CZECH TECHNICAL UNIVERSITY IN PRAGUE

FACULTY OF CIVIL ENGINEERING

DEPARTMENT OF BUILDING STRUCTURES

TECHNICAL REPORT

RESIDENTIAL BUILDING

MALATHE KAMAL ALKHATEEB

NAME OF PROJECT RESIDENTIAL BUILDING IN PRAGUE

CREATED BY: MALATHE KAMAL ALKHATEEB

CZECH TECHNICAL UNIVERSITY IN PRAGUE
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BACHELOR´S THESIS ASSIGNMENT FORM

I. PERSONAL AND STUDY DATA

Surname: Kamal Ahmed Alkhateeb Name: Malathe Personal number: 440217

Assigning Department: K124

Study programme: Civil engineering

Branch of study: Building structues

II. BACHELOR THESIS DATA

Bachelor Thesis (BT) title: Apartment building in Prague

Bachelor Thesis title in English: Apartment building in Prague

Instructions for writing the thesis:
The proposal and target of this new Apartment building is engineering solutions of building structures with fire safety solutions of the building in accordance with applicable Czech standards norms.

List of recommended literature:

1. Hollis M.: Surveying Buildings, RICS Boks 2007
2. Barry R.: The Construction of Buildings, BSP 1989
3. Hanaor, A. : Principles of structures. Blackwell Science. 1998
4. Council on Tall Buildings and Urban Habitat, 1st.ed., Fire Safety in Tall Buildings, Betlehem, Pensylvania, Mc Graw-Hill Inc., 1992, 317 p., ISBN 0-07-012531-7
5. Kupilík, V.: Fire Protection of Constructions, page:182, Dunamenti Tuzvédelem Zrt, Budapest, Hungary,2009, ISBN: 978-963-06-70385-7
6. Newman, G.M. The fire resistance of composite floors with steel decking, 1st.ed., The Steel Construction Institute Ascot, 2001, ISBN 1-870004-67-1

Name of Bachelor Thesis Supervisor: Ing. Malila NOORI, Ph. D.

BT assignment date: 20.02.2018 BT submission date: 27.05.2018

BT Supervisor's signature Head of Department's signature

III. ASSIGNMENT RECEIPT

I declare that I am obliged to write the Bachelor Thesis on my own, without anyone's assistance, except for provided consultations. The list of references, other sources and consultants' names must be stated in the Bachelor Thesis and in referencing I must abide by the CTU methodological manual "How to Write University Final Theses" and the CTU methodological instruction "On the Observation of Ethical Principles in the Preparation of University Final Theses".

20/02/2018
Assignment receipt date Student's name

THANK YOU

I would like to thank very much all those who have provided me knowledge and ideas for this work. My great thankfulness go to Ing. Malila Noori, Ph.D. for her effort, willingness and patience, that she devoted her time to guide me in my bachelor thesis and her outstanding approach. I would also like to thank my parents for allowing me to study in Czech Technical University. Last but not least, thanks to my loved ones for the support I have received.

DECLARATION

I submit the work assessment and defense of bachelor's thesis,

Made at the bachelor's study at CTU in Prague Faculty of Civil Engineering,

I hereby declare that I worked on this bachelor thesis alone.

My work in my bachelor is under supervision of Ing. Malila Noori, Ph.D. and the information I drew from literature.

I do not object to the use of this school work within the meaning of copyright rights

ABSTRACT

Bachelor Thesis is created as the project of residential house in Prague. The engineering design and solutions of the building envelope and structure are designed according to Czech standard norms.

ANNOTATION

Bachelor thesis is focused on the structural and technical solution of the residential building in Prague. The design is proposed as building permit documentation. The bachelor thesis is done in five parts. Civil engineering part (compositions, usable spaces, usability for people and their needs). Structural part, (structural behavior of the building, design of load bearing elements and materials. Foundation part (subsoil interaction with the building and proper design of concrete foundation – design of combination of foundation slab and piles. Fire safety design with proper design securing safety of all the residents during fire event. And in case of fire intervention, nothing would prevent successful saving action. And finally building services part, composed of proper design of drainage, water supply and ventilation and heating of the building

CONTENT

1. **GENERAL INFORMATION**

Residential building in Letnany in Prague is designed. The building is located in the outer border area of Prague in a newly developed residential area. The residential building is designed economically and utilizing modern ways of design and construction. The project emphasizes on good quality. The project utilized orthogonal architecture to blend in with the surrounding. Czech and Euro codes were used during design.

2. **BASIC INFORMATION**

The residential building has 1 underground floor and 5 upper ground floors. The size of the building is different in underground level and in upper floors. Underground level is 47,0 m long and 20,6 m wide. Height above the ground is 17.05 m. Height under the ground is 2,02 m. Total height is 19,07 m.

The underground floor is equipped with a garage, technical room, washing machine room, drying room, rooms for storages. 16 parking spaces, other parking spaces are located outside the building.

Drive in to the building is from east. There are 10 apartments first level, 11 apartments in second till fourth level and 6 apartments in fifth floor. Apartment is of different dispositions from 1+kc to 4+kc. The building consists of 49 apartment units in total. All the apartments are properly lighted. Underground level is bigger than upper floor, there is jump in the slab in the structural system of underground level to achieve the difference in section of first level terraces and apartments. Another recces of building shape is in the fifth level when the fifth level is smaller than others. The roof areas of fourth floor are used as terraces for fifth floor apartments.

