



Brick

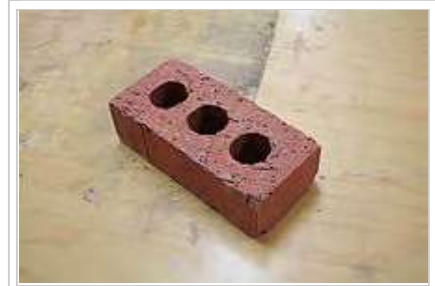
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A **brick** is building material used to make walls, pavements and other elements in masonry construction. Traditionally, the term brick referred to a unit composed of clay, but it is now used to denote any rectangular units laid in mortar. A brick can be composed of clay-bearing soil, sand, and lime, or concrete materials. Bricks are produced in numerous classes, types, materials, and sizes which vary with region and time period, and are produced in bulk quantities. Two basic categories of bricks are *fired* and *non-fired* bricks.

Block is a similar term referring to a rectangular building unit composed of similar materials, but is usually larger than a brick. Lightweight bricks (also called lightweight blocks) are made from expanded clay aggregate.

Fired bricks are one of the longest-lasting and strongest building materials, sometimes referred to as artificial stone, and have been used since circa 5000 BC. Air-dried bricks, also known as mudbricks, have a history older than fired bricks, and have an additional ingredient of a mechanical binder such as straw.

Bricks are laid in *courses* and numerous patterns known as *bonds*, collectively known as brickwork, and may be laid in various kinds of mortar to hold the bricks together to make a durable structure.



A single brick



A wall constructed in glazed-headed Flemish bond with bricks of various shades and lengths



Raw (green) Indian brick

Contents

- 1 History
 - 1.1 Middle East and South Asia
 - 1.2 China
 - 1.3 Europe
 - 1.4 Industrial era
- 2 Types
- 3 Methods of manufacture
 - 3.1 Mudbrick
 - 3.2 Fired brick
 - 3.2.1 Molded bricks
 - 3.2.2 Extruded bricks
 - 3.2.3 Dry-pressed bricks
 - 3.2.4 Rail kilns
 - 3.2.5 Bull's Trench Kilns
 - 3.2.6 Influences on colour
 - 3.3 Chemically set bricks
 - 3.3.1 Calcium-silicate bricks
 - 3.3.2 Concrete bricks
 - 3.4 Compressed earth blocks

- 4 Optimal dimensions, characteristics, and strength
- 5 Use
- 6 Limitations
- 7 Gallery
- 8 See also
- 9 References
- 10 Further reading
- 11 External links



An old brick wall in English bond laid with alternating courses of *headers* and *stretchers*

History



House construction using bricks in Kerala, India

Middle East and South Asia

The earliest bricks were *dried brick*, meaning that they were formed from clay-bearing earth or mud and dried (usually in the sun) until they were strong enough for use. The oldest discovered bricks, originally made from shaped mud and dating before 7500 BC, were found at Tell Aswad, in the upper Tigris region and in southeast

Anatolia close to Diyarbakir.^[1] Other more recent findings, dated between 7,000 and 6,395 BC, come from Jericho, Catal Hüyük, the ancient Egyptian fortress of Buhen, and the ancient Indus Valley cities of Mohenjo-daro, Harappa,^[2] and Mehrgarh.^[3] Ceramic, or *fired brick* was used as early as 3000 BC in early Indus Valley cities.^[4]



Bricked Front Street along the Cane River in historic Natchitoches, Louisiana



The Roman Basilica Aula Palatina in Trier, Germany, built with fired bricks in the 4th century as an audience hall for Constantine I

China

In pre-modern China, bricks were being used from the 2nd millennium BCE at a site near Xi'an.^[5] Bricks were produced on a larger scale under the Western Zhou dynasty about 3,000 years ago, and evidence for some of the first fired bricks ever produced has been discovered in ruins dating back to the Zhou.^{[6][7][8]} The carpenter's manual *Yingzao Fashi*, published

in 1103 at the time of the Song dynasty described the brick making process and glazing techniques then in use. Using the 17th century encyclopaedic text *Tiangong Kaiwu*, historian Timothy Brook outlined the brick production process of Ming Dynasty China:

