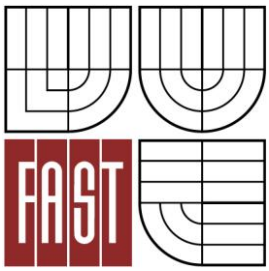
VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ
BRNO UNIVERSITY OF TECHNOLOGY



FAKULTA STAVEBNÍ
ÚSTAV POZEMNÍHO STAVITELSTVÍ

FACULTY OF CIVIL ENGINEERING
INSTITUTE OF BUILDING STRUCTURES

UNIVERSITY RESIDENTIAL CENTRE

DIPLOMOVÁ PRÁCE
MASTER'S THESIS

AUTOR PRÁCE — BC. PETR DVOŘÁK
AUTHOR

VEDOUCÍ PRÁCE — prof. Ing. JITKA MOHELNÍKOVÁ, Ph.D.
SUPERVISOR

BRNO 2014

VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ
FAKULTA STAVEBNÍ

Studijní program	N3607 Civil Engineering
Typ studijního programu	Navazující magisterský studijní program s výukou v anglickém jayzce s presenční formou studia
Studijní obor	3608T001 Pozemní stavby
Pracoviště	Ústav pozemního stavitelství

ZADÁNÍ DIPLOMOVÉ PRÁCE

Diplomant	Bc. PETR DVOŘÁK
Název	University Residential Centre
Vedoucí diplomové práce	doc. Ing. Jitka Mohelníková, Ph.D.
Datum zadání diplomové práce	31. 3. 2013
Datum odevzdání diplomové práce	17. 1. 2014

V Brně dne 31. 3. 2013

.....
prof. Ing. Miloslav Novotný, CSc.
Vedoucí ústavu

.....
prof. Ing. Rostislav Drochytka, CSc.
Děkan Fakulty stavební VUT

Podklady a literatura

Studie dispozičního řešení stavby, katalogy a odborná literatura, Stavební zákon č.183/2006 Sb., Vyhláška č.499/2006 Sb., Vyhláška 268/2009 Sb.,Vyhláška 398/2009 Sb., platné ČSN.

Zásady pro vypracování (zadání, cíle práce, požadované výstupy)

Zadání VŠKP: Projektová dokumentace stavební části k provedení novostavby části studenského cestra. Projekt včetně jeho textových příloh bude vypracován v anglickém jazyce.
Cíl práce: vyřešení dispozice pro daný účel, návrh vhodné konstrukční soustavy, nosného systému a vypracování výkresové dokumentace včetně textové části a příloh podle pokynů vedoucího práce. Textová i výkresová část bude zpracována s využitím výpočetní techniky (v textovém a grafickém editoru). Výkresy budou opatřeny jednotným popisovým polem a k obhajobě budou předloženy složené do desek z tvrdého papíru potažených černým plátnem s předepsaným popisem se zlatým písmem. Dílčí složky formátu A4 budou opatřeny popisovým polem s uvedením seznamu příloh na vnitřní straně složky.
Požadované výstupy dle uvedené Směrnice:
Textová část VŠKP bude obsahovat kromě ostatních položek také položku h) Úvod (popis námětu na zadání VŠKP), položku i) Vlastní text práce (projektová dokumentace – body A,B,F dle vyhlášky č.499/2006 Sb.) a položku j) Závěr (zhodnocení obsahu VŠKP, soulad se zadáním, změny oproti původní studii).
Příloha textové části VŠKP v případě, že diplomovou práci tvoří konstruktivní projekt, bude povinná a bude obsahovat výkresy pro provedení stavby (technická situace, základy, půdorysy řešených podlaží, konstrukce zastřešení, svislé řezy, pohledy, detaily, výkresy sestavy dílců popř. výkresy tvaru stropní konstrukce, specifikace, tabulky skladeb konstrukcí – rozsah určí vedoucí práce), zprávu požární bezpečnosti, stavebně fyzikální posouzení stavebních konstrukcí včetně zadané specializované části. O zpracování specializované části bude rozhodnuto vedoucím DP v průběhu práce studenta na zadaném tématu.

Struktura bakalářské/diplomové práce

VŠKP vypracujte a rozčleňte podle dále uvedené struktury:

1. Textová část VŠKP zpracovaná podle Směrnice rektora "Úprava, odevzdávání, zveřejňování a uchovávání vysokoškolských kvalifikačních prací" a Směrnice děkana "Úprava, odevzdávání, zveřejňování a uchovávání vysokoškolských kvalifikačních prací na FAST VUT" (povinná součást VŠKP).
2. Přílohy textové části VŠKP zpracované podle Směrnice rektora "Úprava, odevzdávání, zveřejňování a uchovávání vysokoškolských kvalifikačních prací" a Směrnice děkana "Úprava, odevzdávání, zveřejňování a uchovávání vysokoškolských kvalifikačních prací na FAST VUT" (nepovinná součást VŠKP v případě, že přílohy nejsou součástí textové části VŠKP, ale textovou část doplňují).

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doc. Ing. Jitka Mohelníková, Ph.D.
Vedoucí diplomové práce

Abstrakt

Název této diplomové práce je University Residential Centre, je psaná v anglickém jazyce. Úkolem bylo vytvořit vysokoškolskou kolej, budovu, která bude poskytovat studentům komfortní bydlení i prostory pro studium. Jedná se o trojpodlažní objekt - ve dvou horních podlažích jsou studentské pokoje. Přízemí je vyhrazeno pro vzdělávací účely. Zde se nachází knihovna a dva přednáškové sály. Z technického hlediska je konstrukční systém monolitický betonový skelet. Hlavními vertikálními nosnými prvky jsou sloupy a hlavními horizontálními jsou křížem vyztužené desky. Zajímavostí je využití prosklené fasády a inovativní tepelné izolace.

Klíčová slova

diplomová práce, vysokoškolská kolej, kolej, ubytování, knihovna, vzdělávání, betonový skelet, prosklená fasáda, zelená střecha, přístupná střecha

Abstract

University Residential Centre is the theme of this Master's thesis. The aim was to create a building, which will provide comfortable living and learning to students. The building has three floors - there are student apartments for one to four people in the upper two floors. The ground floor is dedicated to educational purposes. It contains a library and two lecture halls. From the constructional point of view, the structural system is a reinforced concrete skeleton. Main vertical elements are columns and main horizontal are two-way reinforced slabs. Utilization of glass facade and innovative type of thermal insulation can be found interesting.

Keywords

Master’s thesis, university residential centre, accommodation, dormitory, education, concrete skeleton, glass facade, green roof, accessible roof

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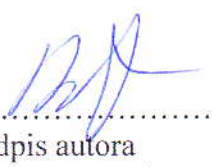
Bibliografická citace VŠKP

Bc. Petr Dvořák *University Residential Centre.* Brno, 2014. 13 s., 367 s. příl. Diplomová práce. Vysoké učení technické v Brně, Fakulta stavební, Ústav pozemního stavitelství. Vedoucí práce prof. Ing. Jitka Mohelníková, Ph.D.

Prohlášení:

Prohlašuji, že jsem diplomovou práci zpracoval(a) samostatně a že jsem uvedl(a) všechny použité informační zdroje.

V Brně dne 6.1.2014



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podpis autora
Bc. Petr Dvořák

Poděkování

Na tomto místě bych rád poděkoval všem, kteří mě podporovali během studia a tvorby této diplomové práce, zejména vedoucí práce prof. Ing. Jitce Mohelníkové, Ph.D. za ochotu a trpělivost při konzultacích. Dále pak mé rodině, spolužákům a škole, především Ing. Aleně Studýnkové, referentce studia v anglickém jazyce.

Obsah

Vlastní projekt včetně následujících zpráv je v příloze. Počet stran je započítán do příloh.

Content

The main project including these reports is in attachments.

Úvod

Úvodem mé práce bych rád zmínil, že tento projekt byl vždy zamýšlen jako součást většího celku nazvaného University Residential Centre, který jsme řešili společně s mým kolegou a spolužákem Bc. Janem Weyrem. I když jsme pracovali odděleně, každý na své části, tyto části se navzájem doplňují.

První myšlenkou bylo vytvoření areálu pro studenty, který by splnil jejich potřeby na ubytování, studium, ale také volný čas. Kvůli náročnosti takového projektu, který by řešil nejen budovy, ale i parkování a zelené plochy, bylo nutné najít dostatečně velký pozemek. Nakonec byl vybrán prostor bývalých kasáren v Brně, Ponavě. Nespornou výhodou toho pozemku je jeho pozice blízká brněnským univerzitám. Dalším krokem bylo vytvoření architektonické studie. Ta je výsledkem kooperace, kdy bylo nutné rozdělit jednotlivé funkce mezi budovy v areálu. V hrubých obrysech vznikl také tvar obou budov a jejich vzájemné umístění, které mezi nimi vytváří komunikační a odpočinkový prostor.

