

## Locating pocket parks: Assessing the effects of land use and accessibility on the public presence

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### ABSTRACT

Nowadays, pocket parks can serve people's interests as outdoor recreational spaces. Existence of these spaces is essential, but it may be challenging to establish and maintain them in some neighborhoods for a variety of reasons. This study aimed to compare land use and accessibility as two main factors that affect choosing appropriate places for these mini-parks. For this purpose, we assessed the effect of these variables on public presence. A survey was conducted among N = 376 respondents, including Baharestan neighborhood residents. We also used Space syntax to investigate residents' access to green local space. The results indicated that the effects that location had concerning packet parks greatly overshadowed the effects of accessibility. It was additionally concluded that, the different types of commercial land use are more closely associated with people's attendance rather than the scale of land use. The findings will help urban planners and authorities to make better decisions towards choosing better pocket park locations in our cities.

### 1. Introduction

Open public areas, like parks, are important places in neighborhoods for public recreational use, destinations for walking, exercising, and releasing energy, irrespective of socio-demographic backgrounds (Kaczynski et al., 2009; McCormack et al., 2010; Sugiyama et al., 2010). Parks are a type of public green space in a built environment. Parks and green space vegetation have long been believed to contribute to a better environment and air quality in dense urban areas as well as the well-being of the population, physical activity, psychological rehabilitation socializing, and social capital (Davies et al., 2011; Nilsson et al., 2010; Parsons et al., 2015). The UN estimates that 'a significant number of the world's population will settle in cities by the next three decades.' (Kerishnan et al., 2020). This rapid urbanization will probably have an

effect on the environment as well as society, especially in terms of the stress that comes with residing in an urban area without access to green spaces (Cox and Gaston, 2018).

Small urban parks have been designed in cities that need green spaces (Nordh and Østby, 2013). A shortage of resources and less opportunities for individuals to reach greater green spaces are results of increasing density (Haaland and van Den Bosch, 2015; Nechyba and Walsh, 2004). This has an impact on how frequently people use green spaces; if they are far away, people are less likely to visit. Thus, mini parks in a crowded city would motivate nearby individuals to easily walk to the nearest park. One type of green space is a pocket park which are recognized by its spatial scale. These parks can be named mini-parks or green pocket parks and their area is often about 1 hm<sup>2</sup> (Hendon, 1977). Having more pocket parks is a necessity for many cities in their

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working environment and neighborhoods (Kerishnan et al., 2020). However, choosing unsuitable locations for these parks may cause them to be rarely used by people assumed to frequent them. For instance, many pocket parks have been developed in inappropriate sites and built on just vacant lands, particularly at a local scale. Therefore, it is essential to choose appropriate locations for these parks to increase people's attendance in these green spaces.

In several studies, it is asserted that possible walking choices are related to the diversity of land use and Neighborhood parks (Fry et al., 2021; Kang, 2015). Some types of land use can discourage people from getting into parks, while the possibility of people's presence in these spaces, especially for physical activity, increases when there is a diversity of land use over the neighborhood (Kaczynski, 2010).

It is said that precise measures of park proximity must be noticed as they support the planning process (Chiang and Li, 2019). In addition to closeness to parks and designing park elements, direct access to parks through the design of street networks helps facilitate the physical activity associated with parks, leading to people's presence in these spaces (Kaczynski et al., 2014). Even though features such as great walking paths, sports facilities, and lighting may be critical for each person's experience of using green public spaces, enhancing access to them is more needed for people than those features (Tannous et al., 2021).

In street network design, some indices and factors affect people's presence in urban spaces. They can positively enhance and improve access to space. For example, one of these indices is the consideration of access hierarchy, which includes organizing and combining spaces based on some of their physical and functional characteristics. Without a proper access hierarchy, people's access from private to public spaces decreases and affects people's presence in urban spaces (Wang et al., 2016). Another index is access to main routes. These routes in the urban network have a social role, which invites people into the space with specific entrances and encourages people to cross these streets. Moreover, the existence of various routes to destinations is another index that aims to make different populations easily reach their destination (Hosseinzadeh Meybodi, 2013). A successful public space is a space to go to and return to easily. In addition, the sidewalks are designed with high quality, interference between driver and pedestrian is minimized, and there is access to public transportation (Pasaogullari and Doratli, 2004). Therefore, a suitable connection between pedestrians and drivers is essential. Also, the intersections and the short distance between them can be considered another indicator. Intersections connect routes, resulting in increasing access. The shorter the distance between the intersections, the more spatially they depend on each other and affect each other in many ways (Abdel-Aty and Wang, 2006).

