

## CHARACTERISTICS OF ON-STREET PARKING, CASE STUDY AL-ROWAD STREET IN AL-MANSOUR AREA / BAGHDAD

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**Abstract:** Parking facility is one of the important means to regulate traffic and facilitate the movement of vehicles in commercial, industrial and entertainment areas. On-street parking is one of the most important problems that need to be managed and organized, especially at peak hours for the area. In the Mansour area and Al-Rowad Street in particular, it is one of the important streets in the city of Baghdad and is due to the presence of various commercial centers, such as Al-Mansour Mall, in addition to shopping centers, restaurants, medical clinics and educational centers. The study took place during the week. The data collection time is for five hours (5: 00-10: 00) PM . The mechanism for collecting data was manually. The data showed that the peak hours start from five in the afternoon and continue until ten in the evening. According to the cumulative scheme, the rush hour was at 8:00 pm with 150 vehicles, as the street capacity is 168 spaces. Moreover, the duration time ranged between (30-60) minutes. Turnover rate was 2.16.

**Keywords:** *Parking Facilities, Demand, Supply, Turnover Rate, Parking duration.*

### 1. Introduction

The development occurs in the uses of the land, especially the lands within the commercial areas, which are considered an attractive area for trips. Most of these developments require

facilities in order to increase the number of arrivals, and the most important facilities are vehicle parking. Every day, a high percentage of vehicles are looking for space to park their vehicles, especially the parking nearby from final destination. Some drivers due to the lack of experience in finding parking spaces lead to the possibility of problems and traffic congestion [1]. The lack of information related to parking users in terms of their choice of appropriate parking spaces for their vehicles in the commercial business area, leads to difficulty in the process of developing the parking facilities and its effective policies within the area [2].

Palmer et al. (2010) found that parking spaces in the United Kingdom are almost never occupied, that the costs of parking services should be included in construction costs or subsidized by city authorities, and that every destination should fulfill its own needs for parking. He proposed that the CBD should try to make effective use of parking facilities. [3].

### 2. On-Street Parking

The absence of parking spaces on the street has negative effects, as the number of pedestrian

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accidents increases, and accidents may reach 11%, and its effect increases on minor roads. [4]. Therefore, urban transport planners in developing countries are facing difficulties in road design due to the lack of appropriate capacity guidelines that would take into account the effect of parking as well. While relatively few attempts have made to quantify the effect of on-street parking on capacity, they still lack sufficient quantification, which is more critical from the point of view of transport planners. In order to obtain an accurate quantification of this effect by developing certain models or adjustment factors, it is therefore necessary to perform additional studies in developing countries. [5]. Finally, parking decreases street capacity by 70- 40% due to traffic congestion [6]. Charlton and Baas (2006) discovered that on-street parking contributes to two ways of limiting road capacity. Firstly, it limits the width of the carriageway by limiting the flow of traffic. Secondly, regular car parking contributes in urban areas to congestion. These two street parking points also resulted in the lack of road space on urban roads. Capacity reduction percentages are in Table 1 [7].

**Table 1.** Indicates the decrease in the width of the road lane

Extent of parking	Reduction in the capacity (%)
Parking width wider than 4m lane divided major street	20-25
1.9m wide single side parking on two lane undivided street	22
35% proportion of the parking vehicles on one way major street	35
Both side parking on two lane undivided road	78-90
Curb parking on four lane and six lane divided road	50,40

Management of parking relates to policies and services that contribute in more quite well usage of resources for parking. Management of

parking includes several complex plans;. When proper parking management is applied, the number of parking spaces available in a particular location can be reducing, generating a range of economic, environmental and social advantages. Established management is also the best approach to parking issues when all aspects are taken into account. [8].

And the importance of off-street parking, especially the multi-story one, increases with the increase in the city's population and the concentration of urban activities, and this explains the importance of providing them in large cities in an American study of several cities as shown in Table 2. It was found that the more the city's population increases, the number of parking spaces inside the street decreases from 43% to 14%, and the parking lot outside the street increases from 57% to 86%. The increase in multi-story parking garages is regular as the city's population increases, in contrast to the lot parking lots, which decrease relatively when the city's population increases significantly [9].