Tento projekt zpracovává severní budovu s názvem Object „P“. Jedná se o třípodlažní betonový skelet, kde přízemí slouží ke vzdělávání, a dvě nadzemní podlaží k ubytování studentů. Nedílnou součástí vzdělávacího prostoru je knihovna. Ta by měla sloužit nejen ubytovaným z bloků Object „P“ a Object „W“, ale také široké veřejnosti. Stejný záměr platí i pro dva přednáškové sály.

Při navrhování jsem zvláštní pozornost věnoval bezbariérovému přístupu. Všechna podlaží jsou přístupná pro invalidy. Navíc je zde devět pokojů v prvním patře určených pro osoby na vozíku. Vybavení a dispozice by jim měly dopřát veškerý komfort. Ostatní pokoje jsou také navrženy s ohledem na pohodlí. Každý byt má svou vlastní kuchyň a sociální zařízení. V jednom pokoji budou nejvíce dva studenti. Buňky na východní straně budovy jsou prostornější a mým záměrem je, že eventuelně mohou sloužit jako takzvané „startovací byty“ pro mladé absolventy.

Introduction

In the introduction to my work, I want to mention, that the project was always designed to be realized together with the project of my colleague Bc. Jan Weyr. They complement each other.

The first idea was to create a space for students. It should have fulfilled their needs for accommodation, studying but also for leisure time. Then a building plot was found in the city of Brno, which is large enough for two buildings and their needs, such as parking lots or vegetation and gardens. Indisputable advantage of the plot is closeness to universities in Brno. Afterwards an architectonic study needed to be done, and it was a product of cooperation. The facilities were divided between the two buildings and their shape was designed to create an enclosed area, a kind of a square.

My project solves the northern building, so called Object "P". It is a three-storey concrete skeleton structure, where the ground floor is dedicated to education and the others to accommodation. There is a library. It should be used not only by residents of Object "P" and Object "W", but also by other people. The two lecture halls have the same philosophy.

A special attention was paid to barrier-free use of the building. The three floors are completely accessible for disabled persons with wheelchairs. Moreover, nine apartments in the first floor are dedicated to them and should provide them all the comfort they need. Also the other apartments are rather higher class. Each of them has full-size kitchen and hygienic facilities. At most two students share a room. The apartments on the eastern side of the building are spacious and can be used also as starting flats for young graduates.

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FACULTY OF CIVIL ENGINEERING
INSTITUTE OF BUILDING STRUCTURES

ACCOMPANYING REPORT

DIPLOMOVÁ PRÁCE
MASTER'S THESIS

AUTOR PRÁCE — BC. PETR DVOŘÁK
AUTHOR

VEDOUCÍ PRÁCE — prof. Ing. JITKA MOHELNÍKOVÁ, Ph.D.
SUPERVISOR

BRNO 2014

A IDENTIFICATION

A.1.1 BUILDING INFORMATION

The subject of this project documentation is a university residential centre, new complex of buildings located in the city of Brno, district Královo pole.

Building name: University Residential Centre
Object "P", Library and Dormitory
Brno, Czech Republic

Plot number: 456/20, cadastral district Ponava (611379),
municipality Brno (582786)

Documentation level: Architectonical study and realization documentation

A.1.2 CLAIMANT INFORMATION

Investor: Vysoké učení technické v Brně

Land owner: Statutární město Brno
Dominikánské náměstí 196/1, Brno, CZ

A.1.3 DESIGNER INFORMATION

Designer: Bc. Petr Dvořák, Okružní 588, Kaplice, CZ

Building authority: Stavební úřad Brno

A.2 SOURCES

- Web cadastral maps (ČÚZK – http://nahlizenidokn.cuzk.cz/)
- Copy of regulatory plan
- Copy of utility networks map
- Geotechnical report

A.3 AREA CHARACTERISTICS

The investor has ordered a project for realization of a new building – a university residential centre. It is a group of two buildings (Object "P" and Object "W") with surrounding pavements and landscaping. This accompanying report and project are solving the northern building – Object "P". It is a three-storey building with reinforced concrete construction.

The project has been based on an architectonical study and has been made in accordance with the urban regulatory plan of city of Brno.

A.4 SUMMARY BUILDING INFORMATION

The building plot, number 456/20, is located in district Královo Pole, in the place of former barracks. Currently, the plot is a brown field, divided to smaller parts 456/1-10, 456/15-16, 456/18-19, 457/1-4 and 458 which are going to be consolidated before the realization. The final plot area is 24 597,41 m^2. The built-up area is 1 776,12 m^2 by Object "P" and 1 837,39 m^2 by Object "W" (total percentage 14,84%). The area of pavements is 4 538,68 m^2 and area of parking lots and roads is 6 410,57 m^2. There is Štefánikova Street going along the eastern border of the plot and on the opposite side there is Staňkova Street. There are two entries to the plot, one from each road (see the situation drawing). The land is almost flat and before the realization self-seeded trees and bushes must be removed.

The new 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.

The ground floor has two main purposes – library and two assembly halls. The first and the second floor are composed of accommodation units. There are nine apartments adjusted for disable persons, each for one or two persons. The floors are connected by three stairwells and two elevators.

The subsoil is formed by loess and loess loams. The level of the ground water is tied to the rift system in a greater depth. More detailed information is written in a separate geotechnical report. The rainwater is gathered to combined sewerage. Also there are other utility lines under the neighbouring road, such as municipal heat distribution. For more information see situation drawing.

This documentation will be consulted and approved by all concerned authorities and utility lines administrators. The building is located in an area intended for built-up and is in accordance with the territorial planning documentation.

The starting and finishing dates have not been stated yet. The investor will decide according to his situation and progression of tenders. The cost will be estimated after all the tender winners will introduce their offers. However, the preliminary evaluation result is 150 000 000 CZK.

A.5 DIVISION OF OBJECTS

According to the situation the objects, which are solved by this project documentation, are listed as: BO01 OBJECT "P", BO02 OBJECT "W", BO03 PAVED AREAS, BO04 ROADS, BO05 PARKING LOT, BO06 GARDEN AND VEGETATION, BO07 FENCE and BO08-11 CONNECTIONS. This project is mainly concerned by the BO01 OBJECT "P", the other objects are listed in two drawings attached – neighbourhood relations and situation. They are used as further reference for positioning and bonds between the building objects.

Civil objects	BO01	Object "P"
	BO02	Object "W"
	BO03	Paved areas
	BO04	Roads
	BO05	Parking lot
	BO06	Garden and vegetation
	BO07	Fence
Utility objects	BO08	Water supply
	BO09	Sewerage
	BO10	Heating
	BO11	Electricity

Brno, 26.12.2013 Created by: Bc. Petr Dvořák

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FAKULTA STAVEBNÍ
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FACULTY OF CIVIL ENGINEERING
INSTITUTE OF BUILDING STRUCTURES

SUMMARY TECHNICAL REPORT

DIPLOMOVÁ PRÁCE
MASTER'S THESIS

AUTOR PRÁCE — BC. PETR DVOŘÁK
AUTHOR

VEDOUCÍ PRÁCE — prof. Ing. JITKA MOHELNÍKOVÁ, Ph.D.
SUPERVISOR

BRNO 2014

Building name:	University Residential Centre Object "P", Library and Dormitory Brno, Czech Republic
Plot number:	456/20, cadastral district Ponava (611379), municipality Brno (582786)
Documentation level:	Architectonical study and realization documentation
Investor:	Vysoké učení technické v Brně
Land owner:	Statutární město Brno Dominikánské náměstí 196/1, Brno, CZ
Designer:	Bc. Petr Dvořák, Okružní 588, Kaplice, CZ
Building authority:	Stavební úřad Brno

B.1 AREA CHARACTERISTICS

This project documentation is concerned by a new building located in Brno. The building plot was built up by barracks. Now it is a brown field. Currently, the plot is a brown field, divided to smaller parts 456/1-10, 456/15-16, 456/18-19, 457/1-4 and 458 which are going to be consolidated before the realization. The final plot area is 30 160 m^2. The built-up area is 1785,82 m^2 by Object "P" and 500 m^2 by Object "W" (total percentage 50%). The area of pavements is 1000 m^2. There is Štefánikova Street going along the eastern border of the plot and on the opposite side there is Staňkova Street. There are two entries to the plot, one from each road (see the situation drawing). The plot is in a slight slope from west to east.

