

Assessment of Green Ratings for Roads

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Abstract— Goa is a tiny state on the west coast of India which is one of the favorite travel destinations among domestic as well as international tourists. Goa being a small state, road transport is one of the most preferred means of transportation with heavy traffic especially during the vacations. As the population in Goa is increasing day by day, the traffic density on the roads is also increasing. This paper focuses on the assessment of green ratings for a selected National Highway which covers major traffic flow over the year. The part of the highway under study stretching from Arlem to Ponda Junction forming major link between several residential areas and public/ private working sector always carries heavy traffic on it. This paper contains information about all the necessary data required to assess and implement green rating system for Arlem to Ponda Junction. A green highway rating system is a proposed standard for quantifying sustainable practices associated with the design and construction of roadways. It requires a stability performance between environment, construction and maintenance of roads. This paper focuses on several criteria like Sustainable Design, Material and Energy Conservation Resources, Water Conservation, etc. for which green ratings are provided based on survey conducted over a stretch from Arlem junction to Ponda junction in Goa.

Keywords— Green road ratings, certification

I. INTRODUCTION

Land for construction of Margao Western bypass was acquired by the Ministry's approval no. RW/NHS-12014/432/98 Goa dated 31/03/999. Job no. 017-GOA-99. Subsequently land was acquired and award was declared vide no. 99/2/LA/92 and area of 48,045.00sq.mt. was acquired. In another award no. LQN/5/2001 and area 4, 48417.00sq.mt. Was acquired. Total area of the project is 4, 96,462.00sq.mt Possession of the land was taken on 15/6/2006 and it is with NH. Highway Division XIV free from all encumbrances. Land acquired in the length of 10.8 km and width 60 mt. Alignment of Margo Western bypass is starting from village Verna at km 26/200 on NH-17B in joining the existing NH-17B at km 38/100 Dharmapur bypassing Margao City which densely populated and commercial capital of Goa. The State Highway we have selected is SH-5 Arlem Island to Borim junction road and its length is 7.8 Km. On NH-17B there is high level 2 Lane Bridge with footpaths across River Zuari constructed in 1986 near Borim. The length of the existing bridge is 431m. During last few years, traffic on NH-17B has increased significantly. Further it gets connected to National Highway NH-17B from Borim junction to Bythkhoh junction and its length is 8 Km. Road transport is taken into account to be one among the value effective and preferred modes of transport for both freight and passengers. The National Highways have a complete length of 70,934 km and function the highway network of the country. A green highway may be a roadway

constructed as per a comparatively new concept for roadway design that integrates transportation functionality and ecological sustainability. The resulting highway will benefit transportation, the ecosystem, urban growth, public health and surrounding communities. More flowers grow along the shoulder, and more trees are planted as wildlife buffers and ridding quality. The guidelines to classify green rating for highway are as follows:

- Provide a net increase in environmental function and values of a watershed.
- Go beyond high standards set by environmental laws and rules.
- Increase the use of existing transportation infrastructure, providing multi-modal transportation options, and encourage ride-sharing/public transportation.
- Use salvage materials to get rid of waste and reduce the energy required to construct the highway.
- Use original, natural methods to decrease imperviousness, and rinse all runoff within the project area.
- Identify and protecting historic and cultural landmarks.
- Map all assets in the area in order to avoid, identify, and safeguard critical resource areas.
- Connect regional transportation plans with regional land use partnerships.
- Control populations of protruding species, and encourage the growth of indigenous species.
- Include post project monitoring to make sure environmental outcome.
- Preserve the hydrology of wetlands and streams channels through refurbishment of natural drainage paths.
- Decrease disturbance to ecological processes by promoting wildlife corridors and passages in areas recognized through wildlife conservation plans.

One of the recent studies shows that the main focus was on improvement of road performance, upgrading and improvement based on highway design. And also, the analysis of highway rating system was framed based on Site Selection, Water conservation, Energy conservation, Material conservation, Environmental Quality, Innovation in design (R Suresh). Another study shows to protect environment and ecological system, implementation of the green road in Indonesia has contributed more to the achievement of natural goals than human goals. The main objective of this research was to identify the performance of each main categories related to areas of success and areas which are in need for improving the road based on points obtained (Susanti 2019).

