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A REVIEW PAPER ON COMPARATIVE STUDY OF RECYCLED CONSTRUCTION WASTE BASED GEOPOLYMER BRICK

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ABSTRACT

Bricks and masonry blocks are widely used in building construction, but their properties vary with raw materials, manufacturing methods and curing conditions. Burnt clay bricks, autoclaved aerated concrete (AAC) blocks and fly ash bricks are established masonry products with different characteristics related to strength, density, water absorption, thermal performance, durability and cost. This review considers these three conventional products and a proposed fourth material: recycled construction waste based geopolymer brick. The proposed material may use processed construction and demolition waste, such as recycled brick powder and recycled concrete powder, with suitable aluminosilicate binders or industrial by-products. Published research indicates that recycled mineral powders can be used in geopolymer systems; however, performance depends on precursor composition, activator system, liquid-to-solid ratio, compaction and curing. The project will therefore prepare and test trial specimens rather than assume that the proposed brick will automatically outperform existing products. The planned comparison includes compressive strength, water absorption, density, dimensions, efflorescence, selected durability indicators, manufacturing process and approximate cost. Relevant Indian Standards and published research will guide test selection. No experimental result or superiority claim is made in this review.

Keywords: Burnt clay brick, AAC block, Fly ash brick, Recycled construction waste, Geopolymer brick, Compressive strength, Water absorption, Sustainable construction

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I. INTRODUCTION



Fig. 1: Geopolymer brick

Masonry units are widely used construction materials for walls, partitions and various building applications. Burnt clay bricks are manufactured by moulding suitable clay into the required shape, followed by drying and firing at high temperatures. Fly ash bricks are produced using fly ash, cement or lime, sand and other suitable materials through mixing, moulding and curing. Autoclaved Aerated Concrete (AAC) blocks are lightweight building materials manufactured by introducing air bubbles into a cement-based mixture, followed by cutting and autoclaving. These masonry products differ in dimensions, density, strength and thermal properties. Therefore, their performance should be compared based on standard test methods, product grades and specified dimensions.

Construction and demolition activities generate large quantities of waste materials, including concrete, mortar, bricks and ceramic fragments. Improper disposal of this waste creates environmental problems and increases the demand for natural construction materials. However, suitable waste materials can be collected, segregated and processed into fine powder or aggregates for reuse in construction.

Waste materials containing silica and alumina may also be used as raw materials for geopolymer production. When these materials are combined with suitable alkaline activating solutions, they can participate in geopolymerisation and form binding materials. However, their performance depends on factors such as chemical composition, particle size, contamination level, alkaline solution concentration and curing conditions.

The present study focuses on understanding the properties and potential applications of waste-based construction materials. It also highlights the importance of converting construction waste into useful building products to promote sustainable and economical construction practices.

II. OBJECTIVES

- To study the basic properties and manufacturing characteristics of burnt clay bricks, AAC blocks and fly ash bricks.
- To review published research on the use of recycled construction and demolition waste in geopolymer materials.
- To develop trial specimens of recycled construction waste based geopolymer brick using a laboratory-approved mix design.
- To compare the four masonry materials for compressive strength, water absorption, density, dimensions and selected durability indicators.
- To identify the effects of waste composition, particle size, binder system, activator and curing conditions.
- To assess the suitability, limitations and possible applications of the proposed brick from measured results.

III. LITERATURE REVIEW

3.1 Ahmed, Md. Imran, Namratha Bharadwaja, Ashwin M. Joshi, M. V. Renukadevi and S. M. Basutkar (2026) : The study titled *Development of Recycled Masonry Concrete Blocks Using Crushed Brick Masonry Debris: Physical, Mechanical, and Sustainability Characteristics* investigated the use of crushed brick masonry debris as a replacement for fine aggregate in concrete masonry blocks. Different replacement percentages were tested to study the physical, mechanical and durability properties. The results showed that 50–75% replacement provided satisfactory performance. The developed blocks also showed reductions in embodied energy and carbon emissions compared with conventional blocks

3.2 Ahmed, Md. Imran, M. V. Renukadevi, Ashwin M. Joshi and S. M. Basutkar (2026): In *Characterization and Assessment of Energy and Carbon Associated with Recycling of Demolished Brick Masonry for the Development of Sustainable Construction Materials*, the researchers studied construction and demolition waste collected from nine demolition sites in Bengaluru. The study identified demolished brick masonry as a major component of the waste. The sand-sized fraction of the waste was found to be suitable for reuse in construction materials. The developed masonry units showed significant savings in embodied energy and embodied carbon, supporting the use of recycled brick waste in sustainable construction.

3.3 Hanafi, Mohammad Reza, Hamed Rahimpour, Faramarz Moodi, Haider Hamad Ghayeb and Ahmad Fahmi (2026): The research *Fully Upcycled Cement-Free Geopolymer Concrete from Recycled Concrete and Brick Powders: Performance, Durability, and Microstructural Mechanisms* investigated the production of cement-free geopolymer concrete using recycled concrete powder and brick powder. The study evaluated strength, durability and microstructural properties. The results demonstrated that recycled demolition powders can be

used to produce high-strength geopolymer concrete. It also highlighted that the proportion of recycled brick powder affects the long-term performance of the material.

