Ranking Methodology for Prioritizing Urban Components to Deter Crime Analytical Case Study: Miami Spring City

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***Abstract*-Crime is an action whichViolates rights and freedoms. It started since the beginning of creation and regrettably will continue as long as human exists. Utopia exists only in our imagination as crime cannot disappear completely.Yet, we can minimize and deter it. Our role as urban planners is to create secured urban spaces and to effectively functionalize urban components to deter crime. First, this paper will gather comprehensive urban elements and featuresfrom different scholars and theories to urban crime prevention. Second, these urban components will be filtered depending on their effect on crime. Third, the urban components which do affect crime will be ranked according to their risk degree depending on definite criteria. Then, the analytical part will discuss Miami Spring city as a case studytocompare its crime index with its urban components. Finally, this paper will conclude the most effective urban elements on crime and how to functionalize them in a proper way.**

***Keywords* - Urban Environment -Crime Rate – Ranking - Integration Analysis –Miami Spring**

I. INTRODUCTION

Nowadays, security with its various levels is an essential human need. Long ago, itwasranked in the second level of importance in the "Maslow's hierarchy of needs"[1] directly after physiological needs. Maslow argued that once a person's physiological needs (air-water-food-sleep-etc.) are relatively satisfied, the safety needs take precedence and dominate behavior.

On an urban planning scope, security in urban spaces becomes an essential indicator for living quality and creating a satisfying life. Lack of security in certain area obstructs its function. Lawlessness is one of the known causes to ghost towns. Thus designing a secured space on whatever scale is not a luxurious supplement anymore.

II. WHY URBAN ENVIRONMENT TO DETER CRIME?

Crime occurrence depends on various factors and dimensions, criminologists summarized these dimensions in the opportunity theory of crime; "Crime Triangle"[2]which consists of three vertices; the offender, the target and the place or the situation. The offender and the target are characterized by dynamism unlike the third static dimension (the place), which means that offender and victim are attracted to an urban area or away from it according to its urban characteristics which is by default reflected on the security index of this area. This static feature gives the place dimension a priority in crime prevention issue. Moreover, many criminologists and sociologists focused on the place dimension arguing that urbanism and city life style are the main cause for crime. The beginning of assuming that the city might have a crime-causing effect was by the European sociologists such as Émile Durkheim (1897)[3], Max Weber (1958)[4], and Ferdinand Tonnies (1887)[5].

Another argument was that of American sociologists associated with the University of Chicago in the period between 1920 and the World WarII. They concluded from their empirical studied that it was not the criminogenic characteristics of ethnic groups which led to high crime rate, but the nature of the urban ecology where they lived.Thus, according to many criminologists and sociologists and with respect to the static characteristic of the place where crime occurs, dealing with the urban environment (place dimension) would be an effective tool to urban crime prevention.

III. THEORIES OF URBAN CRIME PREVENTION

One of the most important theories to Urban Crime Prevention is the argument of Jacobs (1961)[6] that the circulation of people and appreciation of public space are crucial elements to the urban vitality, and indicated that informal (natural) surveillance (”eye on the street”) is a good

[1]Abraham Maslow in 1943

2Lawrence Cohen and Marcus Felson.

3French sociologist. He formally established the academic discipline and—with Karl Marx and Max Weber—is commonly cited as the principal architect of modern social science.

4German sociologist, philosopher, jurist, political economist

5 German sociologist and philosopher. He was a major contributor to sociological theory

[6]An American-Canadian journalist, author, and activist best known for her influence on urban studies, sociology, and economics.

deterrent to criminal activity[7]. Jacobs argued the rule of urban planners in destroying urban diversity and vitality through their renewal strategies in her book "The death and life of great American cities" 1961. She challenged the basic tenets of urban planning during that time. Such as, neighborhoods should be isolated from each other, an empty street is safer than a crowded one, and that the vehicle traffic represents progress over the pedestrian.

Her work was considered as a new way of seeing cities.