The study shows that certification of roadways projects based on the achievement of a list of project requirements and the total points earned. Such implementations help improvement and innovation in roadway sustainability (Suresh R).

II. METHODOLOGY

A. GENERAL

The road stretch selected is SH-5 Arlem Island to Borim junction road, considering that it's a busy highway road used by public on daily basis. The length of this road stretch is 7.8Km and along the distance of 2.5 Km 16 light poles are in working condition. It's a two-lane road with dividers in between. Also, there is double layer of bitumen, sign boards, ramblers, speed breakers etc. that are been noticed. The site is feature-rich with satellite photos, aerial maps, street maps and traffic details. Fig no.3. 1 shows the aerial map. The second road stretch that we have taken is NH-17B from Borim junction to Bythkhol junction. The length of this road stretch is 8 Km. NH-17B originates at Farmagudi, from junction with NH-4A at Km. 127/400 and proceeding via. Borim, Borim, Verna and terminating at Marmagao port. On NH-17B there is high level 2 Lane Bridge with footpaths across River Zuari constructed in 1986 near Borim. The length of the existing bridge is 431m. During last few years, traffic on NH-17B has increased substantially.

B. RATING SYSTEM

An evaluation to scale yarded sustainability must be used to understand and ensuring road control sustainably. These objectives can be attained by having a rating system with specific criteria as a measurement tool for an operational functioning road. Although most of the agencies have established their very own rating system for infrastructure development, especially in road facilities, it is still lacking in the operation and maintenance stage. These tools committed to assessing highways determine a seven-step procedure that can be universally applied for the development of sustainability rating and assessing systems. The seven-steps are as listed as follows: Step 1: Define criteria for chosen infrastructure under assessment evaluation. Step 2: Develop individual sustainability indicator categories. Step 3: Development of sustainable indicators (credits) as the performance measurement for the goal. Step 4: Transmute indicators as credits by identifying measurements associated with each. Step 5: Prioritizing credits by assigning their weights (level of importance). Step 6: Allocate points. Step 7: Developing a rating scale or the certification levels of sustainability reached or achieved by the project.

C. CRITERIA FOR GREEN RATING SYSTEM

Primary criteria: Portable toilets, Water facility, Provision of drainage, facility on both sides of the highway for a full stretch, Daily maintenance, Signal boards, Parking area for every 20 Km, Separate path for differently abled people and non-fossil fuel vehicles, Light facility and electric poles, Water management system in the highway, Drought tolerant species and native plants in the highway, Rainwater harvesting pit at least 100m once, Traffic flow improvement, Safety improvement.

Secondary criteria : Indicators (sensors) before the dangerous point, Water management system, Natural assets, The heat

island effect and its consequences on both sides of the highway to minimize the mirage formed over on the highway during summer season, Light pollution reduction, Pollution prevention during construction, Night sky pollution reduction, Brownfield (useless) area should be utilized by the respective highway, Quality control should maintain from its construction to maintenance stage, Metering provided for monitoring the energy consumption and pollutant emission, On-site renewable energy generation, Innovative pavements provided or replace to the highway, Waste reduction during construction, Encourage and support the recycled material & local material usage, Certified (renewable) materials should be used in highway construction, Alignment selection and sighting should properly done according to the local environment management system, After the construction the highway will be kept on maintenance throughout its lifetime and will be rated accordingly, Provision of Solar panels, Waste material storage and collection of garbage, Safety & noise mitigation plan.

D. CATEGORY

Categories for green highway rating system are as follows: Site Selection And Planning, Material And Resource, Storm Water Management, Energy Conservation, Environment Quality, Innovation And Design. Individually each of these categories includes a number of credits. A credit is a discrete design or construction decision or action that can upgrade the sustainability of a roadway project. In order to achieve credit, designers and contractors must encounter the intent of the credit and submit supporting documentation.

E. CERTIFICATION

Green Roads credits are weighted as per their impact and the duration of that impact. In general:

- 35-45 credit: Average impact only. Once construction is done, the impact is essentially gone. These credits can be awarded for the road stretch that meet regulatory requirements.
- 46-60 credits: longer-term impact. Also used for organizational incentive credit in which significant effort would be needed to meet the stimulated credit requirements.
- 61 or more credits: long-term impact over the life of the roadway. Also used as additional incentive for credits that are difficult or expensive to attain, but whose achievement may brace the innovation.

