



Paper Type: Original Article

# Strategic Assessment of Passive Defense Integration in Urban Construction Management Using SWOT–QSPM Approach: A Case Study of Bandar Anzali, Iran

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## Citation:

Received: 15 November 2024

Revised: 19 December 2024

Accepted: 24 June 2025

Tahbaz, A. (2026). Strategic assessment of passive defense integration in urban construction management using SWOT–QSPM approach: A case study of Bandar Anzali, Iran. *Journal of Civil Aspects and Structural Engineering*, 3(1), 38–57.

## Abstract

Due to the concentration of critical infrastructure, dense population, and strategic role in the national economy, coastal and port cities are highly vulnerable to modern man-made and military threats. Bandar Anzali, as one of the most important port cities in northern Iran, is considered a prime example of this situation due to its linear structure, worn-out texture, limited subsurface development, and the location of sensitive centers in residential areas. The present study aims to strategically analyze passive defense in urban construction management in Bandar Anzali and examine its compliance with the requirements of Section 21 of the National Building Regulations. The research method is applied-developmental and descriptive-analytical, and data was collected through documentary studies, interviews with experts, and a Delphi questionnaire. In order to identify internal and external influential factors, the Strengths, Weaknesses, Opportunities, and Threats (SWOT) model was used, and the Quantitative Strategic Planning Matrix (QSPM) was used to prioritize strategies. The results show that the weakness of the emergency transportation network, the deterioration of the urban fabric, the concentration of sensitive centers, and the lack of an integrated passive defense mechanism are among the most important challenges facing Bandar Anzali against new threats. In contrast, port capacities, the possibility of developing emergency water transportation, and the ability to attract investment were identified as the most important strategic opportunities. Based on the QSPM results, priority strategies include attracting investment to develop safe infrastructure, renovating dilapidated structures with a passive defense approach, creating multi-purpose safe spaces, and strengthening the multi-route emergency transportation network. The research findings emphasize the need for systematic integration of passive defense requirements and topic 21 into the urban construction management cycle and can be used as a practical model for other coastal cities in Iran.

**Keywords:** Urban passive defense, Construction management, Urban resilience, Topic 21 of the national building regulations, Strategic analysis, Strengths, weaknesses, opportunities, and threats–quantitative strategic planning matrix.

## 1 | Introduction

The concept of passive defense has been proposed in recent decades as one of the fundamental pillars of national security and urban resilience against man-made and military threats. The 12-day war between the

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doi <https://doi.org/10.48314/jcase.v3i1.76>



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Islamic Republic of Iran and the Zionist regime in 1404 showed that Iranian cities, especially port and economic centers, are vulnerable to a range of new threats, including precision drone attacks, long-range missiles, cyberwarfare, energy grid disruption, and hybrid attacks. This experience made it clear that relying solely on active defense, without structurally strengthening passive urban defense, cannot guarantee sustainable security.

Bandar Anzali is considered one of the country's strategic points due to its port location, linear urban structure, high population density, and the location of sensitive economic and military centers. Such characteristics make this city a potential target cluster in military threat scenarios, necessitating planning for appropriate distribution of services, physical reinforcement, dispersion of sensitive centers, and design of blast-resistant structures. On the other hand, the concentration of dilapidated infrastructure, the weakness of the emergency transportation network, the lack of public shelters, and the lack of rapid warning systems indicate that urban construction management in Bandar Anzali still does not fully comply with the requirements of passive defense.

Given the above, as well as specific environmental constraints, including high groundwater levels and high humidity, full and accurate implementation of Section 21 of the national building regulations is vital as part of passive defense policies. One of the fundamental challenges in today's cities is the lack of balance between qualitative and quantitative indicators in urban development, such that in many decision-making, quantity (such as increasing density, rapid construction, expanding public services, etc.) has prevailed over the quality of urban life [1]. This is while the concept of urban security, especially in the form of passive defense, is considered one of the most fundamental indicators of the quality and sustainability of the city [2].

In the Islamic Republic of Iran, despite the emphasis of upstream documents, including the National Development Document, the principles of passive defense have still been neglected in construction and urban development planning in many cities. In fact, urban design and the location of strategic centers should be such that in critical situations, while maintaining their functionality, they suffer the least damage and crisis management is carried out properly. Factors such as unbalanced building textures, extensive dilapidated textures, disregard for climatic conditions, and lack of safety standards have made the city of Bandar Anzali extremely vulnerable to threats and crises. This study examines the status of urban construction management in Bandar Anzali to assess its compliance with the principles and requirements of passive defense. Using the Strengths, Weaknesses, Opportunities, and Threats (SWOT) and Quantitative Strategic Planning Matrix (QSPM) methods, it explains SWOT and presents implementation strategies to increase urban resilience against new threats.

Considering the geopolitical location of Bandar Anzali and its importance in commercial and military axes, an analysis of new threats, including man-made and military threats, was conducted to enhance urban resilience, and its results were reflected in the SWOT analysis and QSPM matrix. The innovation of the present research lies in the systematic linking of the requirements of Section 21 of the National Building Regulations with the strategic analysis of urban passive defense and the implementation prioritization of strategies using the QSPM matrix; an approach that has been less integrated in previous studies.

## 1.1 | Principles and Foundations of Passive Defense in Urban Management

In formulating the country's general passive defense policies, passive defense has been defined as follows: Passive defense includes civilian measures to increase deterrence, reduce vulnerability, continue essential activities, promote national stability, and facilitate crisis management against enemy threats and military actions.

Passive defense, complementary to active defense, is the most peaceful and effective defense method that reduces the vulnerability of national infrastructure and vital, sensitive, and important centers and ensures national stability [3].

Physical defense is a set of effective direct and indirect engineering measures in the country's development plans that lead to improving sustainability, reducing vulnerability, and continuing essential services of existing and future infrastructure. The position of passive defense in urban management is very important and is considered a fundamental strategy for maintaining the safety and sustainability of cities against various threats. This approach includes measures in various fields, including urban planning, building retrofitting, crisis management, public education, and information dissemination [4].

To achieve the goals of passive urban defense, in designing cities and determining the required uses of the city and how they relate to each other, determining the appropriate urban development pattern, appropriate population distribution and appropriate services for them, appropriate road network and urban infrastructure, The application of multipurpose functions and uses and how they coexist to manage the city in emergency situations is the responsibility of urban development engineers and urban management.

Chapter 22 of the seventh national development plan is dedicated to the topic of passive defense. In implementation of paragraph 24 of article 107 of the general policies of the plan and in order to strengthen infrastructure and enhance resilience against threats, especially cyber, biological, and chemical threats; the ministry of communications and information technology has been tasked with cyber-securing executive agencies.

Articles 198 and 201 of the fifth five-year development plan state that in order to reduce the vulnerability of infrastructure, promote national stability, protect the people and national resources of the country, and ensure the continuity of services to it in order to complete the civil defense cycle, the following measures will be taken: developing technical standards required for passive defense during the first year of the plan, creating a monitoring system, warning and neutralization of new threats in vital, sensitive and important centers and securing and protecting the country's vital, sensitive and important centers and continuing their safe and sustainable activities are carried out, as well as observing the principles of passive defense in the design and the implementation of sensitive and important projects or those under study, as well as infrastructure facilities and sensitive buildings, the main and vital arteries of the country, and public education of the people by the executive bodies subject to article 179 of this law, has been emphasized in order to prevent and reduce the risks arising from natural disasters (fifth development plan law).