Other theory was that of Oscar Newman (Newman, 1972) "Defensible Space". This theory was based on his study that was examined empirically in New York on crime prevention and neighborhood safety to elaborate the idea of defensible space and natural surveillance. He observed that higher crime rate existed in high-rise apartment buildings than in lower housing projects. Newman's theory was based on specific principles related to social control and public health in relation to community design through the modification of the physical structure of residential areas including streets, open spaces around buildings and interior spaces as well as emphasizing on public participation. He defined defensible space as "a residential environment whose physical characteristics, building layout and site plan function to allow inhabitants themselves to become key agents in ensuring their security." His theory depends on monitoring the urban space arguing that crime and delinquency can be controlled and mitigated through environmental design.

Another theory was "Broken Windows" of Wilson Vavlasky, Kelling and Kales 1982. Its principle focused on the inhabitants' awareness of suspicious behavior, it considered the environment as an indicator for social cohesion and un-official control. This theory proposed solutions to crime prevention such as emphasizing the importance of lighting and signs in urban areas, regarding the quality of living environment, increasing spatial territory, social wealth and public sense of environmental protection among the inhabitants.

Other theory was "Situational crime prevention" of Clark 1997 that focused mainly on modifying and managing the space to control the opportunities of committing crimes. This theory proposed solutions based on the optimization of urban furniture and parking lots of motorcycles and bicycles.

Later on, the concept of defensible spaces and its factors provided the theoretical base for the development of another important approach in urban crime prevention which is Crime Prevention through Environmental Design (CPTED) for Crew and Jeffrey 2000. The principle of this approach based on the effects of the physical environment on reducing crime opportunities, focusing on the roots of crime in the physical environment. Thisapproach proposed various solutions to crime prevention such as;

- Control and investigation through security forces, windows, lighting and balconies.
- Definition of spatial territory (small segments, paved streets and lawns).
- Access control through preventing the entrances of strangers by means of security guards, cameras, locks and physical hindrances like fences, hedges or plants[8].

The noticeable limitation of this approach was in its scope. It deals with micro-level design and physical changes while marginalizing the macro-level (city, neighborhood)[9].

More recently, urban design researchers used Space Syntax techniques to analyze geographic distribution of crimes, and started to pay more attention to other factors that could influence crime occurrence such as spatial and socio-demographic factors.

At the beginning of the twenty-first century, many theories that addressed urban crime (modern criminology) developed through using new analytic techniques, new research tools, and modified explanations relying on the earlier findings from the Chicago School. Many design researches was based on validating the relation between spatial configuration and crime occurrence using space syntax techniques such as, (Baran et al 2006, Nubani&Wineman 2005, Shu 1999, Hillier 1998).

Another recent approach is the "New Urbanism" 2005. Its principles based on both the physical environment and the social dimension. It focused on realizing the physical elements of the urban space, emphasizing on the social spaces and the public presence, penetrability and multiple usage, walkability and social communities

IV. URBAN CRIME PREVENTION

As crime incidence depends on numerous factors, there is a variety in approaches which deals with urban crime prevention; some approaches focused mainly on the social dimension, others focused on the legal issue. Yet, the main concern of this paper is approaches which focused on the physical environment.

Place-based approaches to crime prevention depend on analyzing the effect of physical features of the urban space on crime, and how to effectively functionalize them. Although these physical elements vary from one approach to another, there are many common elements. The following table shows some different scholars belonging to different schools and the functional features of their theories.

