TOPIC SCHEDULE

LECTURE			*PRACTICAL*
week	**Date**	**Topics**	**Topics**
6.		Building materials and their applications: CLAY, CERAMICS	

I. Clay, ceramics:

Soil Walls: In many areas soil itself soon appeared as a building material: digging out holes, where the ground water was deep enough, and the excavated earth was used for wall-like filling or to cover a primitive timber-roof. Later it was learned that a certain type of soil - clay - is exceptionally apt for making walls, specially if plastified by water and mixed with fibrous materials such as: straw, grass, and animal hair, e.t.c First dabs were made which were put beside each other and above each other to obtain a wall. When this dried, the structure assumed a considerable strength and was capable or carrying a floor and a roof. When a mud-wall or cob wall was completed and nearly dry, it was trimmed with a spade to produce a comparatively smooth surface.

Adobe wall: Later a primitive sort as shuttering was used, equal with the thickness of the wall.. About 50 cm high and lifted as the walling proceeded. This was followed by using bottom-less mould to produce adobe-bricks, and walls were built by laying these bricks in bound. (Laying in bound means that vertical brick-joint couldn't be continuous over the horizontal layers.)

Burnt bricks and ceramic blocks: By burning the adobe brick or perhaps generalizing the experience gained with fire-clay pottery, the burned clay brick was obtained, which became one of the most important walling materials and has been used over since. Modern burnt-clay (ceramic) units are made in a wide variety of size, shape, colour and texture. Properties of burnt clay vary with the type of clay or shale used as the raw material and the method of fabrication.

The dimensions of a brick represent a certain relationship with each other, such as the length is the double of the width. The structural ceramic blocks are hollow burnt clay masonry with parallel cells to increase the thermal insulation capacity of the external wall.

Ceramic roof, floor and wall tiles: Ceramic roof and floor tiles are made of burnt-clay as well. These have a clay body, on which a decorative coloured glaze is superimposed or the painting is mixed into the clay.

a) Physical Properties: eg.: Density: 1800 kg/m3 (must learn)

The ***strength*** of ceramics vary on the basis of the clay used and the burning process involved. The same applies to ***density***, ***workability***, ***porosity***, ***permeability*** and ***absorption***. Generally speaking the longer the burning process and the higher the temperature, the more solid (hard, brittle) and/or less porose the ceramic structure becomes.

The porosity of the material parallels insulation, water absorbtion and vapour transmission properties, ie. the more porose the material, the better its insulation property is, with high permeability and water absorption values.

On the contrary, glass (tile glaze) has close to zero transmission and absorption values. Highly burnt tiles will have high ***compression strength*** capacities, with medium bending and tensions ***stress capacities***. The thermal insulation capacity of stone is low as well.

b) Types: Ceramic types in relation to buring (must learn):

Burning process
short **long**
raw clay > medium burnt block > high burn façade brick > roof tile glazing > porcellaine

c) Manufactured building construction elements (a few must-learn examples) LEARN TYPICAL DIMENSIONS FROM EXAMPLES ENCLOSED AND/OR DEPARTMENT LIBRARY:

Solid standard brick **12cm x 6.5cm x 25 cm**
Hollow ceramic block …
Ceramic covering floor tiles…
Ceramic brick wall cladding …
Roof tiles …

II. Mortar (as a bonding material for ceramic elements)

Mortar is the first non-naturally available bonding material used. The material is a combination of burnt lime, water and sand. Sometimes other additives are used such as cement, polystyrol, colouring, ground stone etc. The mixture solidifies as lime/cement returns to its stone phase.

Mortar is the primary bonding matter between stone and brick blocks in traditional architecture and is referred to in the building industry independent of its composition. Lime mortar is soft and thereby resistant to freezing when set (plastering).

Types of mortar (must learn):	Types of plaster (must learn):
lime mortar	general internal plaster
cement mortar	coloured external facade plaster
cement enriched lime mortar	insulating external facade plaster

The quality of mortar also depends on the conditions during solidification, freezing for example will damage the material.

III. Bricklaying rules (must learn)

Bricklaying rules refers to rules on how ceramic building blocks may be layed onto each other for maximum stability of the constructed structure. Basically: no vertical linear gap is allowed to continue through the structure. Solutions are to be learned throug practice in class.

APPLICATIONS FIELDS OF CERAMICS (WHERE WE USE IT) – short, must-learn list

1. Load bearing
1.1. Walls, and arcs - solid brick
1.2. Load bearing and external wall, slab infill blocks - hollow ceramic block

2. Ceramic coverings
2.1. Floor covering
2.2. Wall cladding
2.3. Pitched roof covering

In other areas the soil itself soon appeared as a building material: digging out holes, where the ground water was deep enough, and the excavated earth was used for wall-like filling or to cover a primitive timber-roof. /Similar air-raid shelters were made during the second World War and peaple even lived in them for some time./

Gypsies with a low income also lived in such types of shanties up to the Second World War.

