History and Evolution of Full Bricks of Other European Countries

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Abstract. In our article, where we have named History and evolution of full bricks of other European countries where we focused on the full brick, which is the main construction material since the year 1964. Since the year 1964, many other products were created which replaced bricks in some parts of the constructions and buildings. I also named variations types in individual states of Europe. I focused on the progress up to nowadays. The history of brick reaches up to the year 8300 BC. During the period of 10000 years, the brick has been the main construction material. It made its breakthrough in constructing of vertical constructions. Wars in the medieval times, destruction and burning of wood structures made extreme progress/development among brick buildings and constructions. It made constructional expansive possible from low one-story buildings to many story buildings. The brick was also able to unite functionally and esthetic. The brick is able to resist many centuries. It is recyclable, without any health dangers, anti-allergic, none fire able, chemically resistant. The brick became the basic constructional point since the 19th century until now. It has been used on many vertical buildings which resist to all weather conditions, full-fill esthetical and functional work.

1. Introduction

For the creation of brick products, we have to have a suitable raw material. In the natural environment, raw brick materials can be found in hectare expanse up to expanses of hundreds-hectares. These raw materials are shallowly stratified, which originate from the period of the Mesozoic era to the Quaternary period. They can be found on as well as below the surface. Raw materials which can be found on the surface can be covered or not. Covered deposits are historically older. Among not covered deposits, there can be included human-made creations such as: dumping grand which serve for secondary excavation). After a thorough study of locality, well-chosen excavation technology, and correct processing we will receive the final product. For the creation of full bricks, clay materials with possible parts of loessial and arenaceous fractions are used. Clay-loessial fractions support the fitness of the product, while clay-arenaceous fractions make the drying easier. The disadvantage is abrasive which excessively wears out the device for grinding and pressing. The drying process is susceptible to cracks on the final product. The firmness of clay-arenaceous product is significantly lower.
2. Evolution of bricks
The idea of processing brick materials begins with searching for deposit, exploratory work and follow-up of extraction. The study of location, maps and research of samples prior to the extraction and processing, however, these are not the subjects of this article. The high-quality brick product comes from suitable material and its correct processing from the extraction to the expedition to the final consumer (Figure 1). Cemetery wall in Pilsen, Czech Republic [1].

![Figure 1. Cemetery wall in Pilsen, Czech republic](image)

At the beginning of the whole cycle, we have to find a suitable ingredient. The brick ingredient is up to certain extent specific material. In natural environment, the brick ingredients can be found in areas of hectares as well as excavation site of the area of several hundred hectares. It is about sedimentary shallowly placed raw materials, which have arisen in the period of the Mesozoic era to the Quaternary period. They can be found above and also below the surface. The raw materials sediment above the surface can be coated or without it. Coated deposits are historical older. Among the uncoated deposits, we can also count creations which were created only due to human activity and those are dumping grounds that serve to secondary extraction.

Deposits of raw brick materials are usually stratified horizontally. Occurrence of oblique deposits is not usual. Those are simple deposits with a thickness of several tens of meters. With growing depth, raw materials can be with a higher number of muite or shale. These raw materials are difficult to disjoin, the processing is more energy difficult, wearing out of the device is substantial. The obvi ate solution is to let the raw material over freeze. That means to let rain down into the raw material and leave it be over winter. Expansion of water during the winter period will cause even disjoint of material. With clay, this chase is not so apparent, but visibility on shale is after two Winter over 50%.
By this, it is possible to save a lot of which would have to be used for processing of raw materials. We are talking only about working plants which do not have place for rest space inside them, where excavation takes place and where are homogeneous conditions. Same humidity, same „Lumpiness“. Other producers extract in natural conditions. Which creates problem mainly because of heavy rains when the extracting is made impossible. Adhesiveness is extreme and the number of water inside of materials is so high, it is impossible to model the products. The amount of water exceeded the level of plasticity. That is just rain water which is a problem at that moment. Huge deposits are exposed to underground water which can also appeal during excavation. Sand materials, earthy materials or sand-earthy materials are able to let water through well. If it is claybased material or slates/shales and those undamaged, their ability to let water through is considerably restricted in connection with surface precipitations. It would have a negative effect on the movement of technology and excavation itself. The costs are increased for terrain adjustments for gravitational drainage of water, worst case for the drainage of water in the excavation and transportation site (Figure 2). Cemetery wall of Staňkav, Czech Republic [2].

![Cemetery wall of Staňkav, Czech Republic](image)

**Figure 2**: Cemetery wall of Staňkav, Czech Republic

It is necessary to understand that after the extraction of the raw material its good processing is the most important thing. Without correctly processed raw material, it is impossible to continue in the creation of the new products. Continual intake of the same material guarantees the same final product.

The first information about using of bricks are from the medieval period about 8000 years B.C. where on the shores of the river Jordan people handmade clay into the forms of rectangular shape and after drying on the sun They used these bricks for constructions. Brick went through a revolution. After stabilization of shape and size, the brick changed from unfired to fully fired and up to final perforated brick block. We replaced manual work with machine work and those with robots and automatic machines in the process of creation. Today is the human factor irreplaceable during the preparation phase, analysis, evaluation of gathered data and also excavation. Hand-tamping of clay into wooden forms and drying on sun are already exceeded. Even though the demand for hand brick
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tiling is still present. This product can find its usage with historical objects where we are trying to replace period materials with new materials.

