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RESEARCH ON FACTORS IMPACTING ON ROAD TRAFFIC CONGESTTION ISSUE IN HO CHI MINH CITY

Truong Quang Dung*

*PhD. in economics, Ho Chi Minh City University of Technology (Hutech), Vietnam

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ABSTRACT

This research aim at identifying causes and solution for the traffic congestion in Ho Chi Minh city. There are 5 reasons to be considered and divided into two groups: common reasons and special ones. Consequently, there are 6 solutions divided into 4 groups aimed at selecting suitable solutions for short-term and long-term goals. Legal dissemination solutions are considered by experts to be unsuitable for both groups of causes. Road maintenance isusedtoashort term solution. Suitable classification of traffic flow, the application of information technology, the limited transport means at peak time and the development of public transport are long-term solutions and must be thoroughly researched.

KEYWORDS: Traffic congestion, solutions, Analytic Hierarchy Process.

I. INTRODUCTION

In 2016, there has been 30 serious traffic jams during peak hours in Ho Chi Minh City, concentrated in areas such as city center, Tan Son Nhat international airport, Cat Lai port, gateway Cities and other areas (Figure 1).

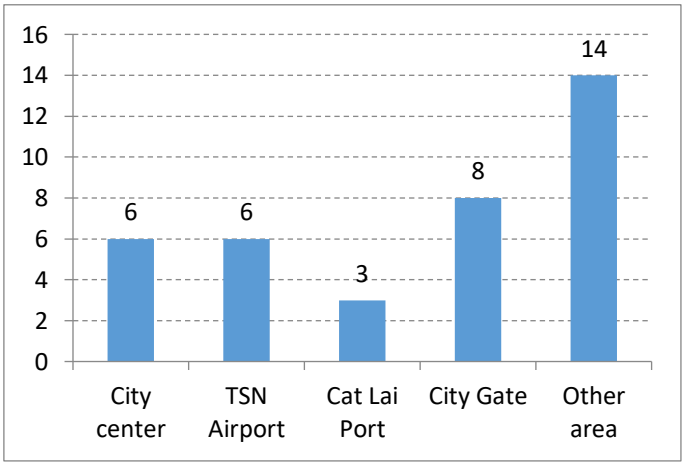

Figure 1. Congestion points in Ho Chi Minh City

Source: Ho Chi Minh City Department of Transportation

The traffic speed in peak hours in CBD area is only 19.3km/ h; in Cat Lai port area (district 2) is 29 - 30km/ h, in Tan Son Nhat International Airport area (Tan Binh district) is 20.3 - 22.3km / h. Ho Chi Minh City is managing more than 7.8 million vehicles, not to mention more than 1 million vehicles registered in other cities and provinces that are joining in the traffic in Ho Chi Minh City everyday. Additionally, Ho Chi Minh City has more than 11,000 taxi cars, more than 15,000 under 9 seats cars for rent, and 2,764 buses that are operating daily. Every day, in Ho Chi Minh City, there are about 100 new cars, and one thousand new motorcycles; there is also an annual increase of 900 vehicles of registered over 10 tons van in Ho Chi Minh City. Roads are always overloaded (Ho Chi Minh City Traffic Safety Board, 2016). Damaged loss caused by traffic jams in Ho Chi Minh City is 2.4 billion VND per hour (about 21,000 billion VND per year) (Ho Chi Minh CityTransport Association, 2016). There have been a number of research studies on the factors that cause traffic congestion in

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urban areas, especially in Ho Chi Minh City. However, previous studies have not shown the relationship between the management factors and the weights of these factors on traffic congestion issue. This research is aimed at understanding the causes and possible solutions to this problem

II. THEORETICAL BASIS AND RESEARCH MODEL

Nguyen Van Thu (2016) pointed out the main cause of traffic jams due to lack of vision and financial conditions. Meanwhile, Hon (2005) argued that traffic congestion was caused by two reasons. The regular cause is that demand exceeds the supply of transport infrastructure in the short term. Less regular cause is due to unforeseen factors such as accidents or emergencies, road maintenance, and bad weather. Dinh La Thang (2016) presented many causes of traffic jams in Ho Chi Minh City. Ho Chi Minh City such as the source of investment capital to develop transport infrastructure does not meet the needs of socio-economic development; the management structure and policies for managing and developing urban transport is inadequate and overlapping. According to the report of Department of Transportation of Ho Chi Minh City (2016), there are 04 main reasons: the increase in mechanical population; uncontrollablyincrease ofquantity of means of transport; unbalanced urban development; and slow transport infrastructure development. According Silianov and Dao Huy Hoang (2016), there are seven causes of traffic jams: transport infrastructure; means of transport; traffic participants; environment; transportation organization; traffic enforcement; and policy and management.

