

## Development and Design the Correlation Area Between Residential Neighborhood and Baghdad Al Mosul Highway in Baghdad City

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**Abstract:** Improvement and development of the highways and intersections are very important factors in the cities in order to focus the future programing. Level of Service (LOS) is a reality factor in evaluation the design speed, travel time, traffic volume, density and others traffic parameters to provide safe, efficient and convenient movement for road users and goods. Random access points and conflicts maneuvers found throw study section which know as Baghdad-Mosul highway intersected with Al-Jediel residential area, cause many types of traffic accidents resulting in Fatal (F), Personal Injury (PI) and Property Damage Only (PDO) due to fail to follow the engineering standards in the study area. Data have been collected according to field survey in order to measure traffic flow parameters using mechanical count methods within peak hour while the analysis was done by using (Excel and highway capacity system programs). It was concluded that, when designing acceleration and deceleration lanes, then re-analysis the data by using highway capacity system 2000 program, the Level of Service (LOS) will be increase from D-C in the study area section length due to improvement in operation speed and traffic characteristics. Then, as the probability of a traffic accidents type right angle and sideswipe collision will be decreases by 22%, due to reduce in merge and conflict points between traffic movements thus it will be increase safety and convenience factors resulting in improvement in traffic characteristics and improvement of pedestrians crossing through separation between the major and secondary highway. However, the improving the performance of overpasses crossing, resulting in decreasing traffic type (vehicle-pedestrian) by 55% in the study area.

**Key words:** Intersection, pedestrian crossing, level of service, pedestrians, decreasing, damage

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### INTRODUCTION

The highways and intersections is the reflective mirror which is reflects the growth, civilization and overall progress in the cities, so, we must adopt scientific methodology and planning as well as providing human and material resources to make the necessary improvements within the scientific programs lead to the comprehensive development of highways and their networks (TRB., 2010). Baghdad City has been shown more increase in the car ownership levels for different types of vehicles like passenger car, heavy vehicles and buses, thus, this study is trying to find a suitable solution for one of main traffic problems which is facing traffic operations in Baghdad City respected to the data analysis using program, the study was concluded that the level of service will be increase from level (D) to the level (C) when designing acceleration and deceleration lanes due to improving operation speed and traffic characteristics as well as providing safe and comfort movement for vehicles and pedestrian, thus, led to reduce the probability of traffic accidents in study area with respect to the following steps:

- Existing study for the roadway section and intersection (Do Nothings)
- Improving the intersection to at grade intersection taking in to account the vehicles maneuvers by design speed change lanes
- Improving the pedestrian's safety in the study area by using overpasses crossing and prepare sidewalks separated by curbstone to reduce vehicle-pedestrian collision

**Study problem:** Al-Mosul Baghdad highway is an important arterial in Baghdad City, so many trips generation during it, mean while random access points and conflicts maneuvers found throw study section length of Al-Jediel residential area intersection is the most hazards location due to direct movement that they generated from the entranced and exit for different types of vehicles (Fig. 1). Many types of traffic severity, collision diagrams between motor vehicles and pedestrian have been happened in this location results in Fatal (F), Personal Injury (PI) and Property Damage Only (PDO), therefore, the study attempt to evaluate exist traffic condition in order to seek some solutions based on filed



Fig. 1: The section of the roadway with illegally turning movement in the study area

survey of traffic data deal with Peak Hour Volume (PHV), spot speed, vehicles classification, percentage of Heavy vehicle (HV%) and engineering survey in the study area. The field data have been analyzed with aid of (excel and highway capacity system) programs while the research included the following methodology (Anonymous, 2002):

- Study the exist situation of the study area (Do nothing)
- Improving the level of service of the intersection through which design acceleration and deceleration lanes at entrance and exit

