

From the perspective of passive defense: necessities for designing and building a safe placeH.Amery Siahoui¹, M.Kameli², M.Soltani³, M.Heidary⁴, E.Mohseni⁵¹. Department of Architecture, Payam Noor University, Bandar Abbas, Iran^{2,3,4,5}. Sama technical and vocational training collage, Islamic Azad University, Qom Branch, Qom, Iran.*Corresponding author: Kameli@live.com, Tel: +98-912-5524484

Abstract: In modern wars (sixth generation) enemies take the "removal of activities" policies instead of "removal of people". Regarding this issue in passive defense, designing "safe place" and "refuge" is definable. Safe place is designed and built for short-term use during tension. This place is of vital importance when we cannot use the exits due to destruction or unsuitable circumstances (like infections and insecurities due to the continuance of tension). Safe place must provide necessary equipments to protect people, maintain and control rudimental activities, and continue function in architecture as long as the rescue forces arrive and the situation gets normal. Living in refuges provides temporary accommodation and living situations for one to two months. It also provides protection and organization of activities and management of circumstances and resistance and protection of municipal lifetime. Based on what reviewed, we should foresee following characteristics for these kinds of places: (1) Resistance against blast wave. (2) Resistance of the foundation and shell of the construction against debris. Due to the change of policies in sixth-generation wars, the experiences of imposed war and the wars of the second half of 20th century will not have efficient use if a new tension occurs. In this descriptive-analytical study, the researcher tries to use the experiences of the important wars of fifth-generation wars to optimize the designing of safe places and refuges according to the needs of sixth-generation wars. Finally some strategies and solutions to design and build these kinds of place are given.

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1- Introduction

Passive Defense¹ no role in threaten and damage can be considered as a national defense strategy, without tension, in time of peace. On the other hand, is strengthening the defense of this country, and will reduce the willingness of other states to seize their resources. Our country has been in a time and place full of advanced security threats. Due to the withdrawal of the garrison city adjacent to critical areas such as military and political potential of ministries and ...Tissue adjacent civilian and Multiple instances of targeting civilian areas - even sixth generation warfare² and Likelihood of military operations in urban areas³ Was not unaware of the need to provide shelter for public places and even private. Using Lessons from eight years of war and

conflict through the experiences of other countries in the last twenty years, for preventive measures to protect civilian lives in a massive war possible is critical given the increasing Israeli threats against Iran. It is considered a critical need for research in the field of architecture and structures for shelter⁴ and safe spaces. This paper is an attempt to benefit from the experience of past wars such as used in the fourth and sixth generation and Measures taken to protect against the threat of the Fifth Generation War. Achieve a set of guidelines for the selection of structures and methods for achieving performance enhancing security to protect lives Until be responsible for the coordination of technical and financial strength of the security situation and the level of threat and the hypothetical scenarios. This study will focus on the scenario of America as the threat of first strike against the country and its army of using common patterns in the sixth generation. In the first part of this paper examines the threats facing

¹ -vulnerability of personnel, buildings, facilities, equipment, funds, documents and passive defense is a set of actions that can reduce arterial unarmed hostile and destructive operations against the enemy

² - as the target precision-guided bombs the Chinese embassy by NATO forces during the Balkan wars and targeting residential apartment in south Beirut during Israel's 33-day war in Lebanon. [13]

³ - Such as urban combat depends on the woman during the war by Russian forces in Basra by U.S. forces during the invasion of Iraq. [8]

⁴ - Refuge is a place that is very much higher due to the special design of specific users against all types of threats, the conventional construction of the degree of protection for a much higher and physical safety of the higher of mental.

our country and the threat that specifies criteria⁵ for the design of the shelter. The second part will examine the definitions, standards and rules defined shelters and safe spaces. In the third part of the experience of eight years of war and military conflicts of the last twenty years, we will continue to examine ways in different countries. The fourth section will present a set of recommendations and strategies for designing shelters and safe spaces for coping with the effects of standard threat scenarios.

2- Materials and Methods

Descriptive and analytical is methods in this article. A tool for data collection is library research, field research, and it is the overall pattern of Internet-based research process of extracting the contents of the texts and experiences. After study predicted, will be analyzed and the results are used to process and analyze data from the studies and findings in the library field to achieve in terms of architectural principles and standards construction of a shelter environment.

