Vehicular Volume: A Parameter in Improving Unsignalized Intersections

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Abstract

This research aimed to present a traffic study using vehicular volume as a parameter for improving unsignalized intersections. The locale of the study is the MacArthur National Highway-Dagupan Asingan Road, Urdaneta City, Pangasinan. There are 27,654 vehicles that traverse the unsignalized intersection during the fourteen-hour period or with a flow of 1976 vehicles per hour. The peak hour was observed to be at 11-12 in the morning and 5-6 in the afternoon/night time. Majority of the transport modes that traverse during the mentioned peak hours are cars (e.g. automobiles, tricycle).

Vehicular volume is a significant input in the transportation planning process between LGUs and Planners if the existence of traffic volume study in an urbanized area is to be considered.

Introduction

Background of the Study

Urbanized areas are now confronted with traffic problems such as traffic accidents, congestion, pollution, and energy problems due to uncontrollable growth of population and the transportation system in the region. Congestion is observed along various corridors in different parts of the country.

Intersections are considered as the vital access to municipalities and cities in the Philippines because they provide the framework for the network of highways, arterials, collectors, and local streets. It cannot be denied that some intersections along the national highways are suffering from congestion and sometimes safety of drivers and pedestrians are limited.

Unsignalized intersections are the most common forms of intersection in the world. And in the Philippines, unsignalized intersections controlled by Stop and Yield signs are the most common types of intersection in rural and urban roads.

In Urdaneta City the number of vehicles passing through the road artery has increased dramatically since the said place was converted into a city five years ago. Aside from hosting a variety of thriving business, the city is also one of the most culturally diverse in Northern Luzon because of its proximity to big cities and municipalities in Region I(Manila Times, Monday, June 2, 2003). So, the researcher considered the intersection of MacArthur Highway-Dagupan-Asingan Road **as a** subject of the study to have a database on the traffic volume, pedestrian, and accident profile of the same unsignalized intersection to serve as bases for solving the congestion problem and to ensure safety among commuters in the region.

Objectives of the Study

The study generally focused on vehicular volume as an indicator of improving an unsignalized intersection - the case of unsignalized intersection of Mac Arthur Highway Dagupan-Asingan Road in Urdaneta City, Pangasinan. The study had the following objectives:

1. Determine the traffic flow in the intersection for the span of fourteen hours
2. Determine the volume of vehicles per mode of transportation during the peak hour in the morning and in the afternoon/evening period
3. Determine if the intersection is warranted for signalization

Scope and Limitation of the Study

This traffic study considered the four-legged and unsignalized intersection of Mac Arthur Highway-Dagupan Asignan Road at Urdaneta, Pangasinan.

The data was limited to the obtained information during the conduct of the field survey from 6:00 A.M. to 8.00 P.M. on January 28, 2004.

The study is exploratory in nature. The output of this study needs to be validated through further study in order to come out with a more precise and more tangible tool for other unsignalized intersections in urbanized areas.

Methodology

The researcher conducted an actual survey on traffic volume at the unsignalized intersection of Mac Arthur Highway-Dagupan Asingan Road on the January 28, 2004.

Data Gathering Technique. The researcher coordinated with the city officials of Urdaneta City, Pangasinan relative to the gathering of data and information pertinent to this research endeavor. Likewise, the researcher determined the actual situation of the location of the intersection after which he collected data on vehicular volume.

Traffic Volume. The data on the total number/volume of vehicles according to the vehicle classification entering/exiting on the specific intersection for each movement (right, through, left turn, excluding u-turns) were considered. Manual counting was done for a period of fourteen (14) hours from 6:00 A.M. to 8:00 P.M. and was recorded in a 15-minute interval. Vehicles were classified into cars, jeepneys, buses, trucks, and tricycles. For comparison purposes, the researcher classified the vehicle into cars, jeepneys, and buses/trucks since the tricycle can be treated as car although it is smaller in size because it can cause considerable queuing on the road like the passenger car. The researcher did this because the TEC adopted this vehicle classification in most of their studies relative to the warranting of unsignalized intersections.

Results and Discussion

Traffic Characteristics of the Intersection

In the MacArthur Highway-Dagupan Asingan Road intersection being studied, it was observed that during peak periods, cars and tricycles contributed much to the worsening of the traffic situation of the city. Likewise, some of the buses and trucks that are bound to the north and even to the south are contributory to the said situation of the city. The unregulated stoppage of vehicles as well as loading and unloading near the intersection causes the unstable flow. It was also noticed that the local tricycles have on-street parking along Ambrosio street which causes the left turning of north bound vehicles of MacArthur Highway to have a long queue which is likewise caused by the insufficient carriageway width for the said turners. When unmanned by traffic officers, the traffic must be managed to force its way into the intersection.

