Gábor Becker PhD

BUILDING CONSTRUCTIONS 1

Design of walls 2: lintels

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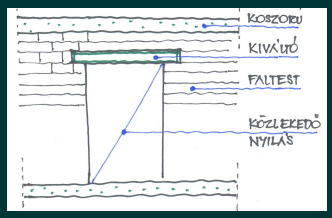
Budapest University of Technology and Economics
Faculty of Architecture ◺ Department of Building Constructions

lintels

function: top delimitation of the openings in walls, and bearing the loads above (door-window openings, mechanical breakthroughs)

grouping by:

- form: arched and horizontal
- structural design: arches and lintel beams



Ring beam

Lintel

Wall

Opening

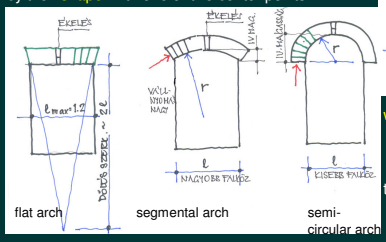
arches

structurally bent pillar (shape is typical of the architecture of the given era)

force diagram: beam with curved axis, only side pressure can occur in its cross section

→ the support should be sized for side (shoulder) pressure

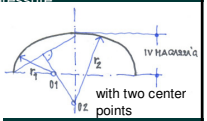
by their shape: with one or two center points



flat arch

segmental arch

semi-circular arch



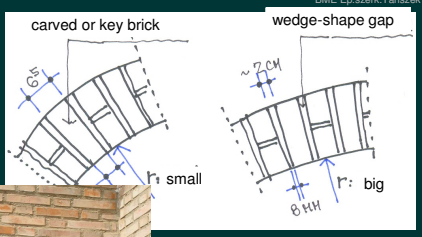
with two center points

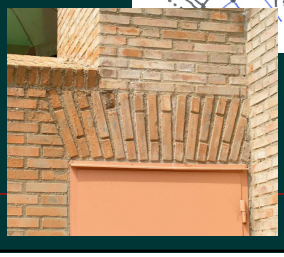
walling of arches: like walling of pillars

- for exposed brick cladding

the appearance of the joint is important (carved bricks, blocks)

arches

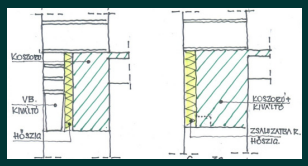




walling of arches: like walling of pillars
- for exposed brick cladding the appearance of the joint is important (carved bricks, blocks)

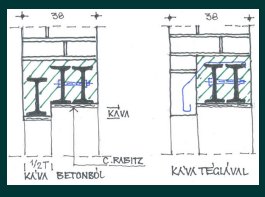
lintel beams - bent supports, transfer their loads to the masonry

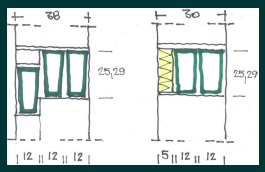
- by material: - steel, - reinforced concrete (RC), - combined (ceramic+RC), aerated concrete+RC, different formwork elements+RC
- structural design: - homogeneous or – complexcros-section
- **when becomes loadbearing: - at once, - soon, later**



complex cross-section

homogeneous



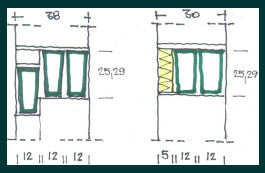


steel beam – at once

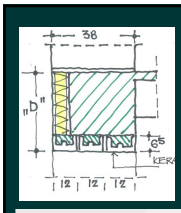
- steel beams in the same number as the half-bricks in the wall thickness
- steel beams working together: screwing them together
- can be loaded immediately
- any span on demand (dimensioned)
- thermal bridge!
- reveal design possibilities
- fire protection: plaster or coating

prefabricated RC beam - at once

- can be loaded immediately
- large span (4.80 m)
- thermal bridge!
- reveal design possibilities



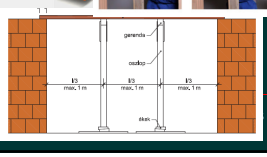
prefabricated RC beam – at once

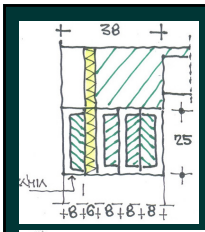


Ceramic + RC - **LATER**

ceramic element only tension-zone
- load-bearing capacity achieved with masonry or concrete („D")
- can be loaded only after concrete works got hardened

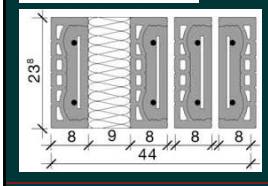
→ support needed

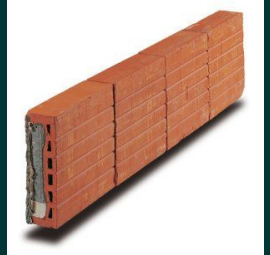




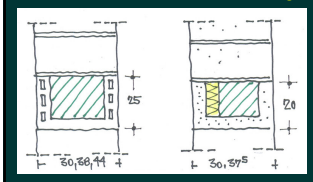
block-high lintel – at once

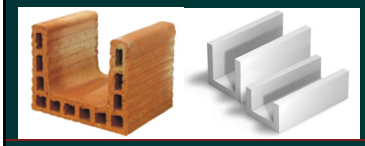
ceramic form, RC inside
- load-bearing capacity achieved in factory





