SUSTAINABILITY CRITERIA FOR ROAD MAINTENANCE WORK IN MALAYSIA USING pHJKR RATING TOOL

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DEDICATION

To my beloved children; Fatin Amiera, Farid Aiman, Farah Aleesa & Faiz Azeem. Thank you for your patience and endless support.

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ABSTRACT

Construction of roads in Malaysia has begun since before independence in 1957. After the country gained independence, the road system has been improved through rapid development planning every five years which launched by the government (Malaysia Plan). The meaning of Federal roads category is all roads declared under the Federal Roads Ordinance (1959). In addition, the federal road also comprises of the major interurban roads joining the state capitals and roads leading to points of entry to and exit from the country. State roads generally categorized as the primary roads in the state area and providing intra-state travel between the district administrative centers. Sustainability for road projects can be defined as concept integrates the economic, societal and environmental aspects which the road projectability to meet our needs without compromising the ability of the next generations to meet theirs. In Malaysia, it is generally found sustainable were evaluated based on planning, design and construction stage and the most commonly used tools are pHJKR. Sustainability of road has not been re-assess after the project defect liability period ends. Referring to a concession maintenance contract, there is no clear indication of the responsibility of concession companies to the compliance of sustainable criteria of the certified roads. No specified tool to measurement on the maintenance of roads in order to assess and evaluate the sustainable elements compliance. There are needs to create its own original criteria based on local conditions. The objective of this study is to identify the current implementation of pHJKR (Road), to identify existing sustainable criteria based on pHJKR that can be used during maintenance phase road in Malaysia and propose a comprehensive sustainable pHJKR criteria for the maintenance phase. The main methods will be used in this research is quantitative and observation. The qualitative methods are concerned to identify and examine the issues governance, applicability of sustainable in road maintenance in Malaysia. Under the qualitative methods, case study, interview, and questionnaire survey will be used. A result of this study presented current maintenance practice in Malaysia and provided a list of sustainable criteria and sub-criteria for the maintenance phase with modifications of assessment criteria.

ABSTRAK

Pembinaan jalan raya di Malaysia telah bermula sejak sebelum kemerdekaan pada tahun 1957 lagi. Setelah negara mencapai kemerdekaan, sistem perhubungan jalan raya telah ditambahbaik melalui perancangan lima (5) tahun oleh kerajaan (Rancangan Malaysia). Jalan persekutuan bermaksud jalan raya yang diisytiharkan dibawah ordinan jalan persekutuan (1959) dan juga terdiri daripada jalan yang menghubungkan ibu negara dengan jalan ke pintu masuk dan keluar negara. Jalan negeri pula umumnya dikategorikan sebagai jalan yang menyediakan intra-negeri antara pusat pentadbiran daerah. Kelastrian bagi projek jalan raya boleh ditakrifkan sebagai satu konsep intergrasi dari aspek ekonomi, sosial dan alam sekitar tanpa menjejaskan sumber dan keupayaan generasi akan datang. Di Malaysia secara umumnya didapati penilaian terhadap kelastrian jalan menggunakan pHJKR hanya dilaksanakan pada peringkat perancangan, rekabentuk dan pembinaan sahaja. Kelastrian jalan raya yang telah dibina tidak dibuat penilaian selepas tempoh liabiliti kecacatan. Merujuk kepada kontrak penyelenggaraaan konsesi, tidak ada petunjuk jelas tentang tanggungjawab syarikat konsesi untuk mematuhi kriteria jalan lestari. Tiada medium khas yang digunapakai untuk menilai pematuhan elemen lestari jalan raya semasa penyelenggaraan dan terdapat keperluan untuk mewujudkan kriteria berdasarkan keadaan tempatan. Objektif kajian ini ialah untuk mengenalpasti perlaksanaan semasa pHJKR (jalan), mengenalpasti kriteria lestari sediada berdasarkan phjkr yang boleh digunakan semasa fasa penyelenggaraan dan seterusnya mencadangkan kriteria lestari yang komprehensif untuk fasa penyelenggaraan. Kaedah kualitatif adalah untuk mengenal pasti, menyiasat dan mengkaji isu-isu tadbir urus, kebolehlaksanaan penggunaan jalan lestari & penyenggaraan. Untuk kaedah kualitatif, temuduga, kajian kes dan tinjauan soal selidik akan digunakan. Selain itu, kaedah pemerhatian juga akan digunakan untuk menyiasat pelaksanaan penyelenggaraan. Hasil daripada kajian ini juga akan menyediakan senarai kriteria dan sub kriteria lestari semasa fasa penyelenggaraan berdasarkan amalan semasa dan seterusnya hasil kajian ini juga akan mencadangkan senarai kriteria dan sub kriteria yang baru dengan pengubahsuaian.