3- To identify threats

For maximum efficiency, the design of passive defense system, it must first determine the type of threat; the solution is used to effectively meet its precision, power, destruction and volume of attacks ahead. The study examined the formation and characteristics of each generation to outline and define the threats facing our country, as a measure of threat.

The first-generation (pre-history to the 15th century): the development of the first generation weapon of war coincides with the trend of development. War of the prehistoric, early humans began to fight without weapons and only using external body.

War second generation, gunpowder and firearms (1450-1775): The technology to achieve this change occurred combat tactics, including the organization of military troops and the motive of conflict or war between the government and religious reasons and governments.

Third Generation War: Technology Wars (1775-1914): the growth of technology and the advent of third generation technology, the core of the revolution. This period was the most revolutionary battles of the war such as the 1789 French Revolution and the American Revolution, 1776

Fourth Generation wars: mechanized war (1914-1945) was the fourth -generation technology product can be harmful, like the invention of the airplane, due to changes in logistical, transportation, etc. The widespread use of tanks and radar. The most

important feature of this period of the war: mechanization and automation, weapons and combat systems, enhanced geometric combat ability, military people and the creation of an international war expansion of horizons incredible war began systematic development of military technology; increase astounding victims War and military power as an instrument of foreign policy. All the armies in the world of technology, there came a period of up to approximately.

War fifth generation, nuclear war (1945-1991): the competition trying to acquire nuclear balance between the superpowers militarily, making clear the need to develop new tools based technology that can increase the support of nuclear weapons operations, efficiency and their reliability. Broke nuclear balance of power, and operational structures. This system was developed and emerged the great systems of retail combined with modern technology. The main motivation for developing nuclear technology that was it: Modern long-range bombers and fighter aircraft, intercontinental ballistic missiles, and cruise and ballistic submarines, satellites and space technology for surveillance, intelligence and early warning technology, command, control, communications and intelligence, (C3I) systems and computer supercomputers and information networks.

The sixth-generation warfare, modern warfare or parallel war (1991) until now: the evolution of the three tools of war, military actions, and the nature of modern warfare has led to the phenomenal war. Modern warfare is conducted based on the potential direct energy weapons, and robotic media operations (based on technology). The most important feature is the use of weapons of war be precise guidance, robots, nonfatal technology, direct energy weapons, directed and computer viruses [11]. The sixth generations are common features of the environment:

First - military technology based on strict guided weapons, (PGM) space warfare, information warfare, and battlefield management systems (C4I).

II - new procedures and organization, including the reduction of strategic weapons (nuclear weapons, chemical and biological) into the changing nature of the damage, injury and damaging information system, changes in air strikes and spatial coordinates of the war, the war in broad but very shallow depth, adding a fourth dimension) time (typical dimensions of space, the decline and fall of infantry operations personnel and even Command [7]

The threat of weapons that will be used in the generation of war:

A - Threat of conventional weapons: the weapons used by the enemy in these cases ranged weapons approved protocols and international agreements approved by the UN.

⁵ - Criterion is threatening the possibility of a threat and the dangers and damage much more than other threats.

B - with the threat of unconventional weapons: Unconventional Weapons are weapons that are banned in the application and use by international organizations. These weapons include chemical weapons, biological and nuclear.

Considered in this study and will be the first class standard chemical attack threats. Nuclear. Microbe. Outside the scope of this paper [6]. It seems, the Iranian threat scenarios can be classified into two main categories of threat sources, including neighboring countries such as Turkey, Pakistan, Iraq and other countries and borders as Israel, the U.S. and NATO member countries [2]. Among these is the threat of American military power threat. But Israel's threats to attack and destroy the nuclear facilities limited to scenarios) and sometimes military (Iran. That the scope of this paper will consider the Israeli attack scenario. Context of current global and regional politics threat measure in this study is a military threat scenario. With respect to the subject of the ways that the U.S. must single out for special attention had to overcome an opponent.

