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Traffic Movement at Five Intersections on Jamal Abdul-Nasser Street – Sebha

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ABSTRACT

Jamal Abdul-Nasser is a major trunk road that divides Sebha city into two semi-equal parts. It connects almost all districts with different activities and services in the center of the city. Alongside Jamal Abdul-Nasser Street, exist various types of activities: administrative, educational, commercial, public services and some other activities. Due to its importance, the street carries out the densest traffic movement within the city. This paper tries to study and analyze traffic movement at five intersections on Jamal Abdul-Nasser Street: (1) Al-Nahdha; (2) Khaled Ibn-Al-Walid; (3) Al-Khotoot; (4) Al-Tijari Bank; (5) Al-Zeraie Bank. Selection of the pre-mentioned intersections referred to their importance as converging points to various important activities and land uses. Data required for the study purposes include intersection characteristics, traffic flow characteristics and traffic composition pattern. The results reveal the significance of taking care of the geometric and regulatory aspects that enable the intersections to perform well with regard the smoothness of traffic flow.

حركة المرور في خمس تقاطعات على شارع جمال عبد الناصر بمدينة سبها

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الكلمات المفتاحية:
تدفق المرور
خصائص المرور
تركيب المرور
شبكة الطرق
تقاطعات الطرق

الملخص

يعد شارع جمال عبد الناصر الشريان الرئيسي الذي يقسم مدينة سبها إلى قسمين متماثلين تقريباً. حيث يربط الشارع المحلات السكنية بمختلف الأنشطة والخدمات المركزية. توجد على جانبي شارع جمال عبد الناصر العديد من الأنشطة: الإدارية، التعليمية، التجارية، الخدمات العامة وغيرها من الأنشطة. ونظراً لأهميته فإن الشارع يحمل حركة المرور الأكثر كثافة في المدينة. تتناول الورقة بالدراسة والتحليل حركة المرور في خمس من التقاطعات الواقعة على شارع جمال عبد الناصر: (1) النهضة، (2) خالد بن الوليد، (3) الخطوط الجوية، (4) المصرف التجاري، (5) المصرف الزراعي. بني اختيار هذه التقاطعات على أساس أهميتها كنقاط تحول نحو مختلف الأنشطة واستعمالات الأراضي المهمة في المدينة. وقد تم تجميع البيانات اللازمة لأغراض الدراسة والتحليل بحيث تشمل: الخصائص الهندسية، خصائص تدفق المرور، ونمط التركيب المروري في جميع التقاطعات المذكورة. هذا وتشير نتائج الدراسة والتحليل إلى ضرورة الاهتمام بهذه التقاطعات في الجوانب الهندسية والتنظيمية بما يساعدها على القيام بدورها في تحقيق انسياب سلس لحركة المرور.

1. Introduction

The road network characterizes the spatial structure of any urban area [1]. It also, provides accessibility required by different land uses [2]. The proper functioning of urban areas depends on efficient transport network [3], which contains sufficient and properly located intersections [4]. If the intersections are neither adequate nor appropriately located, road traffic movement will be vulnerable to excessive problems including congestion [5].

Traffic congestion at intersections, considered the worst on the

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urban road networks, since vehicular flows from several different approach making either left-turn, through and right-turn movements seek to occupy the same physical space at the same time [6]. In addition, pedestrians use this space to cross the streets and thereby worsening the already bad traffic situation. Thus, the most critical points, from capacity, congestion and safety viewpoints for the operation of an urban road network are the intersections [7].

This paper tries to study and analyze traffic movement on Jamal Abdu-Nasser Street in Sebha city. This Street is the major trunk road that divides the city into two semi-equal parts. It connects almost all districts with different activities and services in the center of the city [8].

Alongside Jamal Abdul-Nasser Street, exist various types of activities and services: administrative, educational, commercial, public services and some other activities. Due to its importance, the street carries out the densest traffic movement within the city.

1. Methodology

For the study purposes the following intersections were selected: (1) Al-Nahdha; (2) Khaled Ibn-Al-Walid; (3) Al-Khotoot; (4) Al-Tijari Bank; (5) Al-Zeraie Bank (see figure 1). These intersections are considered the most important ones on Jamal Abdul-Nasser Street in Sebha city. In addition, they are located nearby some administrative and commercial activities.

Figure 1. Location of the selected five intersections [8]

A traffic survey conducted manually (using the most traditional traffic counting method) to estimate the volume and composition of traffic at the intersections. The data were collected for five consecutive days (i.e. Sunday through Thursday) in June 2015, out of which the average was then used.

