



VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ

BRNO UNIVERSITY OF TECHNOLOGY

FAKULTA STAVEBNÍ

FACULTY OF CIVIL ENGINEERING

ÚSTAV POZEMNÍHO STAVITELSTVÍ

INSTITUTE OF BUILDING CONSTRUCTIONS

CENTRUM UMĚNÍ A ŘEMESLA

ARTS AND CRAFTS CENTRE

MAIN TEXT PART OF MASTER'S THESIS

DIPLOMOVÁ PRÁCE

MASTER'S THESIS

AUTOR PRÁCE

AUTHOR

Bc. Denisa Kadubcová

VEDOUCÍ PRÁCE

SUPERVISOR

Ing. František Vajkay, Ph.D.

BRNO 2017



VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ FAKULTA STAVEBNÍ

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Název	Arts and crafts centre
Vedoucí práce	Ing. František Vajkay, Ph.D.
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PODKLADY A LITERATURA

(1) Směrnice děkana č. 19/2011 s dodatky a přílohami; (2) Katalogy a odborná literatura; (3) Stavební zákon č. 183/2006 Sb. ve znění pozdějších předpisů; (4) Vyhláška č. 499/2006 Sb. ve znění pozdějších předpisů; (5) Vyhláška č. 268/2009 Sb. ve znění pozdějších předpisů; (6) Vyhláška č. 398/2009 Sb.; (7) Platné normy ČSN, EN; (8) Vlastní dispoziční a architektonický návrh.

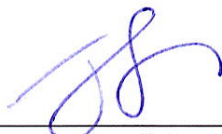
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Zadání: Zpracování určené části projektové dokumentace pro provádění stavby nepodsklepené nebo zadané budovy. **Cíle:** Vyřešení dispozice budovy s návrhem vhodné konstrukční soustavy a nosného systému na základě zvolených materiálů a konstrukčních prvků, včetně vyřešení osazení objektu do terénu s respektováním okolní zástavby. Dokumentace bude v souladu s vyhláškou č. 62/2013 Sb. obsahovat část A, část B, část C a část D v rozsahu části D.1.1 a D.1.3. Dále bude obsahovat studie obsahující předběžné návrhy budovy a jeho dispozičního řešení a přílohou část obsahující předběžné návrhy základů a rozměrů nosných prvků řešené budovy a prostorovou vizualizaci budovy. Výkresová část bude obsahovat výkresy: situace, základů, půdorysů všech podlaží, konstrukce zastřešení, svislých řezů, technických pohledů, min. 5 detailů, výkres(y) sestavy dílců, popř. výkres(y) tvaru stropní konstrukce. Součástí dokumentace budou i dokumenty podrobnosti dle D.1.1 bod c), stavebně fyzikální posouzení objektu a vybraných detailů popř. další specializované části, budou-li zadány vedoucím práce. **Výstupy:** VŠKP bude členěna v souladu se směrnicí děkana č. 19/2011 a jejím dodatkem a přílohami. Jednotlivé části dokumentace budou vloženy do složek s klopami formátu A4 opatřených popisovým polem a uvedením obsahu na vnitřní straně každé složky. Všechny části dokumentace budou zpracovány s využitím PC v textovém a grafickém CAD editoru. Výkresy budou opatřeny popisovým polem. Textová část bude obsahovat i položky h) "Úvod", i) "Vlastní text práce" jejímž obsahem budou průvodní a souhrnná technická zpráva a technická zpráva pro provádění stavby podle vyhlášky č. 499/2006 Sb. ve znění vyhlášky č. 62/2013 Sb. a j) "Závěr".

STRUKTURA 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).
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Ing. František Vajkay, Ph.D.
Vedoucí diplomové práce

Abstrakt

Tato diplomová práce se zabývá návrhem samostatně stojícího centra volného času. Budova se nachází na konkrétním pozemku katastrálního území města Brna, přesněji v Útěchově u Brna. Cílem práce bylo vytvoření objektu vyhovujícímu svým dispozičním řešením požadavkům na provoz centra volného času pro děti a dospělé. Budova je navržena jako nepodsklepená, dvoupodlažní s plochou střechou. Pro nosné stěny byl navržen systém rámové dřevostavby s vloženou tepelnou izolací a s ETICS u obvodových stěn. Pro konstrukci stropu a střechy bylo použito nosného systému Posi-joist dřevěno-ocelových nosníků. Součástí práce je také požární a tepelně-technické posouzení.

Klíčová slova

Centrum volného času, rámová dřevostavba, plochá střecha, Posi-joist, zelená střecha.

Abstract

This Master's Thesis deals with a design of a detached Leisure center. The building is situated on a specific plot of cadastral area of Brno city, more precisely in Útěchov u Brna. The aim was to create an object suitable by its disposition solution for requirements of leisure center for children and adults. The building is designed as basementless, with two above-ground floors topped by flat roof. Wooden frame system with inserted thermal insulation and ETICS system in case of peripheral walls was proposed for load-bearing walls. Load-bearing structure of ceiling and roof is made by wooden-steel Posi-joist beams. The work also includes fire safety and thermo-technical assessment.

Keywords

Leisure center, wooden frame system, flat roof, Posi-joist, green roof.

Bibliografická citace VŠKP

Bc. Denisa Kadubcová *Centrum umění a řemesla*. Brno, 2018. 39 s., 167 s. příl., 36 výkresů Diplomová práce. Vysoké učení technické v Brně, Fakulta stavební, Ústav pozemního stavitelství. Vedoucí práce Ing. František Vajkay, Ph.D.

Declaration

I declare that I worked out the Master's Thesis independently and that I stated all used information sources.

Prohlášení

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

V Brně dne 7. 1. 2018

Bc. Denisa Kadubcová
autor práce

Thanks

I would like to thank supervisor of my Master's Thesis Ing.František Vajkay, Ph.D., for professional guidance, help and advice while proces of this work.

Poděkování

Ráda bych poděkovala vedoucímu mé diplomové práce Ing.Františku Vajkayovi, Ph.D., za odborné vedení, pomoc a rady při zpracování této práce.

V Brně dne 7. 1. 2018

Bc. Denisa Kadubcová
autor práce

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1. INTRODUCTION

The Master's Thesis is focused on elaboration of project documentation of Arts and crafts centre for family and children located in Útěchov u Brna. The designed building has two above-ground floors and is intended for free time activities and community life.