Formwork elements – not loadbearing
- LATER





- element/unit high
- can be loaded only after concrete got hardened
  → support is needed
- additional thermal insulation

MISTAKES

- **BRICK+BLOCK???**
- **POSITION**
- **PRESSED ZONE ABOVE**
- **PLASTIC FOAM**

Gábor Becker PhD / Gyula Dési titular Docent

BUILDING CONSTRUCTIONS 1

Partition walls

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partition walls

role (function): internal space division and space separation
space separation: visual, acoustic + mechanical stress
special: flat separating wall: **Party wall** (20 cm RC, 30 cm limestone or more solid ceramic)

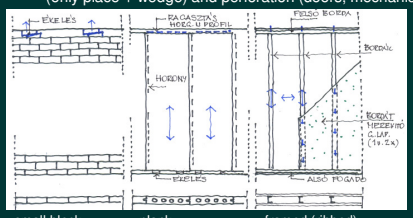
features: • self-supporting, non-load-bearing
• thin and vibration-sensitive
• load to slab
• doors, lintels, piping, mechanical and electrical wiring

grouping • material: clay, gypsum, plasterboard (+ frame), limestone, aerated concrete, concrete, formwork elemen (PS foam, Durisol - wood chips, etc.)
• weight: lightweight part. wall <160 kg/m², heavy part. wall >160 kg/m²
• technology: masonry, attached-bonded, plank, mounted frame-board, monolithic, large panel
• structural construction: homogeneous or multilayer
• structural design: small block, sheets, ceiling-high planks, room-size board, framed
• plastering: plastered or without plaster (bonded, mounted)

partition walls
function, features, and grouping of partitions

requirements: strength, stiffness, acoustics,- water- and moisture-resistance, formability, possibility of mounting, fixability, load capacity, holding plaster layer

• strength: taking loads from usage - sharp and blunt bumps, even load (30kp/m²), slamming doors
• stiffness: ensuring rigidity even in case of non-displacement-free installation (only place + wedge) and perforation (doors, mechanical installation)

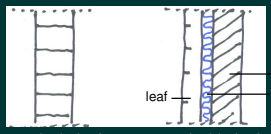


small block plank framed (ribbed)

requirements
partition walls - overview

water and humidity tolerance: to resist water and moisture permanently
• rooms on both sides of the space should be of approx. the same relative humidity (vapor migration, warping can be=l/600)
• sanitary rooms: wall insulation or installation of watertight cladding

acoustic: meet the requirements of air-borne sound insulation (R_W depending on the function of separated rooms)
• acoustically: single-leaf, double-leaf
• enclosure structure should be heavy but flexible
• only few sound bridges allowed (flanking transmission: slab and wall joints)

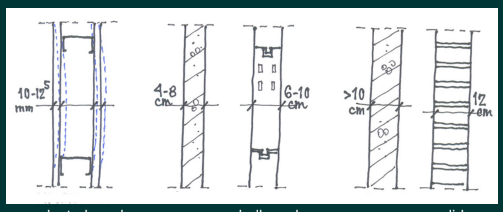


single-leaf double-leaf

requirements 2
partition walls - overview

by acoustical function the partitions are:

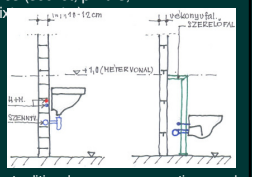
flexible | semi-rigid | bend-rigid



plasterboard + steel rib | concrete | hollowed partition board | concrete | solid brick

formability (cutting), fixability

- allow the reception of additional structures (socket, plinths, switches, plug sockets, lighting fix



traditional | mounting panel

shap

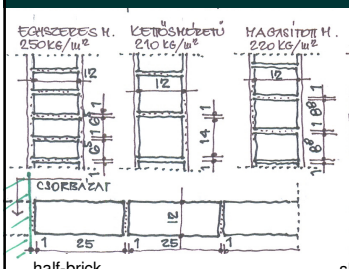
nd angle deviation, edge curvature, plane

holding plaster finish:

frequent vibrations from use → only partition with suitable surface roughness (corrugation) can hold plaster

