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PRACTICES OF LOCAL GOVERNMENTS ON TRAFFIC SIGNALIZATION OF INTERSECTIONS

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ABSTRACT

This paper presents the practices of local government units outside Metro Manila on traffic signalization of unsignalized intersections. The information revealed in this research is based on the perspectives of the local officials of the 23 cities or 23.46 % of the 98 cities in the Philippines excluding the 14 cities of Metro Manila. Most of the city respondents are thickly populated. Majority of them are first class cities wherein there is a yearly increase in the number of registered motor vehicles. The level of necessity and level of attainment of objectives for traffic signalization are Very High and High, respectively. Some of the LGUs have not installed traffic signals because of budget constraints. They tap the expertise of the Traffic Engineering Center (TEC), Traffic Engineering and Management (TEAM), and the academe (e.g. National Center for Transportation Studies) for the conduct of traffic engineering studies. TEC warrant is the most frequently used criterion considering vehicular volume as the indicator for the warrants. There is a significant relationship between the basis in warranting signalization for intersection and the level of necessity and level of attainment of objectives; between funding agencies and level of necessity and level of attainment of objective ; and reason for non-implementation of traffic signalization and necessity and level of attainment of objectives. Also there is a significant relationship between the consultation which was administered by local officials and the level of attainment of objectives for signalization. The formulation of the guidelines in the implementation of traffic signalization among the local government units and agencies concerned are recommended.
Key Words: Traffic Signalization, Traffic Management

1. BACKGROUND

The historical and socio-economic backgrounds of cities vary from country to country. Issues on transportation are some of the concerns of city administrators, engineers, and planners.

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Highly populated cities and municipalities are confronted with serious transport problems. This is the result of inevitable growth of different transport modes that invite more projects that would ease the congestion of vehicles and pedestrians, to ensure safety among drivers and pedestrians, and reduce or eradicate the occurrence of accidents especially along highways and unsignalized intersections.

National highways are considered as vital access to the different local government units (LGUs) in the Philippines because they provide the framework for networks of arterials, collectors, and local streets. Along these national roads are intersections.

Unsignalized intersections (crossroads and T-junctions) where traffic is regulated by traffic signs are the most commonly used intersections in traffic management. The right-of-way regulated by traffic signs presupposes that a driver makes the decision to pass through if he is at the first waiting position directly at the stop line.

It cannot be denied that some unsignalized intersections along the national highways and/or arterial roads are very much congested and most often have limited pedestrian and other safety signals for drivers.

Generally, the monitoring public thinks about traffic control in terms of traffic signals. Signals are the most visible forms of control that can affect the performance of motorists. Other traffic control devices may be in the form of markings and traffic signs. The federal Manual on Uniform Traffic Control Devices (MUTCD) of 2003 states that the purpose of control devices and warrants for their use is to help ensure highway safety by providing for orderly and predictable movement of all traffic throughout the national highway transportation system, and to provide such guidance and warnings as needed to ensure the safety and orderly operation of individual elements of the stream.

Traffic signals are probably the most easily recognized traffic control devices. In some busy intersections in a large city, a traffic signal may control the movement of more than 100,000 vehicles per day. It directs streams of vehicles and pedestrians when to go, stop, or proceed with caution. The traffic signal is effective in reducing congestion and it minimizes delay.

This study assessed the need for traffic signalization at intersections in the Philippines by considering the issues, concerns, and practices of the local governments.

2. OBJECTIVES OF THE STUDY

The study generally presents the practices of the local government units outside Metro Manila on the traffic signalization at intersections.

The study considered the following specific objectives:

- To determine the socio-demographic profile of the city respondents
- To describe the traffic background of the cities
- To determine the significance and level of necessity of signalization

Based on the abovementioned objectives, the study aimed to recommend procedures that are significant for traffic signalization.

3. SIGNIFICANCE OF THE STUDY

The study intends to provide essential empirical data on the traffic conditions, issues, and concerns of the cities which are considered as prime movers of the LGUs as far as traffic management policy formulation and implementation is concerned.

