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Towards a Sustainable Development for improving safety of Building during wars –Gaza Strip as a Case Study

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Abstract— Dangerous and emergency situations are likely to occur without giving you time to prepare in advance. Past experience has shown that people who have prepared themselves ahead of time, and know how to cope with emergencies, manage to behave appropriately and can save themselves and their family members in an emergency. In countries suffered from conflicts such as Palestine, it becomes clear that an additional factor has accelerated the deterioration process; political and security conditions. These have created an atmosphere of fear and despair which has negative impacts on the built heritage. The Gaza Strip has passed through many political conflicts over the past 65years; this affected the building process, causing chaos in architectural planning and development. During the occupation period, the main concern of so many people has been to build a shelter in a very economical way regardless the form, shape, or style. The implementation of the developed approach on different building plans verified its adequacy for designing of a new building in Gaza strip; it can be adopted for buildings in other geographical areas subjected to similar conditions requirement. This paper examines how repeated bombardment, precision attacks, and incursions reconfigure space, buildings and the functionality of the built environment in the Gaza Strip.

Index Terms- Emergency Situation, Sustainable, Construction, Safe room, Solutions.

1 INTRODUCTION

Urbicide (Latin: urbs: city + Latin: caedere to cut, kill) as a tactic of urban warfare has changed the look and feel of many places such as the Balkans, Germany in World War II, and The Gaza Strip. Using data obtained from different non governmental organizations and aid agencies. The shape and composition of the built environment is evaluated after specific bombardments, attacks and incursions in order to assess the extent and form of rebuilding. The results show that each round of destruction is followed by differing degrees of reconstruction that again restructure the look of the built environment. There are many international design manuals and legislations assigned to protect buildings and people from blast damages, but these design manuals were developed mainly to mitigate damages of individual explosions and terrorist attacks. These manuals do not take into consideration the damages and problem that may happen during war which may continue for long periods. It is necessary to develop legislations and design regulation to minimize building damage and people injuries that happen during the long periods of wars.

2. Last Israel, Wars of Gaza Strip.

2.1-Operation Cast Lead

Operation Cast Lead began on the morning of December 27th 2008, and ended on January 18th 2009. Significant, and in some areas total, destruction was wrought on the Gaza Strip. The IDF enforced a total media blackout during the operation and prevented international aid personnel and journalists from entering the area. Unlike previous attacks the existence of twitter, Face book (Face as the local population calls it), and other internet sites made it possible for the international community to get a glimpse into the siege. In survey of the destruction created by Operation Cast Lead the UN noted 3814 different instances of destruction. This included the destruction of 3,450 residential buildings and 2,789 houses (B'Tselem, 2009, Press Releases) as well as the damage of 2,870 housing units (Human Rights Watch, 2010).

2.2-Column clouds IDF Operation of Gaza Strip

Since November14th 2012, the IDF reported targeting over 1,500 sites throughout the Gaza Strip. An estimated 298 homes have been destroyed or sustained major damage. The public infrastructure also damaged or destroyed includes health facilities, schools, bridges, universities, mosques, media and research centers, sports facilities, in addition to security, police and government buildings; according to the IDF, the Protection Cluster reports that, in total, at least 158 Palestinians are reported to have been killed between 14 and 21 November 2012. This includes 103 civilians, including at least 33 children and 13 women. The Gaza Ministry of Health reports that 1,269 Palestinians were injured, the majority of whom are believed to be civilians.

In Gaza, most of the families who had fled their homes and sought refuge in emergency shelters set up in UNRWA and other schools in recent days have now returned home. Local sources estimate that approximately 100 tunnels under the border with Egypt were damaged as a result of Israeli air strikes. However, other tunnels have resumed operations and there are reports of goods, including fuel, construction materials and food, being transferred through. Initial estimates indicate that at least 298 houses have been either destroyed or sustained major damage during air strikes and other attacks between 14 and 21 November 2012. Most of these houses are in Gaza city and areas in northern Gaza. Additionally, more than 1,700 houses have sustained minor damage.

