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Characteristics of on-street parking in Al- Diwaniyah urban street

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ABSTRACT

By creating enough parking places, cities may be able to lessen congestion and traffic disruption. Thus, the primary issue that frequently arises in urban areas is on-street parking. In Al- Diwaniyah city's urban streets, on-street parking is a common occurrence. In order to analyze on-street parking characteristics, this study has concentrated on three congested sites: Al-Orzady Street, Al Saray Street, and Almusawreen Stree. Thus; field data were collected using in-out method. The characteristics and kind of parking were looked into. According to the activities at the three sites, it was mostly discovered that the peak time is in the afternoon between 3:10 PM and 4:40 PM. The results of the data analysis show that St3 has a high parking turnover of 1.348 and St1 has a low turnover of 0.67. It was also found through the questionnaire paper that the majority of the vehicles parked on the street are for the purpose of shopping. Finally, the results indicate that weekdays in the research area are a typical time for illegally parking.

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1. Introduction

At the present time, there are many factors that encourage an increase in the demand for transportation, and consequently the number of vehicles increases, and with this increase, the demand for parking lots increases [1]. Increasing the number of cars that visit a particular location, it is required to provide parking for vehicles in that area[2]. Because of the rapid industrial development that the world is witnessing today, it has led to economic growth and a high level of income for the population. Therefore, we notice an increase in the number of privately owned vehicles [3].The large number of vehicles in urban areas has increased the demand for parking spaces [4]. Most people prefer to do many activities at the same time and in one area, so the government and stakeholders must have the ability to provide various public utilities [5]. In the most city center, there is competition over the use of space between different urban activities. The authorities must consult and control for the purpose of giving the

appropriate use of each place [6]. There have been many developments in the past decades in order to improve roads and meet parking requirements, the situation is constantly changing, which requires a new approach [7]. Most countries suffer from traffic problems at the present time due to the increase in vehicle ownership and the unattractiveness of public transportation, as well as limited parking spaces [8].Public parking as an urban infrastructure is among the best parts of the urban transportation framework beyond reducing traffic on street corners [9].City centers suffer from constant overcrowding due to their inability to provide sufficient parking spaces as a result of an increase in the number of cars heading to the city center, which represents the commercial and economic part of the city [10].Since the number of vehicles has increased in cities, it has become more difficult to obtain parking for vehicles, and because of the slow driving of the driver while looking for a suitable place to park, it causes