As a part of this documentation there is a geotechnical report. According to this (low bearing capacity of the subsoil) it was decided to use pile foundation. Hydrogeological survey – it is partially solved by the geotechnical report. It states that the level of ground water is tied to a rift system in a greater depth. More detailed survey will be done before the construction process.

The building is not located in a conservation area. Therefore, there was no need to carry out historical or archaeological surveys. Also, there is no threat of landslides or earthquakes in the building area. Moreover, it is not a flood area. No special precautions related to mining need to be taken in to account.

The building is located entirely within the building plot. During the built up the building company must follow obligatory rules concerning the protection of the environment and neighbouring properties. Owners of neighbouring properties have no special requirements.

The previous buildings have been removed already. First part of the building process will be to remove trees and bushes. These plants are self-seeded and there is no need of protection. Moreover, as a part of urban changes, new vegetation will be planted.

There are utility lines under neighbouring roads. The concerned authorities have permitted connections and they are solved in an attached situation drawing. The used utility lines are water supply, sewerage, electricity and municipal heat distribution.

The construction works will be carried out in a continuous term (including technological breaks). There are no known additional investments yet.

B.2 OVERALL BUILDING INFORMATION

B.2.1 BUILDING PURPOSE AND CAPACITY

The building is designed to be dormitory – comfortable apartments for students of nearby universities. 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.

B.2.2 OVERALL URBAN AND ARCHITECTURAL 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 (ex. 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 for the building appearance.

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.

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.

B.2.3 OVERALL SOLUTION OF PRODUCTION FACILITIES

As concerns the Object "P", there are no production facilities.

B.2.4 SOLUTION FOR DISABLED PERSONS

The utilization purpose of the building counts with disabled persons on wheelchairs. There is a parking lot with reserved space for them. 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.

B.2.5 SAFETY DURING BUILDING USAGE

The utilization of the building must comply with general mandatory rules.

B.2.6 BASIC STRUCTURAL CHARACTERISTICS

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 founded on piles due to low load-bearing capacity of the subsoil. However, there are no problems with the ground water. The freezing depth is 1 200 mm.

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.

B.2.7 BASIC CHARACTERISTICS OF TECHNICAL FACILITIES

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.

B.2.8 FIRE SAFETY

The fire safety of the building is described in detail in a special part of this project documentation – in the fire safety report.

Fire sectors – the building is divided into fire sectors according to requirements of the standard ČSN 73 0818. Technical facilities, such as technical room, have separate sire sector. Then, the library and its belongings are in a separate fire sector. Also so are the assembly halls. Each apartment is a separate fire sector.

Fire sectors					
Ground floor		**First floor**		**Second floor**	
Sector	**Degree**	**Sector**	**Degree**	**Sector**	**Degree**
N1.01/N3	II.	N1.01/N3	II.	N1.01/N3	II.
N1.02	I.	N2.01	III.	N3.01	III.
N1.09/N3	I.	N2.02	II.	N3.02	II.
N1.03	II.	N2.03	II.	N3.03	II.
N1.04	III.	N2.04	II.	N3.04	II.
N1.05/N3	II.	N2.05	II.	N3.05	II.
N1.06	IV.	N2.06	II.	N3.06	II.
N1.07	III.	N2.07	I.	N3.07	I.
N1.08/N3	II.	N1.05/N3	II.	N1.05/N3	II.
N1.10/N3	I.	N2.08	I.	N3.08	I.
		N2.09	II.	N3.09	II.
		N2.10	II.	N3.10	II.
		N2.11	II.	N3.11	II.
		N2.12	II.	N3.12	II.
		N2.13	II.	N3.13	II.
		N2.14	II.	N3.14	II.
		N2.15	II.	N3.15	II.
		N2.16	II.	N3.16	II.
		N2.17	II.	N3.17	II.
		N1.08/N3	II.	N1.08/N3	II.
		N1.09/N3	I.	N1.09/N3	I.
		N1.10/N3	I.	N1.10/N3	I.

Evaluation of constructions – The construction of the building is class DP1 – non flammable. This allows creation of three protected escape ways by the staircases. The dividing constructions are made from concrete, masonry and plasterboards, materials with high fire resistance.

Fire distances – they have been calculated according to ČSN 73 0802.

Ground floor								
Position	**h_u [m]**	**l [m]**	**S_{po} [m^2]**	**S_p [m^2]**	**p_o [%]**	**Sector**	**p_v [kg/m^2]**	**d_1 [m]**
1	2,15	1,90	4,09	4,09	100	N1.07	57,00	**4,91**
	2,30	5,35	6,65	12,31	54	N1.06	69,13	**3,48**
2	1,50	3,00	3,00	4,50	67	N1.04	51,06	**3,65**
	2,20	21,50	19,80	47,30	42	N1.03	27,58	**2,45**
3	0	0	-	-	-	-	-	**-**
4	4,02	9,26	37,23	37,23	100	N1.03	27,58	**6,04**
5	4,02	54,34	172,74	218,45	79	N1.06	69,13	**10,68**
6	0	0	-	-	-	-	-	**-**

Water for extinguishing – due to ČSN 73 0873 internal hydrants are demanded for the object. The ground floor (which is solved by this report) contains four hydrants. The used type a fire hose system which consists of hose reel, inlet valve, 20 m long lay-flat hose with reach 30 m and a shut-off nozzle.

External sources of water for extinguishing are underground hydrants located in the Štefánikova Street. There are four of them which are closer than demanded 100 m specified in ČSN 73 0873, tab. 1 for building with larger area than 2 000 m^2 and they cover the whole building. The dimension DN150 fulfils the standards. Static pressure of the hydrant must be at least 200 kPa.

Access roads – According to standard ČSN 73 0802 all objects must have an access road to allow action of fire fighters. For the object as access roads can be used Štefánikova Street and the northern parking lot. From there the entrances are less than 20 m far and also paved areas can be used. In the case that the building is lower than 12 m there is no need to have a boarding area for the fire brigade.

Entrances and roads to the plot useable for arrival of fire fighting vehicles have at least 3,5 m of clear width to fulfil the requirements of the standard ČSN 73 0802.

Technical equipment – ventilation will be both natural and forced and there will be two operational units – one in room 1003 and the other in room 1022. The ventilation system has built-in recuperation unit. The inlets and outlets will be placed in vertical shafts leading to the roof. The shaft and the ventilation technical room are together separate fire sector. The ventilation ducts will be placed between reinforced concrete floor structure and suspended ceiling made from plasterboards. Where the ventilation duct crosses a border of a fire sector it will be equipped with fire damper according to standards to prevent smoke from spreading.

The standard ČSN 73 0802:2009 states the requirements for service pipes. If the clear area of the pipe is more than 40 000 mm^2 it (which is true for the ventilation ducts) it will be surrounded by materials with fire reaction class A1 (plastered masonry wall).

Safety devices – the building will be equipped with automatic fire detectors and fire alarm systems according to the Fire safety plan. This is done following the regulation No. 23/2008 Coll. It consists of heat and smoke detectors or it can be activated manually by fire alarm button. In the reception (room 1013) will be installed electronic fire signalling central. Also there will be accessible telephone for fire reporting. Manual fire alarm buttons will be located to be clearly visible and reachable without any obstacles. They will be marked according to regulation.

Acoustic fire signalling device will be in every room. Emergency speaker control will be located in the reception (room 1013) and from there evacuation can be controlled and conducted. It has to fulfil requirements of ČSN EN 60846 and ČSN EN 60849. Both devices will be equipped by accumulators to be fully operational in the case of fire for at least 15 minutes.

Escape ways must be marked according to ČSN ISO 3846 where the exit is not directly visible. These marks must ease the evacuation process. Therefore, changes of direction of escape (horizontally and vertically) and must be marked by signs and arrows. This is valid also for crossings of escape ways.

Emergency lighting must be working in the case of fire for 15 minutes in type A protected emergency ways. This is valid also for non-protected emergency ways (15 minutes). Every emergency light will be equipped by accumulator to meet the required 15 minutes of working time without power connection. Emergency lights will be placed in all rooms according to the Fire safety plan drawing.

B.2.9 ENERGY SOLUTION

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 thermal average loss coefficient U_W = 0,783 W/m²K. 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.

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.

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.

