

Criteria of Passive Defense in Subway Stations

Mohsen Kameli^{1*}, Sana Zarei², Mitra Kalantari³, Elham Soleiman Nejad⁴

¹ Young Researchers and Elite Club, Qom Branch, Islamic Azad University, Qom, Iran

² Department of Architecture, Bandar Abbas Branch, Islamic Azad University, Bandar Abbas, Iran

³ Department of Architecture, Tafresh Branch, Islamic Azad University, Tafresh, Iran,

⁴ Department of Architecture, Varamin Branch, Islamic Azad University, Varamin-Pishva, Iran

*Corresponding author's E-mail:kameli@live.com

ABSTRACT: Defense is an integrated concept, which includes both active and passive defenses. The effects of the war include heavy human and material losses and damages to cities that can be reduced by using passive defense measures and methods before the outbreak of the war. Metro (subway) trains, as one of the critical infrastructures, with a dual function can be considered as a settlement of refugees, and can be applied in times of crisis and threat. Observing safety and protection standards against natural and unnatural threats, gives a defensive approach to the subway buildings as their main feature. This paper provides a brief description about how to apply, benefit, and perform the methods of passive defense in metro stations as a secure underground area, considering the global experiences and investigates the basic and important components of the Metro, the types of threat and vulnerability, the economic justification and the functions of the metro stations with a descriptive-analytic approach, and then offers some considerations and solutions for the relevant passive defense. After achieving the technical criteria and applying them in the Architectural designing phase, in the event of a possible modern war (called the sixth generation of wars) the citizens' security will increase, and the defensive power and national security will enhance subsequently.

Keywords: The Subway, Designing, Passive Defense, Threat, Architecture.

ORIGINAL ARTICLE
Received 17 Apr. 2014
Accepted 23 May 2014

INTRODUCTION

Today, countries that have experienced damage caused by wars, show special attention to passive defense in their defense strategies in order to protect their national capitals and vital resources. To this end, observing passive defense considerations in urban development and design has a great impact on reducing the vulnerability of cities, financial losses and casualties as well as increasing the citizens' tolerance threshold and thus facilitating the urban crisis management (Shakibamanesh, 2014). Indeed, designing and planning optimal urban uses play an important role in reducing their vulnerability to possible enemy attacks and invasions (Hosseini, 2003). Some urban land uses can be considered as the main targets of enemy attacks; therefore, they are very important because loss or destruction of one of these land uses (depending on their type; Vital, critical and important) will have extensive harmful effects and consequences at national, regional and municipal levels. In fact, the destruction and damage of such uses can lead to huge economic losses and paralyze the industrial and manufacturing structure in the related city, region or country (Dehghani, 2007). On the other hand, in most cases, incorrect locating and establishing of these land uses will increase the level of casualties and damages in their immediate physical environment. Airports, railways, subways, urban utility infrastructures (water networks, electricity, gas, etc.), military facilities and shelters are among such important land uses (Movahedinia, 2011).

Passive defense is designed to negate or prevent the effect of the weapon itself. In the medieval era, for example, armour and chain mail were designed to defend a knight against a sword or arrow. During the First World War, it consisted of digging deep trenches to protect soldiers from artillery, machine gun, and rifle fire. In the Second World War, passive air defense for Londoners was the underground subway or tube providing bomb shelters. Confronting nuclear weapons in passive defense terms simply meant more, deeper, stronger, and better provisioned shelters a la the major US public civil defense bomb-shelter exercise, or the extensive Soviet effort, which included the Moscow subway (Jalali, 2012).

Active defense is intended to prevent the use of the weapon, usually by intercepting or destroying the delivery system. If one could locate and destroy an opponent's archers, a delivery system very vulnerable without infantry protection, then one could eliminate the weapon itself – the arrow – thereby defending one's troops. In modern artillery parlance, this is the idea of counter-battery fire intended to destroy an adversary's capacity to fire high explosives at one's forces. Active defense may also take the form of pre-emptive or disarming first strikes against an adversary's offensive military capabilities. During the 1991 Gulf War, the coalition's Scud hunting campaign, albeit largely unsuccessfully, sought to destroy the Iraqi mobile missile launchers dispersed in the desert before they could release their missiles or afterward to prevent reloading. It is also the military side of counter-

proliferation as practiced, for example, in the Israeli strike against the Iraqi nuclear reactor at Osorio in 1985. These latter two examples represent the modern offensive element of defense in which a defensive act is carried out offensively (Asgharian Jedi, 2004).