Later it was learned that a certain type of soil as clay is exceptionally apt for making walls, specially if plastified by water and mixed with fibrous materials such as: straw, grass, and animal hair, etc. First dabs were made which were put beside each other and above each other to obtain a wall, when it dried, assumed a considerable strength and was capable of carrying a floor and roof. Wattle walls were also made in a single or double layer with a gap in between filled and covered with cob. E29

When a mud-wall or cob wall E27 was completed and nearly dry, it was trimmed with a spade to produce a comparatively smooth surface.

Even later a primitive sort os shuttering was used, equal with the thickness of the wall. About 50 cm high and lifted as the walling proceded. This was followed by using bottom-less mould E30 to produce adobe bricks, E31 and walls were built by laying these bricks in bound. /Laying in bound means that no vertical brick-joint should be continuous over the horizontal layers. They shouldnt be "in line"/. In areas where stone was abundant it was also used for erecting walls laying the rouble stones E22 in mud, which provided an even distribution of loads and excluded any draught and insects. The progress in making metal tools enabled the stone to be shaped to exact geometric forms, plans and rectangles, which led to the dressed-stone walls and ashlar walls E26 and to dressed arching and vaulting techniques, later to decorative mouldings and tracery. The principal building stones generally used are:

- igneous:	- sedimentary:	metamorphic:
basalte	sandstone	slate marble
granite	limestone	marble

The strength of building stones display a large variety.

The same applies to specific gravity, workability, porosity, permeability,

Hence it is sensibly used as a plastering material in bathrooms and kitchens. It also has good fire-retarding properties. Its price is comparatively high.

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The dimensions of a brick represent a certain relationship with each other, such as the length is the double of the width. D26

The structural clay tiles are hollow burnt-clay masonry units with parallel cells. Such units have a multitude of uses: facing tile, partitioning, fire-proof tile, floor tile, and header tile, etc. D29

Two general types of tile are available: side-construction and end-construction, depending on whether it is designed to receive its principal stress parallel or at rightangles to the axis of the cell.

Ceramics tiles are burnt-clay products, primarily used for decorative and sanitary effects. They have a clay body on which a decorative glaze is superimposed, which is available in complete colour gradaution from pure whites through pastels of varying hue to deep solid colours and jet blacks.

Architectural terra-cotta. The term is applied to decorative moulded clay objects whose properties are similar to a brick. Can be colored and glazed.

*

Perhaps it was also a random experience that if volcanic dust, such as scoria, is mixed with water, after a while it hardens again and gains a considerable strength and excellent adhesion. It preserves these properties, even if it gets wet again. This represented the identification of cement, and mixing this bonding material with crushed stone or gravel one gained concrete. Concrete was also used extendly by the Romans.

Much later the artificial production of cement was invented by an Englishman, which was rapidly followed by spreading use of concrete. Portland cement is manufactured from marl or limestone and clay, groung together with water to form a slurry, which is burnt to a high temperature and then ground to powder.

