Final Year Design Project Showcase
Batch-2022
Year 2026

Department: Civil Engineering (TIEST) Programme: Bachelor of Engineering in Civil Engineering	
1	**Project Title** Comparative Analysis of Baked Clay Bricks in Sindh
2	**Project Idea** Bricks are the most widely used building material in Sindh, yet there is no standardized production or quality control system across the province. This project aimed to evaluate the quality of baked clay bricks manufactured in different regions of Sindh by testing their compressive strength, water absorption, dimensional accuracy, and efflorescence according to ASTM C67 standards. The study collected 180 brick samples from 15 different brick kilns distributed across various districts of Sindh to conduct a comprehensive comparative analysis. The findings revealed significant variations in brick quality, with most kilns failing to meet international standards, highlighting the urgent need for a quality standardization system in the province.
3	**Process** **Phase 1: Field Work & Sample Collection** • Selected 15 brick kilns across Sindh (Hyderabad, Sanghar, Sukkur, Nawabshah, Nausheroferoz, Larkana, Diplo, Tando Allahyar, Badin, Kashmore, Naukot, Umerkot, Matiari, Khairpur, Thatta) • Conducted site visits to observe manufacturing practices, clay excavation, molding, drying, and firing conditions • Collected 12 bricks from each kiln (total 180 samples) with proper labeling and tagging system • Packed and transported samples to laboratory under controlled conditions **Phase 2: Laboratory Testing** • Dimensional analysis (ASTM C67 Section 13): Measured length, width, and thickness using vernier calipers • Compressive strength testing (ASTM C67 Section 7): Tested using Compression Testing Machine (CTM) with 0-500 kN capacity • Water absorption test (ASTM C67 Section 8): 24-hour cold water immersion method • Efflorescence test (ASTM C67 Section 11): 7-day immersion test for soluble salts **Phase 3: Data Analysis & Comparison** • Compared results with ASTM C67, IS 1077, and Building Code of Pakistan 2007 standards • Performed statistical analysis and identified quality variations across regions • Developed recommendations and interim acceptance criteria for Sindh
4	**Outcome** • **Compressive Strength:** Avg 2.09 MPa. Only Badin (7.04) and Nawabshah (5.72) met IS 1077 (3.5 MPa). None met ASTM C67 (10.3 MPa). • **Water Absorption:** Only 26.7% met ASTM limit (≤17%). Badin (6.03%) best; Sukkur

	(32.63%) worst. • **Dimensions:** All 100% failed width tolerance (±3mm). Avg deviation +9.10mm—3x the limit. • **Efflorescence:** 53.3% no deposits; 46.7% mild to severe. **Deliverables:** Interim criteria (≥5.0 MPa, ≤20% absorption); Grading system (A-Reject); Recommendations for kiln owners and policymakers.
5	**Evidence (Theoretical Basis)** **Standards Referenced:** • ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile (Sections: 5-Sampling, 6-Preparation of Specimens, 7-Compressive Strength, 8-Absorption, 11-Efflorescence, 13-Measurement of Size) • IS 1077 - Indian Standard for Burnt Clay Bricks • Building Code of Pakistan (BCP) 2007 - Section on Masonry (Chapter 5) • ASTM C62 - Standard Specification for Building Brick **Research Methodology:** • 180 brick samples collected from 15 kilns (12 bricks per kiln) • Tests performed: Compressive Strength, Water Absorption, Dimensional Analysis, Efflorescence • Comparison with international and national standards • Field observations of manufacturing practices documented **Literature Support:** • Studies by Azam et al. (2022) on quality assessment of fired clay bricks in Sindh • Research by Narejo (2022, 2023) on traditional brick kilns and quality issues • MUET (2025) study on sustainable additives (fly ash, RHA, SBA) • Javed et al. (2024) on structural performance of durable bricks
6	**Competitive Advantage or Unique Selling Proposition** (Cost Reduction, Process improvement, Attainment of any SDG (Sustainable Development Goal), increase of market share or capturing new market or having superior performance over a competitor. In summary, any striking aspect of the project that compels the industry to invest in FYP or purchase it. Some detailed description is required in terms of how, why when what. You can select one or more from the following dropdown and delete the rest of them). Please keep relevant options, delete the rest of them, and correct the sequence
a	**Attainment of any SDG** (e.g. How it is achieved and why it is necessary for the region) SDGs: SDG 9 (Industry/Innovation), SDG 11 (Sustainable Cities), SDG 12 (Responsible Consumption).
b	**Any Environmental Aspect** (e.g. carbon reduction, energy-efficient, etc.) Environment: Promotes cleaner kiln tech (zigzag), reduces emissions, encourages sustainable additives (fly ash, RHA, SBA).
c	**Cost Reduction of Existing Product** Process Improvement: Standardized molds, uniform firing (900-1050°C), mandatory quality testing, worker training.

d	**Process Improvement which Leads to Superior Product or Cost Reduction, Efficiency Improvement of the Whole Process** (e.g. What is the issue is current process and what improvement you suggests) Cost Reduction: Reduces repair costs, saves 10-20% mortar, lowers fuel consumption.	
e	**Expanding of Market share** (e.g. how it expand and what is the problem with the current market Market: Access to premium markets, export potential, attracts large-scale projects.	
f	**Capture New Market** (e.g. Niche market or unaddressed segment) Addresses unaddressed segment of certified building materials in Sindh; creates new market for quality-assured bricks; enables government and international projects requiring certified materials; opens niche market for sustainable and standardized bricks in Pakistan's construction sector	
g	**Any Other Aspect**	
7	**Target Market** (Industries, Groups, Individuals, Families, Students, etc) Please provide some detail about the end-user of the product, process, or service Construction companies, real estate developers, government housing projects, brick kiln owners, architects, engineers, regulators, and individual home builders.	
8	**Team Members** (Names along with email address)	Mr. Fahad Ali Khuhro - khuhro4505194@cloud.neduet.edu.pk Ms. Minhal Mehmood Waris Alvi - alvi4506004@cloud.neduet.edu.pk Mr. Farhat Ali - ali4507427@cloud.neduet.edu.pk
10	**Supervisor Name** (along with email address)	**Dr. Muhammad Aslam Bhutto**, mbhutto@cloud.neduet.edu.pk
11	**Video (If any)**	NA