International Journal of Architecture and Urban Development
Vol. 13, No.2, P39-52 . Spring 2023

E-ISSN 2345-2331
Applied Research Article
DOI: 10.30495/IJAUD.2022.66041.1589

Comparative Study about Two Utopias from Passive Defense Perspective (Case Study: Howard's Garden City and Mata's Linear City)

[1]Hassan Ahmadi, [2]Behzad Abbasi Kharajou, [3]Masoud Rafiei*

[1] Department. of Urban Planning, Faculty of Architecture and Art, University of Guilan, Rasht, Iran.*

[2] Department. of Urban Planning, Faculty of Architecture and Art, University of Guilan, Rasht, Iran.

[3] Department of Occupational Health, Faculty of Health, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.

Recieved 19.02.2022; Accepted 22.09.2022

ABSTRACT: The principles of passive defense in cities will contribute to the development of sustainable security in urban areas, and failure to comply with these principles will increase human casualties and economic losses, especially in times of crisis. Improving and correcting urban structures can mitigate potential damage incurred during a crisis. The purpose of this study is to compare the concept of Garden City proposed by Howard and Mata's Linear City through the standpoint of passive defense with a view of urban structure. Data collection was performed using library resources. Each approach's strengths and weaknesses were investigated, including centrality, accessibility, and land use dispersion. The results of the study exhibited that the centrality principle in Mata's Linear City concept is superior to Howard's garden city, while the principles of accessibility and dispersion of land use take priority in Howard's garden city.

Keywords: *Passive Defense, Urban Structure, Ebenezer Howard's Garden City, Soria y Mata's Linear City.*

INTRODUCTION

In the late nineteenth and early twentieth centuries, urban thinkers came up with different ideas to respond to urban problems, including Soria y Mata's Linear City and Ebenezer Howard's Garden City, which resulted in the design and planning of several cities, including Letchworth Garden City in England and Linear City of Madrid in Spain.

Mata's idea of a Linear City re-sembles a triangle due to its development along the main axes, and Howard's Garden City is in the form of concentric rings with parks lying at the center of the green spaces. Each of these ideas includes characteristics in the urban structure, which can induce different reactions during a crisis.

In 1970, Ian Morison explored the growth of linear cities over many years by examining Soria Mata's Linear Urban design. This study explored various dimensions of linear cities and the evolution of linear city plans concerning the transformation of transportation systems over 80 years in Spain and the United States (Morison, 1970).

Various studies have explored Howard's Garden City and Mata's Linear City. In 1986, Freestone argued that the concept of a garden city in urbanization was chiefly known for the ideas of Raymond Unvin in theory and practice rather than Howard's concept, and they had exerted a substantial effect around the world. This study examines one aspect of garden city development in Australia over three decades and discusses the essence of the British urban view and its adaption abroad, particularly in Australia. In this study, design ideas such as green belts are conceptually examined in the five main centers of Australia and Canberra. The findings of this study emphasized the relative importance of the garden city concept for metropolitan planning during the study period and promised further prominence in subsequent years (Freestone, 1986).

In another study, Schubert studied the German garden city of Fritsch. This garden city was set forth two years before Howard's garden city was presented. This study explored Fritsch's claims, focusing on people's views of the garden city, and comparing the nature of Howard and Fritsch's garden landscapes. In this study, the idea of Fritsch's garden city became a key planning element for urban planning and national socialism. The idea led to the reconciliation of divergent approaches in a spatial structure model. Howard's garden city, however, was based on social criticism and reforms. The urban garden structure

*Corresponding Author Email: hamed@guilan.ac.ir

generally implied subtle points that complicated its evaluation (Schubert, 2004).

In a paper titled "The Amazing Garden City and New Urban Planning, " conducted in Taiwan in 2010, Wang explored planning paradigms. Howard's garden city concept inspired this study. Its main purpose was to demonstrate the historical context, process, and results of implementing the Garden City planning paradigm in post-war Taiwan (Wang & Heath, 2010).

In a 2016 article titled "From Garden City to Urban Environment: An Attempt for Nurture Sustainable Neighborhood," Sharifi explored five urban movements, including Garden City, Neighborhood Unit, Modernism, Neo-traditionalism, and Eco urbanism. The results exhibited that the evolution of neighborhood planning could be described by the progressive incorporation of different aspects of sustainability. However, many barriers still exist to translating these concepts into practice (Sharifi, 2016).

Shadar compared two linear cities in the UK and Israel and found a drastic difference between the British and Israelite cities. This article delved into the differences between urban planning models in different cultures and focused on presenting an urban character to new cities. This study argued that the ideology of urbanization was the underlying notion behind the linear city model, which had surprisingly maintained the vitality of the city for years (Shadar, 2016).

This study aims to compare Soria Mata's Linear City and Ebenezer Howard's Garden City from the perspective of passive defense in terms of urban structure to diminish damage in crisis conditions. On the other hand, the question is, "Which of these two urban structure ideas is more compatible with the principles of passive defense and can minimize vulnerability?

