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Evaluation and Improvement of an Unsignalized Intersection Performance at Bangi City, Malaysia

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Abstract: ***Traffic congestion and long queues at intersections during peak hour are the major problems in the cities. Growing numbers of road users lead to increasing of traveling times. This study focused at an unsignalized roundabout intersection in Bangi city .This intersection have heavy traffic flow at peak hour (8am,5pm) because of it is connected to the road leading to University Kabangsaan Malaysia (UKM) .Data collected manually (traffic volume, speed travel, No. of lane, width lane …etc). AASIDRA program used for data analysis, finding problem, suggest suitable solutions and its cost. After data analysis we find that the intersection have bad level of service(F), more delay, high degree of saturation, high stop rate .We suggest adding one lane and slip for all approach .This solution is active and the problem of intersection reduced (Delay, Stop rate, Degree of saturation).***

Keywords: Unsignalized Intersection, Roundabout, Traffic Flow, AASIDRA Program, Bangi, Malaysia

1. Introduction

The rapid increase in the use of personal transportation has its roots in the weak traffic system especially at intersections in Malaysian cities so we must solve this problem by using some strategies to reduce congestion [7] .Traffic congestion is a major curse on urban movements. It is a plague that has become an integral part of normal life in almost all urban areas in the world. More seriously, traffic congestion causes unpredictability in journey times, thereby making urban commuters to plan for these problems by leaving home early just to avoid being late. The problem of traffic congestion in urban areas is worse at road intersections. Indeed, there is no other point on cities roads that can be greatly congested as road intersections [1]. The study aims are analyzing the traffic (determining delay, queue and degree of saturation), determine level of service, reduce the congestion & average delay in the intersection and choice the more economical solution for the intersection problems by sidra software.

2. Area Study & Data Collection

2.1. Site Visit and Visual Appraisal

Site visit are conducted during the study in order to get first knowledge of the study focus area and to evaluate the actual site problems. Existing traffic data, documents and drawings was examined to obtain the information of the selected intersections. Preliminary data such as number of lanes, lane width and radius of median are collected during the site visit. This information is important for future planning.

Figure 1: Area study and its location

2.2 Classified Volumetric Count (at Peak Hours)

The survey is usually carried out to collect traffic data for every directional flow at intersection in the study focus area. Working days at peak hours are the suitable time for the survey to be carried out. The counts were carried out for 15 minutes duration in the morning. The numbers of car in 15 minutes are multiply with four to get the total number of car per hour. The data on traffic flows are converted from classified vehicles into passenger car equivalent (pcu/hr) by using pcu factors. In this study pcu factors is based on the study conducted by Highway Planning Unit such adopted in Table 1. Otherwise, Table 2 shows the traffic volume count (pcu/hr) collected during the peak hour at the study focus area.

Table 1: Adopted Passenger Car Unit (pcu) factors

Vehicle	Pcu Factor
Car	1.0
Motorcycle	0.33
Van	1.0
Light Lorry	1.5
Heavy Lorry	2.5
Bus	2.0

Source: HPU, 2002

Table 2: Traffic volume count (pcu/hr)

approach	Traffic Flows In One Hour (60 Minute)						Total
	Car	Lorry <5ton	Lorry >5ton	Mini Bus	Bus	Mc	(pcu/hr)
South	940	145	50	110	14	205	1579
East	846	118	65	33	44	315	2325
North	585	78	67	100	15	64	1578
West	998	122	71	96	52	533	11588
Pcu unit	1	1.75	2.25	2.5	2.75	0.35	

2.3Travel Time Survey

In order to determine the travel speed, the travel time survey was conducted. During travel time survey, enumerator has used car's odometer and stopwatch to record travelling distance and time. The average travel time observed was 25 km/hr equal to 7 m/s. Also queue length was observed for all approach.

