

WALKABLE GREEN CITIES IN MEDITERRANEAN COUNTRIES: CITY OF ALEXANDRIA, EGYPT

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ABSTRACT

Walking is a safe, accessible and pleasant mode of transport. It is a measure of how friendly, healthy and liveable the countries are, in addition to providing many social, environmental, and economic benefits. Walkability is considered as an important element in assessing cities to be green and sustainable. People in the Mediterranean countries, where their cities have narrow streets, which are difficult to access, not always with easy services, have similar cultures and traditions such as the habit of daily walking. A significant number of daily trips are made by foot. However, the walking environment in Alexandria city is limited, unsafe and inconvenient. Mainly, pedestrians are secondary to vehicles causing transportation congestion, pollution, source depletion and increasing statistics of obesity. Therefore, this paper is a chance to find solutions for decreasing the number of vehicles in the streets by converting the short trips into walking tours. This paper proposes to establish a new theoretical basis for walkable green city (WGC) indicators to measure the walkability and the greenness in Mediterranean countries. The case study was conducted on Ramleh Station district in the city centre of Alexandria city with analytical analysis using geographic information system program (GIS). The results showed that the study area is not considered as a walkable green district, despite the fact that it has many potentials that could be exploited. Briefly, the results help to prove that WGC indicators are able to measure how walkable and green any Mediterranean country is.

Keywords: walkability indicators, green city indicators, walkable Mediterranean countries, pedestrian walking paths, walkability index.

1 INTRODUCTION

This paper mainly focuses on two main terms which are Green City and Walkable City. Walkability, the most primary mode of transportation, has green advantages for both environment and equity, which has the less environmental damage from vehicle emissions and waste of resources. Therefore, it has received an increasing interest from both the scientific community and local authorities which led to a series of research in order to develop walkability indicators and measuring tools. The “Green City” term can be considered as a special case of “sustainable development” for cities which has become one of the most critical research areas in the past few decades. As it doesn’t only refer to environmental issues, but also seeks to integrate social and economic considerations into urban development processes [1]–[3]. However, just a few studies have developed an applicable walkability indicator with the consideration of the green aspects [4]–[6].

Therefore, this paper intends to establish a new theoretical basis for walkable green Mediterranean city (WGC) indicators with several goals (see Fig. 1). It has been used to measure the walkability and the greenness – at the same time – of the study area (Ramleh Station district in the city centre of Alexandria city in Egypt as a Mediterranean country, within an analytical deduction work using a geographic information system (GIS) program. Measuring this area has helped to find out how comprehensive, simple and flexible the WGC indicators which make it able to be widely implemented for any Mediterranean country and help the planners and decision makers to develop pedestrian paths. The literature review is divided into three sections. The first section discusses the walking environment in the



Mediterranean region, the second and third sections discuss the previously developed indexes that have been conducted to measure the walkability and Greenness of cities.

