

## EVALUATING INFLUENTIAL VULNERABLE CENTERS ON THE RESILIENCE IN THE FACE OF TERRORIST'S ATTACKS WITH HELP OF HIERARCHICAL ANALYSIS MODEL AHP (CASE STUDY: METROPOLIS TEHRAN)

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**Abstract:** The recent terrorist attacks in Paris, France (2015), indicates that especially in metropolitan cities are always interested to be attacked by the terrorist groups so essentially terrorism can be considered as urban phenomenon. Metropolis Tehran as the capital of Iran that has the most important elements of infrastructure, governmental, political, industrial, and population centers is considered as potential targets of terrorist attacks. According to the results, 6 and 12 because of being within structure of the downtown, the number of applications and critical infrastructures have been more vulnerable to terrorist attacks compared to other regions.

**Key words:** resilience, urban terrorism, terrorist attacks, Tehran, Analytic Hierarchy Process AHP, vulnerable places

### 1. Introduction

Cities are complex and interdependent devices and very vulnerable against the threats of natural, manmade and terrorist. Characteristics that make cities desirable and achievable, such as architecture, population centers, places of community, infrastructure put the cities exposed to higher risks of terrorist attacks (Behtash et al, 2012). Many terrorist attacks are managed in cities, so that the biggest and the most important terrorist attacks would occur in the cities, in Islamic Republic of Iran, the cities have been repeatedly attacked, so the statistics show that so far about 17,000 people have become victimized by the terrorist attacks in Iran. According to the statistics among countries in the world, 82% of people killed in the terrorist attacks were living in five countries Iraq, Afghanistan, Pakistan, Nigeria, and Syria. Iranians has shared borders with 3 out of the five countries and shared treaty with one of them. The statistics of index of global terrorism has embraced our country among the 13 countries in that terrorism index will go up (Global Terrorism Index, 2014).

The metropolis Tehran also due to the role of capital in the metropolis of the country and possession of critical infrastructure, public places and political institutions, and educational institutions is an important one of potential terrorist targets.

### 2. Methodology

The methodology is analytical-descriptive one and based on analogy and reasoning. First, the scientific literature about the adverse effects of urban terrorism in our city becomes studied and reviewed that in the case, documentary-library method, science and news websites are used. Examining the theories, some strategies on the resilience against terrorist attacks are extracted. Tehran is selected study area. In recognition of the area, some efforts are made the GIS-software maps are used and finally analyzed using AHP analysis and software Expert Choice and areas would be categorized in terms of vulnerability to terrorist attacks.

### 3. Viewpoints and theoretical foundations

#### 3.1 Roots of urban terrorism:

The word terror derived from the Latin (terrere) means fear and scare (Zarghani, A., 2010, p. 72) and the words "terrorist" and "terrorism" in various Academies, including French Academy of Sciences, is meant "system or regime of terror" (Tayeb, 2002, p. 55). Jacobins in France before the Great Revolution in their words and writings had used this term with positive impressions about themselves, but after Robespierre's actions who was

influential member of the group this term was converted as the profanity, suggesting that a delinquency act (Tayeb, 2002, p. 56). Furthermore, its historical root got back to the period before the fall of Robespierre's reign known as "terror" (1793-1794) (Kourmount, 2009, p 0.206). Long wave of terrorism in Western Europe with "propaganda action" anarchists arose in the 1890s. Anarchism advocates believed that the best way of achieving political-social change driven from the revolution would be kill those who occupy positions of power. In the midst of all these movements, Russian People's Will Movement (1878-1881) had a lot of far greater importance; many knew this to be a full-fledged example of a terrorist organization supporter of revolutionary violence in the new era. Like trying to explode up a train carrying Tsar and first explosion in the Winter Palace in November 1879. Until 1905 the wave of attacks and assassinations outside of Russia had subsided, and was seen, in a speech, in Central and West Europe, Russia and the Balkans, and in a different manner in Spain. Labors' disputes in the United States almost from the beginning of would be more violence than in Europe including bombings in Haymarket Square in 1886, and many other bloody incidents. Terrorism in the United States would be limited in terms of scope and in terms of goals, neither to overthrowing the government, nor to killing political leaders or changes in the political system (Tayeb, 2002, p. 60). Urban terrorism was best treated as complementary methods for Peasant War and worst, as a dangerous distraction. Castro and Chegvara shared an abiding faith that the city is a "cemetery" for revolutionary struggle for freedom. It was only in the mid-1960s that the urban terrorism became primarily formed independently as a result of the failure of peasant guerrillas in Latin America as well as in the wake of the emergence of urban terrorist groups in Europe, North America and Japan. In the twentieth century, the terrorism by totalitarian regimes such as Nazi Germany under Hitler's control and the regime of the Soviet Union under Stalin's control, in fact, were regarded as policy but not policy-declared. Moreover, in our time, some governments attempted at assassination of the citizens of other countries. This phenomenon causes the generations and popularity of terms like urban terrorism, political terrorism and international terrorism (Tayeb, 2002, p. 63).