Building is also equipped with balconies. Entrance to the garage is from the level of Outside Street. There is no ramp. Underground level floor is in the same height as surrounding street level. Entrance to the building is from the intermediate level of staircase. It is one staircase wing downstairs to the garage and one staircase wing up to the apartment areas. In the entrance area there is common residential building equipment such as cleaning room and staller room. Underground floor is used mainly for parking, there is also storage areas and technical room. The building is not designed specifically for use of disabled people. Disabled people will be in the building not permanently, only occasionally.

Underground level of the building is not fully and whole under surrounding ground, but it is only half underground. Therefore there is no need of entering the object via ramp from the street but the garage is in the same level as the pavement of the street.

3. **VISUALIZATION OF THE RESIDENTIAL BUILDING**

Visualization of the design residential building was done during class taught by CTU in spring semester of 2018

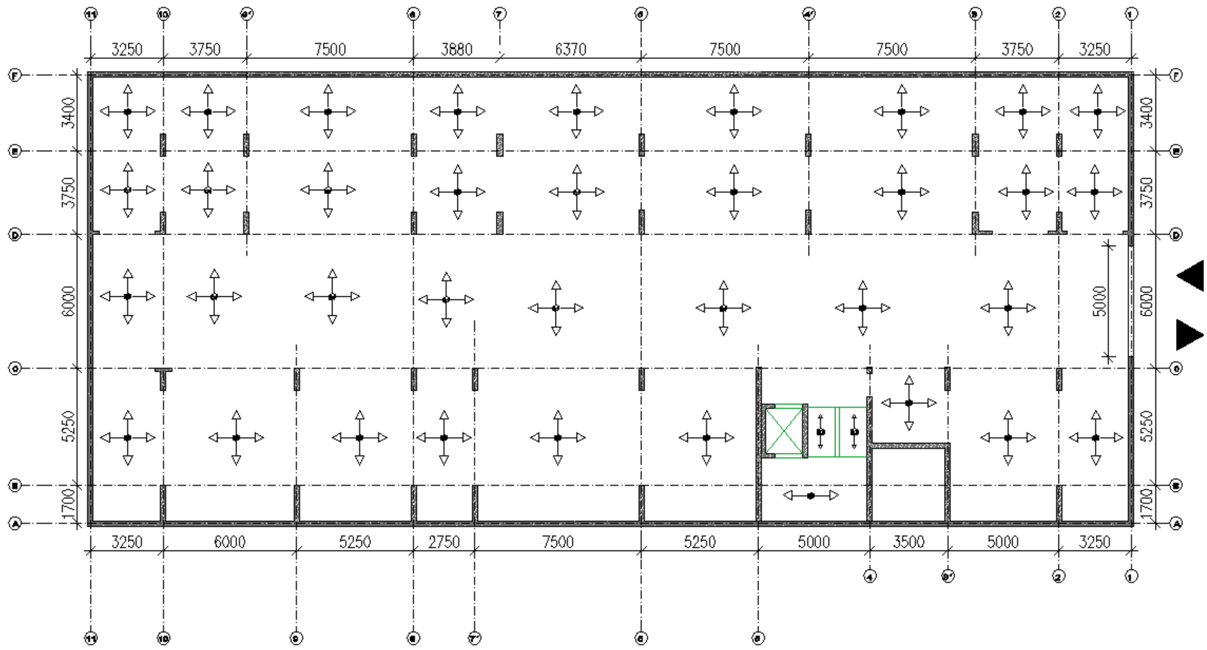
PERSPECTIVE FROM THE WEST

PERSPECTIVE FROM THE EAST

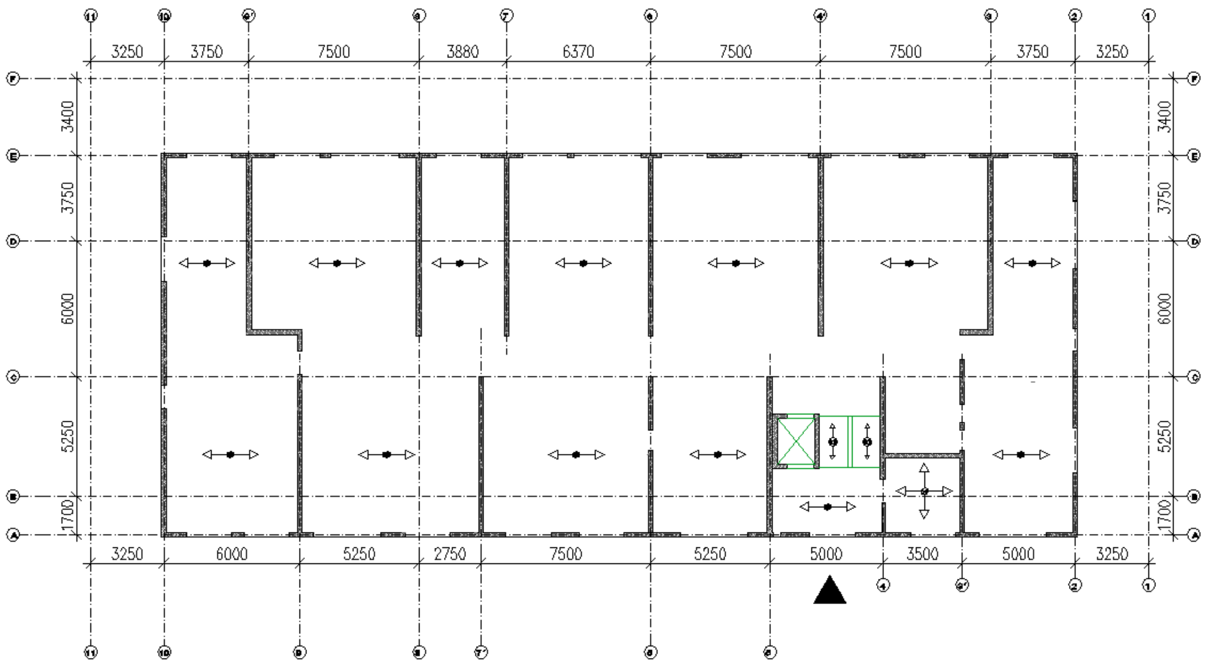
PERSPECTIVE TOP WEST

4. **STRUCTURAL SYSTEM**

STRUCTURAL SYSTEM OF UNDERGROUND LEVEL – SCHEME



STRUCTURAL SYSTEM OF FIRST LEVEL – SCHEME



The structural system of underground floor is a two-way flat slab with thickness of 250 mm. First floor is created by load bearing concrete walls in perpendicular direction of length of the building.