SOLID BRICK

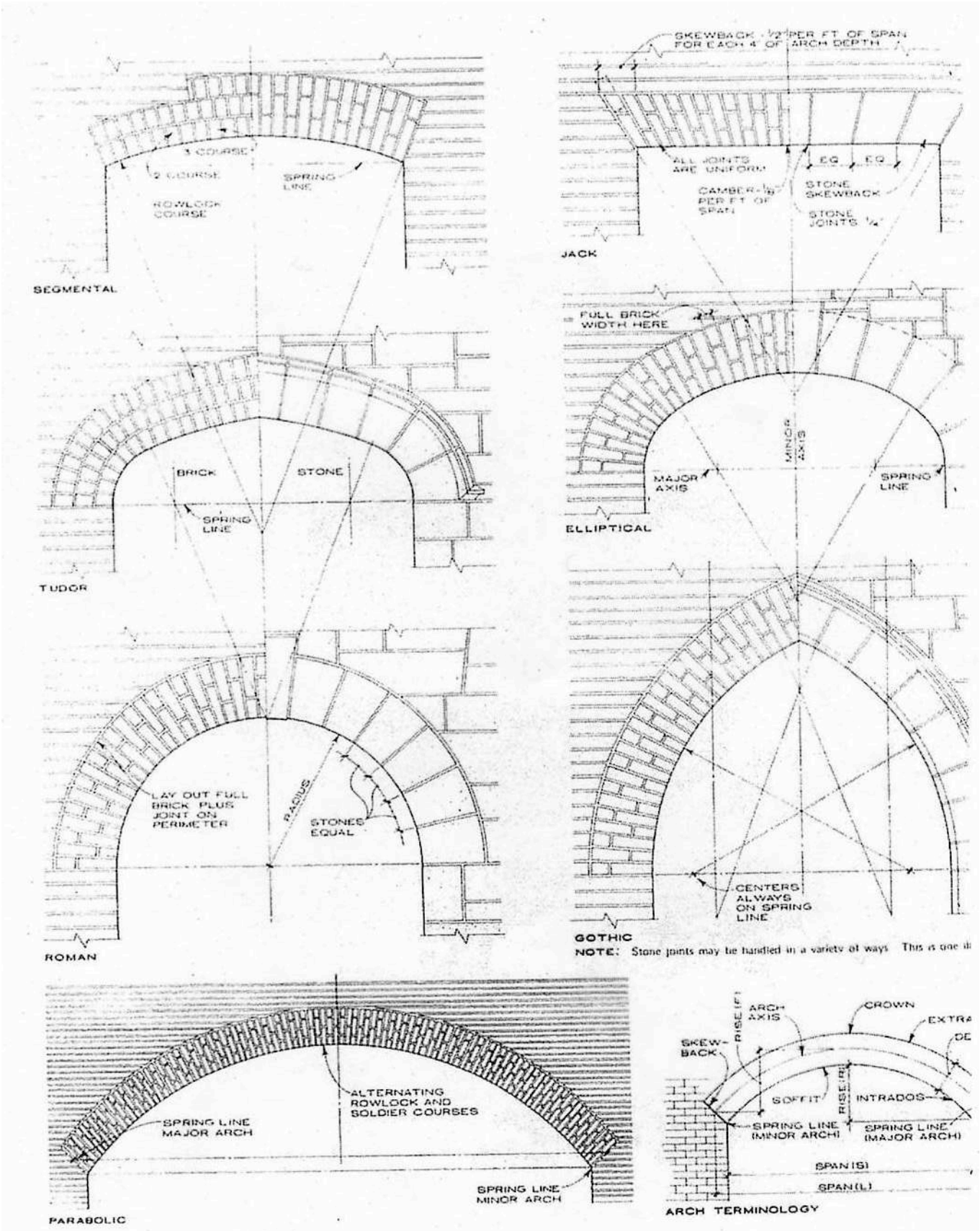


FIGURE 8.30

Arch forms and arch terminology in brick and cut stone. The spandrel is the area of wall that is bounded by the extrados of the arch. (*Reprinted by permission of John Wiley & Sons, Inc., from Ramsey/Sleeper,* Architectural Graphic Standards *(7th ed.), Robert T. Packard, A.I.A., Editor, © 1981 by John Wiley & Sons, Inc.*)

BRICKLAYING:

Laying Bricks

Figure 8.17 shows a basic vocabulary of bricklaying. Bricks are laid in the various positions for visual reasons, structural reasons, or both. The simplest brick wall is a single *wythe* of *stretchers*. For walls two or more wythes thick, *headers* are used to bond the wythes together into a structural unit. *Rowlock* courses are often used for caps on garden walls and for sloping sills under windows, although such caps and sills are not durable in severe climates. Architects frequently employ *soldier* courses for visual emphasis in such locations as window lintels or tops of walls.