3.4 Luga, Erion, Enea Mustafaraj, Marco Corradi and Margarita Dajko (2025 :The study *Recycled Red Brick Masonry Demolition Waste as a Sustainable Cement Replacement Alternative: A DoE-Based Approach* examined the possibility of using ground red brick masonry waste as a partial replacement for cement. Different mortar mixtures were prepared and tested for compressive strength and water absorption. The results indicated that recycled brick powder can be used as a cement replacement in suitable proportions. The research also applied mixture-design methods to identify suitable combinations of materials.

3.5 Günel, Gazi and Ozer Sevim (2025): In *Behavioral Analysis of Geopolymer Mortars Incorporating Brick and Tile Powder from Construction Demolition Waste Under Various Cooling Regimes Following High-Temperature Exposure*, the researchers studied geopolymer mortars containing waste brick powder and waste tile powder. The specimens were exposed to high temperatures and then cooled under different conditions. Their mechanical and microstructural properties were examined. The study showed that the type of cooling and the percentage of waste powder influence the strength and thermal performance of geopolymer mortar.

3.6 Luga, Erion, Enea Mustafaraj, Emrah Tasdemir, Marco Corradi, Ervis Lika and Erion Periku (2025): The paper *Reuse of Solid Bricks in Construction: An Experimental Work* investigated the possibility of reusing existing solid bricks in construction. The researchers examined the properties and performance of reused bricks to understand their suitability for further construction applications. The study highlighted that careful assessment of recovered bricks can support material reuse, reduce construction waste and decrease the demand for newly

3.7 Ma, Zhiming, Yuanhui Wu, Dingyi Yang, Kun Fang, Shaodan Hou, Yunyun Dai and Changqing Wang (2025) The study *Upcycling of Recycled Brick Powder as a Substitute for Precursor and Sand in Completely Recycled Geopolymer: From Micro to Macro Perspective* investigated the use of recycled brick powder as a replacement for geopolymer precursor materials and natural sand. Different replacement proportions were evaluated to understand their influence on the properties of geopolymer. The research demonstrated the potential of recycled brick powder for producing completely recycled geopolymer materials and reducing the consumption of natural resources.

3.8 Tahwia, Ahmed M., Mohamed Abdellatief, Aml Salah and Osama Youssf (2025): In *Valorization of Recycled Concrete Powder, Clay Brick Powder, and Volcanic Pumice Powder in Sustainable Geopolymer Concrete*, the researchers studied the use of recycled concrete powder, clay brick powder and volcanic pumice powder in geopolymer concrete. The materials were evaluated for mechanical, durability and thermal properties. The study considered compressive, tensile and flexural strength, along with water absorption and chemical

resistance. It showed the potential of waste powders as useful materials in sustainable geopolymer production.

3.9 Hameed, Samina, Syed Asad Ali Gillani, Muhammad Tahir, Rashid Hameed, Safeer Abbas, Moncef L. Nehdi and Muhammad Ahmad (2025): The research *Investigating Lightweight Recycled Brick Aggregate Concrete Incorporating EPS Beads: Application to Masonry Units* focused on producing lightweight concrete using recycled brick aggregates and expanded polystyrene beads. Fly ash and coconut fibres were also incorporated into the mixtures. The researchers evaluated density, compressive strength, flexural strength and durability. The results showed that the developed material could satisfy the requirements for lightweight concrete masonry units.

3.10 Dafedar, Md. Mohsin M., Balakrishna Rao K., B. H. Venkataram Pai, Gopal Bharamappa Bekkeri and Kiran K. Shetty (2025): The study *Viability of Using 100% of Recycled Concrete Aggregates for Durable Solid Masonry Blocks* investigated the use of recycled concrete aggregates in solid masonry block production. Natural fine and coarse aggregates were replaced with recycled aggregates. The researchers evaluated compressive strength, flexural strength, water absorption, acid resistance and thermal performance. The findings showed that recycled aggregates can be used in masonry blocks, provided that the mix proportions are properly selected.

3.11 Damion, Tom, Prabhath Ranjan Kumar Soda and Souradeep Gupta (2025): The paper *Enhanced Acid Resistance of Geopolymer Containing Recycled Masonry Wastes as High-Volume Replacement of Natural Sand* studied the use of recycled masonry waste as a replacement for natural sand in geopolymer materials. The research focused on the resistance of the developed geopolymer to acidic conditions. The study demonstrated the potential of recycled masonry waste for reducing natural sand consumption while improving the sustainability of geopolymer construction materials.

3.12 Maaze, Mohammed Rihan and Sandeep Shrivastava (2024): The study *Development and Performance Evaluation of Recycled Brick Waste-Based Geopolymer Brick for Improved Physico-Mechanical, Brick-Bond and Durability Properties* investigated the production of geopolymer bricks using recycled brick waste from construction and demolition activities. The developed bricks were tested for physical, mechanical, fire and durability properties. The results showed that recycled brick waste can be used as a precursor for geopolymer bricks with satisfactory performance and resistance to chemical attack.

3.13 Roy, Aditi and G. M. Sadiqul Islam (2024): In *Geopolymer Using Different Size Fractions of Recycled Brick-Based Mixed Demolition Waste*, the researchers investigated the use of different particle-size fractions of recycled brick-based demolition waste. Fine and coarse fractions were incorporated into geopolymer mortar and concrete in different ways. The study demonstrated that different particle sizes can serve different functions in geopolymer

production, including binder and aggregate replacement. It highlighted the possibility of using a larger portion of brick-based demolition waste.