Traffic Flow

The vehicular volume during the fourteen-hour survey is presented on Table 1. it is noticed that there are about 27,654 vehicles that flow at the intersection during the aforecited number of hours in a day. Thus, the volume or flow is 1976 vehicles per hour for the fourteen-hour survey.

Table 1. Distribution of vehicle volume during the 14-hour survey

Time	Vehicle Classification			Total Vehicle
	Car	Jeepney	Bus/Truck	
6.01-7.00 a.m.	1155	134	198	1487
7:01-8:00	1956	183	269	2408
8:01-9.00	1213	237	278	1728
9.01-10.00	1241	182	278	1701
10.01-11.00	1183	179	256	1618
11.01-12.00	1997	266	339	2602
12:01-1:00 p.m.	1260	170	306	1736
1.01-2.00	1331	166	324	1821
2.01-3.00	1300	200	391	1891
3:01-4:00	1311	176	395	1882
4.01-5.00	1470	146	301	1917
5:01-6:00	2198	211	494	2903
6.01-7.00	1691	98	291	2080
7,01-8.00	1578	79	223	1880
Total	20,884	2427	4,343	27,654
%	75.52	8.78	15.70	100

Peak-Hour Period

The vehicular volume of the intersection under study during the peak-hour period is shown on Table 2. It is revealed that 11-12 is the peak hour in the morning and 5-6 in the afternoon. It presents the movement and the vehicles per hour for

morning and afternoon peak-hour periods. It indicates that vehicles from the north-bound portion of MacArthur highway has the highest number of vehicles followed by the traffic flow for the south-bound of the same corridor.

Table 2. Distribution of vehicles based on classification by movement during the peak hour period

No.	AM Peak (11-12 Nn)				PM. Peak (5-6 P.M.)			
Movement	Car	Jeepney	*Bus/* Truck	Total Vehlcle Per Hour	Car	deepney	Busl Truck	Total Vehicle Per Hour
	107	5	10	122	175	3	11	187
2	209	13	20	242	208	16	24	248
3	195	8	22	225	179	13	31	223
Sub-Total	511	26	52	589	560	32	66	658
4	216	60	54	330	12	20	76	278
5	448	65	0	593	467	53	164	684
6	32		4	37	60	1	7	68
Sub-Total	696	126	138	960	709	74	247	1030
7	73	6	8	87	126	2	9	137
8	177	1	15	193	211	4	26	241
9	71	2	4	77	103	3	8	114
Sub-Total	321	9	27	357	440	9	43	492
10	15	I	2	13	52	3	2	57
11	290	90	119	499	305	70	131	506
12	164	14	1	179	132	23	5	160
Sub-Total	469	105	122	696	489	96	138	723
Grand Total	1997	266	339	2602	2198	211	494	2903
%	76.74	10.22	13.04	100	75.72	7.27	17.01	100

Criteria in Warranting Intersection for Signalization

TEC Warrant

In Figure 1, it is shown that the TEC Warrant is below the computed warrants. The value of the vehicle per hour for the major and minor roads are above the curve as reflected in Figure 1. This indicates that the intersection, MacArthur

Highway-Dagupan Asingan Intersection, is warranted for signalization as described in the criteria used by the Traffic Engineering Center (TEC).