Therefore the slab above underground level is also supported by walls of first level and those are supported by the columns of the underground level, which is used mainly for garage purposes.

Therefore the assumption is made, that the slab above first level acts more in a one way fashion, than as plain two way slab. And the construction system can be characterized as combined with columns in UL and walls in upper structure. Columns in the underground garage are 1000x250 mm.

Underground floor is bigger than the rest of the building, the reinforced concrete slab above underground level is used as a terrace of the apartments in first level. Due to different composition of terrace and regular apartment, there is a slab break in the RC slab above underground level.

First level to fourth level are almost similar in the perimeter of the building, there is few recesses and adding on the perimeter of the building. There is obvious advantage seen in the choice of structural load bearing reinforced concrete walls system.

In a expansion of the floor further from the perimeter of the floor below and in a situation with the balcony cantilever from this expansion, structural solution without expanding load bearing walls would be difficult. Wall system is also much stiffer than skeleton system.

Fifth floor is smaller than the rest with slab above fourth level used as a terrace, this time without slab break, which would create unwelcome appearance in the apartments below. This recess of the fifth floor leads to thicker reinforced concrete slabs than in the regular floor to thickness of 250 mm.

There is an elevator shaft with doubled wall in the face of apartment. Double wall starts directly from foundation slab

5. **MATERIALS**

CONCRETE:

Reinforced concrete columns underground level

C35/45 - XC2, XD1- dmax=22mm - Cl<2%-S4

Reinforced concrete perimeter walls underground level

C30/37 – XC2, XA1, XD1 - dmax=22mm-Cl<2%-S4

Reinforced concrete walls (communication areas) underground level

C30/37 - XC2, XD1 - dmax=22mm - Cl<2% - S4

Reinforced concrete walls (communication areas) upper levels

C30/37 – XC1 - dmax=22mm - Cl<2% - S4

Reinforced concrete slabs

C30/37 – XC1 - dmax=22mm - Cl<2% - S4

Reinforced concrete foundations

C25/30 - XC3, XA1, XD1 - dmax=22mm - Cl<2% - S4 - Xypex

Reinforced concrete of precast staircase elements

C30/37 – XC1 - dmax=22mm - Cl<2% - S4

Reinforced concrete piles

C25/30 - XC3, XA1 - dmax=22mm - Cl<2% - S4

STEEL:

Reinforcing bars B500B

MASONRY:

POROTHERM 25 AKU SYM P15, M10 250 mm

POROTHERM 19 AKU SYM P10, M10 250 mm

POROTHERM 17,5 P+D P8, M2,5 – PARTITIONS 175 mm

POROTHERM 11,5 P+D P10, M2,5 – PARTITIONS 115 mm

6. EXCAVATION

The excavation is made for underground construction. The excavation area is composed of two drainage systems DN100 and backfill soil and gravel 60/32. Volume of excavated soil = 743 m3.

To the possible extent, most of the excavated soil will be used as a backfill, the rest will be take off the site and properly stored.

The top 200 mm of the ground will be carefully put out and used as agriculture soil elsewhere. Some of the area of foundation is already above original ground, so the backfill and proper compaction has to be realized.

There will be several gravity and retaining structures/wall realized in the area to organize the ground in the surroundings of the building.

7. ACOUSTIC

Staircase is separated by acoustic foil elements the landing composition and on the joint of precast flight and landings from load bearing structure of the building.

Due to acoustic reasons, every slab composition is equipped with acoustic insulation. The wall composition also satisfy acoustic requirements.

Façade of the building is also estimated to acoustically isolate whole object.

8. FOUNDATION

8.1. CHARACTERISTIC OF SOIL

Clay F4 –angle of internal friction = 30 deg

Cohesion = 20 kPa

Gamma is = 20 KN/m3

Tabled load bearing capacity = 150 kpa

8.2. FOUNDATION SLAB

The building foundation slab is designed as 250 mm thick and it is from waterproofed concrete with the additive XYPEX (used for closing the cracks in concrete after the crack arising XYPEX reacts with water and very slowly close the crack).

8.3. WATERPROOFING

Waterproofing of the structure below ground is done by asphalt sheets in the places of weak spots, recess in the walls, opening for pipeline, ets.

8.4. PILES

Piles are designed of two diameters, 900 mm and 600 mm. Diameter of 900 mm is used under the places of big loads (columns in the underground level) Diameter of 600 mm is used for example under perimeter wall of underground level or elevator shaft. Piles are design of different length. Under the places of big load, the piles are designed of length of 16 m to be able to carry all the load.

9. STAIRCASE

Staircase is designed as precast reinforced concrete. Staircase is located in the communication area right behind the entrance door. It is 2 flight staircases. 2 main reinforced concrete precast flight elements are bedded in the main landing via hook and to the reinforced concrete wall via Schöck Tronsole® type Z. Staircase is acoustically separated from the load bearing structure of the building. The composition of the staircase is therefore only precast element, plaster and ceramic flooring on glue.