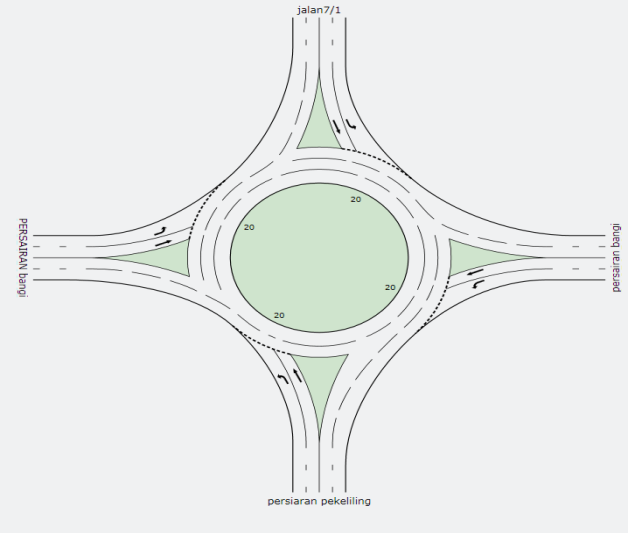

Figure 2.The characteristics of intersection

3. Data Analyses & Results

After study area and data collection we analyzed it by using software program (AASIDRA, Version 5.0).To identify the problem and find economic solutions.

Table 2: Movement summary of intersection

Unlicensed Trial Version
MOVEMENT SUMMARY
Site: intersection before s

sahar p65295
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh
South: persiaran pekeliling										
1	L	947	4.0	1.707	658.0	LOS F	265.6	1922.9	1.00	7.52
2	T	632	3.0	1.440	422.6	LOS F	137.3	985.5	1.00	5.22
Approach		1579	3.6	1.707	563.8	LOS F	265.6	1922.9	1.00	6.60
East: persairan bangi										
4	L	1263	3.0	1.142	141.0	LOS F	121.3	871.1	1.00	3.92
5	T	1062	2.0	1.043	58.6	LOS E	56.1	399.7	1.00	2.18
Approach		2325	2.5	1.142	103.4	LOS F	121.3	871.1	1.00	3.13
North: jalan7/1										
7	L	726	2.0	2.329	1222.4	LOS F	278.4	1982.2	1.00	6.84
8	T	852	5.0	2.420	1301.8	LOS F	333.8	2436.9	1.00	7.54
Approach		1578	3.6	2.420	1265.2	LOS F	333.8	2436.9	1.00	7.22
West: PERSAIRAN bangi										
10	L	1042	5.0	1.785	720.5	LOS F	303.5	2215.7	1.00	8.68
11	T	10546	5.0	9.710	7846.2	LOS F	6001.8	43813.1	1.00	23.45
Approach		11588	5.0	9.710	7205.4	LOS F	6001.8	43813.1	1.00	22.12
All Vehicles		17071	4.4	9.710	5074.6	LOS F	6001.8	43813.1	1.00	16.72

