

ABSTRACT

The increasing complexity of civil infrastructure projects necessitates more intelligent, data-driven decision-making approaches. This thesis explores the integration of Artificial Intelligence (AI) into Decision Support Systems (DSS) to enhance planning, monitoring, and management in the civil infrastructure domain. By conducting an extensive literature review and comparative case studies, this research examines how AI-DSS applications such as real-time structural health monitoring and predictive project management are reshaping traditional engineering practices. Two key case studies are analyzed: one involving a sensor-driven bridge monitoring system integrated with Building Information Modeling (BIM) and Finite Element Modeling (FEM), and another focused on an intelligent DSS using Deep Belief Networks (DBN) for construction project evaluation. The findings highlight how AI-DSS improves safety, efficiency, and decision accuracy across infrastructure types. However, the study also identifies critical limitations, including data quality issues, scalability challenges, cybersecurity risks, and human adoption resistance. To address these, the thesis proposes future research directions emphasizing hybrid modeling, explainable AI, regulatory frameworks, and real-world pilot implementations. The author hopes this work will contribute to the continued advancement and standardization of AI-based DSS in building smarter, safer, and more sustainable civil infrastructure systems.

Keywords: Artificial Intelligence, Decision Support System, Civil Infrastructure, Structural Health Monitoring, BIM.