**MATERIALS AND METHODS**

**Definition of study area:** The study areas a residential zone located in the right side of the Baghdad-Mosul multi-lane highway of about 5.0 km to the North to Al-Kadhimiya Holy. The study area contains a number of activities like residential, educational, commercial and religious while its population of about 3000 persons, serving by main street of 15 m width connected with local streets. The traffic volumes transfers from this area to the main road (Baghdad-Mosul highway) due to random movements and maneuver do not take into account the safety, efficiency and convenient factors, the lake of these factors cause severity and collision diagrams between vehicles and pedestrians. Baghdad-Mosul highway section classify as multi-lanes highway with two-lanes 7.00 m width in each direction, the traffic movement separated by a median 6.0 m width and 2.50 m shoulders stabilized by sub base materials. The highway transfer difference types of trips.

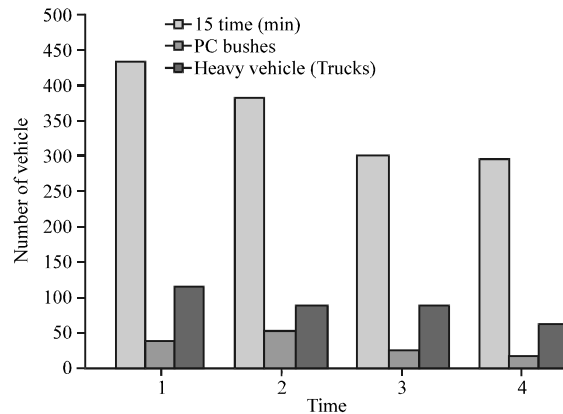


Fig. 2: Classification and variation of traffic flow in the study area

**Data collection:** Reconnaissance survey (Garber and Hole, 2002) have been done for the section of highway within the intersection in order to count with the aid of field measurements the traffic volume according to vehicle classification, average spot speed, traffic density and another factors which they are effecting Level of Service (LOS) in the study area using me technique method (video technique) and manual count method, respectively. The traffic elements were conducting during Peak Hour Volume (PHV). As well as the average traffic speed in the study area has been measured by identifying a particular section of the highway using measuring tape meanwhile the time spent by the vehicles to pass over a given section was determined. Figure 2 and 3 and Table 1 and 2 listed the classification of vehicles, average speed (km/h) and average density (Veh./km) in the study area.

Table 1: Classification of traffic flow in Baghdad-Mosul highway section in the study area

Time	Traffic volume			Total	HV (%)	Density (Veh./km)	Average speed (km/h)
	Pc	B	t-values				
7:30-7:45	436	44	121	601	27.454	13.0930	45.90
7:45-8:00	381	51	92	524	27.290	10.1430	51.66
8:00-8:15	302	22	88	412	26.699	6.5270	63.12
8:15-8:30	298	16	66	445	18.426	6.7332	66.09

Table 2: Vehicle classification and traffic flow variation in the residential area

Time	Traffic volume			Total	HV (%)	Density (Veh./km)	Average speed (km/h)
	PC	B	t-values				
7:30-7:45	112	13	8	133	15.789	13.0930	30.77
7:45-8:00	81	22	12	115	29.560	10.1430	31.45
8:00-8:15	166	9	21	196	15.306	6.5270	29.23
8:15-8:30	129	7	15	151	14.560	6.7332	38.33

Pc = Passenger car, B = Buses, T = Trucks, HV%= Percentage of heavy vehicle

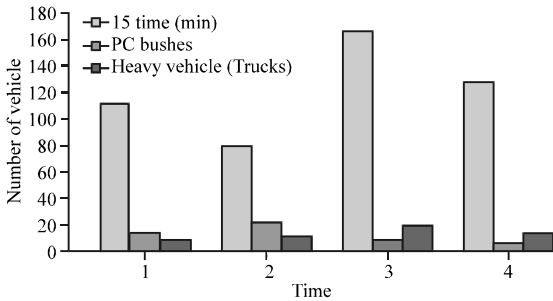


Fig. 3: Classification and variation of traffic flow in the study area (residential area to the Baghdad-Mosul highway)

## RESULTS AND DISCUSSION

### Data analysis

**Study the reality of situation (do nothing):** Data have been analyzed based on data in the tables and figures above in order to find out the parameters of traffic characteristics and therefore, the Level of Service (LOS) in the main highway and the residential area, respectively with the aid of Highway Capacity System Program (Anonymous, 2005; McGraw-Hill, 2002).