2. Results and Discussions

3.1. Intersection Characteristics

The studied intersections are comprised of cross road junctions selected from different locations on Jamal Abdul-Nasser Street in Sebha. The intersections serve as links to major routes, which connect different types of land use activities in the study area. All the intersections are nowadays un-signalized due to lack of maintenance. Table 1 shows the characteristics of the studied intersections.

Table 1: Intersection Characteristics*

No.	Intersection Name	Land-use Characteristics
1.	Al-Nahdha	Retail Shops.
2.	Khaled Ibn-Al-Walid	Wholesale and Retail Shops, Secondary Schools.
3.	Al-Khotoot	Institutional Offices, Retail Shops.
4.	Al-Tijari Bank	Institutional Offices, Banks, Retail Shops, Restaurant.
5.	Al-Zeraie Bank	Institutional Offices, Shops, Collective Intercity-Taxi, Retail Shops.

* Source: The Authors

As shown in the table, the studied intersections are located where educational facilities, public and private institutions, banks, retail shops, wholesale markets, restaurants, and Intercity-Taxis predominate. The intersecting roads also connect residential areas, central area and other major activity-centers in the city.

Al-Nahdha intersection, Figure 2, serves the so-called Sharaa Ed-Thahab (Gold Market Street), retail shops and some other private institutions. Earlier times, the intersection was controlled by pre-timed traffic signal. Absence of any type of traffic control had significant drawbacks on traffic movement in the intersection (mainly traffic congestion and delay).

Figure 2. Al-Nahdha Intersection [9]

Khaled Ibn-Al-Walid intersection, Figure 3, interlinks the convergent roots to some secondary schools, wholesale markets, retail shops and some other private institutions. The existing traffic

signal system is not working and the road pavement is severely damaged. This situation affected traffic flow through the intersection, which exhibited to frequent blockage and traffic delay.

Figure 3. Khaled Ibn-Al-Walid Intersection [9]

Al-Khotoot intersection, Figure 4, considered the northern gate towards the center of the city. Its location nearby some administrative and public services institutions, banks, El-Shaabi theatre, Fezzan hotel, Boy Scout Agency, El-Mahalli vegetable and fruit market, and some other commercial activities. Again, traffic signals are not working, and the flow of traffic through this intersection experience frequent delays.

Figure 4. Al-Khotoot Intersection [9]

Al-Tijari Bank and Al-Zeraie Bank intersections, Figure 5 and Figure 6, have similar characteristics. They are located in the central area nearby different commercial banks, public and private institutions, clinics, intercity collective taxi, restaurants and cafes, intercity bus station and some other commercial and service activities. The traffic signals at both intersections are not working, which, in turn, cause traffic blockage from time to time, especially at Al-Tijari Bank intersection.

Figure 5. Al-Tijari Intersection [9]

Figure 6. Al-Zeraie Intersection [9]

In general, the studied intersections are not performing well because of different factors:

a) No appropriate traffic control system (road marking, signs and traffic signals), applied to smoothen traffic flow within the intersections.

b) There are some cracks and potholes in the surface pavement. These, in turn, have major effects by obstructing the flow of traffic within the intersections.

c) The approaching roads occupied by illegal and irregular parked vehicles. This situation led to reduce the capacity of these roads and hence affect the traffic flow.

3.2. Traffic Flow Pattern

Table **2**, Figure 7 and Figure 8 show the traffic volumes at the studied intersections for both average daily and peak-hour volumes. The analysis reveals that Al-Khotoot intersection recorded the highest daily and peak-hour volumes among the others. These are 17,167 vehicles/day and 2,087 vehicles/hour respectively. The high volumes of daily and peak-hour traffic flow at this intersection illustrate the importance of the roads converging at this intersection and the land use activities they serve.

Table 2: Average Traffic Volume at the Intersecions*

No.	Intersection Name	Approach	Average Daily Traffic Volume		Average Peak Hour Traffic Volume	
			VPH	% of total	VPH	% of total
1.	**Al-Nahdha**	Sukra	3,154	23.14	391	25.44
		Al-Jadeed	1,823	13.37	202	13.14
		Al_Jadeed – Abdul_Kafi	4,284	31.43	463	30.12
		Sukra – City Center	4,371	32.06	481	31.20
		Total	**13,632**	**100.00**	**1,537**	**100.00**
2.	**Khaled Ibn-Al-Walid**	Sukra	2,510	17.69	325	22.59
		Almenshiya	4,421	31.16	348	25.25
		Aljadeed	4,212	29.69	346	25.11

