



The Strategy for Management of Environment-Friendly Expressway Maintenance in Bangkok

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Abstract

The objective of a study on “The Strategy for Management of Environment-Friendly Expressway Maintenance in Bangkok” was to study the strategy for management of environment-friendly expressway maintenance in Bangkok under the certification of the ISO 14001 environmental management system. The sample group used in the study was 41 maintenance personnel of the Chalong Rat Expressway (Bangna-At Narong Expressway), 23 Burapha Withi Special Division Officers (Bangna-Chonburi Expressway), and 70 people of other positions, totaling 143 people. Data were collected by interviews and data were analyzed using descriptive statistics to find percentage, mean, and standard deviation. The study found that two-thirds of the respondents (74.13%) were male, aged between 40-56 years old (44.76%), received a Bachelor’s degree (49.65%), and had other types of responsibilities (55.24%), the highest average working time was more than 15 years (51.75%) and the average income was 20,001 baht or more (66.43%). In terms of management strategy, the respondents had a high level of opinions overall (Mean = 3.47) towards the strategy for management of Expressway maintenance of the Chalong Rat Expressway, Bangna - At Narong Expressway (Ramintra - At Narong and Ram Indra-Outer Ring Road), and the Burapha Withi Expressway. When considering each aspect, it revealed that the operational system average was 3.66, the shared values average was 3.55, the organizational structure average was 3.53, the management style average was 3.51, the skills and abilities average was 3.47, the strategy and plan average was 3.43, and personnel average was 3.16, respectively.

Keywords: Strategic management, Expressway, Environment-friendly, Maintenance, Expressway Authority of Thailand

Introduction

Traffic congestion in Bangkok and its vicinity is a complex problem that has been accumulated for a long time. Communication and transportations have of great importance to the national economy. Without good communication and transportation, other economic development cannot be carried out completely, allowing the country's economic development to proceed rapidly and efficiently. The development of transportation is very important. The agency that supervises this area, namely the Expressway Authority of Thailand (EXAT). It is an agency that concentrates on the development of expressways to provide services to the people who use the expressway and worthwhile, convenient, fast, safe, and sustainable with a commitment to solving traffic problems in Bangkok and its vicinities according to the assigned roles under the policies of the government and the Ministry of Transport (Expressway Authority of Thailand, 2019). The goal is to develop the expressway network to be integrated to facilitate the travel of the people with the safety of the users as the main priority and consistent with the quality development plan and service standards to increase the potential of personnel able to respond to government policies to support systematic management and operations by the goals of EXAT and within the timeframe according to the current development plan. Throughout the past period, EXAT has opened the expressway service for a total distance of not less than 224.60 kilometers, consisting of the Chalerm Maha Nakhon Expressway, Si Rat Expressway, Chalong Rat Expressway, Burapha Withi Expressway, Udon Rattaya Expressway, Bangna - At Narong Expressway, Kanchanaphisek Expressway (Bang Phli - Suksawat) and the Si Rat - Outer Ring Road Expressway which is responsible for quality maintenance of road conditions and other assets of EXAT (Expressway Authority of Thailand, 2019).

The Expressway Authority of Thailand recognizes the importance of environmental performance; therefore, took a special route to Chalong Rat Expressway, Bang Na - At Narong Expressway, and Burapha Withi Expressway into the ISO 14001 Environmental Management System Standard. Such operations will bring benefits to agencies in controlling and solving environmental problems. Resources are used efficiently. There is effective prevention and solution to accidents and a good image of EXAT. In addition, with the consciousness of participation in the preservation of the environment and the safety of employees, workers, related persons, and the public including operational improvements, and controlling impacts due to activities. Various services are continuously systematic for sustainable transportation development and were certified ISO 14001: 1996 environmental management system of the Chalong Rat Expressway on March 8, 2000. After that, the Bangna - At Narong Expressway has been entered into the system and has been certified for the ISO 14001: 2004 environmental management system of the Chalong Rat Expressway and the Bang Na - At Narong Expressway

on June 28, 2008. Later, in 2016, EXAT expanded the scope of the system by introducing the Burapha Withi Expressway into the system and was certified ISO 14001: 2015 environmental management system of the Chalong Rat Expressway and Bangna - At Narong Expressway, and the Burapha Withi Expressway in a total distance of 87.9 kilometers on June 28, 2017. It can be noted that EXAT has focused on the strategic development for the management of environment-friendly expressway maintenance in Bangkok.

Therefore, the researchers are interested in studying the strategy for the management of environment-friendly expressway maintenance in Bangkok under the certification of the ISO 14001 environmental management system by collecting direct speed data and speed data to reduce environmental conditions and increase sustainability in expressway maintenance.