#### 3.2 Types of terrorist attacks

The terror and terrorism is as old as history of politics and government formation in the world, but at last decade and from the twentieth century, with the development of technology and communication tools, advanced weapons proliferation, complex organization, and the formation of ethnic, national, and ideological motivations, every day is added to the power and role of political groups and terrorist organizations (Pape, 2003, P. 343). The terrorist threats include all types of threats creating a sense of insecurity among the people and authorities. The terrorist or security threats may be presented objectively or subjectively (Schulz et al., 2002, p. 93). Bomb, thrown explosives and use of any type of fire and cold arms, assassination, kidnapping, or hostage-taking, collective intimidation and fear and forcing people to leave work, home or school, as it is the instances of terrorist threats (Zarghani Vazemy, 16: 931). The terrorism has been classified and divided on the basis of the different views and approaches. Part of this type of classifications includes: the terrorism under the control of countries and independent terrorism, anarchy-loving terrorism, neo-fascist terrorism and ethnic separatist terrorism (Hamzezhadeh, 2002, p. 5), the conventional and non-conventional terrorism, chemical and nuclear terrorism, (Dehghan, 2002: 933). As well, in addition to the above classification, the terrorism experts believed there are seven types of terrorism including nationalist terrorism, political terrorism, narco-terrorism) of addiction-terrorism (religion

terrorism, government-sponsored terrorism, state terrorism and independent terrorism and there are several dimensions including: nuclear terrorism, bio-terrorism, agriculture terrorism,

chemical terrorism and criminal terrorism, suicide terrorism. The following figures show the extent and types of terrorism:

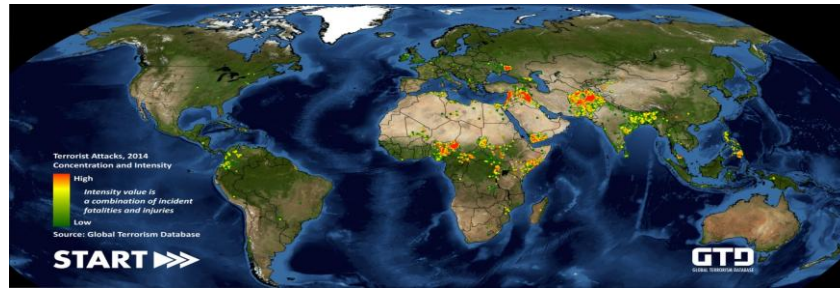


Figure1: Density of attacks occurred in year 2014 (<http://www.start.umd.edu/gtd>: Global Terrorism Database)

Table 1: Types and dimensions of terrorism (source: Zarghani Azam, 2010, p. 73)

Types of terrorism	Dimensions and methods of terrorism
1. Nationalist terrorism	1. Bio-terrorism
2. Political terrorism	2. Chemical terrorism
3. Addiction terrorism	3. Nuclear terrorism
4. Religion terrorism	4. Agriculture terrorism
5. Government-sponsored terrorism	5. Criminal terrorism
6. State terrorism	6. Suicide terrorism
7. Independent terrorism	