According to U.S. military doctrine, such as the theory of "five rings Jordan" [3] is mainly the installation of the following purposes:

- Critical infrastructure - economic development and undermine the economic pressure forces supporting the war
- Residential areas to demoralize people
- Military installations and strategic military and security
- Sensitive and industrial centers.
- Offensive forces and defensive side
- Damage and physical consequences of these attacks can be as follows:
 - Explosion sound wave explosion, fire and smoke, wound
 - Degraded building structure collapse, collapsing roofs and walls, blocking the way out, destroying the building installation system
 - Degraded roads (traffic and transportation, land and air)
 - Degraded urban facilities: lighting, heating, water, sewage and garbage disposal
 - Interrupt radio communications and telecommunications

The loss or lack of access to their resources: water, food, first aid, medicine, fuel, blankets and warm clothing.

By NATO aircraft, an example of precision air strikes in the sixth generation.

Due to the complexity and unique conditions of military stadium and facilities and infrastructure will be critical to addressing the appropriate structures in the agenda present study and present study range encompasses the shelters and safe spaces

that are adjacent to residential areas, it is not possible to target the health center and get them to come [5].



Figure 1 - Target being a weapons factory during the war in Kosovo in 1999 Zstava

4-Shelters and safe spaces

Urban public spaces from the viewpoint of passive defense are required to comply with certain criteria in order to maintain the stability and continuity of life and their activities in crisis. These criteria cover the architectural design new buildings and retrofitting existing buildings and will lead to solutions in each case.

A criterion for improvement and architectural design of public buildings in accordance with the characteristics of modern warfare is based on accountability:

- The macro scale to the micro scale of single buildings in urban cells.
- Emphasis is on improving the overall architectural design of selected buildings.
- Focuses on organizing and optimal use of resources and facilities and spaces and buildings in emergency situations. [5]

In modern warfare the enemy's activities with regard to this matter is dealt two concepts of "safe place" and "Sanctuary." Space located at lower loads due to the risk of explosion and than other conventional buildings or outdoor spaces to be enjoyed immunity from more resistance, called secure. This space will be utilized two or more devices [1]. Secure location and is designed for short-term prediction in time crisis. It is assumed the risk of falling debris and closing the output always and this facility provides a safe place for people to protect and control activities continued until relief and urgent need to return to normal.

Criteria for a safe place:

- Strength of the blast wave
- The strength of the shell against the wound

- Equipped with automatic alarm systems, fire suppression, ventilation and ... Standby
- No glass, shelves, decorative elements and ...Harmful to the environment
- A supply of drinking water, food, first aid, blankets and temporary power supply heat and light

Possibility of radio communication and telecommunication (wireless or wired) with a rest.

It is necessary to predict a safe place in each category. This place serves two functions:

1. Transfer or discharge patients to shelters through a secure place
2. If it is likely to be prolonged crisis or war of attrition would be a safe place for continued settlement building and maintaining a core staff activity.

Stay in shelters for temporary living accommodation and keeps it for about one to two months of individual and organizing activities and also provides

resistance to environmental management and urban survival.

Shelter criteria:

Having all the features of a safe place

Self-sufficiency in the supply

Heating, lighting, ventilation, water and sanitation and waste disposal facilities in the event of failure of urban

Storage of drinking water, food, first aid, medicine,

Fuel, blankets and warm clothing for the expected

Shelters are divided into categories according to three degrees of protection:

1. Sanctuary of degree: for protection against chemical agents, biological and nuclear weapons.
2. The degree of shelter: Shelter in general resistant to conventional weapons.
3. Shelter grade: family shelter relatively resistant to conventional weapons disability wave [4].



Figure 1 - Sample Refuge

From left to right: Family Shelter, modern sanctuary, a haven of old

4-1- Public shelters.