Equipment and Methods/ Research Methods

It is mixed methods research (quantitative and qualitative) to study strategies for the maintenance management of the expressway coupled with the standard ISO 14001 Environmental Management System. The sample group used in the study was 41 maintenance personnel of the Chalong Rat Expressway (Bangna-At Narong Expressway), 23 Burapha Withi Special Division Officers (Bangna-Chonburi Expressway), and 70 people of other positions, totaling 143 people.

Data Collection

Data sources collected for use in research can be divided into two types: 1) Secondary data which is a compilation of information from documents, research reports, the study of concepts, theories, and related research; and 2) primary data: a semi-structured interview was used as tools for collecting research data which the researcher created by researching from textbooks, books, and related research along with seeking advice from a principal advisor, co-advisor, and research experts consisting of prioritization of expressway maintenance using closed-end questions and information on problems, obstacles, and suggestions to develop strategies for the maintenance of the Chalong Rat Expressway, Bangna - At Narong Expressway, and Burapha Withi Expressway with the open-ended questions.

Data Analysis

This research used a ready-made statistical program for the analysis of social science research. The analysis of statistical data was divided as follows: 1) basic personal status economic and social of respondents by using descriptive statistics: Percentage, Mean, and Standard Deviation. 2) Data analysis on expressway maintenance priorities by using descriptive statistics to explain the statistical data used in the interpretation of the case, consisting of

Frequency, Percentage, Minimum, Maximum, and Standard Deviation to measure central tendency.

Research Results and Discussions

Basic personal, economic, and social status of the respondents

The study found that two-thirds of the respondents (74.13%) were male, aged between 40-56 years old (44.76%), received a Bachelor's degree (49.65%), and had other types of responsibilities (55.24%), the highest average working time was more than 15 years (51.75%) and the average income was 20,001 baht or more (66.43%).

The current management of the Highway Maintenance Division of the Chalerm Mahanakorn Expressway and Chalong Rat Highway Maintenance

The study found that a study of information on expressway maintenance management strategies for expressway maintenance works of Bangna - At Narong Expressway (Ramintra - At Narong and Ramintra - Outer Ring Road) and the Burapha Withi Expressway about the nature of the damage on expressways for maintenance. The questionnaire was used as a data collection tool consisting of seven aspects: 1) strategy and plan, 2) organizational structure, 3) operational system, 4) management style, 5) personnel, 6) skills and abilities, and 7) shared values, a total of 28 items. After that, data were taken to find the average to classify the level of importance under the criteria divided into five levels of Likert (1932) as follows:

Level 5: the mean of 4.21 - 5.00 means the highest opinion level.

Level 4: the mean of 3.41 - 4.20. means a high opinion level.

Level 3: the mean of 2.61 - 3.40 means a moderate opinion level.

Level 2: the mean of 1.81 - 2.60. means low opinion level.

Level 1: the mean of 1.00 – 1.80 means the lowest opinion level.

The study found that most respondents had opinions on the expressway maintenance management strategies in all aspects at a high level with a total mean of 3.47 (S.D = 1.103). When considering each aspect, it showed that respondents had the highest average value of expressway maintenance management strategies in terms of operational systems, with an overall average of 3.66 (S.D. = 1.073), followed by the shared values, with an average of 3.55 (S.D. = 1.071), the organizational structure, with an average of 3.53 (S.D. = 1.063), the management style, with an average of 3.51 (S.D. = 1.123), skills and abilities, with an average of 3.47 (S.D. = 1.075), strategy and plan, with an average of 3.43 (S.D. = 1.126), and personnel, with an average of 3.16 (S.D. = 1.192), respectively (as shown in Table 1). This is consistent with Kriengsak Tejawong (2010) who studied "Factors affecting the personnel performance efficiency of Bureau of Rural Roads 10 (Chiang Mai)." The research found that the effectiveness of human resources

at the Department of Rural Roads 10 (Chiang Mai) is average. The internal and external motivation factors that influence the effectiveness of the performance are at a moderate level. In terms of any problems or obstacles affecting performance effectiveness.