MATERIALS AND METHODS

Foundations of Theoretical Research

From the urban planners and managers' point of view, different variables have been proposed based on the passive defense perspective, which are as follows:

1- Urban structure;
2- Urban texture;
3- Urban land use and their distribution in the spatial structure of the city and population distribution;
4- Different types of physical forms and urban fabrics;
5- Spatial positioning and planning (Kamran et al., 2014).

Among the variables mentioned above, the urban structure is of special importance; therefore, in this study, the above two ideas are evaluated along with the urban structure.

Urban Structure

The urban structure is a general concept used in German cities in the 1960s for the first time and then introduced in the concept of urban ecology. This concept is related to the urban spatial structure, which includes the order of public and private space in cities and the density and connection of its constituent elements. The main arteries of transport and open space are some of these structures(Lehner & Blaschke, 2019; Réquia Júnior et al., 2015) . Figure 1 illustrates the concepts of urban structure.

The Role of Single-Center and Multi-Center Urban Structures

A multi-center or (and) single-center form(s) may be created due to the connection of different transport routes and their combination with each other in the city. Also, each of them has different characteristics, as polycentric forms have the potential to achieve more sustainable forms. This kind of urban

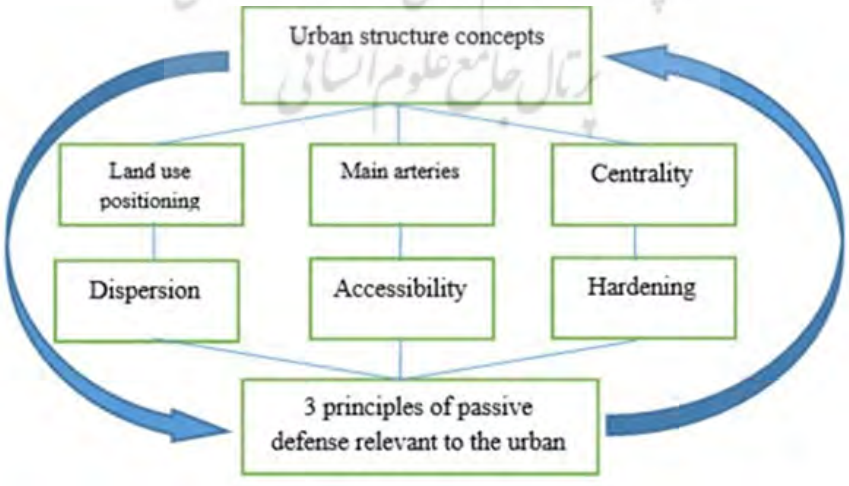

Fig.1: Concepts and principles of passive defense in urban structure

structure is crucial in determining the city's vulnerability to various disasters. In contrast with this urban structure, a single-center form emerges in the radial system, and all concentrated activities are in one city district (Irajifar et al., 2016).

Concerning Howard's Garden city, because most of the activities lie in the urban center, it is classified as a single-center city (Howard, 2006), while Mata's Linear city is considered a multi-center city because of its linear population distribution and activities throughout it. In addition to its longitudinal development, Mata's linear city connects the existing points cities so that the linear and the point cities form the sides and vertices of the triangle and build multiple centers (Tufek-Memisevic & Stachura, 2015).

The Role of Main Arteries

Transport networks are the main backbone of settlements. The resilience concept of road networks has been co nsidered due to the increasing emphasis on "just in time" production methods and reducing the consequences of hazards. Resilient networks emphasize the three basic aspects: improving access, increasing connectivity, and reducing the likelihood of network blockage, because efficient transport networks should facilitate the accessibility of relief facilities, carrying out rescue operations, and recovering after disasters (Aydin et al., 2018). Therefore, a road network is a vital element of crisis management in two respects: the adverse impacts of the crisis on the road network, alleviation of the damage caused by the crisis, and provision of services to the affected areas. There are three different types of transportation network systems:

1-Radial System: The streets branch off the central core. Development is possible in a confined manner with the extension of the streets or other peripheral radiuses. The networks are connected through a central core. The city is in the shape of a star. Most ancient cities with organic textures have this network system (Figure 2)(Gharib, 2021).

2- Ring system: In cities with a radial network, attempts are made to decentralize the network, and parts of the roads that connect radiuses in the form of narrow and minor roads in the old urban texture to transform them into wide, circular (ring) streets (Figure 3) (Gharib, 2021).

This concentric ring model distributes urban land uses between concentric rings; for instance, the Central Business District (CBD) is located in the middle of the model, and the city extends in rings with different land uses(Meyer, 2000).

3. Grid system: or Gridiron map, is a type of urban program in which streets intersect at appropriate angles to form a network. The Hippodamian map is in the context of ancient Greek culture (Cooney & Jackson, 1987). The design of the grid network has many nodes or lattice intersection networks marked by sections of short streets and frequent intersections(Figures 4 & 5). Integrating the features of flexibility and redundancy in the network provides better capabilities for adapting to side events and changing situations (Feliciotti et al., 2016).

The Role of Land Use Dispersion

According to the definition, dispersion is the distribution and decentralization of forces, equipment, facilities, and activities, which reduces their vulnerability (Ostad-Ali-Askari et al., 2018). The separation of land uses a crucial role during crises in cities and towns because of increasing the urban population and infrastructure safety and protection.