Corresponding to the causes, a group of studies also suggested some solutions to limit traffic jams. Nguyen Thanh Phong and Le Van Dat (2016) introduced the following solutions: focus on the improvement of legal documents and coordination structure among related agencies; improve traffic infrastructure to ensure traffic safety; policy that encourages the development of public transport; and strengthen propaganda and dissemination of law.

Nguyen Van Thu (2016) proposed some management measures to minimize traffic congestion such as limiting the number of means of transport during peak hours; development of public transport; arranging road maintenance at reasonable time; strengthen traffic operator force during peak hours; properly arrange traffic flow. Karunanayake et al. (2013) selected a specific route in Kandy city, Sri Lanka and studied the causes of traffic jams, that offered a number of solutions and chose optimal solution options by using **Analytic Hierarchy Process** (AHP). Dinh La Thang (2016) also proposed solutions to reduce traffic jams in Ho Chi Minh City such as improving planning, structures, policies and governmental management mechanism on urban transport; effective exploitation of existing transportation infrastructure, among which, the focus on raising the capacity of management and efficiently exploiting the existing transport infrastructure system; keep revising and reorganizing scientifically and reasonably traffic flow in busy traffic areas; comprehensive development of transport infrastructure; improving the efficiency of passenger transport and cargo transportation; managing personal transportation needs; apply modern science and advanced information technology in the construction, management, exploitation and operation of transport in conformity with urban characteristics; promote the propagation and education, raise the sense of observance of the legislation on traffic safety. Tou Douangmany (2017) examined the role of Mass Communication contributing to the dissemination of legislation, thereby enhancing the legal awareness of traffic participants

III. RESEARCH METHODS

Selection of aggregation factors

Aggregation factors are compared and selected from theoretical basis. It can be seen that the causes given by Silianov and Dao Huy Hoang (2016) are inclusive. The proposed factors also cover the factors mentioned in the report by the Department of Transportation or Nguyen Van Thu (2016) and Hon (2015). Therefore, the author selected the study by Silianov - Dao Huy Hoang (2016) and the study of Hon (2015) as an analytical framework. Factors will be divided into two groups: (1) regular causes include: transport infrastructure; means of transport; traffic participants; environment; transportation organization; traffic enforcement; policy and management and (2) irregular causes include: traffic accidents, traffic maintenance works, special events, bad weather, emergency situations.

Select the solution groups

As presented in the theoretical overview, integrated solutions include: (1) limiting the number of vehicals during peak hours; (2) scientific traffic flow arrangement; (3) development of public transport; (4) road maintenance within a reasonable time frame; (5) application of information technology; and (6) promote law dissemination.

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Weighting method and assessment criterias

The research has decided to choose AHP (Saaty, 1980) to determine the weighting of aggregated assessment criterias because AHP helps to sort criterias by level of importance. AHP can be combined with other methods easily to take advantage of each method in problem solving. The hierarchical analysis process is easy to understand, considering many small criterias and analyzing both qualitative and quantitative factors. By using AHP, the researcher finds the final decision clearly and reasonably. For this research, the author interviews experts to compare the importance of the indicators. 9 transport experts were interviewed by questionnaires.

Multi-indicator analysis method

In addition to such methods as technical assessment, matrix evaluation, Cost Benefit Analysis, Contigent Valuation Method, arithmetic average or geometric average of component scores, factor analysis, multi-indicator analysis method is considered to be more objective and comprehensive.

TOPSIS is a widely used technique among MCDM methods. However, some studies have shown that TOPSIS encounters limitations in determining the weight of standards and consistency of evaluation. Therefore, by combining it with AHP to prioritization standards in the information environment and TOPSIS for evaluation will improve the relevance of results in the model. After identifying the causes and classifying the solutions and determining the weights for each cause, the author averaged the proportion of solutions. A decision-making committee of nine decision makers (Dt, t = 1, ..., 9) was responsible for evaluating the six options (Ai, i = 1, ..., 6) based on two groups of causes (Cj, j = 1,2).