People can identify spaces with better configurations and tend to visit these spaces. Space syntax is a way of describing and measuring the urban spatial configuration of spaces surrounded by buildings or streets and explaining the social definition of these structures (Chiang and Li, 2019; Hillier and Hanson, 1989; Hillier et al., 1987; Koohsari et al., 2019). Space syntax consists of diverse metrics, like connectivity, depth, and integration, which are broadly employed in measuring configurational features within the urban context (Hillier, 2007).

Connectivity is a simple measure used to analyze urban morphology and is defined as how many spaces are directly connected to the space selected for analysis (Jiang et al., 2000). It plays a critical role in neighborhood design and is positively linked to the regularity with which people walk to their destinations (Koohsari et al., 2014; Stangl and Guinn, 2011). Increased street connectivity is linked to higher walking levels and the probability of parks being used for physical activities (Badland et al., 2008; Kaczynski et al., 2014; Koohsari et al., 2014). The number of steps between one node and all other nodes is referred to as depth. The depth of a collection of nodes is defined by the shortest distance between them and other nodes, which means a lower depth denotes more convenient paths and open areas (Bafna, 2003). Integration is a significant index representing the mean of the number of axial lines by which it can be possible to have access from one line to

other lines within a defined area.

Previous studies have found a positive correlation between more integrated streets and an increasing number of pedestrians (Foltête and Piombini, 2007; Hillier et al., 1993; Lerman et al., 2014). Omer and Goldblatt (2016) Indicated that commercial land use is concentrated primarily in areas with relatively high integration.

Most of the research has been conducted concerning studying existing parks and their use. However, no research has been done specifically on locating and predicting suitable locations for parks, especially pocket parks. So, we investigated this issue. In this regard, the type of user and access is considered. The reason for choosing land use as a variable is that previous research worked more on the impact of factors such as diversity and mixed-use land on the use of existing parks. But in the present study, we focused on the effect type of land use on pocket park locations and predicted its role in the presence of people in the park. In addition, according to the information mentioned above related to accessibility, it can be concluded that this factor is significant in using the park. The existence of this factor is essential for predicting the park's location. Therefore, it is considered one of the important variables in our work. It is worth noting that rarely these factors are considered together in studies related to park usage.

This study aims to apply two main factors of pocket parks to investigate their effect on locating these minimal parks. We also compared land use and accessibility to each other to understand which of them plays a more important role in individuals' presence in public spaces. To do this, we gathered information related to the type of land use and accessibility indices and then analyzed them to find suitable locations for pocket parks in the neighborhood.

The hypotheses predict: 1. Commercial types of land use which is inconsistent with neighborhood scale will be negatively associated with People's attendance in public space. 2. The effect of land use exceeds that of accessibility on locating pocket parks.