The building stays on foundation strips out of plain concrete and foundation concrete slab reinforced with kari net. Timber frame system was used for peripheral walls – load-bearing elements are KVH wooden columns 80/160mm. Space between columns is filled with mineral wool and is enclosed by fiber boards FERMACELL. Furthermore, contact thermal insulation system was used on the external façade. Internal load-bearing walls are again from KVH wooden columns 80/160mm with acoustic insulation enclosed by fiber boards FERMACELL. Partition walls are out of timber columns with cross-section dimensions 60/100mm with acoustic insulation enclosed by fiber boards FERMACELL. The whole building is topped by flat roof above 2nd floor and terrace above part of the 1st floor. Load-bearing structure of ceiling and roof is made by wooden-steel Posi-joist beams.

Disposition solution was designed in accordance with valid regulations and standards and also with the use of the specific room. The design intention was to create such a building whose exterior appearance corresponds with neighboring buildings. Therefore simple shape of the building and color selection conform these criteria. The fire safety and thermo-technical solutions are part of this work.



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BRNO 2017

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A.1 Identification data

A.1.1 Data about the construction

Name of construction:	Arts and crafts centre
Place of construction:	cadastral area Útěchov u Brna [775550], parcel number 58/6
Township:	Brno [582786]
Region:	Jihomoravský
Subject of documentation:	Documentation for execution of works

A.1.2 Data about the builder

Builder:	Adam Svoboda
Address:	Arbesova 3/3, 638 00 Brno

A.1.3 Data about the designer

Designer:	Denisa Kadubcová
Address:	Kleštínek 21, 621 00 Brno

A.2 List of input data

- documentation in the scope of Building permission
- protocol for the Energy Performance Certificate
- Territorial plan of Brno city
- Radon survey
- Altitude and position survey
- Hydrogeological survey

A.3 Data about the area

The land with parcel number 58/6 is located in the Northern part of Brno in Útěchov u Brna and according to Territorial plan of Brno city it is determined for buildings for recreation. There are no constructions on the parcel and it was used as fertile ground.

The plot is smoothly sloping down in the direction to the South. The land is of quadrilateral shape. Access road to the parcel is of 3rd category and is about 5 m wide. There are no obstacles on the parcel which would be needed to be taken away at the expense of the investor. The investor is also the owner of the parcel.

There will be new connections to existing utility networks such as sewerage, low pressure gas pipes, low voltage power lines, drinking water, rainwater sewerage and communication lines.

On the basis of hydrogeological survey it was determined that the level of underground water will not influence the construction of the Leisure Center.

Data about building plot

Parcel number: 58/6
Township: Brno [582786]
Cadastral area: Útěchov u Brna [775550]
LV number: 530
Acreage: 4197 m²
Parcel type: Parcel of cadaster estate
Map sheet: DKM
Determination of acreage: from S-JTSK coordinates
Parcel type: fertile ground

Data about property rights relationships

List of affected lands according to cadaster estate:

Parcel number: 57/4, township: Brno, cadastral area: Útěchov u Brna, parcel type: Parcel of cadaster estate, map sheet: DKM, acreage: 1897 m², parcel type: fertile ground, owner: Procházka Fintes Marek

Parcel number: 58/1, township: Brno, cadastral area: Útěchov u Brna, parcel type: Parcel of cadaster estate, map sheet: DKM, acreage: 5985 m², parcel type: fertile ground, owner: Statutární město Brno

Parcel number: 58/4, township: Brno, cadastral area: Útěchov u Brna, parcel type: Parcel of cadaster estate, map sheet: DKM, acreage: 8212 m², parcel type: fertile ground, owner: Statutární město Brno

Parcel number: 58/5, township: Brno, cadastral area: Útěchov u Brna, parcel type: Parcel of cadaster estate, map sheet: DKM, acreage: 1014 m², parcel type: fertile ground, owner: SJM Hošna Miroslav Ing. and Hošnová Eva MUDr.

Parcel number: 58/7, township: Brno, cadastral area: Útěchov u Brna, parcel type: Parcel of cadaster estate, map sheet: DKM, acreage: 2314 m², parcel type: fertile ground, owner: Ambrož Ladislav Mgr.

Parcel number: 58/9, township: Brno, cadastral area: Útěchov u Brna, parcel type: Parcel of cadaster estate, map sheet: DKM, acreage: 793 m², parcel type: family house, owner: SJM Unzeitig Milan and Unzeitigová Ladislava

Parcel number: 58/15, township: Brno, cadastral area: Útěchov u Brna, parcel type: Parcel of cadaster estate, map sheet: DKM, acreage: 966 m², parcel type: fertile ground, owner: SJM Gebhardt Wolfgang Ing. and Gebhardtová Alice Ing.

Parcel number: 58/5, township: Brno, cadastral area: Útěchov u Brna, parcel type: Parcel of cadaster estate, map sheet: DKM, acreage: 1014 m², parcel type: fertile ground, owner: SJM Hošna Miroslav Ing. and Hošnová Eva MUDr.

Parcel number: 108/3, township: Brno, cadastral area: Útěchov u Brna, parcel type: Parcel of cadaster estate, map sheet: DKM, acreage: 9528 m², parcel type: forest land, owner: Mendelova univerzita v Brně

Data about executed surveys

The radon risk surveyed in the soil subgrade, from which the radon exposure was determined as low.

According to hydrogeological survey no underground water was found. On the basis of this review, no restrictions for construction in terms of underground water are necessary.

The engineering-geological survey was performed on the construction site on the basis of which the soil type: Biotite granodiorite, class 5 was determined.

Data about connection to traffic infrastructure

Along the Norther borders of the plot there is a service road for the access to the Arts and crafts centre. To this road, concrete interlocking pavement driveway will be connected to.

The plot is not connected to engineering networks, therefore the following works must be done:

- Water connection pipes with water-meter shaft placed at builder's plot. The piping from water-meter shaft to newly constructed building will be built.
- Rainwater and sewage will be taken to single underground sewage system located on parcels no. 58/4, 108/3 and 110/7 via newly constructed connection. Sewer inspection shaft will be built on the builder's plot.
- Connection of low-voltage power line will end on plot border in masonry pillar signed as MHB.
- Low pressure gas pipe connection will end on plot border in masonry pillar signed as MGC.