[7]Baran, Smith, Toker; The Space Syntax and Crime: Evidence from a Suburban Community

[8]SeyedAbas Aga Yazdanfar, NassimNazari (2015), Asian conference on Environment-Behavior studies. Tehran, Iran

[9]Brantingham 1981

Table1: Functional Features to Urban Crime Prevention

Scholar	Functional Feature
Jacobs "Eyes on the street"1961	Population density, Penetrability, multiple usages, legal jurisdiction, control, liveliness, crowded sidewalks, determining blocks.
Newman "Defensible space"	Population density, accessibility and penetrability, legal jurisdiction, control, sense of ownership, the location of the residential area, elimination of strangers, social conditions.
Crew, Jeffrey	Access, multiple usages, sense of ownership, control, lighting, landscape, management, and maintenance, signs, escape ways, perspective, shelter.
Harl and Taylor	Legal jurisdiction, usage, determining blocks, motional patterns, control, physical hindrances.
Fischer &Naxxar	Senses of ownership, liveliness, shelter, escape way, wide view, legibility.
Hillier and Show	Population density, penetrability, multiple usages, legal jurisdiction, control, legibility.
Wilson and Kelling "Broken window"	Protection, affinity to place, landscape.

Source: SeyedAbas Aga Yazdanfar, Nassim Nazari (2015), Asian conference on Environment-Behavior studies. Tehran, Iran

The proposed methodology depends on gathering comprehensive urban components inspired from different scholars and theories to urban crime prevention.

V. THE METHODOLOGY OF THE PAPER

The first stage in the proposed methodology is gathering comprehensive urban components and classifying them to two categories; urban features and urban elements.Then, the second stage is filtering and excluding those elements which are ineffective on crime or those elements included in others to avoid repetition. The third stage is defining criteria to rank the risk degree of each effective urban component on crime. Thereafter, the proposed ranking methodology will be applied on a case study with known crime rate. Finally, results and conclusions will be listed.

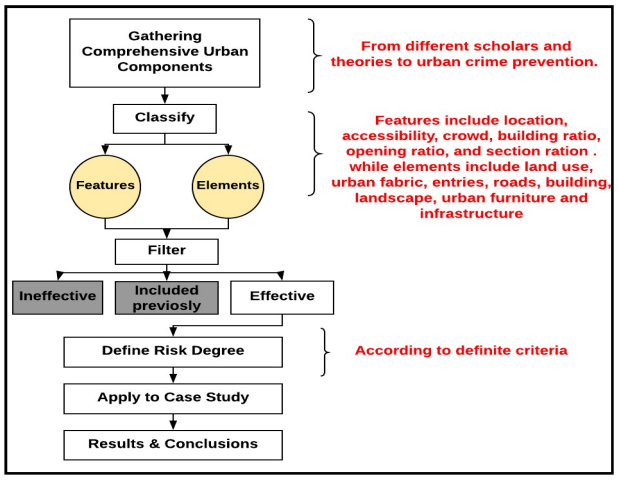

Figure 1: Paper Methodology
Source: By Author

VI. THE PROPOSED URBAN MATRIX

Although the proposed matrix focuses on urban component, social and human dimensions should be taken into consideration in order to achieve more efficient crime deterrence. The proposed matrix gatheredcomprehensive urban component from different scholars and theories to urban crime prevention and classified them as follows;

Table 1(a): Proposed urban matrix to Urban crime prevention

Urban Components			Affect crime
Features	location	core	No
		periphery	
	Accessibility .Navigation		yes
	Crowd		Yes
	Building Ratio		Included
	Opening Ratio		yes
	Section Ratio		yes
Elements	Land use		yes
	Urban Fabric		
	Entries		Yes
	Roads	Width	-
		Hierarchy	Included
		Situation	yes
	Building	Heights	Included
		Situation	
		Materials	No
		Structural system	No
	Landscape	Soft "Afforestation"	yes
		Hard "Sidewalks"	yes
	Furniture	Elements	yes
		Illumination	yes
		Signs	yes
	Infrastructure	Water supply	No
		Sanitation	No
		Electricity	Included
		Communication Network	Yes

