

STORM WATER MANAGEMENT CRITERIA FOR MALAYSIA  
GREEN HIGHWAY

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*Especially dedicated to:*

*My parents*

*Tuan Soh Tuan Losin & Siti Fatimah Mahamad*

*Who give motivation and loves...*

*My beloved supervisor, Prof. Dr. Muhd Zaimi Abd Majid*

*Who give the guidance with continuously in finishing this thesis...*

*All my friends*

*For their helping and loyalty of this friendship...*

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## **ABSTRACT**

Green highway is environmentally responsible and sustainable in all aspects and it is also related to the effort to leave the project area better than before in improving safety and functionality. There are many elements to be considered in order to develop the green highway index. Storm water management is one of the important scopes to establish the green highway index. In fact, improper management on storm water for highway infrastructure will create significant problem such as flooding, surcharge and channel system blockage. As a result, it creates dangerous environment to road users when water ponding on the road surface. The environmental friendly approach should be applied when dealing with storm water runoff. Therefore, this study is focusing on storm water management towards developing the green road index. The current approach will be highlighted in this study starting from reviewing the literature, develop the questionnaire and thus distribute the designed questionnaire to the respondents. This study consists of survey and interview according to the design questionnaire related to green highway criteria. The collected data has been analyzed by using SPSS score index and statistical analysis. The finding of this study is storm water management criteria and element which contributing for new green highway development has been established. In conclusion, score point for each element criteria been determined as a guide for new highway assessment.

## ABSTRAK

Lebuhraya hijau adalah memberi impak terhadap alam sekitar dan mapan dalam semua aspek. Ia juga berkaitan dengan usaha untuk meninggalkan kawasan projek yang lebih baik berbanding sebelum ini dalam meningkatkan fungsi dan keselamatan. Terdapat banyak unsur yang perlu dipertimbangkan dalam usaha untuk membangunkan indeks lebuhraya hijau. Pengurusan hujan adalah salah satu aspek penting untuk mewujudkan indeks lebuhraya hijau. Malah, pengurusan air hujan yang tidak teratur untuk infrastruktur lebuhraya akan mewujudkan masalah besar seperti banjir, dan saluran tersumbat sistem. Akibatnya, ia mewujudkan persekitaran yang berbahaya kepada pengguna jalan raya apabila air bertakung pada permukaan jalan. Oleh itu, kajian ini memberi tumpuan kepada pengurusan air hujan ke arah membangunkan indeks jalan hijau. Pendekatan semasa akan ditonjolkan dalam kajian ini bermula dari mengkaji kesusasteraan, membangunkan soal selidik dan seterusnya mengedarkan soal selidik yang disediakan untuk responden. Kajian ini terdiri daripada kaji selidik dan temuduga mengikut soal reka bentuk berkaitan kriteria lebuhraya hijau. Data yang dikumpul telah dianalisis dengan menggunakan SPSS indeks skor dan analisis statistik. Hasil daripada kajian ini adalah kriteria pengurusan air hujan dan elemen yang menyumbang untuk pembangunan lebuhraya hijau baru telah ditubuhkan. Kesimpulannya, titik perincian untuk setiap kriteria unsur telah ditentukan sebagai panduan bagi penilaian lebuhraya baru.

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**SHORT LIST**

BMP	-	Best Management Practice
EMS	-	Environmental Management System
LID	-	Low Impact Development
LCCA	-	Life Cycle Cost Analysis
MSMA	-	Manual Saliran Mesra Alam

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 Background of the Study**

The network of highway in Malaysia is known as one of the uppermost infrastructures that also called as ‘backbone’ of the economic development of the country. This highway accommodation has served a large connection from one place to another place that has been developed by our local country agencies, Projek Lebuhraya Utara (PLUS), Lembaga Lebuhraya Malaysia (LLM) and etc. The development of highway construction has expanded over the years with the effective advanced planning, intelligent construction and efficient maintenance technique.

Road development in tropical country like Malaysia has vastly accelerated in recent years and construction has progressed from foot tracks to modern highway. However, in current efforts to pursue transformations in highway construction, there are still low stages of awareness towards environmental effect and did not take this environment impact into consideration during construction of highway. This statement has been supported by Bryce (2008) where he stated that highway constructions have a large negative impact on surrounding ecosystem and overall environmental quality.

