DEVELOPMENT OF A RISK-BASED SAFE WORK METHOD STATEMENT FOR PILE RAFT FOUNDATION CONSTRUCTION

FINAL PROJECT

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ABSTRACT

The construction industry remains one of the most hazardous sectors globally, and raft foundation construction presents an especially high-risk context due to the combination of deep excavation, heavy reinforcement work, and dynamic machinery such as diesel piling hammers. Although Safe Work Method Statements (SWMS) are legally established to control High-Risk Construction Work (HRCW), existing research and regulatory reviews show that SWMS often become static administrative documents. In practice, they fail to represent the changing risk conditions that emerge during construction activities. This gap between regulatory intention and field reality forms the primary motivation of this study. The research aims to develop an Integrated Risk-Based Framework that positions the SWMS as a dynamic decision-support tool tailored to raft foundation projects. A mixed-methods approach is applied across six structured stages, integrating qualitative hazard mapping with quantitative Multiple Risk Analysis (MRA) through Monte Carlo simulations. The study begins with a contextual literature review, followed by the use of a Work Breakdown Structure (WBS) and a technical Work Method Statement (WMS) to break down construction activities and identify underlying technical hazards, including vibration resonance from diesel hammers and soil instability during excavation. These hazards and the developed framework are validated through structured questionnaires involving seven industry experts to capture tacit field knowledge that is often not reflected in formal documentation. The study then applies a Hazard Identification, Risk Assessment, and Determining Control (HIRADC) process, which comprises Multi Hazard Identification (MHI), quantitative Multiple Risk Analysis (MRA) via Monte Carlo simulations, and Integrated Determining Control (IDC). This structured evaluation is designed to ensure that high-severity risks are properly escalated and never overshadowed by low probability scores. Based on this analysis, the study proposes a framework that transforms traditional SWMS into a dynamic, decision-based flowchart featuring strict go/no-go operational gates. Ultimately, to ensure practical field applicability, the identified hazards and the developed framework are rigorously validated through structured questionnaires involving seven industry experts. By enforcing the Hierarchy of Controls to prioritize higher-order engineering solutions and introducing a Plan-Do-Check-Act (PDCA) feedback loop, the framework supports a shift from reactive document compliance toward a proactive, self-improving safety workflow.

Keywords: *Safe Work Method Statement (SWMS), Raft Foundation, Risk-Based Framework, HIRADC, Construction Safety.*