

THE IMPACT OF URBANIZATION ON ROAD TRAFFIC SAFETY IN HO CHI MINH CITY

Paper identification number: SCS12-015 Huy Huu NGUYEN¹, Pichai TANEERANANON²

¹EU-Asia Road Safety Centre of Excellence Department of Civil Engineering, Prince of Songkla University Hat Yai 90112, Thailand Fax: +66-74-446519 E-mail: huycongtrinh@yahoo.com

²Centre for Road Safety Research Department of Civil Engineering, Prince of Songkla University Hat Yai 90112, Thailand Fax: +66-74-446519 E-mail: <u>breathislife@yahoo.com</u>

Abstract

Each year Ho Chi Minh City (HCMC) experiences thousands of road accidents which cause great losses with thousands of cases of death, personal injuries and vehicle damage. On the surface, blamed for such poor traffic safety are the overcrowded roads, road users' poor awareness of traffic safety, or poor traffic infrastructure. Beneath the surface lie other contributing factors whose impacts on road traffic safety have been of little consideration from related authorities. Of these ignored factors, urbanization is considered to be the most important one with difficult-to-see but serious influence on road traffic safety. Increasing urbanization entails establishment of new residential areas along roadsides and fosters the increase of population along existing roads. This fact inevitably increases traffic density and poses new challenges to traffic and safety engineering. With the pressure exerted by rapid urbanization, it is unavoidable to come up with poorly-planned and improperly-designed road networks. Together, this problem and the unreasonable categorization of roads have given rise to traffic conflicts and traffic congestion, leading to road accidents as a subjective result. Based on the analysis of collected statistic data, this paper is intended first to point out the impacts of urbanization on road traffic safety in Ho Chi Minh City, and then to suggest a few measures which need to be taken to tackle the problem.

Key words: urbanization, traffic safety, road safety

1. Introduction

Traffic safety has been one of the most serious challenges facing major cities, especially those in developing countries. Increase in population, mainly due to immigration, has given rise to urbanization. Professional incompetence in transport planning and urban development planning has led to poorly-planed urbanization: settlement along roadside without applying access management practice. Urbanization of this type has negative impacts on road traffic safety in Ho Chi Minh City. Based on the analysis of the mutual



main linking the Southern areas with the country's

other part and with foreign countries. The demand for the city's transport is ever growing. However, the transport infrastructure, especially for road

sector, remains very poor and has not yet kept in

pace with the development growth.

relationship between urbanization and road traffic safety, the suggested solutions are developed.

2. Background

Ho Chi Minh City (HCMC) is the biggest financial and economic hub of Vietnam. The city is

Tay Nint TAY NIN To Plei Ku To Dala BINH DUONG \bigcirc NAT To Phnom P Arterial Road and Road Num Collector Road and Road Number LONG To Dana Provice District Roundary Province Center or City Cent Distrio To Can Th Port TIEN GIANG Ben Tre

2.1 Inter-Regional Road Network

Source: JICA, 2005

Figure 2.1 Inter-Regional and the main road networks in HCMC

The current road networks in HCMC and surrounding regions are as in Figure 2.1. All of the national roads either start or ends in HCMC, connecting this city with the surrounding regions and connecting these regions with one another. The provincial road networks are of poor quality and ineffectively connect the centres of the districts with national roads.



2.2 Urban Road Network

Figure 2.2a Main road network in HCMC

Figure 2.2b Number of lane of roads in



Figure 2.2a describes the existing road networks in HCMC. The total length of roads in HCMC is 1,242.13 km. Most of the urban roads are two-lane roads as presented in Figure 2.2b. Only a

few are six-lane or four-lane roads the numbers of lanes of which are reduced in a few streethes. These facts seriously affect the smoothness of the traffic flows.



2.3 Road Network Density (RND) and Road Area Ratio (RAO)

Figure 2.3a Road Network Density in HCMC

There is a very concentration of road density in the city road network. Specifically the road density in the urban areas is much higher than that in sub-urban areas. This is a serious inbalance in the distribution of road area ratio in the whole network which is facing HCMC, but not Singapore and Bangkok. This fact can be esaily inferred from the differences in Road Network Density (RND) and Road Area Ratio (RAO) between HCMC

Figure 2.3b Road Area Ratio in HCMC

(figure 2.3a and 2.3b), Singapore and Bangkok. Namely, the average RND and RAO of whole HCMC are much lower the counterparts of Singapore and Bangkok. But RND and RAO of urban area (inner city) of HCMC are much higher than thoseof Singapore and Bangkok. That means there is bestter balance of distribution in terms of RND and RAO in Singapore and Bangkok than in HCMC.





