

Gábor Becker PhD / Gyula Dési titular Docent

BUILDING CONSTRUCTIONS 1
Floor structures 2:
RC floors and vaults

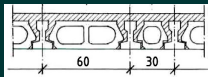
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Budapest University of Technology and Economics
Faculty of Architecture Department of Building Constructions

beam - filler block floors
beam floors prefabricated in full cross-section

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tensioned RC beam "E" e.g. E-36 = 3.60 m
(19 cm high)
span: 2.40 - 6.60 m modular unit: 60 cm
filler blocks: spacing: 60 and 30, height: 19 and
24 cm, sign: EB 60/19



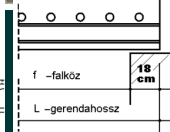
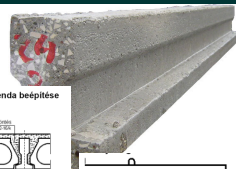
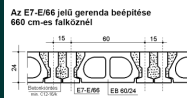
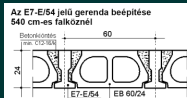
prefabricated beam floors

prefabricated floors - beam and hollow block floors - tensioned RC beam

beam - filler block floors
beam floors prefabricated in full cross-section

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Height: 24 cm
span: 3.00 - 7.20 m, modular unit:
60 cm
Filler blocks are the same

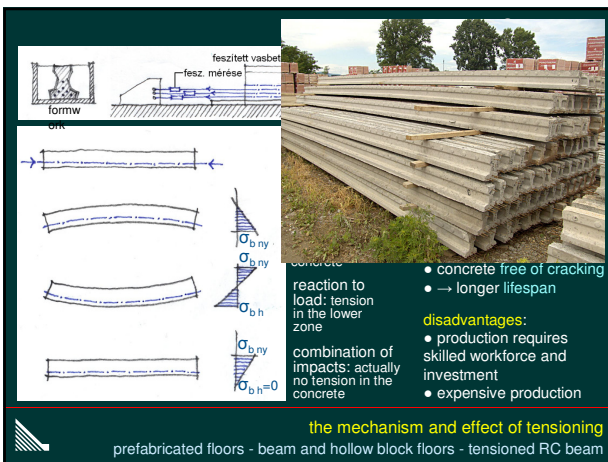


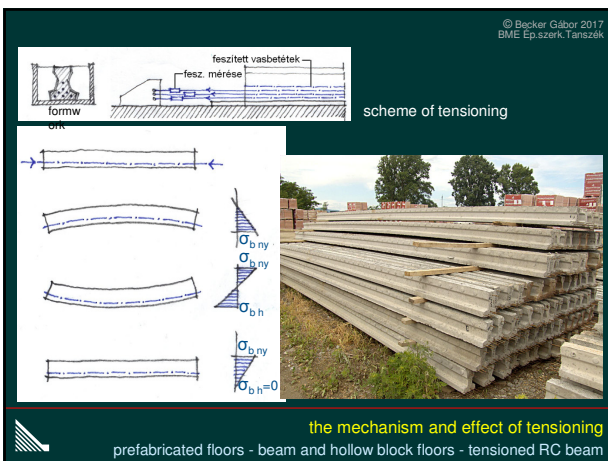


prefabricated beam floors

prefabricated floors - beam and hollow block floors - tensioned RC beam

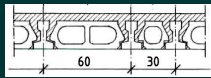




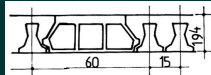


beam - block floors
beam floors prefabricated in full cross-section

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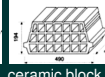


tensioned RC beam „PPB”
sign: EP-157, 178
number of tension bars
height of beam in cm (15 or 17)
span: 2.40 - 7.20 m modular unit: 60 cm

filler blocks: spacing: 60 cm, height: 19.4 and 21.4 cm



concrete



ceramic block



wood-concrete block

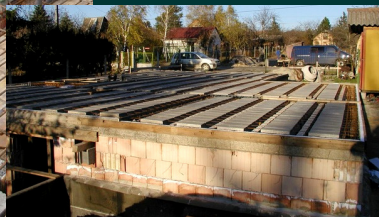
ceramic block and wood-concrete block only with reinforced concrete overlay!

prefabricated beam floors

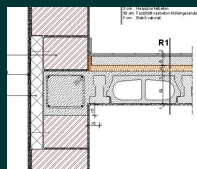
prefabricated floors - beam and filler block floors - tensioned RC beam

beam - block floors
beam floors prefabricated in full cross-section

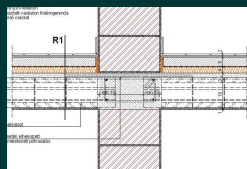
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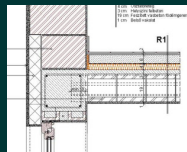
prefabricated floors - beam and filler block floors - tensioned RC beam