"...the kilnmaster had to make sure that the temperature inside the kiln stayed at a level that caused the clay to shimmer with the colour of molten gold or silver. He also had to know when to quench the kiln with water so as to produce the surface glaze. To anonymous labourers fell the less skilled stages of brick production: mixing clay and water, driving oxen over the mixture to trample it into a thick paste, scooping the paste into standardised wooden frames (to produce a brick roughly 42 cm long, 20 cm wide, and

10 cm thick), smoothing the surfaces with a wire-strung bow, removing them from the frames, printing the fronts and backs with stamps that indicated where the bricks came from and who made them, loading the kilns with fuel (likelier wood than coal), stacking the bricks in the kiln, removing them to cool while the kilns were still hot, and bundling them into pallets for transportation. It was hot, filthy work."

In the 21st century, the ILAB has recorded significant instances of child labor and forced labor in the bricks manufacture sector and classified China as one of the 76 countries mentioned in its 2014 *List of Goods Produced by Child Labor or Forced Labor*.^[9]

Europe

Early civilisations around the Mediterranean adopted the use of fired bricks, including the Ancient Greeks and Romans. The Roman legions operated mobile kilns, and built large brick structures throughout the Roman Empire, stamping the bricks with the seal of the legion.

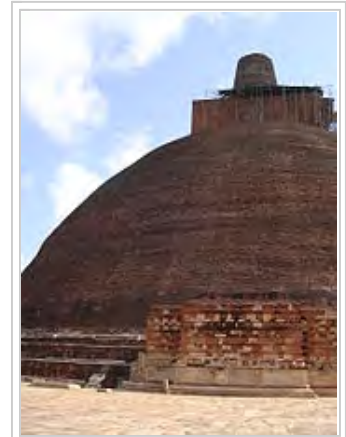
During the Early Middle Ages the use of bricks in construction became popular in Northern Europe, after being introduced there from Northern-Western Italy. An independent style of brick architecture, known as brick Gothic (similar to Gothic architecture) flourished in places that lacked indigenous sources of rocks. Examples of this architectural style can be found in modern-day Denmark, Germany, Poland, and Russia.

This style evolved into Brick Renaissance as the stylistic changes associated with the Italian Renaissance spread to northern Europe, leading to the adoption of Renaissance elements into brick building. A clear distinction between the two styles only developed at the transition to Baroque architecture. In Lübeck, for example, Brick Renaissance is clearly recognisable in buildings equipped with terracotta reliefs by the artist Statius von Düren, who was also active at Schwerin (Schwerin Castle) and Wismar (Fürstenhof).

Long-distance bulk transport of bricks and other construction equipment remained prohibitively expensive until the development of modern transportation infrastructure, with the construction of canal, roads, and railways.

Industrial era

Production of bricks increased massively with the onset of the Industrial Revolution and the rise in factory building in England. For reasons of speed and economy, bricks were increasingly preferred as building material to stone, even in areas where the stone was readily available. It was at this time in London, that bright red brick was chosen for construction to make the buildings more visible in the heavy fog and to help prevent traffic accidents.^[10]



The ancient Jetavanaramaya stupa in Anuradhapura, Sri Lanka is one of the largest brick structures in the world.



The world's highest brick tower of St. Martin's Church in Landshut, Germany, completed in 1500



Malbork Castle, former Ordensburg of the Teutonic Order – biggest brick castle in the world



The brickwork of Shebeli Tower in Iran displays 12th-century craftsmanship

The transition from the traditional method of production known as hand-moulding to a mechanised form of mass-production slowly took place during the first half of the nineteenth century. Possibly the first successful brick-making machine was patented by Henry Clayton, employed at the Atlas Works in Middlesex, England, in 1855, and was capable of producing up to 25,000 bricks daily with minimal supervision.^[11] His mechanical apparatus soon achieved widespread attention after it was adopted for use by the South Eastern Railway Company for brick-making at their factory near Folkestone.^[12] The Bradley & Craven Ltd ‘Stiff-Plastic Brickmaking Machine’ was patented in 1853, apparently predating Clayton. Bradley & Craven went on to be a dominant manufacturer



Chile house in Hamburg, Germany

of brickmaking machinery.^[13] Predating both Clayton and Bradley & Craven Ltd. however was the brick making machine patented by Richard A. Ver Valen of Haverstraw, New York in 1852.^[14]

The demand for high office building construction at the turn of the 20th century led to a much greater use of cast and wrought iron, and later, steel and concrete. The use of brick for skyscraper construction severely limited the size of the building – the Monadnock Building, built in 1896 in Chicago, required exceptionally thick walls to maintain the structural integrity of its 17 storeys.