The position of passive defense in Section 21 of the national building regulations is to determine the minimum criteria and regulations necessary for the design and implementation of buildings and public spaces so that they have the necessary resistance and safety against various threats and crises. This topic provides requirements and criteria for the design and implementation of buildings and urban spaces with the aim of minimizing vulnerability to unnatural threats, and designers, implementers, and supervisors of construction projects are required to comply with the requirements and considerations of passive defense in accordance with the criteria contained in this topic.

## **2 | Urban Planning**

Determining the appropriate urban planning pattern, appropriate road network and urban infrastructure, appropriate population distribution and their appropriate services, employing multipurpose functions and uses, and how they coexist to manage the city in emergency situations is the responsibility of urban planning engineers. Reducing people's vulnerability to threats, providing multipurpose urban functions, providing cities' crisis management capabilities in crisis situations, ensuring the continuity of people's essential functions in crisis situations, and avoiding high-risk functions in the city are among the most important goals of urban design.

### **2.1 | Architecture**

It is essential to consider passive defense considerations in architectural design.

The effects of the blast wave caused by bombing must be comprehensively and balancedly examined and considered in the grand planning and design of buildings, and even in the implementation details and selection of building materials, such as the relationships between components and facade components, in accordance with the importance of the buildings, in order to achieve a stable and resilient complex in crisis conditions. When designing how the building's internal spaces communicate with each other, special facilities must be provided to protect people's lives from hazards, improve the system's performance in threatening conditions, and reduce its vulnerability.

## **2.2 | Structure**

Designing structures against explosions requires knowledge of the dynamic properties of materials. Structural materials must have sufficient strength and structural systems must have appropriate hyperelastic behavior and ductility. The structural design of a building against explosion loads in accordance with the National Building Regulations is the responsibility of the accounting engineer.

## **2.3 | Facilities**

The role of electrical and mechanical facilities in passive defense to prevent damage from the consequences of explosions such as gas leaks, flooding, electrical hazards, fires, etc. Crisis management capability and continuity of functions are essential that must be considered by the facility engineer and also consider the passive defense principles of parallelization, location, dispersion, robustness, stable installation, and repairability [5].

## **2.4 | Study Area**

Bandar Anzali: Bandar Anzali County is located in a completely plain area, where part of the natural environment of the county is the sea and the Anzali Wetland, and its distance from the provincial center is 40 kilometers. Its altitude is -15 meters above sea level and its average rainfall is 1850 mm. With a population of about 120,000 people according to the 2016 census, it is the second most populous city in Gilan Province and one of the most densely populated cities in Iran. Due to the establishment of the provincial fisheries, customs, meteorology, ports and maritime departments in Bandar Anzali, as well as the only free zone on the southern shore of the Caspian Sea, and its climate and geographical location, it is considered the economic and tourism hub of Gilan province and the north of the country.

Location on the international North-South corridor, access to the consumer markets of CIS countries through suitable roads, easy internal access by land, rail, and air due to proximity to Rasht Airport are among the features of the Anzali Free Zone. The structure and texture of the city of Bandar Anzali is a linear structure or corridor that is stretched linearly parallel to the coast. The location of the port and the Anzali Free Zone has made the city a strategic target for military threats. From the perspective of passive defense, this type of urban structure can be most vulnerable to air attacks because many urban activities and population densities, etc., are located on the main axis of the city.

## **3 | Research Background**

In 2025, Joyce [6], after studying the two wars Russia and Ukraine and Zionist Regime and Palestine, concluded that in both wars, air and artillery attacks had priority, and strategic targets included military infrastructure, Critical infrastructure and areas housing large numbers of people, such as high-rise buildings and shelters. Based on the research findings, the researcher has made suggestions for improving passive defense in future cities, which include prioritizing places with natural protection, using multiple network patterns, maintaining low population density, The shape of streets with T-shaped intersections, implementing unpredictable multi-center distribution of goals, designing short homogeneous blocks with low building density, placing basements in the center of the building, using an explosion-resistant structural system, and using explosion-resistant materials and coatings with low emission are among the solutions presented.

Salem et al. [7] based on a purposive sampling method and a statistical population of forty people have concluded that the vital facilities of Shirvan city, with an average impact of 3.6, are the most important urban element vulnerable to threats. Hosseini Amini et al. [8] examined the urban structure of Bushehr using an analytical-descriptive method using the SWOT technique, and after identifying strengths and weaknesses, opportunities and threats, strategies were presented as solutions in the form of medium and long-term plans.

Barnafar and Afradi [9] conducted a descriptive-evaluation study that extracted strategic points of Bandar Anzali city through evaluation methods and analyzed the city's defense status using the SWOT technique. This research, with an innovative approach, links the topic 21 of the national building regulations with the principles of passive defense in urban management, which shows its difference from previous studies that mainly analyzed threats or urban structure without considering the requirements of topic 21.

### 3.1 | Research Method

The present research is of an applied-developmental type with the aim of utilizing the principles and foundations of passive defense in urban construction management. In terms of research method, it was conducted in a descriptive-analytical manner with an approach of problem identification and strategy formulation. First, by utilizing library studies, documents, and written sources, theoretical foundations related to the concepts of passive defense, urban planning, urban safety, and critical infrastructure were collected. In the next step, to analyze the current situation of Bandar Anzali city, the SWOT strategic model was used to identify SWOT related to passive defense in the urban structure. The data required for this section was collected through a structured questionnaire using the Delphi method and opinion polls, as well as face-to-face interviews with thirty experts and specialists in the fields of urban management, architecture, and Passive defense professionals who met the following criteria were recruited: at least five years of managerial or educational experience in the fields of engineering, urban management, or passive defense; professional participation in urban or security projects; or teaching or working experience in related institutions.

After identifying the internal and external factors, using weighting and ranking techniques, the city's strategic position was determined in the form of an evaluation matrix of internal and external factors.

Next, in order to select and prioritize appropriate strategies, the QSPM was used. This matrix, by considering the relative attractiveness of each strategy and combining it with the four SWOT factors, has enabled the evaluation and comparison of strategies. Finally, based on the results of the analyses, selected strategies have been presented to strengthen the dimensions of passive defense in the urban construction management of Bandar Anzali. In the first stage, using a questionnaire, the most important indicators of each criterion were identified and then the strengths and weaknesses were categorized. Also, using a similar method, external factor indicators were identified and categorized into opportunities and threats. After identifying internal and external factors, the importance of each factor was determined using a numerical scale to determine the weight of each factor.

First, the elements should be weighted according to the importance and impact of each goal. To conduct this research, based on the Delphi method, thirty-seven internal and external influential factors affecting the city's infrastructure dimension were distributed among the sample population. Finally, the responses received were coded and analyzed based on a five-point Likert scale (from very poor to excellent), and after summing up the scores and ranking the factors, strengths and opportunities, weaknesses and threats, they were divided into four categories: Infrastructure and physical, social, defense, management, and political and economic.

As can be seen in *Figs. 1-4*, the economic and political indicators of passive defense in Bandar Anzali city have higher average scores and a better situation.