3.14 Rahimpour, Hamed, Alireza Babaeian Amini, Fatemeh Sharifi, Ahmad Fahmi and Sahar Zinatloo-Ajabshir (2024): The research *Facile Fabrication of Next-Generation Sustainable Brick and Mortar Through Geopolymerization of Construction Debris* focused on producing sustainable bricks and mortar from recycled concrete powder and recycled brick powder. The researchers used geopolymerization to convert construction debris into useful building materials. The study examined the physical and mechanical properties of the developed products and demonstrated that construction debris can be reused in the production of sustainable masonry materials.

3.15 Ahmed, Junaid K., Nihat Atmaca and Ganjeena J. Khoshnaw (2024): The paper *Building a Sustainable Future: An Experimental Study on Recycled Brick Waste Powder in Engineered Geopolymer Composites* investigated the use of recycled brick waste powder in engineered geopolymer composites. The researchers studied the influence of brick powder on fresh and hardened properties, including strength and tensile behaviour. The results indicated that recycled brick waste powder can contribute to the development of sustainable geopolymer composites when used with suitable binder materials and fibres.

3.16 Tuisk, Tanel, Simo Ilomets, Tiina Hain, Joosep Kalbus and Targo Kalamees (2024): In *Rheology, Strength, and Durability of Concrete and Mortar Made of Recycled Calcium Silicate Masonry*, the researchers investigated the use of demolition waste from calcium silicate brick masonry as aggregate in concrete and mortar. The study evaluated workability, compressive strength and durability. The findings showed that recycled masonry aggregate can replace a portion of natural aggregate without significantly affecting the performance of the developed materials.

3.17 Atasham ul haq, Muhammad, Peng Xia, Suliman Khan, Muhammad Hassam, Muhammad Sohaib, Fuyuan Gong and Yuxi Zhao (2024): The study *Optimal Utilization of Low-Quality Construction Waste and Industrial Byproducts in Sustainable Recycled Concrete* investigated the use of low-quality recycled brick aggregates along with industrial by-products in concrete. Different replacement levels of recycled brick aggregates were studied, along with supplementary cementitious materials and steel fibres. The research showed that suitable combinations of recycled aggregates and industrial by-products can improve the performance of recycled aggregate concrete.

3.18 Maaze, Mohammed Rihan, Sourav Kumar Das, Nikhil Garg and Sandeep Shrivastava (2024): The paper *A Review of Ecofriendly Brick Production: Exploring the Use of Fly Ash and Industrial Waste in the Construction Industry* reviewed the use of fly ash and industrial waste in brick manufacturing. It discussed the environmental problems associated with conventional brick production and the possible use of alternative materials. The review

highlighted that industrial waste can reduce the consumption of natural clay and support the production of more sustainable bricks.

3.19 Joyklad, Panuwat (2024): The study *Evaluating Research on the Utilization of Recycled Brick Aggregates in Concrete* reviewed research related to recycled brick aggregates in concrete production. It examined the development of research in this field and discussed the importance of using recycled brick aggregates as an alternative to natural aggregates. The study highlighted the need to evaluate mechanical performance and environmental impacts before applying recycled brick aggregates in construction.

3.20 Maaze, Mohammed Rihan and Sandeep Shrivastava (2023): The research *Design Development of Sustainable Brick-Waste Geopolymer Brick Using Full Factorial Design Methodology* investigated the production of geopolymer bricks using brick waste powder obtained from construction and demolition waste. Different alkaline solution concentrations and curing temperatures were studied. The researchers used a full factorial design method to identify suitable mix proportions. The results demonstrated that brick waste powder can be used to develop sustainable geopolymer bricks with suitable physical and mechanical properties.

3.21 Kul, Anil, Behlul Furkan Ozel, Emircan Ozcelikci, Muhammed Faruk Gunal, Huseyin Ulugol, Gurkan Yildirim and Mustafa Sahmaran (2023): The study *Characterization and Life Cycle Assessment of Geopolymer Mortars with Masonry Units and Recycled Concrete Aggregates Assorted from Construction and Demolition Waste* investigated the use of recycled masonry and concrete aggregates in geopolymer mortar. The researchers examined the mechanical properties and environmental performance of the developed mortar. The study reported that geopolymer mortar made with construction and demolition waste can achieve good strength while reducing carbon emissions compared with conventional Portland cement mortar.

3.22 Al-Noaimat, Yazeed A., Mehdi Chougan, Mazen J. Al-kheetan, Marcus H. N. Yio, Hong S. Wong and Seyed Hamidreza Ghaffar (2023): The paper *Upcycling of End-of-Life Bricks in High-Performance One-Part Alkali-Activated Materials* studied the use of waste bricks in one-part alkali-activated materials. Brick powder was used as a precursor replacement, while brick aggregates were used as a replacement for natural aggregates. The researchers examined mechanical and durability properties. The study demonstrated that end-of-life bricks can be converted into useful construction materials through alkali activation.

3.23 Jothilingam, M., V. Preethi, P. Sri Chandana and G. Janardhanan (2023): The research *Fabrication of Sustainable Green Bricks by the Effective Utilization of Tannery Sludge as Main Additive* investigated the production of unfired green bricks using tannery sludge, fly ash, ground granulated blast furnace slag and lime. The developed bricks were tested for compressive strength, water absorption, durability and leachability. The study reported that

suitable proportions of these waste materials could produce green bricks with strength comparable to conventional first-class bricks.