The study showed that the overall expressway maintenance management strategies were at a high level of opinion. When considering each aspect, it showed that the respondents had a high average level of opinions in terms of operational systems and the respondents had management strategies that mainly focused on service users. There is a safe working system for health, sanitary, and ISO 14001 environment. Operations are a strict and clear division of work. In terms of shared values, personnel in the organization are proud of their position including executives and colleagues who support and help each other. In terms of the organizational structure, the chain of command is divided, making the operation flexible and continuous. Supervisors do not have the authority to command alone, but they are closely guided and assisted. As a result, the relationship of the Expressway maintenance department is conducive to the operation. In terms of management style, supervisors are good examples of personnel in the organization and they have high leadership, courage, and determination, and periodically review all aspects of operations. In terms of skills and abilities, personnel with knowledge, understanding, and expertise in responsible expressway maintenance can provide good service and create good works for expressway maintenance work. In terms of strategy and plan, there are clearly defined targets and transferred plans for the expressway maintenance operations. The strategic plan is in line with the mission, which is flexible and can be adjusted according to the situation. In terms of personnel, respondents wanted to express their comments to their superiors or colleagues to improve the organization including fair welfare and personnel performance evaluation. This is in line with Attaporn Khaonuna (2011), who studied "Rural roads maintenance management system". The study found that highways are an important infrastructure in country development. Therefore, it is necessary to plan the construction and maintenance of the correct way and have the right time. However, due to limitations in terms of budget, road maintenance management has to rely on the prioritization of routes to assist in decision-making for road maintenance, so, bringing urgent priority lines to be repaired first to use the limited budget for maximum efficiency.

Table 1 Means and Standard Deviations, and the Respondents' opinion level on Expressway Maintenance Management Strategies

(n=143)

Issues related to expressway maintenance management	\bar{X}	S.D.	Opinion Level
1) Strategy and plan	3.43	1.126	High level
2) Organizational structure	3.53	1.063	High level
3) Operational systems	3.66	1.073	High level
4) Management style	3.51	1.123	High level
5) Personnel	3.16	1.192	Moderate level
6) Skills and abilities	3.47	1.075	High level
7) Shared Values	3.55	1.071	High level
Total	3.47	1.103	High level

The expressway maintenance operating system focuses primarily on service users. It is an issue that the respondents give a high level of opinion towards the Expressway maintenance management strategy. The maintenance of the Chalong Rat Expressway, Bangna - At Narong Expressway (Ramintra - At Narong and Ram Indra - Outer Ring Road), and the Burapha Withi Expressway focuses on a safe working system for health, sanitary, and the ISO 14001 environment where personnel have knowledge, understanding, and expertise in responsible expressway maintenance work. Moreover, there is a promotion of operational systems such as thorough training of employees, so they can perform expressway maintenance work quickly. This is consistent with Eakkaruk Tanacharoenpisarn (2011) found that two factors related to environmental awareness were environmental training and knowledge and understanding of ISO 14001. Three factors significantly related to the acceptance of the implementation of ISO 14001 were age, knowledge, and understanding of ISO 14001, and awareness of the importance of ISO 14001. Recommendations from this study are 1) training and development for all staff to create knowledge, understanding, and awareness about the environmental management system. 2) the executives should pay attention and act as leaders in implying the system by issuing the policy, providing a budget, and cooperating with the working team. 3) create a culture in which the importance of the environmental management system is sustainably recognized because the Office of Natural Resources and Environment Policy and Planning is the country's main agency for the environment. It is also consistent with Arissara Srikacha (2000) who found that the sample used in the research were 620 executives, executive-level, and operational employees, including supervisors/ departments/ units/ divisions and practical employees from industrial

organizations in the eastern region who certified ISO 14001 have an agreeable attitude towards the implementation of the UK ISO 14001 environmental management system. Most of the employees are aware of environmental issues and the importance of implementing the ISO 14001 standard and agree that the ISO 14001 standard helps to improve the quality of life.

Information about problems, obstacles, and suggestions of the respondents regarding the maintenance of the Chalerm Mahanakorn Expressway and the Chalong Rat Expressway

The results of the study of problems and obstacles revealed that 1) strategy and plan found that there was relatively little clarity of strategies and plans, resulting in a lot of steps in the work process and limited use of budget and facing the problem of shortage of human resources. In terms of corporate executives, there was a focus on one group of personnel which is not taken into account thoroughly. As a result, some of the staff were not trained regularly. In terms of obstacles, it revealed that the operation of the information system is not very up-to-date.

2) The organizational structure has a high hierarchy. This results in delays in operations and decision-making. The organizational structure is not clear and transparent. Respondents suggested that the organizational structure should have a clear hierarchy to reduce operational redundancy and consideration should be given to balancing the number of personnel and the number of jobs including the decentralizing decision-making power.

3) The operation system is delayed due to misunderstandings, personnel who does not have sufficient knowledge of operations, and there are many levels of operational procedures. Obstacles encountered related to the use of information technology and insufficient equipment and tools for the operation. This includes overly bureaucratic-based operations.

4) The management style has many aspects of commands causing group work, which affects redundancy in operations. The alignment and duties of personnel are not unsuitable for work.