A green highway is a roadway constructed in relatively new concept for roadway design that integrates transportation functionality and ecological. An environmental approach is used throughout the planning, design, and the construction. The result is a highway that will benefit transportation, the ecosystem, urban growth, public health and surrounding communities. A green highway need more attention from all parties like concessionaires, drivers and last but not least the local government as they have full authority to make sure the green concept are long lasting.

The questions are on how to avoid subsequent environmental destruction and excessive resource consumption and how to incorporate sustainable development concepts into highway projects. One of the helpful answers is the need for promoting sustainability and green highway construction requires a green highway assessment system. Hence, this study will try to come out with several fundamental elements of green highway development within the context of Malaysia. These elements ultimately are hoped to be essential guidance on the path of the establishment of Malaysia's green highway framework model of assessment later on.

## **1.2 Problems Statement**

Sustainability has become a popular issue in today's society with people becoming more aware of the need of green practices. The negative impacts from current living conditions give the impact in pushing towards sustainable practices worldwide. The transportation industry is a large contributor of harmful environmental impacts and needs to follow their example by incorporating sustainable practices. Road development in tropical country like Malaysia has vastly accelerated in recent years and construction has progressed from foot tracks to modern highway.



Inadequate of design procedures may cause the problem to the road users such as endangering the road users and cause traffic disruption as well as causing accident. In order to avoid the problem, planning and design stage should be considered. Therefore, the knowledge of importance on sustainable green implementation should be introduced in highway field. There are many tools that can be a guide in green evaluation, but the existing tools mostly just for general development and mainly focus on buildings.

Thus, this study was conducted to establish storm water criteria that can contribute to green highway assessment. Improper storm water management will cause some problems such as clogging and water ponding on the road surface. Therefore, these criteria proposed can be use as a guide for the road engineers towards environmental awareness.



**Figure 1.1:** Water Ponding on the Road Surface



**Figure 1.2:** Road Congestion due to effect of Storm Water

### **1.3 Aim and Objectives of the Study**

The aim of the study is to establish the criteria for storm water management and provide the guideline that can be further used to develop ‘Green Highway Rating System’. The study is intended to achieve the following objectives:

1. To determine the highway engineers level of awareness on green development;
2. To identify storm water management criteria and element which contributing for new green highway development; and
3. To analyze the agreement level those responses to the storm water management criteria and propose the factor score for each criterion

#### **1.4 Significant of the study**

Many parties who are involved in the development program should concern the effect of development to the environment. The study will provide guideline for development purposes and considering the environment aspects. Engineers must be creative by applying the knowledge in the design and construction aspects. Thus, from this study the parties involved will more aware of environment aspects in road construction by following this guideline.

#### **1.5 Scope of the study**

The scope of this research is to develop an assessment tool for Malaysia green highway. In doing so, a methodological process was developed for creating green rating systems. In process of developing the rating system, the selection of criteria that contributing to green highway with respect to storm water management was the focus of this study. Thus, a survey has been conducted in order to get the feedback from the respondents. The respondents are engineers and people who are professional in highway field which are from different type of companies whether concessionaires, consultant or local authority. In addition, the survey was done in Kuala Lumpur and Johor Bahru highways.

## **1.6 Research Methodology**

In order to achieve the objectives as mention above, this research consists of planned flow methodology. At the beginning, the collection of literature review will be conducted in order to gather the information about Green Highway from existing rating system, journal, books, conference paper and etc. From the literature review that has been reviewed, the criteria and sub criteria of pavement technologies for Green Highway which relevant to the specification Malaysia construction industry will be identified. The identification of element also based on the life cycle of pavement.

Then, the discussion or workshop with the expert professional will be conducted for the selection of criteria and sub-criteria that should be included in Malaysia Green Highway Rating System. This workshop also called as ‘pilot study’ to test the questionnaire template. The finalize criteria and sub criteria will be used to develop the questionnaire before distribute to the respondent in order to analyze the response from the respondent besides indirectly interview session with the professional. After that, the agreement level that has obtained from the response through the questionnaire and interview indirectly session will be analyzed by using SPSS.

## **1.7 Summary of Chapter**

The following are the summary of each chapter in this research project paper. This project paper contains five (5) chapters as follows:

**1. Chapter 1 : Introduction**

The first paper chapter of this research project report is on background of the study and it comprises of introduction, background, problem statements, aim and objectives, scope of the study, research significance and research methodology.

**2. Chapter 2 : Literature Review**

This chapter is base on literature reviews on the related topic for this study. Mainly the literature reviews are from journals, articles, conference papers and internet.

