

# Codal Approach to Size Selection of Solid Concrete Bricks

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**Abstract** – Bricks are among the most fundamental construction materials used in masonry structures due to their durability, strength, and ease of construction. Among the various masonry units, concrete bricks have gained increasing attention owing to their adequate compressive strength, dimensional uniformity, and flexibility in material selection as reported in existing research studies. While several investigations have explored the use of alternative and waste-derived materials in concrete brick production, the dimensional characteristics of bricks remain a critical factor governing structural stability, construction efficiency, and compatibility with masonry systems. This paper discusses the selection of appropriate sizes for solid concrete bricks based on relevant Indian Standard codal provisions, supported by observations from published research literature. The importance of codal guidelines in establishing standardized brick dimensions is highlighted to ensure uniformity, constructability, and satisfactory structural performance. The study aims to provide a clear understanding of codal requirements and literature-based insights related to concrete brick size selection for standardized masonry construction practices.

**Keywords**—Concrete bricks, brick size selection, Indian Standard codes, research literature.

## I. INTRODUCTION

For a conventional building, the materials commonly used include cement, fine and coarse aggregates, steel reinforcement, and masonry units such as bricks or blocks. Among these, bricks significantly influence the structural behavior, construction efficiency, material consumption, and overall performance of masonry structures. Traditionally, burnt clay bricks have been widely used due to their acceptable strength and durability. However, variations in size, shape, and quality, along with environmental concerns associated with clay extraction and kiln firing, have highlighted the need for alternative masonry units that offer improved uniformity, sustainability, and compliance with modern construction practices [20].

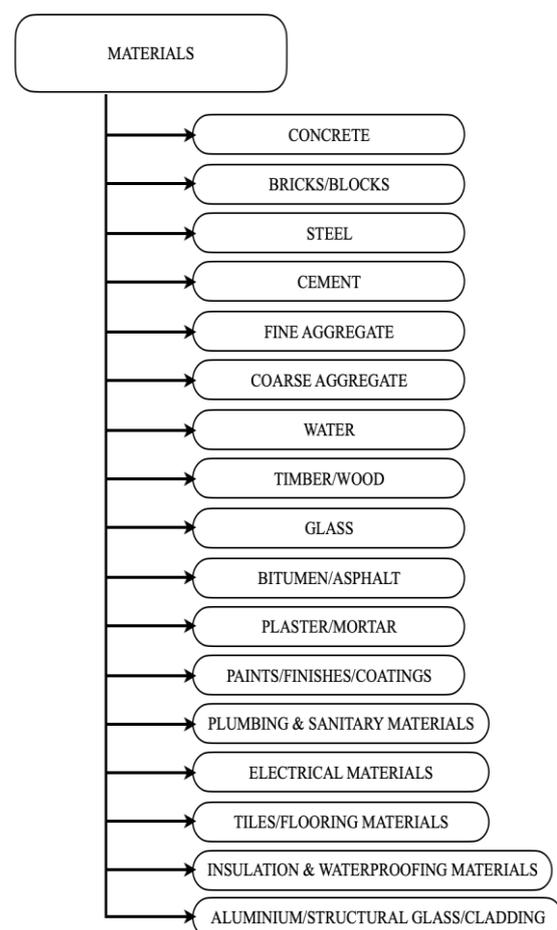


Figure 1. Materials used in a typical building construction.

Figure 1 illustrates the various materials commonly used in building construction, including concrete, bricks/blocks, steel, cement, fine and coarse aggregates, water, timber/wood, glass, bitumen/asphalt, plaster/mortar, paints/finishes/coatings, plumbing and sanitary materials, electrical materials, tiles/flooring materials, insulation and waterproofing materials, and aluminium structural glass cladding. The diagram presents these materials in a structured flow format under the heading “Materials.”