## 2. Case study

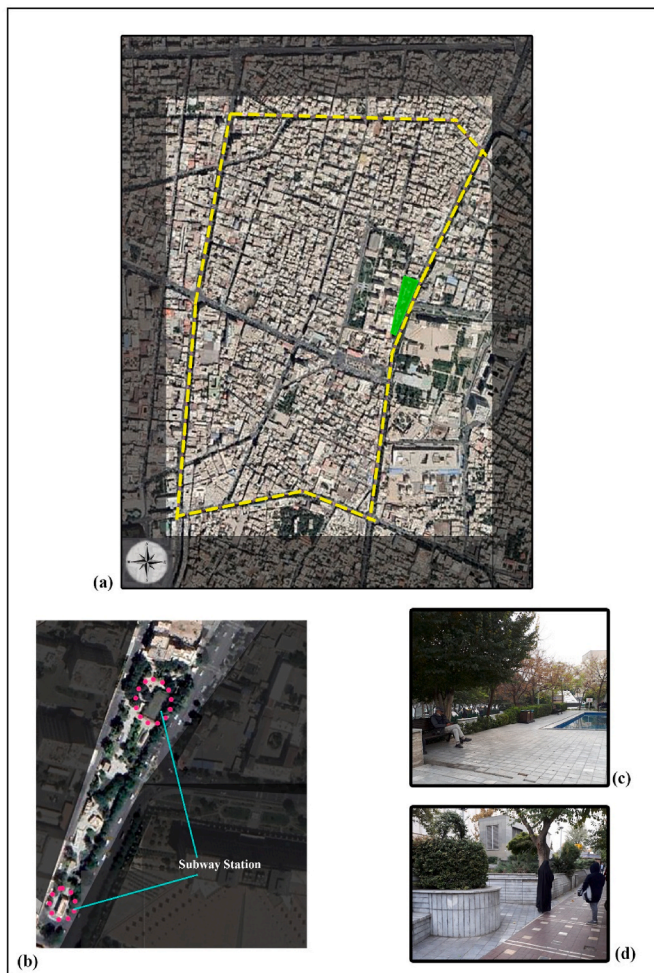
Baharestan neighborhood, the study area, is located in district 12 of Tehran's municipality, and it is also one of the most famous and important historical neighborhoods of Tehran. The neighborhood is bounded north by Enghelab street, south by Amirkabir street, east by Ibn Sina and Mostafa Khomeini Street, and west by south Saadi street. The area is about 1.3 hectares, and its population is about 16505. There is just one small park called Mostafa Khomeini near the Baharestan subway station, on the boulder of the case study (Fig. 1). Also, another green space located in the western part of Mustafa Khomeini Park is a historical place that cannot be used as a public space for people. Therefore, residents cannot use it as a free space that can be used 24 h. This place is considered a tourist attraction.

Moreover, the Baharestan neighborhood is devoid of public green spaces, which can be the reason that people are reluctant to attend in public spaces. According to the commercial and workshop texture of Baharestan, a variety of land use can be identified in the neighborhood. The south of Baharestan square includes a car spare part sale center, industrial pump, and industrial engine sale center. Other parts of this neighborhood have observed wedding card and calendar printing services, bags, and shoe stores, paper and cardboard sale centers, and refrigerator engine sale centers.

The main reason Baharestan neighborhood was chosen is that it is an important historical area, but it also suffers from the lack of green spaces. In addition, specific types of land use function beyond the neighborhood scale, significantly affecting the residents' attendance in the neighborhood.

## 3. Method

In this study, we first selected nine neighborhood streets with particular a specific land use and a neighborhood street with the largest



**Fig. 1.** (a) Baharestan neighborhood and the location of Mostafa Khomeini Park (b) Mostafa Khomeini Park (c & d) Pictures of the park.

volume of residential land use. These streets are named:

Amir Kabir(A), Zahir-ol-Eslam(B), Qaedi(C), Mostafa Khomeyni(D), Jomhouri(E), Mellat(F), Safi Alishah (G), Saadi (H), Azadikhah (I), Saf (J). In Table 1, location, and pictures of each street were introduced. Also, the type of land use related to these streets was indicated in Fig. 2. The sample size was calculated using Cochran's formula resulting in 376 people in a total population of 16,505. (With 0.05 error percentage).

Between May and June of 2021, this study was conducted using a questionnaire. We allocated 25 days to complete it. The questionnaire consisted of three parts including; i) demographic data; ii) Accessibility indices, iii) Effects of land use on people's attendance. The respondents answered questions using the 1–5 Likert scale. IBM SPSS 22.0 was used for all statistical analyses of the participants' data. Through One Sample *t*-Test, each type of land use was evaluated.

We used space syntax as a predictor of people's natural movement to identify the paths that are the more accessible and where residents are more likely to be present. The theory of natural movement can connect the form of urban land and its functional aspects by pedestrian Movement (Hillier et al., 1993). and they illustrate how properly connected street development (urban form) improves accessibility in part through urban function (land use) (Koohsari et al., 2019). First, we used a map made by municipality of district 12 and then extracted CAD map for producing axial map. Finally, by using UCL Depth Map software version 10, we estimated three indices including depth, local integration and connectivity. Global integration measures the proximity of one space with respect to all spaces by calculating the shortest distance between the corresponding spaces, and if integration is confined to be computed

for a set number of adjacent spaces, it calls local integration. Local integration was chosen for this study since it has a greater effect on pedestrian movement (Ratti, 2004). The higher the value of local integration is, the more accessible a spatial is (KLARQVIST, 1993). Another index is Connectivity indicating the relation between spaces and immediate neighborhoods. It plays a critical role in neighborhood design and is positively linked to the regularity with which people walk to their destinations (Koohsari et al., 2014; Stangl and Guinn, 2011). This value shows the number of straight connections each path has with other lines. Mean depth expresses how far an axial line is from other lines. Actually, the more depth a line has, the more segregated it will be, resulting in separated spaces.