From Table 3 the study of highway shows LOS (D), so, it is indicate disturbance of traffic movements due to random access points led to decreases in operation speed and failure to yield right of way, thus, the probability of accidents and level of severity will be increases. The site became hazardous location, so this study seek to develop the intersection area by increasing the safety, convenience and efficient factors through designing acceleration and deceleration lanes to avoid conflicts point between moving vehicles. Figure 4 and 5 shows the exists and improving section area.

The design of acceleration and deceleration lanes length was calculated as show in the following equations: For deceleration lane (Anonymous, 2002). Where:

$$L_1 = 0.278 V_2 * t$$

$L_1$  = Taper length (m)

$V_2$  = Average running speed of major highway (km/h)

$t$  = Time required for transvers movement to shift the lane

$$L_1 = 0.278 * 60 * 2.5$$

$$L_1 = 41.70 \text{ m}$$

Calculate  $L_2$  (Anonymous, 2002):

$$L_2 = \frac{[(V_2)^2 - V_1^2]}{7.2 * a}$$

Where:

$L_2$  = Acceleration lane or deceleration lane length (m)

$V_1$  = Design speed of secondary highway (km/h)

$a$  = Rate of acceleration or deceleration (km/h/sec)

$$L_2 = \frac{[(V_2)^2 - V_1^2]}{7.2 * a}$$

$$L_2 = 75.0 \text{ m}$$

$$L_2 = L_1 + L_2 = 116.70 \text{ m}$$

For acceleration lane:

$$L = L_1 + L_2 = 92.875 \text{ m}$$

Acceleration and deceleration lanes provide drivers with an opportunity to speed up or slow down in space not used by high-speed through traffic.

