MYGHI AND pHJKR COMPARISON FOR SUCCEEDING CRITERIA ON SUSTAINABLE ROAD DESIGN AND CONSTRUCTION ACTIVITIES OF ROAD GREEN TOOLS

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DEDICATION

This thesis is dedicated

To my supportive and inspiring supervisor, who always there giving guidance, motivation and inspired me to become a better person.

And of course, to my lovely wife that always stay by me, giving support, lending shoulder, and making me always smile to endure this Master journey.

And, not to forget, to all of my family members, especially my mother, who always praying for my success.

A word of thanks is not really enough to express my gratitude to each of the person that contribute to make who I am today.

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ABSTRACT

Assessment of green road in Malaysia can be considered new throughout the country. There are two prominent sustainable rating tools for the road in Malaysia which are Malaysia Green Highway Index (MyGHI) and Penarafan Hijau JKR Sektor Jalan (pHJKR-KJ). Penarafan Hijau JKR (pHJKR) was developed by Malaysia Public Work Department (PWD), where it is a measurement tool to assess the sustainability level of government development projects, pHJKR help to promote the requirement in sustainable development within road works project. Whereas, Malaysia. Green Highway (MyGHI) Index assessment which has been introduced in 2015 by Malaysia Highway Authority (LLM), is focused more on sustainability degree assessment of Highway in Malaysia. However, it is found that some assessment criteria are only available in respective rating tools. The specific criteria is only available in pHJKR neither nor MyGHI. In terms of design and construction activities, pHJKR has 43 sub-criteria, while MyGHI has 10 sub-criteria, and 26 super sub-criteria. Even pHJKR cover larger sub-criteria in the assessment, but there are still some sub-criteria in MyGHI is not included in pHJKR. Hence, it is essential to study the comparison between pHJKR and MyGHI. Opinions from the user of MyGHI and pHJKR rating tools are collected thru matrix tabulation survey to measure their level of agreement of respondent on the relation between proposed criteria for succeeding green road rating tools. From the result of the survey, Relative Important Ratio (RIR) analysis was used to represent significant of the proposed criteria for succeeding green road rating tools. By reviewing the existing criteria in both road rating tools, it will lead to the identification of more relevant succeeding criteria into new future road rating tool, with this, any existing rating criteria can be incorporated, revised and improvised, to make it more sustainable and reliable in road project practice.

ABSTRAK

Penilaian jalan hijau dalam Malaysia boleh dipertimbang sebagai perkara baharu di keseluruhan negara. Terdapat dua alat penarafan kelestarian utama untuk jalan raya di Malaysia iaitu Indeks Lebuhraya Hijau Malaysia (MyGHI) dan Penarafan Hijau JKR Sektor Jalan (pHJKR). pHJKR telah dibangunkan oleh Jabatan Kerja Raya (JKR) Malaysia, di mana ia merupakan sebuah alat pengukuran bagi menilai tahap kelestarian projek-projek pembangunan kerajaan. pHJKR membantu mempromosikan keperluan dalam pembangunan lestari dalam kerja projek jalan. Manakala, Penilaian Indeks Lebuhraya Hijau (MyGHI) telah diperkenalkan pada tahun 2015 oleh Lembaga Lebuhraya Malaysia (LLM), di mana ia memberi tumpuan lebih kepada penilaian kelestarian lebuhraya di Malaysia. Walau bagaimanapun, terdapat beberapa kriteria penilaian hanya respektif terdapat di alat penarafan masing-masing. Kriteria yang spesifik hanya terdapat sama ada dalam pHJKR atau dalam MyGHI sahaja. Dari segi reka bentuk dan aktiviti pembinaan, pHJKR mempunyai 43 sub kriteria, manakala MyGHI mempunyai 10 sub kriteria, dan 26 super sub kriteria. Walaupun pHJKR meliputi sub-kriteria yang lebih besar dalam penilaian, tetapi masih terdapat sub-kriteria dalam MyGHI tidak termasuk dalam pHJKR. Oleh itu, adalah penting untuk mengkaji perbandingan antara pHJKR dan MyGHI ini. Pendapat dari pengguna alat penarafan MyGHI dan pHJKR dikumpulkan melalui kajiselidik tabulasi matriks untuk mengukur tahap persetujuan respoden ke atas hubungkait di antara kriteria yang dicadangkan bagi keberjayaan alat penarafan jalan hijau. Dari hasil kaji selidik, analisis Purata Kepentingan Relatif (RIR) digunakan bagi menilai signifikasi kriteria yang dicadangkan bagi keberjayaan alat penarafan jalan hijau. Dengan mengkaji semula kriteria sedia ada dalam kedua-dua alat penarafan jalan, ia akan membawa kepada pengenalan keberjayaan kriteria yang lebih relevan ke dalam alat penilaian jalan hijau. Dengan ini, kriteria penarafan jalan sedia ada boleh disemak dan diperbaiki, untuk menjadikan ia lebih lestari dan boleh dipercayai untuk digunakan di dalam praktik projek jalan raya.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Road infrastructure development plays a significant impact on a country as this infrastructure provides facilities to connect basic life systems for transportation, energy, communication, education, and other systems. Roads and highways are one of the main infrastructures of a country and its play an essential role in a nation's social and economic development. These infrastructures are important to the community since they provide connectivity between towns and cities which will enhance the economic and social engagement of societies. According to data from Public Work Department (JKR), as of 2017, it is reported that there are 237,022.353 km of roads in Malaysia (JKR, 2018). . These roads are inclusive of state and federal roads including highways. The data also recorded that state roads contribute nearly 92% of the total roads in Malaysia with a total length of 217,071.742km (JKR, 2018). Table 1.1 below show the statistics of Malaysia Road in 2017 based on report in Road Statistics 2018 Edition (JKR, 2018).

