City Vulnerability Assessment with Passive Defense Approach; A Case Study: Rasht City, Iran

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Original Article

Abstract

INTRODUCTION: The passive defense approach is one of the approaches in planning and organizing cities and residential complexes with the aim to reduce environmental hazards. Given the vital and sensitive position of cities, while preparing against military invasions, this approach provides special capabilities to cope with natural and human crises to a large extent.

METHODS: This was an applied study conducted with a descriptive-analytical method. Data were collected reviewing the relevant texts, sources, books, and articles, as well as examining maps, interviews, and observations. The data were then analyzed using the geographic information system (GIS) software. In the next step, the strengths, weaknesses, opportunities, and threats (SWOT) analysis technique was employed to investigate the strengths and weaknesses as well as the opportunities and threats of Rasht City, Iran.

FINDINGS: Rasht City accounts for a considerable part of the population, facilities, and services of Guilan Province, Iran, which will experience great damage in case of occurrence of a natural or human disaster. The SWOT analysis results revealed that the strategy obtained was of a defensive nature.

CONCLUSION: On the basis of the results obtained from the investigation of the sensitive land uses, it can be stated that the location of the land uses (particularly, sensitive and important ones) in Rasht does not follow the passive defense principles. In addition, the central areas of the city are more vulnerable due to the density of the important and sensitive uses in these areas. This implies that the city center is the most vulnerable area of Rasht in terms of the passive defense approach.

Keywords: Human Hazards; Natural Hazards; Vulnerability; Passive Defense; Rasht City

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Introduction

Throughout history, with refuging in caves and building habitats in accordance with the technological and socio-economic requirements and conditions of the time, including constructing tall ramparts and digging moats, human beings have sought to protect their lives and provide group security (1,2). In the current era, the passive defense science as one of the newest defense fields has been constantly considered (3). In today world, the process of development of communities is somehow involved in the increase of the risks threatening them and new forms of risks with new manifestations arising from the improper application of technology have emerged (4). In fact, it can be claimed that the human-made hazards are as much as or higher than the ones imposed by the natural factors (5-7).

Regarding cities, the preparedness and security are of higher importance as they are the focus of accumulation of huge masses of people, and most of the industrial, commercial, economic and service, and financial and banking centers are concentrated in urban areas (8-11).

In addition, most of the major command

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centers and the headquarters as well as the place of gathering of the high-level managers and decision-makers are placed in urban areas, which are the centers of communication and information, and the centers of production and dissemination of news and information, especially in times of disaster (12, 13).

Passive defense is referred to a set of unarmed measures taken to reduce the vulnerability of manpower, buildings and facilities, equipment, and arteries of the country to hostile and destructive enemy operations or to reduce the risk of abnormal casualties (14-16). Today, in the technical literature, the term defense covers a very broad range of planning, design, and implementation concepts and actions in the three stages of before, during, and after a crisis (17).

According to Jalali-Farahani, the important goals and functions of the passive defense include protecting the individuals' lives, protecting infrastructure, maintaining essential services, protecting rare facilities and equipment, stabilizing the country's top management, safeguarding the country's cyber security, and fulfilling people's requirements (18).

Selection of safe areas in the geographical domain of the country, determination of the optimal scale of population deployment and activity in the space, distribution of functions in accordance with the threats and geography, selection of optimal scale of dispersion and economic justification of projects, small size, low costs, as well as suggesting initiatives in passive defense, parallelization of the relevant support systems, reinforcing fortifications and immunization of critical structures, defensive crisis management in the field, camouflage and invisibility, blinding the enemy's information system, hiding using land terrains, and covering in all areas are among the passive defense principles (20).

Optimization of the urban land use refers to raising the level of the acceptable environmental standards and its adaptability to humans, ensuring the presence of a proper balance between population and the capacity of urban infrastructures, maintaining the land use effect intensity, and safe levels of development and population and in general, the urban land location (22).

In the land use planning, the optimal criteria for locating urban functions include compatibility [location of compatible land uses along each other and separation of incompatible land uses (23)], accessibility [distance and time to reach from one location to another (24)], optimality (maintaining natural factors, landscapes, open spaces, etc.), and safety [protecting the city from potential natural hazards such as floods, earthquakes, and man-made hazards such as location of the industrial uses in residential areas, etc. (25,26)] in the cities.

