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Evaluating Traffic Performance on Basra City Urban Roads Network

Z. Nassrullah*

Department of Civil Engineering, Collage of Engineering, University of Basrah, Iraq

P A P E R I N F O

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A B S T R A C T

The continuous growth of the economy and population around the world has led to an increase in transportation demand. Consequently, the number of vehicles keeps increasing to satisfy the continued demand for transportation. Traffic congestion and delay, as a result, is becoming the norm in many big cities. The first step to alleviate the traffic congestion and delay is to gain a better understanding of the traffic operations at the city's road network. This study tries to investigate and report about the traffic operations at urban roadways in Basra City, Southern of Iraq. With the focus of studying some of the main traffic parameters such as traffic flow, speed, travel time and delay at some selected sites with interrupted traffic flow within Basra City. Field traffic data from 30 roadways sites has been collected by using two techniques, camcorders and floating car technique. Data analysis showed that most of the selected sites are running under their capacity with an average speed close to the posted speed limit. However, the analysis of data also showed that for the majority of times on these selected sites long travel time and traffic delays were experienced, with an average delay of around 3.0 minutes for each 1.0 km road length. This could be attributed to deficiencies in the operation of traffic signals at intersections, presence of illegal on-street curb parking (with double parking sometimes) and the absence of traffic enforcement controls (with associated penalties).

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1. INTRODUCTION

With the rapid growth and development of the economy and population, transportation demand for both passenger and freight is also increasing. According to SLOCAT the global gross domestic product (GDP) grew by 27% between 2010 and 2019 whereas the global population increased 12% and the urban population grew by nearly 20% between 2010 and 2020. The continuous growing of populations and a denser concentration of people in urban areas around the world has led to increase the transportation demand which affects traffic flow conditions negatively in urban roads [1-3]. In addition, Lukina et al. [4] reported that the city center could create up to 40% of job opportunities which increases the transportation demand for accessing work and other attraction points in the city center. Consequently, the number of vehicles is increasing. The number of private sector vehicles in Iraq has increased nearly fivefolds between 2010 and 2020. The number of vehicles for private sector only in Iraq has reached 7 million vehicles by the end of 2020 and continued increasingly. However, the corresponding road capacity has not been significantly improved. Lengths of paved highways grew only by 7% between 2015 and 2020 [6]. This situation may have exacerbated the situation with serious traffic congestion in some locations leading to higher delays and higher rate of traffic accidents. In 2020, the number of fatalities involving traffic accidents was 2016 accidents whereas the non-fatality traffic accidents were 6170 accidents. Traffic congestion and unsafe driving behavior are the main motivations of the higher rate of traffic accidents [5-7]. Even though, a comprehensive solution of the traffic issues in Basra City's urban roads might not be achieved. European Conference of Ministers of Transport [8] stated that "*dynamic, affordable, livable and attractive urban regions will never be free of congestion*". However, a good understanding of traffic

*Corresponding Author Email: zaid.abbas@uobasrah.edu.iq
(Z. Nassrullah)

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operations at Basra urban roads might help to alleviate traffic congestion and delay and to enhance safety. The present study tries to investigate and report about the traffic operations at urban roadways in Basra City, Southern of Iraq (in Basra Governorate). To inform Basra City's traffic engineers, urban planners, and policymakers about the existing traffic issues.

2. LITRETURE REVIEW

Several previous studies have been found in the literature that deal with traffic performance of roads in urban areas. Liao et al. [9] stated that traffic congestion is commonly occurred in urban areas, especially during peak hours. They reported that analysis and estimation of traffic flow in urban areas is required to understand the causes of traffic congestion. Zang et al. [10] reported that for alleviating traffic congestion, scientific and quantitative evaluation of the traffic congestion should be carried out. Alkaissi and Hussain [11] estimated traffic volumes, vehicle compositions and travel time for some selected interrupted streets in Baghdad City to understand the causes of traffic congestion. Falih [12] studied the causes and remedies of traffic congestion in Samawa city. He reported that the illegal parking of vehicles, lack of vehicles parking, physical constraints of some roads and mismanagements of roads intersections are main reasons for traffic congestion. AlGhanim et al. [13] studied the traffic performance for some selected streets in Al-Najaf City. The researchers estimated traffic volume, travel time, average travel speeds and level of service (LOS). Abbas et al. [14] studied the negative impact of freight transportation on Hilla City roads. The researchers proposed adding new roads to enhance the road network in the city. Hafram et al. [15] evaluating the traffic performance by using simulation model. The researchers used traffic volume, speed, road geometry and roadside parking as input data for modeling process. Yigitcanlar et al. [16] suggested adopting intelligent transport systems (such as traffic control applications and big data analytics) and smart mobility services to optimize traffic conditions. Reddy and Srivastava [17] reported that traffic operations are considered as one of the important factors for dealing with and managing traffic congestion in urban areas. Alkaissi [18]reported that travel time and delay can be considered as one of the important factors that can be used in evaluating traffic performance in an urban road network. Ahmed et al. [19] reported that estimating travel time and average speed are very important to enhance the efficiency and safety of roads. Garber and Hoel [20] reported that the travel time and delay data can be used to identify the traffic problem locations. Skovajsa et al. [21] stated that traffic delay is one of the principal factors that can be used to evaluate the quality of traffic management. Noor et al. [22] studied the traffic congestion in urban areas by measuring traffic volume and speed. Abed et al. [23] studied the effects of traffic operations (such as traffic volume, traffic speed and traffic composition) and characteristics of roads geometry on noise pollution. It can be concluded from the abovementioned studies that the most important factors of traffic operations that affect traffic performance are traffic flow, average speed, average travel time and delay which will be taken into consideration into the present study.