Following pioneering work in the 1950s at the Swiss Federal Institute of Technology and the Building Research Establishment in Watford, UK, the use of improved masonry for the construction of tall structures up to 18 storeys high was made viable. However, the use of brick has largely remained restricted to small to medium-sized buildings, as steel and concrete remain superior materials for high-rise construction.^[15]

Types

There are thousands of types of bricks that are named for their use, size, forming method, origin, quality, texture, and/or materials.

Categorized by manufacture method:

- Extruded – made by being forced through an opening in a steel die, with a very consistent size and shape.
 - Wire-cut – cut to size after extrusion with a tensioned wire which may leave drag marks
- Moulded – shaped in moulds rather than being extruded
 - Machine-moulded - clay is forced into moulds using pressure
 - Handmade - clay is forced into moulds by a person
- Dry-pressed - similar to soft mud method, but starts with a much thicker clay mix and is compressed with great force.

Categorized by use:



This wall in Beacon Hill, Boston shows different types of brickwork and stone foundations

- Common or building – A brick not intended to be visible, used for internal structure
- Face – A brick used on exterior surfaces to present a clean appearance
- Hollow – not solid, the holes are less than 25% of the brick volume.
 - Perforated – holes greater than 25% of the brick volume.
- Keyed – indentations in at least one face and end to be used with rendering and plastering
- Paving – brick intended to be in ground contact as a walkway or roadway.
- Thin – brick with normal height and length but thin width to be used as a veneer

Specialized use bricks:

- Chemically resistant – bricks made with resistance to chemicals.
 - Acid brick – acid resistant bricks.
- Engineering – a type of hard, dense, brick used where strength, low water porosity or acid (flue gas) resistance are needed. Further classified as type A and type B based on their compressive strength.
 - Accrington – a type of engineering brick (England).
- Fire or refractory – highly heat-resistant bricks.
 - Clinker – a vitrified brick.
 - Ceramic glazed – fire bricks with a decorative glazing.

Bricks named for place of origin:

- Cream City brick – a light yellow brick made in Milwaukee, Wisconsin
- Dutch – a hard light colored brick originally from the Netherlands
- Fareham red brick – a type of construction brick.
- London stock – type of handmade brick which was used for the majority of building work in London and South East England until the growth in the use of machine-made bricks.
- Nanak Shahi bricks – a type of decorative brick in India.
- Roman – a long, flat brick typically used by the Romans.
- Staffordshire blue brick – a type of construction brick (England).

Methods of manufacture

Three basic types of brick are un-fired, fired, and chemically set bricks. Each type is manufactured differently.

Mudbrick

Unfired bricks, also known as mudbricks, are made from a wet, clay-containing soil mixed with straw or similar binders. They are air-dried until ready for use.

Fired brick

Fired bricks are burned in a kiln which makes them durable. Modern, fired, clay bricks are formed in one of three processes – soft mud, dry press, or extruded. Depending on the country, either the extruded or soft mud method is the most common, since they are the most economical.

Normally, bricks contain the following ingredients:^[16]

1. Silica (sand) – 50% to 60% by weight



Brick making at the beginning of the 20th century.

2. Alumina (clay) – 20% to 30% by weight
3. Lime – 2 to 5% by weight
4. Iron oxide – $\leq 7\%$ by weight
5. Magnesia – less than 1% by weight

Molded bricks

It starts with the raw clay, preferably in a mix with 25–30% sand to reduce shrinkage. The clay is first ground and mixed with water to the desired consistency. The clay is then pressed into steel moulds with a hydraulic press. The shaped clay is then fired ("burned") at 900–1000 °C to achieve strength.

