D.1.1 ARCHITECTURAL AND TECHNICAL SOLUTION

D.1.1.1 OBJECT PURPOSE AND CAPACITY

The building is designed to be dormitory – comfortable apartments for students of nearby universities. It is a three storey object. There are 14 apartments in two floors, together 28 apartments. There are three types of rooms – for three persons, for four persons and for disabled persons. The capacity is 76 inhabitants. The ground floor is composed of communication areas – library and two assembly halls, each for 56 persons.

D.1.1.2 ARCHITECTURAL SOLUTION

Urban solution – as concerns the urban solution the building was designed to not exceed the height of the surrounding buildings. The neighbourhood is a residential area with shops. Public transport stops (for example Šumavská) are nearby. The buildings will be surrounded by vegetation to provide a place of recreation for the students and also other visitors. There are no strict regulations of the building appearance.

Architectural solution – the architectural solution is tied to the other object on the building plot – Object "W". These two objects create together an enclosed space – a communication area, a kind of a square. Through this way inhabitants can meet and share facilities – library, canteen, fitness and assembly halls. And this is also possible for accommodated disabled persons.

The building has a form of an elongated block in L-shape with angle 50° and north-south oriented axis. Most of the windows are oriented east-west. The eastern facade is more dissected by balconies belonging to the student apartments. Also the ground floor has there a glass facade to bring light to the library. The western facade is simpler, only with windows. According to investor, for the building was chosen ventilated facade. Its cladding is a fibrecement board Cembrit Metro. Their dimension is 1 250 x 2 500 mm and they are available in RAL palette. Mainly used colours are 8003 Clay brown, 3012 Beige red, 6025 Fern green, 6021 Pale green, 6016 Turquoise green and 5024 Pastel blue. The facade will be done in shades of green with brown division lines.

There are three main stairwells. They serve as a communication areas for students. To bring enough light to these stairwells it was decided to use a glass facade. The system is Schüco FW 50+ SI. It is composed of aluminium vertical mullions and horizontal transoms. The sizes of panes can be seen on ground plans. It is equipped with shading system to reduce amount of direct solar gains. Parts of the glass facade can be opened and used for ventilation (mainly in the case of fire).

Because the building is long and relatively low, there were designed columns on the eastern part of the building to emphasize also verticality of the structure. These columns are not bearing any load (with exception of self-weight). They are anchored to concrete walls and also create division lines between balconies.

The solution of the roof is a vegetation (green) flat roof with extensive type flora. The system build-up is made by ZinCo Company. It is called "Sedum Carpet" and it is a shallow, ground covering plant community that contains various low-growing sedum species. The main blooming time is in summer. The roof is accessible by two entrances which are connected to main staircases. Because the roof will be open for inhabitants of the dormitory, there will be installed

heavy wood-plastic pathways. Their placement can be seen in roof plan drawing. However, this requires ensuring safety of the people on the roof. Therefore, there will be installed safety fence along the whole building. It will also divide parts of the roof with technical equipment. The design counts also with utilization of the roof by solar panels.

The height of the building to the attic is 11 120 mm. Clear height for ground floor is 3 100 mm. In the upper floors it depends if there is a suspended ceiling – it is 2 900 mm without and 2 600 mm with it. The project zero 0,000 is related to 219,762 m above sea level.

Interior – the ground floor is the part of the building which is common for the students and visitors. It is composed from two main parts – library and lecture halls. The library is rather small but it was designed to create pleasant working space for students. Sufficient light is ensured by three glass facades. A storage room for books belongs to this part of the building. Also there is an office for the library employees. The other large rooms the ground floor are the lecture halls. They are intended for 56 people each. Between them is a preparation room for lecturers. The project calculates with disabled persons, there restrooms for them and rooms are barrier-free. Other rooms in this floor are dormitory office, technical rooms and storage for bicycles. From this floor, authorized persons can get to a narrow underground installation channel which is going along the building.

The first floor and the second floor are the dormitory part of the building. There is a main corridor going along the centreline of the whole object. The staircases are at both ends of the corridor and also in the middle (breaking point). There are two common rooms in each floor. Also there is a small room for cleaning.

The utilization purpose of the building counts with disabled persons on wheelchairs. There is a parking lot with reserved space for them (9 and 4 places). Entrances are with ramps and there are elevators suitable for wheelchairs. Also the staircases will be equipped with platforms for wheelchairs. In the first floor there are nine apartments dedicated to the disabled persons. The equipment of the rooms and hygienic facilities comply with requirements given by standards and recommendations. The library and assembly halls are also prepared accessible for disabled persons. There are restrooms for them.

Doors – the equipment and dimensions of the apartments for disabled persons are adapted for them. Door must have clear width at least 800 mm. Door wings must be equipped with horizontal handles along the whole width in height 800-900 mm. Door cannot have glazing below 400 mm from bottom or it must be protected against breaking by wheelchair. Door with glazing lower than 800 mm above floor must be in height both 800-1 000 mm and 1 400-1 600 mm marked contrasting the background – by distinctive strip wider than 50 mm. Doors in residential buildings must have clear width 900 mm.