**3. Chapter 3 : Research Methodology**

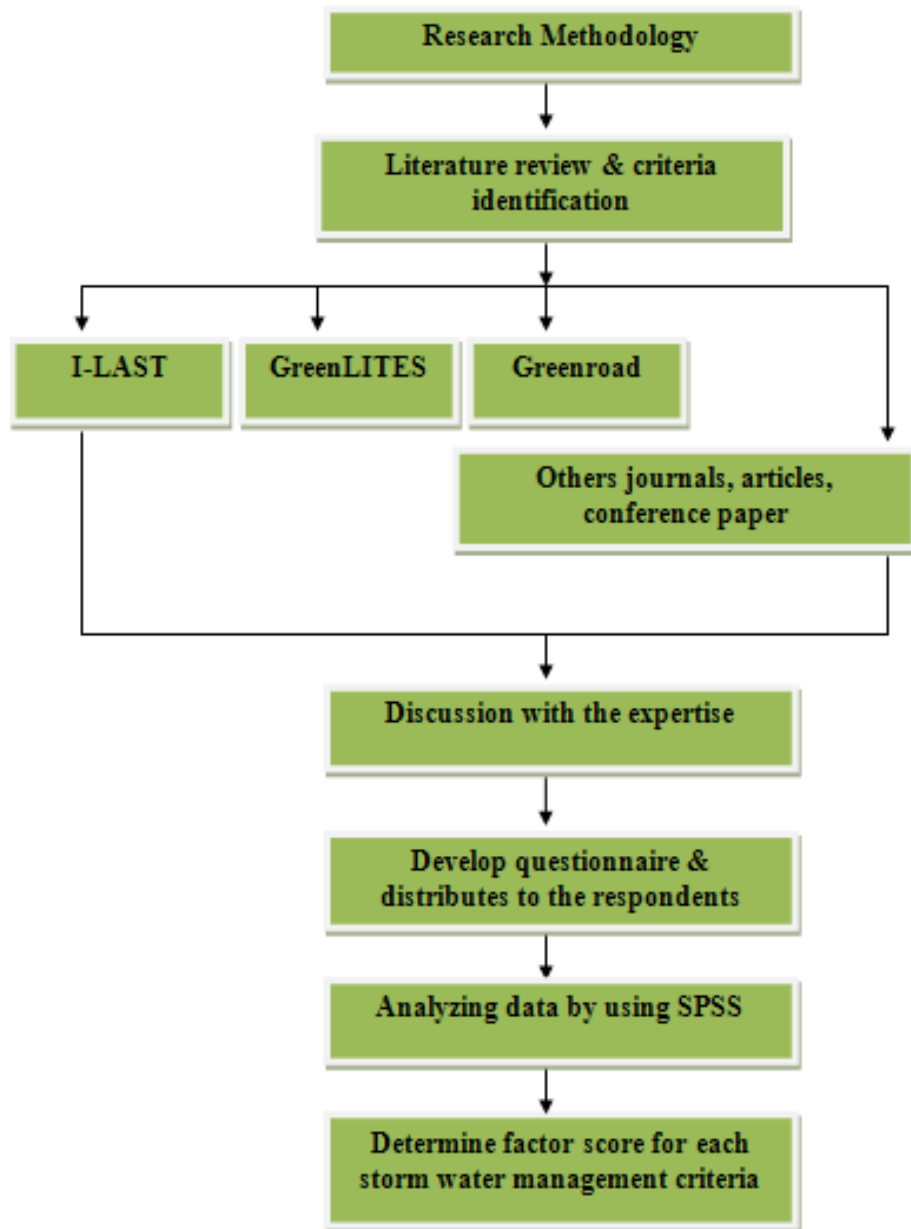
This chapter concentrates on the methodologies used to carry out this study. The subheadings are literature review, interview and discussion, develop questionnaires, data collection and last data analysis by using statistical package for social science (SPSS).

**4. Chapter 4: Results and Discussions**

This chapter focuses on discussing the result and gets the findings. Various suitable techniques and methodologies are used in analyzing the data gathered appropriate with the information needed. Analysis and discussion in this chapter is carried out with regards to fulfilling the objectives of the research.

**5. Chapter 5 : Conclusions and Recommendations**

Lastly, this chapter highlights the conclusion made from the study and the recommendations for further studies.



**Figure 1.3:** General Methodology Flow Chart of the Research

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