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Addressing Traffic Congestion Problem at (Alsinaat) Intersection-Omdurman (State of Khartoum, Republic of Sudan-2015)

Ahmed Abdallah Basheer[1], Morooj Mergane Abdelhadi[2], Dr. Abdalla Babikir Abdelnabi[3] and Prof. Dr. Abdelhalim Awad Abdelhalim[4]

[1,2]ALzaeem ALazhari University, College of Graduate Studies
[1]ahmedasab2009@gmail.com and [2]morooj1233@gmail.com

[3]ALzaeem ALazhari Universiity Engineering College
abdallahmustafa866@gmail.com

[4]Emirates College for Science and Technology
halimconsult2001@hotmail.com

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Abstract

The city of Omdurman has recently seen an increasing population growth, particularly in urban areas, a growth that has led to increased traffic problems. A distinctive feature of the city of Omdurman is that it is served by main streets that pass through from the nearby capital city, Khartoum (see Fig.1). Alshingeety Street is considered to be one the most important streets in Omdurman since huge numbers of vehicles pass through it, with a number of intersections, the most important of which being Alsinaat (industrial areas) (the intersection of Alshingeety Street with Alrabat Street) (see Fig.2).This paper aims at exploring the ways and means of improving the smooth flow of traffic at Alsinaat Intersection through the study of its engineering characteristics. In addition, the study aims at studying the traffic position, determining the peak hours, service levels at the intersection and then put together the necessary short term recommendations, both for the present problem and for the long term ones. The study has made conclusions and recommendations that could help in improving the present traffic situation.

Keywords: *Traffic Congestion, Analysis of Service Levels, Alsinaat Intersection.*

Introduction

The rapid population growth and the expansion of urban areas in the city of Omdurman have led to the increase of the volume of both vehicles and other means of transportation using the city's streets. Thus, the absence of sound traffic designs and traffic law and regulations has caused what is known as traffic congestion and delays of traffic. Traffic congestion is defined as being the increase of the volume of real traffic at certain sectors of the street in comparison with the engineering design capacity of such sectors which consequently leads to what is known as traffic congestion. The city of Omdurman is distinguished for its many main streets, including Alshingeety Street, located North of Omdurman which starts from Omdurman souk up to Alkallabat (Trash Dumping) Area, which includes a number of intersections (Alsinaat Intersection, Alroomi Intersection and Sabreen Intersection).

Significance of the Study

The importance of the location is witnessed by the fact that it connects active popular locations, (see Fig 3).intersectionof two streets, namely (Alshingeety Street –Alrabat Street).This area accommodates six major communication lines: (Alshingeety-Khartoum/ Alshingeety–Bahri/ Alshingeety - Alshohada / Alshingeety- Souk Omdurman /Alshingeety- AlsouqAlshaabi/Alnus - AlsoukAlshaabi).

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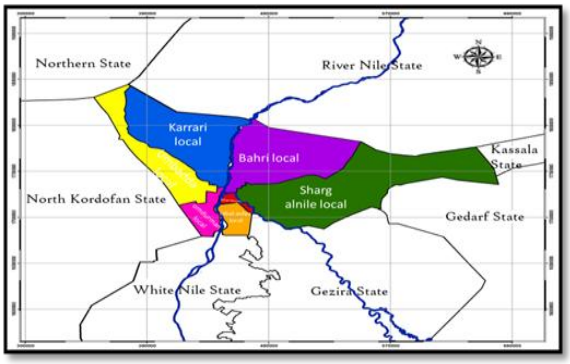

Fig.1: Shows the location of the State of Khartoum in the map of Sudan.
(Source: Researchers, used: gis)

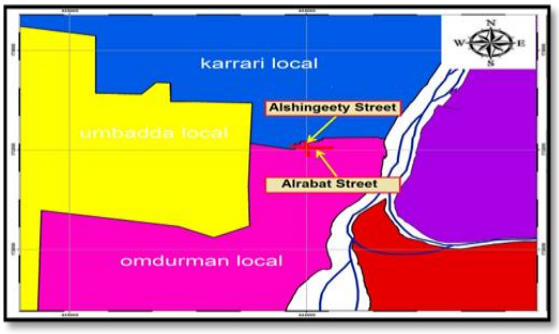

Fig.2: Shows the Location of Intersection within the State of Khartoum,
Coordinates:15°39'58.99"N, 32°28'38.57"E
(Source: Researchers, used:googleearth+gis)

Fig.3: Shows Alsinaat Intersection and the neighborhood, the present position of the intersection design
(Source: Researchers, used: googleearth+gis)

Methodology of the Study

The methodology used in the study is the descriptive analytical method using the theoretical data collected from references, web sites and the use of computer programs.