(United Nations Office for the Coordination of Humanitarian Affairs (OCHA) 2012 Fact sheet) It is estimated that the need for housing and shelters is currently about 75,000 units. This has resulted in thousands of people in the Gaza Strip lacking access to appropriate shelters and still live in crowded or unfit residences. The lack of building materials due to the blockade has halted overcoming this problem. The high unemployment rate, which is about 40% of the total work, is also one of the consequences of the failure in the industrial and construction sectors, which has deepened the economic crisis forcing many people to become more dependent on foreign aid.

3.0 **The construction sector in Gaza**

It is generally agreed by local and international organizations concerned with the housing situation in Gaza that there is a significant shortage of needed housing units to meet the development needs of the growing population. The combined effects of rapid population growth, the blockade and the destruction of houses during and prior to the Cast Lead Operation is considered as the main reasons for the inadequate housing situation. According to a recent USSD report (August 2011) the total housing needs in the Gaza strip is estimated to be about 75,000 units; 75% of which is due to natural population growth, 13% due to the destruction of houses in Israeli military operations, and 12% accounted for replacing substandard units and easing overcrowding. Considerable efforts have been carried out by various organizations to overcome the housing crisis in Gaza; however, insignificant outcomes have been achieved to date. This failure is mainly due to the lack of construction materials and infrastructure facilities available in the Gaza strip. As a result, thousands of people have no access to safe and permanent shelters, which is considered a basic human need. Many of the displaced people from the war, who number around 100,000, still live either in emergency shelters or with host families (USSD, Shelter Advocacy Fact Sheet 3, 2011).

3. 1 **the needs of facilities and housing units in Gaza Strip:**

This research aims to study the effects of war hazards and weapons on the structural and non-Structural elements of the buildings in Gaza Strip in order to identify the shortcomings of design and construction practices followings point are to be considered:

-Up till 2010, the shortage in housing units reached 30,000 housing units.

-The annual increasing rate of census requires 5,000 housing units more.

-The totally destroyed housing units because of the war are about 4,000; 8,000 housing units were partially destroyed and more than 45,000 housing unit was simply damaged.

-The required housing units for the five coming years, including the deficit, are about 60,000 housing units. -Hundreds of public utilities, schools, hospitals and other institutions.

3.2 **Building Damages**

Mostly the ground and the first floors of building were subjected to fire and serious damages which caused structural damages in the columns and floors .the damages in the buildings include the following: -Fire caused minor damages including spalling of plaster and black smoking as it was seen in

the most effected buildings after the war in Gaza Strip.

-Buckling of the concrete and reinforcement steel in some columns.

-Wide cracks and destruction in the walls.

-Damages to windows and breaking the glass and the aluminum frames.

-Spalling of the concrete cover in the some parts of the beams and columns.

-Spalling of plaster in many parts of the internal walls.

This situation was created by the following major factors:

- Bad construction practices and common fatal design mistakes of the buildings (soft storey, short column, lack of verticality and continuity of vertical structural elements, i.e. very high eccentricity and bad quality of material and workmanship).

- Lack of a national code for seismic design and construction absence of national legislative laws and regulations for protection against earthquakes; and Absence of effective mechanisms for control of application (design and construction) and enforcement of regulations.

Figure 1: photo of localized failure of exterior walls, windows, roof system and columns.

Figure 2: photo of totally damaged housing units.

Figure 3: photo of collapse of the building.

4.0 Building a safe room

In case of an emergency Situation such as the existence in Gaza Strip - or even just the fear - of a fire, a bomb, IDF attack, or any similar incident that makes the crowd rush to exit the buildings. Therefore, our suggestion of a new design should to enable the rapid evacuation of panicking users with minimum risk. In case of a conventional missile attack (explosives only), we feel the floor shaking, the windows rattle in their frames, furniture and other items move about in a strange manner, ceiling lamps swing, and the attack makes it harder and harder to maintain stability and normal movement. Normally a "safe room" can give you "near-absolute protection. A safe room is a specially reinforced area in our home that can serve double-duty for another use, such as a closet or bathroom. Or it could be a stand-alone room in the garage or a shelter outside the house. You can build a safe room as part of a new home, or you could retrofit a room in an existing home. The window opening shall have in internal sealed security window an external steel leaf aimed at absorbing the blast loads caused by the detonation. The minimal area of an Apartment Protected Space is could be 5 square meters net per apartment and should not include more than two people. How to improve protection if your house does not have shelter or pro-

tected space? The below considerations are based on answering this quire.