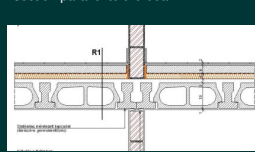
cross section of ring beam perpendicular to the beam



intermediate load bearing wall, cross section parallel to the beam



lintel cross section parallel to the beam



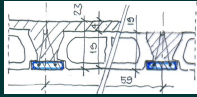
support of partition wall

typical details of prefabricated RC beam floors

prefabricated floors - beam and hollow block floors - tensioned RC beam

partly-prefabricated beam and filler block floors

semi-monolithic: support and over lifting



„Master” floor: RC beam, concrete filler block
filler blocks: spacing: 59 (57.5) cm, height 19 cm
span: 1.20 - 8.90 m modular unit: 20 cm
 overlay concrete: 4-11 cm, with reinforcing mesh

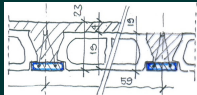
over 6 m cross-rib is required, can also be installed as cantilever



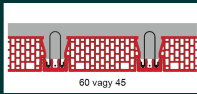
partly-prefabricated beam and filler block floors
 prefabricated floors - beam and filler block floors

semi-prefabricated beam and hollow block floors

semi-monolithic: support and overlifting



„Master” floor: RC beam, concrete filler block
filler blocks: spacing: 59 (57.5) cm, height 19 cm
span: 1.20 - 8.90 m modular unit: 20 cm
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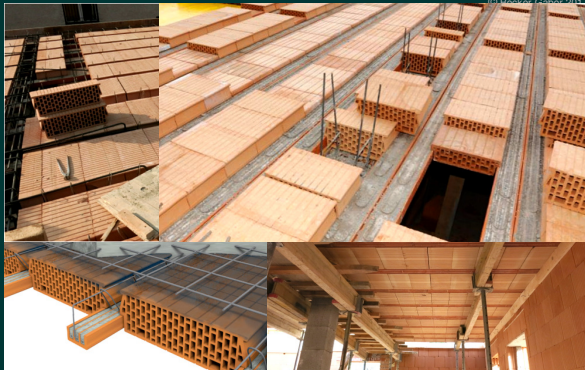
Porothersm precast concrete beam in ceramic shell
span: 2.25 - 7.0 m modular unit: 25 cm
filler blocks: spacing: 60 and 45 cm, height: 17 and 10 cm, sign: PTH 60/17, 45/10
 overlay concrete: 4-7 cm, with reinforcing mesh
 cross rib spacing max. 2 m, 2 pcs over 3.75 m, 3 pcs over 5.75

advantages: easy-to plaster, modular unit matching the walling block, easy-to-shape, flexible (reinforcement, lintels), easy installation of mechanical wiring and piping
Disadvantage: filler block may break during construction



filler blocks

semi-prefabricated beam and filler block floors
 prefabricated floors - beam and filler block floors



Porothersm floor

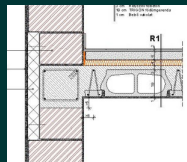
beam and filler block floors – semi-prefabricated floors



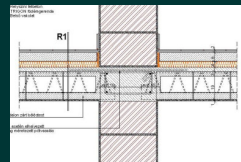
FERT floor

Porotherm and FERT floors

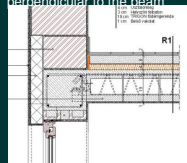
beam and filler block floors – semi-prefabricated floors



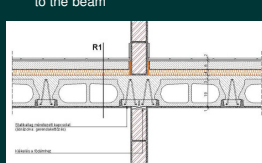
cross section of crown
perpendicular to the beam



middle bearing wall, cross section parallel
to the beam



lintel cross section parallel to the
beam



reinforcement under partition wall

typical details of semi-prefabricated RC beam floors

prefabricated floors - beams and filler blocks

Floor construction stages

1. transportation
2. temporary support installation
3. placement of beam units
(balconies, shafts, etc.)
4. surmounting (over-lifting)
5. filler blocks are put in (ceramic,
concrete etc.)
6. placement of steel upper
reinforcements (eg. steel mesh)
7. placement of beam connection
steel reinforcement
8. pouring of the concrete
9. after treatment
10. support removal

