COMPARING THE DAMAGE FOR USING BRICK AND REINFORCED CONCRETE WALLS EXPOSED TO BLAST LOADING BY USING THE APPLIED ELEMENT METHOD (AEM)

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1. INTRODUCTION

In recent years, events of the accidental explosion have been often reported. There were several injuries from fragments or flying debris such as brick and concrete fragments, although the structure remained un-collapsed. The use of appropriate material for walls could enhance inhabitant safety in structures. This study aims to test a procedure named Comprehensive Blast Analysis (CBA) to interpret the numerical outcomes and the alternative numerical method for damage assessment of blast scenarios involving structural and non-structural elements with different outer cladding.

2. METHODOLOGY AND MODELING

A reinforced concrete frame was selected and subjected to 3 different scaled distances of an explosion, as shown in Table 1. The parameters essential for blast load calculations follow the UFC 3-340-02 standard. The single outer-cladding structure with three stories and three bays along x and y directions resisted blast loading was used to be a simple structure. There are three different structures with outer cladding: without cladding, brick, and reinforced concrete walls with 150 mm thickness. The structure was simulated and analyzed in a powerful numerical tool, Extreme Loading for Structure (ELS) software based on Applied Elements Method (AEM).

Second, the collapsed zone may interpret the residual frame and distinctive structure elements in collapsed parts. A severe evaluation can be considered regarding structural health and inhabitants' damage. The structural health in the collapsed zone was represented by absorbed energy calculated from the acceleration response of structures.

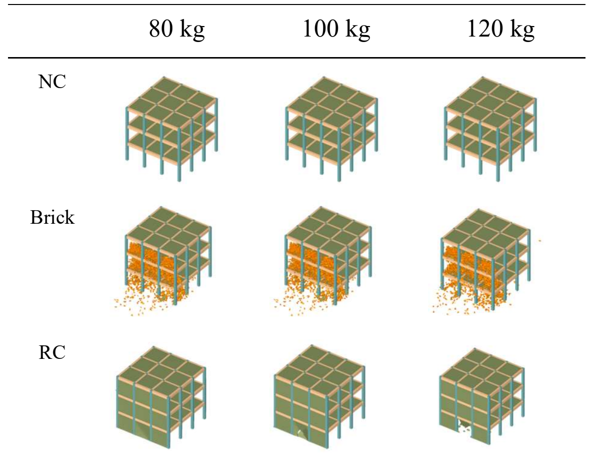
Table 1 Surface burst of blast information

Scaled distance ($m/kg^{1/3}$)	**Weight (kg)**	**Location (m)**	**Peak Pressure (kg/m^2)**
0.70	80	3	1.86×10^6
0.65	100	3	2.24×10^6
0.61	120	3	2.68×10^6

3. RESULTS

In all cases, the absorbed energy suddenly increased within 0.001 seconds before saturating. The rate of increase of 80 kg TNT was seen to be lower than 100 kg TNT. In addition, the structure absorbed the most energy when subjected to the 120 kg TNT.

Table 2 Final damage state with different cladding



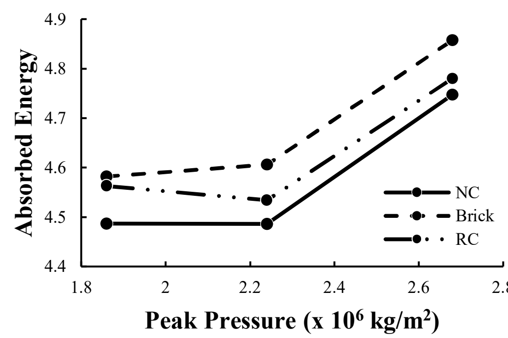


Figure 1 Relationship between Absorbed energy and Peak Pressure

Brick walls generated more severe damage to the structure due to the higher absorbed energy of the main structure. Moreover, the fragments of brick walls caused severe damage to inhabitants.

4. CONCLUSIONS

From the results, reinforced concrete walls absorbed the least energy on the residual structure. In addition, the kinetic energy of non-structural fragments was also lesser, proving it to be safer outer cladding.

REFERENCES

[1] Tagel-Din, H.: A new efficient method for nonlinear, large deformation and collapse analysis of structures, Ph.D. thesis, The University of Tokyo, Sept. 1998.

[2] Unified Facilities Criteria (2008), "UFC 3-340-02 Structures to Resist the Effects of Accidental Explosions", U.S. Army Corps of Engineers, Naval Facilities Engineering Command, Air Force Civil Engineer Support Agency.