The next step is to calculate the mean values of the weights and standardize the indications of the solutions for causes. The next step, the author calculates the importance of standard norms, then the value of the coefficient of association and the mean of the solution groups before arranging the points into the group. After determining the average of solutions, the author will determine the weighting rate (which has been standardized), measure the distance and carry out grouping solutions.

IV. FINDINGS AND DISCUSSION

Weight result by AHP method

After AHP analysis, among the seven criterias of the regular causes group that are often considered factors affecting the traffic jams in Ho Chi Minh City, the vehicle traffic indicator has the most impact on traffic jams with the weight of 0.26 , followed by traffic participants (0.20) and management policy (0.18). The traffic organization weight is 0.14. The environmental factor counts 0.12. Finally, the traffic enforcement factor is found with a weighted value of 0.1.

Among 5 criteria in the irregular causes group, traffic accident is the highest (0.35). The second is traffic maintenance works with a weight of 0.28, followed by bad weather with a weight of 0.25 and the organization of special events weights 0.1.Minimum weight is the emergency events at 0.02.

Result evaluation

After calculating the mean of solutions for regular and irregular causes, the normalized weighted values are shown in Table 1 below

Table 1. The mean value of the solutions for the causes

Solution	Regular cause	Irregular cause
1	(0.094, 0.232, 0.048)	(0.215, 0.145, 0.311)
2	(0.086, 0.225, 0.042)	(0.100, 0.150, 0.231)
3	(0.098, 0.235, 0.051)	(0.240, 0.186, 0.232)
4	(0.084, 0.223, 0.058)	(0.228, 0.154, 0.124)
5	(0.082, 0.221, 0.138)	(0.245, 0.166, 0.110)
6	(0.087, 0.225, 0.151)	(0.190, 0.149, 0.156)

Source: From research results

After calculating the distance values and using it to calculate the coefficient values, the results are presented by Table 2 as below.

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Table 2. The coefficient values for the causes

Solution	Regular cause	Irregular cause
1	0.136	0.167
2	0.129	0.178
3	0.138	0.135
4	0.125	0.124
5	0.425	0.134
6	0.129	0.145

Source: From research results

The mean score at the regular cause is 0.180 and the irregular cause is 0.147. Thus, the grouping results will be as follows: Group 1 – Road maintenance within a reasonable time frame; Group 2: Scientific traffic flows, application of information technology, limit number of vehicle during peak hours; Group 3- Development of public transport; Group 4- promote law dissemination.

V. CONCLUSION AND POLICY RECOMMENDATION

There are 4 groups of solutions formed. Among them, group 4 is a solution that has low weight in both regular and irregular causes groups so it will not be effective for both types of causes. Although workshops the mass media always attache importance to the self-awareness of traffic participants through the legal system, this solution group seems to be incompatible with causes, whether regular or irregular. It has been proven that public information dissemination programs have been implemented from the national to local levels, but raise awareness toward traffic has not yet been formally reported.

Group 1 can deal with irregular causes. One of the causes of congestion is the appearance of "bottlenecks" in traffic flow. Barracks, blockers on roads that slow down traffic and can not avoid local congestion. Therefore, the solution is to allocate road maintenance timetables, especially for inner-city roads. It is possible to allocate maintenance hours during off-peak hours, and maintenance time should be as short as possible to prevent traffic jams in the next peak hours.

Groups 2 and 3 are associated with regular causes. These are long term solutions and should be thoroughly researched before implementation. The development of transport infrastructure requires functional agencies to associate long-term urban planning with the corresponding development of city residence and the increase in traffic demand. Proper traffic flow also requires careful and scientific research. Analyzing the number of congestion points, congestion times, the percentage of vehicles participating in traffic at congestion points is the key to implementing traffic flow solutions.

In summary, evaluating solutions to reduce traffic congestion is a decision-making issue based on a number of complex factors, requiring multiple considerations and requiring many decision-makers. The research has presented decision-making the mod based on multi-criteria analysis. Multivariate analysis provides the appropriate solution groups for the problem. However, there may be more optimal analysis methods. Therefore, it is recommended that the next research should focus on implementing other analytical methods to compare the results and provide the most practical solutions

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