



TÁMOP LECTURE NOTE TENDER

Focusing on the development of education, the development of educative materials and the training of teachers, with special attention to the fields of mathematics, natural sciences, technology in general and information technology in specific.

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FLOOR constructions

Intended for [Budapest University of Technology and Economics](#), Faculty of Architecture students as a special addition to the Building Constructions 4 subject material.

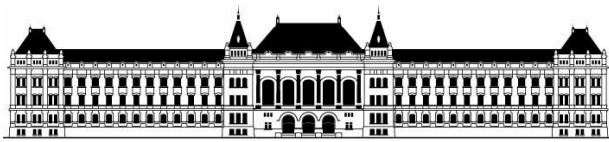
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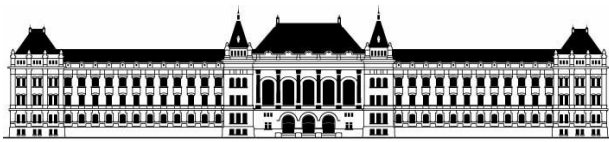
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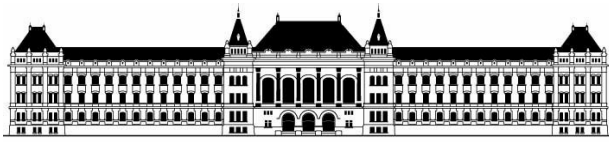
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PREFACE

The expression “floor” or “flooring” is often and widely identified as merely the very top finishing layer of the floor. As such, most consider the floor and its composition as largely an aesthetic issue. This, in turn, is itself frequently the root cause of many of the faults some of which may only be corrected by costly demolition or disassembly. As of yet, no complex and comprehensive overall technical literature is available to the Hungarian architect student or practicing professional which would detail the correlation and condition system of the floor constructions and would elaborate on the available materials and technologies. We intend to fill this gap thru the compilation of two lecture notes on “Floor constructions” and “Industrial floors”, both in the framework of the “TÁMOP lecture note tender”. The first note, entitled “Floor constructions” will cover internal, basement and general level floor compositions in residential or office type applications

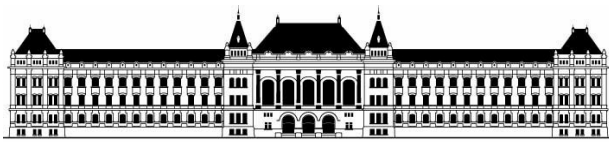
Before compiling these notes, we have performed numerous professional consultation sessions, in order to define a sound methodology for the subject. We have paid careful attention to existing lecture notes and numerous previously prepared (at our department or at other nationally or internationally written) class materials, local and foreign professional elaborations and the valid system of standards. Besides the investigation of available written materials, we have contacted the relevant national professional associations (e.g.: Burkolástechnikai Egyesület, ÉMSZ – Épületszigetelők Tetőfedők és Bádigosok Magyarországi Szövetsége) and a foundation for disabled people (Nem Adom Fel Alapítvány) while partaking in dedicated conferences and exhibitions in the subject field (e.g.: I. MAPEI Burkolástechnikai Konferencia – Comfort Szakkiállítás és Konferencia, Construma).

One of the most important and most difficult task was the definition of the technical terminology. In this aspect the technical literature showed not only confusion but also quite serious inconsistency.

In the end, we chose to organize the groups of the lecture note according to the structural composition of the floors, in order to facilitate the definition identical functional requirements and attributes for each group. The performance oriented design approach, which has been favored at the department for some time and has been developed for other structural building components as well and, was kept in mind. With this approach in the foresight, the effects-loads-requirements system was established as a backbone of the project, with the intention of establishing design guidelines that would result with properly functioning, long-lasting constructions. Afterwards we could elaborate on materials suitable for use in the various functional fields.

The note shows actually and generally used structural compositions for floors, detailing available materials according to the current state of scientific knowledge. We have, however, paid some attention to historical applications of older materials and technologies as well as to new, not yet widely used solutions. The lecture notes did not elaborate on renewal problems because, on one hand this is discussed by another subject (Building constructions 7) and on the other hand, because this would exceed the intended extent of the notes.

We recommend the notes to both students of architecture and to practicing architects. We hope that both groups will benefit from the use of the material.



I. INTRODUCTION

1. FLOOR CONSTRUCTIONS

According to the historical grouping, one may construct floors both in the interior and in the exterior.

In these notes we use the expression “floor” exclusively for floors that are prepared in the interior as:

- exterior floor constructions that are accessible to pedestrian and vehicle traffic typically are not designed by architects, but rather by garden designers, landscape architects or civil engineers
- there are different regulations dealing with exterior floorings
- structural composition and materials use for exterior floors differs greatly from floor materials and compositions in the interior.

Floor constructions may be grouped according to location: they may be built in a general level or in the bottom (basement) area where there is ground contact. Functionally they may satisfy average (e.g. residential, residential-like or office) or special (e.g. sports, agricultural, industrial, commercial) requirements. The latter group is collectively referred to as “industrial floors”.

Floors significantly define the atmosphere, aesthetic appearance and use of the enclosed space through the color, material and appearance of the surface finish. In case of multi-layer constructions, it is not appropriate to investigate the layers individually, but rather collectively, considering the overall effect.

2. GLOSSARY

Raised floor:

A floor that may be disassembled without causing damage

Anti-slip nature:

A condition of the wet floor surface material that prevents unwanted slipping of the human foot when one walks on the surface.

Wetness from intended use:

Moisture load due to the intentional use of specific wet areas or building spaces (e.g.: kitchens, bathrooms etc.)

Surface finish:

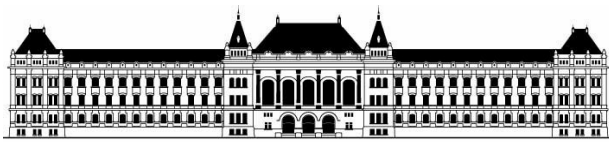
The upper, walkable, useable layer of the floor.

Floor layer structure:

A layered structure which incorporates the top layer of the floor, the finish. The layers include all materials across the slab or above the natural soil.

Assembled floor:

A floor layer structure that intentionally has free space between the base of the finish layer above and the load bearing slab structure below.



Humidity in the ground:

Water adhered to the surface of soil particles forming a film. This “bound” water will not exert hydrostatic pressure.

Waterproofing against ground humidity:

Waterproofing that protects walls and floors from capillary wetness effects from the ground.

Water vapor in the ground.

Evaporated humidity and ground water, trapped in the airspace between soil particles.

Ground water:

Unbound water that fills the free space in between soil particles exerting hydrostatic pressure on building constructions in relation to the depth of immersion.

Cavity floor:

A dual layer or assembled floor that may not be disassembled without damaging its structure.

Water from intended use:

Water effects resulting from the intended use of industrial or agricultural interior spaces or building sections (technological or machinery spaces). Sometimes chemical effects are also to be considered.

II. THE SYSTEM OF EFFECTS - LOADS - REQUIREMENTS

When selecting building construction solutions, on the basis of performance oriented design, effects and loads must be coordinated with the requirements. Only on the basis of these, may the requirement standards be set and the appropriate theoretical layer structure designated. After the theoretical layer structure selection, the specific materials may be chosen.

1. GENERAL REQUIREMENTS

The basic requirements of floor constructions are as follows:

- the use must satisfy expectations in terms of aesthetics, quality and architectural value
- they must be enduring
- the cost-value ratio must be as intended
- they must be safe during use

2. MECHANICAL REQUIREMENTS

All floor constructions must be designated in terms of their **useful load bearing capacities**, according to the expected function and use, on the basis of calculations, as seen with slab constructions. The floor structure must withstand the expected and calculated functional loads (point/concentrated or distributed) without lasting distortions. On the basis of general slab structure regulations (EuroCode), the load calculations are generally to be based on surface-type loads, with only a few spot-like or linear exceptions.



Function	Useful load (kN/m ²)
apartments, hotels rooms, hospital rooms	2,0
parking surface for passenger cars	2,5
school rooms, restaurants, reading rooms	3,0
lecture halls, theatres, movie theatres, churches, waiting rooms, retail space	4,0
museums, exhibition spaces, public building corridors, stages, dance halls, sport halls, in case of no further data: shopping areas, parking space for freight vehicles	5,0
in case of no further data: storage spaces	7,5
industrial buildings, forklift traffic	10-30
e.g.: 3,5 ton forklift	12,5

table 1. function relations to useful loads on EuroCode basis

When performing the calculations, we must consider the nature of the load, whether there are bending or shearing forces besides the compressions (e.g. floating floors).

Other important requirements:

- resistance against castor chairs
- the solidity of the walking/wear surface
- cracking free surface

3. BUILDING PHYSICS REQUIREMENTS

3.1. Comfort

The human foot's surface temperature is approximately 28-30 °C. Floors, on the basis of their surface finishes will absorb heat and the level of heat absorption may be related to the floor structure (b=

$\sqrt{(\rho \times c \times \lambda)}$). On the basis of heat absorption, we may separate three distinct groups:

- warm floors (e.g.: parquets, carpets),
- semi-warm floors (e.g.: linoleum, homogenous PVC),
- cold floors (e.g.: stone, ceramics).

For the most comfortable feeling, the floor temperature is to be as close to the human body temperature as possible. Previously, the floor heat absorption designation/verification rules were laid down in the MSZ 04-140-2:1991 national standard. We recommend the consideration of design suggestions in the standard, even if current regulations do not require this.

3.2. Heat loss



A room is comfortable for the human inhabitant, if the temperatures of the inner surfaces are maximum 2-2,5 °C lower than the average ambient air temperature. An intended floor temperature of about 18 °C may only be achieved (aside from floor heating) through the thermal insulation of ground exposed floors or of floors that are adjacent to non-heated spaces. The ground exposed floors compose the thermal envelope of the building, consequently, the complete floor area is to be thermally insulated. In all other cases a thermal simulation is recommended.

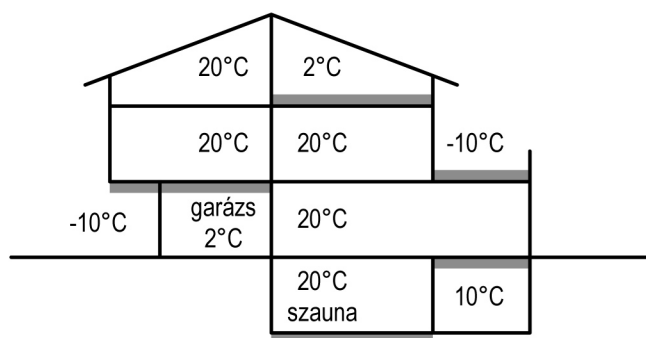


figure 1. Thermal insulation requirements of floors

On the basis of all of the above, a thermal insulation layer is to be inserted on the full surface of:

- above arches, exposed ($U=0,25 \text{ W/m}^2\text{K}$ – recommended.: $U \leq 0,20 \text{ W/m}^2\text{K}$);
- adjacent and above non-heated spaces ($U=0,50 \text{ W/m}^2\text{K}$ – recommended.: $U \leq 0,30 \text{ W/m}^2\text{K}$);
- ground exposed floor ($U=0,50 \text{ W/m}^2\text{K}$ – recommended: $U \leq 0,30 \text{ W/m}^2\text{K}$),

Furthermore, in the case of floors with built-in heating.