It is hoped that the findings thereof, the conclusions, and the recommendations will influence planners and local government units to make changes and improvements in the existing guidelines in the installation of traffic signals with the end in view of alleviating their traffic problems.

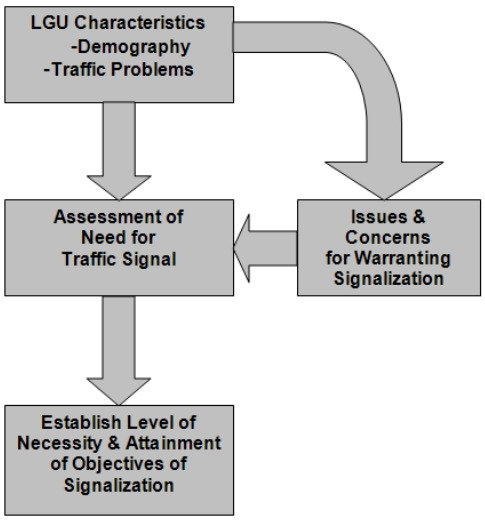

Figure 1. Research Framework

4. STUDY FRAMEWORK

Figure 1 shows the inter-relationship among the following elements: local government unit characteristics, assessment of need for traffic signal, established level of necessity and attainment of objective of traffic signalization, issues and concerns for signalization.

5. RESEARCH METHODOLOGY

This study used the descriptive method of research. This method was employed to describe the existing conditions of the cities as well as obtain facts, practices, and perceptions of the respondents. The respondents were composed of city officials such as the City Engineers and City Planning and Development Coordinators. The said city officials were chosen because they are responsible for engineering services, planning, and evaluating the implementation

Number of Motor Vehicles	Year							
	2001		2002		2003		2004	
	No.	%	No.	%	No.	%	No.	%
60,000 and above	1	4.35	1	4.35	2	8.70	3	13.05
40,000 - 59,999	5	21.74	6	26.09	5	21.74	5	21.74
20,000 - 39,999	10	43.48	12	52.17	12	52.17	13	56.51
Below 20,000	7	30.43	4	17.39	4	17.39	2	8.70
Total	**23**	**100.00**	**23**	**100.00**	23	**100.00**	**23**	**100.00**

Source: Land Transportation Office

Table I. Distribution of Motor Vehicles Registered at the Land Transportation Office CY 2001-2004

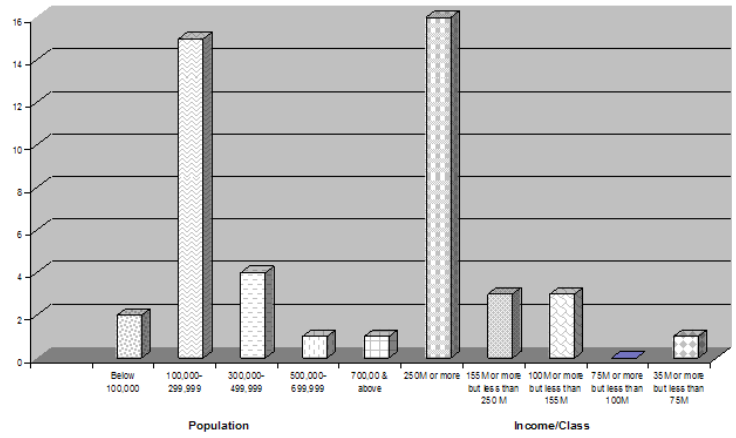

Figure 2. Profile of Cities in Terms of Population and Income/Classification

of different programs, projects, and activities of LGUs. Key Informant Interview (KII) was employed wherein information was drawn from the respondents and revealed in the course of the research. Survey questionnaires were distributed to the different cities outside Metro Manila from January 2005 to September 2005. The retrieval of the questionnaires was completed only in February 2006. Data on the number of registered motored vehicles were gathered from the Land Transportation Office on April 2006.