B.2.10 HYGIENIC REQUIREMENTS

The building satisfies requirements given by act No. 183/2006 Coll., Building Law and by public notice No. 268/2009 Coll., about technical requirements for buildings – especially part three. Further the building satisfies ČSN 73 4301 and other valid standards and regulations. The project documentation fulfils relevant rules both for interior of the building and exterior influences of the building.

Ventilation – in apartments it is designed as natural, using infiltration and ventilation by openings. The ground floor has forced ventilation with recuperation. There are two ventilation units and the inlet and outlet are on the roof. Vapour and fume produced in kitchen is cleaned by kitchen extractor hood and cycled in the room. Every kitchen has the possibility to ventilate by a window.

Air conditioning – cooling is not designed. The perimeter walls have good accumulation capacity and the roof has sufficient thermal insulation, therefore there is satisfactory temperature stability during year.

Heating – it is done by municipal hot water distribution. There is a heat exchanger in the technical room. The hot water is then distributed to radiators.

Daylighting – openings was designed provide sufficient light to all habitable rooms. Every window, including French windows, will have a possibility of shading by curtains or by window blinds.

B.2.11 PROTECTION AGAINST NEGATIVE ENVIRONMENTAL 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 any important plants in the building area.

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.

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 a separate fire safety report and the summary is included in the chapter B.2.8.

B.3 TECHNICAL INFRASTRUCTURE

Sewerage – the project documentation solves the whole area. Therefore there are three connections to the combined sewer main located under the Štefánikova Street (sewage and rainwater together). All of them are made from earthenware pipes. The piping outside the building must be placed at least in the freezing depth, which is 1 200 mm. The north connection is dewatering the north parking lot. The slope is constant 1% and the dimension is DN200. There is a revision shaft on the plot 2 m behind the fence. The inspection shaft is made from prefabricate concrete rings with diameter 1 200 mm. It is closed by a round cast iron cover with diameter 600 mm. The standards state the maximal distance of revision shafts to 18 m (40 m if the section is straight without bends). Therefore there are three other shafts along the whole length. They have the same dimensions.

The south connection is dewatering the south parking lot. There are 7 revision shafts with cleaning armature. The dimensions are DN200 and DN300, slope 2,4% and 8,7%. To this branch is connected the canteen in Object "W". The canteen requires installation of oil retention tank which has to be periodically cleaned by a responsible company. The tank is made from plastic and has retention capacity 3 m^3 (approximately 400 lunches, 4 l/s). It is located 2 m from the building.

The middle sewerage connection is the main for sewerage of the both buildings. It is also designed to take away rainwater from both roofs. The dimensions are DN250 and DN400, constant slope 2,4%. There are three revision shafts.

Water supply – water main is located under the Štefánikova Street. The service pipe leads to three water meter shafts placed on the plot. Each shaft is placed 2 m from each building. The water meter shaft is made by producer EKONA, the type is VŠ-K 15 and dimensions are 1 500x1 000 mm. It is made from plastic (polypropylene) and it has a round plastic cover with diameter 600 mm. Concrete is poured around the shaft. The material of the service pipe is HDPE 100 SDR 11 (ČSN 75 5410), the dimension is DN80. It is also supplying water for internal hydrants. Therefore it has to have pressure at highest hydrant at least $p_{min,f}$ = 200 kPa.

The owner is responsible for protection of water main by anti-pollution check valve. Outside the building, 300 mm above the piping, there will be a warning foil. The piping outside the building must be placed at least in the freezing depth. Also the pipe must be laid into a sand bed (thickness 100 mm) and covered by sand up to the height 300 mm above the pipe.

Power supply – low voltage distribution cable is located by under the Štefánikova Street. From there a standard connection cable will be lead to both buildings amd the filtration station. Power junction boxes will be located on the walls of the buildings above the connections. It is a plastic box Elaplast PS1 100A HH, which is resistant to weather conditions and protects the wiring inside. It is also lockable, only authorizes persons will have the key. The specification is 3 PEN ~50 Hz 400/230 V / TN-C.

Rain water – rain water is taken away together with sewage by combined sewerage. Water from the roof is taken inlets and by internal sewerage pipes. The requirements are the same as for the sewerage pipes.

Municipal heat distribution – the heat is distributed by a hot water piping. Currently it ends under the Štefánikova Street. Now it will be extended and led to the technical room. There will be a heat exchanger which designed by a specialist. There will be an inspection shaft near the border of the plot. The material of the inlet and outlet pipe will be steel with insulation. This will be specified by administrator of the municipal heat distribution. The dimensions are 2x DN100.

B.4 TRAFFIC SOLUTION

The area is connected to the two neighbouring streets – Štefánikova and Staňkova. They provide entrance to the communication area between the objects P and 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.

B.5 VEGETATION AND LANDSCAPING

Vegetation is going to be solved according to the situation drawing. There are no major landscaping changes, which can influence neighbouring buildings or geology of the area.

B.6 ENVIRONMENTAL INFLUENCES AND PROTECTION

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. Storage of municipal waste will be placed according to the situation drawing.

B.7 PROTECTION OF INHABITANTS

The building fulfils all requirements given by standards for protection of inhabitants.

B.8 BUILDING WORKS ORGANIZATION

The building site and workplace will be taken over 22 May, 2014 between the investor and the contractor. There will be made up a site diary involving information about taking over the building site. All building works are supervised by site manager or mandated foreman. He is also checking volumes of earthworks in given places. It's necessary to keep demanded dimensions of excavations and compactions. Before the building works, the area has to be fenced.

The construction company has their own machinery and they will be responsible for their operation. Machinery is operated only by assigned and trained personnel. Before the beginning of construction works operating personnel will have checked technical status of all used machinery. All of the earthworks and construction works are executed at the area of the building site; hence there is no need to provide additional safety precautions.

There will be one entrance for machinery from the Štefánikova Street and one from the street Staňkova. All machinery has to be cleaned before leaving the construction site.

The dewatering will be done by drainage according to a plan which will be specified later. If possible all soil from earthworks will be used on the site; the rest will be taken to a specified place.

Common waste produced before and during the construction works:

Code	Name of waste	Origin
17 01	Concrete, bricks, ceramics	Building works
17 02	Wood, glass, plastics	Building works, Vegetation
17 03	Bitumen and tar	Building works
17 04	Metals	Building works
17 05	Soil and rocks	Earthworks
17 06	Insulation materials	Building works
17 08	Gypsum based materials	Building works
17 09	Other building materials	Building works
20 03	Other municipal waste	Site facilities

In the vicinity of the construction site there are no buildings which are used by disabled persons and this function will be influenced or impossible during the built up process.

There are no other special requirements for the construction works.

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VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ
BRNO UNIVERSITY OF TECHNOLOGY

FAKULTA STAVEBNÍ
ÚSTAV POZEMNÍHO STAVITELSTVÍ

FACULTY OF CIVIL ENGINEERING
INSTITUTE OF BUILDING STRUCTURES

TECHNICAL REPORT

DIPLOMOVÁ PRÁCE
MASTER'S THESIS

AUTOR PRÁCE — BC. PETR DVOŘÁK
AUTHOR

VEDOUCÍ PRÁCE — prof. Ing. JITKA MOHELNÍKOVÁ, Ph.D.
SUPERVISOR

BRNO 2014

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]
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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

VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ
BRNO UNIVERSITY OF TECHNOLOGY

FAKULTA STAVEBNÍ
ÚSTAV POZEMNÍHO STAVITELSTVÍ

FACULTY OF CIVIL ENGINEERING
INSTITUTE OF BUILDING STRUCTURES

FIRE SAFETY REPORT

DIPLOMOVÁ PRÁCE
MASTER'S THESIS

AUTOR PRÁCE — BC. PETR DVOŘÁK
AUTHOR

VEDOUCÍ PRÁCE — prof. Ing. JITKA MOHELNÍKOVÁ, Ph.D.
SUPERVISOR

BRNO 2014

1 BACKGROUND DOCUMENTS

- Project documentation
- Czech National Standards
  - ČSN 73 0810 – Fire safety of buildings, Common provisions
  - ČSN 73 0818 – Fire safety of buildings, Inhabitants
  - ČSN 73 0802 – Fire safety of buildings, Non-production buildings
  - ČSN 73 0873 – Fire safety of buildings, Water supply for fire systems
  - ČSN EN 13501 – Fire classification of construction products
- Public notices
  - No. 23/2008 Coll., about technical conditions for fire safety of buildings
  - No. 268/2011 Coll., about technical requirements for buildings
  - No. 246/2001 Coll., about assessment of conditions for fire safety

2 BRIEF DESCRIPTION OF BUILDING

2.1 GENERAL DESCRIPTION

The project documentation is concerned by a new building – Object "P" in a new campus University Residential Centre. It consists of student apartments, library and two lecture halls. Object "W" is solved in another project documentation. According to the task, this report solves in detail only the ground floor of the building.

