IMPROVEMENT OF TRAFFIC CAPACITY FOR AL-MOTANABI SQUARE IN KUT CITY

Dr.Khalaf T. Mohammed
General Manage
(Amanat Baghdad

Dr. Namir G. Ahmed
Lecturer (Dept. of HWY's
Transportation- University of Al-Mustansiriyah

Abbas F. Jassim
Asst .lecturer (Dept. of HWY's

ABSTRACT

The concept of capacity and level of service are the control points of the analysis of intersections and must be fully considered to evaluate the overall operation of the intersections.

The objectives of the present study include the analysis, evaluation and improvement of the operation for AL-Motanabi square in Kut city and to present a best proposal to enhance the performance from the capacity point of view.

To achieve these objectives, the estimated distribution of the traffic data in different direction that required for the traffic and geometrical analysis were gathered manually, while SIDRA traffic program is used for the requirements of traffic analysis process.

It has been concluded that, two layer flyover is the best proposal to improve the operation ability of AL-Motanabi square.

الخلاصة

أن مفهوم الطاقة الاستيعابية ومستوى الخدمة هما نقاط السيطرة لعمليات تحليل التقاطعات ويجب أن تؤخذ بعين الاعتبار عند تقييم التشغيل للتقاطع.

أن هذه الدراسة تشتمل على ؛ التحليل , التقييم و تحسين القدرة التشغيلية لساحة المتنبي في مدينة الكوت وعرض أفضل المقترحات لتحسين الأداء من حيث الطاقة الاستيعابية .ولتحقيق هذه الأهداف فقد تم جمع المعلومات المرورية يدويا لمختلف الاتجاهات لأغراض التحليل المروري والهندسي بينما تم استخدام برنامج SIDRA لأغراض عمليات التحليل المروري .

لقد تم الاستنتاج بان اقتراح تنفيذ مجسرات بمستويين هو أفضل البدائل لتحسين القابلية التشغيلية لساحة المتنبي .

Key Words

Traffic Spare Capacity, Level of Service (LOS), SIDRA Application, Peak Hour Factor (PHF), Saturation Flow.

INTRODUCTION

The underlying objective of level of service analysis is to quantify a roadway's performance with regard to specified traffic volumes (i.e., its ability to efficiently handle a specified volume of traffic). This performance can be measured in terms of travel delay (as the roadway becomes increasingly congested) as well as other factors. The comparative performance of various roadway segments (which is determined from an analysis of traffic) is important because it can be used as a basis to allocate scarce roadway construction and improvement funds (Zegeer ,1986).

Capacity is simply defined as the highest traffic flow that a roadway is capable of supporting. For level of service analysis, a consistent and reasonably precise method of determining of a roadway section is a function of factors such as roadway type (e.g., freeway, multilane highway

without full access control, or rural road), free-flow speed, number of lanes, and widths of lanes and shoulders(Khisty and Lall ,1998).

Al- Motanabi square is a congested intersection located in the centre of Al-Kut city. Its significant locations and highly traffic volume can be related to:-

1. Al-Motanabi square located in an important location. It connects between main directions from Messan and Nasseria toward Baghdad.
2. The closely location of two main bridges on Tigers river. These Bridges represent a principle path of traffic movement.
3. Existing of High percentage of Heavy vehicles for all arms at Al- Motanabi square. These types of vehicles lead to create a high delay especially at peak hour.
4. The existing of different public activities near Al- Motanabi square. These activities results a high traffic volume.

From site observation and traffic accounts, it was found that the capacity of this square is less than the traffic volume at peak hour. This mean that the construction of a bridge is very important at this site so it is very important to carry out a traffic study to proposed the required improvement to solve the congested traffic problem at Al-Motanabi square.

Study Area

The study area includes Al- Motanabi square and its approaches because there are no closely intersections. **Fig. (1)** Shows a satellite image for Al-Motanabi square and its approaches.

Fig. (1): Satellite image for Al-Motanabi square in Al-Kut City.

OBJECTIVE OF THE STUDY

The main objectives of this study are:

1. Specify the peak hour at Al-Motanabi square, which represent the design hour volume in addition to the distribution of traffic volume at peak hour.
2. Calculate the Peak Hour Factor for all approaches in Al- Motanabi square.
3. Evaluation of the existing level of service (LOS) at AL-Motanabi square.
4. Evaluation of the level of service for all proposals suggested in this study.
5. Selecting the best proposal for Al-Motanabi square in which give the best level of service.

DATA COLLECION

Traffic volume

As previously mentioned, the main aims of this study are to enhance the operation of Al-Motanabi square and suggest the best geometric design. Regarding the existing situation, the traffic account is carrying out at Al-Motanabi square from 7:00 a.m to 5:30 p.m; the traffic volume contains two types of vehicle:

1. Passenger car: Any vehicle contains four tires only.
2. Heavy Vehicle: Any vehicle contains more than four tires. This type of vehicle is converted to passenger car by using (PCU) factor equal to (2.0). **Tables (1)** and **(2)** present the traffic account for each 15 min.**Table1**.

	From Baghdad				From Messan				From Nasseria				From al-Hoor			
Direction / Time	Through		Right		Through		Right		Through		Right		Through		Right	
	P_c	H_V	P_c	H_V	P_c	H_V	P_c	H_V	P_c	H_V	P_c	H_V	P_c	H_V	P_c	H_V
7:00-7:15	280	36	31	4	602	15	49	3	300	17	232	14	210	12	35	3
7-:15-7:30	300	35	41	5	597	16	50	5	308	18	245	16	239	11	36	4
7:30-7:45	275	33	43	5	554	16	70	8	316	15	227	7	251	14	28	4
7:45-800	290	38	41	2	495	9	62	4	294	23	208	14	254	10	31	3
8:00-8:15	250	50	43	3	310	15	61	3	230	27	204	10	317	25	36	5
8:15-8:30	300	45	40	4	390	11	54	5	157	19	159	9	348	20	25	2
8:30-8:45	300	39	44	7	365	15	51	3	199	9	205	12	312	30	31	3
8:45-9:00	310	60	41	5	350	16	70	10	181	14	190	12	273	25	37	2
9:00-9:15	380	42	29	4	438	12	60	7	179	12	187	11	249	21	21	3
9:15-9:30	362	39	32	6	417	20	52	5	168	19	179	14	236	19	27	4
9:30-9:45	342	36	29	7	456	21	51	4	172	17	181	22	221	17	29	5
9:45-10:00	307	27	26	6	439	19	48	5	159	16	179	20	207	12	23	3
10:00-10:15	235	20	30	3	430	14	29	6	161	21	205	9	108	10	27	3
10:15-10:30	240	22	29	3	483	12	48	5	145	28	198	11	261	15	38	2
10:30-10:45	225	25	38	4	490	13	36	6	155	21	209	8	224	15	40	4
10:45-11:00	230	19	30	2	478	20	40	2	161	42	211	13	223	20	37	2
11:00-11:15	225	21	27	4	421	17	29	3	157	20	177	12	190	13	31	4
11:15-11:30	209	27	23	6	443	16	32	4	143	17	181	18	187	17	37	2
11:30-11:45	217	22	28	5	427	15	33	6	139	15	173	13	201	13	33	3
11:45-12:00	230	29	23	4	420	12	43	7	133	19	179	7	210	9	29	4
12:00-12:15	200	15	21	2	410	15	70	5	159	16	202	10	183	10	30	3
12:15-12:30	220	25	32	6	417	10	72	6	140	18	163	6	220	16	39	3
12:30-12:45	243	40	36	4	425	10	74	8	144	24	204	12	216	19	32	4
12:45-1:00	200	10	31	2	556	21	71	6	134	19	220	10	225	15	31	2
1:00-1:15	188	25	30	2	476	23	54	4	139	21	179	15	186	14	28	2
1:15-1:30	170	20	32	2	490	27	43	3	122	21	199	8	214	17	29	2
1:30-1:45	180	16	26	1	460	13	53	5	129	19	167	5	138	12	20	3
1:45-2:00	190	32	32	3	514	10	60	3	130	18	171	12	126	10	22	4