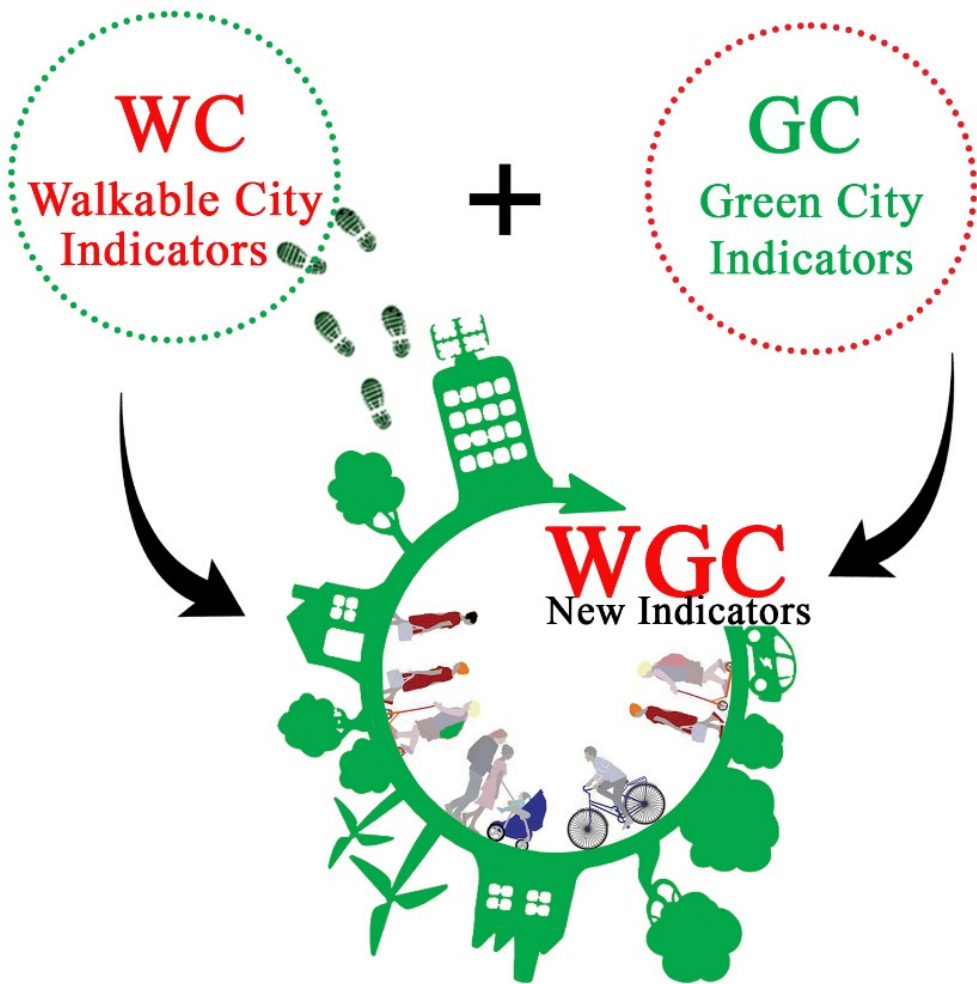


Figure 1: The concept of walkable green city new indicators.

2 WALKING ENVIRONMENT IN THE MEDITERRANEAN REGION

People in Mediterranean countries have a similar habit of walking to satisfy their daily basic necessities [6]. Throughout the year, the climate in the Mediterranean region is moderate, there is no drought or extreme variation in temperature and the trees almost continuously green with wide shading caps, which encourage walking and active movement [7]. Thus, a huge number of daily trips are made on foot. The walkable environment in most Mediterranean countries has been turned into an important research area to be measured. However, this approach still meets difficulties and challenges in developing Mediterranean countries like Egypt [8], [9].

In Alexandria city, the walking environment was totally neglected. Mainly, roads and streets are designed for vehicular transportation and most planning priorities focus primarily on its circulation. When existing cities are developed, roads can be too wide to match their capacity, which make it uncomfortable and unsafe for pedestrians, causing car dependency, high air pollution, transportation congestion and source depletion, increasing statistics of obesity and cardiovascular diseases [9], [10].

3 WALKABLE CITY INDICATORS

Previously, moving on foot was considered as a recreational activity, rather than a legitimate mode of transport to be seriously considered. But walking now is seen as an integral part of the transportation system. Over the past decade, the quality of the walking environment has become a significant factor in transportation development studies. Providing pedestrian comfort and safety and connecting people with varied destinations became necessary goals. It's everyone's right to find close, barrier-free, comfortable walking paths with visual interest within a reasonable amount of time and effort spent [11], [12].

