Cumhuriyet Üniversitesi Fen Fakültesi
Fen Bilimleri Dergisi (CFD), Cilt:36, No: 4 Özel Sayı (2015)
ISSN: 1300-1949

Cumhuriyet University Faculty of Science
Science Journal (CSJ), Vol. 36, No: 4 Special Issue (2015)
ISSN: 1300-1949

ARCHITECTURAL DESIGN REQUIREMENTS AND STANDARDS IN PASSIVE DEFENSE

Alireza Moshabaki ESFAHANI

Department of Architecture, Faculty of Art and Architecture, Faculty Member of Payame Noor University, Robat Karim-Parand Branch, Tehran, Iran

Received: 22.03.2015; Accepted: 29.05.2015

Abstract. Various disciplines of humanities and engineering could be useful in reduction of crises. Among such disciplines is passive defense that has a critical role in the security of the country if its quality improves. Considerations of passive defense in architectural design, as an instrument, enhance the defensive power and appropriately meet the security needs. Examining the civil defense code in the architectural section and available global instances the present study is conducted in two stages of planning and presentation of the design in order to express the process that governs the design of buildings according to the standards of passive defense management. The results have been proposed in the form of tables. To obtain desired results and information, the collection of data has been performed through library research encompassing books, papers, articles etc.

Keywords: Passive Defense, architectural design, risk assessment process

1.INTRODUCTION

During the history, especially from the advent of flying equipment and weapons, destructive consequences of war have rushed on and involved all life centers and activities of countries. Accordingly, towns and buildings are always on top of the targets of invaders, because strike against them entails effects widespread destructive impacts on urban functions. Statistics and records of past wars shows that active defense in itself is not now able to cope with modern offensive and destructive weapons and prevent the devastating effects on vital and critical centers, and human resources. Therefore, the use of passive defense principles and criteria can remarkably help the defensive chain.

Passive defense refers to a set of actions to limit the damage of explosion, military threats, improve physical space to secure and protect lives of individuals and minimize losses of life from the risk of explosion through offering measures for specifications of the building form, peripheral volumes and elements, architectural plan, side views, exterior openings and interior circulation without applying military equipment and only based on architectural planning and design without requiring human factor.

Nowadays, implementing crisis management comprehensive plans could reduce a great extent of intensity and expansion of damages and losses from risks through application of effective measures along with applicable, inexpensive and multi-purpose plans in the pre-crisis preparation phase. Among the main arrangements and measures is application of passive defense principles as a solution to reduce risks against different dangers and increase the performance after the occurrence of risk that should be considered at different levels of local, urbanism and architecture planning.

In the present article, at first, definitions of passive defense in different international texts and global contemporary views are discussed. In the next steps, passive defense in urban designing and architecture is discussed in two sections of planning and architecture. In the section of planning, the risk assessment

*Corresponding author. *Email:* alirezamoshabaki@yahoo.com

Special Issue: Technological Advances of Engineering Sciences

process is performed aiming at identifying the best and most economic dimensions of risk reduction for a building during five phases including threat identification and rating, asset value assessment, vulnerability assessment, risk assessment and finally mitigation options in order to mitigate the options and determine actions that are more likely to be successfully implemented. Then, requirements and measures of architectural planning and design observing passive defense principles is investigated and recommendations for site design, building form, peripheral volumes and elements, structure, architectural plan, side views, exterior openings, interior circulation and installation issues with the type of materials are provided.

2. PASSIVE DEFENSE-CIVIL DEFENSE

Gholam Hossein Sadri Afshar has only attributed a military sense to the term defense and has listed the following definitions:

- Resistance to attack or to prevent its consequences
- Any action to prevent the victory of the enemy or rival
- People, forces or means that it is their responsibility (Sadri Afshar, 1994: 259 and 546)

Ziyari (1999) defines defense within the contexts of two types of active and passive. In his view, active defense is the use of offensive measures aimed at preventing the advance of the enemy, while passive defense is "using methods that reduce or minimize the deleterious effects caused by enemy actions". In other words, unlike active defense, passive defense does not use any kind of weapons against the enemy. Asgharian Jeddi (1995) considers human factor as the distinction between passive and active defense. That is, he considers active defense as a means that requires direct human management and use and includes war implements, organization, training and management of forces which are invalid in the absence of human presence. However, he defines passive defense as architectural facilities in the field of war engineering, so that combat and defense forces are enhanced without such tools and facilities. This, for example includes sheltering in the bunker or in elevations. He argues that passive defense, does not require the presence of human and everyone who captures a place, will have more defensive efficiency (Asgharian Jeddi, 1995).