In the words of James pain, to start terrorist discourse, it must first perform a type of cleanup, which is what others consider as definition. In Douridian's opinion, it is so difficult to perform the rituals according to semantic confusion and mixture dialog consisting of terrorism and anti-terrorism (Solomon, 2011, p. 18). However, the terrorism in the dialogue at any time would be meant within the stereotyped and specific frames and its manifestations and contents would be drawn and depicted, as dominant discourse recognizes the. However, modern terrorism differs from past versions that the victims are often innocent civilians who were either randomly chosen or merely attended at the terrorist situations. In other words, in our times, unknown victim's pan is heavier than the assassination of prominent and famous persons (Tayeb, 2002, p. 64)

### 3.3 Urban Resilience

Resilience is the new way of thinking about urban design so that engages less vulnerability and more flexibility (Kates, 2007, P. 22). The resilient city is of a stable network of physical systems and human communities. The physical systems include components of natural and built environment of the city. Totally, the physical systems would be considered as a body, bones, arteries and muscles of the city. During a crisis, they must be able to withstand versus great pressure and have a good performance. If the system has many defects that cannot be repaired, the return process will be done slowly after the crisis (Rezaee, Mohammad Reza, p. 27).

The resilient cities make manifest situations of the survival, governance, sustainability, adaptability and flexibility (Arif, 2015, p 1059). Total human communities act as the brains of the city, guide its activities, and respond to the needs of the city. During a crisis, the social network also must be able to withstand extreme conditions and act correctly (Rezaei, Mohammad Reza, p. 28). The resilience is rooted in the ecology; the environmental considerations would be the design of the city. The use of metaphors such as resiliency or the organism have stressed on the nature of the city as a living (Kostof, 1991, p.15). How the urban designer to be inspired by ecology depends on two key components that are common in cities and organisms: 1) post-disaster recovery (Vale and Campanella, 2005) 2) coping with the change and managing

them. The first option comes two options to mind or returning to the previous situation or pursuing a preferred status. The first option represents the equilibrium model with making capacity and achieving a normal cell. The risk of natural catastrophes (floods, earthquakes, etc.) or man-made (wars, terrorist attacks, etc.), the need to reduce vulnerability has been caused by increasing safety and adaptability in the city. Related attempts and actions to post-disaster reconstruction and recovery efforts would seek adjust the risk and mitigate vulnerability, by making capacity. In non-interactive version, this is aimed at promoting greater flexibility to reduce the vulnerability. In this model, there are more comprehensive practices for urban design, which are presented by focusing on three aspects of the built environment, including form, function and flow.

A) Forms: define the buildings. As organisms adapted their resilient to the habitat, specific building species increase urban form for the changes. Modules are representation of mirrors of a certain standardized parts of larger uniform part (Lynch, 1990, P.384). The flexibility of entrances and grid patterns are created within the fixed and standardized parts which consist of structures which are repeatable.

B) Function: reflects the purpose or intent of urban form (and organisms). Both cities are in need of quite specific and non-specific units, but are separated from each other until the adaptability for one does not disturb growth and performances (Lynch, 1990, P.382).

C) Flow: currents that form separate but interconnected networks of relationships which are critical and effective on long-term viability. Infrastructure would manage flows related to services (traffic, gas, water and wastewater).

These three aspects of the built environment would cause conceptual sequence of urban form, ranged from the urban of fixed or rigid (infrastructure) and semi-fixed urban form (public space) to urban form of flexible, adaptable or fluid (open and flexible spaces) (Banerjee, 2011, 1061)

### 3.4 Hierarch analysis AHP

AHP is one of the most multi-criteria decision-making techniques invented by Thomas L. clock in the 1970s (Kusek, 2004). This method when decision-taking action involves in few options and decision criteria. The indicators can be quantitative or qualitative. The method's basis relies on paired comparisons. In stage of preparation of the hierarchy, the problem is defined and the purpose of hierarchical decision-making would be the elements and factors making the decision to draw. Analytic hierarchy process needs to break the decision-taking problem by several indicators into a hierarchy of levels. For this purpose, a decision tree is used which is made up of four levels: The first level includes the overall objective of the decision making. On

the second level are the general criteria on the basis of that the decision is taken. On the third level are the last level of the decision options here are 22 districts of Tehran metropolis.

