REVIEW OF SUSTAINABILITY RATING SYSTEMS FOR TRANSPORTATION INFRASTRUCTURE IN LAOS

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1. Introduction

Sustainable rating system was a tool for evaluating the project performance to be less impact for the environment, economic and society. In many developed countries using sustainable rating system more than a decade, which be developed in variety way to be a methodologies and tools to measure the transportation infrastructure project [1]. In sustainable transport project has to be include every stages process on planning, it is needed to consider sustainability while planning, design, construction and implementation as well as operation and maintenance a project. The tools for facilitate the process of making transportation and land development decisions that contribute to community sustainability in practice. This paper will review the existing the sustainable transportation rating systems and identify the component of rating system in order to identify applicable of using those tools in transportation and road infrastructure in Laos. The paper also identifies possibility and opportunities of using suitable sustainable rating system in Laos.

2. Current transportation infrastructure system in Laos

Laos is a land locked country, relies on neighbors such as Vietnam and Thailand for sea port services, also most of commodities are imported through Thailand. Transport infrastructure in the Laos is demonstrated by the Laos road density of 6.1 km per 1,000 people as well as by the road quality. The purpose of developing the transportation infrastructure in Laos is to expend the road network with the traffic volume. As the Table 1 it shows Laos road network is estimated at about 46,000 Km, with only 28% paved. In general more than 60% of the total national roads are classified as in poor or bad condition [2]. The transportation infrastructure activities are undertaken primarily by the Ministry of Public Works and Transport (MPWT). Urban roads are the responsibility of urban development administration authorities, which are responsible to their provincial governments [3]. However, the challenge is there was no specific legal framework for transportation and road infrastructure in the Laos. The standards for specification of infrastructure is depend on the funding supporter.

Table 1: Type of road infrastructure in Laos

Road Type	National	Province	District	Rural Urban	Rural	Special	Total
Concrete	48	39	9	113	2	11	222
Asphalt concrete	600	38	8	87		2	735
Paved	4,631	902	277	683	185	212	6,889
Gravel	1,628	4,596	3,319	909	5,439	470	16,360
Earth	470	2,635	2,032	424	14,632	1,428	21,619
Total	**7,378**	**8,209**	**5,643**	**2,216**	**20,258**	**2,123**	**45,825**

3. Methods

3.1. Rating system model

The rating system for transportation infrastructure project is various types such as BE2ST-in- Highways, Envision, Green Guide for Roads, GreenPave, GreenRoads, Infrastructure Voluntary Evaluation Sustainability Tool (Invest), Sustainability Assessment and Awards for Civil Engineering, Infrastructure, Landscaping and the Public Realm (CEEQUAL) and Sustainable Transportation Analysis rating System (STARS) [4]. However, this paper will focus three rating systems as follow (i)BEST-in- Highways, (ii)Green Guide for Roads and (iii)Green Pave. They will be reviewed to highlight their main characteristics and identify the capabilities for transportation infrastructure project in Laos. As the rating system was created from developed countries, these will be identify applicable using in the developing countries. The analyst will be based on the review from needed requirements categories which be the indicator in each rating system model.

4. Discussion and results

4.1. Framework implementation

Transportation sustainability rating system was created by developed countries, which recognized the energy consumption was rapidly increasing and main reason of greenhouse gas emission, so they has developed tools as rating system aim to improved sustainability development [5]. On the other hand, in term of Laos is a developing country which not yet applying the transportation sustainability rating system in a process of transport sector. In addition, government of Laos is responsible for developing the transportation infrastructure based on needed of traffic level as the transportation infrastructure project. In this paper focus on applicable requirements to implement rating system in Laos on the transportation infrastructure project under four main criteria include Environment, Water use, Energy and Materials; which break down in 5 sub-criteria in each of main criteria.

4.2. Analysis of applying the rating system on transportation and road infrastructure

This part use four different types in criteria (Environment, Water use, Energy and Material) and three rating system model (BE2ST in-Highway, Green Guide for Road and Green pave). In addition, each of criteria divide into 5 sub-criteria in order to narrow on the

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possibility apply to current transportation infrastructure project in Laos. It shows result of addressing the criteria of four rating system models to transportation infrastructure project in Laos. According to the infrastructure planning project in Laos, feasibility study had been done rely on the basic need and traffic volume in the urban area before launch the project. Its primary undertake by Ministry of Public Works and Transport, Department of Road. It describes each rating system on the Table 2 as follows:

Table 2: Transportation Sustainability rating System based on the criteria for Laos

☑ applicable to implement in Laos

	Criteria of Transportation sustainability rating system (TSRSs)	BE2ST-in-Highway	Green Guide for Roads	GreenPave
1	Environment Management System	☑	☑	☑
2	Improve Air Quality by Improve Traffic flow		☑	
3	Legal Requirement		☑	
4	Integrate planning and Natural Environment	☑		
5	Pollution Reduction			
6	Stormwater treatment/Management	☑	☑	
7	Runoff flow control	☑	☑	
8	Legal Requirement	☑	☑	
9	Reduce runoff and treaty water runoff		☑	☑
10	Stormwater cost analysis		☑	
11	Energy and Fuel/Emission Monitoring		☑	
12	Reduce Electrical/Energy Consumption and reduce petroleum		☑	
13	Legal Requirement		☑	
14	Paving Energy Reduction	☑		
15	Paving Emission Reduction			☑
16	Reuse/Recycle Content/Material	☑	☑	☑
17	Life Cycle Assessment/ Costing	☑		☑
18	Durability and Maintenance/Long life pavement			
19	Legal Requirement			
20	Construction Quality	☑		
	Total	9	12	5

1. *BEST-in- Highways:* This tools aim to use recycle material for sustainable development as the main characteristic. Regardless, the goal of development on transportation infrastructure in Laos focus on expending the road network, however there is less of using reuse/recycle in construction road project as priority. Using reuse/recycle material content concerning to reduce overuse of funding. Additionally, it is still not available about legal requirement in sub-criteria due to the standard depend on the project construction.

2. *Green Guide for road:* training and building team of sustainability has to be include in during planning and construction stage. The challenge of implementing this rating system is regarding the technical and professional understanding sustainability development on road infrastructure. Capacity for planning and implementation in provincial and district levels is a critical challenge. MPWT emphasis the priorities for road funding, improvements in rural areas to reduce poverty and upgrading the national road. Moreover, prioritization also take into account climate change and adaptation criteria with respect to road design and maintenance. Building the local ownership for the quality of planning and implementation of road works is fundamental to creating the right environment for effective capacity development. To improving the skills of their personnel for the decentralization process will take time to fully address.

3. *Green Pave:* This rating system was created to implement specific technology, material and energy which concerns on sustainable way, and it might be difficult to applicable applying for road infrastructure in Laos. Regarding to national road infrastructure standard is not available as the requirement for the project, meanwhile the standard depend on the funding supporter and belong to the specialist of each project. The transportation infrastructure projects has generally achieved its objectives, but several projects experienced delays due to the weaknesses in the transport sector included inadequate treatment of social and environmental concerns, lack of financial sustainability, and development of human resources and their skills on the technical engineering.

5. Conclusion

This paper are based on classify the possibility of current sustainable transportation infrastructure rating systems and their limitations. By taking those rating system into account some factors that can affect sustainability assessment in the Laos, such as the effect of urban development. The result of applying four rating systems was ranking as Green Guide for Road, Green Pave and BE2ST in Highway, respectively. The findings also shows the possibility implementation wasn't top priority goal development as economic growth and environment sustainable. The implementation need to support by address rating system into policy and legal framework.

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