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PROSPECTS OF WALKABILITY IN CITY NEIGHBORHOODSCASE STUDY: THE CITY CENTER OF ALEXANDRIA

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Abstract

Sustainability, livability and quality of life have become widely discussed issues in the literature of urban planning and design. This study primarily aims to investigate the concept of walkability as a part of livability. To draw a wider theoretical framework for this study, it first seeks to define the terms of 'livability' and 'quality of life'. Then, it focuses on the concept of 'walkability' as one of the major components of these terms and as a measurable notion in urban design. Thus, this research seeks to identify a set of indicators of walkability in public spaces to be used for the application which can directly impact on the design quality of urban space. Third, this research focuses on Alexandria city center which has been in the process of deterioration due to various current urban strategies. As the case studies, it examines Saad Zaghloul Street at Ramleh Station District by using the set of walkability measures. It investigates the walkability quality of four different zones of the street, and identifies their walkability capacities, problems and potentials. Finally, it suggests the policy and practical solutions on the design of these public spaces that will not only improve the walkability capacity of this street, but also be helpful for the revitalization of the historic city center.

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A. S. AMMAR ¹

ABSTRACT

Sustainability, livability and quality of life have become widely discussed issues in the literature of urban planning and design. This study primarily aims to investigate the concept of walkability as a part of livability. To draw a wider theoretical framework for this study, it first seeks to define the terms of 'livability' and 'quality of life'. Then, it focuses on the concept of 'walkability' as one of the major components of these terms and as a measurable notion in urban design. Thus, this research seeks to identify a set of indicators of walkability in public spaces to be used for the application which can directly impact on the design quality of urban space. Third, this research focuses on Alexandria city center which has been in the process of deterioration due to various current urban strategies. As the case studies, it examines Saad Zaghloul Street at Ramleh Station District by using the set of walkability measures. It investigates the walkability quality of four different zones of the street, and identifies their walkability capacities, problems and potentials. Finally, it suggests the policy and practical solutions on the design of these public spaces that will not only improve the walkability capacity of this street, but also be helpful for the revitalization of the historic city center.

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1. INTRODUCTION

Improving the quality of life has become the particular concern of urban planners in recent times. The word 'quality' within the context of urban environments has been used in the planning professions (Chapman, D., 1999). It refers to "the degree of excellence of a characteristic", but the notion of the QoL is used to refer to 'well-being', 'level of living', 'way of life', 'life satisfaction', 'happiness' and 'morale'. Many studies, planning statements and projects refer to the term QoL as either the 'outcome' of economic, environmental, social, aesthetic, civic conditions, or the 'cause' of impressions about QoL, and these impressions can influence the perceived or actual prosperity or attractiveness of a place" (Massam, 2002).

As for livability, it is often viewed as enhancing the economic, social, cultural and environmental well-being of current and future residents. According to Lynch (1974), a livable environment is "an environment in which one can act with competence, free from such dangers and discomforts as noise, pollution, accident, heat and fatigue".

Hancock et al. (1999) identify the determinants of QoL as sustainability, viability, livability, conviviality, equity, and prosperity. In the same study, walkability is shown as one of the components of livability. The main focus of this study is the notion of walkability; as one of the components of livability, and it will examine it from the urban design perspective.

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2. LITERATURE REVIEW

2.1 Defining Walkability

Walking is the most primary form of transporting (Grignaffini.S., 2008). Walkability is a measure of how friendly an area is to walking. It takes into account the quality of pedestrian facilities, roadway conditions, land use patterns, security and comfort. Walkability is a fundamental concept in sustainable urban design. (Litman.T., 2014)

Walkability definitions in the literature are too numerous; the few treatments highlighted here are chosen for their variety and scope.

- Saelens characterizes high-walkable neighborhoods as concentrating non-residential and uses along main corridors; the street pattern is grid-like, with short block lengths and few cul-de-sacs. (Saelens, 2003)
- Southworth (1997) describes three levels of walkability elements: community (large scale patterns of streets, land use, and growth patterns over time), neighborhood (intermediate patterns of blocks, streets, and intersections in primarily single), and individual street and house characteristics (street cross sections, lot configurations, and building types).
- Litman (2014) defines it as “the quality of walking conditions, including factors such as the existence of walking facilities and the degree of walking safety, comfort, and convenience.”
- According to Olson, the neighborhood concept by Clarence Perry utilized the five minute walk because Perry was very concerned about walking from a residential area to and from school. The five minute walk is a standard describing the average distance that a pedestrian is willing to walk before choosing to drive. (Olson.J., 2010)

2.2 Importance of Walkable Communities

First, walkable community Increases the physical activities as walking is the healthiest and the easiest everyday exercise in a busy day. According to the World Health Organization, adults should walk at least 30 minutes per day.

Second, it increases community cohesion and social justice (Gehl, 2010) by encouraging people to meet their daily needs by walking which will increase the chance to meet neighbors on the streets. Third, it provides personal security because the empty streets are the scary one but full streets are safer. This is commonly known for many people (Walk21, 2013).

Finally, it provides good access to public transport according to the walk21 conferences. Therefore, public transport is used widely in a walkable community.

2.3 The Benefits of Walking and Walkable City

The benefits of walking can be discussed from six perspectives: (Litman.T., 2014)

2.3.1. Public health benefits

There are different kinds of physical activities. Walking is the best option in a busy day. The greatest benefit from walking is health. People can benefit different things from walking such as transport, leisure and improve health (Schmitz et all, 2006).

2.3.2. Economy benefits

Walkable community has economic benefits for people like save money, on health care and save time lost on driving cars (Pope, 2010). There are also benefits for government such as save money spent on building new infrastructures. Furthermore, walkable community has more opportunity to attract investors and tourists, which increases the national income.

2.3.3. Social benefits

Walkable community has social benefits. Neighbors have more chance to talk to each other. Children and women can easily meets at parks nearby. People who are in wheelchairs can join the community and socialize with them. These will improve community cohesion and equity.

2.3.4. Safety benefits

Walkable community increase safety in the city through make the streets actives with pedestrian and shops nearby. Different ages in the city have enjoyed the safe environment in their community (Gehl, 2010).