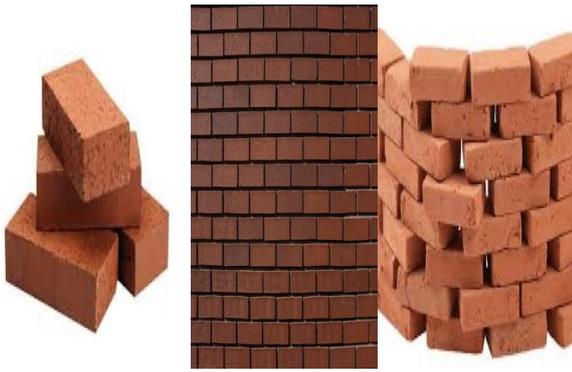


Figure 2. Burnt Clay Bricks And Their Arrangement (Source: www.google.com)

Figure 2 shows red burnt clay bricks in three forms: individual stacked bricks, a brick wall arranged in stretcher bond pattern, and a bulk pile of bricks. The image highlights their uniform rectangular shape and typical masonry arrangement used in building construction.

Various types of bricks have evolved over time to overcome the limitations of conventional burnt clay bricks. Cement-sand bricks, fly ash bricks, and concrete bricks have gained prominence due to their controlled manufacturing process and dimensional consistency. Fly ash and cement-sand bricks provide better surface finish and uniformity, while also contributing to waste utilization and reduced environmental impact. However, irrespective of the type of brick used, dimensional accuracy and standardization remain critical, as non-uniform brick sizes can lead to improper bonding, increased mortar consumption, uneven load transfer, and construction inefficiencies [1,7,14].

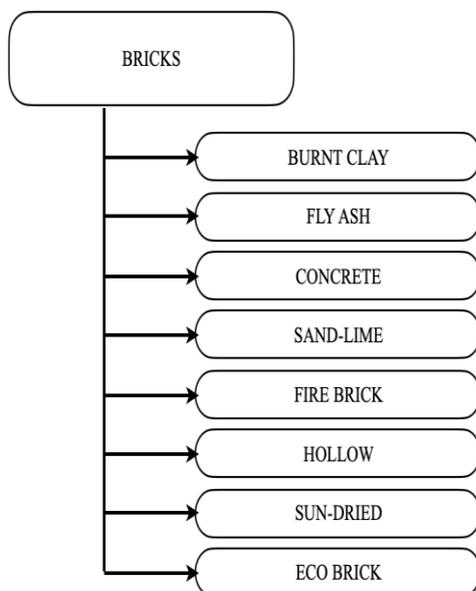


Figure 3. Types of bricks

Figure 3 presents the different types of bricks used in construction, including burnt clay bricks, fly ash bricks,

concrete bricks, sand-lime bricks, fire bricks, hollow bricks, sun-dried bricks, and eco bricks. The diagram categorizes these brick types under the main heading “Bricks,” illustrating their classification based on material composition and manufacturing process.

Concrete bricks have emerged as one of the most adaptable masonry units, offering flexibility in material selection and size configuration. Unlike burnt clay bricks, concrete bricks can be manufactured to precise dimensions, allowing compatibility with modular coordination and standardized construction systems. Their superior dimensional accuracy improves bonding patterns, reduces plaster thickness, and enhances construction speed. Numerous studies have focused on improving the mechanical and durability properties of concrete bricks using materials such as nano-silica, metakaolin, crumb rubber, and construction and demolition waste; however, these studies also emphasize that the performance of such bricks is closely linked to their size and shape, which influence stress distribution and load-carrying capacity [5,13,15].



Figure 4. Concrete bricks

Figure 4 shows cast concrete bricks of varying sizes placed on a flat surface. The bricks exhibit a rough texture and unfinished appearance, indicating they are newly moulded or cured units. Their uniform rectangular shape reflects proper mould preparation and casting, making them suitable for masonry construction applications.

Recent research has explored lightweight and composite concrete bricks incorporating materials such as sawdust, expanded polystyrene, coconut shells, waste rubber, plastic, glass waste, and agricultural by-products. While these bricks offer advantages such as reduced self-weight, improved thermal insulation, and sustainability, their application is highly dependent on appropriate size selection to ensure adequate strength and serviceability. Improper brick dimensions in lightweight and waste-based bricks may lead to excessive

deformation, reduced compressive strength, and poor masonry performance, particularly in load-bearing applications [6,19,17].