The walkability indicators have been developed for several years to identify and assess the walkable environment. A study that was conducted by [13] for the global walkability index (GWI) to assess the quality and performance of walking. In general, the GWI introduces three components to assess walkability, which are (1) safety and security; (2) convenience and attractiveness; and (3) policy support. The GWI applies nine indicators as assessment parameters, which are (1) walking path modal conflict; (2) availability of walking path; (3) availability of crossings; (4) grade crossing safety; (5) motorist behaviour; (6) amenities; (7) disability infrastructure; (8) obstructions; and (9) security from crime [14], [15]. Moreover, with the rising interest in walkability, a number of local agencies in the United States, including those in Portland, Oregon, developed criteria for evaluating walkability. Eight parameters were introduced by Portland's pedestrian planning index: (1) presence of sidewalk; (2) accessibility; (3) safety; (4) connectivity; (5) destination; (6) sense of place; (7) topography; and (8) policy factors. In another study [11] the effective variables were divided into four groups: functional, safety, aesthetic, and destination. The review of different walkability indexes showed that the index of [11] can be considered as the most comprehensive index as it is focusing on detailed objectives and subjective elements.

4 GREEN CITY INDICATORS

A Green City is a city which shows high environmental performance in these elements: (1) quality of environment (air, water, etc.); and (2) efficient use of resources (water, energy, materials, etc.) while maximizing the economic and social benefits. The previous studies on greenness-related topics identified problems which could worry many cities such as pollution, limited green area, poor waste management, limited energy and lack of public transportation. Some of these studies have built a strong correlation with the walkability indexes in environmental improvement [14].

Various institutions have organized competitions between cities by measuring the degree of their "greenness", through the use of urban indicators and rankings [3]. Each of these rankings uses different indicators to assess the cities' degree of "greenness", as shown in Table 1.

Overall, the main limitation of these indicators is the inability to monitor the city performances over time, because most of those indicators are loose, not comprehensive and conducted only once, or did not compare the other cities.



Table 1: List of ranking evaluation systems and its indicators [2], [3], [16].

N	Ranking system	Indicator categories	Methodology
1	Urban Ecosystem Europe (UEE)	Air quality, acoustic environment, water, energy, waste, CO ₂ , transport, green areas and land use, buildings, health and safety, equity, education and participation	Depends on a questionnaire
2	European Green City Index (2009)	CO ₂ , energy, buildings, transport, water, waste and land use, air quality and environmental governance	Takes into account 30 individual indicators which can be grouped in two goals: reduce CO ₂ emissions and increase share of renewable energy
3	European Green Capital Award Evaluation (2010)	Climate change, local transport, green urban areas, nature and biodiversity, ambient air quality, quality of the acoustic environment, waste production and management, water management, waste water management, eco-innovation and sustainable employment, energy performance, and integrated environmental management	Depends on three goals: greenest city, implementation of efficient and innovative measures, and communications and networking
4	Economist Intelligence Unit (EIU)	Land use CO ₂ emissions, energy, buildings, transport, water and sanitation, waste management, air quality and environmental governance	The indicators are based on current environmental aspects as well as the city's intentions to become greener

5 WALKABLE GREEN CITY INDICATORS

This article separately analysed and combined the previous walkability indexes and attributes of green city indexes, these analytical studies led to deduct and develop a new theoretical bases of walkability and green city indicators which consist of six main goals for assessing Mediterranean cities. The goal: Promote Crossing Safely contains six indicators and the goal: Promote Sidewalks and walking paths quality contains another five indicators as shown in Table 2 which illustrate some of these indicators and goals. Each indicator that has been listed in the WGC indicators is a measure factor for some of both walkability and greenness elements as described.

5.1 Indicator 1.1.: Existence of countdown signal timers

It is one of the most important indicators which achieve the crossing safely goal, to enhance pedestrian safety at intersections, with the consideration of the time that the pedestrians wait for crossing the intersections or the mid-block crossings, in addition to coverage elements for shading and protection from rain along the waiting time which could save energy and time.

Table 2: List of walkable green city (WGC) indicators.