2.3.5. Environment benefits

Walkable community has provided benefits to the environment. Examples of the benefits are: less noise and air pollution (W.H.O, 2014).

2.3.6. The Quality of life benefits

A good quality of life means good health, economic situation, community cohesion, safe place and clean environment. Walkable city has provided most of these (Gehl, 2010).

2.4 Creating a Walkable Community

There are many elements and design criteria of creating a walkable community such as:

2.4.1. Permeability: is about give people different alternative routes to their destinations. In addition, permeability is about connectivity and accessibility and it should be in proximity and accessible visually. (McGlynn, S. et all, 2013)

2.4.2. Variety: is about mixed use in the city. There are different levels of it such as: Place with different land uses and types of buildings.

That kind of buildings attracts different people at different times for different reasons. “Because the different activities, forms and people provide a rich perceptual mix, different users interpret the place in different ways: it takes on varied meanings”. (Speck, 2012)

2.4.3. Density: mix use and density are important elements for walkable city (Schmitz, A.et al, 2006). There is no economic value in providing different services for only a few people. Design the city for high density save people time and money as well as reduce air pollutions.

2.4.4. Safety, comfort and beauty of streets and Sidewalks: people should be able to walk safely in their community. There are many elements must be considered such as good sidewalks, safe and easy street crossing, traffic calming, safety and beauty of streets and sidewalks (Schmitz, A.et al, 2006).

2.5 Indicators of Walkability

Walkability quality of urban environment can be measurable. There might be a number of qualitative and quantitative measures to assess its capacity. Safety, orientation, comfort, diversity, attractiveness and street pattern are some of these qualities (indicated in table 1) which will be explained and used as a set of measures for the walkability assessment of the case study.

Table 1: Walkability measures / indicators.
Reference: The author

	Indicators	Components	References
1	Attractiveness and convenience (AaC)	<ul style="list-style-type: none"> Maintenance and cleanliness. Existence and quality of facilities for disabled people. Pedestrian amenities. Availability of crossings along major roads. The existence of interesting urban scenes. A variety of land-use activities. 	<ul style="list-style-type: none"> ▪ Krambeck, H., Shah J., 2006 ▪ Appleyard, 1981 ▪ Jacobs, 1995 ▪ Montgomery, 1998 ▪ English Heritage, 2000
2	Connection to open space (COS)	<ul style="list-style-type: none"> The connection of street network to natural elements. The connection of street network to meeting and gathering places. The connection of street network to places with unique features and visual interest. 	<ul style="list-style-type: none"> ▪ Montgomery, 1998 ▪ Gehl, 1987 ▪ Lambert K., 2005 ▪ Montgomery, 1998 Akkar, 2007
3	Safety (S)	<ul style="list-style-type: none"> Actual safety. Street width and enclosure. Traffic safety. Perceived safety. 	<ul style="list-style-type: none"> ▪ Southworth, 2003 ▪ Barlas, 2006
4	Street pattern (SP)	<ul style="list-style-type: none"> Grid pattern -the most advantages pattern in terms of walkability. Cul-de-sacs and lollipops – the least advantages pattern in terms of walkability. 	<ul style="list-style-type: none"> ▪ Southworth, 1993 ▪ Jacobs, 1995

5	Quality of path (QoP)	Sidewalk width. Paving quality. Street furniture. Street signs. Street lighting. Street trees.	<ul style="list-style-type: none"> ▪ Moughtin and Mertens ,2003 ▪ Gassaway, 1992 ▪ Rubenstein, 1992. ▪ Steiner, F. and Butler, K., 2007
6	Linkage with transportation modes (LwTM)	Well-connected pedestrian networks with other transit modes. Well-planned transportation plan.	<ul style="list-style-type: none"> ▪ Southworth, 2003 ▪ Duany et. al. ,2010
7	Connectivity of path network (CoPN)	Short links, intersections and minimal dead-ends. Continuity of sidewalks without barriers. The presence of alternative path choices Providing clear zones for walking.	<ul style="list-style-type: none"> ▪ Duany et al. , 2010 ▪ Southworth, 2003 ▪ Burden, 2000
8	Accessibility (A)	Access to public transport. Parking. Orientation. Unimpeded movement.	<ul style="list-style-type: none"> ▪ Crankshaw N., 2009 ▪ Lynch ,1960 ▪ Moughtin et al. ,1999 ▪ Appleyard ,1981

3. RESEARCH METHODS

The research method comprises two main sections as research tools related with data collection and method of analysis regarding walkability. The research followed five data gathering stages. These are:

- Literature review; which includes the indicators of walkability for livable environment.
- Desk-based assessment; includes three stages of examination. The first investigates the historical development of the case study area. The second one is the evaluation of current base maps showing the characteristics of walkability. The last one includes a subjective observation revealing the walkability indicators relating to urban design principles.
- Extensive survey; will be carried out to examine the area with its environs in a wider context of city center. It is crucial to reveal the main landmarks, nodes, boundaries and spatial relations.
- Direct observation; to find out the positive and negative factors which contribute to, or reduce the walkability quality, which will be carried out by several visits and taking photos.
- Questionnaires; used to reveal the perception of the streets' users. It includes 64 questions; divided into three sections, the first includes 5 questions about personal information, the second contains 13 questions about using the street and the transportation and then, the third section consists of 46 questions about the walkability assessment, these questions are assessed according to Likert Scale, rated on five degrees, scoring as agree, partially agree, disagree, strongly disagree and don't know. Responses required 20 minutes, and they will be conducted with user groups from different age, gender, education and occupation to reach varying perceptions.

In this context, 220 questionnaires were conducted in the street. This number was determined based on the estimated number in the case study area. In a week day, the number of users was counted for an half an hour in six different time-intervals of the day. Table 2 indicates the number of pedestrians passing from the street in half an hour and the approximate number of people in time period determined according to peak and rush hours. (as shown in figure 1)

Table 2: Counting results and approximate number of people in time periods.