6. RESULTS OF THE STUDY

This study aimed at determining the need for traffic signalization at intersections along national highways. The profiles of the twenty-three city respondents outside Metro Manila are presented on Figure 2, while the traffic background is reflected on Figure 3. Sixty-five percent of the city respondents have 100,000 - 299,999 population; 70% have an income of 250 million or more and 56% have 20,000 - 39,999 registered motor vehicles for the year 2004 at the Land Transportation Office as shown in Table I; 87% of the cities are experiencing traffic congestion; 78% of the city

Region/Province/City	Frequency					
	6	**5**	**4**	**3**	**2**	**Total**
Luzon						
Ilocos Norte (Laoag City)			6			6
La Union (San Fernando City)			3			3
Pangasinan (Dagupan City)			4			4
Pangasinan (Urdaneta City)			2			2
Tarlac (Tarlac City)			3	1		4
Zambales (Olongapo City)			1			1
Pampanga (Angeles City)			5			5
Bataan (Balanga City)			4			4
Batangas (Batangas City)			8			8
Batangas (Lipa City)			5	2		7
Laguna (San Pablo City)		1	2	2		5
Rizal (Antipolo City)			3			3
Albay (Legaspi City)			2	5	1	8
Camarines Sur (Naga City)			4			4
Sub-total		1	52	10	1	64
Visayas						
Iloilo (Iloilo City)			8			8
Negros Occidental (Bacolod City)			19			19
Cebu (Talisay City)			2	1		3
Cebu (Cebu City)	1	2	67	20		90
Cebu (Toledo City)			4	1		5
Leyte (Tacloban City)				4		4
Sub-total	1	2	100	26		129
Mindanao						
Misamis Oriental (Cagayan de Oro City)			15	5		20
South Cotabato (Gen. Santos City)		3	10	5		18
Surigao del Norte (Surigao City)	1			1		2
Sub-total	1	3	25	11		40
Total	2	6	172	46	1	227
%	1	2.5	76	20	0.1	100

Table II. Distribution of Intersections Warranted for Signalization in Selected Cities Outside Metro Manila

respondents claim that the traffic enforcers/policemen are the people responsible for managing the traffic along intersections; 91% claim that passenger jeeps contribute to the problem on traffic congestion; 91% of the LGUs reported that intersections along the national highway and/or arterial roads are warranted for traffic signalization and there are 227 intersections warranted for traffic signalization as reflected on Table II; 61% of the LGUs have existing traffic signals along the intersections and there are 141 installed traffic signals as shown on Table III.

Location	Number of Legs					Year				
	6	5	4	3	Total	1991-1995	1996-2000	2001-2005	Abs-tained	Total
LUZON										
Region I										
Ilocos Norte (Laoag City)			1		1			1		1
La Union (San Fernando City)			1		1			1		1
Pangasinan (Dagupan City)			4	1	5			5		5
Tarlac (Tarlac City)			1	1	2		2			2
Zambales (Olongapo City)			1		1				1	1
Region IV-A										
Batangas (Batangas City)			7		7				7	7
Laguna (San Pablo City)		1	2	3	5	5				5
Rizal (Antipolo City)			2		2				2	2
Region V										
Albay (Legaspi City)				3	3		3			3
Sub-total	-	1	19	7	27	5	5	7	10	27
VISAYAS										
Region VI										
Negros Occidental (Bacolod City)			5		5	4		1		5
Region VII										
Cebu (Cebu City)	1	2	67	20	90				90	90
Cebu (Talizay City)			2	1	3			3		3
Sub-total	1	2	74	21	98	4		4	90	98
MINDANAO										
Region X										
Misamis Oriental (Cagayan de Oro City)	1		9	3	13	10		3		13
Region XIII										
Surigao del Norte (Surigao City)				3		3		3		3
Sub-total	1	-	12	3	16	10	3	3	-	16
Total	2	2	105	31	141	19	8	14	100	141
%	2	2	74	22	100	13	6	9	71	100

Table III. Distribution of Intersections with Traffic Signals by Number of Legs and Year of Installation in Selected Cities Outside Metro Manila

Seventy percent (70%) claim that the traffic signalization is **very much needed** and the level of necessity of traffic signalization is **very high** with an overall mean of 4.43 as shown on Figure 5. On the attainment of the objectives of traffic signalization, the objective on traffic safety level or reduce incidence of accidents has the highest mean rating of 3.86 which is described as **high level** and as a whole , the level of attainment of the objectives is **high** with a mean of 3.60 as revealed on Table IV.

