Dimensional evolution of brick products from the full brick to the present in the Czech Republic

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Abstract. Our presentation describes the evolution of single brick products with an emphasis on the dimensional disproportions, which had changed extremely mainly in the second half of the 20th century. We have to notice that the evolutionary lineage of fired bricks reaches the period of 25.000 years B. C. Around the year 8000 B. C., the production of full bricks started. Another turning point is apparent in the day of 14th April 1883, when in the Czech Republic after the metric reformation, the format of full brick has been set. After that the creation of brick CDm smooth brick block so-called CDk blocks. In the 60s of the 20th century, the brick blocks of the system “spring, groove” were being created. Since then, the dimensional revolution has begun,

1. Introduction
The first mention about the fired brick is possible to find about 25.000 years B. C. The Venus of Věstonice, the statue of a naked woman created from fired clay originated from the period of early Palaeolithic in the period of 29.000 – 25.000 A. D. Venus of Věstonice is the oldest known ceramic figures in the world, which was discovered on 13th July 1925 between the villages Dolní Věstonice and Pavlov. [1]

1.1 History of bricks
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.

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 the 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.

1.2 Adjustment of brick and special shapes
Years 1600 – 1800 – in the period of 17th and 18th century. The number of craftsmen who know the process of production is growing. Especially for Arches, mouldings, parapet elements or chambranles usually on high art level.
Year 1686, 6th September defines Leopold I., for the first time, the 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 South-Austrian inch = 2.634cm) after burning. Definitive dimension on Moravia was introduced finally on 17th August 1810.

2. Full brick
The first standardized dimension of full brick and that is 11½ × 5¼ × 2¾ inches is dated back to 1686 (viz. above). In the year 1839, basic dimensions for the Czech bricks were ordered, 11½ × 5½ × 2½ inches (302 × 144 × 72 mm) dimensions after the fire. It had also been ordered that on the bricks, an emblem or another mark of the creator has to be imprinted (brick factory). In Bohemia, the 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 1).

![Figure 1. Full brick, Brick factory of Štěrboholy (Jan Fiala)](image)

Today’s offer of brick products is very varied. Supporting constructions began to use bricks of type INA A, INA B, CDk blocks. Blocks with mortar pocket. It was possible to develop a unique system of how not to use mortar for vertical joints. Typical are so-called Brick systems, which by using the system “spring, groove” which could have replaced the vertical usage of mortar on the whole house [3]

For a simple usage, different designations were used depending on their usage in the construction. Outer perimeter masonry often in the scale of 490, 440, 380, 365 mm with thermal isolating properties. These bricks are in standard firmness 6, 8, 10, 15 and exceptionally even 20 MPa. Consumption of special shaped brick is 16 pc/ m2.
Supporting masonry is created in the dimensions 365, 300, 250, 240, 175, 145, 140 mm for inner supporting but also non-supporting constructions. Volume weight of these bricks is usually higher than the volume weight of peripheral masonry. The thermal isolating attribute is not an important indicator.

Unsupporting masonry usual thickness 115, 80, 65 mm. The most frequent dimensions, which fasten the construction process, are 497x238x65 mm. For single nogging for example around baths, washbasins, niches, riser and similarly bricks CV14 with dimensions 290x140x140, full bricks 290x140x65, Pk-CD in the dimension 290x140x65. Bricks of type THERM (Table 1 – 6).

**Table 1.** the average thickness of cargo joints 12 mm. Outer masonry of type THERM

| Thickness of wall [mm] | Usual dimensions | Consumption [pc·m⁻²] | Consumption of mortar [l·m⁻²] |
|------------------------|-----------------|----------------------|-----------------------------|
| 490                    | 247 x 490 x 238 | 16                   | 46                          |
| 440                    | 247 x 440 x 238 | 16                   | 42                          |
| 400                    | 247 x 400 x 238 | 16                   | 38                          |
| 380                    | 247 x 380 x 238 | 16                   | 36                          |
| 365                    | 247 x 365 x 238 | 16                   | 34                          |

**Table 2.** Structural masonry from bricks of type THERM

| Thickness of wall [mm] | Usual dimensions | Consumption [pc·m⁻²] | Consumption of mortar [l·m⁻²] |
|------------------------|-----------------|----------------------|-----------------------------|
| 300                    | 247 x 300 x 238 | 16                   | 28                          |
| 240                    | 372 x 240 x 238 | 11                   | 23                          |
| 200                    | 497 x 200 x 238 | 8                    | 19                          |
| 175                    | 497 x 175 x 238 | 8                    | 17                          |

**Table 3.** Non-structural masonry from bricks of type THERM

| Thickness of wall [mm] | Usual dimensions | Consumption [pc·m⁻²] | Consumption of mortar [l·m⁻²] |
|------------------------|-----------------|----------------------|-----------------------------|
| 140                    | 497 x 140 x 238 | 8                    | 14                          |
| 115                    | 497 x 115 x 238 | 8                    | 11                          |
| 80                     | 497 x 80 x 238  | 8                    | 8                           |
| 65                     | 497 x 65 x 238  | 8                    | 6                           |

**Table 4.** Cut bricks of type THERM – average thickness of cargo joints is 1 mm. Outer peripheral masonry.

| Thickness of wall [mm] | Usual dimension | Consumption [pc·m⁻²] | Consumption of mortar [l·m⁻²] |
|------------------------|----------------|----------------------|-----------------------------|
| 490                    | 247 x 490 x 249 | 16                   | 5,9                         |
| 440                    | 247 x 440 x 249 | 16                   | 5,3                         |
| 400                    | 247 x 400 x 249 | 16                   | 4,8                         |
| 380                    | 247 x 380 x 249 | 16                   | 4,6                         |
| 365                    | 247 x 365 x 249 | 16                   | 4,4                         |
Table 5. Supporting masonry from the cut brick of type THERM

| Thickness of wall [mm] | Usual dimensions [mm] | Consumption [pc·m⁻²] | Consumption of mortar [l·m⁻²] |
|-----------------------|-----------------------|-----------------------|-----------------------------|
| 300                   | 247 x 300 x 249       | 16                    | 3,6                         |
| 250                   | 247 x 250 x 249       | 16                    | 3,0                         |
|                       | 372 x 250 x 249       | 11                    |                             |
| 240                   | 372 x 240 x 249       | 11                    | 2,9                         |
| 175                   | 497 x 175 x 249       | 8                     | 2,1                         |
|                       | 372 x 175 x 249       |                       |                             |

Table 6. Non-structural masonry from cut bricks of type THERM

| Thickness of wall [mm] | Usual dimensions [mm] | Consumption [pc·m⁻²] | Consumption of mortar [l·m⁻²] |
|-----------------------|-----------------------|-----------------------|-----------------------------|
| 140                   | 497 x 140 x 249       | 8                     | 1,7                         |
| 115                   | 497 x 115 x 249       | 8                     | 1,4                         |
| 80                    | 497 x 80 x 249        | 8                     | 1,0                         |
|                       | 372 x 80 x 249        |                       |                             |

Out of all named products, it is obvious, that during the last 10.000 years we have recorded only different changes connected with roughly the same dimension having slight changes. On the other hand, the development was so rapid over the last 50 years, it led humanity to many dimensional changes, various uses in vertical constructions. This was primarily achieved by making the construction cheaper and also maximally saving the constructional time. [4]

3. Conclusions

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

References

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