3.24 Nandipati, Sunil, Srinivasa Rao G. V. R., Manjunatha M., Nagaraju Dora and Sifatullah Bahij (2023): The paper *Potential Use of Sustainable Industrial Waste Byproducts in Fired and Unfired Brick Production* reviewed the possible use of industrial waste by-products in fired and unfired bricks. It discussed different types of waste materials and their influence on brick strength and durability. The study highlighted that using industrial by-products can reduce the consumption of natural resources and help in managing industrial waste.

3.25 Jaafar, Ahmed Sadeq, Zena K. Abbas and Abbas A. Allawi (2023): The study *Studying Sustainable Concrete Block Efficiency Production: A Review* examined the use of demolished building waste, including crushed concrete and clay bricks, in sustainable concrete blocks. It discussed the replacement of natural aggregates and cement with recycled materials. The review considered properties such as density, workability, water absorption, compressive strength and thermal conductivity. It concluded that demolished building waste has potential for use in sustainable block production.

3.26 Qiao, Liang, Yuzhou Tang, Yue Li, Mengyue Liu, Xueliang Yuan, Qingsong Wang and Qiao Ma (2022): The research *Life Cycle Assessment of Three Typical Recycled Products from Construction and Demolition Waste* evaluated the environmental performance of recycled products manufactured from construction and demolition waste. The products included masonry bricks, permeable bricks and thermal insulation blocks. The study used life cycle assessment to examine environmental and carbon-related benefits. It highlighted the importance of recycling demolition waste into useful construction products.

3.27 Tan, Jiawei, Jingming Cai and Jiabin Li (2022): The study *Recycling of Unseparated Construction and Demolition Waste Through Geopolymer Technology* investigated the use of mixed construction and demolition waste in geopolymer production. Instead of separating every waste component, the researchers examined the feasibility of using unseparated waste. The study evaluated the reactivity of waste constituents and their effect on geopolymer strength. It showed that geopolymer technology can provide a useful method for recycling mixed demolition waste.

3.28 Dhanjode, Chetan and Anita Nag (2022): The paper *Utilization of Landfill Waste in Brick Manufacturing: A Review* reviewed the use of landfill waste materials in brick production. It discussed the incorporation of different waste materials into brick mixtures and their effects on physical and mechanical properties. The study highlighted the potential of waste utilization for reducing landfill disposal and conserving natural raw materials used in conventional brick manufacturing.

3.29 Dos Reis, Glaydson Simões, Marco Quattrone, Weslei Monteiro Ambrós, Bogdan Grigore Cazacliu and Carlos Hoffmann Sampaio (2021): The paper *Current Applications of Recycled Aggregates from Construction and Demolition: A Review* reviewed the generation, processing and applications of recycled aggregates from construction and demolition waste. It discussed the use of recycled aggregates in bricks, ceramics, pavements, cementitious materials and concrete. The review emphasized that the physical, chemical and mechanical properties of recycled aggregates are important in selecting their suitable construction applications.

3.30 Li, Jing, Jun Zhang, Shuna Ni, Libo Liu and Lubinda F. Walubita (2021): The study *Mechanical Performance and Environmental Impacts of Self-Compacting Concrete with Recycled Demolished Concrete Blocks* investigated the use of recycled demolished concrete blocks in self-compacting concrete. The researchers evaluated mechanical performance and environmental impacts to understand the suitability of recycled materials. The study supported the use of recycled demolition materials as alternatives to natural construction resources.

3.31 Huang, Qian, Xiaohong Zhu, Guangqi Xiong, Chaoqiang Wang, Dongsheng Liu and Liang Zhao (2021): The paper *Recycling of Crushed Waste Clay Brick as Aggregates in Cement Mortars: An Approach from Macro- and Micro-Scale Investigation* studied crushed waste clay bricks as fine aggregate in cement mortar. Different brick aggregate conditions and curing methods were examined. The results showed that the moisture condition and particle characteristics of recycled brick aggregate influence the strength and water absorption of mortar.

3.32 Trang, Nguyen Thi Minh, Ngo Anh Dao Ho and Sandhya Babel (2021): The study *Reuse of Waste Sludge from Water Treatment Plants and Fly Ash for Manufacturing of Adobe Bricks* investigated the use of water-treatment sludge and fly ash as alternative materials in adobe brick production. The researchers used hydraulic pressing to manufacture the bricks and evaluated their compressive strength. The study identified a suitable mixture of sludge, cement and fly ash that could produce bricks meeting the relevant strength requirements.

3.33 He, Ziming, Aiqin Shen, Hansong Wu, Wenzhen Wang, Lusheng Wang, Chao Yao and Jinhua Wu (2021): The paper *Research Progress on Recycled Clay Brick Waste as an Alternative to Cement for Sustainable Construction Materials* reviewed the use of recycled clay brick powder as a partial replacement for cement in construction materials. It discussed the influence of brick powder on fresh properties, hardened properties and microstructure. The review highlighted the potential of recycled brick powder to reduce cement consumption and support sustainable construction.