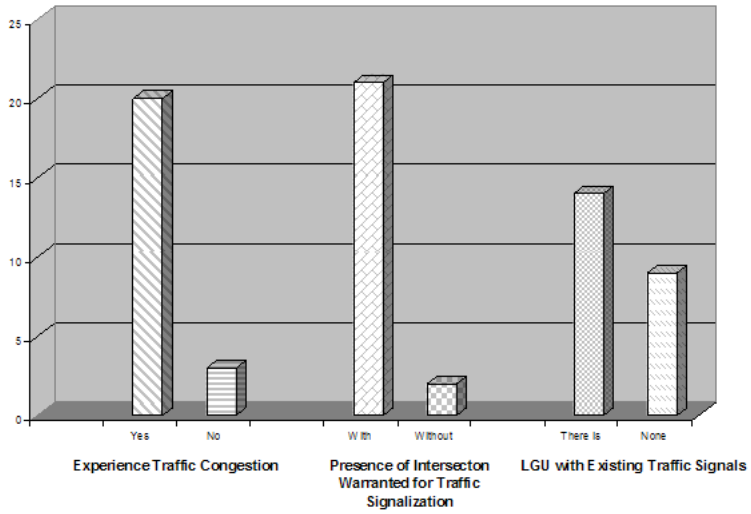

Figure 3. Traffic Backgrounds of the Cities

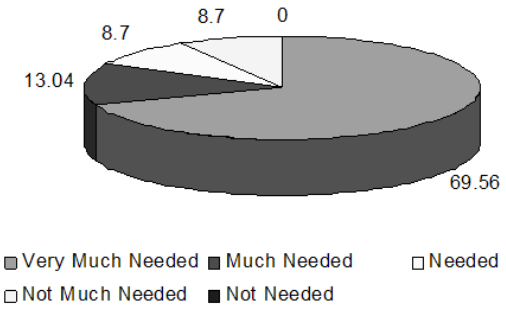

Figure 4. Level of Necessity of Traffic Signalization

Objectives	X	DR
1. Increase safety level or reduce incidence of accidents	3.86	High
2. Increase traffic efficiency and mobility by reducing travel time, delay, stops and improved average speed	3.64	High
3. Ensure a harmonious and comfortable environment by reducing air pollution	3.36	Average
4. Conserve energy	3.57	High
5. Increase road capacity	3.57	High
As a whole	**3.60**	**High**

