



Public Assessment for Environmental Management Plan Implementation: Comparative Study of Performance Indicators of Road and Highway Construction Projects

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Abstract: Road and highway construction projects are often a concern among surrounding communities as these projects possess significant risks to the environment, and their impacts can reach far beyond the project areas. Monitoring the environmental management plan (EMP) implementation of road and highway construction projects is challenging as it requires a high level of human resources. Thus, allowing the public to assess and report any potential misconduct in road and highway construction projects can help monitor EMP performances. This study aims to compare key performance indicators (PIs) for assessing EMP implementation in road and highway construction projects. To achieve the aim, the study objectives are to (1) determine the key PIs for road and highway construction projects, (2) develop underlying components that categorize interrelated PIs, and (3) compare the underlying components between road and highway construction projects. To achieve those objectives, this study first develops a questionnaire survey by conducting a systematic literature review and semistructured interviews with industry professionals. Throughout the process, 39 PIs for assessing EMP performances have been identified. Then, a questionnaire survey was developed using the PIs and distributed to environmental professionals, collecting 111 valid responses. Finally, the data for the study were analyzed using mean score ranking, factor analysis, and agreement analysis among the two project types. This study has identified 18 and 21 key PIs for assessing EMP implementation in road and highway construction projects. The key PIs can be categorized under four underlying components for both types of construction projects: geological, pollution, environmental change, and ecological for roads, and pollution, ecological, public safety, and geological for highways. This study adds to the environmental management literature by comparing potential PIs for road and highway construction projects, potentially helping policymakers and industry practitioners develop public assessments for EMP implementation of road and highway construction projects. DOI: [10.1061/JCEMD4.COENG-13611](https://doi.org/10.1061/JCEMD4.COENG-13611). © 2024 American Society of Civil Engineers.

Introduction

The demand for highway and road construction projects is rising, as reflected in the increasing length of paved roads and highways in many countries, including those in the Association of Southeast Asian Nations (ASEAN) region (The ASEAN Secretariat 2022). However, road and highway construction projects, due to their linear and expansive nature, have a substantial environmental impact (Zhang et al. 2009). For instance, Malaysia's Department of Statistics highlighted that construction activities accounted for MYR

84.7 million (approximately USD 18 million) of environmental protection spending in 2021 (Department of Statistics Malaysia 2022). Environmental management plans (EMPs) are documents developed to outline the strategies, procedures, and measures to manage and mitigate the environmental impacts of a particular project or activity, including highway and road construction projects (Gupta et al. 2005). As a result, inadequate monitoring of EMP implementation in road and highway construction projects can lead to severe environmental consequences. Consequently, it is imperative that every stakeholder, including the public, should have the ability to monitor and assess EMP performance whenever necessary.

It is common not to separate the assessment of EMP implementation of road and highway construction projects. However, road and highway construction projects have different characteristics, including project location, stakeholder priorities, project environment, and climate conditions (Umer et al. 2016). Roads consist of any route or pathway allowing vehicular travel, and highways are major arterial roads designed for high-speed travel and intercity connection (Attahuru et al. 2019). Therefore, compared to roads, highways often have multiple lanes, controlled access, and higher speed limits (Attahuru et al. 2019). As a result, highway construction projects involve more land clearing and have a larger footprint than road construction projects (Radzi et al. 2022). These different characteristics lead to more destruction of the natural environment in highway construction projects compared to road projects (Attahuru et al. 2019). The limited resources of environmental auditors and officers tasked with monitoring these projects further compound the challenge (Asnor et al. 2022). Therefore, it is crucial to identify these critical PIs to develop assessment tools tailored to

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