Iran is a country with a huge number of potential events and Guilan as one of its provinces is subject to frequent disasters. A glance at the history of Rasht city as the center of this province suggests that there is a possibility of disasters with a natural or human origin, which can become a crisis in case of the lack of a proper management. The 1990 earthquake and the 1990 and 1998 floods are examples of the natural disasters taken place in the study area. Besides, inundation of the passageways in the event of heavy rains is among the cases that can impose a special critical situation on the city in a short period of time. Rasht, as the largest focus of population in Guilan province, embraces the largest amount of manpower, investment, and economic and infrastructure plans that have exposed the city to numerous threats and damages and can put increasing pressure on communication arteries in times of crisis. The vulnerable factors and elements of the city were identified and examined taking into account the role and position of this city (provincial capital) with the aim to investigate the current situation and the vulnerability of the city elements including critical arteries (water supply, power, gas, and communication network facilities) crisis management centers, and military, law enforcement, and support centers.

Methods

In this applied, descriptive-analytical study, the data were collected through the review of texts, sources, books, and articles, as well as investigation of the maps, interviews, and observations. Moreover, various software and tools were exploited to update and process the spatial data and information, to create, edit, and classify images, and to obtain the data output.

The study area was Rasht city with an area of 1251.6 km^2, 9% of the total area, and a population of 814368 people, accounts for 33% of the total population of Guilan Province. It has common borders with the Caspian Sea on the north, with Anzali City on the northwest, with Somme Sara and Shaft on the west, with Roudbar on the south,

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with Siahkal on the southeast, with Lahijan on the east, and with Astaneh Ashrafieh on the northeast. The city of Rasht comprises of five municipal districts, each divided into three regions (27).

In this study, ArcGIS software was utilized in the phases of the entry, storage and management, processing, and analysis of data, and then the strengths, weaknesses, opportunities, and threats (SWOT) analysis technique was used to assess the strengths, weaknesses, opportunities, and threats of Rasht in the passive defense field.

Findings

Rasht has a sector pattern and like many old and current Iranian cities, has a shapeless and irregular form. This pattern is generally asymmetric and more dynamic than the regular forms. This form allows for the easy expansion and development of cities on every side and exhibits a great flexibility against changes. The defensive characteristics of this form include the high flexibility against changes, making the city defensively robust against damage. The weaknesses of these types of cities also include disorder in passages, in appropriate division of passages, and lack of a proper access which are among the effective factors in the emergence of traffic complications, causing a high of volume of traffic congestion on the roads during an accident or an attack.

Gas stations are among the most important and critical uses that are very vulnerable to military attacks. There are 13 gas stations in Rasht the vulnerability level of which is demonstrated in Figure 1. Due to the vulnerability map of the study area, most of the gas stations are located in the central and southeastern parts of the study area. In order to determine the vulnerability of the city, given the use of the gas stations, the buffer tool was employed in the geographic information system (GIS) software and five radii of 100, 160, 210, 300, and more than 300 m were applied. Due to the vulnerability map of the city and gas stations, the city's west and southwest areas were less vulnerable.

Firefighting centers are among the most useful applications in times of crisis and a special attention must be paid to their locations. For ease of access to the traffic flow, the location of the fire stations must be specified next to or parallel to the first and second degree main arteries.

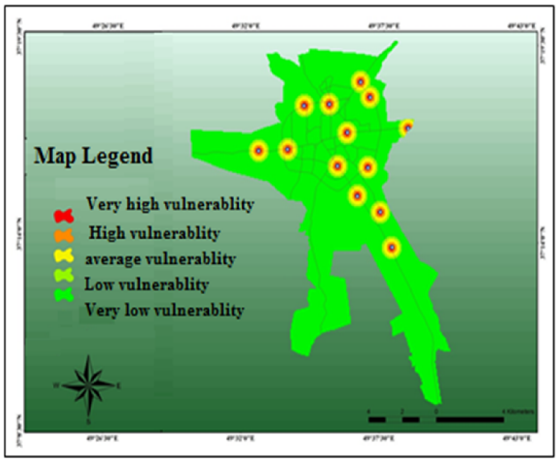


Figure 1. Vulnerability map based on distance from gas station in Rasht City, Iran

It should be noted that the location of the fire stations should not include existing and future access that may prolong the time to reach the accident scene (such as rivers, canals, and other waterways). The distance between fire stations varies considerably depending on the population density, land use, useful service area, and performance. Figure 2 represents the vulnerability based on the distance from the firefighting centers of Rasht City. Given the vulnerability map of the fire centers, it can be declared that these centers were not well distributed, as most of these centers are located in the central part of the city, which makes it difficult to provide rescue to the outskirts of the city.