3.34 Zhao, Zengfeng, Luc Courard, Sylvie Groslambert, Thomas Jehin, Angélique Léonard and Jianzhuang Xiao (2020): The study *Use of Recycled Concrete Aggregates from Precast Block for the Production of New Building Blocks: An Industrial Scale Study* investigated the use of recycled concrete aggregates obtained from old precast blocks in new block manufacturing. Blocks were produced with different replacement percentages of natural

aggregates. The researchers evaluated compressive strength, durability and environmental performance. The results showed that recycled aggregates could be used in industrial-scale block production while supporting resource conservation.

3.35 Gupta, Vivek, Hwa Kian Chai, Yong Lu and Sandeep Chaudhary (2020): The paper *A State of the Art Review to Enhance the Industrial Scale Waste Utilization in Sustainable Unfired Bricks* reviewed the manufacturing of unfired bricks using waste materials. It discussed stabilizing binders, mixing methods, compaction techniques and factors affecting compressive strength. The review also highlighted the challenges involved in large-scale production of sustainable unfired bricks and their potential for waste utilization.

3.36 Al-Fakih, Amin, Bashar S. Mohammed, Mohd Shahir Liew and Ehsan Nikbakht (2019) The study *Incorporation of Waste Materials in the Manufacture of Masonry Bricks: An Update Review* reviewed the use of different waste materials in masonry brick manufacturing. It discussed fired and unfired brick production methods and the influence of waste materials on brick properties. The study highlighted the environmental benefits of waste incorporation and the need for suitable standards and specifications to support wider commercial use.

3.37 Seco, A., J. Omer, S. Marcelino, S. Espuelas and E. Prieto (2018): The research *Sustainable Unfired Bricks Manufacturing from Construction and Demolition Wastes* investigated the manufacturing of unfired bricks using construction and demolition waste. The study focused on converting waste materials into useful building products without the need for conventional firing. It demonstrated the potential of C&D waste in sustainable brick production and in reducing the environmental impact associated with traditional brick manufacturing.

3.38 Goel, Gaurav and Ajay S. Kalamdhad (2017): The study *An Investigation on Use of Paper Mill Sludge in Brick Manufacturing* examined the possibility of using paper mill sludge in brick production. The researchers investigated the effect of sludge incorporation on the physical and mechanical properties of bricks. The study highlighted that industrial sludge can be reused as a raw material in brick manufacturing, helping to reduce waste disposal and conserve natural resources.

3.39 Vieira, Carlos Maurício Fontes, Regina Maria Pinheiro, Rubén Jesus Sánchez Rodríguez, Verônica Scarpini Cândido and Sérgio Neves Monteiro (2016): The paper *Clay Bricks Added with Effluent Sludge from Paper Industry: Technical, Economical and Environmental Benefits* investigated the use of paper industry effluent sludge in clay brick production. Bricks containing paper sludge were compared with conventional clay bricks. The researchers studied compressive strength, water absorption, shrinkage and environmental emissions. The results showed that adding a suitable percentage of paper sludge can produce bricks meeting the required technical and environmental standards.

3.40 Arsenović, Milica, Zagorka Radojević, Željko Jakšić and Lato Pezo (2015): The study *Mathematical Approach to Application of Industrial Wastes in Clay Brick Production – Part I:*

Testing and Analysis investigated the use of organic and inorganic industrial wastes in clay brick production. Different waste materials, including sludge, coal dust, fly ash, landfill ash and agricultural residues, were added to clay in different proportions. The bricks were fired at different temperatures and tested for ceramic and mechanical properties. The study demonstrated the possibility of using industrial waste as an alternative raw material in clay brick manufacturing.

IV. CONCLUSION

After studying the literature review, we concluded that waste materials generated from construction and demolition activities have good potential for manufacturing useful and sustainable bricks. Previous studies indicate that different types of construction waste, such as crushed bricks, concrete waste, cement waste and other building materials, can be reused in brick production. The use of these waste materials can help reduce the disposal of construction waste and decrease the consumption of natural raw materials. It is also observed that the quality and performance of waste-based bricks depend on the type of waste material, its proportion and the manufacturing process. Proper selection and mixing of waste materials can improve the properties of the manufactured bricks. Therefore, our project focuses on preparing bricks using waste building materials and evaluating their properties through various tests, including compressive strength, water absorption and density. The results will help determine the suitability of these bricks as an alternative building material for sustainable construction.

V. REFERENCES

1. Ahmed, Md. Imran, Namratha Bharadwaja, Ashwin M. Joshi, M. V. Renukadevi and S. M. Basutkar (2026). “Development of Recycled Masonry Concrete Blocks Using Crushed Brick Masonry Debris: Physical, Mechanical, and Sustainability Characteristics.” Journal of Asian Architecture and Building Engineering. https://www.tandfonline.com/doi/full/10.1080/13467581.2026.2624237
2. Ahmed, Md. Imran, M. V. Renukadevi, Ashwin M. Joshi and S. M. Basutkar (2026). “Characterization and Assessment of Energy and Carbon Associated with Recycling of Demolished Brick Masonry for the Development of Sustainable Construction Materials.” Civil and EnvironmentalEngineering .https://www.tandfonline.com/action/doSearch?AllField=Characterization+and+Assessment+of+Energy+and+Carbon
3. Hanafi, Mohammad Reza, Hamed Rahimpour, Faramarz Moodi, Haider Hamad Ghayeb and Ahmad Fahmi (2026). “Fully Upcycled Cement-Free Geopolymer Concrete from Recycled Concrete and Brick Powders: Performance, Durability, and Microstructural Mechanisms.” Construction and Building Materials, Volume 521, Article 146140. https://www.sciencedirect.com/science/article/pii/S0950061826010469

