Local Area Traffic Management in Surabaya

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ABSTRACT

There has been a consistent interest at both the metropolitan scale and at the local level to reduce energy consumption, relieve traffic congestion, enhance the mobility of central business areas, promote pedestrian and bicycle use, and improve parking management. Over several years, a large amount of event relevant to local area planning in Surabaya has been required. A few considerable topics of planning, such as pedestrian movement facilities, bicycle lane planning, connected public transportations facilities, the traffic management, and parking design are particularly applicable to local area planning and design in certain area of Surabaya especially with some business area shares, education and commerce.

Keywords: Local area traffic planning and design

1. INTRODUCTION

1.1 Backgrounds

Local area planning embraces solutions for existing neighborhoods and their expansions or renovations. New developments or area improvements of cities can also be included in this category. Local area solutions is a must, absolutely be followed with planning solutions at the wider metropolitan scale, through community involvement and negotiation (Black, 1981 ; Blunden and Black, 1984; Ogden and Bennett, 1984).

Local area planning provides vital access service to abutting lands through local street networks. In this case, local street networks are the main part of local area planning. Accessibility considerations are required by both goods and people and must be carefully managed to maintain a balance between providing all of the needed service without creating too much traffic congestion. These accessibility considerations come in many forms, including on-street parking, access to off-street parking facilities, curb lane loading zones for commercial vehicles operations, curb lanes and spaces for public transportations transit. Inclusion appropriate space and locations for these and similar types of facilities must be incorporated into a cohesive plan for a local street networks. As explained, local street networks serve a wide variety of land-use patterns. Provision of adequate street widths and access to arterial streets is generally required for local streets to function well in such areas. The happening of complicated problems of traffic in Surabaya, for example, can be classified into fourth major problems.

First, is about an uncertainty of land-use planning that is executed. There are a many changes of land-use planning that permitted in downtown not due with the effect to traffic problems possibility.

Second, is about the logic of traffic planning and traffic orderly policy. In generally, the logic of traffic planning that applied in Surabaya is very unordinary and traffic orderly policy is inconsistent. For example, is about application of parking prohibition order in certain street that linked with commercial area but in fact, the prohibition had just violated by a several vehicles, cars or motorcycles parking just right in the front of prohibition sign.

Third, is about pedestrian adequate facilities. One of the related things that need more attentions on traffic engineering process in urban areas especially in Surabaya is the availability of pedestrian facilities. Generally, in residential area and in central business district (CBD) pedestrian lane representing a conflict side in frequently with traffic current. This could often make a traffic delays and affecting the pedestrian safety. From the entirety percentage of sidewalk facilities amount in Surabaya, it's only about 30% that have a good condition and properly to use (Silas, 1996).

Fourth, is about driver behavior. This driver behavior is influence to driving characteristics of each personal who takes a part as the road users. Careless driving and traffic regulations disobedience often makes traffic accidents. Further, in many areas, local street systems divided into three primary objectives of design, management, control and operation. The primary objectives are:

1. Adequate allocation of curb lane and space should be provided among the concerned public transportations
2. Safety of bicyclist and pedestrians must be assured

3. Appropriate access to and through the local network must be provided for emergency vehicles

1.2 Objectives

The objectives of these studies are to:

- Determine a solving possibility of basic problems on local area traffic management in Surabaya
- Arrange the technical strategies about problem and solving related with traffic engineering
- Brainstorm what is the better to do to overcome all the problems due with traffic and city development

2. FORMULATIONS of PROBLEMS

Formulations of problems can be defined as mentions:

- Related with a local area traffic management problems in Surabaya, what the possible and precisely solutions that can be carried out?

3. BASE of THEORY

3.1 Planning for Pedestrians and Bicycle Facilities

3.1.1 Planning for Pedestrians Facilities

Particularly in urban and central business district (CBD) locations, the pedestrian presents an element of sharp conflict with vehicular traffic, resulting in high accident rates and traffic delays. Pedestrian movements and characteristics must be studied for the purpose of providing a design which minimize pedestrian – vehicle conflicts, increases pedestrian safety, and minimizes vehicle delays.

Careful assessment of demand, design standards, functional elements, and space design is required for pedestrian facility planning. It's best to begin a study by defining the goals and objectives of the project. Safety may be the predominant objective when pedestrian-oriented commerce areas permit access to buses, taxis and operations vehicles. Pedestrian demand consists of estimating traffic volumes, traffic patterns, and composition.

Land-use patterns and building types will provide information relating with trip generation. Optimal space design may be considered as the best functional space that most economically, effectively, and safely accommodates the movements of pedestrians.