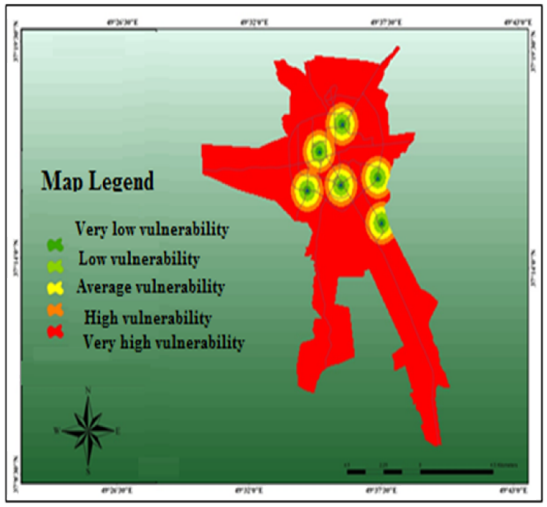


Figure 2. Vulnerability map based on distance from fire centers

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Administrative centers (head offices, provincial governor office, municipalities, broadcasting organization): The urban uses are importance in two physical and functional aspects and are prioritized on the basis of these two characteristics. This identification and prioritization can be examined in two respects: (a) the stability of the strategic points by finding solutions to preserve their body and function; (b) identifying places with no military value.

Generally, there are three approaches associated with priorities of the recognized general threats as follows: 1. Uses that are part of the strategic objectives are the first priority of a military attack (administrative centers), 2. Uses that are part of the mental objectives of war are the second priority of a military attack (urban facilities and equipment), and 3. Uses that are not worth a military attack (backup services). As mentioned, the administrative centers were considered to be among the strategic goals of the enemy, and the location of these places is very important in terms of vulnerability as well as performance. In Rasht, the administrative uses are mostly located in the center of the city, within residential and other uses, and they will be very vulnerable during a war or disaster; this can cause several problems. Moreover, the distance between the administrative centers of the city and the city center is very low. Figure 3 demonstrates the vulnerability of these centers using GIS and buffering tools at different distances (150, 215, 290, 365, and more than 365 m).

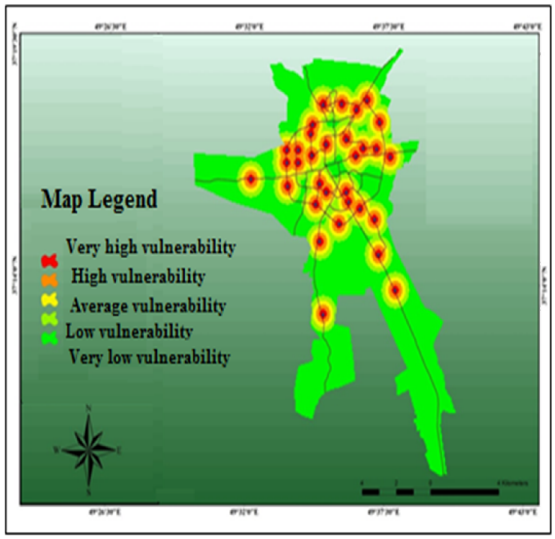


Figure 3. Vulnerability map based on distance from head offices

Industrial centers and workshops: In future battles, the enemy attacks will mostly focus on industrial centers and so on. Therefore, it is necessary to observe the passive defense considerations for all of them. As the greater the distance of these uses from other uses, the more reduced vulnerability of the city. In order to determine the vulnerability of the city due to the use of industrial workshops and centers, the buffer tool was utilized in GIS software and five radii of 500, 1000, 1500, 2000, and more than 2000 m were applied. As illustrated in Figure 4, which indicate the spatial distribution of the industrial centers, most of these centers are located in the southern part of the city, making this area more vulnerable. Thus, locating industries in the residential context of the city is risky.