In Issue 21 of the National Building Regulations (passive defense) any unarmed action that reduces the vulnerability of human resources, buildings, facilities, equipment, documents and arteries in the face of man-made threats is called passive defense (Issue 21, National Building Regulations, 2012).

The term passive defense was first seen in the book Temporary Protective Shelter (TM3-350). Preventing the effects of CBR (Chemical, Biological and Radioactive), was enforced by the American headquarters in 1954 to meet the new phenomenon of a sudden and severe nuclear attack. In this book, design principles of shelters and entrances, air conditioning room, interior design and interior materials of shelters have been studied and designed.

In the USA's NTIS reliable database that can be called the *American Budget and Planning Organization*, a *code* is specified for any science or technique. The code used for passive defense is 741. In 1987 NTIS database published an article entitled "The reliability of passive defense" on the importance of *passive defense* against the influence of the former Soviet Union's missiles. The term *passive defense* is used in other sudden phenomena than air attacks such as sabotage, physical protection, civil defense systems, hardware computer and physical location of satellites.

After September 11 attacks, to reduce the risk of terrorist threats, the American Federal emergency management Agency (FEMA) has discussed passive defense in architecture in detail and has proposed various measures according to different applications, and also has highlighted the inclusion of a secure shelter base in each building under natural hazards and man-made threats (FEMA-426,427,428,453).
In general, passive defense systematically pursues the following objectives:

- To minimize the effects of military attacks or natural disasters on the civilians living in urban
- Immediately encounter/coping with and management of emergency situations resulting from such events
- Restoring and maintaining facilities and providing the victims with services after the incident

3.CONTEMPORARY VIEWS OF PASSIVE DEFENSE

According to the United Nations records, in the beginning of the twentieth century, the proportion of civilian casualties to all casualties of war was only 5%; while this ratio reached 15% during the First World War, 65% in the Second World War and in the 1990s more than 90%. In addition, communities were gripped by damage caused by indirect consequences of war, such as the lack or shortage of food, medicines and other medical supplies, drinking water resources which increased the vulnerability of disabled people, including children, the elderly, women and patients.

Now passive defense is known both as a general purpose as well as the responsibility of any government so that many governments have taken extensive responsibilities in relation to passive defense. Around the world, to ensure the protection of citizens in the face of natural and man-made disasters different methods are used according to prevailing views in the field of passive confrontation or crisis, type of the crisis and available opportunities.

The most important of these are:

- Prevention and warnings, including warning and alarm, building shelters (before the crisis)
- Encounter including evacuation from or fixing in shelters (during the crisis)
- Rescue (during the crisis)
- Rehabilitation (after the crisis)

Investigation of intellectual views at the global level regarding the protection of civilians against military attacks suggests that from the perspective of passive defense an efficient design should minimize the loss of life, damage to infrastructure, the size and scope of the (Daei Nejad, 2006).

The following table briefly mentions some of the intellectual viewpoints prevailing in some countries.

Table 1. Views of different countries in relation to passive defense (Source: Author, adapted from the theoretical research principles).

Country	Priority of policies for passive defense
Germany	• Protecting the civilian population against the devastation caused by war using civilian methods (civil defense as an integral part of passive defense) • Necessary precautions in time of peace (passive defense as an important element in crisis management) • Preventive measures and protection requirements for nationals within national borders
United States of America	• Tremendous boost of the offensive and deterrent power • Consideration of defensive actions and measures such as coping with situations during and after the attack (especially nuclear attacks), including preparation (warning), exposure (vertical and horizontal evacuation from the location) confrontation (rescuing and reducing the scope of damage, rehabilitation after the attack)
Switzerland	• Emphasis on providing sheltered protection and coping with the crisis with a focus on medical aid • Planning to cope with the effects of natural and unnatural disasters and

	• Providing a secure environment (both in military attacks and natural disasters including floods, storms, fire etc.) • Providing sheltered spaces against nuclear attacks (for each Swiss citizens and employees of each of the key industries - before the crisis) • Providing underground hospital spaces resistant against nuclear attacks (before the crisis - providing a secure spaces) • Stage warnings and alarms- proportional to the rise of international tensions (during the crisis) • Permanent stay in shelters (during and after the crisis) of secure spaces
The former Soviet Union or Russia	• Simultaneous application of the strategy of deterrence and preservation of the country • Creating an anti-nuclear bunker (after the collapse of the Soviet Union and the end of the Cold War nuclear competition) • Modernization of weapons and military industries
Israel-Occupied Palestine	• Unclear boundaries between active and passive defense in terms of time and space • All land use at various scales, population areas, especially residential areas, in addition to conventional applications have necessarily military applications as well.