2. The research objectives

The main purpose of this research is to extract and develop those technical criteria to improve the architectural design of metro stations, based on the passive defense essentials, and to enhance national capabilities, especially in order to protect the physical and human resources.

The present study also includes other purposes, which are in the next priorities, but each one alone can be the starting point for major projects and other applications, in the field of military studies and especially, the passive defense.

Some of the most important goals that are considered further in this study are as follows:

1- Engineering of the passive defense, (emphasized by the Supreme Leader)

2- A relative reduction of scientific gaps in the field of the technical knowledge about the architectural design of subway constructions, based on protective and defensive essentials, in the country

3- A better understanding of the modern conflict environment (the so-called sixth generation warfare), and updating the theoretical and technical knowledge about the efficacy of current passive defense principles, in architectural design of subway stations.

4- Development of a common language between architecture and urban design specialists, with expertise in military sciences, through:

a) The Explanation of the great facilities resulting from a combination of architecture and urban design principles, with defensive considerations

b) Understanding the impact of architectural design of underground buildings on the level of user safety, especially in modern warfare conditions

MATERIAL AND METHODS

The present article, which applies a descriptive analytical method, is based on written and library studies, followed by field studies through interviews with experts, as well as observation techniques and simplifying information methods to identify weaknesses and gaps, and finally, present the technical standards of architectural design for the subway constructions, in an attempt to answer some of the key requirements.

Table 1. Passive defense measures in different countries

Country	Measures
Germany	Compilation of laws and required support for passive defense Double use of facilities, shelters Compilation of preparatory measures for foundation of cities in the area of land aiming at equal distribution of small and medium cities after World War II
Switzerland	Establishment of a safe subway in proper depth functioning as urban life and shelter Necessity for public shelters, multipurpose, in required numbers at desirable areas of the country Compulsory development of shelters by private units through public partnership and financial encouragement of the government
Former Soviet Union	Use of shelters and evacuation plan by people regarding major and target areas to safe places prior to attack of the enemy Construction of simple and light shelters for people - Construction of strong shelters for maintaining industrial installations and workers - Great depth of the subway for required policies to be used by people as shelters
America	Construction of similar military stations and dispreading of the same Strengthening of Intercontinental ballistic missiles and headquarters and control of telecommunication centers thereof Construction of light and atomic fall resistant shelters for protection of population and public evacuation of highly populated areas
Sweden	Construction of shelters at residential buildings to be used as parking space, storage room at the peacetime Establishment of power centers, fuel reserves and urgent supplies beneath ground Execution of the plan for probationary evacuation of threatened areas by the people to more safe areas
Denmark	Construction of shelters at personal buildings and factories
Finland	Establishment of group shelters made of reinforced concrete and drilling inner rock shelters
Pakistan	Taking cautionary measures such as control of lighting system of roads, camouflage and concealment
North Korea	Adoption of decentralization policies aiming at decrease of vulnerability of vital and significant resources Transfer of a major part of vital and critical facilities and civil installations to the depth of earth and inner parts of rocks
India	Use of voluntary public organizations in urban defense operations
Italy	Use of specialized services for civil defense: mountaineering federation and ... Convention of briefing classes at schools with respect to passive defense
Former Yugoslavia	Having enough food reserves in a country and control of market as well as ration of significant items such as gas station Closing down schools and universities at the wartime and use of the said places by army
China	Foundation of military and nucleus centers at mountaineering areas and forests Development of Chinese defending wall as the clearest and the most effective measures taken earlier by humans regarding passive defense
Iraq	Construction of shelters, hospitals and communication centers in depth of earth Fixing restrained aerial balloons surrounding economic, military and vital centers
France	Teaching people to campaign against dangers and protection themselves and passive defense measures Amazing wall construction as an important passive defense

The Source: Yeganeghi, 2012

4. Definitions

- A review of the definitions of the passive defense:

- In row (b) of Article (1) in the Executive Regulations section (11), article (121) at the Fourth development plan Act, the definition of passive defense is presented as follows:

- A set of non-weapon actions which reduces the human vulnerability, the buildings and structures damages and the equipment and state highways, against the hostile and destructive enemy actions, or reduces the risk of unnatural disasters, is called the passive defense.

