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Dung Nguyen Thi Tuyet, Hung Bui Manh and
Phuong Nguyen Thi Lan

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Nguyen Thi Tuyet Dung¹, Bùi Mạnh Hùng², Nguyễn Thị Lan Phương³

¹ Dr. Lecturer, Urban Management Faculty, Hanoi Architectural University, Viet Nam

² Pro.Dr, Urban Management Faculty, Hanoi Architectural University, Viet Nam

³ Dr, Urban Management Faculty, Hanoi Architectural University, Viet Nam

khuongdungkt@yahoo.com

Abstract. Planning of road transport development in Vietnam vision to 2030 has emphasized the role of maintenance work in order to make the most of existing transport infrastructure capacity to ensure efficiency and sustainability in exploitation. The Government has also implemented numerous policies to mobilize investment capital for road maintenance and recorded some achievements (in the 2013-2018 period, the average capital allocated for national highway maintenance was VND 6,778.644 billion/year, many times higher than the period from 2009-2012 which was VND 2,615.13 billion/year). However, granted capital for annual maintenance has not met the demand. One of the reasons is that the capital mobilization planning is still limited, particularly the planning medium and long-term maintenance has many shortcomings, not close to reality. Based on the analysis of existing capital and capital needs as well as the survey results, with the aid of SPSS software, the author has proposed solutions to complete capital mobilization planning, aims at increasing revenue for road maintenance, through improving capacity for medium and long-term maintenance planning.

Key words: capital mobilization, maintenance plan, road maintenance

1. Introduction

Roads have a key position in the national transportation system and an important role to play in the socio-economic development process, contribute to ensuring national defense and security, and therefore should be prioritized for investment. In order to have effective and rational development, roads must be maintained in accordance with technical standards to ensure safety and avoid waste throughout the utilization process, in addition to mobilizing sufficient capital for construction investment.

Over the past years, the Government has implemented numerous policies to mobilize capital for road maintenance such as collecting usage fees on motor vehicles, charges for using and exploiting road infrastructure assets and so on, and has achieved numerous positive results : the capital allocated for maintenance in the period 2013-2018 is many times higher than the previous period. Funding for maintenance, however, has not met the demand. [4]-[7]

2. Existing situation of capital mobilization for road maintenance

Implementing Decision No. 355/QĐ-TTg dated February 25th 2013 on "Approving the adjustment of Transportation Development Strategy to 2020, vision to 2030" of the PM, the Ministry of Transport has had a number of comprehensive innovation policies in terms of quality management, payment

mechanism, technology application, implementation methods, standards and norms, and especially capital mobilization. Before 2013, capital for road maintenance was mainly mobilized from the state budget and ODA. Annual capital is much lower than actual demand, only meeting 30-40% demand. [2]-[6]

Since 2013, the capital for road maintenance has been less insufficient, the scale has increased significantly, specifically from the following sources: Annual fee of using toll road on motor vehicles; the annual state budget allocated to the Fund; revenue sources related to road use and other sources of revenue as prescribed by law. [3] The capital results for maintenance in recent years are shown in Table I.

Table I. Capital resource and capital demand for road maintenance in the period of 2013-2018

Unit: Billion dong

No.	Revenues	2013	2014	2015	2016	2017	2018
I	Total capital	6,906.26	8,059.89	9,507.9	10,420.5	11,987.6	12.032,8
1	-Collection of road use fees	5,434.54	4,928.39	5,702.99	6,375.14	7,173.74	8.082,88
2	-Additional allocation from State budget	1,471.73	2,447.87	3,100	3,500	3,700	3.950
3	-Submission from agencies/divisions		22.759	24.490	58.113		
4	-Funds from the previous year transferring to the next year for settlement		660.865	680.435	487.283	1,149.89	
II	Demand for capital for annual maintenance	11,063	12,995	13,797	16,430	18,767.9	21.428,7
III	Response rate (relative number)	62.4%	62%	68.9%	67.5%	63.8%	56%

Sources [1]-[5]

Figures in Table I reveals that the capital for new maintenance meets over 60% of the demand, mainly from two sources (road use fees and the State budget) while there is almost no investment from the private and foreign sectors. One of the reasons for not attracting capital from these two sectors is the Ministry of Transport has not yet developed specific plans and strategies to mobilize. Forming such strategies and plans currently faces numerous difficulties due to the shortcomings of maintenance planning, which does not accurately reflect maintenance needs and investment capital needs as well.