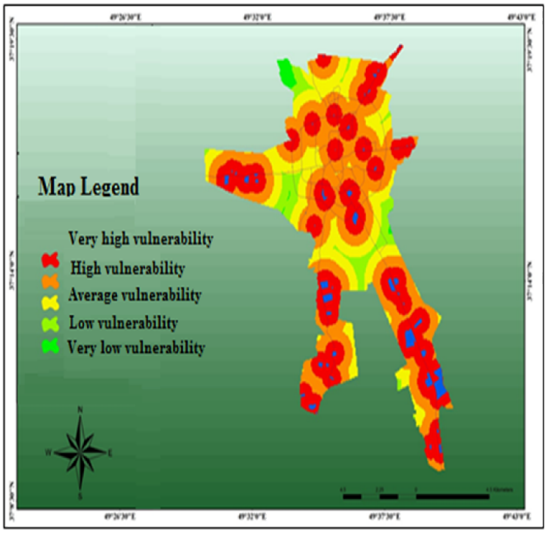


Figure 4. Vulnerability map based on distance from industrial centers

Health centers: Access to medical centers accelerates rescue operations and service provision. Thus, the higher the distance from the medical centers, the higher likelihood of vulnerability. Lack of proper access to health centers is one of the problems that stems from the ignorance of the need for quick and easy access to these centers when locating these centers in the city or even after. In order to determine the vulnerability of the city taking into account the use of the health care centers, the buffer tool was utilized in the GIS software and five radii of 250, 500, 750, 1250, and more than 1250 m were applied. According to the spatial distribution map of the health centers (Figure 5), these centers have

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been mainly concentrated in the central and southern parts of the city and also can be observed as scattered in other parts of the city; this inappropriate dispersion of the centers increases the city vulnerability and makes it difficult to access to them.

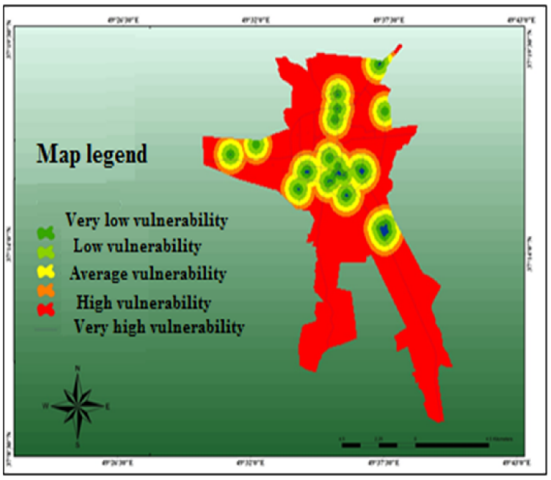


Figure 5. Vulnerability map based on distance from health centers

Sports centers and stadiums: Sports centers are among the uses that are not worth attacking and can be utilized as support service centers for refugees. In order to determine the vulnerability of the city, given the use of the sports centers and stadiums, the buffer tool was used in the GIS software and five radii of 250, 500, 750, 1250, and more than 1250 m were applied. As it is clear in figure 6, all sports centers in Rasht are located in the center of the city in a proper distance; hence, they can be used as shelters in times of crisis.

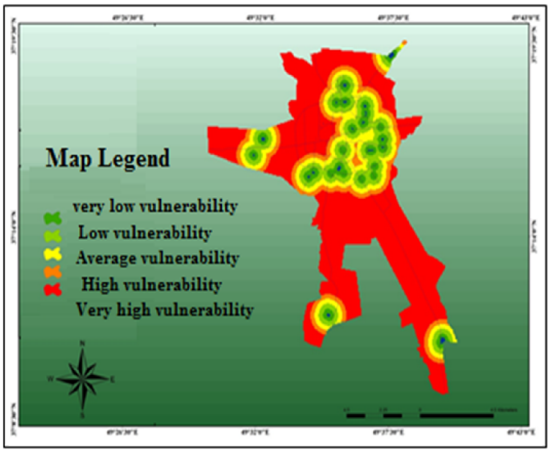


Figure 6. Vulnerability map based on distance from sports centers

The higher the distance to these centers, the more the vulnerability and the lower the distance to the city, the lower the vulnerability.

Urban facilities and utilities (power posts, gas pressure regulating stations, telecommunication stations, and water reservoirs): Uses that are part of the mental goals of war are the second priority of a military attack. Failure to achieve the desired goals will bring the enemy into a new phase in the next stages of the war, in which it will target certain public utilities. When the enemy fails to achieve its strategic goals, it attacks the facilities and equipment in the city. In order to determine the vulnerability of the city, considering the psychological uses (urban facilities and equipment), the buffer tool was employed in the GIS software and five radii of 200, 400, 600, 1000, and more than 1200 m were applied (Figure 7). Given the vulnerability map of these centers, it can be claimed that these centers have not been well distributed and most of them are concentrated in the central areas of the city, making these uses to be highly vulnerable. In this study, case analyses were necessary for further investigation and determination of the vulnerability in critical situations, hence the output map was categorized along with its features. For this purpose, the vulnerability zoning map of Rasht was prepared in five classes. As Figure 8 demonstrates, in terms of passive defense, 21%, 28%, 26%, 15%, and 10% of the total area of the land uses in Rasht was of a very high vulnerability, high vulnerability, medium vulnerability, low vulnerability, and very low vulnerability, respectively. In fact, the central areas of Rasht and its surroundings are very vulnerable in terms of the passive defense.