Shelters are not robust due to the nature and degree of their importance in attacks against chemical, biological and nuclear weapons, but are designed and equipped to protect life and disability in primary and secondary of the blast wave. Several examples of this type are used in various countries including Iran bunker. Have been developed in some countries like Russia, Switzerland, and resisting public shelter for all citizens as well as non-conventional attacks. These shelters can be seen in urban subway network, which sometimes reaches deeper depths greater than 90 meters, and in Switzerland in underground shelters. [8]

Construction is experienced with the protection of groundwater, with the highest possible standards for uses such as subway stations, stadiums, and even power plants in some countries such as Scandinavian countries, But it is not possible due to our economic situation, the construction of such facilities with a range of standard and high safety factor; It must be

determined by understanding the importance of proper use of buildings , degree of protection according to economic factors and the type of operation . This is the main structural components designed to withstand the blast wave destroyed the power and precision weapons used by the sixth generation of the War in shelters civilian And primary and secondary wound and direct fire weapons to be collision resistant.

According to the discussion above and the experiences of wars past two decades, and measured structural secure in this section of the paper(can shelter spaces and secure)general categories shelters grade 2 in three subsets, and for each , presented the preliminary review of existing standards and guidelines experiences.

1- Permanent shelter: buildings that are built from scratch or simply to use as shelter.

2- Temporary shelter buildings that were originally designed for other purposes and only become necessary to resort to partial or total change. Such as

urban metro network structures, prefabricated shelters and etc.

3- Additional shelters: spaces are fitted within or adjacent to existing buildings as shelter or safe room. Tall buildings to shelter underground spaces such as transformation, expansion and equipping of health facilities and services with shelter-resistant structures.



Figure 2 - Examples of permanent refuge in Switzerland during exercise



Figure 3 - The Pyongyang Metro

The city metro area is used during the war as a temporary shelter

5- Experience of other countries in building public shelters.

After the First World War and subsequent military developments, beyond the front lines of battle came to the front and to the cities and population centers. During World War II, the attacks upon the cities were used to destroy the spirit of resistance against the forces of war and the destruction of facilities and infrastructure support. The worst example of this approach can be seen in the atomic bombing of Japanese cities to break their resistance. Thus, during the Cold War and the nuclear arms race upsurge block of East and West, the government took extensive measures to provide adequate shelter space for its citizens. Shelters were built so that in some countries, resistance to chemical attack. Microbe. Nuclear. Standard form for each citizen in the form of government programs, private or voluntary participation rules binding. In countries like the Soviet Union, the United States and even in Switzerland - which had not been directly involved in the conflict - the shelter system was designed to

withstand nuclear war scenarios in the form of a broad So that the Soviet Union was predicted for each shelter resident citizenry space outside the city, and the surrounding fields to refer to the place of refuge in times of disaster quickly. In China at the end of the 60s and the rise of political tensions with the Soviet Union, was constructed various shelters for public protection can be said that including the underground city of Beijing, which claims the authority has sufficient capacity to house Beijing's six million people against nuclear attacks. In addition, the network provides access to the centers of political and military leaders critical of shelters built in the western hills of the city quickly. In about 1980, the per capita costs for the defense of the city in Switzerland, per person expenditure in the U.S. are more than forty times. For every person in this country has been in a shelter environment, and many of these shelters have been built by the private sector and the location of individuals. [12]

During the war and remained defenseless against air attacks on Iraqi cities, construction accelerated efforts to expand the refuge in Tehran and other major cities. These efforts will not only focus on building public shelters in places like schools, hospitals and urban open spaces but was on encouraging people to build private haven. The shelter was built in 66 only 892 schools in Tehran and they have been evaluated in terms of average and below average builds quality. And installed along many streets, squares and public areas densely populated parts of prefabricated concrete for Finding Shelters [4]

Country	Cost capita in dollars
U.S.	0.75
England	1.15
Italy	2.00
Soviet	11.30
Switzerland	33.00



Figure 4 - the basement entrance of the city's public spaces in cities near Beijing

5-1- experiences of the sixth generation

In the early '90s, the world witnessed the first of the sixth generation of the involvement of other

countries such as U.S. and allied forces in Iraq and Yugoslavia. Specificity was mentioned in the wars several measures of passive defense and shelter. In Iraq during the Persian Gulf War (1991) in addition to shelter, public, political and military leaders planned for the deep underground shelters firm, strong and well-equipped accommodation for six months. During Israel's 33-day war against Lebanon can be seen by the signs of the sixth generation warfare. Lebanon to save lives and build shelters were placed on its agenda. Effects of land use, construction, stabilizers such as tunnels, bunkers resistant, comprehensive training on passive defense measures.