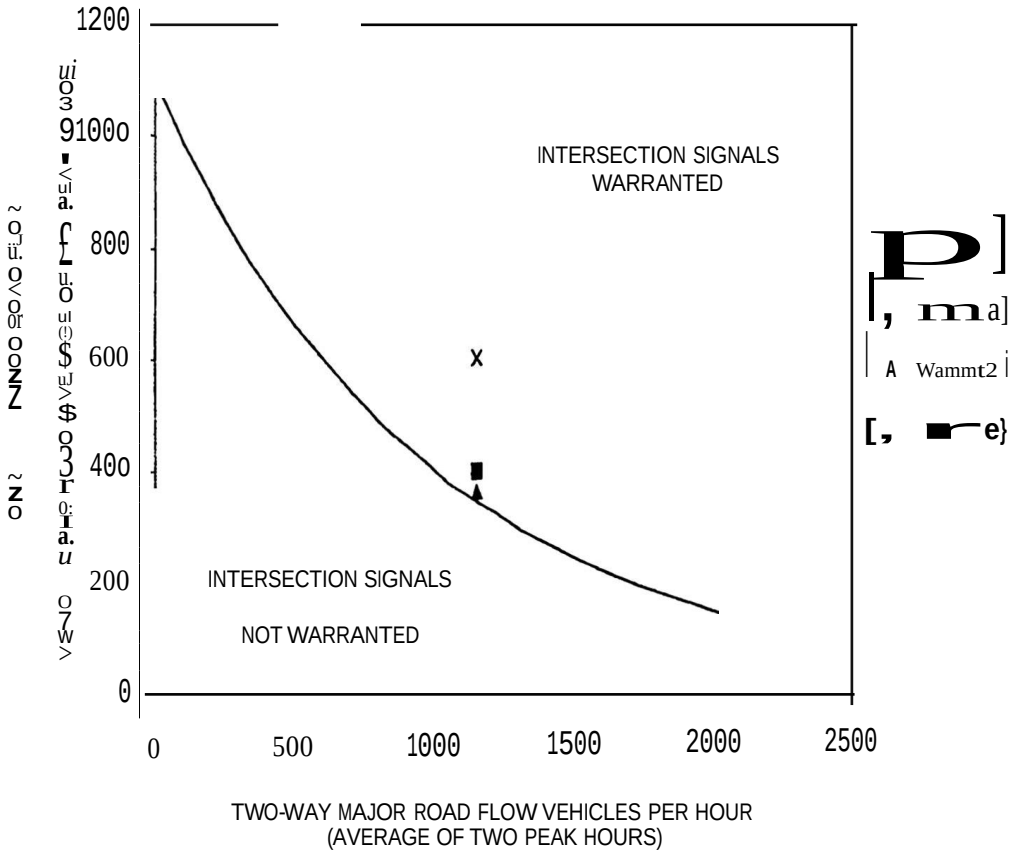

Figure 1. TEC Warrant

MUTCD Warrant, Four-Hour Vehicular Volume

Based on the conditions for hour vehicular volume, the plotted points representing the vehicle per hour on the major street and the corresponding vehicle per hour of the minor street is illustrated in Figure 2.

Figure 2. MUTCD four-hour vehicular volume

Degree of Saturation

Based on the template for capacity analysis for planning and operation method used by the Traffic Engineering Center (TEC), the existing degree of saturation of the intersection in the Mac-Arthur Highway-Dagupan Asingan intersection is presented on Table 3. For the degree of saturation "Y", the total critical y value is greater than 0.85, which are 0.963 and 1.102 for morning and afternoon periods, respectively. This means that it is over capacity or the facility cannot accommodate the number of vehicles moving in the intersection. With the above observations, it is, therefore, conclusive that the intersection is warranted for signalization.

Table 3, Comparative value of degree of saturation for MacArthur-Dagupan Asingan Intersection, Urdaneta City, Pangasinan.

A.M. Peak Period 11-12		P.M. Peak Period 5-6	
Existing Condition	With Geometric Improvement	Existing Condition	With Geometric Improvement
0.963	0.682	1.102	0.794
Over Capacity	Below Capacity	Over Capacity	Near Capacity

It is clearly shown on the table that the degree of saturation for the AM peak hour period is 0.682 and 0.794 for the PM peak hour period. With the additional right-of-way (ROW), the degree of saturation may decrease by about 30%. Thus, the degree of saturation is described as below capacity and near capacity for morning and afternoon peak hour periods, respectively.

It is recalled that the intersection is within the central business district; with twelve (12) movements of traffic; there is heavy volume of vehicles entering/exiting the intersection especially during peak hours; with considerable volume of left-turning vehicles; there is insufficient and substandard traffic control for pedestrians and vehicles; poor visibility and poor lightings; and traffic enforcers manage the traffic flow along the intersection under study.

Suggested Improvement at the Intersection

In order to solve the existing traffic problems of the local government units, the improvement and development of new infrastructure facilities for traffic management plans should be implemented by installing traffic signals. A fly-over is recommended for a long-term solution to ease congestion and to reduce if not to eliminate other transport-related problems. This is presented on Table 4. Also the plan for the traffic signalization and the fly-over is shown in Figure3.

Table 3. Improvement and development of new infrastructure facilities for the traffic management plan

Indicator	Proposed Traffic Management Measure	Traffic Impact Indicator	
		Advantage	Disadvantage
Geometric Improvement • Road Widening • Road pavement	• Additional lane along the MacArthur Highway • Tum regulation, • parking control, • stop/yield, • pedestrian, • Precinct, • bus lane/road vehicle ban and rehabilitation of pavement marking	• Short term to measure aimed at controlling and managing traffic in the site • Reduces conflict movement/flow • Additional lanes for the purpose of increasing road capacity	• Need enforcer visibility to regulate/manage the traffic
Installation of a Traffic Signalization System • *Traffic Actuated Signals* o *Vehicle detector* o *Actuated controller*	• Tum regulation, • parking control, • pedestrian. • and rehabilitation of pavement markings	• **A** medium-term aimed at controlling and managing traffic in the site • Reduce travel time, delay/improve average speed • Increase road capacity by reapportioning green time • Assign right of way (ROW) to conflicting movements • Improve the safety and efficiency of both pedestrians and vehicles,	• Costly to install; and expensive cost of the electrical power consumed during operation 24 hours a day • Causes excessive delay during off-peak hour periods

Table 3 continued.,...