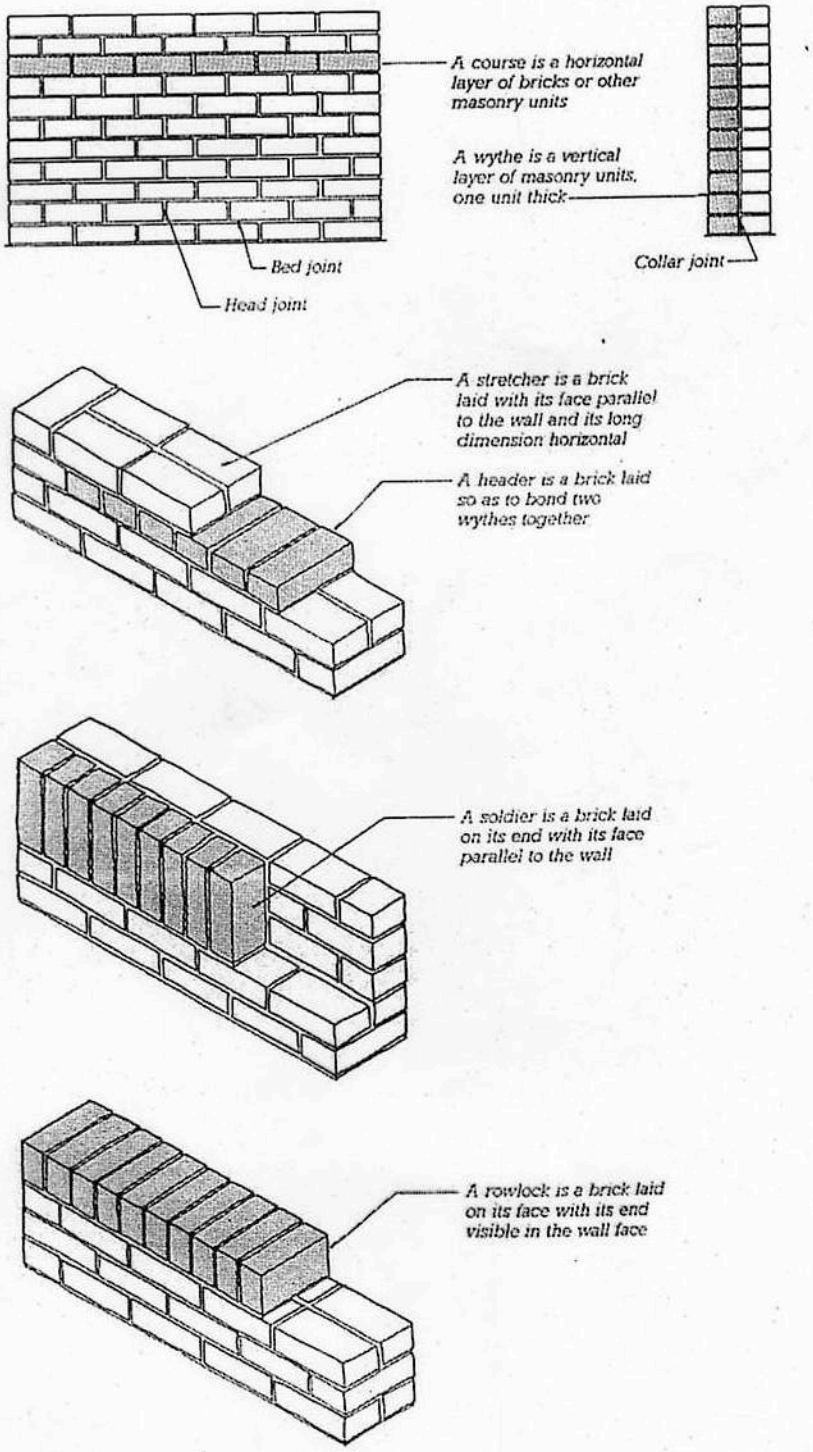
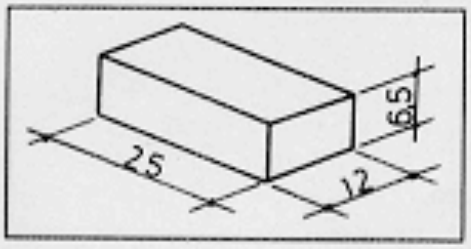


FIGURE 8.17
Basic brickwork terminology.

STANDARD SMALL BRICK

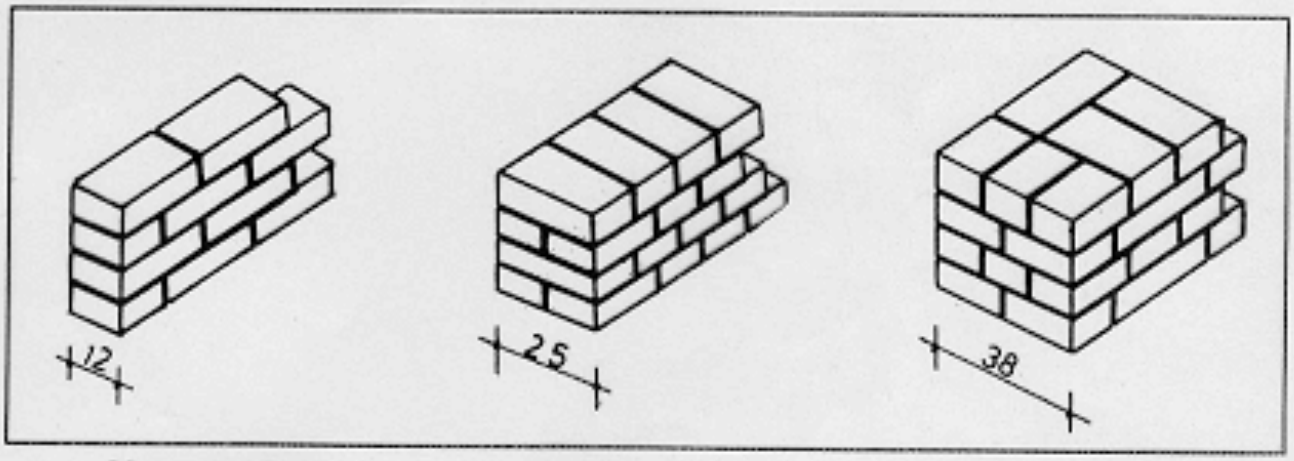
TÖMÖR KISMÉRETŰ TÉGLA
(MSZ 551/2)



Méret:	25 x 12 x 6.5 cm	
Tömeg:	2.9 - 3.5 kg/db	
Minőségi osztály:	nagyszilárdságú és	I. osztályú
Nyomószilárdság:	14 MPa	10 MPa
Anyagigény:	404 db/m²	