Several studies have demonstrated the feasibility of producing sustainable concrete bricks using waste materials such as plastic, glass, marble waste, sugarcane bagasse ash, rice husk ash, recycled concrete aggregates, and foundry sand. Although material optimization has been the primary focus of these investigations, the importance of standardized brick dimensions is consistently highlighted to ensure uniform stress transfer, proper bonding with mortar, and compatibility with existing masonry practices. Size standardization also plays a vital role in reducing construction errors and ensuring repeatability in large-scale production [16,21,12,8,10,9,18].

Apart from material considerations, brick size selection directly influences mortar requirement, wall thickness, dead load, thermal performance, and overall construction economy. Larger brick sizes can reduce the number of mortar joints, resulting in improved structural efficiency and faster construction, whereas smaller bricks may offer better adaptability but increase labor and mortar usage. In India, brick sizes are governed by Indian Standard codes to ensure modular coordination, ease of construction, and structural safety. Adherence to codal dimensions ensures uniformity, quality control, and compatibility with standard masonry practices.

In this context, the present study primarily focuses on the selection of appropriate sizes for solid concrete bricks based on codal provisions. While acknowledging the advancements in material innovations and sustainable brick production, this study emphasizes that optimal size selection is equally critical for achieving structural adequacy, construction efficiency, and standardized masonry performance. The findings aim to support the effective implementation of concrete bricks as a sustainable alternative to conventional masonry units in modern construction practices [1–2, 5–21].

## II. RELEVANCE OF SIZE OF BRICK

The relevance of brick size plays a crucial role in assessing the structural applicability of sustainable and alternative concrete masonry units. Several investigations have adopted dimensions close to conventional brick sizes (around  $215 \times 102.5 \times 65$  mm), enabling direct replacement in masonry without altering construction practices and allowing meaningful performance comparison with traditional units (Abou Sif et al., 2025; Adnan et al., 2023; Khalid et al., 2018). Moderate deviations from standard proportions, such as  $190 \times 90 \times 90$  mm, have also been employed while retaining masonry compatibility, particularly for solid concrete bricks used in low-rise construction (Rajeshwari et al., 2023; Raj Kiran Nanduri et al., 2022).

In contrast, several researchers have adopted larger brick or block dimensions—ranging from approximately  $230 \times 110 \times 90$  mm to  $400 \times 200 \times 200$  mm—to enhance load-bearing capacity, reduce mortar consumption, and suit modern

construction systems (Gawali et al., 2021; Dawood et al., 2021; Bandhavya et al., 2024). Such dimensions align more closely with concrete block masonry rather than conventional clay brickwork and are often intended for structural applications. Studies employing significantly larger units or block-type dimensions further indicate a shift toward masonry systems optimized for strength and sustainability (Usha & Mallesh, 2024; Musrifath et al., 2023).

Smaller-scale specimens have occasionally been used for material characterization; however, these are not directly representative of full-scale masonry behavior (Hamidi et al., 2021). Overall, the selected dimensions across these investigations highlight that maintaining standardized or slightly modified brick sizes enhances constructability and comparability, while larger unit sizes are preferred when structural efficiency and sustainability-driven performance improvements are prioritized (Ahmad et al., 2014; Gehlot & Sankhla, 2016).

TABLE 1. Brick/Block dimensions for masonry

Author(s) & Year	Brick / Block Dimensions	Relevance of Size in Masonry Application
Abou Sif et al. (2025)	$215 \times 103 \times 65$ mm	Dimensions closely match conventional brick sizes, allowing direct use in masonry
Usha & Mallesh (2024)	$101.6 \times 203.2 \times 406.4$ mm	Larger unit size corresponding to concrete block masonry systems
Bandhavya et al. (2024)	$400 \times 200 \times 200$ mm	Larger brick dimensions adopted for modern construction practices
Jithin Viju et al. (2023)	$300 \times 150 \times 190$ mm	Increased dimensions indicating suitability for structural masonry units
Musrifath et al. (2023)	$13 \times 7 \times 5$ inches	Larger unit size supporting load-bearing masonry applications
Rajeshwari et al. (2023)	$190 \times 90 \times 90$ mm	Slightly modified dimensions while retaining masonry compatibility
Adnan et al. (2023)	$215 \times 102.5 \times 65$ mm	Standard brick dimensions enabling comparison with conventional masonry
Raj Kiran Nanduri et al. (2022)	$190 \times 90 \times 90$ mm	Common solid brick dimensions adopted in low-rise construction

