International Journal of Research
Available at https://journals.pen2print.org/index.php/ijr/
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 06 Issue 03
March 2019

Performance of Al- Balda Signalized Intersection Using ArcGIS

Raad Mohsin Hameed & Salih Suliman Kshash
[1]General Directorate for Education Diyala, Baghdad, Iraq
2 Surveying Department, Middle Technical University, Baghdad, Iraq

Abstract:

Signalized intersections are key elements in the urban transportation network where carry heavy traffic of motorized and non-motorized vehicles and pedestrians, which, in turn, generate many conflicts among crossing, turning and merging maneuvers. For these reasons such as increasing of the population, economic growth, and increased car ownership led to an increasing traffic demand can exceed the carrying capacity of the intersection during peak periods. Intersection congestion is expressed in terms of level of service (LOS) as defined by the Highway Capacity Manual (HCM). Level of service is defined in terms of delay and ranges from LOS A (free-flow conditions) to LOS F (long delays). Delay represents an average stopped delay per vehicle for a 15-minute analysis period.

*The objective of this paper is to evaluate the operational capacity of intersection (Baquba). The volumes of traffic get congested in the morning and evening at this intersection. To achieve the evolution performance of intersection 700 TVL Samsung video cameras have been used to measure traffic volume in the intersections with 3.6mm lens and total station were used to survey the intersection whereas ArcGIS were used for processing for the purposes traffic analysis process. The operational analysis of the existing conditions of this intersection indicates that the LOS is (**F**) with an intersection delay value of **175.363**sec. /vehicle.*

Keywords

Signalized intersections, Level of Service (LOS), Traffic volume, Geographic Information System (GIS)

1. Introduction

Traffic engineering is that phase of transportation engineering, which deals with the planning, geometric design and traffic operation of road, street, and highways, their network, terminals, abutting lands, and relationships with other modes of transportation [1]. An intersection is defined as the general area where two or more highways join or cross, including the roadway and roadside facilities for traffic movements within the area. Intersections are an important part of a highway facility because, to a great extent, the efficiency, safety, speed, cost of operation, and capacity of the facility depends on their design. Each intersection involves through- or cross-traffic movements on one or more of the highways and may involve turning movements between these highways **[2].** Signalized intersections are key elements in the urban

International Journal of Research
Available at https://journals.pen2print.org/index.php/ijr/
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 06 Issue 03
March 2019

transportation network where carry heavy traffic of motorized and non-motorized vehicles and pedestrians, which, in turn, generate many conflicts among crossing, turning and merging maneuvers. . For these reasons such as increasing of the population, economic growth, and increased car ownership led to an increasing traffic demand can exceed the carrying capacity of the intersection during peak periods**[3].** Therefore, traffic condition deteriorates and safety risk worsens. Congested and hazardous traffic conditions increase fuel consumption, emission, accidents and noise, therefore a city's quality of life, world energy resources and global atmospheric conditions deteriorate. The concept of capacity, level of service and delay are central to the analysis of intersections, as they are for all types of facilities, therefore that both capacity and level of service must be fully considered to evaluate the overall traffic operation of the intersections **[4].** While the delay is one of problems that occur in any facility of traffic.AL- Balda intersection in baquba city is an important congested intersection due to its critical location on major streets. This intersection has the following characteristics:

- It has a very high traffic volume in two approaches.
- It is located on Major Street, which intersects with two minor streets.
- Many activities are located around this intersection.

2. Description of Site

It is a ground intersection with four legs. Represent one of the main intersections Baquba cities for it links the traffic coming from Al- Muhafazah Street to Al-friesan and Al- Ssaria Street. The volumes of traffic get congested in the morning and evening at this intersection.

Figure 1. Satellite Image for AL- Balda Intersection.