Extruded bricks

For extruded bricks the clay is mixed with 10–15% water (stiff extrusion) or 20–25% water (soft extrusion) in a pugmill. This mixture is forced through a die to create a long cable of material of the desired width and depth. This mass is then cut into bricks of the desired length by a wall of wires. Most structural bricks are made by this method as it produces hard, dense bricks, and suitable dies can produce perforations as well. The introduction of such holes reduces the volume of clay needed, and hence the cost. Hollow bricks are lighter and easier to handle, and have different thermal properties from solid bricks. The cut bricks are hardened by drying for 20 to 40 hours at 50 to 150 °C before being fired. The heat for drying is often waste heat from the kiln.

European-style extruded bricks or blocks are used in single-wall construction with finishes applied on the inside and outside. Their many voids comprise a greater proportion of the volume than the solid, thin walls of fired clay. Such bricks are made in 15-, 25-, 30-, 42-, and 50-cm widths. Some models have very high thermal insulation properties, making them suitable for zero-energy buildings.

Dry-pressed bricks

The dry-press method is similar to the soft mud method, but starts with a much thicker clay mix, so it forms more accurate, sharper-edged bricks. The greater force in pressing and the longer burn make this method more expensive.

Rail kilns

In modern brickworks, this is usually done in a continuously fired tunnel kiln, in which the bricks are fired as they move slowly through the kiln on conveyors, rails, or kiln cars, which achieves a more consistent brick product. The bricks often have lime, ash, and organic matter added, which accelerates the burning process.

Bull's Trench Kilns

In India, brick making is typically a manual process. The most common type of brick kiln in use there is the Bull's Trench Kiln (BTK), based on a design developed by British engineer W. Bull in the late 19th century.



Raw bricks were sun-dried before fired



Xhosa brickmaker at kiln near Ngcobo in 2007

An oval or circular trench is dug, 6–9 metres wide, 2-2.5 metres deep, and 100–150 metres in circumference. A tall exhaust chimney is constructed in the centre. Half or more of the trench is filled with "green" (unfired) bricks which are stacked in an open lattice pattern to allow airflow. The lattice is capped with a roofing layer of finished brick.

In operation, new green bricks, along with roofing bricks, are stacked at one end of the brick pile; cooled finished bricks are removed from the other end for transport to their destinations. In the middle, the brick workers create a firing zone by dropping fuel (coal, wood, oil, debris, and so on) through access holes in the roof above the trench.



A brickmaker in India – *Tashrih al-aqvam* (1825)



West face of Roskilde Cathedral in Roskilde, Denmark.

The advantage of the BTK design is a much greater energy efficiency compared with clamp or scove kilns. Sheet metal or boards are used to route the airflow through the brick lattice so that fresh air flows first through the recently burned bricks, heating the air, then through the active burning zone. The air continues through the green brick zone (pre-heating and drying the bricks), and finally out the chimney, where the rising gases create suction that pulls air through the system. The reuse of heated air yields savings in fuel cost.

As with the rail process above, the BTK process is continuous. A half-dozen labourers working around the clock can fire approximately 15,000–25,000 bricks a day. Unlike the rail process, in the BTK process the bricks do not move. Instead, the locations at which the bricks are loaded, fired, and unloaded gradually rotate through the trench.^[17]

Influences on colour

The fired colour of fired clay bricks is influenced by the chemical and mineral content of the raw materials, the firing

temperature, and the atmosphere in the kiln. For example, pink bricks are the result of a high iron content, white or yellow bricks have a higher lime content. Most bricks burn to various red hues; as the temperature is increased the colour moves through dark red, purple, and then to brown or grey at around 1,300 °C (2,372 °F). The names of bricks may reflect their origin and colour, such as London stock brick and Cambridgeshire White. *Brick tinting* may be performed to change the color of bricks to blend-in areas of brickwork with the surrounding masonry.

An impervious and ornamental surface may be laid on brick either by salt glazing, in which salt is added during the burning process, or by the use of a slip, which is a glaze material into which the bricks are dipped. Subsequent reheating in the kiln fuses the slip into a glazed surface integral with the brick base.

Chemically set bricks

Chemically set bricks are not fired but may have the curing process accelerated by the application of heat and pressure in an autoclave.