Land use planning is one of the most important in regulating and preventing new hazards; sincerely, land use planning can decrease the vulnerability of people and divergent amenities; this plan by identifying the best locations for various land uses such as residential areas, commercial, industrial and also, applying standards (Wehrmann, 2011).

Ebenezer Howard's Garden City

Howard's idea is the city as a concentric circle with six streets dividing it into equal parts. There is a public garden in the center of the circle, and several layers can be seen after it. The first layer includes public buildings that surround the public garden. The second layer is related to the roofed corridor where the shops are located for buying and selling. The third layer is a land that originally covers residential areas so that the

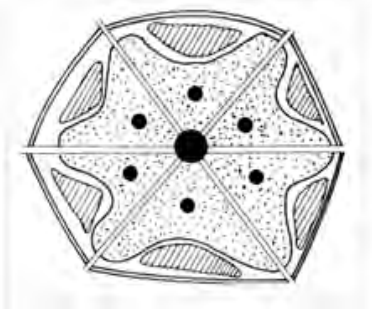

Fig. 2: Radial System

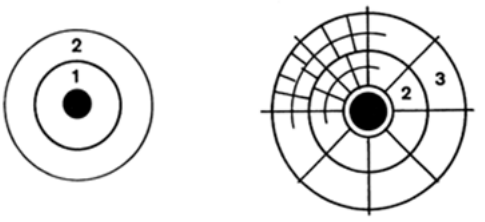

Fig.3: Ring system

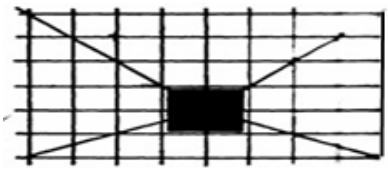

Fig. 4: Grid pathways with diagonal roads

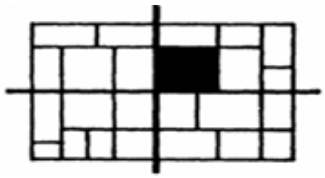

Fig. 5: Grid like system of pathways

"Great Street" passes from the middle of the mentioned land and divides it into two equal segments. In the last stage, he dedicates the fourth layer to industrial facilities, agricultural farms, and orchards that surround throughout the city(Gatarić et al., 2019; Moerman, 2020)(Figures 6 &7).

The area of Howard's city is 6,000 acres, with a thousand acres covering the garden city's population (30,000-32,000 people). He divided each city regarding historical, social, and social affairs (Howard, 2006), consistent with people's demands and environmental issues. He modified and improved the social and environmental model in the initial design (Fainstein & Defilippis, 2016).

Soria y Mata's Linear City Idea

The idea consists of the sides of a triangle with point cities being placed at the top of the triangle and linear cities on its sides. The industrial and agricultural areas and the rural areas are located within the triangles. In this layout, the main urban structure takes the form of a street at least 40 m in width alongside a green belt through which the train route has been anticipated. Residential homes are rectangular and trapezoidal, covering one-fifth of the city ground in a single unit. The residential areas are intersected with minor roads, and public transport routes are designed as underground and aerial routes (Ostrowski, 2017).

Soria Mata envisioned the linear model as a solution to industrial city problems, which was a complex linear project. It overcame transportation problems in a unified manner by inventing the principles of a linear city. As a result, he projected a city with integrated technology at a human scale (Figure 8) (Shadar, 2016). Table 1 Shows the Characteristics of Howard's Garden City and Mata's Linear City Layouts.

RESULTS AND DISCUSSION

Comparison of Howard's and Mata's Urban Structure in terms of centrality from the standpoint of passive defense (hardening principle)

Since Mata's idea of a Linear City develops linearly in the main accesses and connects the isolated cities, realizing this would lead to the creation of multiple urban centers. Howard's idea of a garden city, which has a radial pattern, comprises a single-centered structure. Informed by the importance and

Fig.6: Howard's Garden City

Fig.7: Welwyn –England Garden City Residential Plan in 1920

Fig.8: Soria Mata's Linear City Layout (Stachura, 2015, 191)

Table 1: Characteristics of Howard's Garden City and Mata Linear City (Ostrowski, 2017)

Theorist	City population	Residential plots area (m)	Structure	Centrality	Accessibility	Locating industrial and agricultural land uses
Ebenezer Howard (Garden City)	30000	234	Concentric circles	single-center	Radial	Outside the city limitS
Soria Mata(Linear City)	30000	400	Linear	Multi-center	Linear	Within the city limits

necessity of urban structure in passive defense from the multi-centered and single-centered perspective, one can consider the strengths and weaknesses of these two ideas in the face of natural and artificial crises.

Howard's Garden City in Terms of Centrality

In this concept, given the single-center form of the urban structure from the standpoint of passive defense, the hardening and resistance of the city deteriorates, and consequently, locating different land uses in the city center would exacerbate the vulnerability of the city. The reasons for this event are presented in Figures 9 and 10 and Tables 2 and 3.

In general, the drawbacks of single-centric cities in the face of natural and artificial crises from the outlook of passive defenses are listed in Table 3.