Windows – windows with sill lower than 500 mm above the floor must be equipped with protection against breaking. In every room must be at least one window with lever control at 1 100 mm above the floor.

Restrooms – cabin must have dimensions at least 1 800 x 2 150 mm. Door must open outside, be equipped with handle at 800-900 mm and be unlockable from outside.

Bathroom – toilet must be at least 450 mm from side wall, top edge of the seat must be in height 460 mm and flush control in height 1 200 mm. Handles must be on both sides of the toilet – distance 600 mm, height 800 mm and fixed handle must be 100 mm longer than the toilet, folding 200 mm longer. Basin must be with lever tap and its top edge must be at 800 mm. It should allow underpass. There should be vertical handle at least 500 mm long. Bath must have top edge at 500 mm; it must be 100 mm from wall and there must be 400 mm space between head and wall. There must be horizontal handle 1 200 mm long 100 mm above the bath and another vertical handle 500 mm long maximally 200 mm from the tap. Shower have dimension 900 x 900 mm. There is folding seat 450 x 450 mm in height 460 mm above the floor. There must be vertical handle 500 mm long placed 900 mm from the corner of the shower and horizontal handle 600 mm in height 800 mm. Other equipment is trash bin and hook for clothes.

D.1.1.3 BUILT-UP AREAS AND ORIENTATION

Sufficient area of windows is fulfilled for all rooms. Every room is equipped by suitable means of artificial lighting. The building was designed to catch the largest possible amount of sunlight; however it is often impossible to avoid shading of neighbouring buildings. Especially in limited space of a city.

Object "P"	1 776,12 m^2
Object "W"	1 873,39 m^2
Pavements	4 538,68 m^2
Roads and parking	6 410,57 m^2
Vegetation	9 453,03 m^2
Ponds and streams	693,18 m^2
Plot area	24 597,61 m^2
Built-up area (Object "P")	7,23 %
Built-up area	14,84 %

D.1.1.4 TECHNICAL SOLUTION

The structural system is a monolithic reinforced concrete skeleton. The main vertical load bearing elements are concrete walls and columns. The building envelope is created by infill hollow block masonry with good acoustic properties – Heluz AKU 25. It holds ventilated facade – thermal insulation and fibrecement boards Cembrit Metro on aluminium load-bearing construction. The internal walls are of two types – hollow block masonry (the same as for the facade) and plasterboard partitions. In some spaces there is a suspended ceiling to cover pipes and ventilation ducts (in the ground floor). The roof is flat, with vegetation and accessible for the inhabitants of the dormitory. A part of the roof can be utilized with solar panels. There are two entrances to the roof.

The building is designed in such way, that the intended load acting during construction and usage will not cause: collapse of the building or of its part; higher degree of unacceptable deformation; damage of other parts of the building or of technical facilities or of installed equipment as a result of major deformation of the structure; damage in case, when its range is disproportionate to its original cause. Mechanical resistance and stability of the structures designed by this project documentation has to be assessed in detail in its part concerned by statics and constructions.

There are no production facilities in the object. Therefore, there is a one technical room for the whole object. The connections of water and municipal heating are ended there and the distribution within the building is done by an installation channel going along the centreline of the building under the floor of the ground floor. In the technical room there is a heat exchange unit, which provides heating water. Heating itself is solved by standard radiators. There are two ventilation units in the building, each in a separate room (due to disposition requirements). Their inlets and outlets are on the roof.

All systems must be assembled according to manuals from their producers and according to construction detail drawings included in this documentation. It has to be checked and controlled periodically during the construction works and noted into site diary.

D.1.1.5 THERMAL ASSESSMENT OF CONSTRUCTIONS AND OPENINGS

The standards – the building is designed in accordance with act No. 406/2000 Coll., about energy management and ČSN 730450-2, thermal protection of buildings, with regard to year 2011 amendment. Compositions of constructions in contact with exterior are fulfilling required U-values (thermal loss coefficient) given by the standard.

There has been made an Energy label, which categorized the building as a class B (U_{em} = 0,265 W/m²K) – efficient building. The energy label is a part of this project documentation.

Constructions – ČSN 730450-2 has stated required and recommended U-values in W/m²K for different types of constructions. Also it is necessary to pay attention to construction details and their execution on the construction site. If there are instructions from a producer, they must be followed. Specified compositions are a part of this project documentation.

