Bicklaying – Brick facades

13.04.2013

István Vidovszky PhD

historic overview

round 10,000-7500 B.C. the first known mud bricks
round 3000 B.C. the first known burnt ceramic bricks
Roman Empire burnt ceramic bricks and mobile kiln
12th century brick gothic (Italy + North-West Europe)
19th century Bull’s Trench Kiln (rotating procedure)
early 20th century the use of ceramic blocks
material

- mudbrick (claymud)
- ceramic brick
- ceramic block
- concrete block
- AAC block
- lime-sand brick & block
- insulating ceramic blocks

brick modul systems

National standards – size, brick module

e.g.:
- Austrian, Hungarian: 25x12x6,5 cm
- British: 21,5x11,25x6,5
- French: 22x10,5x6,5 cm
- German: 24x11,7x7,11 cm

German brick module system DIN
Brick module systems

- Load bearing exterior walls
- Load bearing interior walls
- Partition walls between functional units
- Partition walls
- Basement walls
- Hollow clay slab blocks
- Slab beams
- Bond beams
- Facade bricks
- Lintels
construction systems (AAC)

- roof panels
- slab panels
- lintels for load bearing walls
- lintels for partitions
- bond beam
- hollow clay slab blocks
- hollow wall element
- isolating bedding mortar
- bedding mortar
- rendering mortar
- partition wall elements
- tenon & mortise wall elements
- wall elements
- tenon & mortise wall elements

performance of brick walls

- strength – load bearing capacity
- thermal insulation capacity
- acoustic requirements
- water uptake / frost resistance
- fire resistance
- vapour transport capacity
- durability
- accuracy
**Mortars**

**Mortar material:**
- mud mortar
- lime-mortar
- lime-cement mortars
- cement mortar

**Contents of mortars:**
- binder (lime, cement, rasin)
- aggregate (sand, stone dust)
- water
- admixtures and additives

**Performance of mortars:**
- strength H4, H6...H20, H40
- durability
- frost resistance
- workability
- plasticity
- thermal insulation capacity

**Where?**
- bedding
- interior rendering
- facade rendering
- footing zone (plinth)

**What purpose?**
- for restoration:
  - compatibility
  - color
  - desalination
  - porosity
  - capilar activity
  - etc.
mortars

*application:*
- traditional – prepared on-site
- pre-prepared – mixed only with water on-site

loadbearing walls: outer and inner walls with load-bearing role – structures considered as load bearing ones

non-loadbearing exterior walls: self supporting structures on the facades in a case of a frame-structured building

facade walls: the outer layer of the wall structure – usually with a half-a brick width

partition walls: internal wall separating two adjoining units – between two flats acoustic performance required

fire barrier walls: refractory partition wall between fire sections
**thesaurus**

- cornice /string course
- projections
- arch
- horizontal joint
- vertical joint
- angel cuts
- normal courses
- soldier course

**brick wall bonds**

- wall bond for half a brick (12cm) width
- stretched bond
brick wall bonds

wall bond for whole brick (25cm) width

heading bond
crossbond
Dutch bond
English bond
Flamish (Polnish) bond

bonds for wider walls

bond courses
diagonal courses

bonds for wall of 50cm width
bonds for wall of more than 100cm width
(e.g. fortification walls)
**arches**

- **segmental arch**
- **wedged arch**
- **flat arch**
- **semi circular arch**
- **gothic arch**
- **three-centered arch**

**brick joints - pointing**

- **flush joints**: finish is prepared by the trowel at the time of the bedding of the bricks

- **half-round (bucket handle) joints**: finish is prepared with some delay (but within the time of hardening), with special tool

- **recessed /raked joints**: finish joint is raked off – final pointing executed later with the same or different (finer, color, etc.) material

- **weathered /french joints**: the joint finish is inclining into the direction to the lower brick edge
work sequence of the activity

1. set the corner bricks & string lines
2. set the first course (dimensions, water level, etc.)
3. laying the second, third, etc. courses
4. place the lintels
5. jointing / grouting
6. surface treatment

brick walls

block walls

design - execution

**dimensions:** from wall surface to wall surface

**wall joints:** mortar bond / brick bond / bond with other material (e.g. steel wire, plate, etc.)

**vertical module:** the height of the brick/block

**horizontal alignment:** quarter of a brick/block have to be the smallest element
Design costs

High accuracy ceramic blocks, AAC blocks → Thin plaster layer + undercoat + painting (coating)

Clay blocks → 1.5 cm plaster + undercoat + painting (coating)

Application of modern systems

Glued joints

Tenon & mortise joints

Methods of mortar placement

Block bond

Joints with mortar “bag”
Organizational questions:

• unit: pallet – 300-600 bricks/ 50-150 blocks
• transportation to the site: 7-12t truck (+ trailer)
• moving at the site: with pallet jack / pallet track / fork-lift truck
1. Transportation - Site Logistic

arrangement of the palets

handtools

Anglo-saxon
German
Asian
Hungarian
+mason's pan

moulding trowel
finishing trowel
handtools

- pointing trowels (round/square cross section)
- joint raker
- jointing trowels
- masons hammer
- levels
- string line

equipments

- temporary structures:
  - scaffolding (above 1.5m)

- power tools:
  - (electric) brick saw
  - mortar mixer
### String courses and cornices

- Image 1
- Image 2
- Image 3
- Image 4
- Image 5
- Image 6
- Image 7
- Image 8
- Image 9
- Image 10

**Vidovszky – BUTE/BME-Faculty of Architecture – Department of Construction Technology and Management**
special shape bricks

plinth stretcher  plinth head
plinth return
plinth head  plinth return
internal return

special brick cuts

snapped header  queen closure  king closure  bevelled closure

small  large
bevelled bat  quarter bat  three quarter bat  bevelled bat
Residential building, Horsens, Denmark

Fence pillar, Horsens, Denmark
Residential building, Horsens, Denmark

Custom-house, Copenhagen, Denmark
Central Railwaystation, Copenhagen, Denmark

School building, Biberach, Germany
examples

International competitions

new tendencies

bricklayer robots
new tendencies

bricklayer robots

special architectural features
new tendencies

wiggled brick bond

special bond types

new tendencies

special bond types
Brick facade, South Asian Human Rights Documentation Centre, India

Brick facade, Apartment building, New York, USA
Brick separation wall in a Villa in Bali, Indonesia.

Thank you for your attention!
References

Vidovszky – BUTE/BME-Faculty of Architecture – Department of Construction Technology and Management

Klujber Róbert: Falazási munkálk építéstechnológiája. 2009 (Presentation)
http://hu.wikipedia.org/wiki/T%C3%A9gla 19-10-2011
http://www.diydoctor.org.uk/tips/tipsbrickwork.htm 13-04-2013

Bärtschi, Knauss, Bonwetsch, Gramatzio, Kohler: Wiggled Brick Bond, ETHZ
http://robots.net/article/3239.html 13-04-2013