4. Luga, Erion, Enea Mustafaraj, Marco Corradi and Margarita Daijko (2025). “Recycled Red Brick Masonry Demolition Waste as a Sustainable Cement Replacement Alternative: A DoE-Based Approach.” Journal of Building Engineering, Volume 100, Article 111787.https://www.sciencedirect.com/science/article/abs/pii/S2352710225000233
5. Günel, Gazi and Ozer Sevim (2025). “Behavioral Analysis of Geopolymer Mortars Incorporating Brick and Tile Powder from Construction Demolition Waste Under Various Cooling Regimes Following High-Temperature Exposure.” Construction and Building Materials, Volume 463, Article 140072.https://www.sciencedirect.com/science/article/pii/S095006182500220X
6. Luga, Erion, Enea Mustafaraj, Emrah Tasdemir, Marco Corradi, Ervis Lika and Erion Periku (2025). “Reuse of Solid Bricks in Construction: An Experimental Work.” Buildings, Volume 15, Issue 21, Article 3935.https://www.mdpi.com/2075-5309/15/21/3935
7. Ma, Zhiming, Yuanhui Wu, Dingyi Yang, Kun Fang, Shaodan Hou, Yunyun Dai and Changqing Wang (2025). “Upcycling of Recycled Brick Powder as a Substitute for Precursor and Sand in Completely Recycled Geopolymer: From Micro to Macro Perspective.” Construction and Building Materials, Volume 476, Article 141300. https://www.sciencedirect.com/science/article/abs/pii/S0950061825014485
8. Tahwia, Ahmed M., Mohamed Abdellatief, Aml Salah and Osama Youssf (2025). “Valorization of Recycled Concrete Powder, Clay Brick Powder, and Volcanic Pumice Powder in Sustainable Geopolymer Concrete.” Scientific Reports, Volume 15, Article 11049.https://www.nature.com/articles/s41598-025-93598-x
9. Hameed, Samina, Syed Asad Ali Gillani, Muhammad Tahir, Rashid Hameed, Safeer Abbas, Moncef L. Nehdi and Muhammad Ahmad (2025). “Investigating Lightweight Recycled Brick Aggregate Concrete Incorporating EPS Beads: Application to Masonry Units.” Results in Engineering, Volume 25, Article 104019. https://www.sciencedirect.com/science/article/pii/S2590123025001070
10. Dafedar, Md. Mohsin M., Balakrishna Rao K., B. H. Venkataram Pai, Gopal Bharamappa Bekkeri and Kiran K. Shetty (2025). “Viability of Using 100% of Recycled Concrete Aggregates for Durable Solid Masonry Blocks.” Emergent Materials, Volume 8, Pages 6017–6037.https://link.springer.com/search?query=Viability+of+Using+100%25+of+Recycled+Concrete+Aggregates
11. Damion, Tom, Prabhath Ranjan Kumar Soda and Souradeep Gupta (2025). “Enhanced Acid Resistance of Geopolymer Containing Recycled Masonry Wastes as High-Volume Replacement of Natural Sand.” Journal of Building Engineering, Volume 105, Article 112396. https://www.sciencedirect.com/search?qs=Enhanced%20Acid%20Resistance%20of%20Geopolymer%20Containing%20Recycled%20Masonry%20Wastes

12. Maaze, Mohammed Rihan and Sandeep Shrivastava (2024). "Development and Performance Evaluation of Recycled Brick Waste-Based Geopolymer Brick for Improved Physico-Mechanical, Brick-Bond and Durability Properties." Journal of Building Engineering, Volume 97, Article110701. https://www.sciencedirect.com/search?qs=Development%20and%20Performance%20Evaluation%20of%20Recycled%20Brick%20Waste-Based%20Geopolymer%20Brick

13. Roy, Aditi and G. M. Sadiqul Islam (2024). "Geopolymer Using Different Size Fractions of Recycled Brick-Based Mixed Demolition Waste." Cleaner Materials, Volume 11, Article 100224. https://www.sciencedirect.com/search?qs=Geopolymer%20Using%20Different%20Size%20Fractions%20of%20Recycled%20Brick

14. Rahimpour, Hamed, Alireza Babaeian Amini, Fatemeh Sharifi, Ahmad Fahmi and Sahar Zinatloo-Ajabshir (2024). "Facile Fabrication of Next-Generation Sustainable Brick and Mortar Through Geopolymerization of Construction Debris." Scientific Reports, Volume 14, Article 10914. https://www.nature.com/search?q=Facile%20Fabrication%20of%20NextGeneration%20Sustainable%20Brick%20and%20Mortar

15. Ahmed, Junaid K., Nihat Atmaca and Ganjeena J. Khoshnaw (2024). "Building a Sustainable Future: An Experimental Study on Recycled Brick Waste Powder in Engineered Geopolymer Composites." Case Studies in Construction Materials, Volume 20, Article e02863. https://www.sciencedirect.com/search?qs=Building%20a%20Sustainable%20Future%20Recycled%20Brick%20Waste%20Powder