Used acoustic elements:

Schöck Tronsole® type F – between precast flights and landings

Schöck Tronsole® type B – between foundation slab and first flight

Schöck Tronsole® typ B

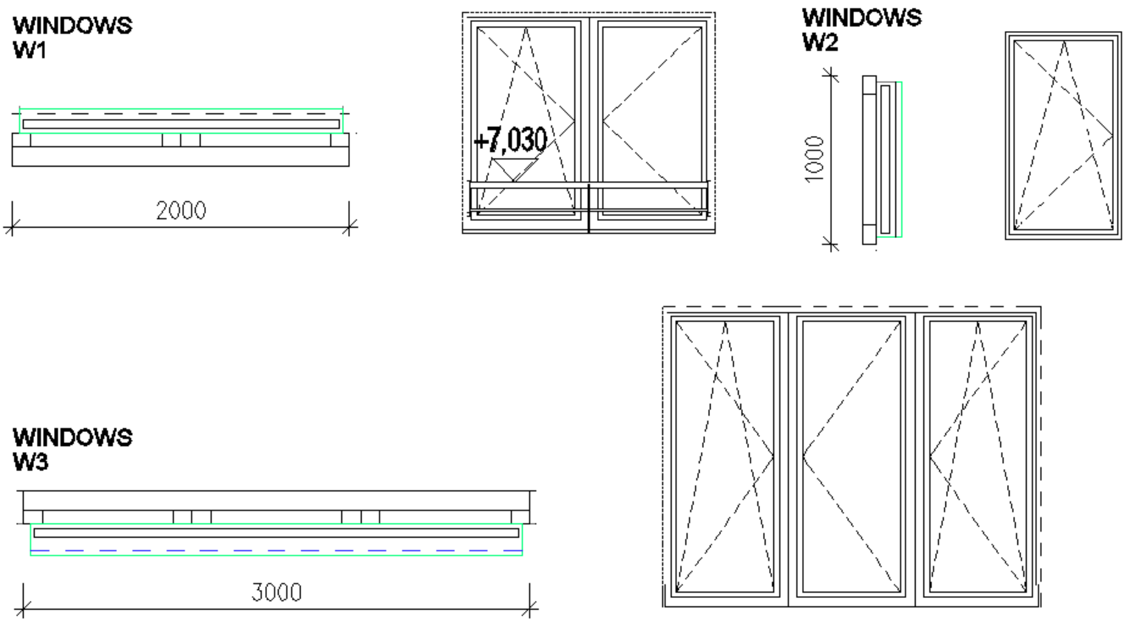
Schöck Tronsole® type L – between precast flights and walls

Schöck Tronsole® typ L

10. **WINDOWS**

Windows with dimensions 2000(2000/1030) and 1000(1000/1030) and 3000(3000/1030)

Windows is made from wooden-aluminium frame and double glassed layers for thermal insulation purposes