3. Scope of the Study

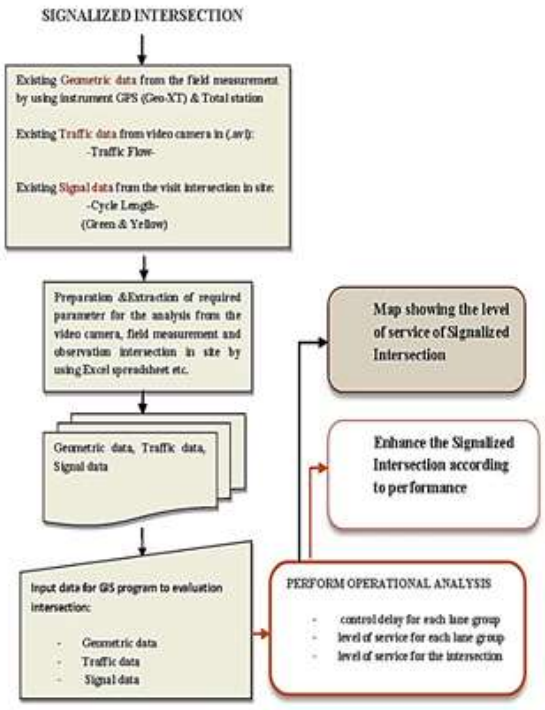
- Specify the peak hour volume and calculate the peak hour factor (PHF) for all approaches at AL- Balda signalized intersection.
- Traffic analysis using computer software for existing conditions to get the level of service.
- Suggest alternative geometric design proposals to improve the traffic performance across the intersection.

International Journal of Research
Available at https://journals.pen2print.org/index.php/ijr/
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 06 Issue 03
March 2019

4. Methodology

This methodology provides a framework designed for the evaluation of signalized intersection. In this methodology the data, where collected through the use video camera and total station. The collected data are analyzed using several software (Excel&GIS). The analyses results are used to draw the conclusion and recommendations at signalized intersection. The figure (2) below generally clarifies and identifies the signalized performance and then does some required improving processes.

Figure 2. Signalized Intersection Methodology.



5. Traffic Data Collection for Signalized Intersection

Collecting data are one essential element in the evaluation process of road networks performance of the roads. It is important to plan beforehand to identify data and the time limits for collecting it. The main data required by ArcGIS software for evaluating typical road intersection includes:

- Geometric Data
- Traffic Data
- Signalization Data

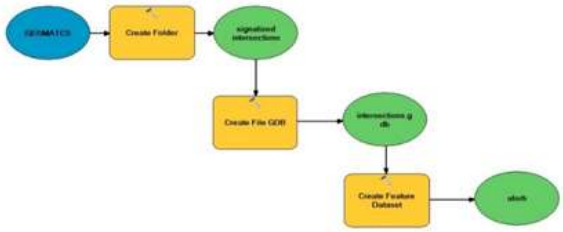


Figure 3. Shown build GDB

5.1 Automated Mapping Using ArcGIS

Following steps describes the process work the database and then drawing maps of the study area:

- Created item in GDB:

The GDB is the newest spatial data file format developed by ESRI.GIS stored information about the feature as a collection of thematic layers that cab be linked geographically. By ArcMap software the workspace was built, which is first step. The second step was building a folder, which includes the file

GDB and the feature dataset as shown in figure (3).

After executing this code through the running for it out the ArcMap window, it is recalled in the above-mentioned window to present the results; one may observe that a folder is built containing all the work, GDB and Feature dataset.

- **Created feature classes and network drawing:**

After determining, the network main points coordinate such as (boundary road and intersection, channelized intersection, Medians, road marking) with the total station. The coordinates are arranged in form of (.xlsx) format in the excel software, and executed by ArcMap below and the results are then presented in the ArcMap window. these approaches were used to develop the maps for all network includes (intersection, street).

5.2 Collection of Traffic Volume Data

It is well known in most of traffic studies for evaluating and enhancement of the existing intersection, the flowing data are needed: Demand volume by movement, V (veh/h), Base saturation flow rate,SO (pc/h/ln), Peak-hour factor, PHF, Percent heavy vehicles, HV (%),Approach pedestrian flow rate, vped (p/h), Local buses stopping at intersection, NB (buses/h), Parking activity, Nm (maneuvers/h), Arrival type, AT, Proportion of vehicles arriving on green, P,and Approach speed, SA (km/h).