Yellow London Stocks at Waterloo station

Calcium-silicate bricks

Calcium-silicate bricks are also called sandlime or flintlime bricks, depending on their ingredients. Rather than being made with clay they are made with lime binding the silicate material. The raw materials for calcium-silicate bricks include lime mixed in a proportion of about 1 to 10 with sand, quartz, crushed flint, or crushed siliceous rock together with mineral colourants. The materials are mixed and left until the lime is completely hydrated; the mixture is then pressed into moulds and cured in an autoclave for three to fourteen hours to speed the chemical hardening.^[18] The finished bricks are very accurate and uniform, although the sharp arrises need careful handling to avoid damage to brick and bricklayer. The bricks can be made in a variety of colours; white, black, buff, and grey-blues are common, and pastel shades can be achieved. This type of brick is common in Sweden, especially in houses built or renovated in the 1970s. In India these are known as fly ash bricks, manufactured using the FaL-G (fly ash, lime, and gypsum) process. Calcium-silicate bricks are also manufactured in Canada and the United States, and meet the criteria set forth in ASTM C73 – 10 Standard Specification for Calcium Silicate Brick (Sand-Lime Brick).



Swedish Mexitegel is a sand-lime or lime-cement brick.

Concrete bricks

Bricks formed from concrete are usually termed as blocks, and are typically pale grey. They are made from a dry, small aggregate concrete which is formed in steel moulds by vibration and compaction in either an "egglayer" or static machine. The finished blocks are cured, rather than fired, using low-pressure steam. Concrete blocks are manufactured in a much wider range of shapes and sizes than clay bricks and are also available with a wider range of face treatments – a number of which simulate the appearance of clay bricks.

Concrete bricks are available in many colours and as an engineering brick made with sulfate-resisting Portland cement or equivalent. When made with adequate amount of cement they are suitable for harsh environments such as wet conditions and retaining walls. They are made to standards BS 6073, EN 771-3. Concrete bricks expand and contract more than clay or sandlime bricks so they need movement joints every 5 to 6 metres, but are similar to other bricks of similar density in thermal and sound resistance and fire resistance.^[18]

Compressed earth blocks

Compressed earth blocks are made mostly from slightly moistened local soils compressed with a mechanical hydraulic press or manual lever press. A small amount of a cement binder may be added, resulting in a stabilized compressed earth block.

Optimal dimensions, characteristics, and strength



A concrete brick-making assembly line in Guilinyang Town, Hainan, China. This operation produces a pallet containing 42 bricks, approximately every 30 seconds.

For efficient handling and laying, bricks must be small enough and light enough to be picked up by the bricklayer using one hand (leaving the other hand free for the trowel). Bricks are usually laid flat, and as a result, the effective limit on the width of a brick is set by the distance which can conveniently be spanned between the thumb and fingers of one hand, normally about four inches (about 100 mm). In most cases, the length of a brick is about twice its width, about eight inches (about 200 mm) or slightly more. This allows bricks to be laid *bonded* in a structure which increases stability and strength (for an example, see the illustration of bricks laid in *English bond*, at the head of this article). The wall is built using alternating courses of *stretchers*, bricks laid longways, and *headers*, bricks laid crossways. The headers tie the wall together over its width. In fact, this wall is built in a variation of *English bond* called *English cross bond* where the successive layers of stretchers are displaced horizontally from each other by half a brick length. In true *English bond*, the perpendicular lines of the stretcher courses are in line with each other.













Loose bricks

A bigger brick makes for a thicker (and thus more insulating) wall. Historically, this meant that bigger bricks were necessary in colder climates (see for instance the slightly larger size of the Russian brick in table below), while a smaller brick was adequate, and more economical, in warmer regions. A notable illustration of this correlation is the Green Gate in Gdansk; built in 1571 of imported Dutch brick, too small for the colder climate of Gdansk, it was notorious for being a chilly and drafty residence. Nowadays this is no longer an issue, as modern walls typically incorporate specialised insulation materials.

The correct brick for a job can be selected from a choice of colour, surface texture, density, weight, absorption, and pore structure, thermal characteristics, thermal and moisture movement, and fire resistance.