2:00-2:15	192 23	27 3	310 15	57 4	117 21	180 17	133 8	22 6
2:15-2:30	202 27	31 2	390 11	58 5	116 23	179 12	141 12	27 4
2:30-2:45	198 28	23 4	365 15	42 4	122 17	184 13	139 17	21 3
2:45-3:00	202 22	20 3	450 16	46 5	136 22	190 7	128 14	20 7
3:00-3:15	195 23	20 4	492 24	44 6	130 17	192 8	120 9	30 6
3:15-3:30	201 21	25 6	499 21	48 5	133 19	198 6	130 8	29 4
3:30-3:45	193 19	22 4	553 17	51 5	142 26	178 3	112 7	27 3
3:45-4:00	170 30	23 3	525 17	48 6	138 37	249 9	106 8	21 2
4:00-4:15	164 32	27 2	537 14	42 7	130 26	174 3	102 9	25 3
4:15-4:30	160 29	25 3	518 15	48 9	115 19	167 5	97 11	20 2
4:30-4:45	130 22	21 3	445 11	41 6	107 12	149 6	108 12	21 3
4:45-5:00	121 24	19 3	412 13	50 3	104 13	151 6	112 9	19 2
5:00-5:15	105 25	20 1	307 10	42 7	98 10	139 5	90 7	17 1
5:15-5:30	90 17	17 2	275 12	36 5	86 8	132 4	82 6	18 2

Table (2). Total traffic volume at Al-Motanabi square for each (15) min.

Time	Pc	Hv	Total =(P_C+2*H_V)
7:00-7:15 a.m	1739	104	1947
7:15-7:30	1816	110	2036
7:30-7:45	1764	102	1968
7:45-8:00	1675	103	1881
8:00-8:15	1451	138	1727
8:15-8:30	1473	115	1703
8:30-8:45	1517	118	1753
8:45-9:00	1452	144	1740
9:00-9:15	1543	112	1767
9:15-9:30	1473	126	1725
9:30-9:45	1481	129	1739
9:45-10:00	1388	108	1604
10:00-10:15	1297	86	1469
10:15-10:30	1442	98	1638
10:30-10:45	1417	96	1609
10:45-11:00	1410	120	1650
11:00-11:15	1257	94	1445
11:15-11:30	1255	107	1469
11:30-11:45	1251	92	1435
11:45-12:00	1267	91	1449
12:00 -12:15 p.m	1270	76	1422
12:15-12:30	1303	90	1483
12:30-12:45	1374	119	1614
12:45-1:00	1468	85	1638
1:00-1:15	1280	106	1492
1:15-1:30	1299	100	1499
1:30-1:45	1183	74	1331
1:45-2:00	1245	92	1429
2:00-2:15	1040	97	1234

2:15-2:30	1144	96	1336
2:30-2:45	1094	97	1288
2:45-3:00	1192	96	1384
3:00 -3:15	1223	997	1417
3:15-3:30	1263	93	1449
3:30-3:45	1278	114	1506
3:45-4:00	1280	132	1504
4:00 -4:15	1154	116	1346
4:15-4:30	1150	113	1336
4:30-4:45	1022	85	1172
4:45-5:00	988	83	1134
5:00 -5:15	818	66	950
5:15-5:30	736	56	848

SATURATION FLOW

Saturation flow represents one of the main parameter in which has a major affect in the capacity of intersection (TRB, 1985). The existing saturation flow is calculated by using Webster method (Charles and Webester, 1958). **Table (3)** shows the calculated saturation flow at the stop line for all approaches in Al-Motanabi square.

Table (3). Saturation flow at Al-Motanabi square

Saturation flow pc/h	approach
1600	From Baghdad
1550	From Messan
1600	From Nasseria
1600	From Al-Hoor

GEOMETRICAL DESIGN

To evaluate the level of service at Al-Motanabi Square, it is very important to specify the number of lanes for each approach. The existing geometric layout for Al-Motanabi square and its approaches are shown in **Fig.(2).**

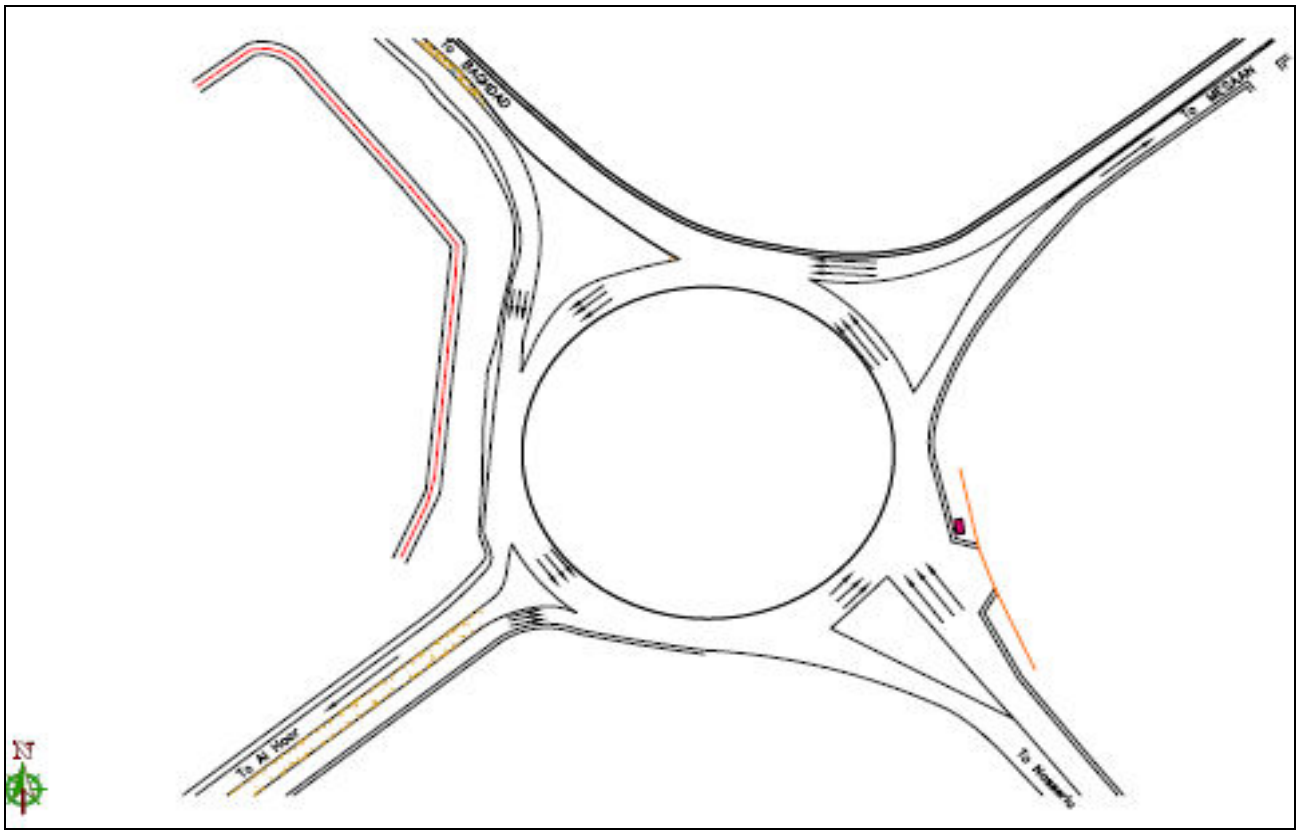

Fig. (2). Existing Geometrical design of Al-Motanabi square

ANALUSIS AND RESULTS

Peak Hour volume

By considering the traffic volume account that previously presented in **Table (1)**, an Excel program is used to specify the peak hour. The peak hour is found to be between 7:00 and 8:00 a.m. Figures (3a and 3b) shows the peak hour in addition to the variation of flow every 15 min during the time of survey. From the traffic account, the following conclusions were observed:-

a- The total traffic volume during the peak hour for all approaches is (7832) pc/h. This peak hour is found to be between 7:00 and 8:00 a.m.