Construction	Real U-value [W/m²K]	Required U-value [W/m²K]	Recommended U-value [W/m²K]
External wall	0,145	0,300	0,250
Green roof	0,163	0,240	0,160
Ground floor	0,230	0,450	0,300
Windows	0,783	1,500	1,200
Doors	1,200	1,500	1,200
Glass facade	0,983	1,182	1,004

Windows and doors – the windows are made by producer Slavona, the type is HA110, which has average thermal loss coefficient U_W = 0,783 W/m²K. The other values are U_g = 0,6 W/m²K and U_f = 0,86 W/m²K and ψ_g = 0,043 W/mK.

The doors are from producer Ador CZ and have thermal loss coefficient U_W = 1,20 W/m²K. Specifications and tinsmith products can be found in list of doors, which is a part of this project documentation.

Glass facade – the producer is Schüco and the type is FW50+ SI. It comes with triple glazing. The U-value needed to be calculated and the protocol is attached. It has solved thermal bridges and to improve the thermal properties

Equipment – the heat is provided by the municipal heat distribution. The building is fully dependent on external power sources. However, part of the green roof can be utilized by solar panels producing electricity, which partially cover consumption of the building. The capacity will be specified later.

D.1.1.6 FOUNDATIONS AND RELATED SURVEYS

Geotechnical report is a part of this project documentation. The subsoil of the three-storey dormitory, up to the depth 10 m, is formed by loess and loess loams. The quaternary cover is formed by sandy loam with fragments. Due to low bearing capacity (ČSN 73 1000) of the subsoil and difficult foundation conditions, the assessed building will be founded on drilled piles. Their preliminary dimensions are calculated in specialized software and the report is attached. The calculation is for the most unfavourable loading case. The dimensions are designed with respect to subsoil conditions, freezing depth and transmitted load. However, the exact value of soil compressive strength and other properties has to be determined by a geologist in-situ.

Perimeter pile		**Internal pile**	
R_s – surface bearing capacity	651,44 kN	R_s – surface bearing capacity	727,95 kN
R_b – End bearing capacity	641,23 kN	R_b – End bearing capacity	673,64 kN
V_d – Extreme vertical force	1118,42 kN	V_d – Extreme vertical force	1 311,77 kN
R_c = 1 292,67 kN > 1118,42 kN = V_d		**R_c = 1 401,58 kN > 1 311,77 kN = V_d**	

The freezing depth is 1 200 mm. Therefore, every load-bearing construction must be founded at least to this depth. As it is stated in the geotechnical report, the level of ground water is tied to a rift system in greater depth.

For these conditions, working space between side of excavation and foundation was stated to 800 mm. The slope of excavation will be at least 1:0,5.

D.1.1.7 BUILDING INFLUENCES TO ENVIRONMENT

According to §4, act No. 100/2001 Coll., about assessment of environmental impacts, it is not necessary to evaluate impacts of the dormitory to environment. Waste produced during the construction works and during the usage of the building is being treated in compliance to act No. 185/2001 Coll., Waste Act, and must be categorized according to public notice No. 381/2001 Coll., and handled according to public notice No. 383/2001 Coll.

The production of waste can be divided to:

- Waste produced during the construction works – this kind of construction does not presume production of dangerous waste, requiring special care during liquidation. However common waste will be produced, it will be liquidated according to act No. 185/2001 Coll. by an authorized company. Glass and steel will be recycled, wood will be burned.
- Waste produced during the usage of the building – the purpose of the building does not deduce risk of production of dangerous waste. Waste production will be solved as is standard for a residential building.

The object is a standard non-production object, thus there are no exceptional hazards for environment. Household appliances are powered by electricity. Heating is solved by a municipal heat distribution system. The building is not affecting natural drainage conditions of the area. The building is not located in a protected area, national park or another type of reservation. During the construction works attention must be paid to existing vegetation. If it has to be preserved, it must be protected – for example by wooden planks. There are standards concerned with landscaping (ČSN 839001, 11, 21, 31, 41, 51, 61), which must be followed when working with vegetation.

Nevertheless there are rules for environment protection during construction works which must be followed. Above all it means protection of ground water against pollution, especially by oil products; protection of adjacent areas and roads against pollution, all vehicles must be cleaned before leaving the building site and all the transported material must be treated to minimize its uncontrolled spreading or leaking; protection against dangerous gases and odours; protection from dust and protection from noise and vibrations. The contractor will proceed during the construction works in compliance with public notice No. 272/2011 Coll., about health protection against negative effects of noise and vibration. He will ensure the limits given by this public notice will not be exceeded. Also he will use tools and machinery in appropriate technical condition. Loud machines can be placed in cells or other suitable closed spaces if necessary.

According to §4, act No. 100/2001 Coll., about assessment of environmental impacts, it is not necessary to evaluate impacts of library or dormitory building. Waste produced during the construction works and during the usage of the building is being treated in compliance to act No. 185/2001 Coll., Waste Act, and must be categorized according to public notice No. 381/2001 Coll., and handled according to public notice No. 383/2001 Coll.