Identification of strengths, weaknesses, opportunities, and threats in Rasht city using SWOT matrix: At this stage, the weaknesses and strengths associated with the internal and external factors related to passive defense in Rasht, identified through interviews and questionnaires, were provided to 15 experts (urban planning professors of University of Guilan and municipal and Provincial Government Office staff). According to their views, each criterion was given a specific coefficient value from zero to one, such that the sum of the coefficients was equal to one. Then, in order to determine the effectiveness of the current strategies and reaction to the factors, a ranking was carried out as follows.

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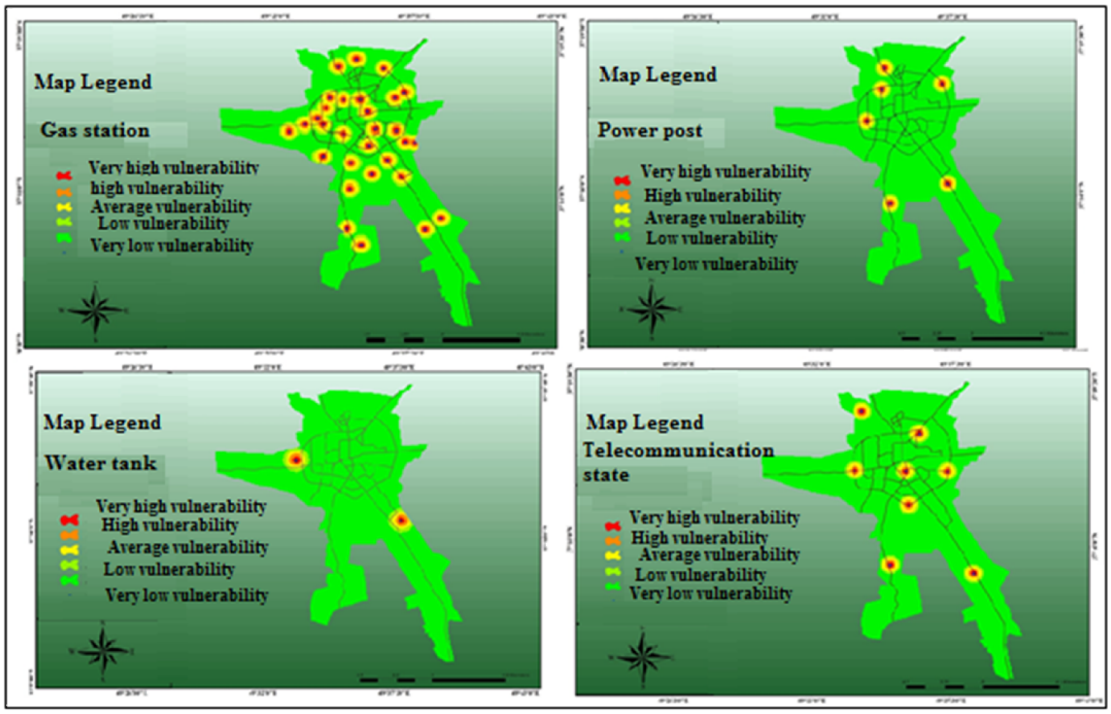


Figure 7. Vulnerability map based on distance from power posts, gas pressure regulating stations, telecommunication stations, and water tanks

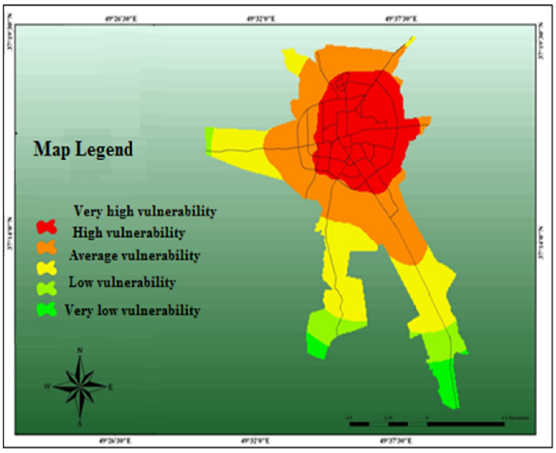


Figure 8. Spatial vulnerability zoning of infrastructure from passive defense approach in Rasht, Iran

In this ranking, ranks 1, 2, 3, and 4 indicated major weakness, normal weakness, normal strength, and high strength, respectively. In the next step, the coefficient of each factor was multiplied by its score to determine the final score. In the matrix of the internal factors, the final score of higher or lower than 2.5, i.e. the mean value of 1 to 4, indicated the higher position of the strengths compared to weaknesses or the higher position of the weaknesses compared to strengths, respectively (Tables 1 and 2).