Reference: The author

Periods	The number of people in half an hour	Approximate number of people in time period
08.00 am - 10.00 am	304	$304 * 4 = 1216$
10.00 am - 01.00 pm	412	$412 * 6 = 2472$
01.00 pm - 04.00 pm	623	$623 * 6 = 3738$
04.00 pm - 06.00 pm	713	$713 * 4 = 2852$
06.00 pm - 10.00 pm	1266	$1266 * 8 = 10128$
10.00 pm - 12.00 am	754	$754 * 4 = 3016$
Total		23.422

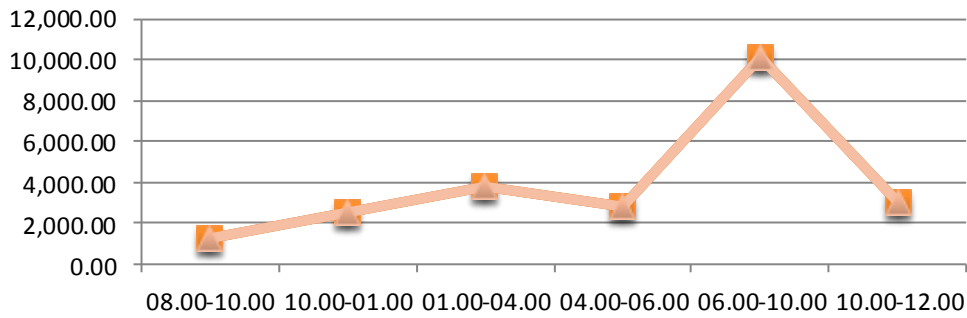


Fig. 1 Peak and rush hours for pedestrian movements in case study area
Reference: Author

The approximate number of people using the street is 23,422 from 08.00 to 24.00, when the street is actively used. The study accepted that 1464 people (23,422 people/16 hours (08.00-24.00)) use the street per hour. Thus, approximately 15% (220*100/1464) sampling was done by 220 questionnaires.

As seen in table 3 among the respondents, 52% were young, 35% middle-aged and 13% elderly. Also, to achieve a substantial representation of the respondent groups, the questionnaires were conducted with twelve pedestrians from vulnerable groups. Furthermore, more specifically, the respondents are composed of various occupations; shopkeepers (23%), pedestrians (66%) and street vendors (11%).

Table 3: Distribution of respondents according to age, occupation and gender
Reference: The author

		Gender		Number of Respondents	
		Female	Male	Number	Percentage
Age Group	16 - 34	74	42	116	52 %
	35 - 59	49	27	76	35 %
	+ 60	18	10	28	13 %
	Total	141 (64%)	79 (36%)	220	100 %
Occupation	Shopkeepers	28	23	51	23 %
	Pedestrians	113	32	145	66 %
	Street vendors	0	24	24	11 %
	Total	141 (64%)	79 (36%)	220	100 %

The results of questions are examined in kwiksurvey.com website to provide information and percentages about characteristics of the case study area.

4. CASE STUDY: SAAD ZAGHLOUL STREET

4.1 Historic Development of Cosmopolitan Alexandria

Alexandria acquired a unique place in history as a cosmopolitan city and a cultural landmark. Its importance is partly attributed to its strategic location on the Mediterranean Sea, which has earned it commercial and historical significance for centuries. The city was founded by the Macedonian general Alexander the Great in 332 BC and became the center of Hellenistic culture and trade. Alexandria embraced one of the Seven Wonders of the ancient world, the ancient lighthouse Pharos, as well as the most well-known library established in the Ptolemaic era. It once more became one of the most important port cities on the Mediterranean, attracted a cosmopolitan mix of people from around the Mediterranean, grew wealthy from trade again and had a vibrant cultural life, (Alexandria Governorate, GOPP, & Bibliotheca Alexandrina, 2008). Alexandria was brilliant, sophisticated, and advanced as any other city in the Mediterranean. It was the gateway into Egypt for fashions, technology, science and culture. (Haag, 2008)

4.2 The Selection of Case Study Area

Saad Zaghoul Street has historically constituted the major spine of Alexandria City Center that has a cosmopolite structure as a “Port City” at past and present. Commercial and administrative functions have created attractive foci in the case study area lying on the east-west direction parallel to the seaside.

However, huge recreational areas along the seaside caused to lose the characteristic of the city. Moreover, especially commercial historic entities have lost their functions which caused a deterioration process in historic districts of urban heritage by modern needs.

Nowadays, high density, development pressure and implicitly vehicular traffic disturb pedestrian movements in relation with lack of livable spaces. Naturally, citizens tend to choose more livable and comfortable areas, so commercial dynamics move to shopping malls.

There is no effectively connected pedestrian axis from Saad Zaghoul Street into Orabi Square or Saad Zaghoul Square. Especially parking areas create barriers for north-south directed movements. Furthermore, lack of transportation facilities cause loses in public spaces networks, so functional efficiency and significant characteristics are harmfully affected.

Due to these factors, Alexandria city center has lost its characteristics, roles, vital dynamics and its identity. Therefore, it should immediately revitalize to sustain its significant character by urban design strategies. Attracting citizens is essential to comprehensively address it as livable foci and to revitalize its commercial, social and cultural life. In defined context, it has to be revitalized as a walkable space.

4.3 Saad Zaghoul Street

Saad Zaghoul Street is located in Ramleh Station District, between Omar Lotfy Street and Salah Salem Street. It starts from the tramway station at its eastern boundary and ends at Orabi Square at its western boundary. It intersects with Safeya Zaghoul, Al Nabi Daniel, Coptic Church, Al Falaki, El Shohadaa, Al Ebiary, and finally with Ahmed Orabi Street.

The street begins with Ramleh

Tramway Station, then, there are Le Metropole Hotel and Trianon which is one of the oldest cafe in Alexandria. Continuing towards western boundary of the Street, there are Omar Effendi, Delices le patisserie, Dar El Maaref library and the Brazilian Coffee store which can be considered as a landmark in the street. Passing by Al Falaky Mall, Al Mansheya Telecommunication Centre till the end of the street, there is the Jewish Monastery situated at the corner between the street and Ahmed Orabi Street overlooking Orabi Square where the end of the case study area is. (Figure 2)

Four zones of distinctive character are identified on the street, which are interconnected and following each others as the spine of the city center. They are determined as shown in Figure 2.