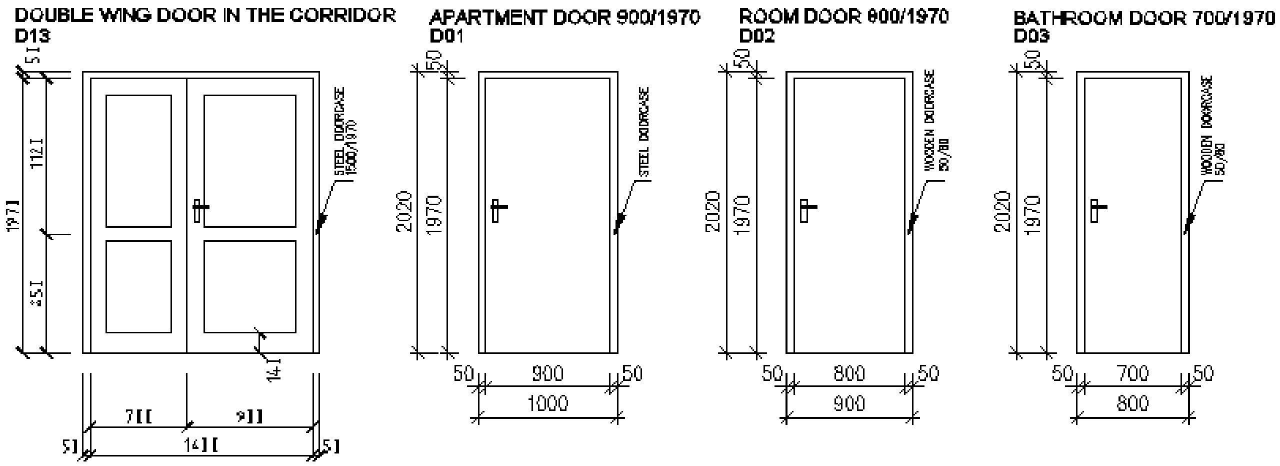


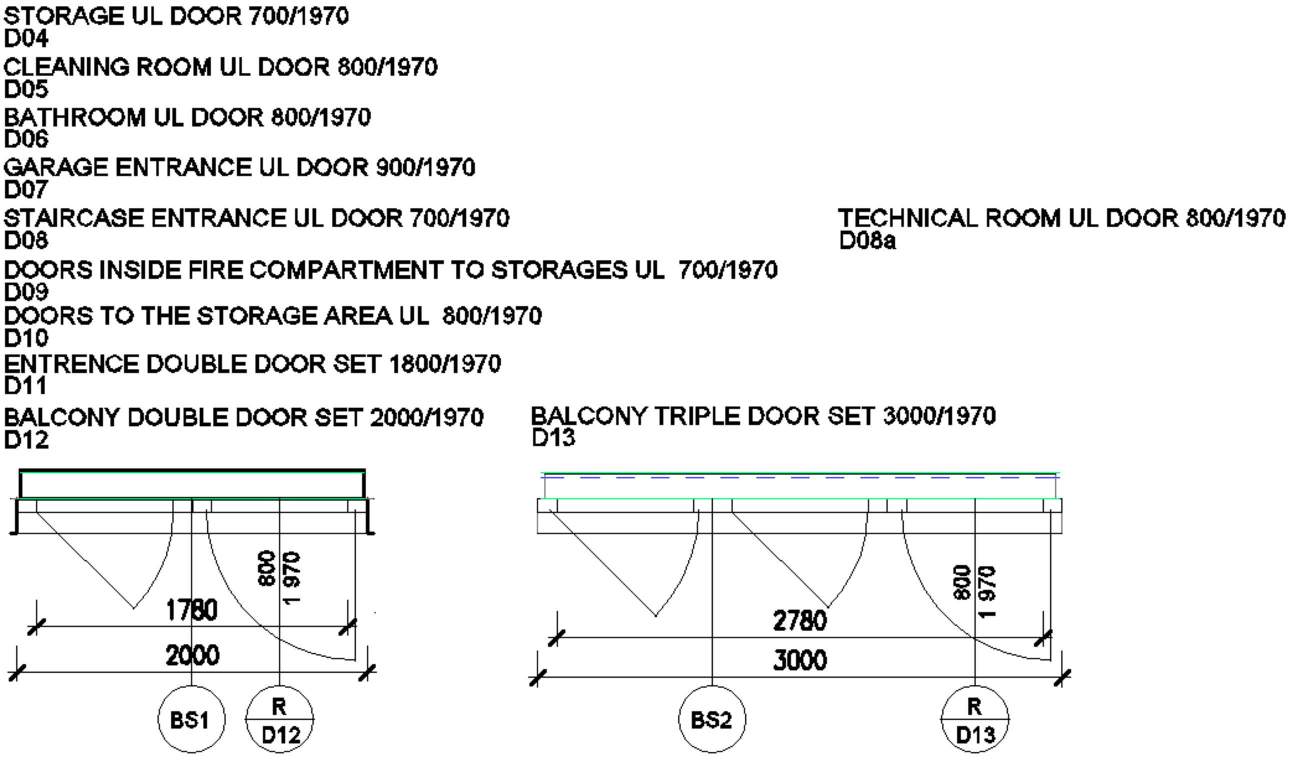
10.1. ROOF ENTRANCE WINDOW

Roof entrance is **Type HAGAROOF S-50TB, E-50TB**

11. **DOORS**

The doors is from aluminum and wood + glass material.





12. **LINTELS**

Lintels are used of Porotherm brand as a system of masonry construction of the building

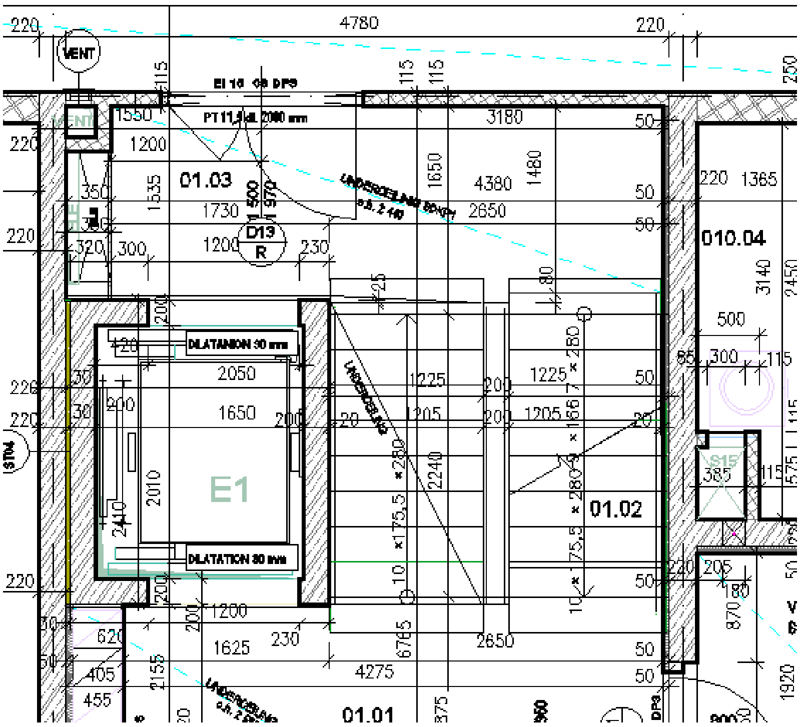
13. **RAILINGS**

Railings are from aluminium.

RAILINGS
R1 - BALCONY RAILING TYPE 1
R2 - BALCONY RAILING TYPE 2
R3 - FRENCH WINDOW RAILING
R4 - STAIRCASE RAILINGS
R5 - APARTMENT GARDENS RAILING TYPE 1
R6 - APARTMENT GARDENS RAILING TYPE 2

14. **ELEVATOR**

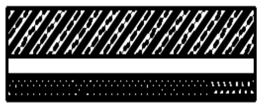
Elevator is used common one from brand chose by investor (Otis, Kone, etc.). Elevator is of these dimension and has door from both sides, there is an entrance from the side of main entrance of the building and exits from elevator are on the other side of the shaft to the corridors of the apartment floors. Wall surrounding elevator and apartment is doubled. There is a recess in the foundation slab for the elevator.



