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Gábor Becker PhD / Gyula Dési titular Docent

**BUILDING CONSTRUCTIONS 1**  
**Walls, slabs, stairs**

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

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**BUILDING CONSTRUCTIONS 1**

Lecturer: Gyula Dési – titular docent

Lecture topic is compiled by PhD Gábor Becker

Leader of english teaching: Ms Zsuzsanna Fülöp

Homepage: <http://www.epszerk.bme.hu/?id=C06> \*

After the practical part of the semester - exam

Practical On Friday morning: workshop exercise,  
consultation, midterm test

**Deadlines:**

Look at the „Topic scedule” on the homepage

To highlight:

- test
- submissions



**basic information**

information – subject, lecturer and course leader, contacts

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- lecture, **note taking !!!**
- lecture slides – downloadable from the website
- lecture plan, check questions: [www.epszerk.bme.hu](http://www.epszerk.bme.hu)




**reading:**

- teaching aid, on website
- János Böhönyey: Conventional walls, slabs – outdated, mainly for renovations
- building material manufacturers' application guides
- catalogs, product brochures – to be read with criticism

**how to learn Building Constructions**

- not by reading, but by sketching and drawing!
- understanding – constructing (requirements – how to fulfil)



**basic information**

note taking, lecture plans, website, reading

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„Architectural creation and construction tasks are realized in building structures, therefore knowing them is important for the whole of our profession. Our aim is to **develop structural thinking and the skills of construction design**, on basis of teaching basic constructions and transferring the basic knowledge of technology and science.”

Building or just an artistic three dimensional object?

according to public opinion, it is a difficult semester – **let's try it in a different way!**

– it has already been proven once ...



**basic thoughts**

introduction – principles, structural way of thinking

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**we create an artificial environment**


**What do we want?**  
e.g. a family house: function is a primary consideration to feel good inside – both from physical and mental/spiritual point of view the realization is **architecture**

**architecture** = fulfilling the space requirements of individual and social activities

**built environment** = artificial environment, cut off from nature

**building constructions:** elements and means of realizing the architectural concept  
the elements that make up the buildings and perform various tasks and functions  
→ everything from which the building is constructed and assembled





**the task of architecture**

relationship between architecture, built environment, and building constructions

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## basic components of architecture and construction

architectural components – close relationship – structural components

- purpose (function)
- space
- mass
- surface
- building materials
- building technology
- building constructions
- building equipment



basic concepts  
basic conceptual elements – introduction, basic concepts

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## technical toolkits – construction methods, techniques

toolkit = method and process of building implementation (construction techniques)  
– changing and developing over time

### construction methods/techniques:

- traditional construction
- industrialized construction
- wet construction
- dry construction
- heavyweight construction system
- lightweight construction system



traditional construction



industrialized construction systems



basic concepts  
walls, construction systems – introduction, basic concepts

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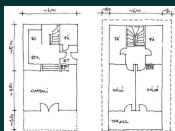
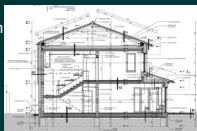
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## the design process, building constructions in the design process

- architectural program: vision, requirements (list, data)
- preliminary sketch, conceptualization - structures in the "background"
- building permit plan – factual structures on a small scale, in description
- tender plan
- construction plan
- (product design)



implementation: preparation-organization → production → assembling →  
as-built drawings



phases of plans  
walls, construction systems – introduction, basic concepts

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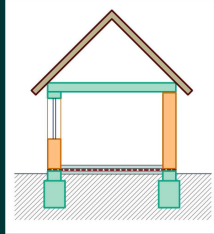
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### Building construction:

the elements that make up the buildings and perform various tasks and functions  
→ everything from which the building is constructed and assembled

#### basic building constructions:

- foundation
- wall (+ doors&windows)
- ceiling
- (pitched) roof, cladding
- (ground) floor



section

basic concepts

walls, construction systems – introduction, basic concepts

### categorization of building structures \*

#### load-bearing structures

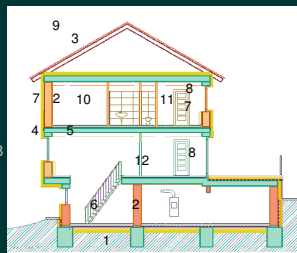
- supporting structures
  - foundations 1
  - walls, pillars 2
  - roofs 3
- spanning structures
  - lintels (headers) 4
  - slabs 5
  - stairs 6
- stiffening structures (walls, spatial elements)