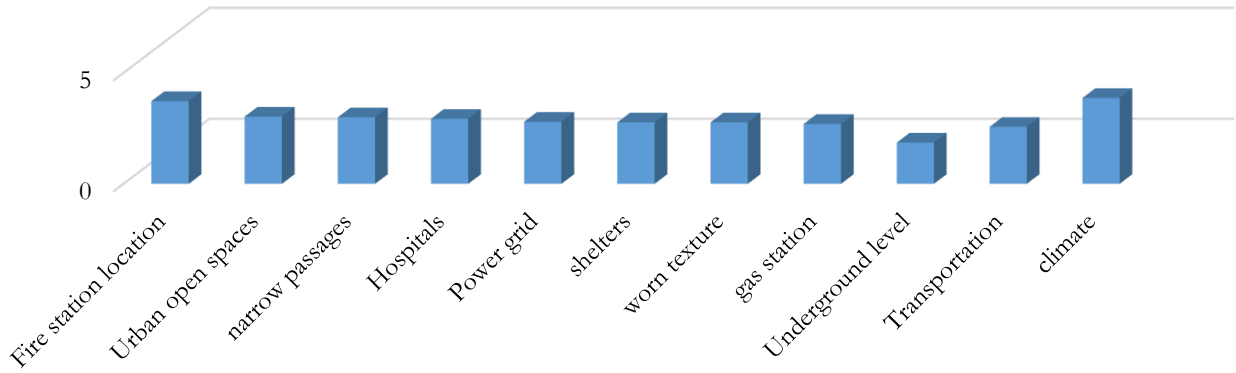


Fig. 1. Comparison of the scores of infrastructure and physical indicators of Bandar Anzali.

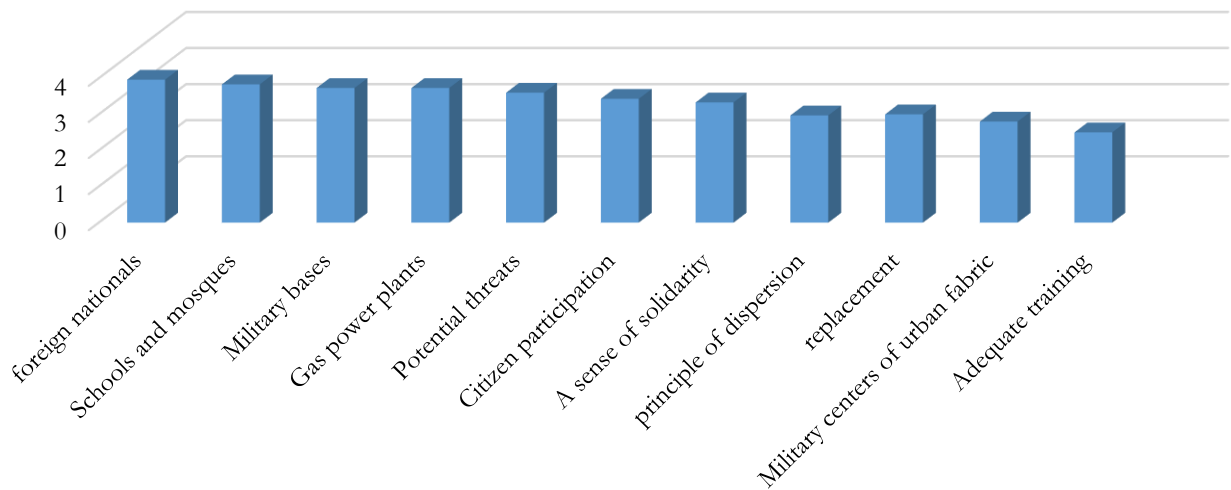


Fig. 2. Comparison of social and defense indicator scores.

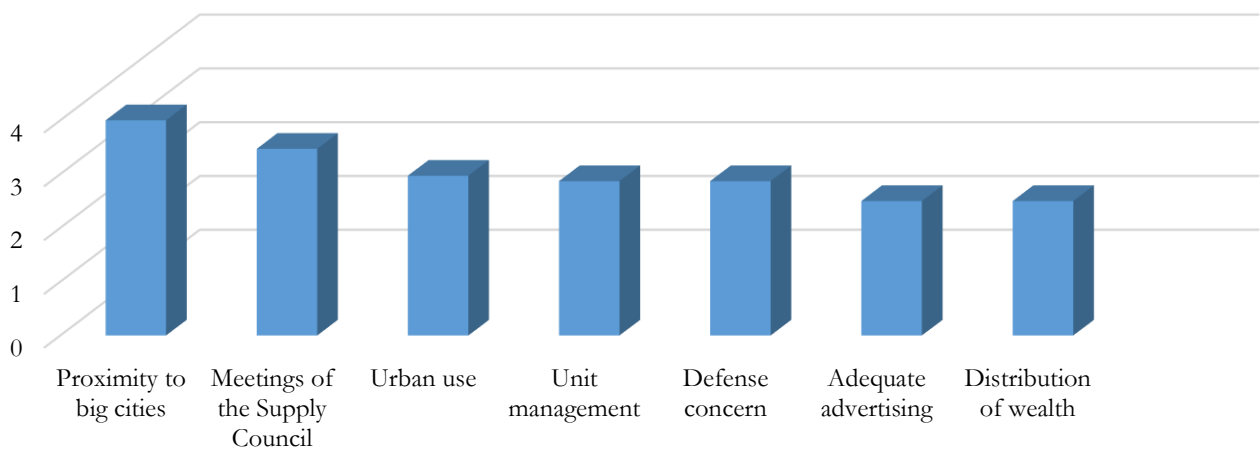


Fig. 3. Comparison of management indicator scores.

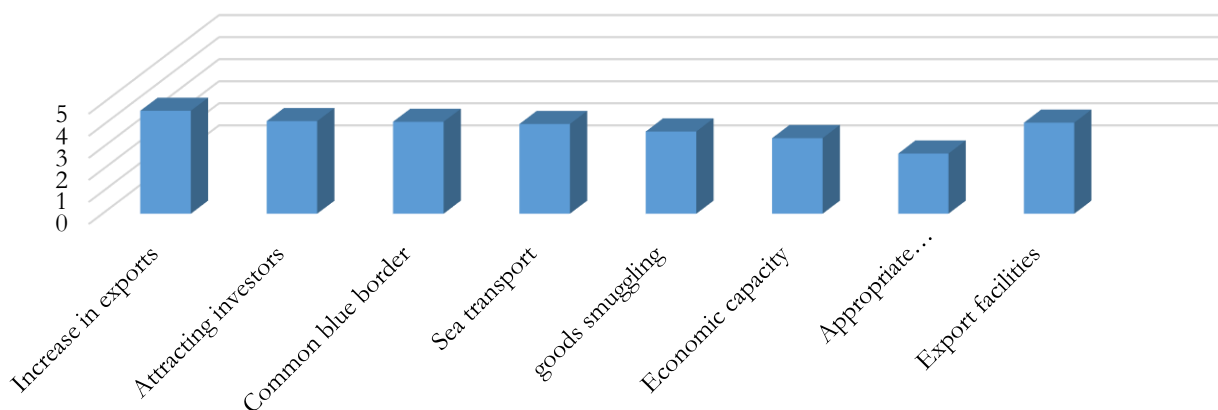


Fig. 4. Comparison of economic indicator scores.

### 3.1.1 | Analysis of internal factors

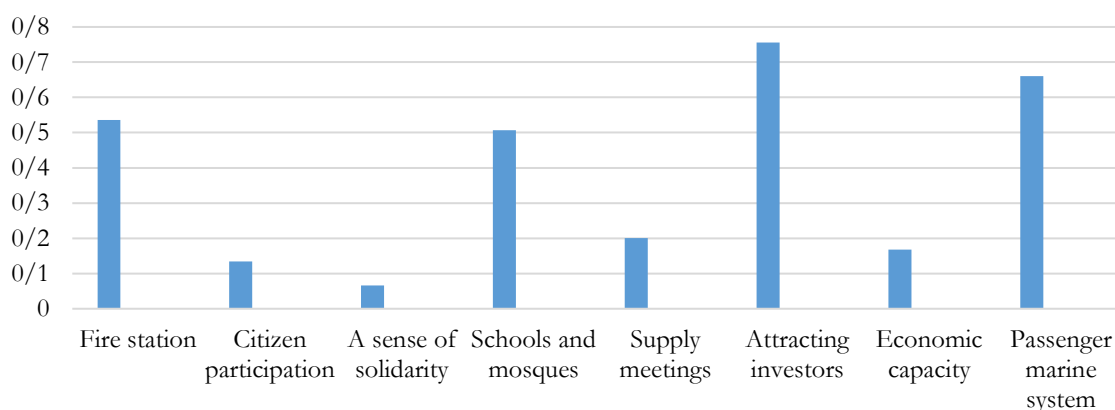


Fig. 5. Comparison of weighted scores of internal factor strengths.

