

PAPER • OPEN ACCESS

Full Brick, History and Future

To cite this article: Jan Fiala *et al* 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **221** 012139

View the [article online](#) for updates and enhancements.

Full Brick, History and Future

Jan Fiala¹, Milan Mikolas², Katerina Krejsova²

¹ Brickfactory of Štěrboholy, Nedokončená 163, Praha 10 - Štěrboholy, 102 00 Praha – Czech Republic

² VŠB – Technical University of Ostrava, 17. listopadu 15/2172, 708 33 Ostrava – Poruba, Czech Republic

milan.mikolas@vsb.cz

Abstract. In our article I tried to name history and evolution in creation of (burnt bricks). I focused on full brick which is the main building component since 1964. Since this year many more products have been created, these products replaced the full brick in some parts of construction yet it is still part of many buildings of different shapes and colours. I named the evolution progress until nowadays. The brick was at the birth of construction industry. It was 8300 years BC (*before Christ*). For the duration of 10.000 years it was main steppe material. It made its breakthrough in structure constructions. It made revolutionary construction Boom from low one story buildings up to many story buildings. Brick connects functionality with aesthetics, It pushed construction industry from material position which is subordinate to weather influences, to material which is able to withstand many centuries. It is recyclable, health wise friendly, antiallergic, fire-resistant, and chemically resistant. The brick became the main pillar for constructions from 19th century until nowadays. It has been used on many constructional sites. They resist the wind and weather influence they also have functional and esthetical value.

Keywords: brick, history, full brick, material, desiccation, size.

1 Introduction

The Big wall (Chinese wall) biggest brick-made construction around the world. Babylonian garden, Hagia Sofia – one of the most beautiful churches in the world which has been built later on- Medieval castle Malbork in Poland, which resembles small city, construction Thadz Mahal in India, skyscraper Chrysler Building in New York. All these buildings have one thing in common, which is material that created them. It is brick, one of the most common and most universal and oldest materials, which is known to us humans and with which we are in touch for more than 10.000 years.

2 Historic trip of bricks

From the old times we can come across construction materials, which world did not know before. We recorded quality shift made by finding out scientific and technical revolution. For 10.000 years the course has been set for brick with few almost to no adjustments. We can come across the revolution in last 60 years. We found out many new scales which found their use in 21st century.

2.1 The time of neolith

8300-7600 B.C. – By the shore of the river Jordan were discovered the oldest bricks in the human history. They had approximate proportions of 260x100x100mm. We can imagine them as loaf of bread. Bricks were yearly processed by kneading when the mixture of dirt/clay and water was made. Bricks were being dried out on the direct sunlight. Then those were used for „massoning“. As mortar they used thin substance of mud and clay/dirt.



7300-6600 B.C. – Second type of bricks which was created by the similar process appears in Jericho. Bricks have these proportions: 400x150x100mm, they resemble shape of fishbone with characteristically fingerprints of their maker.

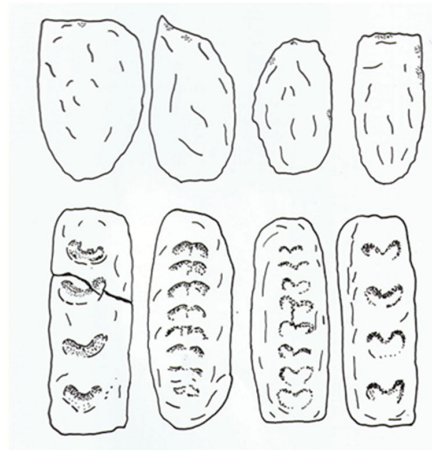


Figure 1 Brick-like shape. Author: J. Hejhálek

5900–5300 B.C. – In this period of time it has being used wooden form for creation of bricks. Around year 3000 B.C. the usage of wooden moulds has increased around Egypt.

5000–4500 B.C. – Ancient Mesopotamia founded baked bricks its creation process is very demanding. On the other hand, the hot weather helped with creating process of unfired bricks. In 3100-2900 B.C: the creation of unfired bricks begun.

2111–2003 B.C. –In the period of antiquity is brick on the rise. It is becoming the synonym for quality and eternal constructional material. Brick was able to made position for itself as quality material for constructions which are suitable, such as temples and palaces, domes for gods, kings and nobility. Add to it their increasing price into space heights. For examples 504 pieces of baked bricks or 14400 unfired bricks were able to be paid by piece of silver by the ratio of price by brick unfired to baked brick was 2 – 5x more expensive than baked brick.

604–562 B.C. in the period of reigning the king Nebuchadnezzar II. Is the architecture and mainly Babylonian on high level. We can see this because of architectural gems – such as Hanging Gardens which belong to 7 marvels of the world. They began to use shaped and glaze baked bricks. The bricks were handmade created and carved. They were dried out and then burnet out. The last step of the adjustment is glazing.

Publication of bricks. 100 B.C. – Roman architect and engineer Marcus Vitruvius Polio states first mention of brick in the oldest extant publication. It contains 10 books about Roman architecture and history of building constructions where only on five spots is the mention about bricks and pavement.