One of the most important required field data are traffic volumes in the intersections. In this research, 700 TVL Samsung video cameras have been used to measured traffic volume in the intersections with 3.6mm lens as they are shown in figure (4). These cameras cover all the in and into out traffics. After that, these traffics will be counted in the office. It is a precise method where there are no human mistakes, which can occur when the vehicles are counted manually. This also help in controlling the obstacles that would happen when counting manually and stopping the counting process at obstacles and then the process would be continued in the office and this would not be controlled in the field to determine the peak hour in each intersection, the traffic volumes in the intersection are counted for a period of a week and for eleven hours per a day in the intersection.

International Journal of Research
Available at https://journals.pen2print.org/index.php/ijr/
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 06 Issue 03
March 2019

Figure 4. Samsung cameras (700TVL)

5.2.1 Determination of the Peak Hour

To identify the best time for collected data of the peak hour the traffic volumes should be counted for eleven hours a day for each intersection. Figure (5) shows the traffic volumes in Al- Balda intersection from seven a.m. to five p.m. the peak hour is at (8.00-9.00 A.M.). The rest of the data adopted in this study are proposed on the basics of Highway Capacity Manual 2000 (HCM) for instance Base saturation flow rate. Which equals 1900 (pc/h/ln) …etc.

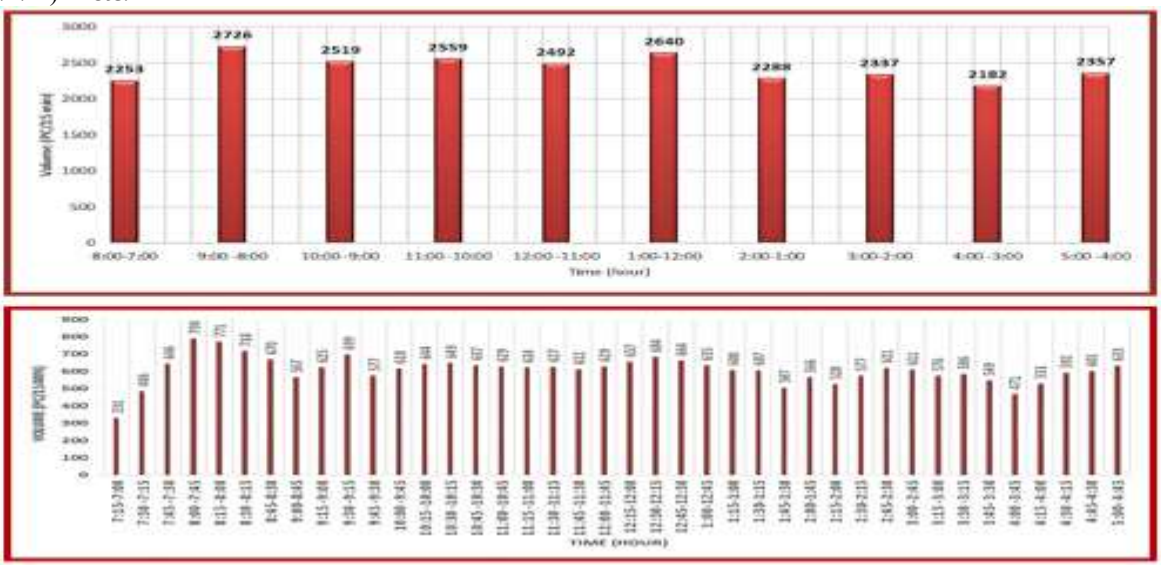


Figure 5. Total Traffic Volume at AL- Balda Intersection

5.3 Collection of signal data

The signalization timing data required for the evaluation are as flow:

- Startup lost time at the beginning of green intervals.
- Extension of effective green at the beginning of yellow, when vehicles tend to continue to enter the intersection for a short period.
- The green, and yellow, intervals for each intersection.

The value for both startup lost time and green extension time, which are used the default values, which are recommended by highway capacity manual (HCM-2000). On the other hand, other element of signal timings (cycle length, green, yellow) where taken by reading the electronic counter at the plate.

6. ArcGIS (Model builder) analysis

After the preparation of the data necessary for the analysis intersection. Arc GIS (model builder) was used for the analysis purpose. Model Builder combines several GIS operations and runs these Modules with different datasets.

