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Preserving The Shoreline: A Potential Approach of Eco-Architecture on The Seacoast of Bay of Bengal

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Abstract

The natural beauty of the coastline of the Bay of Bengal is undoubtedly heavily scenic, with the sea on one side and green hills on the other. To preserve this mesmerizing beauty of the remote area of Inani, the project aimed to establish an eco-friendly tourism hub following an eco-architecture approach without creating any visual disruptions to nature and featuring the ecological, social, cultural, and socio-economic aspects. The methodology involved designing and implementing low height structures using sustainable and recycled materials on the site to ensure a full panoramic view from every level of design so that the tourists can enjoy every drop of connection with nature. This successful eco-friendly design has created a sense of environmental awareness among the locals of this remote area, who came to know a different aspect of architecture that focuses more on the environment's potentiality rather than designing a concrete jungle.

Keywords: Eco-architecture; Eco-friendly; Beach resort; Recycling; Sustainability; Hospitality.

1. Introduction

In the southeast of Bangladesh is the city of Cox's Bazar, a well-liked vacation spot recognized for its magnificent golden sand beach. With a 120-kilometer length along the Bay of Bengal, this beach is the world's longest continuous natural sea beach. With a population of about 200 thousand, the little city has a total area of about 250 square kilometres. This seaside city draws visitors because of its breath-taking scenery, mild tropical climate, shark-free waters, surf waves, soaring cliffs, vibrant Buddhist temples, and mouth-watering cuisines. Nearly 10 million tourists visit Cox's Bazar every year, both domestically and internationally.

The city is a well-liked tourist destination, and its top attractions include the Himchari Waterfalls, Laboni Beach Point, Shugandha Beach Point, Kolatoli Beach Point, Inani Coral Beach Point, and Ramu Monastery. However, concerns have been raised about the city's unplanned urbanization, as hundreds of high-rise structures, hotels, and restaurants have sprung up on the terrain without any tourism planning. Environmentalists worry that the tropical paradise could lose its beauty forever if action is not taken to protect the natural beach. Reports indicate that around 4 kilometres of beach have been lost to erosion, including Laboni Point, Shaibal Point, and Seagull Point. The Director General of the Bangladesh Oceanographic Research Institute (BORI) suggests that unplanned development is one of the primary reasons for this issue. Hills and agricultural areas are also in danger as a result of the rising number of hotels, motels, and residences being built, just like the seaside. However, an eco-friendly architectural strategy can be utilized to create an eco-resort as a tourist destination, limiting the environmental damage brought on by impromptu construction to attract more people.

The eco-resort's location on Inani's Patuartek Beach provides stunning views of an 11-kilometer coral stone beach on one side and verdant hills on the other. It is accessible from the Marine Drive Highway, an 80-kilometer-long road extending from Cox's Bazar to Teknaf, which is located about 32.9 kilometres from Cox's Bazar Airport. This road connects the location directly to the heart of the city and is the longest marine drive in the world. To preserve the ecology of this picturesque coastline, eco-architecture is seen to be the most suitable strategy for building design. The main goal was to create a place where people could experience being near nature without disturbing it or placing any visual obstacles between the blue bay and the hilly green. Lightweight, sustainable, and recyclable materials were employed to highlight the ecological, sociocultural, and socioeconomic features of the community, which promoted a sense of environmental consciousness among the locals.

2. Background

Driven alongside hills on the left and the sea on the right, Marine Drive provides travellers with an unforgettable experience. The construction of high-rise hotels, motels, and restaurants alongside the road is currently a popular trend in tourism development, nevertheless, in an effort to draw in more tourists. Unfortunately, as a result of this practice, a man-made mountain of concrete is being steadily built, obstructing the breath-taking vista of the natural, green slopes and the expansive view of the sea.