Rashid [24] studied the causes of traffic congestion in Basra. He found that the growing population and number of vehicles in Basra are the most significant factors for the traffic congestion. He reported that the number of vehicles in Basra has increased by threefolds for the period from 2004 to 2009. Rashid [24] studied the impacts of traffic accidents on the city of Basra. He reported that traffic accidents in Basra have resulted in 19 fatalities for every 100 injuries. However, traffic operations have not been taken into consideration in both studies, by Rashid [24].

Although many previous researchers studied the traffic performance in urban areas, very limited studies have been found in the literature for Basra city. Therefore, this study will try to furnish investigations about traffic operations at urban roadways in Basra City. With the focus of studying traffic flow, average speed, average travel time and delay (as suggested by previous studies) at some selected interrupted traffic flow roadways in Basra City.

3. DATA COLLECTION

One of the challenges in this study was selecting the sites in the crowded urban center of Basra City to collect field traffic data. However, most of the main roads in Basra City center have been selected. The field traffic data have been collected from 30 roadway sites by using two techniques, these are camcorders and floating car technique, as will be discussed in the following sections.

The approach of this study involves understanding traffic flow conditions by measuring traffic operations (such as flow, speed, travel time and delay as described in the previous studies). Figure 1 shows the research flowchart.

3. 1. Data Collected by Camcorders Field traffic data has been collected by using camcorders from 22 sites dual carriageways roads with 4, 3 and 2 lanes in each direction. The collected data by camcorders were then used to compute traffic flow and average speed.

3. 1. 1. Four Lanes Dual Carriageway Roads Six sites' roadways (with 4-lane) have been selected. The four lanes dual carriageway roads is characterized by

traffic travelling in opposite directions separated by a central median with four lanes in each direction and different posted speed limits for each lane. The posted speed limit for the four lanes dual carriageway roads in Basra City is 40 km/h for lane 1 (inside lane), 40 km/h for lane 2, 60 km/h for lane 3 and 80 km/h for lane 4 (offside lane). Figure 2 shows lanes notations used in this study. These sites have been surveyed during 2021 and 2022. Table 1 summarizes the details of the selected sites, whereas Figure 3 shows locations of these sites.

3. 1. 2. Three Lanes Dual Carriageway Roads Eight sites' roadways (with 3-lane) have been selected. The selected sites for the three lanes dual carriageway roads is also characterized by traffic travelling in opposite directions separated by a central median with three lanes in each direction. The posted speed limit is 40 km/h for all lanes in each direction. These sites have been surveyed during 2021 and 2022. Table 2 summarizes the details of the selected sites, whereas Figure 4 shows the locations of these sites.

3. 1. 3. Two Lanes Dual Carriageway Roads Eight sites' roadways (with 2-lane) have been selected and surveyed as summarized in Table 3 and the location map shown in Figure 5. Likewise, the traffic is travelling in opposite directions separated by a central median with two lanes in each direction. The posted speed limit is 40 km/h for all lanes.

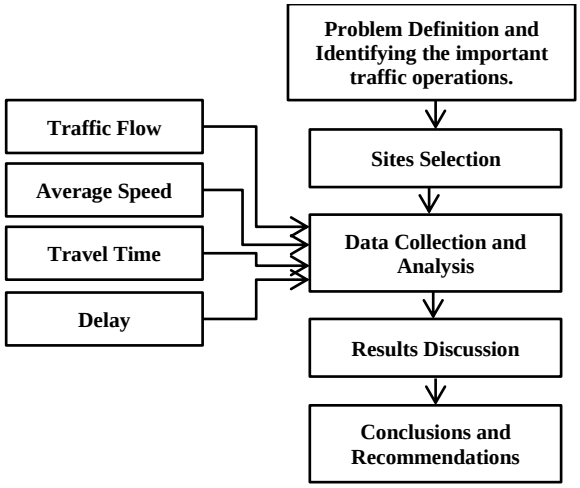


Figure 1. Illustration of research flowchart

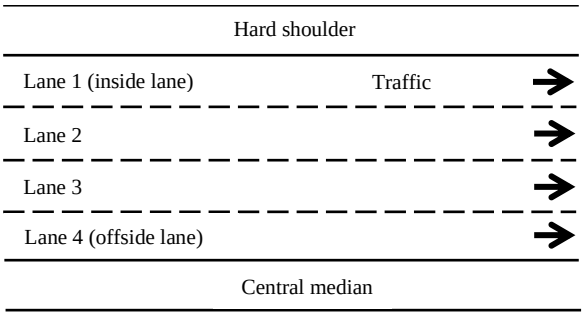


Figure 2. Illustration of four lanes dual carriageway roads

TABLE 1. Sites' location and details for selected 4-lane roads

Site No.	Site location	Traffic direction	Date	Time and duration
1	Lebanon Street	Eastbound	Tuesday 30/11/2021	10:00-13:00 3 hours
2	Lebanon Street	Westbound	Tuesday 30/11/2021	10:00-13:00 3 hours
3	Azzubair street	Eastbound	Wednesday 12/01/2022	07:40-10:40 3 hours
4	Azzubair street	Westbound	Wednesday 12/01/2022	07:40-10:40 3 hours
5	Baghdad street	Northbound	Sunday 21/11/2021	07:40-10:10 2.5 hours
6	Baghdad street	Southbound	Sunday 21/11/2021	07:40-10:10 2.5 hours