#### building envelop

- non-load-b. exterior walls 7
- doors-windows, curtain walls 8
- claddings 9

#### interior space separation structures

- partition walls 10
- doors 11
- slabs 5
- platforms, floors 12



categorization of building structures

walls, construction systems – introduction, basic concepts

### finishing, surface-forming structures

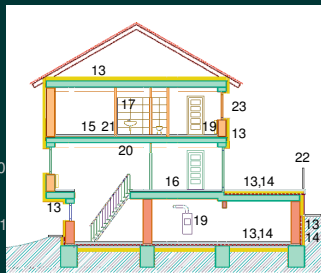
- insulations
  - thermal 13
  - water 14
  - acoustic 15
- claddings, finishes
  - floors 16
  - walls 17
  - ceilings 18

#### building services, electrical equipment, pipelines

- pipelines: water-sewage, gas, heating+ equip. 19
- strong and weak current 20

#### built-in furniture, building equipment

- kitchen units, wardrobe 21
- screens, railings 22
- blinds, shadings 23
- etc.



categorization of building structures

walls, construction systems – introduction, basic concepts

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**grouping of buildings based on space structure**

**cell-type:** small span, many small spaces, wall-frame struct., typically several floors

**open space:** long span, large spaces, hall-like character, typ. few floors –

building constructions 1-2-3-4

building constructions 5

**space structures**  
walls, construction systems – **grouping**

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**grouping of the structural systems of cell-type buildings** \*

**structural system of buildings:** arrangement of load-bearing, spatial separation and division structures

**wall-type structure:** vertical load-bearing structures are the walls, **linear** load transfer

**frame-type structure:** vertical load-bearing structures are pillars/columns, **point** load transfer

**mixed:** (typically) wall outside, pillar inside  
panel (large panel) and spatial element

**structural systems**  
walls, construction systems – **grouping**

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**longitudinal walls**      **cross walls**      **mixed walls**

Legend:  
■ Loadbearing wall  
■ Bracing (stiffening) wall wall

**wall systems**  
walls, construction systems – **structural systems**

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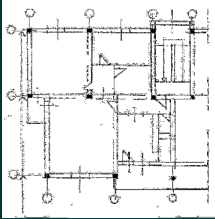
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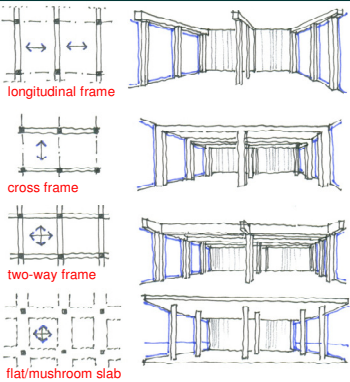
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**frame-type structure**  
(beam-slab, flat bottom-top and mushroom slab)



longitudinal frame



longitudinal frame  
cross frame  
two-way frame  
flat/mushroom slab

**frame-type systems**  
walls, construction systems – structural systems

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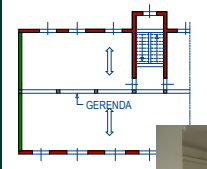

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**mixed structure: frame-wall**

outside wall, inside pillar

**mixed systems**  
walls, construction systems – structural systems

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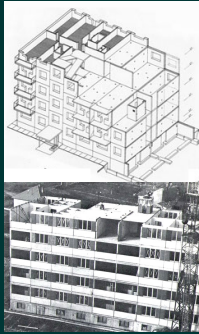


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**panel construction method**   **modular construction method**

**panel and modular systems**  
walls, pillar frames, panels, modular units – structural systems

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**grouping of walls:** by material, load-bearing role, function, geometric position, technology and structural design \*

grouping of walls by their **material**

- walls from **natural material**:
  - adobe
  - stone
  - wood
- walls from **artificial material**:
  - brick, ceramic block (baked)
  - concrete (chemical transformation)
  - aerated concrete
  - PS (formwork) block
- **mixed, lightweight** (mounted) walls:
  - timber, metal, plastic, fibrous materials
  - timber+glass, metal+glass

wooden log wall

ceramic block

metal ribbed curtain wall

**walls by their material**  
walls – grouping options of walls - material

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**by load-bearing role**

- **load-bearing walls**: carry the load of slabs
- **non-load-bearing walls**: carry self-weight (infill walls)
- **stiffening walls**: mainly for frame-type, but also for wall-type structures

**grouping of walls by load-bearing role**  
grouping options of walls - function, **load-bearing** role

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**by function**

**enclosure of built space:** from outside – **enclosure** structures  
from inside – **separation, division** \*

**by geometric (layout) position**

- **enclosure walls**: load-bearing wall, non-load-bearing wall, infill wall, gable, **fire wall**, end wall, basement wall, plinth wall
- **separation walls**: partition wall, load-b. or non-load-b. thick walls

**grouping of walls by geometric position**  
grouping options of walls – geometric position

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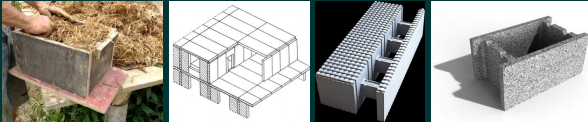
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### grouping by construction technology