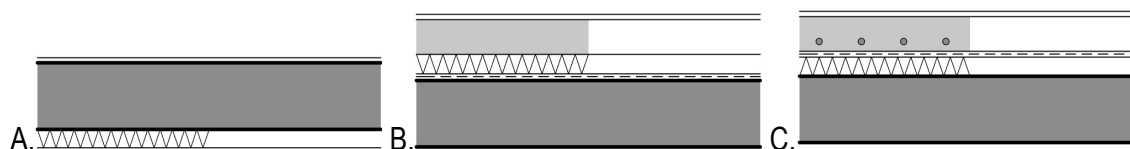


figure 2. Thermal insulation positions: under the slab (A), under subfloor (screed) (B), under heating screed (C)

3.3. Vapor loads

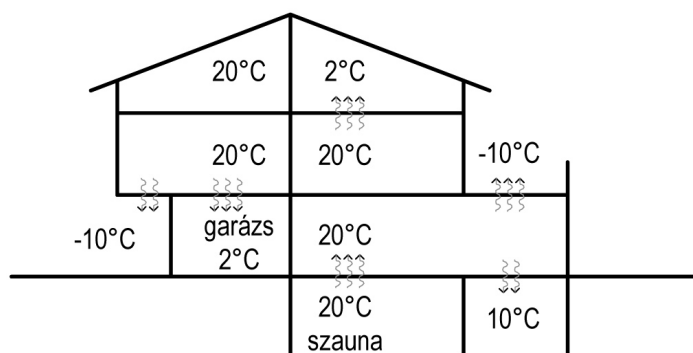


figure 3. Different ambient spaces

In between different spaces with different intended air conditions and between internal and external spaces, as a result of different air and vapor pressures, filtrating air migration and vapor diffusion may be observed (between the sauna, steam rooms, small bathrooms etc.). These effects must be considered during the design work.

3.4. Acoustics

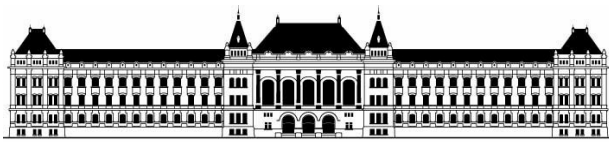
Noise loads on the floor structure:

- airborne noise,
- structure borne noise,
- vibration due to machinery,
- impact sound

Noise insulation requirements are contained in the MSZ 15601-1:2007 national standard, which lists the requirements according to function groups: residential buildings, hospitals, schools, offices, hotels. The intention of listing the noise insulation requirements is to assure adequate protection against noises from the intended use. The requirements are related to the functions in the adjacent spaces.

Space relation	R' _w + C [dB]	L' _{nw} [dB]
Slabs in multi-apartment buildings, between the apartments	51	55
Slabs of hanging corridors, balconies or terraces adjacent or above an apartment	-	55
Slabs in between apartments in a row-house	56	45
Slabs in between units in a hotel building	50	56
Slabs in between hospital units	50	56
Slabs in between classrooms	51	55
Slabs in between office units	51	55

table 2. Noise insulation requirements



The expressions $R'w$, $R'w+C$ and L'_{nw} are discussed under the subject of Building Physics.

In all cases, the full cross section of the slab structure is to be investigated. A principle when regarding slab noise insulation is that

- airborne noise insulation is to be provided thru the adequate mass of the non-layered slab
- structure borne noise is to be insulated thru the layering (floor covering) of the slab structure

There are a few theoretical variations to the structure borne noise insulation capacity of any floor structure, as shown in figure 5.

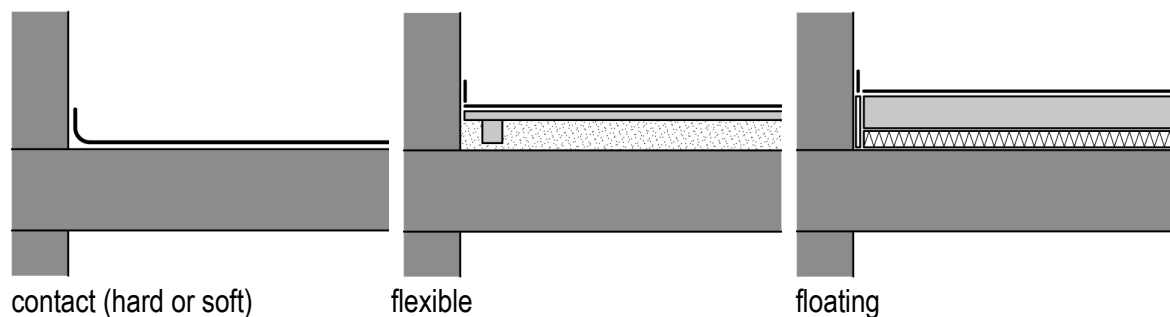


figure 4. Floor structure compositions on the basis of airborne noise insulation

On the basis of function and operation and on the basis of obtainable acoustic effects, floors may be grouped as follows. The acoustic effect of a particular group is considered as comparison to the unfinished slab, in a scaled, proposed transmission reduction amount.

$R'w$, is transmitted airborne noise reduction, $\Delta L'_{w}$: is structure borne (impact sound) noise reduction (refer to Building Physics course materials). The particular materials and their sizes must be selected on the basis of calculations that prove the satisfied requirements.

	$\Delta R'w$, dB	$\Delta L'_{w}$, dB
Hard floors (glued, mortared stone, ceramics etc.)	0	0
Soft floors (carpets, pvc surface)	0	10-30 (1)
Flexible floor (most of the dry floor screeds)	0	Max 20
Floating floors	Calculation reserve (3)	Max 40 (2)

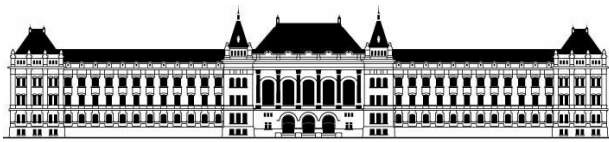
(1): depends on the material;

(2): depends on the structure;

(3): only minimal effect, to be considered only as calculation reserve.

3.5. Fire exposure

Floors may be exposed to fires in two manners:



- If the floor is exposed to fire on the upper surface, it may react in two ways: if it is flammable, the fire may spread sideways. In some cases the finish may expel highly toxic gases when ignited (e.g.: PVC emits chlorine gas when burned).
- Assembled floors, due to cavities in the structure, may burn from both below and above the finish surface.

Fire exposure processes reflect the expressed dual nature of the floors.

4. MOISTURE LOADS

4.1. Precipitation

Internal floor surfaces are not prone to precipitation loads. The only exceptions are industrial buildings and covered, open storage sheds – in these cases wind-blown rainwater may reach the surface of the floor. All other constructions are grouped in the accessible or vehicle trafficable flat roof categories.

4.2. Dampness from the ground

Floors are to be considered in terms of protection against ground dampness from two aspects:

- function
- covering material.

Complete dryness is required for spaces of constant human occupation (e.g.: apartments, offices, work spaces, hospitals, schools), for spaces where dampness sensitive the technology is operated, or sensitive materials are stored (e.g.: paper, foodstuffs, chemicals, micro-electronics). Complete dryness is only achieved – considering dampness loads – thru impregnable waterproofings.

In case of relative dryness requirements, some moisture may be transmitted by the structure, but this will not influence the generic conditions of the internal space according to its function. Furthermore the evaporated dampness may not create an unhealthy environment nor may it harm structural components.



4.3. Wetness due to functional use

4.3.1. General requirements

Water loads that arise from the intended use of the building (shower, kitchen etc.) are called “function associated waters” while “operation associated waters” are related to technologies operated within the building (industrial, laundry function, swimming pools etc.) As a consequence, primary functions that this note deals with will mainly result with function associated water loads.

The goal of the protective measures against function associated water loads is dual: the protection of the constructions as well as the protection of the surrounding spaces.

Function associated water load waterproofing performance categories are preferably defined, as shown in the table below.

Moisture load :

Moisture exposure	Protection level		
	General	Protected area	Highly protected area
Moderate	Watertight floor cover	Waterproofing covering system	Waterproofing and superstructure
Medium (with gutter)	Waterproofing covering system	Waterproofing and superstructure	Dual waterproofing
High	Waterproofing and superstructure	Dual waterproofing	Dual waterproofing

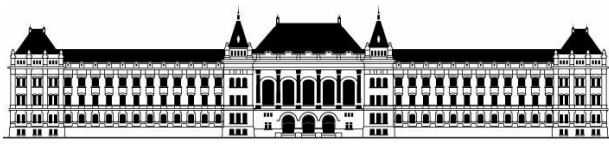
table 3. performance levels of waterproofings against “function associated waters”

4.3.2. Options for waterproofing floor constructions exposed to waters associated to functional use

A. Waterproof surface finish

We may build a waterproof surface finish, if:

- the water load is periodic and moderate
- there is no drain hole in the floor



- below is a space of equal or lesser protection level
e.g.: tea kitchen, apartment kitchen, toilet block, etc.

Waterproof finishes are:

- flexible glue fixed, and flexible gap filled (pointed - grouted) ceramic tiles
- welded-joint PVC covering
- waterproof concrete structure surface

B. Waterproofing in the layer structure

We may build a waterproof layer structure if:

- there is a floor drain, but the protection level is general;
- the water loads occur seldom, these loads are low, but the spaces underneath are used for continuous human habitation;
- the primary goal is the protection of the structure.

Waterproof layer constructions are:

- contact surfaces (covering, glue, gap fill (pointing), spread-type waterproofing, dilatation!)

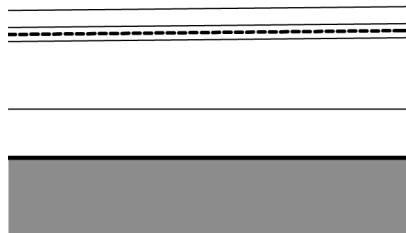


figure 5. Contact type, waterproof layer structure (theoretical disposition)

- wet area qualified, welded-joint, PVC surface finish;
- some epoxy finishes (see lectures on “industrial floors” section 5.3.2.).