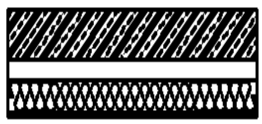
15. UNDERCEILINGS

There are four different types of underceilings located in the building. It can all be seen in the composition drawing and excel file.

UNDERCEILING USED IN HALLS AND CORRIDOR

HALLS – SDKP1	t [mm]	
-SDK UNDERCEILING WITH THERMAL INSULATION -KNAUF THICKNESS OF THERMAL INSULATION 40mm DOUBLE LAYER ALUMINIUM GRID FIRE RESISTANCE EI30 INCLUDING LIGHTS	in layouts	

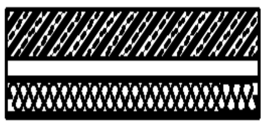
UNDERCEILING USED IN THE UNHEATED SPACE IN THE GARAGE BELOW APARTMENTS OF THE FIRST FLOOR

UNHEATED AREAS BELOW APARTMENTS IN 1PP – SDKP2	t [mm]	
-SDK UNDERCEILING WITH THERMAL INSULATION -KNAUF -THICKNESS OF THERMAL INSULATION 80mm	120	

UNDERCEILINGS IN THE BATHROOM

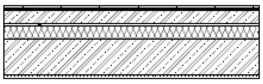
BATHROOMS AND APARTMENT HALLS – SDKP3	t [mm]	
-KNAUF D - 112WITH ANTI HUMIDITY IMPREGNATION INCLUDING LIGHTS	in layouts	

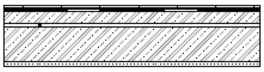
UNDERCEILING IN THE ENTRY HALL

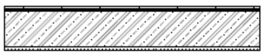
ENTRY HALL – SDKP 4	t [mm]	
-KNAUF D 1 - 112x GKF ; 15CERTIFIKATION EI 30WITH THICKNESS OF THERMAL INSULATION 80mm DOUBLE LAYER ALUMINIUM GRID FIRE RESISTANCE EI30 INCLUDING LIGHTS	120	

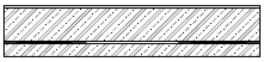
16. COMPOSITIONS

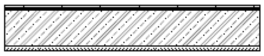
List of other compositions used for the project

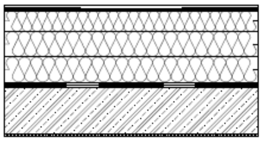
GENERAL FLOOR SECTION–H1	SELFWEIGHT	t [mm]	kN/m2	
-SURFACE: CARPET/CERAMIC	150 kg/m2	10	0.15	
-GLUE LAYER	5 kg/m2		0.05	
-OPTIONAL (FOR WET AREAS-BATHROOMS) WATERPROOFING PLASTER FORTISOL WITH PENETRATION FORTE PENETRAL				
-CONCRETE LEVELING LAYER -ANHYDRIT WITH FLOOR HEATING	2500 kg/m3	40	1.0	
-SEPARATION FOIL	5 kg/m2		0.05	
-ACCUSTIC INSULATION	70 kg/m3	80	0.06	
-REINFORCED CONCRETE SLAB	2500 kg/m3	230	5.75	
-PLASTER	1800 kg/m3	3	0.05	
		360	7,11(1,36)	

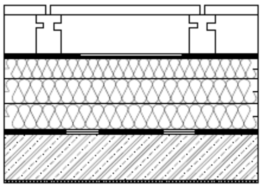
STAIRCASE INTERMEDIETE LANDING – H2	SELFWEIGHT	t [mm]	kN/m2	
-CERAMIC SURFACE LAYER EMBEDED IN GLUE LAYER	15 kg/m2	15	0.15	
-CONCRETE LEVELING LAYER	2500 kg/m3	35	0,9	
-ETHAFOAM PE INNER LAYER	5 kg/m2	10	0.05	
-REINFORCED CONCRETE SLAB	2500 kg/m3	190	4,75	
-GYPSUM PLASTER	1800 kg/m3	3	0.05	
		250	5,9	

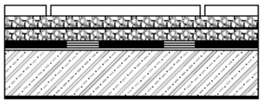
STAIRCASE FLIGHTS, STAIRCASE AREAS, CLEANING 1PP–H3	SELFWEIGHT	t [mm]	kN/m2	
-CERAMIC SURFACE LAYER EMBEDED IN GLUE LAYER	15 kg/m2	15	0.15	
-REINFORCED CONCRETE SLAB	2500 kg/m3	160	4.0	
-LIMECEMENT PLASTER	1800 kg/m3	3	0.05	
			4.2	

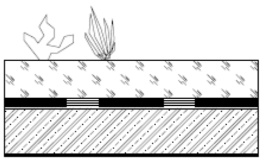
GROUND FLOOR SECTION–H4	SELFWEIGHT	t [mm]	kN/m2	
-FINISH OF FLOORING -PALETTE KNIFE	15 kg/m2		0.15	
-REINFORCED WATERPROOFING CONCRETE	2500 kg/m3	250	6,25	
-GEOTEXTILE 2xPE				
-UNDERLAYING CONCRETE LAYER C16/20	2400 kg/m3	100	2.4	
		350	8.7	

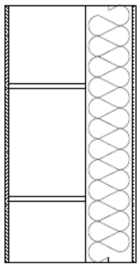
BALCONY–H5	SELFWEIGHT	t [mm]		
-CERAMIC SURFACE LAYER EMBEDED IN GLUE LAYER	150 kg/m2	15	0.3	
-WATERPROOFING SHEETS -FORTISOL				
-CONCRETE IN SLOPE	2400 kg/m3	60	1.44	
-REINFORCED CONCRETE SLAB	2500 kg/m3	190	4.75	
-PLASTER	1800 kg/m3	3	0.05	
		200	6.54(1.79)	