The experience of these countries can be considered as part of the most important steps in the following ways:

1. Multi-purpose shelter
2. To critical facilities underground
3. Downsizing of equipment and facilities
4. Decentralization prevent condensation building
5. Extensive training to citizens. [5]



Figure 5 - Distribution of Israeli air attacks during the 33-day war, the residential areas Dahiyeh In the south of Beirut, before and after the bombing of 22 July 2006

6- Important points in the design

Criteria considered in the construction of a shelter that will be determined by the type of architecture are related to the following four parameters:

- 1- Type of setting: Transportation and construction of a shelter is a very important consideration in the design of its structure, which certainly affects the choice of form and methods of pre-fabricated.
- 2- Location: shelter may be built on the ground or under it. Underground shelters built to be assembled on the ground and be buried underground. Each of these cases, the definition is different in different conditions; due to enter into force on the body, and they have different effects on disability.
- 3- In modern warfare, public shelters, usually not part of the main goals of the enemy, and the staggering costs of the war generation, high velocity weapons and hostile forces would have caused the destruction

of buildings and facilities, critical more. Thus, the protection intended to be used in the war of the Sixth shelters, dealing with wound primary and secondary explosions caused by the generation of powerful weapons in the war. Thus, the protection intended to be used in the war of the Sixth shelters, dealing with wound primary and secondary explosions caused by the generation of powerful weapons in the war.

4-Building Maintenance, one of the common concerns in the shelter, the shelter is likely to strand damage and release of it. It is vital to building a devoted member of various vital in times of peace. It is about technical matters, the choice of dynamic response, for use in the design of protective structures and components based on the following factors will be affected by an explosion:

- Properties (Type, weight, shape, etc.) and the location of explosives
- Sensitivity acceptor systems
- Physical properties and structure of their
- The selected structural response of the system depends on the structural properties [10]
- Explosive Properties
- Location of blast protective structures
- The amount of boost pressure, interference with earth shield or protective structures [10]

6-1 -The initial structural design philosophy

Based on passive defense, it is better to construct underground bunkers, but under the circumstances), such as the use of public places built as shelter (the shelter is a multi-storey structure on the ground should be separate basic concepts for the design of on the ground and basement floors. For this purpose they are intended to measure the resistance of buildings and structures on the ground criteria for amortized And exclusion criteria of the explosion energy is required in both the design and construction based on the concept of passive defense observance of all rules.

6-2- Prevent progressive damage

Structural design for buildings three stories or higher must be so, the damage caused by localized structural damage so that not all of the building and land to maintain its stability. For this purpose, use of special methods in structural analysis and design:

Strength(and flexural strength)structures, the internal load-bearing partitions, walls designed around the bend [14]

And charge distribution of structures affected areas to other areas by increasing the continuity and integrity of structural elements, structural ductility and indefinite, a chain of elements of roof systems and roof slab designed to span a variety of transmission [16],

And charge distribution of structures damaged areas by increasing the linkage to other areas of structural

elements, structural ductility, causing a chain-like elements of roof systems and Roof slab designed to span different for transmission [16]

6-3- Isolated

Also considered is the linkage Structural members, Units shall be isolated from the facial structure of a component failure, do not damage adjacent sections with an existing building to provide shelter, sparsely populated areas will not be used as shelter and are not built on the principles of passive defense [14]

6-4- Perimeter walls with masonry

Not recommended for masonry walls at the shelter. All masonry walls should be reinforced around the foundation, keeping the maximum distance of one meter and a maximum of forty foundations cm horizontal spacing [9]

6-5- Structural systems

Due to the structural principles to prevent progressive damage depending on distance and near the explosion source, and aerodynamic dome forms when there is sufficient distance between blasting source and shelter But for the stability and strength of the structure, it is recommended to use concrete structural system with shear walls, and bracing of steel with strong connections to the small distance between the columns [9] [15]

Shelter made it possible to be on the lower ground floor and continue straight on the ground and in the solid parts of the building structure to match the shape of the building structure, a simple [1]. In particular, we suggest the following areas:

- 1- Use building with underground parking or concrete ceiling (of at least 4 floors) beam blocks (at least 5 floors) or vaults percussion (at least 6 floors)
- 2- Under the bridge under the tracks or concrete area around the base of the shorter bridge. This can give more security to protect the most by plucking sack or installing prefabricated wall.
- 3- Use of city parks, especially parks and playgrounds with trees and thick that they are not in a building at 15 m radius [4]

Points that a designer must consider the structure and architecture in common: their design can be evaluated in four areas of "form and size", "plan", "posing" and "design phase". These recommendations should be considered in all public buildings and shelters:

6-6- Form and size of the building

The pilot of the explosive forces of the two parties helped to evacuate the building immediately and to inhibit the deleterious effects of explosive forces on the body size and the amount of open space. [1]

Avoid the sharp corners of the ground and first floors, because, trapped wind or steep angle of the shock wave of the explosion could be worse [1].

· Sudden changes are not significant and integral form, are better forms of convex and concave form [5].

· More "aerodynamic", the shape of the building), such as forms, spherical, oval and so on (is able to pass easier blast wave [2].

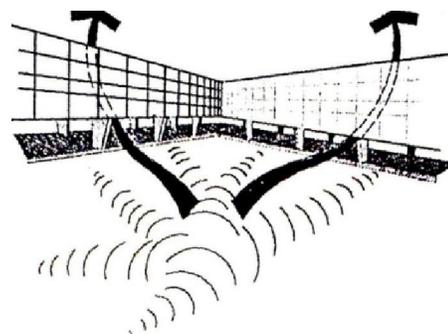


Figure 6 - rapid evacuation of power blast open space pilot

6-7- Plan

· The building should be as simple and symmetrical in both along and perpendicular projection of the high dislocation.

· Be prevented from making changes and particularly high levels of asymmetric plan buildings as possible.

· The development plan is expected to solid fuel or electric motor auxiliary spaces [5]

6-8- Frontage

· Contact the blast wave breaks, or resist the passage of fire.

· The glass should be very susceptible to the blast wave design and large windows with integrated frames.

· Prevent breakage of glass or broken glass to cut down on things like a raised frame, sunken windows, windows divided into small frames, the use of shatterproof glass, the withdrawal of the ferry window and etc.

· Use of two scaling features.

· Full Strength is a shell binding mode [5]

6-9- Design phase

· Public buildings should be designed to be seen in the table's structural strength groundwater levels, ground floor and the second and third floors above the 2800 standard

· Be independent of the main structure of the class structure to maintain a safe room in the event of damage to buildings, rooms, secure your table

· To increase public buildings to withstand explosive forces of waves, all classes must be ground and below-ground structures resistant coated steel structure with concrete.

· To avoid the creation of large openings, and adjacent to each other on the floor diaphragm.

· The components of a building, facility or objects should avoid large rock on the crater [5]

As a defense mechanism against the Japanese vessel after the earthquake, the structure can be framed her face in one hand, mobile force to move into damage control [5]

The use of shear walls, and bracing of concrete structures, particularly with strong connections in steel structures and Designing a small distance from each other and the columns that support the building of the shelter to prevent progressive deterioration.

7 -Conclusion

New age structure, provide the following guidelines to ensure. It is worth mentioning that the development of this proposal and closer to simpler ideas might be the next steps in this article:

Using predetermined motion on floating foundations or other measures to deal with the stresses occurring in the earth's surface.

Helping to create architectural forms with the help of false aerodynamic structures such as construction work space.

Implementing a multi-layer structure, with the help of gravity, and also taking advantage of the flexible and dynamic.

Cover related areas to avoid falling debris and resistance to shock waves in the space provided for the discharge shock force.

Having good resistance to fire and heat-induced explosions in structural components. Using continuous elements at levels associated with blasting, to prevent materials falling on refugees.

Capacity development in post-conflict conditions of space remaining for temporary housing. Design of expanding opportunity for exposure in the open spaces, gardens and squares. Since it is considered the most difficult to prevent structural damage, should be avoided by using different approaches are described, the incidence of progressive deterioration.

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