The article titled "Preserving the Shoreline: A Potential Approach of Eco-Architecture on The Seacoast of Bay of Bengal" highlights the Eco-architectural approach for designing a tourism hub in Patuartek, Inani because this eco-friendly approach has the most promising concept of emphasizing sustainability and environmental responsibility

while synchronizing with the requirements of human life. Additionally, to protect the natural landscape of the Bay of Bengal shoreline, the project focuses on using low height structural elements instead of heavy concrete structures to maintain visual uniformity (Figure 1).

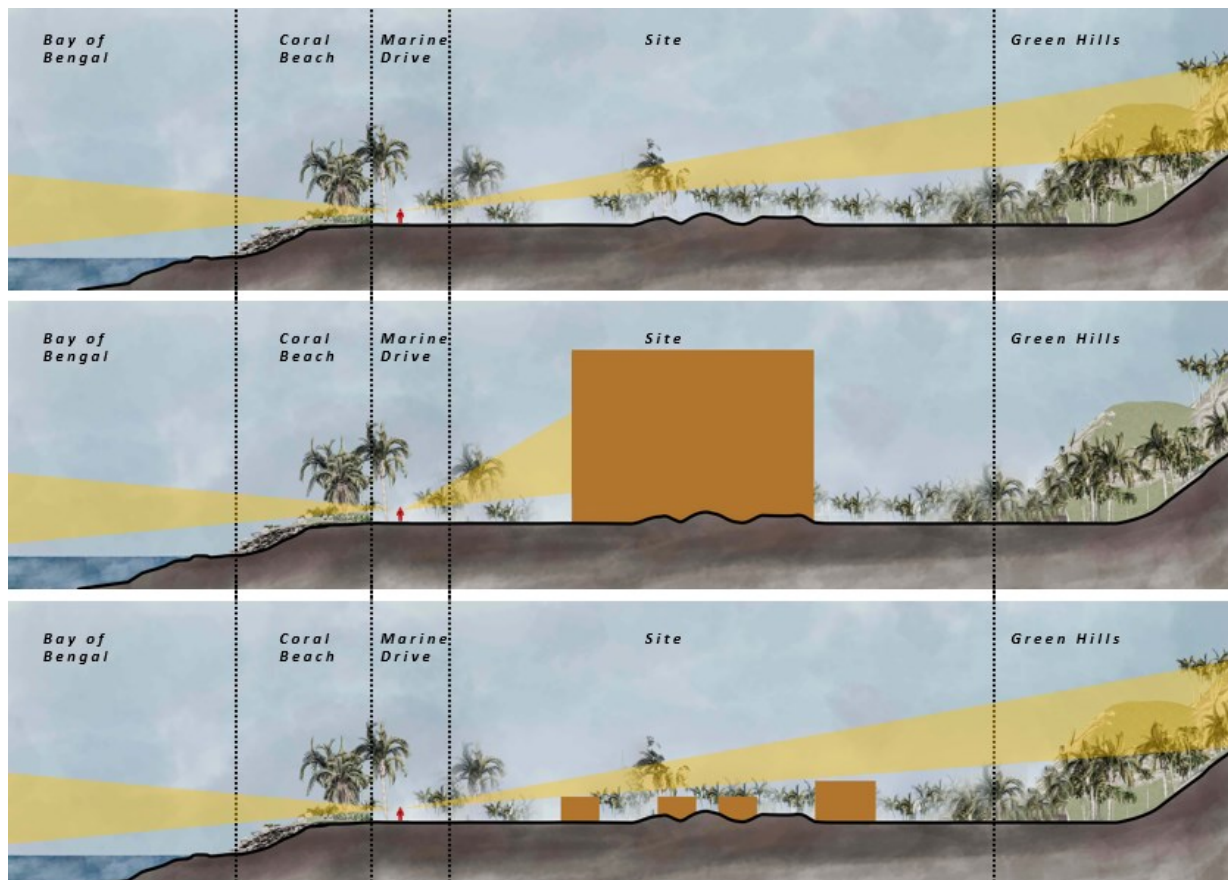


Figure 1. Conceptual Section (Developed by Author)