Table IV. Level of the Attainment of Objectives of Traffic Signalization

a. With Consultation Administered for the Installation of Traffic Signals	**No.**	**%**
Yes	16	69.56
No	7	30.44
b. Source of Data on Traffic Accident Experiences in the Cities*		
Hospital	23	100.00
Police Stations	20	86.96
Traffic Enforcement Group/Department of Public Traffic Division/Traffic Management & Eng'g Unit	5	21.74
c. Criteria Used in Warranting Intersection for Signalization*		
TEC Warrant	20	86.96
Eight-Hour Vehicular Volume	8	34.78
Minimum Pedestrian Volume	10	43.47
Traffic Accident Experience	5	21.73
Peak - Hour Volume	13	56.52
Peak - Hour Delay	4	17.39
Four-Hour Vehicular Volume	12	52.17
d. Basis in Warranting Intersections for Signalization*		
A Guide to Traffic Engineering and Management Technique (Manual used by TEC and TEAM)	14	60.86
Manual on Uniform Traffic Control Device (MUTCD)	9	39.13
Template for Capacity Analysis for Planning and Operational Method (Program used by TEC)	14	60.86
Philippine Regional Manuscript Development Project and Transport & Traffic Management Studies	1	4.35
RA 4136 and City Ordinances	1	4.35
e. LGUs with a Feasibility Study to Support the Installation of Traffic Signals		
There is	14	60.86
None	9	39.14
f. Agencies Responsible for the Conduct of an Engineering Study*		
Traffic Engineering Center (TEC)	10	43.47
Traffic Engineering & Management (TEAM-PMO)	5	21.73
Department of Public Works & Highways (DPWH) District Office	2	8.69
Local Government Units (LGU)	13	56.52
National Center for Transportation Studies (NCTS)	1	4.35
Metro Cebu Land Use and Transport Study (MCLUTS)	1	4.35
Regional Cities and Development Project (RCDP)	1	4.35
g. Funding Agencies in the Installation of Traffic Signals at the Intersections		
LGUs	11	47.83
National Economic Development Authority (NEDA)	7	30.43
Regional Cities & Development Project (RCDP)	3	13.04
Countryside Development Funds (Congressmen)	1	4.35
Australian International Development Assistance Bureau (AIDAB)	1	4.35
h. Offices Involved in the Installation of Traffic Control System/Traffic Signals*		
City Officials (LGUs)	14	60.87
DPWH (District)	5	21.74
TEAM - DPWH (National Office)	1	4.35
Traffic Engineering Center (TEC)	6	26.09

*Multiple Response

Table V. Issues and Concerns of the LGUs Pertaining to Common Practices in the Installation of Traffic Signals

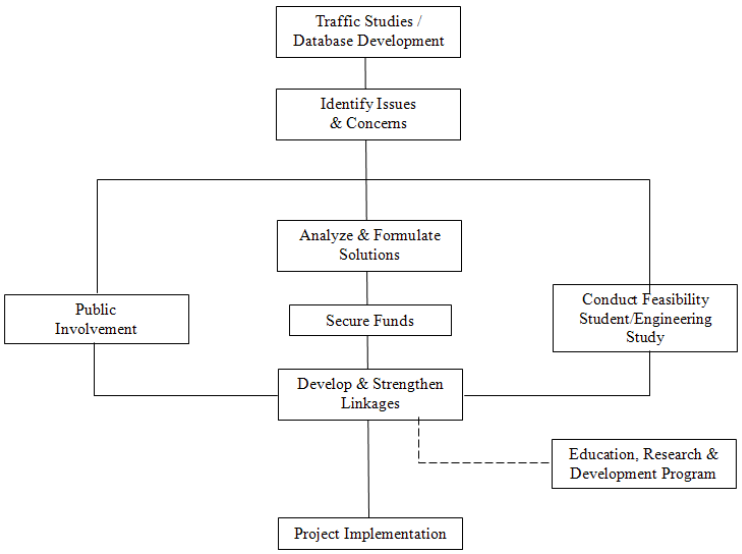

Figure 5. Traffic Signalization Process

Scheme*	No.	%	Alternative Traffic Scheme	No.	%
A. Modification and/or Improvement on:			A. Fly - over	2	8.70
-Sidewalk	11	47.82	B. Interchange		
-Channelization	7	30.43	Diamond interchange	1	4.35
-Markings	12	52.17	Directional interchange	2	8.70
-Pavements	12	52.17	C. Others		
B. Installation of:			Truck ban/bus ban	3	13.04
-Mid-block lane markings	4	17.39	Rerouting of vehicles	5	21.74
-Traffic signs	19	82.60	New road network	2	8.70
-Directional signs	6	26.08	Overpass	3	13.04
C. Creation of Traffic Management Unit	5	21.73	Odd & even scheme	1	4.35
D. Creation of Traffic Management Board	1	4.35	Segregation of public		
E. Traffic Enforcement Management	1	4.35	& private vehicles	1	4.35
			One-way scheme	2	8.70
			Turning movement regulation	1	4.35

*Multiple Response

Table VI. Traffic Management Schemes Implemented and Alternative Traffic Schemes to Alleviate Traffic Congestion