4. PASSIVE DEFENSE: ARCHITECTURAL PLANNING AND DESIGN

4.1. Planning and risk assessment process in passive defense

In the section of planning, the risk assessment process is performed aiming at identifying the best and most economic dimensions of risk reduction for a building during five phases including threat identification and rating, asset value assessment, vulnerability assessment, risk assessment and finally mitigation options in order to mitigate the options and determine actions that are more likely to be successfully implemented.

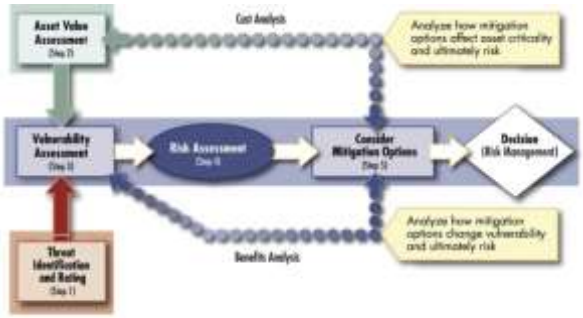

Figure 1 Risk assessment process model

Diagram 1. Risk assessment process from Threat Identification and Rating to Mitigation Options (Source: FEMA-452, 2005).

4.1.1. Threat Identification and Rating

Assessment and analysis of the threats against a building could include analysis of the residents, the distance of the source of the threat from the building, cultural and economic importance of the building, the history of threat against it etc. In this process, threatening groups or organizations are classified on the basis of

being criminals, protesters, terrorists and saboteurs. In this context, the history of terrorism in the region and its tactics along with the weapons used is studied. Then points near the building that can be possibly targeted are addressed (GSA Security criteria, 1997; DoD Security Engineering Facilities Planning Manual, 2008).

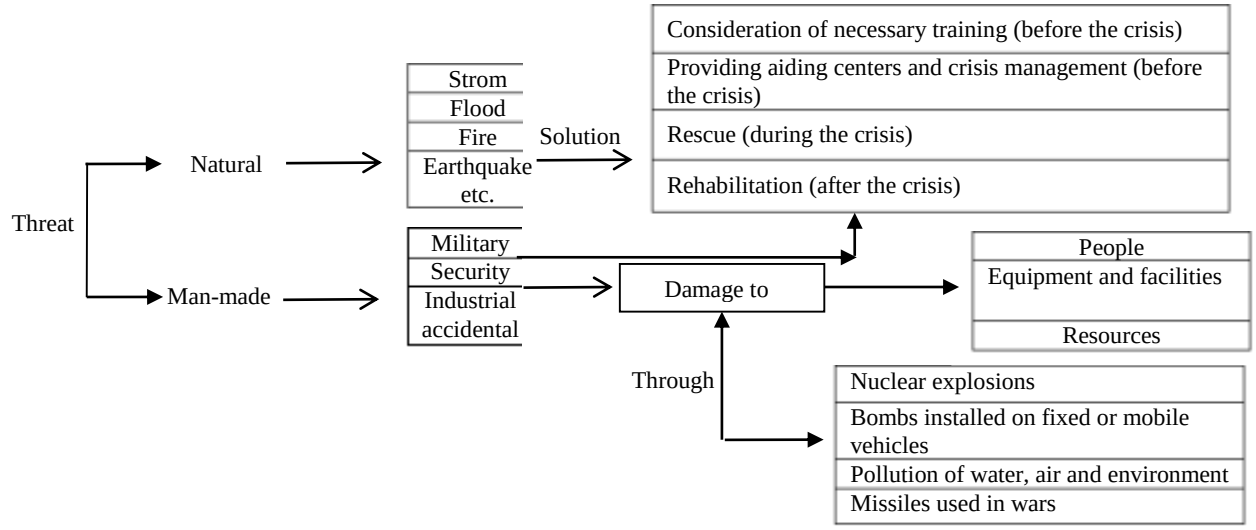

Diagram 2. Classification of risks (Source: Author, Adapted from the theoretical research principles)