		City Center	3,044	21.45	359	26.05
		Total	**14,188**	**100.00**	**1,378**	**100.00**
3.	**Al-Khotoot**	As_Sooq Al_Mahalli	3,868	22.53	529	25.35
		Al_Menshiya	3,797	22.12	475	22.76
		City Center	3,863	22.50	602	28.84
		Sukra – Al_Jadeed	5,640	32.85	481	23.05
		Total	**17,167**	**100.00**	**2,087**	**100.00**
4.	**Al-Tijari Bank**	City Center	3,205	22.98	342	22.32
		Al_Menshiya	2,153	15.44	251	16.38
		City Center - Sukra	4,381	31.42	464	30.29
		City Center – Al_Qurdha	4,205	30.16	475	31.01
		Total	**13,944**	**100.00**	**1,532**	**100.00**
5.	**Al-Zeraie Bank**	City Center	3,236	24.69	415	27.23
		Al_Menshiya	2,920	22.28	313	20.54
		Al_Qurdha	3,710	28.30	452	29.66
		City Center	3,241	24.73	344	22.57
		Total	**13,107**	**100.00**	**1,524**	**100.00**

* Source: The Authors

Al-Zeraie Bank intersection recorded the lowest average daily traffic volume, about 13,107 vehicles, while Khaled Ibn-Al-Walid recorded the lowest peak-hour volume, about 1,373 vehicles. The average peak-hour volume at Al-Zeraie Bank intersection was about 1,524 vehicles.

The average daily traffic volume at Ibn-Al-Walid intersection was about 14,188 vehicles. This is the second highest daily traffic volume, which expresses the importance of the convergent roads and at this intersection and the land use activities they serve (such as the wholesale market and the educational facilities.

More than 50% of the daily traffic at Jamal Abdu-Nasser Street and more than 43% of peak-hour volume either end at the center of the city or pass through it to the other residential districts of the city.