Gyártó: Pilisborosjenői Téglagyár
Budapest, Külső Bécsi út (18-as autóbusz végállomása)
Telefon: 168-2008, 168-2009

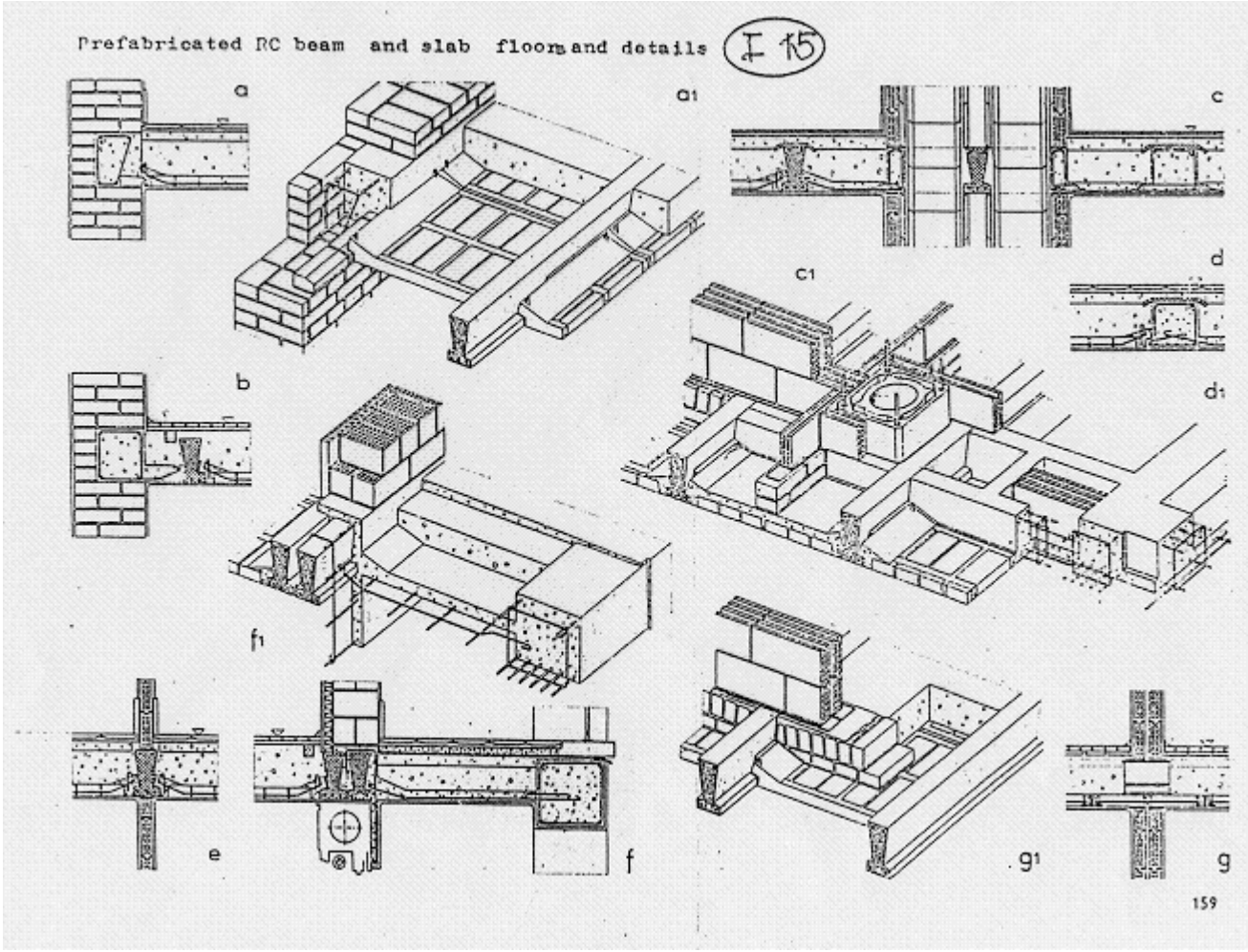
A nagyszilárdságú téglát (360 db/rakat) önhordó zsugorfóliába csomagolva hozzuk forgalomba.