4 .1 **Permanent solutions:**

Improvements in construction to increase the protection level of the sealed room envelope (walls, ceiling against chemical and conventional weapons).

-Windows: Window frames should be replaced by steel or aluminum frames while anchoring the window. The glass should be replaced by polycarbonate (plastic material) or multi-layer glass. Doors: should be replaced with blast doors opening outwards.

4.2 **Emergency Solutions to be executed during emergency**

If permanent improvements were not carried out during peace time, emergency solutions can still be managed as followed:

Prepare and seal a single room in an apartment, during the emergency period. Windows: Prevention of fragments in one of the two ways: Strengthening the glass by coating or gluing sticky plastic materials.

Covering the windows from the inside with an anti-blast and anti-fragment ballistic cloth (blast curtain) Gluing polyethylene sheet to cover all the window area, and in addition gluing with adhesive tape along perimeter and with two vertical and two horizontal adhesive tapes on the polyethylene sheet. Doors: Similar to the air-tightness of the windows, the connection between the door's leaf and the frame sealed. Sit adjacent to an inner wall, perpendicular to the outer wall. Sit as far away as possible from the outer wall and window.

5.0 **Designating the Secure Space**

This paper tries to demonstrate the main design objectives of such durability through the case study. Designing for durability requires some expectation of the nature of the disaster. The higher the expectations are, the higher the complexity of the design and its related cost. Gazaner buildings should be designed to minimize the health effect resulting particularly from performing ablution. Meanwhile, Gazaner buildings should be designed as a durable building to support its community in cases of disaster. Such durability extends beyond structural integrity to include providing an acceptable level of thermal comfort Here are some examples of buildings with their most protected spaces marked to be re-used as a safe area or rooms: Stairway, Corridor, windowless inner room and safe exit which could be used for the most buildings types in Gaza strip (Private sector or NGOS Installation and governmental issues).

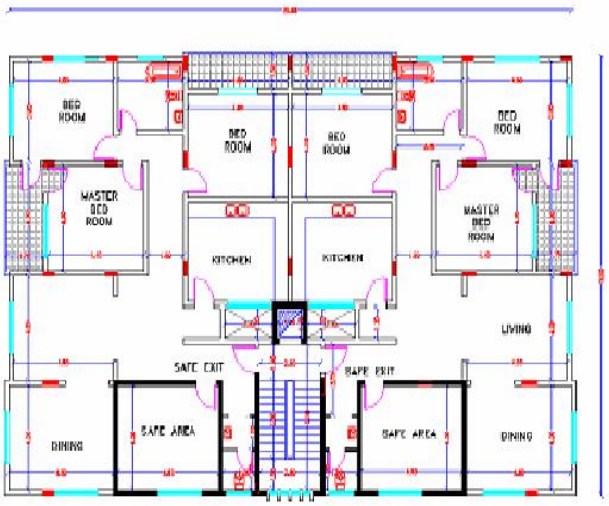


Figure 4: Proposed floor plan for safe areas in a five-story residential building.

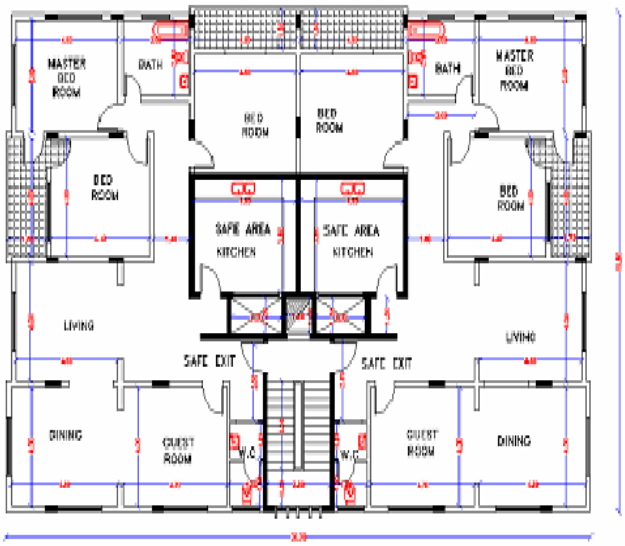
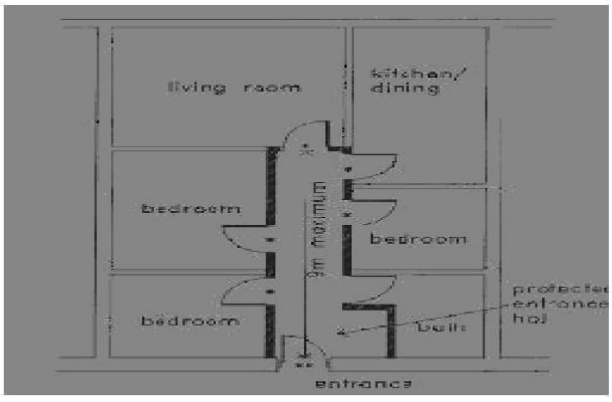