D.1.1.8 TRAFFIC SOLUTION

The area is connected to the two neighbouring streets – Štefánikova and Staňkova. They provide entrance to the communication area between Object "P" and Object "W" and also entrances to the two parking lots according to the situation drawing. Also it shows paved areas. All paved areas with risk of standing water are sloped. The area is accessible for personal cars, trucks and by public transport from a nearby stop.

Both objects will allow connection to the public traffic infrastructure of Brno's municipal part Ponava through the parking lots and their connecting roads. There are two parking lots designed made of interlocking concrete tiles. A standard parking spot for car of group 1/O2 group is 2,5 m wide and 5,3 long, the parking spot for people with reduced mobility is 3,5 m wide and 5,3 long.

The northern parking lot is primarily designed for Object "P" with sufficient parking places for residents and visitors with reduced mobility. There is also one parking spot for families with children in strollers. The southern parking is designed for Object "W" with standard, family and wider parking spots for disabled people. There is also access road to canteen service doors of Object "W" and one parking spot for car group 1/N1. Both parking lots are connected to neighbouring streets Štefánikova and Staňkova. There is reduced speed on both parking lots to 20 km/h. Moreover there are designed speed bumps of type MP59 to further control excessive speeding. Curbs of road will have dimensions 150x250 mm.

The calculation were made in accordance with ČSN 73 6110.

Object	Unit type	Number of units per 1 parking place	Unit amount	Total amount of parking places
Dormitory				
-Object "W"	student bed	5	105	21
-Object "P"	student bed	5	85	17
Library				
-building P	public area [m²]	20	636	32
Lecture halls				
-building P	student	6	102	17
Canteen				
-Object "W"	public area [m²]	6	284	47
Shops				
-Object "W"	area [m²]	50	129	3
Fitness				
-Object "W"	visitor	2	20	10
	TOTAL AMOUNT OF PARKING PLACES:			147

D.1.1.9 PROTECTION OF BUILDING AGAINST NEGATIVE EFFECTS

During the construction works attention must be paid to existing vegetation. If it has to be preserved, it must be protected – for example by wooden planks. There are standards concerned with landscaping (ČSN 839001, 11, 21, 31, 41, 51, 61), which must be followed when working with vegetation. However, the plans and permissions do not show important plants in the plot.

The contractor will proceed during the construction works in compliance with public notice No. 272/2011 Coll., about health protection against negative effects of noise and vibration. He will ensure the limits given by this public notice will not be exceeded. Also he will use tools and machinery in appropriate technical condition. Loud machines can be placed in cells or other suitable closed spaces if necessary.

Other precautions for minimizing negative effects:

- Usage of modern machinery and tools with minimal noise levels
- The construction works will have as short duration as possible
- The construction works will be done with respect to environment and used machinery will be modern with minimal emissions (regularly checked) and without leakage of dangerous petroleum products
- In the case of leakage, the supplier of the machinery will be equipped with means for liquidation of the leaked substances (detergents, absorbers...)
- Vehicles leaving the construction site must be cleaned, so that they do not pollute other areas or roads; any pollution must be immediately removed
- Brash and debris must be moistened before transportation
- It is necessary to accept precautions, which will protect ground water against pollution
- Negative effects, especially emissions, noise, heat, quakes, vibration, dust, odour, dazzles and shades and water contamination must not deteriorate environment on the construction site and in its surroundings over admissible limits

Noise protection – In accordance with the type of building, the massive masonry walls and the composition of the roof structure, there is a sufficient airborne sound insulation of the building. The weighted laboratory acoustic resistance R_w of the perimeter infill masonry is 57 dB which is enough even with correction -4 dB. All constructions were designed to fulfil requirements for acoustic properties stated in ČSN 73 0532.

As concerns spreading of sound within the building, constructions must be done according to rules and recommendations from the producers. All floor structures in or above habitable rooms must have a layer of acoustic (impact) insulation. Layers above this insulation must be separated from walls by a mineral wool strip, thickness 10 mm.

Piping has to be bedded flexibly in relation to constructions to interrupt sound spreading within the construction. It is forbidden to wall up the piping without foam insulation. Piping leading through a floor structure must be separated from both concrete screed and the load-bearing construction below – these two constructions must not touch in any case.

Fire protection – is solved by Fire safety report and the summary is included Summary technical report in the chapter B.2.8.

Radon risk – According to a preliminary report, the objects are located in an area with a low radon index. In this case, there are no requirements for the waterproofing from this point of view. This layer is made from SBS modified bitumen Glastek 40 Special Mineral in two layers, which provides sufficient protection (class B waterproofing, ČSN 73 0601). These layers have to be continuous with welded connections. For the low radon index, there are no other requirements for constructions or devices.

Ground water – A standard protection against ground water is done according to the site conditions. Aggressive ground water was not detected; however this will be specified by an authorized geologist after assessment of subsoil conditions. The building is not located in an area with known seismic activity or undermining.