Figure 3. Sites' locations map (camcorders, 4 Lanes roads) (Source of map: Google Maps, 2023)

TABLE 2. Sites' location and details for selected 3-lane roads

Site No.	Site's location	Traffic direction	Date	Time and duration
7	Al-Basra street	Eastbound	Sunday 28/11/2021	07:00-10:00 3 hours
8	Al-Basra street	Westbound	Sunday 28/11/2021	07:00-10:00 3 hours
9	AlJomhoria street	Eastbound	Sunday 09/01/2022	08:00-11:00 3 hours
10	AlJomhoria street	Westbound	Sunday 09/01/2022	08:00-11:00 3 hours
11	Ashar Street	Eastbound	Sunday 16/01/2022	08:00-11:00 3 hours
12	Ashar Street	Westbound	Sunday 16/01/2022	08:00-11:00 3 hours
13	Trade Street	Eastbound	Wednesday 05/01/2022	11:05-14:05 3 hours
14	Trade Street	Westbound	Wednesday 05/01/2022	11:05-14:05 3 hours

Figure 4. Sites' locations map (camcorders, 3 Lanes streets)

TABLE 3. Sites' location and details for selected 2-lane roads

Site No.	Site location	Traffic direction	Date	Time and duration
15	Dinar Street	Northbound	Wednesday 12/01/2022	11:00-13:30 2.5 hours
16	Dinar Street	Southbound	Wednesday 12/01/2022	11:00-13:30 2.5 hours
17	14 July Street	Eastbound	Tuesday 09/11/2021	07:00-10:00 3 hours
18	14 July Street	Westbound	Tuesday 09/11/2021	07:00-10:00 3 hours
19	Al-Saadi Street	Northbound	Sunday 02/01/2022	11:30-14:30 3 hours
20	Al-Saadi Street	Southbound	Sunday 02/01/2022	11:30-14:30 3 hours
21	Al-Jaza'ar Street	Northbound	Sunday 23/01/2022	11:00-14:00 3 hours
22	Al-Jaza'ar Street	Southbound	Sunday 23/01/2022	11:00-14:00 3 hours

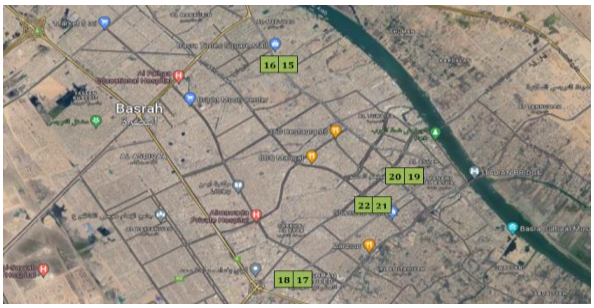


Figure 5. Sites locations map (camcorders, 2 Lanes streets)

3. 2. Data Collected by Floating Car Technique

Field traffic data have been collected by using floating car technique from 8 sites dual carriageways roads with 4, 3 and 2 lanes in each direction. The collected data by floating car technique were then used to compute average travel time and delay. Likewise, these 8 roadways sites have been surveyed during 2021 and 2022. Table 4 summarizes the details of the selected sites, whereas Figure 6 shows locations of these sites.

TABLE 4. Sites' locations and details for the data collected by floating car technique

Site No.	Site location	Traffic direction	Date and Time	Street length covered (m)
23	Baghdad Street	Northbound	Sunday 15/05/2022	4200
24		Southbound	07:30-09:20	4200
25	Al-Basra Street	Eastbound	Monday 14/03/2022	2200
26		Westbound	07:30-09:00	2200
27	14 July Street	Eastbound	Thursday 19/05/2022	1800
28		Westbound	19:00-21:32	1800
29	Dinar Street	Northbound	Wednesday 02/03/2022	2300
30		Southbound	07:30-09:20	2300

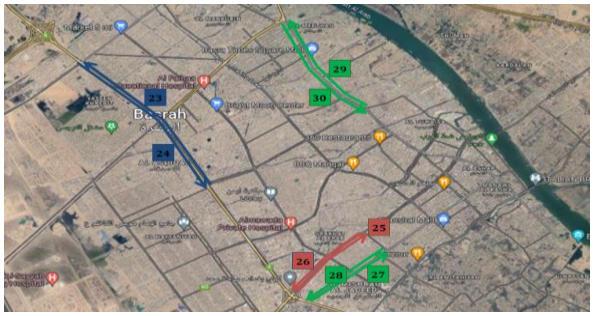


Figure 6. Sites' locations map (floating car technique)

4. DATA ANALYSIS

4. 1. Traffic Flow Field data from 22 sites with 4 lanes, 3 lanes and 2 lanes dual carriageways roads have been collected and analyzed to calculate the traffic flow parameter. The traffic flow data has been measured manually by displaying the video recording on the screen of a computer and drawing a thin line across the computer screen by using a marker pen to help in counting the vehicles. The collected flow data were then grouped into five-minute intervals and converted to hourly flows for each five-minute interval, as recommended by many previous researchers such as [25]. Figures 7, 8 and 9 show traffic flow for 4 lanes dual carriageways sites, 3 lanes dual carriageways sites and 2 lanes dual carriageways sites, respectively.