Table 1.1 Malaysia Road Statistics in Year 2017

Peninsular Malaysia	Federal Road Length = 14,886 km
	State Road Length = 165,326 km
Sabah and Sarawak	Federal Road Length = 3,062 km
	State Road Length = 51,745 km
Highway Overall Malaysia	Highway Length = 2,000.880 km

Road construction activities obviously bring impacts on nature. As most of the time, road development requires a connection from one point to another point, thus its alignment affect a long stretch of the natural environment. In road construction activities along the road alignment, the natural environment will be exploited and disturbed to construct the road infrastructure. These activities may include tree cutting, earthmoving activities, backfilling, slope trimming, natural water flow realignment and other activities, that have the potential to bring unfavourable impacts towards the environment. Apart from that, road construction activities also cannot escape from solid waste production, carbon emission and other pollutions such as noise pollutions. Therefore, to ensure road construction activities and development can be implemented sustainably, it is important to have sustainable road construction guidelines.

As sustainable development becomes one of the global concerns recently, many authorities and agencies around the world have come out with their sustainability rating tools in measuring the level of sustainability in development. While, in Malaysia, there are two rating tools specifically established for the development of road and infrastructure, which are Malaysia Green Highway Index (MyGHI) and Penarafan Hijau JKR for road (pHJKR). MyGHI is a rating tool to assess the sustainability of tolled Highway, whereas pHJKR is a rating tool to assess non-tolled road. pHJKR has been introduced by the Public Works Department (JKR), where it assesses the sustainability of government projects development. This particular rating tool was established with the basis of the present government's development operation requirements and standard in project implementation.

Figure 1.1 Logo of MyGHI and pHJKR

1.2 Problem Background

Malaysian scholars and policymakers have recognised the importance of assessment of sustainable development, and they have taken some initiatives, and have adapted some frameworks and tools for assessment. Frameworks and tools are mediums, which enable different institutions and organization, assess the level of sustainable development. Some examples of those assessment approaches and green rating tools are the Green Building Index (GBI), Malaysia Green Highway Index (MyGHI) and Penarafan Hijau JKR (pHJKR). Referring to phJKR, it can be classified into two categories, which are pHJKR-KB which specifically for a project involving building work, and pHJKR-KJ for a project involving roadwork (JKR, 2012).

Malaysia Green Highway Index (MyGHI) assessment was developed by Malaysia Highway Authority (MHA) or Lembaga Lebuhraya Malaysia (LLM), where this assessment consists of five categories which are Sustainable Design and Construction Activities, Energy Efficiency, Environmental and Water Management, Material and Technology, and Social and Safety with twenty-seven relevant main criteria (LLM, 2010). This rating tool was studied and developed based on the established rating tools system available around the globe.

Whereas, Penarafan Hijau JKR (pHJKR) Sektor Jalan Version 1 Manual for New Federal Roads category was produced in 2012 by the JKR This effort is aligned with PWD's first Green Mission that has been established since the Eighth Malaysia Plan (2001-2005). This rating tool has the objective to integrate the green initiatives taken by JKR, by assessing the level of sustainability in the development of government projects. The implementation of this rating tool, set a benchmark to ensure the development project adopted by the government is able to achieve the required standard in sustainability.

JKR is a Malaysian Federal Government department under the Ministry of Works Malaysia (MOW) is the agency who holds the responsibility in construction and maintenance of public infrastructure in Malaysia, including federal road and state road. According to record from the Ministry of Works Malaysia in 2010, a total length of road under JKR supervision is 137,219 km which include both federal road and state road. Whereas, in 2017, as recorded by Ministry of Works, the total length of the road increases to 237,022 km (JKR, 2018). This shows the increment of 99,803 km length of road that has been constructed only within 7 years. As the development of roads and infrastructures are growing rapidly and these will greatly bringing impact towards the society, social, economy and environment. Thus, it is very crucial to have a comprehensive and relevant assessment of the road construction project in order to measure the degree of sustainability and green initiatives that has been taken in delivering the road construction.

