

Designing of an Efficient Mini Hydraulic Forklift

W.Y Kavyanga^{1*} and P.U.H.K.K. Bandara²

¹Wayamba University of Sri Lanka, Kuliyaipitiya, Sri Lanka

²University of Ruhuna, Matara, Sri Lanka

*yasinthakavyanaga@gmail.com

Abstract

This research presents the design and development of a compact mini hydraulic forklift to enhance material handling efficiency in confined spaces, a prevalent challenge in modern industries. The project emphasizes key factors such as maneuverability, lifting capability, safety, and cost-effectiveness. The forklift, constructed using high-strength steel and equipped with a piston-type hydraulic hand pump, is designed to lift to 1200 kg. Finite Element Analysis (FEA) confirmed the design's structural integrity, with a maximum bending stress of 3.834 MPa and deflection of 0.019 meters. Additionally, a factor of safety was incorporated to ensure reliability. Prototype testing compared the forklift's performance against traditional engine hoists, demonstrating a 20% faster lifting speed and reduced operator exertion, improving efficiency. Key parameters tested included lifting speed, stability under load, and operator fatigue. Design features such as small tires and a low center of gravity enhanced stability and maneuverability, making it suitable for use in limited spaces. The forklift's compact design and ergonomic improvements reduced operator fatigue, boosting productivity in industrial settings. Future work will optimize the hydraulic system and further reduce weight and cost. Thus, this project offers valuable insights and a robust approach to designing efficient, safe, and cost-effective material handling solutions.

Keywords: *Material Handling, Compact Design, Hydraulic System, Finite Element Analysis, Ergonomics*