The issues and concerns in warranting intersections for signalization are shown on Table V; 70% have administered consultation; one hundred percent of the respondents got data from the hospital while 87% got data from the police station on traffic accident experiences. As to the criteria used in warranting intersections for traffic signalization, rank 1 by 87% is a TEC warrant and rank number 2 by 57% is peak-hour volume; 61% of the city respondents used both "'A Guide for Traffic and Management Technique"' and "'Template for Capacity Analysis for Planning and Operational Method"' ; 61% conducted a feasibility study to support the installation of traffic signals; 57% of the cities conducts engineering studies; 48% get funding

Variables	Level of Necessity	Level of Attainment Objectives
A. Socio-Economic Characteristics		
- Population	6.836	1.366
- Income Classification	1.6	1.137
- No. of registered motor vehicles	7.09	4.4
B. Traffic Background		
- Presence of Intersection confronted with congestion	1.228	.80
- Types of vehicles that contribute to congestion	1.0347	1.3883
- Presence of Traffic Signals	1.327	0.0

* significant at 0.05 level

Table VII. Relationship Between the Level of Necessity and the Level of Attainment of the Objectives of Signalization

Variables	Level of Necessity	Level of Attaining Objectives
Consultation	1.88	6.45*
Traffic Accident	1.456	2.66
Criteria Used in Warranting Signalization	3.281	0.699
Basis in Warranting Signalization	12.547*	7.35*
Presence of Feasibility Study	0.181	6.21
Agencies Conducted Engineering Study	15.91*	4.35
Funding Agencies	6.84*	7.78*
Offices Involved in the Installation of Traffic Signals	1.095	3.25
Reasons for non-implementation of traffic signalization	5.23*	8.925*

* significant at 0.05 level

Table VIII. Relationship Between the Level of Necessity and the Level of Attainment of Objectives of Signalization with the Issues and Concerns for Warranting Signalization

for the traffic signalization of intersection from the city administration; 61% say that the City Administrator is the number one involved in the installation of traffic signalization.

The most common traffic management schemes implemented by the city officials are the following: modification and/or improvement on marking and pavement and installation of traffic signs as shown on Table VI. The most common alternative traffic scheme being practiced is rerouting of vehicles.

Table VII presents the relationship between the level of necessity and level of attainment of objectives of signalization with the demographic profile and traffic background of the LGU which is the city in this study. The level of necessity and level of attainment of objectives are not significantly related to any of the items in the demographic profile and traffic background.

There is a significant relationship between the basis in warranting signalization for intersections and the level of necessity with chi-square $\left(\chi^2 = 12.547\right)$ and the level of attainment of objective $\left(\chi^2 = 7.35\right)$; between funding agencies and the level of necessity $\left(\chi^2 = 6.84\right)$ and level of attainment of objectives $\left(\chi^2 = 7.78\right)$; and reason for non-

implementation of traffic signalization and necessity $\left(\chi^2 = 5.23\right)$ and level of attainment of objectives $\left(\chi^2 = 8.925\right)$. Also there is a significant relationship between the consultation which was conducted by the local officials and the level of attainment of objectives for signalization as shown on Table VIII.

7. CONCLUSIONS

The information presented in the findings of this study are based on the perspectives revealed by the different local officials such as the City Engineers , City Planning and Development Officers, and the personnel in charge of the implementation of traffic management in their respective localities through key informant interview. A statistical analysis was used to determine the correlation between the level of necessity and level of attainment of objectives of traffic signalization.