The concept of Eco-architecture is to design for humans considering nature, to minimize the negative impacts on the environment and wildlife, and to use sustainable natural resources in building construction. This multifaceted approach has various dimensions- economic, socio-cultural, and ecological integrity are only a few of the many aspects of this comprehensive strategy. The practice of eco-architecture is highly complex, solid, and vital compared to the general practice of architecture. However, the implementation of simple passive design strategies and eco-friendly choice of building materials and construction method techniques can help a great deal to preserve the natural ecology and to minimize the negative effects on nature brought by the built environment (Udomiaye,2018). In this study project, the authors aimed to employ eco-friendly sustainable design by studying the ecology of the site properly before proceedings to building design, implementing the use of recyclable and locally manufactured building materials, taking measures to preserve the natural environment of the site as much as possible and propagating the use of passive solar design and wind power to reduce dependence on fossil fuels and to encourage the practice of green design more.

3. Methodology

To achieve the goal of establishing eco-architecture design in Patuartek Beach, Inani, and to understand the present tourism trend of Cox's Bazar in order to make future development projections, an in-depth empirical survey has been employed in this design research to collect primary and secondary data through a qualitative approach. The primary data collection was carried out through several field surveys in order to thoroughly explore the site and its surroundings and comprehend the natural, socio-economic, and physical environment of the area. Photos, videos, sketches, and field notes have aided in the documentation. The main objective of the field survey was to find out the actual condition of the site and generate a graphical report so that it could help allocate appropriate design and planning solutions. The secondary data was obtained from a literature review about eco-architecture and its principles, carried out by going through case studies from different countries in order to acquire knowledge about

the past and present work done on eco-architecture in coastal areas as guidance. Standard data analysis based on space and requirements in the resort facility has been employed to formulate references.

An investigation has been conducted on the local workforce and construction methods as green building construction tends to rely more on human force than technology (Ragheb,2016). Local suppliers were used to purchase recycled and sustainable building materials, which cut down on operating expenses and had a positive environmental impact. The sturdy and non-toxic structural components came from Chittagong Ship Breaking Yard, one of the biggest shipbreaking yards in the world, which breaks down up to 100 ships annually and is situated in the Faujdarhat, neighbourhood of Chittagong.

The conceptual form was developed, the layouts were planned, and the site was designed using eco-architecture techniques to blend in with the environment and provide visitors with a closer encounter with nature while also ensuring that passive sunlight and wind flow were available to reduce the need for indoor heating and cooling. Although there isn't a clear-cut limit for eco-architecture, it is challenging to reach the standard that can be assessed. The design considered four main areas of the eco-friendly building: site development, material selection and minimization, energy efficiency, and indoor air quality to establish an eco-friendly resort (Ragheb,2016).