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traffic congestion on the street, and this is a serious problem[11]. One of the negative effects on the flow of traffic is the parking of vehicles in the road in order to obtain a place to stop [12]. At the beginning of the twentieth century, a parking system was built in response to the use of storage areas for automobiles [13]. As a result, much of the current research is directed towards determining the role of the various factors that influence parking policies. There is a previous study that worked in China to know the characteristics of parking lots in the center of Shanghai, and the facilities were analyzed based on parking indicators. It was found that market areas and areas designated for food and drink show a high saturation of parking spaces. Therefore, parking improvement policies have been proposed in Shanghai city based on the current parking situation in the city (Chen et al.,2016). A study was conducted in the city center of Najaf in both locations (Al-Rawan, Al-Iskan) in order to verify the characteristics of parking on the street. Data were collected by manual census, drones, and video camera. The results indicated that the waiting time for most cars in all the two locations (Al-Iskan, Al-Rawan) is more than 80% for a period of 30 minutes (Al-Jameel and Muzhar,2020). study was conducted in the city of Bat Yam to estimate parking patterns in the city, where it relied on a spatially high-resolution display of heterogeneous demand and supply of parking, as it was shown that the time approaches zero if the distance between the place of parking the vehicle and the destination is less than 50 meters and the time reaches 4.5 minutes if the distance is 200 meters [14]. A study was conducted in the city center of Hilla, to address the problem of high demand for on-street and off-street parking. Where he explained that the vehicles parked on the street contribute to traffic accidents and affect safety, so he suggested using some small spaces for the purpose of making parking spaces for vehicles. [15]. Several studies of parking spaces were made in nine sectors in Delhi, the business district where the peak for parking was 3.25, as well as the peak for bicycles was 6.21, which indicates a significant indirect condition (Mahmoud, 2011). There is a previous study in Iran in the city of Sanandaj in which geographic information systems were used to determine the parking spaces of vehicles, as it was shown that 234,887 m² or 14.16% of the study area would be suitable for constructing parking spaces [9]. Among the factors that affect the choice of a place to park vehicles (the distance that the driver walks from the parking place to the exits of the car park, protecting the vehicle from sunlight, the safe place to park the vehicle, the distance from the entrance to the parking lot to the area where the car is parked) [16]. Urban planning often exceeds parking problems and this is a reason for increasing traffic congestion in urban areas, so solutions must be made during planning and design and improve the level of management [17]. The urban planning of the city must take into account the parking spaces [18]. Al-Diwaniyah city is one of the Iraqi cities in which there are many daily commercial activities in general. The majority of the activities in the city are concentrated in the central business area (CBD), — in other words, the economic center of the city, where people must be able to reach the places where we get activities easily. Increasing demand for mobility the need to provide many parking spaces to accommodate the number of parked cars increases [19]. Al- Diwaniyah city suffers from scarcity of parking places in several regions such as Al-Orzady Street , Al Saray Street and Almuswreen Street. [20] found that on-street parking decreases roadway capacity in two ways. For begin, it minimizes the width of the highways by limiting the traffic flow. Second, excessive parking of vehicles contributes to congestion in urban areas. These two parking places on the street cause a reduction in road capacity city streets.

This study's aim is to evaluate on-street parking behavior in metropolitan streets like, Al-Orzady Street, Al Saray Street, and Almusawiran Street in

Al- Diwaniyah city, because there are few or no studies that deal with on-street parking in Al- Diwaniyah city or in Iraq in general. The aim of this study may be achieved by gathering information and comprehending the quantity of parked cars on both sides of the street as well as the properties of street.

1.1 Parking characteristics

In the initial stage of the study, it is required to determine the number of parking spots and to take sufficient and relevant information for the goal of deriving different characteristics linked to on street parking, which are called parking stats or characteristics. In generally, the following criteria are utilized for car parks [21]:

1. Parking volume: The total number of cars parked at one time is known as the parking volume. The recurrence of vehicles is not taken into account. It is tracked how many vehicles actually enter the region.
2. Parking accumulation: the quantity of parked cars in a studied area at any specified instant. The fluctuation in parking accumulation throughout the day can be shown by plotting this data as a parking accumulation vs. time curve.
3. Parking load (space-hour): The area under the accumulation curve is provided by the parking load. It can also be calculated by merely multiplying the quantity of automobiles parked in the designated location at each interval by the interval. It is described as (space-hours).

$$\text{Parkingload} = \text{time interval (hr)} * \sum \text{parked vehicles at each time interval}$$

4. Average parking duration is the amount of time a car is left parked in a space. An indication of how frequently a parking place becomes available is provided when the parking duration is presented as an average. It represents the proportion of total vehicle hours to the quantity of parked cars.

$$\text{Parkingduration} = \text{Parkingload} / \text{Parkingvolume}$$

5. Parking turnover: is how frequently a parking place is used. It is calculated by dividing the volume of parking for a given time period by the quantity of parking spaces.

$$\text{Parkingturnover} = \text{Parkingvolume} / \text{No. of bays available}$$

6. Parking index: The term occupancy or efficiency also applies to the parking index. It is described as the proportion of the total space that is accessible to the number of bays that are occupied throughout time. It provides a total assessment of how well the parking space is used. Parking index can be found out as follows:

$$f = \text{Parkingload} / \text{Parking capacity} * 100 (1)$$

2. Methodology

The demand for parking lots varies by region. In this research, the city center of Al-Diwaniyah (commercial center, government departments and offices) was selected. Al-Diwaniyah City is the administrative, economic, and political center of Al-Diwaniyah Governorate and one of the cities in

Iraq in the middle Euphrates region. **Fig 1** show the location of Al-Diwaniyah city.