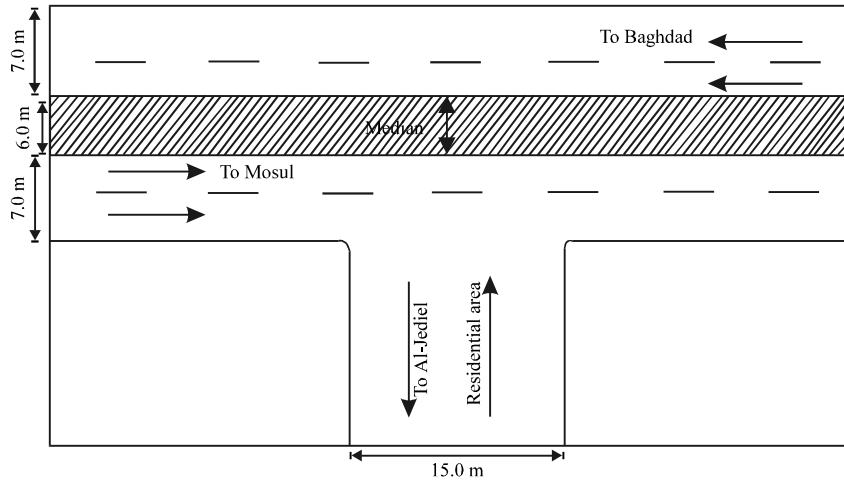


Fig. 4: The current situation in the study area

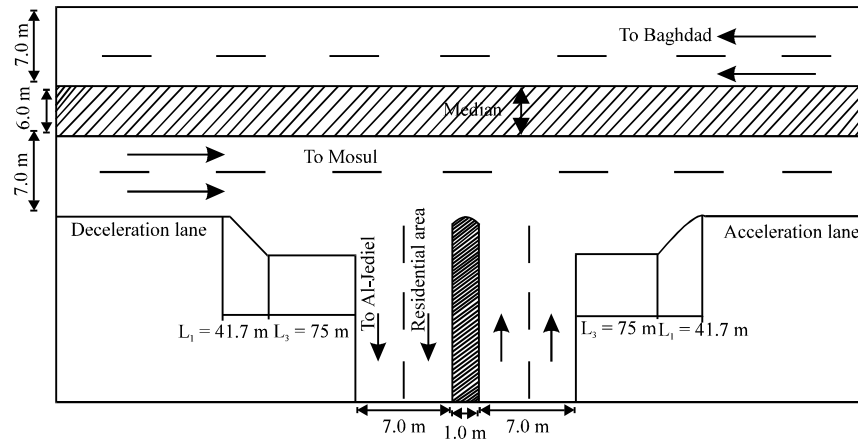


Fig. 5: Improvement of the study area by designing acceleration and deceleration lanes

Table 3: Level of Service (LOS) number of lanes needed in Baghdad-Mosul highway section

Direction	1	2
<b>Free-flow speed</b>		
Lane width	12.0 ft	12.0 ft
<b>Lateral clearance</b>		
Right edge	6.0 ft	6.0 ft
Left edge	6.0 ft	6.0 ft
Total lateral clearance	12.0 ft	12.0 ft
Access points per mile	3	2
FFS or BFFS	50.0 mph	50.0 mph
Lane Width adjustment (FLW)	0	0
Lateral Clearance adjustment (FLC)	0	0
Median type adjustment (FM)	0	0
Access points Adjustment (FA)	0	0
Free-flow speed	50.0 mph	50.0 mph
<b>Volume</b>		
Volume (V)	1982 vph	1750 vph
Peak-Hour Factor (PHF)	0.82	0.80
Peak 15 min volume (v15)	604	547
Trucks and buses	25%	24%
Recreational vehicles	0%	0%
Terrain type	Level	Level
Grade	0%	0%

Table 3: Continue

Direction	1	2
Segment length	2 mi	2 mi
Number of lanes	2	2
Driver Population adjustment (fP)	1.00	1.00
Trucks and buses PCE (ET)	1.5	1.5
Recreational vehicles PCE (ER)	1.2	1.2
Heavy Vehicle adjustment (fHV)	0.889	0.893
Flow rate (vp)	1359 pcphpl	1224 pcphpl
<b>Results</b>		
Flow rate (vp)	1359 pcphpl	1224 pcphpl
Free-Flow Speed (FFS)	50.0 mph	50.0 mph
Avg. passenger-car travel Speed (S)	50.0 mph	50.0 mph
Level of Service (LOS)	D	C
Density (D)	27.2 pc/mi/ln	24.5 pc/mi/ln

### CONCLUSION

When designing acceleration and deceleration lanes, then re-analyzed data using highway capacity system 2000 program, it was noticed that the Level of Service (LOS) will be improved from D-C in the study area section length due to improving in operation speed and traffic characteristics.

The design of acceleration and deceleration lanes led to decreases the probability of traffic accidents type right angle and sideswipe collision by 22%, due to decreases in merge and conflict point between traffic movements thus it will be increase safety and convenience factors resulting in improving in traffic characteristics.

Improvement of pedestrians crossing through separation between the major and secondary highway using curbstone and suitable sidewalk with improving performance of overpasses crossing resulting in decreasing of traffic accident type (vehicle-pedestrian) by 55% with in the study area.

Acceleration and deceleration lanes can reduce major highway congestion by providing speed change lane resulting in safe, convenient, efficiency movement for vehicles and pedestrians.

### RECOMMENDATIONS

It was recommended that the roadway must be furnished with the signs, signals and marking in order to consolidate safety factors. Designing the highways under technical specifications with the aid of traffic studies to avoid the random movements of vehicles which led to get many traffic accidents cause Fatality (F), Personal Injury (PI), Property Damage Only (PDO).

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