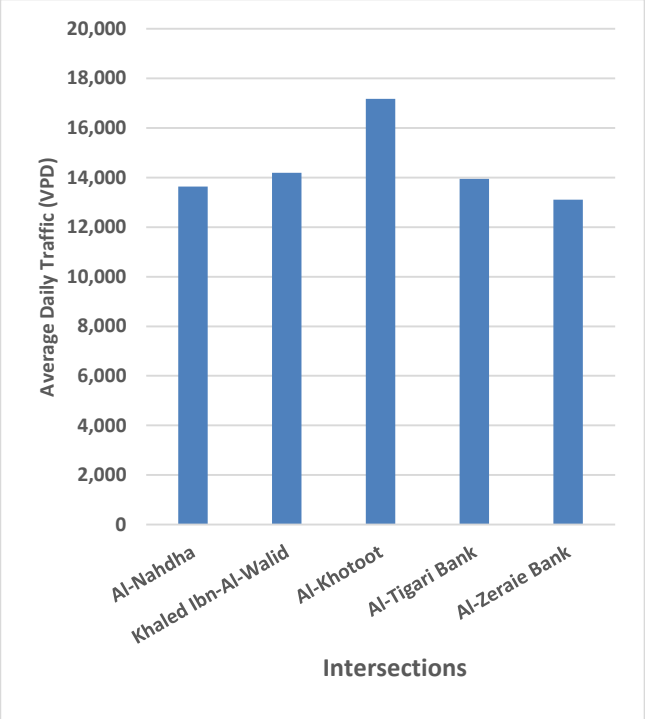

Figure 7: Average Daily Traffic At The Intersections

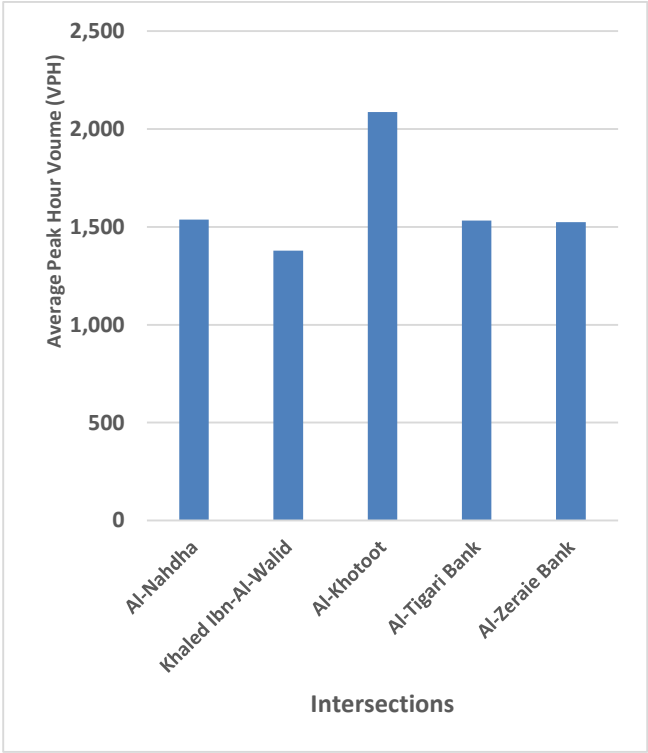

Figure 8: Average Peak Hour Volume At The Intersections

3.3. Traffic Composition

Table **3**, Figure 9 and Figure 10 show the average daily and peak-hour traffic composition at the studied intersections. Of all the vehicle types recorded at the intersections, passenger cars had the highest average daily and peak-hour volumes, 13,546 (78.9%) and 1,622 (77.7%) respectively.

Pick-ups comprise around 3,569 (20.8%) and 457 (21.9%) of daily and peak-hour volume respectively. One should notice that pick-ups used for both passenger and goods transport. This mode of transport mainly used for loading and unloading goods from wholesale stores to small stores and supermarkets.

Heavy, medium and small truck movement is not dense. The average daily and peak-hour volumes are around 53 (0.3%) and 7 (0.3%) respectively.

From the traffic data, one can easily notice that there is nothing about taxi and public transport. Unfortunately, this is true, not only on Jamal Abdul-Nasser Street but also throughout the whole city of Sebha. To the best knowledge of the authors, public transport stopped working since the eightieth of the last century. The

affordability of private cars might be the reason, or maybe there are some other reasons, which are out of the scope of the study.

Table 3: Average Daily and Peak-Hour Traffic Composition*

No.	Intersection Name	Approach	Daily Traffic Composition (%)			Peak Hour Traffic Composition (%)		
			PC	Pick-up	Truck	PC	Pick-up	Truck
1	**Al-Nahdha**	Sukra	85.90	13.21	0.89	85.42	13.30	1.28
		Al-Jadeed	81.56	17.29	1.15	80.00	17.73	2.27
		Al_Jadeed – Abdul_Kafi	87.79	11.80	0.40	86.60	12.80	0.60
		Sukra – City Center	82.22	17.36	0.42	82.14	17.44	0.42
		Total	**84.73**	**14.65**	**0.62**	**84.06**	**15.00**	**0.95**
2	**Khaled Ibn-Al-Walid**	Sukra	74.31	24.96	0.73	72.43	26.32	1.25
		Almenshiya	75.15	24.52	0.33	75.26	24.47	0.26
		Aljadeed	77.24	22.43	0.34	75.63	23.98	0.39
		City Center	80.04	19.61	0.35	72.97	26.58	0.45
		Total	**76.67**	**22.92**	**0.41**	**74.14**	**25.29**	**0.58**
3	**Al-Khotoot**	As_Sooq Al_Mahalli	76.16	23.46	0.38	77.14	22.29	0.57
		Al_Menshiya	73.37	26.27	0.35	73.33	26.45	0.22
		City Center	84.38	15.34	0.29	80.61	19.06	0.34
		Sukra – Al_Jadeed	80.74	19.01	0.26	79.07	20.72	0.20
		Total	**78.90**	**20.79**	**0.31**	**77.74**	**21.92**	**0.34**
4	**Al-Tijari Bank**	City Center	88.49	11.14	0.37	88.40	11.36	0.25
		Al_Menshiya	83.55	15.82	0.64	85.02	14.23	0.75
		City Center – Sukra	86.14	13.60	0.26	80.80	19.00	0.20
		City Center – Al_Qurdha	85.47	14.01	0.51	84.78	14.43	0.79
		Total	**86.08**	**13.50**	**0.42**	**84.51**	**15.02**	**0.48**
5	**Al-Zeraie Bank**	City Center	79.29	20.20	0.51	79.80	19.69	0.51
		Al_Menshiya	75.89	23.51	0.60	71.10	28.24	0.66
		Al_Qurdha	79.65	19.54	0.81	74.56	24.34	1.11
		City Center	79.25	19.73	1.02	71.51	26.03	2.47
		Total	**78.62**	**20.64**	**0.74**	**74.49**	**24.32**	**1.19**