Information about fulfillment of requirements of concerned authorities

Documentation meets all requirements of concerned authorities.

Information about compliance with general requirements for construction

All requirements for construction are fulfilled in the documentation. These are requirements stated by Building Law 186/2006 Coll. and Notice no. 137/1998 Coll. about general requirements for construction, and Notice no. 502/2006 Coll. about change of notice about general technical requirements for construction, Decree of Ministry of Regional Development of the Czech Republic: no. 268/2009 Coll. about technical requirements for buildings; no 62/2013 Coll. about Construction documentation. Documentation abides mandatory standards ČSN, such as ČSN 73 0540 Thermal technology of buildings, and hygienic regulations and requirements about health protection and healthy living conditions, 398/2009 Coll. about barrier-free use of buildings, ČSN 73 0833/2010: Fire safety of buildings.

Data about fulfillment of regulation plan, zoning permission, eventually land use planning in construction according to § 104 article 1 of Building Law

All conditions are fulfilled, building is in accordance with approved land use plan of Brno city.

A.4 Data about the construction

The Arts and crafts centre for children and family is a newly constructed building. There are no legal obstacles and the building does not belong to any protected constructions. The building is proposed as barrier-free, low-energy Leisure Center of class of energy performance B. The building is L-shape with walkable terrace and balcony in the second floor.

Build-up area: 710,7 m²

Enclosed space: 4481 m³

Floor area: 1275,2 m²

Demarcation of building plot: 4197 m²

Maximal height above the terrain: 7,210 m

Number of parking places: 17 cars outside

Construction process is not anyhow bound to other construction activity or measure. Construction period is approximately 12 months from the beginning of construction.

- Construction initiation after issuing of approval from the Building office is assumed
02/2018
- Completion of construction
02/2019

Statistic data about preliminary value of construction residential and nonresidential, for environmental protection etc. in thousands of CZK, further data about floor area of residential and nonresidential area of the building in m², and about number of flats in residential and nonresidential buildings.

The final price is based on price index of average budget price in 2017. Price of building for education is 6316 CZK/m³. Total volume of the building is $V = 4481\text{m}^3$.

Supposed implementation costs are therefore about 28 302 000 CZK. Final price may differ according to purchase price of individual material.

A.5 Division of the object into parts

The building is not divided into objects.

Elaborated by:

.....

Denisa Kadubcová

In Brno, December 2017



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B.1 Description of the parcel

B.1.1 Land characteristics

The land with parcel number 58/6 is located in the Northern part of Brno in Útěchov u Brna and according to Territorial plan of Brno city it is determined for buildings for recreation. There are no constructions on the parcel and was used as fertile ground.

The plot is smoothly sloping down in the direction to the South. The land is of quadrilateral shape. Access road to the parcel is of 3rd category and is about 5m wide. There are no obstacles on the parcel which would be needed to be taken away at the expense of the investor. The investor is also the owner of the parcel. There is newly constructed family house in the neighboring parcel in the South. Other neighboring lands are used as fertile grounds.

There will be new connections to existing utility networks such as sewerage, low pressure gas pipes, low voltage power lines, drinking water, rainwater sewerage and communication lines.

On the basis of hydrogeological survey it was determined that the level of underground water will not influence the construction of the Arts and crafts centre.

B.1.2 Data about building plot

Parcel number:	58/6
Township:	Brno [582786]
Cadastral area:	Útěchov u Brna [775550]
LV number:	530
Acreage:	4197 m ²
Parcel type:	Parcel of cadaster estate
Map sheet:	DKM
Determination of acreage:	from S-JTSK coordinates
Parcel type:	fertile ground

B.1.3 Data about executed surveys

The radon risk surveyed in the soil subgrade, from which the radon exposure was determined as low.

According to hydrogeological survey no underground water was found. On the basis of this review, no restrictions for construction in terms of underground water are necessary.

The engineering-geological survey was performed on the construction side on the basis of which the soil type: Biotite granodiotite, class 5 was determined. Frost resistant depth was determined as 800mm.

B.2 General description of the building

B.2.1 Purpose of the object, basic capacity of function unit

Future object will be built on parcel 58/6 in Útěchov u Brna and both building and land will be property of the investor, Adam Svoboda.

The building is proposed according to Territorial plan of Brno city.

The building is composed of mutually connected units such as communication areas, hygienic areas, coffee house, activity rooms, storages and offices. In the 1st floor, there is an entrance hall leading to the common hall with main staircase with elevator. There are two halls, one leading to the East Wing of the building, second to the South Wing. When going to the East Wing, there are common rooms (coffee house, activity room, creative workshop), hygienic rooms (restrooms, showers, locker rooms, changing room for babies), as well as rooms for staff (storage, locker room with toilet, kitchen of the coffee house, office). When going to the South Wing of the building, there are also common rooms (free time room, music room, drama/dance class room), hygienic rooms (restrooms), as well as rooms for staff (storage, janitor's closet, technical room). The access to the 2nd floor is possible by two staircases, or by an elevator. There are three lecture rooms, board game room, computer room, cooking room, playroom, restrooms and separate locker rooms for visitors and staff, three office rooms for staff, conference room, kitchen for staff, shower room for staff, storage and janitor's closet.

B.2.2 Urban and architectural solution

a) Urban solution – territorial regulations, composition of space solution

The terrain of Útěchov u Brna is sloping down to the South, which allows the sunlight to reach most parts of the building during whole year. This resulted in such a disposition of the building, that mostly used rooms are facing South.

Future building is proposed in such way that respects requirements of Territorial plan of Brno city. The object's look corresponds to the architectural style of the surrounding structures.

b) Architectural solution – composition of shape solution, material and color solutions

The Arts and crafts centre is two-floor high and without basement. The building is of four rectangles creating an L-shape arrangement, three rectangles with dimensions 6,985x14,23m, 22,565x13,23m, and 10,7x14,23m which go to the second floor level. The last rectangle with dimensions 10,7x15m is of the height of only one above-ground floor. The bigger part made of above-mentioned three rectangles is finished by flat roof, and the smaller portion serves as flat walkable terrace with part as a green roof. In the Northern part of the plot, there is paved area for parking of about 17 cars. All unhardened areas will be grasses and planted with trees and bushes. The building is placed in the Northern section of the plot, which leaves enough space in the South of the plot for outdoor courts and other activities. The main entrance to the building and also one of the 5 exits is in the North-West of the construction. Furthermore, exits

located in the North, North-East, South, and South-East also lead to the free area.