Table 1. Analysis Result by ArcGIS

International Journal of Research
Available at https://journals.pen2print.org/index.php/ijr/
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 06 Issue 03
March 2019

Intersection Name	lane group	(v/c) ration	Control delay (d)	LOS	Intersection delay	LOS
AL-Balda	Right (from) Al muhafazah	0.747	57.259	E	175.363	F
	Through (from) muhafazah	1.375	237.53	F		
	Left AL(from) muhafazah	1.695	382.516	F		
	Right Al frisan	0.298	40.832	D		
	Through Al frisan	0.693	46.315	D		
	Left Al frisan	0.451	44.086	D		
	Through Al ssaria	0.641	46.633	D		
	Right Al ssaria	0.309	41.66	D		
	Left Al ssaria	0.510	45.765	D		
	Through from baquba	1.45	263.821	F		
	Left from baquba	0.078	36.558	D		
	Right from baquba	0.721	56.98	E		

A model consists of three fundamental elements: input parameters, geoprocessing tools, and output data. The equation off used for evaluation are written in script language python, moreover other tools were used to complete analysis. The output of evaluation by GIS software is directed by a report in excel showing the assessment result for each lane group and intersection. With performance map, which shows the color-classified performance of each lane group and intersection. figure (6) shown map performance for AL- Balda intersection. Table (1) indicate the result of simulation run with (v/c) ration, control delay, and level of service for intersection.

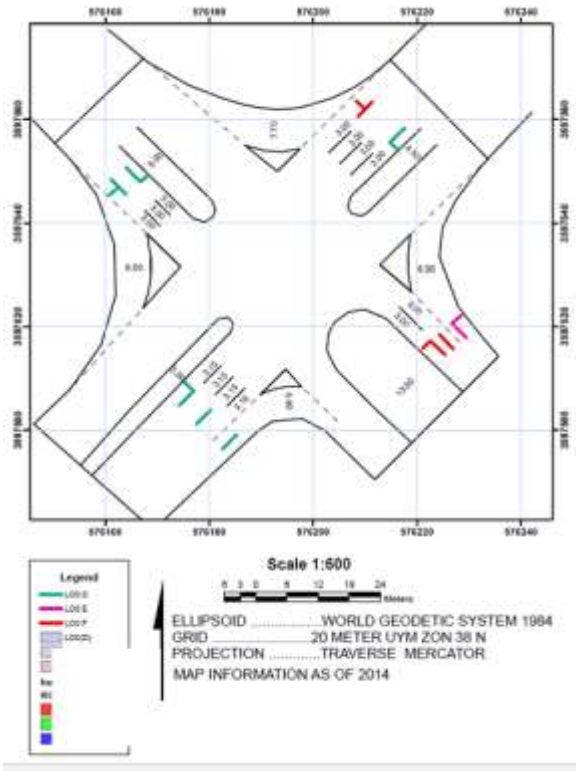


Figure 6. Map performance for AL-Balda intersection

8. Conclusions

AL- Balda signalized intersection is one of the most important intersections in AL-Baquba city, and serves of about 8000000 passages of vehicles yearly.

The operational analysis of the existing conditions of this intersection by the ArcGIS indicates that the LOS equal to (F) with an intersection delay value of 175.363 sec. /vehicle. Therefore, and because of the

reasons above, two enhancement proposals were suggested. The study showed that increasing number of lanes to right turn for AL-Muhafaza and AL-Friesan approach is the best solution to enhance the intersection performance.

9. References.

[1]. Roger P. Roess et al., "Traffic Engineering", Handbook, Forth Edition, 2004

[2]. (American Association of State Highway and Transportation Officials, 2001).

[3]. Hamid A. Awad**.,** Hameed A. Mohammed., Wasan M. Mahmood. "Evaluation and Improvement of Traffic Operation for Al-Seat Intersection in Al-Ramadi City", Anbar Journal for Engineering Sciences, AJES-2010, Vol.3, No.2

[4]. Chakroborty, P., and Das, A., (2007**),**"Principles Transportation Engineering", India Private Limited, M-97, Connaught Circus, New Delhi-110001