Figure 2.4 Comparision of RND and RAO among selected Cities



Figure 2.7 Concept of the application of road hierarchy in Vietnamese

One key weakness of the Vietnamese road network is the poor articulation of road hierarchy (figure 2.7), and this has become increasingly more an issue as Vietnam progresses toward becoming a motorized country with superlative growth rates in motorcycle ownership, car ownership, and truck movements. To rectify the situation, one important

Figure 2.8 Road categorization in

aspect is the enhancement of design standards by setting standards on access control and the functionality of roads in coordination with other parameters such as design speeds. At present, this is not considered by the current Vietnamese road network planning and road design standards, and as example, Figure 2.5, 2.6, and 2.8 describes the road



classification standards in US and European countries. This has strong effect on road traffic

safety because of the mixture of high-speed through traffic, and the stop-and-go flow of local traffic.

3. The Impact of Urbanization on Road Traffic Safety3.1 Urbanization and Population in HCMC (1989 – 2009)



Souce: Tran, 2007 and Antoine, 2011

Figure 3.1 Maps of urban spatial distribution in HCMC (1989 - 2009)

The maps of urban spatial distribution in HCMC show rapid urbanization from 1989 to 1999, but the trend was down by 13.41 % each year from

2000 to 2006. The pace of urbanization rocketed from 2006 to 2009, even faster than the period from 1989 to 1999 as shown in table 3.1.

Year	Total Built-Up Area (km ²)	Percentage of City Area (%)	Total Urban Area Annual Change (%)	Population (million)
2009	879.00	41.96	-	7.16
2006	407.83	19.47	38.51	6.43
1999	210.33	10.04	13.41	4.31
1989	72.83	3.48	18.88	3.58

Souce: Tran, 2007 and Antoine, 2011



3.1.2 A typical characteristic of urbanization in HCMC



Source: LINCOLN Institute of Land Policy, 2010

Figure 3.2 Urban expansion in HCMC (1989-1999) with the linear settlement alongside the roads

In view A, before urbanized, there were only a few houses along the side of the road. Most of these houses serve as temporary accommodation for the farmers who were in charge of the farming in the areas.

In this period of time the roadway is rural in character, with few delays caused by vehicles entering or exiting the road way. Driving through the area is a relatively stress-free experience.

In view B, the increase in population led to the increasing needs for housing, which resulted in spontaneously-established residential settlements along the roadsides.

More housing and urban development, more commercial development has taken place, and the resulting side streets add more opportunities for vehicle to enter or leave the roadway, causing poorer traffic flow. Vehicle spacing is denser, as traffic volumes have increased, and the average speed has dropped. VIEW A

VIEW B





In view C, resident areas alongside the road, food shops, and supper markets develop without applying access management leading to addition of too many driveways and intersections causes traffic to be restricted by vehicles entering or exiting the roadway. This condition causes vehicles to collide; resulting in more crashes, and slow through traffic. Driving through the area has become highly stressful, and the average speed has dropped further.



Figure 3.3 depicts how development and urbanization growth alongside the road and uncontrolled access

The figure 3.2 shows that the highlight of the urbanization in HCMC is linear settlement along the sides of the roads connecting HCMC and

3.2 Urbanization as a Major Factor of Roads' Function and Safety

3.2.1 Primary function of roads

An efficient and safe road network is organized like our blood system. It is a hierarchy of arteries and veins. It is further divided to main arteries, distributor arterioles and capillaries to access single cells in the muscles and organs. The blood moves much faster in the main arteries than in capillaries as shows in table 3.2. surrounding provinces and other regions. The figure 3.3 depicts a detailed description of this phenomenon.

Table 3.2 Blood system function in comparison to
blood flow

Blood system	Flow/speed	
Main arteries (to legs and arms)	5.8 (cm/s)	
Arterioles (to organs)	0.28 (cm/s)	
Capillaries (to organs)	0.05 (cm/s)	

Taken from Hans-Joachim Vollpracht, PIARC Road Safety Seminar, Lome, Togo, October 2006



Taken from Hans-Joachim Vollpracht, PIARC Road Safety Seminar, Lome, Togo, October 2006

Figure 3.4 The comparison of the blood system and the road network

The main blood vessels never provide their surrounding tissue and the organs directly as in

figure 3.4. The road network has a similar function and therefore fast and long-distance traffic is



separated from the slow local traffic. The main roads of the road network should have a strict access control, to be in the same function as the arteries are in our blood system. The road's function is defined by the shape and size of vehicles, presence of other participants in traffic as vulnerable road users, speed limit, traffic volume, road geometry and connecting. Roads should be designed by considering road's functions, in such a way for the traffic to flow smoothly and evenly, with a clear, credible and safe design to provide safety for all. In case of urbanization, as almost anyone can build a house, warehouse or other industrial structure alongside long-distance roads, their function has changed towards the connecting roads and the connecting roads have become collector roads. The consequences are lower level of service, lower travel speed, worse traffic safety and all that as up to great financial losses.