D.1.1.10 TECHNICAL DEMANDS FOR CONSTRUCTION

The project documentation is made in accordance with valid standards, acts and regulations and respects properties of used building materials and processes.

D.1.2 BUILDING AND CONSTRUCTIONAL PART

D.1.2.1 DESCRIPTION OF CONSTRUCTIONS

Foundations – the subsoil of the area is formed by loess and loess loams. This is subsoil with low load-bearing capacity. Therefore it was decided to use piles for foundation of the building. Their preliminary design was done by specialized software and it is attached to this project documentation. All piles are with the same diameter – 750 mm. The perimeter piles have length 7 m and the internal 7,5 m. Piles under balconies are 8 m long. The freezing depth is 1 200 mm.

Piles are designed as reinforced by welded rebar cages made from steel B500B and adapted for manipulation on the construction site. Longitudinal reinforcement is symmetrical. Shear resistance of the rebar cages is improved by stirrups in form of a spiral. The stirrups are especially important in the head of the pile. Cover of the reinforcement is given as 100 mm. The exact dimensions of the reinforcement will be calculated later by a specialized person according to ČSN EN 1992-1. The concrete class used for piles is C20/25, which means cylindrical pressure strength f_{ck} = 20 MPa, the degree of the influence of environment is XC2. Connection of monolithic columns is done in such way that in head of the pile are prepared reinforcement bars in anchorage length. Reinforcement of the column is then connected.

The piles are interconnected by foundation beams (strips) in thickness 300 mm. The bottom edge of these beams is in the level of pile head. The height is 1 010 mm on the perimeter. The internal piles are in greater depth, therefore the foundation beam is higher – 1 600 mm. This was done to create a longitudinal installation shaft. The material of the foundation beams is concrete class C30/37 and steel B500B, the degree of the influence of environment is XC2.

A concrete slab in thickness 150 mm is placed over the foundation beams with the column reinforcement drawn up to allow connection of columns in the next floor (keep anchorage length). The slab is reinforced by KARI mesh 150 x 150 mm. The overlap of two meshes must be at least 300 mm. It is laid on gravel bed, which has to be compacted to strength of the original subsoil. Under the internal walls is the KARI mesh in two layers. In locations, where an internal wall crosses the installation channel, the slab thickness of the slab is increased to 250 mm and it will be additionally reinforced. This strengthening is done also under walls with bracing function.

Water-tight construction is done by two layers of SBS modified bitumen. The bottom layer is on penetration paint Dekprimer and fully welded to the base slab. The top layer is then fully welded to the bottom layer. The type of both layers is Glastek 40 Special Mineral with thickness 4 mm and impregnated glass mat.

In the places of columns the waterproofing layer has to be cut out. To ensure water-tightness of the edges around columns a steel plate is put on the place of future column. The reinforcement is going through holes in the plate and it is welded to it. The steel plate has welded bolt shanks. Then another steel strips are tightened by nuts to the bolt shanks and the waterproofing is squeezed between the steel plate and steel strip.

The installation channel has to be water-tight too. Therefore, it was decided to cover floor, walls and ceiling by PVC waterproofing layer Fatrafol. It is covered by platon wrap and both anchored to walls by screws and wall plugs. The floor of the installation channel is protected by 50 mm thick layer of concrete screed. It is important to make expansion joints in the screed every 6 m. There are four entrances to the installation shaft – they are positioned according to plan. The main entrance has dimensions 1 500 x 900 mm and it is located in the technical room 1002. The other entrances are only for service; their dimensions are 900 x 700 mm. The cover is made from insulated metal deck.

There is thermal insulation to break the thermal bridge going through the foundations. It is placed along the full height of the foundation beams and the type is Styrodur 2800 C in thickness 80 mm. It is connected by adhesive compound and from the exterior side protected by a platon wrap in thickness 20 mm and with protrusions facing the insulation.

For detailed information about subsoil see attached geotechnical report.

Vertical constructions – the main load bearing element of the structure is a column. They are made from reinforced concrete. The concrete class is C30/37, the degree of the influence of environment is XC4. There are several (11) types of columns, different in cross-section and height. The columns in the ground floor have height 3 870 mm (with additional 1 600 mm for the internal columns in the installation shaft) and the columns in the upper floor have height 3 000 mm. Each column is based on an axis of a pile. Each column has reinforcement from steel B500B – longitudinal and stirrups, it has to be designed later by a specialist. All columns are plastered by Profimix JM 303 single layer plaster.

There are two main dimensions of the columns – 400 x300 mm in the interior and 400 x 400 mm on the perimeter of the building. The higher dimension of the perimeter columns is due to higher moments in transversal direction.

There is a special column between each balcony. It is not bearing any load except the self-weight. It is based on a foundation pad instead on a pile. To ensure stability of these columns, they are anchored to concrete walls by special steel plates and screws each 1 m – the scheme can be seen in foundations drawing. The top edge of these columns is protected by galvanized metal sheets against weather conditions.