White smooth façade in combination with facing bricks of red-brown color creates contrast which gives the overall appearance a nice tint. Windows and doors are plastic of rectangular shape in light brown color – Birke Rose. Exterior parapets are of white color. Detailed color choice is listed in relevant project documentation. Paving around the house is designed of concrete blocks colormix ‘fall’ of sandy-brown color.

B.2.3 Layout and operational solutions, production technology

The central area is the main hall with elevator and main staircase that leads visitors to other rooms, such as activity rooms, hygienic rooms, coffee house and rooms for staff (offices, kitchen, technical room, janitor’s closet). Through one of the exits we can get to a spacious backyard with terrace, multipurpose playground and children’s playground.

The second floor is accessible via one of the two staircases or elevator. The hall connects us with three lecture rooms, cooking room, computer room, board game room, offices, hygienic rooms, playroom and separate locker rooms. The second floor is intended for more quiet activities than the ones in the first floor.

B.2.4 Barrier-free use of the building

Considering the object as newly constructed building of civic amenities, it is necessary to propose it for usage of people also with limited mobility.

The access to the building is designed according to the prescribed sloping of a ramp 1:8. Height differences inside the Arts and craft centre are not bigger than 20mm. Minimal clear width of doors is fulfilled (900mm), doors must also have handrail in the height of 800-900mm and door handle 1000mm above floor level. Glassing of doors cannot be lower than 400mm above floor level. In front of the entrance there must be also free manipulation area of at least 1500x1500mm serving for turning of the wheelchair. Internal dimensions of restroom must be at least 2150x1800mm. The toilet has to have two railings – one fixed and one hinged. Axis of toilet must be at least 450mm from a wall. Axis of lavatory is placed 550mm from a wall. There must be hinged stool and handrails in the shower room.

B.2.5 Safety during usage

There are no special requirements on safety during usage. Handrails are in height of 900mm.

B.2.6 Basic technical description of the buildings

a) Construction design

The building is composed of mutually connected units such as communication areas, hygienic areas, coffee house, activity rooms, storages and offices. In the 1st floor, there is an entrance hall leading to the common hall with main staircase with elevator. There are two halls, one leading to the East Wing of the building, second to the South Wing. When going to the East Wing, there are common rooms (coffee house, activity room, creative workshop), hygienic rooms (restrooms, showers,

locker rooms), as well as rooms for staff (storage, locker room with toilet, kitchen of the coffee house, office). When going to the South Wing of the building, there are also common rooms (free time room, music room, drama/dance class room), hygienic rooms (restrooms), as well as rooms for staff (storage, janitor's closet, technical room). The access to the 2nd floor is possible by two staircases, or by an elevator. There are three lecture rooms, board game room, computer room, cooking room, playroom, restrooms and separate locker rooms for visitors and staff, three office rooms for staff, conference room, kitchen for staff, shower room for staff, storage and janitor's closet.

b) Structural and material solution

The building is proposed as frame timber structure assembled on construction site. The Arts and crafts centre is two-floor high, without basement, based on foundation strips. Roof above 2nd floor is flat finished with waterproofing layer, roof above 1st floor is also flat finished with walkable wooden planks on rubber pads and vegetation roof. The building is of four rectangles creating an L-shape arrangement, three rectangles with dimensions 6,985x14,23m, 22,565x13,23m, and 10,7x14,23m which go to the second floor level. The last rectangle with dimensions 10,7x15m is of the height of only one above-ground floor. The highest point is 7,210 above the ±0,000 (refers to 478 m.a.s.l.) floor level.

Earthworks

The terrain is slightly sloping down in the direction to the South. Levelling of the terrain will be done with help of machinery. The groundwater level in below foundations and will influence neither foundations nor earthworks. Exact description of individual structure compositions are listed in annex Floor and Wall Compositions.

Foundations

The foundation strips are made of plain concrete of class C20/25 poured into previously excavated grooves. As soon as concrete is solid, the crushed aggregates are poured and compacted. On top of this layer, the foundation slab is then made out of concrete reinforced with KARI net with diameter 8 mm and mesh 150x150mm. There will be waterproofing layer and thermal insulation on exterior side of foundation strips. Furthermore on the top of the foundation slab waterproofing, thermal insulation and flooring layers will be placed. Exact description of individual structure compositions are listed in annex Floor and Wall Compositions.

Load-bearing peripheral walls

Load-bearing peripheral walls are made of timber columns 80/160mm covered by 30mm of fiber board FERMACELL from both sides. The space between columns is filled by mineral wool of thickness of 160mm. Interior side of the peripheral wall has wooden grid which serves as space for installations, closed by 10mm of fiber board. The exterior side is covered by contact thermal insulation of thickness of

100mm. Total thickness of peripheral wall is 380mm. Exact description of individual structure compositions are listed in annex Floor and Wall Compositions.

Load-bearing internal walls

Load-bearing internal walls are made of timber columns 80/160mm. The space between columns is filled with acoustic/thermal insulation of thickness of 160mm. There are 30mm of fiber board FERMACELL from both sides. Total thickness is 220mm. Exact description of individual structure compositions are listed in annex Floor and Wall Compositions.

Internal non-load bearing partition walls

Internal non-load bearing partition walls are made of timber columns with dimensions 60/100mm and mineral wool in between the columns. The structure is enclosed by 10mm of FERMACELL panels from both sides. Total thickness is 120mm. Exact description of individual structure compositions are listed in annex Floor and Wall Compositions.

Internal non-load bearing fire walls

Internal non-load bearing fire walls are made of timber columns 80/160mm. The space between columns is filled with acoustic/thermal insulation of thickness of 160mm. There are 30mm of fiber board FERMACELL from both sides. Total thickness is 220mm. Exact description of individual structure compositions are listed in annex Floor and Wall Compositions.