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BQ	-	Bill Of Quantity
FGD	-	Focus Group Discussion
HODT	-	Head Of Design Team
HOPT	-	Head Of Project Team
JKR	-	Jabatan Kerja Raya
MCDA	-	Multiple Criteria Decision Analysis
MyGHI	-	Malaysian Green Highway Index
OECD	-	Organization for Economic Cooperation and Development
pH JKR	-	Penarafan Hijau JKR
PWD	-	Public Works Department (JKR)
SO	-	Site Officer

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CHAPTER 1

INTRODUCTION

1.1 Background

Development of infrastructure has a huge impact on a country where it is a basic service. It also provides facilities for connecting fundamental system to boost economic growth and quality of life such as education, transportation, communication, energy and other systems. The main structure such as roads contributes significantly to economic development and provide important social benefits. It essential to supports government initiatives for development and social needs. Constructions of road and others development must be well planned to ensure the path is in line with government development strategy to stimulate nation's economy.

Roads and transportation contribute significantly to economic growth and development and also bring significant social benefits to people. The roads have a high impact to the aspect of sustainable in the transportation sector and poorly maintained roads will contribute to negative effects such as increase poor in health, accident rates, poverty, illiteracy in rural area, constrain mobility, raise vehicle operating costs and others other adverse effects. Roads are one of the most important public assets in many countries. Improvements to road users carry immediate benefits. Good road surface conditions will contribute the well-being of the people through improved access to hospitals, schools, markets and others location. In order to sustain these benefits, road improvements must be followed by a well-planned maintenance program (Burningham & Stankevich, 2015)

The construction of infrastructure has been provided by the government; therefore, the assessment of sustainability must be recognized at each level of

implementation in order to balance the economic factor of growth and development. It is important to look at how governments can assess eco-efficiency in terms of infrastructure growth, which has traditionally been funded by the public sector. (United Nations ESCAP. 2006). Although resolving economic growth and stimulation has become main focal point for many developing countries but majority of countries are accepting facts that substantial efforts are required to ensure strategic changes in regulating policies in protecting ecosystem.).

The Department of Public Works (JKR) is one of the departments in the Ministry of Public Works of Malaysia, which has established the JKR Strategic Framework 2016-2020 On the government's side and this agency responsible for the management and execution of road infrastructure works, including outlined five strategic themes and also leading of sustainability. The strategic outcome for the theme is sustainable development of infrastructure (JKR Strategic Plan, 2016).

1.2 Research Background

Sustainable environmental and social responsibility infrastructure approach would increase the tolerance of community and, in turn, the network itself will have a longer life span. Nevertheless, a longer life span will contribute to long-term cost savings in operation and maintenance, but with consequences of higher initial costs. While initial construction costs may be higher than normal projects, it is widely believed that long-term cost savings in operation and maintenance will help to recover those costs. Numerous public and private agencies around the world have implemented rating systems that are compliant with current standards, legislation and regulatory criteria that can measure sustainability. While several systems of rating are commonly used to measure the sustainability of individual buildings, he sustainability evaluation method of infrastructure projects has discouraged the widespread adoption of green roads.

Road and highway is the important infrastructure of the country and plays a key role in the social and economic growth of a country. Such infrastructures,

including highways, buildings, tunnels and others development, are can benefit to the people by giving inter-city connection. Data from Public Work Department (JKR), as reported in 2018 there are 237,022.353 km of roads in Malaysia (Statistik Jalan, 2018). These roads are inclusive of state roads and federal roads including highways. Data from the Department of Public Works (JKR) is 237,022,353 km roads length in Malaysia as recorded in 2018 (Statistik Jalan, 2018). World Bank also reported, Malaysia's overall road spans 20 km per 100 km2 with 76% of roads being paved.