**Table 2.** Illustrates the relationship between population and parking facilities

Population (1000)	On-street	Parking lot	Multi-story	Total parking	Space per 1000 person
10-25	1090 (43%)	1530 (57 %)	10 (0%)	2630	150
25-50	1430 (38 %)	2420 (59 %)	140 (3 %)	3990	120
50-100	1610 (35 %)	2790 (60 %)	260 (5 %)	4660	70
100-250	2130 (27 %)	4760 (62 %)	820 (11 %)	7710	50
250-500	2450 (20 %)	7910 (64 %)	1940 (16 %)	1230	30
500-1000	3200 (14 %)	12500 (56 %)	6900 (30 %)	2260 0	30

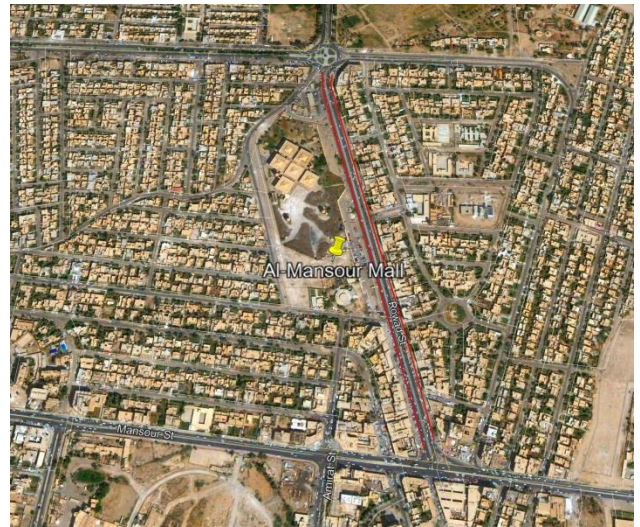
-1000	8000	32200	18600	5880	20
	(14 %)	(55 %)	(31 %)	0	

The threat of on-street parking in Lokoja (Nigeria) was assessed, and it was discovered that parking issues are caused by the area's land use trend, insufficient parking spaces or services, and inefficient traffic devices [10].

When the level of service of all alternate modes of transportation is strong, the demand for parking is decreased, Public transportation (if it reaches the intended destinations), a taxi service, a bicycle, cycling, or carpooling are examples of such options [11].

### 3. Methodology

For the study the effect of On-street parking, first it is necessary to collect data from which we can analyze and know the efficiency of parking on the street in the study area. The Mansour area within the city of Baghdad (the capital of Iraq) considers having a high attraction for citizens. Because it is a central area and the presence of commercial streets that allow many to place their vehicles on-street spaces, so studying parking in this region is one of the important indicators to know the efficiency of traffic in it. One of the most important streets with high on-street parking is Al-Rowad Street. This street is located in the middle of the Mansour area, which considers one of the most important streets in the city of Baghdad, specifically the Mansour area. In addition, the presence of shops and large commercial centers such as Al Mansour Mall made this street of great importance. Image 1 illustrates location of Al-Rowad Street.



**Image 1.** On-street parking vehicle in Al-Rowad Street

Parking on this street is on both sides. The length of this street is about 926 meters. In order to facilitate data collection, the both sides street divided into nine parts. Turnover rate, Parking Duration, and type of parking are the chosen criteria for on-street parking in this analysis. The study time for which the data were collected is (5-10) p.m.

#### 3.1 License Plate Number Survey

The survey was conducted by dividing each street into parts to facilitate work. The observer stands in a position where he can see all of the vehicles parked on the street, allowing him to determine the time of each vehicle's entry and exit, as well as the other required accounts. The majority of streets in the Mansour area are not restricted to use, i.e., street use is allowed and unrestricted. Collecting data is based on the License Plate Number and determining the time of its entry and exit in order to calculate the parking time and find the cumulative scheme for parking during the study period.