b- It was found that the approach from Messan city have the highest volume of traffic while the approach from Al-Hoor have the lowest volume during the Hours of the account.

c- The percentage of heavy vehicles for all approaches in Al-Motanabi square is as shown in **Table (4)**

Table (4). Percentage of heavy vehicles at Al-Motanabi square.

approach	% of heavy vehicles
From Baghdad	10.8
From Messan	3
From Nasseria	5.5
From Al-Hoor	5.3

d- For peak Hour volume, the distribution of traffic volume in Al- Motanabi square is as shown in **Figure (4)**. This Figure shows the total volume during the peak hour for passenger car and heavy vehicles.

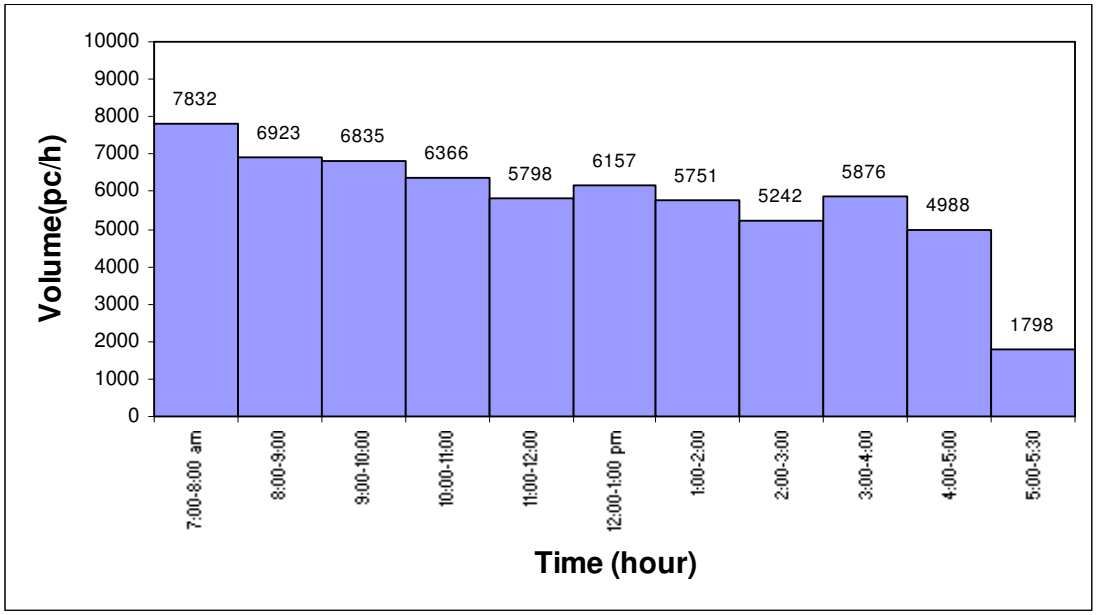

Fig.(3.a) Distribution of traffic volume from 7:00 a.m to 6:00 p.m at Motanabi square

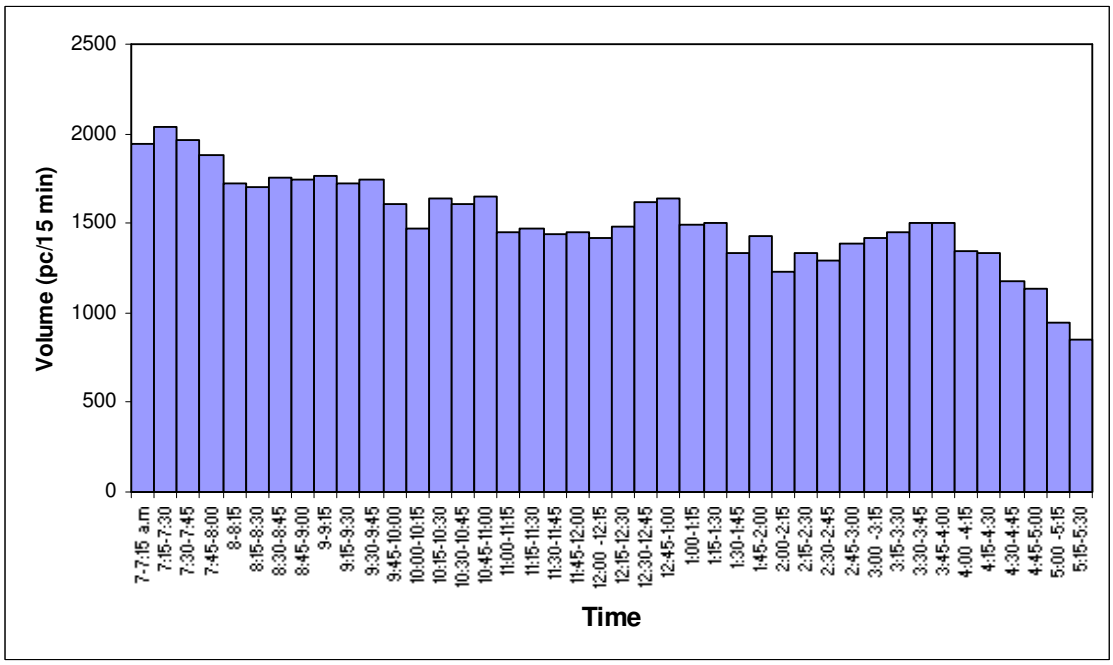

Fig. (3.b)Total of traffic volume every 15 min for all approaches at Al-Motanabi square.

Peak Hour Factor (PHF)

The peak hour factor is defined as the ratio of total hourly volume to the maximum 15- min rate of flow within the hour.

$$\mathbf{PHF} = \frac{Hourly\ \ volume}{peak\ \ rate\ of\ \ flow\ (within\ hour)}$$

$$\mathbf{PHF} = \frac{Hourly\ \ volume}{4 * \mathrm{V15\,min}}$$

Where:-

PHF= Peak-hour factor
$\mathbf{V_{15}}$= Volume during the peak 15 min of the peak hour, on veh/15min

The peak hour factor is calculated for each direction in Al-Motanabi square by using the data mentioned in **Table (1)**. Results of PHF is shown in **Table (5)** below

Table (5). PHF for all approach at Al-Motanabi square

Approach	PHF
From Baghdad	0.96
From Messan	0.93
From Nasseria	0.96
From Al-Hoor	0.96

EXISTING LOS AT AL-MOTANABI SQUARE

After specifying the peak hour which represent the design hour volume, it is very important to estimate the level of service (LOS) at Al-Motanabi square with existing geometric design and traffic flow. As mention before the existing geometric design consists of Unsignalized Roundabout operate under the control of Policemen.

To estimate the LOS For existing condition, the average delay at Al-Motanabi square must be calculated because the average delay represent the main parameter for LOS estimation.
According to American specification, the (LOS) classified into six types depending on the value of average delay as shown in **Table (6)**.