- Zone One (Z1): starts from Safeya Zaghoul Street to Al Nabi Daniel Street.
- Zone Two (Z2): starts from Al Nabi Daniel Street to Al Falaky and Al Shohadaa Streets.
- Zone Three (Z3): starts from Al Falaky Street to Al Ebiary Street.
- Zone Four (Z4): starts from Al Ebiary Street to Ahmed Orabi Street and Orabi Square.

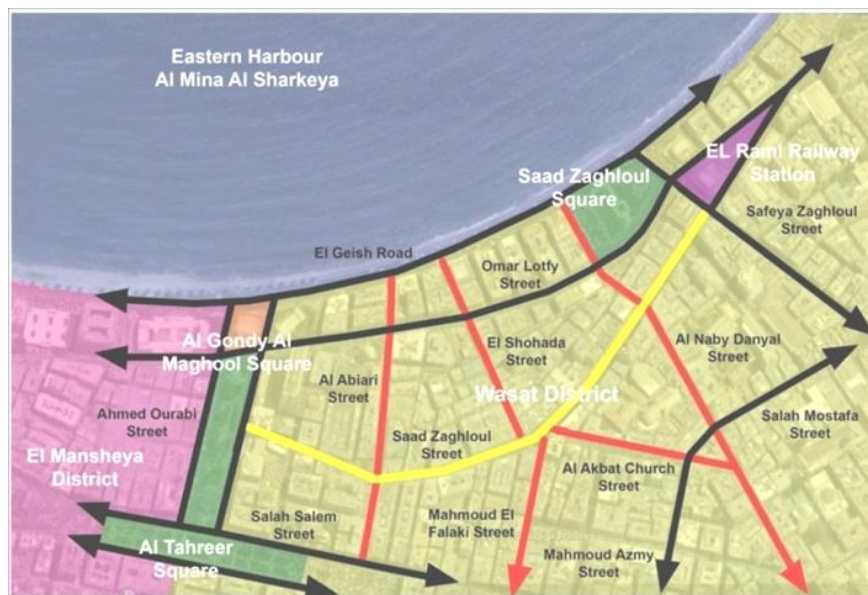


Fig. 2 General layout and main roads around Saad Zaghoul Street.
Reference: Author

5. ANALYSIS OF WALKABILITY IN SAAD ZAGHOUL STREET

This part examines Saad Zaghoul Street within the context of walkability. Each indicator is discussed with its variables. Firstly, the results of questionnaire are presented to get an overall context about users' perceptions. After that, each indicator is analyzed with descriptive observations, desk-based assessments and visual analysis, which are defined in the method of study.

5.1 Attractiveness and Convenience (AaC.)

Attractive and convenient streets should provide the following features:-

5.1.1. Maintenance and cleanliness of walking paths (AaC.1)

According to direct observations, these are serious problems, especially cleaning in Z4 because of narrow walking paths, crowded street and the peddlers sellers. Z1 and Z2 are relatively clean and well maintained because of their width and the existence of public buildings and stores. The streets users were asked whether "the street is clean and well maintained". Although in Z1 and Z2 the respondents partially agreed, the majority did not.

5.1.2. Existence and quality of facilities for disabled people (AaC.2)

Attractive and convenient streets should include public facilities designed with a particular attention to vulnerable groups. The pedestrians were asked, and they generally find insufficient facilities for vulnerable groups. Moreover, the majority did not think that bumps, traffic lights and pedestrians crossings are carefully designed for them. According to direct observations, along the pavement, there are deformed ramps and the width of walking path is not enough for wheelchairs specially in Z3 and Z4, also there are no traffic lights or pedestrian crossings.

5.1.3. Pedestrian amenities (AaC.3)

Pedestrian amenities improve pedestrian conditions and encourage pedestrian activity by enhancing functionality and vitality to the pedestrian realm. Two questions were asked shown in table 4. The great majority thought that there is no sufficient sheltering, benches or rest places in the case study area. According to direct observations, the number of pedestrian amenities is quite insufficient and existing amenities are in poor condition. The majority of shop fronts do not include protection coverages. Also, there are no benches or public toilets.

5.1.4. Availability of crossings along major roads (AaC.4)

Two related questions were asked; and the respondents relatively claimed that there is a lack of crossings, and they are not well situated. In addition, direct observations indicate the same result. The only crossings in the street are not clear and the traces are disappeared.

5.1.5. The existence of interesting urban scene (AaC.5)

The case study area has various urban scenes because of its historical feature. More specifically, Z1 and Z2 have more interesting urban scenes and they are more preferable than other parts of the street. However, Le Metropole Hotel in Z1 is the most preferred foci and interesting place of the case study area. Although there are no attractive shops in Z4, historic entities like the Jewish Monastery provide interesting scene.

According to the results of questionnaire, Z1 is the most attractive foci where there are Le Metropole Hotel, Trianon, The Brazillian Coffee, Omar Efendi and Chiccurel.

5.1.6. A variety of land-use activities (AaC.6)

The variety of activities increases pedestrian vitality in street. Therefore, the diversity of buildings and land-use activities plays fundamental role to create walkable environment. For this assessment, the question of "whether the variety of activities on the street arouses people's interest" was asked and most users agreed. There is diversity in uses like hotels, cafes, tourism offices, banks and clothing stores, beside other commercial activities.

5.1.7. The overall evaluation of attractiveness and convenience (AaC)

In this section, the perceptions of users are re-evaluated by means of direct observations and desk-based assessments. Questions of questionnaire are grouped and presented along rows with their results. (as shown in table 4)

Table 4: The evaluation of results according to attractiveness and convenience.

Reference: The author

Code	Question/Statement	Agree %	Partially Agree%	Disagree %	Strongly Disagree	Don't Know
AaC.1	It is a clean and well-maintained street	6	40	42	10	2
	There are enough facilities for disabled people	2	15	38	33	12

AaC.2	Bumps, traffic lights and pedestrian crossings are designed for disabilities	4	7	45	33	11
AaC.3	There are enough canopies for pedestrians	4	22	44	23	7
	There are enough benches and rest places	1	5	41	51	2
AaC.4	There are sufficient street crossings	5	21	47	20	7
	The street crossings are well-situated	2	20	47	12	19
AaC.6	The variety of activities arouse people's interest	52	29	10	2	7

In brief, the results of questionnaire show that pedestrians do not find the street attractive and convenient. However, the field investigation and direct observation show that Z1 is more attractive than other zones.