16. Tuisk, Tanel, Simo Ilomets, Tiina Hain, Joosep Kalbus and Targo Kalamees (2024). "Rheology, Strength, and Durability of Concrete and Mortar Made of Recycled Calcium Silicate Masonry." Materials, Volume 17, Issue 12, Article 2790.https://www.mdpi.com/1996-1944/17/12/2790

17. Atasham ul haq, Muhammad, Peng Xia, Suliman Khan, Muhammad Hassam, Muhammad Sohaib, Fuyuan Gong and Yuxi Zhao (2024). "Optimal Utilization of Low-Quality Construction Waste and Industrial Byproducts in Sustainable Recycled Concrete." Construction and Building Materials, Volume 428, Article 136362. https://www.sciencedirect.com/search?qs=Optimal%20Utilization%20of%20Low-Quality%20Construction%20Waste

18. Maaze, Mohammed Rihan, Sourav Kumar Das, Nikhil Garg and Sandeep Shrivastava (2024). "A Review of Ecofriendly Brick Production: Exploring the Use of Fly Ash and Industrial Waste in the Construction Industry." Journal of Structural Design and Construction Practice, Volume 30, Issue 1 https://ascelibrary.org/action/doSearch?AllField=A+Review+of+Ecofriendly+Brick+Production

19. Joyklad, Panuwat (2024). "Evaluating Research on the Utilization of Recycled Brick Aggregates in Concrete." Discover Applied Sciences, Volume 6, Article 167

https://link.springer.com/search?query=Evaluating+Research+on+the+Utilization+of+Recycled+Brick+Aggregates

20. Maaze, Mohammed Rihan and Sandeep Shrivastava (2023). "Design Development of Sustainable Brick-Waste Geopolymer Brick Using Full Factorial Design Methodology." Construction and Building Materials, Volume 370, Article 130655. https://www.sciencedirect.com/search?qs=Design%20Development%20of%20Sustainable%20Brick-Waste%20Geopolymer%20Brick
21. Kul, Anil, Behlul Furkan Ozel, Emircan Ozcelikci, Muhammed Faruk Gunal, Huseyin Ulugol, Gurkan Yildirim and Mustafa Sahmaran (2023). "Characterization and Life Cycle Assessment of Geopolymer Mortars with Masonry Units and Recycled Concrete Aggregates Assorted from Construction and Demolition Waste." Journal of Building Engineering, Volume 78.https://www.sciencedirect.com/search?qs=Characterization%20and%20Life%20Cycle%20Assessment%20of%20Geopolymer%20Mortars
22. Al-Noaimat, Yazeed A., Mehdi Chougan, Mazen J. Al-kheetan, Marcus H. N. Yio, Hong S. Wong and Seyed Hamidreza Ghaffar (2023). "Upcycling of End-of-Life Bricks in High-Performance One-Part Alkali-Activated Materials." Developments in the Built Environment, Volume 16, Article 100231.https://www.sciencedirect.com/search?qs=Upcycling%20of%20End-of-Life%20Bricks
23. Jothilingam, M., V. Preethi, P. Sri Chandana and G. Janardhanan (2023). "Fabrication of Sustainable Green Bricks by the Effective Utilization of Tannery Sludge as Main Additive." Structures, Volume 48, Pages 182–194. https://www.sciencedirect.com/search?qs=Fabrication%20of%20Sustainable%20Green%20Bricks%20Tannery%20Sludge
24. Nandipati, Sunil, Srinivasa Rao G. V. R., Manjunatha M., Nagaraju Dora and Sifatullah Bahij (2023). "Potential Use of Sustainable Industrial Waste Byproducts in Fired and Unfired Brick Production." Advances in Civil Engineering, Volume 2023, Article 9989054 https://onlinelibrary.wiley.com/action/doSearch?AllField=Potential+Use+of+Sustainable+Industrial+Waste+Byproducts
25. Jaafar, Ahmed Sadeq, Zena K. Abbas and Abbas A. Allawi (2023). "Studying Sustainable Concrete Block Efficiency Production: A Review." Journal of Engineering, Volume 29, Issue 9, Pages 134–149. https://joe.uobaghdad.edu.iq/index.php/main/search/search?query=Studying%20Sustainable%20Concrete%20Block%20Efficiency%20Production
26. Qiao, Liang, Yuzhou Tang, Yue Li, Mengyue Liu, Xueliang Yuan, Qingsong Wang and Qiao Ma (2022). "Life Cycle Assessment of Three Typical Recycled Products from Construction and Demolition Waste." Journal of Cleaner Production, Volume 376, Article 134139. https://www.sciencedirect.com/search?qs=Life%20Cycle%20Assessment%20of%20Three%20Typical%20Recycled%20Products

27. Tan, Jiawei, Jingming Cai and Jiabin Li (2022). "Recycling of Unseparated Construction and Demolition Waste (UCDW) Through Geopolymer Technology." Construction and Building Materials, Volume 341, Article 127771. https://www.sciencedirect.com/search?qs=Recycling%20of%20Unseparated%20Construction%20and%20Demolition%20Waste

28. Dhanjode, Chetan and Anita Nag (2022). "Utilization of Landfill Waste in Brick Manufacturing: A Review." Materials Today: Proceedings, Volume 62, Part 12, Pages 6628–6633.https://www.sciencedirect.com/search?qs=Utilization%20of%20Landfill%20Waste%20in%20Brick%20Manufacturing