Then, based on the final scores obtained from the internal and external factors evaluation matrix, the passive defense status of Rasht City was determined from the four situations of SO, ST, WO, and WT indicating the offensive, competitive, conservative, and defensive statuses, respectively. For this purpose, the total weight of the internal factors matrix and the external factors matrix was respectively 1.88 and 1.66 and was plotted in the internal-external matrix (Figure 9).

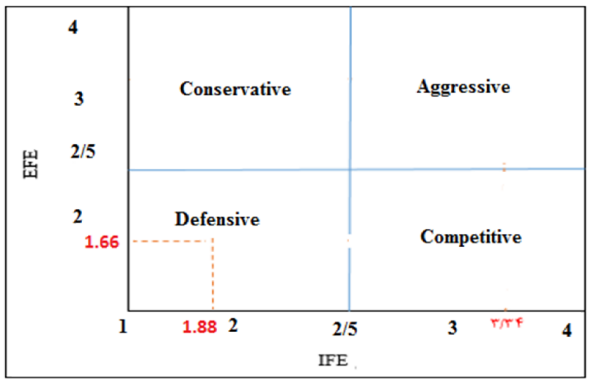


Figure 9. Diagram of final score of the internal and external evaluation factors matrix
Internal factors evaluation matrix final score
External factors evaluation matrix final score
Conservative-Offensive
Defensive-Competitive

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Table 1. Internal factors of the strengths, weaknesses, opportunities, and threats (SWOT) model

Factor code	Factor description	Relative weight	Rank	Final score
Strengths				
S1	Low vulnerability of power grid due to low congestion of these lines in main passages	0.076	3	0.028
S2	Presence of religious beliefs among citizens that increase the potential of coping with cultural crises and media-psychological warfare in times of crisis.	0.061	3	0.183
S3	Presence of some formal and informal active cultural, religious and social institutions such as Basij resistance bases, religious confraternities, etc., and their area of application in the development of passive defense culture	0.057	4	0.228
S4	Lack of concentration of some service uses and their distribution in several points of the city	0.078	3	0.234
S5	Lack of concentration of telecommunications network in the city	0.068	3	0.204
S6	Further attention to the passive defense issue in cities and the possibility of culture-building regarding the importance of passive defense to citizens	0.064	3	0.192
Total				1.269
Weaknesses				
W1	Lack of coordination of programs and arrangements among the crisis management headquarters	0.056	1	0.056
W2	High vulnerability of gas stations due to their density in the central part of the city	0.047	1	0.047
W3	Increasing trend of urban population and migration from suburban to urban areas which is in conflict with the principle of optimal dispersion in the passive defense approach	0.053	1	0.053
W4	Lack of adequate and proper public education for passive defense and potential threats	0.044	1	0.044
W5	Lack of institutionalization of the passive defense principle as a more important and cost-effective necessity than the direct defense among the executives and decision makers	0.041	1	0.041
W6	Lack of publicity and background on the importance and essentials of passive defense among different segments of the population and consideration of equality of passive defense with active defense and direct military engagement among the citizens	0.040	1	0.040
W7	A severe and relative shortage of urban open spaces in some neighborhoods, especially in old, traditional neighborhoods with relatively high population density, which makes it difficult to provide rescue in times of crisis.	0.058	1	0.058
W8	Absence of strategic planning of physical-spatial development and urban land use based on the passive defense principles	0.038	1	0.038
W9	Position of manufacturing workshops inside the city, especially their proximity to the gas stations	0.043	1	0.043
W10	Increased building and population density in downtown areas, increased traffic, and inefficiency of downtown roads in the future	0.045	1	0.045
W11	Aerial wiring the city electricity grid and extremely high vulnerability to graphite bombs and military attacks	0.029	1	0.029
W12	Ignorance of the passive defense issue, management of crisis and other disasters in urban development plans	0.048	1	0.048
W13	Politicization of occupation of urban management positions and related offices	0.047	1	0.047
Total				0.589

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Table 2. External factors of the strengths, weaknesses, opportunities, and threats (SWOT) model