5.2 Connection to Open Spaces (COS)

The open spaces are places where citizens could interact, meet and talk. The variables of this indicator are mentioned above as follow.

5.2.1. The connection of street network to natural elements (COS.1)

The sea is a natural element with its primary importance in the development of Alexandria. Saad Zaghloul Street, which is parallel with the seaside, needs connection of street network to the sea. In addition, Saad Zaghloul Park and Orabi Park are essential natural elements too.

The analysis shows that Z1 has 3 connections with the park and 2 connections with the seaside. Also, there are 4 connections with the seaside between Al Nabi Daniel and Al Shohadaa Street. Z3 has only one connection at Al Ebiari Street. Z4 has 4 connections with the seaside. In addition there is a connection to Orabi Square which is highly used.

5.2.2. The connection of street network to gathering places (COS.2)

Gehl (2010) indicates that all activities in urban zones play a significant role in the modern city landscape. He adds that the real attraction of sidewalk cafés are precisely “life on the sidewalk”. The opportunity to rest and have refreshments is an excuse to watch city life.

The public buildings, such as the Telecommunications Centrals of Ramleh Station and Al Mansheya are the most used in the street. The street network in Z1 lets to connection with the tramway Station which is a huge gathering place. Also, Z1 has many gathering places, such as Trianon, Delices Patisserie and the Brazillian Cofee. In Z2, Al Falaky Mall is the main attraction point, Sofianopoulo Cafe in Z3 and finally, the Jewish Monastery in Z4.

5.2.3. The connection of street network to places with unique and visual interests (COS.3)

Unique features and visual interest offers an aesthetic experience for pedestrians. Also, that helps to empower community's heritage and provides attractive environments and sustain characteristic of place. Historic structures, like the sculpture of Saad and Safeya Zaghloul enhances the identity of the area. The small fountain between the park and Alex Bank is unmaintained and is used as an advertising board. Also, Z2 has a sculptured wall on the building of Al Falaky Mall which visually enriches the zone.



Fig. 3 Open Spaces Analysis
Reference: Author

5.2.4. The evaluation of connection to open space in the case study area

According to direct observations, the connectivity of path network to natural elements and meeting places in Z1 and Z4 is relatively better than Z2 and Z3. Despite of Z2's many gathering places, they cannot attract people due to lack of diversity of land-use and maintenance. Z1 has many public arts and visually interesting assets. Therefore, it is more walkable in terms of the connection to open spaces. (as shown in figure 3)

5.3 Safety

Creating walkable environment is possible by providing safe streets. The safety plays an important role in bringing people. Life and people make the city safe in terms of both experienced and perceived safety (Gehl, 2010). It is examined under two titles as actually and perceptually.

5.3.1. Actual safety (AS)

Wider street limits the sense of movement; similarly, narrow streets help to slow down vehicular traffic so they improve the general safety. In defined context, a harmony should be set to achieve pedestrians' ease of movement without effecting vehicular traffic. Also, the control of vehicular traffic is another essential component for pedestrian safety that is possible with traffic calming policies. The following sections discuss the measures of actual safety.

5.3.1.1. Street width and enclosure (AS.1)

Narrow streets are safer than wider streets because of helping to slow down traffic. Related questions were asked (Table 5) and the results show that walking in Z1 is easier and more comfortable, however, Z4 is more difficult and uncomfortable. Also, the majority claimed that the street (Z3, Z4)'s sidewalks should be widened, and they feel unsafe when walking there. Finally, they claimed that the street is wide enough for vehicular traffic except In Z4.

Direct observations of current map reveals that the width of sidewalks between 1.00-3.50 meters, is not enough to provide a sense of safety. However, the width of vehicular traffic zone is between 5.30-7.20 meters in Z3 and Z4, and approximately 10.00-15.00 meters in Z1 and Z2. Only in Z1, the width of sidewalk which is approximately 5 meters provides a safe environment. (as shown in figure 4 and figure 5)

By using common traffic calming tools, pedestrians can feel safer. According to the results, the most of users claimed that their movement is disturbed by vehicular traffic and the car drivers should slow down. Also, the majority agreed that on-street car parking disturbs them, and they added that crosswalks and pedestrians ways are unsafe for vulnerable groups.

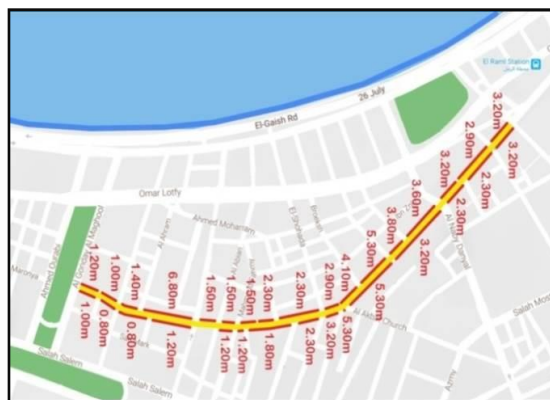


Fig. 4 Sidewalks Widths.
Reference: Author

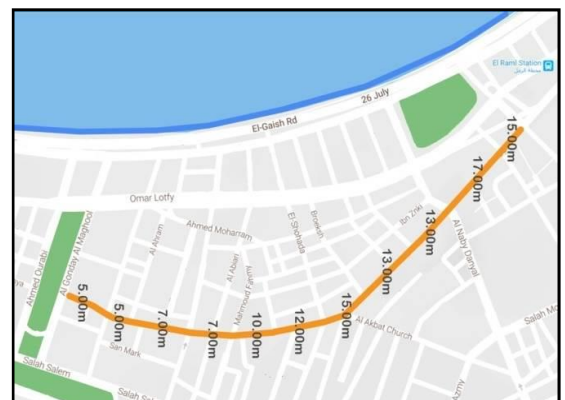


Fig. 5 Street Widths.
Reference: Author

5.3.2. Perceived safety (PS.1)

Being able to walk safely is a prerequisite for creating well-functioning cities for people (Gehl, 2010). It is obvious that vital spaces provide perceived safety (Jacobs, 1995). For this assessment, the great majority claimed that the street is noisy due to car traffic. In addition, most respondents stated that facilities open until late night, and more residential use make the street safer. That indicates that upper floors are located by clinics, offices and companies.

