

ABSTRACT

The construction sector is highly dynamic and inherently dangerous, with elevated risks of fatal workplace accidents, particularly in bridge engineering. The Ciharuman Suspension Bridge Construction Project (Pangandaran-Tasikmalaya) presents extreme technical difficulties, including high-altitude tasks, main steel cable installation, material mobility without heavy machinery, and dynamic river current fluctuations. This condition is exacerbated by the absence of risk analysis documents specific to asymmetric suspension bridges and a lack of worker compliance with standard safety procedures. Objective: This study aims to identify potential occupational hazards, evaluate risk levels by measuring likelihood and severity, and formulate applicable risk control recommendations to achieve a zero-accident work environment.

This research utilizes the Hazard Identification, Risk Assessment, and Risk Control (HIRARC) framework based on the AS/NZS 4360:2004 standard and Minister of PUPR Regulation No. 10 of 2021. The scope is focused on the construction phase of a 24-meter span bridge with a 6-meter pylon height and a road width of 1.4 meters, divided into sub-structure and super-structure works. Primary data were gathered through visual field observations and structured interviews with project executors, while secondary data were obtained from technical project documents and national safety regulations.

The initial risk assessment indicates that primary structural operations are dominated by High Risk to Extreme Risk categories. Extreme risks are prominently identified during the super-structure phase, specifically during the erection of the 6-meter pylon tower (risk of free fall) and the main cable pulling process across the 24-meter span (risks of mechanical cable failure, whipping effects, and drowning). Consequently, multi-layered risk controls were designed based on the hierarchy of controls, including engineering controls (installation of scaffolding, lifelines, and safety nets) and double protection mechanisms combining full-body harnesses and life jackets. The practical implication of this research is providing a concrete contribution for contractors to formulate accurate Construction Safety Plans compliant with current regulations, while fostering a proactive safety culture to minimize residual risks to an acceptable level.

Keywords: Construction HSE, Asymmetric Suspension Bridge, HIRARC, Risk Level, Construction Safety Plan.