As concerns the non load-bearing masonry, it is made from ceramic hollow blocks Heluz AKU 25. These blocks have good acoustic properties (the weighted laboratory acoustic resistance R_w of the perimeter infill masonry is 57 dB which is enough even with correction -4 dB) and they are used as internal and also external infill masonry. These walls in some places have also bracing function against horizontal loads. Infill masonry has to be anchored to neighbouring concrete constructions by metal plates, especially in the case of bracing walls. Internals walls are covered by Profimix JM 303 single-layer plaster. The used type of mortar is Profimix ZM 920. The exterior walls are from exterior side covered by a ventilated facade which is described in chapter concerned by thermal insulation. If there is an opening in this type of masonry, there is a ceramic lintel which is specified in an attached table.

There are several types of partitions; all of them are from producer Knauf. The most used type is Knauf W111 with single coating by 12,5 mm thick plasterboard Knauf White. In bathrooms and restrooms it was recommended to use Knauf Green impregnated plasterboards. If the partition is a dividing construction between fire sectors (border between protected and non-protected escape way and several other places in the ground floor) is coated by Knauf Red plasterboard with improved fire resistance. The Knauf W111 partitions are used in thickness 150 mm for more stressed locations and 100 mm for division of rooms in one apartment or unit. The thickness of insulation is 40 mm unless stated otherwise. Another type is a Knauf installation partition W116 in thickness 220 mm or more. It is used to hide water supply and sewerage.

The Knauf partitions are mounted only after all wet processes in the vicinity are completed. It is necessary to place expansion joints – every 15 m of straight length or 100 m^2 of partition area. If there are ceramic tiles on a plasterboard partition, it is suitable to decrease distance of CW profiles to 400 mm. All partitions are covered by acrylic paint on a penetration. If the surface is too uneven, it is recommended to use full putty cover.

Horizontal constructions – the main horizontal load-bearing construction is a monolithic two-way reinforced concrete slab. The concrete class is C35/45 and the degree of the influence of environment is XC1, XC4 in the highest floor. The reinforcement will be calculated later by a specialist and he will state its dimensions. The steel of reinforcement bars is B500B. This system is without girders; their function is supplied by reinforcement distribution inside the slab. Each field of the slab is divided into three strips, two "column" strips and one "span" strip, where the "column" strips are much more reinforced. A calculation will be made to state stresses and resistances in the critical perimeters around columns and, if necessary, punching reinforcement has to be designed. Due to thermal length changes, there are expansion joints in the horizontal floor structures made according to drawing. It is necessary to keep in mind that the walls and partitions must be divided in those places too.

The design thickness of the floor is 100 mm. It is composed of acoustic insulation made from mineral wool Isover T-N with $\Delta L_{n,w}$ 26 dB and cement screed Cemflow as a distribution layer. Distribution layer must be divided from masonry walls by 10 mm thick mineral wool strips to prevent spreading of impact sound. Also it is necessary to make expansion joints every at most 6 m of length. The flooring is made either from laminate, ceramic tiles or marmoleum.

Because there are pipes going through the slab during the concreting there must be left space for them which will be concreted after placement of pipes. Pipes must be divided from the floor structure by insulation (Tubex Sonik) and by a space.

In some places it is necessary to lead pipes horizontally under the floor structure. Again, they must be insulated by acoustic sleeves. To cover these distributions there is a suspended ceiling in some rooms – see the plan drawings. There are two types of suspended ceilings – Knauf D113 single coated by Knauf Red plasterboards. Its weight is 17 kg/m^2. In the two lecture halls in the ground floor there is another type – Knauf D127 "Cleaneo" suspended ceiling with acoustic properties. It consists of perforated single plasterboard Knauf White and absorption fabric Paratex. In the ground floor the suspended ceilings are also covering the ventilation ducts. Therefore, the clear height of the room is 3 100 mm. In the first floor there are no suspended ceilings. In the second floor they are used to hide pipes going above the roof structure –

ventilation of toilets and vertical sewers. Also there are the rainwater pipes. The clear height of the rooms below is 2 600 mm.

Position of heating pipes going through the floor structure and through the stiffening ring will be measured in-situ and drilled into concrete according to the documentation.

To fulfil requirements for thermal losses, the floor in the ground floor has to be insulated. This is done by 150 mm of expanded polystyrene; the type is EPS 150 S.

The construction height of the ground floor is 4 120 mm, 3 250 mm it is for the two upper floors.