4.1.2. Asset value assessment

The second step of the assessment process is to determine assets of the site and the building that might be targeted. These step include the following:

- Identification of defense layers
- Identification of critical assets
- Identification of the main tasks of the building
- Asset value rating (FEMA, p-452,2005,S2,P1)

Providing a defense layer is a traditional approach in security engineering, which aims to create an in-depth defense and thus create additional and time-specific warnings to respond security personnel and allow the residents to move to safe shelters (FEMA-430, 2007, S3, P2).

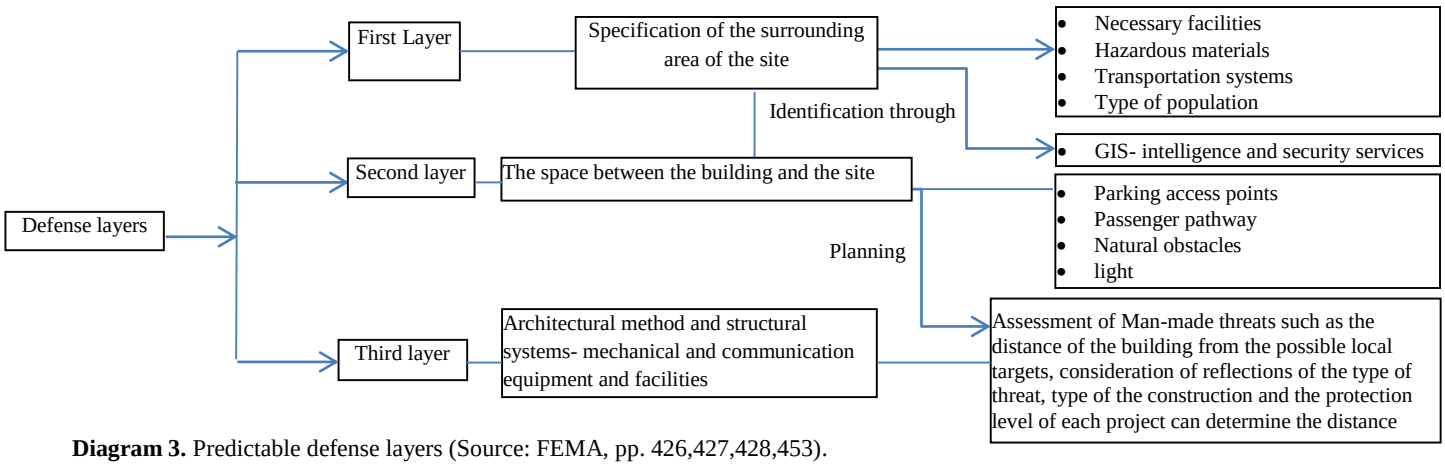

Diagram 3. Predictable defense layers (Source: FEMA, pp. 426,427,428,453).