- earth-type walls (from adobe **brick** masonry wall, **cob wall**)
- brick and block **masonry** wall (small-size brick, fireclay blocks)
- walls built from medium-sized **masonry blocks** (with half and full ceiling height)
- large reinf. concr. **panels** (housing factory panels, **panel technology**)
- walls built with **poured** technology (reinf. concr. wall between large panel formwork)
- **semi-monolithic** walls (formwork block walls - homogenous, PS blocks - layered, several functions)
- lightweight **mounted** curtain walls



adobe brick      medium-size block      PS formwork block      formwork block

**walls by construction technology**  
grouping options of walls - technology

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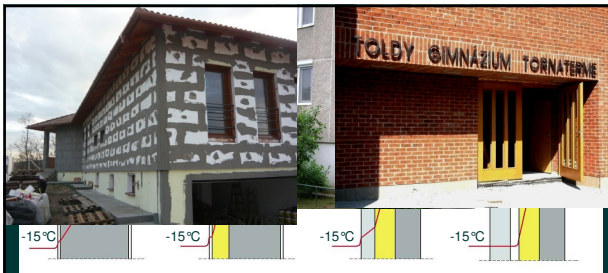
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#### homogeneous

- surface finish (cladding)
- self-supporting wall
- surface finish

#### layered

- surface finish (plastering)
- thermal insulation
- self-supporting wall
- surface finish

#### core insulated

- surface finish (cladding)
- thermal insulation
- self-supporting wall

#### ventilated

- surface finish (cladding)
- air gap
- thermal insulation
- self-supporting wall

**structure of exterior walls**  
grouping options of walls – structure

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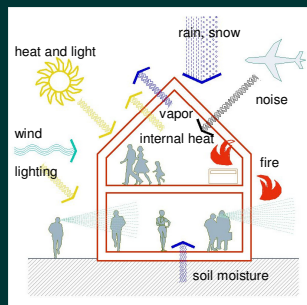
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### building requirements

Országos Településrendezési és Építési Követelmények (OTÉK, = National Settlement Planning and Construction Requirements)

- **stability**
- **fire safety**
- **hygiene**, health and environmental protection
- life protection, **safety** in use
- **noise** and vibration protection
- **energy** saving and thermal protection
- sustainable use of natural resources

+ **economy**, expediency  
- we spend the money of others!



**building requirements**  
walls, building systems – introduction, basic concepts

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impact → stress → requirement → **structure** ← performance

**external** (natural) and internal impacts of **usage**

**main** (primary) and **additional** impacts

example: loads • **main impacts**: dead and live loads  
• **additional**: swelling, deformation, vibrations

**general requirements:**

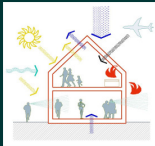
- strength
- durability
- fire protection
- moisture protection
- thermal and damp prot.
- air tightness
- noise pollution control

**other requirements:**

- against chemical impacts
- against mechanical impacts
- property protection (security)
- color stability
- carvability
- construction, installation
- economical

**special requirements:**

- radiation protection
- biological
- relocatability



**impacts, requirements of walls**  
walls, building systems – introduction, basic concepts

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the **level** of structure requirements depends on:

- function (what?)
- site/location of installation (where?)

the requirements are **regulated** by

- rules, standards, regulations, guidelines


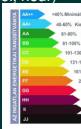
**quantifiable:**

- bearing capacity (kN, N/mm<sup>2</sup>)
- insulating capability (W/m<sup>2</sup>k)
- sound-proofing (dB)
- fire resistance (combustibility level, hour)

**compliance of building constructions:**

✱ **performance**

service life, capacity, thermal transmittance, airborne sound insulation, fire resistance etc.

**requirements of walls**  
walls, building systems – introduction, basic concepts

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- we create an artificial environment – the task of architecture is to fulfil the **space requirements** of individual and social activities
- the basic **conceptual elements** of architecture and construction
  - technical tool systems: **construction methods**, techniques
- **the design process**, building constructions in the design process
- **grouping** of building constructions: load-bearing, enclosure and space separation, enveloping-surface finishing; building services' pipelines, wiring and equipment, built-in furniture, building equipment
- grouping of buildings by their **space structure**: cell-type and hall-like
  - division of the **structural systems** of **cell-type** buildings: wall-type, frame-type, mixed, panel, modular
- grouping of **walls**: by material, load-bearing role, function, geometric position, technology and structural design
  - **impacts** on buildings and structures (known), impacts on **walls**
    - **requirements** for walls, compliance: **performance**

**summary**  
walls, building systems – introduction, basic concepts

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