- City train system: It is defined as a set of independent railway lines, places, surface and subsurface spaces, facilities, equipment and machinery, which is responsible for transporting passengers in the city or its suburbs, through railways.

- Shelter: Refers to the place, where can resistance against the hit bombs, missiles, rockets and ..., to prevent personnel, equipment and installations and partially eliminate the effects of the fragmentation and the blast wave.

- Metro station: One of the most important components of the subway system, that is designed and constructed on the surface and sub-surface (underground), and connect the surface with the railways.

5. Measures taken by different countries in passive defense:

In order to remain safe from natural and artificial threats, each country is seeking for a collection of measures by which it can minimum corresponding damages incurred by financial and bodily damages of its personnel. The following is a brief summary of measures taken by various countries in the field of passive defense (Yeganegi, 2012):

6. Passive defense in architecture

Architecture and urban development as an intermediate can raise the defense power, and satisfy the need of security in Maslow's hierarchy and survive the human. In "Extix", the word "defense" applied when somebody faced with man-made threats, but the term "safety and protection" is used when somebody is encountered with natural threats (Abolhassani, 2005). This psychological approach in architecture and urban development can improve human security at all levels of planning and design. Passive defense methods in architecture and urban development can reduce the damages of natural threats and bombardment (Blum, 2010). Passive defense methods can also protect human from earthquakes, in times of peace.

Offensive actions of an enemy include detection of targets, recognition, destruction and fleeing; the following steps can postpone the enemy to reach his targets; these architectural requirements are categorized into 5 groups (Asgharian, 2004):

- 1-Planning, which includes: site selection and deployment, the obstacles, the distribution and management of construction and the operation
- 2-Counter Surveillance
- 3-camouflage, concealment and deception

4-Designing, which includes interior design, multi-functional spaces, normal and emergency entrances and exits, restoration, interior and exterior face of the construction

5-construction, which includes infrastructure networks, installations and fortifications

7. Engineering Subways

In subway systems, lines are radial lines across the concentric circles; for example, in network planning of New York City subway, both parallel and radial lines are used. Metro system in Paris has both central and radial systems but London has only the radial system. Tehran Metro has a radial system; all intersections meet in the city center, but the start points and end points goes around Tehran.



Map 1. Moscow subway system

8. Warden's Five Rings

Warden's Five Rings represent a theory of military strategic attack, based on five levels of system attributes. They are named in honor of Col. John A. Warden III, a former USAF officer and theorist of air power.

The Five Rings include:

- Leadership
- Organic/System Essentials/Key Production
- Infrastructure
- Population
- Fielded Military Forces

Each level of system or "ring" was considered one of the enemy's centers of gravity. The idea behind Warden's five rings was to attack each of the rings to paralyze their forces, an objective also known as physical paralysis. To optimize a strike attack the attacker would engage as many rings as possible with special emphasis on taking out the center ring, which is the enemy's leadership. This would result in total physical paralysis.

Warden's theories on the application of air power in modern war have been criticized as little more than a reiteration of earlier strategic bombing concepts discredited by historical analysis of the Second World War and the Vietnam War, similar to the effect on the writings of Giulio Douhet. Dismissal of the theories has led some to mistakenly conclude that the theories have no application, thereby missing the application of air power as a modern means of accomplishing the Strategic Indirect of Sir B. H. Liddell Hart.