5) The number of personnel is insufficient for the operation and cannot correspond to the operation affecting the risks to the users. The obstacle that arises in terms of personnel is the difference in age making it difficult to accept new technologies. Respondents suggested that there should be personnel replacement when relocating or relocating including supporting adequate welfare to encourage workers to work efficiently.

6) Skills and abilities with the operation in various positions lack professional consciousness. The operation does not have standards, which has a wide impact, for example, the equipment breakdown before its actual lifespan, sub-standard lighting, and also resulting risks to road users.

7) Shared values within the organization, there is a division of parties causing different values from each other. So, the respondent suggested that more value-related activities should be promoted, to create pride and love in the unit and the organization so that the concept of working in a positive direction together.

The result of the study of suggestions for the development of expressway maintenance management strategies found that respondents suggested that there should be continuously improved and development strategies to be consistent with the development of the organization and the nation by enhancing skills, knowledge, training, work visits to personnel thoroughly and continuously. In terms of organizational structure, awareness of one's duties and positions should be created. In terms of operations for strategy and plan development, there should be planning and participation in the presentation of opinions between executives and personnel. Appropriate decision-making power is distributed according to the management model to make operations more flexible and quicker to operate, including management of budget, work, and people to be suitable for the development of effective strategies. Another important factor is that personnel should build morale to allow personnel to progress whether adjust the salary base or promote the position for personnel appropriately.

Conclusion

The results of the study on "The Strategy for Management of Environment-Friendly Expressway Maintenance in Bangkok" found that the expressway maintenance management strategy for the maintenance of the Chalong Rat Expressway, Bangna - At Narong Expressway (Ramindra - At Narong and Ram Indra - Outer Ring Road), and the Burapha Withi Expressway, had overall opinions at a high level with a total mean of 3.47. When considering each aspect, it revealed that the operational system had an average of 3.66, the shared values had an average of 3.55, the organizational structure had an average of 3.53, the management style had an average of 3.51, Skills and abilities had an average of 3.47, the strategy and plan had an average of 3.43, and personnel had an average of 3.16, respectively.

The results of the study of problems and suggestions about the development of strategies for the maintenance management of the Chalong Rat Expressway, Bangna - At Narong Expressway (Ramintra - At Narong and Ramintra - Outer Ring Road), and the Burapha Withi Expressway, divided into seven aspects, found that 1) the main problem with the strategy is that there are a few clarities of strategies and plans resulting in unclear goals. As a result, the work process has a lot of steps and uses over budgets. There is also a shortage of human resources. On the part of the organization's executives, there is a focus on only one group of personnel. 2) The main problem with the organizational structure is that the organizational structure has too many

hierarchies resulting in decision-making actions and work delays including changes in organizational structure affecting the operation as well. The organizational structure should be clear and transparent. There must be a balance between the number of people and the number of jobs. 3) The main problem with the operating system is that the operating system is delayed due to misunderstanding. Personnel do not have sufficient knowledge of the operation and the sequence of operational procedures has many steps. Obstacles that arise in operational systems are often related to the use of information technology and equipment and tools in operation are inadequate, damaged, and frequently repaired. As a result, the support budget is insufficient. 4) The main problem with the management style is that the management style commands many aspects, causing group work, which results in redundancy in operations. 5) The main problem in terms of personnel is that the number of personnel is insufficient for the operation and have inconsistent skills with operations, affecting long-term work, losing budget, including some positions that may affect the risks of motorists. When it comes to resignation or retirement, causing a lack of personnel in practice. 6) The main problem in terms of skills and abilities with the operation in various positions is a lack of professional consciousness. The operation does not have standards, which has a wide impact, for example, the equipment breakdown before its actual lifespan, sub-standard lighting, and also resulting risks to road users. 7) The main problem in terms of shared values is that within the organization there is a grouping of parties and divisions resulting in different values from each other. This is consistent with Natthanan Thanadrob (2012), who studied “Factors Affecting the Performance Efficiency of Employees of the Railway Authority of Thailand”. The research results suggested that to achieve the performance efficiency of the employees of the Railway Authority of Thailand, the agency should improve career advancement opportunities, love and pride in the profession, relationship with colleagues, freedom to express opinions on work and adjust remuneration rates in line with current economic conditions including adjusting the working environment to suit to achieve efficiency and achieve the goals of the organization.