Problem of the Study

1. Problems in the designing of Alsinaat Intersection.
2. Problem in traffic flow at Alsinaat Intersection.

Study of the Present Situation at Alsinaatinter Section

1. The Engineering characteristics of Alsinaat Intersection

Table 1: The Engineering Characteristics of Alsinaat Intersection

Branch	Number of lanes			Island (m)	Independent U Turn	Ground Signs
	Right	Continuous	Left			
Northern	1	1	1	3 at intersection	–	–
Southern	1	1	1	2 at intersection	–	–
Eastern	1	1	1	2	–	–
Western	1	1	1	2	–	–

Table 2: Traffic Light Setting at Alsinaat Intersection

Branch	Time green "one second"	Time Yellow "one second"	Time Red "one second"
Northern	35	3	45
Southern	40	3	30
Eastern	25	3	35
Western	20	3	40

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2. Traffic activity at Alsinaat Intersection

The number of vehicles has been recorded, and peak hour and volume of traffic determined. In addition, the service level has been determined by using Traffic Simulation. The recording of vehicle activity has shown that the volume of traffic at the peak hour is on Sunday, which is as follows:

In the morning, the peak hour is from 9 AM to 10 AM, where the numbers of vehicles crossing the intersection stand at about **3944 vehicles/hour**. The majority of the vehicles pass from the north to other directions(see Fig.4),the number of the lanes becomes 2 heading from north to east.

Fig.4: Shows Traffic activity from 9 AM to 10 AM (Source: Researchers, used: gis)

The Peak hour is from 6 PM to 7 PM where the number of vehicles crossing the intersection stands at about **3140 vehicles/ hour**, mostly heading to the North to Alshingeety Street. Most of these vehicles are public transport vehicles, rickshaws, donkey-propelled carts(see Fig.5),the number of lanes from South to north becomes 2.

Fig. 5: Shows Traffic activity from 6-7 PM (Source: Researchers, used: gis)

Traffic Activity during the Remaining Hours of the Day

Congestion is due to the fact that the street cannot accommodate the number of vehicles using it, and because of the parking of vehicles at the curves at the ends of the intersection (see Fig.6).

Fig .6: Shows Traffic activity during the remaining hours of the day (Source: Researchers, used: gis)

The study on Vehicle Traffic Direction with respect to all directions showsthat there are 32 vehicle collision points (see Fig.7)

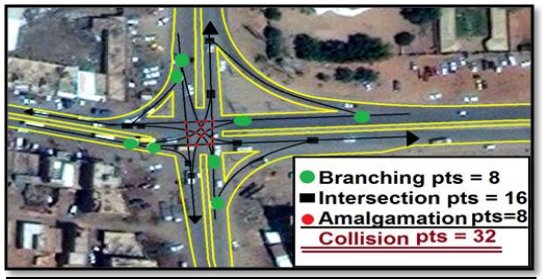

Fig. 7: Shows the points of collision-32 points (Source: Researchers, used: gis)

Analysis of Service Levels at the Intersection

A Traffic Simulation Program was used and data of the intersection, (see Fig.8) were collected for obtaining the services level at each direction. It was concluded that the intersection service level according to the USA's Highway Capacity Manual (HCM) was "F" (see Fig .9) due to the long cycle of the traffic signals of 45 seconds.

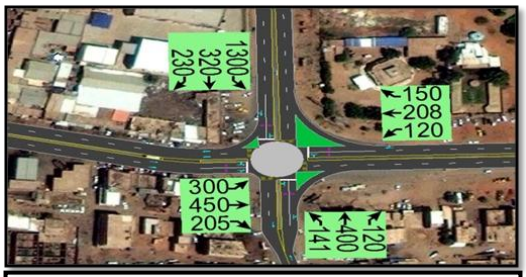

Fig. 8: Shows the number of vehicles at each direction
(Source: Researchers, used: traffic simulation)

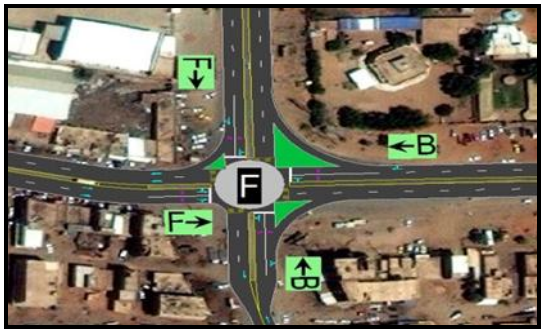

Fig. 9: Shows the levels of service for each direction and the intersection
(Source: Researchers, used: traffic simulation)

Calculation used in Determining Traffic Volume

– Increase in Load Capacity = Real Load Capacity-Model Capacity

∵ Increasein Capacity = 3944-1800= 2144 vehicle/Hr. According to this equation, the number of lanes that could accommodate such increase is 2 lanes approximately.