As shown in *Fig. 5*, among the strengths of internal factors, the factor of the possibility of attracting foreign investors to increase security with a score of 0.756, the factor of the possibility of creating a passenger maritime system with a score of 0.660, and the appropriate establishment of fire centers with a score of 0.536 are in the top ranks of strengths.

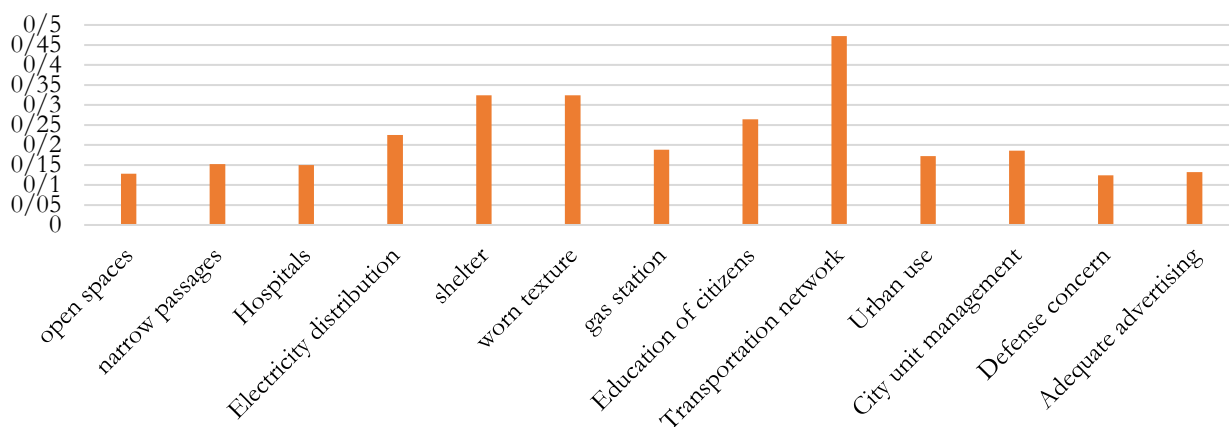
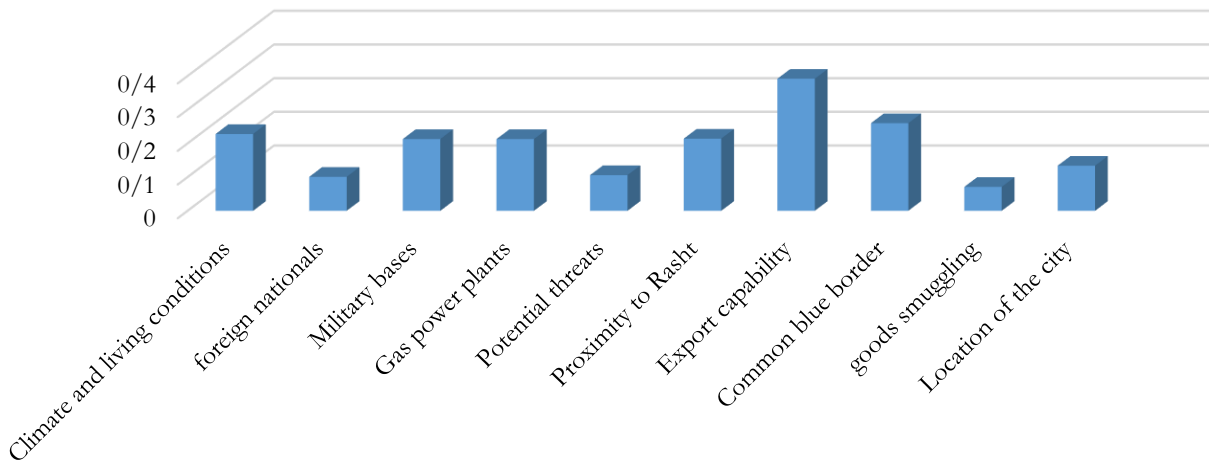


Fig. 6. Comparison of weighted scores of internal factor weaknesses.

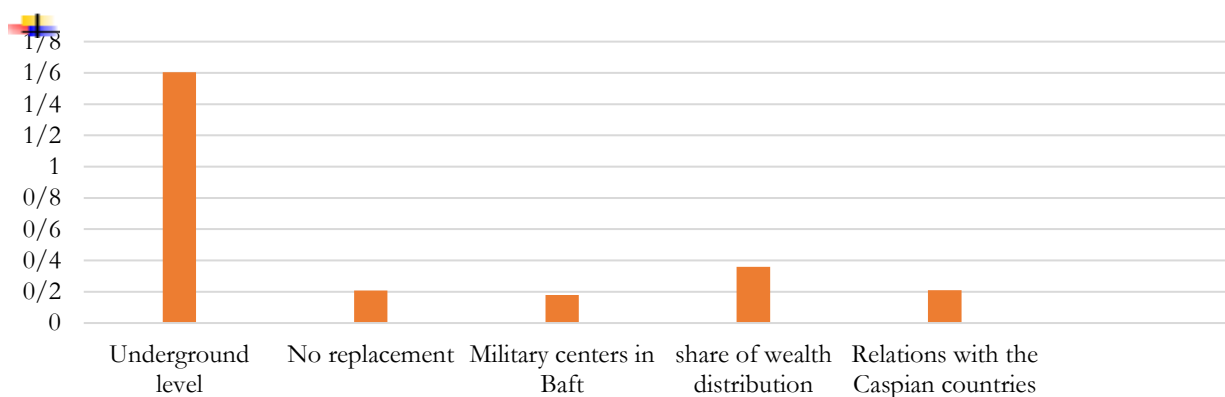
According to Fig. 6, among the weaknesses of internal factors, the index of lack of access network and appropriate urban transportation system with respect to the principles of passive defense with a score of 0.472, failure to consider uses for the construction of multipurpose shelters, and The traditional and dilapidated texture of most of the city's neighborhoods, which is contrary to the paragraphs of topic 21 regarding the design of multipurpose spaces for critical situations, both indicators with a score of 0.324, and the lack of adequate and appropriate education of citizens in passive defense with a score of 0.264, are the four indicators with higher weakness scores.

**3.1.2 | Analysis of external factors**



**Fig. 7. Comparison of weighted scores of external factor opportunities.**

To organize external factors into the category of opportunities and threats, passive defense planning was calculated using rating factors and considering the importance of each of them on the city of Anzali. Fig. 7 shows that the ability to increase Iran's exports to other countries on the Caspian Sea coast through Anzali Port with a weighted score of 0.392, The existence of a common water border and the possibility of communication with the countries bordering the Caspian Sea with a weighted score of 0.260, and climate and living conditions with a weighted score of 0.228, are the most important opportunities among external factors.