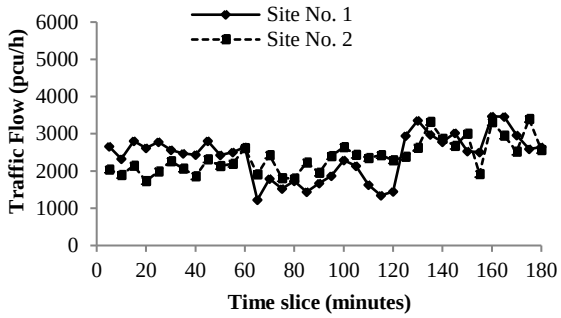
It can be seen from Figure 7 that the traffic flow conditions for Lebanon Street (Site no. 1 and Site no. 2) can be considered as a moderate traffic flow conditions and it is ranging from around 2000 to 3000 pcu/h. The data taken from Sites no. 1 and 2 was collected at off peak hours from 10:00 am to 13:00 pm. Where, the traffic flow

conditions for Azzubair Street (Site no. 3 and Site no. 4) and Baghdad Street (Site no. 5 and Site no. 6) can be considered as a heavy traffic flow conditions and it is ranging from around 4000 to 6000 pcu/h. The data for both sites was collected at peak hours, as mentioned in Table 1. Also. It is worth mentioning here that the heavy vehicles percentages for Site no. 1 are 5% and 4% for Site no. 2, 5% for Site no. 3, 8% for Site no. 4, and 16% for both Sites no. 5 and 6.

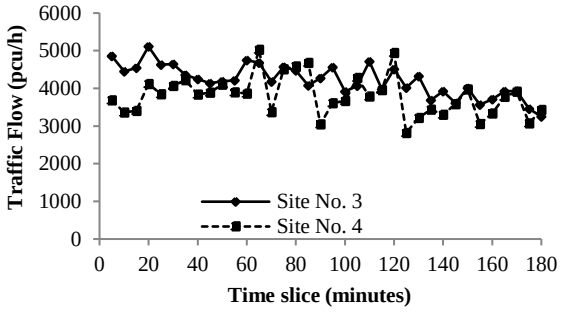
Figure 8 showed that the traffic flow conditions for all the observed sites range from 1000 to 3000 pcu/h. Also, it can be seen from Figure 8 – A that there are some fluctuations in flow rates for Site no. 7 and it reached zero at 08:35 am. This could be attributed to the influence of the nearby intersection. The heavy vehicles percentages for all observed 3-lanes dual carriageways streets is around 5%.

Figure 9 shows that the traffic flow conditions for all the observed two lanes dual carriageways roads is ranging from 1000 to 2000 pcu/h and can be considered. Likewise, the heavy vehicles percentages for all observed two lanes dual carriageways streets is around 5%.

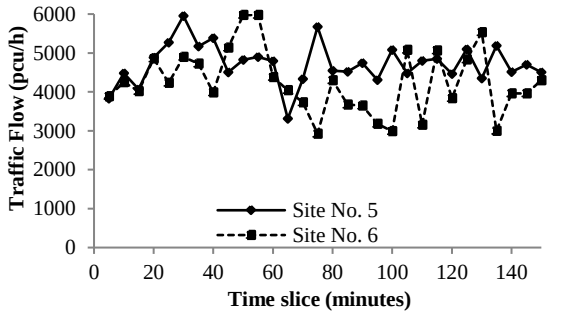
In general, it can be concluded from Figures 7, 8 and 9 that the traffic flow conditions for sites with 4 lanes can be considered as heavy traffic flow conditions. Where, for sites with 3 lanes and 2 lanes the traffic flow conditions can be considered as moderate traffic.



(A) Site 1 & 2 [Lebanon Street]

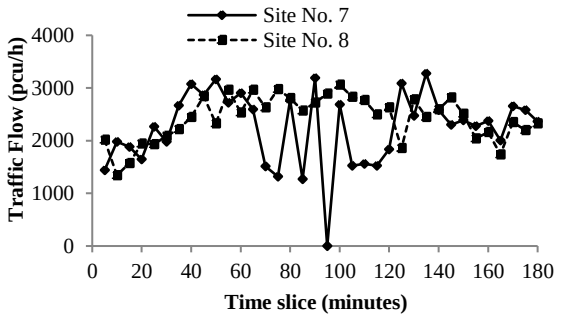


(B) Site 3 & 4 [Azzubair Street]

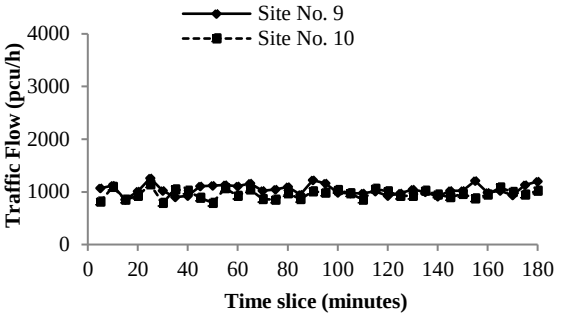


(C) Site 5 & 6 [Baghdad Street]

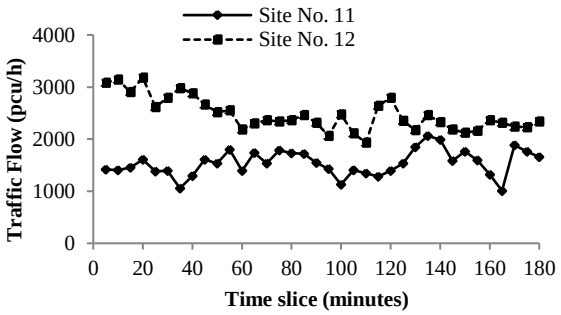
Figure 7. Traffic flow for 4-lanes streets (A) Lebanon, (B) Azzubair and (C) Baghdad Street