Mata's Linear City in terms of Centrality

In this idea, multiple urban centers are formed across the main access ways of the city, and the urban points are connected linearly, thereby enhancing urban hardening and stability from a passive defense approach. The main justifications for this concept are shown in Figure 11 and Tables 4 and 5.

In general, the advantages of multi-center cities in the face of natural and artificial crises from the standpoint of passive defense can be summarized in Table 5.

Howard and Mata's Urban Structure in Terms of the Road Network from the Standpoint of Passive Defense (Accessibility Principle)

Road network, as the main arteries of a city, plays a vital role in times of crisis. During disasters, these arteries facilitate the relief and quick response to diminishing vulnerabilities and losses. The importance of such arteries and their geometrical form are so intertwined that they cannot be separated from a passive defense perspective. It is because a timely response in times of crisis and relief activities depends entirely on the road

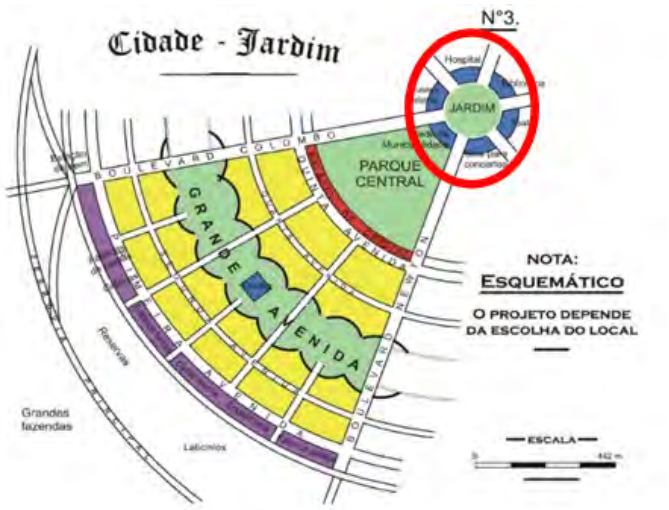

Fig. 9: Howard's Garden City in terms of centrality (Ostrowski, 2017, 38)

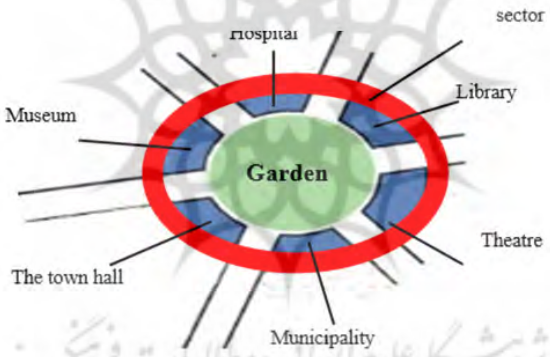

Fig.10: Central elements of Howard's Garden City (Ostrowski, 2017, 38)

Table 2: Causes of the Vulnerability of Howard's Garden City in Terms of Vulnerability from the Standpoint of Passive Defense

1	Hospitals at the center of medical use: A hospital is one of the vital lands used during a crisis to which everyone should have quick and convenient access; however, its concentration at the center of the city will increase spatial distance for all people in the society so that their inflow to the city center during a crisis would instigate chaos and disorder.
2	City theaters and public gardens can be used as safe and open zones during a crisis. Still, given their concentration in the downtown and adjacency to other uses, their access and security are restricted due to overcrowding during a crisis.
3	Business sector at the center: This sector provides various welfare services to people, but its function may be disrupted when the population flocks to this area during a crisis. This sector is amongst the zones highly vulnerable to disorder and turmoil in times of crisis.
4	City Hall: The city hall building as a command center would be vulnerable in times of crisis due to crowding, disorders, and possible post-crisis chaos if located in the city center and adjacent to other land uses.

Table 3: Drawbacks of single-centric cities from a passive defense approach

1	The concentration of facilities in a single area and escalating damage during crises would disrupt the city's core functions.
2	Inequitable distribution of equipment and facilities in the city hampers people in the community from adequate access in times of crisis.
3	The concentration of medical centers in central areas makes these places inaccessible to everyone in times of crisis.
4	High vulnerability of facilities and equipment at the city center due to high density (demographic, construction), land use adjacency, and domino disasters in times of crisis.

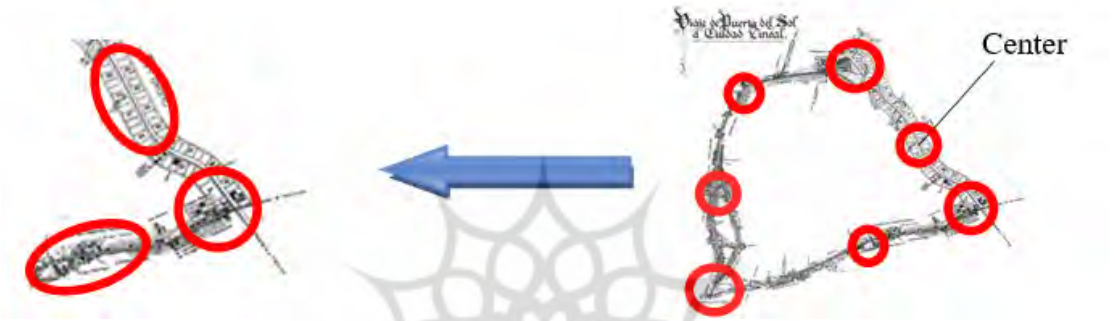

Fig.11: Mata's Linear City in Terms of Centrality (Ostrowski, 2017, 23)