Table(6). Level of service definitions based on delay (HCM method)

Level of service (LOS)	Control delay per vehicle in sec.
A	$d \leq 10$
B	$10 < d \leq 20$
C	$20 < d \leq 35$
D	$35 < d \leq 55$
E	$55 < d \leq 80$
F	$80 < d$

By using SIDRA program(Akcelick,2000), the average delay for existing geometric at Al-Motanabi square is (71.6) sec/veh and according to the U.S Highway Capacity Manual, Al-Motanabi square will operate 5 in LOS (E). **Table (7)** shows the average delay and LOS's for all approaches connected with Al-Motanabi square. While **Table (8)** shows the main indicators to evaluate the existing efficiency.

The details of results (Akcelick ,1986) and calculation are presented in Appendix A. The result shown in **Table (7)** is critical according to all international specification in traffic engineering.

Table (7) .Existing LOS at Al-Motanabi square

Approach	Average delay sec/veh	Degree of saturation	Level of service(LOS)
From Baghdad	30.6	0.84	C
From Messan	112.6	1.03	F
From Nasseria	144.9	1.04	F
From Al-Hoor	12.6	0.48	B
Average	71.6		E

Table (8) - Significant indicators affecting LOS in Al-Motanabi square

Average delay (sec/veh)	71.6
Total delay (veh.h/h)	155.58
Stop rate	1.25
Performance index	611.71
Practical spare capacity	-14%

DESIGN PROPOSALS FOR AL-MOTANABI SQUARE

The following proposals can be suggested:

Proposal NO.1,

This proposal includes removing the Roundabout and use crossing intersection with signalization as shown in **Fig (5)**. By using this proposal, the results show unaccepted level of service (LOS F) because the average delay will be (240.4) sec/veh. **Tables (9)** and **(10)** show the level of service at Al-Motanabi square if this proposal is adopted.

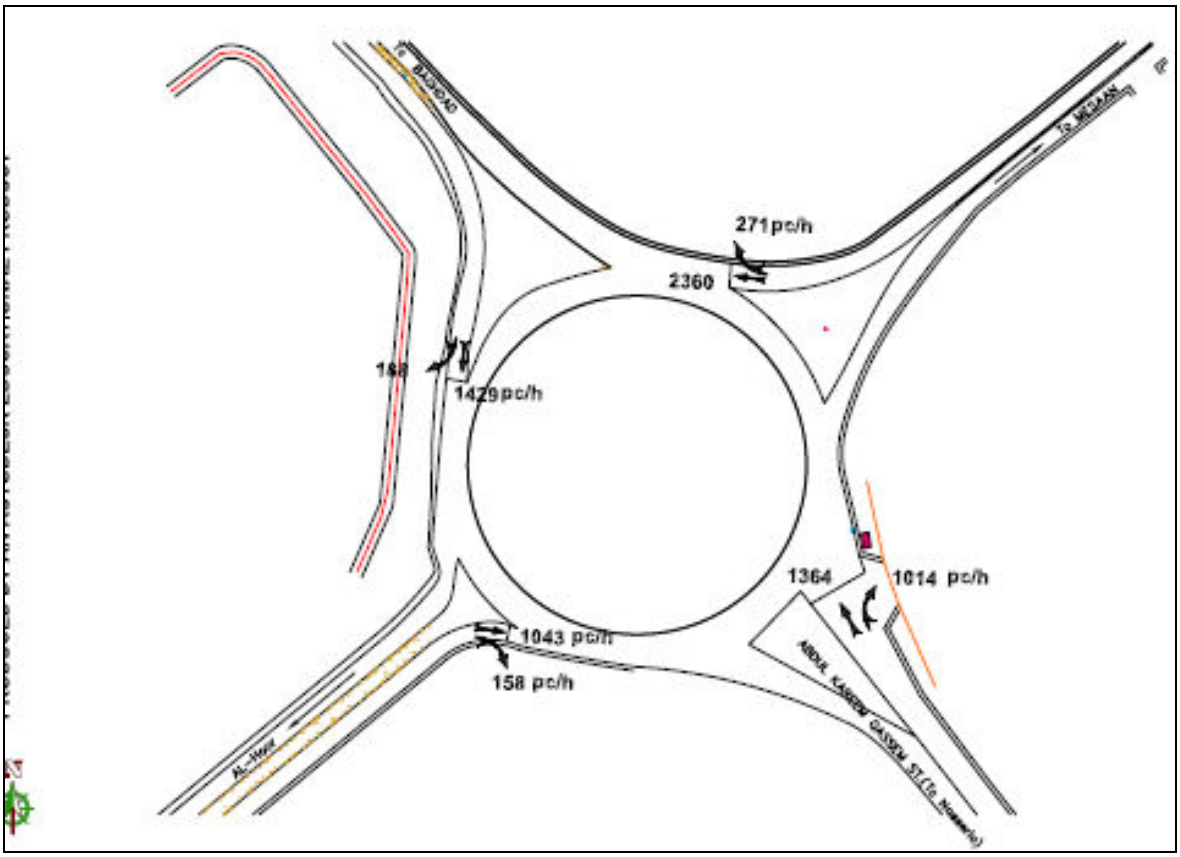

Fig. (4) .peak Hour volume, the distribution of traffic volume in Al- Motanabi square

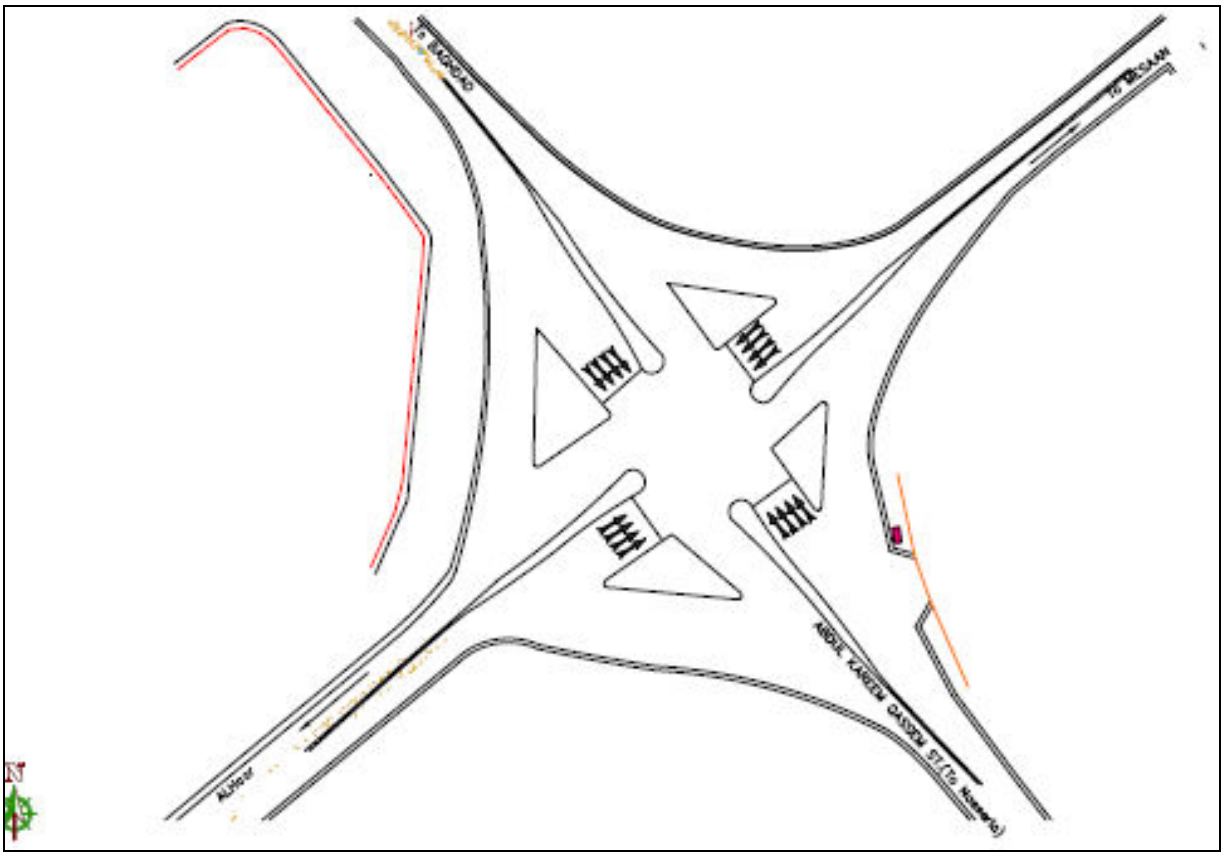

Fig. (5) .proposal NO.1 (crossing intersection)

