Study of Blast Analysis For Structural Building

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Abstract-*The objective of this paper is to show that we can analyses the blast loading analytically as well as on software too. Nowadays, there are various terrorist attack happened in our country and therefore for the security the structure we should design our structure by considering blast load. Security of structure against the effects of blast in both architectural and structural design process. To have a better understanding of blast and characteristics of blast will enable us to make blast resistant building design much more efficiently. Essential techniques for increasing the blast resistant capacity of a building to protect the building against blast effects is discussed both with an architectural and structural approach. The increase in the number of terrorist attacks especially in the last few years has shown that the effect of blast loads on buildings is a serious matter that should be taken into consideration in the design process. Although these kinds of attacks are exceptional cases, man-made disasters; blast loads are in fact dynamic loads that need to be carefully calculated just like earthquake.*

Keywords-Blast Analysis, staad pro, Time history Loading

I. INTRODUCTION

Generally the structures are not designed by considering blast charge because the cost of blast loading design and construction is very high. As a result, the structure is susceptible to damage from blast load. The explosion of bombs in and around buildings can cause catastrophic impacts on the structural integrity of the building, such as damage to the external and internal structural frames and collapse of walls. Moreover, loss of life can result from the collapse of the structure, direct blast effect, debris impact, fire and smoke. Some terrorist organizations have targeted buildings around the world. The consequences of those attacks proved the vulnerability of buildings to explosion. Many countries have become victims of bomb explosion attacks in the last decades. There are many deliberate explosion incidents that occurred in many different places such as the bombing of Alfred P. Murrah Federal Building, Khobar Towers Bombing, World Trade Center Bombing, among others. At the time of building design the consideration of performance of high-rise buildings under blast load is very important to protect such a high rise buildings from blast. Structures require a detailed understanding of explosives, blast phenomena and blast effects on buildings. Following are the examples of past disasters happened such as the terrorist bombings of the U.S. embassies in Nairobi in 1998, the Murrah Federal Building in Oklahoma City in 1995, and the World Trade Center in New York in 1993 have demonstrated That need for a thorough examination of the behavior of structure subjected to blast loads. The blast occurred at the basement of World Trade Centre in 1993 has the charge weight of 816.5 kg tri-nitro-toluene (TNT).

The Oklahoma bomb in 1995 has a charge weight of 1814 kg at a standoff of 5 m. Hence to provide adequate protection against explosions, the design and construction of public buildings are receiving renewed attention of structural engineers.

II. OBJECTIVE

1) To use the Staad pro software for easy analysis of blast load.
2) To study the behavior of the structure under blast loading.
3) To make the blast resistant buildings.

III. PROBLEM STATEMENT

To minimize the structural collapse or structural damage to the building because of bomb blast load we must have to Understand the performance of structure under blast load. So that we can Design our structure to resist the blast load. because there are so many buildings which are not designed for the blast load, and if there is any bomb blast near the building, this will definitely damage the building. The analysis and design of blast-resistant structures require a detailed understanding of explosives, blast phenomena and blast effects on buildings. Therefore, it is important to gather the available literature review on explosives, blast phenomena, blast wave interaction and the response of structures to blast loads.

IV. LITERATURE REVIEW

T. Ngo et.al. [1] (2007) This paper conclude that for high-risks facilities such as public and commercial tall buildings, design considerations against extreme events (bomb blast, high velocity impact) is very important. It is recommended that guidelines on abnormal load cases and provisions on progressive collapse prevention should be

included in the current Building Regulations and Design Standards. Requirements on ductility levels also help improve the building performance under severe load conditions.

Zeynep Koccaz et.al. [2] (2008) The objective of this study is the architectural and structural design, the behavior under extreme compression loading of the structural form, structural elements e.g. walls, flooring and secondary structural elements like cladding and glazing should be considered carefully. With correct selection of the structural system, well designed beam-column connections, structural elements designed adequately, moment frames that transfer sufficient load and high quality material; it's possible to build a blast resistant building.

Vasilis KARLOS et.al. [3] (2013) This paper studies on the behaviour of engineering structures under blast or impact loading. The use of explosives by terrorist groups around the world that target civilian buildings and other structures is becoming a growing problem in modern societies. Explosive devices have become smaller in size and more powerful than some years ago, leading to increased mobility of the explosive material and larger range effects. Usually the casualties from such a detonation are not only related to instant fatalities as a consequence of the direct release of energy, but mainly to structural failures that might occur and could result in extensive life loss.

Osman Shallan et.al. [4] (2014) This paper investigates, through numerical simulations, the effects of blast loads on three buildings with different aspect ratios. Finite element models of these buildings were developed using the finite element program AUTODYN. Blast loads located at two different locations and spaced from the building with different standoff distances were applied. The simulations have revealed that the effect of blast load decrease with increasing the standoff distance from the building and with variation the aspect ratios of the buildings there is no variation in the displacement of the column in the face of the blast load but with increasing the aspect ratio the effect of blast load decrease in other element in the building. And author conclude that blast load decrease with increasing the standoff distance from the building and with variation the aspect ratios of the buildings there is no variation in the displacement of the column in the face of the blast load but with increasing the aspect ratio the effect of blast load decrease in other element in the building.

V. SOFTWARE ANALYSIS OF BLAST

For the software Analysis of blast load in staad pro software the methodology will be Time history Analysis.

In staad pro we can apply blast load on the structure in form of time history loading. So that we can apply blast load in terms of Time vs Force, Time vs Acceleration or Time vs moment.and we can find all these parameter form the IS code 4991-1968.

STAAD or (STAAD.Pro) is a structural analysis and design computer program originally developed by Research Engineers International at Yorba Linda, CA in 1997. In late 2005, An older version called Staad-III for Windows is used by Iowa State University for educational purposes for civil and structural engineers. The commercial version, STAAD.Pro, is one of the most widely used structural analysis and design ssoftware products worldwide. It supports several steel, concrete and timber design codes. It can make use of various forms of analysis from the traditional 1st order static analysis, 2nd order p-delta analysis, geometric non-linear analysis, Pushover analysis(Static-Non Linear Analysis) or a buckling analysis. It can also make use of various forms of dynamic analysis from modal extraction to time history and response spectrum analysis. In recent years it has become part of integrated structural analysis and design solutions mainly using an exposed API called OpenSTAAD to access and drive the program using a Visual Basic macro system included in the application or by including OpenSTAAD functionality in applications that themselves include suitable programmable macro systems. Additionally, STAAD.Pro has added direct links to applications such as RAM Connection and STAAD.Foundation to provide engineers working with those applications which handle design post processing not handled by STAAD.Pro itself. Another form of integration supported by the STAAD.Pro is the analysis schema of the CIMsteel Integration Standard, version 2 commonly known as CIS/2 and used by a number modelling and analysis applications.

VI. DISCUSSION AND CONCLUSION

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.

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