Sector	Goals	Indicators
Safe and Secure Green Walking	1. Promote Crossing Safely	1.1. Existence of countdown signal timers
		1.2. Intersections with curb cut ramp
	2. Promote Sidewalks and walking paths quality	2.1. Sidewalk condition
		2.2. Number of trees per linear kilometre
		2.3. Sidewalks coverage (trees, arcades, etc.)

5.2 Indicator 1.2.: Intersections with curb cut ramp

The existence of curb cut ramps in each intersection or mid-block is so important especially for the wheelchair users, disabled people, and strollers, then comes the importance of its characteristics such as the appropriate surface slope, the channel between the ramp and the street used for drainage, its condition and maintenance, etc.

5.3 Indicator 2.1.: Sidewalk condition

Through this indicator, it's important to record the surface physical condition from least to most serious, included: (cracking, dirt, grass and spalling) and record if the surrounding environment was the main source of surface materials. It is also important to figure out the number of vertical faults, cracked panels, and obstructions using a dedicated point.

5.4 Indicator 2.2.: Number of trees per linear kilometre

This is one of the most important indicators that could achieve the sidewalks and walking paths quality goal to improve the thermal comfort of the walking environment and reduce the CO₂ and vehicle emissions and pollution, in addition to providing the coverage that the pedestrian needs through the walking trip. It is usually measured by the number of trees per kilometer unit, scaling a map with different percentages.

5.5 Indicator 2.3.: Sidewalks coverage (trees, arcades, etc.)

This indicator measures the ratio between the covered walking paths/sidewalks and no covered paths/sidewalks and records the type of shading system, such as vegetation elements, arcades, or street shading louvers. Certainly, this ratio can show how green and walkable the walking path/sidewalk is.

6 THE STUDY AREA

Alexandria is the second capital of Egypt which has a population exceeding 4.1 million. It is an important touristic harbor due to its strategic location on the Mediterranean Sea, which gives it commercial and cultural advantages for centuries. [9], [17].

The case study was conducted on Ramleh Station district in the city center of Alexandria city in Egypt. The selected area surrounded by four main intersections between four of the most important streets in the city, which are Saad Zaghloul St. (north side), Safeya Zaghloul St. (east side), Gamal abd El Nasser St. (south side) and El Naby Daniel St. (west side), (see Fig. 2). The four sides are major commercial and recreational spines in the whole Ramleh district which are full of attractive points and destinations at too close distances from each other to walk around.



Figure 2: The study area in Ramleh Station district.

7 METHODOLOGY

This article is an analytical deduction work to create the indicators of WGC to be conducted and measure the walkability and greenness of the case study area through these main steps:

- Field visit to the case study area as a method of data collection through recording data into printed maps, taking photos and short conversations with the passers.
- Desk analytical assessment process that includes three phases of examination. The first investigates the historical development of the case study area to understand its



characteristics. The second one is the evaluation of current condition. The last one includes a self-observation revealing the indicators.

- Develop the derived WGC indicators list to be more updated after the visit and analysis.
- Built a 2D model for the study area on the Geographical Information System (GIS), storing all the data to conduct the measurement basis on the existing situation and output the measuring maps, as shown in Figs 3–5.
- Conduct the new WGC indicators to measure each street in the study area and output the results.