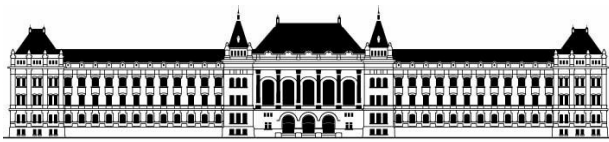
C. Waterproofing and surface finish superstructure

We may use this if:

- there is a seldom occurring, moderate water load, but with a high protection area below
- there is a seldom occurring medium water load and/or a floor drain with a protected space below
- there is a high water load above a generally protected area

This protection level is satisfied by:

- sheet-like waterproofing (typically plastics) in itself (e.g.: drinking and firefighting water storage facilities etc.)



- sheet-like waterproofing (e.g.: self-adhesive bitumen sheets, soft PVC sheets etc.) and surface finish superstructure ,

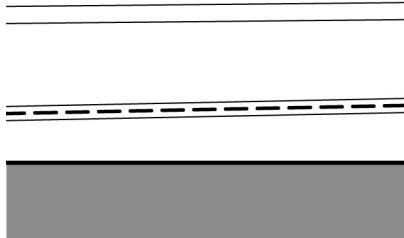


figure 6. waterproofing with surface finish superstructure

D. Dual waterproofing

Dual waterproofing means that there is both a full value sheet-like waterproofing and a surface finish superstructure with a built-in waterproofing layer in a single layer composition.

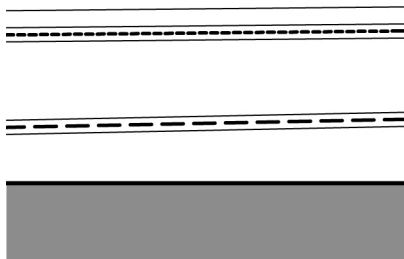


figure 7. dual waterproofing floor structure

5. PROTECTION FROM SLIPPING

Anti-slip nature is necessary for the safe and accident free use of floors, either for trafficking or for working. The anti-slip surface may never be a non-slip surface. A heightened slipping danger occurs in areas where the functional use/work results with lubricant materials soiling the floor on a constant basis. In all of these areas the liquid on the floor surface must be effectively and quickly led-off the inclined surface. The incline is preferably universal, even, and may – in order to avoid slipping due to the incline itself - not exceed 1% in intensity.

Anti-slip nature is influenced by the surface of the finish material:

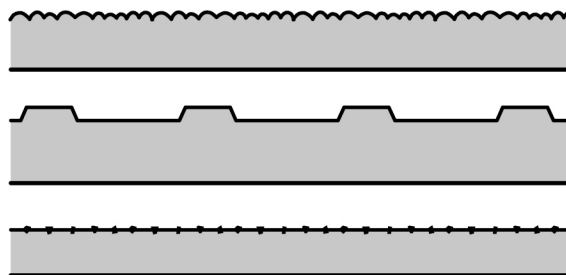


figure 8. Variations in the non-slip nature of the surface materials
(rugged and profiled surfaces, special particle additives in the upper material)

There are multiple internationally recognized anti-slip nature categorizations.

Position	SRT class	Ramp / incline classification
external arcades and walkways	T4 (good)	R10
external ramps	T5 (very good)	R11
Hotel entrance corridor, office and public buildings (wet)	T3 (medium)	R10
Hotel entrance corridor, office and public buildings (dry)	T1 (very weak)	R9
Shopping malls with the exeption of food consumption areas	T1 (very weak)	R9
Shopping malls, food consumption areas, food exposed areas	T3 (medium)	R9
internal ramps, inclines (dry)	T2 (weak)	R9
Communal changing rooms	T3 (medium)	A
Pool and shower areas	T4 (good)	B
Office, hotel and shopping mall toilets	T3 (medium)	R10
Internal stairs edges (dry)	T3 (medium)	R10
Internal stairs edges (wet)	T4 (good)	R11
living area, kitchen	T2 (weak)	R9
living area, bathroom and toilets	T2 (weak)	A
Foyer	T1 (very weak)	A
Terrace -covered	T2 (weak)	R10
Terrace-open	T2 (weak)	R9

table 4. anti-slip level values for certain selected areas (ÉMI – Terjék)

6. OTHER REQUIREMENTS

6.1. Climatics



Climatic requirements are typically defined for industrial applications. Residential, residential-like and office applications are mostly investigated from a heat balance perspective (e.g.: machinery, sauna) and as a result, mostly heat migration is the relevant load on the structure. (For elaboration see “Industrial Floors” section 2.2.3.)

6.2. Protection against fire

Floor surface and assembled floor fire protection requirements may be divided into two relevant groups: constructions used in the general- and in the escape route areas. Naturally, constructions used in the escape route areas are to have much better fire resistance qualities.

	Structure	N=1	1<N≤3	3<N≤5*	5<N≤11**	N>11
I.	Floor surface in the escape route area	B _{fi} -s1	B _{fi} -s1	B _{fi} -s1	A1 _{fi} ²	A1 _{fi} ²
	Raised floor structure in the escape route	A2 REI 30	A1 REI 45	A1 REI 60	A1 REI 60	A1 REI 90
	Floor surface in the general area	D _{fi} -s1	D _{fi} -s1	D _{fi} -s1	D _{fi} -s1	D _{fi} -s1
	Raised floor constructions in the general area	B REI 15	B REI 15	A2 REI 15	A2 REI 30	A1 REI 30
II.	Floor surface in the escape route area	B _{fi} -s1	B _{fi} -s1	B _{fi} -s1	B _{fi} -s1	
	Raised floor structure in the escape route	A2 REI 30	A2 REI 30	A2 REI 45	A1 REI 60	
	Floor surface in the general area	D _{fi} -s1	D _{fi} -s1	D _{fi} -s1	D _{fi} -s1	
	Raised floor constructions in the general area	B REI 15	B REI 15	A2 REI 15	2 REI 30	
III.	Floor surface in the escape route area	C _{fi} -s2	C _{fi} -s1	C _{fi} -s1		
	Raised floor structure in the escape route	B C REI 15	B REI 30	A2 REI 30		
	Floor surface in the general area	D _{fi} -s2	D _{fi} -s1 s2	C _{fi} -s2		
	Raised floor constructions in the general area	D REI 15	D REI 15	C REI 15		
IV.	Floor surface in the escape route area	C _{fi} -s2	C _{fi} -s1			
	Raised floor structure in the escape route	C REI 15	C REI 15			
	Floor surface in the general area	E	D-s2			
	Raised floor constructions in the general area	D REI 15	D REI 15			
V.	Floor surface in the escape route area	D _{fi} -s1				
	Raised floor structure in the escape route	D REI 15				



	Floor surface in the general area	E_{fl}				
	Raised floor constructions in the general area	D -				

Notes:

² in case of automatic fire signal and extinguishing systems, B_{fl}-s1 fire protection category products may also be used.

table 5. fire protection standards for floor surface finishes and assembled floors

6.3. Chemical effects

Requirements related to chemical effects are typically associated with industrial building applications. Floor surfaces in the functions discussed here are exposed to chemicals mainly during cleaning, moisture resistance and chemical compatibility must be considered. (For more detail see "Industrial Floors" section 2.2.4.)

6.4. Electrical requirements

Electrical effects are mostly relevant in the case of other building functions. (For more detail see "Industrial Floors" section 2.2.5.)

6.5. Dimensional requirements

Basic requirements posed against floor coverings are:

- dimensional regularity,
- constant volume,
- resistance to lasing deformity,
- levelness or prescribed inclination,
- smoothness,
- lacking horizontal graduality,
- continuity,
- having no cracks in the surface,
- non-dusting nature.

6.6. Building machinery lines in the floor structure

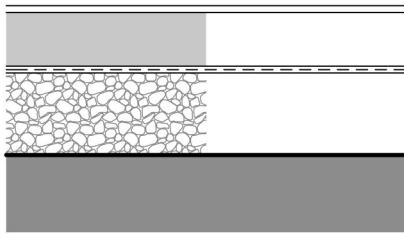
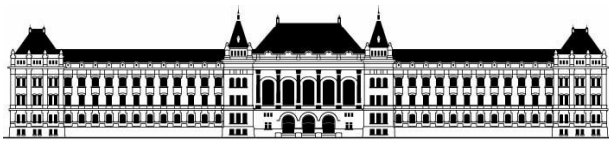


figure 9. fill, intended for the accommodation of building machinery lines

Floor structure disposition is greatly influenced by layer integrate, built-in building machinery- or electrical lines. The position and the potential crossing of the lines are to be consciously selected during the design phase. It is not permissible to lead pipes or other lines in the floated concrete layer, for this purpose the insulation or a dedicated fill layer is to be utilized. In some cases an assembled raised floor may be the appropriate solution.

6.7. Construction related requirements

When designing/constructing floor constructions the following must be considered:

- ease of construction
- least necessary upkeep or renewal periods, when necessary these should be performed with the least possible disturbance,
- gap formation, lack of gaps if possible.

The fixation method of the floor covering will define the requirements on and the type of the subfloor. According to laying, we distinguish the following floor types:

- glued (e.g.: mortar laid, glued)
- nailed
- unfixed (loose laid) and
- stretched.

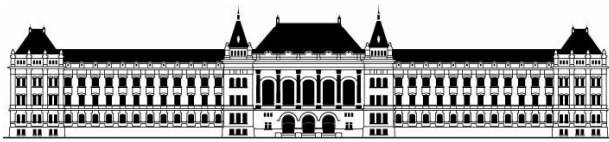
6.8. Handicap access

A handicap access friendly environment supposes that both healthy (e.g. with baby carts), temporary incapacitated (e.g. accident or illness related), permanently handicapped (wheelchair using, physically limited capacity) or otherwise challenged (blind, limited vision etc.) people may use the spaces in an equal, independent manner, with as little required outside help as possible.

6.9. Upkeep related requirements

When considering upkeep issues, the most relevant aspect is the ease of manipulation, cleaning and in some cases sanitization. It is important, that the cleaning materials are to be compatible with the materials of the surfaces, there must be no apparent discoloration or other damages. The surfaces are to be kept in a dust-free, anti-allergenic state.

III. THE COMPOSITION OF FLOOR CONSTRUCTIONS



1. Structural composition

The floor structure is a multi-layer construction where the layers may be combined, left out or may satisfy multiple requirements.

The typical layers of the floor structure are:

- upper walkable (useful) or finish layer,
- the base of the finish layer.