2.2 LAYOUT

Entrances – the building can be accessed by four entrances (the other two are purpose only). Three entrances lead from protected escape ways. All entrances have clear width 1 800 mm and are equipped with emergency door handle (horizontal bar).

Floors – the building has three floors. The upper two floors are composed only from student apartments, 14 flats in each floor. The capacity is one, three or four people per apartment. There are three stairwells – protected escape ways, which create main corridor for people.

Area, floor area – the total object "P" built-up area is 1 776,12 m^2. Area of library is 636,74 m^2. and the two lecture halls have area 78,62 and 75,38 m^2 respectively. The sum of areas of all apartments is 2 086,97 m^2.

2.3 CONSTRUCTIONS

Foundations – are composed from reinforced concrete raft based on piles. Under the floor of the ground floor there is an installation channel which concentrates many service pipes. Clear height of the channel is 1 550 mm.

Vertical constructions – the main load-bearing elements are reinforced concrete columns, locally substituted by reinforced concrete walls (200 mm). Between the columns is infill masonry – hollow block masonry with acoustic properties Heluz AKU 25 (250 mm). This all is covered by ventilated facade with layer of thermal insulation – PIR (polyisocyanurate) panels Kingspan Kooltherm K15 in thickness 130 mm. The cladding is hanged on aluminium profiles and is made from fibrecement panels – Cembrit Metro.

Horizontal constructions – the floor structures are made from reinforced concrete. The static scheme is two-way reinforced slab with thickness 250 mm. Ceilings are plastered by lime cement plaster or covered by suspended ceilings with fire protection properties (Knauf RED 12,5 mm). The space above the suspended ceiling is used for service pipes and, in the ground floor, for ventilation ducts.

Roof – the load-bearing element of the roof is the same as the other floor structures (reinforced concrete slab 250 mm). It is an extensive green roof. The upper layer is formed by the substrate. Between these two layers is thermal insulation. Its minimal thickness is 220 mm and more because it creates the sloping layer. The roof is accessible by two entrances.

2.4 PURPOSE OF THE OBJECT

¨The purpose of the object is to combine student living with studying – there are 15 apartments on the upper two floors. In the first floor there are 9 apartments designed for disabled persons. In the ground floor there are two parts – one is library and the other is composed of two lecture halls. Both these parts can be also used by public. Concerning the fire safety, there are no special demands. No hazardous purposes are planned.

2.5 LOCATION DESCRIPTION

The object is located in the city of Brno, between Štefánikova and Staňkova Street (Královo Pole, Ponava) in the place of former barracks. Now the location is a brownfield. Together with the project documentation of Obejct "W" it creates a new way of utilization of the area. The neighbouring buildings are mainly residential. The distances between the neighbouring objects are sufficient and fulfilling standards. The terrain is flat, without any difficult conditions.

3 FIRE CHARACTERISTICS

- The building is assessed according to ČSN 73 0802 as a non-production building.
- Fire height of the building is h = 7,25 m.
- The construction system is DP1.

4 DIVISION INTO SECTORS

The building is divided into 44 fire sectors. Technical rooms and apartments are each separate fire sector. Other areas are mainly combined into greater units. There are three protected escape ways.

The areas and division to fire sectors can be seen in attached sheets and drawings. Summary is shown in the table below:

Fire sectors					
Ground floor		**First floor**		**Second floor**	
Sector	**Degree**	**Sector**	**Degree**	**Sector**	**Degree**
N1.01/N3	II.	N1.01/N3	II.	N1.01/N3	II.
N1.02	I.	N2.01	III.	N3.01	III.
N1.09/N3	I.	N2.02	II.	N3.02	II.
N1.03	II.	N2.03	II.	N3.03	II.
N1.04	III.	N2.04	II.	N3.04	II.
N1.05/N3	II.	N2.05	II.	N3.05	II.
N1.06	IV.	N2.06	II.	N3.06	II.
N1.07	III.	N2.07	I.	N3.07	I.
N1.08/N3	II.	N1.05/N3	II.	N1.05/N3	II.
N1.10/N3	I.	N2.08	I.	N3.08	I.
		N2.09	II.	N3.09	II.
		N2.10	II.	N3.10	II.
		N2.11	II.	N3.11	II.
		N2.12	II.	N3.12	II.
		N2.13	II.	N3.13	II.
		N2.14	II.	N3.14	II.
		N2.15	II.	N3.15	II.
		N2.16	II.	N3.16	II.
		N2.17	II.	N3.17	II.
		N1.08/N3	II.	N1.08/N3	II.
		N1.09/N3	I.	N1.09/N3	I.
		N1.10/N3	I.	N1.10/N3	I.

5 FIRE RISK, DEGREE OF FIRE SAFETY

The areas and division to fire sectors can be seen in attached sheets and drawings together with classification into degrees of fire safety according to ČSN 73 0802.

6 EVALUATION OF RESISTANCES OF CONSTRUCTIONS

Green roof is stated according to regulation No. 268/2011 Coll., paragraph 7 – $B_{roof,t1}$

For buildings with fire height lower than 12 m are fire strips not demanded. However, the solution with concrete wall, PIR insulation and fibrecement facade fulfills the conditions for fire strips. Height difference for roof is not required, the building stands alone.

Construction	Demand	Real structure
External walls		
Ground floor – masonry, no stability demand	EI 30	EI 180 / EW 180 DP1
Ground floor – concrete, ensuring stability	REI 60	REI 180 / REW 180 DP1
First floor – masonry, no stability demand	EI 30	EI 180 / RE 180 DP1
First floor – concrete, ensuring stability	REI 45	REI 180 / REW 180 DP1
Second floor – masonry, no stability demand	EI 30	EI 180 / RE 180 DP1
Second floor – concrete, ensuring stability	REI 30	REI 180 / REW 180 DP1
Internal walls		
Ground floor – masonry, bracing wall	REI 60 DP1	REI 180 DP1
First floor – masonry, bracing wall	REI 45 DP1	REI 180 DP1
Second floor – masonry, bracing wall	REI 30 DP1	REI 180 DP1
Internal partitions		
Ground floor	EI 30 DP1	EI 60 DP1
First floor	EI 15 DP1	EI 60 DP1
Second floor	EI 15 DP1	EI 60 DP1
Floor structures		
Ground floor – with suspended ceiling	REI 60 DP1	REI 90 DP1
Ground floor – without suspended ceiling	REI 15 DP1	REI 240 DP1
First floor – without suspended ceiling	REI 45 DP1	REI 240 DP1
Second floor – with suspended ceiling	REI 30 DP1	REI 90 DP1
Second floor – without suspended ceiling	REI 30 DP1	REI 240 DP1
Columns		
Ground floor	REI 60 DP1	REI 120 DP1
First floor	REI 45 DP1	REI 120 DP1
Second floor	REI 30 DP1	REI 120 DP1

7 EVALUATION OF MATERIAL PROPERTIES

Fire reaction class is stated according to ČSN EN 13501.

Material	Fire reaction class
Masonry	A1
Mineral wool	A1
Reinforced concrete	A1
Ceramic tiles	A1
Fibrecement panels	A1
Plasterboard	A2, s1, d0
PIR panels	B, s1, d0
EPS 150 S	B
Laminate flooring	C, s1
Marmoleum flooring	C, s1

8 EVACUATION

In the object there are three protected escape ways (PEW). The ČSN 73 0802 states the maximal length for PEW type A is 120 m. For the object the maximal length is 59 m. Protected escape ways are listed in attached table. The maximal length of the non-protected escape way is 29 m, which fulfils the standard.

The protected escape ways will be separated from other fire sectors by smoke-tight door with automatic closing systems. Ventilation will be provided by windows. It is restricted what object can be placed in PEW, the list is given by ČSN 73 0802.

In the case of fire the electronic fire signalling system will unlock and open all exits from the building and opens all windows in PEW to ensure sufficient air exchange.

Doors on escape ways have to allow quick and easy pass, the shape of ironwork should prevent trapping of clothes. Doors should be provided with ironwork, which allows opening them from the other side than it was locked (in the case of emergency).

