A Review on Blast Analysis And Blast Resistant Design of R.C.C. Building

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Abstract- *Need of designing certain important structures to resist blast loads is gaining important day by day due to increase in terrorist activities from the recent years. Blast force causes loss of structural integrity due to partial or complete collapse of structural members. Blast loads are dynamic loads that must be calculated carefully as that of other dynamic loads. This project presents effect of blast loads on three storey R.C.C. building. Effect of (100,125,150) kg Tri nitro toluene (TNT) blast source which is at (15,30,45) m away from the building is considered for analysis and designed. Blast loads are calculated manually as per IS: 4991-1968 and force time history analysis or blast load analysis is performed in STAAD Pro. The influence of blast loads on structure is compared to that of same structure in static condition. The parameters like peak displacements, velocity and acceleration are studied.*

Keywords- Blast Loading, Explosives, Charges, Standoff Distance.

I. INTRODUCTION

The term blast refers to release of enormous amount of energy from the blast source that lasts for few milli-seconds. General buildings are not designed for blast loads due to which design loads because of explosion are quite high. Blast loads primarily depend on weight of charge taken and distance between source and the target. Throughout the force-time profile the force above ambient level is positive phase that lasts for very small duration and below the ambient level is Negative phase of duration that lasts for longer duration of time.

II. LITERATURE REIVEW

2.1 Neeti Mishra et. al. 2021

From the results it is clear that as the stand-off distance increases from the building, the magnitude of blast pressure reduces significantly. As the weight of blast increases i.e. from 500 kg to 1000 kg at stand-off distance of 20 m, the pressure increases by 106.527% and when the blast weight increases from 1000 kg to 1500 kg at same distance then the pressure increases by 226%.If the stand-off distance increases from 20 to 30 m for 500 kg blast weight then the blast pressure reduces by 66% and if distance changes from 20 to 40 m for 500 kg blast, then the pressure reduces by 77%.It was also observed that if the distance of blast changes from 20 m to 30 m for 1000 kg of blast then the blast pressure reduces by 68.4% and if distance of blast changes from 20 to 40 m for 1000 kg blast, then the pressure reduces by 85.2%.

2.2 Romesh Malviya et. al. 2020

Conclusions evolved by analyzing the result data of various parameters for all five grade pair location cases are as follows:-

1) Nodal displacement in X direction and Z direction shows least value when grade location case T will be used.
2) The base shear result will not show a particular change, since none of the member is increasing or decreasing from framed multistoried building structure.
3) Axial force parameter in column shows least value in R and more aggressive when grade location case T will be used.
4) Maximum shear force in column (both in Sy and in Sz) shows least value when grade location case T will be used.
5) Both shear force and moment in beam also is in the favor when grade location case T will be used.
6) Again torsion moment both in beam and in column shows least value when grade location case T will be used.

Under the effect of earthquake forces, the column grade pair case shows a drastic result on comparing a singular grade in entire building. After analyzing, Grade location case T shows least parametric values after comparison with other grade location cases.

2.3 Urjal Das et. al. 2020

Doing the wide survey of the literature obtainable on structure it can be accomplished that due to a broad diversity

of structure, the in deepness of thoughtful in the ground of blast analysis analysis and design of building structures is insufficient.

1) The I.S. code 4991-1968 has provided assured instruction on the source of which the structures can be planned and designed when subjected to blast loads.
2) The literature review in the presentation and behavior of building structures when exposed to blast loads proposes that the condition of establishing a methodology for learning the response of building structure to blast loads and seismic loads has become vital. This will move us toward implementing performance-based design by using pushover analysis and time history analysis.
3) Numerous researchers have been worked on various types of buildings subjected to the blast loading and find out the important parameter which is beneficial for understanding the behavior of structures under blast loading.
4) In this study of structures under blast loading would give suggestion about how to decrease the displacement and base shear of the structures and also how to prevent axial force as well as shear force not exceeded the conventional value.