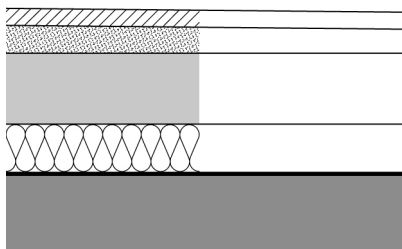


figure 10. a schematic floor layer structure

Additional layers are placed on the basis of construction, location, requirements etc.:

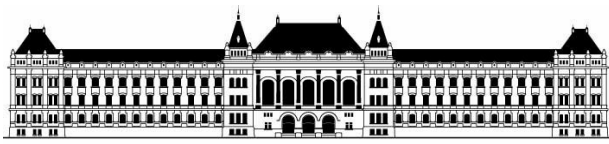
- load bearing structure
- mortar or glue,
- leveling layer
- surface priming layer
- inclination layer
- heat or sound insulation layer
- waterproofing layer
- vapor insulation layer etc.

2. SUBFLOORS

We call “subfloor” the foundation of the surface finish of the floor constructions.

The requirements on the base of the floors are:

- an adequately rigid and thick layer, i.e. a layer that will not experience lasting deformation when exposed to the useful loads of the floor;
- cracks are not allowed
- must resist wearing,
- must resist impacts,
- must be able to carry the intended loads,
- should not absorb more moisture than intended,
- must not deform when exposed to humidity,



- must be adequately level, or in the intended incline

Floor base types are:

- the load bearing structure (e.g.: general level slab)
- floor slab (e.g.: basement slab)
- concrete subfloor
- floor screed
- dry screeds

2.1. Variations to the base construction

Other than using the load bearing structure as base, or constructing an assembled floor, there are three major types of floor bases in practical use:

- adhesive base – foundation screed, estrich;
- slipping base – floor slabs, foundation screed, estrich;
- floating base– floor slabs, foundation screed, estrich, dry estrich foundation.

2.1.1. Adhesive base

Adhesive bases are constructed directly onto the load bearing constructions in a force transmitting nature. The connection is full surface, “adhesive” contact. The solution is mostly used in case of great loads and/or when an exact level is to be kept between a variation of layers.



figure 11. Adhesive base

Adhesive bases may be constructed upon intermediate slabs and basement slabs, but only when the construction-related motions or cracking (contractions etc.) have ceased.

2.1.2. Slipping base

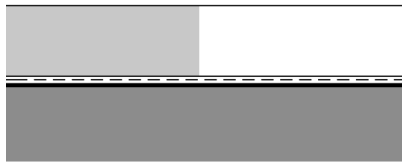
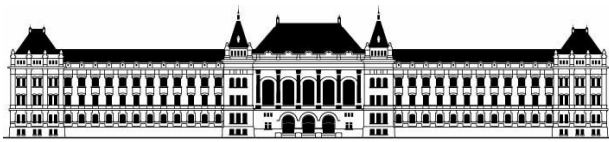


figure 12. Slipping base

In case of a slipping base, the base itself is laid upon a separation/sliding layer, thus the base will not adhere to the underlying structure. As a result, under certain conditions, bending forces may occur in the base layer. Sliding bases are used when the structural foundation (slab) is soiled (e.g. oil stains), the transfer of the loads is not economical or there must be an inserted a vapor barrier layer.

2.1.3. Floating base

In case of a floating base, the load bearing structure is separated from the base of the floor by a heat and/or noise insulation layer. The base will move in absolute independence from the underlying load bearing structure. Due to the elastic floatation layer, there may be considerable bending forces in the base layer. As a result, these bases are designed and calculated as free floating slab constructions.

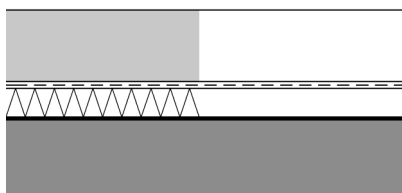


figure 13. Floating base

It is important, that the floatation layer material is to be selected according to the maximum expected load (compressive strength, resistance to compression). When the base is of a screed or estrich type, the bases - practically in all cases - are reinforced with steel meshes or fibrous additives.

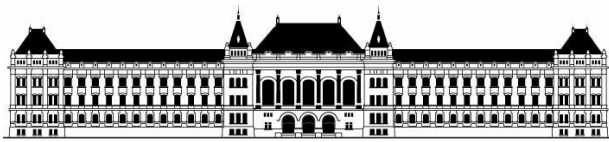
When building a floating floor, it is necessary to define the goal of the floatation: heat and/or structure borne noise insulation. "Traditional" floatation materials (sheet products) will function as heat insulators, but in general, the thermal insulation layer will not function as a structure borne noise insulator.

In case of floating floors, the thermal insulation is located under the base layer of the floor. This is typical in the following situations:

- heated floors (heated concrete),
- floors against the ground,
- in case of accessible attic slabs.

The thickness of the thermal insulation must be calculated according to the function. When a structure borne noise insulator is used, a part of the thermal insulation task may be performed by the noise insulation layer.

A. Improving structure borne noise insulation thru floating



The improvement of structure borne noise insulation may be described with the reduction of transmitted noise levels (the higher the value, the better the sound insulation quality): $\Delta L_w = L_{nw1} - L_{nw2}$

The phenomenon is explained by the spring-and-weight behavior of the layer structure. The floated base and any useful loads upon it (e.g. furniture) behave as the weight and the floatation material acts as the spring.

The floated structure will reduce airborne noise only by about 3-5 dB, but it will give the necessary structural noise insulation for any kind of surface finish. The reduction value for structural sound is about 19-35 dB, depending on the quality and thickness of the floated base.

The floatation layer selection is influenced by:

- functions above the protected space;
- the relative position of the spaces;
- the theoretical structural loads in the space under investigation;
- the type of operated machinery (when applicable).

The floatation material is described by the following qualities:

- dynamical stiffness (s_d)
- compressibility (CP).

The floatation material is to be laid continuously and without gaps. Building machinery lines, pipes or other lines are not to be placed into the floatation material without proper protective casing. If the placing of such lines above the slab is unavoidable, then the proper solution is to create a dedicated assembly layer above the slab (see section II.6.6.). The floatation layer is to be protected by a continuous sheet of technological insulation, that prevents cement seepage thru the material. In all other cases the seeping cement mixture may solidify into unwanted cement spikes that effectively transmit noise.

B. Heated base,

When heated floors are constructed, the base of the floor is not only a load bearing / weight distribution element, but also a heat storage / dissipation layer. The latter qualities are also improved by steel meshing. We prevent unwanted heat loss towards the space below, thru the insertion of thermal insulation materials. For the appropriate designation, we must understand the type of heating used, as follows:

- electrical: typically directly below the finish;
- hot water type:
 - the heating lines may be located directly above the technological insulation (e.g. tied onto the steel mesh);
 - within the base with some kind of elevation method;
 - using plastic or polystyrene forms;
 - placed into the thermal / sound insulation layer, typically in a sheet-like metal form.

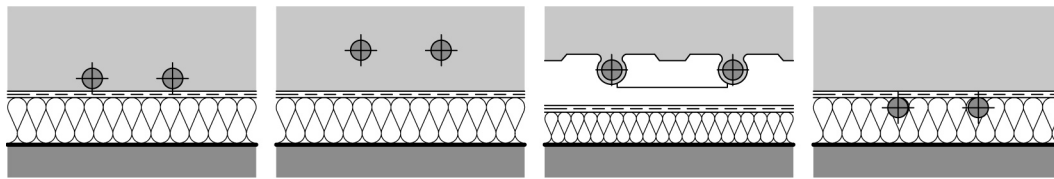
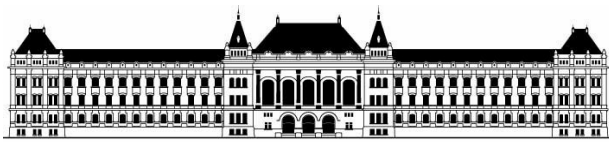


figure 14. Variations to the placement of hot water floor heating lines relative to the floor base

With the exception of the polystyrene form elements, the acoustic insulation will also behave as the thermal insulation. In case of a polystyrene form element, the thermal insulation is the element itself, while if structure borne sound insulation is a requirement, the insertion of an additional sound insulation layer is required.

2.2. Base types

2.2.1. Load bearing structure

The base of the surface finish may simply be the load bearing structure. In this case, contact floors are typical.

The load bearing structure may be:

- generic slab between the levels,
- foundation constructions (slab foundation, counter slab, weigh-down slab).

2.2.2. Floor slab

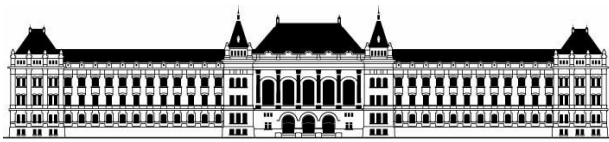
The floor slab is not a load bearing structure, it is purposely removed from the structural system. Floor slabs are used for great statical and/or dynamical loads, i.e. mostly in industrial and retail functions and in halls. For a detailed description, refer to "Industrial Floors" section 3.2.

2.2.3. Concrete base

There is no universal standpoint on the distinction of estrich and concrete bases. According to our opinion, concrete bases are constructed from a mixture of cement as a binding material, with the addition of water, aggregates (typically sand-gravel mixture or ground stone) and sometimes chemical additives. The mixture will reach its final rigidity after complete solidification.

The minimum thickness of the concrete base is 5 cm. Due to drying and consequent shrinking and cracking during the solidification process, it is necessary to reinforce the base with a steel reinforcement mesh. The mesh will prevent the opening of the cracks and thus the uniform surface of the base is retained.

2.2.4. Floor screed type bases



The international standard on estrichs and the currently prepared national estrich standard defines estrichs as single or multi-layer mortars which is poured on site in a thickness of 2-80 mm, in order to

- reach a pre-defined floor level,
- give a properly prepared base surface for the finish layer,
- to serve as a wear-off layer.

Amongst the traditional mortar types we will not find one that is categorized as “base mortar”, so the use of the expression “mortar” is not the most fortunate. According to the current terminology, we do distinguish base leveling layers (see section III.3.) so a layer that is less than 20 mm in thickness will not be discussed as an “estrich” layer.

Based on all of the above, in these notes we will call “estrich” all floor base layers that have a thickness of 20-80 mm, which have the mixture composition of: binding material, water, aggregates (e.g. 0-8 mm sand, finely ground stone or fine gravel) and in certain cases chemical additives and that will reach its final structural strength after complete solidification. Estrichs may be used both as a floor foundations or as stand-alone surface finishes.

Estrichs may be grouped according to the location of their preparation:

- regular:
- factory premix:

Estrichs may be grouped according to the binding material:

- cement estrich
- gypsum or anhydrite estrich, magnesium estrich
- poured asphalt estrich or rolled asphalt
- epoxy based estrich

Estrichs may be built as:

- adhesive estrich:
- slipping estrich:
- floating estrich:

2.2.5. Dry base

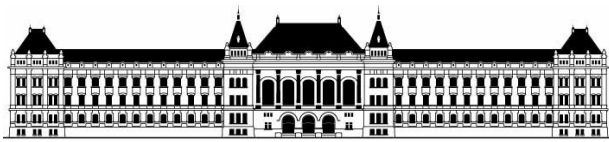
Dry base may be built without utilizing wet technologies thru the laying of building sheets on the applicable foundation. The result is a continuous, load bearing surface which is typically used when there is not enough space for the layer or when the load bearing slab is not strong enough to carry other layers. Dry bases may be covered with a surface finish within 24-48 of their completion.