The amount of persons evacuated by escape way is stated by ČSN 73 0818. Then, according to ČSN 73 0802, number of needed escape strips can be calculated. Width of one strip is 550 mm. The attached table shows that the maximal width of an escape way is 3*550 = 1 650 mm which is fulfilled by all escape ways. This has to be fulfilled also by doors. Minimal clear height of door is 2 000 mm. All obstacles which can decrease these dimensions must be removed.

The building has two elevators. One of them is meant for evacuation; it can be used in the case of fire (see drawing). The dimensions of the cabin are 1 200 x 2 100 mm.

The evacuation elevator will have energy source to be operational without power source for 45 minutes. The speed of the elevator will be designed to keep duration of one way under 2,5 minutes. The elevator shaft will be protected against smoke. The receptionist will be responsible for the elevator and will operate it in the case of fire.

The shaft of the evacuation elevator is made from plastered masonry with fire reaction class A1. The evacuation elevator will be marked in the cabin and also on the door from external side. The other elevator, which is not for evacuation, will have sign “Don’t use in the case of fire”.

9 FIRE HAZARDOUS AREA

Fire hazardous area is calculated according to the standard ČSN 73 0802, appendix F. The results are defined in the situation plan.

Ground floor								
Position	**h_u [m]**	**l [m]**	**S_{po} [m^2]**	**S_p [m^2]**	**p_o [%]**	**Sector**	**p_v [kg/m^2]**	**d_1 [m]**
1	2,15	1,90	4,09	4,09	100	N1.07	57,00	**4,91**
	2,30	5,35	6,65	12,31	54	N1.06	69,13	**3,48**
2	1,50	3,00	3,00	4,50	67	N1.04	51,06	**3,65**
	2,20	21,50	19,80	47,30	42	N1.03	27,58	**2,45**
3	0	0	-	-	-	-	-	**-**
4	4,02	9,26	37,23	37,23	100	N1.03	27,58	**6,04**
5	4,02	54,34	172,74	218,45	79	N1.06	69,13	**10,68**
6	0	0	-	-	-	-	-	**-**

10 WATER FOR EXTINGUISHING

Due to ČSN 73 0873 internal hydrants are demanded for the object. The ground floor (which is solved by this report) contains four hydrants. The used type a fire hose system which consists of hose reel, inlet valve, 20 m long lay-flat hose with reach 30 m and a shut-off nozzle. The hydrants will be in wall boxes located 1,1 m above floor.

External sources of water for extinguishing are underground hydrants located in the Štefánikova Street. There are four of them which are closer than demanded 100 m specified in ČSN 73 0873, tab. 1 for building with larger area than 2 000 m^2 and they cover the whole building. The dimension DN150 fulfils the standards. Static pressure of the hydrant must be at least 200 kPa.

11 ACCESS ROADS

According to standard ČSN 73 0802 all objects must have an access road to allow action of fire fighters. For the object as access roads can be used Štefánikova Street and the northern parking lot. From there the entrances are less than 20 m far and also paved areas can be used.

In the case that the building is lower than 12 m there is no need to have a boarding area for the fire brigade.

Entrances and roads to the plot useable for arrival of fire fighting vehicles have at least 3,5 m of clear width to fulfil the requirements of the standard ČSN 73 0802.

12 FIRE EXTINGUISHERS

According to regulation No. 23/2008 Coll. each fire sector will be equipped with fire extinguishers. Their amount is calculated in an attached table Fire extinguishers.

They are placed according to public notice No. 246/2001 Coll. and according to public notice No. 23/2008 Coll. free passage to the fire extinguisher must be kept.

The type will be PG6 – 6 kg powder extinguisher 113B. It is useable for categories A, B and C.

13 TECHNICAL EQUIPMENT

Heating of the building is done by heat exchanger which will be located in the technical room (1002). This device is also used for domestic hot water (DHW). Technical room will be separated fire sector with access only for authorized persons.

Ventilation will be both natural and forced and there will be two operational units – one in room 1003 and the other in room 1022. The ventilation system has built-in recuperation unit. The inlets and outlets will be placed in vertical shafts leading to the roof. The shaft and the ventilation technical room are together separate fire sector. The ventilation ducts will be placed between reinforced concrete floor structure and suspended ceiling made from plasterboards. Where the ventilation duct crosses a border of a fire sector it will be equipped with fire damper according to standards to prevent smoke from spreading.

The standard ČSN 73 0802:2009 states the requirements for service pipes. If the clear area of the pipe is more than 40 000 mm^2 it (which is true for the ventilation ducts) it will be surrounded by materials with fire reaction class A1 (plastered masonry wall).

There will be two elevators located in protected emergency ways. The type is Schindler 3300 with integrated engine. It causes no additional fire risk.

14 SPECIAL REQUIREMENTS FOR CONSTRUCTIONS

There are no special requirements.

15 FIRE SAFETY DEVICES

According to the Fire safety plan all rooms will be equipped by automatic fire detectors and fire alarm systems. This is done following the regulation No. 23/2008 Coll.

It consists of heat and smoke detectors or it can be activated manually by fire alarm button. In the reception (room 1013) will be installed electronic fire signalling central. Also there will be accessible telephone for fire reporting. Manual fire alarm buttons will be located to be clearly visible and reachable without any obstacles. They will be marked according to regulation.

Acoustic fire signalling devices must be placed to be audible for every inhabitant of the object. There will be two types of signalling devices – acoustic fire signalling and emergency speakers. Acoustic fire signalling device will be in every room. Emergency speaker control will be located in the reception (room 1013) and from there evacuation can be controlled and conducted. It has to fulfil requirements of ČSN EN 60846 and ČSN EN 60849. Both devices will be equipped by accumulators to be fully operational in the case of fire for at least 15 minutes.

Fire safety devices will be placed according to the Fire safety plan drawing. They will be periodically checked by a responsible person (or a company).

16 SAFETY SIGNS AND LIGHTING

The fire extinguisher and the main power switch (“total stop”) must be marked by signs according to ČSN ISO 3864, ČSN 01 0813 and according to public notice No. 11/2002 Coll.

Escape ways must be marked according to ČSN ISO 3846 where the exit is not directly visible. These marks must ease the evacuation process. Therefore, changes of direction of escape (horizontally and vertically) and must be marked by signs and arrows. This is valid also for crossings of escape ways.

Escape ways must be lightened by natural or artificial light at least during the working hours of the object. Non-protected escape ways must have artificial light in every place where is standard wiring. Protected escape ways must have emergency lighting. Emergency lighting is designed according to ČSN EN 1838.

Emergency lighting must be working in the case of fire for 15 minutes in type A protected emergency ways. This is valid also for non-protected emergency ways (15 minutes). Every emergency light will be equipped by accumulator to meet the required 15 minutes of working time without power connection.

Emergency lights will be placed in all rooms according to the Fire safety plan drawing.

17 CONCLUSION

The building Object "P" is a three-storey building. The ground floor serves for education, there is a library and two lecture halls. The upper two floors consist of apartments for students.

Constructions – the construction system is a monolithic reinforced concrete skeleton with columns as main load-bearing elements. Non-load bearing external wall are made from hollow block masonry Heluz AKU 25 (250 mm). PIR panels are the thermal insulation inside the ventilated facade. Internal walls are either masonry (the same as external – Heluz AKU 25) or made from plasterboards – Knauf partitions. If the plasterboard partition creates a border of a fire sector it will be coated with Knauf RED type plasterboard.

Horizontal constructions will be made from reinforced concrete in thickness 250 mm. It is a two-way reinforced slab. In many rooms there is a suspended ceiling made from Knauf plasterboards. The roof is green, extensive type. The thermal insulation is EPS 150 S. There are two entrances to the roof.

Escape ways – There are three protected escape ways – stairwells. They will be divided from other fire sectors by smoke-tight door and equipped with lighting working without power supply. There is one emergency elevator which can be used in the case of fire.

Electronic systems – All rooms in the ground floor (which is solved by this report) will be equipped with automatic fire detectors connected to electronic fire signalling central. Evacuation can be controlled by emergency speakers and acoustic fire signalization.

Final notes – fire hazardous area does not exceed to neighbouring objects or plots.

For final inspection approval will be presented valid tests and certificates according to act No. 22/1997 Coll., public notice No. 246/2001 Coll. and others.

The building fulfils the conditions of fire safety.