12 cm-es válaszfal	25 cm-es fal	38 cm-es fal
Anyagigény (db/m²)		
52	103	155

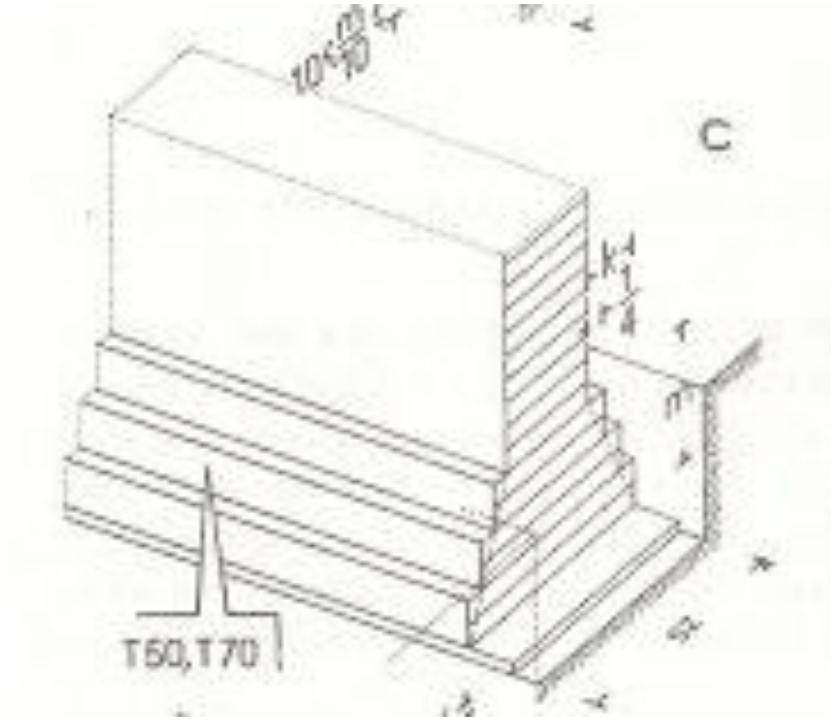
Felhasználási terület: belső teherhordó falak, pincék, kémények (tetőszerkezeten belül), válaszfalak, pillérek

BRICK COMBINATION SLABS



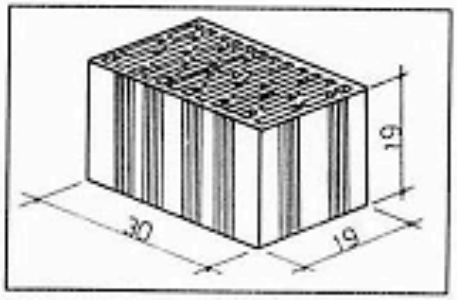
FOUNDATION

Solid brick



HOLLOW CERAMIC BLOCKS

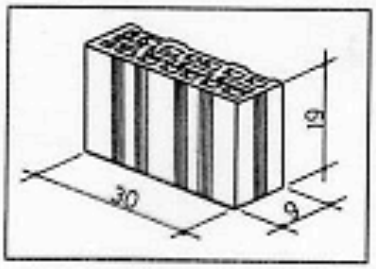
PF 45/19 POROTON (MSZ 5940/3)



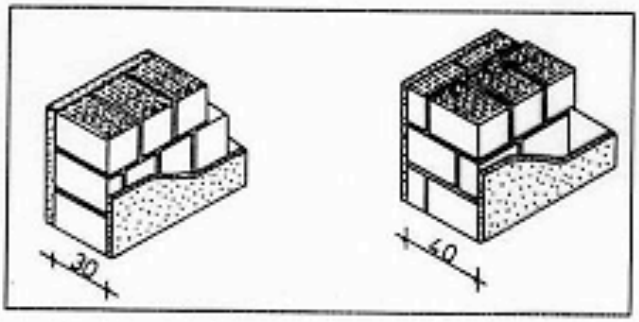
Size	30 x 19 x 19 cm
Weight	7 - 9 kg/db
Airspace	40-55%
Density	750 kg/m³
Compression	7 MPa
Requirement	25 db/m²

Man.: **Solymár II. Téglagyár**
Solymár, Rókus utca 5. (vasútállomás mellett)
Telefon: (26) 39-122, (26) 39-336

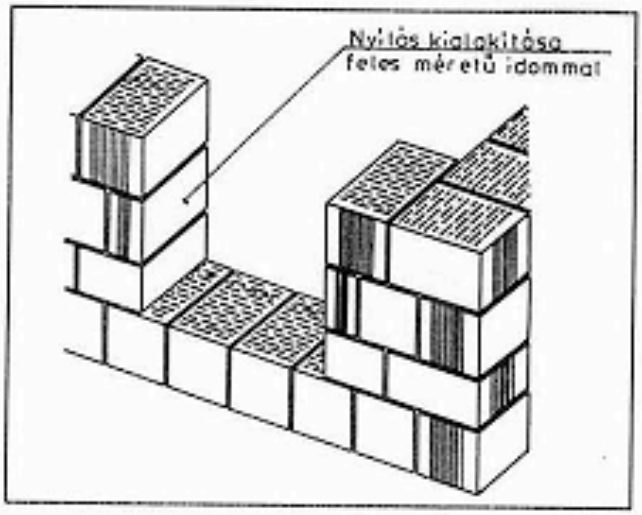
PF 45/19 POROTON (MSZ 5940/3)