For proposing solutions and developing strategies for the maintenance of the expressway for environmental sustainability, they are as follows: (1) International standards should be applied in the operation of social responsibility to solve environmental problems; (2) It should strive to create awareness among workers at all levels of social responsibility; (3) Integration between internal and external agencies should be encouraged; (4) the organization should participate in supporting activities for public benefit; (5) All project implementation information should be disclosed to society; and (6) there should be an energy conservation policy. This will lead to the energy conservation process of the Expressway Authority of Thailand. In addition, there is a good action plan that is suitable for the organization to achieve the goal of energy

management. Implementation can be divided into six steps as follows: 1) Establish an energy conservation policy, 2) Set goals and plans for energy conservation, 3) Training plans and public relations communication plans, 4) Execute according to the plan, 5) Follow up and review the energy conservation plan, and 6) Review of energy management systems as shown in Figure 1.

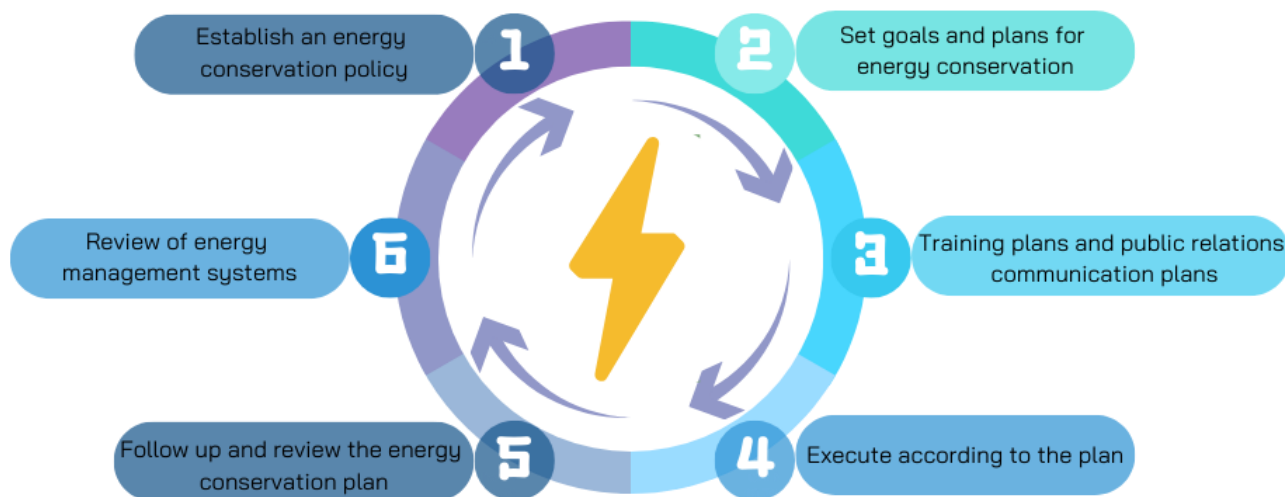


Figure 1 Energy Conservation Steps of Expressway Authority of Thailand
(Expressway Authority of Thailand, 2020)

Recommendations from research results

1. Knowledge should be promoted to executives/ officers about the prioritization of damage on the expressway for maintenance by becoming more aware of the importance of traffic users. There should be quick solutions to reduce road accidents whether it is damage on the expressway of the traffic surface, damage on the expressway of the guide sign, damage on the expressway of the retaining wall road, damage on the expressway of the sound barrier, or damage on the expressway of the drainage system which should have clear priorities.

2. The expressway maintenance management strategy should be promoted in terms of personnel by exchanging knowledge between executives and personnel including the development of skills such as planning operations together within the organization to create more interaction with each other or stimulating and motivating by increasing welfare and fair evaluation of the performance of personnel and so on.

3. The expressway maintenance management strategy should be promoted to be flexible and appropriate to the situation, including the aims and missions of expressway maintenance work, and develop knowledge about ISO 14001 safe working systems for health, sanitary, and environment.

4. Technology should be introduced to improve maintenance management. This may include the use of a Computerized Maintenance Management System (CMMS) to efficiently track maintenance activities, schedule audits, and manage work orders. Furthermore, consider using a remote monitoring system to detect potential problems and collect real-time data on road conditions.

5. Collaborating with stakeholders for effective maintenance of the expressways requires cooperation among various stakeholders, including government agencies, contractors, and local communities to engage in regular communication and coordination to ensure that everyone has understanding each other and works towards a common goal.

6. Budget and resource allocation by establishing a comprehensive budget plan for the maintenance of the expressway taking into account needs both in the short term and the long term. Resources should be allocated efficiently to prioritize critical maintenance tasks and manage high-priority areas.

7. There should be ongoing training and education by providing regular training and education to maintenance workers, keeping them updated on the latest techniques and best practices in the field. This will enhance their skills and knowledge, leading to better maintenance results.

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