Brno, 12.1.2014 Created by: Bc. Petr Dvořák

VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ
BRNO UNIVERSITY OF TECHNOLOGY

FAKULTA STAVEBNÍ
ÚSTAV POZEMNÍHO STAVITELSTVÍ

FACULTY OF CIVIL ENGINEERING
INSTITUTE OF BUILDING STRUCTURES

ENERGY LABEL OF BUILDING ENVELOPE

DIPLOMOVÁ PRÁCE
MASTER'S THESIS

AUTOR PRÁCE — BC. PETR DVOŘÁK
AUTHOR

VEDOUCÍ PRÁCE — prof. Ing. JITKA MOHELNÍKOVÁ, Ph.D.
SUPERVISOR

BRNO 2014

Protocol of energy label of building

Identification data

Type of building Address Cadastral territory and cadastral number Investor	University Residential Centre Brno, Czech Republic Brno, Ponava, 465/20 Vysoké učení technické v Brně
Future owner Address Telephone number/email address	Vysoké učení technické v Brně Brno, Czech Republic - / -

Building characteristic

Volume of building V – outer volume of the heated zone, does not include balcony, cornices, attics and foundations	**19 325,96 m3**
Total area A – sum of inner surfaces of cooled structures	**6 547,91 m2**
Area/Volume factor of building	**0,34**
Prevailing inside temperature during heating season Outside design temperature in winter period	20 °C -15 °C

Characteristics of energy-relevant data of cooled structures

Cooled structure	**Area A_i (m_2)**	**Coefficient of heat transfer U_i (W.m-2.K-1)**	**Required (Recommended) coefficient of heat transfer Un U_i ($W.m^{-2}.K^{-1}$)**	**Temperature reduction factor b_i (-)**	**Heat transfer specific loss $HT_i = A_i.U_i.b_i$ ($W.K^{-1}$)**	**$HT_i = A_i.U_i.b_i$ ($W.K^{-1}$) for reference building**
F1 (ground)	1317,890	0,232	0,45 (0,30)	0,43	130,957	254,165
F1 (inst. corr.)	238,610	0,232	0,60 (0,40)	0,29	15,807	40,905
F2 (ground)	183,060	0,240	0,45 (0,30)	0,43	18,833	35,304
R1	1727,898	0,163	0,24 (0,16)	1,00	282,482	414,696
R2	28,010	0,210	0,24 (0,16)	1,00	5,885	6,722
W1	1077,464	0,133	0,30 (0,25)	1,00	143,068	323,239
W2	1010,896	0,145	0,30 (0,25)	1,00	146,504	303,269
W5	595,753	0,983	1,18 (1,00)	1,00	585,373	704,447
W3	36,356	0,229	0,30 (0,25)	1,00	8,335	10,907
Windows	304,000	0,783	1,50 (1,20)	1,00	238,162	456,000
Doors	15,714	1,200	1,70 (1,20)	1,00	18,857	26,715
Doors (glass)	12,255	0,983	1,70 (1,20)	1,00	12,041	20,834
Thermal bridges between structures	**(ΣA_i)**	**($\Sigma\psi_i$. l +$\Sigma\chi_i$)/A_i**		$A . \Delta U_{tbm}$ =	130,958	
Total	**6547,906**	**0,020**		Q_{Ti} =	60 804	

Construction meet the requirements for heat transfer coefficient according to CSN 73 0540-2.

Determination of heat envelope

Heat transfer specific loss H_T	**$W.K^{-1}$**	1737,262
Heat transfer for reference building $H_{T,em}$	**$W.K^{-1}$**	2728,159
Average coefficient of heat transfer U_{em}	**$W . m^{-2}.K^{-1}$**	0,265
Coefficient of heat transfer for reference building $U_{em,N,20}$	**$W . m^{-2}.K^{-1}$**	0,417

Heat transfer classification classes of envelope of rated building

Classification classes	**Index CI for limits of classification classes**	**U_{em} ($W . m^{-2}.K^{-1}$) for limits of classification classes**	
		Generally	**For rated building**
A - B	0,50	0,50 $U_{em,N,20}$	0,208
B - C	0,75	0,75 $U_{em,N,20}$	0,312
C - D	1,00	1,00 $U_{em,N,20}$	0,417
D - E	1,50	1,50 $U_{em,N,20}$	0,623
E - F	2,00	2,00 $U_{em,N,20}$	0,834
F - G	2,50	2,50 $U_{em,N,20}$	1,043

Classification: **B – Efficient building**

Date of issue of energy label: 14.1.2014

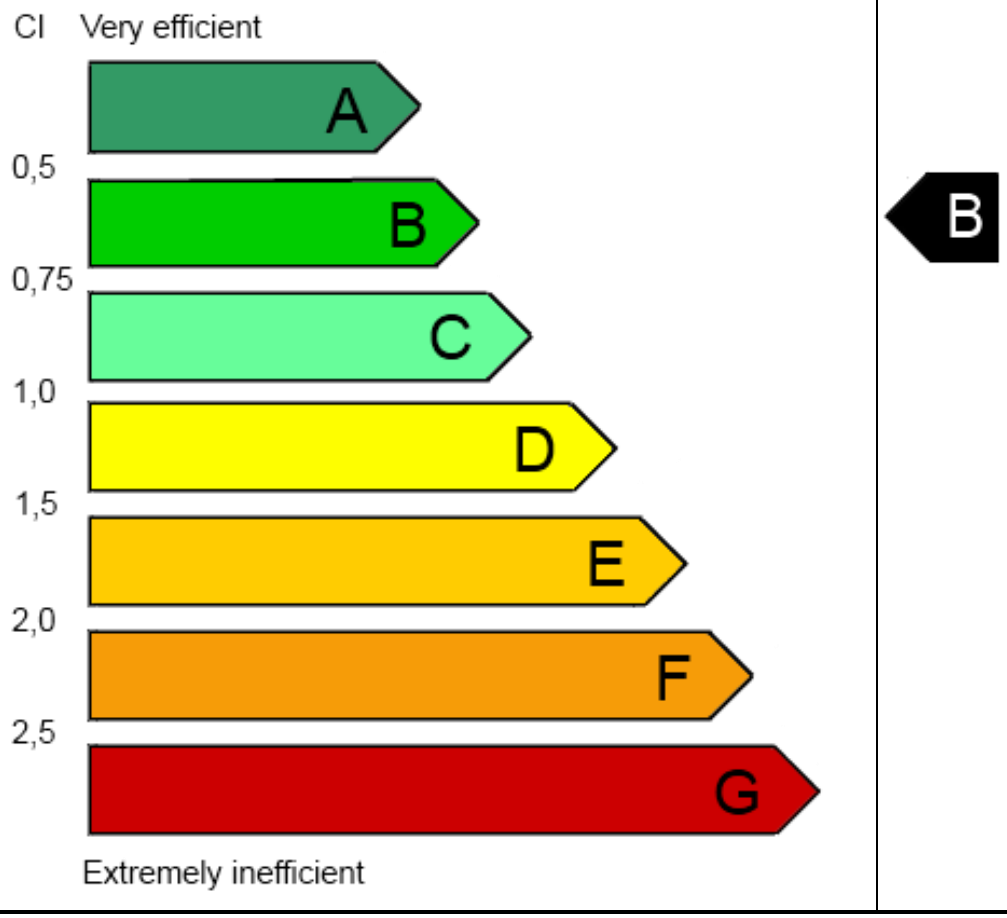
Processor of energy label: Bc. Petr Dvořák
Address of processor: Okružní 588, Kaplice
IČO: -

Signature:

This protocol and energy label corresponds with directive of European Parliament and Council No. 2002/91/EC and EN the 15217. The protocol and the energy label has been prepared in accordance with CSN 73 0540 and the project the project construction documentation supplied by the customer.

ENERGY LABEL OF BUILDING

Type of building, local designation: Address of building:	Evaluation of building envelope	
Total floor area Ac = 1 776,12 m²	Current	Recom.



Average coefficient of heat transfer	U_{em} (W . m^{-2}.K^{-1})	0,265
Recommended coefficient of heat transfer	$U_{em,N,20}$ (W . m^{-2}.K^{-1})	0,417

Classification indexes CI and corresponding value of $U_{em,N}$

CI	0,5	0,75	1,0	1,5	2	2,5
U_{em}	0,208	0,312	0,417	0,623	0,834	1,043

Validity of label:	Date:
Prepared by:	Signature:

Závěr

V závěru je nutné zmínit, že zadání i cíle této diplomové práce byly splněny.

Po mnoha změnách a úpravách tato práce obsahuje konečnou podobu budovy Object „P“ z celku University Residential Centre. Studie a technická řešení včetně zpráv se nachází v příloze.

Mým cílem bylo navrhnout budovu vysokoškolské koleje tak, aby byla pohodlná pro své obyvatele a ti by si užívali každý den zde strávený. Doufám, že jsem tento záměr splnil.