### 4. Ecology research

Tehran Province is located with an area of 13692.413 km between 34 and 36.5 degrees north and 50 to 53 degrees east longitude. Tehran Province among the metropolis of the country has a privileged position due to the centers of political, economic and social to exist. Some of these centers are unique, less visible in the remained metropolis in the country and this is a good target for terrorist groups to be exposed.

Table 1: Management and Planning Organization, Iran's statistics center 2011-2012

Name	Population	Annual average growth of population	Portion of country's population	Household dimension	Amount of urbanization	Literacy in percent	Area (km <sup>2</sup> )	The number of towns	Number of district	Number of cities	Number of rural areas	Number of villages
Tehran	12183391	1.44	16.2	3.3	92.8	90.5	13692.413	16	33	44	71	757

### 4.1 Terrorist events in Iran and the world

Globally, the country without the violence would be almost nonexistent. But there are some countries that have been associated with the violent events. For example, Columbia would be including in those countries. In this country, the average daily violent incidents killed 71 people and 4 "terrorist attack" took place (Ozzie, 2011, p 281)

Some of the terrorist attacks that occurred in the world, including the following:

In Wall Street in New York City in America, on September 16, 1920 TNT bomb that was locked in the carriage of horses, 35 people were killed and hundreds were injured. Although the Bolsheviks and anarchists were suspected but main officials are not known certainly. On January 24, 1975 in New York City, the historic restaurant Francis was exploded. Based on the explosion, four people were killed and 50 people were injured.

In 1983, two major attacks took place in Beirut. The first occurred on April 18 and throw bombs to the embassies of America included 63 people are dead and 17 injured. The second occurred on October 23. In the port of Beirut near the Americans' accommodation, bomb exploded would kill 241 sailors. Minutes later a second bomb was exploded in West Beirut and the accommodation of French troops and 58 people were killed (Ozzie, 2011, p 282). In America in Oklahoma City, on April 19, 1995, a car bomb was exploded outside a federal office building and it led to 19 child victims, along with 168 others. In August 7, 1998, in Kenya and Tanzania, exploding car bomb next to the building of embassies of America, 224 people have been killed and 4,500 injured. The biggest terrorist attack

in history took place September 11, 2001. This day was marked by an unprecedented terrorist attack on America. Following the collision of two airplanes on the World Trade Center in America, there has been great destruction. After the incident, the Pentagon reported a large explosion in 18/47 pm. After the attacks, in 18.57 pm another huge explosion occurred in a commercial center in Washington. As a result, the 3038 terrorist attacks have lost their lives (Ozzie, 2011, p. 284).

On November 13, a series of coordinated terrorist attacks occurred in Paris, France. Paris AFP reported the number of victims of terrorist attacks at least 120 people and 200 injured. Some news sources declared the number of people killed over 150 people. In Paris attacks, six-shooter and two suicide blasts occurred in Paris seven points. This is the first time in French history that suicide attacks carried out on its territory. The first explosion occurred near a soccer stadium in Paris, during a friendly match between Germany and France and when 'Francois Hollande' French president was inside the stadium. He quickly left the place and went to the Interior Ministry to convene an emergency meeting. The second explosion occurred about 15 minutes later in other parts of the city's six-shooter. At the same time in other parts of the city, six shooting cases occurred and then gunmen got at the entrance to the concert hall more than a thousand 500 people hostage. Hostage-taking ended with police's intervention, during which nearly 100 people were killed and several attackers (Islamic Republic News Agency, December 6, 2015). According to statistics from the 1980-2001, 4155 terrorist incidents happened around worldwide in which 3207 people were killed. Recent statistics showed an increase in the number of victims of terrorist attacks, so that in 2012, 11133 people were killed and in 2013, 17,958 people died occurred among 102 countries (Global Terrorism Index, 2014, P. 5)

