IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)
e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 12, Issue 4 Ver. V (Jul. - Aug. 2015), PP 41-44
www.iosrjournals.org

Study on blast wave parameters over the facade of high rise buildings

[1]K.Srinivasa Rao, [2]M.K.M.V.Ratnam, [3]C.Ramesh Dutt, [4]Dr.U.Ranga Raju
[5]Dr.R.Harinadha babu
[1, 2, 4]*(DNR College of Engineering and Technology, Bhimavaram, AP, India)*
[3, 5]*(Sir C R R College of Engineering, Eluru, AP, India)*

Abstract : *Generally, tall reinforced concrete structural buildings have been designed for normal loads like dead, live and lateral loads. There are several codes and well known procedures for the determination of lateral loads i.e. wind and earthquake, but in the case of blast loads, there is no sufficient techniques to evaluate the impact over the structures. this study contributes to find out the blast load parameters like incident, reflected pressures, arrival time and positive phase time duration over the facade of a multistory RCC structure (G+13) using US Army Technical Manual 5-1300. It is observed a remarkable variation in the pressures, arrival time, positive phase time duration with height, charge weight and distance.*
Keywords: *Blast; Impact; Arrival; Reflected; Incident;*

I. Introduction

Presently many of countries facing a serious problem i.e. terrorism, recently 26/06 kuwait suicide bomb attack. This activity is performed by terrorists/militants. Major terrorist attacks are chemical explosion, accidental or both. Unexpected bomb explosions cause damage and demolish target buildings and surrounded structures. Example for this is progressive collapse of Ronan point apartment (22 floors) in England; because of gas explosion load bearing walls were demolished. With This incident Structural engineers have started research throughout the world towards preventive collapse of high rise buildings under abnormal loads. Structural engineers have developed methods for structural analysis and design against blast impact, also engineers in the U.S Military developed empirical methods and TM5-1300 [1] to predict blast load parameters.

Blasting load can be defined as the load result from the explosions or chemical ammunitions. The threat of bomb depend on two factors, which shows in Figure.1, the charge weight (W), and the standoff distance between the blast source and target(R). The main results of detonation are the temperature, which depend on the Charge weight and material properties, and the hot gases which expand out of the occupied volume forming an air waves (blast waves) at the front, which contain the most of energy released by explosion.

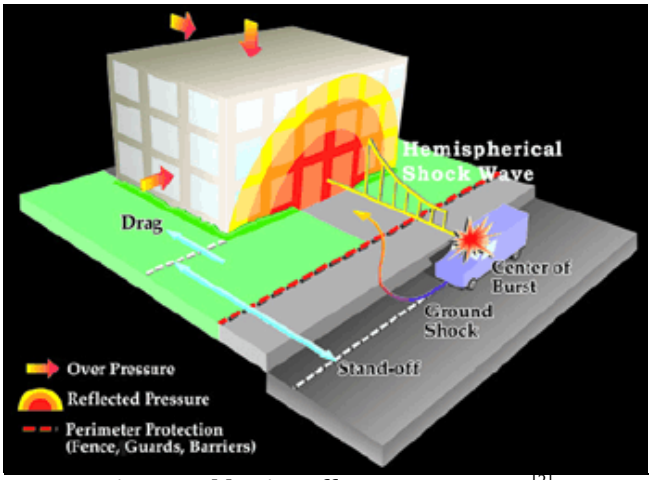


Figure.1: blasting effect on structures [2]

II. Blast Wave Parameters

In this paper, it is proposed to study the blast wave parameters for unconfined surface blast with hemispherical charge. Blast wave parameters are determined using the graphs shown in figure.2 from US Technical Manual-5