Source: By Author

The excluded elements to avoid repetition are roads' width and building height as both of them are gathered in othercomponent which is the section ration. Also built-up ratio is excluded as it is included in urban fabrics. Moreover, electricity as a part of infrastructure is excluded for the same reason; it will be discussed within public illumination. On the

other hand, there are some urban components which are excluded because they are ineffective on crime such as building material, structural system, water supply and sanitation. Although such elements affect the quality of live, their effect is clearly remarkable in the indoor spaces. Yet, the lack of them is not often recognized by the public users. Another urban feature which is excluded for its ineffectiveness on crime is the location. As there is no clear evidence that high crime rate is limited to certain type of location whether core or periphery. However, each type of location has certain potentials and limitations; areas with high crime rate on both global and local scope are found in locations with both types without an advantage for one type over the other.Then, the remaining effective urban components are ranked to define their risk degree according to three main criteria;

- The first criterion depends on the difficulty and the possibility in changing and maintaining each urban component without affecting the main characteristics of the space. Component which are very difficult to be changed have higher risk than those components which easily changed or maintained.
- The second criterion refers to urban components which can create perfect circumstances for an offender to offend and escape, if they exist in a wrong way or in a vandal condition.
- The third criterion depends on does the urban component have a role in monitoring the urban space or not.

By applying ranking criteria, it isfound that four urban components which are accessibility, section ratio, land use and urban fabric are high risk urban components.

Table 2: Ranking criteria for iffectiveurban components on crime

Urban Component	Criteria for Ranking the Risk Degree			
	1st Criteria	2nd Criteria	3rd Criteria	Total
Accessibility	*	*	*	***
Crowd	-	*	*	**
Opening ratio	-	*	*	**
Section Ratio	*	*	*	***
Land use	*	*	*	***
Urban Fabric	*	*	*	***
Entries	-	*	*	**
Roads, situation	-	*	*	**
Building, situation	*	-	-	*
Landscape, Soft, Afforestation	-	*	*	**
Landscape, Hard "Sidewalks"	-	-	*	**
Furniture, elements	-	-	*	*
Furniture, illumination	-	*	*	**
Furniture, signs	-	*	*	**
Communication Network	-	*	-	*

Source: By Author

(*) this symbol in the table means that such component achieves the criterion. Total risk degree equal to (***= High, **= Medium, *= Low)

VII. ANALYTICAL CASE STUDY (MIAMI SPRING CITY)

Miami Springs is a city located in Miami-Dade county, Florida, the U.S.A. the area of the city is (7.76 km^2) with population 13,809 in 2010 and density 1,899.77/km^2. This city contains different races, yet with a majority to white or Caucasian with 93.4 %of the city dwellers.

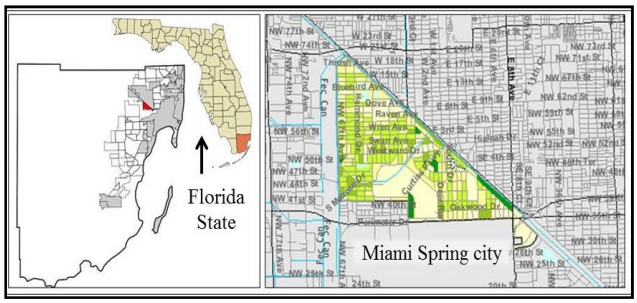

Figure 2: Miami Spring city

Source: //www.wikiwand.com/en/Miami_Springs,_Florida

A. The Crime Index of Miami Spring

Miami Spring city is located in Florida State which has a very high crime rate in comparison with other states. Yet, the crime index of Miami country is overall moderate; estimated to be 52.91% in 2019[10]. Crime Index is an estimation of overall level of crime in a given city or a country. Crime levels lower than 20 are considered very low, crime levels between 20 and 40 are low, crime levels between 40 and 60 are moderate, crime levels between 60 and 80 are high and finally crime levels higher than 80 are very high.

On a more detailed scale, the official reports recorded over 570 crimes in Miami Spring city in the time period between January 2018 and January 2019, classified to violent crime (13.6%), quality of life crime (1.7%) and property crime with majority (84.7%).