### 4. The Results and Discussions

For a period of 5 hours the data collected, during which the data required for the analysis collected. The evening period is of high

attraction for visitors in addition to the high traffic momentum, which causes traffic jams. Al-Rowad Street considers a traffic road for public transport, which makes it easy to reach the surrounding areas.

Standing on-street parking at Al-Rowad Street was at a parallel angle. The reason for this is that the street has high traffic, which may cause parking at an angle to a traffic problem. The side adjacent to the Mansour Mall is forbidden to park for security reasons. This portion of the study excluded. Table 3 shows the length of the eight sections of Al Rowad Street.

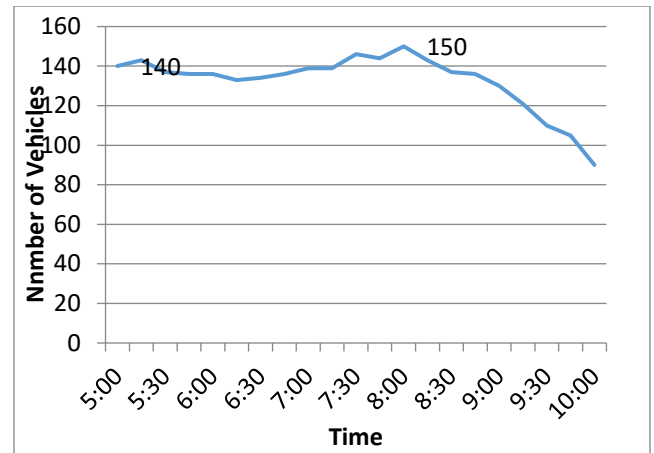
**Table 3.** Al-Rowad Street Sections

segments	capacity	Length (m)
1	12	66
2	24	132
3	25	137
4	15	82
5	15	82
6	10	55
7	23	126
8	23	126
9	21	120

#### 4.1 Parking Accumulation

It is the number of vehicles parked on-street parking during the study period. The importance of this characteristic is to find the peak number of parked vehicles. "Fig. 1" illustrates parking accumulation for Al-Rowad Street.

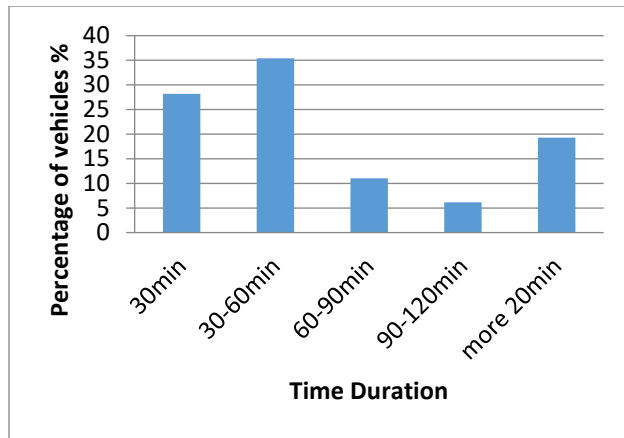
The cumulative chart shown in "Fig. 1" shows the discrepancy in parking during a certain period. Whereas, at 8:00 p.m. is the height of parking, because there is the highest parking rate of 150 vehicles. The peak period for parking on Al-Rowad Street usually starts at 5:00 p.m., with 140 vehicles parking. In general, parking on-street peak begins at 5:00 to 10:00 p.m. When comparing the street capacity, which equals 168 spaces, with the peak demand of 150 vehicles, the demand was less than the capacity.



