STUDY OF GREEN HIGHWAY-A REVIEW

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Abstract

Different technologies available to scale or measure environmental impact of highways for different activities like the advanced designing, intelligent construction and also, efficient support methods normally used in advanced highway design, however the current Indian situation watches keeps an eye on different building short costs road, usually neglecting ways that to lower long-run or life cycle prices through more sustainable road construction. This paper reviewed on the green highway definition and green highway terminology to improve knowledge and awareness of green highway for highway construction projects. Moreover, this paper discussed briefly on the rating system for green highway by highlighting various eight rating systems for green highway. This study adopted the secondary data from previous research and findings on green highway construction from all over the world. There is need of Growing open consciousness of temperature changes and incorporates green ideas into the roadway construction process Subsequently, there's the prerequisite of a rating framework that characterize roadway supportability characteristics for green highway and confirm the weightage for every criteria so as that the majority contribute to the green practices and sustainable development.

Key words: Green highway, definition, terminology, Green rating system, Green light, Green road, Invision.

1.Introduction

Highway in every country plays significant roles where it provides linkages of transportation for nation economic activities. Highways development involve massive earthwork and conversion of land used in it construction. This requirement applies the knowledge of environmental science whereby control have to be made in conserving of natural resources, at the same time sustain the need of the present and future generation. To accomplish a green pathway arranging, plan, development and appraisal of roadway need to coordinate with nearby natural insurance thought, along these lines it help to maintain a strategic distance from resulting ecological devastation and extreme asset utilization. People need highways to stay in connection to daily lives [1]. As an uppermost infrastructure, highway plays its role as a “backbone” of the nation’s social and economic development of the country [2]. But in early 1960s, construction projects including the highway construction projects seem to affect the environment, resources, raw materials and people [3]. The initial research and development on green highway technology was found at year 2002 in United States of America [4], while in Malaysia, National Green Technology Plan was launched on July 24, 2009 as a main agenda to promote green technology initiatives in the country development. One of the key issues that have been brought into discussion is the development of sustainable green highway for the future needs. Different models, framework and sustainable rating system have been put forward [1, 5-13] which mostly relate to the development of sustainable green highway.

2.Rating systems

Rating systems attempt to measure performance of transportation decisions or projects. They are planned for use in benchmarking, in identifying areas of success, and in identifying areas of opportunity for improvement. Rating systems provide credits for sustainable choices or practices, and according to that certification awarded.[14]

Rating systems used in the following ways:

• **Defining basic transportation sustainability characteristics**- list of sustainable transportation characteristics can be useful to those seeking to design/construct a more sustainable roadway.[15]

• **Greater participation in transportation sustainability**. The rating systems involved present transportation requirements and sustainability in a straightforward manner so that everyone can understand and participate in
sustainability – particularly at a project level.

- **Evaluating sustainability tradeoffs**- Rating systems can compare two different criteria using a common point system to determine their relative impact.

- **Sustainability assessment**. Rating systems use to track sustainability progress.

- **Contribute market recognition for sustainability efforts**- Rating systems can use to increase awareness of sustainability efforts and gives recognition to those who participated in the effort.

Nowadays, green highway Rating system becomes a popular tool to confirm the green credential of highways. With the successful implementation of green building rating system, the rating system can be widened into the highway. This rating system was established with the help of existing green building rating system. There are some common criteria that can be found in every green rating system such as sustainable site, water efficiency, energy efficiency, materials and resources and innovation.

The six rating systems are GREENLITES, GREENROAD, ENVISION, I-LAST, INVEST reviewed have similarities and differences. Specifically, all six sustainability rating systems are applicable to the planning and design phases of projects. Only Envision, GreenLITES, Greenroads and INVEST are applicable to the construction phase; and only Envision, GreenLITES and INVEST are applicable to the operations and maintenance phases of a project. I-LAST is currently developing a sub-system applicable to the construction phase. Envision is the only system applicable to many different types of infrastructure projects. The other rating systems are only applicable to highway projects[16].