Table 4: The Reasons for Hardening of Mata's Linear Urban Structure from Passive Defense Approach

1	Distribution of Facilities and Services at the City Level: Appropriate access to facilities and services for all members of society during a crisis reduces the damage incurred by the crisis.
2	Decentralization of facilities and equipment at the city level: With the decentralization and dispersion of facilities and equipment at the city level, urban resilience is improved during and after a crisis.
3	3 Distribution of population and activity across the city and existence of multiple centers across main routes: Low population density in urban centers and the distribution of activities across the city and centers during a crisis can diminish losses and casualties of the crisis.

Table 5: Advantages of multi-center cities from the standpoint of passive defense

1	Distribution of facilities and services across the city and proper access of people to facilities and services in times of crisis
2	Multi-centered structures with decentralization of facilities and equipment across the city reinforce resilience and endurance during a crisis.
3	Dispersion of population and activity across the city and multiple centers shrinks casualties during a crisis.

network in the cities. Given the importance of accessibility from a passive defense approach standpoint, the road networks in Howard's Garden City and Mata's Linear City can be examined in terms of their geometric structure.

Howard's Garden City in Terms of Accessibility

Howard's idea of Garden City comprises the main center from which important networks originate and divergent streets spread in the surrounding areas so that six main streets constitute the radial axes (Figure 12). In its general layout, in Howard's Garden City, circular rings encircle the center like a ring (Figure 12). These rings form the circular axes relative to each other and the overall shape of Howard's garden city (Figure 13). Circular axes are, in fact, the modified versions

of radial axes and can have a pivotal role in times of crisis by facilitating and expediting relief and rescue operations. Circular axes mediate between oblique access and radial axes, which decreases traffic and speeds up relief activities (Figure 13).

Given that circular and radial axes intersect in Howard's garden city, grid-like axes in each part of this garden city establish several nodes or intersections (Figure 14). These grid-like axes form trapezoidal blocks. Moreover, they split large blocks into smaller ones, enhance the permeability of the city, reduce distances, and increase the speed of relief operations. In general, Howard's garden city is composed of a circular-grid axis, which is particularly useful in the urban road network from the standpoint of passive defense. In addition, a major advantage of Howard's garden city in terms of rail access system is its connection to the neighboring metropolitans, which is crucial for ensuring safety and relief in passive defense.

The advantages of a structure with road networks (circular-grid) in Howard's Garden City from the outlook of a passive defense are presented in Table 6.

The Mata's Linear City in Terms of Accessibility

The most important factor in creating linear cities is their development along roads, routes, rivers, and beaches. Accordingly, Mata's Linear City expanded along the railroad and constructed linear cities along its path (Figure 15).

The road system in these cities consists of linear accesses and grids. These cities are subject to many limitations in access and relief, so they have been considered the weakest access points from the standpoint of passive defense and response during crises. These networks can substantially intensify vulnerability during crises and restrict relief and rescue efforts. Despite the weaknesses associated with accessibility in Mata's linear city, it has several strengths in Table 7.

The limitations of cities with (linear) road networks from the standpoint of passive defense in the face of natural and artificial crises are listed in Table 8.

Howard's and Mata's Urban Structure in termstermsand Use Dispersion from the Standpoint of Passive Defense

The dispersion of physical elements is one of the major aspects

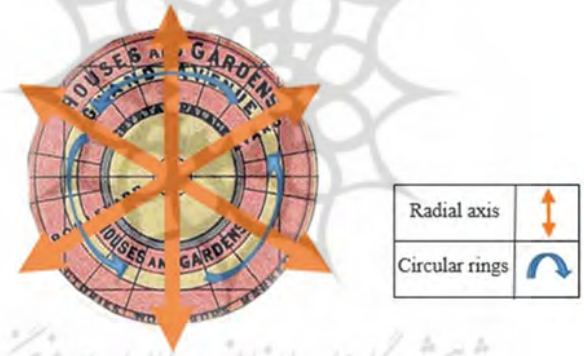

Fig.12: Radial axes and circular rings of Howard's Garden City (Abel , 2010, 21)

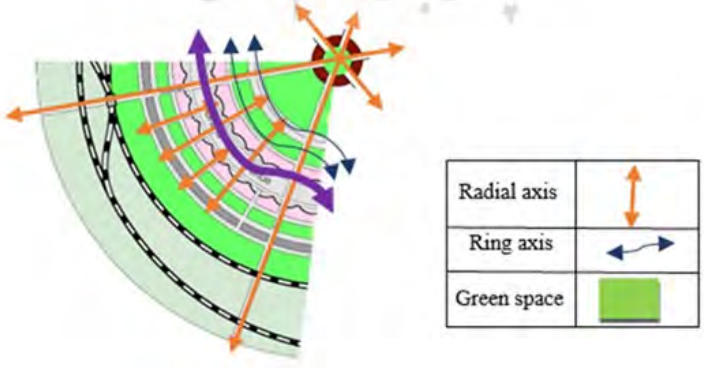

Fig.13: Howard's Garden City structure in terms of access centrality (Ostrowski, 2017, 38)