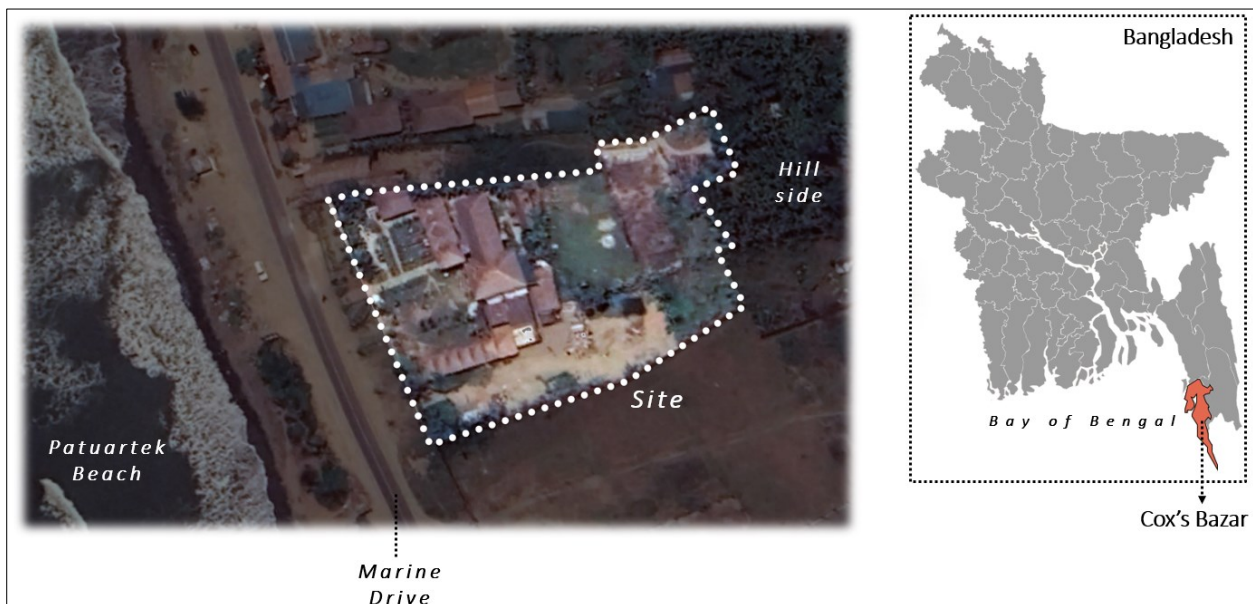


Figure 2. Project Location

4. Results

4.1. Site Potential

The eco-friendly resort's location is beside Marine Drive Road, along the coastal shoreline of the Bay of Bengal. The site has an area of 3,683 square meters. The Patuartek Beach coast is just across from the site's front side, and its rear offers a lovely view of Cox's Bazar's verdant hills and is bordered by agricultural lands on the north and south (Figure 2). Tropical trees abound all around the existing site, which was formerly farmland, is now booming as a new tourist destination, creating a new identity for the distant area of Inani that is lying far away from the city's commotion and noise. The site's current purpose is to develop tourism trends in this outlying region of Patuartek Beach. The beach features stunning coral stone and a blend of white cloudy sky and blue sea. Tourists adore the picturesque vista of the sun setting over the coral stone beach and the majestic lush greenery of the hills (Figure 3).

4.2. Site Design

Understanding the site's beauty and complexity was the first step in the design process of the green structure. The authors aimed to design the site in such a way that visitors would feel as though they were moving toward the hills and being warmly welcomed by them, and as they were departing, they would feel as though the sea was inviting them to come to join her. The buildings were positioned in an east-west direction to take advantage of sunlight and wind flow, while also giving every function a clear view of the sea in the west and the hills in the east. To control the excessive thermal and sunlight exposure from the west, green plantation treatment has been applied as shading to the building masses. Concerning the tropical climate, to ensure a more soakable surface, soft-scaping is prioritized over hard paving. The site design is a perfect blend of functionality and aesthetics. It seamlessly integrates indoor

and outdoor dining options, luxurious resorts, verdant green activity zones, and a refreshing swimming pool to make the tourists feeling rejuvenated.