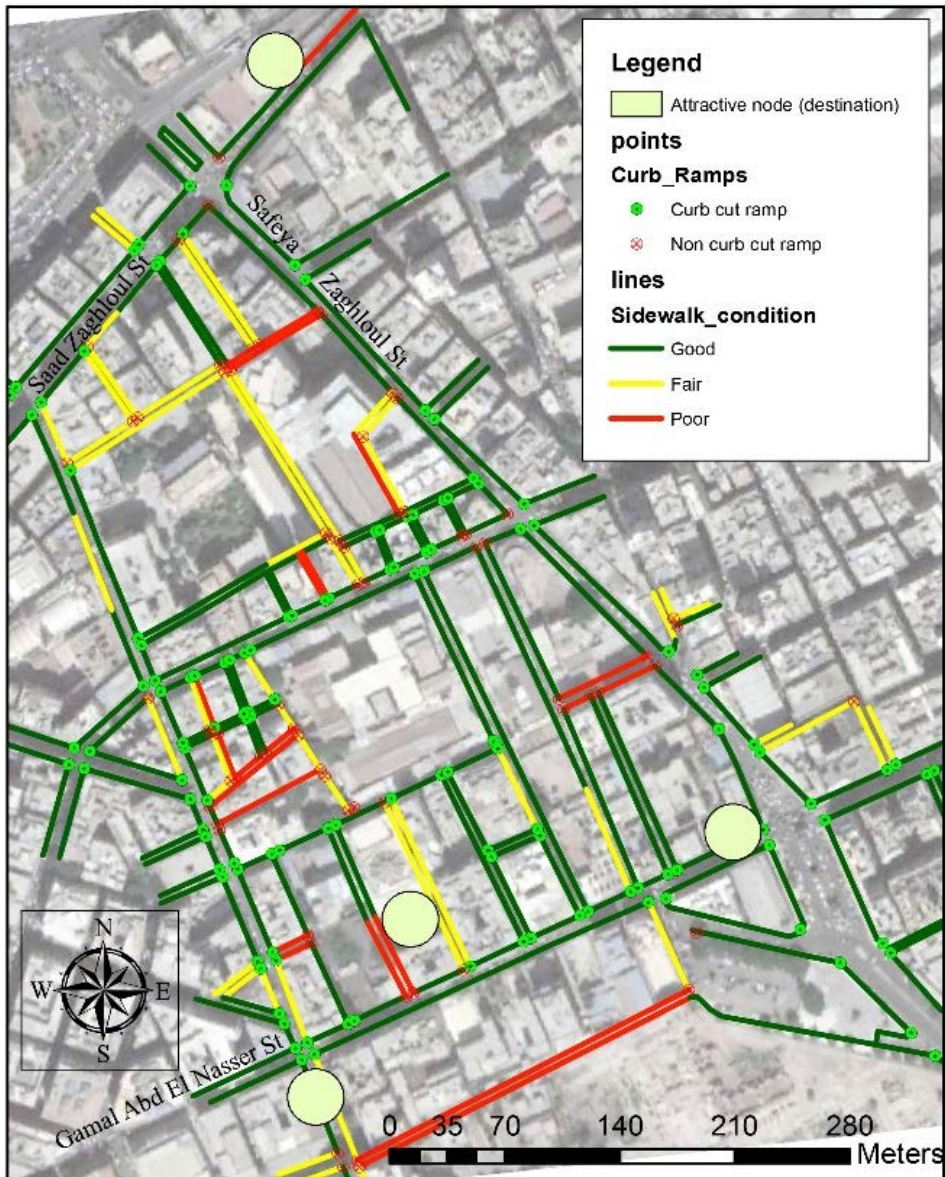


Figure 3: The measuring map of indicators (1.2.) and (2.1.).