Size	30 x 9 x 19 cm
Weigth	3.5 - 5 kg/db

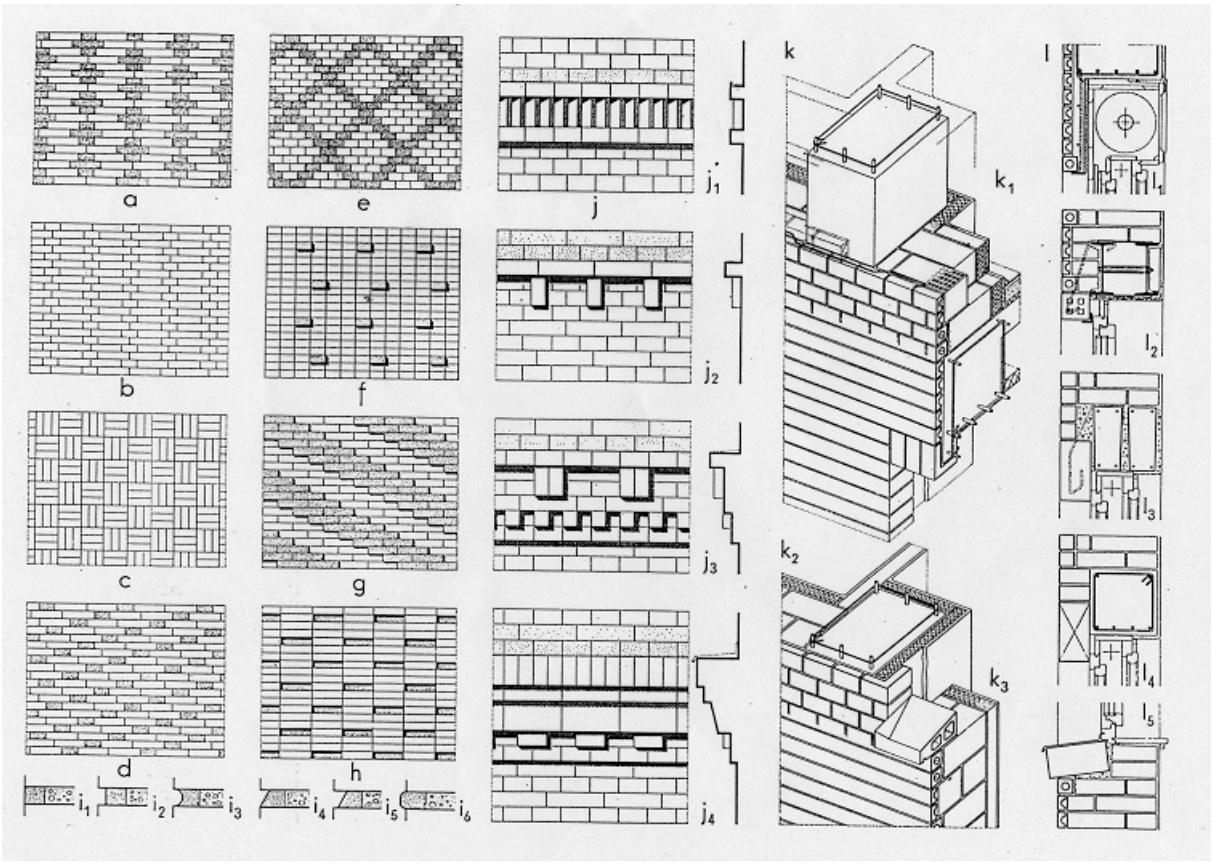


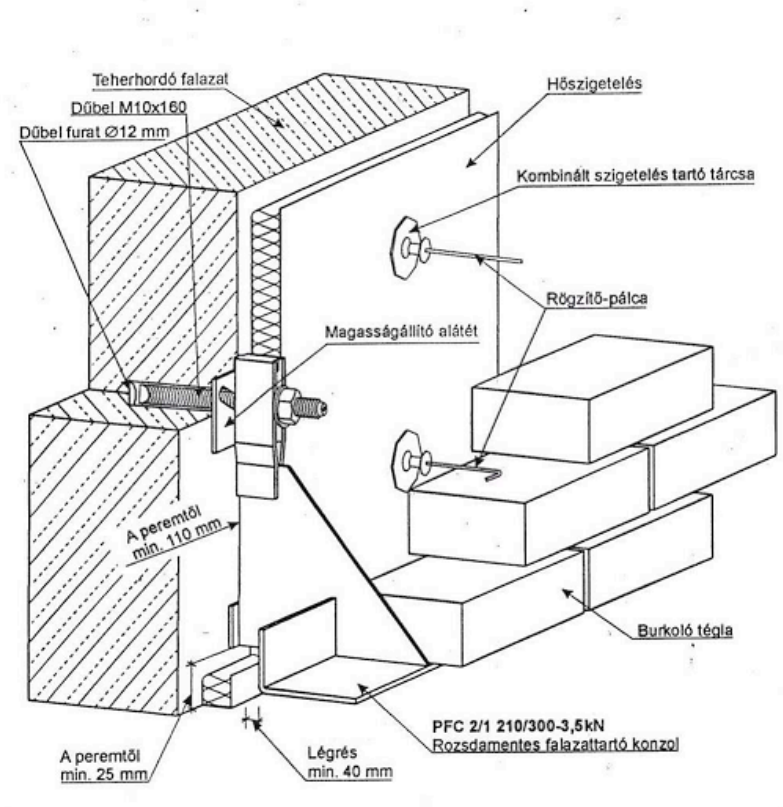
The building blocs are designed with attention to combination potential. The example on the left shows the combination of the ceramic block with the insulation element to form a 40 cm thick insulation wall.