Table 1 : Important elements consider in Highway rating systems

<table>
<thead>
<tr>
<th>Sustainable Management Systems</th>
<th>MATERIALS CATEGORY</th>
<th>WATER QUALITY AND USE CATEGORY</th>
<th>ENERGY CATEGORY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Management Systems</td>
<td>Reuse of Materials</td>
<td>Stormwater Treatment / Management</td>
<td>Energy and Fuels</td>
</tr>
<tr>
<td>Site Vegetation/Trees and Plant Communities</td>
<td>Recycled Content</td>
<td>Reduce runoff and treat stormwater runoff</td>
<td>Energy Efficiency</td>
</tr>
<tr>
<td>Protect Enhance or Restore Wildlife (Habitat Restoration)</td>
<td>Locally Provided/Regional Material</td>
<td>Runoff Flow Control</td>
<td>Reduce Electrical/Energy Consumption</td>
</tr>
<tr>
<td>Ecological Connectivity</td>
<td>Bioengineering</td>
<td>Runoff Quality</td>
<td>Reduce Petroleum Consumption</td>
</tr>
<tr>
<td>Environmental Training</td>
<td>Techniques</td>
<td>Stormwater Cost Analysis</td>
<td>Stray Light Reduction</td>
</tr>
<tr>
<td>Improve Air Quality by Improving Traffic Flow</td>
<td>Hazardous Material Minimization</td>
<td>Reduce Impervious Areas</td>
<td>Renewable Energy Consumption</td>
</tr>
<tr>
<td>Improving Bicycle and Pedestrian Facilities</td>
<td>Life Cycle Assessment</td>
<td>Construction Practices to Protect water Quality</td>
<td>Total achievable for Energy</td>
</tr>
<tr>
<td>Noise Abatement</td>
<td>Pavement reuse</td>
<td>Water Tracking</td>
<td></td>
</tr>
<tr>
<td>Integrated Planning Natural Environment</td>
<td>Earthwork Balance</td>
<td>Total achievable for water quality</td>
<td></td>
</tr>
<tr>
<td>Siting &amp; Biodiversity</td>
<td>Energy Efficiency</td>
<td></td>
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</tr>
</tbody>
</table>

3. Terminology Used for Green Highway Aspects

There are terminologies or a system of words used to name broad topics in green highway in which one of them contains diversified aspects in highway construction. Five broad topics are listed below that cover green highway aspects.
3.1 Watershed Driven Storm-Water Management

Watershed driven storm water management is defined as a process of reducing the runoff water from the highway, or in another words, treating the runoff water as well as diverting the runoff water to the place where the water can be infiltrated into the ground water table [2]. Some examples of watershed driven storm water management technologies in highway construction are bio-slopes, bio-swales, bio-retention cell, permeable pavers, vegetated filter strip and street trees, which are widely used in United States, and the initiative to develop suitable but yet economical with a proper design and analysis for storm-water management and treatment alongside the highway [18].

3.2 Recycle, Reuse and Renewable

Usage of recycle materials derived from industrial by product is not only significantly in reducing the greenhouse gas emissions and reducing the energy consume by a highway but it also reduces the overall highway construction cost [2]. In European countries, the high tax rate for virgin material pits required in highway construction was proven to reduce the amount of highway construction waste material into the landfills [17]. Another benefit of recycle, reuse and renewable of highway construction material is increasing the water saving and reducing the carbon emission as well as reducing the air emission.

4.RESULTS AND DISCUSSION

From studding many criteria in different rating system, main criteria of sustainable site had the highest importance from other criteria. It shows that sustainable sit selection and Material and resources are the most important criteria to achieve green highway development. The lowest importance in water efficiency. Quality management is a second important criteria in green highway development because as to achieve and maintain the green highway should have a good quality of design and construction method. Other criteria follow respectively based on their weightage/point noise mitigation, context sensitive design, erosion and sedimentation control and alignment selection. Those criteria had equal total of weightage/point. It show that they are related to each other and had same level of important during design and construction of green highway.

5.Conclusions and Recommendations

This paper only reviews the literature on highway construction from overseas project, organizations, journals paper and publications from Malaysia, Washington, Oregon, California, United States, Singapore, Indian and China to get a clear view to cover on green highways aspects and elements. The review of the literature search in this paper can be summarized as below:

• At the beginning of this paper, the researcher diagnosed on the green highway definitions by other country and organizations, and finally came out with suitable and applicable definition of green highway in this research to conclude the findings;
• Then, the researcher briefly explained five terminologies that cover green highways aspects which are the watershed driven storm water management; life cycle energy and emission reduction; recycle, reuse and renewable; conservation and ecosystem management and overall societal benefits;
• Next, the researcher listed the rating systems for green highway and green highway initiatives in order to address the sustainability criteria for the green highway construction;
• Finally, the researcher indicated the key findings of the paper by mentioning other research findings regarding to the highway construction.

• Rating System depicts a proposed standard for measuring maintainable practices related with roadway plan and development which can be utilized as a part of India. Green highway rating can potentially provide a common metric for considering sustainability in roadway design and construction The idea of this system is to present roadway sustainability in a straightforward manner so that everyone can understand and participate in roadway sustainability.

• In India different rating systems are available for Green Building construction which evaluates and gives identity to that building in terms of sustainability but the there are very rare rating systems for green highway infrastructure development so there is need to focus on rating systems.

The Smart city concepts mainly focus on sustainability which is essential requirement where it would maintain the
ecological balance hence the study focuses guidelines on design, construction and evaluation criteria’s of green highway which will play an important role in smart city development.

6. References

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