BLAST RESISTANT STRUCTURE

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ABSTRACT

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 and wind loads. firstly, explosives and explosion types have been explained briefly. In addition, the general aspects of explosion process have been presented to clarify the effects of explosives on buildings. To have a better understanding of explosives and characteristics of explosions will enable us to make blast resistant building design much more efficiently.

Keywords: ***Blast Resistant Design, Blast Load, Explosive Effects, Etc***

I. INTRODUCTION

Damage to the assets, loss of life and social panic are factors that have to be minimized if the threat of terrorist action cannot be stopped. Designing the structures to be fully blast resistant is not an realistic and economical option, however current engineering and architectural knowledge can enhance the new and existing buildings to mitigate the effects of an explosion. blast resistant structural designs are becoming essential because of the upsurge in terrorist attacks throughout the world in recent years. A lot of research has been done since 1940s to develop design philosophies against blast forces. As a result, a number of methods have been introduced to estimate design parameters and procedures have been developed to carry out blast resistant designs.

II. OBJECTIVES

The objective of this study is to shed light on blast resistant building design theories, the enhancement of building security against the effects of explosives in both architectural and structural design process and the design techniques that should be carried out. Firstly, explosives and explosion types have been explained briefly. In addition, the general aspects of explosion process have been presented to clarify the effects of explosives on buildings.

III. BLAST EFFECTS

An explosion is an extremely rapid release of energy in the form of light, heat, sound, and a shock wave. A shock wave consists of highly compressed air traveling radially outward from the source at supersonic velocities. As the shock wave expands, pressures decrease rapidly (with the cube of the distance) and, when it meets a surface that is in line-of-sight of the explosion, it is reflected and amplified by a factor of up to thirteen. Pressures also decay rapidly over time (i.e., exponentially) and have a very brief span of existence, measured typically in thousandths of a second, or milliseconds. Diffraction effects, caused by corners of a building, may

act to confine the air-blast, prolonging its duration. Late in the explosive event, the shock wave becomes negative, creating suction. Behind the shock wave, where a vacuum has been created, air rushes in, creating a powerful wind or drag pressure on all surfaces of the building. This wind picks up and carries flying debris in the vicinity of the detonation. In an external explosion, a portion of the energy is also imparted to the ground, creating a crater and generating a ground shock wave analogous to a high-intensity, short-duration earthquake.

IV. BLAST DESIGN

The design of a blast windows system involves very detailed areas of design.first the peak pressure must be determined from the size of the charge and the set back distance from that change.then a positive phase duration must be known to determine the impulse of the blast wave.finally performance condition must be specified to determine the expected performance level. it is important to note that a blast resistant window operates as a system.it involves not only the glass itself,but also the framing system.anchoring system and even the structure of the building.a frame that is not designed for blast or that is not anchored properly may not hold the glazing during a blast situation causing unnecessary failure and possible injury.

V. DESIGN STRENGTH OF BLAST RESISTANT STRUCTURE

5.1 Reinforcing Steel

Dynamic yield stress 25 percenthigher than the minimum specified static yield stress.

5.2 Concrete

The dynamic cube compression strength may be assumed to be 25 percent higher than the minimum static cube strength at 28 days

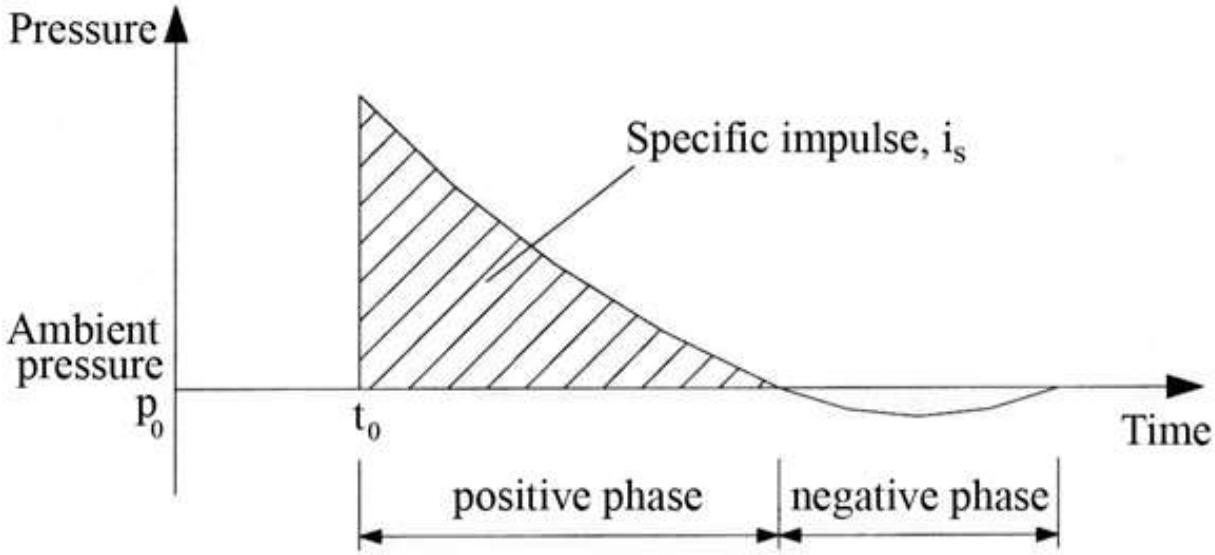
5.2.1 Design Stresses for Plain Concrete

The dynamic flexural strength of plain brick and stone masonry to be assumed to be the same at the corresponding static strength the compressive strength shall be taken 25% higher than the corresponding static strength.for unreinforced brick work the ductility ratio may be limited to 1.5 For reinforced brickwork, with not less than 0.05 percent steel on each face and not more than balanced percentage, the ductility factors as for reinforced concrete may be used.