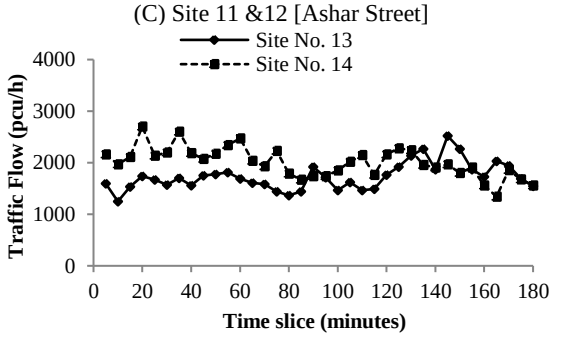
(A) Site 7 & 8 [Al-Basra Street]



(B) Site 9 &10 [Al-Jomhoria Street]



(C) Site 11 &12 [Ashar Street]



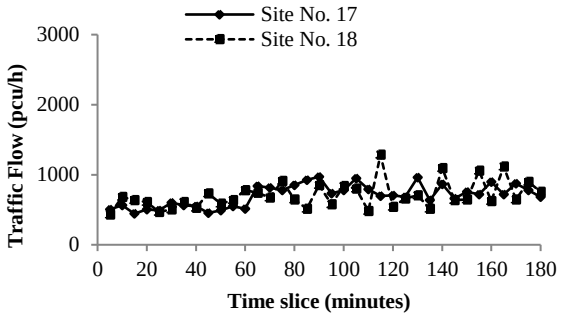
(D) Site 13 &14 [Trade Street]

Figure 8. Traffic flow for 3-lanes streets (A) Al-Basra, (B) Al-Jomhoria, (C) Ashar and (D) Trade Street

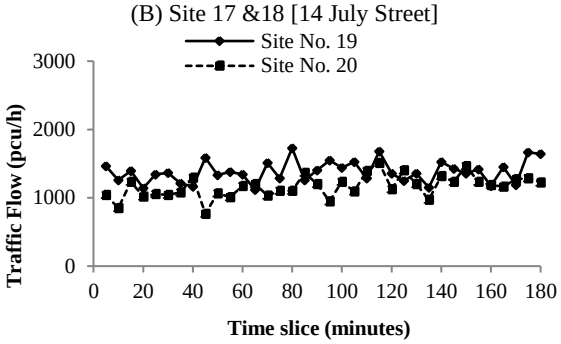
4. 2. Average Speed Field data from 22 sites with 4 lanes, 3 lanes and 2 lanes dual carriageways roads have been collected and analyzed to calculate the average speed. The average speed data has been measured manually by displaying the video recording on the screen of a computer and sketching two reference lines on the computer screen to cover a specified distance. A stopwatch was used to measure the required time for a vehicle to cross this distance. Simple calculations of distance over the measured time have been used to convert the readings into speeds. Figures 10, 11 and 12 show average speed for 4 lanes dual carriageways sites, 3 lanes dual carriageways sites and 2 lanes dual carriageways sites, respectively.

It can be seen from Figure 10 that the average speed for Site no. 1 and Site no. 2 (Lebanon Street) is ranging from around 30 km/h to 70 km/h. It should be noted that the posted speed limit for both sites is 40 km/h. The average speed for Azzubair Street (Site no. 3 and Site no. 4) is ranging from 60 km/h to 80 km/h, whereas the average speed for Baghdad Street (Site no. 5 and Site no. 6) is ranging from 50 km/h to 100 km/h. The posted speed limit for both Azzubair street and Baghdad Street is variable speed limits based on the lane's location (as mentioned in section 3.1) with a maximum value of 80 km/h for off-side lane.

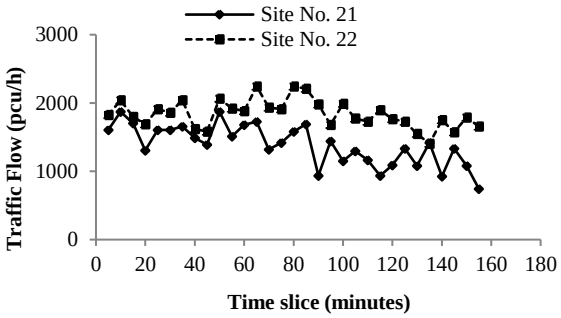
Figure 11 shows that the average speed for Site no. 7 and Site no. 8 (Al-Basra Street) is ranging from 20 km/h to 50 km/h with a value of 0.0 km/h at 08:35 am (i.e., stationary traffic), as shown in Figure 10– A and discussed in section 4.1. For Sites no. 9 and 10 (Al-Jomhoria Street) and Site no. 11 and 12 (Ashar Street), the average speed is ranging from around 30 km/h to 60 km/h. Where, the average speed for Trade Street (Sites no. 13 and 14) is ranging 20 km/h to 40 km/h. It is worth mentioning here that the posted speed limit for all the observed 3 lanes dual carriageways streets is 40 km/h. The lower value of observed average speed (i.e., 20 km/h), especially for Al-Basra Street and Trade Street, could be attributed to the higher number of vehicles that were parking illegally on curb with double parking sometimes on both streets.