– Expected No. of lanes= the highest number of vehicles / Design Capacity

∵ 3944/900= 4 lanes.

The Conclusions

1. The outputs of the Traffic Simulation has shown that Analysis of the Intersection during the peak hours a low service level of (F) because of the long cycle of the traffic light signal (45 seconds) , something which indicates an unstable situation;
2. The traffic signals have not been adjusted according to the quantity of vehicle flow at the intersection;
3. Through this analysis, a delay of vehicle traffic occurs, which leads to wasting of fuel, something which pauses an economic problem;
4. Alshingeety North Street does not continue with the same width and number of lanes at the southern side. Moreover, Alrabat Street to the east does not continue at the same width and number of lanes at the western side;
5. The presence of Island in the intersection which is only 10 m long on both the northern and southern sides has led vehicles to ignore the Island during congestion periods;
6. Public transport habitual stopping at the intersection obstructs traffic, particularly when turning to the right;
7. The actual width of the street is not activated fully since only one part of the street is used while the other part is used for other ineffective purposes;
8. There are no ground traffic signs, something which leads to disrespect of traffic regulations by drivers.

The Recommendations

Firstly: Short Term Recommendations:

For obtaining a standard of service higher than (F) standard, the following Short term recommendations are as follows:

1. The maximum utilization of the actual width of the street.
2. The addition of a 3.5 m wide route at each direction for ensuring a smooth traffic follow;
3. The increase of the length of the island at the Northern and Sothern sides so that vehicles cannot cross the island;
4. The construction of public transport Stop 50 meters away from the intersection at the eastern and southern sides for maintaining smooth flow of traffic (See Fig.11);

5. The construction of a terminal island at south western side for providing freedom of turning to the right. (See Fig.10);
6. The provision of bus stop that serves commercial shops with a 1.5 m passageway for pedestrians that separates the shops and the stop.(See Fig .11);
7. Vehicles should be banned from parking besides the street save for public Transport buses;
8. The adjustment of traffic signals setting according to vehicles rate of flow;

The construction of pedestrian crossing 50 cm wide and stop line 1.2 m away from the pedestrian crossing for prohibiting vehicles from crossing (see Fig. 10).

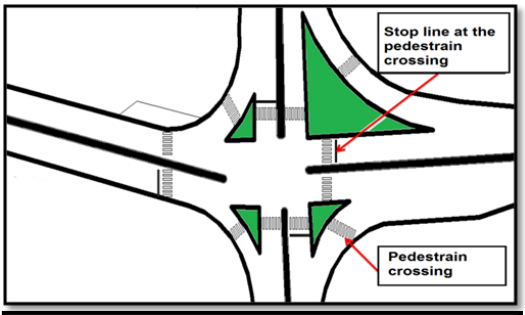

Fig.10:Shows the design of pedestrian crossings and the addition of Island.
(Source: Researchers, used: gis+autocad)

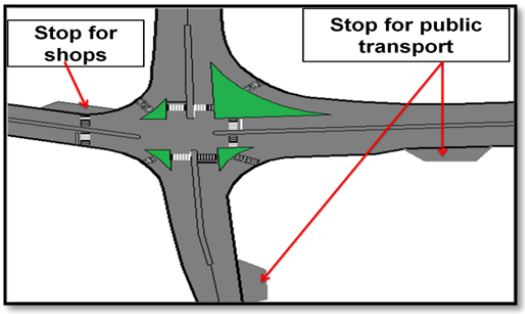

Fig.11: Shows Vehicles Stops Locations.
(Source: Researchers, used: gis+autocad)

Secondly: Long Term Recommendations:

1. For obtaining level (A) service, a bridge from East to West should be constructed, with consideration given to the following:
   - Minimum collision points;
   - Speed control;
   - Avoidance of double conversion and diversion;
   - Separation of inhomogeneous traffic activity;
   - Achievement of sufficient vision at junctions.
2. Electrical poles crossing the intersection should be provided with cables.

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