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

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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-planned 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
2. Background

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

2.1 Inter-Regional Road Network

![Image](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

![Image](source: JICA, 2005)

**Figure 2.2a** Main road network in HCMC  **Figure 2.2b** Number of lane of roads in HCMC
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 stretches. These facts seriously affect the smoothness of the traffic flows.

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

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 imbalance in the distribution of road area ratio in the whole network which is facing HCMC, but not Singapore and Bangkok. This fact can be easily inferred from the differences in Road Network Density (RND) and Road Area Ratio (RAO) between 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 those of Singapore and Bangkok. That means there is a better balance of distribution in terms of RND and RAO in Singapore and Bangkok than in HCMC.
2.4 Road Hierarchy

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 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 Safety


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.

**Table 3.1** Urban area (km$^2$) and Population in HCMC

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Built-Up Area (km$^2$)</th>
<th>Percentage of City Area (%)</th>
<th>Total Urban Area Annual Change (%)</th>
<th>Population (million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>879.00</td>
<td>41.96</td>
<td>-</td>
<td>7.16</td>
</tr>
<tr>
<td>2006</td>
<td>407.83</td>
<td>19.47</td>
<td>38.51</td>
<td>6.43</td>
</tr>
<tr>
<td>1999</td>
<td>210.33</td>
<td>10.04</td>
<td>13.41</td>
<td>4.31</td>
</tr>
<tr>
<td>1989</td>
<td>72.83</td>
<td>3.48</td>
<td>18.88</td>
<td>3.58</td>
</tr>
</tbody>
</table>

Source: Tran, 2007 and Antoine, 2011
3.1.2 A typical characteristic of urbanization in HCMC


**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.
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 growth alongside the road and uncontrolled access surrounding provinces and other regions. The figure 3.3 depicts a detailed description of this phenomenon.

### 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.

**Table 3.2** Blood system function in comparison to blood flow

<table>
<thead>
<tr>
<th>Blood system</th>
<th>Flow/speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main arteries (to legs and arms)</td>
<td>5.8 (cm/s)</td>
</tr>
<tr>
<td>Arterioles (to organs)</td>
<td>0.28 (cm/s)</td>
</tr>
<tr>
<td>Capillaries (to organs)</td>
<td>0.05 (cm/s)</td>
</tr>
</tbody>
</table>

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 financially 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.
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 3.6 Relationship of crash rate to access points per mile](image)

The facilities of the new residential settlement along the roadsides increased the access to these roads; and therefore the existing roads could no longer support the demand for increased traffic. 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. 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.
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;
● To apply access management to the road networks;
● 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

[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.