Within capital mobilization plan, an important factor is determining the amount of capital to be mobilized, which means calculating the capital needs for future maintenance. To calculate that, in addition to using statistical forecasting methods, it is necessary to rely on maintenance plans. Maintenance plans include annual plans and medium- and long-term plans. Annual maintenance plans play an important role in calculating maintenance costs, which is the basis for determining annual State budget expenditure estimation. Long- and medium-term maintenance plans not only show maintenance strategies, but also serve as a basis for mobilizing capital for a long time as well as encouraging and calling for appropriate investment forms.

Currently, the annual maintenance planning is far from reality due to the lack of a road tracking system and shortage of funding. The proposed budget in the maintenance plan is usually based on the budget allocation situation and the actual trend of the previous years, i.e. estimating the proposed cost in the similar way, taking the forecast based on the value allocated in previous years. Preparing tasks and allocating of funds have not yet based on the demand for road maintenance capital and the actual

situation of the transport works. Consequently, the annual maintenance plan has not shown precisely the maintenance and capital needs.[1]-[5]

The medium- and long-term maintenance plans are still incomplete and have not been officially approved despite the existence of policies and implementation guidelines. The reason is that the road system database has not been fully and synchronously built to monitor road conditions, which could serve as a basis for deciding repair time and cycle during the development of maintenance plan. Also, for a long time, the roads have been only partly and unexpectedly repaired, so they could not return to the basic state (according to original design) to build the plan of medium- and major repair in compliance with regulations. This directly affects the mobilization and management of capital use for road maintenance. As a result, the innovation of the maintenance plan is an urgent need in the current context.

3. Completing development of capital mobilization plan by improving maintenance planning capacity

Through the research process, in order to improve the capacity of road maintenance planning, the author has developed four groups of criteria : (i) characteristics of the route, (ii) technical status of the route, (iii) driving status, and (iv) natural, economic and social environment. In order to assess the plausibility of the criteria and their levels of influence on maintenance planning so that the planning is accurate and consistent with reality, the author has conducted investigation and surveys with the support of SPSS software. The research process has three steps.

* *Step 1: Questionnaire design.* Through domestic and foreign studies, the author has developed the *Test Questionnaire* as follows.

Test Questionnaire:

QUESTIONNAIRE On developing maintenance plans

In your opinion, how do the following criteria have an influence (important) on developing maintenance plans?

- 1 = no influence;
- 2 = little influence;
- 3 = influence but not considerable;
- 4 = significant influence;
- 5 = profound influence (decisive level of influence).

Table II. Criteria as the basis for developing maintenance plans

No.	Selected criteria	Level of influence				
		1	2	3	4	5
I	Group of criteria on characteristics of the route					
B1	Year of new construction and latest upgrade or improvement					
B 2	Last maintenance (preventative maintenance, medium and major corrective maintenance)					
B 3	Road length, road width and number of lanes					
B 4	Type of road surface					
II	Group of criteria on the current technical status of the route					
B 5	Condition of road surface: roughness (IRI), crack rate, rutting depth, pothole size and Eyc elastic module.					
B 6	Road technical condition: intensity coefficient, slip coefficient, coefficient of cohesion in permissible limit					
B 7	Technical grade of the route					

No.	Selected criteria	Level of influence				
		1	2	3	4	5
B 8	Other damage on the road causing traffic insecurity such as damage to railings, barriers, drainage systems, signposts, roadside trees, limited visibility of drivers ...					
III	Group of criteria on driving status					
B 9	Vehicle traffic					
B 10	Types and loads of vehicles (occupying large quantities)					
B 11	Average speed					
IV	Group of criteria related to natural, economic, social environment and national defence					
B 12	Data on traffic accidents					
B 13	Having some dangerous points with potential risks of traffic insecurity or weak bridges					
B 14	Topographical, climate, weather, geological and hydrologic conditions of the route area					
B 15	Level of difficulty of the locality where the route passes					
B 16	Influence on socio-economic development of the locality where the route passes					
B 17	Related to security and defense					
B 18	The importance of the route (e.g. the main axis connecting Hanoi, Ho Chi Minh City and big cities to key economic regions, connecting to international ports and border gates; or connecting to administrative centers of provinces and cities ...)					

** Step 2: Experimental research*

The purpose of this step is to evaluate and adjust the Test Questionnaire before conducting official research. The Test questionnaire is sent to respondents in two forms: direct and emailed, and the author has explained in detail the issues that need to be consulted. Subjects selected for the investigation/survey are those who have worked for a long time in state management agencies, research institutes, consultancy contractors or construction contractors operating in the field of road transport infrastructure. According to the number of years of experience: 5-10 years accounted for 10%, from 10-20 years accounted for 48%, over 20 years accounted for 42%. According to the working unit: State management agencies and research institutes on road maintenance accounted for 36%, consultancy contractors accounted for 44%, construction contractors accounted for 20%. According to education level: university accounted for 50%, post-graduate accounted for 50%.