Face brick ("house brick") sizes, (alphabetical order)

Standard	Imperial	Metric
 Australia	$9 \times 4\frac{1}{3} \times 3$ in	$230 \times 110 \times 76$ mm
 Denmark	$9 \times 4\frac{1}{4} \times 2\frac{1}{4}$ in	$228 \times 108 \times 54$ mm
 Germany	$9 \times 4\frac{1}{4} \times 2\frac{3}{4}$ in	$240 \times 115 \times 71$ mm
 India	$9 \times 4\frac{1}{4} \times 2\frac{3}{4}$ in	$228 \times 107 \times 69$ mm
 Romania	$9 \times 4\frac{1}{4} \times 2\frac{1}{2}$ in	$240 \times 115 \times 63$ mm
 Russia	$10 \times 4\frac{3}{4} \times 2\frac{1}{2}$ in	$250 \times 120 \times 65$ mm
 South Africa	$8\frac{3}{4} \times 4 \times 3$ in	$222 \times 106 \times 73$ mm
 Sweden	$10 \times 4\frac{3}{4} \times 2\frac{1}{2}$ in	$250 \times 120 \times 62$ mm
 United Kingdom	$8\frac{1}{2} \times 4 \times 2\frac{1}{2}$ in	$215 \times 102.5 \times 65$ mm
 United States	$7\frac{5}{8} \times 3\frac{5}{8} \times 2\frac{1}{4}$ in	$194 \times 92 \times 57$ mm

In England, the length and width of the common brick has remained fairly constant over the centuries (but see brick tax), but the depth has varied from about two inches (about 51 mm) or smaller in earlier times to about two and a half inches (about 64 mm) more recently. In the United Kingdom, the usual size of a modern brick is $215 \times 102.5 \times 65$ mm (about $8\frac{5}{8} \times 4\frac{1}{8} \times 2\frac{5}{8}$ inches), which, with a nominal 10 mm ($\frac{3}{8}$ inch) mortar joint, forms a *unit size* of $225 \times 112.5 \times 75$ mm ($9 \times 4\frac{1}{2} \times 3$ inches), for a ratio of 6:3:2.

In the United States, modern standard bricks are specified for various uses;^[19] most are sized at about $8 \times 3\frac{5}{8} \times 2\frac{1}{4}$ inches ($203 \times 92 \times$

57 mm). The more commonly used is the modular brick $7\frac{5}{8} \times 3\frac{5}{8} \times 2\frac{1}{4}$ inches ($194 \times 92 \times 57$ mm). This modular brick of $7\frac{5}{8}$ with a $\frac{3}{8}$ mortar joint eases the calculation of the number of bricks in a given wall.^[20]

Some brickmakers create innovative sizes and shapes for bricks used for plastering (and therefore not visible on the inside of the building) where their inherent mechanical properties are more important than their visual ones.

^[21] These bricks are usually slightly larger, but not as large as blocks and offer the following advantages:

- a slightly larger brick requires less mortar and handling (fewer bricks), which reduces cost
- their ribbed exterior aids plastering
- more complex interior cavities allow improved insulation, while maintaining strength.

Blocks have a much greater range of sizes. Standard co-ordinating sizes in length and height (in mm) include 400×200, 450×150, 450×200, 450×225, 450×300, 600×150, 600×200, and 600×225; depths (work size, mm) include 60, 75, 90, 100, 115, 140, 150, 190, 200, 225, and 250. They are usable across this range as they are lighter than clay bricks. The density of solid clay bricks is around 2000 kg/m³: this is reduced by frogging, hollow bricks, and so on, but aerated autoclaved concrete, even as a solid brick, can have densities in the range of 450–850 kg/m³.

Bricks may also be classified as *solid* (less than 25% perforations by volume, although the brick may be "frogged," having indentations on one of the longer faces), *perforated* (containing a pattern of small holes through the brick, removing no more than 25% of the volume), *cellular* (containing a pattern of holes removing more than 20% of the volume, but closed on one face), or *hollow* (containing a pattern of large holes removing more than 25% of the brick's volume). Blocks may be solid, cellular or hollow

The term "frog" can refer to the indentation or the implement used to make it. Modern brickmakers usually use plastic frogs but in the past they were made of wood.