A dry base may be prepared out of

- building sheets
- thermal insulating building sheets;
- Raised floors with steel support legs, assembled ready-made finish covers or metal sheet floorings.

Any kind of warm or semi warm finish may be applied onto the dry base. When glued ceramic tiles are used, the size may not exceed 60x60 cm. The dry base is usually floated.

2.3. Base dilatation



Bases must be constructed with gaps, for the habitation of movements that result from various forces on the base. Gaps allow structural movements (different sinking or setting) and/or expansion movements (thermal expansions) and movements between buildings or building sections. The location of the designated building dilatation gaps is a structural engineering issue. The dilatation gap will cross all building components, at the same location, with a dedicated dilatation profile in the surface finish.

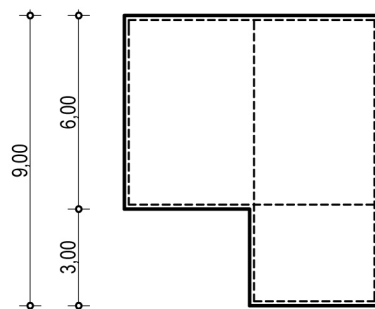


figure 15. base expansion gap locations, when floor heating is used

Professional rules apply calculations that start off with values for the heated floor. When floor heating is used, the base must be built with expansion gaps if

- the space area exceeds 40 m²;
- the side ratios exceed 1:3
- one of the sides is longer than 8 m

The expansion zones are preferably rectangular in shape. Floor heating circulation must not intersect the expansion zones.

3. BASE LEVELING, FOUNDATIONS

The finish is to be laid onto a base leveling surface that will :

- provide an adequately flat, properly inclined surface;
- will cover any non-intended gaps,
- will provide horizontal smoothness (will be in plane),

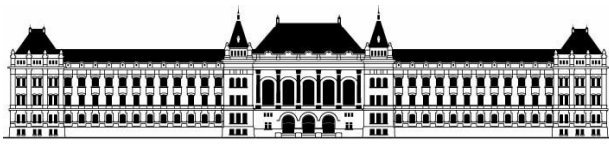
This will ensure that the final finish will withstand the intended loads and that increasingly thin finishes could also be glued onto the base. Floor leveling is to be at least 2mm in thickness.

Before performing the finishing work, the base surface is preferably treated with a priming layer, in order to:

- adhere dust,
- reduce infiltration,
- reinforce the surface,
- to create an adhesion bridge.

4. REGULAR FLOOR FINISHES

Floor finishes may be grouped according to:



- raw material:
 - organic (wood, cork, plastic, etc.),
 - inorganic (stone, concrete, artificial stone etc.);
 - natural (wood, cork, stone, etc.),
 - artificial (artificial stone, artificial rubber, metal etc.);
- according to material:
 - wood, cork, stone, artificial stone, concrete, ceramics, plastics, artificial rubber, textile, metals etc.,
- manufacturing:
 - elemental,
 - rolled,
 - applied;
- according to human foot the heat absorption level (see section II.3.1.).

Finishes may - according to the function and the intensity of use - be categorized into different resistance category groups.

4.1. Cold floors

Cold floors (see section II.3.1.) may be built as:

- monolithic – homogenous or single layer finishes,
- assembled element finishes.

4.1.1. Monolithic floor (site made concrete)

Although this solution has lately become popular for both residential and office applications, originally it was used for industrial applications. The floor type is investigated in detail in the “Industrial floors” notes, under section 4.1.

The expression “monolithic floor” encompasses a great number of solutions, amongst these are:

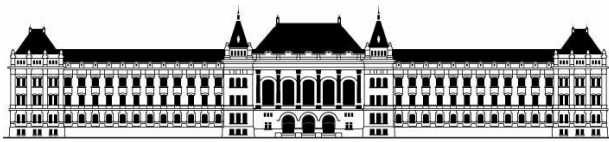
- surface leveled concrete floors
- colored concrete floors
- cement treated floor finishes
- magnesite floors
- asphalt floors
- Terazzo floors
- epoxy floors

4.1.2. Elemental cold floor finish

A., Natural stone tiles

B. Artificial tiles

B1. Artificial stone



- B2. Terazzo (mosaic tile)
- B3. Pressed-ground granite tile (stone porcelain)
- B4. Clay based tiles
 - B4.1. Brick-type finishes
 - B4.2. Clinker finish
 - B4.3. Stone-clay (Mettlach) finish
 - B4.4. Ceramit finish
- B5. Ceramics

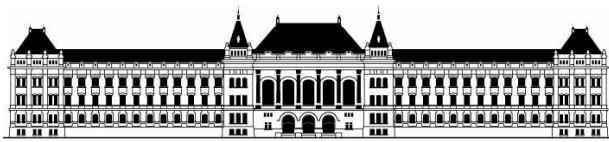
4.1.3. The laying of elemental cold floors

Elemental cold floor laying is defined by the thickness of the tile, the water absorption quality and the loads on the finish surface. The tiles may be laid in an extravagant variety of patterns: grid work, binding, strip, weaved or many other kinds.

Laying may be:

- into sand: only in areas where ease of cleaning and hygienics are not a primary concern – typically at outside areas. the thickness of the tiles is to be selected according to the base type;
- into a „mortar base”: previously a very popular method, however, due to its lime content the use of lime mortar is to be avoided in the base;
- into glue
 - thin layer: appr. 3-5 mm thick
 - medium thickness: appr. 5-7 mm
- in case of heated floors, wet areas, waterproofing, we always use flexible glue
- flowing glue: appr. 3 mm
- thick layer: at least 3,5 cm thick, earth-damp mixture of cement and sand
- vibro-ceramics: this laying is used for industrial floors, consequentially we explain the method in the “Industrial floors” notes, under section 4.2.2.;
- gluing onto a base that is thin, but with great expansion qualities: e.g. steel elevator floors, stairs, thin bases – typically polyurethane type glues.

When placing ceramic tiles into glue or mortar base on the ground level, the floor structure is to be protected against dampness from the ground.



4.2. Semi-warm floors

Semi-warm floors (see section II.3.1.) may be according to material:

- linoleum,
- PVC,
- rubber,

according to element size

- roll,
- cut to tiles,

according to construction:

- without liner,
- soft (with liner).

4.2.1. Linoleum finish

Linoleum (or lino for short) is manufactured thru the mixing of linseed-oil, pine resin, cork finely ground wood, limestone powder and natural colorings. The material is then pressed onto some kind of fabric mesh (typically linen) in one or two layer. The final product is surface treated.

Linoleum may be utilized under a great variety of conditions (in public buildings, nurseries, schools, hospitals, other care institutions, in the living room, child room, in the kitchen etc.) with the exception of wet areas.

4.2.2. PVC finish

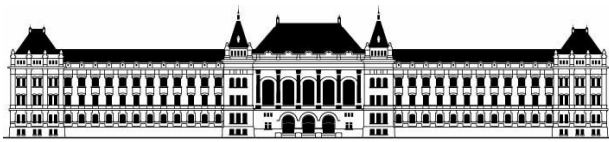
PVC finish contains polyvinyl-chloride as binding material, mineral fill material, softener, solvent, colorings and anti-slip additives.

4.2.3. Rubber finish

Rubber finish contains industrial and natural rubbers as base, with mineral fills and natural colorings. After cooking the mass is formed into sheets on a calander. Subsequently, the rough base is covered with a hard, solid, elastic vulcanized upper layer.

4.2.4. The laying of semi-warm floors

Semi warm floors are typically of a thin nature, as a result, they are prone to base irregularities. To avoid this, base leveling is to be applied in all cases.



Both rolls and tiles are glued on the full surface. Since the glue has a high vapor barrier quality, when constructed on the ground level, the semi-warm floor is to be laid onto a base that is protected from ground humidity.

The continuity of the finishes is assured with “welding strips”, but rubber finishes may be connected only with gluing alone, anyways, as material homogenous connection could not be achieved.

4.3. Warm floors

Warm floors (see section II.3.1.) may be further divided into the following groups:

- carpet floors
- wooden floors
- cork floors.

4.3.1. Carpet floors

Types:

according to manufacturing:

- tufted:
 - cut pile (velour)
 - closed end
- woven
- needle felt

according to material

- most abundant: polyamide
- wool
- polypropylene or
- mixture (e.g.: 80/20% wool/polyamide).

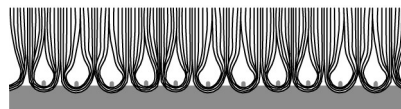


figure 16.

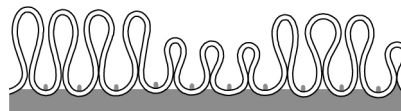
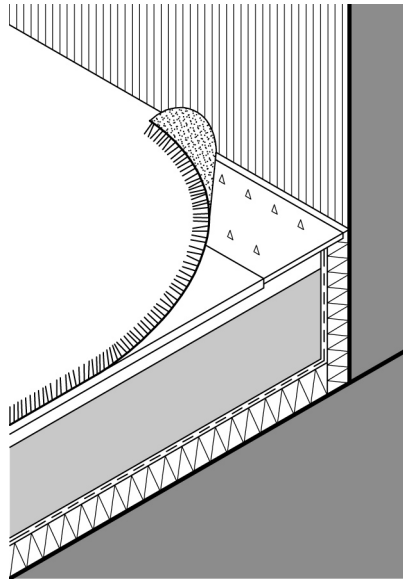
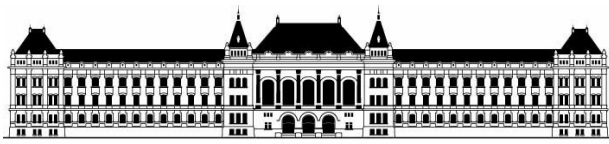


figure 17.

Carpets may be laid:

- when rolled and onto a small area: simply laid loosely;
- glued on the whole surface (when using cut carpet tiles: always);



- stretching;
- in spaces where variability, change of function is a concern: with removable glue.

4.3.2. Wooden floors

Wooden floors may be categorized according to:

- material,
- surface treatment:
 - raw, un-lacquered (plank floor, Swedish floor, parquet, blade floor, etc.) or,
 - lacquered (e.g.: ready floors),
- size,
- layer composition.