This paper classifies Miami Spring city to nineteen areas in order to discuss in details the differences between areas with high and low crime rate on an urban scope with respect to the proposed ranking methodology which rankedfour urban components (accessibility, section ratio,land-use and urban fabric) as high risk urban components affecting crime.

[10]https://www.numbeo.com/crime/

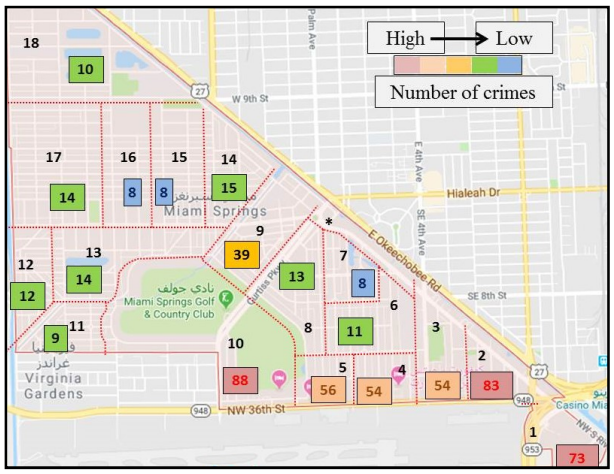

Figure 3: Number and types of crimes in Miami Spring city (2018- 2019)

Source: By Author, Crime number
source:://www.crimereports.com/agency/miamisprings

By classifying the crimes geographically among the nineteen areas, it was found that there is a notable variation in crime numbers among them. Yet, all areas showed a very high property crime in comparison to violent crime.

Table 3: Number and types of crimes in Miami Spring (2018- 2019)

Number of area	1	2	3	4	5	6	7	8	9	10
P*	65	67	46	47	49	10	7	11	31	74
V*	8	14	7	6	6	1	1	2	7	11
Q*	-	-	1	1	1	-	-	-	1	3
T*	73	83	54	54	56	11	8	13	39	88

Number of area	11	12	13	14	15	16	17	18	*
P*	8	8	13	12	6	6	10	9	4
V*	1	3	1	2	2	2	3	1	-
Q*	-	1	-	1	-	-	1	-	-
T*	9	12	14	15	8	8	14	10	4

*P: Property Crime, V: Violent Crime, Q: Quality of life Crime, T: Total number of crimes

source://www.crimereports.com/agency/miamisprings

B. *Analyzing the urban components of the city*

First, there are some urban component which are the same among the whole city, thus they are not the cause behind the varying rates of crime. These components are:

- Entries: Those are clear but many which stimuli crime and weaken the natural surveillance and residential control.
- Urban fabric: Miami city is characterized by regular urban fabric almost orthogonal grid which is the safest type of urban fabric for residential areas[11].

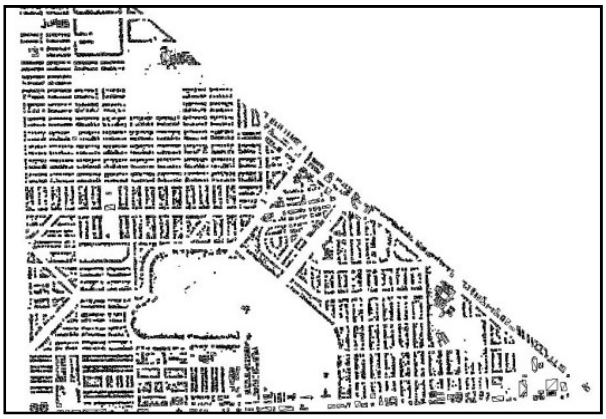

Figure 4: Urban fabric of Miami SpringCity

Source: By Author

- Section ratio: the residential style of the city is luxurious housing with garden rather than residential buildings or apartments, thus the section ratio among the whole city is well functionalized.
- Roads' situation, Building situation, Sidewalks, Furniture elements, and Infrastructure, all exist in well condition in the whole city which contributes to deter crime.