From Table 1.0, it is clear shows that state roads category contribute to 91.7% of total roads in Malaysia, which cost the maintenance costs of government RM4,328,342,800.00 in 2017. (Statistik Jalan, 2018).

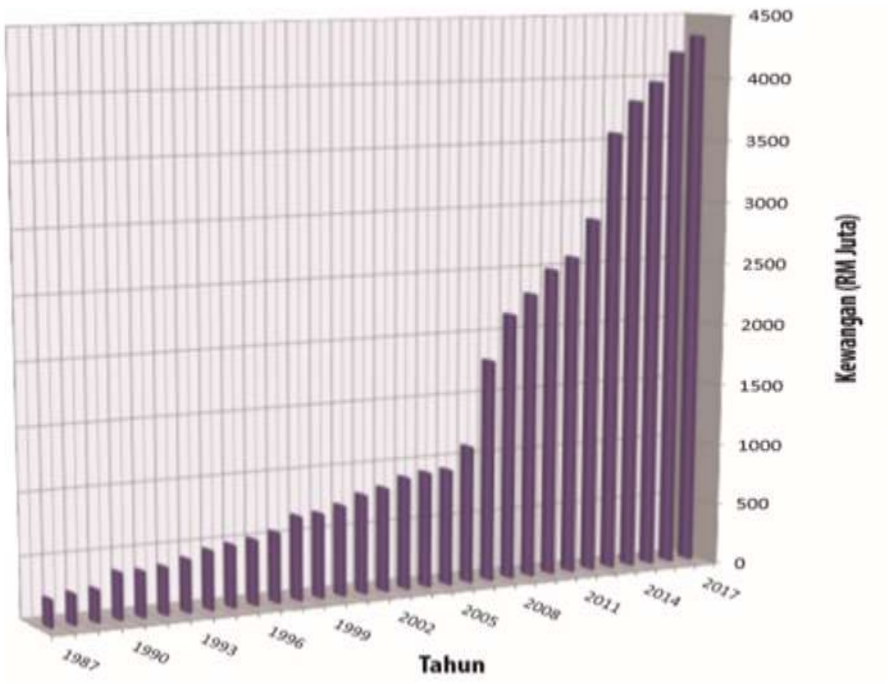

Figure 1. 1 Provision of state road maintenance
Souces : Buku Statistik Jalan 2018

Currently, there are approximately 240,000 km roads need to maintain and data showing the length of the road increases in every year. Road maintenance is assumed to play very important role in maintaining longer lifespan and safety. According to data from 2000, the total length of the road in Malaysia was only 67,590.46 km, while there were 237,022,353 km in 2017, indicating a significant

increase of over 300%. (Statistik Jalan, 2018). The overall maintenance cost of the state road in 2000 was RM841,900,000.00 and raised regularly annually in parallel with the increase in road length to RM4,328,342,800 in 2017 with an increase of more than 500% (Statistik Jalan, 2018). Very high maintenance costs will not only burden the government, but will also cause public harm while rehabilitation activities are done. The maintenance works were allocated to concession firms work to ensure road quality on behalf of the government (Road Maintenance Contract, 2015). An efficient and effective road design would definitely reduce the cost of the lifecycle and eventually increase the lifespan of the roads.

Road construction consists of several stage which beginning with planning, followed by design, constructions, operation and maintenance. Such phases the extend to a period of 40 years where the maintenance phases cover the majority periods by 35 years, while the average of 5 years is for the others earlier phases. Hence, the maintenance process should be considered as an important to the sustainability of roads.

The assessment of the yarded sustainability scale must be used to consider and ensure the efficiency of road operations. Create a rating system based on specific criteria as a measuring device for maintenance of road will achieve this objective. Some ranking systems, however, are commonly used to determine building sustainability. While many company and agencies have set up their own rating system, there is still a lack in maintenance in their own assessment particularly in road development facilities. In order to assess sustainable buildings and infrastructure, few rating systems have been developed in Malaysia**.** The very popular transportation rating tools are Penarafan Hijau JKR (pHJKR-Road) and Malaysia Green Highway Index (MyGHI). Such tools are dedicated to Malaysia's evaluation of highways and non-toll roads. These systems were designed equally for road development. However, pHJKR has been found to lack maintenance criteria compared to MyGHI, where all stages of road construction are covered. Therefore, the work aimed at studying the much-needed criteria for assessing the activity of roads (without toll). The study findings are criteria for determining the actual sustainability of the road to benchmarking the road before being handed over to the

contractor for maintenance work. This will result in an extensive study of the proposed criteria for sustainable maintenance activities and indexing for maintenance pHJKR (Roads).