Table (9) .Level of service at Al-Motanabi square by adopting proposal1at base year

Approach	Average delay sec/veh	Degree of saturation	Level of service(LOS)
From Baghdad	307.7	1.11	F
From Messan	312.7	1.135	F
From Nasseria	303.0	1.112	F
From Al-Hoor	278.4	1.086	F
Average	240.4		F

Table (10). Significant indicators affecting LOS in Al-Motanabi square with proposal 1at base year

Average delay (sec/veh)	240.4
Total delay (veh.h/h)	522.73
Stop rate	2.11
Performance index	1352.76
Practical spare capacity	-21%

PROPOSAL NO.2:

This proposal includes the execution of flyover along Baghdad –Nassreia approache, the expected number of vehicles which will use the proposed flyover will be as follow:-

- About 900 pc /h from Baghdad to Nasseria in peak hour.
- About 1000 pc/h from Nasseria to Baghdad in peak hour.

The expected traffic volume for peak hour at ground level will be as shown in Figure 6. With the execution of the proposed flyover along Baghdad- Nasseria Approaches, the new geometric for Al-Motanabi square need to enhance the number of lanes to increase the capacity of the intersection in addition to use traffic lights.

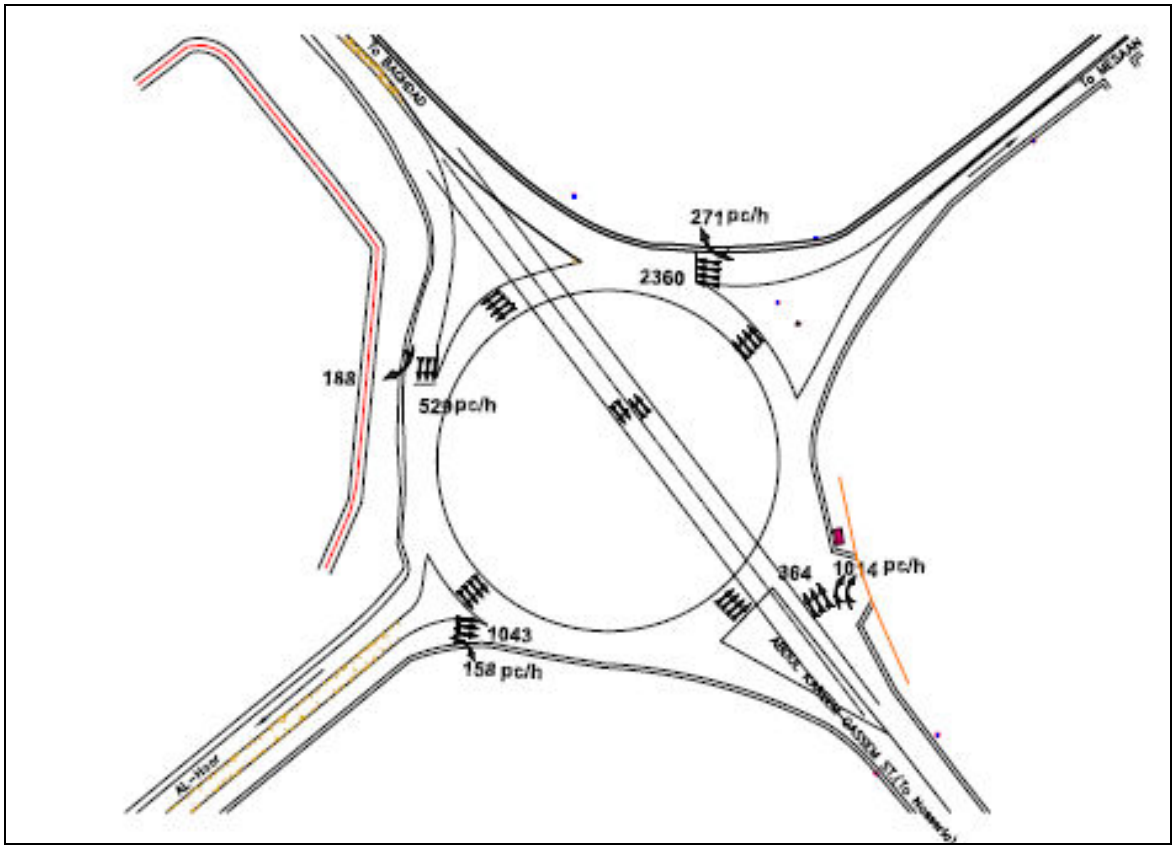

Figure 6. Expected traffic volume at Base year with adopting proposal 2

The expected average delay at the at-grade level will be (13.1) sec/veh, which means the intersection, will be in LOS (B). **Tables (11)** and **(12)** showed the results of analysis **.**

Table (11)- Level of service at Al-Motanabi square by adopting proposal NO.2 on the base year

Approach	Average delay sec/veh	Degree of saturation	Level of Service(LOS)
From Baghdad	31.5	0.522	C
From Messan	12.0	0.626	B
From Nasseria	31.6	0.539	C
From Al-Hoor	9.7	0.369	A
Average	13.1		B

Table (12).Significant factors affecting LOS at Al-Motanabi square on the base year by adopting proposal No.2

Average delay (sec/veh)	13.1
Total delay (veh.h/h)	21.51
Stop rate	0.53
Performance index	222.91
Practical spare capacity	44%

For target year (after 20 years with 3% annual increasing rate), the expected traffic volume will be as shown in Figure 7. The average delay will be (107.7) sec/veh and the square will operate at LOS (F). Tables 13 and 14 show the LOS's and some important parameters that affecting level of service at target year. The results for target year are unaccepted according to the international traffic specification.

Table (13).Level of service at Al-Motanabi square for the target year (proposal NO.2)

Approach	Average delay sec/veh	Degree of saturation	Level of service(LOS)
From Baghdad	161.4	1.024	F
From Messan	186.8	1.078	F
From Nasseria	32.0	0.504	C
From Al-Hoor	13.5	0.617	B
Average	107.7		F

Table (14).Significant parameters affecting LOS's for the target year (proposal NO.2)

Average delay (sec/veh)	107.7
Total delay (veh.h/h)	319.18
Stop rate	1.58
Performance index	1054.69
Practical spare capacity	-17