Roof – the load-bearing construction for roof is described in chapter Horizontal constructions – it is the same slab as for the other floors. The roof is insulated by at least 220 mm of thermal insulation EPS 150 S. Because the sloping 2% is done by polystyrene wedges (again EPS 150 S) the thickness of the insulation increases from inlets to the attic. The type is an extensive green roof. The upper layer is formed by the substrate, which is levelled to be horizontal. The system build-up is made by ZinCo Company. It is called "Sedum Carpet" and it is a shallow, ground covering plant community that contains various low-growing sedum species. Therefore underneath it is hydroaccumulation and filtration layer and a root barier – all from producer ZinCo.

The roof is accessible for inhabitants of the dormitory. There are two entrances to the roof. They are light constructions made from aerated concrete masonry Ytong P4-500 in thickness 200 mm. Thermal insulation is made from 60 mm thick PIR panels Kingspan Kooltherm K5 which are connected by adhesive Profimix JM 303 and mechanical anchors – dowels IDK T 8/60L 120 mm. The roof is sloped in angle 19° and made from Ytong floor panels. Insulation is the same as for the walls only it is in thickness 70 mm. The waterproofing layer is done by two overlapping SBS modified bitumen layers – bottom Glastek 40 Special Mineral with glass fabric mat and Elastek 40 Special Dekor with polyester mat. The bottom layer is mechanically fixed to the load bearing structure and the top layer is welded to it. The roof edges are provided with flashing made from galvanized steel.

For the reason that the roof is accessible, there is a safety fence going at least 800 mm from the edge of the roof. It is 2 270 mm high and it is made from steel tubes fixed to the floor structure. To prevent thermal bridges, the tube is filled by PUR foam. Onto this tube is placed another tube which creates the fence itself and it is fixed by screw to be removable for future reconstructions. Between the fence stands is steel wire fence. Also to this fence stands can connect a worker who is on the "exterior" side of the fence to be protected against fall. All pipes leading to the roof are on the roof protected by fence or box against damage.

There is a wood-plastic raft to create pathways on the roof. It is made from wood plastic profiles 150 x 40 mm in two perpendicular layers. The raft is anchored every 5 m by the same system as the safety fence.

The attic height is 735 mm, 208 mm above the top of the substrate, which means +11,120 m related to project zero. The top edge of the substrate is at +10,881 m.

The project documentation counts with the possibility to install solar panels on a part of the roof. In this case is the solar panel mounted on a system solution by ZinCo – Solar Base SB200 made from recycled ABS plastic, which is placed under the substrate. To this base is fixed a frame from steel profiles. There is one advantage of solar panels on the green roof – due to lower surface temperatures of the roof, the efficiency of the panels is increased.

Staircases – there are three staircases in the building. All of them are made from reinforced concrete C30/37 with reinforcement steel B500B, cast in-situ. Due to different construction height in the ground floor the staircases there have 26 steps, 153,85 mm high and 300 mm long. In upper floor number of steps is 21 – height 154,76 mm and 300 mm long. The railing is made from steel tubes with diameter 40 mm and with wooden handrail. It is fixed by steel plates and screws from the top or side to the flight. The design can be seen in section drawings. However, it can be changed later by the investor. The top material of a step is made from granite tiles in thickness 22 mm. They are provided with anti-slip surface treatment.

In the ground floor, the staircases are based on Foamglass base to prevent thermal bridges. Its dimensions are 80 x 300 x 1 500 mm. The slab is additionally reinforced and thickened to 250 mm. Lowest thickness of the flight is 180 mm.

There is another staircase – auxiliary staircase leading to the roof. It has 4 steps with dimensions 154,76 mm to 300 mm. It is made from steel threads, welded to steel stringers, both from 3 mm thick profiled steel plates. It is fixed by screws to distribution layer which is reinforced by KARI mesh 150 x150 mm. The steel threads are with anti-slip finish.

Requirements for minimum clearance height have been fulfilled.

With respect to disabled persons, the staircases in the ground floor are equipped by platforms for wheelchairs. They have to be operational, especially in case of elevator outage.

Balconies – the static scheme for balcony is a cantilever with overhang 1 400 mm. The load-bearing slab is 160 mm thick and it is connected by "ISO" girder Schöck K30 CV30 H160 with 80 mm EPS to prevent creation of thermal bridge.

Protection of construction against water is done waterproofing and separation layer Schülter-Ditra 25. It is laid in 10 mm thick layer of adhesive Weber.for.flex, which is also gluing frost resistant ceramic tiles. They have dimension 200 x 200 mm and are with anti-slip surface. The sloping layer is done by concrete screed and the slope is 2%. For detailed description of railing see detail D02 – Detail of balcony connection. There is also displayed a Compacfoam profile under the balcony door.

Windows and doors – the windows are made by producer Slavona, the type is HA110, which has average thermal loss coefficient U_W = 0,783 W/m^{2}K. It is made of wood with aluminium cover and it has insulating triple glazing. It can be tilted or turned to ensure suitable type of ventilation. Specifications and ironwork can be found in list of windows, which is a part of this project documentation. Mounting of windows can be seen in detail D05 – Detail of window. The main mounting element is "Ejot" fixing point made from Compacfoam. It is necessary to use internal vapour barrier tape and external waterproofing tape according to detail drawing.