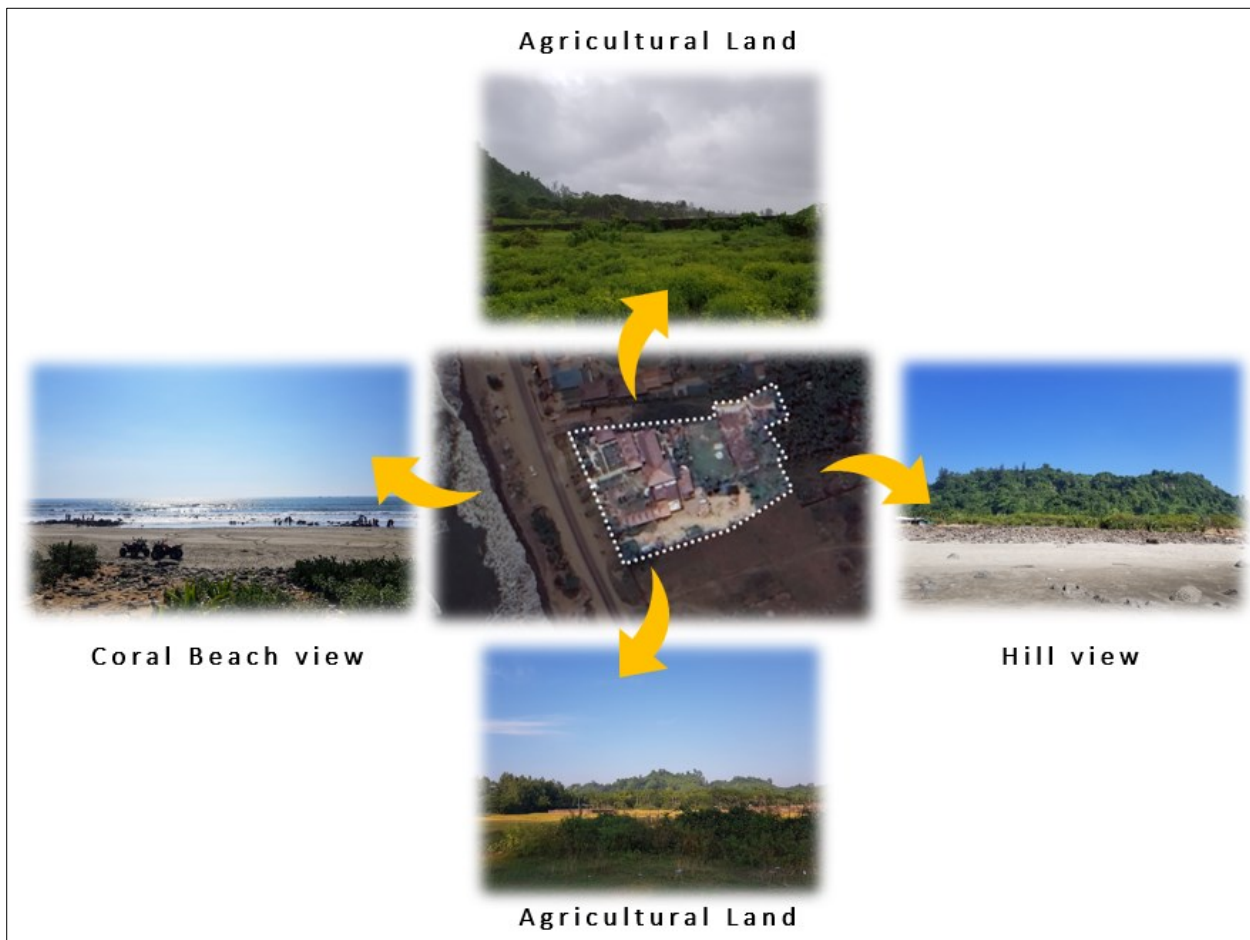


Figure 3. Site Potential

4.3. Building Form Concept

Maintaining an ideal relationship between the building surface and the building volume is one of the key principles of environmentally friendly design (Udomiaye, 2018). In keeping with the concept, the main goal was to build one- or two-story buildings with sloped roofs to retain low-height structures and to emulate the traditional architecture of village homes of Bangladesh. Instead of building a large floor area for the restaurant function, the authors chose to divide the platform into multiple levels to reduce building surface area and to create a stunning staggered pattern of the structures, while also guaranteeing magnificent views from every platform. The cottages are positioned on the site with consideration given to various factors, including site alignment, view adjustment, and tropical climate conditions. The buildings have employed sloppy thatched roofs with a unique treatment of windbreaker, using bamboo, to make the roof more sustainable against heavy stormy weather. In addition, a secondary green layer of plantation has been applied in the façade of the staff quarter structure to maintain privacy and to create an aesthetic view of the wall from the outer periphery.