Indicator	Proposed Traffic Management Measure	Traffic Impact Indicator	
		Advantage	**Disadvantage**
		reduce angle (broadside) collision • Ensure a hannonious and comfortable environment by reducing air pollution through efficient energy consumption • Enforce discipline	
» *Fly-Over*		• A long-term facility for linking the site to other arterial roads	ı Costlyto Construct
» *Additional ROW*		• Reduces travel time and delay/ improves average speed • Improves efficient movement of vehicles • Improves the safety and efficiency of vehicles • Ensuresa hannonious and comfortable environment by reducing air pollution through efficient energy consumption • Reduces conflict	• Costly road mainte-nance • Decreases Road Friction

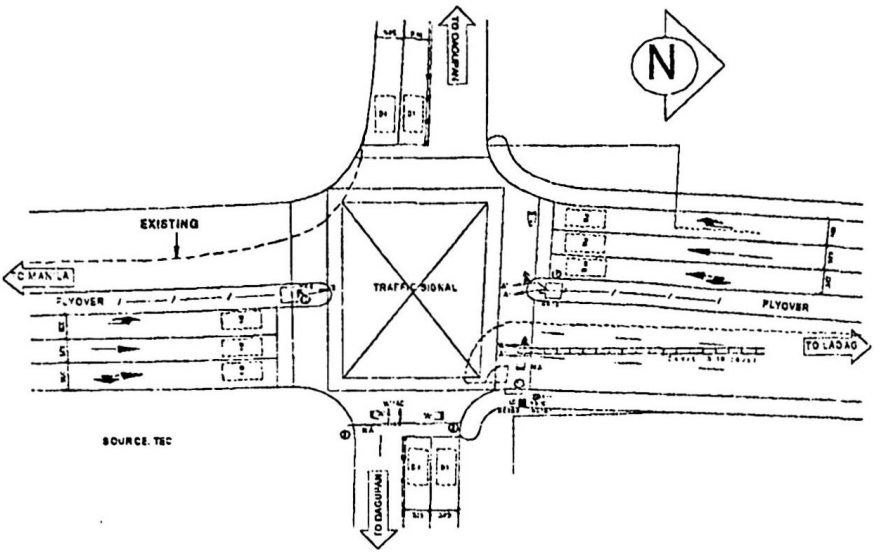

Figure 3. MacArthur Highway Dagupan Asingan intersection, Urdaneta City, Pangasinan with traffic signalization and flyover project

Conclusions and Recommendations

Based on the findings of this study, the following conclusions and recommendations are drawn:

I. The Traffic flow or volume of vehicles that traverse the unsignalized intersection located at the concentrated central business district or CBD of the urban area which is the Mc-Arthur-Dagupan Asingan Road of Urdaneta City, Pangasinan is very alanning because there are about 27,654 vehicles with different modes of transportation. Therefore, the flow in the intersection is 1976 vehicles per hour. It is recommended that the LGUs of the said city should review their traffic scheme or traffic management scheme and reroute the vehicles to other alternative roads in order to reduce the traffic flow in the intersection. Likewise, other researchers are encouraged to conduct similar studies in order to analyze and project the trip generation by zone or neighborhood, flow patterns in order to project the future transportation demand. Also origin-destination should be considered in order to improve the traffic assignment in the area. Further, an in-depth analysis of traffic flow should be considered to determine whether or not the intersection is warranted for signalization.

2. The peaking period in the afternoon/evening along the Mc-Arthur Highway-Dagupan Asingan Road is within the period that is commonly observed in the concentrate central business district of most urban areas which is 5-6P.M. The peaking period in the morning which is 11-12 NN is outside the common peak period in some places which is 7 to 9. These are common peak hours in the area because Urdaneta is found almost half-way from Metro Manila and from the Northern part of Ilocos Region (**e.g.** Vigan City and CAR). The local media should inform the public about the traffic situation of a certain road or intersection so that the drivers can take alternative roads in case of traffic congestion in the area.

3. The LGU should introduce new alternative solutions to address traffic congestion at unsignalized intersections such as geometric improvements, installation of traffic signals, and construction of fly-overs.

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