* Source: The Authors

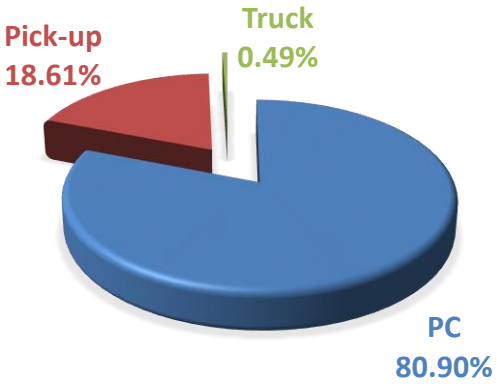

Figure 9: Average Daily Traffic Composition (%)

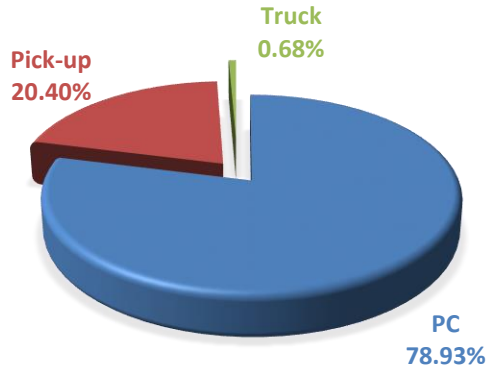

Figure 10: Average Peak-hour Traffic Composition

3.4. Level of Service

Absence of traffic signals or any other type of traffic control, together with improper parking of cars on the right lanes of the approaching roads, had affected the capacity of the studied intersections, especially during the peak-hours.

In order to estimate the intersections' levels of service (LOS) at the studied intersections the authors used the methods presented in [10] and [11]. The LOS's range at low levels, especially at Al-Nahdha, Al-Tijari and Al-Zeraie intersections, which showed LOS (F), as presented in Table 4.

Table 4: Intersections' Levels of Service*

Intersection	Level of Service	
	Un-signalizes	Signalized
Al-Nahdha	F	B
Khaled Ibn-Al-Walid	B	A
Al-Khotoot	D	B
Al-Tijari	F	B
Al-Zeraie	F	A

* Source: The Authors, 2015

As presented in the table, LOS can be improved if the intersections are signalized. Using traffic signals together with prohibiting roadside car parking at the approaches of the intersections, expected to increase the LOS to reach levels (A) and (B).

Conclusions

Jamal Abdul-Nasser Street is the principal street in Sebha city. It connects almost all the residential districts with each other and with the center of the city. Analysis of the selected five intersections raised the following issues:

- All the approaching roads to the intersections occupied by illegal and irregular parking of vehicles.
- All the traffic signals are either not working or destroyed, and no other control measures are applied.
- The traffic movement at the intersections characterized by high share of private cars. Heavy and medium vehicles' share is less than 1% of the traffic.
- No public transport or collective taxi for urban passengers recorded at the studied intersections. These systems are not used and eventually not available in Sebha. However, some kind of intercity busses and collective taxis run by private owners for passenger transport between Sebha and other sub-regional

centers: Ghat, Ubari, Murzuq, Brak and Hun, and to the coastal cities Tripoli and Benghazi.

- Because of the existing circumstances flow to capacity ratios are very high, and thus the LOSs are very low (LOS F at some intersection branches).
- Referring to the previous point, traffic at some intersections, exposed to very extensive delays, especially during peak-hours (more than 120 seconds/vehicle)
- A hypothesis of preventing or totally prohibiting parking of vehicles gave indications that LOSs will have very high values and the traffic flow will be very smooth.

3. Recommendations

- To improve the traffic flow at the studied intersections decisive actions, need to be taken. These include forbidding any kind of parking of vehicles, especially at the intersections.
- A scheduled maintenance program for the traffic network system need to be introduced to improve the quality of traffic movement especially at the intersections.
- Reviving traffic signals together with some other control measures in order to improve traffic movement at the intersections.
- Further studies need to be undertaken. These include: signal timing studies, effect of intersection geometry, effect of neighboring commercial activities, intersection traffic simulation and so on.
- Along Jamal Abdul-Nasser street exist more intersections, which also, need to be studied. Thereafter, a type of signal coordination between the intersections need to be introduced.
- A kind of public transport system need to be introduced and promoted in order to encourage shifting from the private cars to this system, this is needed not only for Jamal Abdul-Nasser street but also for the city center and all the other districts in the city.

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