Hamidi et al. (2021)	5 × 5 × 5 cm	Small-scale specimens used for laboratory evaluation only
Gawali et al. (2021)	230 × 110 × 90 mm	Thicker brick dimensions selected to enhance structural capacity
Dawood et al. (2021)	230 × 115 × 75 mm	Dimensions compatible with standard concrete brick masonry
Chhatani et al. (2019)	19 × 9 × 9 cm	Balanced dimensions for lightweight masonry applications
Khalid et al. (2018)	215 × 105 × 65 mm	Near-standard dimensions preserving conventional brick proportions
Gehlot & Sankhla (2016)	225 × 100 × 75 mm; 225 × 212 × 324 mm (prisms)	Brick and prism sizes used for evaluating masonry behavior
Ahmad et al. (2014)	22.5 × 10 × 7.5 cm; 16 × 8 × 8 inches	Size-based comparison between brick and block masonry systems

### III. CODAL RELEVANCE AND PRACTICAL CONSIDERATIONS IN BRICK SIZE SELECTION

#### A. Selection of size of brick based on IS 2185 (Part 1)

The selection of masonry unit dimensions is a critical parameter that governs constructability, dimensional uniformity, and the overall structural and functional performance of masonry systems. Indian Standard codes, particularly IS 2185 (Part 1): *Concrete Masonry Units – Specification*, place significant emphasis on the adoption of standardized unit dimensions along with permissible tolerances to ensure compatibility with modular construction principles and established masonry practices. Compliance with these provisions facilitates uniform bonding patterns, consistent load transfer mechanisms, and improved structural integrity of masonry assemblies. In addition, appropriate size selection minimizes the need for on-site cutting, adjustments, and rework, thereby reducing material wastage and enhancing construction quality.

From a practical construction standpoint, the dimensions of masonry units directly influence ease of handling, placement accuracy, and overall construction productivity. While larger masonry units offer advantages such as reduced number of joints, faster construction, and lower mortar consumption, excessively large units can introduce challenges related to manual handling, positioning, and alignment. These difficulties are particularly relevant in routine construction practices where masonry work is predominantly executed without mechanized lifting equipment. Improper handling of oversized units may adversely affect workmanship

quality, lead to misalignment, and increase labor fatigue, thereby limiting their practical applicability in conventional building projects.

Considering both codal provisions and practical construction requirements, a solid concrete brick size of 400 × 200 × 100 mm was selected in this study. The chosen dimensions reflect a balanced approach that aligns with modular coordination concepts prescribed in Indian Standards and accommodates standard mortar joint thickness. This dimensional configuration enables seamless integration into conventional masonry layouts while maintaining consistency with codal intent. The selected size ensures adequate dimensional uniformity and stability, while remaining sufficiently compact to allow ease of manual handling and accurate placement during construction.

In comparison with traditional burnt clay bricks, the selected concrete brick size significantly reduces the number of units required per unit area of masonry, leading to improved construction efficiency and reduced mortar consumption. The larger and more uniform geometry of concrete bricks enhances alignment, surface regularity, and overall workmanship, thereby minimizing variability commonly associated with burnt clay brick masonry. At the same time, the adopted size avoids the handling and placement issues often encountered with very large concrete blocks, offering a practical compromise between unit size and constructability.



Figure 5. Mould preparations

Figure 5 shows the preparation of wooden molds used for casting bricks or blocks. The images illustrate the assembly of plywood boards into rectangular compartments, ensuring uniform dimensions and proper alignment before the casting process. These molds help maintain shape, size accuracy, and surface finish of the produced units.

Overall, the selected brick dimensions comply with Indian Standard requirements while effectively addressing practical construction constraints. The size selection supports efficient construction, consistent workmanship, and standardized implementation of concrete brick masonry, making it well suited for typical building applications and aligned with contemporary masonry construction practices.