(B) Site 17 &18 [14 July Street]



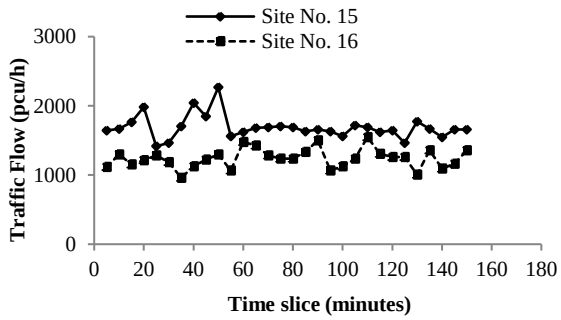
(C) Site 19 &20 [Al-Saadi Street]



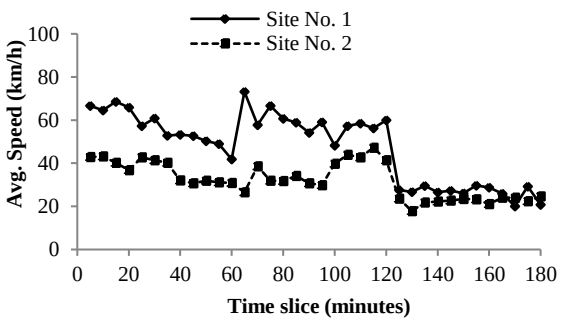
(D) Site 21 &22 [Al-Jaza'ar Street]

Figure 9. Traffic flow for 2-lanes streets (A) Dinar, (B) 14 July, (C) Al-Saadi and (D) Al-Jaza'ar Street

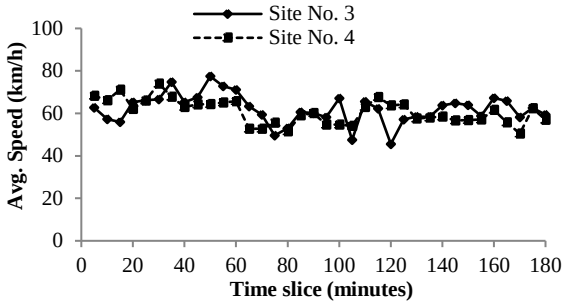
Figure 12 shows that the average speed for Sites no. 15 and 16 (Dinar Street) and Sites no. 17 and 18 (14 July Street) ranges from around 25 km/h to 40 km/h. For Al-Saadi Street (i.e., Sites no. 19 and 20) the average speed is ranging from around 40 km/h to 60 km/h. Where, the average speed for Al-Jaza'ar Street (i.e., Sites no. 21 and



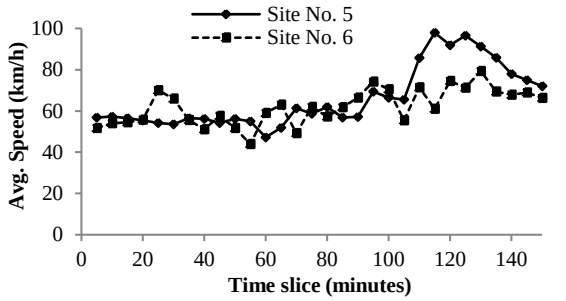
(A) Site 15 &16 [Dinar Street]



(A) Site 1 & 2 [Lebanon Street]

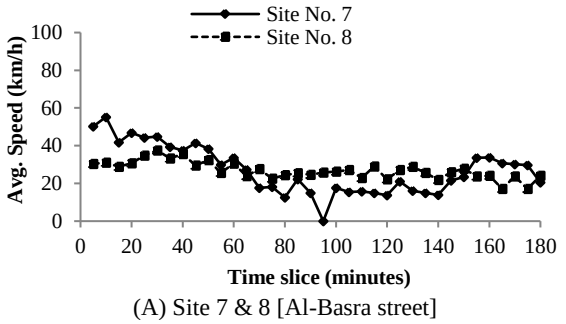


(B) Site 3 & 4 [Azzubair Street]

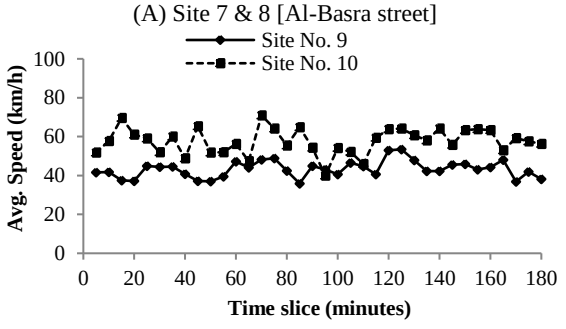


(C) Site 5 & 6 [Baghdad Street]

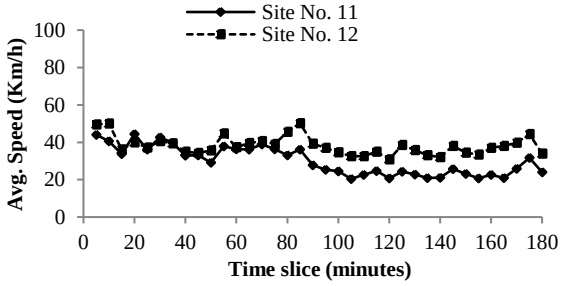
Figure 10. Average speed for 4-lanes streets (A) Lebanon, (B) Azzubair and (C) Baghdad Street