2.2 Medieval period

1400-1600 AD. From medieval times we preserved very few messages about the system or process of creation. Even the description of technological steps is missing. Some information we gathered by most modern analysis of historical bricks. On the brink of the 15th and 16th century was the creating process rewarded with progress. Press table has been introduced which had utmost on the quality of pressing. The drying room was usually a dry piece of land or straw placed on the ground. Flow of air got rid of the humidity from bricks. This drying process took about one month compared to what we have now (these days). Which depends on the materials

that the brick is made out of and it usually takes 45-90 hours. Furnaces were very similar to Roman furnaces. They have sturdy floor on which the bricks were placed and beneath which is fire in one or more tunnels. Wood is used as fuel.



Figure 2. Glazed brick. Author: J. Hejhálek

2.2.1 Adaptation of brick and special shapes. *1600-1800 A.D.* – In the period of 17th and 18th century the craftsman who know the creating processes and use each of the available materials they can cut the materials and correctly set it into the vertical constructional units. They have ability to work with detail of the construction such is vault, window ledge, parapet elements, ornamental purposes. Their ability with decorating are reaching the ability of artists. Special bricks are made from soft and simple clay. The consistence which makes possible the creation of difficult elements with the emphasis on details. Afterwards they put emphasis on the correct firing so that the red brick can be created without faults and errors. When the brick is removed from the furnace the brick had to have precise and correct format. The best craftsman could have made curved brick and also carve the statues of persons. All this with usage of variety of tools, axes and saws and polishing stones. Each brick they control thoroughly.

2.2.2 „Coade stone“ *1750 A.D.* – Architects managed to popularize style which was propagated by Robert Adam in England. The demand for quality materials and for the possibilities to create ornaments and patterns not just in small scale but also in large scale on small aswell as big buildings. Stone carving is very expensive and so Eleanor Coade comes on the scene with revolutionary solution which was named Coade stone. The products appear so similar to the stones products that they are being mistaken for them for many centuries later. However problems with creating of some masterpieces of these structures starts to kick with this so called „artificial stone“. There are problems with shrinking of material and creation of cracks. Eleanor Coade is able to find the solution for these problems. The creation of materials is especially made so that it eliminates all the possibility of shrinking. Technology of the creation is in the mixture of clay and quartz with grinded glass and with grinded and fired to dust clay. And because the glass and clay is already fired then during the process they don't shrink. Eleanor Coade used white clay balls from which becomes characteristically coloured stone. Shrinking during firing is lowered from 20% to 8%.

Emperor Leopold I defines the scales of brick on 6.9.1686 in Vienna. The scales are set in Austrian inches. One inch equalled 2.634 cm. These scales were changed only two more times in years 1715 and 1773. In Moravia were set scales little bit different. In the day of

18.2.1808 were set scales 12x6x3 inches for firing. Final dimensions in Morava were written on 17.8.1810.[1]

3 Full brick 290x140x65

In Czech Republic creation of these bricks was developing since 9th century. Huge development of these bricks helped Charles IV. Across all of the war overrun cities which were made out of wood. The brickmaking was increasing from 18th century. 1st scale is dated since year 1686. Brick had scales $11\frac{1}{2} \times 5\frac{1}{4} \times 2\frac{3}{4}$ inches. In the year 1839 were required bricks for Czech masons with scale of $11\frac{1}{2} \times 5\frac{1}{2} \times 2\frac{1}{2}$ inches ($302 \times 144 \times 72$ mm). Furthermore, it was necessary to print the emblem of producer on the brick. Those were scales of the product after firing. Czech known format **290x140x65** has been set on 14.4.1883 with the income of metrological reformation, [2].



Figure 3. Full brick. Author: Jan Fiala

For last 135 years the scale hasn't been changed. Name for it was „The Czech format of full brick „. The only difference we can find in quality and usage. In the past we could find full brick on all the scales of vertical construction. We could find it on hedges, stairways from hoses or stairs to the dungeons. We can also see them on retaining wall, chimney solid figures up to the floors of stables for farm animals. Today full bricks are additive types of all constructions. We can find their usage during reconstructions and repairs with old and new buildings. They are used with pillars and statically strained buildings/constructions. Even though in industrial and administrative buildings they are fighting with constructions from reinforced concrete.

4 Successors of full brick

The usage of full bricks is continually going from year 1883 until now. Only their extent has been changed. Until the half of 20th century were full bricks created in different types. In the years 1946-1960 they were moving to the bricks such are CDm brick. In the years 1961-1980 type of brick CDK and CD tyn is appearing. Bricks of type CD Tyn we can consider a landmark, because they were block of the scale (length x width x tallness). E.G. $290 \times 190 \times 215$ or $240 \times 365 \times 238$ mm, also called bricks of large format.