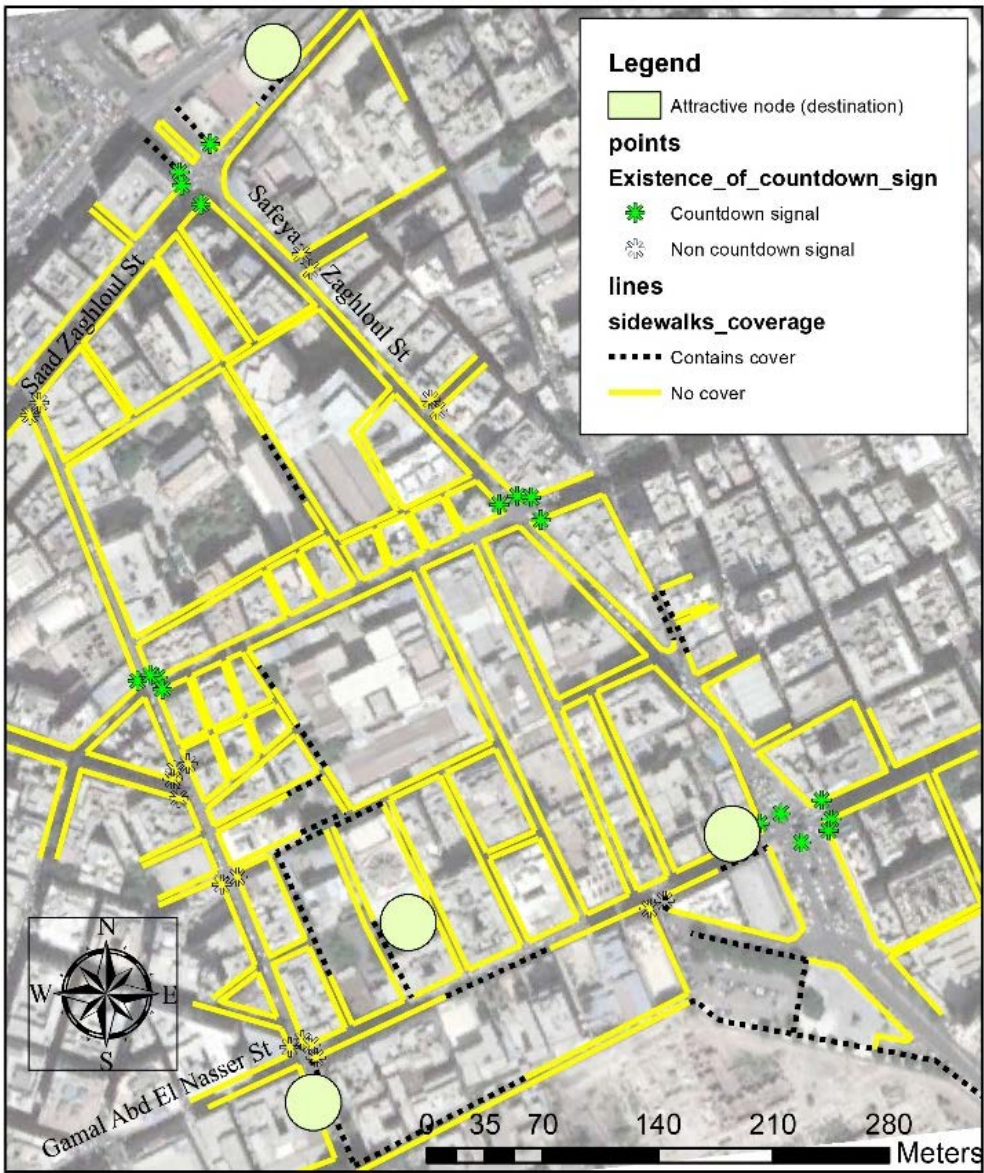


Figure 4: The measuring map of indicators (1.1.) and (2.3.).

8 RESULTS AND DISCUSSION

The results showed that the study area is not considered as a walkable green district. Although that, people never hesitate to make their short trips on foot. The study area has many advantages that can be exploited and developed for pedestrians. Briefly, the results help to prove that WGC indicators are able to measure how walkable and green any Mediterranean country is.



Figure 5: The measuring map of indicator (2.2.).

According to the case study, the results were extracted as some statistics for different percentages of previous studied indicators. For example, the indicator (1.1.): the existence of countdown signal timers, has been measured and the results revealed that the ratio of the intersections with timers did not exceed 50% of all intersections in the study area district, which means that the study area is not walkable or green according to this indicator. The

same result was revealed when measuring the indicators (2.1.), (2.2.), (2.3.), as all the ratios revealed the non-walkable greenness of the case study area, but when measuring the indicator (1.2.): Intersections with curb cut ramp, the results showed that the ratio exceeded reaches 66 percent of all the intersections in the study area district (see Fig. 6).