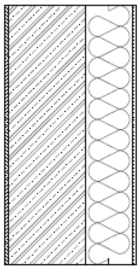
FLAT ROOF – R1	self weight	t [mm]	kN/m2	
-WATERPROOFING - 2xMODIFIED ASPHALT SHEETS	1650 kg/m3	4		
-THERMAL INSULATION IN SLOPE 3%	70 kg/m2	280		
-VAPOUR BARRIER	10 kg/m2	1,5		
-PENETRATION	1000 kg/m3	1		
-REINFORCED CONCRETE SLAB	2500 kg/m2	230		
-PLASTER	25 kN/m3	10		

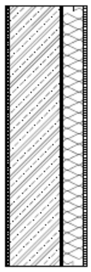
FLAT ROOF – TERACE WITH CONCRETE TILES – R2	self weight	t [mm]	kN/m2	
-CONCRETE TILES 400 -x400x50	1650 kg/m3	50		
-HIGHT ADJUSTED STANDS				
-WATERPROOFING - 2xMODIFIED ASPHALT SHEETS				
-THERMAL INSULATION IN SLOPE 3%	70 kg/m2	280		
-VAPOUR BARRIER	10 kg/m2	1,5		
-PENETRATION	1000 kg/m3	1		
-REINFORCED CONCRETE SLAB	2500 kg/m2	230		
-PLASTER	20 kN/m3	10		

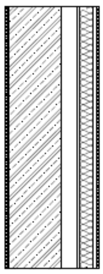
TERACE WITH CONCRETE TILES ABOVE UL – R3	self weight	t [mm]	kN/m2	
-CONCRETE TILES 400 -x400x50	1650 kg/m3	50		
-GRAVEL 4-6mm	2000 kg/m2	60		
-GRAVEL	2000 kg/m2	60		
-GEOTEXTILE -POLYPROPYLEN				
-DRAINAGE PE WITH PROFILATION				
-WATERPROOFING - 2xMODIFIED ASPHALT SHEETS	1800 kg/m2	4		
-PENETRATION PAINT -ASPHALT	1000 kg/m3	1		
-REINFORCED CONCRETE SLAB	2300 kg/m2	230		
-PLASTER	2000 kg/m3	10		

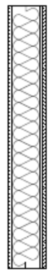
GARDENS ABOVE UL – R4	self weight	t [mm]	kN/m2	
-VEGETATION LAYER ,SUBSTRATE	2000 kg/m3	100		
-FILTRATION LAYER -SYNTHETIC TEXTILE	10 kg/m2	1,5		
-DRAINAGE AND WATER ACCUMULATING LAYER -PE PHOLIE	10 kg/m2	1,5		
-PROTEXTION LAYER -SYNTHETIC TEXTILE	10 kg/m3	1,5		
-WATERPROOFING - 2xMODIFIED ASPHALT SHEETS	10 kg/m2	4		
-PENETRATION PAINT	10 kg/m2	4		
-REINFORCED CONCRETE SLAB IN SLOPE 2%	25 kN/m3	230		
-PLASTER	20 kN/m3	10		

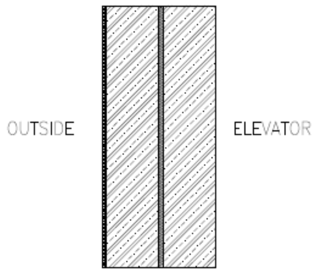
PERIMETER WALL MASONRY – V1	t [mm]	
-INNER PLASTER - DOUBLE LAYER LIMECEMENT PLASTER -MASONRY POROTHERM 19AKU -THERMAL INSULATION SYSTEM -ETICS - EPS70F -OUTER PLASTER - SYLICON	15 200 160 15	

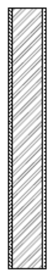
PERIMETER WALL REINFORCED CONCRETE – V2	t [mm]	
-INNER PLASTER - DOUBLE LAYER LIMECEMENT PLASTER -REINFORCED CONCRETE WALL -THERMAL INSULATION SYSTEM -ETICS - EPS70F -OUTER PLASTER - SYLICON	15 200 160 15	

PERIMETER WALL – UNDERGROUND LEVEL – V3	t [mm]	
-INNER PLASTER - DUSTFREE INTERNAL PAINT -REINFORCED WATERPROOFING CONCRETE WALL -XPS BOARDS -NOP FOIL	15 300 80 15	

INNER WALLS – REINFORCED CONCRETE NEXT TO APARTMENT – V4	t [mm]	
-INNER PLASTER -REINFORCE CONCRETE WALL -FRONT WALL FROM SDK AND THERMAL INSUATION -INNER PLASTER	15.0 200 100 15.0	

INNER WALLS–SDK FORWALL–MAILBOX ROOM AND ELECTRICITY BOX–V5	t [mm]	
-FRONT WALL FROM SDK AND THERMAL INSUATION -INNER PLASTER	115 17.5	

INNER WALLS – DOUBLE RC WALL – ELEVATORS – V6	t [mm]	
-DOUBLE REINFORCED CONCRETE WALL -EPS 30mm BETWEEN -INNER PLASTER	2x200 10	