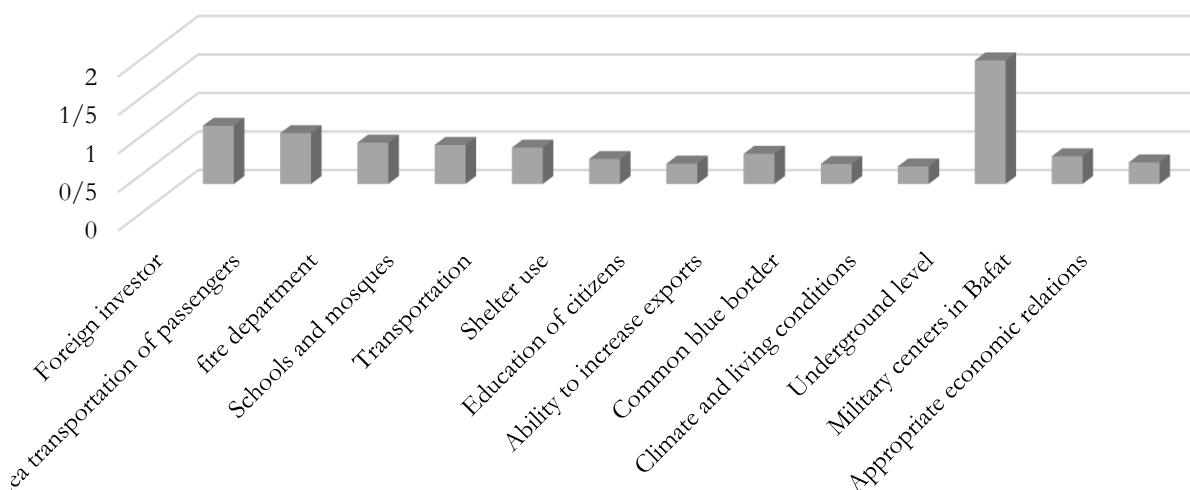
**Fig. 8. Comparison of external threat scoring.**

Fig. 8 shows that the most important threat from external factors to the city in terms of passive defense is the inability to use the underground level of buildings due to the sea level with a weighted score of 1.604, and in the next ranks is the lack of proper development of economic, political, Socially, it has a common water

border with neighboring countries with a weighted score of 0.280, and the presence of a military garrison in the city's residential area due to being a target cluster with a weighted score of 0.240. After quantitatively evaluating internal and external factors based on expert opinions and calculating weighted scores, qualitative analysis of these factors is necessary to better understand their priorities and effects within the framework of passive defense in Bandar Anzali city. The weighted scores of strategic factors are given in the table below.

**Table 1. Analysis of strategic factors.**

Weighted Score	Grading	Weight	Indicator
0.756	3	0.252	S1 possibility of attracting foreign investors to increase security
0.660	3	0.220	S2 possibility of creating a passenger maritime transport system with Caspian littoral countries
0.536	4	0.134	S3 proper location and establishment of fire stations
0.507	3	0.169	S4 the presence of schools and mosques in neighborhoods for support in times of crisis
0.472	4	0.118	W1 lack of proper urban transportation network considering defense fundamentals
0.324	4	0.081	W2 considering uses for the construction of multipurpose shelters
0.264	2	0.132	W3 lack of adequate and appropriate public education of citizens on defense issues
0.392	2	0.196	O1 the possibility of increasing Iran's exports to Caspian littoral countries via Anzali
0.260	2	0.130	O2 the existence of a common water border and the possibility of communication with the countries bordering the Caspian Sea
0.228	3	0.076	O3 climate and living conditions
1.604	4	0.401	T1 possibility of using the underground level of buildings according to sea level
0.360	3	0.120	T2 the presence of military centers in urban areas and residential areas (target cluster)
0.280	2	0.140	T3 appropriate economic, political, etc. relations with neighboring countries with maritime borders



**Fig. 9. Comparison of strategic factor scores.**

Table 1 and Fig. 9 show that among internal factors, the possibility of attracting foreign investors to increase security, the possibility of creating a passenger maritime system, and the appropriate establishment of fire centers are considered key strengths that reduce the risk of sudden threats. On the other hand, the weakness in the urban transportation network, considering the principles of passive defense, the lack of consideration of uses for the construction of multipurpose shelters, and the dilapidated texture of most city neighborhoods are among the most fundamental weaknesses that can become a threat in the event of an attack. They severely reduce the city's emergency response capacity, and on the other hand, not considering the use of shelters is contrary to the clauses of Chapter 21 on the design of safe multi-purpose spaces.

Increasing exports through the water border, as well as the existence of a common border with the Caspian littoral countries, and the climate and living conditions, are strategic opportunities that, if managed properly, can help strengthen the city's defense infrastructure and increase its resilience.

At the same time, the impossibility of subsurface development due to high groundwater levels, and the lack of proper development of economic, political, and social relations with neighboring countries with shared water borders, lead to a decrease in regional cooperation and a limitation of cooperative capacities in managing threats. On the other hand, the presence of military centers and barracks in the city's residential area, due to their becoming a target cluster, can greatly increase the vulnerability of nearby settlements in times of crisis.

### 3.1.3 | Extracting strategies

Extracting strategies from the SWOT matrix involves combining internal factors (strengths and weaknesses) and external factors (opportunities and threats) to formulate an appropriate strategy.

This process helps to identify the relationships between these factors and select the optimal strategy. Then, based on the relationship analysis, we select one or a combination of four strategies: Offensive strategies SO, contingency strategies ST, adaptive strategies WO, and defensive strategies WT [10].

**Table 2. Strategy scorecard.**

Internal Factors		External Factors	
Strength of S 3.028	Weakness of W 2.841	Opportunity O 1.992	The threat of T 2.841
A combination of factors			
SO Offensive Strategy 5.020	WT defensive strategy 5.682	ST contingency strategy 5.689	WO Adaptive Strategy 4.833

**Table 3. Offensive, contingent, adaptive, and defensive strategies.**

ST Contingency Strategies: Use Strengths to Avoid Threats	SO Offensive Strategies: Exploit Opportunities by Leveraging Strengths
Gradual transfer of military centers from urban areas to non-residential areas and change of use of the freed spaces to defense support spaces	Taking advantage of the geographical location of Bandar Anzali to develop exports and imports in normal and critical conditions
Using the capacity of military bases and the city's natural location to confront potential threats and protect sensitive centers	Attracting foreign investors to develop safe and multipurpose defense infrastructure
Attracting private investors to build multipurpose spaces with priority given to building floating platforms. Using the capacity of schools and mosques to support, aid, and shelter people in times of crisis	Developing regional cooperation with Caspian Sea countries to increase resilience and logistical support. Establishing a passenger maritime transport system to enhance economic, political, and social relations with countries with a common water border.

Table 3. Continued.

<b>WT Defensive Strategies: Reduce Weaknesses and Avoid Threats</b>	<b>WO Adaptive Strategies: Eliminate Weaknesses by Taking Advantage of Opportunities</b>
Developing a comprehensive urban regeneration plan with a passive defense approach to retrofit worn-out structures and infrastructure	Improving urban transportation infrastructure and access networks using investor support and national resources
Utilizing new technologies such as modular surface shelters, early warning systems, and cyber defense to compensate for the weakness of underground infrastructure	Renovating dilapidated urban structures and building multipurpose shelters by utilizing the capacity of regional interactions
Applying strict construction regulations in areas with high elevations and optimal distribution of land uses	Promoting public and specialized education and awareness about passive defense with regional and international cooperation.  Designing and developing a knowledge-based model for urban passive defense in collaboration with universities and specialized institutions

Table 4. Scoring of SO offensive strategies in the QSPM matrix.