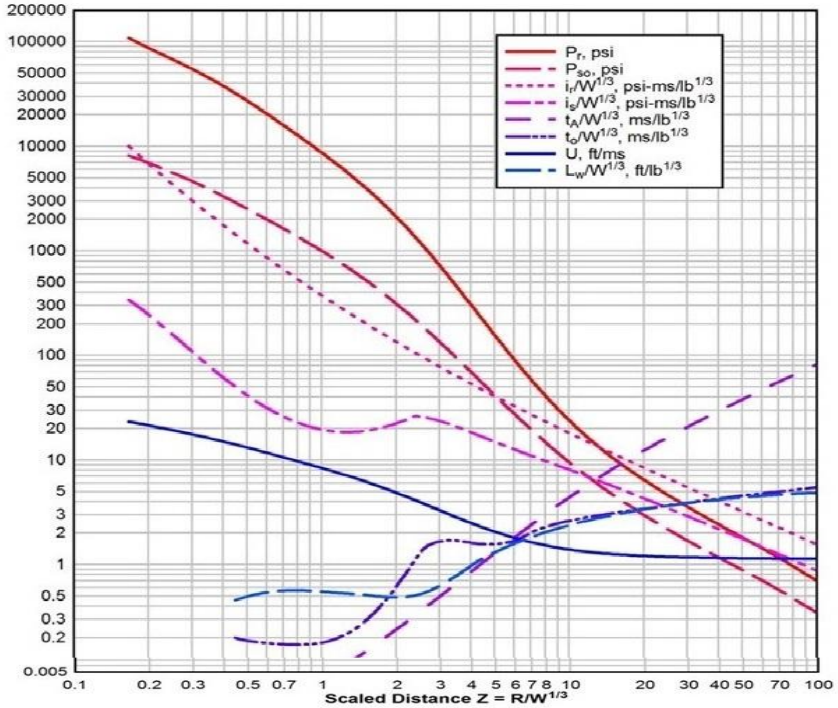


Figure.2: Positive phase shock wave parameters for hemispherical TNT Charge Weight [2]

2.1 Brief over view

A G+13 storied building consisting of each storey height 4m and the total height of the building frame is 52m. The present project is proposed to study the blast wave pressures of the multi-storey 2-D building frame using TM-5 1300 plots in UFC[3] (Unified Facilities Criteria). The following structure is considered, for finding out the pressures which are induced due to blast.

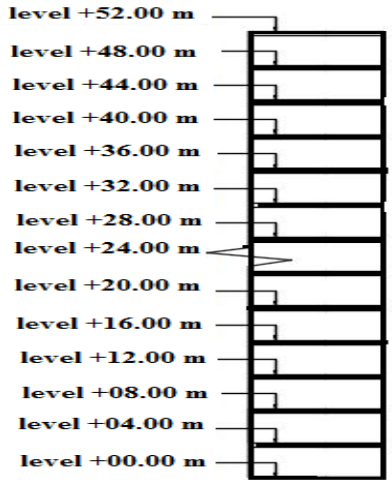


Figure.3: facade of tall structure

III. Results And Discussions

In this paper, Incident pressure, reflected pressure and blast impulses are determined for four combinations 10m-1000kg, 10m-4000kg, 40m-1000kg and 40m-4000kg and results observed are shown in the form of graphs in figures 4, 5 and 6.