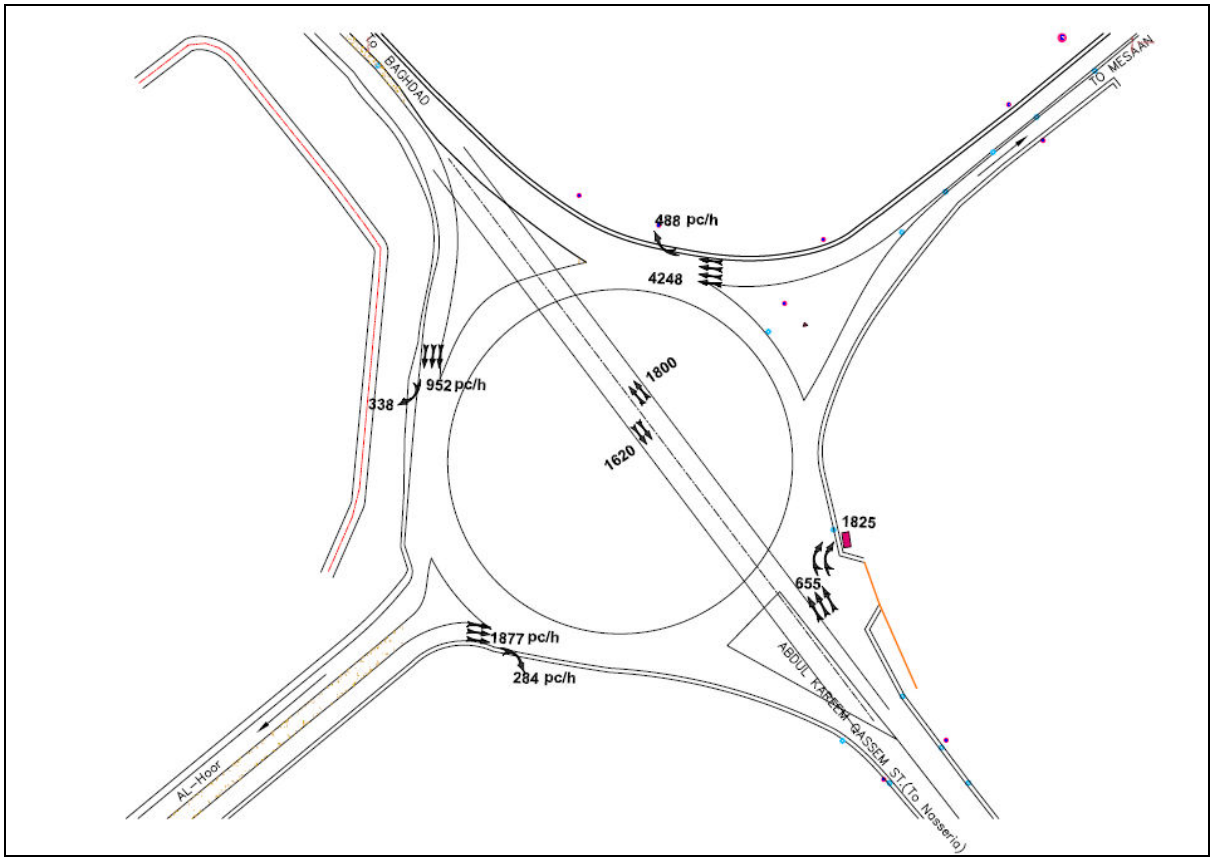

Fig. (7). The expected traffic volume for Al-Motanabi square at target year

PROPOSAL (3).

To improve proposal 2, the problem of congestion can be solved by establishing another flyover which connect between Messan and Naseria approaches. This proposal will make AL-Motanabi square work with three levels as shown in **Figure (8)**.By adopting this proposal ,the average delay at ground level is (18) sec/veh and the LOS will be LOS (B) for target year. Tables 15 and 16 show the results .

Table (15).Level of service at Al-Motanabi square at target year (Proposal NO.3)

Approach	Average delay sec/veh	Degree of saturation	Level of service(LOS)
From Baghdad	29.4	0.709	C
From Messan	18.9	0.691	B
From Nasseria	29.4	0.709	C
From Al-Hoor	20.4	0.735	C
Average	18		B

Table (16).Significant parameter affect level of service at target year (proposal NO. 3)

Average delay (sec/veh)	18
Total delay (veh.h/h)	39.90
Stop rate	0.67
Performance index	345.51
Practical spare capacity	22%

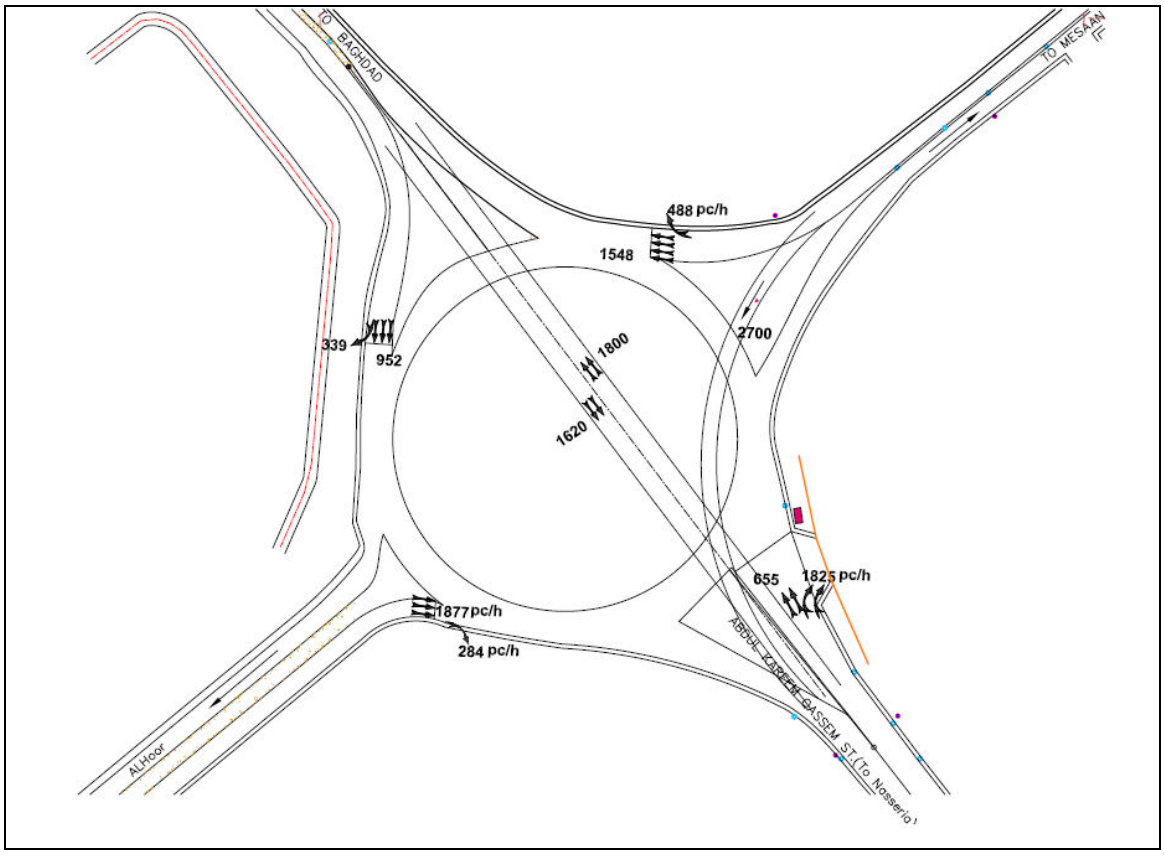

Fig. (8). Traffic volume at Al-Motanabi square at peak hour with proposal 3 at target year

PROPOSAL 4

This proposal includes the execution of flyover along Messan –AL-Hoor approaches. For this proposal the expected traffic volume at ground level in AL-Motanabi square will be as shown in Figure(9). The expected traffic volume, which will be use the proposed flyover will be as follow:

.600 pc/h from Messan toward AL-Hoor in peak hour.
.500 pc/h from AL-Hoor toward Messan in peak hour.

For this proposal, the same number of lanes must be adopted as shown in Figure (9). This proposal includes traffic light at ground level.

For the base year, the results of analysis show that the average delay is (21.1) sec/veh. and the square will operate at LOS(C). **Tables (17)** and **(18)** show the level of service and some significant parameters affect the performance of AL-Motanabi square.