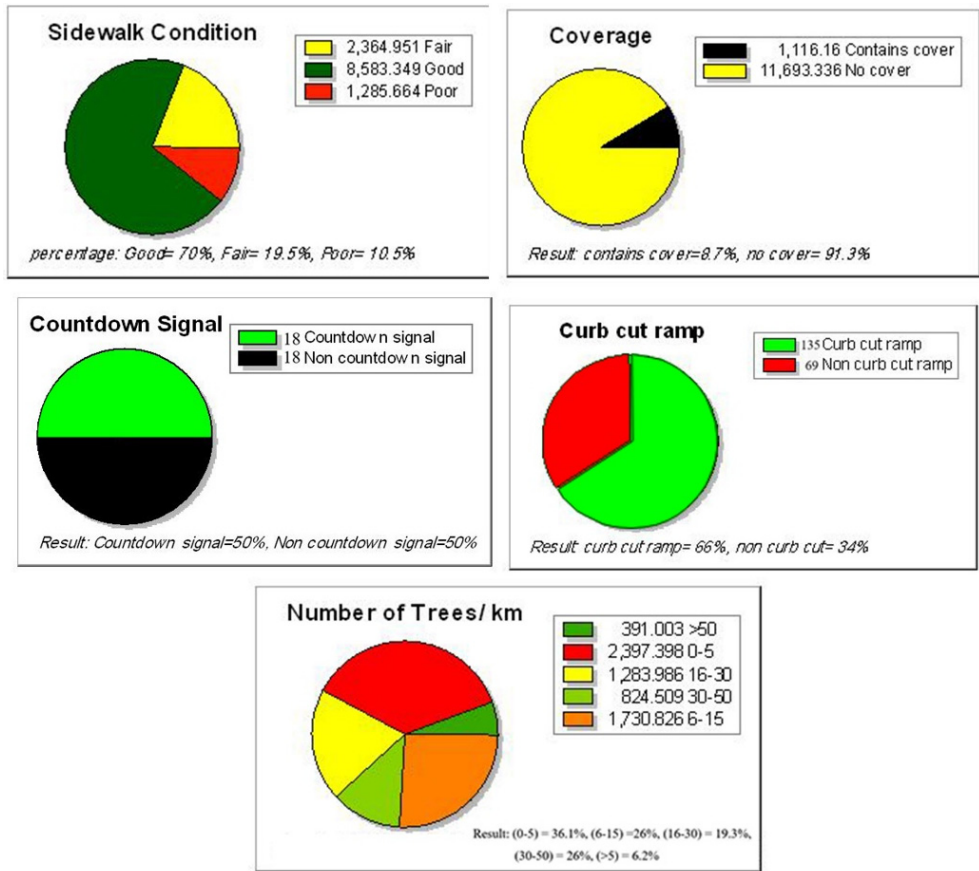


Figure 6: Statistical results of studied indicators.

9 CONCLUSION

The article examined the possibility of using the new WGC indicators to measure the walkability and greenness at the same time for a Mediterranean country and the result showed that the new WGC indicator is truly a comprehensive efficient tool for assessing cities to be green and walkable. It could help the planners and decision makers to develop a walking environment for any Mediterranean country. The WGC new indicators seek to achieve six different goals, and the major findings of the article is that, inside each goal there were indicators successfully achieve the walkability and greenness together at the same time more than another indicator, and by conducting the previous studied five indicators, and according to the goal of Promoting of Crossing Safely, the indicator (1.1.) was more efficient than the other one, and according to the goal of Promoting of Sidewalks and walking paths quality, both indicators (2.1.) and (2.3.) was efficient.

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