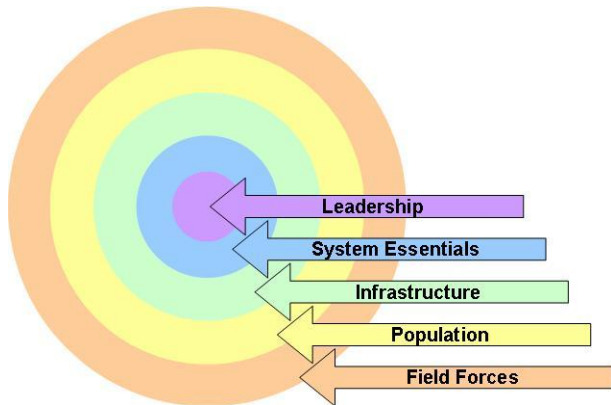


Figure 1. Five Rings of Warden

An important matter in the subway system is classification of the interior parts and components of Metro, depending on their functions and applications in critical and safe conditions; this classification is as follows:

9. Various parts and components of metro and passive defense considerations

The subway consists of various parts, such as tunnels, stations and spaces in stations (e.g. platforms, entrances and exits, corridors, stairs, etc.) and depot and parking lot. Therefore, Passive defense measures should be considered in design of these parts (Mirzaii, 2009).

Tunnels: the subway tunnel is one of the most important parts of it, which is for transportation of people and materials by trains and is one of the most important underground structures.

This structure could have second functions in crisis conditions; with constructing appropriate access for it, according passive defense measures, it can have the function of a carrier for the municipal utilities, such as: electricity, water, telecommunication, etc. and can have the function of a connection between the urban centers as an emergency exit for the city. Depot and parking lot: the depot and parking lot are also another important part of

the subway system, which can be on the surface or subsurface.

Since this part is extremely crucial, passive defense principals in this area are important and the following points should be considered:

- Establishing appropriate protective walls, surrounding depot and parking lot, equipped with fixed Day and Light CCTV cameras which are sensitive to motion and have appropriate magnification, to cover the image of the area
- Using theft sensors and alarms at the depot and parking lot
- Storing enough water for fire fighting purposes (with automatic and hand water jet) at the parking area and the depot and garage
- Creating emergency paths at the parking lot

Stations: station is a connecting area between the surface and railways, which provide services and facilities for individuals. Stations must be secured in their function against the threats (conventional and unconventional), with appropriate depth (for different applications), multiple usage (for usage as a public safe haven for travelers with enough capacity) and with proper access (Dehghani, 2007).

10. Priority criteria of the subway system

The subway is very vulnerable; these vulnerabilities include: the train damages, the water, electricity and Telephone installation damages, the tunnel collapses, the rail failures, vulnerabilities in software systems and computer networks, transportation systems, human resources and experts, key components, etc. The subway installations depend on the surface facilities, and this is one of the weak points of it. The electricity, water and telephone installations are entirely dependent on the surface facilities, and all of Metro network (at ordinary and crisis conditions) will fail, if these facilities damage in any case; so this is required to predict and provide some emergency systems (Dehghan, 2007). Since the subway structure can be applied as a haven at crisis conditions, and have a dual function, the feasibility evaluation of this structure, among other alternatives is important, for protecting and supporting usage by non-military civilians against the danger arising from aerial and artillery bombardment. The following priorities are presented and some optimized factors in the subway building obtained, to provide the dual function and reduce vulnerability (Imensazan, 2011).

Table 2. priority assessment criteria of the subway building

The Priority assessment criteria	The Subway building
The Priority based on the scope and scale of major urban applications	Local- municipal
The Priority based on the areas of functional necessity	Necessary
The Priority based on the application in crisis	Direct usage (keeping the current function)
The Priority based on the Sensitivity of the enemy (Strategic or non-strategic)	The first priority is attacking (a strategic objective) and the next is functional The second priority is attacking (the objective : psychosocial war) and the next is physical
The Priority based on the Flexibility of the location	Multi-functional capabilities
The Priority based on the physical resistance against damages	High
The appropriate action for each of urban usages when threatened	Keeping the form and the usage

1. The structure of subway stations

The definition of a successful project is various in different times and eras, and the principles of subway station designing need a dynamic structure, like all other public places, which change according to the current necessity and demand and are flexible and applicable. There is no specific principle or criteria for designing subway stations and the principals of designing are usually determined by owners and performers of projects, due to the location, conditions, facilities and services offered by the station as well as international standards of fire protection, the principals of public spaces designing, architectural standards of handicaps and general principals and dimensions of transit and transportation systems (Ghazi Zahedi, 1987).

