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Assessment Performance at Al- Thawra Signalized Intersection in Babil City

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ABSTRACT

Hilla cities center of province Babil is one of the most important cities in Iraq 100 km (62 mi) south of Baghdad .its relate the Governorate Baghdad with Governorates south Al-Thawra signalized intersection is one of the most important intersections in AL-Hilla city Being a major crossing point to the governorates of holy Karbala and Baghdad.The excessive traffic volumes, during the peak periods (at morning and evening), of vehicles that entering the intersection increase traffic density, reduce travel speed, increase travel time, and increase the delay values This paper aims to assess the traffic performance of Al-thawra signalized intersection in Babil city that is consistent with the existing conditions and intersection's geometric properties. For all approaches, video recording has been used to collect traffic volume data. These data are taken out of videos from Babil police cameras (department of communications and information systems)..The intersection was evaluated and analyzed using the SYNCHRO 10.0 software, and the best option was selected. The outcome of the evaluation process indicated that the intersection is operated at the level of service (LOS F) and with a control delay of 162.5 seconds.by recommending a variety of strategies, ranging from signal optimization to geometric enhancements. The suggestion of widening the pavement in the north-south direction was found to be the best solution. resulting in a decrease in vehicle delays from 162.2 seconds to 95.4 seconds and the level of service remains constant (LOS F) considered an acceptable and cost-effective solution to the intersection's problems.

1. Introduction

Vehicle delay has been the primary measure of signalized intersection performance for many years. The number of vehicles stops at intersection approaches have been found to play an important part in the performance of evaluation of signalized intersections in developing countries, where the majority of the time the intersections remain near or at an oversaturated status. In addition to vehicle delay, thereare additional performance easurements like the spatial volume of queues as aresult, the intersection frequently periences a"go and stop" situation. These measurements not only had to do with the drivers' level of service (LOS), but they also had to do with the amount of air pollution and fuel consumption caused by vehicles crossing the signalized intersection. In particular, estimations of vehicle stop play a crucial role in determining the consumption of fuel and emissions from vehicles at intersection approaches. Additionally, estimations of queue length are crucial not only for the design of lanes

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but also for ensuring that traffic signal operations. fect queues that spill back into the upstream intersection [1,2].

Studies evaluated the traffic performance of the Al Ameer signalized intersection in the city of Samawa used SYNCHRO 8.0 software to evaluate and analyze the intersection .The evaluation process result showed that the intersection is operated with level of service (LOS F) By suggestion of several strategies which vary from signal optimization to geometric improvements.The best solution has been found by suggestion an overpass at the east-west direction result is considered an acceptable and economical solution for the existing problems at intersection. And the level of service has improved from (LOS F) to (LOS C).Jon and Hikmatt,(2017)[3] Studied the improvement of traffic flow on arterials,signalizeandun-signalized intersections. byusing SIDRA and SYNCHRO programs for performance analysis and evaluation of three signalized intersections (Al-Hakeem,Fatima Bridge, Al-Sayed Jawda) and four roundabouts (Abtal Al-Taf, Al-Mizan, Al-Zahraa) through the development of three statistical models (linear with 95% confidence level, linear with 50% confidence level and polynomial) for the estimation of roundabout delay. Two alternatives were recommended to solve the current and future problems. The first was by Signal Timing Optimization and Coordination and the second by suggestion some geometric improvement Al-Haydari, (2011) [4.5.6].

The main objectives of this study are to evaluate performance the traffic at Al-Thawra intersection , and suggest the required traffic and/or geometric solutions to alleviate the congestion problem at the selected network.

2. Case Study

This four-approach signalized intersection in Babil city is one of the most significant in the city center. It is a fixed-time signal control intersection with four signal phases. The south approach experiences high traffic volumes because it connects the provinces of Babil and Karbala from the north to the south and between the provinces of Babil and Baghdad through the presence of an overpass from the east to the west, as depicted in Figure (1).