Table 2: MKO military operations in Tehran (1971-1978) (Source: Ismaili, 2011, p. 103)

Row	Date	Attack place	Description
1	5/21/1972	Symbols and visions of governed policy power	Bombings in America Information Administration, Building and Construction Forum Anglo-Iranian Council in Tehran
2	5/30/1972	Crowded and public places	Explosion at the way for General Price, the American advisers in Tehran
3	5/30/1972	Symbols and visions of governed policy power	Exploding a bomb in the tomb of Reza Khan, coincided with Nixon's trip to Tehran
4	8/2/1972	Symbols and visions of governed policy power, Crowded and public places	When King Hussein of Jordan to Iran, to the explosion of a bomb at the Jordanian Embassy
5	1/26/1973	Crowded and public places	Exploding a bomb in the cafeteria International Hotel in Tehran
6	4/19/1974	Crowded and public places	The explosion at the headquarters guard Aryamehr University of Technology (SUT)
7	6/25/1974	Critical infrastructure of the city	Explosion-proof electrical installations IRNA factory in Karaj

8	6/25/1974	Critical infrastructure of the city	Power plant explosion Jeep Land Rover factory in Karaj
9	7/21/1975	Crowded and public places	Bomb blast in Forums
10	7/26/1981	Symbols and visions of governed policy power/ Crowded and public spaces	Abuzar Mosque bombing during the speech, Ayatollah Khamenei in Tehran
11	7/27/1981	Symbols and visions of governed policy power/ Crowded and public places	The explosion of the Islamic Republic of Iran, Ayatollah Beheshti testimony
12	8/29/1981	Symbols and visions of governed policy power/ Crowded and public places	Explosion presidential office and the testimony of Mohammad Ali Rajai

#### 4.2 Vulnerable areas against urban terrorism:

Cities especially in metropolitan cities due to demographic, political and economic niches are addressed by the terrorism. However, these people do not choose at random places of interest; according to the studies conducted by the author, the places where 1- there is concentration of population and economic, 2- making a terror a lot 3- have high political and ethnic dimensions, 4- have physical and human casualties, 5- have the symbolic value, 6- have priority than other locations for broadcasting a lot. Based on the terrorist attacks, most places are interested by these groups based on theoretical principles described in the section on resilience can be divided into the following categories:

1) Fix the city: a) critical infrastructure, b) symbols and perspectives of political power (seat of government and state) (Banerjee, 2011, 1062)

2) Semi-fixed city: a) public and crowded places in the city (Banerjee, 2011, 1063)

#### 4.3 City Fixed

##### 4.3.1 Critical infrastructures of the city

Infrastructure systems are known targets of terrorism. Even unsuccessful attacks on critical infrastructure can be extensive broadcasted and cause significant economic losses. For example, security of airlines, marine, railways, roads and transit systems should be guarded against the terrorism. The infrastructure of energy, gas, water, electricity, sewage and communications would be the basic requirements of any progress. The life lines should be protected against the attacks by taking the supports or bringing them out of state monopoly on one area and increasing their number (Edward, 2001, P.10)