Ceiling above the 1st floor

Ceiling above the 1st floor is made of load-bearing Posi-Joist beams, with 120mm of mineral wool in between, covered from below by 25mm of FERMACELL panels fastened on CD 27/60/0,6mm profiles. The total thickness is 505mm. Exact description of individual structure compositions are listed in annex Floor and Wall Compositions.

Roof structure above the 2nd floor

Roof structure above the 2nd floor is made of load-bearing Posi-Joist beams. Thermal insulation on top of the OSB board is made of sloping layers (20-310mm) which are used for dewatering of the flat roof, and thermal insulation of thickness of 140mm. The roof is covered by 25mm of FERMACELL panels from the interior side, and by asphalt waterproofing layers from the exterior. Total thickness varies from 589,5mm up to 879,5mm. Exact description of individual structure compositions are listed in annex Floor and Wall Compositions.

Staircases

Main staircase is proposed as two-wing self-supporting. Clear width is in case of main staircase 1250mm, in East staircase 1350mm. There are in total 20 steps, 10 in each wing. The step depth is 300mm, height 161mm and the angle 28.8°. There is also handrail in the height of 1000mm.

Windows and doors

Sliding windows are proposed as plastic with thermal insulating triple glazing with heat transfer coefficient of glazing $U_{\text{glass}} = 0,5 \text{ W/m}^2\text{K}$, framing $U_{\text{frame}} = 1,5 \text{ W/m}^2\text{K}$ and the total $U_{\text{total}} = 0,795 \text{ W/m}^2\text{K}$. Windows are proposed as plastic with thermal insulating triple glazing with heat transfer coefficient of glazing $U_{\text{glass}} = 0,5 \text{ W/m}^2\text{K}$ and the total $U_{\text{total}} = 0,71 \text{ W/m}^2\text{K}$. Furthermore entrance doors are also plastic with heat transfer coefficient of glazing $U_{\text{glass}} = 0,5 \text{ W/m}^2\text{K}$ and the total $U_{\text{total}} = 0,93 \text{ W/m}^2\text{K}$. Internal doors are proposed as laminate casing in maple tree décor placed into laminate casing doorframe of the same color. Specific description and number of pieces of individual windows and doors are listed in annex List of windows and doors.

Insulations

- Waterproofing insulation

Damp proofing layer applied on top of a concrete foundation slab is out of modified asphalt strip. The strip is smelted to the foundation slab. Waterproofing of roof and terrace is out of two layers of asphalt felts – one is self-adhesive SBD modified asphalt strip, and second one is smelted SBD modified asphalt strip with slate gritting. Waterproofing of vegetation roof has the same composition as of terrace, the only difference is that on top of these two asphalt strips, there is a third one – SBD modified asphalt strip with additives against growing through of vegetation. Exact description of individual structure compositions are listed in annex Floor and Wall Compositions.

- Thermal insulation

Peripheral walls are thermally insulated in two ways – by mineral wool in between the individual columns of the thickness of 160mm, and by contact thermal insulation system with EPS of thickness 100mm. For thermal insulation of floors of the 1st floor EPS boards in two layers are used with total thickness of 140mm. Roof is thermally insulated by both sloping layer out of EPS with thickness varying from 20-310mm, and EPS with thickness of 140mm. Exact description of individual structure compositions are listed in annex Floor and Wall Compositions.

- Acoustic insulation

In floors above 1st floor 60mm of acoustic fiber boards against impact noise are used. Walls are acoustically insulated via inserted mineral wool in between columns with thicknesses of either 160mm or 100mm. Exact description of individual structure compositions are listed in annex Floor and Wall Compositions.

Chimney

There is proposed chimney SHIEDEL ICS with diameter of 200mm for gas condensed boilers. Chimney head will be provided with chimney sheathing according to instructions of the distributor. Requirements on standoff distances from flammable structures must be fulfilled. This distance is at least 30mm, dilated by mineral wool. Flooring in around chimney must be out of non-flammable top layer (ceramic tiles). Chimney head will be led out at least 500mm above roof level.

Floorings

Individual floor compositions are described in annex Floor and Wall compositions.

Wall tiles

Wall tiles will be done in different heights as described in technical drawings.

Plasters

Silicone colored coated plaster is used for exterior. Exact description of individual structure compositions are listed in annex Floor and Wall Compositions.

Paintings

Interior paintings are out of silicate paint. Color choice of individual rooms depends on the request of the investor.

c) Mechanical resistance and stability

The building is designed in such a way that loads acting on it during construction and usage would not result in:

- a) Collapse of the structure or its part
- b) Bigger degree of unaccepted deformation
- c) Damage of other parts of the building or technical equipment due to deformation of load-bearing structures
- d) Damage disproportionate to cause

Technological procedures of distributors were followed when designing the building. Calculations of foundation strips, timber columns and staircase are attached in separate annex of project documentation. Dimensions of ceiling and roof beams were proposed according to empiric calculations of the distributor.

B.2.7 Technical and technological equipment

Technical equipment solution is not a part of this project.

B.2.8 Fire safety solution

For more information, see annex Fire safety report.

B.2.9 Principles of energy management

The Energy performance of the building was assessed as B – very economical. For more information, see Annex Building Physics.

B.2.10 Hygienic, working and communal requirements

The building will not have negative effect on the environment because the land is intended according to Territorial plan of the Brno city for such a type of a building. During construction there will be used only materials that do not negatively influence the environment. The building will not shadow neighbouring buildings. The Arts and craft centre meets all requirements concerning standoff distances from the land borders. The surrounding areas will be grassed and planted by trees and bushes.

During construction, it will be dealt with waste materials according to valid regulations, such as Law 185/2001 Coll., amendment 169/2013 Coll., and regulation 383/2001 Coll. The waste material will be sorted out, stored separately, taken away and disposed on the basis of contract with authorized organization. Documentation about wastes will be submitted for the final approval.

- Ventilation

Ventilation of the Leisure Center is ensured by natural ventilation via windows and doors, also via exhaust fan in toilet room and via kitchen hood in the kitchen.

- Heating

Proposed were three gas condensed boilers providing heating and hot domestic water.

- Lighting

Common rooms are illuminated naturally via windows and doors. Rooms that do not have windows/doors will be illuminated via artificial lighting.