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

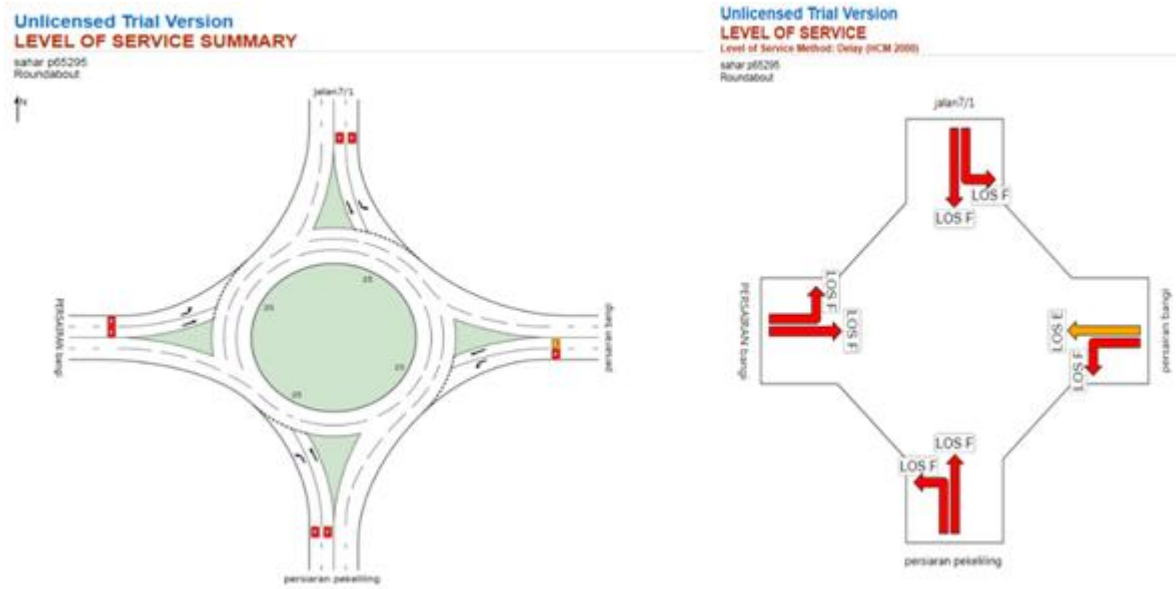

Figure 3: Level of service summary

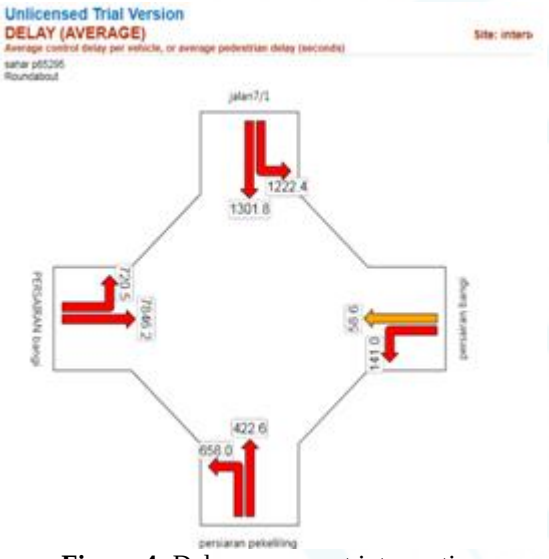

Figure 4: Delay average at intersection

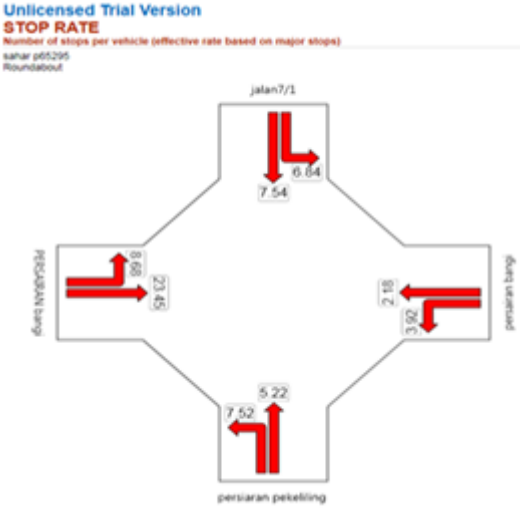

Figure 5: Stop rate at studied intersection

After identify the intersection problem and studying the surrounding structures of it, it was found that it is possible to add a one lane and slip for all approach of intersection to reduce the congestion and improve the level of service .