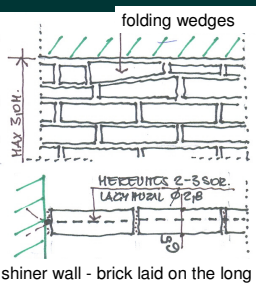
partitions requiring plaster finish

- small brick, double brick, masonry



half-brick

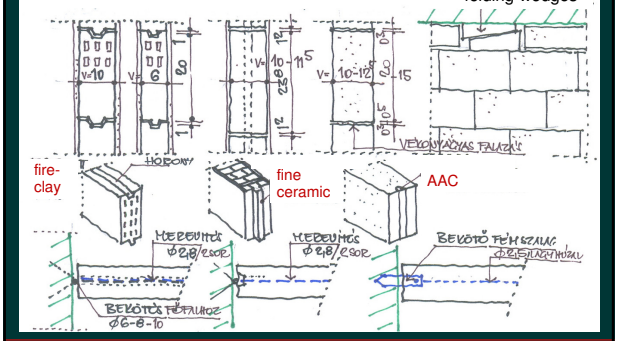
folding wedges



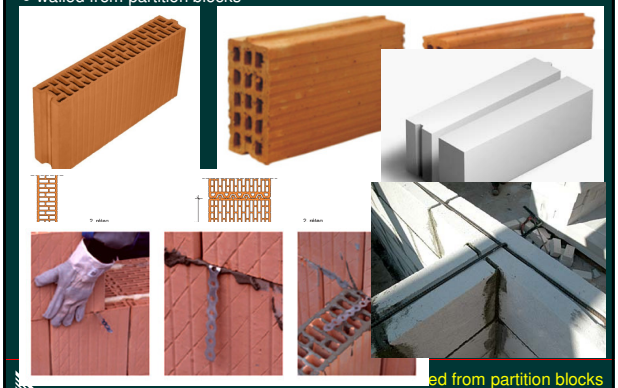
shiner wall - brick laid on the long narrow side - barge position

- walled from partition blocks

folding wedges

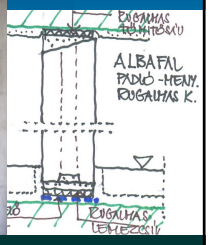


- walled from partition blocks



(MISTAKES)

partitions with no need of plastering

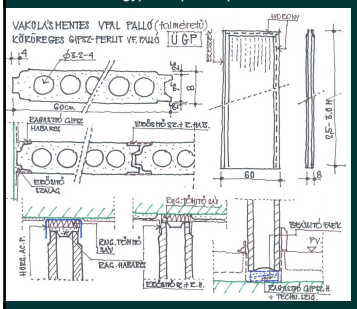


attached from partition blocks

partitions with no need of plastering 1

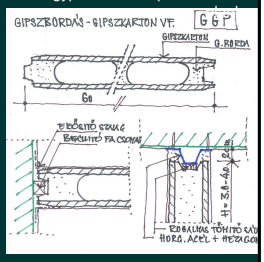
- plank-like, attached and bonded

hollow-section gypsum-perlite plank



T

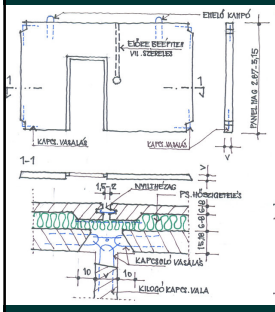
gypsum ribbed plasterboard



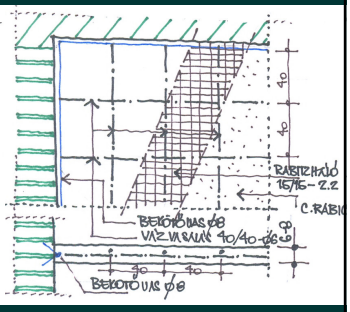
plasterboard, floor-high planks

partitions with no need of plastering 2

- large-size panels, floor-high partitions



- wall-size monolithic cement-steel mesh partitions



large-size, cement-steel mesh

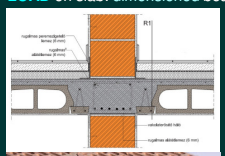
partitions with no need of plastering 3

apartment separating wall – PARTY WALL

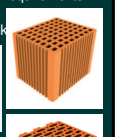
role (function): space separation between two apartments

requirements: as for partition walls, but stronger mechanical and acoustic requirements:
$R'_w + C = 52$ dB

can be made from: 20 cm RC, 25-30 cm sandlime or heavy clay block
LOAD on slab: dimensioned beam!

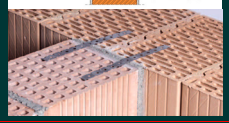


sandlime block



ceramic

slab connection: with soft acoustic plate



Inserting into the wall is acoustically much more favorable!

lintels – function, grouping
- arches – only side pressure, with one or two center points
  - flat, segmental, semi-circular arch
- lintel beams – bent supports
  - grouping: by material, structural design, manufacturing method, **when becomes loadbearing**
  - steel, prefabricated RC beam
  - ceramic and block-high, formwork lintel

partition walls

function, features, grouping

requirements
- strength, stiffness
- acoustic: structure: single-leaf, double-leaf
  functioning: flexible, semi-rigid, bend-rigid
- formability (cutting), fixability, reception of additional structures, shape and size tolerance, holding plaster finish

partitions requiring plaster finish
- small block, masonry
- walled from partition blocks

partitions with no need of plastering
- partition blocks attached and bonded
- plank-like, attached and bonded
- large-size panels, floor-high partitions
- wall-size monolithic cement-steel mesh partitions

apartment separating wall
- can be made from: 20 cm RC, 25-30 cm limestone or heavy clay block
- acoustic requirement: $R'_w + C = 52$ dB, prevention of sound bridges