According to layer composition we distinguish:

- single layer solid (plank, Swedish, batten, and industrial floors, etc.),
- multi-layer (pl.: strip and laminated floors, etc.).

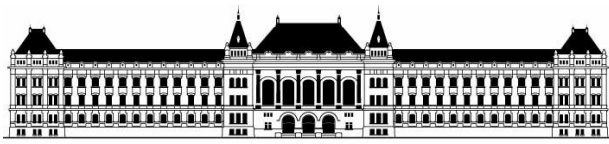
Some disadvantageous traits of wooden floors:

- sensitivity to moisture content changes
- prone to fungal diseases, especially in damp conditions or when the material is not dried appropriately
- when the elements are joined with an unintended gap: “dust effect”.

Some advantageous traits of wooden floors:

- natural
- gives a warm feeling,

According to the method of laying we distinguish (see section III.4.3.4.):



- battened – nailed (e.g.: plank floor, Swedish floor, parquet floor),
- glued (e.g.: parquet, laminated floor),
- loose laid (e.g.: laminated floor, plank parquet floor).

A. Plank floor

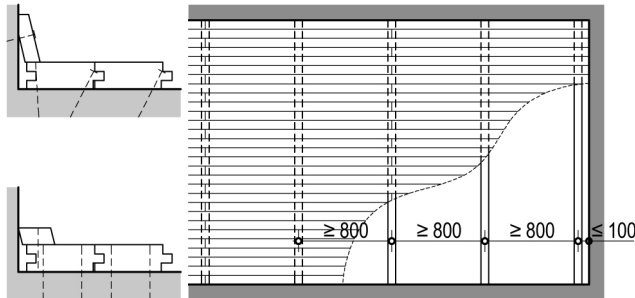


figure 19. the laying of plank floors

The plank floor is simply an evolved min. 24 mm thick plank floor. The material is planed on the top surface, 20-22 mm thick, (80-)120(-150) mm wide softwood (pine) with grooved connections. The elements are laid in a bind and nailed to the battens with either visible or non-visible nails. Typical to low use intensity spaces.

B. Swedish floor

A more aesthetic version of the plank floor, a version that pleases the eye. The material here is 22 mm thick, 50-80 mm wide, 1000 mm long, tongue and groove connected, paned redwood. The elements are nailed in a bind to the battens with non-visible nailing.

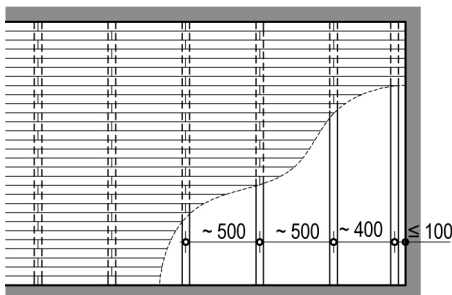


figure 20. the laying of Swedish floors

C. Parquet floor (rod– or tongue and groove parquet floor)

Material: 17-19-22 mm thick, 43-73 mm wide, 90-505 mm long, tongue and groove oak battens which are made as either right or left oriented. The elements are nailed with non-visible nailing to a thinly laid blind floor that is, in turn, nailed to the battens. An alternative is direct gluing to the base. A nice, lasting finish that may be easily and multiply renewed.

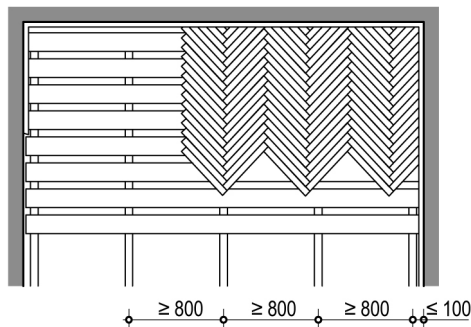
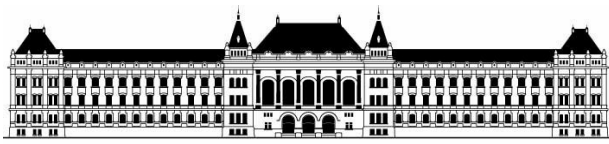


figure 21. Parquet floor on a battened blind floor

D. Tabular parquet floor

An ambitious and architecturally prestigious version of the Raised floor nailed parquet floor. Typically manufactured in a pre-designed groove pattern with a decorative surface (possibly artistic) onto rectangular element. The elements (tablets) are 400-600 mm wide with a 22 mm wood base onto which the color and shape alternating, 8 mm thick hardwood patterns are glued. The sides of the tablets are grooved, the connection is usually made with a slat, the nailing is non-visible.

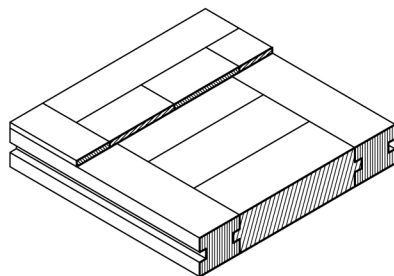
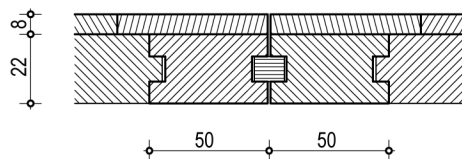


figure 22. Tablet of the tabular parquet floor

E. Mosaic parquet floor

The material is 8-10 mm thick, 20-25 mm wide, 107-150 mm long, typically oak or ash slats, with butt joints which are glued onto a net or paper base in a rectangular pattern. The rectangles are appr. 214-480 mm in width. The individual rectangles are typically laid in a checkerboard pattern into full surface glue.

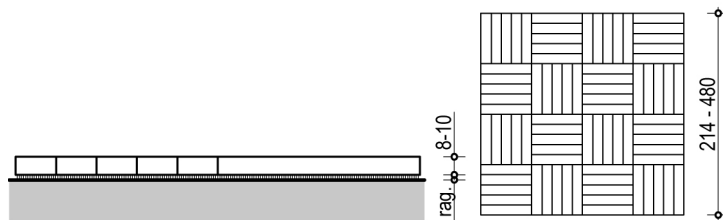
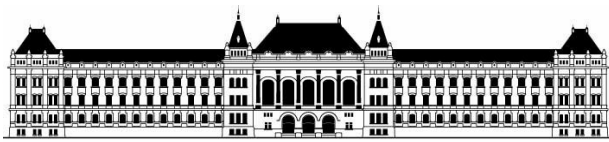


figure 23. Mosaic parquet floor

F. Industrial parquet floors (side oriented, or side oriented batched parquet floors)

The by-product of the mosaic parquet floor manufacturing utilized for industrial floors. The wood is laid onto its side, the elements are 8-35 mm high, 6-10 mm thick and 115-325 mm long. Due to its endurance, lifespan, resistance, varied and aesthetic appearance the industrial parquet floor may be used not only in residential, but also in public, school, retail or even industrial areas. It may be easily and multiply renewed, and can be sanded in the full cross-section. Only full surface gluing is used.

G. Lamella floor

Lamella floors are made of 10 mm thick, 40-55 mm wide and 150-400 mm long hardwood strips. The elements are butt joined and can only be glued.

H. Ready-made floors

The expression is a collective term for differently manufactured, typically multi-layer wood parquet floor products sold with a final finish surface. The elements usually may be laid in a traditional manner with hidden nailing onto a Raised floor, or alternatively, when the elements are at least of 10 mm in thickness, into glue. Lately ready-made floors are manufactured with “click” type (self-closing) joints that will not only connect, but also permanently fix the elements to each other, without the use of glue.

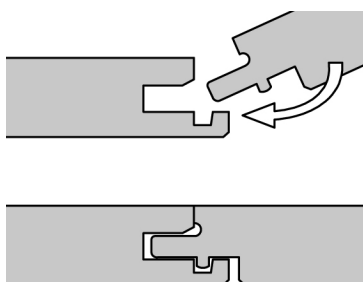
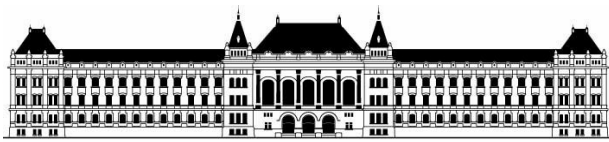


figure 24. self-closing “click” type connection

H1. Panel, or two-layer parquet floor

The flooring element is made of two layers: the under layer with a variation of top thin wear layers, both are made of wood. The elements are tongue and groove connected, the finish is factory made multiple layer lacquer. The backsides are also grooved, to allow for the twisting of the material.

Typical dimensions:	top layer	3,5-5 mm
	total thickness:	10-13 mm
	width:	appr. 70 mm, max. 90-120 mm



length appr. 490 mm, max. 1000-1200 mm

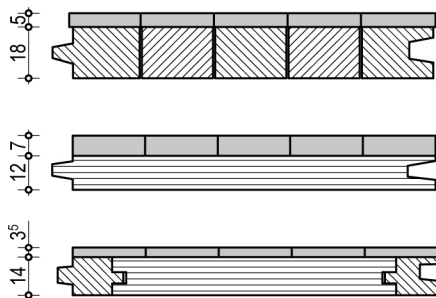


figure 25. Panel parquet floor composition

H2. Plank parquet floor

Plank parquet floors are manufactured from three, perpendicularly oriented wood layers. The middle layer is typically made of pine chips, while the top layer is typically hardwood. There are some veneer finish plank parquet floors, but these cannot be sanded due to their thin top layer. Plank parquets are increasingly sold in a tabular format, where several planks are already joined in the factory (tabular parquet floors).

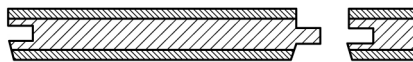


figure 26. Plank parquet floor composition

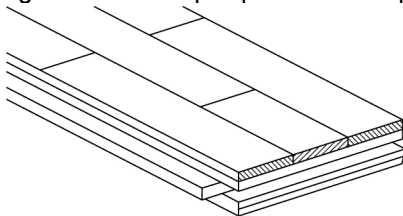


figure 27. Tabular plank parquet floor

The elements are tongue and groove connected and finished with multiple factory lacquering.

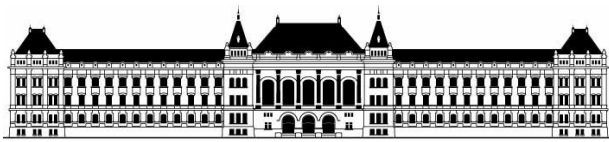
Typical plank dimensions:	top layer	2,5-6 mm
	total thickness:	8-22 mm
	width:	cca. 180-200 mm
	length:	cca. 1000-2500 mm

H3. Laminated floors

The more simple, inexpensive version of the plank parquet. There are more layers in the laminated floor, the middle and bottom layer is usually woodchip, while the outer hard surface is a melamine-resin saturated, multi-layer paper composition, onto which the actual pattern of the floor is printed.