5.3.3. The overall evaluation of safety in the case study area

In table 5, statement of questionnaire are presented with their results.

Table 5: The evaluation of questionnaire results according to term of safety.

Reference: The author

Code	Question/Statement	Agree %	Partially Agree%	Disagree %	Strongly Disagree%	Don't Know%
AS.1	The street is wide enough for pedestrian traffic	32	37	26	2	3
	The street is wide enough for vehicular traffic	44	28	20	5	3
AS.2	Vehicular traffic disturbs pedestrian movement	35	25	34	3	3
	Car drivers should drive slower	38	30	26	2	4
	It is difficult to cross the street	7	23	49	8	13
	Crosswalks are safe for vulnerable groups.	3	9	49	29	10
	Pedestrian ways are safe for vulnerable groups.	4	13	45	26	12
PS.1	On-street parking disturbs pedestrian movement	60	19	16	2	3
	It is a noisy street	61	26	10	1	2
	Noise is resulted from car traffic	41	39	15	3	2
	Facilities open until late make the street safer	50	36	9	2	3
	It is safer street if there are more residential uses	38	36	18	3	5

As a result of discussions, Z3 and Z4 are not wide enough for both vehicular and pedestrian movements. Z1 is the safest part of the case study area in terms of street width, enclosure and traffic safety because of its width (15 meters). The street is vital, but at evening, perceived safety is decreased after the closing hours of shops in a relation with “Eyes on the Street”. The findings of field investigation reveal that Z2 is relatively safer than Z3 and Z4. However, Z1 is the safest.

5.4 Street Pattern (SP.1)

Street pattern is one of the main urban design qualities, it improves the walkability and reveals the character of community within the length of streets and the number of intersections, cul-de-sacs, and loops (Southworth, 1993). Grid iron is the most walkable system by offering strong interconnections, the shortest trip lengths and the largest number of route choices. In the 19th century, the spatial form of Alexandria had been guided in terms of grid-iron axes system.

For this assessment, the great majority claimed that they can easily walk in the street and access to it from other places by walking. However, most users see vehicular traffic creates a problem for pedestrians to access to different parts of the street.

5.4.1. The evaluation of street pattern in the case study area

Street pattern is assessed by related questions and street pattern map. Table 6 presents the evaluation of street pattern according to the questionnaire.

Table 6: The evaluation of questionnaire results in terms of street pattern.

Reference: The author

Code	Question/Statement	Agree %	Partially Agree%	Disagree %	Strongly Disagree%	Don't Know%
SP.1	It is easy to walk along the avenue	33	37	25	2	3
	It is an easily accessible avenue by walking	45	28	20	4	3
	Vehicular traffic is a problem to access to different parts of the street	35	25	34	2	4

To sum up, the case study area provides a walkable and livable environment for pedestrians; however, the vehicular traffic and parking problems discourage pedestrians to walk in the Street.

As seen in figure 6, the street pattern system is modified grid system and this provides non-hierarchical, strongly interconnected street network; it also offers the shortest trip lengths and the largest number of route choices; and it creates the most walkable neighborhood.



Fig. 6 Street Pattern Analysis

Reference: Author

5.5 Quality of Path (QoP)

Enhancing the quality of path is a significant aspect to set a walkable environment. The measures to examine the quality of path indicators are:

5.5.1. Sidewalk width (QoP.1)

This is an essential component of quality of path for comfortable trip. Street width enables one to feel physically and perceptually safe. Ideal “walking zone width” allows passing 2-3 people together; and/or 2 wheelchairs (1.8meters) together. However, in Z1 and Z2, sidewalk widths vary from 3.20 to 5.30 meters, the widths of sidewalks are not equal, even in both sides. In Z3 and Z4, the sidewalks are narrower, their width varies from 2.90 to 1.20 meters.

5.5.2. Paving quality (QoP.2)

Ideal path should be continuous, without gaps and should have a relatively smooth surface without irregularities (Gassaway, 1992). Also it should support the character of streets. The great majority thought that there are obstructions for pedestrians along sidewalk, except in Z1, and most of the pavement slabs are deformed or broken.

According to direct observation, there is unqualified maintenance along the sidewalks, the pavement in Z3 obstructs pedestrians, the ramps are in low quality and their pavements are not appropriate. However, the pavement of Z1 and Z2 is better than other zones.

5.5.3. Street furniture (QoP.3)

Street furniture increases functionality and vitality of pedestrian realm. According to the questionnaire results and direct observations, the number of street furniture is not sufficient at all and it obscures the pedestrian movement.. There is only one rubbish bin in Z1 and its location is not appropriate for pedestrian flow. Although, some of street furniture is fixed at correct places, others especially electric boxes are fixed at misplace. Moreover, advertising board creates visual pollution and obstruction for pedestrians.

According to Gehl (2010) benches should be located at regular intervals every 100 meters in a good city. However, there are no benches on the case study area. So, varying points are used for sitting like stairs or sidewalks.

5.5.4. Street signs (QoP.4)

Street signs are one of the visual components of streetscape. They are investigated in two groups. These are private signs i.e., advertising boards and shop signs, and public signs i.e., routing signals and way-finding signs, providing information and rules for the use of the public spaces. The style, placement, uniqueness of street signs is essential for walkable environment to enhance the identity and imageability of streets scenes.

For the evaluation of street signs, the great majority claimed that they are aesthetically disturbed by the store signs, and that traffic signs are not sufficient. In brief, the analysis shows that the design and the shape of signs are not appropriate and unique. Besides, the advertising boards and shop signs are not aesthetically designed. In addition, there are traffic signs to control the entrances of vehicular traffic, but insufficient.

5.5.5. Street lighting (QoP.5)

Street lightning is an essential component of quality of path. A well-lit street could encourage more pedestrian activity. Lightning increases pedestrian’s safety, comfort and encourages walking, also street lights emphasize the linearity of the street and it is an important part of streetscape design. The placement, height and style are the measures of lightning. In city centers, street lights should be placed at intervals of 9 meters. In addition, the height of street lights should be less than 4, 5-6 meters.