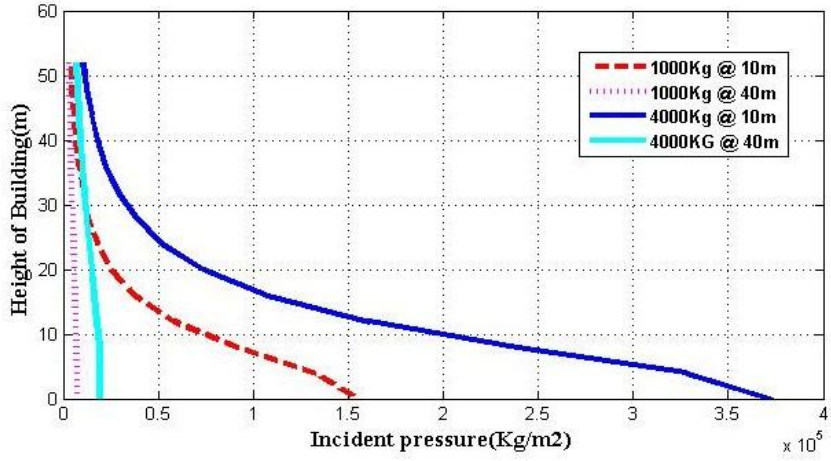


Figure.4: incident pressure for 1000, 4000kg @10 and 40m distance

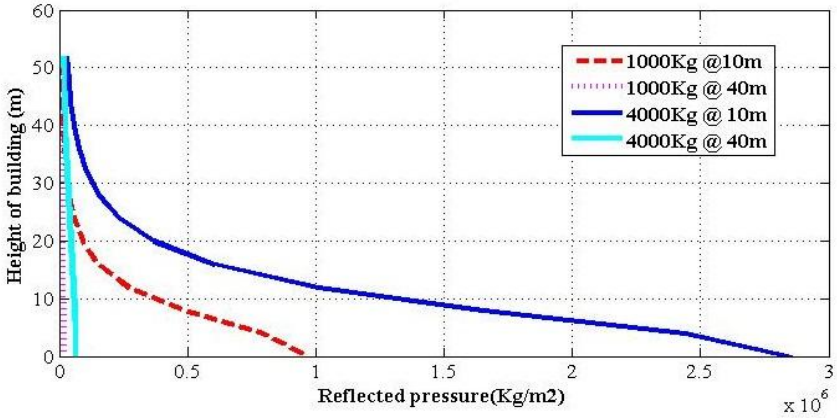
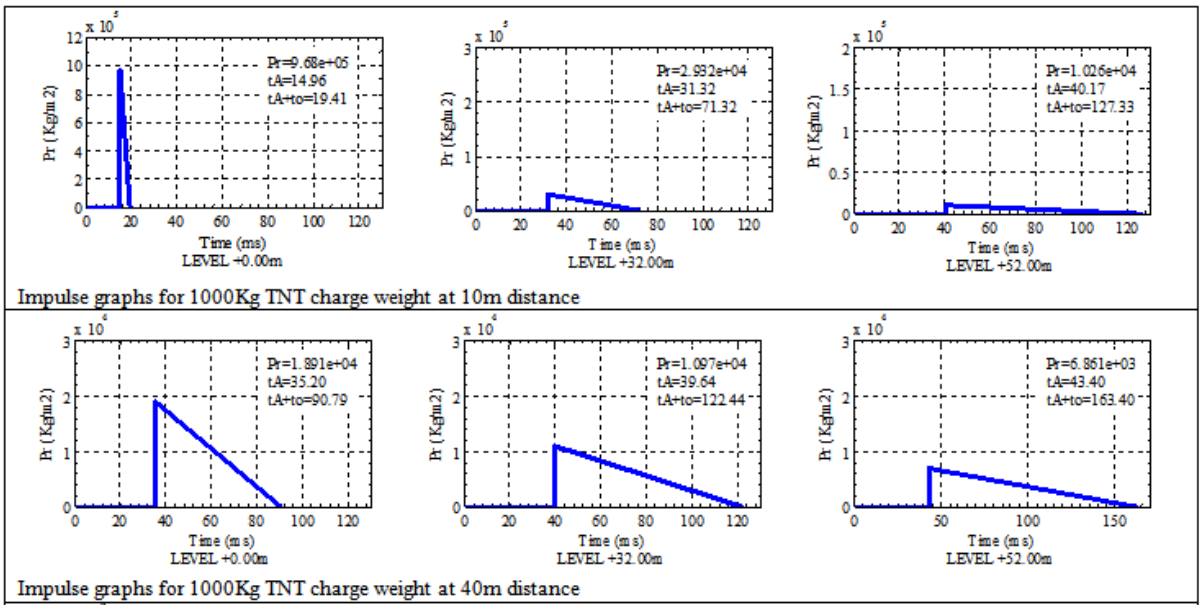