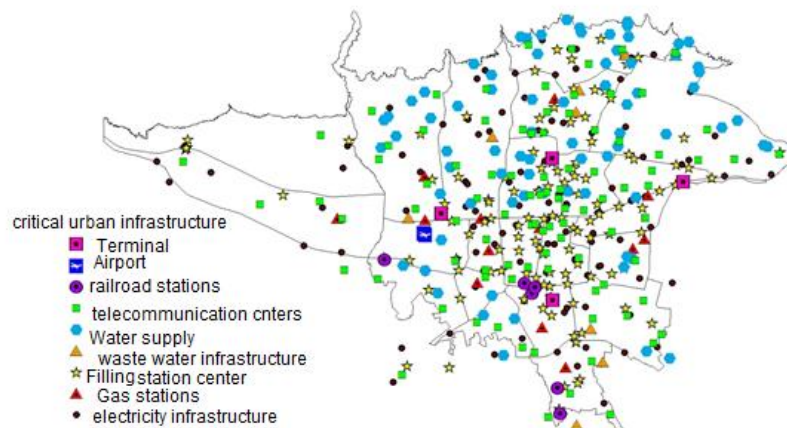


Figure 2: Critical Infrastructure of Tehran

##### 4.3.2 Symbols and prospects of politically governed power (seat of government and state)

Today, the terrorists to challenge the governments, as well as receive the media and the world of existence, have attacked political and even non-political symbols and perspectives of ruling power. The prospect and size usually include Parliament House, the Congress, Ministries, Governors, Office of the Prime

Minister or President, judicial complexes, national radio and television, government buildings and centers and even public statues and sculptures. The following symbols and prospects would practice for the government as a political tool to remind people who is seated in power or what ideology or philosophy governs the society (Jones et al., 121: 2, 48) The symbolic nature of terrorist acts would be considered as an important geographical aspects (Flint, 2 30).

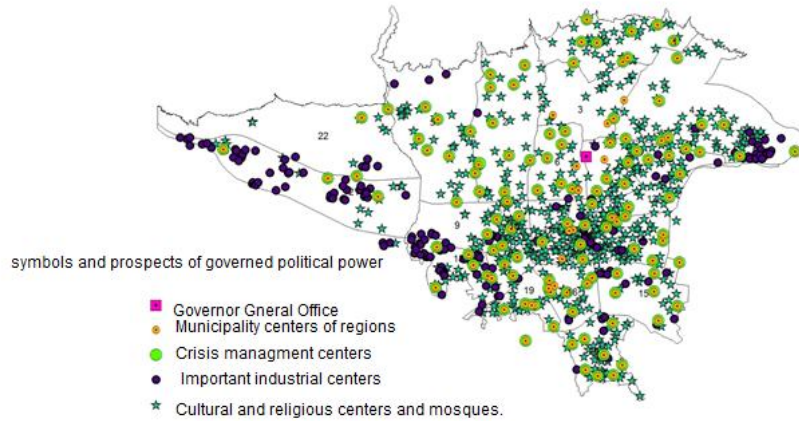


Figure 3: Symbols and prospects of politically governed power (seat of government and administration)

4.4 Semi-fixed Cities

4.4.1 Crowded and public places in the city

The crowded places are a tempting target for the terrorists because ease of access, lack of security protection, high impact and political confrontations are what makes an attack successful

on the existing spaces. On this basis, most of the attention of the terrorism has paid to the spaces of the building environments. These spaces include terminals, major sporting spaces, clubs, shopping malls, cinemas and theaters and health services, also public spaces such as parks and squares, too. (RIBA, 2010, P.6)

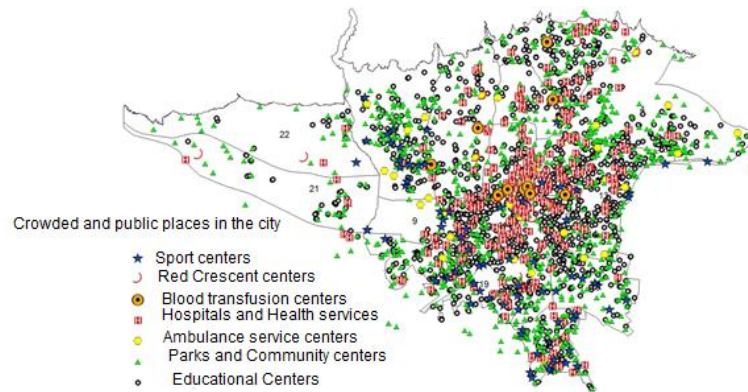


Figure 4: Crowded and public spaces of Tehran (Source: author)

5. Analysis and Results

The cities, as most complex man-made, have encountered with extensive risks due to both the wide range of risks and multi-vulnerabilities. The urban vulnerabilities everywhere, from buildings and infrastructure, to telecommunication, transport and energy lines would be palpable. Tehran Metropolis given valuable structures of economic, political and social has been

considered as a potential target to attack, because Tehran can be attacked due to any of the urban elements by the terrorism to achieve its goals, such as creating panic, damaging the vital elements of the city, putting on the international news' headlines. To rank the areas of Tehran, after identification of centers in the areas of high vulnerability against the terrorist attacks above, first, AHP hierarchy tree that is made up of objective, criteria and alternatives would be drawn.