12. Guidelines for optimal design

Assimilation (camouflage principle):

In Assimilation, the components of a system become homogeneous with its surrounding environment, in a way that, it displays the minimal contrast with that environment.[The use of non-Euclidean geometry (fractal)]on the surface of Metro components, such as: the main inlet and outlet doors of the metro station, the entire air vents, etc. (Salarifar, 2005). Only, the assimilation and uniformity with the surrounding environment, respecting the exterior architecture should be considered or designing of components like the ducts, due to the traditional architecture, to obtain an elegant, uniform environment.

- The entrances and exits of the subway station should conform to the surrounding environment in material, color, shape, texture, form, etc. Provided that they will attract and invite passengers. One of the features of an exterior design for the station is to be easily identified by users.

- It is crucially essential, to observe the camouflage, simulation and uniformity principles, in emergency entrances and exits, at appropriate points.

Concealment (the concealment principle):

The concealment terminologically, means to hide individuals or objects in the surrounding environment from the enemy, so that the threat factor or the enemy could not detect or recognize it, at the first step or if he can, could not shoot directly to the critical points of it (Khatamolnbia, 2005).

This principle is applied in the subway stations in the critical places, spaces, installations, facilities, etc. so, some instances of using it in the subway stations will be presented in the following:

- Cover the command and control centers, by hiding them (for domestic threats).
- Not to use signs and panels for equipment units, safety and security systems, etc.
- Easy access to emergency ventilation systems (the storage of ventilation facilities).

Safety and security systems, including:

- Hidden cameras (input and output, station spaces and platforms, tunnels).
- NBC or attack warning sensors.
- Sensors for drug discovery.
- Emergency entrances and exits.
- The main areas for electrical installations (Power posts).

- Water and fuel tanks for surface and subsurface areas

- Stockpiles for Specific and required parts of the station, depot, etc.

False targets (the deception principle):

The deceptive projects are designed for the emergency entrances and exits, the emergency ventilation parts and the entire surface structures, that are required for the second performance of the subway, inside the context of residential neighborhoods, with residential and commercial usage or architectural design (view and plan), to convey the abstract concept of falsity and unrelated functions of that structure. For example, consider the emergency entrances and exits and shelters inside the neighborhoods. Under normal conditions, design some false concepts, such as: local power buildings, the gas pressure reducing station or other similar cases, which need less constant traveling.

The dispersion and distribution principle: the dispersion means, an appropriate and reasonable distance, between the members of a system as a whole, so that prevent the entire system to be a single target against the enemy attacks. There, should be the possibility of mission for the system in the dispersion.

Distribution means that, the critical sectors of a system (such as specific sections in the depot storages), could be moved and transported to another location, in the crisis conditions (Divsalar, 2006). The distribution of the subway systems can be represented in this way: since the subway systems are composed of various components, and these components work together to continue the activity and motion of the subway system, an appropriate distribution pattern is needed, which separate the critical system components aside, and distribute them in different sections of the system, so that prevent the critical parts, to be a single target against the enemy attacks or threats.

For instance, there are different sections such as management and control, ticket sales, checking ticket terminals, ventilation systems and air vents, electrical equipment, power posts, the electronic systems, etc. to control and protect the platform, entrances and exits, etc. in a subway station, which are located in an area of several thousand feet in the normal conditions (Salari Far, 2005)

The critical parts of this complex, like the management and control, the ventilation and air conditioning vents, power posts and electronic systems should be away from each other, as far as possible, and should not be adjacent to each other. In this way, the system is less vulnerable against the threats, because the treating factor needs to design a different operation plan, to destroy or damage each of these parts; and it will raise the costs for the aggressive force and decrease the possibility of their success in destroying or disabling the entire system.

