

Sustainable Design and Construction of Bridge – Case Study of Design of Arch Bridge in Nepal using Multi-Criteria Decision Analysis

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Abstract

The importance of sustainability in transport infrastructure continues to gain momentum. Policymakers and planners play a vital role in integrating sustainability into transport infrastructure, so sustainability assessment should begin with decision-making. This paper highlights the use of the Multi-criteria Decision Analysis (MCDA) technique: Analytical Hierarchy Process (AHP) to compare bridge design options in terms of sustainability. AHP can be a user-friendly assessment tool in developing countries where incorporating sustainability is not prioritized yet. The project "Design and Build of Bridges along Narayanghat-Mugling Highway" in Nepal is selected as the case study. Using AHP, a monolithic concrete arch bridge was compared with a two simply supported spans of prestressed concrete bridge. Criteria such as economic, environment, construction ease and maintenance were incorporated in the AHP. The results of AHP show that the Arch bridge is a more sustainable design option.

Keywords: Analytical Hierarchy Process (AHP), Multi-criteria Decision Analysis (MCDA), Sustainable design, Arch Bridge, Transport Infrastructure.

1 Introduction

The sustainable solutions, tools and techniques in the construction sector have long been discussed. Policymakers have a great influence on the sustainability performance of an infrastructural project, so sustainability assessment should begin with decision-making [1]. Traditionally in developing countries factors such as economics and functionality are prioritized over sustainability and carbon emissions in the design and planning of infrastructure. With rising awareness toward

sustainable development, changes in governmental policy and contractual requirements are being observed. But the pressing question remains- "How to compare and select sustainable infrastructure design option?" Decision makers are in search of tools and techniques to assess sustainability in various life stages of infrastructure projects [2].

In this research, Multi-Criteria Decision Analysis (MCDA) technique Analytical Hierarchy Process (AHP) has been used to compare and select sustainable bridge design option. In this paper, "Design and Build of seven bridges along