5.2.2 Bomb Proof Concrete

The material has a high cement content, low water/binder ratio and uses fine silica sand as its only aggregate. Short, straight steel fibers with a high compression and tensile strength in the region of 1,800 and 2,000N/mm2, respectively, reinforce the material.

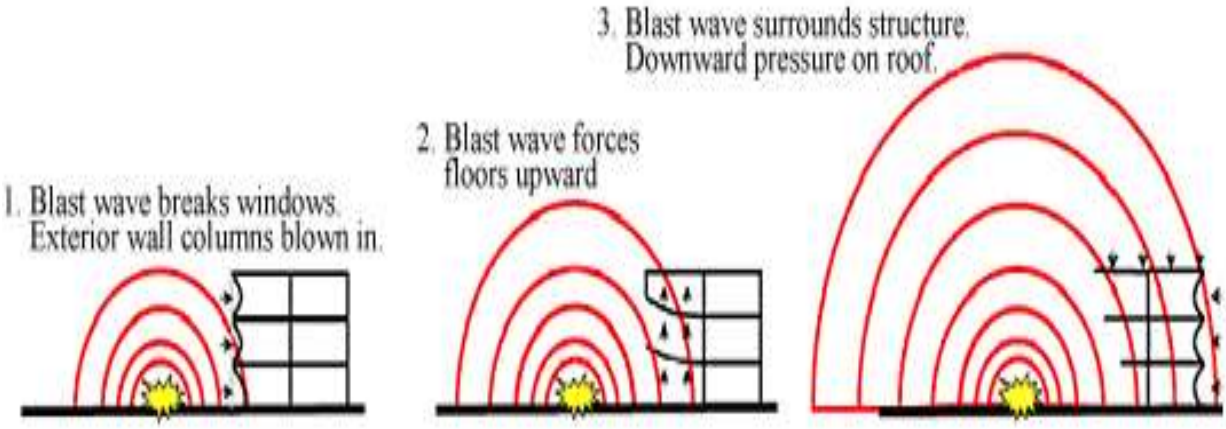
5.2.3 Blast Wave Pressures Plotted Against Time



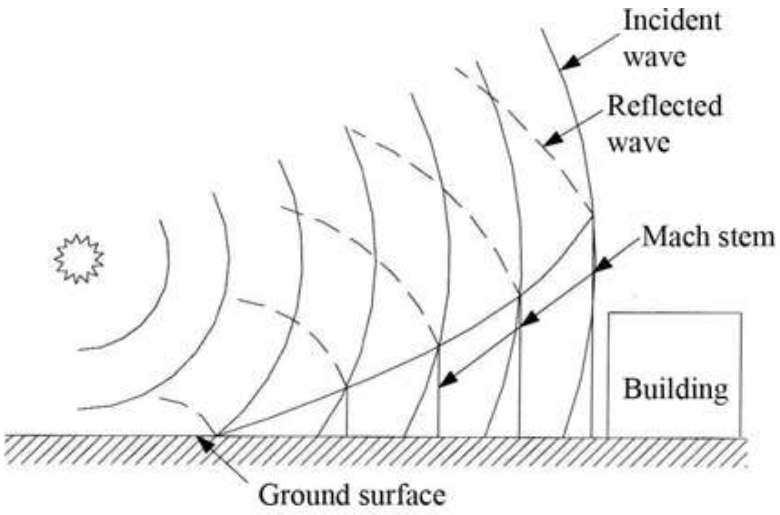
VI. STAND-OFF DISTANCE AND THE EFFECTS OF BLAST

Energy from a blast decreases rapidly over distance. In general, the cost to provide asset protection will decrease as the distance between an asset and a threat increases however, increasing stand-off also requires more land and more perimeter to secure with barriers, resulting in an increased cost not reflected.as stand-off increases, blast loads generated by an explosion decrease and the amount of hardening necessary to provide the required level of protection decreases

6.1 Sequence of Air-Blast Effects



The initial shock wave is reflected and amplified by the ground surface to produce a reflected wave unlike the air burst, the reflected wave merges with the incident wave at the point of detonation and forms a single wave. In the majority of cases, terrorist activity occurs in built-up areas of cities, where devices are placed on or very near the ground surface.



VII. ARCHITECTURAL ASPECT

1> Planning and layout

2> Structural form and internal layout

3> Bomb shelter areas

4> Installations

5> Glazing and cladding

VIII. STRUCTURAL ASPECT

Blast loadings are extra ordinary load cases however, during structural design, this effect should be taken into account with other loads by an adequate ratio. Similar to the static loaded case design, blast resistant dynamic design also uses the limit state design techniques which are collapse limit design and functionality limit design. In collapse limit design the target is to provide enough ductility to the building so that the explosion energy is distributed to the structure without overall collapse. For collapse limit design the behavior of structural member connections is crucial. In the case of an explosion, significant translational movement and moment occur and the loads involved should be transferred from the beams to columns.

IX. CONCLUSION

Blast resistant building design is to prevent the overall collapse of the building and fatal damages. Despite the fact that, the magnitude of the explosion and the loads caused by it cannot be anticipated perfectly, the most possible scenarios will let to find the necessary engineering and architectural solutions this study is motivated from making buildings in a blast resistant way, pioneering to put the necessary regulations into practice for preventing human and structural loss due to the blast and other human-sourced hazards and creating a common sense about the explosions that they are possible threats in daily life. In this context, architectural and structural design of buildings should be specially considered.

REFERENCE

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