4.4. Structure and Building Material

Eco-friendly construction materials usually result in lower maintenance and replacement costs over the life of the structure while also enhancing occupants' comfort and activity levels. To make the project more environmentally sustainable, some common eco-friendly materials are employed in the construction such as wood, straw, bamboo, jute ropes, etc. The thatched roof of the restaurant structure is supported by recycled timber posts and wooden trusses, while the base of the structure is constructed from refurbished non-toxic wood deck. In cottages, the walls are built from locally produced clay bricks to make the structures more economically feasible and the roof is made with straw, supported by wooden truss and wood post (Figure 4). The windows are made of glass, while the railing is made of repurposed jute rope, which is both cost-effective and aesthetically pleasing. The shipping container has been transformed into a classier and cost-effective souvenir shop. Concrete blocks have been utilized in the soft

pavement to make the soft scaping more durable. The interior of the restaurant and the cottage are decorated with recycled wooden staircases, doors, and furniture to give the tourists a more harmonious experience. Hence, locally sourced natural building materials are used in this project as they are easy to use and lack any toxic elements. Additionally, these eco-friendly materials can increase the energy efficiency of the project, while creating an aesthetic appeal toward the users and visitors.



Figure 4. Cottage Building Materials

4.5. Zoning Layout

The outdoor zoning layout was planned based on functions and space activities. The main front area was designed as a public zone, featuring restaurants, both indoor and outdoor dine-in for all users. In order to allow all visitors to enjoy the amenities without disturbing the privacy of cottage guests, the public space, designed in the front portion of the site, includes a BBQ area, green activity zone, souvenir shop, and children's play zone (Figure 5). Servicing areas were designed in the center of the site to access both public and private functional areas.

Table 1. Cottage layout

Cottage type	A	B
Total area	315 square feet	580 square feet
Number of rooms	1	2
Living area	172 square feet	320 square feet
Service area	75 square feet	140 square feet
Balcony	62 square feet	116 square feet

A private zoning layout was designed on the eastern and south-eastern parts of the site, consisting of cottages and a swimming pool with other amenities. The indoor layout of the restaurant and cottage buildings features big openings to create an inviting impression to the tourists and more importantly, to utilize natural light as a source of lighting during daytime and a complete utilization of natural ventilation. In addition, two types of cottage layouts have been designed based on standard data to meet the tourist's demand and the market requirements (Table 1).



Figure 5. Landscape Layout of Major Programs

5. Discussion

To design an eco-friendly architecture, the following main objectives are considered in the design and construction process:

1. **Site development:** While designing the site area, the priority was to merge the architecture with mother nature in order to create harmony between the built and natural environment without making any visual disruption between hills and the sea. Considerations are taken into account to lessen the adverse environmental effects while planning building orientation, building formation, and material selection.
2. **Material selection and minimization:** Materials place a major emphasis on sustainable development. Focusing on the materials' durability, minimally processed plenty of renewable and recycled resources have been used to reduce impacts on the natural ecology and to promote existing quality recycled products, available at affordable prices.
3. **Passive design:** The advantages of solar energy are taken into account to incorporate passive solar design features by employing natural light for complete daytime illumination. The shape and form of the building prioritized the natural ventilation process for heating and cooling to ensure high indoor air quality and to promote occupants' health and productivity. As mechanical solutions are not required in passive design, it also eliminates operational costs of heating, cooling, and lighting.
4. **Comfortable environment:** A careful selection of non-toxic recycled local materials, the use of energy-efficient passive design solutions, and the use of natural elements like a lot of greenery, plantations, and water bodies have all been taken into consideration and successfully implemented on the site to ensure a comfortable, clean, healthy, and pleasant environment for the users and visitors.
5. **Climate responsive:** Respecting the tropical environment context, several design solutions are employed in the project. For example, sloped roofs have been installed to prevent leaks and water pooling over the surface due to tropical rains. Additionally, all structures and walkways are constructed elevated to ensure stormwater runoff from hilly terrain. Besides, the platforms are divided at different heights to ensure the airflow of the comforting sea breeze (Figure 6).