It is crucial to get parking information from urban streets in order to research the effects of on-street parking. Al-Orzady Street, Al Saray Street, and Almuswreen Street are the first three locations that have been chosen for this project to study its characteristics in the evening period. In Al-Diwaniyah city, these locations are among the busiest ones on-street parking. **Fig 2** show the border of study area.



Figure 1. A map of Iraq showing the location of the city of Diwaniyah



Figure 2. Screenshot for the study area

The number of all vehicles parked on and off streets in the study area was calculated at the morning and evening at different days, and the parking sites on the street were chosen using the GIS application, which was also used to estimate the length of the street allowed for stopping. The attributes were ascertained using the in-out survey method. To find out why the car was parked on the street, a questionnaire was also created.

3. Data collection

The data of this study were collected for the purpose of finding the characteristics of parking in Al-Orzady Street, Al Saray Street, and Almuswreen Street at the evening period. The study does not include standing in the squares. The survey was conducted using the in_out method. Where three ways were chosen in which vehicles are allowed to stop, the survey that was conducted counted the number of vehicles parked on the street at the beginning of the survey, and counted the number of vehicles that parked or left the street at certain periods of time. The **Fig 3**

shows an aerial picture of the city center of Al-Diwaniyah, showing the roads for which, the survey was conducted. Streets for which properties were found ST1 Orzady Street, ST2 Saray Street and ST3 Street of Almuswreen. Table (1) show the information of on street parking in ST1, ST2, ST3.

Figure (3) locations on street parking in the study area

Table 1. Existing on-street parking survey in Al-Orzady Street ST1, Al Saray Street ST2, and Almuswreen Street ST3.

Street name	Width (m)	Length(m)	Number of lanes	Direction of flow	Number of spaces	Type of parking
ST1	13m	90m	2	One way	20	One side (45 angle)
ST2	10m	290m	2	Two way	50	Both sides (parallel)
ST3	20m	195m	2	Two way	43	Both sides (parallel)

Then a survey was conducted to determine the number of parked vehicles in all of the streets of Al-city Diwaniyah's centre in the study area, as well as the number of parked vehicles in 22 parking spaces located in the city centre of Al-Diwaniyah. **Fig 4** show the location of on street and off street parking lots in the study area.



Figure 3. Location on-street parking in the study area



Figure 4. Screen shot for all roads and parks in the study area

A questionnaire was undertaken in Al-Orzady Street, Al Saray Street, and Almuswreen Street. 60 vehicles were taken in the streets to determine the reason of parking a vehicle on the street, as well as the duration the vehicle was parked. According to the instructions on the questionnaire sheet. Shown in Table (2).

Table 2. The questionnaire sheet

The name of on street which vehicles are allowed to park in it	St1 <input type="checkbox"/>	St2 <input type="checkbox"/>	St3 <input type="checkbox"/>
Car no.	The reason for stopping, the vehicle		The time of stopping vehicle
	Shopping <input type="checkbox"/>	Shop owner <input type="checkbox"/>	Doctor review <input type="checkbox"/>
	Min <input type="checkbox"/>	hr. <input type="checkbox"/>	

4. Results and discussion

In this research, what was inferred from the data collected in Al-Diwaniyah city center, where it was found that the total number of vehicles that parked on the street and the total number of vehicles parked in the parking. It was found that the number of vehicles parked in the street is twice the number of vehicles in the parking are as shown in the Table (3) and Table (4) show the characteristics of on street parking at the evening in Al-Orzady Street , Al Saray Street and Almuswreen Street.

Table 3. The demand for on-street and off-street parking for all of the local parked vehicles (22 park).