SO4	AS	SO3	AS	SO2	AS	SO1	AS	Weight	Factor
0.900	4	0.775	3	0.775	3	0.775	3	0.225	S1
0.880	4	0.660	3	0.660	3	0.660	3	0.220	S2
0.268	2	0.268	2	0.268	2	0.134	1	0.134	S3
0.169	1	0.169	1	0.338	2	0.169	1	0.169	S4
0.472	4	0.354	3	0.472	4	0.354	3	0.118	W1
0.243	3	0.243	3	0.324	4	0.162	2	0.081	W2
0.132	1	0.132	1	0.264	2	0.132	1	0.132	W3
0.348	3	0.232	2	0.232	2	0.348	3	0.116	O1
0.390	3	0.390	3	0.390	3	0.390	3	0.130	O2
0.228	3	0.228	3	0.228	3	0.228	3	0.076	O3
0.802	2	0.802	2	1.604	4	0.401	1	0.401	T1
0.240	2	0.360	3	0.240	2	0.240	2	0.120	T2
0.420	3	0.280	2	0.560	4	0.420	3	0.140	T3
5.732		5.053		6.569		4.653			Total points

Table 5. Scoring of WO adaptive strategy in QSPM matrix.

WO4	AS	WO3	AS	WO2	AS	WO1	AS	Weight	Factor
0.225	1	0.450	2	0.775	3	0.775	3	0.225	S1
0.440	2	0.440	2	0.660	3	0.660	3	0.220	S2
0.268	2	0.268	2	0.536	4	0.134	2	0.134	S3
0.169	1	0.507	3	0.338	2	0.169	1	0.169	S4
0.354	3	0.236	2	0.354	3	0.472	4	0.118	W1
0.162	2	0.081	1	0.324	4	0.162	2	0.081	W2
0.528	4	0.528	4	0.264	2	0.132	1	0.132	W3
0.116	1	0.116	1	0.348	1	0.348	3	0.116	O1
0.260	2	0.260	2	0.260	2	0.390	3	0.130	O2
0.152	2	0.152	2	0.152	2	0.228	3	0.076	O3

**Table 5. Continued.**

WO4	AS	WO3	AS	WO2	AS	WO1	AS	Weight	Factor
1.206	3	0.802	2	1.604	4	0.802	2	0.401	T1
0.360	3	0.360	3	0.480	4	0.360	3	0.120	T2
0.240	2	0.280	2	0.420	3	0.420	3	0.140	T3
4.597		4.560		6.263		5.326			Total points

**Table 6. ST contingency strategy scoring in the QSPM matrix.**

ST4	AS	ST3	AS	ST2	AS	ST1	AS	Weight	Factor
0.225	1	0.900	4	0.225	1	0.225	1	0.225	S1
0.220	1	0.880	4	0.220	1	0.660	3	0.220	S2
0.402	3	0.402	3	0.402	3	0.134	2	0.134	S3
0.676	4	0.169	1	0.169	1	0.169	1	0.169	S4
0.354	3	0.354	3	0.236	2	0.236	2	0.118	W1
0.243	3	0.324	4	0.243	3	0.162	2	0.081	W2
0.396	3	0.264	2	0.264	2	0.528	4	0.132	W3
0.116	1	0.116	1	0.116	1	0.232	2	0.116	O1
0.130	1	0.260	2	0.390	3	0.390	3	0.130	O2
0.152	2	0.228	3	0.152	2	0.228	3	0.076	O3
1.203	3	1.604	4	1.203	3	0.802	2	0.401	T1
0.360	3	0.360	3	0.240	2	0.360	3	0.120	T2
0.140	1	0.420	3	0.420	3	0.420	3	0.140	T3
4.697		6.081		4.360		4.840			Total points

**Table 7. Evaluation of the WT defensive strategy using the QSPM matrix.**

WT3	AS	WT2	AS	WT1	AS	Weight	Factor
0.900	1	0.225	3	0.225	1	0.225	S1
0.880	1	0.220	1	0.660	2	0.220	S2
0.402	2	0.402	3	0.134	3	0.134	S3
0.169	1	0.169	2	0.169	3	0.169	S4
0.354	1	0.236	1	0.236	3	0.118	W1
0.324	4	0.243	4	0.162	4	0.081	W2
0.264	2	0.264	3	0.528	1	0.132	W3
0.116	1	0.116	1	0.232	2	0.116	O1
0.260	2	0.390	2	0.390	2	0.130	O2
0.228	4	0.152	4	0.228	3	0.076	O3
1.604	4	1.203	4	0.802	4	0.401	T1
0.360	4	0.240	4	0.360	4	0.120	T2
0.420	1	0.420	2	0.420	1	0.140	T3
4.572		5.697		5.448			Total points

To determine the priority of strategies from the QSPM matrix, it is sufficient to look at the total TAS attractiveness score. The higher this number, the greater the attractiveness and the higher its implementation priority [9].

**Table 8. Prioritization of the top eight strategies based on the QSPM matrix scorecard.**

Score	Strategy
6.569	SO2 attracting foreign investors to develop defense infrastructure
6.263	WO2 renovation of dilapidated structures and construction of multipurpose shelters
6.081	ST3 attracting private investors to build multipurpose shelters
5.732	SO4 establish a passenger maritime transport system to enhance relations with Caspian littoral countries.
5.697	WT3 utilizing new technologies such as modular surface shelters and warning systems
5.448	WT2 improving urban transportation infrastructure by attracting capital
5.326	SO3 develop regional cooperation with Caspian Sea littoral countries
5.053	ST1 gradual transfer of military centers from urban areas to non-residential areas

The results of the QSPM matrix showed that the SO2 strategy, with a final score of 6.569, had the highest attractiveness score among other strategies. This strategy refers to attracting private sector investment and utilizing its capacity to upgrade passive defense infrastructure in the region. In a situation where limited government resources and weak infrastructure are considered serious challenges in implementing defense policies, private sector participation can be an effective solution for financing the retrofitting of critical facilities and the construction of multi-purpose surface and semi-surface shelters in accordance with Section 21 of the national building regulations. Also, utilizing the technical capacity, innovation, and productivity of the private sector can accelerate the implementation process. This strategy is very practical and implementable, especially in a region like Bandar Anzali, which has high investment capacities in the fields of tourism, logistics, and trade. Combining economic opportunities with security requirements will provide a safe and sustainable development path for the city.

The WO2 strategy was recognized as the second most attractive strategy in the QSPM matrix with a final score of 263.6. This strategy emphasizes renovation of dilapidated structures with priority for the dispersion of sensitive uses and the creation of safe multipurpose spaces (multi-storey parking, sports halls and commercial centers as surface shelters). In Bandar Anzali city, much of the city's central and old fabric has infrastructure problems, narrow streets, and limited access for emergency and military vehicles. This can severely challenge the process of emergency evacuation, relief, and crisis control in times of threats or crises (whether military, natural, or industrial).

Implementing this strategy, with the aim of reducing the vulnerability of dense and degraded areas, is important in several ways:

- I. Improving accessibility in critical areas of the city.
- II. Increasing the speed of emergency evacuation of residents in times of threat.
- III. Reducing the likelihood of road blockages following incidents.
- IV. Possibility of deploying defense or relief equipment in strategic locations.
- V. Reducing damage and human casualties from attacks.

Since there is currently a mismatch between urban renewal plans and passive defense requirements in Anzali, this strategy can be a bridge between urban planning and security policies. The dilapidated fabric, as one of the most important internal weaknesses and at the same time exposed to direct threats, requires redesign with a safety and resilience approach.

If we set the goal of urban construction management in Bandar Anzali in line with the principles and goals of passive defense, as well as in accordance with Section 21 of the national building regulations, and considering the conditions of Bandar Anzali (geopolitical, climatic, economic, dilapidated texture, etc.), the table below can be a perspective for these goals.