#### IV. CONCLUSION

This study establishes a codal-based rationale for selecting the dimensions of solid concrete bricks, with particular emphasis on a size of 400 × 200 × 100 mm. Adherence to the provisions of IS 2185 (Part 1): 2005 – Concrete Masonry Units – Specification (Solid Concrete Blocks) ensures dimensional uniformity, modular compatibility, and suitability for conventional masonry construction practices. The selected brick size aligns with the intent of the codal guidelines and supports efficient construction, improved constructability, and standardized application in masonry works. The outcomes of this study provide a clear reference framework for the adoption of codal-compliant concrete brick dimensions in practical masonry applications.

#### ACKNOWLEDGMENT

I would like to express my sincere gratitude to Rajadhani Institute of Engineering and Technology for providing me with the opportunity and necessary facilities to successfully complete this project. The academic environment, infrastructure, and continuous support offered by the institution have played a vital role in the successful completion of this work.

I am especially thankful to the Department of Civil Engineering for their valuable guidance, encouragement, and technical assistance throughout the course of this project. The knowledge and support provided by the faculty members have greatly enhanced my understanding and practical skills in the field of civil engineering.

I also extend my heartfelt thanks to all those who directly or indirectly supported me in completing this project successfully.

#### REFERENCES

[1] [1] S.H. Adnan, S.N.S.M. Satti, M.A. Safea'ai, M. Hairi Osman, W.J. Wan Amizah, Z. Jamellodin, P.S.E. Ang, W.I. Wan Mastura, and J. Garus, "Performance of cement sand brick containing bamboo ash as cement replacement material," *Arch. Metall. Mater.*, vol. 68, no. 4, pp. 1301–1306, 2023, doi: 10.24425/amm.2023.146195.

[2] [2] Rafiq Ahmad, Mohammad Iqbal Malik, Mohammad Umar Jan, Parvez Ahmad, Himanshu Seth, and Javaid Ahmad, "Brick masonry and hollow concrete block masonry – A comparative study," *Int. J. Civil Struct. Eng. Res.*, vol. 1, no. 1, pp. 14–21, 2014.

[3] [3] Bureau of Indian Standards, *IS 2185 (Part 1): Concrete masonry units – Specification (solid concrete blocks)*. New Delhi, India: Bureau of Indian Standards, 2005.

[4] [4] Yash Chhatani, Shiwangi Dhawankar, Vipin Gajbhiye, Rahul Kuhikar, Rohan Potpose, Devesh Rarokar, and Nikeeta Dethe, "Cellular light weight concrete brick by using quarry dust," *Int. J. Innov. Sci. Res. Technol.*, vol. 4, no. 3, pp. 59–63, 2019.

[5] [5] Eethar Thanon Dawood and Marwa Saadi Mahmood, "Production of sustainable concrete brick units using nano-silica," *Case Stud. Constr. Mater.*, vol. 14, 2021, doi: 10.1016/j.cscm.2021.e00498.

[6] [6] A. Hamidi, S. Haniza, and A. Yudi, "The analysis of strength for lightweight concrete brick with adding solid crude palm oil," *IOP Conf. Ser.: Earth Environ. Sci.*, vol. 737, 2021, doi: 10.1088/1755-1315/737/1/012004.

[7] [7] Chetan N. Gawali, Chetan S. Nandankar, Payal L. Waghmare, Gaurav T. Gupta, Sooraj S. Patil, Akshata R. Badhiye, and Pooja V. Danao, "Study on compressive strength characteristics of brick with partial replacement of cement and lime by using granite powder," *Int. J. Innov. Res. Technol.*, vol. 8, no. 1, pp. 252–257, 2021.

[8] [8] Faisal Sheikh Khalid, Nurul Bazilah Azmi, Puteri Natasya Mazenan, Shahiron Shahidan, and Noorwirdawati Ali, "The mechanical properties

of brick containing recycled concrete aggregate and polyethylene terephthalate waste as sand replacement," *E3S Web Conf.*, vol. 34, 2018, doi: 10.1051/e3sconf/20183401001.