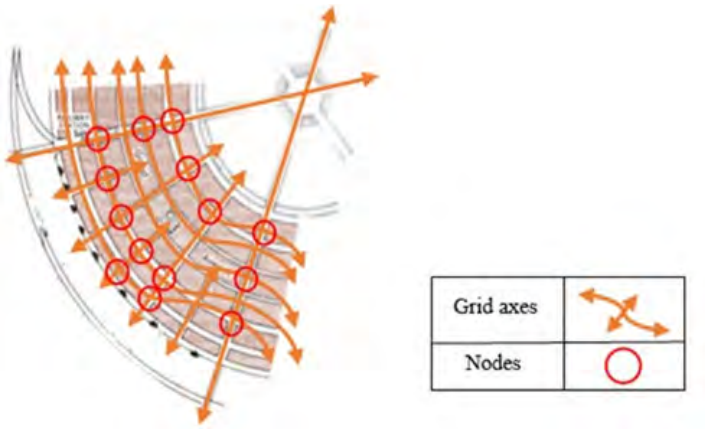

Fig.14: Grid axes and nodes in Howard's Garden City

Table 6: The advantages of Howard's Garden City Structure from the Outlook of Passive Defense

1	The radial axes leading to the center improve the legibility of the axles and expedite the relief operations.
2	Circular axes, as a mediator between radial and diagonal axes, distribute the traffic in other road networks, facilitating relief operations and curbing traffic problems.
3	The existence of small trapezoidal blocks on the grid axis increases permeability and accurate relief operations.

Fig. 15: The Axis of Mata's Linear City (Stachura, 2015, 191)

of passive defense. Proper positioning of these elements represents a crucial component of passive defense and greatly influences reducing the damage caused by threats. This section examines Howard's Garden City and Mata's linear city.

Howard's Garden City in Terms of Land Use Dispersion

In Howard's Garden City, land uses can be investigated in three parts, including:

1-Central (center land uses)

2. Middle (mid-layer land uses)

3. Exterior (exterior layer land uses) (Figure 17)

In the analysis of urban structure in terms of centrality, central land uses will be analyzed thoroughly. The following section will explain the middle and exterior land uses.

Middle Land Uses

The middle land uses in Howard's garden city include schools, residential areas, churches, and green spaces, with a large round street like a park (Boulevard) passing through residential areas. It divides residential areas into two circular sections (Figure 17).

The following points describe the positioning of land uses in Howard's idea from the standpoint of passive defense.

1. First, a cursory look at the middle land uses in Howard's garden city suggests that land uses in this area are perfectly compatible without any interference, and the principle of land use compatibility has been respected. It can be of utmost importance from the standpoint of passive defense as it minimizes the city's vulnerability in times of crisis.

Table 7: Strengths of Mata's Linear City structure in terms of accessibility from the Standpoint of Passive Defense

1	The main axis of a linear city is characterized by boulevard trees, which can be used as a multi-purpose space in times of crisis from a passive defensive approach (Figure 16).
2	The tram lines pass through the main axis to speed up relief operations and facilitate access during crises.
3	Main axis classification in terms of access: According to Mata, traffic is one of the major urban problems in that era, which demands special attention. Due to urban traffic issues and minimum displacement for residents, Mata considered different access routes in the main axis of the linear city for pedestrians, trolleys, and trams (Figure 16).

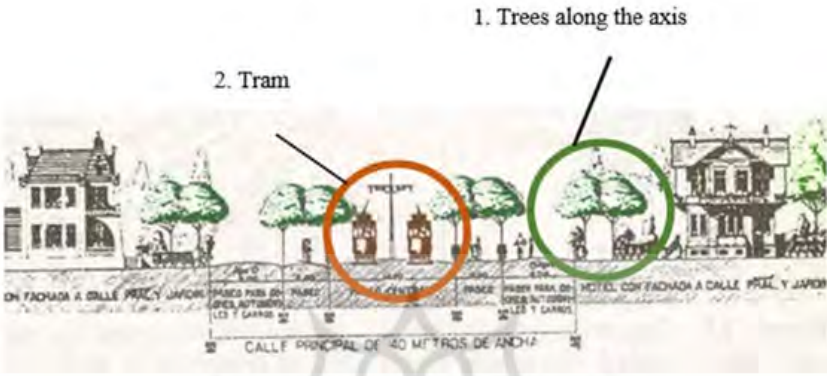

Fig.16: Cross-section of Mata's linear city

Table 8: Limitation of Mata's Linear City structure in terms of accessibility from the Standpoint of Defense Perspective

1	The geometry of the City: The dominance of a specific geometry in the city can increase its legibility and vulnerability in times of crisis, so that in cities with a particular geometry, in the event of natural and artificial disasters, equipment and facilities are easily identifiable and vulnerable.
2	Limited access: During crises, linear axes face many problems accessing the targeted area during relief activities, including the possible blockage of the route, the U-turn of relief vehicles, etc.
3	Traffic, extended distance, and increased time during crisis: All sideways and pass ways flow straight into the main axis. The constant presence of vehicles on the main axis disrupts relief operations in this central part of the city.