Factor code	Factor description	Relative weight	Rank	Final score
Opportunities				
O1	Ability to use new experiences of leading countries in the passive defense issue	0.143	3	0.429
O2	Presence of inter-city interactions on passive defense in the form of certain defense plans	0.109	3	0.327
O3	Possibility of attracting foreign funds to increase security of the city	0.114	3	0.342
Total				1.098
Threats				
T1	Insufficiency of relief centers in the city to respond to crisis conditions	0.093	1	0.093
T2	Threat of air raid and vulnerability of critical and vital centers of the city to it	0.109	1	0.109
T3	Less resilience of the city to threats and thus the time-consuming process of revitalization of the city centers	0.084	1	0.084
T4	Vulnerability of most important, sensitive, and critical centers of the city to missile and air strikes	0.110	1	0.110
T5	Increased civilian casualties due to the declined communication network efficiency during rescue	0.087	1	0.087
T6	Lack of timely rescue due to the blockage of the communication network	0.101	1	0.101
Total				0.584

Conclusion

The present study was accomplished with the aim to identify and evaluate the vulnerability of Rasht using a passive defense approach. This city, with 557366 people residents, has a considerable population density. The gross population density of the city has been estimated to be 68.7 people per hectare based on the figures collected in 2006, with a numerical focus on the central area and the old textures of the city. Thus undoubtedly, natural and man-made crises can cause remarkable casualties in these points. According to the latest map of Rasht, this city has an irregular sector shape. In addition, more density can be observed in the central areas of the city. Estimates suggest that the population of the city reaches more than 1 million during day, and most people commute from surrounding parts to the center of the province to fulfill their executive and daily affairs. Given the focus of most of the governmental offices in the central part, which is the densest part of the city, the population density increases in this region significantly, especially in office hours. Given that the city expansion starts from its center and progresses along the main arteries, there is a high volume of commutes towards the center of the city. Such a complication will cripple the access to the city, in particular to the central parts and will complicate the evacuation of the central parts and the areas along the communication routes. Rasht has always been subjected to floods and earthquakes, besides, as the Guilan provincial center, this city has a particular geopolitical position in the region given its special strategic position in the vicinity of the Caspian Sea. Therefore, in case of a war, the risk of the aerial raids of the enemy will threaten this city. Accordingly, in the event of either a war or a natural disaster, there will be a high volume of destruction, debris, and casualties which will also impose the cost of the clean-up and reconstruction of the ruined textures.

In this study, the critical land uses of Rasht were evaluated from the perspective of the passive defense. Based on the results, the gas stations were located in the central and southeastern parts of the study area, thus the western and southwestern parts of the city are less vulnerable. Fire stations were not well distributed so that most of these centers were located in the central part of the city, making it difficult to provide rescue to the outskirts of the city. In addition, the military and law enforcement centers were located in the southeast of the city, whereas the location of the military centers and garrisons in the city is incorrect in terms of urban planning and the passive defense principles because it increases the vulnerability of the city. Moreover, the industrial and workshop centers were located in the southern part of the city and some of these industries were located in the central part of the city, which increases the vulnerability of this area as placing industries in the residential context of the city is risky. In Rasht, the administrative land uses (provincial head offices) were mostly located in

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the center of the city or in a near distance to it, inside the residential and other land uses, which would be very vulnerable and problematic in times of war and crisis. Furthermore, the urban facilities and equipment (power stations, gas pressure regulating stations, telecommunication stations, and water reservoirs) were not well distributed, so most of these centers were focused in the central area of the city, making them very vulnerable. In total, in terms of the passive defense, 21%, 28%, 26%, 15%, and 10% of the total area of the land uses in Rasht was of a very high vulnerability, high vulnerability, medium vulnerability, low vulnerability, and very low vulnerability, respectively. In fact, the central areas of Rasht and its surroundings are very vulnerable in terms of the passive defense.

Accordingly, the following recommendations are made regarding the passive defense for Rasht City:

– establishment and development of more rescue centers in the city of Rasht and coordination of management and executive staffs in times of crisis to reduce the vulnerability of the city.

– Dispersion and prevention of high density of the vital centers of the city in order to reduce vulnerability to air raids (especially in the central parts of Rasht).

– Establishment of appropriate centers and facilities in the villages and prevention of irregular migration to the cities, which causes high density, and poses a serious threat in times of crisis.

– Training the citizens of Rasht regarding air and missile attacks, passive defense, and crisis management, as well as establishing appropriate shelters in urban centers of Rasht (especially in Moallem, Bistoon, Motahhari, Gholipur Boulevard, Takhti streets, etc.).

– Providing appropriate communication routes enabling faster and easier access for rescue of the civilians in times of crisis, as well as construction of the overpass bridges across the city to prevent traffic congestion, and also training the passive defense principles as an urgent need for Rasht city officials and executives.