Finally, we used Paired Sample *t*-Test to assess the difference of two variables for the same subject. So, we applied it to assess the level of significance between land use and accessibility.

The statistical hypothesis is as following:

$$\begin{cases} H_0 : \mu_1 = \mu_2 \\ H_1 : \mu_1 \neq \mu_2 \end{cases}$$

## 4. Result

### 4.1. Demographic characteristics of participants

From the 376 participants who provided useable data, 48% were female while men were marginally overrepresented in the sample (52%). Also, they were aged between 18 and 75 years with a mean of 37.6. About 55% had a bachelor's degree and the rest included a diploma (38%), a small percentage in a doctorate (17%). 70% of the participants were residents of the neighborhood and the rest just worked in it. Finally, people with children accounted for 60% of the total sample.

### 4.2. Neighborhood accessibility evaluation

#### 4.2.1. Results of the questionnaire

In the questionnaire, the accessibility indices were first discussed, and participants were questioned. The results showed that "the existence of various routes to destinations", "access to main routes", "an appropriate connection between driver and pedestrian", and "consideration of access hierarchy" had significant difference with neighborhood accessibility ( $p < 0.05$ ). However, "the number of conjunctions and a short distance between them" had no significant effect on accessibility ( $p > .05$ ) (Table 2). Then, each index's effectiveness on individuals' choice to attend each route was assessed by comparing the mean of each index; if the mean is more than 3, the effectiveness will increase. According to the Table 2, "The number of intersections and the short distance between them" have the highest number, whereas "an appropriate connection between driver and pedestrian" has the lowest. Overall, these indices had no important impact on accessibility.

#### 4.2.2. Space syntax as a predictor of the presence and accessibility in the neighborhood

As mentioned in the research method, three space syntax indices were considered in this study: local integration, mean depth, and connectivity. Safi Alisha, Zahir al-Islam, Ghaedi, and Saadi streets had a high value, among which Safi Alisha streets had high connectivity, Safi Alisha, Zahir al-Islam, Ghaedi, and Saadi streets had a high value, among which Safi Alisha had the highest (Table 3). This significant value indicated its high permeability compared to all the streets and more impact on the surrounding space. The lowest connectivity was for Amir Kabir Street. With respect to local integration, Ghaedi, Azadikhah, and Safi Alishah, respectively, had a higher value than others, contributing to increasing individuals' presence and the usability of these spaces (Fig. 3). Almost all streets had the same value of mean depth. In detail, Azadikhah and Saf had the lowest and the highest mean depth.

**Table 1**  
Location and pictures of each street.

Street's location	Street's name	Street's pictures		Street's location	Street's name	Street's pictures	
	A				E		
	B				F		
	C				G		
	D				H		
	K				I		



**Fig. 2.** The type of activity and retails of each street.

Generally, mean depth of the selective streets was lower than the whole neighborhood streets. As a result, according to space syntax findings, Safi Alishah, Ghaedi, Zahir al-Islam, and Azadikhah were identified as streets playing so important role in accessibility and dwellers' attendance.

**4.3. Evaluating the impact of land use on the attendance of people**

The One-Sample *t*-Test was used to investigate the role of land use in each street on people's attendance. As shown in Table 4, the level of significance was less than 0.05. The effectiveness of selected land use on the presence of people in the space was assessed. Except for two land use ("car spare part sale center" and "warehouses"), the rest of land use had a positive effect on the presence of individuals, which was mainly related to "wedding card and calendar printing services" in Jomhuri Street ( $M = 4.2$ ) (Table 4). The results of the questionnaire also showed that a significant percentage of women avoided using the streets, where "car spare part sale center" was located (Fig. 2) since this type of land use was frequently used by men and women preferred to cross the side roads around these streets to access the others parts of the neighborhood. The least of the mean was dedicated to warehouses, indicating an inappropriate effect on attendance (see Table 5).