2- A school in the residential area: The presence of a school in residential areas, in addition to its educational function, can be used as a multi-purpose space during a crisis.

3. A Church in Residential Areas: In addition to its religious function, a church could be used as a multi-purpose space in times of crisis.

4- A Circular Boulevard in Residential Areas: A boulevard in residential areas can be used as a safe zone and green space alongside residential areas, especially during a crisis (Figure 17).

Exterior Layer Land Uses

The exterior land uses in the Garden City concept include industries, farms, and orchards. Investigating these land uses can disclose valuable points from the passive defense perspective.

1. Locating industries outside residential areas: Locating industries outside residential areas is a fundamental principle from the standpoint of passive defense, which urban planners should observe. Adherence to this principle (the principle of land use compatibility) and nurturing peace in residential areas will reinforce city strength and hardening in times of crisis.

2. Placing farms and orchards in the outermost layer, in addition to boosting tranquility in the city, curbs traffic, eliminates unnecessary commutes, and precludes motor vehicles from entering the city, which in turn contributes to the peacefulness and serenity of the road systems and rapid relief operations in times of crisis. At the same time, it provides the city with green space and gardens, which can mitigate the city's vulnerability during crises (Figure 17).

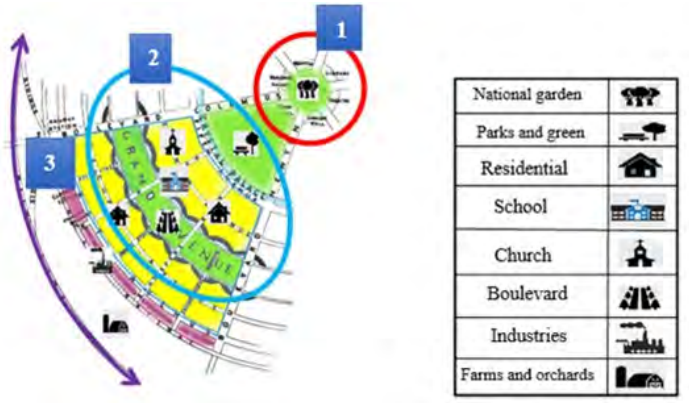

Fig.17: Dispersion of land uses in Howard's Garden City

The Concept of Marta's Linear City in Terms of Land Use Dispersion

In general, the concept of Mata's linear city can be analyzed in terms of land use dispersion in two parts.

1. Axial uses that grow along with the city's development on either side of the city's main arteries.

2. Intermediate land uses are shaped by the development of linear cities across the sides of a triangle (Figure 18). In the analysis of the first part, it is worth noting that the development of land uses on a linear axis due to the city expansion can be analyzed from the standpoint of passive defense. That is, locating land uses linearly across an axis can hugely increase the city's vulnerability and reduce its resistance during a crisis so that the damage imposed on land use in a linear axis can undermine the safety of other land uses. Moreover, positioning land uses across a single axis can disrupt the operation of multi-purpose land uses in times of crisis and give rise to subsequent accidents, exacerbating the crisis and inflicting massive damages and losses. As for the second part, it can be said that locating industrial land uses alongside residential areas, in addition to violating the principle of land use compatibility, allocates a percentage of green and open space per capita to industries. From the perspective of passive defense, the lack of green and open spaces and the proximity of residential areas to industrial areas will magnify losses and amplify the city's vulnerability in times of crisis. Besides, the adjacency of agricultural and industrial land uses with residential areas causes unnecessary city traffic, which slows down relief

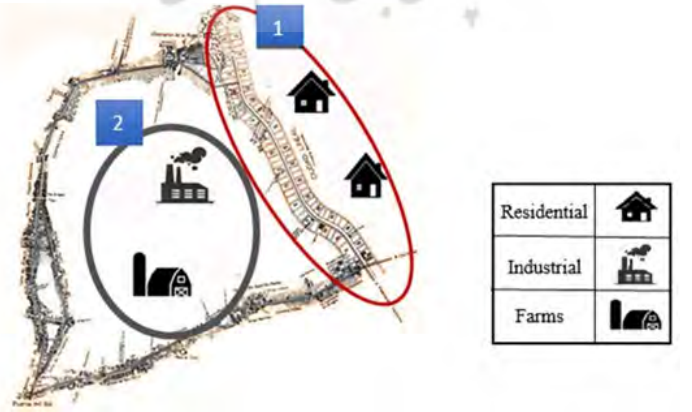

Fig.18: Dispersion of Land Uses in Mata's Linear City

operations during crises (Figure 18).

The following section lists the strengths of Howard's garden city and Mata's Linear City concerning passive defense principles in Tables 9 and 10.