– Promoting and providing a proper platform for passive defense training to Rasht citizens, as well as deploying helicopters and mechanical devices in case of blockades of the communication routes and creating emergency helicopter landing sites on buildings and complexes with high population density to provide relief.

– Identifying places with a potential for use in times of threat containing the minimum suitable facilities for use in emergency and establishing relief centers in traditional neighborhoods and worn-out textures with a relatively high density.

– Moving all urban workshops to the outskirts and outer areas of the city, as well as the transfer of gas stations, which are major threats, to areas away from the critical centers of the city of Rasht to reduce vulnerability.

– Developing strategic plans and appropriate strategies for physical and spatial development of Rasht urban land uses and addressing the issue of passive defense in the urban development plans, such as the comprehensive and detailed development plan of Rasht.

– Transmission of electricity distribution lines of Rasht City to underground to prevent them from being damaged by air and military attacks

Geographical and climatic solutions

– Maximum use of natural and artificial environmental terrains in the design and location should be considered.

– Locating sensitive installations in plain and open areas, sites along the roads, and similar actions will increase the risk of being damaged in case of an attack and will make the case an easy target.

– The climatic features of the area should be used in designing buildings, centers, and important facilities, especially using the extensive green space for camouflage.

Management and executive improvement strategies

– A scheduled and periodic comprehensive urban defense plan should be prepared for the city.

– There should be greater oversight in the preparation of comprehensive urban plans in terms of observance of passive defense principles and criteria.

– Conducting annual public and official exercises to ensure the effectiveness of equipment and personnel in the event of an enemy invasion.

– Organizational and non-organizational tasks must be properly defined and a qualified management system should be established.

– Establishment of sites and bases for the restoration and reconstruction of buildings and equipment to expedite the process of control, supervision, and refurbishment of buildings and facilities appropriate to defense requirements.

– Establishment of sufficient barriers to reduce the risk of attacks, especially air bombardments.

– Defining protection limits.

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– Emphasizing the passive defense as a set of non-military measures that lead to the increased deterrence, reduced vulnerability, continuation of urgent activities, upgrading national stability, and facilitating the crisis management against threats and military actions of enemies.

– Observing the passive defense principles such as selection of safe areas, dispersion or aggregation in terms of the necessity and sensitivity of the enemy, immunization, concealment, camouflage, and deceptive efforts for the populated and important centers, especially in the spatial preparation projects and plans for the future development of the country.

– Classification of the important centers, places, and installations into the three categories of critical, sensitive, and important and updating them as necessary;

– Developing a passive defense plan against uncommon weapons such as nuclear, microbial, and chemical weaponry;

– Providing two or more uses for buildings, facilities, and communication routes and networks for a defensive application of the construction projects, especially in border and sensitive areas;

– Observing the classification of information of the passive defense plans using GIS;

– Avoiding the establishment of the risky installations in the populated areas, and removing all of these installations from the cities, predicting necessary safety measures for the installations required, and preventing the creation of crowded centers around the risky installations by defining the necessary limits.

Solutions to improve the status of the facilities

– Constructing stations beside the city for the maintenance of the excavation and fire extinguishing machinery and fire extinguishing capsules;

– Designing local fire and emergency stations, especially in the central part, taking into account the physical and public context of the areas and also in the worn-out texture of Rasht;

– Moving fuel stations from the residential or other strategic locations to other sites;

– Vulnerability assessment of transmission channels (especially water and gas) as part of a system;

– Applying the approach of using new energies given the climatic characteristics of the region to provide electricity to strategic locations, especially in times of crisis and in the power outages.

Solutions to improve the status of uses

– Investigation of the construction of any large administrative, industrial, or residential complex according to the type of threats and considering all internal and external threats and even natural disasters;

– Observing defensive measures in the design, architecture, and construction of all strategic centers.

– Moving all military and hazardous installations to an area in a distance of at least 1000 m from the city hospitals and observing this in the construction of the hospitals;

– Flexible and multifunctional design of large buildings and spaces for changing the use when needed;

– Designing fast-accessible local squares and areas for local residents to access outdoor at the time of a disaster.

– Identifying and predicting appropriate and safe locations throughout the city for temporary resettlement of the people and essential activities during war or crisis which can be effective in reducing injuries.

– Development of relief applications with proper distribution throughout the city

– Providing quick access to safe places for the population

– Predicting appropriate spaces and locations for the temporary deployment of the military that is needed in times of crisis to protect the people and activities.

Proper distribution of open spaces throughout the city, especially in the vicinity of high-risk and high population uses.

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Conflict of Interests

Authors have no conflict of interests.

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