



Budapest University of Technology and Economics

Department of Mechanics, Materials and Structures

English courses

General course /2020

Fundamentals of Structures

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Lecture no. 2:

## **Building design requirements**

# General problems related to building design

Main **components** of buildings

## Spaces

(main) functional spaces

services for circulation  
social activities  
installations

## Constructions

building constructions  
loadbearing constructions  
installations

Main **design characteristics of the components**

Connections

Form and dimensions

Connections

Form and dimensions

Materials

Main **design requirements**

Functionality

Human comfort, safety by use

Economics

Aesthetics, environment protection

Functionality

Safety

Economics

Aesthetics, environment protection

**Fundamental requirement of architectural design:**

Unity of function, construction and form

## Some questions to put about the way of fulfilment of requirements

### Way of handling of local conditions?

Characteristics of the natural and built environment, local building prescriptions, culture, climate, orientation, slope, underground conditions

### Materials (products, constructions) to use?

Availability of local materials, economic, functional, load-bearing and aesthetical considerations

### Aesthetics?

Way of handling of the general architectural *requirement of the unity of function, construction and form*

Materials, forms (space ratios, dimensions) and styling, colours, surface structures to apply? Today: minimal art

### Economic considerations: price/performance rate?

### Safety considerations: Safe use? Danger of slip, air pollution etc.

Numerical verification of safety against rupture and collapse of the loadbearing structures

## The need of a *design team*

### Parts of buildings

The house as a whole  
composition of *building constructions*

#### *Installations*

Piping (water, waste-water, heating)

Electric supply, informatics

#### *Loadbearing structures*

Furnishing

Surroundings of the building

### the designer of the parts

architect,  
the chef of the design team

building mechanical  
engineer

electric and informatics  
engineer

*civil or structural engineer*

architect of the interior

garden architect  
designer of the external  
utilities

## 2. Investigation of the fulfilment of the fundamental requirements in case of the K-building

that of its *functional units* (spaces)  
and of *constructional units* (building constructions)

-*functionality*: that is to serve well the purpose they were designed and are used for, assuring conditions of human comfort

-*safety*:

*safe use* without health damage or accidents

*no rupture or collapse* of the load-bearing structure

-*aesthetics*

-*economics*: advantageous price/performance rate

expenses: the total sum of money spent for design and construction, maintenance, rehabilitation and demolition

-*environment protection* by district heating

Try to put questions and formulate critical observations!

# List of European international requirements of buildings and construction works

the related fundamental requirement  
functionality

hygiene

health protection

noise and vibration protection

heat protection

burglary and property protection

stability

mechanical strength

fire safety

safe use, unhindered entering

health protection, life protection

minimizing expenses of design, constr.,

use, maintenance, demolition, energy saving

maintainable use of natural resources

environment protection

safety

economics

environment protection  
aesthetics

## Detailed content of the fundamental requirements

*-functionality, requirements of human comfort and use*

acoustic insulation

heat insulation

water and humidity insulation

natural illumination, orientation to sunshine, orientation to panoramic view, aspects of intimacy

space dimensions fitting to use

materials used fitting to use

cleanable surfaces, possibility of maintenance, reconstruction, demolition

*-safety that is life and health protection*

safe bearing capacity of the loadbearing structural system

fire resistance of the loadbearing structural system

durability of the load-bearing structural system

dust-free, slip-proof pavement, safe use without accidents

anti-hurt details, rounded edges and corners  
well operating ventilation system

-*aesthetics* (human aspect, that can not be prescribed in detail, and is motivated by the latest fashion and taste of people)

interior and exterior *forms* and textures

*colours* applied, colour harmony

*material* use

surface *decoration*

*light* propagation, distribution (l. introduction, reflexion)

environmental *harmony*, harmony of the different components

-*economic solutions*

price/performance rate which proves to be acceptable by all the investor, the user and the taxpayer citizens

The price/performance rate can the better be evaluated by comparison with similar other realizations.

-*environment protection*

protection against air pollution, prescription of min. green area



Many of the design decisions have influence onto the fulfilment of several main requirements, for example:

-*material use* (the choice of a given material for a given purpose) has all functional, safety, aesthetical and economic aspects (consequences)

**Analysis of the way and rate of fulfilment of the general and detailed requirements of the *functional units* and of the *construction units* of the central (K) building of the TUB**

service areas	roof constructions
corridors, staircases,	top floor constructions
elevators	intermediate floor constructions
sanitary rooms	pavement constructions
bureaus	facade wall constructions
departments	intermediate load-bearing walls
educational areas	columns
classrooms	partition walls
lecture halls	doors and windows
communal areas	pavements
assembly hall	installations:
aula	piping and conducts (water and electric conducts, heating, waste-

water canalization, comm. lines,  
lighting, radiators, sanitary inst.) etc.

## The way of analysing of the fulfilment of the fundamental requirements

by answering *questions* concerning

spaces of the building or constructions of the building:

for example:

1. -What are its functions? Does it serve well all the important functions that were to be considered by design?

For example in the K building:

aula

doors of the classrooms

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Or another question:

2. -Is its use safe, considering all aspects of safety? What is the rate of danger of accidents, or of getting ill by normal use, or of losing the bearing capacity (if it is a loadbearing structure)?

Concerning other examples in the K building, like:

classrooms

floor constructions

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Or :

3. -Does its outlook meet the aesthetical requirements of the present?  
(Unity of function, construction and form, colour harmony, aspects of material use, surface textures harmony, environmental harmony etc.)

Considering the examples in the K building:

aula

doors of the classrooms

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Or:

4. -Is its prize/performance rate acceptable by all participants interested in construction, use and demolition?

Examples in the K building

classrooms

stair flights

And so on...

**Most of the *safety requirements* refer to *loadbearing structures***

# Safety requirements of loadbearing structures

Safety against

Requirement

*rupture and collapse due to overloading*

***bearing capacity*** of the members of the loadbearing structure

*buckling, overturning, sliding*

***stability*** of the loadbearing structure and of all of the structural members

*corrosion or fatigue failure*

***durability*** of the structural materials:

*fire collapse*

***fire resistance*** of the structural members

**END**