Table (17). Level of service at Al-Motanabi square on base year (proposal No.3)

Approach	Average delay sec/veh	Degree of saturation	Level of service(LOS)
From Baghdad	26.5	0.766	C
From Messan	26.3	0.784	C
From Nasseria	24.6	0.731	C
From Al-Hoor	18.3	0.363	B
Average	21.1		C

Table (18). Significant parameter affecting LOS at Al-Motanabi square on the base year (proposal No 3)

Average delay (sec/veh)	21.1
Total delay (veh.h/h)	39.52
Stop rate	0.69
Performance index	305.43
Practical spare capacity	15%

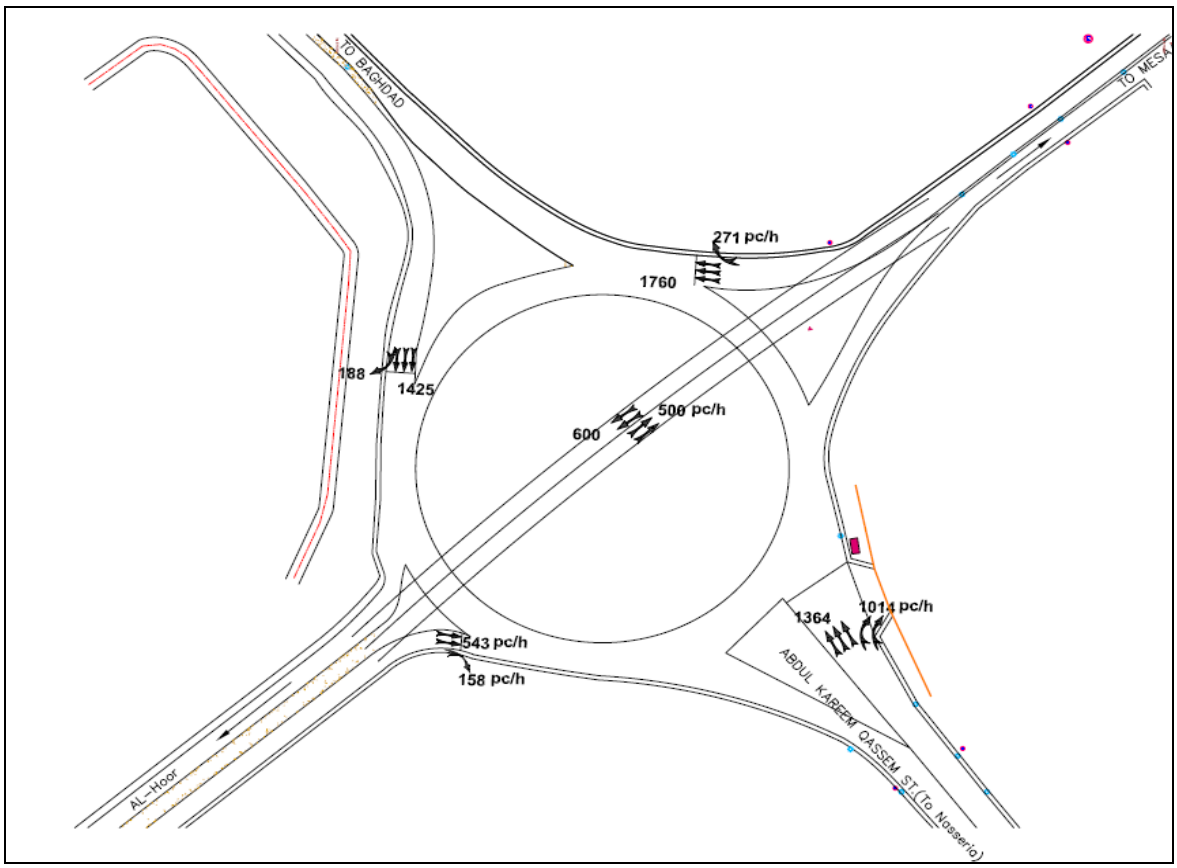

Fig. (9). Traffic volume at Al-Motanabi square at peak hour with proposal 4 at base year.

For target Year the expected traffic volume at the at-grade level will be as shown in **Figure (10)**. On the target year, the average delay is (464.2) sec/veh and the level of service will be (F) This delay and LOS are unaccepted according to the international specification. **Table (19)** and **(20)** present the above-mentioned results.

Table (19). Level of service at Al-Motanabi square at target year (proposal No.4)

Approach	Average delay sec/veh	Degree of saturation	Level of service(LOS)
From Baghdad	444	1.223	F
From Messan	714.1	1.374	F
From Nasseria	681.2	1.354	C
From Al-Hoor	20.5	0.635	B
Average	464.2		F

Table (20). Significant parameter affecting LOS at Al-Motanabi square at the target year (proposal No 4)

Average delay (sec/veh)	464.2
Total delay (veh.h/h)	1561.05
Stop rate	4.11
Performance index	3417.74
Practical spare capacity	-35%

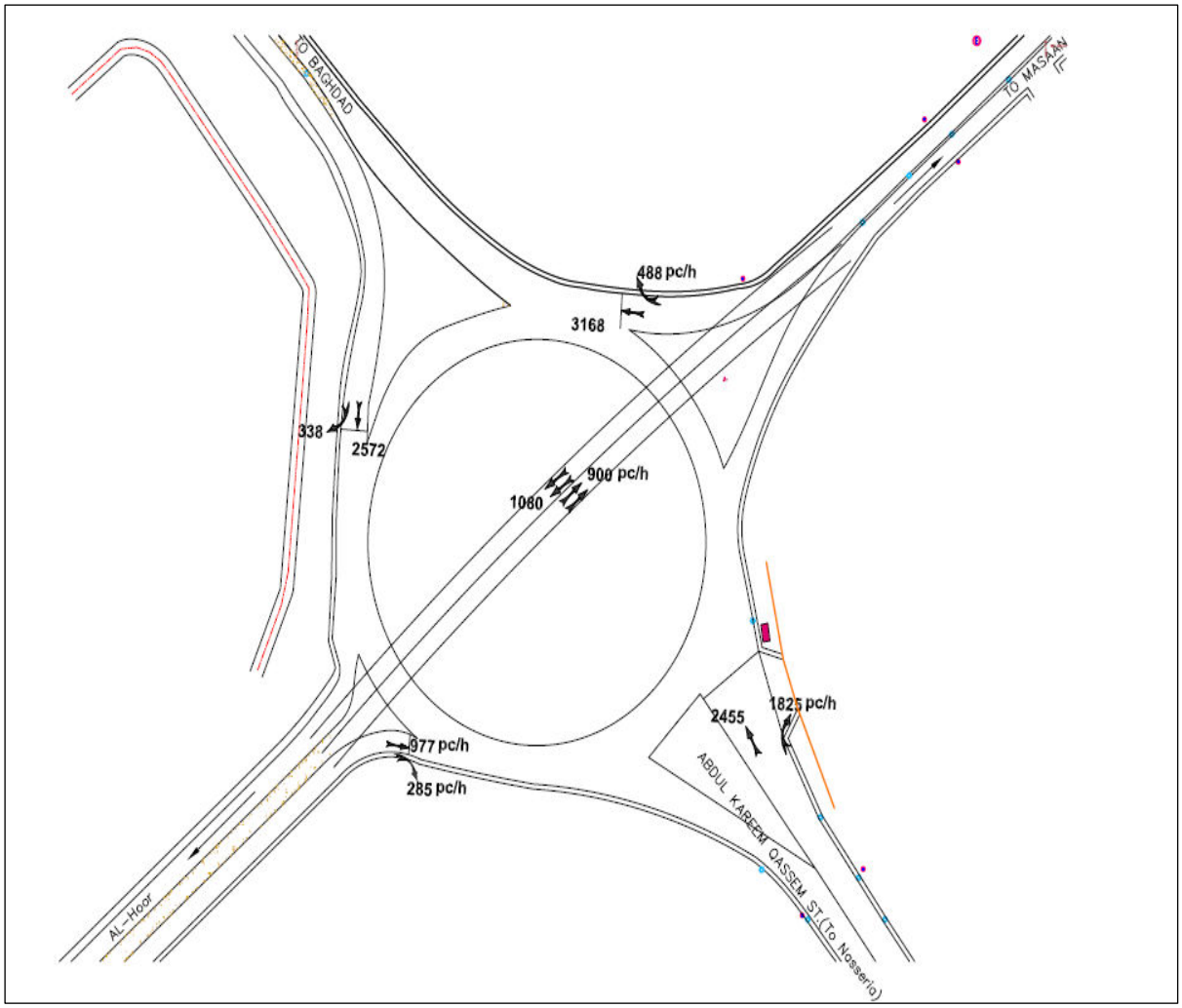

Fig. (10). Traffic Volume at AL-Motanabi Square at target year with (Proposal No.4).