From the findings and analysis made, the following were concluded:

1. Most of the cities involved in the study are highly populated. Majority of them are first class cities and have increasing number of registered motor vehicles every year. With this demographic profile, the cities experience traffic congestion. This may be the reason for the installation pf traffic signals at the unsignalized intersection along the national highways and implementation of traffic management schemes by the local government units.
   Despite the very high level of necessity and high level of attainment of objectives of traffic signalization, some cities have not implemented traffic signalization projects because of budget constraints.
2. Although the local government implemented the project on traffic signalization, they still tapped the expertise of TEC, TEAM, and the academe for the conduct of traffic engineering studies because they may be lacking in technical knowledge.
3. The city officials claim that they used TEC warrant as the criterion in warranting intersection signalization. Likewise, they have considered vehicular volume as the primary factor used as indicator for warranting signalization.
   As to the significant relationship between the level of necessity for signalization and the agencies responsible in the conduct of traffic engineering studies, significant relationship was shown between the level of attainment of objectives of signalization and consultation. This indicates that the city officials have disseminated the important reasons for implementing traffic signalization and the social benefits derived from this project.
   Both the level of necessity and level of attainment of the objectives of signalization show significant relationships with the basis of the warranting signalization of intersections and the funding agencies, and another significant relationship exists between the level of necessity and level of attainment of the objectives for signalization with reasons such as non-implementation of the project. This implies that the basis for warranting signalization could justify the urgency and the funding agency could validate the exigency of the project, and the sustainability of attaining the objectives of installing such traffic signals.

8. RECOMMENDATIONS

The following are the recommendations of the study:

1. To make the city officials more responsive, the concerned agencies on traffic administration should review and enrich the criteria and procedures in the implementation of traffic signalization.
2. The Traffic Engineering Center (TEC), Traffic Engineering and Management (TEAM) should extend their services in the planning and designing of transport facilities (e.g. traffic signals) to deliver an effective and efficient implementation of traffic services in the cities. Likewise the academe (e.g. National Center for Transportation Studies, University of the Philippines, etc..) with their expertise should take the lead in developing and strengthening the knowledge of the local government units along traffic management and engineering studies (e.g. traffic signalization, etc.), so as to enable the local officials (e.g. City Engineer, City Planning and Development, etc.) to provide better quality and more prompt service for all. Likewise, the Department of Transportation and Communications (DOTC) should be tapped also because it is directly in charge of the formulation of transportation policies and it is responsible for recommending such policies to the Land Transportation Office (LTO) and Land Transportation Franchising and Regulatory Board (LTFRB).
3. To enable the local government units to achieve effective and efficient implementation of traffic management, it should increase taxes in order to enhance general funds appropriation through ordinances promulgated by the City Council . The fees generated for special funds shall cover operating and capital expenditures and to achieve sustainability of the traffic signalization program of the city. Likewise it should seek funds from funding agencies for the construction of developmental projects in line with the improvement of the transportation system in the city.

Because of the limitations of this study, other researchers may consider other factors in warranting signalization using other settings Likewise, other researchers should conduct an economic analysis to explore the possibility of trying these aspects to determine the ultimate decision of the local government units to find out whether or not to install or remove traffic signals at intersections.

A procedure for traffic signalization is suggested based on the common practices of the implementing agencies. Likewise, they recommend the formulation of a policy to set guidelines in the implementation of traffic signalization among local government units and agencies concerned.

The following are the suggested procedures for traffic signalization:

1. The city officials shall prepare a proposal indicating the conduct of a traffic signalization project.
2. The city officials shall extend their linkages by requesting the Traffic Engineering Center (TEC) and the Traffic Engineering and Management Office of the Department of Public Works and Highways (TEAM-DPWH) and the LGUs outside Metro Manila to formulate a technical working team. The team will conduct reconnaissance, traffic survey, physical inventory, identification of land use, and other related traffic engineering studies. The team is also responsible for the planning and designing of traffic signals.

3. The members of the technical working team and the representatives from the city governments such as the City Engineer and the City Planning and Development Officers and other personnel who are involved in the project shall prepare a traffic engineering study.
4. After the conduct of the engineering study, the mechanics for the implementation of the project shall be employed.

Finally, the traffic signalization process shown in Figure 5 is recommended to uplift the traffic signalization program of the different local government units outside Metro Manila. The process provides interrelationship between basic elements that are necessary in providing an effective and efficient flow of people and goods at intersections through traffic signalization.

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