The thickness of the laminates is appr.6-12 mm.

Laminated floors cannot be applied in wet areas, but their standardized versions may be used on top of heated floors.



4.3.3. Cork floors

Cork may be used to manufacture tabular floor elements of at least 3 mm thickness. The typical composition is one or two layers of natural or colored ground corkwood mixed with adhesive. The two layers are glued together, the finish may be natural or lacquered. The tabular elements are glued to the base. Some products may be used with heated floors. Cork floors are also manufactured in a solid plank floor manner, in this case the elements are 10-12 mm thick.

4.3.4. The laying of wood and cork based floors

Wood floors are prone to wetness and will expand when wet. Biological corrosion and mildew will also occur. As a result, floors directly laid upon the soil are to be protected from wetness thru the insertion a full value waterproofing layer. All bases are to be considered for water content. In order to avoid damages resulting from movements due to humidity changes, in case of wooden floor coverings, a 10 mm gap is to be kept at all of the edges of connecting constructions, irrespective of the laying method.

A. Traditional batten based floors

All floors with a batten base belong to the flexible floor group (see section IV.1.3.). The 70/50 mm battens are normally laid into a dry sand fill in a flexible manner. The distance between the batten center lines is determined by the floor that is laid upon the battens. With the development of slabs with plane upper surfaces, the battens are lately laid on flexible, soft, sound absorbent bases in order to avoid the reverberation of the finish. To avoid dusting, it is recommended to use technological insulations.

When Raised floors are built under parquet floors, the battens are covered by planks that are nailed to the wood, in a manner that allowed the planks to rest on at least three battens. The upper finish is nailed to the planks or to the battens directly.

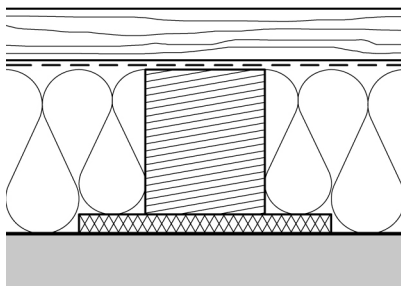


figure 28. a batten in a wood floor finish

B. The gluing of wood based floor materials



Wooden finishes were traditionally glued on the whole surface to the base with either hot bitumen (this has disappeared completely) or with cold, bitumen based adhesives. Nowadays one may select from a variety of glue types appropriate for the selected finish material: water based acrylic, alcohol solvent, silicone or polyurethane based adhesives. The wood finishes are either glued on the whole surface, or only partially.

C. The unbound laying of wood based floor materials

Ready-made floors may be laid loosely onto the base, in other words, no nailing or gluing is required. The reason for this is that the elements are either connected in a nut and tongue manner with gluing or lately with a “click” self-closing method. The result is a large plane surface that acts as an individually intact disk. In these cases a flexible under layer is applied below the surface, traditionally this was a few mm thick industrial felt, lately this means polyethylene foam. The fashionable solution that suggests the laying of a vapor barrier layer underneath the loosely laid ready floor is not recommendable. The fashion is the result of the need to quickly lay the floor onto a base that is not adequately dry, thus the need to protect the finish and lessen construction time.

IV. DESIGNING FLOOR CONSTRUCTIONS

1. Floor structure construction options

Floor constructions may be constructed according to the following principles, based on the comparison of loads and requirements:

- contact floors
- sliding floors
- flexible floors
- floating floors.

1.1. Contact floors

The finish is constructed directly on the load bearing slab, floor slab or adhesive base (see section III.2.1.1.) This is the least thick construction method.

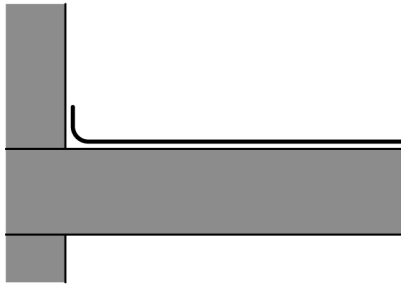
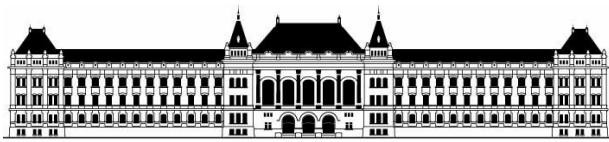


figure 29. The theoretical scheme of a contact floor

We may construct contact floors if the base has ceased all shrinking movements and when the cracking and other dimensional changes are finished and there is no thermal or noise insulation requirement.

1.2. Sliding floors

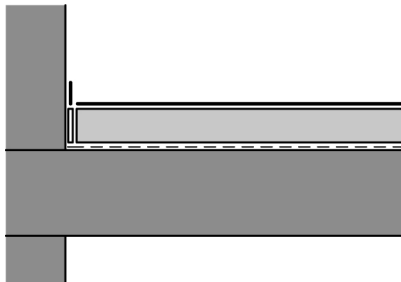


figure 30. The theoretical scheme of a sliding floor

Sliding floors may be constructed onto sliding bases (see section III.2.1.2.) if there are no transmitted noise / thermal insulation requirements and when there is a need that the floor base should move independently from the underlying structure.

1.3. Flexible floors

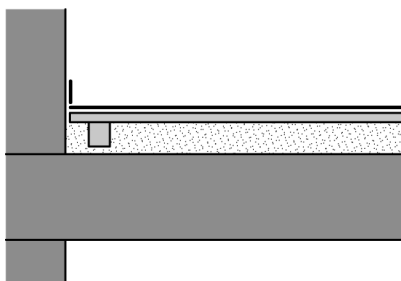
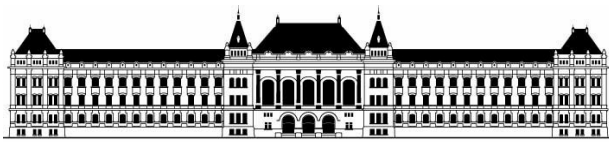


figure 31. The theoretical scheme of a flexible floor

The transmitted noise insulation property may be improved with the construction of flexible floors. In this case the floor construction forms an independently moving vibration mass, or a mass that moves



together with the useful load. The flexible floor uses the useful load as the weight and the flexing floor section as the spring in the weight-and-spring construction.

1.4. Floating floors

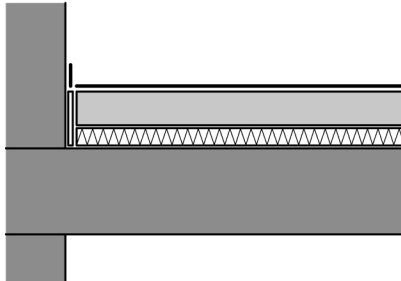


figure 32. The theoretical scheme of a floating floor

Floating floor is made with the construction of a floating base (see section III.2.1.3.). It is used when the floor is to have noise and/or thermal insulation properties. The base moves absolutely independently from the load bearing structure.

2. DEVELOPING THE LAYER STRUCTURE

2.1. Defining the layers in various function areas

Any space in the building will need to have its effects, loads and requirements analyzed. The surface finish is to be selected according to architectural expectations. The level of noise and/or thermal insulation is to be calculated and the type of the waterproofing is to be defined.

2.2. The coordination of the variations in layer thickness

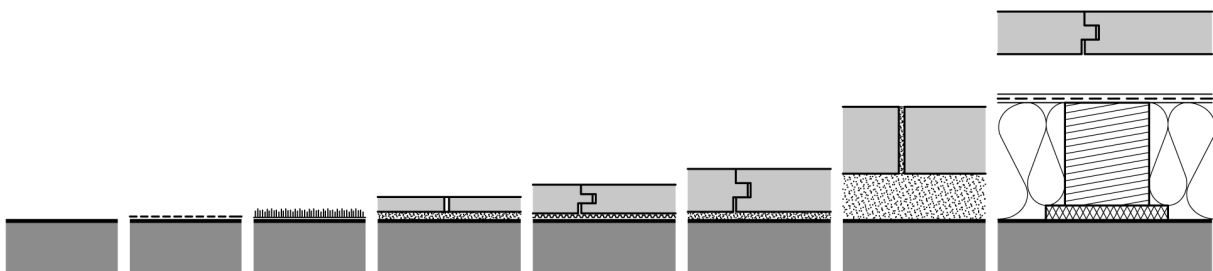


figure 33. layer thicknesses based on the surface finish

The difference in the thickness of the various surface finishes may be anywhere up to 100 mm. Further deviation may arise from different loads and requirements. Contact finishes glued directly to the load bearing structure and dual insulation and construction layers for pipes and machinery may result in a difference of up to 350-450 mm.

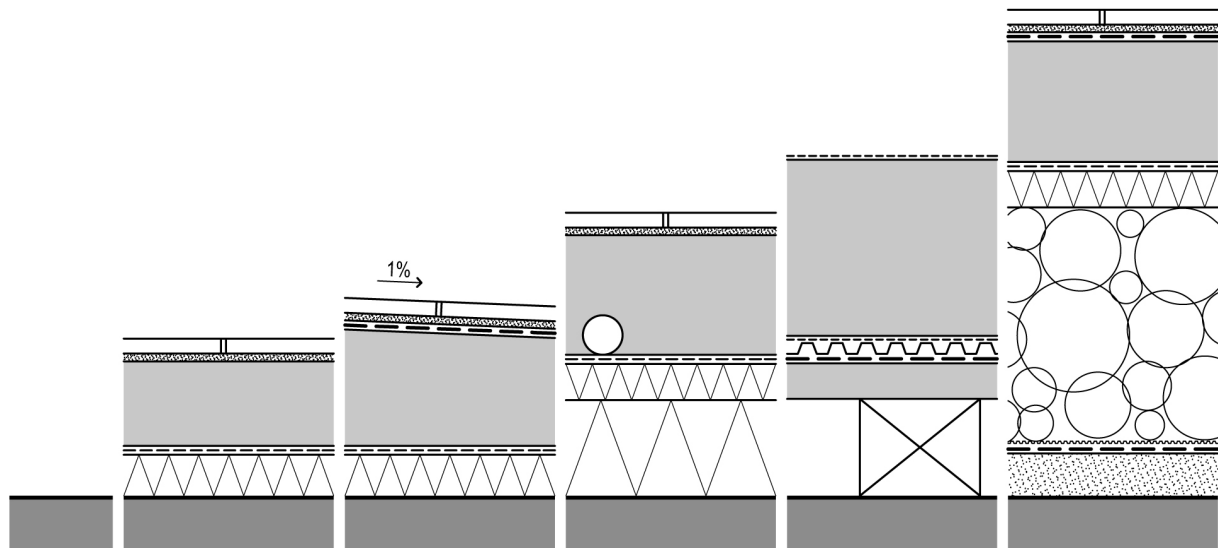
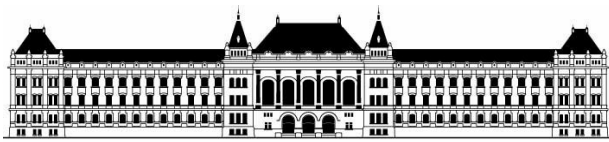


figure 34. Layer thickness deviations on the basis of floors constructed to satisfy various requirements

Layer thickness deviations are to be equalized in the design phase in order to provide a floor level that is the same in all spaces and to allow for an unhindered handicap access to all rooms.