An analytical approach proposed by Benz (1987) and Fruin (1992) uses a time – space (T – S) concept, taking into the balance between time and space. T – S analysis is particularly applicable in dealing with complicated cases of personal space occupancies related to pedestrian activities.
T – S supply is the product of the time of the analysis and the area of the space being analyzed. So, the T – S demand is the product of the total number of pedestrians using the analysis space and their time of occupancy. The objective is to evaluate the adequacy of a given space for a forecasted peak-period demand and the occupancy time of pedestrians walking or standing in this space. By dividing the T – S supply by the T – S demand, the average area occupied per pedestrian and the corresponding Level of Service can be determined as follows:

$$a = \frac{T - S\,supply}{T - S demand} = \frac{TS}{nt}$$

Note:

a = average area per pedestrian (ft^2/ped) within the analysis space, during the analysis period
T = time of analysis period (min)
S = net effective area of analysis space (ft^2)
N = numbers of pedestrians occupying the space (walking, standing, etc.)
t = predicted occupancy times of pedestrians for functions performed during the analysis period

The basic pedestrian characteristics and their application are important to planning and designing of pedestrian facilities. The basic pedestrian characteristics are:

- Pedestrian speed (average walking speed, expressed in ft/sec)
- Pedestrian flow rate (number of pedestrians passing a point per unit time, expressed as pedestrians per minute)
- Pedestrian density (average number of pedestrians per unit area within a walkway, expressed in pedestrian per ft^2)
- Pedestrian space (average area provided for each pedestrian, expressed in ft^2 per pedestrian)

A basic requirement of pedestrian lane width for pedestrians passing each other generally is 2.5 ft (0.75 m) width each. Pedestrians walking together may require a width of 2.2 ft (0.66 m) each. The width of walkway that can effectively be used by pedestrians is called the *clear walkway width*.

The space required for pedestrian movement may be divided into a pacing zone, the area required for stepping and walking, and also the area required for psychological factors of the pedestrian (sensory zone). The length of the pacing zone is dependent on the age, gender, and physical condition of the pedestrian. Both the pacing and sensory zones can be affected by external influences such as terrain and traffic conditions.

The relationship between pedestrian speed, density and flow relationship is expressed on this equation:

$$\upsilon = S \times D$$

Note:

υ = pedestrian flow (ped/min/ft)

S = pedestrian speed (ft/min)
D = pedestrian density (ped/ft^2)

In designing pedestrian facilities, these following factors should be considered:

- Comfort and convenience: walking distances, directness, grade on ramps, stair suitable for elderly and disabled person, directory maps, and other things that contribute to the ease of pedestrian movement
- Safety: separation of pedestrian traffic control devices from vehicular traffic that safeguard the lives of pedestrians
- Security: pedestrian lane lighting, crime-free environment

3.1.2 Planning for Bicycle Facilities

Although bicycle traffic composes only a small percentage of the total traffic stream, it is sufficient enough to have an impact on street design and planning. Recent accident studies have indicated that the bicyclist has been increasingly involved in vehicles with bicycle collisions. According of this fact, initiative extensive programs must provide the bicycle facilities designated as bikeways as well as bicycle lanes on streets. Now, bicycling is no longer a recreational activity, but is considered a feasible alternative of 'eco-friendly' mobile particularly.

Designated bicycle lanes are lanes of the street that are assigned exclusively for the use of bicycles. These lanes are separated from vehicles traffic by pavement markings. Bicycle lanes are normally placed on streets where bicycle use to move and the separation of bicycle lanes from vehicles traffic may be warranted. Bicycle lanes are generally used for flow in one direction only, with a lane provided on each side of the street.

The width of on-street bicycle facilities vary widely, ranging from 4.0 ft (1.20 m) designated lane to a 10-ft (3.0 m) paved shoulder. In addition, bicycles can use space from the adjacent lane when vehicles traffic is low. It is recommended that bike-way facilities should be observed to determine the number of effective lanes. Level of service of on-street bicycle lanes is impacted by following aspects such as light and heavy vehicle traffic, commercial and residential access road, and adjacent on-street parking.

Usually, bikeway facilities have to be planned and located to integrate with the existing street. Some important criteria used in evaluating feasible bikeway routes are as follows:

- The potential demand for the use of the route must be determined.
- The basic width needed for safe usage must be provided
- Continuity and directness of bikeway route is essential, connecting points of importance area
- Safety is a prime objective of planning. Attempts to minimize vehicles with pedestrian conflicts should be given in the main priority.
- Environmental disturbance such as heavy vehicle emissions must be considered, because carbon monoxide is definitely hazardous to bikeway users
- Separations between vehicle traffic and bicycle lane should be considered in order to avoid the affect of moving vehicles that can upset the balance of a bicyclist

Highlights of important design elements are as follows (ITTE, 1975; FHWA, 1980 ; Edwards, 1992 ; Pline, 1992):

- Design speed: 7 – 20 mph (11,2 – 32 km/h)
- **Bikeway width:** the bikeway width depends on the bicycle width, maneuvering allowance, clearance between oncoming and passing bicycles. There must be at least 2.50 ft (0.75 m) of horizontal separation between bicycle lanes and pedestrian lanes.