Proposal (5)

This proposal includes executing of full cloverleaf to provide continuous movements for all directions as shown in **Figure (11)**, which illustrated the expected traffic volume at target year. This proposal cannot be adopted for the following reasons.

1-Traffic volume at ramp A is more than the capacity due to high number of vehicles and effect of heavy vehicles.

2- The weaving sections (Messan – Al Hoor) and (Baghdad – Nasseria) have a very high volume in weaving sections.

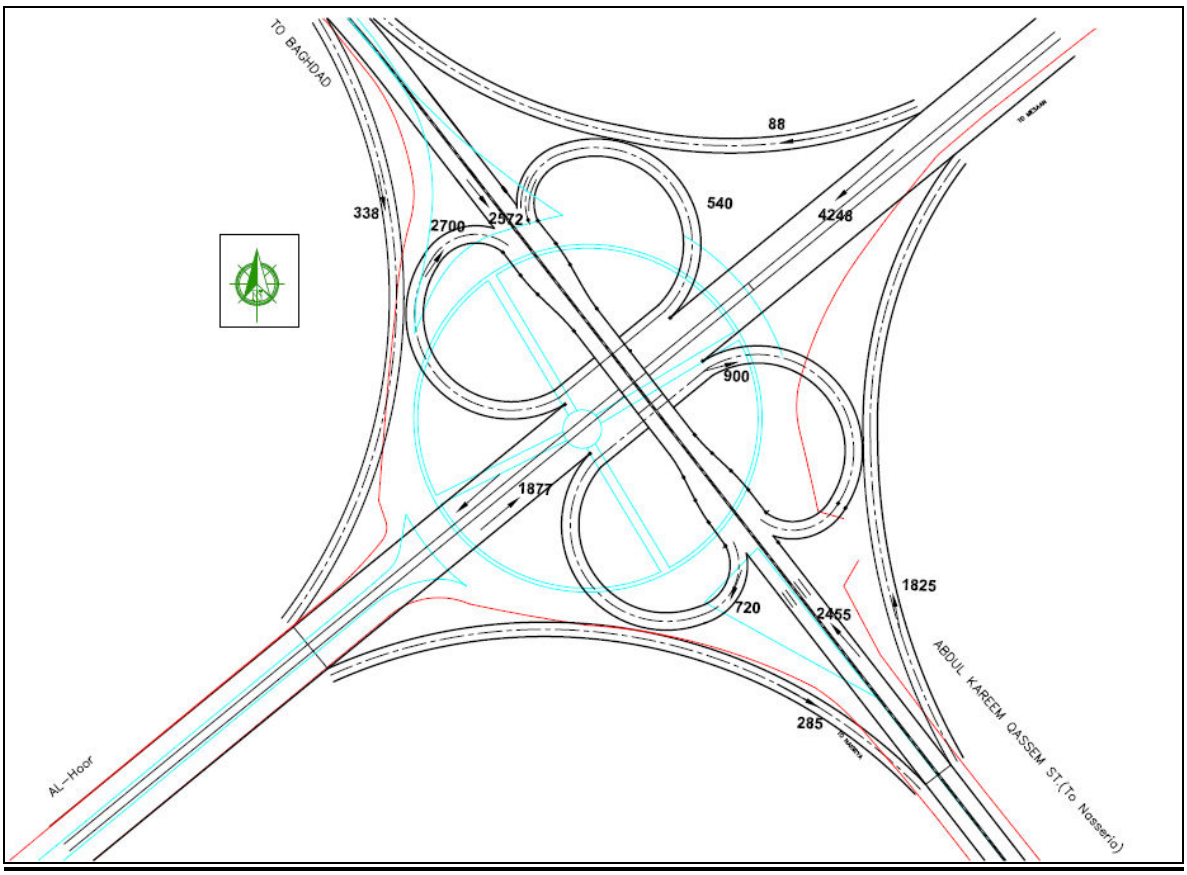

Fig (11). Proposal No. (5), Full cloverleaf.

DESIGN OF FLYOVER (NUMBER OF LANES)

HCM specification is used to calculate the number of lanes for the proposed flyover:

-For proposal No. 3 on the target year

a-Direction between(Baghdad –Nasseria)

$$N = [\, SF / (\, C_j * \frac{v}{c} * f_w * f_{Hv} * f_p \,)\,]$$

Where

N = number of lanes in one direction

SF = service flow LOS under prevailing and traffic condition for N lanes in one direction (vph)

C_j = Capacity under ideal condition for freeway element of design speed.

f_w = Factor to adjust for the effect of restricted laree widths (and lour) lateral clearance.

f_{Hv} = Factor to adjust for the effect of heavy vehicle.

f_p = Factor to adjust for the effect of driven population.

SF = 1000 * 1.8 = 1800 pc/h

Assume LOS(D)

$\frac{v}{c}$ = 0.80, f_{Hv} = 1.0, f_p = 1.0 , $f_{w=}$ 0.93

f_w = 0.93 (use standard lane with 1 ft obstruction on both sides)

≈N = [1800 / (1900 *0.80 *0.93 *1.0 *1.0)] = 1.3 lanes

≈Use two lanes with standing lane for each direction.

b-Direction between (Messan - Nasseria)

SF = 1500*1.8 = 2700 pc/h

Assume Los(D)

$\frac{v}{c}$=0.80

F_{HV} = 1.0

F_w = 0.93 (use standard lane with 1 ^{ft} obstruction on both sides)

N=[2700/(1900*0.80*0.93*1.0*1.0)]=1 .9,lane

use two lanes

CONCLUSIONS

By considering the previous mentioned results, and throughout the presented five proposals, it is concluded that proposal No. (3) reflects the best solution on the target year from the capacity and the performance operation point of view at Al-Motanabi square in Kut city.

REFERANCES

Akcelik R.(1986). " SIDRA version 2.2 input and out put" Austrian road research board . Technical manual ,ATM No. 19.

Akcelick ,R. ,(2000) ," aaSIDRA user guide " , Akcelick and Associates pty Ltd.

Transportation Research Board , (1985),Special Report 209 , Highway Capacity Manual,National Research council Wtashington , DC

Zegeer ,D.C ,(1986), " Field Validation of Intersection capacity Factors" , Transportation Research record 1091 , Transportation research Board Washoington , DC .

Khisty , C,J and Lall , B. k ,(1998) , "Transportation Engineering " , Handbook , Second edition , Prentice –hall International ,Inc.

Charles W. and Webster f. V. (1958) ," Some Factors affecting the Capacity of Intersection Controlled by Traffic signals "Forth Int. Traffic engineering Conference ,Copenhagen.