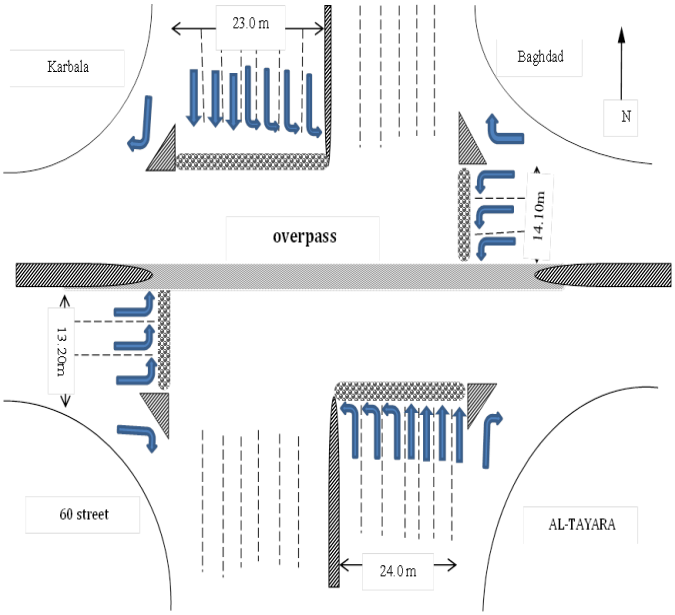

Figure 1 .AlThawra Intersection Layout.

3. Geometric data

The video recording method is used to collect traffic volume data over four weeks at three distinct times after numerous personal observations and pilot surveys have been The video recording method is used to collect traffic volume data over three weeks at three distinct times:after numerous personal observations and pilot surveys have been conducted in the study area, the morning peak period is from 7:30 to 9:30 a.m., the noon peak period is from 12:30 to 2:30 p.m., and the evening peak period is from 5:00 to 6:00 p.m.In addition, numerous individual interviews are conducted with interested individuals, including traffic police officers in the study area and a number of road users, in order to identify the most productive times to collect traffic data.

4.Traffic Signal Data

One of the most effective ways of controlling traffic at an intersection is the use of traffic signals. Traffic signals can be used to eliminate many conflicts because different traffic streams can be assigned the use of the intersection at different times [7.8]. For signalized intersections, the cycle length phase length, green time and all red time are measured from video films, as shown in Table (1).

Table 1. Phase and Cycle Length for Signalized intersection

Phase Timing				
North	South	East	West	Cycle length
Diagram				
				124
G +Y+AR 30+3+1	G +Y+AR 30+3+1	G +Y+AR 28+3+1	G +Y+AR 20+3+1	

5. Traffic Volume and Data abstraction

This data includes calculation of the traffic volumes abstracted from the video Babil policecameras department communications and information. systems department of communications and. information systems) recording for each approach at Al-Thawra intersection data is collected during times when there were no statutory holidays or occasions and the weather was good at intersections. three days a week (Monday, Tuesday and Wednesday) were used to record the selected intersections. during the day peak and off-peak times last five hours (two hours in the morning and three in the afternoon) were investigated. The volume count was performed at the most optimal time of day occurring at 15-minute intervals throughout the day. Therefore, the traffic volumes have been converted by using conversion factors. These factors for converting various types of vehicles into PCU equivalents SORB, 2005 [9] are shown in Table (2).

Table 2. Conversion Factors to pcu (SORB, 2005)

Class of vehicle	Flat Terrain
Pick-up, van and bus up to 24 passengers	1.25
Private car and taxi	1
Truck and trailer combination	2
Heavy vehicle	3
Motorcycle	0.5

6. Delay and Level of service

When optimizing traffic signal timing, delay is one of the most important factors to take into account. The level of service (LOS) provided to motorists at signalized intersections is also heavily influenced by delay. A factor that is challenging to estimate is delay because it includes the delay caused by braking, stopping, and acceleration from braking. There are a variety of delay time types that can be calculated at intersections.There may be two aspects of intersection delay:control and stop the delay (queue).Due to its stochastic nature, which is influenced by random arrival, the stop delay—also known as the queue delay—is difficult to quantify.Planning models frequently do not lend themselves to these sophisticated methods due to the amount of data they require, despite the fact that they may be more effective at estimating queue delay.Finding a balanced queue delay model that can be incorporated into planning models is frequently challenging.Using the assumption of a moderate control delay for each vehicle, the LOS and limit of signalized convergences are evaluated.A portion of the total delay for traffic signal operations at signalized intersections could be referred to as the control delay.[10.11].

7. Application of SYNCHRO10 Software

SYNCHRO10.0 was used to simulate the current flow of traffic at the chosen intersection.It is a comprehensive traffic system modeling, optimization, and simulation programming package. The results in Table (3). show that the intersection suffers from an oversaturation

condition with high total delay values and an unacceptable level of service (LOS F).

Table 3. Performance Analysis for Al-Thawra intersection

Intersection Name	Approach	Traffic volume	Average delay Sec	LOF
	North	2352	144.2	F
	South	3502	224.3	F
Al- Thawra	East	1040	60.2	F
	West	815	96.7	F

Average Delay = 162.2 Sec LOS = F V/C = 1.48

8. Al-Thawra intersection Improvement

This section describes the traffic flow improvement strategies that were implemented at the selected intersection using the calibrated software SYNCHRO10 .