**Table 9. Passive defense objectives in urban construction management of Bandar Anzali.**

<b>Application in Bandar Anzali</b>	<b>Connection with Topic 21</b>	<b>Target Category</b>	<b>Target Category</b>
Camouflage of port and military facilities against air and sea threats	Architecture: Camouflage and covering design	Reducing enemy identification and targeting capabilities	Security
Strengthening military bases and cooperation with Caspian littoral countries	Urban planning: Safe distribution of uses	Promoting deterrence and sustainable security	Security
Creating integrated passive defense management in Bandar Anzali Municipality	Urban development: urban crisis management	Improving knowledge and management systems in crisis situations	Managerial
Cyber security of Anzali Port and Free Zone	Urban planning: Safe distribution of uses	Securing infrastructure against soft threats	Infrastructure
Retrofitting dilapidated structures and sensitive buildings such as hospitals	Structure: Explosion-proof design	Reducing the vulnerability of facilities and human resources	Infrastructure
Protecting port infrastructure to continue exports and imports	Structure: Explosion-proof design	Preservation of national assets	Economic
Creating floating shelters for crisis support	Architecture: Multipurpose spaces	Maintaining the ability to continue activities and services	Operational
Using geographic location to deceive the enemy (such as camouflaging facilities)	Architecture: Deception and cover design	Taking the initiative away from the enemy and creating difficult conditions	Military
Using indigenous technologies to reduce defense costs	Facilities: Use of local materials	Savings in weapons and manpower costs	Economic
Public passive defense training for the readiness of Bandar Anzali citizens	Urbanization: Reducing people's vulnerability	Increasing the threshold of popular resistance against invasions	Social
Designing false structures in port areas to mislead the enemy	Architecture: Deception design	Imposing costs on the enemy with deceptive goals	Military
Strengthening coastal defense infrastructure considering the location of the Caspian Sea	Structure: Resistance design	Increasing the country's defense capabilities	Defensive
Scattering of production infrastructure in Bandar Anzali and the free zone	Urbanization: Proper distribution of population and services	Distribution of wealth and capital in territorial space	Economic
Protecting Anzali Port as a commercial gateway to the north of the country	Urban planning: Ensuring continuity of functions	Maintaining the country's territorial integrity, national security, and independence	National

In summary, it can be said that the city of Bandar Anzali faces a set of potential threats due to its geopolitical location, specific climatic characteristics, and the establishment of important military and economic institutions, while having extensive opportunities for the development of passive defense.

A detailed analysis of these characteristics is of fundamental importance in formulating preventive, reactive, and deterrent passive defense strategies in this city. According to the research findings, the most important challenges facing Bandar Anzali in the field of passive defense include the following:

- I. Lack of comprehensive and updated plans in the field of passive urban defense.
- II. Deterioration of critical infrastructure, especially in the fields of energy, transportation, and communications.
- III. Lack of a clear mechanism for coordination between local institutions, the military, and urban management.
- IV. Environmental threats, including coastal erosion and pollution of water resources.
- V. Possibility of cyberattacks on critical facilities such as ports, traffic control centers and distribution networks.
- VI. High population density in some residential areas without access to safe shelters.

## 4 | The Findings

The city of Bandar Anzali, as one of the most important coastal and port cities in the country, has specific geographical, economic, and infrastructure characteristics that make it vulnerable to various threats, especially military and man-made threats. Considering the economic and infrastructural role of the Anzali Free Zone in urban development, its effects on the city's resilience against new man-made and military threats have been analyzed and evaluated. According to SWOT analysis, the most important strengths of this city are the existence of port infrastructure, water transportation capabilities, and access to international markets. On the other hand, the most important weaknesses are the lack of comprehensive passive defense plans, the deterioration of some critical facilities, and the lack of coordination between responsible institutions.

Opportunities such as investing in water transportation, developing resilient tourism areas, and utilizing new technologies to increase urban safety can play an important role in promoting urban resilience.

Overall, the strategies developed through the QSPM matrix show that prioritizing actions in the field of infrastructure renovation, public education, developing safe havens, and establishing an early warning system are among the most important steps towards strengthening passive defense in Bandar Anzali.

Given the new man-made and military threats, passive defense strategies were reviewed to increase urban resilience against these threats. For example, strategies related to the construction of floating shelters and the development of water transportation aimed at countering military and man-made threats were strengthened and prioritized in the QSPM matrix.

With a general conclusion from the analyses and evaluations conducted using SWOT and QSPM models, the following results are presented regarding passive defense in Bandar Anzali city:

### 4.1 | Construction of Floating Platforms and Shelters as a Complementary and Innovative Option in Vital Coastal Points

Hardened surface shelters, such as large bus stops, multi-storey car parks, or sports halls, can serve as multipurpose shelters. Prefabricated modular concrete structures, which are manufactured in the workshop and installed on site, are also capable of withstanding moderate blast pressures with insulation and backfilling [11].

Creating emergency escape routes (longitudinal protective corridors) along urban lines and semi-buried structures on artificial hills are other proposed solutions that are coordinated with the city form and reduce the need for transportation in a crisis. The use of multi-purpose surface and semi-surface shelters (multi-storey parking lots equipped with prefabricated concrete walls resistant to blast waves, sports halls, and dual-use local markets) is a completely realistic option that is in harmony with the climatic and geological conditions of Bandar Anzali due to its speed of implementation, lower cost, and no need for deep excavation. This strategy, emphasizing the public-private partnership model, is fully operational and in line with the cost-benefit principle and can reduce a significant part of the government's financial burden. Considering the limitation of constructing underground shelters in Bandar Anzali due to the high groundwater level, resilient floating platforms are proposed as an innovative and locally compatible solution. These structures, which are

made of precast concrete or stainless steel and anchored with advanced anchors, are resistant to climatic and military threats.

Due to cost-benefit considerations and population capacity limitations, the floating platform is proposed only as a supplementary and emergency option in very critical coastal locations (general ports authority and naval base). The use of indigenous materials, such as moisture-resistant concrete, can reduce construction costs. Successful global examples of this approach include floating homes in Amsterdam; in Japan, tsunami-resistant platforms are deployed in ports as emergency shelters; and in Malaysia, floating relief platforms are deployed in Sarawak to distribute aid and provide temporary shelter.

**Table 10. Challenges and solutions for floating platforms.**

Solution	Challenge
Construction with local materials, production in the form of a pilot project	High initial cost
Dual-purpose design and urban camouflage (such as a recreational or environmental station)	Protection in peacetime
Location near crowded routes and emergency ramp design	Quick access in a crisis

**Table 11. Proposed risk assessment for the use of floating platforms.**

Risk Reduction Solution	Possible Risk	Solution
Use of advanced anchors and hydrodynamic design	Instability in a storm	Floating platforms
Regular dredging and alternative routes	Water blockage in roads	Water transport

## 4.2 | Development of a Multi-Route Emergency Transportation Network (Land + Sea)

Considering the linear and dense texture of Bandar Anzali and the presence of natural waterways such as the Anzali Wetland and local rivers, developing an emergency water transportation network is an effective solution to reduce pressure on land routes and facilitate population evacuation in crisis situations.

The system consists of light boats with a capacity of 15-20 people and small piers at key points such as Anzali Bazaar, Motahari Street, and near the lagoon. The network can be integrated with tourism and environmental protection and can serve as a tourist attraction or local transportation route in peacetime [12]. Global examples of this approach include the water transport system of Venice, Italy, which uses small boats and small piers for emergency transportation during floods. In Malaysia, relief boats in Sarawak are used to evacuate and distribute aid in flooded areas.