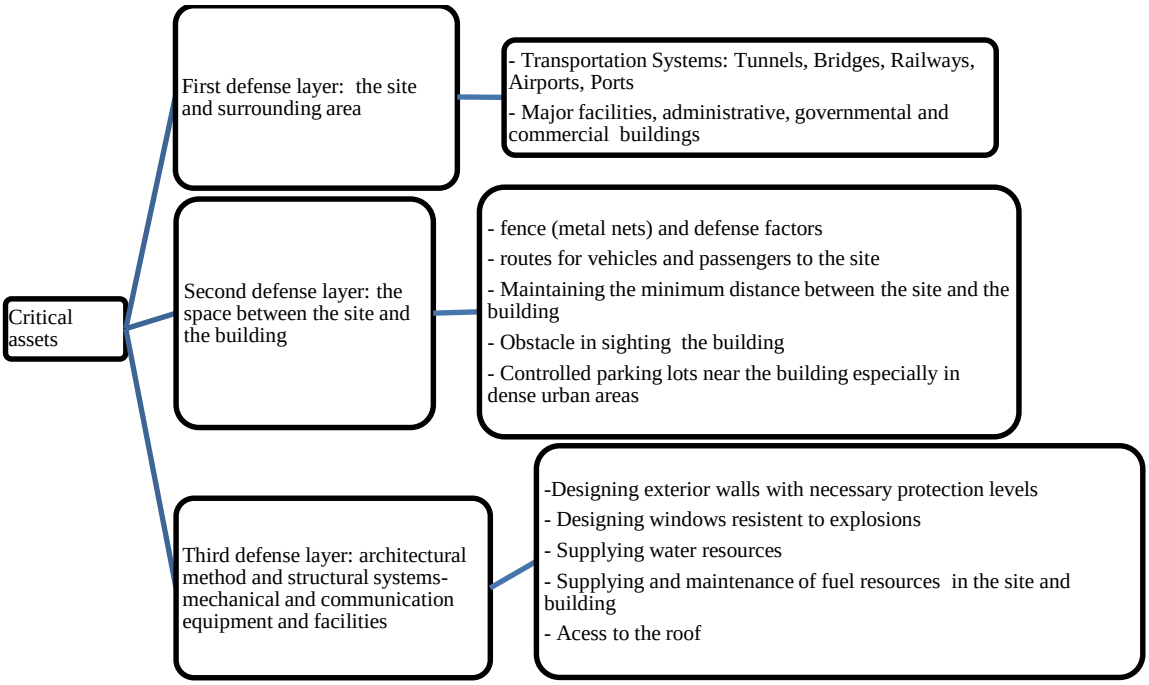

Diagram 4. Critical assets in a triple layer of defense (Source: Author, Adapted from the theoretical research principles).

To identify critical priorities the highest risk reduction could be performed with the lowest cost. This identification is carried out in two stages.

1. Identification of the main tasks of the project (type of service, type of basic activity, users)
2. Identification of its sub-buildings (determining possible alternatives, determiningthe availability of alternatives, identifying the location of critical equipment, determining the readiness to respond in an emergency)

Finally, with regard to the listed issues according to the most valuable asset that damage to them will lead to disruption in the city or loss of infrastructural facilities or increase in victims of the attacks, various scales could be used to express them in this section and apply them in the planning and management phases before, during and after the crisis.

4.1.3. Vulnerability Assessment

Vulnerability is defined as any disadvantage that an attacker can exploit. Vulnerability studies are of an integral part of all (active and passive) defense studies after studies on threats (Hosseini, 2010, p. 32).
Factors such as use, location of the building, type of the structure and economic characteristics are among the determinants of the level of assessment.
Knowing the type, nature and geographical range of threats that can occur at the site or building for is necessary vulnerability assessment.

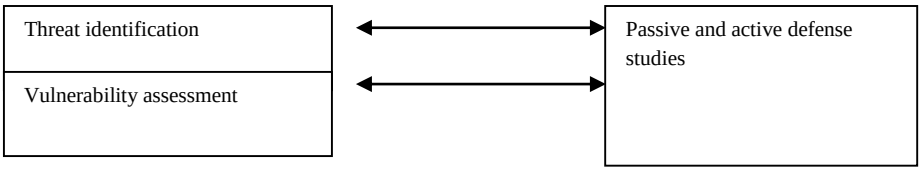

Diagram 5. The relationship between defense studies, threat identification and vulnerability assessment.

4.1.4. Risk Assessment on the site and building:

There are several methods to assess the risk, all of which have a common goal as follows:
1. Identification of assets with the highest risk
2. Evaluating measures that can reduce risks

For this purpose it is necessary that three major factors to be considered:
1. Identification of and rating threats to the building and residents
2. Identification the value of assets and supported individuals
3. Identification of weaknesses in the region and building

4.1.5. Risk mitigation options

The step next to identification of major risks in the stage of risk assessment is to identify options that mitigate these risks. In the first step, assumptions, procedures and options are identified and in the second step, resources and capabilities to implement these measures are discussed. The third step estimates the cost of each of the strategies and reduction of the costs with respect to defense layers and asset value assessment.

Table 2. Risk Assessment process for a building (Sources: FEMA- 452, 2005).