The questionnaire results indicate that, more than the half of the respondents thinks that it is a well-lit street but partially safe at night. In Z1, there are 18 street lights with distance 15 meters and height 5.5 meters. So, they are insufficient and inaccurate in heights. In Z2, there are 30 street lights of the same design as Z1 and Z3 which includes 24 street lights. But there are no street lights in Z4 and that's why there is a problem of safety there.

5.5.6. Street trees (QoP.6)

According to Gehl (2010), trees landscaping play a key role among the elements in city space. Closely planted trees to sidewalks provide visually narrowed street that use in traffic calming and so enhance pedestrian safety. In addition, trees could play crucial role in streetscape design with its visual features.

To create a clear walking path on sidewalk, street trees should be planted on the curb zone with spacing from 4,5 meters to 7,5 meters (Jacobs, 1995).

According to the questionnaire results, most users claimed that there is not enough greenery in the street. Briefly, there is only one tree in front of Al Mansheya Telecommunication Central which enriches the area. But generally, the street has a strong lack of greenery.

5.5.7. The overall evaluation of quality of path in the case study area

Path quality makes the streets more walkable by encouraging pedestrians to walk. More specifically, path quality of the street is analyzed in six sections (as indicated in table 7).

Table 7: The evaluation of questionnaire results in terms of quality of path.

Reference: The author

Code	Question/Statement	Agree %	Partially Agree%	Disagree %	Strongly Disagree	Don't Know
QoP.1	Sidewalks are wide enough	25	36	32	4	3
QoP.2	There is no obstacles along sidewalks	12	8	45	34	1
	The pavement slabs are not deformed and don't disturb pedestrian movement	4	7	45	33	11
	Level variations along the sidewalks are safe	11	14	39	18	18
QoP.3	Street furniture is sufficient	8	11	41	30	10
	Street furniture obscure pedestrian movement	17	15	45	8	15
QoP.4	Store signs aesthetically disturb pedestrians	41	25	17	2	15
QoP.5	Traffic signs on the streets are sufficient	15	26	36	7	16
QoP.6	It is a well-lit street at night	35	33	22	1	9
	It is a safe street at night	30	45	12	4	9
QoP.6	There is enough greenery in the street.	3	8	52	37	0
	The trees disturb pedestrian movement	4	5	65	16	10

To sum up, the survey and direct observations show that, Z1 is relatively more walkable compared to Z2, Z3. However, Z4 is the worst in terms of quality of path.

5.6 The linkage with other Transportation Modes (LwTM)

Designing streets to accommodate all modes of transportation is essential for walkable environment. City center of Alexandria can be accessed by tram, bus, minibus, taxi and private car from other parts of the city. There is a main bus stop on El Geish Road at the entrance of the street. The public buses and minibus provide uncomfortable and unsafe trips because of size of vehicles, climatic features and problems in their schedule. Thus, pedestrians generally prefer to travel by private car or by tram. However, the improvement of recent conditions of mass transportation and the preparation of well-planned transportation plan could increase livability and walkability. Moreover, a good tram system will enhance the walkability in the city center. In addition, tramway station is located on Omar Lotfy Street and the entrance of Saad Zaghloul. So, walking from the station to the street takes two minutes.

To sum up, multi-mode transportation and well-planned transportation plan are key factors to create accessible and so walkable and livable environment.

5.7 Connectivity of Path Network (CoPN)

Providing connections between gathering points, open spaces and landmarks within shortened trips and convenient access provides connectivity of path network in a positive manner.

The connectivity of path network in the street is examined regarding “alternative path choices”, “short links, numerous intersections and minimal dead ends”, “continuity of pedestrian network” and “clear zones on sidewalks”. These indicators are investigated under the headings of “street pattern” and “quality of path”.

As mentioned, the street pattern of the case study is modified grid which presents short path links and many intersections on street network, there is no dead-ends, cul-de-sacs or lollipops.

Therefore, connectivity of path network provides a high level of walkability in terms of path choices routes, short links and many intersections. In addition, pedestrians are negatively affected from sidewalks maintenance and continuity. Moreover, in the western part of the street, there are no walking, furnishing and frontage zones on the sidewalks because of insufficient width. However, Z2 is the most walkable street part in terms of continuous and well maintained sidewalks, in this part furnishing and walking zone are relatively defined.

5.8 Accessibility (A)

Accessibility refers to the ability to reach desired goods, services and activities (Litman 2003). Accessibility of urban facilities, amenities and transportation facilities help to create walkable and pedestrian friendly environment within equity.

5.8.1. Access to public transport (A.1)

As mentioned before, there is one bus stop and mini-bus on El Geish Road, and the tramway station. However, pedestrians can easily access public transportation points because continuity of path network in terms of short distance and be reached in a short time by walking. In brief, Z1 is the most walkable part in this term within continuous and well maintained sidewalks.

5.8.2. Parking (A.2)

Parking is crucial part of accessibility in terms of site selection. Parking has both positive and negative effects on pedestrian movement and streetscape. More specifically, on-street car parking creates a buffer zone between a roadway and sidewalk; however it decreases safety of pedestrian. For this assessment, the majority claimed that on-street car-parking disturbs their movement, and they do not find the parking areas of the case study area sufficient.

In brief, the analysis and survey results show that there is no sufficient street car-parking along the street. In Z4, there are two closed-parkings beside and in front of the Telecommunications Central of Al Mansheya. In addition, Saad Zaghloul Square and Orabi Square are used as parking areas, which cause misuse and visual pollution.

5.8.3. Orientation (A.3)

In accordance with Lynch (1974), directed lines, sequences, landmarks, spaces or areas, diffuse, topographic and symbolic dimensions and decoration are essential on orientation by means of reading the city. Orientation can be evaluated with street pattern revealing the features of place in terms of permeability and legibility.

For this assessment, the street pattern map is examined. Landmarks enable orienting pedestrians, assisting them to read the city. More specifically, a street is memorable and familiar with landmarks. Le Metropole Hotel, the Brazillian Coffee and Omar Efendi are used landmarks of Z1. Besides, Chiccorel and el Falaky Mall are well-known in Z2, Saad Zaghloul Center and Sofianopoulo in Z3, and the Telecommunications Central of Al Mansheya in Z4.