Parking type	No. of parked vehicles			
	Thursday 10:00Am. (2/12/2021)	Friday 4:30 P.m. (3/12/2021)	Wednesday 10:00Am. (8/12/2021)	Wednesday 4:30P.m. (8/12/2021)
Off-street	749	805	586	546
On-street	1626	1501	1539	1250
Total	2375	2306	2125	1796

Table 4. The parking characteristics for the selected on-street parks at the evening

Street name	ST1	ST2	ST3
Peak time	4:10PM 4:40PM	3:10PM 3:20PM	3:10PM 3:40pM
Peak parking accumulation	0020	0045	0044
Parking load	2030	4860	4810
Parking volume	0030	0059	0058
Parking index	37.59%	69.8%	93.22%
parking duration	67.670	82.37	82.93
Parking turnover	0.670	1.017	1.348

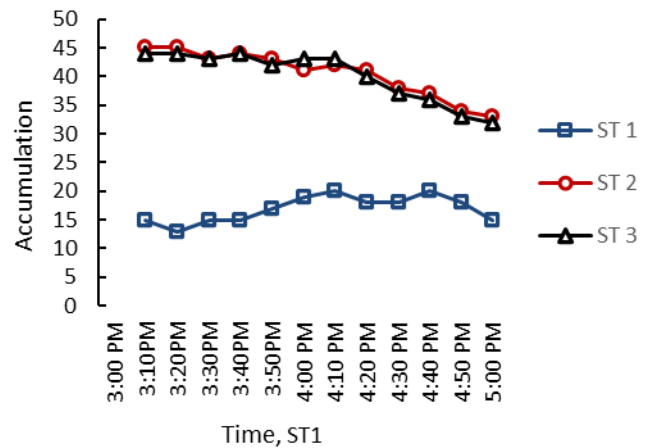


Figure 5. The accumulative curve for on street parking

From Fig 5 found that the peak times for Al-Orzady Street ST1 are at (4:10 and 4:40 pm), Al Saray Street ST2 (3:10 and 3:20) while the peak times for Almuswreen Street ST3 are at (3:10, and 3:40 pm), because it is located in the center of Al-Diwaniyah, which is the commercial and administrative center of the city. Where these time periods are considered the time when most people perform their work in commercial areas and areas that contain medical centers, and after this time we notice a decrease in the number of vehicles parked on the street.

What was discovered from the questionnaire survey that took place in ST1, ST2, and ST3 to determine the reason for parking the vehicle on the street, as show in the Fig 6.



Figure 6. The percentage of purpose of stopping

The majority of parked vehicles are for the purpose of shopping, at a rate of 55%, 38 percent are for shop owners, and 7% are for the purpose of visiting medical facilities, as seen in the Fig 6.

What has been observed in the roads that have been studied is that the process of parking vehicles on the street occurs on a daily basis and can have a number of negative consequences, including a negative impact on traffic flow and a reduction in vehicle speed as a result of obstructing traffic, as well as a negative effect on road capacity and congestion.

5. Conclusions

The following conclusions are based on this study:

- 1- The peak time for ST1(4:10 and 4:40 pm), ST2 (3:10 and 3:20) and, ST3 are at (3:10 and 3:40 pm).
- 2- The average turnover for ST1, ST2, ST3 are (0.67, 1.017, 1.348). This suggests that the efficiency of existing parking spaces with low average turnover is less performance
- 3- The high value of parking index in ST3 93.22% while the low value in ST1 37.59%
- 4- Some people prefer to park the car on the street, because free parking.
- 5- Most of the vehicles parked on the street are for the visiting shopping center, because commercial area is the main area in the city, where it attracts large numbers of people for shopping, in addition to government departments, offices and nearby banks, so this area needs to provide parking for vehicles with a high capacity and provide protection for the vehicle.
- 6- The paper indicates promoting advanced mobility technologies, such as smart parking.

Authors' contribution

All authors contributed equally to the preparation of this article.

Declaration of competing interest

The authors declare no conflicts of interest.

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