- Drinking water supply

The building will be supplied with drinking water through local water supply pipes.

B.2.11 Principles of protection of buildings against negative effects of environment

The object is protected against penetration of radon by damp proofing layer in foundation slab. Protection against noise – see Annex Building Physics.

B.3 Connection to infrastructure

There are four connections to the building:

- Connection of water pipes with drinking water that is about 73m long. There is also water meter shaft on the borders of the land.
- Sewerage connections for both waste water and rain water sewerage are totally about 190m long, with sewer inspection shafts.
- Low voltage power line is about 77m long with main house box electrometer
- Low pressure gas pipes are about 77m long with main gas closure.

All above-mentioned connections are connected to public utility network system.

B.4 Traffic solution

The parcel is directly connected to the asphalt service road and the parcel is easily accessible. There will be 17 parking places from which 4 are intended for disabled people or parents with young children.

B.5 Vegetation and terrain solution

After the end of building works, the plot will be adjusted into required sloping via rotavator.

The plot will be grassed with trees and bushes along the fence.

B.6 Description of an impact of construction to the environment and its protection

All used materials meet the hygiene requirements for emissions and foreign substances. During the construction around the building site the dust and noise will be increased. Conditions to minimize these negative effects will be determined. Municipal waste will be sorted out and taken away. Finished object will not bother neighbourhood with dust or noise by its operation.

The construction does not have any negative effect on the environment.

B.7 Protection of population

Building of the Arts and crafts centre meets all conditions of the township regulatory plan, it means it meets basic requirements for the location of buildings and building solutions from the point of view of protection of population according to Decree no. 380/2002 Coll., preparation and execution of the tasks of civic protection.

B.8 Principles of construction organization

It is necessary to build water and power line connections prior beginning of works. Water will be mainly used for washing or treating of concrete and power lines will be used for powering of building equipment. Drainage of the construction site is natural during building process. New access road will be constructed and connected to existing road. No demolition is necessary. The waste from the construction works will be sorted out, so further recycling is possible. Waste can be sorted into: concrete, plastic, wood, steel, other metals, insulation material, gypsum, soil and rock, mixed building waste. Dry toilet will be brought to the construction site. Any bigger soil movement is not expected. It is important to follow given health protection instructions and to wear proper clothes, shoes and protection helmets.

Elaborated by:

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Denisa Kadubcová

In Brno, December 2017



VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ

BRNO UNIVERSITY OF TECHNOLOGY

FAKULTA STAVEBNÍ

FACULTY OF CIVIL ENGINEERING

ÚSTAV POZEMNÍHO STAVITELSTVÍ

INSTITUTE OF BUILDING CONSTRUCTIONS

CENTRUM UMĚNÍ A ŘEMESLA

ARTS AND CRAFTS CENTRE

D TECHNICAL REPORT

DIPLOMOVÁ PRÁCE

MASTER'S THESIS

AUTOR PRÁCE

AUTHOR

Bc. Denisa Kadubcová

VEDOUCÍ PRÁCE

SUPERVISOR

Ing. František Vajkay, Ph.D.

BRNO 2017

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D.1 Solution of the construction

D.1.1 Architectonic solution

The project documentation deals with the construction of Arts and crafts centre on the plot number 58/6 in Útěchov u Brna. The building is designed as detached, with two above-ground floors, without basement, based on foundation strips from plain concrete.

The building is of four rectangles creating an L-shape arrangement, three rectangles with dimensions 6,985x14,23m, 22,565x13,23m, and 10,7x14,23m which go to the second floor level. The last rectangle with dimensions 10,7x15m is of the height of only one above-ground floor. The highest point is 7,210 above the $\pm 0,000$ (refers to 478 m.a.s.l.) floor level. The bigger part made of above-mentioned three rectangles is finished by flat roof, and the smaller portion serves as flat walkable terrace. In the Northern part of the plot, there is paved area for parking of about 17 cars. All unhardened areas will be grasses and planted with trees and bushes. The building is placed in the Northern section of the plot, which leaves enough space in the South of the plot for outdoor courts and other activities.

D.1.2 Art solution

The Leisure Center is two-floor high and without basement. The building is of four rectangles creating an L-shape arrangement, three rectangles with dimensions 6,985x14,23m, 22,565x13,23m, and 10,7x14,23m which go to the second floor level. The last rectangle with dimensions 10,7x15m is of the height of only one above-ground floor. The bigger part made of above-mentioned three rectangles is finished by flat roof, and the smaller portion serves as flat walkable terrace. In the Northern part of the plot, there is paved area for parking of about 17 cars. All unhardened areas will be grasses and planted with trees and bushes. The main entrance to the building and also one of the 5 exits is in the North-West of the construction. Furthermore, exits located in the North, North-East, South, and South-East also lead to the free area.

The aim of the design of the building is to avoid excessive division of an object. White smooth façade in combination with facing bricks of red-brown color creates contrast which gives the overall appearance a nice tint. Windows and doors are plastic of rectangular shape in light brown color – Birke Rose. Exterior parapets are of white color. Detailed color choice is listed in relevant project documentation. Paving around the house is designed of concrete blocks colormix ‘fall’ of sandy-brown color.

D.1.3 Material solution

Materials used for construction of the Leisure Center are based on current trends in building industry.

D.1.4 Disposition and operational solutions

The central area is the main hall with elevator and main staircase that leads visitors to other rooms, such as activity rooms, hygienic rooms, coffee house and rooms for staff (offices, kitchen, technical room, janitor’s closet). Through one of the exits we can get to a spacious backyard with terrace, multipurpose playground and children’s playground.

The second floor is accessible via one of the two staircases or elevator. The hall connects us with three lecture rooms, cooking room, computer room, board game room, offices, hygienic rooms, playroom and separate locker rooms. The second floor is intended for more quiet activities than the ones in the first floor.

Build-up area: 710,7 m²

Enclosed space: 4481 m³

Floor area: 1275,2 m²

Demarcation of building plot: 4197 m²

Maximal height above the terrain: 7,210 m

Number of parking places: 17 cars outside

D.2 Barrier-free use of the building

Considering the object as newly constructed building of civic amenities, it is necessary to propose it for usage of people also with limited mobility.