The number of questionnaires distributed is 58. The author obtained 45 valid re-sponses. The SPSS software will be used for Reliability Statistics and correlation statistics between each criterion with all criteria in the group (Item-Total Statistics) to verify the reliability of Test Questionnaire.

According to the auditing results, there are 2 failing criteria of the Experimental questionnaire, namely criteria B11 and B15 (with Corrected Item-Total Correlation index <0.300). These two criteria are excluded. So, in the official Questionnaire, there are 16 criteria.

** Step 3: Official research.* Conducting mass survey by sampling survey method, the number of samples that need to be investigated is 250, the SPSS software is continuously used to assess the influence of the criteria and criteria with the average value (mean), the greater the level of influence. [2]

The auditing results of the official questionnaire on the correlation statistics between each criterion with all criteria in the group (Item-Total Statistics) and the Reliability Statistics is satisfactory, with Cronbach's Alpha index > 0.700 and all Corrected Item-Total Correlation > 0.300. This is entirely

consistent with step 2. The results of SPSS software are also publishes in the assessment of the level of the criteria in developing the maintenance plans, as shown in the table III.

Table III. Level of influence of the criteria on the development of maintenance plans

No.	Selected criteria	Level of influence		Ranking level of influence
		Mean	Standard deviation	
(1)	(2)	(3)	(4)	(5)
I	Group of criteria on the nature and characteristics of the route			
B1	Year of new construction and latest upgrade or improvement	3.91	.596	2
B2	Last maintenance (preventative maintenance, medium and major corrective maintenance)	3.80	.757	7
B3	Road length, road width and number of lanes	3.71	.661	9
B4	Type of road surface	3.91	.701	3
II	Group of criteria on the current technical status of the route			
B5	Condition of road surface: roughness (IRI), crack rate, rutting depth, pothole size and Eyc elastic module.	3.92	0.72	1
B6	Road technical condition: intensity coefficient, slip coefficient, coefficient of cohesion in permissible limit	3.85	0.47	6
B7	Technical grade of the route	3.90	0.38	4
B8	Other damage on the road causing traffic insecurity such as damage to railings, barriers, drainage systems, signposts, roadside trees, limited visibility of drivers ...	3.72	0.62	8
III	Group of criteria on driving status Vehicle traffic			
B9	Vehicle traffic	3.70	0.65	10
B10	Types and loads of vehicles (occupying large quantities)	3.69	0.64	11
IV	Group of criteria related to natural, economic, social environment and national defence			
B12	Data on traffic accidents	3.17	0.68	16
B13	Having some dangerous points with potential risks of traffic insecurity or weak bridges	3.89	0.67	5
B14	Topographical, climate, weather, geological and hydrologic conditions of the route area	3.54	0.62	13
B16	Influence on socio-economic development of the locality where the route passes	3.54	0.69	14
B17	Related to security and defense	3.40	0.71	15

No.	Selected criteria	Level of influence		Ranking level of influence
		Mean	Standard deviation	
(1)	(2)	(3)	(4)	(5)
B18	The importance of the route (e.g. the main axis connecting Hanoi, Ho Chi Minh City and big cities to key economic regions, connecting to international ports and border gates; or connecting to administrative centers of provinces and cities ...)	3.64	0.75	12
	Medium	3.73		

From table III, the author gives following comments:

- The criteria have mean value >3 . Thus, the criteria provided by the author have a certain level of influence on developing the maintenance plans. However, the mean values of the criteria are different, so the levels of influence are different. Therefore, the author suggests that the criteria with a high level of influence should be prioritized (according to ratings from 1 to 16 of column 5, Table III);

- No criteria has a decisive level of influence (mean value >4) or no influence (mean value <3) on developing the road maintenance plans. The levels of influence between the criteria do not have large difference, the highest level is 3.92, the lowest level is 3.17, and the mean value of the criteria is close to 3.73. This reflects (i) the nature of planning in Viet Nam that depends on many factors (not only technical status and route characteristics but also specific situations) and (ii) the current state of roads in Viet Nam (lots of damage and maintenance cannot keep up with the degradation rate);

- In each group of criteria, the levels of influence of each criteria are also different; hence, in addition to prioritizing the criteria in order of influence as shown above, in some special situations, if priority is given to a group of criteria, the criteria with a high level of influence in that group should be prioritized.

4. Conclusion

From the analysis of the current situation of maintenance plans and shortcomings of capital mobilization for road maintenance, with the aid of SPSS software, the author has established four groups of criteria and assessed their levels of influence on development of the maintenance plans in order to help the planning more accurate and consistent with reality. This is the basis for developing long-term capital mobilization plans, which ensures stable and sustainable investment capital for maintenance work.

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