The layer thickness differences may be “bridged” thru::

- surface finish change profiles
- keeping the plane
- level access thru ramps or stairs
- sinking of the slab
- changes.

3. FLOOR LAYING PLANS

It is highly recommended to prepare floor laying plans for all floor kinds. When so, the designer is to define:

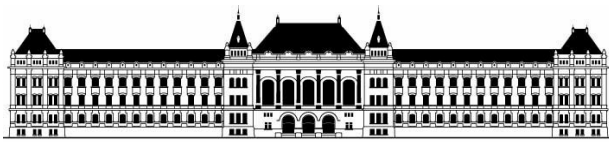
- stake out points (the position of the first element);
- the girdwork of the other elements
- the direction of the division, the defining geometry of the direction,
- gap sizes,
- the sizes of the cut elements,
- frame properties, etc.

On the basis of the floor laying plan, the element list of the floor is prepared.

4. DETAILS

4.1. Skirtings

The skirting will provide the edge of the floor surface where it meets connecting structure, it will also protect the wall during the cleaning of the floor. The later aspect is lately neglected by architects. As a



result, we see more and more self-developed “skirtings” that are simply exposure discolorations of the wall surface. The floor is practically prepared after the finishing of the walls: with the exception of contact floors and elemental floors, the skirting is not to be connected to the floor finish. Due to acoustic needs, the separation of the skirting and the floor is to be dual phase gap.

4.1.1. Cold floor skirtings

The skirting to be constructed in case

a) of homogenous finishes:

- different material (e.g.: wood element with mechanical fixation with a glued tile finish);
- epoxy resin finish may be continued onto the wall surface in a curve.

b) elemental floor finishes:

- made from the floor tiles themselves (glued onto the wall),
- made from ceramic skirting elements (glued to the wall)
- other finish material (glued or mechanically fixed),
- made from pre-fabricated skirting elements, e.g. when hygienic requirements are to be met, in case of hospitals, kitchens etc. The elements are easily cleaned with a curved inner corner. (glued to the wall).

4.1.2. Warm floor skirtings

May be prepared as:

- traditional nailed slat edge,
- dedicated edge slat/element (special shape, cable gap etc.),
- pre-fabricated skirting element.

The fixing of the skirting may be:

- nailing to the floor surface – in this case the edge slat may not touch the wall due to acoustic requirements (the space may be closed thru a dual phase gap);
- glued to the wall;
- connected to the wall via “click” elements.

In the latter two situations, the skirting is not to touch the floor surface, due to acoustic requirements (the space may be closed thru a dual phase gap);

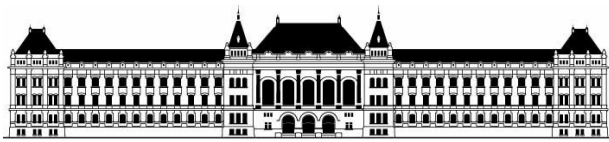
The skirting material may be:

- solid wood
- veneered wood
- laminated elements.

4.1.3. Semi-warm floor skirtings

The skirting may be prepared as:

- an edge made from the material itself (e.g. folded up),
- made as a hard plastic edge,
- a curved form element,
- an edge made from a different material (e.g.: wood, ceramics).



4.2. Changes in the surface finish

When the floor is properly designed before construction, there is no need to cover changes in the elevation of various levels. As a result, only structural gaps are to be provided. Various surface change gap elements are available on the market (plastic, aluminum, stainless steel, mixed materials) which may provide a fixed or a mobile connection of the surfaces.

4.3. Solving the gaps

Floors are to be made with gaps that allow the motion due to a wide variety of effects. Structural motion (e.g. sinking differences) and/or expansion (thermal expansion movement) gap will separate two building components or two buildings in a pre-disposed, designed manner. The gap will allow movement, the location and properties are to be defined by the structural engineer.

The dilatation gap must be consequentially continued thru all building layers in the same location. The finish must be constructed with an appropriately calculated size dilatation gap profile. During the designation, fire sections and earthquake requirements are to be considered. The gap is preferably placed along a straight, continuous line.

Base movement gaps are to be continued thru to the finish surface. The base dilatation may be constructed:

- in case of small loads, without a gap element;
- in case of medium loads (residential, office) using finish profiles;
- in case of high loads (great wear, retail areas, vehicle traffic, loaders etc.) using profiles selected for the particular load. In case of hygienic requirements, the profiles are watertight.



V. A LIST OF CURRENTLY VALID LEGISLATIONS AND TECHNICAL STANDARDS

- [1] MSZ 04-140/2-79 Épületek és épülethatároló szerkezetek hőtechnikai számításai. Hőtechnikai méretezés
- [2] MSZ 04-140/2-85 Épületek és épülethatároló szerkezetek hőtechnikai számításai. Hőtechnikai méretezés
- [3] MSZ 04-140-2:1991 Épületek és épülethatároló szerkezetek hőtechnikai számításai. Hőtechnikai méretezés
- [4] MSZ-04-803
- [5] MSZ-04-803/130 Építő- és szerelőipari épületszerkezetek. Lapburkolatok
- [5] MSZ EN 548 Rugalmas padlóburkoló anyagok. A mintázatlan és a mintázott linóleum előírásai.
- [6] EN 649:1996/A1:2003 és MSZ EN 649:1996/A1:2004 Rugalmas padlóburkoló anyagok. Homogén és heterogén poli(vinil-klorid) padlóburkoló anyagok. Előírás
- [7] EN 685:2007 és MSZ EN 685:2008 Rugalmas, textil és rétegelt padlóburkoló anyagok. Osztálybesorolás
- [8] MSZ EN 12004:2002 Habarcsok és ragasztók kerámia burkolólapokhoz. Fogalommeghatározások és követelmények.
- [9] MSZ EN 12354-2:2000 Épületakusztika. Épületek akusztikai minőségének becslése az elemek teljesítőképessége alapján. 2. rész: Helyiségek közötti lépéshangszigetelés
- [10] MSZ EN 12466:1998 és MSZ EN 12466:2000 Rugalmas padlóburkoló anyagok. Mintázatlan és mintázott linóleum előírásai
- [11] EN 13226:2009 és MSZ EN 13226:2009 Fa padlóburkolatok. Csaphornyos és vendégcsapos parkettaelemek
- [12] EN 13227:2002 és MSZ EN 13227:2003 Fa padlóburkolatok. Tömör lamellaparketta termékek
- [13] EN 13228:2002 és MSZ EN 13228:2003 Fa padlóburkolatok. Vékony csaphornyos és blokkparketta tömör fából
- [14] EN 13488:2002 és MSZ EN 13488:2003 Fa padlóburkolatok. Mozaikparketta-elemek
- [15] EN 13489:2002 és MSZ EN 13489:2003 Fa padlóburkolatok. Többrétegű parkettaelemek
- [16] MSZ CEN/TR 13548 A kerámia burkolás tervezésének és kivitelezésének általános szabályai
- [16] EN 13629:2002 és MSZ EN 13629:2003 Fa padlóburkolatok. Táblásított, lombos tömör fa padlódeszka
- [17] EN 13756:2003 Fa padlóburkolatok. Fogalommeghatározások
- [18] MSZ EN 13813:2003 Esztrich és padozati anyagok Esztrichhabarcsok. Tulajdonságok és követelmények
- [19] MSZ EN 13845:2005 Rugalmas padlóburkolók. Szemcsézéssel javított, csúszásgátlású poli(vinil-klorid) padlóburkolók. Műszaki leírás
- [20] EN 13990:2004 és MSZ EN 13990:2004 Fa padlóburkolatok. Hajópadló fenyő fűrészárúból
- [21] EN 14041:2004 és MSZ EN 14041:2004 Rugalmas, textil és rétegelt padlóburkoló anyagok. Alapvető jellemzők
- [22] MSZ EN 14231:2003 Természetes építőkövek vizsgálati módszerei. A csúszási ellenállás meghatározása ingás vizsgálóeszközzel (SRT értékek megadása)
- [23] EN 14342:2005 és MSZ EN 14342:2005 Fa padlóburkolatok
- [24] EN 14354:2004 és MSZ EN 14354:2005 Fa alapanyagú lemezek. Furnérozott padlók
- [25] MSZ EN 14411 Kerámia burkolólapok. Fogalommeghatározások, osztályozás, jellemzők és megjelölés



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- [25] EN 14761:2006 és MSZ EN 14761:2006 Fa padlóburkolatok. Parketta tömör fából. Élkötegelt keskeny, széles és modul-parkettaelemek
 - [26] MSZ 15035-79
 - [27] MSZ 15601:2007 Épületakusztika
 - [28] MSZ 15601
 - [29] DIN 4109 Schallschutz im Hochbau
 - [30] DIN 18560 Estriche im Bauwesen 2004
 - [31] DIN 51097
 - [33] DIN 51130
 - [34] BGR 181: „Fokozott csúszásveszélyességű munkahelyek és munkatermek padozatai” irányelv
 - [35] GUV-I. 8527: „Mezítláb használt területek padlóburkolatai”
 - [36] A 28/2011 (IX. 06.) BM rendelettel kiadott Országos Tűzvédelmi Szabályzat
 - [37] 7/2006-os TNM rendelet „Az épületek energetikai jellemzőinek meghatározásáról”
 - [38] 2010/31/EU számú irányelv „Az épületek energiahatékonyságáról – Energy Performance of Buildings Directive (EPBD)”
 - [39] 9/2008 (II.2.) OTM rendelet
 - [40] 253/1997. (XII. 20.) Korm. rendelet az országos településrendezési és építési követelményekről (OTÉK)



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- [4] Dr. Gábor László: Épületszerkezetek IV., Nemzeti Tankönyvkiadó Budapest 1977.
- [5] Pataky Rita: Energetical and constructional problemathic of post thermal insulation of floor constructions; Konferenz „PAROPAS – 12” PORUCHY A OBNOVA OBALOVÝCH KONŠTRUKCIÍ BUDOV 07-09.03.2012 Vysoké Tatry, Podbanské - hotel Permon
- [6] Pataky Rita: Padlók felépítése, szerkezetelemzés. Comfort Budapest Szakkiállítás és Konferencia I. MAPEI Burkolástechnikai Konferencia 2012. 02. 17. SYMA Rendezvényközpont
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