast loadings at the design phase.

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