The access to the building is designed according to the prescribed sloping of a ramp 1:8. Height differences inside the Arts and craft centre are not bigger than 20mm. Minimal clear width of doors is fulfilled (900mm), doors must also have handrail in the height of 800-900mm and door handle 1000mm above floor level. Glassing of doors cannot be lower than 400mm above floor level. In front of the entrance there must be also free manipulation area of at least 1500x1500mm serving for turning of the wheelchair. Internal dimensions of restroom must be at least 2150x1800mm. The toilet has to have two railings – one fixed and one hinged. Axis of toilet must be at least 450mm from a wall. Axis of lavatory is placed 550mm from a wall. There must be hinged stool and handrails in the shower room.

D.3 Structural and construction-technical solution

Earthworks

The terrain is slightly sloping down in the direction to the South. Levelling of the terrain will be done with help of machinery. The groundwater level is below foundations and will influence neither foundations nor earthworks. Exact description of individual structure compositions are listed in annex Floor and Wall Compositions.

Foundations

The foundation strips are made of plain concrete of class C20/25 poured into previously excavated grooves. As soon as concrete is solid, the crushed aggregates are poured and compacted. On top of this layer, the foundation slab is then made out of concrete reinforced with KARI net with diameter 8 mm and mesh 150x150mm. There will be waterproofing layer and thermal insulation on exterior side of foundation strips. Furthermore on the top of the foundation slab waterproofing, thermal insulation and flooring layers will be placed. Exact description of individual structure compositions are listed in annex Floor and Wall Compositions.

Load-bearing peripheral walls

Load-bearing peripheral walls are made of timber columns 80/160mm covered by 30mm of fiber board FERMACELL from both sides. The space between columns is filled by mineral wool of thickness of 160mm. Interior side of the peripheral wall has wooden grid which serves as space for installations, closed by 10mm of fiber board. The exterior side is covered by contact thermal insulation of thickness of 100mm. Total thickness of peripheral wall is 380mm. Exact description of individual structure compositions are listed in annex Floor and Wall Compositions.

Load-bearing internal walls

Load-bearing internal walls are made of timber columns 80/160mm. The space between columns is filled with acoustic/thermal insulation of thickness of 160mm. There are 30mm of fiber board FERMACELL from both sides. Total thickness is 220mm. Exact description of individual structure compositions are listed in annex Floor and Wall Compositions.

Internal non-load bearing partition walls

Internal non-load bearing partition walls are made of timber columns with dimensions 60/100mm and mineral wool in between the columns. The structure is enclosed by 10mm of FERMACELL panels from both sides. Total thickness is 120mm. Exact description of individual structure compositions are listed in annex Floor and Wall Compositions.

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Internal non-load bearing fire walls are made of timber columns 80/160mm. The space between columns is filled with acoustic/thermal insulation of thickness of 160mm. There are 30mm of fiber board FERMACELL from both sides. Total thickness is 220mm. Exact description of individual structure compositions are listed in annex Floor and Wall Compositions.

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Roof structure above the 2nd floor

Roof structure above the 2nd floor is made of load-bearing Posi-Joist beams. Thermal insulation on top of the OSB board is made of sloping layers (20-310mm) which are used for dewatering of the flat roof, and thermal insulation of thickness of 140mm. The roof is covered by 25mm of FERMACELL panels from the interior side, and by asphalt waterproofing layers from the exterior. Total thickness varies from 589,5mm up to 879,5mm. Exact description of individual structure compositions are listed in annex Floor and Wall Compositions.

Staircases

Main staircase is proposed as self-supporting steel-light construction with two-wings. Clear width is in case of main staircase 1250mm, in East staircase 1350mm. There are in total 20 steps, 10 in each wing. The step depth is 300mm, height 161mm and the angle 28.8°. There is also handrail in the height of 1000mm.

Windows and doors

Sliding windows are proposed as plastic with thermal insulating triple glazing with heat transfer coefficient of glazing $U_{\text{glass}} = 0,5 \text{ W/m}^2\text{K}$, framing $U_{\text{frame}} = 1,5 \text{ W/m}^2\text{K}$ and the total $U_{\text{total}} = 0,795 \text{ W/m}^2\text{K}$. Windows are proposed as plastic with thermal insulating triple glazing with heat transfer coefficient of glazing $U_{\text{glass}} = 0,5 \text{ W/m}^2\text{K}$ and the total $U_{\text{total}} = 0,71 \text{ W/m}^2\text{K}$. Furthermore entrance doors are also plastic with heat transfer coefficient of glazing $U_{\text{glass}} = 0,5 \text{ W/m}^2\text{K}$ and the total $U_{\text{total}} = 0,93 \text{ W/m}^2\text{K}$. Internal doors are proposed as laminate casing in maple tree décor placed into laminate casing doorframe of the same color. Specific description and number of pieces of individual windows and doors are listed in annex List of windows and doors.

Insulations

- Waterproofing insulation

Damp proofing layer applied on top of a concrete foundation slab is out of modified asphalt strip. The strip is smelted to the foundation slab. Waterproofing of roof and terrace is out of two layers of asphalt felts – one is self-adhesive SBD modified asphalt strip, and second one is smelted SBD modified asphalt strip with slate gritting. Waterproofing of vegetation roof has the same composition as of terrace, the only difference is that on top of these two asphalt strips, there is a third one – SBD modified asphalt strip with additives against growing through of vegetation. Exact description of individual structure compositions are listed in annex Floor and Wall Compositions.

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Peripheral walls are thermally insulated in two ways – by mineral wool in between the individual columns of the thickness of 160mm, and by contact thermal insulation system with EPS of thickness 100mm. For thermal insulation of floors of the 1st floor EPS boards in two layers are used with total thickness of 140mm. Roof is thermally insulated by both sloping layer out of EPS with thickness varying from 20-310mm, and EPS with thickness of 140mm. Exact description of individual structure compositions are listed in annex Floor and Wall Compositions.

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There is proposed chimney SHIEDEL ICS with diameter of 200mm for gas condensed boiler. Chimney head will be provided with chimney sheathing according to instructions of the distributor. Requirements on standoff distances from flammable structures must be fulfilled. This distance is at least 30mm, dilated by mineral wool. Flooring in around chimney must be out of non-flammable top layer (ceramic tiles). Chimney head will be led out at least 500mm above roof level.