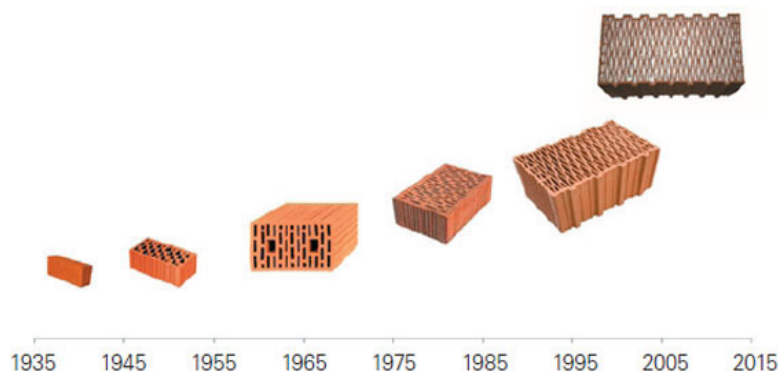


Figure 4. Evolution production of brick. Source: Journal Stavebnictví

The height module of masonry was 250mm with usage of mortar bed of width of 12mm. In 90s brick of nowadays type comes on the scene. „Therm “with dry and vertical joint between each brick blocks marked as tongue and groove also P+D. In neighbouring Germany in first half of 90s were created so called ground bricks. Which have grinded off cargo spaces. In Czech Republic were created grand bricks after the year 2000. Nowadays we are not able to come Gross grand bricks and that is up until the scale of 248 x 500 x 249 [3].

5 Full bricks in 21st century

In spite of hasty development some productions for bricklaying in last 50 years and in paste of all innovative processes the full brick will have its own usage. For builders will be able to find its usage during the construction of pillars for balconies and family houses. For elevator shafts in low-floor buildings. Isolation screening for reconstruction of older buildings. Building of screening, chimney figures even here are set demands for full bricks – like: Frost resistant ability which unfortunately now in Czech Republic cannot any of the founders accomplish. That's why bricks are being imported from foreign countries. Both Czech format (290x140x65) and German format (240x115x71). Creation of atypical or historical scales such are (290x140x50) repair of “Písecká brána“ Prague 6 delivered Brick factory Štěrboholy. (320x160x80) „Šancová“ brickfull firmness P30 producer Brick factory Polom (320x160x80). „Šancová“ brick full firmness P80 producer Brick factory Štěrboholy. „Šancová“ brick full firmness P30 producer Zlínské brick factory is also brick resistant to chemical effects Brick factory Štěrboholy „Stájová dlažba“ scale (240x115x71) Full brick „Austrian format“ (250x12x65) Brick factory Polom and Zlín brick factories.



Figure 5. Brick Orange 511 Author: Lipea

Among the founders of classical „Czech format“, which is 290x140x65 we can rank these production facilities: Brick factory Bratronice, Brick factory Miskolézy, Brick factory Polom, Brick factory Šitbořice, Brick factory Štěrboholy, Brick factory Vysoké Mýto, Zlín brick factories, Brick factory Žopy.

5.1 Full brick created out of Czech republic

Whole new chapter of full brick are bricks which are created mainly out Czech Republic. The only producer of full bricks facing briks with measurable value of 50 frost resistant cycles and not just in Czech format (290x140x65), but also in „German format“ (240x115x71). Both bricks are created in two shades light and dark add to it perfect unchanging colour even after many years. These bricks are created in Austria and these are bricks extruded. Other full bricks are

imported from different countries such as Belgium, Holland, England etc. They use as decorations, interior and exterior materials for facies facing walls, retaining walls, pillars with main head closures in many colours and shades. Their surface is usually smooth and rustically. They are being made as bricks extruded but as bricks embossed. The scales differ 210x100x65, 214x98x66, 215x100x65, 215x102x63, 240x115x71 egg. company Brickland or Lipea [4].

Furthermore we can come across bricks with rounded edge/corner or bricks, webe-shepes bricks which are used during constructions of sewer shafts. We could also mention „Šamotové“ bricks in the scale of Czech format (290x140x65) also in German format (240x115x71). Other bricks are bricks from concrete which are created in scale of (290x140x65) and bricks „lime concrete“, which are being made in „Czech format“ (290x140x65), and also in „German format“ (240x115x71).

6 Conclusions

The brick became the constructional element which has range from history until 21st century. It resists fashion influence and building courses. In each period of development, it was able to found usage in many ways. With pressure on the recycling and due to the influence on the environment its role will be even more increased. Modern trends will set the shape and functionality; reconstruction of historical sites will make them immortal.

Acknowledgements

We would like to thank company Wienerberger and company Brick factory Štěrboholy for their support.

References

- [1] Hejhálek L., Intro č.3, článek: Historie cihly, Intro No.3, Article: History of the Brick Vega Ltd. Czech Republic, 2017, pp. 14-17.
- [2] Koubová K, Overview and evaluation of material for masonry structures in the period 1900 - 2015 in the locality of Western Bohemia, Diploma thesis, Czech Republic, 2015, pp. 36-41.
- [3] Expo Data Ltd. – Information magazine ČKAIT, Czech Republic, 2011, č. 6-7
- [4] Cihlářský lexicon, Cihlářský svaz Čech a Moravy, Masonry lexicon, Masonry Union of Bohemia and Moravia, Czech Republic, 2007, pp. 16-30.