In Bandar Anzali, setting up a small fleet of 10 boats and 5 berths (estimated cost: 300000\$-500000\$) is feasible within 12 months. These boats should be semi-enclosed, diesel or electric powered, and designed to withstand light waves. Maintenance at fixed or floating berths and regular dredging of waterways are essential to ensure accessibility.

**Table 12. Water transport implementation challenges and considerati.**

Suggested Solution	Challenge
Dredging, environmental cleanup, and defining specific routes	Obstruction or pollution of waterways
Design of a fleet of small motorized or electric boats (with a capacity of 10-20 people)	Need for light floating equipment
Building small docks at key points, steps or safe ramps	Public access to waterways
Public education, installation of rescue equipment, local warning system	Safety in crisis

This system in Bandar Anzali can ensure rapid and safe evacuation of the population in times of crisis by creating boat stations in densely populated areas (such as Anzali Bazaar and Motahari Street) and connecting to floating shelters.

Integrating this network with environmental and tourism activities, such as the revival of traditional boating occupations, can strengthen the economic and social sustainability of the project.

### **4.3 | Compliance with Safe Urban Design Criteria**

The linear structure of Anzali city-safe areas should be defined and networks should be reviewed and modified with the aim of guiding the population to safe areas in times of crisis.

If possible, relocate vital, sensitive, and important infrastructure, such as important military and relief centers, to places with appropriate privacy around them.

- I. Compliance with national building regulations, topic 21.
- II. Avoiding the use of additional elements in buildings.
- III. Minimum use of glass in facades and reconstruction of urban physical elements.
- IV. Creating a hierarchy of open spaces across the city.

### **4.4 | Worn Texture**

The old, worn-out, and dense urban fabric poses a risk of collapse and blockage of streets, and the following measures should be put on the agenda:

- I. Strengthening structures against explosion, fire and vibration.
- II. Mandatory second emergency exit for high-traffic buildings.
- III. Prohibition of the use of heavy materials, glass, and extension facades in public spaces.

Old neighborhoods with narrow alleys in Anzali should be a priority for reconstruction, improvement, and implementation of topic 21.

### **4.5 | Humidity and Rainfall**

High humidity due to proximity to the sea and humid winds increases the likelihood of decay of vital equipment and fires on metal surfaces or wiring, resulting in fires and explosions near densely populated areas, and the following measures should be on the agenda of city managers. Use of slow-burning, moisture- and salt-resistant materials in the facade and skeleton design of independent fire extinguishing systems in buildings above 3 floors protect gas tanks, fuel, electrical equipment and cables against moisture, sparks or leaks

### **4.6 | Securing Dangerous Centers**

In the city of Bandar Anzali, due to specific environmental characteristics, including high groundwater levels, high humidity, dilapidated infrastructure, and the establishment of military centers in the urban context, full and precise implementation of Section 21 of the national building regulations is vital as part of passive defense policies.

Adapting the principles of this topic to local conditions, including the development of surface shelters, the reinforcement of buildings, the dispersion of vital centers, and the imposition of construction restrictions in sensitive areas, are among the executive requirements of crisis management and urban safety. There are several gas stations in the central area of Anzali that could become secondary bombs in an attack or crisis.

- I. Minimum distance from residential and busy areas.
- II. Design with protection against blast wave and danger radius.
- III. Safe placement of electrical, gas, and utility panels on lower or isolated floors.

#### 4.7 | Decentralization of Sensitive Centers

In particular, the presence of military centers in the urban context can be a potential target cluster, and the following measures are recommended for decentralization:

- I. Mandatory dispersion of sensitive and vital centers and their non-concentration in residential areas.
- II. Rational dispersion of fuel facilities, hazardous materials warehouses and sensitive centers by creating a standard protective zone (at least 800 meters from densely populated residential areas).
- III. Deployment of sensitive facilities in multiple layers of protection.
- IV. Naval bases and military centers located in residential areas should either be relocated or be reinforced in accordance with defensive protection principles.
- V. Design and construction of urban furniture in the middle of the square and pedestrian centers around the square to allow people to take refuge in terrorist and military attacks.
- VI. Development of a model of self-reliant neighborhoods in wartime conditions.
- VII. Strengthening integrated physical and cyber protection of ports and critical facilities using visual camouflage systems, optical deception, blast wave protective walls, and native cyber surveillance.
- VIII. Repainting cranes, silos and port walls with multispectral camouflage patterns (similar to the sea surface in satellite images).
- IX. Installing 3D camouflage nets and thermal coatings on fuel tanks and naval ammunition depotsIndigenously compatible blast wave protection walls.
- X. Native cyber-physical monitoring and warning system.

### 5 | Conclusion

The main objective of this research was to conduct a strategic analysis of passive defense in the urban construction management of Bandar Anzali using SWOT and QSPM models and relying on intentional man-made threats. The research results show that the linear and elongated structure of the city, population concentration in the coastal area, the strong dependence of the access network on a small number of axes, and the deployment of critical infrastructure in the vicinity of the coast make Bandar Anzali significantly vulnerable to modern military threats, including remote-controlled attacks, drone attacks, cyber disruption, and disruption of urban infrastructure. The SWOT analysis showed that the city's most important weaknesses in the field of passive defense include the limited possibility of creating subsurface shelters near the sea, the inadequate network of safe evacuation routes, the deterioration of parts of urban structures, and the lack of alternative plans for the continuity of essential services.

On the other hand, the existence of coastal capacities for emergency logistics, the possibility of utilizing water transportation in crisis situations, and the special position of Bandar Anzali in the defense system of the north of the country are considered reliable opportunities.

In the next step, the QSPM matrix was used to prioritize the extracted strategies. The quantitative assessment results showed that the strategies of strengthening the resilience of the access network.

Through the design of safe and multi-path routes, promoting passive defense principles in the renovation of inefficient textures, Using maritime transport capacity to support safe evacuation and relief efforts, and increasing physical and cyber protection of critical infrastructure have the highest weight of appeal.

At the same time, solutions such as supplementary use of floating platforms or offshore structures for emergency services are only recommended as a complementary option and not as the main strategy, because capacity constraints and cost-benefit analysis do not justify their widespread use. Accordingly, the present study shows that focusing on increasing the resilience of urban networks, strengthening critical infrastructure, developing secure access, and employing indigenous technologies for passive defense are the main paths to improving urban security in Bandar Anzali. The proposed strategies focus directly on intentional man-made threats and can be used as input for urban and defense planning at operational levels.

Overall, the results show that integrating the requirements of Section 21 of the National Building Regulations into the cycle of licensing, high-level supervision, and acceptance of completed buildings, along with revising the city's master plan with a passive physical defense approach, is the most important key to increasing Bandar Anzali's resilience against new intentional man-made threats.

## Acknowledgments

The authors would like to express their sincere gratitude to all academic experts, researchers, and professionals who contributed valuable insights and constructive comments during the development of this study. Special appreciation is extended to colleagues and specialists in the fields of industrial engineering, accounting, artificial intelligence, and economic resilience for their support and guidance throughout the research process. The authors also acknowledge the support provided by their affiliated institutions in facilitating this research.

## Author Contributions

Conceptualization, M.G. and M.I.; Methodology, M.G.; Software, M.G.; Validation, M.G. and M.I.; Formal analysis, M.G.; Investigation, M.I.; Resources, M.I.; Data curation, M.G.; Writing—original draft preparation, M.G.; Writing—review and editing, M.I.; Visualization, M.G.; Supervision, M.I.; Project administration, M.G. All authors have read and agreed to the published version of the manuscript.

## Funding

This research received no external funding.

## Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request. No publicly available datasets were generated or analyzed during the current study.

## Conflicts of Interest

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analysis, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

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