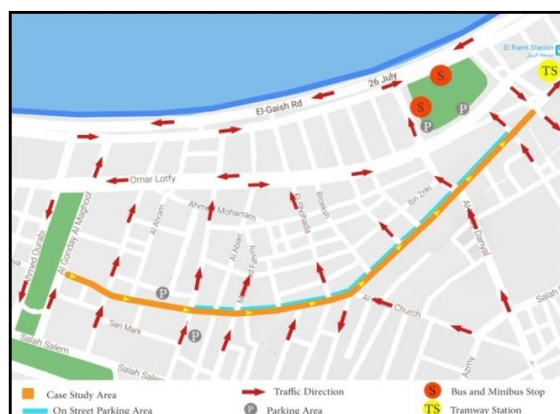
5.8.4. Unimpeded movement (A.4)

The acceptable walking distance for most people in daily situations has been found to be around 400 to 500 meters. For children, old people, and disabled people, it is less (Gehl, 2010). In addition, the quality of road, pavement and amenities play essential roles on it.

The results of the direct observation reveal that the width of sidewalks, pavements, signs and illumination are inappropriate and insufficient. However, the lack of sitting facilities decreases accessibility, and thus decreases the walkability of street.

5.8.5. The overall evaluation of accessibility in the case study area (A.5)

Walkable street should provide accessibility for everyone to provide free circulation, well-lit and well-maintained sidewalks, also, direct and convenient access to amenities for pedestrians. In table 8, questionnaire results for



(A.2) are evaluated according to the street.

To sum up, Z2 is relatively more walkable in terms of accessibility compared to the Z3, Z4. However, Z1 is more accessible part of the case study area in terms of access to public transport, orientation and unimpeded movement. (as shown in figure 7).

Fig. 7 Accessibility Analysis.
Reference: Author

Table 8: The evaluation of questionnaire results according to accessibility.
Reference: The author

Code	Question/Statement	Agree %	Partially Agree%	Disagree %	Strongly Disagree	Don't Know
A.1	On-street car-parking disturbs the pedestrian movement	60	19	16	1	4
	There are enough parking areas for vehicles in Saad Zaghoul Street	5	8	50	35	2

6. CONCLUSIONS

This research investigated the walkability capacity of a major street of the historic city center, Saad Zaghoul. Walkability indicators were defined based on literature review. The research comparatively assessed the walkability capacities of street zones. Literature review, desk-based assessment, extensive survey, direct observation and questionnaires were used as research tools.

Likewise, the research findings have shown the strengths and weaknesses of the street in order to develop strategies to revitalize Alexandria City Center, where a deterioration process has been seen.

In the study, the indicators, which are determined in varying categories are re-evaluated in spatial context. This table provides a comparative evaluation of zones in terms of each walkability indicator to show essential differences and similarities, as well as potentials and problems.

Table 9: Comparative evaluation of zones according to walkability indicators.
Reference: The author

Code	Indicator	Z1	Z2	Z3	Z4
1. AaC	Attractiveness and Convenience	*	+	+	-
2.CtOS	Connection to Open Space	*	+	-	+
3. S	Safety	*	+	+	-
4. SP	Street Pattern	+	*	+	-
5. QoP	Quality of Path	*	+	+	-
6.LwTM	The Linkage with Other Transportation Modes	*	+	-	+
7.CoPN	Connectivity of Path Network	*	-	+	+
8. A	Accessibility	*	+	-	+
*	Significantly better than other zones	+	Fairly better than other zones	-	Inadequate walkable environment

- A. Attractiveness and convenience is one of the most important indicators to enable a walkable environment. With regard to Saad Zaghoul Street, Z2 is more attractive and convenient than Z3 and Z4, but there are problems in terms of cleaning and maintenance. Briefly put, Z1 is the most attractive and convenient in all aspects of variables.
- B. Providing connection to open spaces is another walkability indicator of this research. Z1 and Z2 are relatively more vivid spaces than Z3 and Z4. Open space connections, visual richness, unique features, connections to sea, parks and gathering places in Z1 make it a more walkable and livable part of the case study area than other zones.
- C. Safety of pedestrians in ‘perceived’ and ‘actual’ terms is a major component of walkable environment. In the case study area, Z2 is safer than Z3 and Z4 in terms of appropriate street width and enclosure. Furthermore, traffic safety is considerably inadequate for pedestrians in Z3 and Z4. In brief, Z1 provides more livable environment to pedestrians in terms of actual and perceptive safety than other zones.
- D. The characteristic of street pattern, which contributes the identity of a community, directly affects the capacity of walkability. Street pattern also plays a crucial role on attractiveness, ease of movement and safety of environment within its features. In regard to the case study area, the research findings reveal that the pattern is modified grid which offers more route choices and legible network.
- E. The path quality is another walkability indicator, directly related to physical design quality of the street. The research indicates that, Z2 has relatively better than Z3 and Z4 in terms of sufficient

- sidewalk width, existing street furniture, sufficient number of street lighting, and street trees. In addition, quality of pavement is in better situation in Z2 than Z3 and Z4. On the other hand, Z1 is the most walkable part within path quality.
- F. The availability of the linkage of transportation modes, public transport or private car, is an essential factor on improving access to destinations to set walkable environment. The locations of tramway station and bus-mini bus stops are accurate to accommodate transportation modes. In the case study area, connections between different transportation modes are relatively available; however, the opportunities are not sufficient.
- G. Connectivity of path network is primarily related to the street pattern type of space, and secondly related to the clear walking zones on sidewalks. Although the case study area as a whole provides path choices routes, short links, numerous intersections due to modified grid pattern, Z3 and Z4 do not have clear walking zones due to inadequate sidewalk width. On the other hand, the walking zone of Z1 and Z2 is relatively clear than other zones by means of path network connectivity for pedestrians.
- H. In defined context, access to public transport, orientation, parking and unimpeded movement are the measures of accessibility. However, Z1 is relatively more walkable than Z2, Z3 and Z4 in terms of parking. In addition, visually appealing landmarks on the case study area create familiar and memorable environment for pedestrians to perceive the street.
- I. The results show that, Z1 is the most walkable and livable part of the case study area. Pedestrian areas, existing interesting scene and streetscape, historic entities, existing facilities and amenities have great importance on this situation.

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