Figure.5: Reflected pressure for 1000, 4000kg @10 and 40m distance



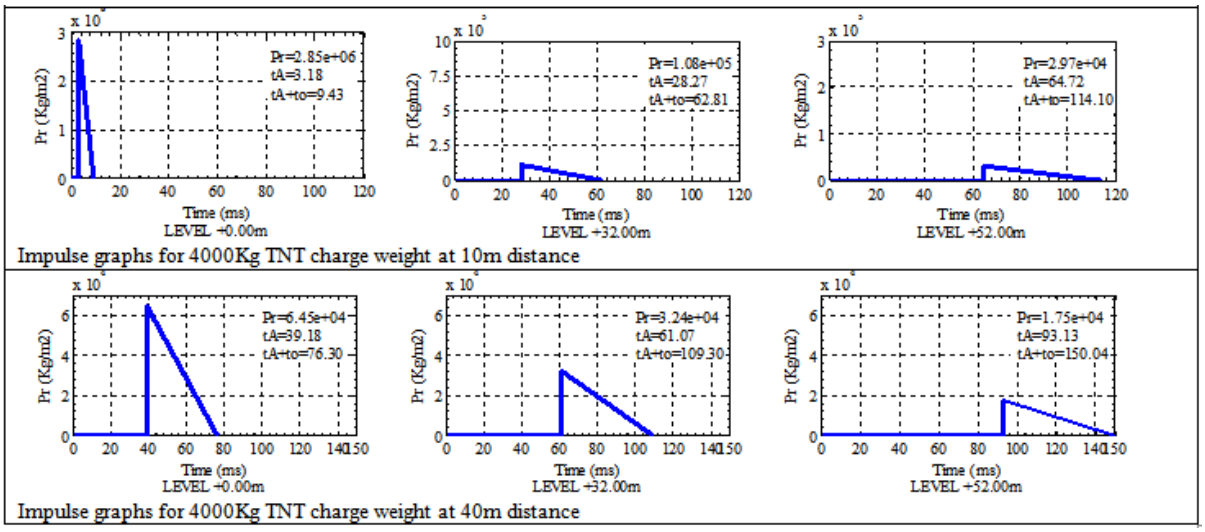


Figure.6: Impulsive peak pressure for 1000, 4000kg graphs for 10 and 40m distance.

This paper is devoted to the prediction of blast loads both using technical manuals and. In this present work, we focused on the effect of external blast over the facade of structures by a high explosive detonation (unconfined surface blast) with hemispherical charge. The reflected pressure p_r, arrival time t_A and positive phase time duration for reflected pressure t_O be estimated. Distribution graphs are prepared throughout the height of structure for the charge weights of 1000, 4000 kg TNT and the ground distances (ranges) of 10, 40m. Blast force-time curves (impact) are prepared throughout the height of the frames in order to study the linear and non linear pressure variation of the structures.

Application of blast load in the form of impact load over the RC frames is discussed in this work. Category of blast explosion considered in this study is external explosion, where the blast effect is considered over the face opposite to the detonation. The charge shape considered, for the calculation of the blast parameters is hemispherical.

IV. Conclusions

1. For lower charge weights and lower ranges the pressure variation is less over the upper floors and the pressure difference is more in lower floors compared to upper floors due to angle of incidence.
2. For high charge and lower ranges the pressure variation component is more from the above case, this is due to both charge weight and angle of incidence.
3. Whether the lower or higher charge for higher ranges, the pressure is nearly uniform, the magnitude of the pressure depends on the charge weight and range. Pressure is nearly uniform and it is due to the ranges from the location to the point of interest. For this case the range is predominant and the angle of incidence role is minimum.

References

[1] TM 5-1300 1990 Edition, November 1, 1990

[2] Unified Facilities Criteria (UFC), Structures to Resist the Effects of Accidental Explosions, U. S. Army Corps of Engineers, Naval Facilities Engineering Command, Air Force Civil Engineer Support Agency, UFC 3-340-02, 5.