**4.4. Comparison the effect of land use and accessibility on individuals' attendance**

As mentioned before, Paired Sample *t*-Test was conducted to look for any significant difference between land use and accessibility. Because the *p*-value was less than 0.05, the null hypothesis was rejected. AS a result, there was a significant difference between the two variables. Considering that the land use mean was 3.45, we conclude that the respondents considered land use more effective than accessibility in their presence in urban spaces.

Space syntax was used to examine people's spatial access, and

**Table 2**  
Evaluation of accessibility indices on the presence of residents by One Sample t-Test.

Indices	Mean	t	Significance	Mean Difference	95% confidence interval of the Difference	
					Lower	Upper
The existence of various routes to destinations	2.5904	-6.471	.000	-.40957	-.5340	-.2851
The number of conjunctions and a short distance between them	2.9415	-.388	.698	-.05851	-.3551	.2381
Access to main routes	2.4495	-7.646	.000	-.55053	-.6921	-.4089
An appropriate connection between driver and pedestrian	2.2101	-11.097	.000	-.78989	-.9299	-.6499
Consideration of access hierarchy	2.7287	-3.709	.000	-.27128	-.4151	-.1275

**Table 3**  
Comparison of space syntax indices for streets.

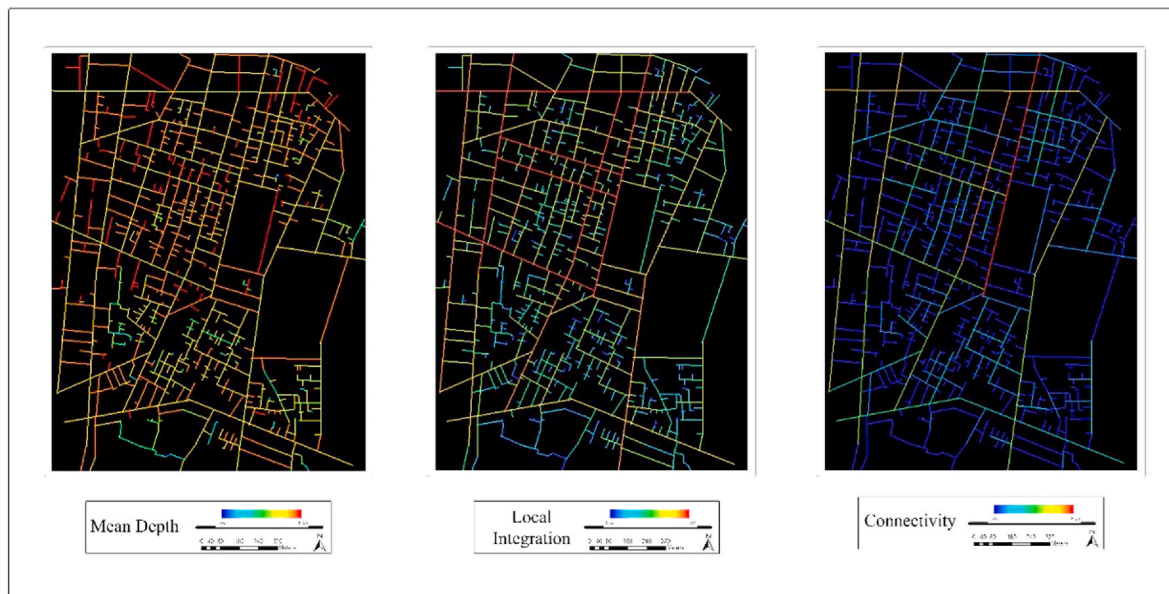
Streets	Local Integration	Connectivity	Mean Depth
Ghaedi	3.85	20	2.42
Saadi	3.59	21	2.58
Azadikhah	3.79	18	2.4
Zahir-ol-Eslam	3.51	24	2.58
Safi Alishah	3.65	28	2.58
Jomhour	3.63	17	2.51
Saf	3.18	14	2.63
Mellat	3.44	16	2.58
Amir Kabir	3.1	12	2.58
Mostafa Khomeyni	3.26	15	2.5

natural movement, which resulted in four streets (Gaedi st., Zahir-Ol-Eslam st., Azadikhah st., and Safi Alish st.) were selected among nine streets. The possibility of the presence of people in these four streets is high, and pedestrian movement is more predictable in them.