3.2 Traffic Planning and Management at The Local Level

There are wide range of land-use and traffic planning problems that call for quantitative and qualitative examination ranging from commerce area to aligning the best approach to a residential area. Development applications call for meaningful traffic appraisals by local traffic engineers on a day to day measurement. Examples of traffic generation appraisals can take various forms, such as the following:

- Estimating the site's future effects on the traffic services of existing adjacent roads
- Planning a major residential area development with an internal and external accessibility system, parking arrangements, and connecting with existing surface roads
- Assuming various alternatives for proposed changes to land-use zoning ordinances and subdivision regulations over extensive areas of the city

Generally, the use of traffic generation analysis to assess traffic impacts is what is required in most local area planning. For performing this analysis, the traffic activity associated with a site or particular land-use activity is needed. From this information, the number of one-directional vehicular movements departing or arriving from the studied area per unit of time is determined.

The basic data requirements are the following:

- Expected daily traffic generation rates for each land-use or activity encountered
- Expected hourly traffic generation rates

- Expected traffic generation rates at peak-hour traffic conditions

The most important considerations for the street design when analyzing street closures for vehicles are as follows:

- Parking facilities along the street (on street parking) must be analyzed as a lateral obstruction and it's reduce the effective width of street and also affecting the street capacity
- Signing, striping, and signalization must conform to the closure and the approaching vehicles must be given adequate information for proper actions to take
- Part-time closures during the most congested hours can often be a more acceptable approach to take, allowing heavy vehicles to retain a normal schedule

3.2.1 Traffic Diverters

Most of residential street should be planned and designed for local traffic, generally incorporate curvilinear patterns, and T-intersections to a large degree. There are positive aspects to such patterns, such as during closures of parallel collector or arterials. However, in many situations the negative aspects outweigh the positives. Negative factors include the following:

- As traffic volume build up on adjacent parallel collectors and arterials, many drivers or the road users begin using local streets to save time and to avoid congestion.
- The increase of through trips on local streets is usually accompanied by an increase in average speed, which is undesirable along residential streets
- Environmental disturbance such as noise and air pollution created by through traffic brings an undesirable consequence to residents of the area

In order to attempting of reduce traffic loading, traffic diverters at residential intersections have begun using. The concept is simply that when through trips become numerous enough to create undesirable residents effects. Most typical residential streets operate with from 100 to 500 vehicles per day. When volumes reach 500 or 1000 vehicles per day, it is at the traffic level and any higher level that diversion techniques might be considered.

Traffic diversion is intended to accomplish one or more of the following effects:

- reduction in total vehicular traffic
- reduction in average speed of traffic
- reduction in environmental disturbance such as noise and air pollution
- efficient protection for pedestrians

3.2.2 Driving Behavior Modification

Driving behavior modification is an important component of strategies for accident prevention and exposure reduction of accident occurrence. Affecting mode choice is a major behavior modification action that is hard to successfully achieve. This requires providing convenient public transportation alternatives and implementing policies that make public transportation a much more attractive alternative than driving for commuter and other types of trips. By this strategy, reduction of traffic congested will be achieved. Driving behavior modification involves a number of policy measures, including driver and pedestrian training, removal of driver with 'bad' driving records (through suspension or revocation of driving licenses), and provision of better highway designs and control devices that encourage good driving practices and minimize the occurrence of driver error. Use of high-occupancy vehicle lanes and other restricted-use lanes to speed public transportation, providing an efficient travel time differential between public transportation and private vehicles, is another useful strategy. The final strategy in driving behavior modification is the law enforcement. This can be very effective. Speed limits will be more closely obeyed if the law enforcement is strict, and the sanctions for violations are expensive.

3.3 Parking Facilities

Parking is a major urban land-use. Anyone who drives a vehicle needs no difficulties of finding a parking space in areas which intensively used for business, commercial, or residential purposes. An area containing a central business district (CBD), a regional or community shopping center, commercial activities, and others is usually an area where extensive parking problems are found.

Parking facilities are an essential parts of the total transportation system. The designing and planning of these facilities demands an understanding of the characteristics of vehicles, the behavior of the driver, the parking operation, and the parking generating characteristics of the different land uses served.

As one of the activities of the urban complex, parking is requiring for space, both on-street and off-street. Ideally, a the road users would like to be able to park right in front of their home, to avoid the need for walking, but this privileges is not always possible because street space is more profitably used for moving traffic.