The doors metal with aluminium finish. They are from producer Ador CZ and have thermal loss coefficient U_W = 1,20 W/m²K. They have PUR foam insulating infill. Specifications and tinsmith products can be found in list of doors, which is a part of this project documentation.

It is necessary to fulfil requirements for disabled persons in their apartments. For details see chapter 1.2 Architectural solution in this report.

Also the door must fulfil conditions given by fire safety report, especially when leading to protected escape way.

Elevators – the manufacturer of both elevators in the building is company Schindler. The type is 3300, which is favourable for its engine, which is mounted directly above the counterweight and therefore it requires only small space above the cabin. They have different cabin sizes – one is 1 200 x 2 100 mm, this elevator is used for evacuation, it has accumulator to work also in the case of fire. The dimension of the other one is 1 200 x 1 400 mm. Other dimensions can be seen in ground plans.

When there is planar contact of an elevator shaft with a wall, there is 50 mm wide gap filled with mineral wool as acoustic insulation.

Standard and glass facades – The envelope of the structure is created by concrete and masonry walls. To this base is fixed the thermal insulation – polyisocyanurate (PIR) panels Kingspan Kooltherm K15 in thickness 130 mm which has great thermal properties. The fixing is double, mechanical by 11 dowels per panel IDK T 8/60L 180 mm and by adhesive Profimix JM 303. Fasteners at board edges must be located between 50-150 mm from edges and corners of the board and not overlap the joints. The joints should be always tapped using a 75 mm wide self-adhesive aluminium foil rainscreen cladding tape. In the absence of other protection, exposed edges must be protected by self-adhesive aluminium foil tape with 50 mm wide overlap onto the insulation board face.

The facade itself is ventilated – with air cavity. The ventilation openings cannot be closed and are covered by protection net against insects, fixed by sealant. The construction system is made by Cembrit and it is composed of aluminium girders LV-T55, fixed to walls by brackets LVZ, and fibrecement boards. The distance of girders is 500 mm and their maximal length is 3 000 mm (with expansion joint 15 mm). The profiles are fixed in upper part of the profile, the other connections are movable.

The boards are Cembrit Metro in thickness 8 mm and dimension 1 250 x 2 500 mm. They are fixed by blind rivets with spacing at most 400 mm from each other and 100 mm from edge in both vertical and horizontal directions. To cover the thermal dimension changes, there is an 8 mm gap between panels. When the panels have to be cut, the edges are painted to exactly the same colour provide by the manufacturer.

The glass facade is from the manufacturer Schüco. The type is Schüco FW50+ SI, which means super insulating. It is made from aluminium and it is composed from vertical mullions and horizontal transoms, both in depth 130 mm and width 50 mm. Between them are the glass panels. They are triple glazed and the frame has solved thermal bridges by PUR foam. The scheme of the facade can be seen in ground plans. The facade is anchored to reinforced concrete constructions on the perimeter – that means to the floor structure of the last floor and

neighbouring walls. Moreover, it is hanged on structural columns and also there are added columns to help the other reinforced concrete constructions to carry weight of the glass facade and the wind load. The calculation of the facade will be done directly by Schüco Company. If some transoms or mullions are under-dimensioned, they can reinforced by an integrated steel brace. The bottom of each mullion is anchored to the lowest floor structure heightened by a concrete block connected to the floor structure by reinforcement. It has dimensions 100 x 250 x 500 mm and on the top of it is a steel bearing plate in thickness 8 mm (see detail drawing). These elements are for transmitting of horizontal forces. Parts of this facade are glass windows and doors. Both are equipped by automatic opening system in the case of fire. The doors are marked according to requirements for disabled persons and are adapted to serve as emergency exits, especially by horizontal handles (bars).

Where there is a suspended ceiling going to the glass facade, the glazing is dimmed and 500 mm behind the glazing in the space between suspended ceiling and floor structure is a black curtain hanged on the floor structure to cover pipes and ventilation ducts.

In all cases it is necessary to follow manuals from manufacturers and standards.

D.1.2.2 LOADINGS

Static calculation of reinforcement of concrete structures was not demanded by the project task and must be provided later. It includes calculation of piles, foundation beams, columns and floor slabs.

For preliminary purposes were used following values. Values were taken from ČSN EN 1991-1.

Characteristic values of variable loads:

- for rooms 1,5 kN/m^2 (loading category A)
- for corridors staircases and balconies 3,0 kN/m^2 (loading category A)
- for green roof 3,0 kN/m^2 (loading category I-C1)
- snow load 1,0 kN/m^2 (Brno – II. snow area)

Characteristic values of permanent loads:

- for habitable floor 8,532 kN/m^2
- for green roof 9,906 kN/m^2