[9] [9] Ms. Bandhavya G B and Dr. Prashath S, "Optimizing green concrete brick production with rice husk and glass waste: A path to sustainable building," *Int. J. Eng. Appl. Phys.*, vol. 4, no. 3, pp. 1091–1099, 2024.

[10] [10] Musrifath M, Anfa Anju K, Nijil Gafas P V, Kunhassan K M, Silia Mary Silbi, and Fathima Fayiza Elachola, "Experimental concrete brick adding glass, plastic and foundry sand," *Int. J. Innov. Res. Sci. Eng. Technol.*, vol. 12, Special Issue 4, pp. 28–32, 2023.

[11] [11] P. M. B. Raj Kiran Nanduri, Doddi Srinath, Jogu Divya, and Gajula Nagamani, "Experimental investigation on concrete brick preparation using fly ash and coconut shells," *Int. J. Food Nutr. Sci.*, vol. 11, no. 10, pp. 4854–4863, 2022.

[12] [12] R. Rajeshwari, Raj Kumar E, Shaik Subhani, Srihari T, and Venkatesh T, "Experimental investigation on concrete bricks by replacing cement with sugar cane ash and coarse aggregate with marble waste," *Int. J. Eng. Sci. Adv. Technol.*, vol. 23, no. 6, pp. 102–114, 2023.

[13] [13] Mohamed Tohami M. Abou Sif, Mariyana Aida Ab Kadir, Nurul Hafizah Ismail, Mohd Zulkifli Ramli, and Mohamad Nur Irfan, "Advancing concrete bricks: Enhancing mechanical and durability properties with crumb rubber and metakaolin," *J. Adv. Res. Appl. Mech.*, vol. 132, no. 1, pp. 171–184, 2025, doi: 10.37934/aram.132.1.171184.

[14] [14] Tarun Gehlot and S.S. Sankhla, "Study of compressive strength of fly ash concrete brick with 1:6 and 1:8 cement mortar ratio with varying percentage of recron fiber," *Int. J. Res. Eng. Technol.*, vol. 5, no. 10, pp. 189–194, 2016.

[15] [15] Usha S and T.V. Malleth, "Strength and durability assessment of concrete bricks enhanced by construction & demolition waste integration," *Appl. Sci. Eng. J. Adv. Res.*, vol. 3, no. 1, pp. 14–19, 2024, doi: 10.54741/asejar.3.1.3.

[16] [16] Jithin Viju, Milan Sreemath, Nitheesh P. Arun, Roshan Reji, and Ann Mary Josel, "An experimental concrete brick, replacing a portion of m-sand by using saw dust and recycled plastic waste," *Int. J. Eng. Res. Technol.*, vol. 11, no. 2, pp. 214–217, 2023.

[17] [17] Mohamed A. Saafan, Fatma M. Eid, and Awatef N. Abdellatif, "Using different types of concrete to produce lightweight bricks," *J. Civil Eng. Struct.*, vol. 2, no. 1, pp. 34–47, 2018.

[18] [18] Joshuva A, Karthik M, Arunraj V, and Jeyaseelan S, "Experimental study on concrete brick using plastic and glass waste," *Int. J. Adv. Res. Manag. Archit. Technol. Eng.*, vol. 1, no. 1, pp. 288–291, 2021.

[19] [19] Anjana Ghimire and Sanjeev Maharjan, "Experimental analysis on the properties of concrete brick with partial replacement of sand by saw dust and partial replacement of coarse aggregate by expanded polystyrene," *J. Adv. Coll. Eng. Manag.*, vol. 5, pp. 27–36, 2019.

[20] [20] Alaa A. Shakir, Sivakumar Naganathan, and Kamal Nasharuddin Bin Mustapha, "Development of bricks from waste material: A review paper," *Aust. J. Basic Appl. Sci.*, vol. 7, no. 8, pp. 812–818, 2013.

[21] [21] Ravi Kiran K, Rajkamal D H, Punith Kumar H K, Rayees Wakeel, and Rahul M, "Plastic based concrete bricks," *Int. Res. J. Eng. Technol.*, vol. 8, no. 1, pp. 848–853, 2021.