On the other hand, the remaining urban components vary from one area to another within the city which led to the notable variation in crime rates. These components are; accessibility, crowd, opening ratio, land use and landscape (vegetation).

1) *Accessibility*

Accessibility can be described as how easily the space is navigable by users. Accessibility could be discussed and analyzed using space syntax[12].

Space Syntax software such as Depthmap analyses the spatial configuration of a space as a set of axial lines and measures integration value which is one of the most popular Space Syntax analyses of street network. It measures how many turns one has to make from a street segment to reach all other street segments in the network, using the shortest paths.The street segments that require the least amount of turns to reach all other streets are called 'most integrate' and are usually represented with warmer colors, such as red or yellow. Integration analysis is applied to axial maps which represents

[11]B.Hillier and O.Sahbaz
12Bill Hillier, Julienne Hanson and colleagues at The Bartlett, University College London in the late 1970s to early 1980s

roads network only, each line in axial map represents a straight sight line and a possible pass in reality.

By applying the integration analysis to the roads network of Miami Spring city the average integration value of the city was (1.05) for the whole city.

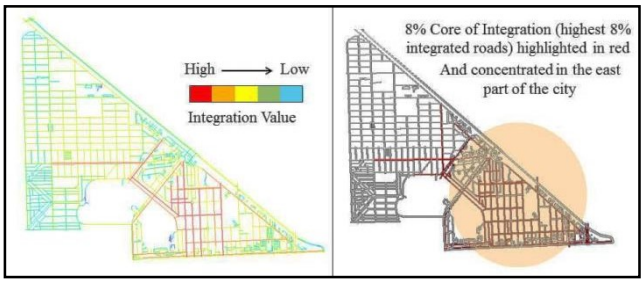

Figure 5: Axial Map of Miami Spring City

Source: By Author

The integration analysis of Miami spring showed that the eastern part of the city has higher integration value than the western part. Moreover the roads with the highest integration values are concentrated in the eastern part; it appears more clearly in the core of integration map which shows the 8% most integrated roads in the city.

The westernpart of the city has moderate integration values which still above the average of the whole city. The segregated roads are scattered in different places, the only area that was found to have low integration value in the city is area number 12 which is located in the south-west part of the city.

By comparing the integration analysis value with the crime number in each area within Miami Spring, it was found that: the eastern part of the city which has higher integration values has also notable higher numbers of crime. This could be explained as; areas with higher integration values (good accessibility) are characterized by more users. These users could act either as "eyes on the street", thus this would decreases the crime rate, or they could be proper targets (victims) and this will result in increasing the crime rate.

Determining the right case depends on two main things; first is the crime type (as property crime always targets crowd places with many users, and second is the land use which is a high risk urban component and at the same times it is quite related to integration value.

Commercial, administrative and mixed land uses are often located on roads with the highest integration value. If areas with high integration value (good accessibility) have at the same time commercial use, thus the "target" theory of users overweight the monitoring theory because the users of this space are limited to definite time and the urban space becomes deserted at the other times. That is one of the reasons behind increasing crime rate in the commercial zone.

2) Crowd

Crowd is quite related to the accessibility and to integration value. "Areas with high syntactical accessibility have a higher number of pedestrians and car users"[13]. Moreover, the traffic map shows fluent traffic except for few roads in the commercial area located in the eastern part of the city compatible with accessibility results.

