Masters Desertion Showcase
Year 2023

Department: Civil Engineering

Programme: Masters in Engineering

Specialization: Coastal and water Resources Engineering

1	**Title of the Thesis** "Sustainable Plumbing Solutions in High-Rise Buildings for Water Distribution and Soil and Waste Management"
2	**Abstract** This study analyzes international and local plumbing models developed on Revit to identify sustainable materials for plumbing systems, including pipes, fixtures, and fittings. The analysis of five models (three international and two local) concluded that PP-R (polypropylene random) and PP-RCT (enhanced polypropylene random at elevated temperature and pressures) are optimized materials for water supply distribution systems in buildings. These materials exhibit minimum pressure loss, and friction factors and perform well within a temperature range of -10 °C to +95 °C. While ABS (Acrylonitrile-Butadiene-Styrene) piping systems showed promising results due to their enhanced composition, their usage in the Pakistani piping industry is not feasible due to the lack of local manufacturers. CPVC (chlorinated polyvinyl chloride) pipes, commonly used in Pakistan, demonstrated elevated pressure loss and had drawbacks such as vulnerability to freezing temperatures, degradation under direct sunlight, and toxic fume release when burned. Iron pipes performed poorly due to their high corrosion rates, while steel pipes showed mixed results due to their high costs and thermal conductivity issues. For drain, waste, and vent (DWV) systems, the study suggests the use of enhanced plumbing fittings and fixtures. These include AAVs (air admittance valves) to control unpleasant odors and low-flow sensor faucets and aerators for water conservation and controlling wastewater flow velocities. By implementing these enhanced plumbing solutions, it is possible to improve the productivity, efficacy, and sustainability of plumbing design models.
3	**Impact on Sustainability of Urban Regions or SDG-11 "Sustainable Cities and Communities"** The findings of the thesis emphasize the importance of utilizing optimized materials in water supply distribution systems, which can help reduce pressure loss and improve overall efficiency. These solutions promote resource efficiency and mitigate environmental impacts, contributing to Target 11.6 on reducing the adverse environmental impact of cities. Furthermore, the enhanced plumbing fittings and fixtures recommended for drain, waste, and vent systems align with Target 11.7, which aims to provide universal access to safe, inclusive, and accessible public spaces, particularly for vulnerable groups. The implementation of AAVs, low-flow sensor faucets, and aerators can improve water conservation, odor control, and wastewater management, thus supporting the overall sustainability of urban regions. The research presented in this thesis has a positive impact on the sustainability of urban regions by offering practical solutions for sustainable plumbing in high-rise buildings, aligning with the objectives outlined in SDG-11
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