This section divides the improvement strategies into two sections based on the software and method used."The cycle length optimization" could be used to describe the first section, which includes splits optimization, phasing sequences, and cycle length optimization."The second section could include pavement widening and name marking.

9. Method for optimizing the cycle length

The optimization of traffic signal timing is one of the most economical methods for reducing vehicle operating costs and improving traffic flow performance on urban roadways. SYNCHRO 10.0 offers a number of optimization types. It optimizes used a default range of cycle times between 50 and 200 seconds. Table(4).shows that using optimization functions for Al-thawra signalized intersection has no effect; the level of service (LOS F) stays the same regardless of the degree of saturation (V/C). The optimization results also show that, despite the cycle time decrease's continued effectiveness under oversaturated conditions, the second part of the interaction strategies needs to be tried to improve performance.Knowing that an 2. increase in the cycle lengths, phase sequences, and split timings to shorten delay and stop times[12.13}. These types are applied to the chosen intersection in the same order as shown in Figure (2)

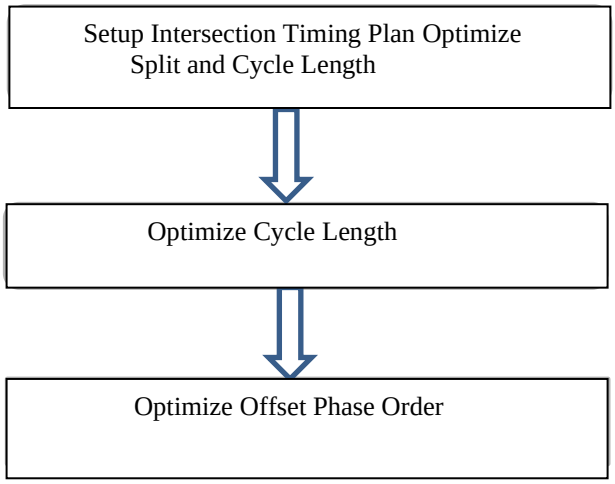

Fig.2.Steps for Optimization in Synchro 10

The HCM recommends a cycle duration of 60 to 120 seconds.A cycle time of more than one hundred seconds will be suggested so that an additional 10% capacity can be accommodated.It will be recommended to accommodate an additional 10% capacity when the cycle length exceeds 100 seconds.Operations may be negatively impacted by cycle times of more than 120 seconds, which can result in blocking, long lines, and inefficient use of turning lanes.A more limited process duration may be desirable over abbreviate the line, which would build limit and make traffic stream more smoothlyFor the enhancement interaction, Synchro 10 defaulted to process durations somewhere in the range of 50 and 200 seconds, utilizing turning paths, extended lines, and hindering.Shortening the line might be better than shortening the cycle time because it would increase capacity and smooth traffic flow.For the optimization process, SYNCHRO10

cycle length cannot occur because it causes an increase in increase in the delay vehcle.

Table 4. SYNCHRO 10 developed an Effectiveness

Improvement type	Cycle Length	V/C	Average delay/Sec	LOF
Base condition	124	1.48	162.2	F
Cycle Length	120	1.40	148.8	F
Splits	124	1.38	138.0	F
Phase Sequences	120	1.40	148.8	F
Percent saving			11.5%	

10. Geometric improvements

Since the cycle length optimization process did not improve the intersection, It is necessary to improve the geometric charact.eristics of saturated approaches at the AL-Thawra junction by using pavement widening as shown in Table (5) and Figure(3).

The application of pavement remarking is the first step in the geometric improvement process.In order to reorganize the vehicles queuing at the stop line, this step considered noting the approaching lanes.Additionally, an exclusive lane is used to separatetraffic-heavy movements.Optimization is carried out for the signalized intersections following the application of each improvement type. As is actually observed to be used in the field, the measurement indicates that many approaches to these intersections can be improved by reducing the lane width (while maintaining a width of lanes

Measure for the Al-thawra Intersection.