Floorings

Individual floor compositions are described in annex Floor and Wall compositions.

Wall tiles

Wall tiles will be done in different heights as described in technical drawings.

Plasters

Silicone colored coated plaster is used for exterior. Exact description of individual structure compositions are listed in annex Floor and Wall Compositions.

Paintings

Interior paintings are out of silicate paint. Color choice of individual rooms depends on the request of the investor.

D.4 Building Physics

See Annex Building Physics.

3. CONCLUSION

I worked this work using all necessary standards, regulations, notices and technical lists of individual manufacturers. The project was based on earlier prepared studies. The project documentation was worked out in scope of assignment. There is also part Building Physics assessment of the building. The result of calculation of Protocol for the Energy Performance Certificate made in Energie software was that the proposed object belongs by its thermo-technical properties to category B (very efficient). Building also meets all fire-safety regulations and decrees. Fire danger area does not extend to surrounding properties. Report, calculations and drawings are attached to this work in Annex Fire safety. In addition, I proposed dimensions of wooden elements based on my static calculations as can be seen in Annex Calculations. The result of my work is a complete design of Arts and crafts centre that respects the architectonic solutions of neighbouring buildings.

4. LIST OF USED SOURCES

Related standards and laws

ŘSN 01 3420 Výkresy pozemních staveb – kreslení výkresu stavební části
ČSN 73 0540 - 1,2,3,4 Tepelná ochrana budov.
ČSN 73 0833 Požární bezpečnost staveb – Budovy pro bydlení a ubytování.
ČSN 73 0802 Požární bezpečnost staveb – Nevýrobní objekty.
ČSN 73 0810 Požární bezpečnost staveb – Společná ustanovení
ČSN 73 0818 Požární bezpečnost staveb – obsazení objektu osobami
ČSN 73 0873 Požární bezpečnost staveb – Zásobování požární vodou
ČSN 73 4301 Obytné budovy
ČSN 73 0580 Denní osvětlení budovy
ČSN 73 0532 Akustika, ochrana proti hluku v budovách
ČSN 01 3420 – Výkresy pozemních staveb – kreslení výkresů
Zákon č. 183/2006 Sb. o územním plánování a stavebním řádu.
Vyhláška č. 268/2009 Sb. o technických požadavcích na stavby
Vyhláška č. 62/2013 Sb. o dokumentaci staveb
Vyhláška 499/2006 Sb., o dokumentaci staveb
Vyhláška 23/2008 Sb., o technických podmínkách požární ochrany staveb
Vyhláška 246/2001 Sb., o požární prevenci
Vyhláška č. 501/2006 Sb., o obecných požadavcích na výstavbu

www-sources

FERMACELL, available at: www.fermacell.cz
VEKRA, available at: www.vekra.cz
SAPELI, available at: www.sapeli.cz
ISOVER, available at: www.isover.cz
CEMIX, available at: www.cemix.cz
DEK stavebniny, available at: www.dek.cz
KNAUF, available at: www.knauf.cz
VAILLANT, available at: www.vaillant.cz
KONE, available at: www.kone.cz
TZB INFO, available at: www.tzb-info.cz
RAKO, available at: www.rako.cz
QUICK-STEP, available at: www.quick-step.cz
SOUDAL, available at: www.soudal.cz
RONN, available at: www.ronn.cz
BEST, available at: www.best.info
HELUZ, available at: www.heluz.cz
NAHLÍŽENÍ DO KATASTRU, available at: www.cuzk.cz
MITEK, available at: www.mitek.cz
SIMPLESTONE, available at: www.simplestone.cz
LINDAB, available at: www.lindabstrechy.cz

5. LIST OF USED ABBREVIATIONS AND SYMBOLS

Coll.	collocation
ČSN	česká státní norma = Czech state standard
FC	fire compartment
LV	list of ownership
S-JTSK	jednotné trigonometrická síť katastrální = uniform trigonometric cadastral network
VŠKP	vysokoškolská kvalifikační práce = university qualification work
min	minimal
max	maximal
no.	number
par	paragraph
RC	reinforced concrete
mm	milimeter
m	meter
th.	thickness
S	scale
IGL	initial ground level
FGL	finished ground level

6. LIST OF ANNEXES

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D.1.2.13 Detail F	S 1:5
D.1.2.14 Detail G	S 1:5
D.1.2.15 List of windows and doors	
D.1.2.16 List of floor and wall compositions	
D.1.2.17 List of tinsmith works	
D.1.2.18 List of plastic works	
D.1.2.19 List of locksmith works	

File no. 4 – FIRE SAFETY SOLUTION

D.1.3 Fire safety solution (report)

Drawings:	D.1.3.01 Floorplan of the 1st floor for fire safety	S 1:150
	D.1.3.02 Floorplan of the 2nd floor for fire safety	S 1:150

File no. 5 – BUILDING PHYSICS

Building physics (report)

Annex 1:	BP.1 Situation drawing for building physics	S 1:150
	BP.2 Floorplan of the 1st floor for building physics	S 1:150
	BP.3 Floorplan of the 2nd floor for building physics	S 1:150
	BP.4 Sections for building physics	S 1:150

Annex 2:

Calculation of heat transfer coefficient of structures
Calculation of heat transfer coefficient in windows and doors
Calculation of temperature factor and surface temperature
Calculation of temperature in corners
Calculation of airborne and impact sound insulation

Annex 3:	Protocol for the energy performance certificate	
Annex 4:	Compositions of structures for calculation of building physics	
Annex 5:	BP.5 Shading of windows in summer and winter	

File no. 6 – CALCULATIONS

Calculation of timber elements, foundations and staircase

File no. 7 – STUDY AND PREPARATORY WORKS

S.1 Study of the first floor	S 1:150
S.2 Study of the second floor	S 1:150
S.3 Study of section A-A', B-B' and C-C'	S 1:150
S.4 Study of elevations	S 1:150
S.5 Visualization	-
S.6 Visualization	-

PROHLÁŠENÍ O SHODĚ LISTINNÉ A ELEKTRONICKÉ FORMY VŠKP

Prohlašuji, že elektronická forma odevzdané typ práce je shodná s odevzdanou listinnou formou.

V Brně dne 7. 1. 2018

titul jméno a příjmení studenta