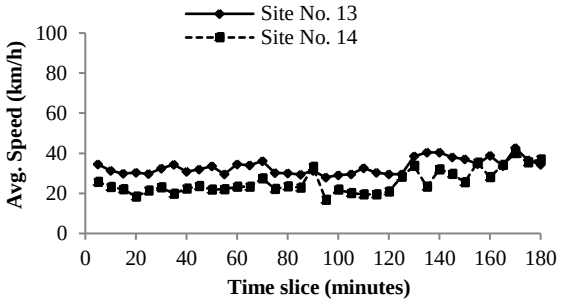
(A) Site 7 & 8 [Al-Basra street]



(B) Site 9 &10 [Al-Jomhoria street]



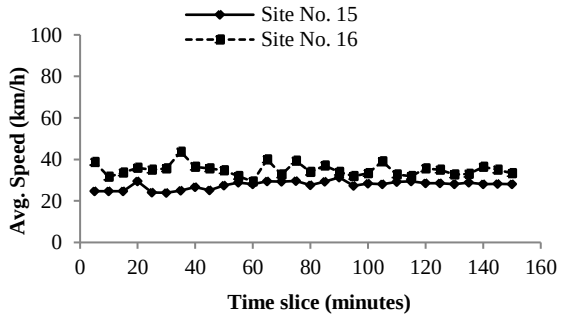
(C) Site 11 & 12 [Ashar street]



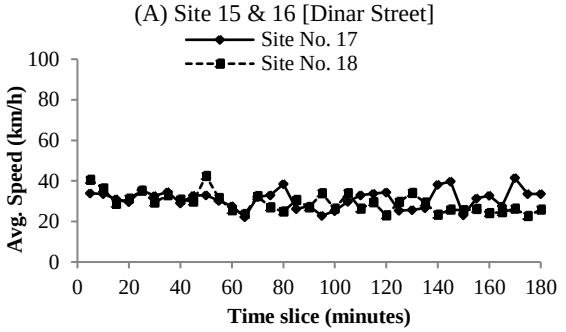
(D) Site 13 & 14 [Trade Street]

Figure 11. Average speed for 3-lanes streets (A) Al-Basra, (B) Al-Jomhoria, (C) Ashar and (D) Trade Street

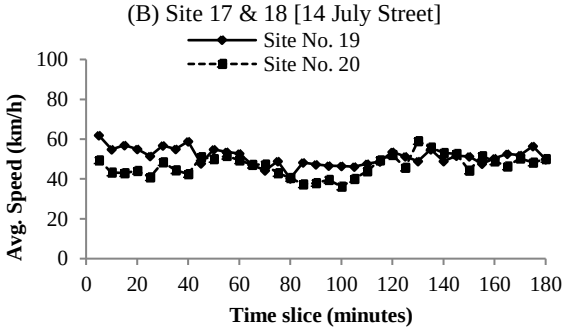
22) ranges from around 15 km/h to 50 km/h. Likewise, the posted speed limit for all the observed 2 lanes dual carriageways streets is 40 km/h. Similarly, the lower value of observed average speed (i.e., 15 km/h), especially for Al-Jaza'ar Street, could be due to the higher number of vehicles that were parking unofficially on the street.



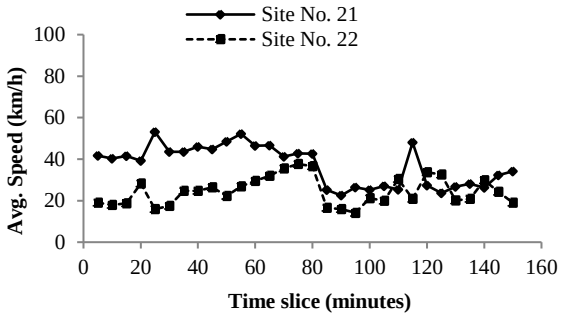
(A) Site 15 & 16 [Dinar Street]



(B) Site 17 & 18 [14 July Street]



(C) Site 19 &20 [Al-Saadi Street]



(D) Site 21& 22[Al-Jaza'ar Street]

Figure 12. Average speed for 2-lanes streets (A) Dinar, (B) 14 July, (C) Al-Saadi and (D) Al-Jaza'ar Street

4. 3. Average Travel Time and Delay As mentioned in section 2.2, the floating car technique was used to compute the average travel time. Six runs for each site have been conducted to compute the travel time as recommended by the Highway Capacity Manual (HCM, 2010) [26]. The required travel time to traverse the selected site is recorded and this is repeated for six runs. Then, the recorded travel times are averaged. Table 5 summarizes the average travel time and delay for the selected 8 sites.

It can be seen from Table 5 that the busiest street is the "14 July Street" with around 10 minutes of delay for only 1.8 km length covered of the street. This could be attributed to the nearby intersections which have improperly designed traffic signals. Iftikhar et al. [27] reported that the weak traffic signals timing is one of the factors that leads to traffic congestion and delay. The other reason of the delay is because of the highly number of motorists that were observed illegally parked on curb and some of them were even observed doing double parking on curb on a street with 2 lanes. This is because the 14 July street is a commercial street which contains many commercial facilities and restaurants located on both sides of the street. Also, due to the absence of traffic enforcement and associated penalties. It is worth mentioning here that the field data was collected on the evening peak hours started from 7:00 pm, as shown in Table 4. However, these two reasons are not restricted for only this street, but it can be found almost for all the streets in Basra City.