1.3 Problem Statement

Penarafan Hijau JKR (pHJKR) is a measurement tool to assess the sustainability level of government development projects, and subsequently, help to promote the requirement in sustainable development within a road works project. However, currently, this rating tool only applied to a new federal road project with a value of more than RM50 Million. From a statement in pHJKR-KJ Version 2.0 documents, it is stated that pHJKR manual Version 1.0 for New Federal Roads category that has been published in 2012 is not widely being used as not many projects

were deemed suitable (JKR, 2012). In the year 2013, version 1.0 of pH JKR manual for Upgrading of Roads category, was consequently produced. However, this manual was also minimally used due to the unsuitability of the criteria allocated. Later, version 2.0 was published by PWD with both new roads and upgrading of the road were combined and simplified in one manual. The latest version of pHJKR was published in 2018, which is pHJKR Version 3.0. As pHJKR was developed in 2012, where not much local reference for green road rating tools available at that time, hence further study and assessment on this rating tool is needed, therefore it can become more practical and suitable to be implemented locally in Malaysia. The reason is due to the uniqueness of Malaysia local road, local geography, local topography, local environment and also local industry practice, which may not be similar to the other country.

Thus, Malaysia's local road element needs to be integrated into the rating tool, there are criteria used to be assessed by the rating tool shall be reliable. Opinions and insight from local stakeholder and local experts in road works must be taken into consideration in reviewing the rating tool. Besides that, based on a study by Jeffryl et. al (2019), it is found out that pHJKR rating tool design is suitable for the road project above RM50 Million. A pilot study was carried out by JKR to investigate the possibility of projects below RM50 Million value achieving any certification level by adopting existing criteria in pHJKR (Roads). From pilot study involving 21 road projects from 11 districts, that have variation in project value, which above and below RM50 Million, it is found out that only 4 road projects achieve minimum rating as Potential Certification (40%-49%). And, these 4 road projects have value above RM50 Million, which proved the idea that pHJKR is more suitable for project value above RM50 Million.

Whereas, Malaysia Green Highway (MyGHI) Index assessment which has been introduced around 2015 is focused more on sustainable degree assessment of tolled Highway in Malaysia. Comparatively, MyGHI was produced later than pHJKR, and MyGHI referred the larger number of worldwide rating tool than pHJKR, where MyGHI developed based on a study from Greenroads, BE2ST, Sustainable Infrastructure Project Rating System (SIPRS), Sustainable Transportation

Environmental Engineering and Design (STEED), GreenLITES, I-LAST and STARS (Balubaid et al., 2015).

However, it is found that some rating criteria are only available in respective rating tools. In terms of design and construction activities, pHJKR has 43 sub-criteria, while MyGHI has 10 sub-criteria, and 26 super sub-criteria. Even pHJKR cover larger sub-criteria in the assessment, but there are still some sub-criteria in MyGHI is not included in pHJKR. Besides that, it is important to acknowledge that, MyGHI is concentrating on Highway project which has differences in terms of works specifications, project delivery method, and project cost. Therefore, to directly use sub-criteria from MyGHI for assessment of sustainability in rural roads, it will might be not appropriate. Further study for comparison are required for succeeding criteria between pHJKR and MyGHI in order to fulfil suitable rating criteria of the road in general. This study is focused on what succeeding criteria in the context of sustainable design and construction activities for a road project, either toll road or non-toll road. By reviewing the existing criteria in both rating tools, it will lead to the identification of more relevant succeeding criteria into new future road rating tool, where any existing rating criteria can be incorporated, revised and improvised to make it more sustainable and reliable in practice. For current there is research undertaken for Rural Road Index a collaboration research between universities and JKR.

1.4 Research Aim and Objectives

This study aims to compare the criteria regarding design and construction activities within rating tools of Penarafan Hijau JKR Sektor Jalan (pHJKR-KJ) and Malaysian Green Highway Index (MyGHI) which leads to the succeeding criteria of the design and construction activities context. The objectives of this study are:

i. To compare the criteria of sustainable design and construction activities between pHJKR and MyGHI.
ii. To analyse the importance relation of criteria for sustainable design and construction activities between pHJKR and MyGH.

iii. To propose succeeding criteria for sustainable design and construction activities in Malaysia green road development.

1.5 Scope of Works

This study focuses on the road infrastructure within Malaysia, either tolled or non-tolled which includes federal roads, state roads and highways. In terms of tools compared for this study, only criteria of MyGHI tools and pHJKR tools are used in this study. Whereas, this study also only focuses on the criteria of sustainable design and construction activities of roadwork. Other criteria such as procurement, economic, social, operation and maintenance were out of scope by this study. The target respondent to obtain the data and verification included the stakeholders of the development and construction of the roads including road professionals in Ministry of Public Works, Public Work Department (JKR), Malaysia Highway Authority (LLM), road concession companies, and road works contractors.

Figure 1.2 Photo of non-tolled road in Malaysia

Figure 1.3 Photo of tolled road in Malaysia

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