The difficulties of parking policies formulation lies in coordinating parking policies with several other planning objectives. The considerations objectives as follows are to:

- design parking lots and their approaches so that street traffic is not adversely affected by the in or exit vehicles

ensure that the interest of business establishments along the street is enhanced by good parking arrangements
ensure that parking policies and public transit policies are complementary
preserve the character of the residents by restricting parking and enforcing land-use controls
control parking supply and demand through the pricing mechanism

To carry out a parking planning, it is necessary to have information on the following points:
- The supply and type of parking facilities
- How and for what purpose parking facilities are used
- The demand for parking space
- The characteristics of parking demand
- The location of parking generators
- The legal, and administrative factors associated with the parking management

4. CONCLUSIONS

These studies covered a number of topics that are of much importance to traffic engineers and planners at the local level. Related with a traffic management problems in Surabaya, the possible and precisely solutions that can be carried out are:

About planning the urban facilities:
- The pedestrian must be considered in a variety of situations. In business district or commercial area, sidewalks must be wide enough to accommodate prevalent pedestrian volumes. Where pedestrian board mass-transit vehicles, it is important that boarding times and other characteristics be studied in order to properly designed as to size and location
- In designing pedestrian and bicycle facilities, these following aspects such as comfort and convenience, safety and also security should be considered

About planning the traffic management at the local level:
- Planning a major residential area development with an internal and external accessibility system, parking arrangements, and connecting with existing surface roads
- The use of traffic generation analysis to assess traffic impacts is what is required in most local area planning, for conduct this analysis the traffic activity associated with a site or particular land-use activity is needed.
- Traffic diversion may considered to conducted in the congested area with improving alternative road to perform reduction in total vehicular traffic, reduction in average speed of traffic, reduction in environmental disturbance such as noise and air pollution and to protect the pedestrians efficiently
- To achieve a modification of driver behavior there are some strategies that considered to be done such as converting the usage of private vehicles into public transportations to provide an efficient travel time differential between public transportation and private vehicles, removal of driver with 'bad' driving records (through suspension or revocation of driving licenses), provision of better highway designs and control devices that encourage good driving practices and minimize the occurrence of driver error and also the law enforcement must be assured.

3. About planning the parking facilities:
Parking programs must deal with the following points:
   1. Planning and policy: overall objectives must be established and plans drafted to achieve them and general policy on parking must be set as part of the planning effort
   2. Parking regulation enforcement: parking and other use regulations must be strictly enforced.

REFERENCES

Benz Gregory B., ***Transit Platform Analysis Using the Time-Space Concept***, Transportation Research Board Record 1152, National Research Council, Washington D.C. : 1987.

Black John., ***Urban Transport Planning***, Baltimore: Johns Hopkins University Press, 1981.

Blunden W.R., and Black, J.A., ***The Land-Use/Transport System***, 2nd ed., New York: Pergamon Press, Elmsford,1984.

Edwards John D., ***Transportation Planning Handbook***, 4th ed., Institute of Transportations Engineers, New Jersey: Prentice Hall, Englewood Cliffs, 1992.

Federal Highway Administration, ***Safety and Locational Criteria for Bicycle Facilities:Users Manual***, vol.2., U.S. Department of Transportation, Washington D.C.: 1976.

Federal Highway Administration, ***Design of Urban Streets***, U.S. Department of Transportation, Washington D.C.: 1980.

Fruin John J., ***Pedestrian Planning and Design***, New Jersey: Prentice Hall, Englewood Cliff, 1971.

Fruin John J., ***Designing for Pedestrians***, Metropolitan Association of Urban Designers and Environmental Planners, New York: 1992.

Institute of Traffic and Transportation Engineering (ITTE), ***Bikway Planning Criteria and Guidelines***, University of California at Los Angeles, Los Angeles: 1975.

Khisty C.Jotin., Lall, B.Kent., ***Transportation Engineering***, Third Edition, , New Jersey, USA: Pearson Education Inc., Upper Saddle River, 2003.

Ogden K.W., and Bennett, D.W., ***Traffic Engineering Practice***, 3rd ed., Monach University, Department of Civil Engineering, Victoria, Australia: 1984.

Pignataro Louis J., ***Traffic Engineering: Theory and Practice***, First Edition, , New Jersey, USA: Prentice-Hall Inc., Englewood Cliffs, 1973.

Pline James L., ***Traffic Engineering Handbook***, 4th ed., Institute of Transportation Engineers, New Jersey: Prentice Hall, Englewood Cliffs, 1992.

Roess Roger P., Prassas, Elena S., and McShane, William R., ***Traffic Engineering***, Third Edition, New Jersey, USA: Pearson Education Inc., Upper Saddle River, 2004.

Silas Johan, ***Kampung Surabaya Menuju Metropolitan***, Cetakan Pertama, Yayasan Keluarga Bhakti Surabaya Post, Surabaya: 1996.