Title	Tasks
Threat identification and rating	Identification of threats
	Data collection
	Determining the basic threat to the design
	Rating the threat
Asset value assessment	Identification of defense layers
	Identification of the main tasks of the building
	Pricing the value of assets
Vulnerability Assessment	Organizing resources to prepare assessment
	Examination of the construction site
	Preparation of Sample vulnerability tasks
Risk assessment	Making risk assessment matrices
	Prioritizing risks
	Observation of priorities in vulnerability assessment of the building
	Identification and review of options and estimating cost reduction

4.2. Passive defense in architecture

The main measures of passive defense in urban planning that have effective roles in reducing the damage caused by military attacks can be outlined as follows:

1. Decentralization and dispersion of buildings and facilities in the urban area
2. Strengthening valuable installations
3. Camouflage, concealment and deception of installations that have military value
4. Creation of shelters in urban areas, especially in major urban centers
5. Adequate equipment for national risk warning as soon as possible (Hosseini, 1389, p. 28)

Asgharian Jeddi (2004) divides architectural requirements for passive defense into the following groups:

1. Planning, including topology and arrangement, obstacles, distribution and management of construction and operation
2. Turbulence in the enemy sight including anti- vigilance
3. The enemy sight, including camouflage, concealment and deception factors
4. Designing including interior architecture, multi-functional spaces, regular and emergency entrances and exits, repairability, interior and exterior view
5. Construction, including infrastructural networks, installations and fortifications (Asgharian Jeddi, 2004).

Ibrahim Barzegar (2010) in an article entitled “Passive Defense in Architecture: Strategy for Reducing Vulnerability to Disasters” stressed the following to reduce damage to buildings in explosive threats:

1. Building form
2. Attention to additional elements to the building view
3. Designing multi-functional spaces
4. Attention to the architectural plan, and interior spaces relations
5. Normal and emergency entrances and exits
6. Decoration space
7. Exterior view and exterior walls
8. Exterior openings
9. Interior architecture

5.SUMMARY

With regard to the issues raised some passive defense measures and standards in urbanism, architecture, structures and facilities are proposed in Table 3 as follows:

Table 3. Standards of design for passive defense (Source: Author).

Aspect	Standards	
Urban development	Determination of an appropriate urban development model with respect to the natural background, climate, geography, culture	
	Appropriate road network and urban infrastructure	
	Appropriate distribution of population and services	
	Creating appropriate spaces for the protection of people against threats	
	Providing urban multi-purpose functions	
	Uninterrupted continuation of essential activities and reduction of vulnerability against crises	
	Proximity of urban functions to manage the situation in an emergency	
	Securing crisis management capabilities of cities in crisis	
	Avoiding high risk functions in cities	
	Attention to distribution, development, and decentralization of structures, equipment, facilities and activities in order to reduce vulnerability to enemy attacks	
Landscape architecture and design	Landscape design and security	Streets should be paved without annoying obstacles to provide the possibility of escape in times of crisis
		Checking the distance between the stand and location of the building on the site
		Principles of designing parking and considerations of vehicles access
		Using physical protection barriers (barbed wire and fence)
		Security lighting principles
		Considerations of the facilities on the site
		Materials used in the site
		Materials used in the site should be based on security tips
		Using vegetation and the benefits of plants with respect to reduction of blast waves
		A location for helicopter landing in an emergency in residential complexes
		Removing sharp edges from the elements of urban furniture
		Access routes to the building should be at least one third of the height of the building (especially in high-rise buildings)
Architecture	Building form	Avoiding windward angles such as L and U in buildings due to trapping shock waves and resonance of explosion
		Using circular and preferably convex surfaces , because the intensity of the reflected pressure on it is lower than a flat surface
		Construction of the building on pilots with at least three sides of transparency because these pilots help quick evacuation of explosion forces from the below of the building
		Using disruption and discontinuity within 20 meters of buildings to discharge the explosion energy from the space between buildings
		In buildings with 7 floors or more the building form should guarantee that debris does not block the access to the building
	Building and openings views	Avoiding additional loose elements in the building view
		Exterior walls should be quite strongly connected and light materials should be used for the view
		Employing more than 30% of glass for the opening view surface is forbidden and the glass used of each opening must be resistant
		The frame of windows should be anchored to the structure. Large glass should be divided into smaller components be small window frames