Porotherm and FERT floors

beam and filler block floors – semi-prefabricated floors

Main rules at arranging beam + filler block floor constructions

1. fulfill the average load bearing requirements (depending on the span)
2. beam must not be in the chimney wall
3. Minimum ring beam cross dimension 12 cm
4. support of special loads (For i. partition wall, monolithic area) → arrangement (double, triple beam)
5. cross ribs to avoid buckling + load transfer
6. changing of span
7. technology of balconies → **monolithic** (frost-resistance)
8. support of balconies → cantilever with **thermal insulation** → thermal break (see later)

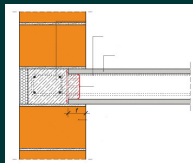


Porotherm and FERT floors

beam and filler block floors – semi-prefabricated floors

tensioned RC hollow-core floor slabs

height: 6; 20; 26.5; 32; 40; 45; 50 cm
span: 3.50 – 23.50 m (!!!)
width: 120 cm (60, 90)



ring beam section
parallel to the floor plank
axis - closure of circular
cavities

- advantages:
- plaster-free surface
 - large selection - slab thickness and load bearing capacity
 - large spans as well
 - fast construction
 - can be used immediately
- disadvantages:
- width is determined
 - transport requires special machines



hollow-core floor slabs

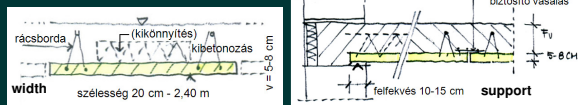
prefabricated floors - plank floors



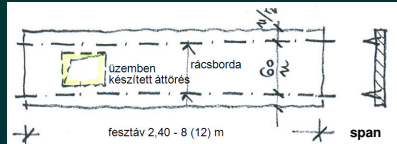
hollow-core floor slabs

prefabricated floors - plank floors

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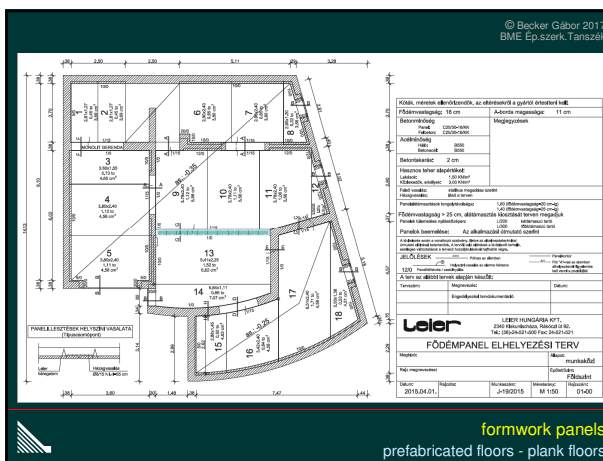
slab thickness: 14-30 cm



larger **openings** made in plant, on site max. 20x20 cm
computer-controlled production → actually any size and shape can be produced

- plaster-free surface
- good sound insulation
- variable slab thickness and load bearing capacity
- wide range of sizes, unique forms
- easy installation of mechanical wiring and piping
- fast construction

formwork panels
prefabricated floors - plank floors



thermal break elements

essence of thermal bridges: multidimensional heat flow (uneven heat distribution)

cause: e.g. change of materials – different heat-conducting materials

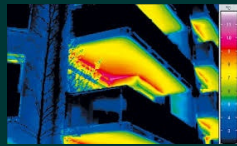
consequences: discoloration (dust sitting on), condensation (dew point), mold formation (not healthy), higher heat loss

most common

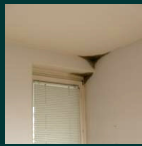
structural: structures joining the slabs for proper static operation (slabs, beams, balconies, loggias, canopies)

doors and windows, ventilation

geometric: wall corners, wall-floor corners, corners along the floor



thermal imagery of a cantilevered balcony – RC slab runs to outdoor space without thermal break



thermal break elements

prefabricated floors - floor design

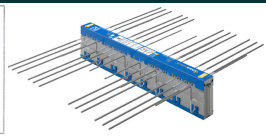
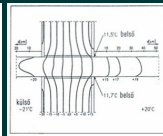
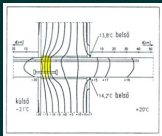
avoiding thermal bridges

for structures connected to the floor:

slabs: wrapping with thermal insulation or using thermal break elements

beams: wrapping with thermal insulation (with thermal break elements!)

ring beam, lintels: thermal insulation placed in the formwork + thermal insulation of exterior wall



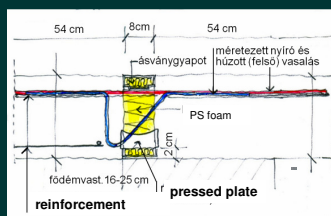
isotherms with or without thermal break elements – balcony slab

thermal break element

thermal break elements

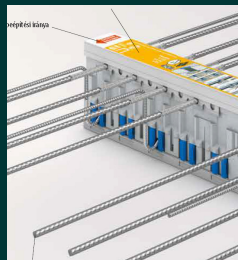
prefabricated floors - floor design

thermal break elements



construction and typical dimensions of a thermal break element (also available with thicker – 10, 12, 16 cm – thermal insulation)