Considerably, pocket parks are more successful and useable when people can be encouraged to be present in these parks. Therefore, because of increasing the resident's presence in these places, the possibility of using pocket parks would be developed will increase. According to Figure (2), introducing type of land use related to each given street, and also Table (4), showing the impact of land use on people attendance in the space, Azadikhah street has a high integration value. However, since a large part of it includes warehouses, it can be said that it negatively impacts the presence of people (especially women and children) in that

**Table 5**  
Comparison of the effect of land use and accessibility on people's attendance using paired t-test.

Pair	Accessibility	Mean	N	Std. Deviation	Std. Error Mean	sig
		1	Land use	2.5867	375	.86817
		3.4590	375	.70803	.03656	



**Fig. 3.** Space syntax values for Baharestan neighborhood.

**Table 4**  
Investigating the effect of each type of land use on people's attendance using One Sample t-Test.

Land use	Mean	t	Significance	Mean Difference	95% confidence interval of the Difference	
					Lower	Upper
wedding card and calendar printing services	4.2480	8.477	.000	1.03467	.9075	1.1618
bags and shoes store	3.9654	18.344	.698	.93617	.8316	1.0407
paper and cardboard sale center	3.7660	5.035	.000	.76596	.4668	1.0651
refrigerator engine sale center	3.1915	2.737	.000	.35638	.2239	.4889
car spare part sale center	2.8670	-1.849	.000	.38830	.2593	.5173
industrial pump, and industrial engine sale center	3.4681	7.050	.000	.46809	.3375	.5986
warehouses	2.7021	-4.358	.000	-.29787	-.4323	-.1635

street. Although some parts of Ghaedi and Zahir al-Islam streets have a specific and trans-regional land use, according to the mean (Table 4), these types of land use did not deter residents from attending these streets. Safi Alishah Street had the most residential texture compatible with the creation of the park as well as residents' attendance and having high indices of spatial configuration. Finally, Safi Alishah, Ghaedi, and Zahir al-Islam streets were selected as suitable options for developing pocket parks for the whole neighborhood (Fig. 4).

## 5. Discussion

In this study, we addressed the impact of accessibility and distance besides land use as significant factors for using and locating mini-parks. More recent studies like Venhari et al. (2019) concentrate on issues like human thermal comfort or the influence of major road construction on cityscapes (Xie et al., 2016). However, in this paper, through examining two given factors, results showed that land use plays a more prominent role than accessibility in the attendance of individuals in pocket parks. This may be comparable to Parra et al. (2010) and Huang et al. (2020) findings which indicated significant relationships between land use mix and park use through the elderly and children in Bogota' and New York City, respectively. Nevertheless, Kaczynski et al. (2010) indicated that more diversity of land-use decrease park usage for physical activity. Additionally, some studies like Kang (2015) showed how access and centrality to land use affect pedestrian presence, but we have less understanding about the impacts of land use on people's choice in order to use a space, like pocket parks, for leisure time.

The results also showed that apart from the types of land use, the kind of commercial land use is a vital factor in the presence of local people in the space and for locating a pocket park. However, Fry et al. (2021) indicated that no model supported the notion that the existence of various commercial activities is hopefully related to park usages. Furthermore, Land use mix, including retail stores, various services, and amenities in a space, indicates a viable feature of a land and people will

persuade to walk more for transportation if there is higher land use mix (Koohsari et al., 2019).

In the present study, it was shown that the type of land use has a more significant impact on the presence of people in comparison with the land use scale. For example, although bag and shoe stores and wedding card and calendar printing services act on a trans-local scale and attract many people from diverse parts of the city, the results showed that these two types of land use positively affect the presence of neighborhood residents. On the contrary, the other types of land use on a similar scale, such as warehouses and the car spare part sale center, negatively impacted people's attendance due to their function.

In previous studies, space syntax was used as a factor to guide pedestrians' movement in cities and neighborhoods, and local factors such as land use and space attractions are said to play a less vital role in this regard (Hillier et al., 1993; Toker et al., 2005). Nevertheless, in this study, on the contrary, it was shown that land use in shaping the behavior of the users and their presence in space is more important than combining spaces with other existing ones. For example, with respect to space syntax theory, people may find it difficult to access space if mean depth increases. However, although Saf Street has the highest depth, according to observation, it always attracts many people due to its specific land use.