29. Dos Reis, Glaydson Simões, Marco Quattrone, Weslei Monteiro Ambrós, Bogdan Grigore Cazacliu and Carlos Hoffmann Sampaio (2021). "Current Applications of Recycled Aggregates from Construction and Demolition: A Review." Materials, Volume 14, Issue 7, Article 1700.https://www.mdpi.com/1996-1944/14/7/1700

30. Li, Jing, Jun Zhang, Shuna Ni, Libo Liu and Lubinda F. Walubita (2021). "Mechanical Performance and Environmental Impacts of Self-Compacting Concrete with Recycled Demolished Concrete Blocks." Journal of Cleaner Production, Volume 293, Article 126129.https://www.sciencedirect.com/search?qs=Mechanical%20Performance%20and%20Environmental%20Impacts%20of%20Self-Compacting%20Concrete

31. Huang, Qian, Xiaohong Zhu, Guangqi Xiong, Chaoqiang Wang, Dongsheng Liu and Liang Zhao (2021). "Recycling of Crushed Waste Clay Brick as Aggregates in Cement Mortars: An Approach from Macro- and Micro-Scale Investigation." Construction and Building Materials, Volume 274, Article 122068. https://www.sciencedirect.com/search?qs=Recycling%20of%20Crushed%20Waste%20Clay%20Brick

32. Trang, Nguyen Thi Minh, Ngo Anh Dao Ho and Sandhya Babel (2021). "Reuse of Waste Sludge from Water Treatment Plants and Fly Ash for Manufacturing of Adobe Bricks." Chemosphere, Volume 284, Article 131367. https://www.sciencedirect.com/search?qs=Reuse%20of%20Waste%20Sludge%20from%20Water%20Treatment%20Plants%20and%20Fly%20Ash

33. He, Ziming, Aiqin Shen, Hansong Wu, Wenzhen Wang, Lusheng Wang, Chao Yao and Jinhua Wu (2021). "Research Progress on Recycled Clay Brick Waste as an Alternative to Cement for Sustainable Construction Materials." Construction and Building Materials, Volume 271, Article 122113.https://doi.org/10.1016/j.conbuildmat.2020.122113

34. Zhao, Zengfeng, Luc Courard, Sylvie Groslambert, Thomas Jehin, Angélique Léonard and Jianzhuang Xiao (2020). "Use of Recycled Concrete Aggregates from Precast Block for the Production of New Building Blocks: An Industrial Scale Study." Resources, Conservation and Recycling, Volume 157, Article 104786.

https://www.sciencedirect.com/search?qs=Use%20of%20Recycled%20Concrete%20Aggregates%20from%20Precast%20Block

35. Gupta, Vivek, Hwa Kian Chai, Yong Lu and Sandeep Chaudhary (2020). "A State of the Art Review to Enhance the Industrial Scale Waste Utilization in Sustainable Unfired Bricks." Construction and Building Materials, Volume 254, Article 119220. https://www.sciencedirect.com/search?qs=A%20State%20of%20the%20Art%20Review%20Sustainable%20Unfired%20Bricks
36. Al-Fakih, Amin, Bashar S. Mohammed, Mohd Shahir Liew and Ehsan Nikbakht (2019). "Incorporation of Waste Materials in the Manufacture of Masonry Bricks: An Update Review." Journal of Building Engineering, Volume 21, Pages 37–54. https://www.sciencedirect.com/search?qs=Incorporation%20of%20Waste%20Materials%20in%20the%20Manufacture%20of%20Masonry%20Bricks
37. Seco, A., J. Omer, S. Marcelino, S. Espuelas and E. Prieto (2018). "Sustainable Unfired Bricks Manufacturing from Construction and Demolition Wastes." Construction and Building Materials, Volume 167, Pages 154–165. https://www.sciencedirect.com/search?qs=Sustainable%20Unfired%20Bricks%20Manufacturing
38. Goel, Gaurav and Ajay S. Kalamdhad (2017). "An Investigation on Use of Paper Mill Sludge in Brick Manufacturing." Construction and Building Materials, Volume 148, Pages 334–343.https://www.sciencedirect.com/search?qs=An%20Investigation%20on%20Use%20of%20Paper%20Mill%20Sludge%20in%20Brick%20Manufacturing
39. Vieira, Carlos Maurício Fontes, Regina Maria Pinheiro, Rubén Jesus Sánchez Rodríguez, Verônica Scarpini Cândido and Sérgio Neves Monteiro (2016). "Clay Bricks Added with Effluent Sludge from Paper Industry: Technical, Economical and Environmental Benefits." Applied Clay Science, Volumes 132–133, Pages 753–759. https://www.sciencedirect.com/search?qs=Clay%20Bricks%20Added%20with%20Effluent%20Sludge%20from%20Paper%20Industry
40. Arsenović, Milica, Zagorka Radojević, Željko Jakšić and Lato Pezo (2015). "Mathematical Approach to Application of Industrial Wastes in Clay Brick Production – Part I: Testing and Analysis." Ceramics International, Volume 41, Issue 3, Part B, Pages 4890–4898.https://www.sciencedirect.com/search?qs=Mathematical%20Approach%20to%20Application%20of%20Industrial%20Wastes%20in%20Clay%20Brick%20Production