Figure 5: second proposed floor plan for safe areas in a five-story residential building.

In older buildings, owners can create fortified rooms, reinforcing a standard room with 12 centimeters of concrete and add-

ing a specialized steel door and window and a reinforced ceiling. Another, cheaper, option that can be built according to experiences trail is a steel cage in an existing room, covered by another layer of cement. And for those lacking a safe room or bomb shelter, there's always the stairwell, usually cast in concrete and surrounded by pillars that keep the building standing, making it the safest place in the building. Safe rooms and stairwells, there will probably be an initial increase in bomb shelter improvement and construction of safe rooms, but just for a short time, not for new building recommended. In case of existing old buildings safe rooms should be built for each floor, or in each apartment, usually one on top of the other, creating a core of safe rooms in the building. While the first safe rooms were made out of concrete blocks, the safe rooms built in the last decade are made out of 20 centimeters of high-end concrete, a thicker and stronger material than regular concrete and with an inner wall of reinforced steel. It's recommended for the UNRWA installation to create a similar safe room for each building based on a war at frequent intervals in Gaza strip without any protection their. The main design objective for a durable building should consider the Architectural as the Structural design aspects.

Figure 6: Proposed floor plan for safe areas in a low –rise residential building.



5 .1 Structural system selection

Building frame system with shear walls is the proposed structural system for new buildings. This system is the preferred structural system to improve the building resistance against the direct effects of weapons threats during wars. This system consists of solid or ribbed slabs reinforced in two directions (two –way system) supported on columns and reinforced walls transmitting the loads to foundations. The roof system provides the required mass, strength and continuity to resist all phases of blast loading including the uplift forces during the negative phase of the explosions. Buildings with large mass perform well under loading; lightweight constructions are unsuitable .large mass buildings have large inertia and hence take a while before they respond to the severe blast overpressure. My recommendation for future studies is to cover this subject from different point views, (Architectural, Structural and others).

5.2 Concluding Remarks

The analytical methods of analysis and design of affected the building structures are complex, even with the simplified static analysis method that is allowed by the building codes. However, a great deal of resistance is provided by the basic configuration and structural system of a building. The design of buildings loads requires an early and close collaboration between the architects and construction engineers, in order to arrive at an optimum cost-effective structural design, while satisfying the needs of the client. These actions are mainly to study better estimate losses, to effectively adapt new technologies that mitigate losses, to improve prediction of natural hazards like earthquakes, and war.

In addition to the general requirement, the following specific requirements are used in the redesign of the building:

-Safe areas in each apartment with areas of about 14m2 for each apartment are located in the interior part of the building near the staircases to provide protection. Safe areas may be used for other purposes in normal conditions such as a kitchen or utility room. The required amount of floor area per person is selected to be 1.5square meters.

-Locations of the safe areas in each apartment of a building should be in the same part in each floor plan, one above the other along the building elevation to form a continuous pro-

tected reinforced concrete core area.

-Walls of the safe area should consist of reinforced concrete walls with thickness of 20cm to provide protection against weapons and fragment penetration.

-Walls of staircase should consist of reinforced concrete walls to provide a maximum strength to the structure and to enhance the evacuation requirements.

- The developed design approach can be applied on the existing buildings, however ,further research is recommended to be carried out in this regard .and against no conventional weapons hazard like nuclear ,chemical ,biological and radiological weapons which are not within the scope of this approach.

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