Numerous studies on people's behavior in pocket parks and their impact on the quality of life, physical health, social benefit, and physical health have been conducted. (Bertram and Rehdanz, 2015; Cohen et al., 2014; Danford et al., 2018; Hashim et al., 2019; Kerishnan et al., 2020; Wood et al., 2017). But, nothing has been done about their location and what factors prevent their access and presence in these parks. In addition, just as the internal characteristics of pocket parks, such as furniture, slope, lighting, and sports equipment, are influential in people's attraction and use of pocket parks, external factors such as accessibility and types of land use are also significant in encouraging people to attend these public spaces, which should be considered in locating this type of parks.

Although the result of this study demonstrated land use plays a more critical role than accessibility, and this variable can be used as a predictor for locating pocket parks, this study had several limitations that should be noted. First, only the effects of land use and accessibility were addressed, and other surrounding factors, such as sidewalk slope, shading, and lighting, were not considered when studying individuals' presence. Second, our study sample is small. We just worked on this small sample because of the historical importance of the neighborhood and the types of land use located in this area. Therefore, it is necessary to conduct further studies of other similar samples in different parts of the world. Third, Disabled and vulnerable people should be considered in other research as it was not worked in our research. Forth, it is expected that designing pocket parks can also influence public presence. In this way, Future studies can consider this matter besides locating these mini parks. It is also recommended that locating inconsistent land use at the local scales should be investigated, and implications for planning policies and solutions should be provided. It is also suggested that research be carried out on the safety of paths leading to pocket parks and their impact on residents.

## 6. Conclusion

This study sought to investigate the effect of land use and accessibility on the presence of residents in the neighborhood so that potential places for developing pocket parks would be identified.

The results showed that accessibility indicated less impact on the presence of people in space compared to land use. The Space Syntax method was used in another section of the current study to assess residents' access in the neighborhood. Due to the useable variables of connectivity, integration, and mean depth, more accessible routes making residences' attendance more likely, were identified. However, one of these guidelines was excluded from the proposed pocket park

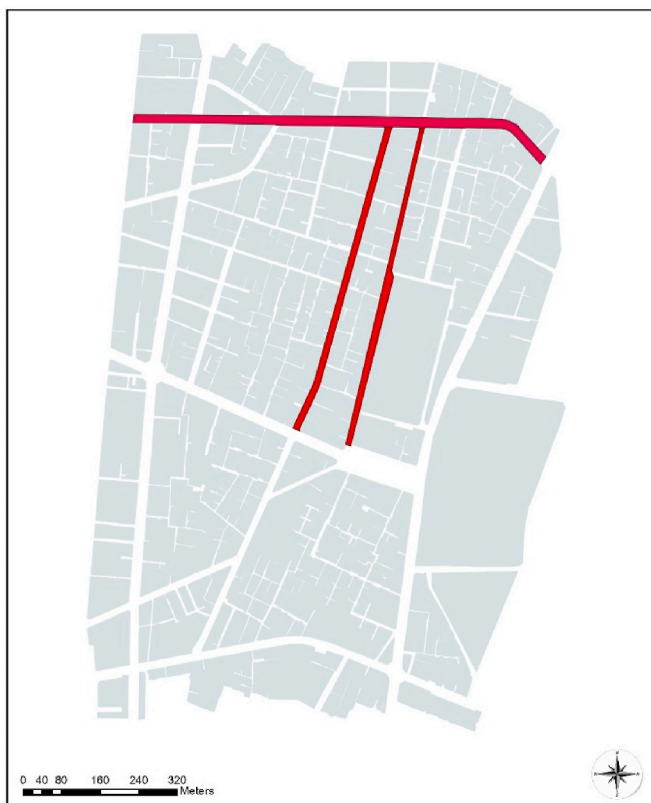


Fig. 4. selected streets as suitable options for developing pocket parks.

location options due to the negative impacts of land use has on visitation. This research also showed how a specific type of land use in the great majority of the space could invite or deter residents from that local space, which can be further explored in the future.

### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### Data availability

Data will be made available on request.

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