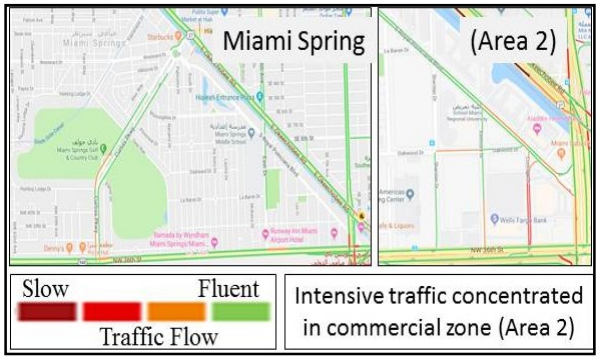

Figure 6: Traffic map, Miami Spring City

3) Opening Ratio

Opening ratio as an urban feature refers to building openings whether windows or entryways over streets or urban spaces. Many scholars favor facing building openings to streets or urban spaces as a way to enhance natural surveillance and therefore, deter crime[14]. Street network within Miami Spring city is monitored by residential houses which overlooked them. Yet, the problem appears in the commercial zone located in the eastern part of the city (Area number 2) where there are many streets without any opening overlooking them.

Figure 7: Streets without windows overlooking them (Area number 2)

Source: By Author, Map source: Google map 2019

13Penn, et al., 1998; Hillier et al., 1993.
14Zelinka and Brennan "Safescape" 2001

4) Land-Use

The most three common land use types in the city are residential, commercial and mixed land use.

- *Residential land-use:* represents the bulk of any city. It has a deterrent effect to crime which lies mainly in the characteristics of dwellers. For example, their ability to eliminate strangers, their sense of ownership and the extent of their public participation. These characteristics are considered as a kind of natural surveillance
- *Commercial land-use*: commercial zones are areas often characterized by hustle and dense population during the day, yet, almost deserted at night which made these areasdissociation not only socially but also spatially[15]. Thus mixed use is recommended in these zones to bring users outdoor at different times and for different purposes.
- *Mixed land-use:* mixed land use creates multi-purpose urban spaces that attract more users at different time. Yet, it could be a double edged weapon. If mixes land use is functionalized to maximize natural surveillance through more users, it would be an effective deterrent to crime. Many scholars adopted this argument like Jane Jacob " The district, and indeed as many of its internal parts as possible, must serve more than one primary function; preferably more than two"[16]. On the other hand, mixed land use in many cases includes uses that act as crime generator, crime attractor or both. In such cases the negative effect of mixed land use overweight the deterrent effect of natural surveillance. It could be concluded that each land-use has its pros and cons regarding security aspect and many times has both deterrent and stimulus effect on certain types of crime. Thus the key solution to positively functionalize land-use in deterring crime lies in thoughtful mixed-use.

By comparing the land use of Miami Spring with the crime numbers, it was found that areas with the highest number of crime are those areas with commercial use, for example; area number "2" which is a pure commercial area.

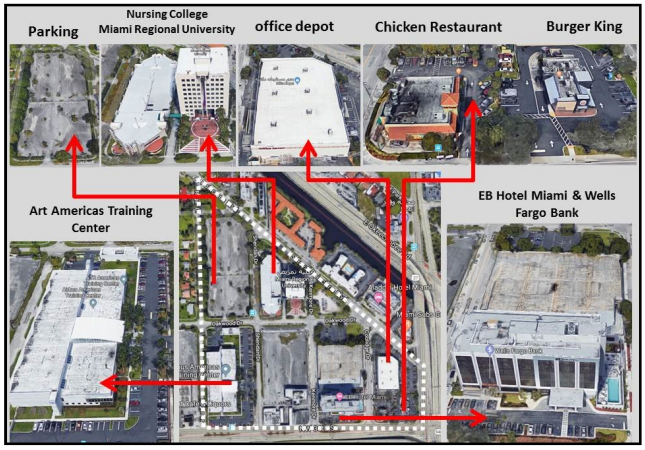

Figure 8: land use of area number 2, Miami Sprring city

Source: By Author, Map source: Google map 2019

Also area number "10" which has high number of crimes has commercial zone and two residential zones, yet separated from the commercial one. It is notable that the crime incidence is concentrated in the commercial zone rather than the residential.