Table 5. Effectiveness Measure of Al- Al- thawra intersection that Produced SYNCHRO10.0

Improvement type	Cycle Length	V/C	Average delay/Sec	LOF
Base condition	120	140	148.8	F
Pavement Remarking	124	1.37	135.0	F
Pavement Widening	120	1.15	92.7	F
Percent Saving			60.52 %	

greater than the minimum value of 2.4 m as specified by HCM).This is the next phase of the geometric i mprovement.The traffic performance measure of effectiveness (MOE) for the Al-Thawra intersections will rise as a result of an increase in the number of lanes. This will also increase the saturation capacity of the approaches that are affected.However, the delays calculated using this method of intersection were considered unsatisfactory, and the level of service [LOS] and effectiveness measure (MOE) were notimproved in this way. In any case, it has reduced the impact of vehicle delays to a biting point, and the geometric characteristics and high water levels prevent the improvement of the intersection by using the tunnels unless the height of the groundwater levels is also practically improved, it is difficult to operate an intersection overpass because there is an intersection a few times away from the near intersection[14.15]

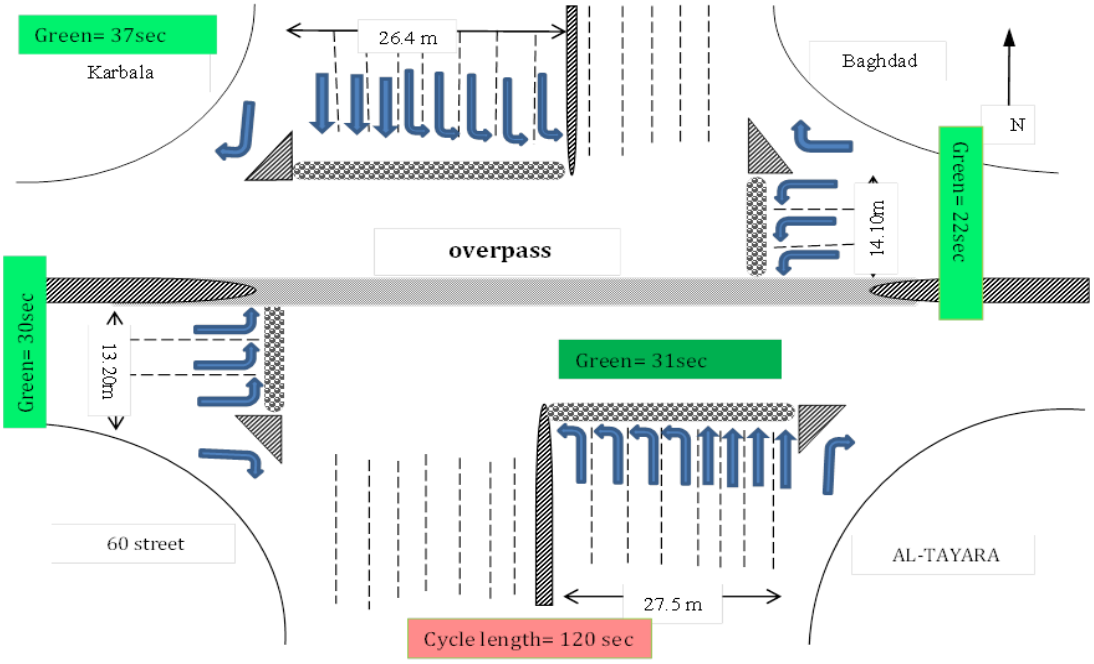

Figure 3. Improvement proposal for the Al-Thawra Intersection

11. Results and Discussion.

This section presents the analysis of the study results through four sections as follow:

- Average delay 162.5 sec for signalization intersection lead to High vehicle stop delay at intersection which is unacceptable
- increase in the cycle length cannot occur because it causes increase in the delay vehcle.
- optimization of traffic signal timing, Splits, Phase Sequences reduce averge delay from 162.5Sec to 138.0 Sec with Percent saving 11.5%
- Geometric improvements includes :
  a. Pavement Remarking reduce average delay from 148.8 Sec to 135.0 Sec
  b.Pavement Widening reduce average delay from 148.8 Sec to 92.7 Sec .
- This best improvemen considered an acceptable and cost- effective solution to the intersection's problems becase the north-south trend cannot be improved by the construction of an overpass or tunnel for several reasons, including its incompatibility with the overpass established in the south-west direction reasons for the existence of groundwater due to its proximity to the River Al- Hilla, as well as buildings constructed on both ides of the road belonging to citizens' private property.

12. Conclusion

Due to the high volume of traffic, the use of signalization timing optimization with the SYNCHRO 10 software, which includes splits for each phase and phase sequences, does not provide an effective solution for improving traffic operation performance. According to the Highway Capacity Manual, Al-Thawra intersection suffers from severe congestion on both approaches north and south, resulting in a minimum level of service (level F).
The best strategy for the north-south direction was to use pavement widening, which reduced the delay to 92.7 seconds. However, an overpass for the intersection cannot be used.
Although the service level remains F, the proposed improvement reduced the vehicle delay from 162.2 to 92.4, with a cycle time of 120 instead of 124.

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