NON–LOADBEARING WALLS – V7	t [mm]	
-INNER PLASTER -MASONRY -INNER PLASTER	15.0 VAR. 15.0	

17. LIST OF ATTACHMENTS

1. List of composition
2. Energy protocol

18. LIST OF DRAWINGS

3. Situation, scale 1:250
4. Underground level, scale 1:50
5. First level, scale 1:50
6. Second level, scale 1:50
7. Third and fourth level, scale 1:50
8. Fifth level, scale 1:50
9. Roof, scale 1:50
10. Section A, scale 1:50
11. Section B, scale 1:50
12. Detail 1, scale 1:10
13. Detail 2, scale 1:10
14. Detail 3,scale 1:10
15. Detail 4, scale 1:10
16. Detail 5, scale 1:10
17. View southwest, scale 1:50
18. View northeast, scale 1:50
19. View northwest, scale 1:50
20. View southeast, scale 1:50

19. USED REFRENCE OF LITERATURE AND CZECH NORMS

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2. [2] ČSN 73 2902 - External Thermal Insulation Composite Systems (ETICS) - Design and use of mechanical fastenings for connection to the substrate. Czech Standards Institute, Prague, 04/2011.

3. [3] ČSN 73 0540-1 - Thermal protection of buildings. Part 1: Terms, definitions and quantities for design and verification. Czech Standards Institute, Prague, 07/2005.

4. [4] ČSN 73 0540-2 - Thermal protection of buildings. Part 2: Requirements. Czech Normalization Institute, Prague, 10/2011.

5. [5] ČSN 73 0540-2 Z1 - Thermal protection of buildings. Part 2: Requirements. Český normalizačníinstitut, Praha, 04/2012.

6. [6] ČSN 73 0540-3 - Thermal protection of buildings. Part 3: Design values for quantities. Czech Normalization Institute, Prague, 11/2005

7. [7] ČSN 73 0540-4 - Thermal protection of buildings. Part 4: Calculation methods. Czech Normalization Institute, Prague, 06/2005.

8. [8] POKORNÝ, Marek. Fire Safety of Buildings - Syllabus for Practical Teaching. Prague: CTU in Prague, 2014. 124 pp. ISBN 978-80-01-05456-7.

9. [9] ZOUFAL, Roman and colleagues. Fire resistance values of building structures according to Eurocodes. Praha: PAVUS a.s., 2009. 128 pp. ISBN 978-80-904481-0-0.

10. [10] ČSN 73 0802 - Fire Safety of Buildings - Non-Manufacturing Objects. Český normalizačníinstitut, Prague, 06/2009.

11. [11] ČSN 73 0802 Z1 - Fire Safety of Buildings - Non-Manufacturing Objects. Český normalizačníinstitut, Prague, 06/2009.

12. [12] ČSN 73 0810 - Fire Safety of Buildings - Common Provisions. Český normalizačníinstitut, Praha, 05/2009.

13. [13] ČSN 73 0818 - Fire Safety of Buildings - Object occupation by persons. Czech Normalization Institute, Prague, 08/1997.

14. [14] ČSN 73 0818 Z1 - Fire Safety of Buildings - Object assignment by persons. Czech Normalization Institute, Prague, 10/2002.

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16. [16] ČSN 73 0833 - Fire safety of buildings - Housing and accommodation buildings. Český normalizační instituce, Praha, 09/2010.

17. [17] ČSN 73 0834 - Fire Safety of Buildings - Changes in Constructions. Český normalizačníinstitut, Prague, 03/2011.

18. [18] ČSN 73 0834 Z1- Fire Safety of Buildings - Changes in Buildings. Czech Normalization Institute, Prague, 07/2011.

19. [19] ČSN 73 0834 Z2- Fire safety of buildings - Changes in structures. Czech Normalization Institute, Prague, 02/2013.

20. [20] ČSN 73 0872 - Fire Safety of Buildings - Protection of Fire Extinguishing Structures by Air-Conditioning Devices. Czech Standards Institute, Prague, 01/1996.

21. [21] ČSN EN 1838 (ČSN 36 0453) - Light and lighting - Emergency lighting. Český normalizačníinstitut, Praha, 05/2014.

22. [22] Decree No. 23/2008 Coll., On technical conditions of fire protection of buildings.

23. [23] Decree No. 148/2007 Coll., On the energy performance of buildings.

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25. [25] Decree No. 499/2006 Coll., On building documentation.

26. [26] Promat fire safety [online]. 2015. [cit. 2015-05-14]. Available from: http://web.promatpraha.cz/pozarni-bezpecnost-staveb

27. ČSN 73 0818 - Fire safety of buildings - Occupancy of objects

28. ČSN 73 0802 - Fire safety of constructions - Non-production objects

29. ČSN 73 0804 - Fire safety construction - Production objects - Annex I, garages

30. ČSN 73 0835 - Fire safety of buildings - Building of sanitary and social facilities

31. Fire Safety of Buildings - Syllabus for practical training; First Education, Czech Technical University in Prague 2014; 124 pages; ISBN 978-80-01-05456-7Actor: POKORNÝ Marek

32. ČSN EN 1991-1-1 73 0035 Eurocode 1: Construction loads - Part 1-1: General loading - Volume, ownership and use of land

33. ČSN 73 0532 - Acoustics. Assessment of sound insulation of buildings and buildings. Requirements

34. ČSN EN 1990 (730002) - Eurocode: Designing principles for construction

35. ČSN EN 1992-1-1 Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for building

36. ČSN 73 0540-2 Thermal protection devices, Part 2: Requirements

20. **FIRE SAFETY**

More details via fire safety report

21. **BUILDING SURVICES**

More details via building Services report

22. **CONCRETE**

More details via concrete report

23. **FOUNDATIONS**

More details via foundations report

24. **USED SOFTWARES**

- AutoCAD 2018
- MS Office
- Teplo