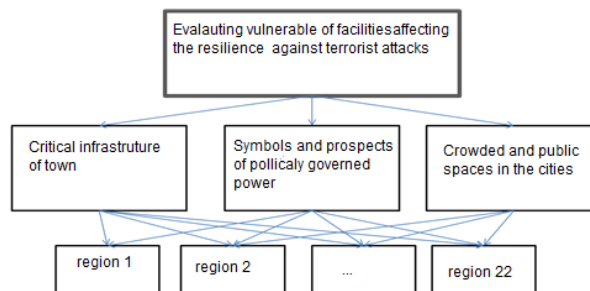


Figure 5: Model Tree AHP

And according to the following graph obtained by software expert choice, the corresponding weights on target options, i.e.

all 22 district of Tehran.



Figure 6: Prioritizing the amount of vulnerability of metropolitan areas against terrorist attacks (Etaat et al, 2014)

Finally, after the classification of regions, Region 6, 12 due to having a central-urban structure and high accumulation areas, especially in the day, traffic and high population density in these

areas and the great health for services applications in times of crisis and important educational centers such as Tehran University, were among the most vulnerable areas.

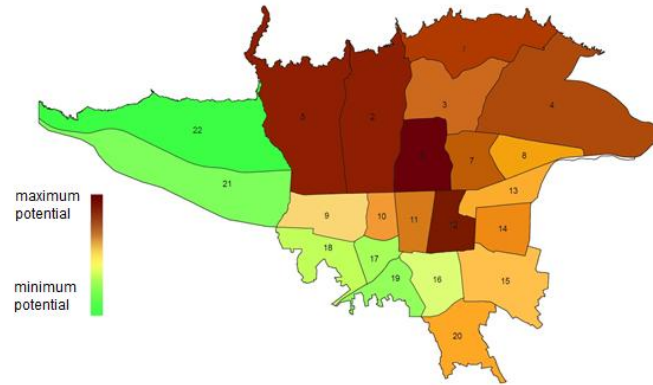


Figure 7: 22 districts of Tehran categorized based on the amount of vulnerability against terrorist attacks (Source: author)

According to the analysis as shown in the map above how far we are from central and northern Tehran and get closer to the West, the potential of attacks will be less; district 22, according to a detailed analysis, is that are least likely to terrorist attacks.

**6. Conclusion**

Reviewing attacks in Iran and over the world, the vulnerability parameters were selected by the theoretical foundations of urban resilience (in fixed and semi-fixed cities) and identifying the vulnerable in the Tehran metropolitan centers and analysis by AHP that 22 districts of Tehran including 6, 12, 5, 2, 1, 4, 7, 3, 11, 14, 20, 8, 13, 10, 15, 9, 16, 18, 19, 17, 21, 22 are located in the threat of terrorist attacks, respectively.

Table 3: 22-districts vulnerability in Tehran Metropolis against terrorist attacks

Region	Infrastructure	Public spaces	Symbol	Rank
1	High	High	Average	5
2	High	High	Average	4
3	High	High	Low	8
4	High	High	High	6
5	High	High	Average	3
6	High	High	High	1
7	Low	High	Average	7
8	Low	Average	Low	12
9	Low	Low	Low	16
10	Low	Average	Average	14
11	Average	Average	Average	9
12	High	High	High	2
13	Average	Average	Average	13
14	Average	Average	Average	10
15	Average	Average	Average	15
16	Average	Average	Low	17
17	Low	Average	Low	20
18	Low	Average	Average	18
19	Low	Average	Low	19
20	Average	High	Low	11
21	Low	Low	Low	21
22	Low	Low	Low	22

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