Conclusion

In the conclusion must be mentioned that the task was accomplished and the objectives of this master's thesis were fulfilled.

After many modifications and adjustments, this work contains the final form of the University Residential Centre, Object "P". The architectural and technical solution can be found in the attachments.

I hope that I was able to create a building, which will be comfortable for students and they will enjoy it every day.

Seznam použitých zdrojů a materiálů

a) Právní předpisy

- 272/2011 - Nařízení vlády o ochraně zdraví před nepříznivými účinky hluku a vibrací
- 591/2006 - Nařízení vlády o bližších minimálních požadavcích na bezpečnost a ochranu zdraví při práci na staveništích
- 361/2007 - Nařízení vlády, kterým se stanoví podmínky ochrany zdraví při práci
- 495/2001 - Nařízení vlády, kterým se stanoví rozsah a bližší podmínky poskytování osobních ochranných pracovních prostředků, mycích, čisticích a dezinfekčních prostředků
- 309/2006 - Zákon, kterým se upravují další požadavky bezpečnosti a ochrany zdraví při práci v pracovněprávních vztazích a o zajištění bezpečnosti a ochrany zdraví při činnosti nebo poskytování služeb mimo pracovněprávní vztahy (zákon o zajištění dalších podmínek bezpečnosti a ochrany zdraví při práci)
- 262/2006 – Zákoník práce
- 183/2006 - Zákon o územním plánování a stavebním řádu (stavební zákon)
- 100/2001 - Zákon o posuzování vlivů na životní prostředí a o změně některých souvisejících zákonů (zákon o posuzování vlivů na životní prostředí)
- 185/2001 - Zákon o odpadech a o změně některých dalších zákonů
- 381/2001 - Vyhláška Ministerstva životního prostředí, kterou se stanoví Katalog odpadů, Seznam nebezpečných odpadů a seznamy odpadů a států pro účely vývozu, dovozu a tranzitu odpadů a postup při udělování souhlasu k vývozu, dovozu a tranzitu odpadů (Katalog odpadů)
- 383/2001 - Vyhláška Ministerstva životního prostředí o podrobnostech nakládání s odpady
- 406/2000 - Zákon o hospodaření energií
- 398/2009 - Vyhláška o obecných technických požadavcích zabezpečujících bezbariérové užívání staveb
- 23/2008 - Vyhláška o technických podmínkách požární ochrany staveb
- 268/2011 - Vyhláška, kterou se mění vyhláška č. 23/2008 Sb., o technických podmínkách požární ochrany staveb
- 246/2001 - Vyhláška Ministerstva vnitra o stanovení podmínek požární bezpečnosti a výkonu státního požárního dozoru (vyhláška o požární prevenci)
- 22/1997 - Zákon o technických požadavcích na výrobky a o změně a doplnění některých zákonů
- 11/2002 - Nařízení vlády, kterým se stanoví vzhled a umístění bezpečnostních značek a zavedení signálů

b) České národní a evropské normy

- ČSN 73 4301 – Obytné budovy
- ČSN 73 4108 – Šatny, umývárny a záchody
- ČSN 73 0580 – Denní osvětlení budov
- ČSN 73 0540-2 – Tepelná ochrana budov
- ČSN 01 3420 – Výkresy pozemních staveb - Kreslení výkresů
- ČSN 73 0810:06/2005 – Požární bezpečnost staveb – Společná ustanovení
- ČSN 73 0802:05/2009 – Požární bezpečnost staveb – Nevýrobní objekty
- ČSN 73 0833:10/2010 – Požární bezpečnost staveb – Budovy pro bydlení a ubytování
- ČSN 73 0873:06/2003 – Požární bezpečnost staveb – Zásobování požární vodou
- ČSN-EN 1992-1 – Zásady navrhování betonových konstrukcí

c) Webové stránky výrobců a dodavatelů

www.isover.cz, www.soudal.cz , www.weber-panel.cz, www.knauf.cz, www.kmb-profimix.cz, www.dektrade.cz, www.slavona.cz, www.cemix.cz, www.best.info, www.kingspaninsulation.com, www.tzb-info.cz, www.brno.cz, www.fce.vutbr.cz, www.mvcr.cz, www.schonox.cz, www.zinco-greenroof.com

Seznam použitých zkratek

RC, R. C.	reinforced concrete
WPC	wood-plastic
U-value	overall heat loss coefficient
PIR	polyisocyanurate
PUR	polyurethane
HVAC	heating, ventilation, air-conditioning
XPS	extruded polystyrene
EPS	expanded polystyrene
ČSN	Czech National Standard, Česká národní norma
EN	European Standard, Evropská norma
BPV	Baltic Sea level
DHW	domestic how water

List of attachments

FOLDER A: BASIC DOCUMENTS

1. Zadání diplomové práce (Task)
2. Abstrakt a klíčová slova (Abstract and keywords)
3. Bibliografická citace VŠKP (Bibliographic quotation)
4. Prohlášení o původnosti VŠKP (Declaration)
5. Prohlášení o shodě listinné a elektronické formy VŠKP (Declaration of compliance)
6. Seznam zdrojů a materiálů (List of used sources and materials)
7. Úvod (Introduction)
8. Obsah (Content of folders)
9. Závěr (Conclusion)
10. Popisný soubor závěrečné práce (Metadata)

FOLDER B: STUDIES

B01 Elevations	1:300	2 x A4
B02 Floor One	1:280	2 x A4
B03 Floor Two	1:280	2 x A4
B04 Floor Three	1:280	2 x A4
B05 Renders I	---	2 x A4
B06 Renders II	---	2 x A4
B07 Disposition details	1:100	2 x A4
B08 Compositions	---	1 x A4
B09 Maps	---	2 x A4

FOLDER C1: PROJECT DRAWINGS

C01 NEIGHBOURHOOD RELATIONS	1:1500	2 x A4
C02 SITUATION	1:350	30 x A4
C03 FOUNDATIONS	1:50	30 x A4
C04 FLOOR PLAN - GROUND FLOOR WITH SECTION C-C'	1:50	30 x A4
C05 FLOOR PLAN - FIRST FLOOR WITH SECTION A-A'	1:50	30 x A4
C06 FLOOR PLAN - SECOND FLOOR WITH SECTION B-B'	1:50	30 x A4
C07 SECTION Da-Da' AND Db-Db'	1:50	4 x A4
C08 FLOOR STRUCTURE - ABOVE GROUND FLOOR	1:100	12 x A4
C09 FLOOR STRUCTURE - ABOVE FIRST FLOOR	1:100	12 x A4
C10 FLOOR STRUCTURE - ABOVE SECOND FLOOR	1:100	12 x A4
C11 ROOF PLAN	1:100	12 x A4
C12 TECHNICAL VIEWS	1:150, 1:200	4 x A4
C13 D01 DETAIL OF ATTIC	1:5	4 x A4
C14 D01a AXONOMETRY OF RAILING CONNECTION	1:10	1 x A4
C15 D02 DETAIL OF BALCONY CONNECTION	1:5	4 x A4
C16 D03 DETAIL OF ROOF INLET	1:5	4 x A4

C17 D04 DETAIL OF WINDOW	1:5	2 x A4
C18 D05 DETAIL OF BOTTOM END OF FACADE	1:5	4 x A4
C19 COMPOSITIONS	1:10	4 x A4
C20 LIST OF WINDOWS	---	2 x A4
C21 LIST OF DOORS	---	2 x A4
C22 LIST OF TINSMITH PRODUCTS	1:10	1 x A4
C23 LIST OF RAILINGS	1:50	1 x A4
C24 F01 FIRE SAFETY SITUATION	1:1000	2 x A4
C25 F02 FIRE SAFETY PLAN - GROUND FLOOR	1:200	3 x A4

FOLDER C2: TECHNICAL DOCUMENTS AND CALCULATIONS

1. Calculation of foundations and loading scheme	6 x A4
2. Calculation of piles (CZECH)	12 x A4
3. Calculations of U-values and Energy label	6 x A4
4. Fire sectors and schemes	7 x A4
5. Geotechnical report	2 x A4
6. Other calculations:	
Ventilation preliminary	1 x A4
Preliminary design of concrete members	1 x A4
Design value of thermal conductivity	1 x A4
Temperature fields in details	2 x A4
Software TEPLO - calculations (CZECH)	12 x A4

FOLDER C3: REPORTS

1. Accompanying report	4 x A4
2. Energy label of building envelope	3 x A4
3. Fire safety report	9 x A4
4. Summary technical report	12 x A4
5. Technical report	16 x A4