3.2.6 Urbanization and Traffic Safety



Figure 3.5 Urbanization with linear settlement alongside the National Road 1A in HCMC without applying access management practices.

Urbanization has a great impact on traffic safety and roads' function. If we (professionals, communities, decision-makers) will not deal with the problem, our roads will not comply to the standards and vision regarding safety and welfare. In the end, the costs of dealing with the problem will be too high and we will not be able to finically cope with them. The dispersed construction alongside the roads (figure 3.5) is a very negative phenomenon, for the environment, traffic safety and roads' function.

Many studies have shown that crash rates increase with greater number frequency of driveways and intersection as in figure 3.6.





Figure 3.6 Relationship of crash rate to access points per mile

The number of junction on roads and the effect of possible conflicts between road users should be minimized. A special care must be taken in the vicinities of schools along or near the national roads or provincial roads. The investments in infrastructure must be made to improve road safety for the vulnerable road users, and make sure that their locations and designs are adequate.



3.3 The Impact of Urbanization on Road Traffic Safety in HCMC

Figure 3.7 Percentage of road traffic accidents according to type of roads in HCMC (2008 – 2011)

Each year Ho Chi Minh City experiences approximately 12,000 of road accidents including fatality, injury, and property damage only. Approximately 60% of these accidents occur in non-urban roads in urbanization area without applying access management. According to Nguyen and Pichai (2011), the number of black spots in national roads, provincial roads has gradually increased in last recent years. These black spots are located in areas which rapid urbanization. The density of fatal accident in the segments of national road 1A, national road 52, and national road 22 in HCMC even reached 2.0 to 3.0 accidents per km.

The facilities of the new residential settlement along the roadsides increased the access to these roads; and therefore the existing roads could no



longer function as they had been designed. In other word the nature of these roads were changed in terms of function. Overall the traffic situation became chaotic with more accidents.

4. Suggested Solutions

- To develop the guidelines, standards related to transport planning, roads design, urban development planning, and regional development planning suitable for the particular conditions in Vietnam;
- **O** To apply access management to the road networks;

O To apply corridor management to the road networks;

- To cooperate in the transport planning, regional development planning, and urban development planning;
- Holistic solutions based on five sustainable safety principles should be developed and applied so as to increase the effectiveness of the process of improving road traffic safety in HCMC. These principles are the functionality of roads, the homogeneity of mass and/or speed and direction, physical and social forgivingness, recognition and predictability of roads and behavior, and state awareness.

References

- ALMEC, 2008, Study on National Road Traffic Safety Master Plan in the Socialist Republic of Vietnam until 2020.
- [2] ALMEC, 2005, Study on Traffic Safety Stakeholders of Inter-urban National Road in the Socialist Republic of Vietnam, Final report.
- [3] Atlas of Urban Expansion, <u>http://www.lincolninst.edu</u>, Lincoln and Institute of Land and Policy.

- [4] An International Centre Supported by Deutsch Bank, <u>http://lsecities.net</u>, The London School of Economics and Political Science.
- [5] Japan International Cooperation Agency (JICA), 2005, Study on Urban Transport Master Plan and Feasibility Study in HCM Metropolitan Area (HOUTRANS), Final Report, Volume 2: Master Plan Study.
- [6] LIMA & ASSOCIATES Transportation G.I.S, Access Management Manual, 2008.
- [7] Michigan Department of Transportation, Reducing Traffic Congestion and Improving Traffic Safety in Michigan Communities: The Access Management Guidebook, 2001.
- [8] Nguyen Huu HUY and Pichai TANEERANANON, 2010, Centre for Road Safety Research, Department of Civil Engineering, Prince of Songkla University, Reality of Urban Road Safety in Ho Chi Minh City and Suggested Solutions.
- [9] Nguyen Huu HUY and Pichai TANEERANANON, 2011, Centre for Road Safety Research, Department of Civil Engineering, Prince of Songkla University, Phenomenon of Black Spot Relocation in Ho Chi Minh City: Causes and Lessons.
- [10] Shlomo Angel, Jason Parent, Daniel Civco, Alexander Blei, and David Potere, Lincoln Institute of Land Policy, 2010. A Planet of Cities: Urban Land Cover Estimates and Projections for All Countries, 2000-2050.
- [11] Tran Thi VAN, Hoang Thai LAN, Le Van TRUNG, 2007, Research on The Change Of Urban Surface Temperature Under Impact of Urbanization In Ho Chi Minh City by Using Remote Sensing Data, Institute for Environment and Resources, Vietnam National University Ho Chi Minh City, 142 To Hien Thanh, Dist. 10, Ho Chi Minh City, Vietnam.
- [12] Uroš Brumec, 2010, Urbanism as a Major Factor of Roads' Function and Safety, DRI upravljanje investicij, d.o.o. Kotnikova ulica 40, P.O.B. 258, SI - 1000 Ljubljana, Slovenia.