In the 20th century, the production made critical changes, even though some machines stayed the same. The critical change was in the transportation of materials to production plants. Primary stage of extraction stayed in general unchanged. Extracted material is being transported

3. **Brick**

The brick product is such a product which went through a technological process of excavation and processing, drying and burning.

- 8300 – 7600 B.C. the bricks were created by hands and were dried on the sun.
- 7300-6600 B.C. First bricks with dimension 400x150x100 appeared in Jericho
- 5900-5300 B.C. – for the creation of bricks wooden forms were used and even in Egypt.
- 5000-4500 B.C. – Mesopotamia discovered fired brick
- 2111-2003 B.C. – From bricks are made: temples, palaces, domes for gods, kings and nobility. Also, their value astronomically grows, for example, 504 pieces of fired brick or 1440 unfired could be bought with a single silver coin. Fired brick was 2 up to 5 times more expensive than brick unfired.
- 604-562 B.C. – Architectural gems are being built such as: Hanging gardens of Babylon, which had been addend among Seven Wonders of the World. Shaped and glaze-fired bricks started to be used.

3.1. **Medieval period**

Years 1400- 1600 – Establishment of a press machine, which had the main impact on the quality of pressed products. Medieval kilns were very similar to those from the Roman period. It had a firm floor, on which the brick or tile had been put and under which fire was burning in one or more tunnels. Wood was used as fuel.

Adjustment of brick and special shapes

Year 1600 – 1800 – in the period of 17th and 18th century. The number of craftsmen who knows the process of production is growing. Especially for Arches, moldings, parapet elements or chambranles usually on high art level.

Year 1686, 6th September defines Leopold I. For the first time standard dimension of brick. These dimensions had two editings and those happened in 1715 and 1773.

Year 1808, 18th February the dimensions were set to 12x6x3 inches (1 dolnorakouský inch = 2,634cm) after burning. Definitive dimension on Moravia was introduced finally on 17th August 1810. [3]

3.2. **Full brick 290x140x65**

The first standardized dimension of full brick and that is 11½ × 5¼ × 2¾ inches. Is dated back to 1686 (viz. Above). Year 1839, there were ordered basic dimensions for Czech bricks for bricks, 11½ × 5½ × 2½ inches (302 × 144 × 72 mm). Dimensions after the fire. It had also been ordered that on bricks has to be imprinted emblem or other marks of the creator. (brick- factory). In Bohemia known format was
290x140x65, which was named „Czech format of full brick“. Order as such on 14th April 1883 with coming of metrological reform (Figure 3). Wall in Prague, Letná, Czech Republic

4. Types of brick products
The brick-built product has its application in all civil structures. For the vertical structures, bricks are nowadays manufactured up to the wall thickness of 5 cm to 50 cm. Solid bricks, as well as lightweight, perforated, external, slip, acoustic bricks, are included. The solid bricks have several specific sizes, usually used in particular countries in Europe. In the Czech Republic, and in the Slovak Republic, the size is 290x140x65, drawn bricks. For Poland and Austria, the size is 250x120x65, drawn bricks. For Germany, the size is 240x115x71, drawn bricks, for Great Britain, the size is 215x102,5x65, drawn bricks. For Belgium, the size is 210x70x50 or 210x100x50, stamped bricks. For the Netherlands, the size is 215x102x65, stamped brick, and 240x115x113, drawn brick. For Spain, the size is 237; 238x113x48; 52; 72, drawn, but perforated brick. For horizontal structures, the Miako
and Hurdis bricks are used, as well as brick tubs for the ceiling system beams. For roof structures, various kinds of roofing are used, with various dimensions, such as: plain tiles, border tiles, half tiles, starter tiles, gutter tiles, hooks, French tiles, ventilating tiles, decoration elements of roof structures, all that in various colors, using engobes and glazing. For the floor, stairs, sidewalk and inroads, paving is used as well as risers, angle bricks, non-skid paving, chemical-resistant paving, heavy duty paving, and all these are nowadays available in many color tones, both full and partial ones, achieved by annealing during the burning process. Also, decoration components for fence structures, marquees, and sills are available. Around houses, tiles (drainpipes) with a clearance of 65 – 200 mm can be applied. By crushing burned shards (rejected bricks and roof tiles), the clay is manufactured, used for surfaces of sports grounds, and also as a suitable material for growing succulents, and at last, for breeding birds, such as sportpigeons.

Correct choice of the materials influences the final form and shape of the product. It compels us to listen to the material itself which is indicating the right way to the quality. All we have to do is to understand these indications and know how to work with them in continuing the correct production and its processing [4].

5. Conclusion
Brick materials are integral parts of everyday life. In the time of innovation and modernization in the building industry, bricks were irreplaceable. Many centuries bricks resisted weather conditions, made the aesthetic value. They are exchangeable, non-toxic, fire resistant, after their life, they are recyclable, and will be used throughout next millennium.

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