Half size blocks will allow quick and precise creation of standard size openings. As the blocks come in 20/20 elements the standard openings may vary in 10 cm steps.

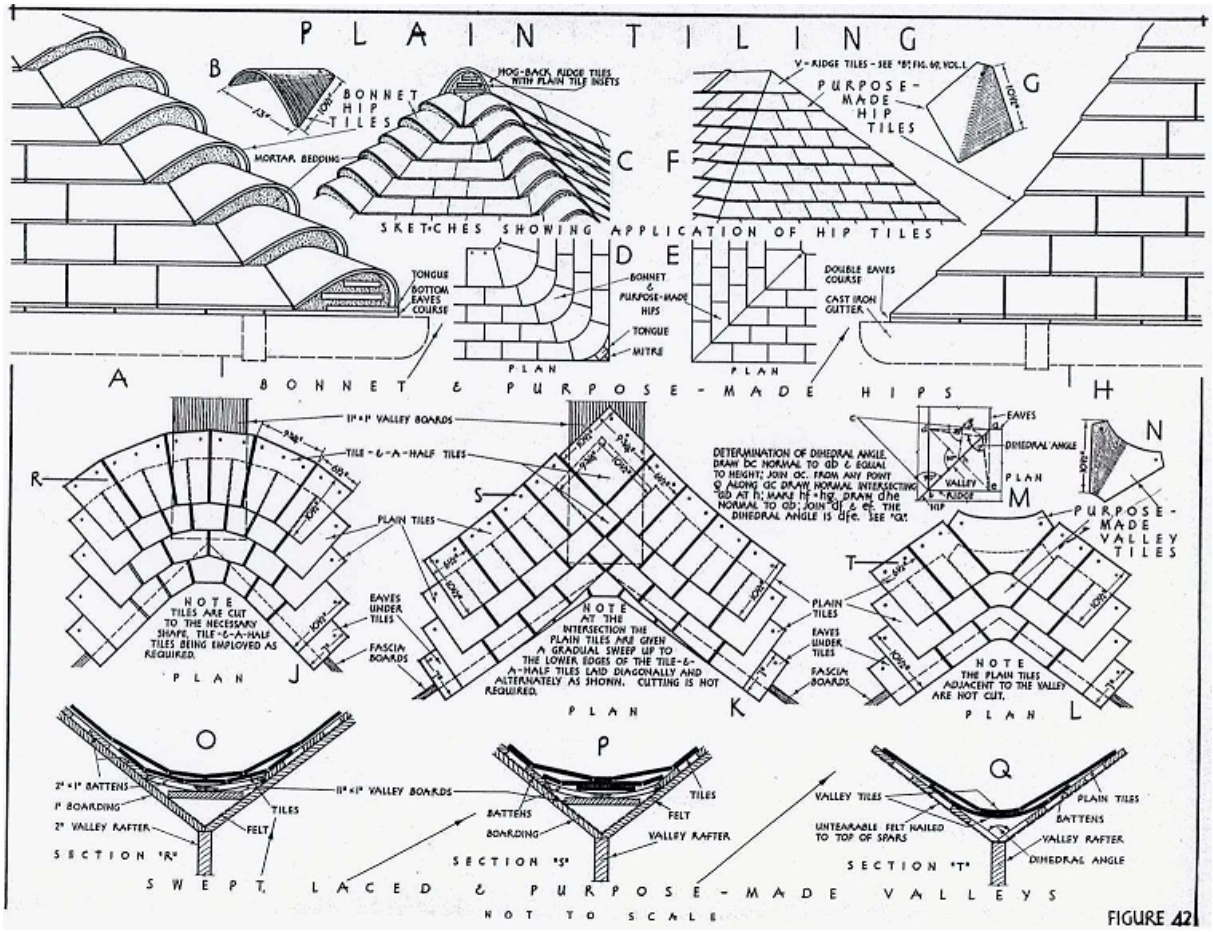
WALL COVERING





Typical modern brick facade solution with insulation and airspace layers.

ROOF TILES



TILES AS FLOOR COVERING