2.4 Pranali R. Nikure 2019

1) The magnitude of blast pressure increases on increase in standoff distances.
2) Blast pressure and blast scaled distance is inversely proportional.
3) Blast pressure increases on increase in weight of blast and blast pressure decreases when standoff distance increases.
4) The variation of force in the structural members is such that the blast force must be considered in the analysis.
5) The arrival time of blast wave increases as the standoff distance increases.

2.5 M. Meghanadh et. al. 2017

Blast resistant design refers to improving structural integrity of structure instead of complete collapse of building ,The present study on G+5 Residential building proves that Increase in stiffness of structural members by increasing in size proving 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.

2.6 Qureshi Rizwan et. al. 2017

1) With the increase in Blast load and decrease in the Standoff distance, the Displacement and Storey Drift increases rapidly. So the response of the structure completely depends on the standoff distance and blast load.
2) The maximum displacements are 1695.9mm and 1654.1mm for 250kg explosive from 25m standoff distance. And 1453.9mm & 714.2mm was the maximum displacement for 150kg explosive at 25m standoff distance.
3) For model 2 having steel braces the storey displacement is reduced to 58% and storey drift are reduced to 52.2% for 150kg of explosive.
4) Here, while using 250kg of explosive the thickness of shear wall was increased to 250mm but the grade of concrete used is M40 only.
5) In case 3 and case 4, where the thickness of shear wall is increased (Model 1) the difference in the response of both the models was effectively reduced.
6) The responses of both Model 1 and Model 2 at their respective distances are obtained.

2.7 Swamini T Gaikwad et. al. 2017

The aim of this paper is to discuss about the use of computer software for the easy analysis of blast load. So that we can improve the blast load design to prevent the building collapse. Each and every member of the structure must be design by considering blast charge. And the existing structure which are not designed by considering blast load retrofitting will be the solution to bear the blast charge. But these will increase the cost of construction. So the retrofitting will be the uneconomical solution for blast load which is not feasible solution for all buildings. The main objective of the study is to make the blast resistant buildings & analyses the structure by using Staad pro software.

2.8 Sana N Qazi et.al. 2017

The explosion in or near the structure can cause catastrophic damage to the structure, formation of fragments, destruction of life-support systems (air conditioning, sprinklers). Injuries and deaths can be caused by exposure to explosion wave front, collapse of the structure, impact of parts, fire and smoke. Blast load for close explosion was determined and simulated on a model building using SAP2000, the conventional software for the static/dynamic analysis of structures. Loading was defined as a record of pressure over time (pressure-time history) with the parameters calculated by the available literature. It was necessary to analyze the loading for each point. Deformation history of particular points of interest was calculated. It is shown that the

effects of blast loading can be taken into account for structural design by the use of available literature. Available commercial software for structural analysis can be used for design purposes, while further analysis should be directed towards familiarizing the phenomenon of the internal explosion. Thus, a complete picture of the explosion effects on the structure can be obtained.

2.9 Suraj D Bhosale et. al. 2016

In this paper modeling of multistoried building G+5 building is being analysis in which we have concluded.

1) Effect of peak static pressure and reflected overpressure was more at ground store then upper store varies linearly.
2) Blast wave take millisecond to reach the building from the side of explosion and affect the building.

III. PROBLEM STATEMENT AND OBJECTIVE

The primary objectives for providing blast resistant design for building are:

1. Personnel safety
2. Controlled shutdown
3. Financial consideration

Blast resistant design should provide a level of safety for persons in the building that is no less than that for persons outside the building in the event of an explosion. Evidence from past incidents has shown that many of the fatalities and serious injuries were due to collapse of buildings onto the persons inside the building. This objective is to reduce the probability that the building itself becomes a hazard in an explosion.

IV. CONCLUSIONS

Blast resistant design refers to improving structural integrity of structure instead of complete collapse of building, the present study on three storey building proves that increase in stiffness of structural members by increasing in size proving better 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. But it increase the cost of construction and make uneconomical project.

Though there are guidelines available for the design of buildings to be blast resistant, those guidelines are very rarely used in designing the general structures. Hence by considering such guidelines the buildings are designed more robust in nature.

It was found that the most ideal model to resist the blast effect is a regular symmetrical frame because they are least prone to damage & exhibit great strength when compared to that of irregular buildings.

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