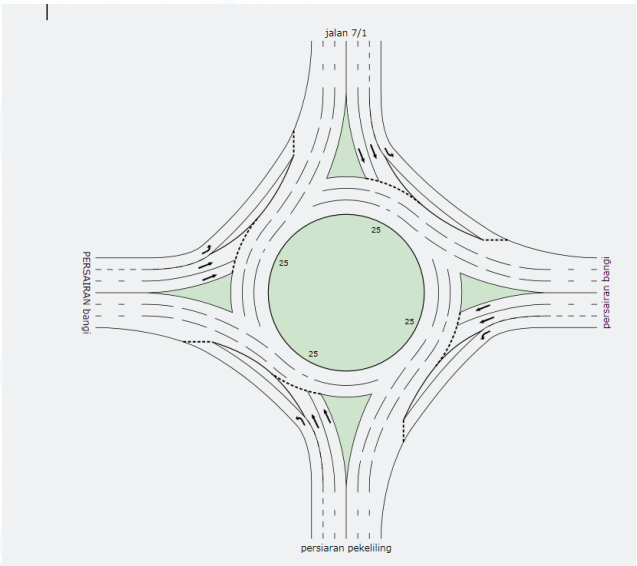

Figure 6: Characteristics of intersection after adding lane &slip

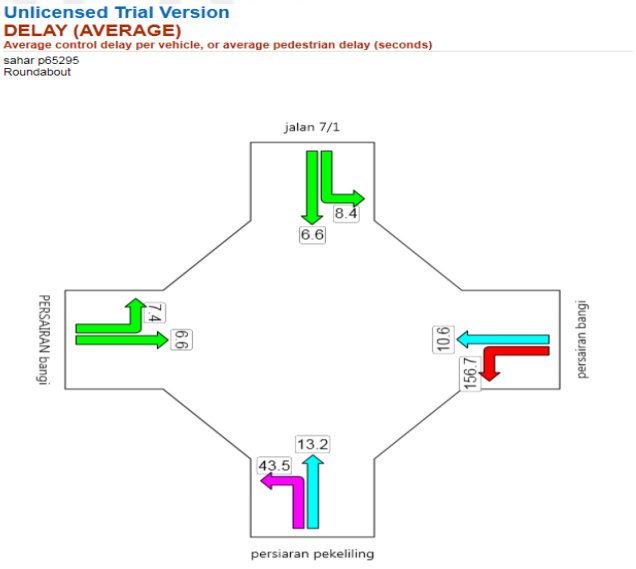

Figure 7: Average delay after adding lane&slip

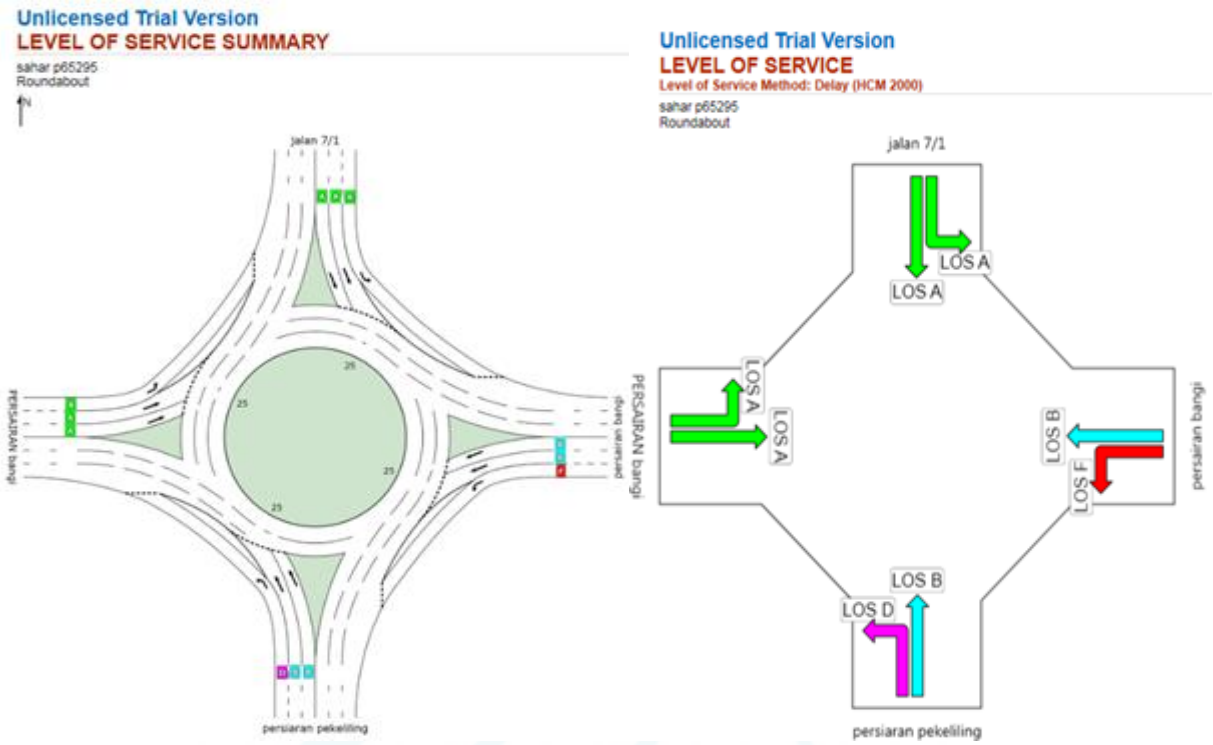

Figure 8: Level of service after adding lane& slip

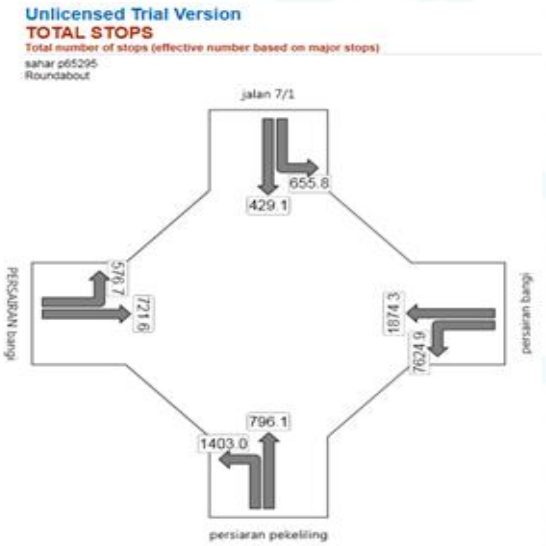

Figure 9: Total stop after adding lane & slip

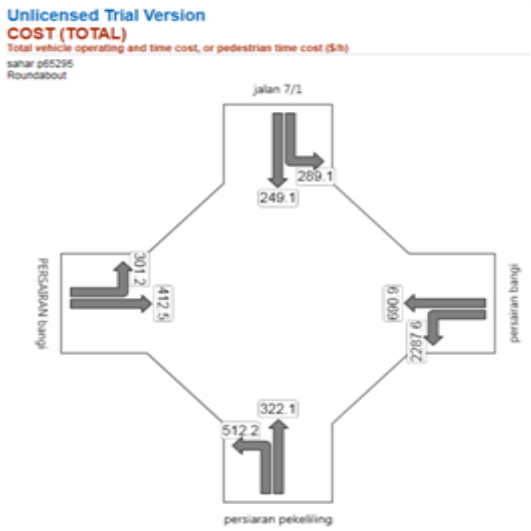

Figure 10: Total cost of the changes

4. Conclusion

There are many problems that can occur at an unsignalized intersection such as the safety, operations, and accessibility. After study the intersection we find that it have poor operational performance. Because of the congestion of intersection its level of surface is F that consider more crowded. We suggest some solutions to reduce the congestion and reduce delay and carbon emission in this area as below.

1) Add one lane and slip for all approach of intersection this solution is active and congestion reduced also the delay and stop rate reduced.
2) Strategies to enhance the ability of individuals who are blind to detect gaps and to detect vehicles that have yielded for them are needed to increase access to these intersections by individuals who are blind.

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