6. Socio-economic influence: Since social progress is one of the main goals of sustainable design, social, economic, and cultural factors are taken into account in the design process. The successful application of green design has raised community members' understanding of social and environmental issues and reflects a change in the local practice of building construction.

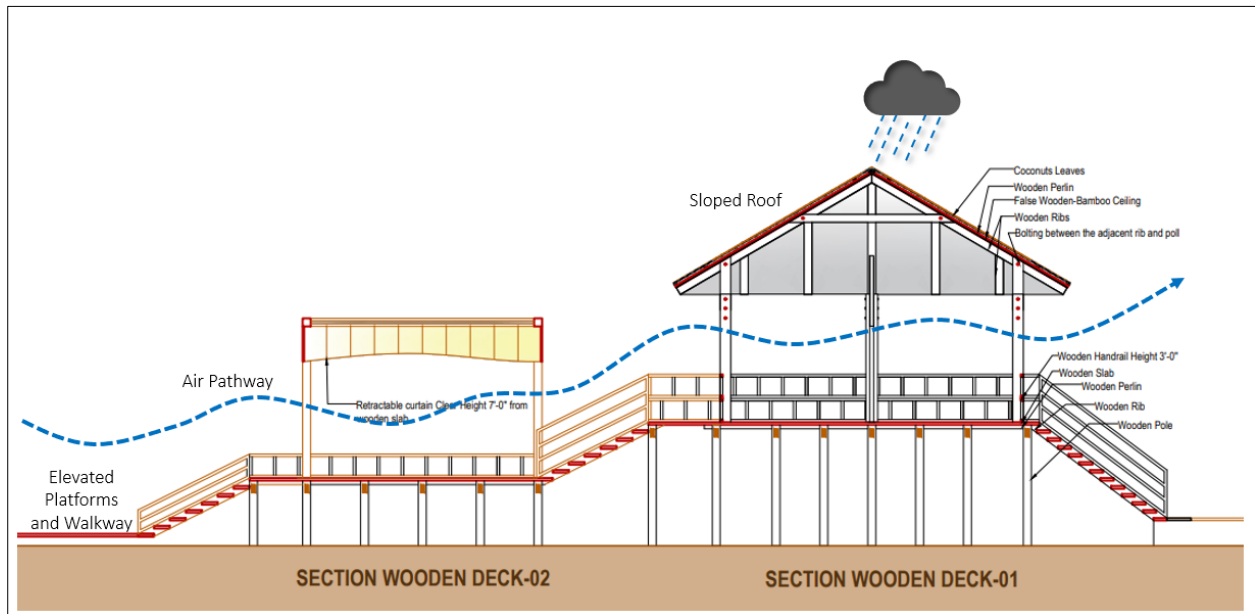


Figure 6. Restaurant Structure Section

6. Conclusion

To conclude, to preserve the shoreline of the Bay of Bengal from trendy unplanned tourism development, an eco-resort has been designed following an eco-architectural approach to meet the tourism need of Patuarterk Beach, Inani in an environmentally friendly way, without creating any negative impacts on the existing natural potency. The design follows the principles of eco-architecture to blend in the structures within the landscape to maintain visual connectivity and uniformity between hills and the blue sea. The world is developing in an unstoppable way using the limited resources of the earth. Passive energy design and the use of recycled and renewable materials are increasingly necessary to achieve sustainable goals and preserve the world's sustainability. Future civilizations will be endangered if the practice of environmental architecture is not extensively considered. Eco-design will reduce the degree of environmental pollution, conserve our natural resources, prevent environmental degradation, and promote a sustainable healthy environment for humans and other living beings.

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Conflict of Interests

The authors declare no conflict of interest.

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