Therefore, compliance with the below requirements in designing and implementation is necessary:

- The central control systems must be independent at each station, in the crisis conditions, and continue their performance (as a shelter), in the crisis situations
- In designing the emergency entrances and exits into the main input and output, it is necessary to observe the distribution principle.

- Using multiple ventilation shafts along the way, at appropriate intervals between them, as well as consideration of their appearance and location, due to the importance and value of a good performance.

- The main and the emergency power distribution panels and posts should not be installed in the same location and space, in the subway system.

- Because the parking lots, garages and depots are located on the surface, it is necessary to consider some measures, to separate and distribute their important pieces and tanks.

The entrances and exits: designing normal and emergency entrances and exits, based on the passive defense criteria, provide the possibility of rescue operations to disaster victims more readily, in the underground spaces, when they are damaged by the enemy offensive weapons. One of the subway station parts, that is threatened, is its input and output, and it is required to install and build two main entrances and exits for the low or medium population areas, and three or four, for crowded areas (in the cross stations), in opposite sides of the station (Dehghani, 2007).

Restoration: one of the passive defense methods in the subway system, as a transportation system and a safe defensive residence, is the restoration and repair ability of the various sections and components. In this way, the damaged sections and components by the enemy invasion, can be repaired and reconstructed rapidly and with low costs. Security and stability: the metro subsurface spaces are known as the strong and appropriate fortifications, with high resistance against the effects of enemy weapons.

Applying the passive defense measures in architectural design of these structures, makes them more resistant and stable. In this case, a subsurface structure should have an appropriate depth, and have the minimal dependence to the surface installations, and have a good performance and operation at the time of city crisis (Volvy, 2011).

Optimal site selection: it means the selection of a proper place for a project, where all affecting conditions and factors on the project are considered. Site selection requires a high percent of study and design, since various aspects should be examined for that. If an appropriate site selection took place at first, and the protection, security and safety practices employed, the equipment and experts will be maintained with a low cost (Ashtiani, 1990). Site selection is one of the fundamental and essential activities in a study, and is a software and Brain ware activity. If we suppose the subway system as an economic project, and ignore the defensive issues, the site selection based on the affective factors and criteria for a public civil transportation, is still an important issue that only involves some factors like the population, the density, the access and the technical factors. And the main goals of it, in such situation, includes: transporting passengers, reducing the city traffic, more speed in urban travels and...; but if we suppose a secondary function for it, in crisis conditions, then, the site selection will be associated with the passive defense discussions.

In this case, in addition to the above-mentioned factors, the following effective factors should be considered:

- Access to the open areas, access to the medical care and relief centers and ...

- Establishing a secure cover to prevent the underground facilities due to the enemy weapons power.

CONCLUSION

The subway stations are one of the underground structures with long life (high service life) and continuous operation and frequency of users (the general public). So in designing, establishing and operation of subway stations, the progress of enemy weapons should be considered and the necessary actions should be taken and then with using the latest scientific achievements and technical knowledge of the world, we can neutralize or reduce the enemy power. This important matter will be done by employing the effective methods and scales of passive defense to counter the enemy's capabilities. Therefore, this is necessary to employ passive defense considerations in a subway station when we study and design the Metro line networks and stations and other parts so that the advisor's plan contains the characteristics and considerations of passive defense and all of subway constructions meet the crisis conditions needs.

So by employing the guidelines and the processes of approved passive defense proposals which are ready at executive organizations as well as the permanent committee of passive defense about the centers in operation, construction and implementation and also centers in study and design and based on the implementation regulation, section 11 of Act 121 in the law of the Fourth Plan, the passive defense Preparations should carry out in all plans and projects. These preparations should conform to the guidelines and processes of passive defense project performance at centers in operation.

14. Suggestions

- The access between the subway and special buildings or outside for safety, legibility, ease and speed of traffic must be carefully designed. A maximum radius of 500 meters to subway shelter is recommended.