Certification is based on attaining a minimum number of credits. The least possible level of certification is based up on achieving roughly 40% of the credits. Following are the certification levels proposed: Certified. 35-45 credits. Silver: 46-60 credits. Gold: 61-75 credits. Evergreen: 75 credits or more.

III. RESULTS

TABLE I. SUMMARY OF STATE HIGHWAY-5 GREEN RATINGS

Criteria	Points Available	Points Provided
Site Selection Planning	20	8
Water Conservation	22	2

Energy Conservation	22	2
Material Conservation	20	3
Environment Quality	17	3
Innovations In Design	14	3
Total	100	21

TABLE II. SUMMARY OF NATIONAL HIGHWAY-17B GREEN RATINGS

Criteria	Points Available	Points Provided
Site Selection Planning	20	8
Water Conservation	22	2
Energy Conservation	22	2
Material Conservation	20	4
Environment Quality	17	3
Innovations In Design	14	1
Total	100	20

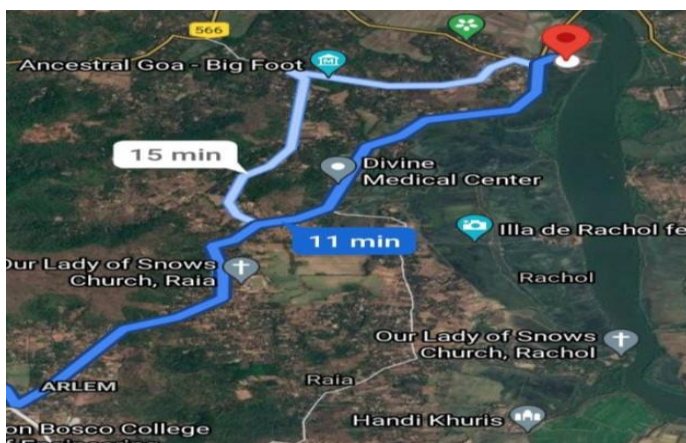


Fig 1. Aerial Map Of SH-5 Arlem Island to Borim Junction Road

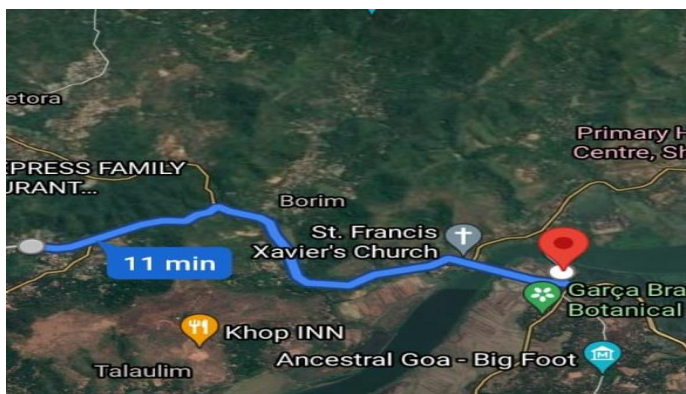


Fig 2. Aerial Map Of NH-17B From Borim Junction To Bythkhol Junction

IV. CONCLUSION

The road survey was carried out by using six major categories of green highway guidelines that are Site Selection and Planning, Energy Conservation, Water Conservation, Material and Resources, Environment Quality and Innovation in Design. Due to improper road shoulder, there is no provision of drainage at some parts due to which over flooding occurs. On the plan there is provision for shoulders but at the site no proper shoulders are provided. Road widening is not possible on national highway (NH-17B) due to local houses. Basic amenities like shops, petrol pump etc. was present on both state highway (SH-5) as well as national highway (NH-17B). There is no proper drainage management so during rainy season the road gets submerged with water due to over flowing of drains. Conditions of dividers are improper and at some places dividers are missing. After doing the detailed project report we conclude that the total points for state highway (SH-5) is 21 points and for national highway (NH-17B) is 20 points. According to green highway ratings these two highways must improve their performance and follow green highway guidelines.

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