TABLE 5. Average travel time and delay for the selected sites

Site No.	Site location	Traffic direction	Average Travel Time (minutes)	Delay (minutes)
23	Baghdad Street	Northbound	8.2	4.0
24	Baghdad Street	Southbound	10.1	5.9
25	Al-Basra Street	Eastbound	7.7	4.4
26	Al-Basra Street	Westbound	7.5	4.2
27	14 July Street	Eastbound	12.8	10.1
28	14 July Street	Westbound	12.5	9.8
29	Dinar Street	Northbound	7.8	4.3
30	Dinar Street	Southbound	10.6	7.1

As discussed in sections 4.1, 4.2, and 4.3, all the collected data (i.e., traffic flow, average speed, travel time and delay) were measured manually, which may be affected by human errors. Therefore, an attempt was carried out to check the accuracy of the measurements. This has been done by requesting two well-trained observers to extract the traffic data from same sample separately then compare their results, a sample of 15 minutes from each video recording was chosen. The comparison of the results showed a very close fit between the two observers.

5. RESULTS DISCUSSION

The results of data analysis show that the traffic flow rates for all observed roads are running under moderate traffic flow conditions. Except, the traffic flow conditions for Baghdad and Azzubair streets (both are 4 lanes streets) which are ranging from moderate to heavy flow rates. The results of average speed data showed that on average most of the motorists are driving at speeds close to the posted speed limit. However, the average travel time and delay data showed that all observed sites experienced longer travel time and delays. This is in good agreement with the study by Noor et al. [22]. The study's results showed that the surveyed roads experienced traffic congestion although they were running with traffic flow under their designed capacity. The causes of the traffic congestion are fragile public transportation and pedestrians' behavior, illegal road occupancy by roadside vendors and weak law enforcement [22]. Also, Noor et al. [22] reported that these causes could lead to decrease the road efficiency by 32 to 82% in different areas.

Field observations showed that a high number of the motorists in Basra City are illegally parking on streets and sometimes they are even doing double parking on curb. This needs further investigations, since the on streets parking has a significant impact on reducing road capacity [28]. Yousif and Purnawan [29] reported that on busy roads inappropriate parking can lead to sever delays. In addition to the absence of traffic enforcement and associated penalties.

Other field observations showed that all at-grade intersections in Basra City are operated by a traffic police officer due to the deficiency of the traffic signals. This has led to the cycle length of intersection to be extended highly and sometimes it reaches 10 – 15 minutes, which makes travel time and delay longer. Also, this needs further investigation and documentation.

Also, it is worth mentioning here that all observed streets have good pavement surfaces, however, 65% of the observed streets have no road markings.

6. CONCLUSIONS

The aim of this study is to investigate and report on the traffic operations on some selected urban roads in Basra City. This paper tries to help inform traffic engineers and urban planners who are working with the local authorities in Basra City to put the required plans to mitigate the existing traffic congestion and delays in the city urban roads. Bear in mind that roads are the main and viable mode of commuting in urban areas for Iraqis. The results showed that, although, most of the observed sites were running under their capacity flow with driving speeds close to the posted speed limit. However, all the observed sites experienced longer travel time and delays. This could be attributed (1) high number of the motorists are doing illegal parking on streets with doing double parking on curb sometimes, (2) absence of traffic enforcement and associated penalties, (3) the deficiency of the traffic signals at the intersections, and (4) the physical constraints of some 2 lanes streets. In addition to the very weak public transportation services in Basra City. To overcome the longer travel time and delay; the traffic signals at all Basra City intersections should be properly designed and activated, providing adequate parking lots, activating traffic enforcement and associated penalties, in addition to enhance public transportation services. Further investigation on the impacts of physical parameters of roads on traffic operations is required.

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Persian Abstract

چکیده

رشد مداوم اقتصاد و جمعیت در سراسر جهان منجر به افزایش تقاضای حمل و نقل شده است. در نتیجه، تعداد وسایل نقلیه برای ارضای تقاضای مداوم برای حمل و نقل افزایش می یابد. در نتیجه ازدحام و تاخیر ترافیک در بسیاری از شهرهای بزرگ به یک امر عادی تبدیل شده است. اولین گام برای کاهش ازدحام و تأخیر ترافیک، دستیابی به درک بهتر از عملیات ترافیکی در شبکه راه های شهر است. این پژوهش سعی دارد عملیات ترافیکی معابر شهری در شهر بصره، جنوب عراق را بررسی و گزارش دهد. با تمرکز بر مطالعه برخی از پارامترهای اصلی ترافیک مانند جریان ترافیک، سرعت، زمان سفر و تأخیر در برخی از سایت‌های منتخب با جریان ترافیک قطع شده در شهر بصره. داده های ترافیکی میدانی از 30 سایت جاده با استفاده از دو تکنیک دوربین فیلمبرداری و تکنیک ماشین شناور جمع آوری شده است. تجزیه و تحلیل داده‌ها نشان داد که اکثر سایت‌های منتخب تحت ظرفیت خود با سرعت متوسط نزدیک به حد مجاز اعلام شده در حال اجرا هستند. با این حال، تجزیه و تحلیل داده‌ها همچنین نشان داد که در اکثر مواقع در این مکان‌های انتخابی، زمان سفر طولانی و تاخیرهای ترافیکی با میانگین تاخیر حدود 3 دقیقه برای هر 1.0 کیلومتر طول جاده تجربه شده است. این را می توان به نقص در عملکرد علائم راهنمایی و رانندگی در تقاطع ها، وجود پارکینگ غیرقانونی در حاشیه خیابان (با پارکینگ دوبل) و عدم وجود کنترل های اجرایی ترافیک (با مجازات های مرتبط) نسبت داد.