		The use of glass blocks is allowed providing the use of anchors
	Safe spaces are all or part of a building spaces with different functions in time of peace that secure the safety and physical protection of people against threats with some measures	Safe Spaces Properties: Safety against collapse of debris, resistant against waves and their damage, resistant against secondary flakes caused by the explosions with minimum smoke and dust penetrability In large buildings, libraries, auditoriums, shops, and chapel and in small buildings, a small part such as part of the living room with no proximity to outside or immediate proximity to exterior windows
	Architectural plans and interior spaces relations: separation of high-risk areas unsafe places from safe places, safe spaces must be surrounded by unsafe spaces.	
	Designing emergency entrances and exits as hidden with high strength	
	Decorated spaces should be designed with obstacles and bolts to amortize the blast wave.	
	Interior architecture: In interior walls and equipment sharp materials and materials that generate fragmentation should not be used as much as possible	
Structural and non-structural systems - building materials	Compartments layout and non-structural elements	Avoiding the use of sharp and fragile materials like glass
		Avoiding the use of heavy equipment in the ceiling such as unit heater
		Avoiding the use of glass in false ceilings
		Connecting and containment of detachable walls to the building structure
	Suitable materials for explosion-proof structures	Reinforced concrete and compliance with structural design aspects of explosion-proof buildings
		Reinforced building materials
		ST52 and ST31 structural steel have enough plasticity for explosion-proof designs
	The design of the structure	Special attention to the dynamic properties of materials
		Attention to the Strength Increase Factor of structural materials
		Attention to Dynamic Increase Factor of structural materials
		Attention to Yield Stress in the structural design of explosion-proof structures and Dynamic Yield Strength and Ultimate Dynamic Resistance
	Explosion-proof structural systems	Reinforced masonry wall as the facade elements and bearing elements can be used in explosion-proof materials. At the same time these can be used along steel or concrete frame to withstand vertical and lateral loads
		Concrete walls with a minimum thickness of 12 cm
		In-situ concrete walls with a minimum thickness of 20 cm
		Arched and sloping structural with light roof
	Common systems to construct sheltered structures	Buried and half-buried in-situ sheltered structures (resistant against any explosions than underground explosions) with a concrete structure
		Prefabricated buried and half-buried sheltered structures
		Prefabricated Domes and arches
		Using building materials in the manufacture of shelters is prohibited
Mechanical and electrical installations	Lifts and safety regulations protection for blast waves	Lifts and related hole (well) should be structured so that the transmission of shock waves and smoke are prevented.
		If possible, the lift hole should be designed spacing of staircase to reserve the staircase from the influence of explosion to the lift.

		In high-rise buildings lifts are better to be converted into several lifts with different shafts so that when the lift hole breaks, it cannot act like a chimney
		In high-rise buildings, for evacuation in emergency, lifts in external walls should be predicted expected
		Roof cap on top of the lift shaft should have enough resistance against shock waves.
	General criteria: Design, installation, actuating, service and maintenance of mechanical systems, natural gas pipelines, firefighting systems and electrical installations should comply with safety requirements and points.	
	Electrical installations	Walls and floors in the vicinity of equipment should be structurally resistant
		Main entrances, fire alarm systems and emergency power distribution lines should be protected against explosion and its waves
		Normal and emergency switchboards, distribution boards and electrical pipes the weak and moderate pressure protection, should be implemented as separately as possible in different places and far enough from each other.
		Installation of emergency (battery-operated) lights in escape routes and shelters
		For the protection of sensitive electrical equipment suitable covers must be used
		To protect electrical circuits with high sensitivity, automatic protection switches with magnetic bars and thermal relays should be used.
		Creation of positive pressure in place of installation of some sensitive electrical, electronic and telecommunications equipment to prevent the entry of dust and dirt into them
		Tubes, trays and in general anchoring building facilities should have necessary flexibility to withstand lateral movement
		In thermal insulation of channels and pipes, and fire-resistant materials should be used.
		The use of systems with high possibility of leakage or cooling systems with direct coils should be avoided; otherwise gas and materials inside the systems should be discharged with especial tubes.
		Plumbing networks and air conditioning systems must have expansion joints and flexible parts in the place of installation as well as the interface of pipes and channels and walls.
		Engine room need to be placed in a safe location with sufficient strength
		Engine rooms should have at least two installation systems such as tank, pumps, chiller, cooling towers etc. With overlapping capacity in order to maintain the systems and increase the repair power in emergency.
		In engine rooms, installations such as pumps and water tankers should be implemented horizontally to avoid overturn against the thermal shock of the explosion
		Thermal burners should be hybrid. The fuel storage tanks should be anticipated in a safe distance from the engine room. To cope with electromagnetic waves through (metal) air-conditioning channels, necessary measures should be considered.