**Figure 1.** Parking accumulation for Al-Rowad Street

#### 4.2 Parking Duration

Parking duration is the length of time it takes for the vehicle to using parking space. The duration varies according to the driver's final destination [12]. Some parking systems use parking duration time to price parking depending on Parking Meter. In addition, because the study area is a commercial and recreational nature, parking times are usually high, especially in commercial streets, as is the case in Al-Rowad Street. "Fig. 2" shows the parking duration for the vehicles used for this street. Through the "Fig. 2", it is noticed that most vehicles stand at duration between (30-60) minutes, that is, an average of 35% of the total parking vehicles. In 28% of the vehicles, the duration was between (10-30) minutes. We note that 19% of the total vehicles had a parking duration time more than 120 minutes. The reason is due to the shop owners who park their vehicles in front of their stores, which causes a decrease in the possibility of parking other vehicles and thus reducing the benefit.



**Figure 2.** Percentage of vehicles according to their parking duration

The absence of pricing and management laws that organizes the parking duration and absence of the administrative side of the parking spaces on the street, all of these reasons lead to the deterioration of the traffic reality inside the area, where we notice the large traffic pumping on Al-Rowad Street and therefore these parking and large parking duration lead to traffic and health damages due to vehicle exhaust.

#### 4.3 Turnover Rate

The importance of calculating the parking Turnover is to know the efficiency of the parking spaces. The mechanism for calculating parking turnover is somewhat complicated and can be calculated based on field surveys by numbering each space and the number of stops for 30 minutes per vehicle is calculated, while the parking turnover can be calculated based on mathematical equation that can be easily applied and calculate the turnover directly. In our study, we relied on the mathematical equation. In this study, the period was limited between 5:00 to 10:00 p.m., and its unit of measurement (vehicle / parking space / hour).

$$\text{Turnover Rate} = \frac{\text{parking volume}}{\text{supply}} \quad (1)$$

Where:

Parking volume: Total number of vehicles parked during parking period.

Supply: Number of parking spaces.

Parking facility	Parking volume	Supply	Turnover (veh/space/hr)
Al-Rowad Street	364	168	2.16

## 5. Conclusions

The results obtained from the analysis of Al-Rowad Street data can summarize as follows:

- 1- The peak of parking was at 8:00 p.m., with 150 vehicles. At the same time, the street is at the peak of vehicle traffic flow.
- 2- The Turnover Rate of Al-Rowad Street was 2.16. Where the presence shops owner's vehicles are the main reasons for reducing the amount of turnover rate, thus reducing on-street parking efficiency and serving the largest possible number of vehicles.
- 3- The parking duration is commensurate with the purpose of trip, as the period of standing was (30-60) minutes and by 35% of the total of the total parking vehicles. The parking duration time was less than 30 minutes, at a rate of 28%.
- 4- On-street parking in Al-Rowad Street is free (no prices) and is not limited to a parking duration, in addition to random parking due to unmarked street.

## 6. Recommendation

After collecting and analyzing data, and clarifying the prevailing situation of parking in the study area, there are some proposals related to on-street parking, which are missing many things. We will summarize them as follows:

- 1- Regulating traffic movement, especially at peak hours, by activating government public transport means that reduce private vehicles, which are widely used in the streets of Al-Mansour area.
- 2- Implementing traffic policies to reduce the problems resulting from on-street parking, as parking management is one of the methods used to regulate parking. The study area is not subject to any parking management policy.
- 3- Parking management includes the existence of a special mechanism for restricting parking through pricing and determining the time at which parking starts and ends as well. In addition, this is done by placing guide signs that clarify this, as in the Photos 1.



**Photos 1.** Illustrated sign for guiding pay and time duration on-street parking

- 4- Restricting parking by limiting the parking period, and parking on the street can cancel, especially at peak hours.
- 5- Activate the role of off-street parking. Where peak hours can be accommodated by canceling the on-street parking and thus activating the off-street parking role.
- 6- Pricing, which is one of the most important restrictions to reduce the on-street parking vehicles, as Al Rowad Street lacks such. Pricing is done using parking meter as shown in the Photo 2.



**Photo 2.** Illustrates parking meter

### Conflict of interest

The authors declare no conflict of interest in publication of this research.

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