The compressive strength of bricks produced in the United States ranges from about 1000 lbf/in² to 15,000 lbf/in² (7 to 105 MPa or N/mm²), varying according to the use to which the brick are to be put. In England clay bricks can have strengths of up to 100 MPa, although a common house brick is likely to show a range of 20–40 MPa.

Use

In the United States, bricks have been used for both buildings and pavements. Examples of brick use in buildings can be seen in colonial era buildings and other notable structures around the country. Bricks have been used in pavements especially during the late 19th century and early 20th century. The introduction of asphalt and concrete reduced the use of brick pavements, but it is used as a method of traffic calming or as a decorative surface in pedestrian precincts. For example, in the early 1900s, most of the streets in the city of Grand Rapids, Michigan, were paved with bricks. Today, there are only about 20 blocks of brick-paved streets remaining (totalling less than 0.5 percent of all the streets in the city limits).^[22] This is true in many other cities around the United States

Bricks in the metallurgy and glass industries are often used for lining furnaces, in particular refractory bricks such as silica, magnesia, chamotte and neutral (chromomagnesite) refractory bricks. This type of brick must have good thermal shock resistance, refractoriness under load, high melting point, and satisfactory porosity. There is a large refractory brick industry, especially in the United Kingdom, Japan, the United States, Belgium and the Netherlands.



Brick arch from a vault in Roman Bath – England



A brick section of the old Dixie Highway, United States

In Northwest Europe, bricks have been used in construction for centuries. Until recently, almost all houses were built almost entirely from bricks. Although many houses are now built using a mixture of concrete blocks and other materials, many houses are skinned with a layer of bricks on the outside for aesthetic appeal.

Engineering bricks are used where strength, low water porosity or acid (flue gas) resistance are needed.

In the UK a redbrick university is one founded and built in the Victorian era. The term is used to refer to such institutions collectively to distinguish them from the older Oxbridge institutions, the post-war 'plate glass' universities, and the "new" universities of the 1990s.

Colombian architect Rogelio Salmona was noted for his extensive use of red bricks in his buildings and for using natural shapes like spirals, radial geometry and curves in his designs.^[23] Most buildings in Colombia are made of brick, given the abundance of clay in equatorial countries like this one.

Limitations

Starting in the 20th century, the use of brickwork declined in some areas due to concerns with earthquakes. Earthquakes such as the San Francisco earthquake of 1906 and the 1933 Long Beach earthquake revealed the weaknesses of unreinforced brick masonry in earthquake-prone areas. During seismic events, the mortar cracks and crumbles, and the bricks are no longer held together. Brick masonry with steel reinforcement, which helps hold the masonry together during earthquakes, was used to replace many of the unreinforced masonry buildings. Retrofitting older unreinforced masonry structures has been mandated in many jurisdictions.



A panorama after the 1906 San Francisco earthquake.

Gallery



Ishtar Gate of Babylon in the Pergamon Museum, Berlin, Germany



Roman opus reticulatum on Hadrian's Villa in Tivoli, Italy (2nd century)



Frauenkirche, Munich, Germany, erected 1468–1488, looking up at the towers



Eastern gable of church of St. James in Toruń (14th century)



Decorative pattern made of strongly fired bricks in Radzyń Castle (14th century)



Mudéjar brick church tower in Teruel, Spain, (14th century)



Brick sculpturing on Thornbury Castle, Thornbury, near Bristol, England. The chimneys were erected in 1514



A typical brick house in the Netherlands.



A typical Dutch farmhouse near Wageningen, Netherlands



Decorative bricks in St Michael and All Angels Church, Blantyre, Malawi



Virgilio Barco Public Library, Bogotá, Colombia



FES Building, Cali, Colombia



A brick kiln, Tamil Nadu, India



Brick sidewalk paving in Portland, Oregon



Closeup of brick sidewalk in Cambridge, Massachusetts



Porotherm style clay block brick



Moulding bricks, Poland



Brick made as a byproduct of ironstone mining Normanby – UK

See also

- Autoclaved aerated concrete
- Banna'i
- Ceramic building material
- Glossary of British bricklaying
- Opus africanum
- Opus latericium
- Opus mixtum
- Opus spicatum
- Opus vittatum
- Polychrome brickwork
- Stockade Building System
- Wienerberger

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