6.CONCLUSIONS

Considering the similarity of some types of natural and man-made risks, passive defense including optimal measures could be used to mitigate the potential risks and incidents such as reduction of losses from earthquakes and bombs blast waves. On the one hand, the interactions between passive defense measures against man-made threats and on the other hand their overlap with others natural risks such as earthquake can lead to stability of architecture. Therefore, applying the principles of passive defense in comprehensive crisis management plans can reduce a great extent of intensity and expansion of damages and losses from risks through application of effective measures along with applicable, inexpensive and multi-purpose plans in the pre-crisis preparation phase.

In order to plan the design of a building to have a safe environment many factors should be observed, application of which in designing a building the level of security of citizens in wars increases and the defensive power is promoted at the national security level against growing external threats. The present study indicates that the planning phase as the planning process is performed in five phases including threat identification, asset value assessment, vulnerability assessment, risk assessment and finally risk mitigation options. Each of these steps includes comprehensive measures to determine better options. In the designing phase, security could be affected by three issues including topology, design, and site security through attention to the location of the building, type of the furniture, vegetation, lighting etc. Finally, cooperation of architect engineers of structures and installation including designing the security of interior spaces, attention to principles of façade/view, designing structures resistant against explosion, using resistant materials and designing security systems for the facilities could be added as important factors in passive defense architecture.

REFERENCES

[1] Asgharian Jeddi, A. (2004). Architectural Requirements in Stable Passive defense. PhD dissertation, School of Architecture, Shahid Beheshti University, Tehran.

[2] Asgharian Jeddi, A. (1995). Passive defense in Bam. Paper presented at the Congress of History of Architecture and Urban Development, Iranian National Organization of Cultural Heritage, Tehran.

[3] Haji Ebrahim Barzegar, A. & Mesgari Houshyar, S. (1999). Passive defense in Architecture: Solutions to Risk Reduction in incidence. Third International Conference on Crisis Management in Natural Unexpected Events, Tehran.

[4] Hosseini, S. B. (1999). Passive defense Standards for Architectural Design of Urban Complexes. Tehran, Abed Publications.

[5] Daei Nejad, F. et al. (2006). Principles and Guidelines of Designing And Equipping Open Spaces of Residential Complexes for Passive Defense. Tehran, Center for Building and Housing Research.

[6] Ziari, K. (1999). Planning new cities. Organization of Studies and Development of Human Sciences Academic Books (SAMT), Tehran.

[7] Dehkhoda, A. A. (1772). Dehkhoda Glossary (4th Ed.). University of Tehran, Institution for Printing and Publication, pp. 47-48.

[8] Sadri Afshar, Gh. & Hakami, N. (1994). Persian Today Dictionary. Kalameh Publications, Tehran. pp. 259 and 546.

[9] Issue 21 of National Building Regulations (2012). Ministry of Housing and Urban Development, Tehran.

[10] DOD Security Engineering Facilities Planning Manual(2008), Unified Facilities Criteria.

[11] Federal Emergency Management Agency (FEMA)-426. (2003) Risk Management Series, Reference Manual to Mitigate Potential Terrorist Attacks against Buildings, Chapter 2, 3.

[12] Federal Emergency Management Agency (FEMA)-427. (2003) Risk Management Series, Primer for Design of CommercialBuilding to Mitigate Terrorist Attacks, Chapter 6.
[13] Federal Emergency Management Agency (FEMA)-428. (2003) Risk Management Series, Primer to Design Safe School Projects in Case of Terrorist Attacks.
[14] Federal Emergency Management Agency(FEMA)- 430(2007), Risk Management Series , Guidance Against Potential Terrorist Attacks Site and Urban Design for Security, USA.
[15] Federal Emergency Management Agency -452 (2005), Risk Management Series, A How-To Guide to Mitigate Potential Terrorist Attacks Against Buildings, USA.
[16] Federal Emergency Management Agency (FEMA)-453. (2003) Risk Management Series, Safe Rooms and Shelters, Protecting People Against Terrorist Attacks.
[17] Department Of Defense (DOD) Minimum Antiterrorism Standards For Building, USA, 2002.
[18] GSA Security Criteria(1997), Building Technologies Division Office of Property Development Public Buildings Service General Services Administration.