- Within radiuses more than 500 meters, the access to the subway is through a medium like subsurface accesses from buildings to underground space and the Metro which is located inside the radius of 500 meters.

- Some facilities are predicted in Metro lines for the conditions of destruction and closure of Metro parts to provide the continuity of connection with the surrounding environment. Therefore, it is better to create some emergency exits with a depth more than the depth of refugees gathering place.

- It is rather for refugee population not to stop and settle in the subway stations more than 24 hours. This makes the subway networks as the main access route and safety traffic way in the heavy air and missile strikes. But it prevents it becoming the permanent gathering place for refugees and provides the required space to conduct them to the less vulnerable environments.

- The subway lighting system should be based on independent and CFLs facilities. In this system the lighting is very low and only for finding the direction and a short timely settlement of the refugees, so the required lighting facilities in subway networks include the ventilation system, the minimal light, the alarm system,

relevant speakers and finally the low energy monitors for determining the position and direction. .

- To prevent the possibility of direct penetration from the surface to the subsurface metro network, the above mentioned pattern should be used via periscope models to conduct and transmit the light in different levels.

- So it is suggested that the light path through the subway have multiple fractures and curves and transmit the light into the intended direction by using some mirrors. To prevent the declining of the light, some special optical amplifiers can be used at different levels.

REFERENCES

- Abdollahi, M. (2010). Crisis management in urban areas, publisher of the country's municipalities, second edition, Tehran. Iran.
- Abolhasani, A. (2005). Passive defense, Architecture and Urban Design in Iran, Publication No. 4, Headquarters of Air Defense Khatamolanbia (p), Tehran, Iran.
- Asgharian Jedi, A. (2004). Requirements of architecture in sustainable passive defense; Phd research project, University of Shahid Beheshti, archive documents.
- Blum, W. (2010). The Vietnam War and the United States Lessons. Retrieved April 18.
- Darvishisei Tlany, F. (1997). Theoretical reflections on national security. Islamic Iranian Revolutionary Guards. Command and General Staff College, Research Assistant.
- Dehghani, Esfandiar. (2007). The principles of metro station design in passive defense, master's thesis, MalekAshtar University, Iran.
- Divsalar, A. (2006). Military Environmental Studies "sixth generation warfare operational area" Defense Industries Research and Training Institute, Ministry of Defense and Armed Forces Logistics, Science, Research and Development, Center for Defense Science, Tehran, Iran.
- Ghazi Zahedi, M. (1987). Ardeshir Rokni, M., architecture dissertation research and proposal for central metro station. Volumes I and II. Metro Library.
- Hosseini, S.B. (2003). Design in crisis, medical centers in deserts, Master Thesis of Architecture.
- Hosseini, S.B. (2007). Passive defense measures in municipal buildings, Abed publication, Iran.
- Jalali, GR. (2012). Theoretical foundations of the architecture of passive defense, MalekAshtar University, Iran.
- Movahedi Nia, J. (2011). Passive defense, Army Command and General Staff College.
- Mirzaei, M.A. (2009). Varamin Metro Station design, master's thesis, Islamic Azad University, Tehran, Iran.
- Norouzi Liayi, AR. (2010). Passive defense principles in urban planning, Iran.
- Passive defense. (2007). Air defense Khatamolanbia Headquarters, Department of passive defense, Iran.
- Pukheradmand, R. (2009). (Translator), crisis management (principles and scientific guide for local governments) Author: Thomas E, Tehran: Tehran center for studying planning, publication of the urban planning process.
- Passive Defense of the Tehran Metro Line 7 studies. (2011). The company of ImenSazan.
- SalariFar M. (2005). Fractal geometry in the design camouflage paper, MalekAshtar University, Institute of Engineering of civil defense.
- Vahidi A.T. (1990). Safe design principles and precautions for war, MS Thesis, Tehran.
- Volvy, MR. (2011). booklet "scenarios of military threats against Iran, focusing on defense relations," Passive Defense Institute of Engineering, General Staff of the Armed Forces, Strategic Research Center, Department of National Power in Material and Logistics; Producer: MR Mirzaamini (Andishgah Sharif).