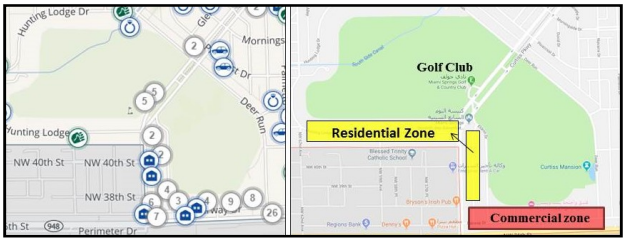

Figure 9: land useand crime number of area number 10, Miami Spring

5) Landscape (Vegetation)

There is a wide debate among scholars about the effect of afforestation on urban crime; whether it is a deterrent or stimuli. According to this debate, afforestation and urban greenery have both effects on crime incidence. The first team is convinced that afforestation has direct relationship with urban crime, because afforestation may create natural hiding places for criminal especially those low and dense trees and shrubs. On the other hand, the other team believed that afforestation has a deterrent effect to crime as it creates livability in urban spaces that attract more users (Jacob's theory "eyes on the street"), in addition, it hints criminals that users care about their place (Wilson's theory "Broken Window").

In order to maximize the deterrent effect of afforestation on crime, some guidelines need to be taken into consideration:

- Vegetation within 6 feet (nearly 1.8 meter) distance from a walkway or a side walk should be with low height that do not exceed 2 feet (nearly 0.6 m) to

15E.Aksoy, " Geography of Crime and Its Relation to Location: The City of Balıkesir (Turkey)" 2017
16 Jacob, "Death and Lifeof Great Americian cities", 1961

maximum visibility and avoid creating hiding spots[17].

- Shrubbery could be used after these 6 feet to 12 feet, yet its height should not exceed 3 feet (nearly 0.9m)[18].
- Any tree should be 10 feet (nearly 3m) away from any house in order to avoid being a climbing aid[19].
- Trees should be trimmed in order not to obstacle vision or lighting, to do so; the lowest foliage should not be less than 7 feet (nearly 2m) from the ground[20].

Miami Spring city is characterized by dense vegetation especially within residential areas these trees obstacle vision line in some areas.Moreover, in other residential areas trees are located too close from houses that they could be used as climbing aid. On the other hand, vegetation is well trimmed and better functionalized in the commercial zone than in residential areas.

Figure 10: Examples for Vegetation in residential areas

Source: By Author, Map source: Google map 2019

VIII. CONCLUSIONS

Committing a crime is a mental process translated to a physical action that occurs within spatial and temporal frame. Thus, offenders realize their crime scene as dynamic environments. Their perception is not limited to urban elements separately, yet, it mainly depends on the correlation between them either to offend or to retreat. This correlation and the effect of urban components on crime vary from one component to another. Thus, ranking them according to definite criteria contributes to deep understanding to what makes urban space safer.

By ranking comprehensive urban elements and features according to three main criteria; the possibility of changing or maintaining, the possibility in create perfect circumstances for an offender to offend and escape, and finally the role in monitoring urban space, it was found that accessibility, section ration,land use, and urban fabricgot high risk degree in crime issue.

From the analytical case study, it is concluded that;

- Accessibility cannot be analyzed separated from land use, owing to the strong correlation between them.
- Areas with good accessibility translated in high integration values are more likely to crime incidence (especially property crime) in case of the land use of these areas is commercial.
- Mixed land use is better than commercial in deterring crime, as the mixed use attract users for different purposes and at different times. Thus, it provides better surveillance for the urban space.
- Crime rate changes as the scope changes; the outer scope of the case study (the state) is characterized by high crime rate, yet, this rate totally changed on the scope of the city. This gives us the hint that we can create secured urban space regardless the depressing rates of the wider scope.
- On the city scale, the crime rate changes notably from one area to another, such thing refers to urban changes between these areas, and how offenders exploit some urban component to offend.

17The American Crime Prevention Institute , AEGIS Protection Group, Inc.
18The American Crime Prevention Institute , AEGIS Protection Group, Inc.
19https://police.cityofboise.org/crime-prevention/protecting-your-home/landscaping-for-crime-prevention/
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