According to the results of the study, it was found that the Howard Garden induced better responses in times of crisis in terms of various access and positioning in different parts of the city so that the existence of circular and grid-like access compared to linear access could expedite rescue and relief operations and minimize the adverse consequences of the crisis. Also, the positioning of land uses along the linear accesses in Mata's concept can be considered multi-centers. In Howard's concept, all important land uses are concentrated in one place, which turns the garden city into a single-center notion and is thus highly vulnerable. Many studies have looked at other variables. For example, Freestone exhibited that the idea of a garden city has received particular attention in urban planning for metropolises. Schubert's study on the idea of Fritzsch garden city in Germany showed that urban design and social reform issues are important variables that should be prioritized in large cities. Another study by Shader (2016) demonstrated that in a cultural transition emphasizing the characteristics of the new city in both Britain and Israel, the ideology of urbanization had been preserved for many years.

Table 9: The Strengths and Weaknesses of Howard's Garden City According to the Passive Defense Principles

	Indices	Strengths	Weaknesses
Howard's City Garden	**Centrality** (Single Center) (the principle of hardening and resistance of the urban structure)		-Concentration of population and activity in the city center and amplified vulnerability in times of crisis - Imbalanced distribution of facilities - The single-center nature of the city and the high probability of urban vulnerability and dysfunction of main arteries
	Road System (circular-grid-like) (Principle of Access to Urban structure)	The hierarchy of access reduced traffic and accelerated emergency relief in times of crisis - Wide streets that radically connect neighborhoods to the center and increase legibility on the axes. - The small trapezoidal blocks in the grid-like axes improve permeability and expedite relief operations. - The rail-based public transport system constitutes the structural elements and links the garden city to the metropolitan.	
	Land uses (Principle of dispersion in the urban structure) –	- Locating important industries and vital centers outside the city - Positioning residential areas amid a green space coverage - Existence of green and open spaces as multi-purpose zones in times of crisis - Observance of the principle of land use compatibility between the middle and outer layers to prevent sequential accidents –	- Establishment of medical land uses like hospitals in the center of the city - Positioning of city hall in the city center as a headquarter - Establishment of the commercial and service sector in the city center

Table 10: The Strengths and Weaknesses of Mata's Linear City Based on Passive Defense Principles

	Indices	Strengths	Weaknesses
Mata's Linear City	**Centrality** (Multi-Center) (the principle of hardening and resistance of the urban structure)	Dispersion of Population and Activities Across the City - Distribution of facilities and services throughout the city - Decentralization of facilities and equipment at the city level	
	Road System (linear (Principle of Access to Urban structure)	- Minimum displacement and ease of access for urban residents -Allocation of the main axis for a variety of transport routes such as trams, rides, pedestrians	-Lack of hierarchical access and the possibility of traffic jams and thus prolongation of relief during crises - The possibility of major arteries blockage at the time of the crisis - Restrictions on prompt access of relief vehicles to the area
	Land uses (Principle of dispersion in the urban structure) –		Positioning of key and important land uses in the main axis -Construction of industrial and agricultural centers among the main axes amid major connections of linear cities, which increases traffic in residential areas -Adjacency of land uses in single axis linearly, and the possibility of disruption in the multi-purpose land uses during crises and, therefore, a greater risk of accidents and lower city safety. -Non-compliance with the principle of compatibility between residential and industrial areas

CONCLUSION

Given The results of this study, The principles of passive defense have a substantial essential in cities. In terms of Centrality, This comparison shows that Mata's Linear City, with multiple centers in times of crisis, is more responsive than Howard's Garden City, which promotes hardening and reduces damage in the city. However, due to its single-center nature, Howard's Garden City can be highly vulnerable during crises. Accessibility: In Howard's Garden City, the relief and rescue operations are expedited due to circular and grid-like accesses in the road network. So this theory is more consistent with principles of passive defense, and implementing circular and grid patterns are more appropriate in designing accesses during a crisis. However, urban accesses in Mata's Linear City follow a linear pattern.

For this reason, there are many restrictions on taking emergency measures during a crisis. Dispersion of land uses: Since land use compatibility has been observed in Howard's garden city, proper land use positioning during a crisis can impede domino accidents. In contrast, in Mata's Linear City, there are incompatible land uses, increasing the possibility of accidents and damages. In the end, Howard's garden theory seems more desirable than other principles, except for the centrality principle in Mata's theory. Realizing these theorists' goals can help create and optimize new cities and prevent potential damages.

AUTHOR CONTRIBUTIONS

H, Ahmadi, and B. Abbasi performed the prepared literature review and the manuscript text and figures. M.Rafiei has contributed to the manuscript's structure and has played a crucial role in materials and methods. Finally, all authors discussed the results and commented on the manuscript.

ACKNOWLEDGEMENT

I want to express my deep gratitude to the board of the Iranian Relief Association, Hesamaldin Naragh, for their patient guidance, enthusiastic encouragement, and valuable critiques of this research article.

CONFLICT OF INTERESt

The authors declare no potential conflict of interest regarding the publication of this work. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication or

falsification, double publication and, or submission, and redundancy, have been completely witnessed by the authors.

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