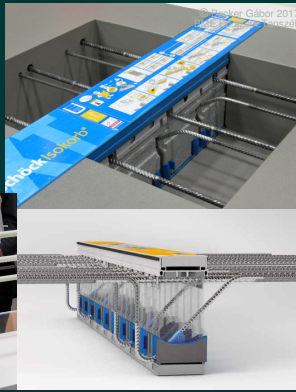
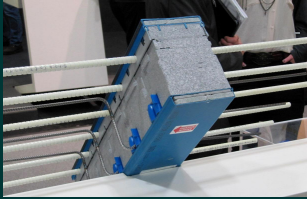
photo of a thermal break element press plates are painted in blue



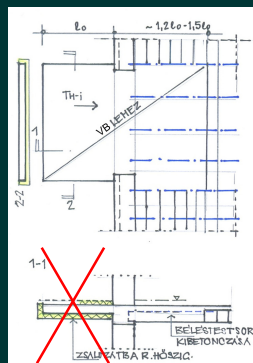
construction of thermal break elements

prefabricated floors - floor design

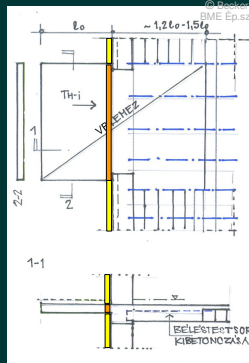
thermal break elements



construction of thermal break elements
prefabricated floors - floor design



cantilever slab with thermal insulation
wrap



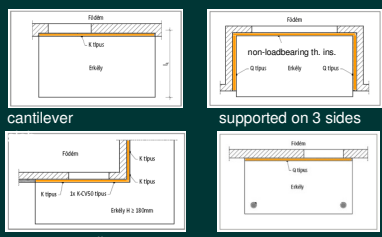
cantilever slab with thermal break element

thermal break elements
prefabricated floors - floor design



thermal break elements
prefabricated floors - floor design

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cantilever

supported on 3 sides

two-way cantilever slab


supported on 2 sides

the geometry of reinforcement for a variety of forces and geometries: cantilever, only sit on the wall, cantilever and sit on the wall with plane change, to attic wall etc.

advantages: no need of thermal insulation around balcony (+ waterproofing), slimmer construction, quick and easy installation

disadvantage: relatively expensive, less freedom in geometry and force arrangement

thermal break elements
prefabricated floors - floor design

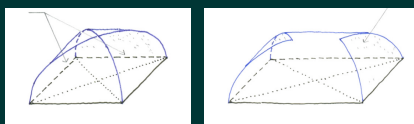


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vaults

can be derived from arched surfaces

from cylindrical



vault

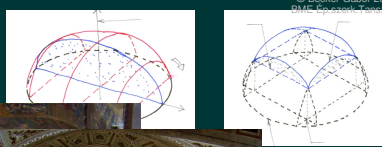
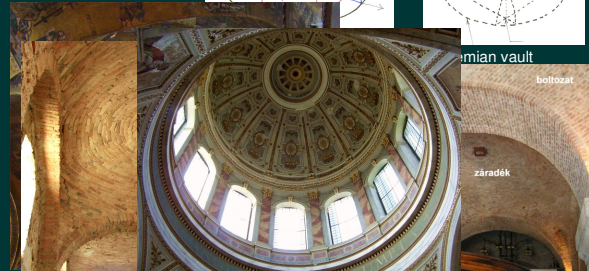


vault types
non-flat floors – vaults

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vaults

from spherical

roman vault

boltozat

záradék

vault types
non-flat floors – vaults

structure of vaults

origin:
"stretched arch" → the concepts are the same

material of vaults

- historical structures: brick and carved stone
- today (e.g. transport facilities) – prefabricated RC concrete
- in modern architecture: **shell** vaults with small thickness, (monolithic RC, based on the force model of an egg shell)
- false vaults: wire-lattice structure
- small clear span, flat arch: **Cambered** vault

Diagram labels: hátfalazat, boltváll, váltóvonal, intradosz, nyílásköz, bolt. heveder, bolt. hék, extradosz, boltózási tengely, gyámfal, ívmagasság

structure and parts of vaults

non-flat floors – vaults

taking the lateral thrust (shoulder comp

removed only after that

lateral thrust of vaults

non-flat floors – vaults

lateral thrust of vaults

non-flat floors – vaults