1.3 Problem Statement

The only available rating tools for roads (excluding highways) in Malaysia is penarafan Hijau – pHJKR (Roads) Sustainability for road projects was measured start on the basis of the planning. Next process is design, construction and was not reassessed after the end of the project's responsibility for defects. Since there is no re-evaluation after the certification of roads, the maintenance concession companies have retained questionable sustainability factors.

Referring to the concession company contract, there really shows no clear ind ication of the obligation of the concession companies to fulfill the approved roads ' e nvironmental criteria. Ultimately the certified roads would turn into any normal roads where all green elements during operation and maintenance was intentionally or accidentally destroyed after road refurbishment. When reviewing the research issue with the Department of Public Works (JKR), researchers discover that the revision of the contract for the road maintenance is inevitable where conventional contracts are substituted with performance-based contracts and will be introduced in the near future. The 5-year revision contract is required to reduce maintenance costs in every 2 years while improving road quality. Assuming that the agreement in the contract is focused on the performance standards that have been achieved and not on the quantification of the work that has been done, contractors would definitely be encouraged to increase profit margins if the concessionaires have succeeded in minimizing costs in order to meet specific performance levels. Accordingly, there will naturally be a lack of control over application design, materials, technology, processes and maintenance work management when it is solely concession companies ' prerogative.

The Malaysian Green Highway Index (MyGHI) assesses the sustainability of highways where operations are regulated and tolled within highway boundaries. While, non-toll roads are viewed as an open access network where lane borders are not clearly demarcated. It includes community and variety of environmental conditions along the road alignment and can be accessed without restriction at any time, any place, and anyone, including individuals and animals. Therefore, pHJKR (Roads) and MyGHI, which act as local highway rating tools, are possible tools in offering different factors related to their physical engineering design, function, safety, environmental, economic and social, but some modifications are expected to match the characteristic road infrastructure and its local environment. No method developed to assess road maintenance in order to evaluate and analyze compliance with sustainable elements. This is due to the uniqueness, adjustment and enhancement of the local road if it is required to suit any other existing road rating tools with local road conditions. As a consequence, in addition to having a system based directly on Malaysia's geographical and social environment, it will generate further acceptance and impediment factors and promote sustainability to coexist in the region's road infrastructure. For road maintenance, therefore, a measurement tool is necessary to assess and analyze compliance with sustainable elements, thus encouraging cost reduction in operation as a priority.

Based on its current selection criteria, specifications and sub-criteria for PHJKR may not be suitable for all road types where it is specifically designed for Federal Road evaluation. Even with the specific criteria, many projects are beyond the requirements circle thereby limiting the use of the assessment due to the inadequacy of the provided criteria. During the maintenance phase, road concession firms are not bound by any green and sustainable practice apart from compliance with the local environmental law. This will dissuade the use of sustainability even on sustainable graded roads during the operating process. There is also a chance that existing state roads would receive a minimum standard if tested with rating methods, but clearly the evaluation criteria had to be adjusted to the characteristics of the roads.

1.4 Aim and Objectives of the study

The aims of this study is to determining the appropriate sustainable road criteria that can be developed later in the maintenance phase for un-tolled roads in Malaysia. The following objectives are identified to achieve this aim:

(a) To investigate the current implementation of pHJKR (Road) in Malaysia
(b) To identify existing sustainable criteria based on pHJKR that can be used during maintenance phase road in Malaysia
(c) To propose a comprehensive sustainable pHJKR criteria for maintenance phase

1.5 Scope and Limitations of the study

This study will focus to federal roads and state roads in Malaysia. The target respondent are the stakeholders of the said roads including road professionals in Ministry of Public Work, Public Work Department (JKR), concession companies and road users. The respondents also include professionals from multi-level stakeholders of road maintenance and green rating in Malaysia.

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